



Baoding Shenchen Precision Pump Co., Ltd.

Add: No. 103, Building 2, Pivot Industrial Park, Fuxing East Raod, Baoding, China.

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MODBUS Communication Protocol of DF600 Plus

Note: The hexadecimal numbers are expressed by 'XXXXH' or 'XXH' in the below description.

1. MODBUS-RTU standard communication format

This communication use MODBUS RTU mode, message frame as below:

Slave address	Function code	Data area	CRC Check (Cyclic Redundancy Check)	
1 Byte	1 Byte	0 or up to 252 bytes	2 Bytes	
			CRC low	CRC high

- (1) **Slave address:** Host control peristaltic pump address No. The pump address No. should not be same when they are in the same 485 line. The address No. range is 1~247, 0 means broadcast.
- (2) **Function code:** The protocol use 2 common function codes which defined by MODBUS protocol.
 - 03H:** Read the contents of holding register
 - 06H:** Write a word to the holding register
 - 10H:** Write a long type to the data zone of holding register.
- (3) **Data area:** Specific information instructions that the peristaltic pump needs to execute, such as start/stop, direction, accelerate/decelerate etc.
- (4) **CRC check:** CRC code is 2 bytes, 16 check codes. Use CRC-16(which used in American binary synchronous system).

Polynomial: $G(X)=X^{16}+X^{15}+X^2+1$.

CRC check C language code please refer to Appendix 1.

2. Communication Setting

- (1) **Communication baud rate: 1200, 2400, 4800, 9600 optional.**
- (2) **Byte structure:** 1 start bit + 8 data bits + 1 even parity bit + 1 stop bit
- (3) **Bit serial sending order:** The least significant big(LSB)..... The most significant bit (MSB)

Start	1	2	3	4	5	6	7	8	Check	Stop
-------	---	---	---	---	---	---	---	---	-------	------

(4) Data transferring format:

Integer (2 bytes):

Data: (High bit) The second byte The first byte (Low bit)

Send: The second byte The first byte

For example: 1234H send 12H 34H

Floating-point type (4 bytes):

Data: (High bit) The fourth byte The third byte The second byte The first byte (Low bit)

Send: The fourth byte The third byte The second byte The first byte

For example: 8.9 send 41H 0EH 66H 66H



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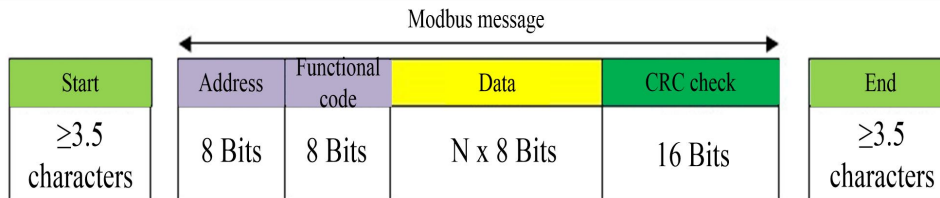
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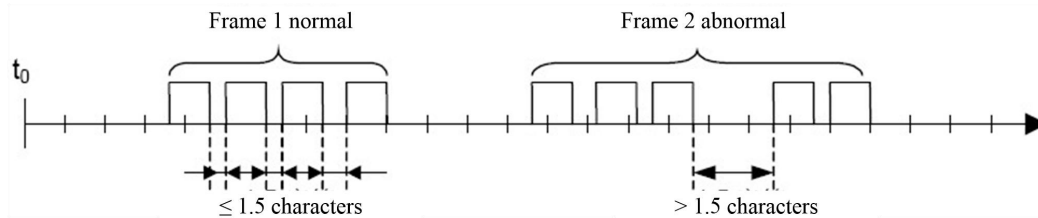
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3. MODBUS Message RTU Frame Format

In RTU mode, the message frames are distinguished by idle intervals with a duration of at least 3.5 characters. As the follow picture:



The entire message frame must be sent in a continuous stream of characters. If the idle space between two characters is greater than 1.5 character times, the message frame is considered as incomplete, should be discarded by receiving node. As below:



4. Abnormal Response

When host sending request data, the slave receives abnormal data, an abnormal response is required. If the address code sent from host is wrong, there is no this address code between slaves or the data received by slave is wrong when CRC check, no abnormal code return, the host should have super response mechanism.

Function code domain: Abnormal response function code is normal response function code +80H.

Data domain: Return to abnormal code, define as below:

Chart 1: Abnormal code definition

Code	Name	Meaning
01H	Illegal function code	The function code received by peristaltic pump except 03H/06H/10H.
02H	Illegal data address	This abnormal code means the register address is not allowed data which received by peristaltic pump.
03H	Illegal data value	Written data does not meet the operating range.
06H	Slave(peristaltic pump) busy	The current state of the peristaltic pump conflict with the command received, unable to complete the command.
0CH	Filling unit error	The filling unit setting is invalid when in calibration process.



