

Intelligent multi-channel data acquisition display control module

2-channel analog AD acquisition display control isolation transmitter: ISO 4021 (LED1) series

Features

- Low-cost, small-volume modular design, convenient for desktop and guide rail installation and use
- The collected analog quantity is converted into RS485/232 to support Modbus RTU communication protocol
- Intelligent real-time monitoring of data collection and LED digital tube display in two modes
- The measurement accuracy is better than 0.05%, and the module accuracy can be programmed to calibrate
- Power supply wide voltage supply range: 8 — 50VDC
- High reliability, convenient programming, easy installation and wiring
- User programmable setting of target module address, baud rate, etc.
- It can be monitored based on on-site data collection and display results directly.
- Isolation voltage between signal input and output 3000VDC
- Petrochemical industry, environmental protection monitoring,
- intelligent control of traffic operation system
- Industrial temperature range:-40 ~ + 85 °C

Summarize:

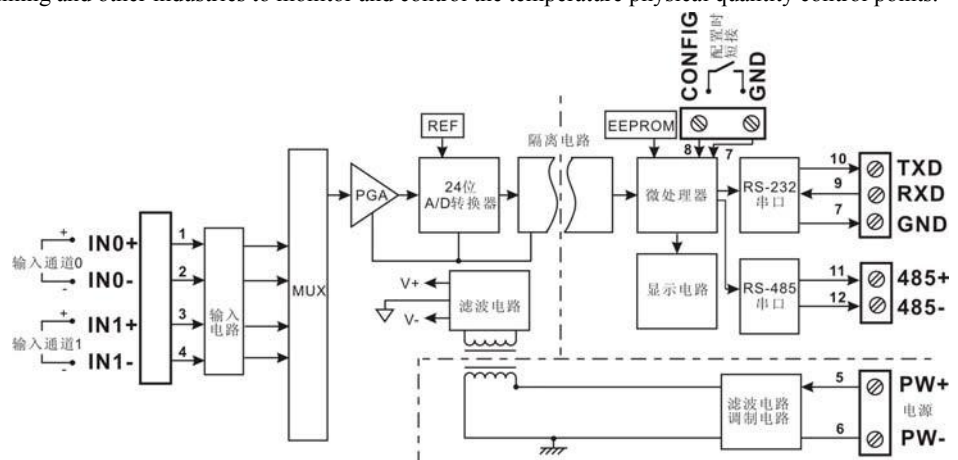
Sunyuan The ISO 4021 series of intelligent data acquisition and display control modules can realize signal safety isolation and high-precision data acquisition, isolation display and monitoring between the sensor and the host. This product integrates isolation, display, alarm control, and transmission. It is often used in RS-232/485 bus industrial automation control systems, 4-20mA / 0-10V signal measurement, monitoring and intelligent control, small signal measurement and Remote monitoring occasions such as industrial field signal isolation and long-line transmission. Through the configuration of the software, a variety of sensor types can be connected, including current output type, voltage output type, etc.

The ISO 4021 series of intelligent data acquisition and display control products include power isolation, signal isolation, linearization, A/D conversion, digital tube display and RS-485 serial communication modules. Each serial port can connect up to 256 ISO AD series modules, using ASCII code character communication protocol or MODBUS RTU communication protocol standard common communication method, its instruction set is compatible with ADAM module, the baud rate can be set by the user, can be with other manufacturers The control module is hung on the same RS-485 bus for easy host programming.

ISO 4021 series of intelligent data acquisition and display control products are intelligent monitoring and control systems based on single-chip microcomputers. All user-set calibration values, addresses, baud rates, data formats, checksum status and other configuration information are stored in non-volatile Sexual memory in EEPROM. The analog signal is isolated and amplified by AD conversion, and it has the signal display function. The product adopts intelligent design and possesses a variety of functions that traditional products do not possess. With only a single power supply, the analog signal can be isolated and transmitted, and displayed in decimal digital according to the set range linearly. The traditional embedded analog display meter is adjusted by a potentiometer, and the adjustment parameters are single, inflexible, and greatly affected by temperature. Compared with the traditional analog display meter, this embedded intelligent digital display meter is controlled by the central processing unit CPU. Through the configuration software control, it can realize the setting of various parameters such as zero point, full scale, data format, communication protocol, etc. It has strong flexibility and practicality. The digital display meter adopts an LED display board and has reverse and overcurrent protection functions. Products are widely used in industrial control, petrochemical, environmental protection, smart home, mining and other industries to monitor and control the temperature physical quantity control points.

