

LS129 Digital Probe Communication Protocol (Customer) V3.2

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I. Introduction to MODBUS communication protocol

1.1 Hardware parameters

- Hardware uses RS-485, master-slave half-duplex communication, central-switch calling system and switch-central answering communication.
- There are 10 bits, 1 start bit, 8 data bits and 1 stop bit. There is no verification.
- Factory default: Baud rate 9600 bps; station number 1.

1.2 Communication function code 03H, 04H (read register value)

- Note: In this protocol, the 03H and 04H function codes are in common use

- **Host transmit:**

1	2	3	4	5	6	7	8
ADR	03H	Start register high byte	Start register low byte	Register number high byte	Register number low byte	CRC low byte	CRC high byte

- 1st byte ADR : Slave address code (1 ~ 254)
- 2nd byte 03H : Read register value function code
- 3rd and 4th bytes : Register start address to be read
- 5th and 6th bytes : Register number to be read
- 7th and 8th bytes : The CRC16 checksum from byte 1 to 6

- **When the slave receives correctly, the slave returns:**

1	2	3	4、5	6、7	...	M-1、M	M+1	M+2
ADR	03H	The total number of bytes	Register data 1	Register data 2	...	Register data M	CRC low byte	CRC high byte

- 1st byte ADR : Slave address code (= 001 ~ 254)
- 2nd byte 03H : Return to read function code
- 3rd byte : The total number of bytes from 4 to M (including 4 and M)
- 4th and M bytes : Register data
- M + 1, M + 2 bytes : The CRC16 checksum from byte 1 to M

- **When the slave receives an error, the slave returns:**

1	2	3	4	5
ADR	83H	Information code	CRC low byte	CRC high byte

- 1st byte ADR : Slave address code (= 001 ~ 254)
- 2nd byte 83H : Read register value error

3rd byte information code : See information code table
 Byte 4 and 5 : The CRC16 checksum from byte 1 to 3

1.3 Communication function code 10H (write register value)

● **Host transmit:**

1	2	3	4	5	6	7
ADR	10H	Start register high byte address	Start register low byte address	Register the number of high bytes	Register the number of low bytes	Total number of data bytes

8,9	10,11	N,N+1	N+2	N+3
Register data 1	Register data 2	Register data M	CRC code low byte	CRC code high byte

● **When the host receive correctly, the slave returns:**

1	2	3	4	5	6	7	8
ADR	10H	Register high byte address	Register low byte address	Register number high bytes	Register number low bytes	CRC code low byte	CRC code high byte

● **When the host receives an error, the slave returns:**

1	2	3	4	5
ADR	90H	Error message code	CRC low byte	CRC high byte

1st byte ADR : Slave address code (= 001 ~ 254)
 2nd byte 90H : Read register value error
 3rd byte wrong information code : See information code table
 Byte 4 and 5 : The CRC16 checksum from byte 1 to 3

1.4 Communication function code 06H (write a single register value)

● **Host transmit:**

1	2	3	4	5	6	7	8
ADR	06H	Register high byte address	Register low byte address	Register number high bytes	Register number low bytes	CRC code low byte	CRC code high byte

● ***When the host receive correctly, the slave returns:***

1	2	3	4	5	6	7	8
ADR	06H	Register high byte address	Register low byte address	Register number high bytes	Register number low bytes	CRC code low byte	CRC code high byte

● ***When the host receives an error, the slave returns:***

1	2	3	4	5
ADR	86H	Error message code	CRC low byte	CRC high byte

- 1st byte ADR : Slave address code (= 001 ~ 254)
 2nd byte 86H : Read register value error
 3rd byte wrong information code : See information code table
 Byte 4 and 5 : The CRC16 checksum from byte 1 to 3

1.5 Broadcast command

The slave address “0” is broadcast command

II. Instructions of digital probe

1. LS129 UVA digital probe supports standard MODBUS protocol, and the default communication address is "1". The probe communication address can be modified by "human-computer interface debugging tool" or communication protocol. The address setting range is 1-247.
2. In order to facilitate the customer to communicate with the host computer (PC) or PLC communication, the station number and Baud rate of digital probe can be set by debugging human-computer interface settings or communication protocol.
3. The instrument provides Float type and uint16 type data for the optical power value. The float type data also provides two decoding modes, "2-3412" and "0-1234". Developers can choose any type according to actual needs. View "**Controller address mapping table**" for register address.

III. Register address mapping table

- Out of considerations for compatibility and convenience, mapping of different formats with various addresses are made for the same datum. Please read as needed.
- The instrument provides two decoding modes for float data, "2-3412" and "0-1234" corresponding to register addresses 1-2 and 101-102, respectively.
- Concerning optical power value represented by float type, a data needs 4 bytes. So that the contents of the two registers are a variable. For example, registers 1 and 2 represent a value.

