MPPT Solar Charge Controller MODBUS Protocol

1、MODBUS RTU Communication protocol format and Command resolution:

1.1、Format:

Starter	Address field	function code	data	Error check	Terminator

1.2、Instruction:

(all below datas with "H" are Hexadecimal, on the contrary are Decimal)

1)Starter: >10ms

2)Address field: 1byte, range: 01H～F7H(Decimal1～247), 00H is Broadcast address, All slaves respond, but do not return commands

3)function code: 1byte

Command name	Access data type	function code	Error code
Read single or multiple word registers	2byte	03H	83H
Write a single word register	2byte	06H	86H
Write consecutive N word registers	2byte	10H	90H
Restore factory defaults	No access data	78H	F8H
Clear history	No access data	79H	F9H

4)data: Nbyte

5)Error check: 2byte is Device address、function code and data byte's CRC Checksum.

6)Terminator: >10ms

Notes:

1)、data address and data are 2byte, send high byte first, then send low byte; for CRC, pls send low byte first, then send high byte.

2)、Error code means there's error under Frame data delivered by the server, Error exception response returned by the client function code; Error code = function code | 80H

1.3、Processing flow chart:

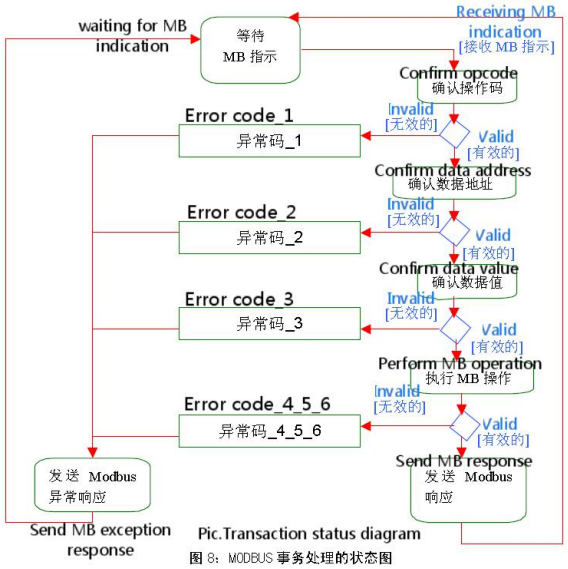

图 8：MODBUS 事务处理的状态图

Exception code description

a、01H -- unsupported function code

b、02H -- PDU starting address wrong or PDU starting address+data length

c、03H -- Read register’s data or write register’s data is too long

d、04H -- Client failed to read or write register--Unused

e、05H -- The data checksum sent by the server is incorrect--Unused

Note：The server receives the exception code returned by the controller means that The controller received the command from the server, But the command has an error, The server should resend the command.

