



Peristaltic Pumps

Gear Pumps

Syringe Pumps

MODBUS Communication Instruction

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1 Introduction

Golander's product range, which includes the S, L, and F series of peristaltic pumps, S and F series of gear pumps, syringe pumps, supports RS485 MODBUS RTU protocol to communicate with external controlling devices such as HMIs, PCs, or PLCs. The program is designed with a modular approach, ensuring stability and reliability. The Modbus communication stack comprises two layers: the Modbus application layer and the network layer.

Table 1. Currently Supported Commands

Function code	Command text	Description
0x01	Read Coils	Read the status of coil (on/off)
0x02	Read Discrete Inputs	Read Input Status (on/off)
0x03	Read Holding Registers	Read the contents of read/write location
0x04	Read Input Registers	Read the contents of read-only location
0x05	Write Single Coil	Force single coil
0x06	Write Single Register	Preset single Register
0x0F	Write Multiple Coils	Force multiple coils
0x10	Write Multiple Registers	Preset multiple registers
0x11	Gateway Target Device Failed to Respond	Specialized use in conjunction with gateways, indicates no response was received from the target device.
0x17	Read/Write Multiple Registers	Read/Write multiple registers at the same time

2 Modbus Protocol

2.1 Modbus Protocol Model

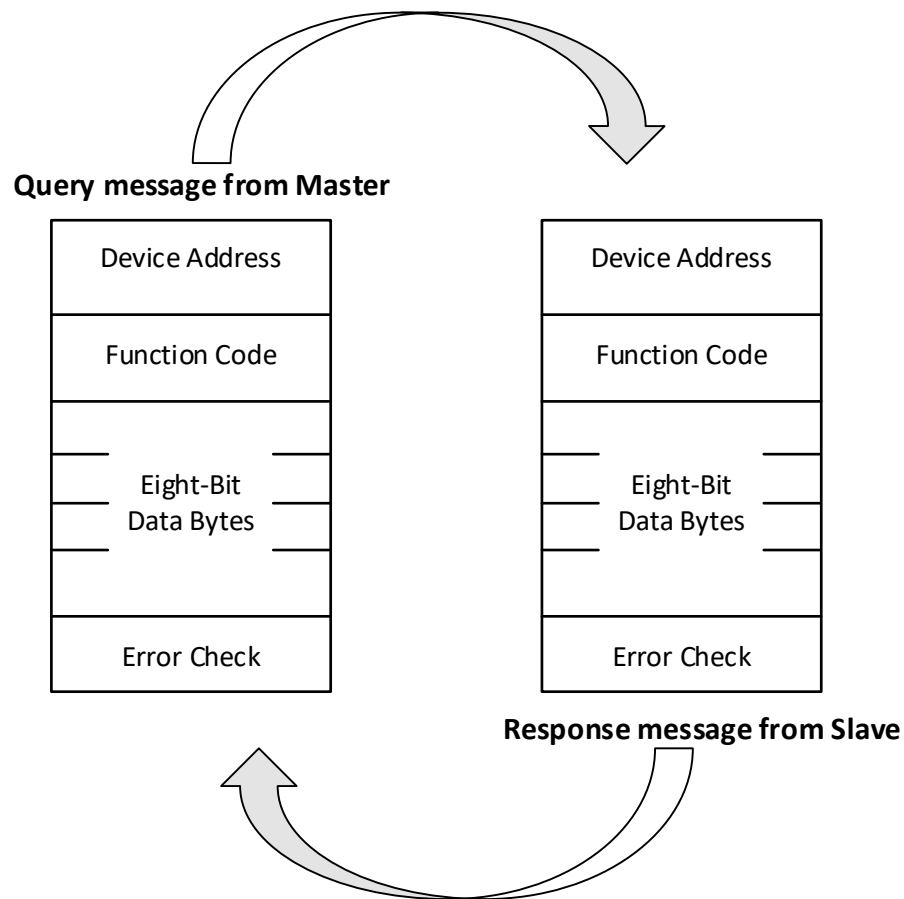


Figure 1. Master-Slave Query-Response Cycle

2.2 Byte Format

- **Coding System**
8-bit binary, hexadecimal 0-9, A-F. Two hexadecimal characters contained in each 8-bit field of the message.
- **Bits per Byte:**
 - 1 start bit
 - 8 data bits, transmitted with the least significant bit first
 - 1 parity bit for even/odd parity; no parity bit for no parity
 - 1 stop bit if parity is used; 2 stop bits if no parity
- **Error Check Field**
Cyclical Redundancy Check (CRC)

2.3 MODBUS Message Timing

In RTU mode, messages start with a silent interval of at least 3.5 character times. This is most easily implemented as a multiple of character times at the baud rate that is being used on the network (shown as T1-T2-T3-T4 in [Table 2](#)). The first field then transmitted is the device address. The allowable characters transmitted for all fields

are hexadecimal 0-9, A-F. Devices monitor the network bus continuously, including during the “silent” intervals. When the first field (the address field) is received, each device decodes it to find out if it is the addressed device. If the device determines that it is the one being addressed it decodes the whole message and acts accordingly, if it is not being addressed it continues monitoring for the next message. Following the last transmitted character, a silent interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval. The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before the completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message. Similarly, if a new message begins earlier than 3.5 character times following a previous message, the receiving device will consider it a continuation of the previous message. This will result in an error, as the value in the final CRC field will not be valid for the combined messages. A typical message frame is shown below.

Table 2. RTU Message Frame

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
T1-T2-T3-T4	8 BTIS	8 BTIS	n x 8 BTIS	16 BITS	T1-T2-T3-T4

2.4 Address Field

The address field of a message frame contains eight bits (RTU). Valid slave device addresses are in the range of 0-247 decimal. The individual slave devices are assigned addresses in the range of 1-247. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding. Address 0 is used for the broadcast address, which all slave devices recognize. When Modbus protocol is used on higher level networks, broadcasts may not be allowed or may be replaced by other methods. For example, Modbus Plus uses a shared global database that can be updated with each token rotation.

2.5 Function Field

The function code field of a message frame contains eight bits (RTU). Valid codes are in the range of 1-255 decimal. Of these, some codes are applicable to all xLogic, while some codes apply only to certain models, and others are reserved for future use. When a message is sent from a master to a slave device the function code field tells the slave what kind of action to perform. Examples are to read the ON/OFF states of a group of discrete coils or inputs; to read the data contents of a group of registers; to read the diagnostic status of the slave; to write to designated coils or registers; or to allow loading, recording, or verifying the program within the slave.

When the slave responds to the master, it uses the function code field to indicate either a normal (error-free) response or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most-significant bit set to logic 1. For example, the Read Holding Registers command has the function code 0000 0011 (03H).

If the slave device takes the requested action without error, it returns the same code in its response. However, if an exception occurs, it returns 1000 0011 (83H) in the function code field and appends a unique code in the data field of the response message that tells the master device what kind of error occurred, or the reason for the exception.

The master's application program must handle the exception response. It may choose to post subsequent retries of the original message, it may try sending a diagnostic query, or it may simply notify the operator of the exception error.

2.6 Data Field

The data field is constructed using sets of two hexadecimal digits, in the range of 00 to FF hexadecimal. These can be made from one RTU character, according to the network's serial transmission mode. The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. For example, when the master request the slave to read the holding registers (function code 03H), the data includes register address, the quantity of the registers.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken. The data field can be nonexistent (of zero length) in certain kinds of messages. For example, in a request from a master device for a slave to respond with its communications event log (function code 0B hexadecimal), the slave does not require any additional information.

2.7 CRC Error Checking

Two kinds of error-checking methods are used for standard Modbus networks. The error checking field contents depend upon the method that is being used. When RTU mode is used for character framing, the error checking field contains a 16-bit value implemented as two 8-bit bytes. The error check value is the result of a Cyclical Redundancy Check calculation performed on the message contents.

The CRC field is appended to the message as the last field in the message. When this is done, the low-order byte of the field is appended first, followed by the high-order byte. The CRC high-order byte is the last byte to be sent in the message.

3 Transmit Characters Serially

When messages are transmitted on Modbus serial networks, each character or byte is sent in the order of Least Significant Bit (LSB) to Most Significant Bit (MSB) as outlined below (left to right).

