ATC Series

Communication Protocol

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目录

1. Basic ModBus Rules

All RS485 communication circuits must operate in master-slave mode. This configuration enables data transmission between a master station (e.g., PC) and 32 slave stations.

No communication can start from the substation.

All communications on the RS485 loop are transmitted as information frames.

If the master or slave station receives an information frame containing an unknown command, it will not respond.

2. Data Frame Format

The communication is asynchronous and operates in byte (data frame) units. Each data frame transmitted between the master and slave stations is a 11-bit serial data stream.

data frame format

start bit	1st place
data bit	8 bits
parity check bit	Optional odd, even, or invalid check
stop bit	Invalid: 2 digits, valid: 1 digit
Baud rate	2400、4800、9600、19200、38400bps

3. Communication Protocol

When a communication command is sent to a module, the module with the corresponding address code receives the command, removes the address code, and reads the information. If no error is detected, it executes the corresponding task and returns the result to the sender. The returned information includes the address code, the function code of the executed action, the data after the action, and the error check code (CRC). If an error occurs, the system returns an error message.

information frame format

initial structure	address code	FC	data field	error check	End structure
Delay (equivalent to 3.5 bytes of time)	1 byte 8 bits	1 byte 8 bits	N bytes N*8 bits	2 bytes 16-bit	Delay (equivalent to 3.5 bytes of time)

Address code (ADDRESS): The address range for a single module is 1-247.

FUNCTION CODE: The function code is the second piece of data transmitted in each communication. If the most significant bit of the function code returned by the slave unit is 1 (function code>127), it indicates a response or data error. The table below lists the specific meanings and operations of the function code.

FC	definition	operate
03H	read register	Read one or more registers
06H	write single register	Write a single register
10H	write multiple registers	Write multiple register data

4. Calculation steps of CRC-16 code

a) Set the 16-bit CRC register to hexadecimal FFFF;

b) XOR an 8-bit data with the lower 8 bits of the CRC register, then store the result in the CRC register;

c) Right-shift the CRC register by one bit, pad the most significant bit with 0, and check the shifted-out bit;

d) If the least significant bit is 0: repeat step 3 (shift again);

e) If the least significant bit is 1: XOR the CRC register with the hexadecimal number A001;

f) Repeat steps 3 and 4 until the data is shifted right 8 times, processing all 8 bits.

g) Repeat steps 2 to 5 to process the next set of data.

h) The final CRC register value constitutes the CRC code. During transmission, the lower 8 bits are sent first, followed by the upper 8 bits. Note: The CRC code calculation starts from the <sub-machine address> and is computed by dividing all bytes except the <CRC code>.

5. Example of Information Frame Format

5.1. Function code 03H

Primary server request message format:

Substation address	FC	data starting address		data size		redundant check	
1 byte	03H	MSB	LSB	MSB	LSB	LSB	MSB

Response message format:

Substation address	FC	Byte count	Data 1		···	data n		redundant check	
1 byte	03H	1 byte	MSB	LSB	···	MSB	LSB	LSB	MSB

Note: MSB stands for the high byte of a two-byte number; LSB stands for the low byte (the same applies below).

5.2. Function code 06H

Primary server request message format:

Substation address	FC	data storage address		modified value		redundant check	
1 byte	06H	MSB	LSB	MSB	LSB	LSB	MSB

Response message format:

Substation address	FC	data storage address		modified value		redundant check	
1 byte	06H	MSB	LSB	MSB	LSB	LSB	MSB

5.3. Function code 10H

Primary server request message format:

Substation address	FC	data starting address		number of registers		Byte count	Data 1		···	data n		redundant check	
1 byte	10H	MSB	LSB	MSB	LSB	1 byte	MSB	LSB	···	MSB	LSB	LSB	MSB

Response message format:

Substation address	FC	data starting address		number of registers		redundant check	
1 byte	10H	MSB	LSB	MSB	LSB	LSB	MSB

6. Error Code Handling

If the data address or data value sent by the master station is wrong, the slave station will send back the error information.