1.3.1、Read register flow chart

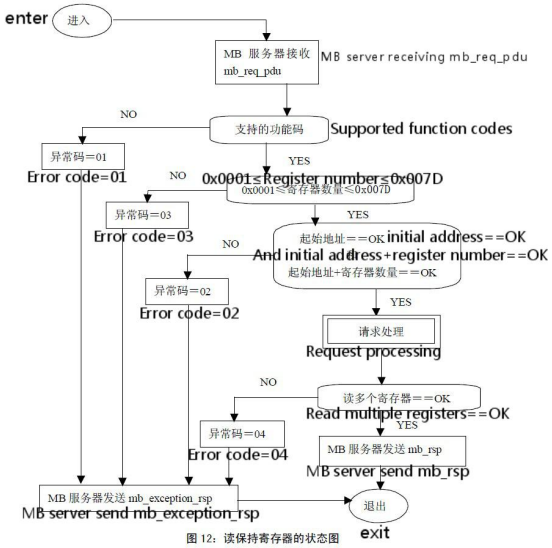

图 12：读保持寄存器的状态图

1.3.2、Write a single register flow chart

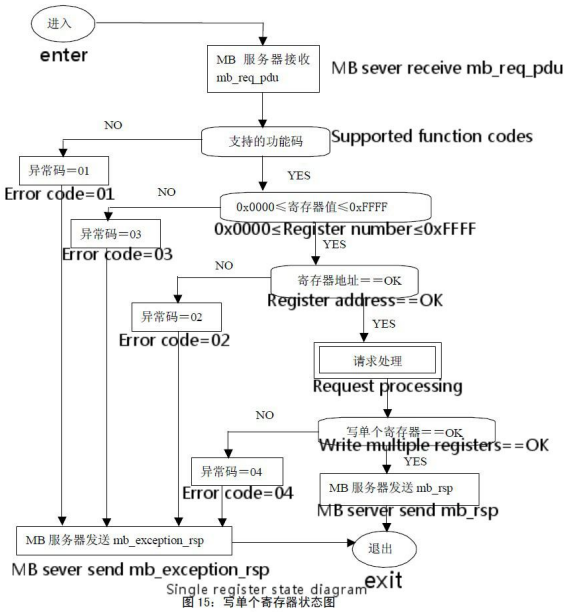

图 15：写单个寄存器状态图

1.3.3、Write continuous N register flow chart

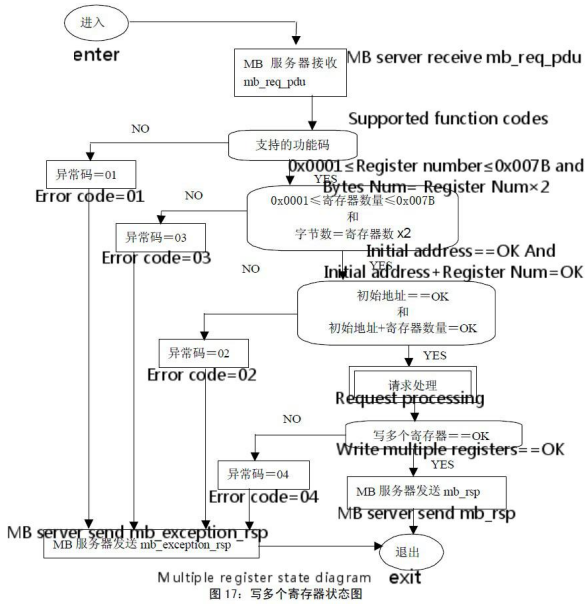

图 17：写多个寄存器状态图

1.4、Instance：

1.4.1、Read register

request：

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	03H
starting address	WORD	0000H～FFFFH
Number of words read	WORD	0001H～007DH
Check code	WORD	The CRC Checksum for all above byte

Normal response:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	03H
Data length	BYTE	01H～FAH
Data content	WORD	Read data (send high byte first and send low byte)
...	WORD	Read data (send high byte first and send low byte)
Check code	WORD	The CRC Checksum for all above byte

Abnormal response:

description	Byte number	command
Device address	BYTE	01H～F7H
Error code	BYTE	83H
Abnormal code	BYTE	N (N=1, 2, 3, 4)
Check code	WORD	The CRC Checksum for all above byte

1.4.2、Write a single register

request:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	06H
starting address	WORD	0000H～FFFFH
Write data	WORD	0000H～FFFFH
Check code	WORD	The CRC Checksum for all above byte

Normal response:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	06H

starting address	WORD	0000H～FFFFH
Write data	WORD	0000H～FFFFH
Check code	WORD	The CRC Checksum for all above byte

Abnormal response:

description	Byte number	command
Device address	BYTE	01H～F7H
Error code	BYTE	86H
Abnormal code	BYTE	N (N=1, 2, 3, 4)
Check code	WORD	The CRC Checksum for all above byte

1.4.3、Write consecutive N registers

request:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	10H
starting address	WORD	0000H～FFFFH
Number of words written	WORD	0001H～007DH
Number of writing	BYTE	1 times of the Byte number
Data content	WORD	Written data (send high byte first and send low byte)
...	WORD	Written data (send high byte first and send low byte)
Check code	WORD	The CRC Checksum for all above byte