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Peristaltic Pump only receive MODBUS command with the Main Interface, other interface do not receive message.

5. Holding register address and content

When change the below register content , the all relative filling units parameter also will be changed.

Address (Decimal)	Name	Range	Data Type
1000	Pump head mode	The relative parameters refer to Chart 1	unsigned short int (2 Bytes)
1001	Tubing size	The relative parameters refer to Chart 1	unsigned short int (2 Bytes)
1002	Filling volume	0.01-9999.99mL	Float (4 Bytes)
1004	Filling time	0.1-9999.99s	Float (4 Bytes)
1006	Pause time	0.5-9999.99s	Float (4 Bytes)
1008	Filling times	0-9999	unsigned short int (2 Bytes)
1009	Back suction angle	0-3600°	unsigned short int (2 Bytes)
1010	Running direction	0: Counterclockwise 1: Clockwise	unsigned short int (2 Bytes)
1011	Start/stop control	0: Stop 1: Running	unsigned short int (2 Bytes)
1012	Full speed control	1: Full speed running with liquid 0: Stop	unsigned short int (2 Bytes)

The register content as below changing is relative to single filing unit, when it is used to calibrate volume:

Address (Decimal)	Name	Range	Data Type
2000	Filling unit address	1-32	unsigned short int (2 Bytes)
2001	Filling unit speed	0.1-600 (rpm)	Float (4 Bytes)
2003	For filling unit to start/stop control	1: The relative filling unit runs, when finish filling time it stops automatically. 0: The relative filling unit stops running.	unsigned short int (2 Bytes)
2004	Actual filling volume	0.01-9999.99mL	Float (4 Bytes)
2007	Restore calibration factor	1: Restore calibration factor	unsigned short int (2 Bytes)

Note: You need to set register 2000 (Filling unit address) before set register 2007(Restore calibration factor). That is, the recovery of calibration coefficient can only be performed for a certain unit.

Chart 1 Pump Head & Tubing No.



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Pump Head Name	Pump Head Model	Tubing Model	Tubing Specification
EasypumpI	0	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
EasypumpII	1	15	15#
		24	24#
		35	35#
		36	36#
EasypumpIII	2	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
EasypumpIV	3	15	15#
		24	24#
		35	35#
		36	36#
EasypumpV	4	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
EasypumpVI	5	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
2*EasypumpI	6	13	13#
		14	14#
		19	19#



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		16	16#
		25	25#
		17	17#
		18	18#
2*EasypumpII	7	15	15#
		24	24#
		35	35#
		36	36#
2*EasypumpIII	8	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
2*EasypumpIV	9	15	15#
		24	24#
		35	35#
		36	36#
AMC_(10)	10	101	1*1
		102	2*1
		103	2.4*0.86
		104	2.79*0.86
		105	3*1
		106	0.19*0.86
		107	0.25*0.86
		108	0.51*0.86
		109	0.89*0.86
		110	1.14*0.86
		111	1.42*0.86
		112	2.06*0.86
		114	0.13*0.86
AMC_(6)	11	101	1*1
		102	2*1
		103	2.4*0.86
		104	2.79*0.86
		105	3*1
		106	0.19*0.86



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		107	0.25*0.86
		108	0.51*0.86
		109	0.89*0.86
		110	1.14*0.86
		111	1.42*0.86
		112	2.06*0.86
		114	0.13*0.86
YZ1515x	12	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
YZ2515x	13	15	15#
		24	24#
2*YZ1515x	14	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
2*YZ2515x	15	15	15#
		24	24#
MCn(10)	16	101	1*1
		102	2*1
		103	2.4*0.86
		104	2.79*0.86
		105	3*1
		106	0.19*0.86
		107	0.25*0.86
		108	0.51*0.86
		109	0.89*0.86
		110	1.14*0.86
		111	1.42*0.86
		112	2.06*0.86
MCn(6)	17	101	1*1



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		102	2*1
		103	2.4*0.86
		104	2.79*0.86
		105	3*1
		106	0.19*0.86
		107	0.25*0.86
		108	0.51*0.86
		109	0.89*0.86
		110	1.14*0.86
		111	1.42*0.86
		112	2.06*0.86
DZ25-3L	18	15	15#
		24	24#
		35	35#
		36	36#
2*DZ25-3L	19	15	15#
		24	24#
		35	35#
		36	36#
DZ25-6L	20	15	15#
		24	24#
		35	35#
		36	36#
2*DZ25-6L	21	15	15#
		24	24#
		35	35#
		36	36#
YZ35	22	26	26#
		73	73#
		82	82#
2*YZ35	23	26	26#
		73	73#
		82	82#
DY15	24	13	13#
		14	14#
		19	19#
		16	16#
		25	25#