Principle block diagram:

4-20mA转RS232/485
智能显示数据采集器



Function introduction

The ISO 4021 (LED1) series of intelligent signal isolation acquisition modules can be used to measure one voltage or current signal, or two current or voltage signals that can share the same ground and will not interfere with each other. The data collection result is displayed through the LED digital tube in two modes.

24-bit acquisition accuracy, analog signal input. 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、 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. It can be programmed to use which kind of communication protocol, which can realize network communication with PLC, RTU or computer monitoring system of various brands.

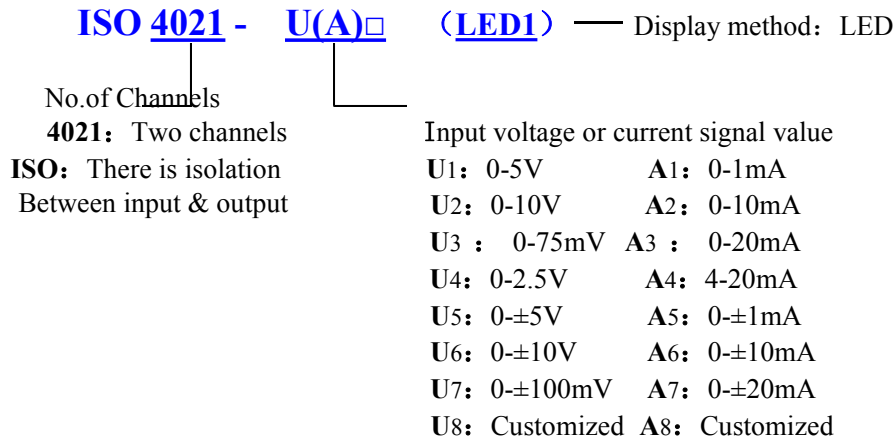
Data format: 10 bits. 1 start bit, 8 data bits, 1 stop bit.

Communication address: (00H-FFH) and baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400bps) can be set; the longest distance of communication network can reach 1200 meters, connected by twisted pair shielded cable. The communication interface is designed with high anti-interference, $\pm 15KV$ 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 filtering can also well suppress the power frequency interference from the power grid.

Product Model



Remarks: ISO 4021 (LED1) series products support both RS23 and RS485 communication interface output. Users can choose the corresponding communication interface according to the use environment, but only one of the two interfaces can work online at the same time, otherwise interference will occur.

Product selection example

- Example 1, Two-channel signal input: 4-20mA; auxiliary power supply: 24VDC; output: RS23 and RS485 communication; LED display. Product number: **ISO 4021-A4-LED1**
- Example 2, Two-channel signal input: 0-±20mA; auxiliary power supply: 12VDC; output: RS23 and RS485 communication; LED display. Product number: **ISO 4021-A7-LED1**
- Example 3, Two-channel signal input: 0-5V; auxiliary power supply: 12VDC; output: RS23 and RS485 communication; LED display. Product number: **ISO 4021-U1-LED1**

General parameters (typical @ +25°C, Vs 为 24VDC)

Input type: Current input /voltage input
 Accuracy: 0.05%
 Input offset: $\pm 0.1 \mu A/^{\circ}C$
 Temperature drift: $\pm 15 \text{ ppm}/^{\circ}C$ ($\pm 30 \text{ ppm}/^{\circ}C$, maximum)
 Input resistance:
 50 Ω (4-20mA/0-20mA/0-±20mA current input)
 100 Ω (0-10mA/0-±10mA current input)
 1K Ω (0-1mA/0-±1mA current input)
 > 1M Ω (voltage input)
 bandwidth: -3 dB 10 Hz
 Conversion rate: 10 Sps
 (CMR): 120 dB (1k Ω Source Imbalance @ 50/60 Hz)
 (NMR): 60 dB (1k Ω 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