Table 1: Address of 2-3412 decoding process

Register address	Type	Data content	Instruction
1	Read only	Floating point power value (Real-time value)	Float, "2-3412" decoding
2	Read only	Floating point power value (Real-time value)	Float, "2-3412" decoding
3	Read only	Floating point power value (Maximum)	Float, "2-3412" decoding
4	Read only	Floating point power value (Maximum)	Float, "2-3412" decoding
5	Read only	Floating point energy value	Float, "2-3412" decoding
6	Read only	Floating point energy value	Float, "2-3412" decoding

Table 2: 0-1234 decoding process address:

Register address	Type	Data content	Instruction
101	Read only	Floating point power value (Real-time value)	Float, "0-1234" decoding
102	Read only	Floating point power value (Real-time value)	Float, "0-1234" decoding
103	Read only	Floating point power value (Maximum)	Float, "0-1234" decoding
104	Read only	Floating point power value (Maximum)	Float, "0-1234" decoding
105	Read only	Floating point energy value	Float, "0-1234" decoding
106	Read only	Floating point energy value	Float, "0-1234" decoding

Table 3: Address represented by optical power value short int:

Register address	Type	Data content	Instruction
201	Read only	Integer power value (Real-time value)	Uint16, no decimal

202	Read only	Integer power value (Real-time value)	Uint16, no decimal
203	Read only	Integer energy value	Uint32, no decimal, “0-1234” decoding
204	Read only	Integer energy value	Uint32, no decimal, “0-1234” decoding

Note:

- The data of address 201-202 register is un-signed 16-bit integer data and no decimal. Such as the 1996 data represents the optical power value is 1996.
- The data of address 203-204 register is unsigned 32-bit integer data and no decimal. Such as the 1996 data represents the energy value is 1996.

Table 4: Address represented by optical power value long int:

Register address	Type	Data content	Instruction
401	Read only	Integer power value (Real-time value)	Uint32, no decimal, “0-1234” decoding
402	Read only		
403	Read only	Integer power value (Real-time value)	Uint32, no decimal, “0-1234” decoding
404	Read only		
405	Read only	Integer energy value	Uint32, no decimal, “0-1234” decoding
406	Read only		

3.1 “2-3412” and “0-1234” decoding instruction

Based on IEEE754 standard, 123.4567 of float amount will be represented by 0x42F6E9D5 in hexadecimal.

Byte number	1	2	3	4
Byte data	0x42	0xF6	0xE9	0xD5

3412 is the transmission order of “2-3412” decoding data. 1234 is the transmission order of “0-1234” decoding data.

Example: Read the real-time power, maximum power and energy of probe 1. The slave address of controller is 1.

A: The code of reading “2-3412” decoding data is as follows:

- Read the data using 03H code

Send source code -> 01 03 00 01 00 06 94 08

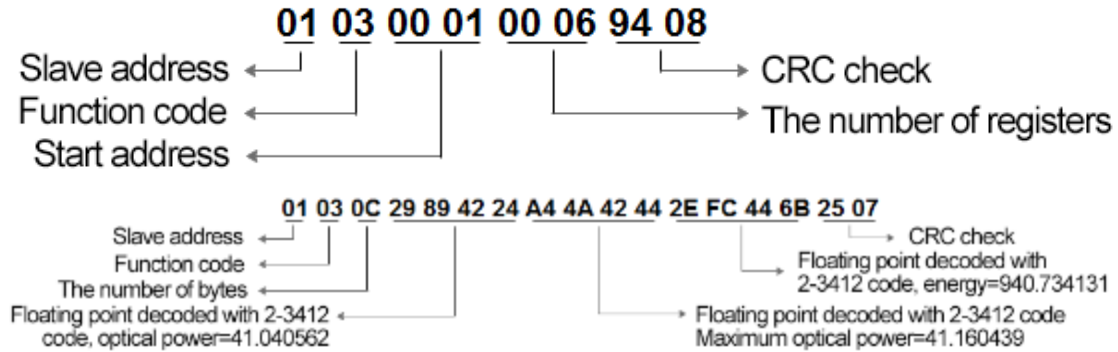
Receive source code -> 01 03 0C 29 89 42 24 A4 4A 42 44 2E FC 44 6B 25 07

● Read the data using 04H code

Send source code -> 01 04 00 01 00 06 21 C8

Receive source code -> 01 04 0C 29 89 42 24 A4 4A 42 44 2E FC 44 6B 23 C0

The code has the following meaning:



B: The code of reading “0-1234” decoding data is as follows:

● Read the data using 03H code

Send source code ->01 03 00 65 00 06 D5 D7

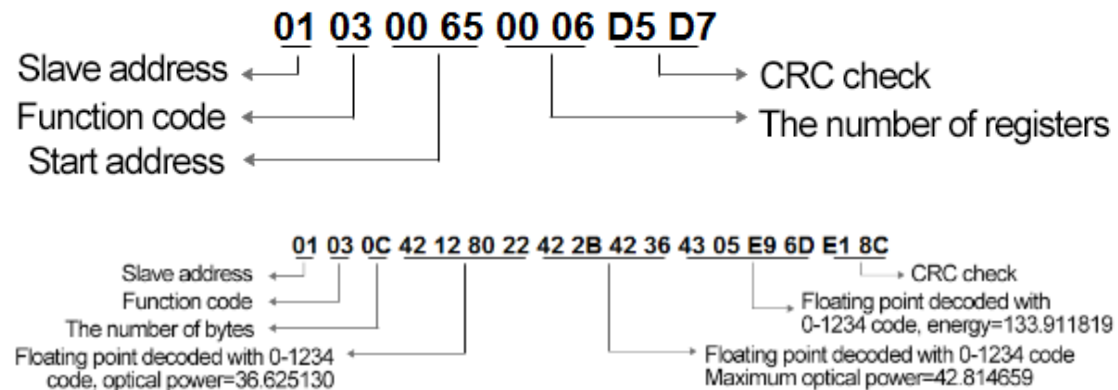
Receive source code->01 03 0C 42 12 80 22 42 2B 42 36 43 05 E9 6D E1 8C

● Read the data using 04H code

Send source code ->01 04 00 65 00 06 60 17

Receive source code->01 04 0C 42 12 80 22 42 2B 42 36 43 05 E9 6D E7 4B

The meaning of the code is:



3.2 Example of reading unsigned integer real-time power values decoding

- Read the data using 03H code

Send source code->01 03 00 C9 00 04 94 37

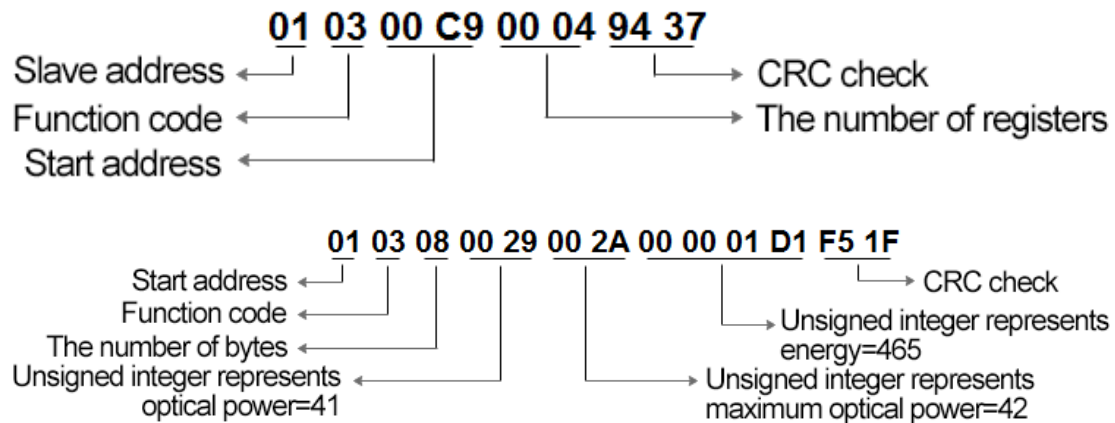
Receive source code-> 01 03 08 00 29 00 2A 00 00 01 D1 F5 1F

- Read the data using 04H code

Send source code->01 04 00 C9 00 04 21 F7

Receive source code-> 01 04 08 00 29 00 2A 00 00 01 D1 44 C5

Meaning of the code is:



3.3 Example of reading unsigned long integer real-time power values decoding

- Read the data using 03H code

Send source code->01 03 01 91 00 06 95 D9

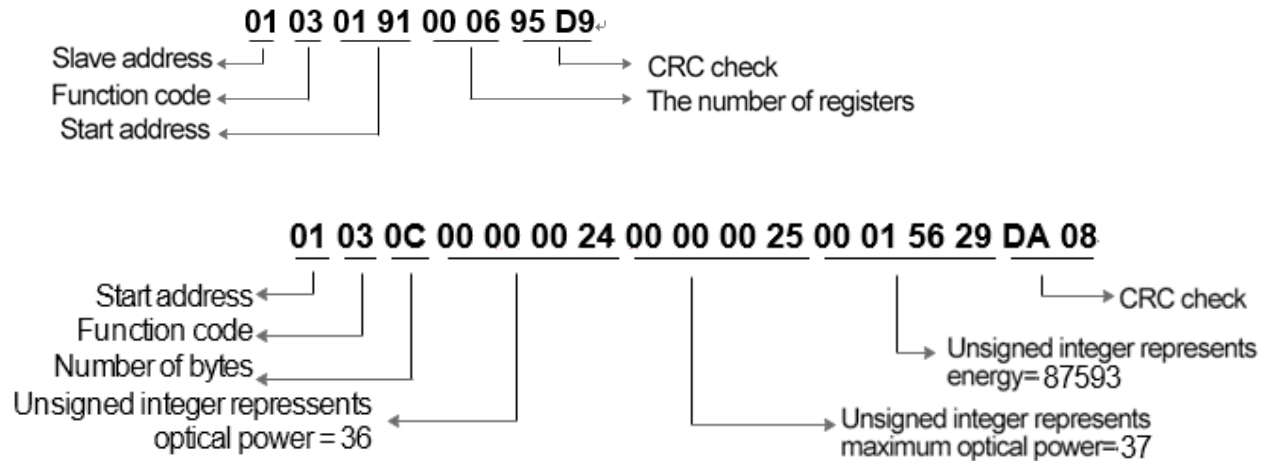
Receive source code->01 03 0C 00 00 00 24 00 00 00 25 00 01 56 29 DA 08

- Read the data using 04H code

Send source code->01 04 01 91 00 06 20 19

Receive source code->01 04 0C 00 00 00 24 00 00 00 25 00 01 48 4F 55 45

Meaning of the code:



IV. Recount Instruction

The maximum power value and energy value are calculated in a certain measurement period. After each measurement period, the probe needs to be sent the recount instruction, and the probe starts to recount after receiving the instruction.

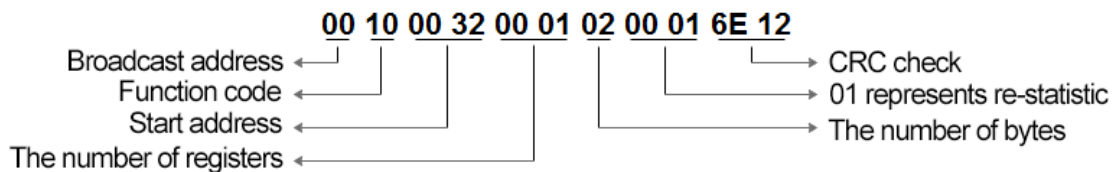
- Send the recount instruction using the 06H / 10H function code.
- Support broadcast command, one instruction recounts all probes in one link.

Register address	Type	Data content	Instruction
50	Write	Execute recount instruction	uint16, 1—Execute recount instruction The other values do not perform a recalculation instruction, and the probe is recalculated each time the instruction is sent

4.1 Example of sending a re-statistic command using a broadcast command

Send source code->00 10 00 32 00 01 02 00 01 6E 12

Meaning of the code is:

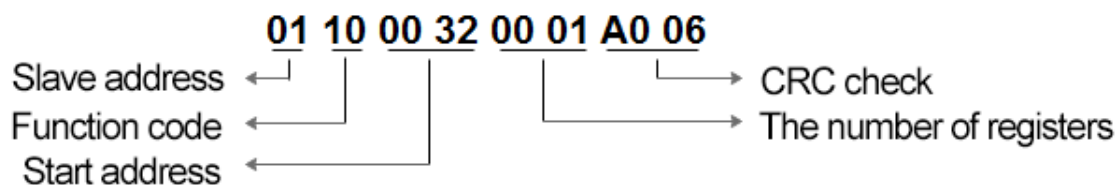
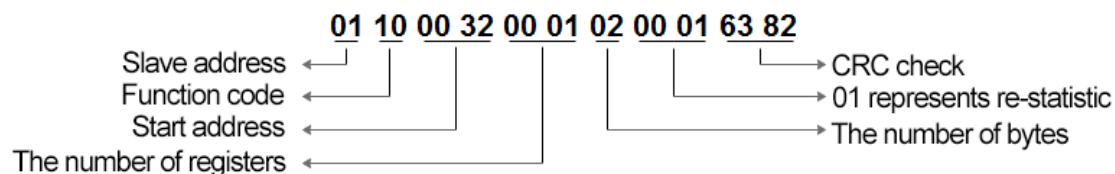


