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V Series MODBUS Communication Protocol

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 1~32, 0 means broadcast.

(2)**Function code**: The protocol use 2 common function codes which defined by MODBUS protocol.

03H: Read holding registers

06H: Write a word to holding register

10H: Write a long to holding registers

Data area:the detailed information command of peristaltic pump,for example: start/stop,direction,speed etc.

(3)**CRC check**:CRC code is 2 bytes, 16 check codes. Use CRC-16(which used in American binary synchronous system).

Polynomial: G(X)=X16+X15+X2+1**.**

CRC check C language code please refer to Appendix 1.

2. Communication Setting

(1) Communication boudrate: 1200, 2400, 4800, 9600 optional

(2) Byte structure: 1 start bit + 8 data bits +1 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: The second byte The first byte

Send: The second byte The first byte

For example: 1234H send 12H 34H

Long integer and Float (4 bytes):

Data: The fourth byte The third byte The second byte The first byte

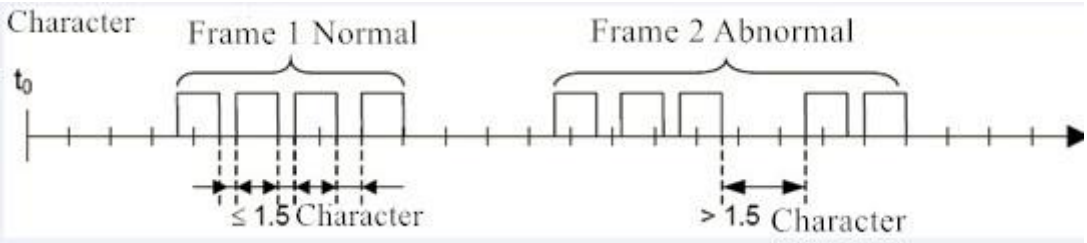
Send: The second byte The first byte The fourth byte The third byte

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

3. MODBUS Message RTU Frame Format

← MODBUS Message →					
Start	Address	Function Code	Data	CRC Check Code	End
≥3.5 characters	8 Bits	8 Bits	N x 8 Bits	16 Bits	≥3.5 characters

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 reaction

When host sending request data, slave receiving data abnormal, it should have abnormal reaction. 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 reaction process.

Function code area: Abnormal reaction function code is normal reaction function code +80H.

Data area: Return 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.

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

5. Holding register address and content

Basic Parameters Setting

Address（Decimal）	Name	Range	Data Type
1000	Pump Head	Relative datas refer to Chart 1	unsigned short int (2 Bytes)
1001	Tubing Size	Relative datas refer to Chart 1	unsigned short int (2 Bytes)
1002	Motor Speed	0.1-600rpm	float (4 Bytes)
1004	Flow Rate	0.1-99999 mL	float (4 Bytes)
1007	Back Suction Angle	0-360 °	unsigned short int (2 Bytes)
1008	Start/Stop Control	1:Start 0:Stop	unsigned short int (2 Bytes)
1009	Direction Control	1:Anticlockwise 0:Clockwise	unsigned short int (2 Bytes)
1010	Full Speed Running	1:Start full speed 0:Stop full speed	unsigned short int (2 Bytes)
1015	Set Flow Volume	0-99999 mL	Float (4 Bytes)
1018	Working Time	0.1-9999（s）	Float (4 Bytes)
1020	Working Mode	0: Transferring 1:Dispensing	unsigned short int (2 Bytes)
1021	Pause Time	0.1-9999（s）	Float (4 Bytes)
1023	Copy Numbers	0-9999 times. 0 means infinite	unsigned short int (2 Bytes)

Note:

① When working mode is transferring, set up register 1015, 1018 invalid.
② When working mode is dispensing, set up register 1002 1004 invalid.

③when working mode is fixed volume metering,set up register 1018 invalid.

④Please set up the register datas refer to the chart, it can not receive one order with setting up multiple registers.

Calibration Parameters Setting Up

Address（Decimal）	Name	Range	Data Type
2001	Testing time	0.5-9999s	float (4 Bytes)
2003	Start test	1:Start 0:Stop	unsigned short int (2 Bytes)
2004	Actual volume	0-9999 mL	float (4 Bytes)
2006	Restore Defaults	1:Restore calibration	unsigned short int (2 Bytes)
2007	Micro Adjustment	1:Increase 0: Decrease	unsigned short int (2 Bytes)

Chart 1 Pump Head & Tubing No.

