Two PWM duty cycle signals converted to RS485, Modbus RTU module WJ152

Product features:

- Measure PWM conversion to standard Modbus RTU protocol
- At the same time, it can measure the frequency of PWM
- Support measuring the phase difference between two PWM circuits
- Wide power supply range: 8~32VDC
- High reliability, easy programming, and easy application
- Standard DIN35 rail installation, convenient for centralized wiring
- Users can program module addresses, baud rates, etc

Typical applications:

- Motor PWM signal measurement
- Measurement of PWM signal for servo motor
- PLC signal measurement
- Frequency detection of PWM
- Intelligent factory and industrial Internet of Things
- PWM signal is transmitted remotely to the industrial computer

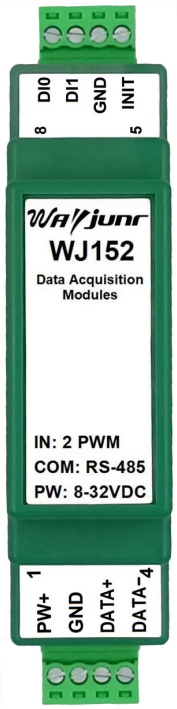


Figure 1 Appearance of WJ152 module

Product Overview:

The WJ152 product implements signal acquisition between sensors and hosts for measuring PWM signals. The WJ152 series products can be applied in RS-485 bus industrial automation control systems, automated machine tools, industrial robots, three coordinate positioning systems, PWM measurement, servo measurement, and more.

The product includes signal acquisition, pulse signal capture, signal conversion, and RS-485 serial communication. Each serial port can connect up to 255 WJ152 series modules, and the communication method adopts ASCII code communication protocol or MODBUS RTU communication protocol. The baud rate can be set by code and can be hung on the same RS-485 bus as control modules from other manufacturers, making it easy for computer programming.

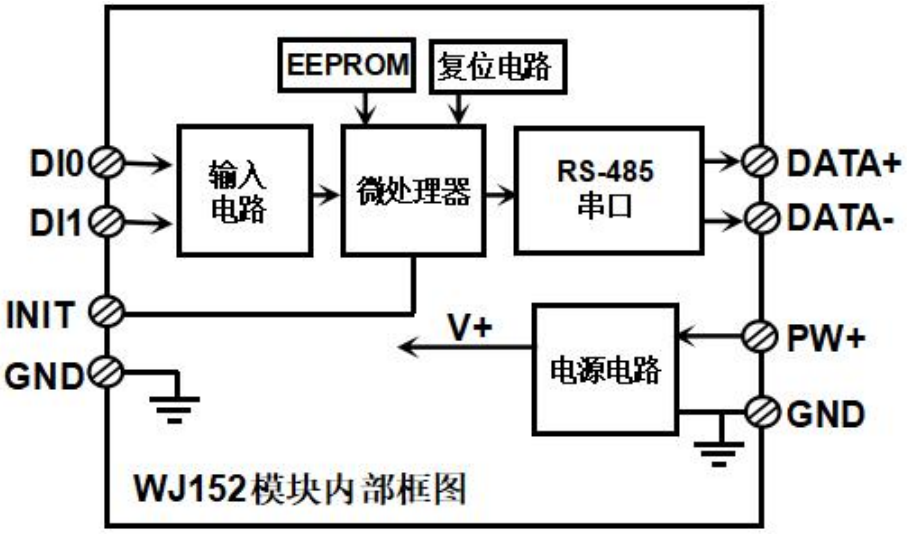


Figure 2 Internal Block Diagram of WJ152 Module

The WJ152 series products are intelligent monitoring and control systems based on microcontrollers. All user set configuration information such as address, baud rate, data format, parity status, etc. are stored in non-volatile memory EEPROM.

The WJ152 series products are designed and manufactured according to industrial standards, with no isolation between signal inputs/outputs, strong anti-interference ability, and high reliability. The working temperature range is -45 ℃ to+85 ℃.

Function Introduction:

The WJ152 remote I/O module can be used to measure 2 PWM signals.

1、 Signal input

2-channel PWM signal input, can be connected to dry contacts and wet contacts, and the input type can be set through commands.

2、 Communication Protocol

Communication interface: 1 standard RS-485 communication interface.

