MPPT Solar Controller
Communication protocol

Catalog

1 Introduction

Communication protocol requirements

1. data arrangement: low in the left, high in the right
2. the entire packet length is not more than 120 bytes.

Starting mark	Addr		Command ID	Data item	Data length	Data (optional)	Check
	device type	device addr					
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	0~120 byte	1 byte

1.1.1 Starting mark

It is necessary. Each packet needs to start with the start flag as the data packet.

1.1.2 Addr

It is necessary. The address is used to indicate the object that the packet is sending, used in the multimachine communication. The device type is used to indicate the target device type of the communication. 0x00 represents all devices. The device address is used to indicate the address of the communication equipment. 0x00 represents any address, that is, the broadcast address. The recipient parses the packets only when the broadcast or address is consistent with its own address.

1.1.3 Command ID

It is necessary. The command ID is used to define the behavior of the current packet. (see detailed list of commands).

1.1.4 Data item

It is necessary. The region is used to define the operating object of the current command. The general operating object is the data structure, but it is not limited to the data structure.

1.1.5 Data length

It is necessary. The length of data defined here refers only to the length of the data region following it, and does not contain the check domain.

1.1.6 Data：optional，Some instructions include the return of the data (as required).

1.1.7 Check

It is necessary. The verification region is to verify the correctness of the data packet. The value of the check region is equal to the addition of the bytes and then the lower bytes of the data of all other domains of the packet, and then the inverse plus one.

1.1.8 Data type specification

U16 -- 16bit Unsigned char

S16 -- 16bit Signed char

U32 -- 32bit Unsigned char

S32 -- 32bit Signed char

U16 and S16 data formats: low bytes in front (left), high bytes in the back (right);

U32 and S32 data format: low words in front, high word after; low bytes in front, high

bytes in the back;

For example, sending data 1234 and converting to hex to 0x04D2, then transmit 0xD2 at the time of transmission, and transmit 0x04;

For example, sending data 123456789 and converting to hex to 0x07 5B CD 15, then the data sequence is: 0x5B 0x07 0x15 0xCD;

2 Addr

Device type	Describe
0x00	all
Device Addr	
0x00	
0x01	

3 Command list

Command ID	Describe
0x00	CMD_ACK, acknowledge command
0x01	CMD_GET, Get some data item commands
0x02	CMD_SET, Set some data item commands and need to reply
0x03	CMD_SET_NO_RESP, Set some data item commands without a reply
0x04	CMD_NACK, No acknowledge command
0x05	CMD_EXEC, Carry out a particular action and need a reply
0x7F	CMD_ERR，A command or parameter that can not be identified

4 Command item list

Describe	Data item number	Remarks
db_ChgSts	**0**	**Controller running state**
db_BatParam	**1**	**Battery parameters**
db_Log	**2**	**Operation log**
db_parameters	3	sampling parameters
db_LoadParam	**4**	**Load parameters**
db_ChgDebug,	5	Debug
db_remoteControl	**6**	**Control**
db_ProParam	**7**	**Protection parameters**
db_Information	**8**	**Product information**
db_TempParam	**9**	**Temporary data storage**
db_EngSave	**10**	**Power generation information**

5 Data region

For different commands, the format of the data region is different and is defined as follows:

Command ID	value	Describe
CMD_GET	0x01	The data region is necessary, and the first, second byte is the high and low offset. The low third, fourth is the length of the whole column of the data (the length of the word).
CMD_SET	0x02	The data region is necessary, and the first, second byte is the high and low offset, and the following data is the data to be set, the length of which can be obtained from the data length domain.
CMD_SET_NO_RESP	0x03	Data format is the same as CMD_SET, but no reply is required.
CMD_ACK	0x00	Without a data domain, the command ID is replaced by a CMD_ACK, a data packet that is replying at the same time, and the data length region is 0.
CMD_NACK	0x04	Without a data domain, change the command ID into CMD_NACK, the data field and its reply packet, the data length region is 0.
CMD_EXEC	0x05	The data region is necessary, and its specific content depends on the command ID and the specific command content.