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DY25	25	17	17#
		18	18#
		15	15#
		24	24#
		35	35#
		36	36#

6. Send Data Format

Unsigned short int format

Peristaltic pump address	Function code	Register address		Data (unsigned short int)		CRC check	
		Address H	Address L	Data H	Data L	L	H
	06H						

Float format

Peristaltic pump address	Function code	Register address		Register quantity		The number of bytes	Data (Float)				CRC check		
		H	L	00H	02H		04H	H2	H1	L2	L1	L	H
	10H												

(1) Setting pump head type

The peristaltic pump address is 1, set the pump head to EasyumpI, the number is 0000H.

Send: **01 06 03 E8 00 00 09 BA**

Back: **01 06 03 E8 00 00 09 BA**

(2) Setting tubing size

The peristaltic pump address is 1, set the tubing type to 16#, the number is 0010H.

Send: **01 06 03 E9 00 10 59 B6**

Back: **01 06 03 E9 00 10 59 B6**

(3) Setting filling volume

The peristaltic pump address is 1, set the filling volume to 58.8mL.

Send: **01 10 03 EA 00 02 04 42 6B 33 33 58 29**

Back: **01 10 03 EA 00 02 60 78**

(4) Setting filling time

The peristaltic pump address is 1, set the filling time to 1s.

Send: **01 10 03 EC 00 02 04 3F 80 00 00 E4 BE**

Back: **01 10 03 EC 00 02 80 79**

(5) Setting interval time

The peristaltic pump address is 1, set the interval time to 1s.

Send: **01 10 03 EE 00 02 04 3F 80 00 00 65 67**



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Back: **01 10 03 EE 00 02 21 B9**

(6) Setting filling times

The peristaltic pump address is 1, set the filling times to 20 times.

Send: **01 06 03 F0 00 14 89 B2**

Back: **01 06 03 F0 00 14 89 B2**

(7) Setting back suction angle

The peristaltic pump address is 1, set the back suction angle to 60°.

Send: **01 06 03 F1 00 3C D8 6C**

Back: **01 06 03 F1 00 3C D8 6C**

(8) Direction control

The peristaltic pump address is 1, clockwise is 0001H, counterclockwise is 0000H.

Send: **01 06 03 F2 00 01 E9 BD** (clockwise)

Back: **01 06 03 F2 00 01 E9 BD**

(9) Start/stop control

The peristaltic pump address is 1, 0001H controls start, 0000H controls stop.

Send start: **01 06 03 F3 00 01 B8 7D**

Back: **01 06 03 F3 00 01 B8 7D**

Send stop: **01 06 03 F3 00 00 79 BD**

Back: **01 06 03 F3 00 00 79 BD**

(10) Full speed

The peristaltic pump address is 1, full speed is 0001H

Send: **01 06 03 F4 00 01 09 BC**

Back: **01 06 03 F4 00 01 09 BC**

7. Appendix 1—CRC Check C Language Code

CRC generation process:

- (1) Put one 16 bits register into hexadecimal FFFF(all 1), we call it CRC register.
- (2) Make the first 8 bytes with 16 CRC register low bytes XOR, the result put in CRC register.
- (3) Detect LSB of CRC register

If LSB is 0, move CRC register 1 bit to right (towards to direction of LSB), MSB zeroing.

If LSB is 1, move CRC register 1 bit to right (towards to direction of LSB), MSB zeroing, then XOR the polynomial value of the CRC register 0xA001 (1010 0000 0000 0001).

- (4) Repeat step 3, until finish 8 shifts. After finish this operation, will finish the complete operation for 8 Bytes.
- (5) Repeat Step 2 to Step 5 for the next Bytes in message. Continue this operation till all the message be deal with finished.
- (6) The final content in CRC register is CRC value.

(7) When put CRC value in message, high and low Bytes must be exchanged, described as below:

C language code:

```
void CRCVerify(char *rec,char CRClen,char CRCdata[2])
```

```
{
```

```
www.good-pump.com
```



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```
char i1,j;

unsigned int crc_data=0xffff;

for(i1=0; i1<CRClen; i1++)
{
    crc_data=crc_data^rec[i1];

    for(j=0; j<8; j++)
    {
        if(crc_data&0x0001)
        {
            crc_data>>=1;

            crc_data^=0xA001;
        }
        else
        {
            crc_data>>=1;
        }
    }
}

CRCdata[0]=(char)(crc_data);

CRCdata[1]=(char)(crc_data>>8);
}
```