Normal response:

description	Byte number	command
Device address	BYTE	01H～F7H
function	BYTE	10H

code		
starting address	WORD	0000H～FFFFH
Written Byte number	WORD	0001H～007DH
Check code	WORD	The CRC Checksum for all above byte

Abnormal response:

description	Byte number	command
Device address	BYTE	01H～F7H
Error code	BYTE	90H
Abnormal code	BYTE	N (N=1, 2, 3, 4)
Check code	WORD	The CRC Checksum for all above byte

1.4.4、Restore factory defaults

request:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	78H
Make up data	WORD	0000H
Make up data	WORD	0001H
Check code	WORD	The CRC Checksum for all above byte

Normal response:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	78H
Make up data	WORD	0000H
Make up data	WORD	0001H
Check code	WORD	The CRC Checksum for all above byte

Abnormal response:

description	Byte number	command

Device address	BYTE	01H～F7H
Error code	BYTE	F8H
Abnormal code	BYTE	N (N=1, 2, 3, 4)
Check code	WORD	The CRC Checksum for all above byte

1.4.4、Clear history

request:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	79H
Make up data	WORD	0000H
Make up data	WORD	0001H
Check code	WORD	The CRC Checksum for all above byte

Normal response:

description	Byte number	command
Device address	BYTE	01H～F7H
function code	BYTE	79H
Make up data	WORD	0000H
Make up data	WORD	0001H
Check code	WORD	The CRC Checksum for all above byte

Abnormal response:

description	Byte number	command
Device address	BYTE	01H～F7H
Error code	BYTE	F9H
Abnormal code	BYTE	N (N=1, 2, 3, 4)
Check code	WORD	The CRC Checksum for all above byte

2、PDUAddress allocation table

Table 1：(all below datas with “H” are Hexadecimal, on the contrary are Decimal)

	PDU address	byte	Read/ Write	description	data(range)	Meaning	Unit	Remarks
Describe system information							-	
	000CH ～ 0013H	16	R	Product alias		16character		
	0014H	2	R	software version	255	2.55version		
	0015H	2	R	hardware version	255	2.55version		
	0016H	2	R	Production year				
	0017H	2	R	Number of this month				
RAM information								
Controller status information	0100H	2	R	Current system voltage		12/24/36/48:Current system voltage	V	
	0101H	2	R	battery power	0~100		%	
	0102H	2	R	Battery voltage		Battery voltage*0.1	V	
	0103H	2	R	Charging current (flowing into the battery)		charging current*0.01	A	
	0104H	2	R	Charging power		Actual value	A	
	0105H	2	R	High 8 bits: controller temperature		Actual temperature value (b7:Sign bit; b0-b6Temperature value)	℃	
				Low 8 bits: battery temperature				
	0106H	2	R	Street lamp (load) voltage		Street lamp voltage*0.1	V	
	0107H	2	R	Street lamp (load) current		Street lamp current*0.01	A	
	0108H	2	R	Street lamp (load) power		Actual value	W	
	0109H	2	R	solar panel voltage		solar panel voltage*0.1	V	
	010AH	2	R	Maximum power of the day		Actual value	W	
	010BH	2	R	Power generation on the day		Actual value	WH	
	010CH	2	R	Electricity consumption on the day		Actual value	WH	
	010DH	2	R	Load status	high 8 byte	0：load off、	-	