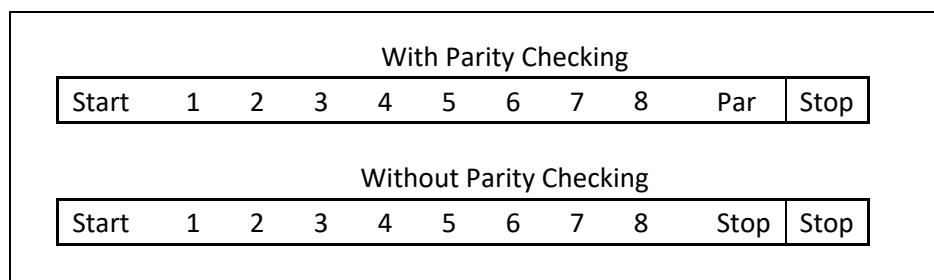


Figure 2. Bit Order (RTU)

4 Instructions for Use

- During communication debugging, start by testing a single-word input register, such as temperature, and observe if the readout matches the display to confirm normal communication. If the data consistently appears incorrect, try swapping the A and B wiring connections.
- The communication status displayed on the LCD is determined by the transmission and reception of communication data, not by physical connections.
- In this technical standard, unless under special circumstances, it is recommended to use the default byte order CDAB for long integers and floating-point numbers (original communication mode: computer mode). Under byte order ABCD (original communication mode: PLC mode), to ensure data correctness, each time only one instruction is allowed to read or write a long integer or single-precision floating-point variable. In this mode, attempting to read or write two or more consecutive single/double-word registers will result in erroneous data.
- When devices communicate, there must be a delay of more than 50ms between each instruction frame to ensure the integrity of communication data. Otherwise, it may lead to data errors and communication abnormalities. Especially in PLC programming and computer programming, each instruction frame must be manually added.
- When writing to registers for flow rate and liquid volume, ensure to write the unit first and then the value. Otherwise, it may lead to abnormal units and prevent startup.
- Changing the pump number, communication rate, or parity bit requires restarting the device for the changes to take effect.

5 Parameters and Addresses of S Series Peristaltic Pumps

Products include: BQ50S, BQ80S, BT50S, BT102S, BT100S, BT300S, BT600S, BT101S, BT301S, BT601S, WT300S, WT600S, WT600S-65, WG600S, BT100S-1, and BT103S

Mode: RTU

Addresses: 1-247 (User Defined)

Baud Rate: 9600

Data Bits: 8

CRC: Even Parity

Stop Bit: 1

Table 3. Input Registers (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	1000	Reserved			Unsigned Short int (2 bytes)	
2	1001	Speed timer value	Determines the rotating speed	200-65535	Unsigned Short int (2 bytes)	
3	1002	Subdivide number	Steps in one revolution	BQ-S:6400 BT-S V2:6400 BT-S:10000	Unsigned Short int (2 bytes)	Not available for WT series

4	1003	Analog speed control	Speed setting controlled by external analog signal	BQ-S:1-800 BT100S/BT101S/BT100S-1: 1-1500 BT300S/BT301S: 1-3500 BT600S/BT601S: 1-6000 WT300S: 30-350 WT600S/WG600S: 30-600	Unsigned Short int (2 bytes)	
5	1018	Manufacturer information	Display manufacturer information	"LeadFluid"	Unsigned Char (10 bytes)	
6	1023	Product information	Display product information	"BT100S " "BT300S " "BT600S"	Unsigned Char (10 bytes)	

Table 4. Holding Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	3000	Key value	Modify key value	0-8	Unsigned Short int (2 bytes)	
2	3001	Easy dispense status	Easy dispense is running or not	Normal: 0 Dispensing: 1	Unsigned Short int (2 bytes)	Applicable to BT-S series
3	3002	Time dispense status	Time dispense is running or not	Normal: 0 Dispensing: 1	Unsigned Short int (2 bytes)	Applicable to BT-S V2 series, BQ-S series, WT-S series, WG-S series; BT-S V2 series requires setting the working mode to Time Dispense mode.

Table 5. Holding Register (Power-off Memory EEPROM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	3100	Rotating Speed	Adjust rotating speed	BQ-S: 1-800 BT100S/BT101S/BT100S-1: 1-1500 BT300S/BT301S: 1-3500 BT600S/BT601S: 1-6000 WT300S: 30-350 WT600S/WG600S: 30-600	Unsigned Short int (2 bytes)	Except for the WT series, the values divided by 10 represent the actual rotation speed for other series as follows: BQ-S: 0.1-80 BT100S/BT101S/BT100S-1: 0.1-150 BT300S/BT301S: 0.1-350 BT600S/BT601S: 0.1-600
2	3101	Direction	Set rotation direction	Clockwise: 0 counterclockwise: 1	Unsigned Short int (2 bytes)	
3	3102	Running state	Set to run or stop	Stop: 0 Start: 1	Unsigned Short int (2 bytes)	
4	3103	Priming (full speed) state	Set priming state	Normal: 0 Priming: 1	Unsigned Short int (2 bytes)	
5	3104	Control mode	Set control mode	Internal control: 0 External control: 1 Footswitch control: 2 Logic Level control: 3	Unsigned Short int (2 bytes)	Applicable to BT101S/BT301S /BT601S/WG600S
				Internal control: 0 External control: 1 Footswitch control: 2 Logic Level control: 3 Communication: 4		
				Internal control: 0 External control: 1 Time Dispense: 2 Logic Level 1 control: 3 Logic Level 2 control: 4		Applicable to BT100S V2 /BT300S V2 /BT600S V2 /BT100S-1 V2
6	3105	Easy dispensing volume	Set the value of the easy dispensing quantity (in microsteps)	0-4294967295	Unsigned long int (4 bytes)	
7	3107	Slave device address	Set the communication slave	1-247	Unsigned Short int (2 bytes)	Restart required

			address			
8	3108	MODBUS mode	Switch MODBUS byte order	CDAB (PC): 0 ABCD (PLC): 1	Unsigned Short int (2 bytes)	
9	3109	Dispensing time	Set Dispensing time	1-9999	Unsigned Short int (2 bytes)	Correspond to 0.1-999.9
10	3110	Pause time	Interval time between two consecutive doses	1-9999	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series, corresponding to 0.1-999.9
11	3111	Cycle	Number of cycles	0-999	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
12	3112	Anti-drip angle	Set anti-drip angle	0-720	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
13	3113	Maximum speed	The maximum speed corresponding to the analog signal	1-6000	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
14	3114	Language	Set the language	Chinese: 0 English: 1	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
15	3115	Buzzer	Setting the buzzer to be on or off	Off: 0 On: 1	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
16	3116	Lock	Setting the keypad Lock	Unlock: 0 Lock: 1	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
17	3117	Time unit	Run Time and Pause Time unit	Second: 0 Minute: 1 Hour: 2	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 V3 series, but not applicable to the pause unit of BT-S V3 series (See No. 23)
18	3118	Contract	Adjust the contrast of the LCD	1-50	Unsigned Short int (2 bytes)	Applicable only to the BT-S V2 and V3 series
19						
20	3124	Acceleration	Setting	1-20 corresponds to 0.S-	Unsigned Short	Applicable only to

		time	acceleration time	2.0S	int (2 bytes)	the BT-S V3 series
21	3125	Deceleration time	Setting deceleration time	1-20 corresponds to 0.S-2.0S	Unsigned Short int (2 bytes)	Applicable only to the BT-S V3 series
22	3126	Stall protection	Turn on stall protection	On: 0 Off: 1	Unsigned Short int (2 bytes)	Applicable only to the BT-S V3 series
23	3127	Pause time unit	Pause time unit	Second: 0 Minute: 1 Hour: 2	Unsigned Short int (2 bytes)	Applicable only to the BT-S V3 series
24	3128	Baud rate	Set baud rate	4800: 0 9600: 1 19200: 2 38400: 3	Unsigned Short int (2 bytes)	Applicable only to the BT-S V3 series
25	3129	Baud rate stop bit		Stop bit 1: 1 Stop bit 2: 2	Unsigned Short int (2 bytes)	Applicable only to the BT-S V3 series
26	3130	Baud rate parity mode		No parity: 0 Odd parity: 1 Even parity: 2	Unsigned Short int (2 bytes)	Applicable only to the BT-S V3 series

6 Parameters and Addresses of L Series Peristaltic Pumps

Products include: BT100L, BT300L, BT600L, BT101L, BT301L, BT601L

Mode: RTU

Addresses: 1-247 (User Defined)

