Modbus communication protocol

1. **Communication mode RTU, slave**
2. **The default baud rate is 9600, 1 start bit, 8 data bits, no parity bit, 1 stop bit**
3. **Frame format**

Controller ID	function code	data	CRC16 check
8bit (1~99)	8bit	N*8bit (HI, LO)	16bit (LO, HI)

The gray area is the PDU part. The data of each frame should preferably not exceed 20 bytes。

1. **Support function code： 0x03,0x10。**
2. **Function code example：**

A. Function code 0x01, reading coil

Host send	
Slave address	0x01
function code	0x01
Coil start address HI	0x00
Coil start address LO	0x01
Number of coils HI	0x00
Number of coils LO	0x0A
CRC16 check LO	0xED
CRC16 check HI	0xCD

Slave return back	
Slave address	0x01
Function code	0x01
Coil bytes	0x02
Data（Coil 7~0）	0xA2
Data（Coil 15~8）	0x03
CRC16 Check LO	0x80
CRC16 Check HI	0x9D

B. Function code 0x02, read discrete input

Host send	
Slave address	0x01
function code	0x02
Coil start address HI	0x00
Coil start address LO	0x01
Number of coils HI	0x00
Number of coils LO	0x0A
CRC16 Check LO	0xA9
CRC16 Check HI	0xCD

Slave return back	
Slave address	0x01
Function code	0x02
Coil bytes	0x02
Data(Coil 7~0）	0xA2
Data（Coil 15~8）	0x03
CRC16 Check LO	0x80
CRC16 Check HI	0xD9

C. Function code 0x03, read holding register

Host send	
Slave address	0x01
function code	0x03
Register start address HI	0x00
Register start address LO	0x10
Number of registers HI	0x00

Slave return back	
Slave address	0x01
Function code	0x03
Number of data bytes	0x06
Data HI	0x09
Data LO	0x92
Data HI	0x00
Data LO	0x1A
Data HI	0x0A
Data LO	0x46
CRC16 Check LO	0x3E
CRC16 Check HI	0xA4

Number of registers LO	0x03
CRC16 check LO	0x04
CRC16 check HI	0x0E

D. Function code 0x04, read input register

Host send	
Slave address	0x01
function code	0x04
Register start address HI	0x00
Register start address LO	0x10
Number of registers HI	0x00
Number of registers LO	0x03
CRC16 check LO	0xB1
CRC16 check HI	0xCE

Slave return back	
Slave address	0x01
Function code	0x04
Number of data bytes	0x06
Data HI	0x09
Data LO	0x92
Data HI	0x00
Data LO	0x1A
Data HI	0x0A
Data LO	0x46
CRC16 Check LO	0x7F

E. Function code 0x05, write single coil

Host send	
Slave address	0x01
Function code	0x05
Coil address HI	0x00
Coil address LO	0x07
Data HI	0xFF
Data LO	0x00
CRC16 Check LO	0x3D
CRC16 Check HI	0xFB

Slave return back	
Slave address	0x01
Function code	0x05
Coil address HI	0x00
Coil address LO	0x07
Data HI	0xFF
Data LO	0x00
CRC16 Check LO	0x3D
CRC16 Check HI	0xFB

E. Function code 0x06, write a single register

Host send	
Slave address	0x01
function code	0x06
Register address HI	0x00
Register address LO	0x21
Data HI	0x05
Data LO	0x64

Slave return back	
Slave address	0x01
Function code	0x06
Register address HI	0x00
Register address LO	0x21
Data HI	0x05
Data LO	0x64
CRC16 Check LO	0xDB
CRC16 Check HI	0x7B

CRC16 check LO	0xDB
CRC16 check HI	0x7B

F. Function code 0x0F, write multiple coils

Host send	
Slave address	0x01
Function code	0x0F
Coil start address HI	0x00
Coil start address LO	0x01
Number of coils HI	0x00
Number of coils LO	0x0A
Number of bytes	0x02
Date HI（Coil 7~0）	0xD5
Data LO（Coil 15~8）	0x03
CRC16 Check LO	0xFA
CRC16 check HI	0x78