						>0:load on		
				charging status	Low 8 byte		-	Annex Table 6
	010EH	2	R	Controller failure, alarm information				Annex Table 5
	010FH	2	R	Total running days		days		Annex Table 2
	0110H 0111H	4	R	Cumulative power generation	Actual value	WH		
	0112H 0113H	4	R	Cumulative power consumption	Actual value	WH		
	。。。							
	0120H	2	W	Load forced on	Non Constant current output	Greater than 0 is on, 0 is off		
					Constant current output	Test output ratio (0 is output off, 50 is 50% proportion)		
EEPROM								
Controller parameter setting	0201H	2	R/W	controller、Device address	1～247	0xff is broadcast,	-	
	0202H	2	R/W	System voltage setting		12：12V; 24：24V; 36：36V 48：48V FF:auto recognition	-	
	0203H	2	R/W	Battery type	0~3	Flood, Sealed, GEL, Li	-	
	0204H	2	R/W	equalizing charge voltage	700～1700		0.01V	
	0205H	2	R/W	boost charge voltage	700～1700		0.01V	
	0206H	2	R/W	float charge voltage	700～1700		0.01V	
	0207H	2	R/W	boost charge return voltage	700～1700		0.01V	
	0208H	2	R/W	over discharge return voltage	700～1700		0.01V	
	0209H	2	R/W	Alarm voltage	700～1700		0.01V	
	020AH	2	R/W	over discharge voltage	700～1700		0.01V	
	020BH	2	R/W	equalizing charge time	0-600min		Min	
	020CH	2	R/W	boost charge time	0-600min		Min	
	020DH	2	R/W	Light control delay time	01H	10S	S	
	020EH	2	R/W	Light control voltage	02H	10V	V	
	020FH	2	R/W	Load working mode	00~21		Annex	

							Table 4	
	0210H	2	R/W	Temperature compensation coefficient	3-5		-Mv/℃	
	0211H	2	R/W	equalizing charge duration	0-200		Days	
	Street lamp special parameters							
	0300H	2	R/W	1st working time	00～12		H	
	0301H	2	R/W	high 8: 1st working power low 8: 1st induction power	0~100		%	
	0302H	2	R/W	2nd working time	00～12		H	
	0303H	2	R/W	high 8: 2nd working power low 8: 2nd induction power	0～100		%	
	0304H	2	R/W	3rd working time	00～12		H	
	0305H	2	R/W	high 8: 3rd working power low 8: 3rd induction power	0～100		%	
	0306H	2	R/W	4th working time	00～12		H	
	0307H	2	R/W	high 8: 4th working power low 8: 4th induction power	0～100		%	
	0308H	2	R/W	5th working time	00～12		H	
	0309H	2	R/W	high 8: 5th working power low 8: 5th induction power	0～100		%	
	0308H	2	R/W	6th working time	00～12		H	
	0309H	2	R/W	high 8: 6th working power low 8: 6th induction power	0～100		%	
	0308H	2	R/W	7th working time	00～12		H	
	0309H	2	R/W	high 8: 7th working power low 8: 7th induction power	0～100		%	

	0308H	2	R/W	8th working time	00～12		H	
	0309H	2	R/W	high 8: 8th working power low 8: 8th induction power	0～100		%	
	0308H	2	R/W	9th working time	00～12		H	
	0309H	2	R/W	high 8: 9th working power low 8: 9th induction power	0～100		%	
	030AH	2	R/W	morning light working time	00H～15H		H	
	030BH	2	R/W	high 8: morning light working power low 8: morning light induction power	0～100		%	
	030CH	2	R/W	induction delay time			S	
	030DH	2	R/W	LEDLoad current setting			1mA	N*mA
	030EH	2	R/W	Special function control		BIT0: power management switch		
	030FH	2	R/W	Energy management upper limit				
	0310H	2	R/W	Energy management lower limit				
History (Annex Table 3)								
history	0400H	2	R	History of the day data				Must ready day by day
	0401H	2	R	1day before data				
				…				
	0412C	2	R	300 days before data		history record is 300 day		

3、Command resolution and example: (eg: controller address 01H, belows are unconcerned about the PDU' s actual adress)

3.1、read load status、battery status, the PDU address is 010D

send: 01 03 010D 0001

receive: 01 03 02 8002

Analysis: 8002 is (80H | 02H)