6 Command acknowledge

If the packet is successfully parsed (it means that the packet format is correct and the address matches), it will be returned as required; if the packet error is received (the packet format is incorrect or the address is not consistent), the packet will be ignored. The acknowledge of the command is defined as follows:

Command ID	Acknowledge
CMD_GET	CMD_SET_NO_RESP
CMD_SET	CMD_ACK or CMD_NACK
CMD_SET_NO_RESP	No reply
CMD_ACK	No reply
CMD_NACK	No reply
CMD_EXEC	CMD_ACK or CMD_NACK

7 Detailed description of data items

7.1.1 Run state data

ChgSts information				
Data item ID: 0x00				
Attributes: Read-only(Read all: AA 01 00 01 00 03 00 00 1E 33)				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wChgMode;	00 00		Charge Mode（0~4）
2	Uint16 wPvVolt;	01 00	0.1V	PV input Voltage
2	Uint16 wBatVolt;	02 00	0.1V	Bat Voltage
2	Uint16 wChgCurr;	03 00	0.1A	Charging Current
2	Uint16 wOutVolt;	04 00	0.1V	/(Internal use)
2	Uint16 wLoadVolt;	05 00	0.1V	Load Voltage
2	Uint16 wLoadCurr;	06 00	0.1A	Load Current
2	Uint16 wChgPower;	07 00	1W	Charging Power
2	Uint16 wLoadPower;	08 00	1W	Load Power
2	int16 wBatTemp;	09 00	1℃	Battrey temperature
2	int16 wInnerTemp;	0A 00	1℃	Internal temperature
2	Uint16 wBatCap;	0B 00	1%	Battery level
4	Uint32s dwCO2	0C 00	0.1kg	CO2 emission reduction
2	Uint16 wFault;	0E 00	Table 9-1 breakdown information details	
2	Uint16 wSystemReminder;	0F 00	Table 9-2 system hints details	

7.1.2 Battery parameters

BatParam information				
Data item ID: 0x01				
Attributes: Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
2	Uint16 wBatType;	01 00		Battery type: 0: User-defined 1: Flooded 2: Sealed; 3: Gel;
2	Uint16 wBatSysType;	02 00		Battery system: 00 00:auto 01 00:1*12V 02 00:2*12V ... 20 00:32*12V
2	Uint16 wBulkVolt;	03 00	0.1V	Bulk voltage

2	Uint16 wFloatVolt;	04 00	0.1V	Float voltage
2	Uint16 wMaxChgCurr;	05 00	0.1A	Charge current limit
2	Uint16 wMaxDisChgCurr;	06 00	0.1A	DisCharge（Load）current limit
2	Uint16 wEqualizeChgVolt;	07 00	0.1V	Activation charge voltage
2	Uint16 wEqualizeChgTime;	08 00	1min	Activation charge time
2	Uint16 bLoadUseSel;	09 00	1%	Load utilization
2	Uint16 ChkSum;			

7.1.3 Run log

Log information				
Data item ID: 0x02				
Attributes： Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
4	Uint32s dwRunTime;	01 00	1min	-------
2	Uint16 wStartCnt;	03 00		-------
2	Uint16 wLastFaultInfo;	04 00		-------
2	Uint16 wFaultCnt;	05 00		-------
4	Uint32s dwTodayEng;	06 00	1wh	Daily power generation
4	data_t wTodayEngDate	08 00		
4	Uint32s dwMonthEng;	0A 00	1wh	Monthly power generation
4	data_t wMothEngDate;	0C 00		
4	Uint32s dwTotalEng;	0E 00	1wh	Total power generation
4	Uint32s dwLoadTodayEng;	10 00	1wh	Consume electricity daily
4	Uint32s dwLoadMonthEng;	12 00	1wh	Consume electricity Monthly
4	Uint32s dwLoadTotalEng;	14 00	1wh	Consume electricity Total
2	Uint16 wBacklightTime;	16 00	1S	Backlight time
2	Uint16 bSwitchEnable;	17 00	1 或 0	Key switch enabled (1 active)
2	Uint16 ChkSum;			