Baud Rate: 4800, 9600, 19200, 38400

Data Bits: 8

CRC: Even Parity

Stop Bit: 1

Table 6. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	(1000)	Internal temperature	Monitor the temperature inside the pump	-100 - +100 Degrees C	Signed Short int (2 bytes)	
2	(1001)	Reserved			Unsigned Short int (2 bytes)	
3	(1002)	Rotating speed	Monitor the current rotating speed	BT10XL:0.1-150 BT30XL:0.1-350 BT60XL:0.1-600	Float (4byte)	

4	(1004)	Current running step	Check the current running step	0-4294967295	Unsigned Long int (4 bytes)	
5	(1006)	Requisite running steps	Check requisite running steps	0-4294967295	Unsigned long int (4 bytes)	
6	(1016)	Speed timer value	Determine the speed	150-65535	Unsigned Short int (2 bytes)	
7	(1018)	Manufacturer information	Display manufacturer information	"LeadFluid"	Unsigned Char (10 bytes)	
8	(1023)	Product information	Display product information	"BT10XL" "BT30XL" "BT60XL"	Unsigned Char (10 bytes)	
9	(1028)	Touchscreen X-coordinate	Display Touchscreen X-coordinate		Unsigned Short int (2 bytes)	
10	(1029)	Touchscreen Y-coordinate	Display Touchscreen Y-coordinate		Unsigned Short int (2 bytes)	
11	(1030)	Analog speed	Display analog input speed	BT10XL: 1-1500 BT30XL: 1-3500 BT60XL: 1-6000	Unsigned Long int (4 bytes)	Corresponding to: BT10XL: 0.1-150 BT30XL: 0.1-350 BT60XL: 0.1-600
12	1032	Cumulative liquid volume	Monitor cumulative liquid volume		Float (4 bytes)	
13	1034	Cumulative volume unit	Monitor cumulative volume unit	µL: 1 mL: 2 L: 3	Unsigned Short int (2 bytes)	
14	1036	Maximum pump head speed	Monitor the current maximum pump head speed	Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-L V1 software version 1.28 and above, as well as BT-L V2
15	1038	maximum flow rate	Monitor the current maximum flow rate in the tubing	Unit: µL	Float (4 bytes)	Applicable to BT-L V1 software version 1.28 and above, as well as BT-L V2
16	1040	Minimum flow rate	Monitor the current minimum flow rate in the tubing	Unit: µL	Float (4 bytes)	Applicable to BT-L V1 software version 1.28 and above, as well as BT-L V2

Table 7. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
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1	(2800)	Total on time	Monitor the total uptime	0-4294967295 Unit: second	Unsigned Long int (4 bytes)	
2	(2802)	Total running time	Monitor the total operating time	0-4294967295 Unit: second	Unsigned Long int (4 bytes)	
3	(2804)	Total startup counts	Monitor the startup count	0-4294967295	Unsigned Long int (4 bytes)	

Table 8. Holding Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	3000	Switch monitoring screen	Switch monitoring screen	Page 1: 0 Page 2: 1	Unsigned Short int (2 bytes)	

Table 9. Holding Register (Power-off Memory FRAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	4000	The leftmost physical coordinate of the touchscreen	The leftmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
2	4002	The rightmost physical coordinate of the touchscreen	The rightmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
3	4004	The uppermost physical coordinate of the touchscreen	The uppermost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
4	4006	The downmost physical coordinate of the touchscreen	The downmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
5	4015	Flow rate	Set flow rate	0.001-999.9	Float (4 bytes)	
6	4017	Working mode	Set the working mode	Flow: 0 Time dispense: 1	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
7	4018	Key tone	Key tone on or off	Off: 0 On: 1	Unsigned Short int (2 bytes)	
8	4019	Parameter lock	Set parameter lock	Unlock: 0 Lock: 1	Unsigned Short int (2 bytes)	
9	4020	Language	Set the language	Chinese:0 English: 1	Unsigned Short int (2 bytes)	
10	4021	Pump head and tubing type	Set installed pump head and tube type	0-64	Unsigned Short int (2 bytes)	

11	4023	Direction	Set rotating direction	Clockwise: 0 Counterclockwise: 1	Unsigned Short int (2 bytes)	
12	4024	Priming (full speed) state	Set priming state	Normal: 0 Priming: 1	Unsigned Short int (2 bytes)	
13	4025	Dispensing state	Start dispensing	Stop: 0 Run: 1	Unsigned Short int (2 bytes)	
14	4026	External mode	Set external mode	Internal: 0 Footswitch: 1 Voltage: 2 Current: 3	Unsigned Short int (2 bytes)	
15	4027	Suction angle	Set suction angle	0-720	Unsigned Short int (2 bytes)	
16	4028	Slave address	Set slave address	1-247	Unsigned Short int (2 bytes)	
17	4029	Communication baud rate	Set Communication baud rate	4800bbs 0 9600bbs 1 19200bbs 2 38400bbs 3	Unsigned Short int (2 bytes)	
18	4030	External control	Set external control signal type for start/stop	Pulse: 0 Logic Level: 1	Unsigned Short int (2 bytes)	
19	4031	Infrared function	Turn on or off the infrared function	Off: 0 On: 1	Unsigned Short int (2 bytes)	
20	4032	Easy dispense	Set Easy dispense (unit: micro-step)	0- 4294967295	Unsigned long int (4 bytes)	Applicable to BT-L V1
21	4034	Restore defaults	Set defaults	Restore: 55 Normal: 170	Unsigned Short int (2 bytes)	
22	4035	Flow factor	Set flow factor	0.1-99999	Float (4 bytes)	
23	4126	Running state	Monitor start/stop in flow mode and monitor running or stop in dispensing mode	Stop: 0 Run: 1	Unsigned Short int (2 bytes)	
24	4127	MODBUS mode	Switching MODBUS byte order	CDAB (original Computer mode): 0 ABCD (original PLC mode): 1	Unsigned Short int (2 bytes)	
25						
26	4168	Time allocation data structure	Setting the time allocation parameters	(4168+6×N) Flow rate 4-byte floating point	12*5 bytes 30 words	Applicable to BT-L V2 and V3

				(4170+6×N) Runtime 2-byte unsigned (4171+6×N) Downtime 2-byte unsigned (4172+6×N)Times 2- byte unsigned (4173+6×N) Flow rate unit 2 bytes unsigned (uL/min is 1, mL/min is 2, L/min is 3)	N is 0-4, five groups of data	
27						
28	4256	Communication parity bit	Communication parity bit	No parity: 0 Odd parity: 1 Even parity: 2	Unsigned Short int (2 bytes)	
29	4257	LCD backlight contrast	Setting the brightness of the LCD backlight	0-100	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
30	4258	Timed start hours	Setting the hourly value for a timed start in flow mode	0-999 hours	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
31	4259	Timed start minutes	Setting the minutes value for timer start in flow mode	0-59 minutes	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
32	4260	Timed start seconds	Setting the seconds value for timer start in flow mode	0-59 seconds	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
33	4261	Timed stop hour	Setting the hourly value for timer start in flow mode	0-999 hours	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
34	4262	Timed stop minutes	Setting the minute value for timer start in flow mode	0-59 minutes	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
35	4263	Timed stop seconds	Setting the value of the second for timed start in flow mode	0-59 seconds	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
36	4265	Interval unit	Setting the interval time unit for time and volume dispensing	Seconds: 0 Minute: 1 Hour: 2	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3

37	4267	Speed of analog 0V	Rotational speed at 0V analogue	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
38	4268	Speed of analog 5V	Rotational speed at 5V analogue	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
39	4269	Analog 4mA rotational speed	Rotational speed at 4mA analogue	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
40	4270	Analog 20mA rotational speed	Rotational speed when analogue is 20mA	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
41	4271	External control direction control signal	External control signal trigger direction control method	Pulse: 0 Level: 1	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
42	4272	Pulse control signal	Pulse control method	Falling edge: 0 Rising edge: 1	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
43	4273	Level control signal	Level control method	Low level: 0 High Level: 1	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3

Table 10. Holding Register (Power-off Memory RAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	4800	Cumulative running times	Record cumulative running times	0- 4294967295	Unsigned Long int (4 bytes)	
2	4802	Cumulative running steps	Record cumulative running times (equivalent to cumulative volume)	0- 4294967295	Unsigned Long int (4 bytes)	Clearing the value will result in the clearing of the total liquid volume