Working power supply: +8 — 50 VDC wide power supply range, internal anti-reverse connection and overvoltage protection circuit

Power consumption: less than 1W

Working temperature: -25 — +80°C

Working humidity: 10 — 90% (no condensation)

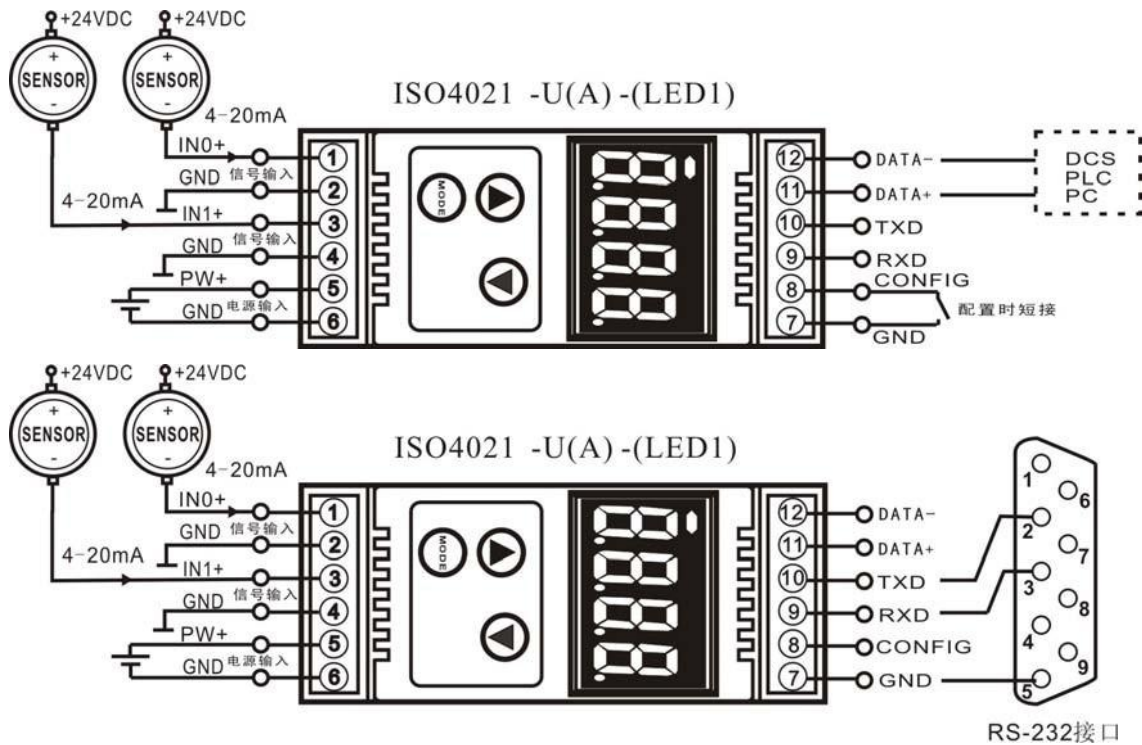
Storage temperature: -55 — +85°C

Storage humidity: 10 — 95% (non-condensing)

Isolation withstand voltage: between input and output: 3KVDC, 1 minute, leakage current 1mA, where the output and the power supply share the same ground. Impulse withstand voltage: 3KVAC, 1.2/50us (peak value)

Dimensions: Standard guide rail shape 83.8 x 40.0 x 63.0 (mm)