7.1.4 Sampling parameters

Parameter information				
Data item ID: 0x03				
Attributes： Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
2	Uint16 wPvVoltRatio;	01 00	int	/(Internal use)
2	Uint16 wPvVoltOffset;	02 00	int	/(Internal use)
2	Uint16 wBatVoltRatio;	03 00	int	/(Internal use)
2	Uint16 wBatVoltOffset;	04 00	int	/(Internal use)
2	Uint16 wChgCurrRatio;	05 00	int	/(Internal use)
2	Uint16 wChgCurrOffset;	06 00	int	/(Internal use)
2	Uint16 wLoadCurrRatio;	07 00	int	/(Internal use)
2	Uint16 wLoadCurrOffset;	08 00	int	/(Internal use)
2	Uint16 wLoadVoltRatio;	09 00	int	/(Internal use)
2	Uint16 wLoadVoltOffset;	0A 00	int	/(Internal use)
2	Uint16 wOutVoltRatio;	0B 00	int	/(Internal use)
2	Uint16 wOutVoltOffset;	0C 00	int	/(Internal use)
2	Uint16 wChkSum;			

7.1.5 Load parameter

LoadParam information				
Data item ID: 0x04				
Attributes： Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
2	Uint16 wLoadModuleSelect1;	01 00	int	Load Module 1：5100~5118
2	Uint16 wLoadModuleSelect2;	02 00	int	Load Module 2：5201~5215
2	Uint16 wLoadOnPvVolt;	03 00	0.1V	Turn on the load's PV voltage
2	Uint16 wLoadOffPvVolt;	04 00	0.1V	Turn off the load's PV voltage
2	Uint16 wPvContrlTurnOnDelay;	05 00	1min	Open the light-control load time delay
2	Uint16 wPvContrlTurnOffDelay;	06 00	1min	Close the light-control load time delay
4	time_t AftLoadOnTime;	07 00		Open the load time in the evening
4	time_t AftLoadOffTime;	09 00		Close the load in the evening

4	time_t MonLoadOnTime;	0B 00		Open the load in the morning
4	time_t MonLoadOffTime;	0D 00		Close the load in the morning
2	Uint16 wLoadSts	0F 00	1 or 0	Load switch status (read-only): 1 :open 0 :shut down
2	Uint16 wTime2Enable	10 00	1 or 0	Enable time 2: read and write data "1" opening period 2 setting; read and write data "0" closing time 2 settings
2	Uint16 ChkSum;			

7.1.6 RemotControl parameters

RemoteControl information				
Data item ID: 0x06				
Attributes: Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	int16 uwMagicNum;	00 00		----------
2	int16 eRemoteCmd;	01 00		Remote command (subcommand)
16	int16 uwData[8];	02 00		Command parameters (used for time correction)

7.1.7 Protection parameters

ProParam information				
Data item ID: 0x07				
Attributes: Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
2	Uint16 wLoadOvp;	01 00	0.1V	Load overvoltage protection
2	Uint16 wLoadUvp;	02 00	0.1V	Load low voltage protection
2	Uint16 wBatOvp;	03 00	0.1V	Overvoltage protection of battery
2	Uint16 wBatOvB;	04 00	0.1V	Battery overvoltage recovery point
2	Uint16 wBatUvp;	05 00	0.1V	Battery low voltage protection

2	Uint16 wBatUvB;	06 00	0.1V	Battery low voltage recovery
2	Uint16 ChkSum;			

7.1.8 Equipment information

Information information				
Data item ID: 0x08				
Attributes: Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
16	Uint16 wSerialID[8];	01 00		Serial number
4	Uint16 wFirmWare[2];	09 00		Version number
16	Uint16 wModel[8];	0B 00		Model
2	Uint16 wChkSum;			

