Modbus communication protocol

The inverter provides RS232/RS485 communication interfaces and supports the Modbus communication protocol. Users can achieve centralized control through a computer or PLC. This communication protocol allows users to set inverter operation commands, modify or read function code parameters, and read the inverter's operating status and fault information.

1.1. Communication frame structure

The Modbus-RTU protocol communication data format of the inverter is as follows.

Frame header START	3.5 characters per second
Slave address ADR	Communication address: 1~247 (set by P8-02)
Command code CAD	03: Read slave parameters; 06: Write slave parameters
Data content DATA (n-1)	Data content: function code parameter address, number of function code parameters, function code parameter value, etc.
Data content DATA (n-2)	
...	
Data content DATA0	
CRC CHK low	Check value: CRC16 check value. When transmitting, the low byte comes first and the high byte comes last. For the calculation method, see the CRC check description in this section.
CRC CHK high bit	
END	3.5 characters per second

Command code (CAD) and data description (DATA)

Read operation instruction 0x03H, read n words (Word), up to 12 words can be read, that is, n = 1 to 12

Host read command frame

≥3.5 символов	1 байт	1 байт	2 байта	2 байта	2 байта	
Заголовок	Адрес ведомого устройства	Код команды чтения 0x03	Адрес регистра (Старший ... младший)	Количество читаемых регистров (Старший ... младший)	Проверка CRC (Младший ... старший)	Конец

Slave read response frame

≥3.5 символов	1 байт	1 байт	2 байта	2 байта	2 байта	
Заголовок	Адрес ведомого устройства	Код команды чтения 0x03	Адрес регистра (Старший ... младший) (2n)	Количество читаемых регистров (Старший ... младший)	Проверка CRC (Младший ... старший)	Конец

Host write command frame

≥3.5 символов	1 байт	1 байт	2 байта	2 байта	2 байта	
Заголовок	Адрес ведомого устройства	Код команды чтения 0x06	Адрес регистра (Старший ... младший)	Количество читаемых регистров (Старший ... младший)	Проверка CRC (Младший ... старший)	Конец

Slave write command frame

≥3.5 символов	1 байт	1 байт	2 байта	2 байта	2 байта	
Заголовок	Адрес ведомого устройства	Код команды чтения 0x06	Адрес регистра (Старший ... младший)	Количество читаемых регистров (Старший ... младший)	Проверка CRC (Младший ... старший)	Конец

If the slave detects a communication frame error, or if reading or writing is unsuccessful due to other reasons, it will reply with an error frame. Slave read response error frame:

≥3.5 символов	1 байт	1 байт	1 байт	2 байта	
Заголовок	Адрес ведомого устройства	Код неисправности 0x83	Тип ошибки	Проверка CRC	Конец

Error Type:

(01: Command code error; 02: Address error; 03: Data error; 04: Command cannot be processed.)

Slave write response error frame

≥3.5 символов	1 байт	1 байт	1 байт	2 байта	
Заголовок	Адрес ведомого устройства	Код неисправности 0x86	Тип ошибки	Проверка CRC	Конец

Example: Read the contents of two consecutive parameters starting from P0 -03 of the inverter whose slave address P8 -02 is 01.

The host sends the frame as shown in the figure:

Frame header	Slave Address	Read command code	Function code address	Read function code number	CRC check	Finish
≥3.5 characters	0×01	0×03	0×F0 0×03	0×00 0×02	0×07 0×0B	

The slave machine responds to the frame as shown below:

Frame header	Slave Address	Read command code	Number of data nodes	F0-03 parameter value	F0-04 parameter value	CRC check	Finish
≥3.5 characters	0×01	0×03	0×04	0×00 0×00	0×00 0×00	0×07 0×33	

1.2. Address definition of communication parameters

This part is the communication content, which is used to control the operation of the inverter, the inverter status and related parameter settings.