Slave retun back	
Slave address	0x01
Function code	0x0F
Coil start address HI	0x00
Coil start address LO	0x01
Number of coils HI	0x00
Number of coils LO	0x0A
CRC16 Check LO	0x84
CRC16 Check HI	0x0C

G. Function code 0x10 write multiple registers

Host send	
Slave address	0x01
Function code	0x10
Register start address HI	0x00
Register start address LO	0x26
Number of registers HI	0x00
Number of registers LO	0x02
Number of bytes	0x04
Data HI	0x04
Data LO	0x38
Data HI	0x04
Data LO	0xEC
CRC16 check LO	0xF2
CRC16 check HI	0x2D

Slave return back	
Slave address	0x01
Function code	0x10
Register start address HI	0x00
Register start address LO	0x26
Number of registers HI	0x00
Number of registers LO	0x02
CRC16 Check LO	0xA0

6. Register and address used by the controller

Register address	Register name	Data type (16bit)	Authority	Remarks
0x0001	Solar panel voltage	Unsigned integer, 0.01V/LSB	Read only	
0x0002	Solar panel current	Unsigned integer, 0.01V/LSB	Read only	
0x0003	Solar panel output power	Unsigned integer, 0.1W/LSB		
0x0004	Solar panel working status	Unsigned character type, 0,1,2 enumeration	Read only	Note 7
0x0005	Battery voltage	Unsigned integer, 0.01V/LSB	Read only	
0x0006	Battery temperature	Signed character type, 1 ℃ /LSB	Read only	
0x0007	recharging current	Unsigned integer, 0.01A/LSB	Read only	
0x0008	Discharge current	Unsigned integer, 0.01A/LSB	Read only	
0x0009	Current system voltage	Unsigned character type, 0,1,2,3,4,5,6,7,8,9 enumeration	Read only	*Note 1
0x000A	Current battery power (SOC)	Unsigned character type, 1%/LSB	Read only	

0x000B	Current charging stage	Unsigned character type, 0,1,2,3,4,5 enumeration	Read only	*Note 2
0x000C	Controller internal temperature	Signed character type, 1℃/LSB	Read only	
0x000D	Accumulated charging Ah on the day	Unsigned integer, 1Ah/LSB	Read/write	Write 0 to clear
0x000E	Accumulated charging Ah of the month	Unsigned integer, 1Ah/LSB	Read/write	Write 0 to clear
0x000F	Accumulated charge KAh in the current year	Unsigned integer, 0.01KAh/LSB	Read/write	Write 0 to clear
0x0010	Total accumulated charge KAh	Unsigned integer, 0.01KAh/LSB	Read/write	Write 0 to clear
0x0011	Accumulated discharge Ah of the day	Unsigned integer, 1Ah/LSB	Read/write	Write 0 to clear
0x0012	Cumulative discharge Ah of the month	Unsigned integer, 1Ah/LSB	Read/write	Write 0 to clear
0x0013	Accumulated discharge Ah of the year	Unsigned integer, 0.01KAh/LSB	Read/write	Write 0 to clear
0x0014	Total accumulated discharge Ah	Unsigned integer, 0.01KAh/LSB	Read/write	Write 0 to clear
0x0015	Accumulated charging kWh on the day	Unsigned integer, 0.01kWh/LSB	Read/write	Write 0 to clear
0x0016	Accumulated charging kWh of the month	Unsigned integer, 0.1kWh/LSB	Read/write	Write 0 to clear
0x0017	Accumulated charging MWh that year	Unsigned integer, 0.01MWh/LSB	Read/write	Write 0 to clear
0x0018	Total accumulated charge MWh	Unsigned integer, 0.01MWh/LSB	Read/write	Write 0 to clear
0x0019	Accumulated discharge kWh on the day	Unsigned integer, 0.01kWh/LSB	Read/write	Write 0 to clear