Pump Head Name	Pump Head	Tubing Size	Tubing Specific
YZ1515x	0	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
YZ2515x	1	15	15#
		24	24#
2*YZ1515x	2	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
2*YZ2515x	3	15	15#
		24	24#
MCn(10)	4	101	1*1
		102	2*1
		103	2.4*0.8
		104	2.79*0.9
		105	3*1
MCn(6)	5	101	1*1
		102	2*1
		103	2.4*0.8
		104	2.79*0.9
		105	3*1
DZ25-3L	6	15	15#
		24	24#
		35	35#
		36	36#
SN15	7	14	14#
		16	16#
SN25	8	24	24#

YZ35	9	26	26#
		73	73#
		82	82#
2*YZ35	10	73	73#
		82	82#
DZ25-6L	11	15	15#
		24	24#
		35	35#
		36	36#
DY15	12	13	13#
		14	14#
		19	19#
		16	16#
		25	25#
		17	17#
		18	18#
DY25	13	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	
	06H	Address H	Address L	Data H	Data L	L	H

Float format

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

1.Setting pump head model

Peristaltic pump address is 1, setting pump head YZ1515x No.: 0000H

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

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

2.Setting tubing model

Peristaltic pump address is 1, setting tubing model 16# No.: 0010H

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

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

3.Setting motor speed

Peristaltic pump address is 1,setting motor speed 58.8rpm

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

Return:01 10 03 EA 00 02 60 78

4.Setting flow rate

Peristaltic pump address is 1,setting flow rate 50ml/min

Send:**01 10 03 EC 00 02 04 42 48 00 00 7D 2C**

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

5.Setting back suction angle

Peristaltic pump address is 1,setting back sunction angle 60 °

Send：**01 06 03 EF 00 3C B8 6A**

Return：**01 06 03 EF 00 3C B8 6A**

6.Start/Stop control

Peristaltic pump address is 1,start 0001H, stop,0000H

Send start: **01 06 03 F0 00 01 48 7D**

Return: **01 06 03 F0 00 01 48 7D**

Send stop: **01 06 03 F0 00 00 89 BD**

Return: **01 06 03 F0 00 00 89 BD**

7.Direction control

Peristaltic pump address is 1,clockwise 0001H, anticlockwise 0000H

Send: **01 06 03 F1 00 01 19 BD**（clockwise）

Return: **01 06 03 F1 00 01 19 BD**

8.Full speed

Peristaltic pump address is 1,full spees 0001H

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

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

9. Setting volume

Peristaltic pump address is 1,setting filling volume 100.00mL

Send: **01 10 03 F7 00 02 04 42 C8 00 00 3C 7B**

Return: **01 10 03 F7 00 02 F0 7E**

10. Setting working time

Peristaltic pump address is 1,setting working time 10.00s

Send: **01 10 03 FA 00 02 04 41 20 00 00 7D 92**

Return: **01 10 03 FA 00 02 61 BD**

11.Setting working mode

Peristaltic pump address is 1,setting working mode is transferring

Send: **01 06 03 FC 00 00 49 BE**

Return: **01 06 03 FC 00 00 49 BE**

12.Setting pause time

Peristaltic pump address is 1,setting pause time 1s

Send: **01 10 03 FD 00 02 04 3F 80 00 00 24 7E**

Return: **01 10 03 FD 00 02 D0 7C**

13.Setting copy numbers

Peristaltic pump address is 1,setting copy numbers 100

Send: **01 10 03 FF 00 64 B8 55**

Return: **01 10 03 FF 00 64 B8 55**

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. Move CRC register 1 bit to right, MSB zeroing. Extraction and detection of LSB.
4. (If LSB is 0): Repeat Step 3 (another shift).

   (If LDB is 1): XOR register for CRC polynomial value 0xA001 (1010 0000 0000 0001).
5. Repeat Step 3 and 4, until finish 8 shifts. After finish this operation, will finish the complete operation for 8 Bytes.
6. Repeat Step 2 to Step 5 for the next Bytes in message. Continue this operation till all the message be deal with finished.
7. The final content in CRC register is CRC value.
8. When put CRC value in message, high and low Bytes must be exchanged.