7 Parameters and Addresses of F Series Peristaltic Pumps

Products include: BT100F, BT300F, BT600F, BT101F, BT301F, BT601F, BT100F-1, WT300F, WT600F, WG600F

Mode: RTU

Addresses: 1-247 (User Defined)

Baud Rate: 4800, 9600, 19200, 38400

Data Bits: 8

CRC: Even Parity

Stop Bit: 1

Table 11. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	(1000)	Internal temperature	Check the temperature inside the pump	-100 - +100 Degrees	Signed Short int (2 bytes)	
2	(1001)	Reserved			Unsigned Short int (2 bytes)	
3	(1002)	Rotating speed	Check the current rotating speed	BT10XF: 0.1-150 BT30XF: 0.1-350 BT60XF: 0.1-600	Float (4 bytes)	
4	(1004)	Current running step	Check the current running step	0-4294967295	Unsigned Long int (4 bytes)	
5	(1006)	Requisite running steps	Check requisite running steps	0-4294967295	Unsigned long int (4 bytes)	
6	(1008)	Current dispensing time	Check the current dispensing time	0-4294967295	Unsigned long int (4 bytes)	
7	(1010)	Current dispensing volume	Check the current dispensing volume	0-4294967295	Unsigned long int (4 bytes)	
8	(1012)	Current dispensing Cycles	Check current dispensing Cycles	0-4294967295	Unsigned long int (4 bytes)	
9						
10						
11	(1016)	Value of rotating speed timer	The setting that determines the current rotating speed	150-65535	Unsigned Short int (2 bytes)	
12	(1018)	Manufacturer information	Display manufacturer information	"LeadFluid"	Unsigned Char (10 bytes)	
13	(1023)	Product information	Display product information	"BT100F" "BT300F" "BT600F"	Unsigned Char (10 bytes)	
14	(1028)	Touch panel X-coordinate	Display touch panel X-coordinate		Unsigned Short int (2 bytes)	
15	(1029)	Touch panel Y-coordinate	Display touch panel Y-coordinate		Unsigned Short int (2 bytes)	
16	(1030)	Analog speed control	Display of analog input speed	0.1-max speed	Unsigned Long int (4 bytes)	
17	1032	Cumulative	Monitoring of the		Float (4 bytes)	

		Liquid Volume Monitoring	cumulative liquid volume value			
18	1034	Accumulated liquid volume unit monitoring	Monitoring of accumulated liquid volume units	μL: 1 mL: 2 L: 3	Unsigned Short int (2 bytes)	
19	1036	Maximum pump head speed	Monitoring of the current maximum pump head speed	Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-F V1 software version 1.28 or above, V2 and V3
20	1038	Maximum flow rate	Monitoring of the current maximum tubing flow	Unit: μL	Float (4 bytes)	Applicable to BT-F V1 software version 1.28 or above, V2 and V3
21	1040	Minimum flow rate	Monitoring of the current minimum tubing flow	Unit: μL	Float (4 bytes)	Applicable to BT-F V1 software version 1.28 or above, V2 and V3

Table 12. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	(2800)	Total on time	Check the cumulative time that the pump powered on (seconds)	0-4294967295	Unsigned Long int (4 bytes)
2	(2802)	Total running time	Check cumulative running time (seconds)	0-4294967295	Unsigned Long int (4 bytes)
3	(2804)	Total powered on times	Check how many times the pump powered on	0-4294967295	Unsigned Long int (4bytes)

Table 13. Holding Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	3000	Switch monitoring screen	Switch monitoring screen	Page 1: 0 Page 2: 1	Unsigned Short int (2 bytes)

Table 14. Holding Register (Power-off Memory FRAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	4000	The leftmost physical coordinate of the touchscreen	The leftmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
2	4002	The rightmost physical coordinate of the touchscreen	The rightmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
3	4004	The uppermost physical coordinate of the touchscreen	The uppermost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
4	4006	The downmost physical coordinate of the touchscreen	The downmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)	
5	4015	Flow rate	Set flow rate	0.001-999.9	Float (4 bytes)	
6	4017	Working mode	Set the working mode	Flow: 0 Time dispense: 1	Unsigned Short int (2 bytes)	Applicable to BT-L V2 and V3
7	4018	Key tone	Key tone on or off	Off: 0 On: 1	Unsigned Short int (2 bytes)	
8	4019	Parameter lock	Set parameter lock	Unlock: 0 Lock: 1	Unsigned Short int (2 bytes)	
9	4020	Language	Set the language	Chinese:0 English: 1	Unsigned Short int (2 bytes)	

10	4021	Pump head and tubing type	Set installed pump head and tube type	0-64	Unsigned Short int (2 bytes)	
11	4023	Direction	Set rotating direction	Clockwise: 0 Counterclockwise : 1	Unsigned Short int (2 bytes)	
12	4024	Priming (full speed) state	Set priming state	Normal: 0 Priming: 1	Unsigned Short int (2 bytes)	
13	4025	Dispensing state	Start dispensing	Stop: 0 Run: 1	Unsigned Short int (2 bytes)	
14	4026	External mode	Set external mode	Internal: 0 Footswitch: 1 Voltage: 2 Current: 3	Unsigned Short int (2 bytes)	
15	4027	Suction angle	Set suction angle	0-720	Unsigned Short int (2 bytes)	
16	4028	Slave address	Set slave address	1-247	Unsigned Short int (2 bytes)	
17	4029	Communication baud rate	Set Communication baud rate	4800bbs 0 9600bbs 1 19200bbs 2 38400bbs 3	Unsigned Short int (2 bytes)	
18	4030	External control	Set external control signal type for start/stop	Pulse: 0 Logic Level: 1	Unsigned Short int (2 bytes)	
19	4031	Infrared function	Turn on or off the infrared function	Off: 0 On: 1	Unsigned Short int (2 bytes)	
20	4032	Simple dispensing	Set simple dispensing (unit: micro-step)	0- 4294967295	Unsigned long int (4 bytes)	Applicable to BT-L V1
21	4034	Restore defaults	Set defaults	Restore: 55 Normal: 170	Unsigned Short int (2 bytes)	
22	4035	Flow factor	Set flow factor	0.1-99999	Float (4 bytes)	
23	4126	Running state	Monitor start/stop in flow mode and monitor running or stop in dispensing mode	Stop: 0 Run: 1	Unsigned Short int (2 bytes)	
24	4127	MODBUS mode	Switching MODBUS byte order	CDAB (PC): 0 ABCD (PLC): 1	Unsigned Short int (2 bytes)	
25						

26	4168	Time allocation data structure	Setting the time allocation parameters	(4168+6×N) Flow rate 4-byte floating point (4170+6×N) Runtime 2-byte unsigned (4171+6×N) Downtime 2-byte unsigned (4172+6×N)Time s 2-byte unsigned (4173+6×N) Flow rate unit 2 bytes unsigned (uL/min is 1, mL/min is 2, L/min is 3)	12*5 bytes 30 words N is 0-4, five groups of data	Applicable to BT-L V2 and V3
27						
28	4256	Communication parity bit	Communication parity bit	No parity: 0 Odd parity: 1 Even parity: 2	Unsigned Short int (2 bytes)	
29	4257	LCD backlight contrast	Setting the brightness of the LCD backlight	0-100	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
30	4258	Timed start hours	Setting the hourly value for a timed start in flow mode	0-999 hours	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
31	4259	Timed start minutes	Setting the minutes value for timer start in flow mode	0-59 minutes	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
32	4260	Timed start seconds	Setting the seconds value for timer start in flow mode	0-59 seconds	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
33	4261	Timed stop hour	Setting the hourly value for timer start in flow mode	0-999 hours	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
34	4262	Timed stop minutes	Setting the minute value for timer start in flow mode	0-59 minutes	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
35	4263	Timed stop seconds	Setting the value of the second for timed start in flow mode	0-59 seconds	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3