Communication Protocol: Supports two protocols, the character protocol defined by the command set and the MODBUS RTU communication protocol. The module automatically recognizes communication protocols and can achieve network communication with various brands of PLCs, RTUs, or computer monitoring systems.

Data format: 10 digits. 1 start bit, 8 data bits, and 1 stop bit. No verification.

The communication address (0-255) and baud rate (2400, 4800, 9600, 19200, 38400, 57600, 115200bps) can be set; The communication network can reach a maximum distance of 1200 meters and is connected through twisted pair shielded cables.

High anti-interference design of communication interface, ± 15KV ESD protection, communication response time less than 100mS.

3、 anti-interference

Parity check can be set as needed. There is a transient suppression diode inside the module, which can effectively suppress various surge pulses, protect the module, and the internal digital filter can also effectively suppress power frequency interference from the power grid.

Product selection:

WJ152 - □

└ Communication interface

485: Output as RS-485 interface

Selection example: Model: **WJ152-485** indicates an RS-485 interface for output

WJ152 General Parameters:

(Typical @+25 ℃, Vs is 24VDC)

Input type: 2-channel PWM signal input.

Low level: Input<1V

High level: Input 3.5~30V

PWM frequency range 0-10KHz.

Input resistance: 30K Ω

Communication: RS-485 standard character protocol and MODBUS RTU communication protocol

Baud rates (2400, 4800, 9600, 19200, 38400, 57600, 115200bps) can be selected by software

The address (0-255) can be selected by software

Communication response time: 100 ms maximum

Working power supply:+8~32VDC wide power supply range, with internal anti reverse and overvoltage protection circuits

Power consumption: less than 1W

Working temperature: -45~+80 ℃

Working humidity: 10~90% (no condensation)

Storage temperature: -45~+80 ℃

Storage humidity: 10~95% (no condensation)

Dimensions: 106 mm x 59mm x 24mm

Pin definition:

Pin	name	Description	Pin	name	Description
one	PW+	Positive end of power supply	**five**	INIT	Initial state setting
two	GND	Negative end of power supply	**six**	GND	Digital signal output ground
three	DATA+	RS-485 signal positive terminal	**seven**	DI1	PWM signal first input terminal
four	DATA-	RS-485 signal negative terminal	**eight**	DI0	PWM signal input terminal 0

