Lithium iron phosphate battery system for communication

Communication protocol V1.7

(foreign)

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1. Communication protocol

1.1 Basic format of the agreement

The monitoring system is a distributed structure, and the communication between the monitoring unit (SU) and the monitoring module (SM) is master-slave.

The monitoring unit is the upper computer, and the monitoring module is the lower computer.

Communication process: SU calls SM and sends commands, and SM returns response information after receiving the commands. Within 500ms,

If the SU fails to receive the SM response information or the response information is wrong, it considers that the communication process has failed.

- - - - Command information sent from SU to SM, referred to as command information.

- - - - Response information returned by SM to SU, referred to as response information.

1.1.1 The basic format of the frame structure is shown in Table A1

Table A1

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	CID1	CID2	LENGTH	INFO	CHKSUM	EOI

3.1.2 See Table A2 for the explanation of the basic format

Table A2 Basic format

serial number	symbol	Meaning	Remark
1	SOI	Start bit flag (START OF INFORMATION)	(7EH)
2	VER	Communication protocol version number	
3	ADR	Different address descriptions for devices of the same type (1-254, 0, 255 reserve)	
4	CID1	Control ID	
5	CID2	Command information: control identification code (data or action type description)	

		Response information: return code RTN	
6	LENGTH	INFO byte length (including LENID and LCHKSUM)	
7	INFO	Command information: control data information (COMMAND_INFO) Response information: Response data information (DATA_INFO)	
8	CHKSUM	checksum code	
9	EOI	End code (END OF INFORMATION)	CR (0DH)

Remark:

VER—see specific version protocol analysis. ADR—different addresses for multiple power supply devices, up to 254 power supplies can be networked.

The explanation about INFO (including COMMAND_INFO and DATA_INFO) is as follows:

a) COMMAND_INFO includes the following forms:

COMMAND_INFO is included in the command information, and its content is shown in one or a combination of several in Table A3.

b) DATA_INFO includes the following forms:

DATA_INFO is included in the response information, and its content is shown in one or several combinations in Table A4.

DATA_FLAG is defined in Table A5.

Table A3 COMMAND_INFO format

COMMAND_GROUP	1 byte	Indicates different group numbers of the same type of equipment
COMMAND_TYPE	1 byte	Indicates different remote control commands or different control commands in historical data transmission
COMMAND_ID	1 byte	Indicates different monitoring points in the same group of the same type of equipment
COMMAND_TIME	7 bytes	Indicates the time period

Table A4 DATA_INFO format

DATAI	Fixed-point number response information (this protocol does not use floating-point numbers)

DATAF	Floating point number response information
RUN_STATE	Equipment running status
WARN_STATE	Device alarm status
DATA_FLAG	data identification information
DATA_TIME	event time

Table A9 Datetime format

Year	(1--9999)	INTEGER	(integer 2 bytes, hexadecimal)
moon	(1--12)	CHAR	(character type 1 byte, hexadecimal)
day	(1--31)	CHAR	(character type 1 byte, hexadecimal)
hour	(0--23)	CHAR	(character type 1 byte, hexadecimal)
point	(0-59)	CHAR	(character type 1 byte, hexadecimal)
Second	(0--59)	CHAR	(character type 1 byte, hexadecimal)

Date and time data is transmitted in the order of year, month, day, hour, minute, and second, and finally split into 14 ASCII codes for transmission.

1.2 Data format

basic data format

Except for SOI and EOI which interpret hexadecimal transmission in hexadecimal, the rest of the items are interpreted in hexadecimal.

Hexadecimal - ASCII code mode transmission, each byte is represented by two ASCII codes, such as when CID2=4BH, transmission

When sending 34H (ASCII code for "4"), and 42H (ASCII code for "B") two bytes.

1.3 LENGTH data format see Table A7

Table A7 Data format of LENGTH

high byte	low byte

Checksum LCHKSUM				LENID (represents the number of bytes of ASCII code in the transmission of INFO)											
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

LENID indicates the byte number of the ASCII code of the INFO item. When LENID=0, INFO is empty, that is, there is no such item. because LENID is only 12bit, so the maximum size of the data packet is required to be no more than 4095 bytes. LENGTH Transmit high first byte, and then transmit the low byte, which is transmitted in four ASCII codes.