Typical application wiring diagram



RS-232接口

Dimensions and pin description

Pin	Name	description
1	IN0+	Input channel 0 positive terminal
2	GND	Input channel 0 negative terminal
3	IN1+	Input channel 1 positive terminal
4	GND	Input channel 1 negative terminal
5	PW+	Power positive terminal
6	GND	Power negative terminal
7	GND	Power negative terminal
8	CONFIG	Configure the port
9	RXD	RS-232 signal RXD
10	TXD	RS-232 signal TXD
11	DATA+	RS-485 signal positive terminal
12	DATA-	RS-485 signal negative terminal

Product Design Portfolio Picture



4-20mA转RS485
模拟量数据采集器

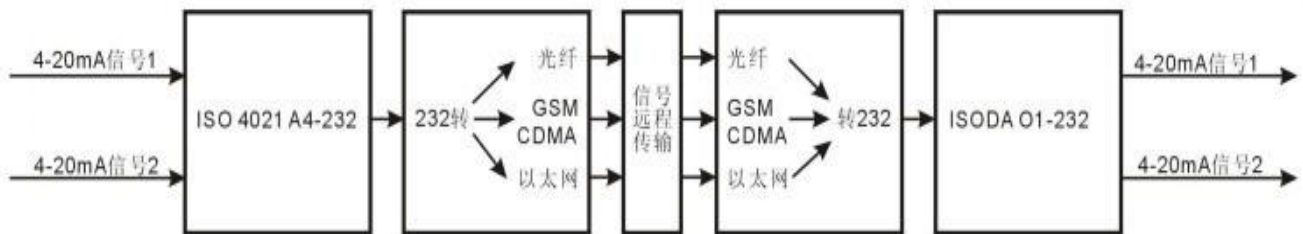


智能化数显表

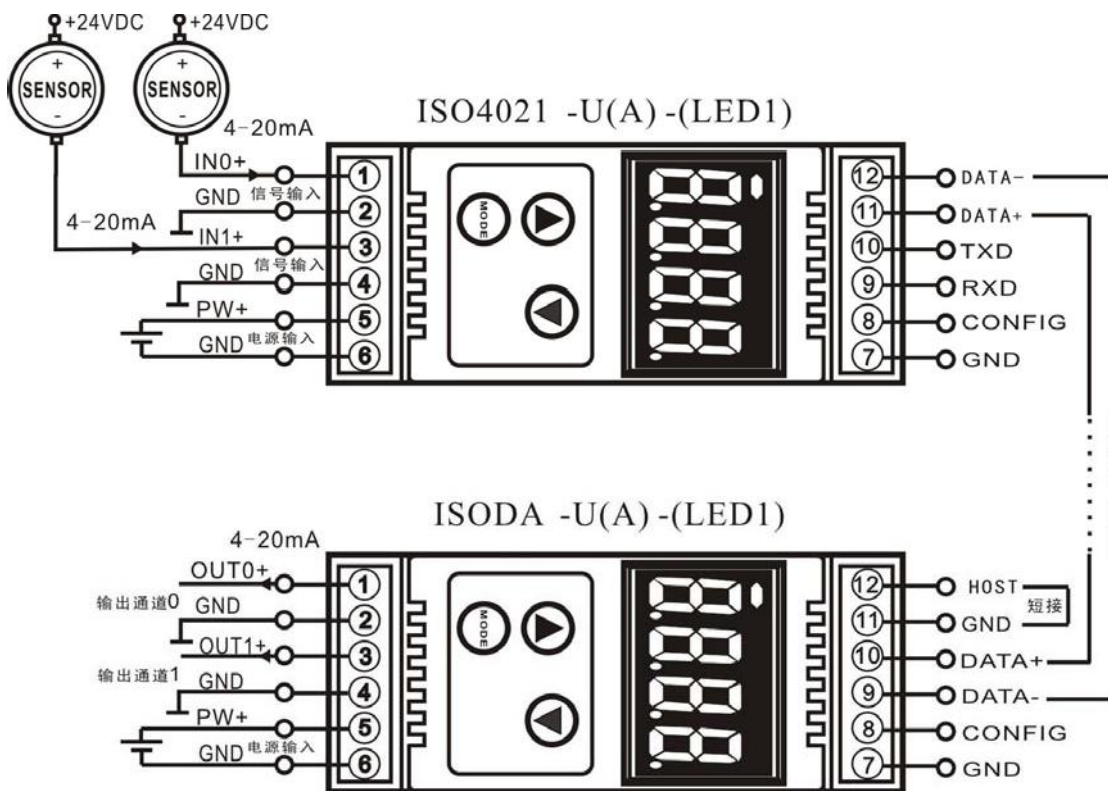


4-20mA转RS232/485
显示控制智能采集器

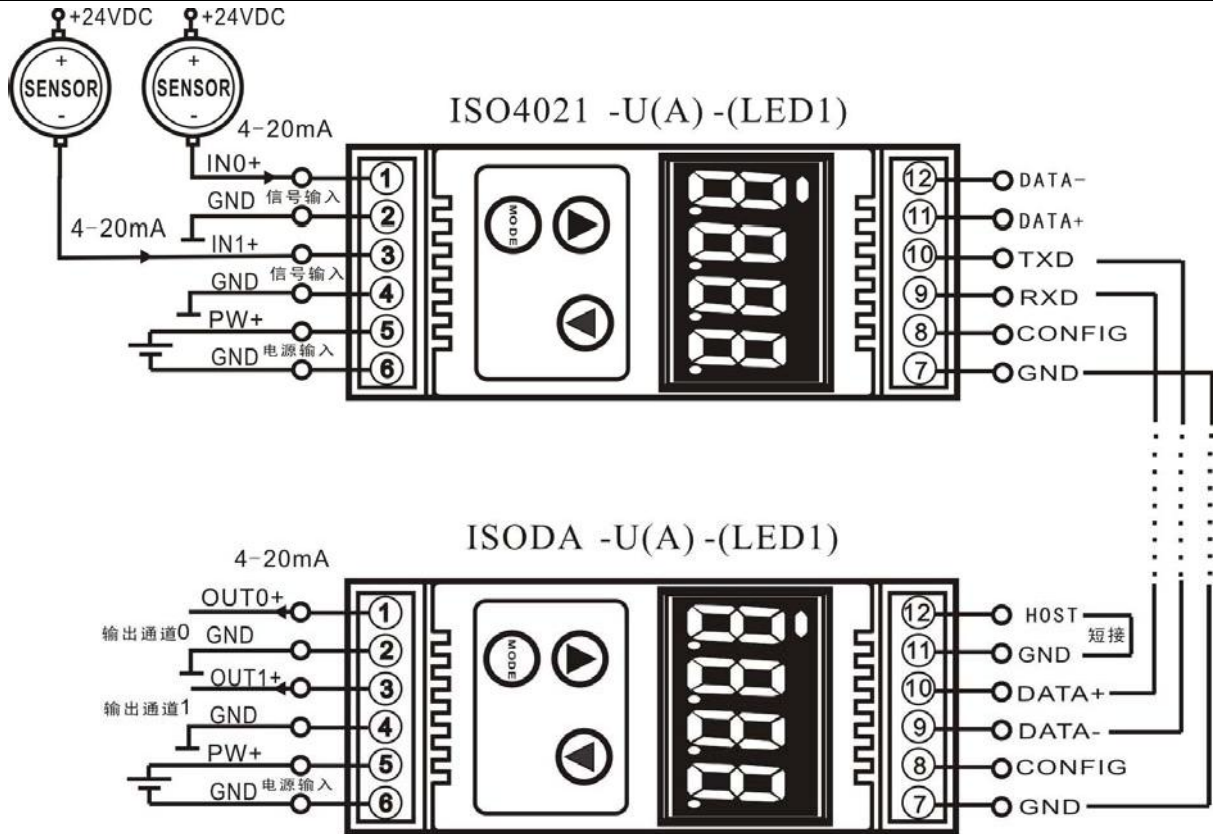
ISO 4021 (AD conversion) and ISO DA (DA conversion) connection typical application diagram