36	4265	Interval unit	Setting the interval time unit for time and volume dispensing	Seconds: 0 Minute: 1 Hour: 2	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
37	4267	Speed of analog 0V	Rotational speed at 0V analogue	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
38	4268	Speed of analog 5V	Rotational speed at 5V analogue	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
39	4269	Analog 4mA rotational speed	Rotational speed at 4mA analogue	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
40	4270	Analog 20mA rotational speed	Rotational speed when analogue is 20mA	Value/10 Unit: rpm	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
41	4271	External control direction control signal	External control signal trigger direction control method	Pulse: 0 Level: 1	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
42	4272	Pulse control signal	Pulse control method	Falling edge: 0 Rising edge: 1	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
43	4273	Level control signal	Level control method	Low level: 0 High Level: 1	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
44	4275	Transfer mode	Flow Transfer Mode	Flow Mode 0 Time mode 1	Unsigned Short int (2 bytes)	Applicable to BT-F V3
45	4276	Fluid volume unit	Units of transmitted fluid volume	Volume unit 0 Weight unit 1	Unsigned Short int (2 bytes)	Applicable to BT-F V3
46	4277	Plugging Alarm	Blocking Alarm Development	Close 0 Open 1	Unsigned Short int (2 bytes)	Applicable to BT-F V3
47	4278	Dispense complete alarm	Setting the dispense alarm value	50-100 (APP push alarm when dispensing progress completes the set value)	Unsigned Short int (2 bytes)	Applicable to BT-F V3
48						
49	4297	Total cycle dispensing steps	Total number of steps under cyclic dispensing	1-30	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3

50	4298	Total number of cycles	Total number of cycles under cyclic dispensing	0-999	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
51	4299	Steps for currently displayed parameters	LCD display of which step's parameters	1-30	Unsigned Short int (2 bytes)	Applicable to BT-F V2 and V3
52	4300	Programming mode data structure	Setting the programming mode parameter	<p>(4300+10×N) Flow rate 4-byte floating point</p> <p>(4302+10×N) Liquid volume 4-byte floating point</p> <p>(4304+10×N) Interval time 2 bytes unsigned</p> <p>(4305+10×N) Cycle times 2-byte unsigned</p> <p>(4306+10×N) Liquid volume unit 2-byte unsigned (1 for microliters, 2 for milliliters, 3 for liters)</p> <p>(4307+10×N) Flow rate unit 2 bytes unsigned (uL/min is 1, mL/min is 2, L/min is 3)</p> <p>(4308+10×N) Interval unit 2-byte unsigned (0 for seconds, 1 for minutes, 2 for hours)</p> <p>(4309+10×N) direction of rotation 2 bytes unsigned (clockwise is 0, counterclockwise is 1)</p>	<p>20*30 bytes</p> <p>300 words</p> <p>N is 0-29, a total of thirty groups of data</p>	Applicable to BT-F V2 and V3

53	4600	Time allocation	Setting the time dispensing parameter	(4600+2×N) Time running time unit 2 bytes unsigned (4601+2×N) downtime unit 2 bytes unsigned (Seconds are 0, minutes are 1, hours are 2)	4*5 bytes 10 words N is 0-4, a total of five sets of data	Applicable to BT-F V2 and V3
54	4610	Data structure (supplement 4168)	Setting the liquid volume dispensing parameter	(4610+4×N) Runtime 4-byte floating point (4130+4×N) Runtime unit 2-byte unsigned (4132+3×N) downtime unit 2-byte unsigned (seconds are 0, minutes are 1, hours are 2)	8*5 bytes 20 words N is 0-4, total five data sets	Applicable to BT-F V2 and V3
55	4630	Liquid volume allocation	Setting the Programming Mode Oh parameter	(4630+3×N) Running time 4 bytes floating point (4630+3×N) running time unit 2-byte unsigned (Seconds are 0, minutes are 1, hours are 2)	6*30 bytes 90 words N is 0-29, a total of thirty sets of data	Applicable to BT-F V2 and V3

Table 15. Holding Register (Power-off Memory RAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	4800	Cumulative running times	Record cumulative running times	0- 4294967295	Unsigned Long int (4 bytes)
2	4802	Cumulative running steps	Record cumulative running times (equivalent to cumulative volume)	0- 4294967295	Unsigned Long int (4 bytes)

8 Parameters and Addresses of S Series of Gear Pumps

Products include: CT3000S, CT3001S

Mode: RTU

Addresses: 1-247 (User Defined)

Baud Rate: 9600

Data Bits: 8

CRC: Even Parity

Stop Bit: 1

Table 16. Input Registers (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	1000	Reserved			Unsigned Short int (2 bytes)	
2	1001	Value of rotating speed timer	The setting that determines the current rotating speed	99-998	Unsigned Short int (2 bytes)	
3	1003	Analog speed control	Speed setting controlled by external analog signal	300-3000 rpm	Unsigned Short int (2 bytes)	
4	1018	Manufacturer information	Display manufacturer information	"LeadFluid"	Unsigned Char (10 bytes)	
5	1023	Product information	Display product information	"CT3000S " "CT3001S"	Unsigned Char (10 bytes)	

Table 17. Holding Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	3000	Key value	Modify key value		Unsigned Short int (2 bytes)	
2	3001					
3	3002	Time dispensing	Time dispensing is running or not	Normal: 0 Dispensing: 1	Unsigned Short int (2 bytes)	

Table 18. Holding Register (Power-off Memory EEPROM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	3100	Rotating Speed	Adjust rotating speed	300-3000 rpm	Unsigned Short int (2 bytes)	
2						
3	3102	Running state	Set to run or stop	Stop: 0 Start: 1	Unsigned Short int (2 bytes)	
4	3103	Priming (full speed) state	Set priming state	Normal: 0 Priming: 1	Unsigned Short int (2 bytes)	
5	3104	Control mode	Set the control mode	Internal control: 0 External control: 1 Footswitch control: 2	Unsigned Short int (2 bytes)	

				Logic level control: 3		
6						
7	3107	Slave device address	Set the communication slave address	1-247	Unsigned Short int (2 bytes)	
8	3108	MODBUS mode	Switch MODBUS byte order	CDAB (PC): 0 ABCD (PLC): 1	Unsigned Short int (2 bytes)	
9	3109	Dispensing time	Set Dispensing time	1-9999 (0.1-999.9 seconds)	Unsigned Short int (2 bytes)	

9 Parameters and Addresses of F Series of Gear Pumps

Products include: CT3000F, CT3001F

Mode: RTU

Addresses: 1-247 (User Defined)

Baud Rate: 4800, 9600, 19200, 38400

Data Bits: 8

CRC: Even Parity

Stop Bit: 1

Table 19. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	(1000)	Internal temperature	Check the temperature inside the pump	-100 - +100 Degrees	Signed Short int (2 bytes)	
2	(1001)	Reserved			Unsigned Short int (2 bytes)	
3	(1002)	Rotating speed	Check the current rotating speed	50-3000 rpm	Unsigned Short int (2 bytes)	
4	(1004)	Current running step	Check the current running step	0-4294967295	Unsigned Long int (4 bytes)	
5	(1006)	Requisite running steps	Check requisite running steps	0-4294967295	Unsigned long int (4 bytes)	
6	(1008)	Current dispensing time	Check the current dispensing time	0-4294967295	Unsigned long int (4 bytes)	
7	(1010)	Current dispensing volume	Check the current dispensing volume	0-4294967295	Unsigned long int (4 bytes)	
8	(1012)	Current dispensing Cycles	Check current dispensing Cycles	0-4294967295	Unsigned long int (4 bytes)	
9						

10	(1016)	Value of rotating speed timer	The setting that determines the current rotating speed	720-43200	Unsigned Short int (2 bytes)	
11	(1018)	Manufacturer information	Display manufacturer information	"LeadFluid"	Unsigned Char (10 bytes)	
12	(1023)	Product information	Display product information	"CT3000F" "CT3001F"	Unsigned Char (10 bytes)	
13	(1028)	Touch panel X-coordinate	Display touch panel X-coordinate		Unsigned Short int (2 bytes)	
14	(1029)	Touch panel Y-coordinate	Display touch panel Y-coordinate		Unsigned Short int (2 bytes)	
15	(1030)	Analog speed control	Display of analog input speed	50-3000 rpm	Unsigned Long int (4 bytes)	
16	1032	Cumulative Liquid Volume Monitoring	Monitoring of the cumulative liquid volume value		Float (4 bytes)	
17	1034	Accumulated liquid volume unit monitoring	Monitoring of accumulated liquid volume units	µL: 1 mL: 2 L: 3	Unsigned Short int (2 bytes)	
18	(1980)	List of 20 groups of errors	Error inquiry		Unsigned Short int (2 bytes)	