Calculation of the check code LCHKSUM: D11D10D9D8+D7D6D5D4+D3D2D1D0, take the remainder of modulo 16 and add 1 after summing.

For example:

The number of ASCII code bytes in INFO is 18, that is, LENID=0000 0001 0010B.

D11D10D9D8+D7D6D5D4+D3D2D1D0=0000B+0001B+0010B=0011B, modulo 16 remainder is 0011B, Invert 0011B and add 1 to 1101B,Then LCHKSUM is 1101B. The available LENGTH is 1101 0000 0001 0010B, That is D012H.

1.4 CHKSUM data format

The calculation of CHKSUM is to accumulate and sum the ASCII code values of other characters except SOI, EOI and CHKSUM, and the result is

If the fruit model is 65536, the remainder is reversed and 1 is added.

For example:

The character sequence received or sent is: "~1203400456ABCEFEFC72\R" (where "~" is SOI, "CR" EOI), then "FC72" in the last 5 "FC72\R" is CHKSUM, the calculation method is:

"1"+"2"+"0"+...+"F"+"E"=31H+32H+30H+...+46H+45H=038EH

The remainder of 038EH modulo 65536 is 038EH, 038EH inverse plus 1 is FC72H.

1.5 DATA_INFO data format

It is mainly used in the transmission and collection of analog data.

Both fixed-point and floating-point forms are available, and this protocol adopts the fixed-point form.

Fixed-point number format (INTEGER, 2 bytes, the order of transmission is first high byte and then low byte)

- - - - Signed integer -32768~+32767

- - - - Unsigned integer 0~65535

Unsigned char (CHAR, 1 byte, 0--255)

Fixed-point data type

serial number	telemetry content	type of data
1	Battery single cell voltage	unsigned integer
2	temperature	unsigned integer
3	Total battery voltage	unsigned integer
4	Charge and discharge current	signed integer (charge is positive)
5	System parameters	signed/unsigned integer
6	An hour	unsigned integer

1.6 Code table

CID1 code table

serial number	content	CID1	Remark
1	Lithium battery data	46H	

CID2 Response Code Table (RTN)

serial number	content	RTN value (HEX)	Remark
1	normal	00H	
2	VER wrong	01H	
3	CHKSUM wrong	02H	

4	LCHKSUM wrong	03H	
5	CID2 invalid	04H	
6	command format error	05H	
7	invalid data	06H	INFO data is invalid
8	ADR error	90H	customize
9	communication error	91H	customize
10	Data transfer failure or error	A0H	customize

1.7 Communication interface and transmission rate

- - - - Physical interface: serial communication port, standard RS485 mode, and asynchronous mode for information transmission.

- - - - Communication rate: 9600bps.

- - - - Communication format: 1 start bit, 8 data bits, 1 stop bit, no parity.

2. Communication command

1. The upper computer obtains the quantized data of the analog quantity (fixed-point number)

command information

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	42H	LENGTH	INFO	CHKSUM	EOI

SOI = 0x7E; VER = 0x21;

ADR = PACK destination address; EOI = 0x0D; lenid = 2;

INFO is a byte, which is Command:

Command= 0xff get all Pack battery data

Command= 0x01 Obtain Pack1 battery data

Command= 0x02 Obtain Pack2 battery data

.....

Command=0x10 Obtain Pack16 battery data

response message

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

SOI = 0x7E; VER = 0x21;

ADR = PACK destination address; EOI = 0x0D; LENID = Calculated;

Note: INFO consists of INFOFLAG and DATAI.
(INFOFLAG is reserved for one byte)

Corresponding DATAI data

serial number	content	Remark
1	Pack Quantity M / Command Value	1 byte
2	Pack1 battery data	
. . . . .		
M+1	PackM battery data	
M+2		