Signal remote transmission application examples



Application wiring diagram of the RS485 communication mode of ISO DA and ISO 4021



Application wiring diagram of the RS232 communication mode of ISO DA and ISO 4021

Initialize ISO 4021 (LED1)

When connecting to the RS-232/RS-485 network, a unique address code must be assigned to the ISO 4021 (LED1) module. The address code is a hexadecimal number and the value is between 0x00 and 0xFF. All new ISO 4021 (LED1) 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. You can modify the address of the ISO 4021 (LED1) module through configuration commands after connecting the power cord of the ISO 4021 (LED1) module and the RS485 communication line. 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 ISO 4021 (LED1) module has a special pin labeled CONFIG. Short-circuit the CONFIG pin to the ground wire (GND pin), then turn on the power supply, and the module enters the configuration state. In this state, the configuration of the module is as follows:

Address code is 00H

Baud rate 9600 bps

Prohibit checksum

ASCII character communication protocol

At this time, the baud rate, checksum status and other parameters of the ISO 4021 (LED1) module can be modified through the configuration command, and the communication protocol can also be selected by setting the communication protocol command of the module. 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.

ISO 4021 (LED1) 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:

A DC voltage/current signal source with stable output and low noise

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 zero point of the ISO 4021 (LED1) module is calibrated when 0 is input, and the full scale is calibrated when 120% of the input full scale.
3. For example, when inputting 4-20mA, input 0mA when calibrating zero point, and input 24mA when calibrating full scale. (For 0-5V input, input 0V when calibrating zero point and 6V when calibrating full scale).
4. Input the zero signal to the channel to be calibrated for the analog input module, usually 0mA or 0V.
5. 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).
6. Input the current or voltage signal of 120% of the full scale to the channel that the analog input module needs to be calibrated.
7. 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).
8. Calibration is complete

Instructions on the use of LED digital tube display

ISO 4021 (LED1) is an analog data acquisition module with display, which displays the acquired analog voltage or current value through a four-digit LED digital tube, which is convenient for users to view the current acquisition value. If the display is not needed, the user can turn off the display by pressing the MODE key. After the display is turned on, two display modes are used, namely single-channel display and multi-channel circular display.

The display data format is: channel number, symbol mark, three data bits; the data bits are divided into integer and decimal parts, separated by decimal points. The first digit from the left is the channel number (1-2). The channel number is followed by a decimal point as a sign bit. If the decimal point is on, it means that the current collected data is positive. If the decimal point is off, it means that the current collected data is negative. The last three digits are the decimal value of the collected data.

Display mode

Switch the display mode through the mode switch button (MODE button). After pressing the mode button, the LED briefly displays C1 to indicate that the current mode is a single-channel display mode, and briefly displays C2 to indicate that the current mode is a multi-channel cyclic display mode.

C1: Single channel display. In this mode, the LED only displays the collected value of one channel at a time (the channel number indicates which channel data is displayed). The two channel switching buttons above the mode key switch the display channel, and the left button is pressed, the displayed channel number is increased by one; after the right button is pressed, the displayed channel number is decreased by one.

C2: Multi-channel cyclic display. In this mode, the LED displays the collected value of each channel in a fixed time interval. If you need to switch the display mode or turn off the display, just press the MODE button.

ASCII character communication protocol

Introduction; when the controller communicates with the ASCII character communication protocol, every 8Bit in a message is transmitted as 2 ASCII characters (such as transmitting digital

34. The ASCII codes 0x33 and 0x34 corresponding to 3 and 4 will be transmitted respectively. The main advantage of this mode 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 ISO 4021B module does not support broadcast addresses, so the host only controls one ISO 4021B module at a time.

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

(Leading code)	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- character
(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- character
(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, the checksum [Checksum] parameter must be attached to both the command and response. 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 first codes of 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.
The command must be in capital letters.**

1、Read all channels acquisition 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) Terminator, 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)**

Explanation: Input yes on the module whose address is 23H (data format is engineering unit):

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) 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)

Explanation: 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. The configuration information is stored in the non-volatile memory EEPROM.