Table 20. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	(2800)	Total on time	Check the cumulative time that the pump powered on (seconds)	0-4294967295	Unsigned Long int (4 bytes)
2	(2802)	Total running time	Check cumulative running time (seconds)	0-4294967295	Unsigned Long int (4 bytes)
3	(2804)	Total powered on times	Check how many times the pump powered on	0-4294967295	Unsigned Long int (4bytes)

Table 21. Holding Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	3000	Switch monitoring screen	Switch monitoring screen	Page 1: 0 Page 2: 1	Unsigned Short int (2 bytes)

Table 22. Holding Register (Power-off Memory FRAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
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1	4000	The leftmost physical coordinate of the touchscreen	The leftmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
2	4002	The rightmost physical coordinate of the touchscreen	The rightmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
3	4004	The uppermost physical coordinate of the touchscreen	The uppermost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
4	4006	The downmost physical coordinate of the touchscreen	The downmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
5	4008	Assigning a parameter group	Selection of the assignment parameter group	Group I: 0 Group II: 1 Group III: 2 Group IV: 3	Unsigned Short int (2 bytes)
6					
7	4015	Flow rate	Set flow rate	0.001-999.9	Float (4 bytes)
8	4017	Working mode	Set the working mode	Flow: 0 Volume dispense: 1 Time dispense: 2 Copy dispense: 3	Unsigned Short int (2 bytes)
9	4018	Key tone	Key tone on or off	Off: 0 On: 1	Unsigned Short int (2 bytes)
10	4019	Parameter lock	Set parameter lock	Unlock: 0 Lock: 1	Unsigned Short int (2 bytes)
11	4020	Language	Set the language	English:0 Chinese: 1	Unsigned Short int (2 bytes)
12	4021	Pump head model	Set installed pump head model	MS204: 0 MS209: 7 MS213: 9	Unsigned Short int (2 bytes)
13	4022	Flow rate unit	Set the flow rate unit in the flow mode	uL/min: 1 mL/min: 2 L/min: 3	Unsigned Short int (2 bytes)
14					
15	4024	Priming (full speed) state	Set priming state	Normal: 0 Priming: 1	Unsigned Short int (2 bytes)
16	4025	Dispensing state	Start dispensing	Stop: 0 Run: 1	Unsigned Short int (2 bytes)

17	4026	External mode	Set external mode	Internal: 0 Footswitch: 1 Voltage: 2 Current: 3	Unsigned Short int (2 bytes)
18					
19	4028	Slave address	Set slave address	1-247	Unsigned Short int (2 bytes)
20	4029	Communication baud rate	Set Communication baud rate	4800bbs: 0 9600bbs: 1 19200bbs: 2 38400bbs: 3	Unsigned Short int (2 bytes)
21	4030	External control	Set external control signal type for start/stop	Pulse: 0 Logic Level: 1	Unsigned Short int (2 bytes)
22	4031	Infrared function	Turn on or off the infrared function	Off: 0 On: 1	Unsigned Short int (2 bytes)
23	4034	Restore defaults	Set defaults		Unsigned Short int (2 bytes)
24	4035	Flow factor	Set flow factor		Float (4 bytes)
25					
26	4126	Running state	Monitor start/stop	Stop: 0 Run: 1	Unsigned Short int (2 bytes)
28	4127	MODBUS mode	Switching MODBUS byte order	Computer: 0 PLC: 1	Unsigned Short int (2 bytes)
29	4128	Liquid volume dispensing data structure	Setting the liquid volume dispensing parameters	(4128+8×N) Flow rate 4-byte floating point (4130+8×N) Liquid volume 4-byte floating point (4132+8×N) Downtime 2-byte unsigned (4133+8×N) Number of times 2 bytes unsigned (4134+8×N) Liquid volume unit 2-byte unsigned (1 for microliters, 2 for milliliters, 3 for liters) (4135+8×N) Flow rate unit 2 bytes unsigned (uL/min is 1, mL/min is 2, L/min is 3)	16*5 bytes 40 words N is 0-4, total five sets of data
30	4168	Time dispensing data structure	Setting the time dispensing parameters	(4168+6×N) Flow rate 4-byte floating point (4170+6×N) Runtime 2-byte unsigned	12*5 bytes 30 words

				(4171+6×N) Downtime 2-byte unsigned (4172+6×N) Times 2-byte unsigned (4173+6×N) Flow rate unit 2 bytes unsigned (uL/min is 1, mL/min is 2, L/min is 3)	N is 0-4, five groups of data
31	4198	Copy dispensing data structure	Setting the copy dispensing parameters	(4198+8×N) Flow rate 4-byte floating point (4200+8×N) Total liquid volume 4-byte floating point (4202+8×N) Downtime 2-byte unsigned (4203+8×N) Number of times 2 bytes unsigned (4204+8×N) Total liquid volume unit 2 bytes unsigned (1 for microliters, 2 for milliliters, 3 for liters) (4205+8×N) Flow rate unit 2 bytes unsigned (uL/min is 1, mL/min is 2, L/min is 3)	16*5 bytes 40 words N is 0-4, five groups of data

Table 23. Holding Register (Power-off Memory RAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	4800	Cumulative running times	Record cumulative running times	0- 4294967295	Unsigned Long int (4 bytes)
2	4802	Cumulative running steps	Record cumulative running times (equivalent to cumulative volume)	0- 4294967295	Unsigned Long int (4 bytes)

10 Parameters and Addresses of Syringe Pumps

Products include: LAA-01, LAA-02, LAB-01, LAB-02, LAB-04, LAB-10, LAC-01, LDA-01, LSA-01, LSB-01, LSC-02, TYD01-01, TYD01-02, TYD02-01, TYD02-02, TYD02-04, TYD02-10, TYD03-01, TSD01-01, TFD01-01, TFD02-01, TFD03-01

Mode: RTU

Address: 1-247 (User Defined)

Communication rate: 4800, 9600, 19200, 38400

Data bits: 8

Parity bit: even parity (EVEN)

Stop bit: 1

Table 24. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type	Note
1	(1000)	Internal temperature	Check the temperature inside the pump	-100 - +100 Degrees	Signed Short int (2 bytes)	
2	(1001)	Reserved			Unsigned Short int (2 bytes)	
3	(1002)	Rotating speed	Check the current rotating speed	0.001-150 rpm	Unsigned Short int (2 bytes)	
4	(1004)	Current running step	Check the current running step	0-4294967295	Unsigned Long int (4 bytes)	
5	(1006)	Requisite running steps	Check requisite running steps	0-4294967295	Unsigned long int (4 bytes)	
6	(1008)	Current operating time	Check the current operating time	0-4294967295	Unsigned long int (4 bytes)	
7	(1012)	Current completed cycles	Monitor the completed cycles	0-4294967295	Unsigned long int (4 bytes)	
8	(1016)	Value of rotating speed timer	The setting that determines the current rotating speed	50-65535	Unsigned Short int (2 bytes)	
9	(1018)	Manufacturer information	Display manufacturer information	"LeadFluid"	Unsigned Char (10 bytes)	
10	(1023)	Product information	Display product information		Unsigned Char (10 bytes)	
11	(1028)	Touch panel X-coordinate	Display touch panel X-coordinate		Unsigned Short int (2 bytes)	
12	(1029)	Touch panel Y-coordinate	Display touch panel Y-coordinate		Unsigned Short int (2 bytes)	
13						
14	1032	Cumulative liquid volume monitoring	Monitoring of the cumulative liquid volume value		Float (4 bytes)	
15	1034	Accumulated liquid volume unit monitoring	Monitoring of accumulated liquid volume units	nL: 0 μL: 1 mL: 2 L: 3	Unsigned Short int (2 bytes)	
16	1035	Liquid Consumption	Monitoring of liquid consumption values		Unsigned Short int (2 bytes)	
17	1037	Liquid Consumption Unit	Monitoring of liquid consumption units	nL: 0 μL: 1 mL: 2	Unsigned Short int (2 bytes)	
18	1038	Remaining liquid	Monitoring of		Float (4 bytes)	

		volume	remaining liquid volume			
19	1040	Unit of remaining liquid volume	Monitoring liquid volume units	nL: 0 μL: 1 mL: 2	Unsigned Short int (2 bytes)	
20	1041	Pump speed	Monitoring of speed	0.001-150 rpm	Float (4 bytes)	
21	1043	Consumption time	Monitoring of consumption time	0-4294967295 Unit: milliseconds	Unsigned Long int (4 bytes)	
22	1045	Remaining time	Monitoring of remaining time	0-4294967295 in milliseconds	Unsigned Long int (4 bytes)	
23	1047	Alarm status	Monitoring for alarms	Normal: 0 Alarm: 1	Unsigned Short int (2 bytes)	
24	1052	Maximum flow rate	Maximum flow rate of the current syringe	Unit: nL/min	Float (4 bytes)	Applicable to software version 1.15 and above
25	1054	Minimum flow rate	Minimum flow rate of the current syringe	Unit: nL/min	Float (4 bytes)	Applicable to software version 1.15 and above

