

## Ayi9 Modbus Communication Protocol

### III. Modbus message format

The Modbus communication agreement of UPSEN smart management card provides the following two types of function codes:

- a. 03 instruction queries the contents of the register to **obtain** the working status of the UPS (power supply) device;
- b. 06 instruction sets the contents of the register to **control** the operation of the UPS (power supply) device.

#### 1. RTU mode:

Format of request order:

Definition	Address	Function code	Start register	Number of registers	CRC parity
Data	ADDR	xx	sREG	nREG	CRC 16
Number of bytes	1	1	2	2	2

Format of request response:

Definition	Address	Function code	Return data bytes	Return date	CRC parity
Data	ADDR	xx	X	DATA	CRC 16
Number of bytes	1	1	1	X	2

Note:

- a) Address: Modbus communication address of UPSEN smart management card, which is configurable, and default is 0xA9;
- b) CRC16 parity: the CRC16 parity of Modbus rule is performed for all bytes except under the CRC parity.

#### 2. TCP mode:

PDU frame format is used under TCP mode.

Format of request order:

Definition	MBAP message header	Function code	Start register	Number of registers
Data		xx	sREG	nREG
Number of bytes	7	1	2	2

Format of request response:

Definition	MBAP message	Function	Return data bytes	Return data
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	header	code		
Data		xx	X	DATA
Number of bytes	7	1	1	X

Format of MBAP message header:

1. Transmission ID:  
2 bytes generated on request, and copied on response, which can be understood as the serial number of the order;
2. Agreement ID:  
2 bytes generated on request, and copied on response. The fixed value is 0.
3. Instruction length:  
2 bytes generated on request, and recalculated based on the return value on response.  
Its value is the number of subsequent bytes, including the Modbus address.
4. Modbus address: 1 byte, which is the Modbus address of the device.

### Special note:

- a. Whether it is RTU mode or TCP mode, when the function code is 0x06, the start register is 0x80, and the number of registers is the value to be written to register 0x80. Please see below---IV (4).
- b. When the function code is 0x06, the return value is 0x01 after successful writing.
- c. For the start register, the number of registers, the return data, and the CRC parity, when the data of more than 2 bytes is transmitted, the high-order byte is first and the low-order byte is followed.

### 3. Error return:

When the instruction is wrong, the device response format:

#### a. RTU mode:

Definition	Address	Function code	Error code
Data	ADDR	xx	ERROR
Number of bytes	1	1	1

#### b. TCP mode:

Definition	MBAP message header	Function code	Error code
Data		xx	ERROR
Number of bytes	7	1	1

Function code xx = function code | 0x80 when request; for example, the function code when request is 0x03, and the function code of error return is 0x83.

Error code:

- 0x01 -- Function code is unsupported;
- 0x02 -- Start register is wrong;

- 0x03 – The number of registers is wrong;  
 0x05 -- The device has received the instruction, but will return the result later;  
 0x06 -- The device is busy and does not accept instructions;  
 0x08 – CRC parity is wrong.

#### IV. Register definition:

The register data query function code is 0x03, and the control function code is 0x06.

##### 1. Rated information of power supply:

Order	Register address	Parameter definition/name	Data length /BYTE	Coefficient	Unit
03	0	Total rated power	2	0.1	KVA
03	1	Input and output phase	2		
03	2	Output and input voltage type (0=220V, 1=110V)	2		
03	3	Output rated voltage	2	0.1	V
03	4	Output rated current	2	0.1	A
03	5	Output rated frequency	2	0.1	Hz
03	6	Rated battery voltage	2	0.1	V
03	7	Reserved	2		

Input and output phase: 0x11—single input and single output, 0x31—three input and single output, 0x33—three input and three output.