Command syntax: %AANN TTCCFF(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 4021B 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
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Table 3 Data format, checksum code

Bit7: reserved bit, must be set to zero

Bit6: Checksum status, if 0: prohibit; if 1: allow

Bit5-bit2: No, generally set to zero.

Bit1-bit0: Data format bits.

00: (Engineering Units)

01: Percentage of full scale(% of FSR) 10:

16 Base complement(Twos complement)

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

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

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

Parameter description:! Delimiter, which means the command is valid.

? Delimiter, indicating that the command is invalid.

AA represents the target module address

(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 signal will be returned.

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)**

Explanation: % delimiter.
 00 means that the original address of the analog input module you want to configure is 00H.
 11 means that the hexadecimal address of the new module is 11H.
 00 type code, ISO 4021B products must be set to 00.
 06 means 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 keywords.
(cr) Terminator, host computer enter key (0DH).

Response syntax: **!AATTCFF(cr)** command is valid.
?AA(cr) command is invalid or illegal operation.

Parameter description: ! Delimiter.
AA stands for the address of the target module.
TT stands for type code.
CC stands for baud rate coding. **See Table 3 for details**
FF **see Table 4**
(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 **\$302(cr)**

Module response **!300F0600(cr)**

Explanation: ! Delimiter.
 30 means the target module address is 30H.
 00 represents the input type code.
 06 means 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) command is invalid or illegal operation. Parameter description: ! Delimiter, which means the command is valid.

? Delimiter, indicating that the command is invalid.
AA represents the target module address
(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 currents. 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 example: User command **\$2310(cr)**

Module response **!23(cr)**

Explanation: 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) command is valid.

?AA(cr)

command is invalid or illegal operation. Parameter description: ! Delimiter, which means the command is valid.

? Delimiter, indicating that the command is invalid.

AA represents the target module address

(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 input voltages or currents. 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 example: User command **\$2303(cr)**

Module response **!23(cr)**

Explanation: 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) command is valid.

?AA(cr) Invalid command or illegal operation

Parameter description: ! Delimiter, which means the command is valid.

? Delimiter, indicating that the command is invalid.

AA stands for the address of the target module.

(ModuleName) The name of the module can be ISOADA08, ISO 4021B or ISO4014, 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 example: User command **\$08M(cr)**

Module response **!08SYAD02B (cr)**

Explanation: The name of the module whose address is 08H is SYAD02B.

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 module's data acquisition channel command keyword.

V is a hexadecimal number, the bit 1~0 of the corresponding binary expression represents the bit value of channel 1~0

is 0: channel is forbidden Bit value 1: Enable channel (cr) Terminator, host computer enter key (0DH).

Bit value is 0: Disable the channel

Bit value 1: Enable channel

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

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.

5 The 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: **!** Delimiter, which means the command is valid.

? Delimiter, indicating that the command is invalid.

AA stands for the address of the target module.

V is a hexadecimal number, the 1~0 digits of the number represent the 1~0 channel

Bit value is 0: channel is forbidden

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 example: User command **\$186 (cr)**

Module response **!1803(cr)**

Explanation: 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 communication protocol command

11、

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, which 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: **!** Delimiter, which means the command is valid.

? Delimiter, indicating that the command is invalid.

AA stands for 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.

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	7FFFFFFF	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	7FFFFFFF	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	7FFFFFFF	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	7FFFFFFF	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	7FFFFFFF	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	7FFFFFFF	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	7FFFFFFF	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	7FFFFFFF	000000	800000	1LSB
A8: User customized U8: User customized	Engineering unit	+100.00	±000.00	-100.00	0.01%
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFFFF	000000	800000	1LSB

Table 4 Input range and data format

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)**

Explanation: Set the communication protocol to Modbus RTU protocol.