Table 1 Pin Definition

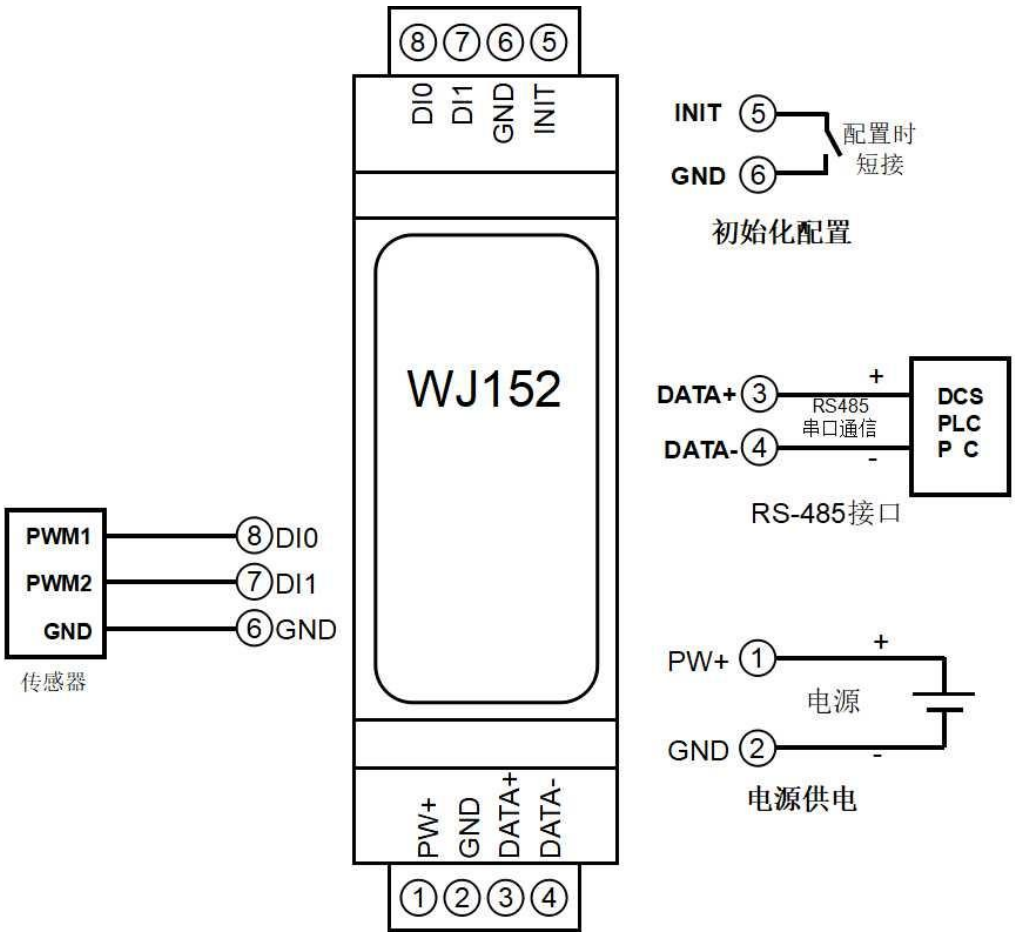


Figure 3 Wiring diagram of WJ152 module

Note: The **factory default is** to **turn off** the **pull-up** function**. If** it **is** an **NPN sensor, dry contact**, **or switch input,** the **internal pull-up** resistor **needs** to be **turned on,** the **40082 register set to 1, or** the **character command** **$01Q1** needs to be **sent**. **Other sensors such as NPN sensors with pull-up resistors, PNP sensors, push-pull sensors, TTL levels, etc. can be used directly. If** you **want** to **turn off** the **internal pull-up resistor, set** the **40082 register to 0 or send** the **character command** **$01Q0**

WJ152 Character Protocol Command Set:

The factory initial settings of the module are as follows:

The address code is 01

Baud rate 9600 bps

No verification

If using an RS-485 network, a unique address code must be assigned, with a hexadecimal value between 00 and FF. Since the address codes of new modules are the same, their addresses will conflict with those of other modules. Therefore, when building the system, you must reconfigure the addresses of each WJ152 module. After connecting the power line and RS485 communication line of the WJ152 module, the address of the WJ152 module can be modified through configuration commands. The baud rate and parity check also need to be adjusted according to the user's requirements.

Method to put the module into default state:

The WJ152 module has a special pin labeled as Initiat. Short circuit the Initiat pin to the GND pin, then turn on the power, and the module will enter the default state. In this state, the configuration of the module is as follows:

The address code is 00

Baud rate 9600 bps

No verification

When unsure of the specific configuration of a module, the Initiat pin can also be short circuited to the GND pin, and then the power can be turned on to put the module into default state, and then the module can be reconfigured.

The character protocol command consists of a series of characters, such as the prefix, address ID, and variables.

Note: In some cases, many commands use the same command format. To ensure that the address you are using is correct in a command, if you use the wrong address that represents another module, the command will take effect in that module, resulting in an error.

2. Commands must be entered in uppercase letters.

1. Read switch status command

Description: Read back the switch status of all DI input channels from the module.

Command format: **# AA**

Parameter description: # delimiter. Hexadecimal is 23H

AA module address, with a value range of 00 to FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

Response format:>**CC (cr)** command is valid.

? The **01 (cr)** command is invalid or an illegal operation.

Parameter description:>delimiter. Hexadecimal is 3EH

CC represents the read DI input switch status, consisting of 2 numbers arranged in the order of DI1 and DI0,

Value 0: Input low level; Value 1: Input high level

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Application example: User command (character format) **# 01**

Module response (character format)**>01 (cr)**

Explanation: The input switch status of the module is **01**, and the arrangement order is DI1, DI0

DI0: High level DI1: Low level

2. Read PWM value command for DI input

Explanation: Reading the PWM value of DI input can read all channels or a single channel.

Command format: **# AA5**

AA module address, with a value range of 00 to FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

5 represents the PWM command for reading DI0~DI1 inputs. Arrange in order DI0, DI1.