Each pack battery data format:

serial number	content	DATAI bytes
1	Number of battery cells M	1
2	Cell1 voltage	2
3	Cell2 Voltage	2
...	...	...
M+1	CellM voltage	2
M+2	Temperature number N	1
M+3	temperature 1	2
...	...	...
M+N+2	temperature N	2
M+N+3	Pack current	2
M+N+4	Pack total voltage	2
M+N+5	Pack remaining mAh	2
M+N+6	User-defined number=5	1
M+N+7	Pack Total mAh	2
M+N+8	battery cycle	2
M+N+9	SOC (high byte), SOH (low byte)	2
M+N+10	balanced	2
M+N+11	humidity(%)	1

Note:

serial number	content	illustrate
1	Battery single cell voltage	unsigned integer Unit mV
2	temperature	Unsigned integer transfer data is increased by 40 to the actual value Unit °C
3	total voltage	Unsigned integer unit 10mV

4	Charge and discharge current	Signed integer (charge is positive) unit 10mA
5	An hour	Unsigned integer unit 10mAH
6	SOC, SOH	Unsigned integer unit 1%
7	Pack Quantity M / Command value	When command=0xff, this byte is the number of pack, when command is other value, this byte is the value of command.
8	equilibrium state	Each bit represents the balanced state of a battery, 1: balanced, 0: unbalanced. (0~15bit corresponds to AA batteries 1~16)

2. The upper computer obtains the alarm information

command information

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	44H	LENGTH	INFO	CHKSUM	EOI

SOI = 0x7E; VER = 0x21;

ADR = PACK destination address; EOI = 0x0D; lenid = 2;

INFO is a byte, which is Command:

Command= 0xff get all Pack warning information

Command= 0x01 Obtain Pack1 warning information

Command= 0x02 Obtain Pack2 warning message

.....

Command=0x10 Obtain Pack16 warning information

response message

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

SOI = 0x7E; VER = 0x21;

ADR = PACK destination address; EOI = 0x0D; LENID = calculated;

Note: INFO data consists of DATAFLAG and WARNSTATE.

(INFOFLAG is reserved for one byte)

Corresponding WARSTATE information

serial number	content	Remark
1	Pack Quantity M / Command Value	1 byte
2	Pack1 warning information	
...		
M+1	PackM warning message	

The data format of each Pack:

serial number	content	DATAI bytes
1	Number of battery cells M	1
2	Cell1 voltage	1
3	Cell2 Voltage	1
...	...	...
M+1	CellM voltage	1
M+2	Temperature number N	1
M+3	temperature 1	1
...	...	...
M+N+2	temperature N	1
M+N+3	battery charging current	1
M+N+4	Total battery voltage	1
	Short circuit protection times	2 bytes The 8th bit of the low byte (0-non-red 1-red) high byte table count
M+N+5	Number of custom flags = 10	1
M+N+6	status indication 1	1
M+N+7	status indicator 2	1
M+N+8	status indicator 3	1
M+N+9	status indication 4	1
M+N+10	status indication 5	1
M+N+11	status indication 6	1
M+N+12	status indication 7	1
M+N+13	status indication 8	1
M+N+14	status indication 9	1
M+N+15	status indication 10	1
M+N+16	status indication 11	1
M+N+17	status indication 12	1
M+N+18	status indication 13	1
M+N+19	status indication 14	1
M+N+20	status indication 15	1
M+N+15	reserve	2

Alarm byte description (serial number 1~M+N+5)

00H————————Normal

01H————————Below the lower limit

02H - - - - - - higher than the upper limit

F0H————————other errors

status indication 1

bit	instruct	Remark
0	Single overvoltage alarm	1: Alarm 0: normal
1	Single undervoltage warning	1: Alarm 0: normal
2	Total pressure overvoltage alarm	1: Alarm 0: normal
3	Total pressure undervoltage alarm	1: Alarm 0: normal