7.1.9 Temporary data storage

TempParam information				
Data item ID: 0x09				
Attributes: Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		Flag
4	time_t PeriodLoadCtr2Time;	01 00		----------
2	Uint16 bPVEnergySel;	03 00		----------
2	Uint16 bBatTempSel;	04 00	1 or 0	Temperature display unit selection: 1: degrees Fahrenheit. 0: centigrade degrees centigrade
2	Uint16 bLoadUseSel;	05 00		----------
2	Uint16 bLoadLaststate;	06 00		----------
2	Uint16 wChkSum;			

7.1.10 Information on power generation and electricity consumption

EngSave information				
Data item ID: 0x0A				
Attributes: Read and write				
Bytes	**Content**	**Offset**	**Unit**	**Remarks**
2	Uint16 wFlag;	00 00		
48	Uint32s wMonthPower[12];	01 00		[0] ~ [11] data statistics for 1~12 month power generation
48	Uint32s wMonthLoadPower[12];	19 00		[0] ~ [11] data

				statistics for 1~12 monthly electricity consumption
124	Uint32s wDayPower[31];	31 00		[0] ~ [30] data statistics for 1~31 day power generation
124	Uint32s wDayLoadPower[31];	6F 00		[0] ~ [30] data statistics for 1~31 daily electricity consumption
2	Uint16 wChkSum;			

7.1.11 Table 9-1 breakdown information details

位	**Fault information**
1 bit	Battery voltage over
2 bit	PV voltage over
3 bit	Charge current over
4 bit	Dis-charge over
5 bit	Battery temperature alarm
6 bit	Internal temperature alarm
7 bit	PV voltage low
8 bit	Battery voltage low
9bit	Trip zero protection trigger
10bit	In the control of manual switchgear

8 Relevant data description:

1.**wBatType :** Battery type (available)

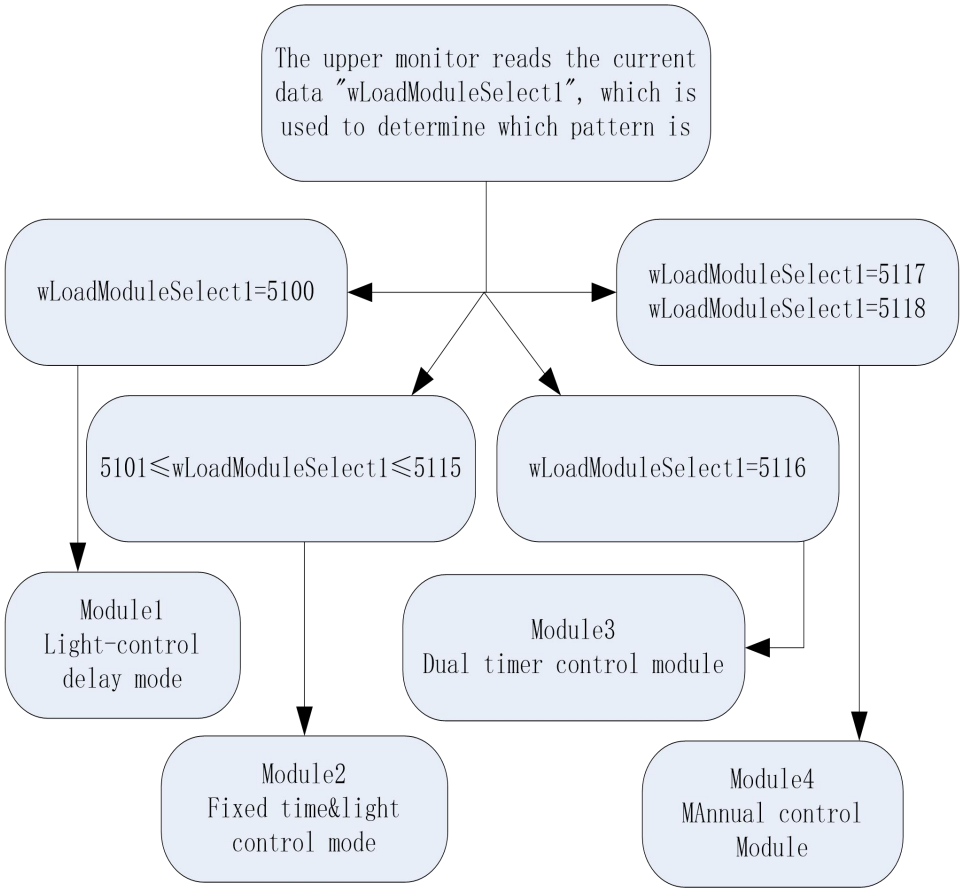
①0-User-defind; ②1-Flooded; ③2-Sealed; ④3-Gel;