Response format:**! AAA.AA, AAA.AA (cr)**

Command format: **# AA5N**

N represents the PWM value of channel N. N value: 01, corresponding to DI0~DI1

Response format:**! AAA.AA(cr)**

Application Example 1: User Command (Character Format) **# 015**

Module response (character format)**! 050.00, 050.00 (cr)**

Explanation: The PWM value for all channels is 50%.

Application Example 2: User Command (Character Format) **# 0151**

Module response (character format)**! 080.00(cr)**

Explanation: The PWM value of channel DI1 is 80%.

3. Read DI input frequency command

Explanation: The frequency of the input can be read for all channels or for a single channel.

Command format: **# AA6**

AA module address, with a value range of 00 to FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

6 represents the input frequency command for channels DI0 to DI1.

Response format:**! AAAAAA.AA,AAAAAA.AA (cr)**

Command format: **# AA6N** read channel N input frequency.

N represents the frequency command for reading channel N. N value: 01, corresponding to DI0~DI1

Response format:**! AAAAAA.AA (cr)**

Application Example 1: User Command (Character Format) **# 016**

Module response (character format)**! 001000.00,001000.00 (cr)**

Explanation: The input frequency value for all channels is 1KHz.

Application example 2: User command (character format) **# 0160 (cr)**

Module response (character format)**! 001000.00(cr)**

Explanation: The input frequency value of channel DI0 is 1KHz.

4. Read the phase difference command between two DI channels

Explanation: Reading the phase difference between two DI inputs is only valid when the two DI inputs have the same frequency.

Command format: **# AA7**

AA module address, with a value range of 00 to FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

7 represents the command to read the phase difference between two DI inputs.

Response format:**! AAA. AA (cr)** range 0-360 ° represents the angle of phase difference.

Application example: User command (character format) **# 017 (cr)**

Module response (character format)**! 090.00(cr)**

Explanation: The phase difference between the two DI inputs is 90 °.

5. Set the pull-up switch for DI

Explanation: Set the pull-up switch of DI to the factory default value of 0 (DI turns off the pull-up function).

Command format: **$01QX**

Parameter description: **Q** sets the pull-up switch command for DI.

X 0: DI turns off the pull-up voltage; 1: Connect the pull-up voltage to DI.

Response format:**! 01 (cr)** indicates successful setting

Application example: User command (character format) **$01Q1**

Module response (character format)**! 01(cr)**

Explanation: Set the pull-up voltage for DI connection. When DI is an NPN input, it can be set to turn on the DI pull-up voltage.

6. Configure WJ152 module command

Explanation: Set the address, baud rate, and parity for a WJ152 module. The configuration information is stored in non-volatile memory EEPROM.

Command format:**% AANNTTCCFF**

Parameter description:**%** delimiter.

AA module address, with a value range of 00 to FF (hexadecimal).

NN represents the new module hexadecimal address, with values ranging from 00 to FF.

TT uses hexadecimal to represent type encoding. The WJ152 product must be set to 00.

CC uses hexadecimal to represent baud rate encoding.

Baud rate code	Baud rate
04	2400 baud
05	4800 baud
06	9600 baud
07	19200 baud
08	38400 baud
09	57600 baud

Table 2 Baud rate codes

FF uses 8 bits in hexadecimal to represent parity check.

00: No verification

10: Odd verification

20: Even verification

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

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

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

? The delimiter indicates that the command is invalid.

AA represents the input module address

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Other instructions: If you are configuring the module for the first time, AA=00, NN equals the new address.

If the format is incorrect, the communication is incorrect, or the address does not exist, the module will not respond.

Application example: User command**% 0011000600**

Module response**! 11(cr)**

Explanation:**%** delimiter.

00 means that the original address of the WJ152 module you want to configure is 00H.

11 indicates that the new module's hexadecimal address is 11H.

00 type code, WJ152 product must be set to 00.

06 represents a baud rate of 9600 baud.

00 indicates no verification.

7. Read configuration status command

Explanation: Read configuration for a specified WJ152 module.

Command format: **$AA2**

Parameter description: **$**delimiter.

AA module address, with a value range of 00 to FF (hexadecimal).

2 represents the command to read the configuration status

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

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

? The **AA (cr)** command is invalid or an illegal operation.