0x001A	Cumulative discharge kWh of the month	Unsigned integer, 0.1kWh/LSB	Read/write	Write 0 to clear
0x001B	Cumulative discharge MWh in the current year	Unsigned integer, 0.01MWh/LSB	Read/write	Write 0 to clear
0x001C	Total cumulative discharge MWh	Unsigned integer, 0.01MWh/LSB	Read/write	Write 0 to clear kWh
0x001D	Float voltage (Float)	Unsigned integer, 0.01V/LSB	Read/write	
0x001E	Boost voltage (Absorption)	Unsigned integer, 0.01V/LSB	Read/write	
0x001F	Equalization	Unsigned integer, 0.01V/LSB	Read/write	
0x0020	Increase charging time	Unsigned character type, 1min/LSB	Read/write	
0x0021	Equalizing charging time	Unsigned character type, 1min/LSB	Read/write	
0x0022	Temperature compensation coefficient	Signed character type, (1mV/cell/℃)/LSB	Read/write	
0x0023	Undervoltage protection voltage (LVD)	Unsigned integer, 0.01V/LSB	Read/write	
0x0024	Undervoltage recovery voltage (LVR)	Unsigned integer, 0.01V/LSB	Read/write	
0x0025	Undervoltage warning voltage	Unsigned integer, 0.01V/LSB	Read/write	
0x0026	Undervoltage alarm recovery voltage	Unsigned integer, 0.01V/LSB	Read/write	
0x0027	Load working mode	Unsigned character type, 0,1,2,3,4 enumeration	Read/write	*Note 3*
0x0028	Night time	Unsigned character type, 1min/LSB	Read/write	
0x0029	Morning light on time	Unsigned character type, 1min/LSB	Read/write	

0x002A	Timing 1 on time	Unsigned integer, HI-hour, LO-minute	Read/write	
0x002B	Timing 1 closing time	Unsigned integer, HI-hour, LO-minute	Read/write	
0x002C	Timing 2 on time	Unsigned integer, HI-hour, LO-minute	Read/write	
0x002D	Timing 2 close time	Unsigned integer, HI-hour, LO-minute	Read/write	
0x002E	Light control start voltage	Unsigned integer, 0.01V/LSB	Read/write	
0x002F	Light control off voltage	Unsigned integer, 0.01V/LSB	Read/write	
0x0030	Light control start delay	Unsigned integer, 1min/LSB	Read/write	
0x0031	Light control off delay	Unsigned integer, 1min/LSB	Read/write	
0x0032	Battery type	Unsigned character type, 0,1,2,3,4 enumeration	Read/write	*Note 4
0x0033	System voltage setting	Unsigned character type, 0,1,2,3,4 enumeration	Read/write	*Note 5
0x0034	Overvoltage protection voltage (HVD)	Unsigned integer, 0.01V/LSB	Read/write	Read only
0x0035	Overvoltage recovery voltage (HVR)	Unsigned integer, 0.01V/LSB	Read/write	Read only
0x0036	Controller working status flag	Unsigned integer	Read/write	*Note 6
0x0037	Backlight time	Unsigned character type, 1S/LSB	Read/write	
0x0038	Rated voltage	Unsigned character type, 1V/LSB	Read only	
0x0039	Rated charging current	Unsigned character type, 1A/LSB	Read only	
0x003A	Rated discharge current	Unsigned character type, 1A/LSB	Read only	

0x003B	Maximum battery voltage	Unsigned character type, 0.01V/LSB	Read only	
0x003C	Minimum battery voltage	Unsigned character type, 0.01V/LSB	Read only	
0x003D	Battery overvoltage times	Unsigned character type, 1 time/LSB	Read only	
0x003E	Battery undervoltage times	Unsigned character type, 1 time/LSB	Read only	
0x003F	Load power kWh	Unsigned character type, 0.01kWh/LSB	Read only	
0x0040	Real-time clock-year and month	Unsigned character type, high 8 digits year, low 8 digits month	Read/write	
0x0041	Real time clock-time of day	Unsigned character type, high 8 digits, low 8 digits	Read/write	
0x0042	Real Time Clock-Minutes and Seconds	Unsigned character type, high 8 digits for minutes, low 8 digits for seconds	Read/write	
0x0043	Boost recovery voltage	Unsigned character type, 0.01V/LSB	Read/write	
0x0044	Charging limit voltage	Unsigned character type, 0.01V/LSB	Read/write	
0x0045	Discharge limit voltage	Unsigned character type, 0.01V/LSB	Read/write	
0x0046	Controller hardware version number	Unsigned character type, 10-V1.0	Read only	
0x0047	Controller software version number	Unsigned character type, 10-V1.0	Read only	
0x0048	Controller model bit 1	Unsigned character type, ASCII format	Read only	
0x0049	Controller model bit 2	Unsigned character type, ASCII format	Read only	
0x004A	Controller model bit 3	Unsigned character type, ASCII format	Read only	
0x004B	Controller model bit 4	Unsigned character type, ASCII	Read	