Read and write function code parameters (some function codes cannot be changed and are only for

manufacturer use or monitoring):

Function code parameter address marking rules:

The function code group number and label are used as the parameter address representation rules:

High byte: P0~PF (P group), A0~AF (A group), B0~BF (B group), C0~CF (C group), D0~DF (D group), 70~7F (U group) Low byte: 00~FF

For example: P0-11, the address is F00B;

Notice:

PF group: parameters cannot be read or changed;

Group U: Parameters can only be read but not modified.

Some parameters cannot be changed when the inverter is in operation; some parameters cannot be changed regardless of the inverter's state; when changing function code parameters, pay attention to the parameter range, unit, and related instructions.

Function code group number	Communication access address	Communication modification of function code address in RAM (write only)
P0 ~ PE group	0 ×F000 ~ 0 ×FEFF	0 ×0000 ~ 0 ×0 EFF
A0 ~ AE group	0 ×A000 ~ 0 ×AFFF	0 ×4000 ~ 0 ×4F FF
B0 ~ BE group	0 ×B000 ~ 0 ×B FFF	0 ×5000 ~ 0 ×5F FF
C0 ~ CE group	0 ×C000 ~ 0 ×C FFF	0 ×6000 ~ 0 ×6F FF
U0, U1 groups	0 ×7000, 0 ×71××	

Note that since EEPROM is frequently stored, its service life will be reduced. Therefore, some function codes do not need to be stored in the communication mode. You only need to change the value in RAM.

If it is a P group parameter, to realize this function, just change the high bit F of the function code address to 0.

If it is a parameter of group A, to realize this function, just change the high bit A of the function code address to 4.

The corresponding function code addresses are as follows: High byte: 00~0F (P group), 40~4F (A group) Low byte: 00~FF

For example: function code P0-11 is not stored in EEPROM, and the address is represented as 000B;

this address means that it can only be written to RAM and cannot be read. When reading, it is an invalid address.

Stop/Run parameters section:

address	Parameter Description	address	Parameter Description
0 ×1000 / 0 ×9000	1000 : *Communication setting value (-10000~10000) (decimal) (unit: 0.01%), readable and writable	0 ×1014	AI1 voltage before correction (unit: 0.001V) read only
	9000: Communication setting frequency: 0HZ~P0-14 (minimum unit: 0.01HZ), readable and writable	0 ×1015	AI2 voltage before correction (unit: 0.001V) read only
0 ×1001	Set frequency (unit: 0.01Hz), read only	0 ×1016	Actual line speed (unit: 1m/min), read-only
0 ×1002	Operating frequency (unit: 0.01Hz), read-only	0 ×1017	Load speed (unit: custom, refer to P7-31), read-only
0 ×1003	Bus voltage (unit: 0.1V), read only	0 ×1018	Current power-on time (unit: 1min), read-only
0 ×1004	Output voltage (unit: 0.1V), read only	0 ×1019	Current running time (unit: 0.1min) read-only
0 ×1005	Output current (unit: 0.1A), read only	0 ×101A	Input pulse frequency (unit: 1Hz), read only
0 ×1006	Output power (unit: 0.1kW), read-only	0 ×101B	Main frequency X display (unit: 0.01Hz), read only
0 ×1007	DI input flag (unit: 1), read-only	0 ×101C	Auxiliary frequency Y display (unit: 0.01Hz), read only
0 ×1008	DO output flag (unit: 1), read only	0 ×101D	Target torque (unit: 0.1%), with the motor rated torque as 100%, read-only
0 ×1009	PID setting (unit: 1), read-only	0 ×101E	Output torque (unit: 0.1%), with the motor rated torque as 100%, read-only
0 ×100A	PID feedback (unit: 1), read only	0 ×101F	Output torque (unit: 0.1%), based on the inverter rated current as 100%, read only
0 ×100B	AI1 voltage (unit: 0.01V), read-only	0 ×1020	Torque upper limit (unit: 0.1%), Take the inverter rated current as 100%, read only
0 ×100C	AI2 voltage (unit: 0.01V), read-only	0 ×1021	VF separation target voltage (unit: 1V), read only
0 ×100D	AO1 output voltage (unit: 0.01V) read only	0 ×1022	VF separationoutVoltage (unit: 1V), read-only
0 ×100E	PLC step (unit: 1), read-only	0 ×1023	Reserved, read-only
0 ×100F	Speed (unit: 1rpm), read-only	0 ×1024	Motor 1\2Indication (unit: 1), read only