4.2 Example of performing re-statistics on probe 1 using the 10H code

Send source code->01 10 00 32 00 01 02 00 01 63 82

Receive source code-> 01 10 00 32 00 01 A0 06

Meaning of the code is:

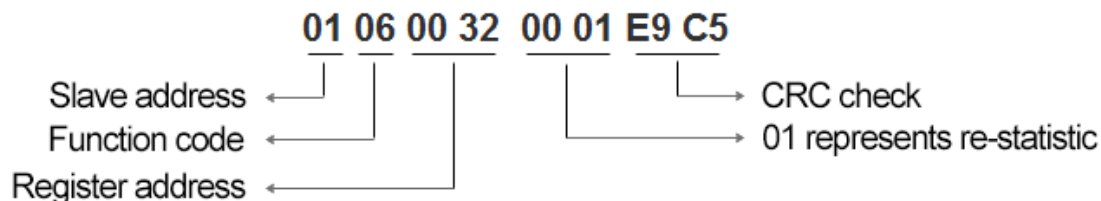


4.3 Example of performing re-statistics on probe 1 using the 06H code

Send source code->01 06 00 32 00 01 E9 C5

Receive source code-> 01 06 00 32 00 01 E9 C5

Meaning of the code is:



V. Smoothing Setting

If the UV lamp is powered with alternating current, the frequency of alternating current will influence the irradiance measurement. Thus, the smooth processing is needed.

0: need to be set if the UV lamp is powered with direct current and no need smooth processing

1: need to be set if frequency of the alternating current is 50HZ

2: need to be set if frequency of the alternating current is 60HZ

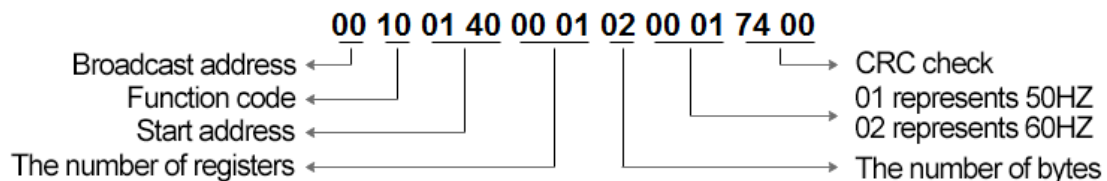
- Send smooth setting instructions using the 06H/10H function code
- Support broadcast commands, smooth setting for all probes in a link using one instruction

Register address	Type	Data content	Instruction
320	Read and write	Smoothing setting	uint16, 0—No smoothing 1—50HZ smoothing (default) 2—60HZ smoothing

5.1 Example of 50HZ smoothing Settings for all probes of a link using the broadcast command

Send source code->00 10 01 40 00 01 02 00 01 74 00

Meaning of the code is:

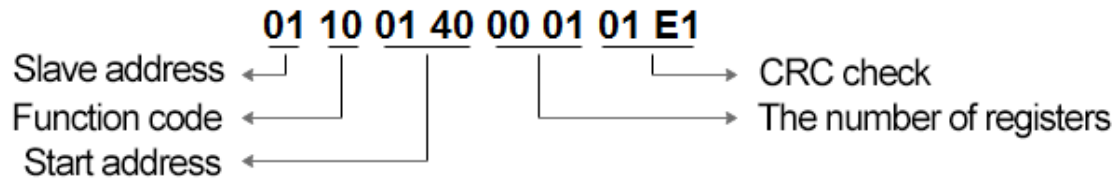
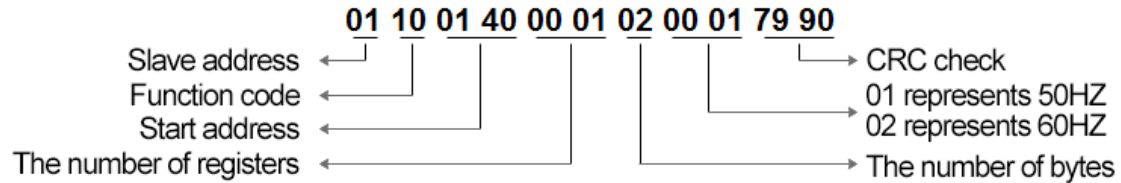


5.2 Example of 50HZ smoothing settings for probe 1 using the 10H code

Send source code->01 10 01 40 00 01 02 00 01 79 90

Receive source code-> 01 10 01 40 00 01 01 E1

Meaning of the code is:

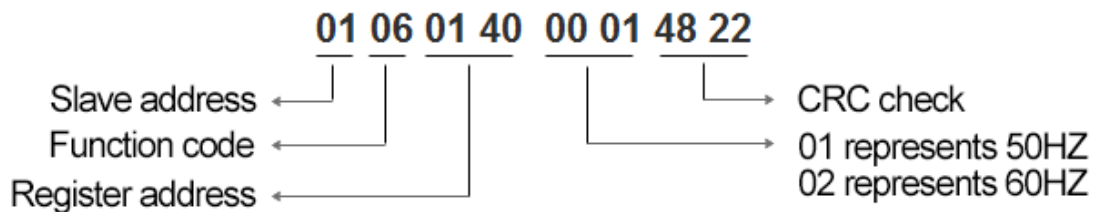


5.3 Example of 50HZ smoothing settings for probe 1 using the 06H code

Send source code->01 06 01 40 00 01 48 22

Receive source code-> 01 06 01 40 00 01 48 22

Meaning of the code is:



VI. Station number and baud rate settings

- The station number (controller address) and baud rate of digital probe are set by function code

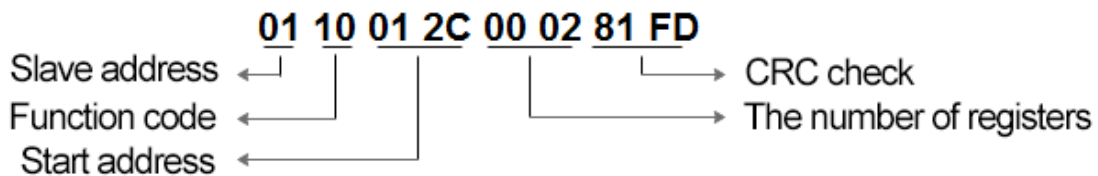
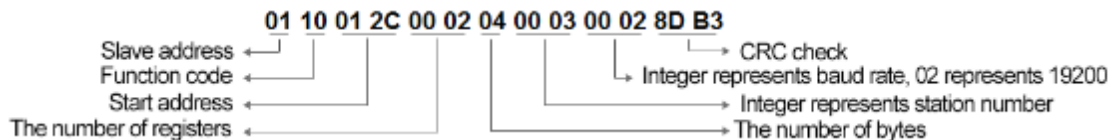
Register address	Type	Data content	Instruction
300	Read and write	RS485 station number	uint16, 16-bit integer data, range (1-247)
301	Read and write	RS485 baud rate	uint16, 0 for 4800, 1 for 9600, 2 for 19200, 3 for 38400

Example: The station number and baud rate of the probe are set using the 10H code, suppose the station number is 3 and the baud rate is 19200

Send source code->01 10 01 2C 00 02 04 00 03 00 02 8D B3

Receive source code-> 01 10 01 2C 00 02 81 FD

Meaning of the code is:

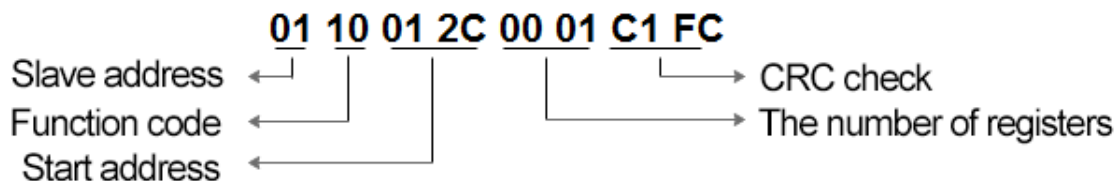
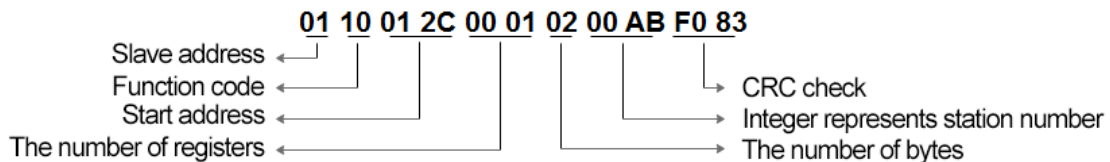


Example: Set the station number of the probe using the 10H code, suppose the station number needs to be set to 171

Send source code->01 10 01 2C 00 01 02 00 AB F0 83

Receive source code-> 01 10 01 2C 00 01 C1 FC

Meaning of the code is:

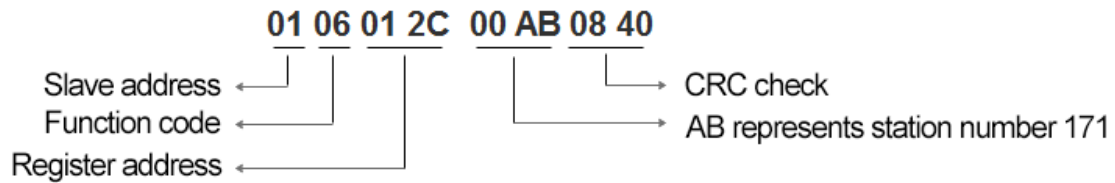


Example: Set the station number of the probe using the 06H code, suppose the station number needs to be set to 171