The format of the error code returned by the slave is as follows:

Address code: 1 byte

Function code: 1 byte (most significant bit is 1)

Error code: 1 byte

CRC code: 2 bytes

The error codes are as follows:

01: Invalid function code: The received data is not a valid function code.

02: Invalid data address: The received data address exceeds the table's address range.

03: Invalid data value: The received data value exceeds the data range of the corresponding address.

7. Register Address and Description

Table 1: Operational Status Parameters and Basic Measurement Data

register	number of registers	access rule	unit	form	span	explain
C00H	1	a slight pause in reading	V	UINT	0-500	Common A-phase voltage
C01H	1	a slight pause in reading	V	UINT	0-500	Commonly used phase B voltage
C02H	1	a slight pause in reading	V	UINT	0-500	Common C-phase voltage
C03H	1	a slight pause in reading	V	UINT	0-500	standby phase A voltage
C04H	1	a slight pause in reading	V	UINT	0-500	standby phase B voltage
C05H	1	a slight pause in reading	V	UINT	0-500	standby C phase voltage
C06H	1	a slight pause in reading	—	Bitmap16		Power supply over/under voltage status: 0=Normal 1=Abnormal ●bit0: Commonly used A-phase under-voltage ●bit1: Common A-phase overvoltage ●bit2: Commonly used for B-phase under-voltage ●bit3: Common B-phase overvoltage ●bit4: Commonly used C-phase under-voltage ●bit5: Common C-phase overvoltage ●bit6: Standby A-phase under-voltage ●bit7: Reserve A-phase overvoltage ●bit8: Backup B-phase under-voltage ●bit9: Reserve B-phase overvoltage ●bit10: Standby C-phase under-voltage ●bit11: Reserve C-phase overvoltage

C07H	1	a slight pause in reading	—	Bitmap16		Switch position status: ●bit0: Common closing ●bit1: Standby closing ●bit2: Switch open
C08H	1	a slight pause in reading	—	Bitmap16		Switch fault status information: ●bit0: Switching failure ●bit1: Fire protection circuit breaker

Table 2: Switching Control and Setting Parameters

register	number of registers	access rule	unit	form	span	explain
D00H	1	Read/ Write	V	UINT	160-200	Commonly used power undervoltage setting value
D01H	1	Read/ Write	V	UINT	240-290	Common Overvoltage Setting Value for Power Supply
D02H	1	Read/ Write	S	UINT	0-180	conversion delay time
D03H	1	Read/ Write	V	UINT	160-200	backup power supply under-voltage setting value
D04H	1	Read/ Write	V	UINT	240-290	backup power supply overvoltage setting value
D05H	1	Read/ Write	S	UINT	0-180	Return delay time
D06H	1	Read/ Write	S	UINT	0-180	generator start-up delay time
D07H	1	Read/ Write	S	UINT	0-180	generator shutdown delay time
D08H	1	Read/ Write	—	UINT	0-2	Working Mode 0: Auto-Backup 1: Auto-Backup 2: Grid -Generator
D09H	1	Read/ Write	—	UINT	0-2	Work mode 0: Auto 1: Manual 2: Remote

Table 3: Remote Control Register

register	number of registers	access rule	unit	form	span	explain
E00H	1	—	—	UINT	5A01H-5A03H	remote control register

In the remote control mode (when the value of the E09H register unit is 2), the switch can be remotely controlled by writing the set parameters to the remote controller.

- Write 5A01H to the E00H unit to switch to the common power supply.
- Write 5A02H to the E00H unit to switch to backup power.
- Write 5A03H to the E00H unit to switch to the open position.

Note: To switch to a specific power supply, ensure its voltage is normal before the switch performs the corresponding action. Otherwise, the switch will not respond.

8. Communication parameter settings

When the controller is operational, press the set key twice to display the parameter setting menu interface ◀shown ▶in Figure 2. Within the menu, press the " and " keys to scroll up or down through ▲the ▼options. Pressing the auto/manual key will exit the menu. Pressing the " and " keys allows you to modify parameters.