2.**wEqualizeChgVolt :** Activation charge voltage
wBulkVolt : Balanced charging voltage
wFloatVolt : Float charging voltage
The set voltage range is 9V~17V, principle:
wFloatVolt < wBulkVolt < wEqualizeChgVolt

3.**wBatSysType :** Battery system voltage
(here is the 12V battery as the standard, set the number of batteries in series Cell)
Set range 0~32, meaning: Cell*12V= system voltage, example: set number 2, then 2*12V=24V, 24V for battery system voltage. Set 0, which is represented as automatic recognition

4.**wBacklightTime :** Backlight time setting
Range: 1~999

5.Load control mode specification: 4 modes (Note: when wLoadModuleSelect1 is set to 5100, 5116, 5117 or 5118, wLoadModuleSelect2 data cannot be set, and the default is 5200).



① Light-control delay mode (5100): starting voltage (can be set), closed voltage (can be set), action time delay (can be set);

②Fixed time-light control mode：

	Period 1		Period 2
5101	Light control opens the load and closes 1 hours later	5201	The load is opened 1 hours before daybreak and the day is closed
5102	Light control opens the load and closes 2 hours later	5202	The load is opened 2 hours before daybreak and the day is closed
5103～5113	Light control opens the load and closes 3~13 hours later	5203～5213	The load is opened 3~13 hours before daybreak and the day is closed
5114	Light control opens the load and closes 14 hours later	5214	The load is opened 14 hours before daybreak and the day is closed
5115	Light control opens the load and closes 15 hours later	5215	The load is opened 15 hours before daybreak and the day is closed

③Dual timer mode：

5116	Turn-On Time1: (can be set) Turn-Off Time1: (can be set)		Turn-On Time2: (can be set) Turn-Off Time2: (can be set)

④Manual switching mode：

5117：Normally open state
5118：Normally close state

6.**wChgMode** : charge state

```
#define cChgWait    0
#define cMpptChg    1
#define cBulkChg    2
#define cFloatChg   3
#define cPreChg         4
```

7.Data structure

```
typedef struct
{
    Uint16 wHi16;
    Uint16 wLow16;
}Uint32s;
typedef struct
{
    int hour;
    int minute;
}time_t;

typedef struct
{
```

```
    int month;
    int day;
}data_t;

8.typedef enum
{
    remoteCmd_null,      // /* 0 */ Meaningless
    remoteCmd_start,     //Start charging command
    remoteCmd_shutdown,     //Stop charging command
    remoteCmd_update,     //Update command
    remoteCmd_modifyDateTime,   //Synchro time command
    remoteCmd_startSelfTest,
    remoteCmd_resetAll,    //Restore factory settings
    remoteCmd_Set
}remoteCmdType_t;

extern remoteControl_t stRemoteControl;

case remoteCmd_modifyDateTime:
strCalendarTmp.IccYear = stRemoteControl.uwData[0];
strCalendarTmp.IccMon = stRemoteControl.uwData[1];
strCalendarTmp.IccDay = stRemoteControl.uwData[2];
strCalendarTmp.IccHours = stRemoteControl.uwData[3];
strCalendarTmp.IccMin = stRemoteControl.uwData[4];
strCalendarTmp.IccSec = stRemoteControl.uwData[5];
```

Check and reference code:

```
uint8_t cProtocol::proGenChecksum(uint8_t* pbData,uint16_t uwLen)
{
    uint8_t ubChksum = 0;
    while(uwLen--)
    {
        ubChksum += *pbData++;
    }
    return (0 - ubChksum) & 0xFF;
}
```

Remarks: by reading the length of the “offset address + data byte”, we can read a continuous information in the real-time information table. We should pay attention to the "end address = offset address + byte length /2 + 1", which should not be greater than the largest offset address in the table.