Send source code->01 06 01 2C 00 AB 08 40

Receive source code-> 01 06 01 2C 00 AB 08 40

Meaning of the code is:

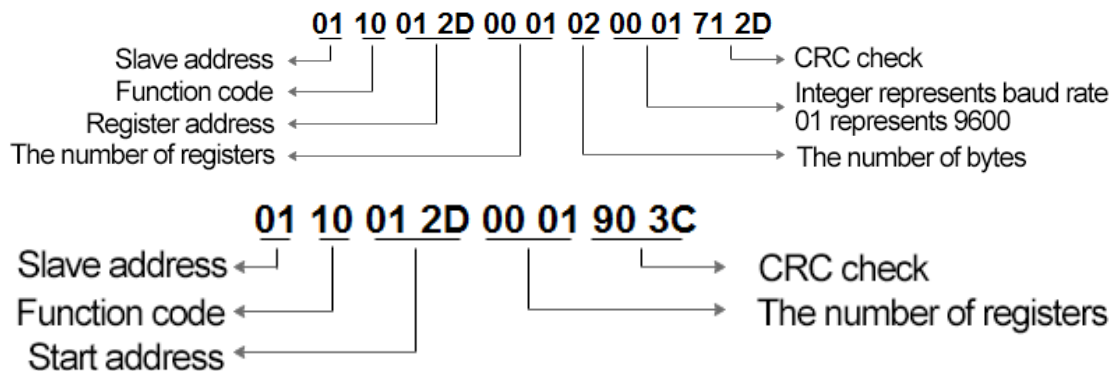


Example: Set the baud rate of the probe using the 10H code, suppose the baud rate needs to be set to 9600

Send source code->01 10 01 2D 00 01 02 00 01 71 2D

Receive source code-> 01 10 01 2D 00 01 90 3C

Meaning of the code is:

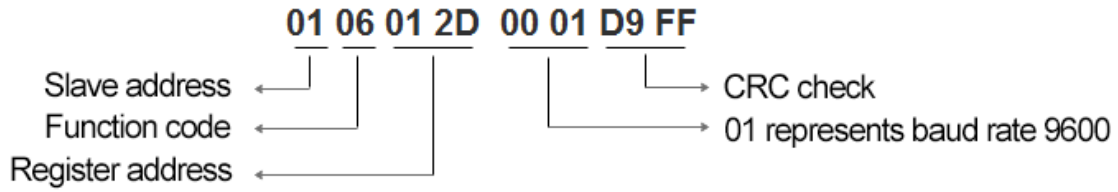


Example: Set the station number of the probe using the 06H code, suppose the baud rate needs to be set to 9600

Send source code->01 06 01 2D 00 01 D9 FF

Receive source code-> 01 06 01 2D 00 01 D9 FF

Meaning of the code is:



VII. Communication reply delay setting

If the communication device reply speed is too fast, resulting in code loss, you can set the communication reply delay.

- Send Communication reply delay instructions using 06H/10H function code

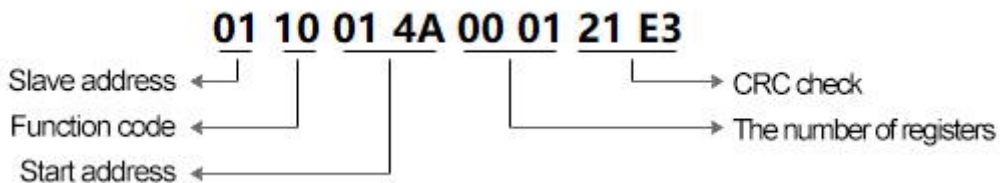
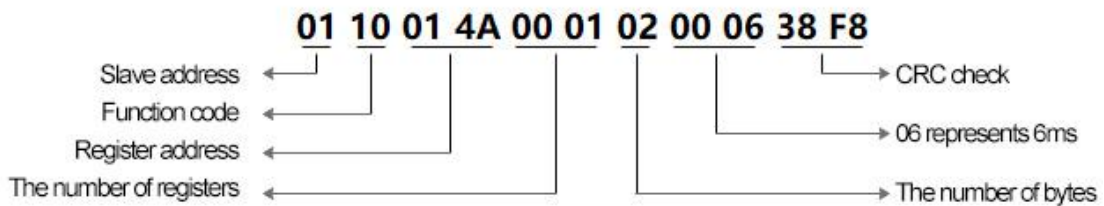
Register address	Type	Data content	Instruction
330	Read and write	Communication reply delay option	uint16, range (1-1000ms)