Table 25. Input Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	(2800)	Total on time	Check the cumulative time that the pump powered on (seconds)	0-4294967295 Unit: second	Unsigned Long int (4 bytes)
2	(2802)	Total running time	Check cumulative running time (seconds)	0-4294967295 Unit: second	Unsigned Long int (4 bytes)
3	(2804)	Total power-on times	Check how many times the pump powered on	0-4294967295	Unsigned Long int (4bytes)

Table 26. Holding Register (Read Only)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1*	(3001)	Fast Injection	Starting or stopping fast	Stop: 0	Unsigned Short

			injection	Fast Forward: 1	int (2 bytes)
2*	(3002)	Fast Withdrawal	Start or stop fast extraction	Stop: 0 Fast Forward: 1	Unsigned Short int (2 bytes)

Table 27. Holding Register (Power-off Memory FRAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	4000	The leftmost physical coordinate of the touchscreen	The leftmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
2	4002	The rightmost physical coordinate of the touchscreen	The rightmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
3	4004	The uppermost physical coordinate of the touchscreen	The uppermost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
4	4006	The downmost physical coordinate of the touchscreen	The downmost physical coordinate of the touchscreen		Unsigned long int (4 bytes)
5	4008	Assigning a parameter group	Selection of the assignment parameter group	Group I: 0 Group II: 1 Group III: 2	Unsigned Short int (2 bytes)
6	4015	Flow rate	Set flow rate		Float (4 bytes)
7	4017	Working mode	Set the working mode	Injection only: 0 Withdrawal only: 1 Withdraw/Inject: 2 Inject/Withdraw: 3 Continuous: 4	Unsigned Short int (2 bytes)
8	4018	Mute	Mute on or off	Mute: 0 Tone: 1	Unsigned Short int (2 bytes)
9	4019	Parameter lock	Set parameter lock	Unlock: 0 Lock: 1	Unsigned Short int (2 bytes)
10	4020	Language	Set the language	Chinese:0 English: 1	Unsigned Short int (2 bytes)
11	4021	Syringe nr.	Syringe nr.		Unsigned Short int (2 bytes)
12	4022	Flow rate unit	Set the flow rate unit in continuous mode	nL/min: 0 uL/min: 1	Unsigned Short int (2 bytes)

				mL/min: 2	
13	4023	Direction	The current direction (can be set in continuous mode)	Withdrawal direction: 0 Injection direction: 1	Unsigned Short int (2 bytes)
14	4024	Pause state	Whether paused or not	Stop: 0 Pause: 1	Unsigned Short int (2 bytes)
15	4025	Dispensing state	Start dispensing	Stop: 0 start/continue: 1	Unsigned Short int (2 bytes)
16	4026	External mode	Set external mode: pulse or level (can be set in continuous mode)	Pulse 0 Level 1	Unsigned Short int (2 bytes)
17	4027	Thrust Size	Setting the amount of thrust	1-100	Unsigned Short int (2 bytes)
18	4028	Slave Address	Setting the slave address for communication	1-247	Unsigned Short int (2 bytes)
19	4029	Baud rate	Setting the communication baud rate number	4800bbs: 0 9600bbs: 1 19200bbs: 2 38400bbs: 3	Unsigned Short int (2 bytes)
20	4030	LCD backlight	Setting the brightness of the LCD backlight	20-100	Unsigned Short int (2 bytes)
21	4035	Flow rate coefficient	Setting the coefficient of a custom syringe		Float (4 bytes)
22	4034	Restore default value	Set the default value	Restore: 55 Normal: 170	Unsigned Short int (2 bytes)
23	4087	Blocking alarm	Enable or disable the blocking alarm	Off: 0 On: 1	Unsigned Short int (2 bytes)
24	4088	Customize syringe inner diameter	Set the inner diameter of the customized syringe	0.001-40mm	Float (4 bytes)
25	4090	Customize syringe size	Set the volume of the custom syringe	0.001-200	Float (4 bytes)
26	4092	Customize syringe units	Set the volume unit of the custom syringe	uL/min: 1 mL/min: 2	Unsigned Short int (2 bytes)
27	4093	Number of hours of interval time	Set the number of hours for the interval	0-999	Unsigned Short int (2 bytes)
28	4094	Number of minutes of interval time	Set the number of minutes for the interval	0-59	Unsigned Short int (2 bytes)
29	4095	Number of seconds between intervals	Setting the interval time in seconds	0-59	Unsigned Short int (2 bytes)

30	409 6	Number of milliseconds between intervals	Set the interval time in milliseconds	0-99	Unsigned Short int (2 bytes)
31	4097	Number of cycles	Set the number of cycles	0-999	Unsigned Short int (2 bytes)
32	4126	Operation status	Set whether to run or stop	Stop, running	Unsigned Short int (2 bytes)
33	4127	MODBUS mode	Switching MODBUS mode	Computer or PLC	Unsigned Short int (2 bytes)
34	4128	Injection-only data structure	Setting individual parameters for injection only (three groups in total)	4128+6*N liquid volume 4-byte floating point 4130+6*N injection flow rate 4-byte floating point 4132+6*N Liquid volume unit 2 bytes unsigned 4133+6*N injected flow rate unit 2 bytes unsigned	12*3 bytes 18 words N is 0-2, a total of three sets of data
35	4146	Withdrawal-only data structure	Setting the individual parameters for withdrawal-only (three groups in total)	4146+6*N liquid volume 4-byte floating point 4148+6*N extraction flow rate 4-byte floating point 4150+6*N Liquid volume unit 2-byte unsigned 4151+6*N extraction flow rate unit 2-byte unsigned	12*3 bytes 18 words N is 0-2, a total of three groups of data
36	4164	Extraction only	Setting the individual parameters of the extraction injection (three groups in total)	4164+10*N liquid volume 4-byte floating point 4166+10*N injected flow rate 4-byte floating point 4168+10*N extraction flow rate 4-byte floating point 4170+10*N Liquid volume unit 2 bytes unsigned 4171+10*N injected flow rate unit 2 bytes unsigned 4172+10*N extraction flow unit 2-byte unsigned	20*3 bytes 30 words N is 0-2, a total of three groups of data
37	4194	Data structure	Setting the individual parameters for injection extraction (three groups in total)	4194+10*N liquid volume 4-byte floating point 4196+10*N injected flow rate 4-byte floating point 4198+10*N extraction flow rate 4-byte floating point	20*3 bytes 30 words N is 0-2, a total of three groups of data

				4200+10*N liquid volume unit 2 bytes unsigned 4201+9*N injected flow unit 2 bytes unsigned 4202+10*N extraction flow unit 2-byte unsigned	
--	--	--	--	--	--

Table 28. Holding Register (Power-off Memory RAM)

No.	Address (Decimal)	Name	Function	Data Range	Data Type
1	4800	Cumulative running times	Record cumulative running times	0- 4294967295	Unsigned Long int (4 bytes)
2	4802	Cumulative running steps	Record cumulative running times (equivalent to cumulative volume)	0- 4294967295	Unsigned Long int (4 bytes)

11 RS485 Interface (DB15)

11.1 Use external power supply

Connect the positive end of the external +24V or +12V power supply to pin 4 VCC_W, and connect the negative end to pin 8 COM.

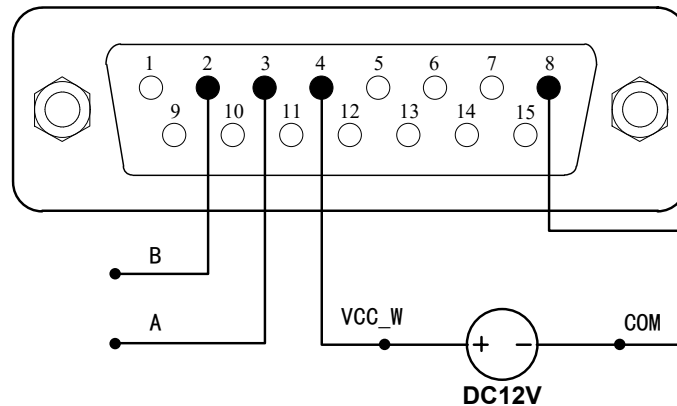


Figure 3. RS485 External Power Supply

11.2 Use internal power supply

Connect DB15 pin 10 +12V to pin 4 VCC_W, and connect pin 11 GND to pin 8 COM.