Parameter description:**!** Boundary symbol.

AA represents the input module address.

TT stands for type code.

CC stands for baud rate encoding. See Table 2

FF represents verification

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Other instructions: If the format is incorrect, the communication is incorrect, or the address does not exist, the module will not respond.

Application example: User command **$012**

Module response**! 01000600(cr)**

Explanation:**!** Boundary symbol.

01 indicates that the WJ152 module address is 01H.

00 represents the input type code.

06 represents a baud rate of 9600 baud.

00 indicates no verification.

8. Reset all parameters set by the above character command to factory settings.

Explanation: The parameters set by the above character commands in the module will be reset to factory settings, and the

module will automatically restart after completion.

Command format: **$AA900** Set parameters to factory settings.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Response format:**! AA (cr)** indicates successful setup, and the module will automatically restart.

Application example: User command (character format) **$01900**

Module response (character format)**! 01(cr)**

Explanation: Parameters are reset to factory settings.

Modbus RTU communication protocol:

The factory initial settings of the module are as follows:

The Modbus address is 01

Baud rate 9600 bps

Data format: 10 digits. 1 start bit, 8 data bits, and 1 stop bit. No verification.

Method to put the module into default state:

The WJ152 module has a special pin labeled as Initiat. Short circuit the Initiat pin to the GND pin, then turn on the power, and the module will enter the default state. In this state, the module temporarily returns to its default state: address 01, baud rate 9600. When unsure of the specific configuration of a module, users can query the address and baud rate registers 40201-40202 to obtain the actual address and baud rate of the module, or modify the address and baud rate as needed.

Supports Modbus RTU communication protocol, with command format following the standard Modbus RTU communication protocol.

Register **Address Description for WJ152**

Supports registers with function codes 03, 06, and 16

Address 4X (PLC)	**Address (PC, DCS)**	**Data content**	**attribute**	**Data Explanation**
forty thousand and one	0	PWM input for channel DI0	read-only	The measured PWM value, 16 bit integer, range 0~10000 Indicating PWM duty cycle 0%~100%
forty thousand and two	one	PWM input of channel DI1	read-only	
forty thousand and three	two	Frequency of channel DI0 input	read-only	The input PWM frequency is a 16 bit unsigned integer, Unit Hz
forty thousand and four	three	Frequency of channel DI1 input	read-only	
40005~40006	4~5	Frequency of channel DI0 input	read-only	Input PWM frequency, 32-bit floating-point number, The storage order is CDAB. Unit Hz If floating-point numbers are not supported and integers need to be read, please refer to registers 40003 and 40004
40007~40008	6~7	Frequency of channel DI1 input	read-only	
forty thousand and nine	eight	Level status of channel DI0	read-only	0 represents a low-level input, 1 represents a high-level input
forty thousand	nine	Level status of	read-on	

and ten		channel DI1	ly	
forty thousand and eleven	ten	Phase difference between channels	read-only	16 bit integer, ranging from 0 to 3600, representing the angle of phase difference from 0 to 360.0 degrees. The data is only valid when the two DI inputs have the same frequency.
forty thousand and eighty-two	eighty-one	DI's pull-up switch	Read/ Write	0: DI turns off the pull-up voltage; (default value is 0) 1: Connect the pull-up voltage to DI.
forty thousand and eighty-nine	eighty-eight	Parameter reset to factory settings	Read/ Write	If set to FF00, all register parameters of the module will be restored to factory settings, and the module will automatically restart after completion
forty thousand two hundred and one	0200	Module address	Read/ Write	Integer, effective after restart, range 0x0000-0x00FF
forty thousand two hundred and two	0201	Baud rate	Read/ Write	Integer, effective after restart, range 0x0004-0x000A 0x0004 = 2400 bps， 0x0005 = 4800 bps 0x0006 = 9600 bps， 0x0007 = 19200 bps 0x0008 = 38400 bps， 0x0009 = 57600 bps 0x000A = 115200bps
forty thousand two hundred and three	two hundred and two	Parity check	Read/ Write	Integer, takes effect after restart 0: No verification 1: Odd verification 2: Even verification
forty thousand two hundred and eleven	0210	Module Name	read-only	High position: 0x01 Low position: 0x52

Table 5 Modbus Rtu Register Description

Communication example 1: If the module address is 01, send **010300100002C5CE** in hexadecimal to retrieve the data from the register.