Application example 2: User command **\$00P0(cr)**

Module response **!00 (cr)**

Explanation: 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:

Twos complement

Application examples

1、The input range is $\pm 20\text{mA}$, the output is 4 mA

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

2、The input range is $\pm 10\text{V}$, and the output is 2.5V

Engineering unit	User command	#01(cr)
Percentage of full scale	Module response	>+02.500(cr)
Hexadecimal complement	Module response	>+025.00(cr)
	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: $X/7FFFFFFF=X_{in}/X_f$

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

X_{in}: Indicates the amount of analog signal input by the channel.

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

4. In the voltage input type, X_{in} is the channel voltage input V_{in}, and X_f is the full-scale voltage input.

5. If the input value is 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.

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 slave device is also composed of the Modbus protocol, including the field to confirm the action, any data to be returned, and an error detection field. 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;

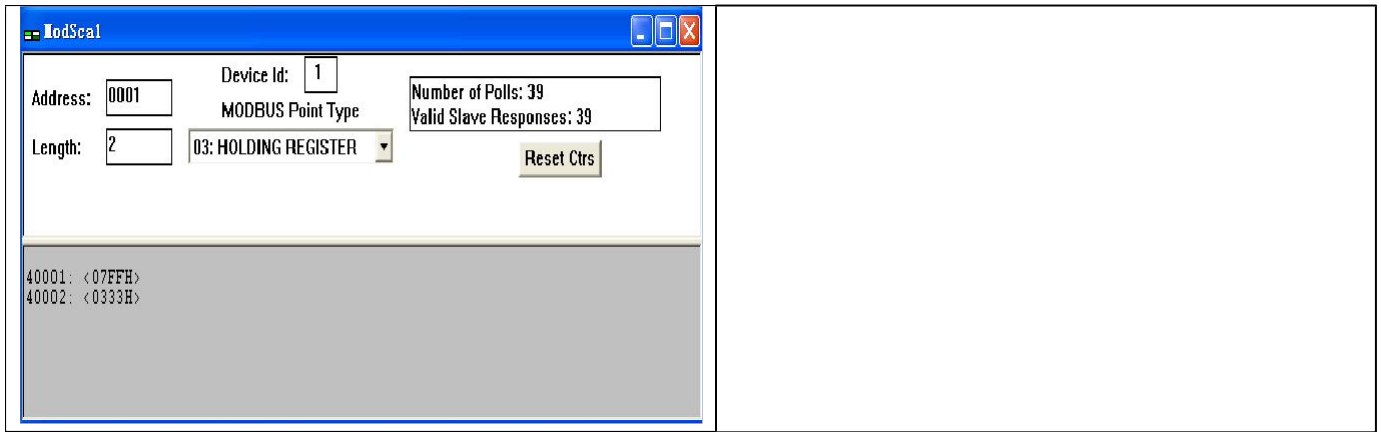
When communicating in RTU mode, each 8-bit byte in the message contains two 4-bit hexadecimal characters. CRC error detection is adopted. The advantage is that at the same baud rate, it can transmit more than ASCII data.

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

Data format comparison between ASCII mode and RTU mode:

	ASCII mode	RTU model
Code system	<ul style="list-style-type: none"> Hexadecimal, ASCII characters 0~9, A~F Each ASCII character in the message is composed of a hexadecimal character 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 1 start bit 7 data bits, the least significant bit is sent first 1 parity bit, no parity, no 1 stop bit (when there is parity), 2 bits (when there is no parity) 	<ul style="list-style-type: none"> 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 bits (when there is no parity)
Error checking area	<ul style="list-style-type: none"> LRC(Vertical lengthy detection) 	<ul style="list-style-type: none"> CRC(Long loop detection)

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



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-circuit the CONFIG pin (pin 3) and GND pin (pin 4).
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 communication address of the module is 00 and the baud rate is 9600.
4. Wait for 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 command to set the communication protocol**), 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 host query under MODBUS RTU

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. of Points Hi	No. of Points 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-order data, 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

Corresponding information such as slave Rx: 01 03 10 19 99 00 00 00 00 0000 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 supported registers through the register information viewed by MODSCAN software:

Address 4X	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	Analog input value of the second channel (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