		format	only	
0x004C	Controller model bit 5	Unsigned character type, ASCII format	Read only	
0x004D	Controller model bit 6	Unsigned character type, ASCII format	Read only	
0x004E	Controller model bit 7	Unsigned character type, ASCII format	Read only	
0x004F	Controller model bit 8	Unsigned character type, ASCII format	Read only	
0x0050	Controller model bit 9	Unsigned character type, ASCII format	Read only	
0x0051	Controller model bit 10	Unsigned character type, ASCII format	Read only	
0x0052	Controller model bit 11	Unsigned character type, ASCII format	Read only	
0x0053	Controller model bit 12	Unsigned character type, ASCII format	Read only	
0x0054	Controller serial number bit 1	Unsigned character type, ASCII format	Read only	
0x0055	Controller serial number bit 2	Unsigned character type, ASCII format	Read only	
0x0056	Controller serial number bit 3	Unsigned character type, ASCII format	Read only	
0x0057	Controller serial number bit 4	Unsigned character type, ASCII format	Read only	
0x0058	Controller serial number bit 5	Unsigned character type, ASCII format	Read only	
0x0059	Controller serial number bit 6	Unsigned character type, ASCII format	Read only	
0x005A	Controller serial number bit 7	Unsigned character type, ASCII format	Read only	

0x005B	Controller serial number bit 8	Unsigned character type, ASCII format	Read only	
0x005C	Controller serial number bit 9	Unsigned character type, ASCII format	Read only	
0x005D	Controller serial number bit 10	Unsigned character type, ASCII format	Read only	
0x005E	Controller serial number bit 11	Unsigned character type, ASCII format	Read only	
0x005F	Controller serial number bit 12	Unsigned character type, ASCII format	Read only	
0x0060	Company name in English 1-2	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0061	Company name in English 3-4	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0062	Company name English digits 5-6	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0063	Company name English bits 7-8	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0064	Company name English digits 9-10	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0065	Company name English digits 11-12	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0066	Company name English digits 13-14	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0067	Company name English digits 15-16	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0068	Company name English digits 17-18	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0069	Company name English digits 19-20	Unsigned character type, high 8 and low 8, ASCII format	Read only	

0x006A	Company name English digits 21-22	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x006B	Company name English digits 23-24	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x006C	Company name in English 25-26	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x006D	Company name English bit 27-28	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x006E	Company name in English 29-30	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x006F	Company name English digits 31-32	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0070	Company name English digits 33-34	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0071	Company name in English 35-36	Unsigned character type, high 8 and low 8, ASCII format	Read only	
0x0072	Lithium battery charge rate	Unsigned character type, 0.01C/LSB	Read/write	Lithium battery type is valid
0x0073	Lithium battery capacity	Unsigned character type, 0.1Ah/LSB	Read/write	Lithium battery type is valid
0x0074	Lithium battery CV voltage	Unsigned character type, 0.01V/LSB	Read/write	Lithium battery type is valid
0x0075	Baud rate	Unsigned char, enum	Read/write	*Note 8
0x0076	MPPT gain	Unsigned character type, 1%/LSB		
0x0077	Keep			
0x0078	Keep			
0x0079	Keep			