4	Charging overcurrent warning	1: Alarm 0: normal
5	Discharge overcurrent 1 alarm	1: Alarm 0: normal
6	Differential pressure alarm	1: warning 0: normal
7	Differential pressure protection	1: protection 0: normal

status indication 2

bit	instruct	Remark
0	Single overvoltage protection	1: protection 0: normal
1	Single undervoltage protection	1: protection 0: normal
2	Total pressure overvoltage protection	1: protection 0: normal
3	Total pressure undervoltage protection	1: protection 0: normal
4	Charging overcurrent protection	1: protection 0: normal
5	Discharge overcurrent 1 protection	1: protection 0: normal
6	Discharge overcurrent 2 protection	1: protection 0: normal
7	Short circuit protection	1: protection 0: normal

status indication 3

bit	instruct	Remark
0	Charging high temperature warning	1: Alarm 0: normal
1	Charging low temperature warning	1: Alarm 0: normal
2	Discharge high temperature alarm	1: Alarm 0: normal
3	Discharge low temperature warning	1: Alarm 0: normal
4	Ambient high temperature warning	1: Alarm 0: normal
5	Ambient low temperature warning	1: Alarm 0: normal
6	MOSFET high temperature warning	1: Alarm 0: normal
7	MOSFET low temperature warning	1: Alarm 0: normal

status indication 4

bit	instruct	Remark
0	Charging high temperature protection	1: protection 0: normal
1	Charging low temperature protection	1: protection 0: normal
2	Discharge high temperature protection	1: protection 0: normal
3	Discharge low temperature protection	1: protection 0: normal
4	Environmental high temperature protection	1: protection 0: normal
5	Environmental low temperature protection	1: protection 0: normal
6	MOSFET high temperature protection	1: protection 0: normal
7	MOSFET low temperature protection	1: protection 0: normal

status indication 5

bit	instruct	Remark
0	Reverse polarity alarm	1: Alarm 0: normal
1	SOC low warning	1: Alarm 0: normal
2	CFET error warning	1: Alarm 0: normal

3	DFET error warning	1: Alarm 0: normal
4	High battery temperature alarm	1: Alarm 0: normal
5	Low battery temperature warning	1: Alarm 0: normal
6	Effective charging current indication	1: effective charging current 0: no charging current
7	Effective discharge current indication	1: effective discharge current 0: no discharge current

status indication 6

bit	instruct	Remark
0	DFET indication	1: ON 0:OFF
1	CFET indication	1: ON 0:OFF
2	PreFET indication	1: ON 0:OFF
3	Have AC	1: ON 0:OFF
4	Fully charged	1: Fully charged state 0: non-full charge
5	Charging current limiting function enabled	1: enable 0: disabled
6	Current limit enabled	
7	Self-depletion	

status indication 7

bit	instruct	Remark
0	Heating function enabled	1: enable 0: disabled
1	heating state	1: ON 0:OFF
2	Cooling function enabled	1: enable 0: disabled
3	Thermal status	1: ON 0:OFF
4	Buzzer function enable	1: enable 0: disabled
5	buzzer status	1: ON 0:OFF
6	LED function enable	1: enable 0: disabled
7	GPRS function enabled	1: enable 0: disabled

status indication 8

bit	instruct	Remark
0	Section 1 Battery Detection	1: failure 0: normal
1	Section 2 Battery Detection	1: failure 0: normal
2	Section 3 Battery Detection	1: failure 0: normal
3	Section 4 Battery Detection	1: failure 0: normal
4	Section 5 Battery Detection	1: failure 0: normal
5	Section 6 Battery Detection	1: failure 0: normal
6	Section 7 Battery Detection	1: failure 0: normal
7	Section 8 Battery Detection	1: failure 0: normal

status indication 9

bit	instruct	Remark
0	Section 9 Battery Detection	1: failure 0: normal
1	Section 10 Battery Detection	1: failure 0: normal
2	Section 11 Battery Detection	1: failure 0: normal
3	Section 12 Battery Detection	1: failure 0: normal

