

# Communication:Modbus

Data Transmitted via UART		
Baud Rate : 9600bps		
Transmission:RTU		
Start:LSB first		
Start bite:1		
Data bit:8		
Verification:None		
Stop bit:1		

**Software & Hardware**

1. Standard Modbus-RTU, RS485 master cable, Master-slave half duplex asynchronous serial communication;
2. Default communication setting : 9600-8-N-1; Low bit first, big edian in front, little edian afterwards;
3. Master port :External controller ; Modbus slave: Frequency converter ; Default slave address : AAH
4. This protocol supports the following 2 Modbus function codes for Modus xxxx
  - 1). Function code 03H: Read multiple holding registers
  - 2). Function code 10H: Write multiple holding registers
5. If Modbus slave can't connect to correct data for 15 seconds, communication error will be reported (not open considering compability), once correct data received,error will be eliminated

**Communication Timing Procedure**

1. Master port calls at a regular interval, interval:1000ms [ Calculation of duration: Master port callT1+Slave reply wait time T2+ Slave reply time T3)+T4]
2. Timing as follows :

The diagram illustrates the timing sequence for two consecutive Modbus calls. It shows two horizontal timelines: the top one for the Master Port and the bottom one for the Slave. 
 

- Master Port Call 1:** A box labeled '主机点名 1' (Slave Name 1) is shown on the Master timeline. A double-headed arrow below it is labeled T1.
- Slave 1 Reply:** A box labeled '从机 1 回复' (Slave 1 Reply) is shown on the Slave timeline. A double-headed arrow below it is labeled T2.
- Master Port Call 2:** A box labeled '主机点名 2' (Slave Name 2) is shown on the Master timeline. A double-headed arrow below it is labeled T3.
- Slave 2 Reply:** A box labeled '从机 2 回复' (Slave 2 Reply) is shown on the Slave timeline. A double-headed arrow below it is labeled T4.

 Vertical dashed lines indicate the start and end of each call and reply. The interval between the end of the first call and the start of the second call is also marked with a double-headed arrow.

3. Conditions:
  - 1). Response time of Modbus slave (T2): Upon receipt of name frame from master port, Modbus slave has to send out first byte of response frame within 50ms
  - 2). Sending time from master port (T4) :Upon receipt of last byte from reply frame, wait at least 50ms before sending out next data.
  - 3). Timing is accounted by 1ms, maximum deviation is 1ms, a deviation of +/-1ms is acceptable by above mentioned timing conditions

## Function Code

	<p>Description: Register reading</p> <p>Note: Master control board register reading, does Function code: 0x03 (user grade)</p> <p>Table 8 Request Frame</p>						
<b>0x03</b>	Address	Function Code	Start Address	Number of Data	CRC Verification Code		
	1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes		
	Address	Function Code	Number of Bite	Valid Data	CRC Verification Code		
	1 Byte	1 Byte	1 Byte	n Bytes	2 Bytes		
	<p>Note: Address, function code, start address, Data of response frame same as request frame</p>						
	<p>Description: Register Writing</p> <p>Note: Write master board data into register, support broadcasting. Function code: 0x10 (user grade)</p> <p>Table 8 Request Frame</p>						
<b>0x10</b>	Address	Function Code	Start Address	Number of Data	Number of Bite	Valid Data	CRC Verification
	1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	n Bytes	2 Bytes
	Address	Function Code	Start Address	Number of Data	CRC Verification Code		
	1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes		
	<p>Note: Address, function code, start address, Data of response frame same as request frame</p>						
<b>Notes</b>	<p>1. Transmission format for "Start address", "Data/Quantity" and "Valid Data" is the same, 8 big edians first, then 8 little edians. E.g.: To transmit 0x1234, Transmit 0x12 first, then 34</p> <p>2. Transmission format for CRC verification code is :8 big edians first, then 8 little edians E.g.: To transmit 0xAA55, Transmit 0xAA first, then 0x55</p>						

Notion	Spec.Address	Attribution	Function	Data Type	Function Description	Remarks	
Order to Master Control Board	3001	W	Setting Running Capacity	INT16	0:Off; 30-100:Running Capacity		
	3002	W	Reservation	INT16			
Master Board Data Reading	2001	R	Error Code	INT16	Bit0	DC voltage Abnormal	
					Bit1	AC current sampling circuit failure	
					Bit2	Phase-deficient protection	
					Bit3	Master drive error	
					Bit4	Heat sink sensor error	
					Bit5	Heat sink over	
					Bit6	Output current exceeds limit	
					Bit7	Input voltage abnormal	
					Bit8	no water protection	
					Bit9	Display board & master device communication failure	
					Bit10	Display board EEPROM reading failure	
					Bit11	RTC time reading Error	
					Bit12	Master board EEPROM reading failure	
					Bit13	Motor current detection Error	
					Bit14	Motor power overload	
					Bit15	PFC protection	
	2002	R	Frequency Converter Operation Condition	INT16	Bit0 Pump On Bit1-bit15 Reservation		
	2003	R	Pump Running capacity (percentage)	INT16	True value		
	2004	R	Pump Running Capacity	INT16	True value		