80: load on

02: mppt charging

3.16、read failure、alarm, knows the PDU address is 010EH

send:01 03 010D 0001

receive:01 03 02 0002

Analysis: 0002 means battery over voltage

3.17、turn on the load (non constant current source), knows the PDU address is 0120H, Write on/off command to that address

turn on the load:

send:01 06 0120 0001

receive:01 06 0120 0001

turn off the load:

send:01 06 0120 0000

receive:01 06 0120 0000

3.18、test load output 50% (constant current source), knows the PDU address is 0120H

send:01 06 0120 0064

receive:01 06 0120 0064

3.20、set equalizing charge voltage、boost charge voltage、float charge voltage、boost charge return voltage、

over discharge return voltage、over discharge voltage。knows the PDU address is 0205H～020AH, total 6 words, 12byte

0205H	R/W	equalizing charge voltage	14.8*100 = 05C8
0206H	R/W	boost charge voltage	14.4*100 = 05A0
0207H	R/W	float charge voltage	13.8*100 = 0564
0208H	R/W	boost charge return voltage	13.2*100 = 0528
0209H	R/W	over discharge return voltage	12.6*100 = 04EC
020AH	R/W	over discharge voltage	11.1*100 = 0456

send:01 10 0205 0006 000C 05C8 05A0 0564 0528 04EC 0456

receive:01 10 0205 000C

Annex Table1 (battery type and default parameter)

battery type	equalizing	boost	float charg	Boost charge return	over discharge	over discharg

	charge	charge	e	voltage	return voltage	e voltage
Fld	14.8	14.6	13.8	13.2	12.6	11.1
GEL	14.6	14.4	13.8	13.2	12.6	11.1
SEL	15.2	14.2	13.8	13.2	12.6	11.1
LI		Adjustable	Adjustable	Adjustable	Adjustable	Adjustable

Annex Table2 (total history parameters)

Total history data	definition	type	unit	Precision	description
Field1	sRunDayCount	Shaping (16 byte)	day	1day	total running day
Field2	sAllChgWH	Long Shaping (32 byte)	WH	1WH	Total charging WH
Field3	sAllLoadWH	Long Shaping (32 byte)	WH	1WH	Total discharge WH (non-discharge function is 0)

Annex Table3 (daily history parameters)

daily history data	definition	type	unit	Precision	description
Field1	sCharge_W_H_Today	Shaping (16 byte)	WH	1WH	Daily Cumulative power generation
Field2	sLoad_W_H_Today		WH	1WH	Daily discharge WH (non-discharge function is 0)
Field3	sMaxChargeWH		WH	1WH	daily max.Power generation
Field4	sMaxBatVolt		V	0.1V	Daily highest Battery voltage
Field5	sMinBatVolt		V	0.1V	Daily lowest Battery voltage

Annex Table4 (load mode parameter)

load mode	definition	description
Pure light control	0	Working based on day/night

Light+time control 1~14 hour	1~14	Set working time at night
manual	15	Manual on/off
debug	16	Day off, night on
always-on	17	Load Always on
no load	0xff	No load mode

Annex Table5 (malfunction)

malfunction	Appear byte (bit)	Release condition
battery over discharge	0	Battery voltage higher than over discharge return voltage
battery over voltage	1	Battery voltage lower than over voltage return voltage
Battery low voltage alarm	2	Battery voltage higher than alarm return voltage
Load short circuit	3	Long press load button or timing release
Load power too big or load open circuit	4	Lower load power
Controller temperature too high	5	temperature lowed to over-temperature return value
Surroundings temperature too high	6	temperature lowed to over-temperature return value
Input power too big	7	Power lowed to return value
Input side short circuit	8	timing
Solar panel input over voltage	9	Voltage lowed to over voltage return voltage
Solar panel reverse connected	12	Correct connect
Battery reverse connect	13	Correct connect
。。		Unused

Annex Table6 (charging status)

status	value

No charge	0
Open charge mode	1
Mppt charge mode	2
equalizing charge mode	3
boost charge mode	4
float charge mode	5
Current limit (over power or over temperature)	6