01	03	00	ten	00	02	C5	CE
Module address	Read and hold register	Register Address High Bit	Low bit register address	Register quantity high	Low register quantity	CRC check low bit	CRC check high bit

If the module replies: **010304CA90FFFFC476**, the read data is 0xFFFCA90, which is converted to decimal as -13680, indicating that the current count value of DI0 is -13680.

01	03	04	CA	ninety	FF	FF	C4	seventy-six
Module address	Read and hold register	The number of bytes in the data	Data 1 high position	Data 1 Low Bit	Data 2 high bit	Data 2 Low Bit	CRC check low bit	CRC check high bit

Communication example 2: If the module address is 01, send **010300200002C5C1** in hexadecimal to retrieve the data from the register.

01	03	00	twenty	00	02	C5	C1
Module address	Read and hold register	Register Address High Bit	Low bit register address	Register quantity high	Low register quantity	CRC check low bit	CRC check high bit

If the module replies: 010304CA90FFFFC476, the read data is 0xFFFCA90, which is converted to decimal as 4294953616 , indicating that the current count value of channel DI0 is 4294953616.

01	03	04	CA	ninety	FF	FF	C4	seventy-six
Module address	Read and hold register	The number of bytes in the data	Data 1 high position	Data 1 Low Bit	Data 2 high bit	Data 2 Low Bit	CRC check low bit	CRC check high bit

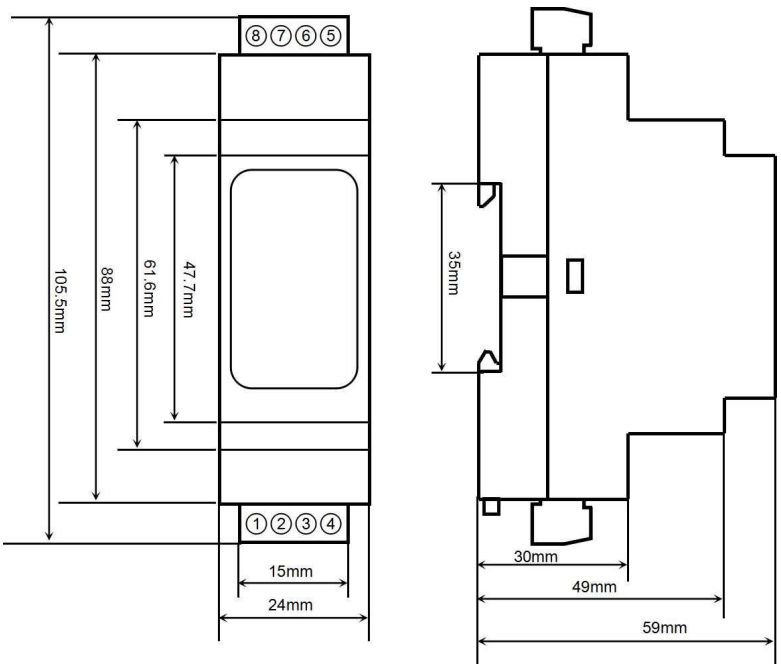
Communication example 3: If the module address is 01, send in hexadecimal: **01060043000AF819**, which means reset the count value of DI0.

01	06	00	forty-three	00	0A	F8	nineteen
Module address	Write a single hold register	Register Address High Bit	Low bit register address	data-high	data-low	CRC check low bit	CRC check high bit

If the module replies: 01060043000AF819, it means the setting is successful, and the count value of DI0 is changed to 0.

01	06	00	forty-three	00	0A	F8	nineteen
Module address	Write a single hold register	Register Address High Bit	Low bit register address	data-high	data-low	CRC check low bit	CRC check high bit

Dimensions: (Unit: mm)



Can be installed on standard DIN35 rails

guarantee:

Within two years from the date of sale, if the user complies with the storage, transportation, and usage requirements and the product quality is lower than the technical specifications, it can be returned to the factory for free repair. If damage is caused due to violation of operating regulations and requirements, device fees and maintenance fees shall be paid.

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