##### 2. Real-time running data

Order	Register address	Parameter definition/name	Data length /BYTE	Coefficient	Unit
03	8	Total battery voltage	2	0.1	V
03	9	Battery temperature (reserved)	2	0.1	℃
03	10	UPS battery capacity	2	0.1	%
03	11	Battery life (reserved)	2	0.1	Min
03	12	Battery charge and discharge current (reserved)	2	0.1	A
03	13	UPS temperature	2	0.1	℃
03	14	Reserved	2		
03	15	Reserved	2		
03	16	Input frequency	2	0.1	Hz
03	17	Input voltage R phase	2	0.1	V
03	18	Input voltage S phase	2	0.1	V
03	19	Input voltage T phase	2	0.1	V
03	20	Input current R phase	2	0.1	A
03	21	Input current S phase	2	0.1	A

03	22	Input current T phase	2	0.1	A
03	23	Input apparent power R phase	2	0.1	VA
03	24	Input apparent power S phase	2	0.1	VA
03	25	Input apparent power T phase	2	0.1	VA
03	26	Total input apparent power	2	0.1	VA
03	27	Output frequency	2	0.1	Hz
03	28	Output voltage R phase	2	0.1	V
03	29	Output voltage S phase	2	0.1	V
03	30	Output voltage T phase	2	0.1	V
03	31	Output current R phase	2	0.1	A
03	32	Output current S phase	2	0.1	A
03	33	Output current T phase	2	0.1	A
03	34	Output apparent power R phase	2	0.1	VA
03	35	Output apparent power S phase	2	0.1	VA
03	36	Output apparent power T phase	2	0.1	VA
03	37	Total output apparent power	2	0.1	VA
03	38	Output effective power R phase	2	0.1	VA
03	39	Output effective power S phase	2	0.1	VA
03	40	Output effective power T phase	2	0.1	VA
03	41	Total output effective power	2	0.1	VA
03	42	Load power factor R phase (reserved)	2	0.1	%
03	43	Load power factor S phase (reserved)	2	0.1	%
03	44	Load power factor T phase (reserved)	2	0.1	%
03	45	Output load percentage R phase	2	0.1	%
03	46	Output load percentage S phase	2	0.1	%
03	47	Output load percentage T phase	2	0.1	%
03	48	Total output load	2	0.1	%
03	49	Bypass frequency	2	0.1	Hz
03	50	Bypass voltage R phase	2	0.1	V
03	51	Bypass voltage S phase	2	0.1	V
03	52	Bypass voltage T phase	2	0.1	V
03	53	Bypass current R phase	2	0.1	A
03	54	Bypass current S phase	2	0.1	A
03	55	Bypass current T phase	2	0.1	A
03	56	Bypass apparent power R phase	2	0.1	VA
03	57	Bypass apparent power S phase	2	0.1	VA
03	58	Bypass apparent power T phase	2	0.1	VA
03	59	Total bypass apparent power	2	0.1	VA
03	60	Reserved	2		
03	61	Reserved	2		
03	62	Reserved	2		
03	63	Reserved	2		

## 3, 实时运行状态

## 3. Real-time running state

Order	Register address	Bit	Parameter definition/name	Data length /bit
03	64	15	UPS type: 0=ONLINE,1=BAKCUP	1
		14		1
		13		1
		12		1
		10~11	Battery self-test discharge results: 00=unknown, 1=failed, 2=successful	2
		9		1
		8	0= no overload, 1= overload	1
		07	Normal AC = 0, unnormal AC= 1 (actually charging state)	1
		06	Battery voltage: 0= not low, 1=low	1
		05	0= running state, 1= is shutting down or shutdown state	1
		04	0=open state, 1= buzzer mute state;	1
		00~03	UPS state: 0=POWE ON Power-on state 1=STANDBY Standby mode 2=BYPASS Bypass state 3=LINE AC work state 4=BAT Battery powered state 5=TEST Test self-test discharge state 6=FAULT Fault state 7=CONVERTER 8=HE Economic state, basically equivalent to BYPASS 9=SHUTDOWN Shutdown state	4

## 4, 实时运行状态

## 4. Real-time running state

Order	Register address	Bit	Parameter definition/name	Data length /bit
06	0x80	5~15	Reserved	1
		4	=1, power-off	1
		3	=1, power-on	1
		2	=1, turn off the buzzer	1
		1	=1, turn on the buzzer	1
		0	=1, 10 second discharge test	1

Note: when the 06 function code is sent, only one control state can be sent at a time.