7.1 Example of communication reply delay setting for probe 1 using 10H code

Send source code-> **01 10 01 4A 00 01 02 00 06 38 F8**

Receive source code-> **01 10 01 4A 00 01 21 E3**

Meaning of the code is:

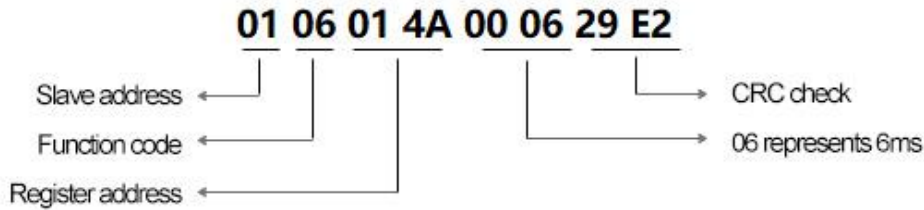


7.2 Example of communication reply delay setting for probe 1 using 06H code

Send source code-> 01 06 01 4A 00 06 29 E2

Receive source code-> 01 06 01 4A 00 06 29 E2

Meaning of the code is:



VIII. External calibration factor setting

If the device power value is not the same as the customer's target value, the external factor can be set to correct the device power value.

- Send external calibration factor setting instructions using 06H/10H function code

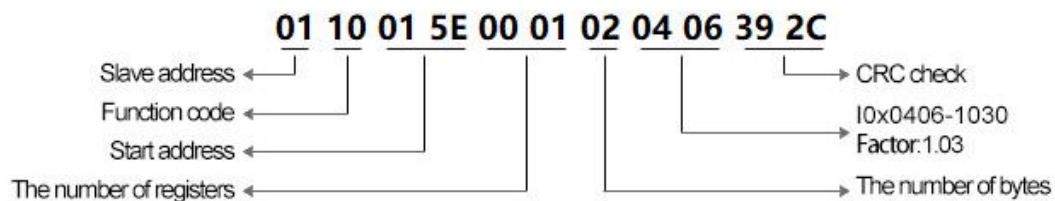
Register address	Type	Data content	Instruction
330	Read and write	External calibration factor	uint16, range (1-1000ms)

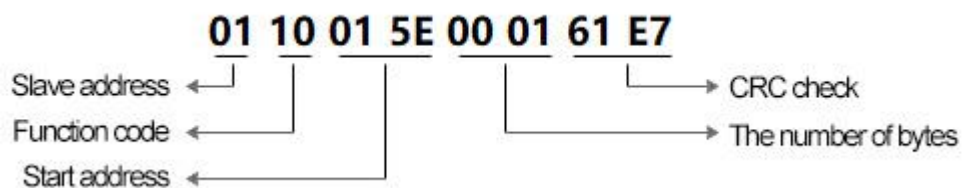
8.1 Example of external calibration factor setting for probe 1 using 10H code

Send source code-> 01 10 01 5E 00 01 02 04 06 39 2C

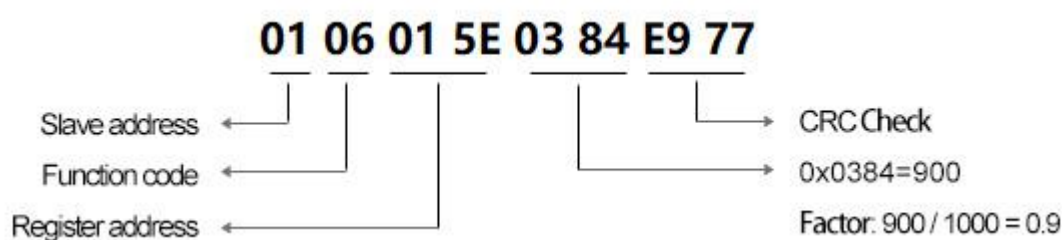
Receive source code-> 01 10 01 5E 00 01 61 E7

Meaning of the code is:





8.2 Example of external calibration factor setting for probe 1 using 06H code



IX. Error information code table

Information code	Description
01	Invalid function code
02	Error reading or writing address or quantity

X. Special value description

When the probe abnormal, the power value will be a special value, convenient for the user to debug and troubleshoot.

Special value	Error content
11.1	The instrument is out of order and needs to be returned for repair
22.2	Instrument calibration information is not available
88.8	Data acquisition error