0 ×1010	Count value input (unit: 1), read-only	0 ×1025	Length value input (unit: 1) read only
0 ×1011	Input pulse frequency (unit: 0.01kHz), read only	0 ×1026	AO2 output voltage (unit: 0.01V), read only
0 ×1012	Feedback speed (unit: 0.1Hz), read only	0 ×1027	Inverter status (unit: 1), read only
0 ×1013	Remaining running time (unit: 0.1min), read-only	0 ×1028	Current fault (unit: 1), read-only

Example 1: Read the operating frequency of the first device: 0x01 0x03 0x10 0x02 0x00 0x01 0x21 0x0A

0x10 0x02 (1002) operating frequency address, 0x00 0x01 (0001) one data

0x21 0x0A (210A) CRC check value

Example 2: Simultaneously read the bus voltage, output voltage, and output current of the first device: 0x01 0x03 0x10 0x03 0x00 0x03 CRC check value. The data meaning is similar to that of Example 1.

Note: The communication setting value is a percentage of the relative value. 10000 corresponds to 100.00%, and -10000 corresponds to -100.00%.

For frequency-dimensional data, the percentage is the percentage relative to the maximum frequency (P0-14); for torque-dimensional data, the percentage is P3-21, P3-23, A3-21, A3-23.

The D0 output terminal needs to select function 16 (communication control). The AO output needs to select function 7 (communication control output).

type	Command address	Command content
Control command input (write only)	0 ×2000	0001: Forward run 0002: Reverse run 0003: Forward jog 0004: Reverse jog 0005: Coast to stop 0006: Deceleration to stop 0007: Fault reset 0008: Fault reset (fault reset is only available in communication control mode)
Status read (read-only)	0 ×3000	0001: Forward operation 0002: Reverse operation 0003: Stop
Digital output terminal control (write only)	0 ×2001	BIT0: RELAY1 output control BIT1: DO1 output control BIT2: RELAY2 output control
Analog output AO1 control (write only)	0 ×2002	0 to 7FFF represents 0% to 100%
Analog output AO2 control (write only)	0 ×2003	0 to 7FFF represents 0% to 100%

Inverter fault address	0 ×8000	0000: No fault 0002: Reserved 0004: Acceleration overcurrent 0006: Constant speed overcurrent 0008: Accelerating overvoltage 000A: Constant speed overvoltage 000C: Undervoltage fault 000E: Motor overload 0010: Reserved 0012: Reserved 0014: Motor short circuit to ground fault 0016: Reserved 0018: Output phase loss 001A: Password input times exceeded 001C: External fault 001E : User-defined fault 1 0020: PID feedback lost during operation 0022: Load drop 0024: Contactor abnormality 0026: Motor overtemperature (reserved) 0028: Cumulative running time reached 002A: Failure in switching motor during operation 002C: Reserved 002E: Reserved	0001: Reserved 0003: Reserved 0005: Deceleration overcurrent 0007: Stop overcurrent 0009: Deceleration overvoltage 000B: Stop overvoltage 000D: Inverter overload 000F: Module overheating 0011: Current detection fault 0013: Reserved 0015: Motor tuning failure 0017: Input phase loss 0019: EEPROM read/write exception 001B: Communication abnormality 001D : Speed deviation is too large 001F : User-defined fault 2 0021: Hardware current limiting fault 0023: Buffer resistor overload fault 0025: Agent running time reached 0027: Current running time has expired 0029 : Power-on time reached 002B: Motor overspeed 002D: Reserved 002F : Point-to-slave fault

Return address when communication fails: read failure 83XX, write failure 86XX