4	Section 13 Battery Detection	1: failure 0: normal
5	Section 14 Battery Detection	1: failure 0: normal
6	Section 15 Battery Detection	1: failure 0: normal
7	Section 16 Battery Detection	1: failure 0: normal

status indication 10

bit	instruct	Remark
0	Section 17 Battery Detection	1: failure 0: normal
1	Section 18 Battery Detection	1: failure 0: normal
2	Section 19 Battery Detection	1: failure 0: normal
3	Section 20 Battery Detection	1: failure 0: normal
4	Section 21 Battery Inspection	1: failure 0: normal
5	Section 22 Battery Detection	1: failure 0: normal
6	Section 23 Battery Detection	1: failure 0: normal
7	Section 24 Battery Detection	1: failure 0: normal

status indication 11

bit	instruct	Remark
0	Section 25 Battery Detection	1: failure 0: normal
1	Section 26 Battery Detection	1: failure 0: normal
2	Section 27 Battery Inspection	1: failure 0: normal
3	Section 28 Battery Detection	1: failure 0: normal
4	Section 29 Battery Detection	1: failure 0: normal
5	Section 30 Battery Inspection	1: failure 0: normal
6	Section 31 Battery Test	1: failure 0: normal
7	Section 32 Battery Inspection	1: failure 0: normal

status indication 12

bit	instruct	Remark
0	Section 33 Battery Test	1: failure 0: normal
1	Section 34 Battery Test	1: failure 0: normal
2	Section 35 Battery Test	1: failure 0: normal
3	Section 36 Battery Test	1: failure 0: normal
4	Section 37 Battery Test	1: failure 0: normal
5	Section 38 Battery Test	1: failure 0: normal
6	Section 39 Battery Test	1: failure 0: normal
7	Section 40 Battery Test	1: failure 0: normal

status indication 13

bit	instruct	Remark
0	Section 41 Battery Test	1: failure 0: normal
1	Section 42 Battery Test	1: failure 0: normal
2	Section 43 Battery Test	1: failure 0: normal
3	Section 44 Battery Test	1: failure 0: normal
4	Section 45 Battery Test	1: failure 0: normal
5	Section 46 Battery Test	1: failure 0: normal

6	Section 47 Battery Test	1: failure 0: normal
7	Section 48 Battery Test	1: failure 0: normal

status indication 14 (detection state 1)

bit	instruct	Remark
0	DFET error	1: error 0: normal
1	CFET error	1: error 0: normal
2	front-end chip error	1: error 0: normal
3	clock chip error	1: error 0: normal
4	data storage error	1: error 0: normal
5	parameter storage error	1: error 0: normal
6	High voltage protection	1: protection 0: normal
7	PDFET error	1: error 0: normal

status indication 15 (detection state 2)

bit	instruct	Remark
0	P+ insulation protection	1: error 0: normal
1	P-insulation protection	1: error 0: normal
2	Battery failure	1: error 0: normal
3	temperature fault	1: error 0: normal
4		1: error 0: normal
5		1: error 0: normal
6		1: error 0: normal
7		1: error 0: normal

Note:

1. When command=0xff, this byte is the quantity of pack; when command is other values, this byte is the value of command. 2. Battery detection - In actual work, the voltage of each battery should be relatively consistent. If the voltage of a certain battery is different from other batteries by a certain effective value (depending on the specific battery characteristics), it is considered that the battery is faulty.

3. The upper computer sends a command to read product information to the host

command information

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	F1H	LENGTH	INFO	CHKSUM	EOI

ADR: Host computer address

LENID is computed to

INFO information:

Bytes	1
content	PACK address

response message

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

ADR: The device address of the returned data

LENID: Calculated

RTN: 0x00 for success; 0xA0 for failure.

INFO information:

Bytes	1	20
content	PACK address	product information

product information		
serial number	name	Bytes
1	Company name (not enough to fill in the blank space)	30
2	Production Date	30
3	Module name (not enough to fill in the spaces)	30
4	Version number (not enough to fill in the blanks)	30
5	Battery type (not enough to fill in the blanks)	30
6	Serial number (not enough to fill in the blanks)	30
7	Remarks (not enough to fill in the blanks)	30

4. The upper computer sends a command to set product information to the host

command information

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	46H	F2H	LENGTH	INFO	CHKSUM	EOI

ADR: Host computer address

LENID is computed to

INFO information:

Bytes	1	20
content	PACK address	product information

response message

serial number	1	2	3	4	5	6	7	8	9
Bytes	1	1	1	1	1	2	LENID/2	2	1

Format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

ADR: The device address of the returned data