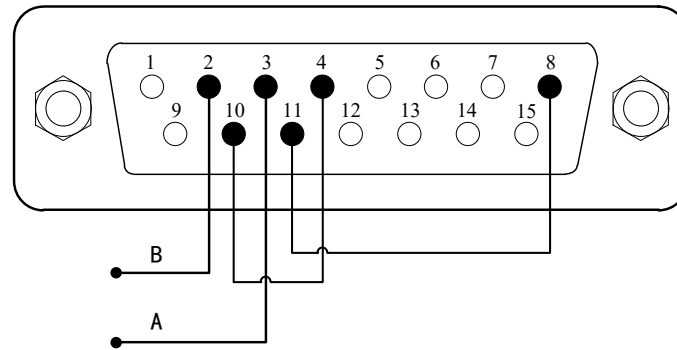


Figure 4. RS485 Internal Power Supply

12 Instruction on data transmission format

12.1 Read Input Register

Temperature: Address 1000, L or F series, 1 word length, integer variable

000000-Tx: 01 04 03 E8 00 01 B1 BA

000001-Rx: 01 04 02 00 22 39 29

Read

	HEX
Slave Address	01
function code	04
Register high	03
Register low	E8
Register number high	00
Register number low	01
CRC high bit	B1
CRC low bit	BA

Description: Address 1000 (03E8)

response

	HEX
Slave Address	01
function code	04
Number of bytes	02
Data high	00
Data low	22
CRC high bit	39
CRC low bit	29

Description: Actual return value 34 (00 22)

12.2 Read holding register

Flow: Address 4015, L or F series, 2 bytes, single precision floating point variable, byte order CDAB (original

computer mode)

000032-Tx:01 03 0F AF 00 02 F7 3E

000033-Rx:01 03 04 EF CA 42 65 1E 52

read

	HEX
slave address	01
function code	03
Register high bit	0F
Register low bit	AF
Register number high bit	00
Register number low bit	02
CRC high bit	F7
CRC low bit	3E

Description: Address 4015 (0F AF)

response

	HEX
slave address	01
function code	03
Number of bytes	04
Data 1 high bit (4015)	EF
Data 1 low bit (4015)	CA
Data 2 high bit (4016)	42
Data 2 low bit (4016)	65
CRC high bit	1E
CRC low bit	52

Note: The actual return value is 57.484169 (42 65 EF CA). The byte order used here is: CDAB (original communication mode: computer mode), and the data format is data 2 + data 1 to form a four-byte hexadecimal number, which needs to be converted to a floating point number.

IEEE 754 Converter, 2024-02

	Sign	Exponent	Mantissa
Value:	+1	2^5	1 + 0.7963802814483643
Encoded as:	0	132	6680522
Binary:	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Decimal Representation	<input type="text" value="57.48417"/>		
Value actually stored in float:	<input type="text" value="57.48416900634765625"/> 1		
Error due to conversion:	<input type="text" value="0.00000099365234375"/> -1		
Binary Representation	<input type="text" value="01000010011001011110111111001010"/>		
Hexadecimal Representation	<input type="text" value="4265efca"/>		

Website: <https://www.h-schmidt.net/FloatConverter/IEEE754.html>

12.3 Writing Holding Registers

Start and stop : Address 4126, L or F series, 1 word length, integer variable

Tx:088-01 06 10 1E 00 01 2C CC

Rx:089-01 06 10 1E 00 01 2C CC

Write

	HEX
Slave Address	01
function code	06
Register high	10
Register low	1E
Register number high	00
Register number low	01
CRC high bit	2C
CRC low bit	CC

Description: Address 4126 (10 1E)

response

	HEX
Slave Address	01
function code	06
Register high	10
Register low	1E
Register number high	00
Register number low	01
CRC high bit	2C
CRC low bit	CC

12.4 Writing Holding Registers

Traffic: Address 4015, L or F series, 2 word length, single precision floating point variable, byte order CDAB (original computer mode)

Tx:000082-01 10 0F AF 00 02 04 00 00 41 20 C9 EF

Rx:000083-01 10 0F AF 00 02 72 FD

write

	HEX
slave address	01
function code	10
Register high bit	0F
Register low bit	AF
Register number high bit	00
Register number low bit	02
Number of bytes	04
Data 1 high bit (4015)	00
Data 1 low bit (4015)	00
Data 2 high bit (4016)	41
Data 2 low bit (4016)	20
CRC high bit	C9

CRC low bit	EF
-------------	----

Description: Address 4015 (0F AF); data 10.0 (41 20 00 00)

response

	HEX
slave address	01
function code	10
Register high bit	0F
Register low bit	AF
Register number high bit	00
Register number low bit	02
CRC high bit	72
CRC low bit	FD

Note: The byte order selected here: CDAB (original communication mode: computer mode), the data format is data 2 + data 1 to form a four-byte hexadecimal number, which needs to be converted to a floating point number

IEEE 754 Converter, 2024-02

	Sign	Exponent	Mantissa
Value:	+1	2^3	$1 + 0.25$
Encoded as:	0	130	2097152
Binary:	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Decimal Representation	<input type="text" value="10"/>		<input type="button" value="1"/>
Value actually stored in float:	<input type="text" value="10"/>		<input type="button" value="-1"/>
Error due to conversion:	<input type="text" value="0"/>		
Binary Representation	<input type="text" value="01000001001000000000000000000000"/>		
Hexadecimal Representation	<input type="text" value="41200000"/>		

12.5 Read Holding Registers

Flow: Address 4015, L or F series, 2 word length, single precision floating point variable, byte order ABCD (original PLC mode)

000032-Tx:01 03 0F AF 00 02 F7 3E

000033-Rx:01 03 04 42 65 EF CA 32 33

Read

	HEX
Slave Address	01
function code	03
Register high	0F
Register low	AF
Register number high	00
Register number low	02
CRC high bit	F7
CRC low bit	3E

Description: Address 4015 (0F AF)

response

	HEX
Slave Address	01
function code	03
Number of bytes	04
Data 1 high digit (4015)	42
Data 1 low bit (4015)	65
Data 2 high digit (4016)	EF
Data 2 low bit (4016)	CA
CRC high bit	32
CRC low bit	33

Note: The actual return value is 57.484169 (42 65 EF CA).

The byte order used here is: ABCD (original communication mode: PLC mode). Its data sorting order is different from that of the computer mode. The data format is data 1 + data 2, which forms a four-byte hexadecimal number and needs to be converted to a floating point number.

IEEE 754 Converter, 2024-02

	Sign	Exponent	Mantissa
Value:	+1	2^5	1 + 0.7963802814483643
Encoded as:	0	132	6680522
Binary:	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Decimal Representation		<input type="text" value="57.48417"/>	
Value actually stored in float:		<input type="text" value="57.48416900634765625"/>	<input type="button" value="1"/>
Error due to conversion:		<input type="text" value="0.00000099365234375"/>	<input type="button" value="-1"/>
Binary Representation		<input type="text" value="01000010011001011110111111001010"/>	
Hexadecimal Representation		<input type="text" value="4265efca"/>	

Appendix 1: Solution for converting hexadecimal to single-precision floating point numbers

Union

```
{
float f;
char buf[4];
}data;
```

```
void write_Df(u16 ndata, float df)
```

```
{
u16 d0,d1;
data.f = df;
```

```
d0 = (data.buf[1] << 8) + data.buf[0];
d1 = (data.buf[3] << 8) + data.buf[2];
}
```

Appendix 2: CRC cyclic redundancy check

```
unsigned char *puchMsg; //To generate CRC value, point the pointer to the buffer containing binary data
```

```
0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE,  
0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26,  
0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2,  
0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,  
0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79, 0xBB,  
0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,  
0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0, 0x50, 0x90, 0x91,  
0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54, 0x9C, 0x5C,  
0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59, 0x58, 0x98, 0x88,  
0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,  
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83, 0x41, 0x81, 0x80,  
0x40  
};
```