0x007A	Keep			
0x007B	Keep			
0x007C	Keep			
0x007D	Keep			
0x007E	Keep			
0x007F	Keep			
0x0080	Function mask address segment 0x0000~0x000F			
0x0081	Function mask address segment 0x0010~0x001F			
0x0082	Function mask address segment 0x0020~0x002F			
0x0083	Function mask address range 0x0030~0x003F			
0x0084	Function mask address segment 0x0040~0x004F			
0x0085	Function mask address range 0x0050~0x005F			
0x0086	Function mask address range 0x0060~0x006F			
0x0087	Function mask address segment 0x0070~0x007F			
0x0088	Commissioning commands			Note 9
0x0089	Invert the code 0x0088 for commissioning			
0x008A	Write data for commissioning			

0x008B	Write data for commissioning			
0x008C	Write data for commissioning			
0x008D	Write data for commissioning			
0x008E	Write data for commissioning			
0x008F	Write data for commissioning			

**Note 1* Current system voltage

Enumeration	0	1	2	3	4	5	6	7	8	9
System voltage	auto recognition	12V	24V	36V	48V	60V	72V	84V	96V	108V

**Note 2* Current charging stage

Enumeration	0	1	2	3	4	5	6	7
Charging stage	Stop charging	Strong charge	MPPT	Float	Promote	balanced	Constant current CC	Constant voltage CV

**Note 3* Load working mode

Enumeration	0	1	2	3
Load working mode	ordinary	Light control + dual time period	Pure light control	timing

**Note 4* Battery type

Enumeration	0	1	2	3	4
Battery type	Custom	Colloidal GEL	Sealed	Flooded	Lithium battery

**Note 5* System voltage setting

Enumeration	0	1	2	3	4	5	6	7	8	9

System voltage setting	auto recognition	Lock 12V	Lock 24V	Lock 36V	Lock 48V	Lock 60V	Lock 72V	Lock 84V	Lock 96V	Lock 108V

**Note 6* Controller working status flag

Bit	Bit definition	Logo/Operation	Authority
bit15	Reboot	Flag position 1, restart	write
bit14	Factory default	Flag position 1, factory default	write
bit13	Reserved		
bit12	Reserved		
bit11	Controller parameter calibration mark	The flag position is 1, which means that the controller has not been calibrated at the factory	Read only
bit10	Controller self-check error flag	The flag position is 1, indicating that the controller has an error in self-checking	Read only
bit9	Battery temperature check fault sign	Mark position 1, indicating that the battery temperature probe temperature measurement failure	Read/write, write 0 to clear the flag
bit8	Internal temperature check fault sign	Mark position 1, indicating that the internal temperature probe temperature measurement failure	Read/write, write 0 to clear the flag
bit7	PV not connected sign	The flag position is 1, indicating that the PV within 24h is an access prompt	Read/write, write 0 to clear the flag
bit6	PV overpressure sign	Flag position 1, indicating that the controller is in PV overvoltage protection	Read/write, write 0 to clear the flag
bit5	Overheating sign inside the controller	The flag position is 1, indicating that the controller is in overheating protection	Read/write, write 0 to clear the flag
bit4	Battery overvoltage sign	Flag position 1, indicating that the controller is in overvoltage protection	Read/write, write 0 to clear the flag
bit3	Load switch state	Flag position 1, load is off	Read/write, write 0 on, write 1 off

bit2	Load short circuit sign	Flag position 1, indicating that the controller is under load short-circuit protection	Read/write, write 0 to clear the flag
bit1	Load overload sign	The flag position is 1, indicating that the controller is under load overload protection	Read/write, write 0 to clear the flag
bit0	Battery undervoltage sign	The flag position is 1, indicating that the controller is under voltage protection	Read/write, write 0 to clear the flag

**Note 7* Photocell working status

Enumeration	0	1	2	3
Working status	low voltage	Power generation	high voltage	Not connected

*Note 8 Baud rate

Enumeration	480	960	1440	1920	3840	4300	5760	7680	11520
Baud rate	4800	9600	14,400	19200	38400	43000	57600	76800	115200

*Note 9 Commissioning instruction

Bit0	School solar voltage
Bit1	School battery voltage
Bit2	School rechargeable battery
Bit3	School discharge current
Bit4	Write encrypted ID
Bit5	Write factory serial number