9 Some examples of command：

The upper monitor reads real-time information. Its corresponding data item is shown in 5 data items, and the command ID is CMD_GET, and its data region format is "address + byte length (see 6 data region)". Besides, for this product, the maximum length of bytes is 102.

Read the data ， Read the machine's status information

Command： AA 01 00 01 00 03 00 00 1A 37

Description：

AA Data packet header
01 Device Type: MPPT Controller
00 Address: 0 broadcast address
01 Commandc：CMD_GET
00 Data item：Real-time information
03 Data region length：3 Refers to the back of "00 00 1A", a total of three bytes
00 00 Offset address: 0x0000, the low byte is on the left and the high byte is on the right
1A The total length of the data to be read from the offset address is 26 bytes
37 Check 37 = (0-(AA+01 +01 +03 + 1A))&0xFF

```
00000000:AA 01 00 01 00 03 00 00 1A 37
```

Response(Received data)：

```
AA 01 00 03 00 1C 00 00 00 00 2F 00 0C 00 C8 00 0B 00 0C 00 F6 01 18 00 00 00 05 00 78 00 00 00 00 00 90
```

Description：

AA Data packet header
01 Device Type: MPPT Controller
00 Address: 0 broadcast address
03 Commandc：CMD_SET_NO_RESP
00 Data item：Real-time information （Refer to Section 5 for a list of data items）
1C The total data byte length is 28 bytes (14 data)
00 00 Data offset (lower 8 bits left and 8 upper right)
00 00 wChgMode;
2F 00 wPvVolt; 0x002f :47 This means that the PV voltage is 4.7V
。 。 。 。 。 。 。
90 checksum

Write the data，For example, set the battery type

Command： AA 01 00 02 01 04 01 00 01 00 4C

Description：

AA Data packet header
01 Device Type: MPPT Controller
00 Address: 0 broadcast address
02 Command：CMD_SET
01 Data item：Battery parameters (refer to Section 5 Data List)
04 Data region length：4 Refers to the back of "01 00 01 00", a total of four bytes
01 00 Offset address: 0x0100, the low byte is on the left and the high byte is on the right
01 00 Battery type data 0x0001
4C checksum

```
00000000:AA 01 00 02 01 04 01 00 01 00 4C
```

Response(Received data)：

```
00000000: AA 01 00 00 01 00 54
```

AA 01 00 00 01 00 54

AA Data packet header
01 Device Type: MPPT Controller
00 Address: 0 broadcast address
00 Command：CMD_ACK
01 Data item：Battery parameters (refer to Section 5 Data List)
00 Data length: 0 Indicates there is no data
54 checksum

Time correction：

Write data：AA 01 00 02 06 10 01 00 04 00 01 00 01 00 01 00 02 00 02 00 01 00 30

Description：

AA Data packet header
01 Device Type: MPPT Controller
00 Address: 0 broadcast address
02 Command：CMD_SET
06 Data item：remoteControl
10 Data region length：
01 00 Offset address
04 00 Subcommand
01 00 Year
01 00 Month
01 00 Day
02 00 Hour
02 00 Minute
01 00 Second
30 checksum

```
00000000:AA 01 00 02 06 10 01 00 04 00 01 00 01 00 01 00;? 
00000010:02 00 02 00 01 00 30                             ;
```

说明：

AA Data packet header
01 Device Type: MPPT Controller
00 Address: 0 broadcast address
00 Command：CMD_ACK
06 Data item：remoteControl
00 Data region length:0
4F checksum

The data received indicates that the setting was successful