PACE RS485 Communication Protocal

(PACE-RS485-MS)

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Change Record		
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For example

When the external monitoring equipment needs to obtain battery data through RS485 interface , the PACK address range is 2-15, please set it in sequence . For example , to obain the PACK data of address 0 , follow these steps:

step1、Issue the confirm PACK address command with address 2 .If there is a correct response , the PACK with address 2 can communicate normally. If no response is received ,steps2 and 3 are not required.(This step is not required. You can directly perform steps 2 and 3)

7E 32 35 30 32 34 36 39 30 30 30 30 30 46 44 41 34 0D

step2、Issue the command to obtain the PACK analog quantity with address 2:

7E 32 35 30 32 34 36 34 32 45 30 30 32 30 32 46 44 32 45 0D

step3、Issue the command to obtain the PACK alert quantity with address 2: :

7E 32 35 30 32 34 36 34 34 45 30 30 32 30 32 46 44 32 43 0D

To obtain the PACK data of other addresses , replace the ADR and INFO fields with the corresponding addresses (marked in red in the preceding example)and calculate the correct CHKSUM

Response command information explanation: :

Command information: 7E 32 35 30 32 34 36 34 32 45 30 30 32 30 32 46 44 32 45 0D (Command to obtain analog information of address 2)

Response information:

7E 32 35 30 32 34 36 30 30 46 30 37 41 30 30 30 32 31 30 30 44 33 37 30 43 45 35 30 44 30 38 30 43 45 44 30 44 30 36 30 43 45 37 30 44 31 44 30 43 45 42 30 43 46 38 30 43 46 41 30 43 46 42 30 44 30 37 30 43 45 31 30 43 46 31 30 43 43 32 30 44 30 36 30 36 30 42 41 41 30 42 41 43 30 42 41 36 30 42 41 37 30 42 41 39 30 42 42 32 30 30 30 30 43 46 39 34 30 36 44 36 30 33 31 33 38 38 30 30 30 30 31 33 38 38 45 32 36 31 0D

Response information explanation:

7E (SOI)

32 35 (VER, that is veision 25H, V2.5)

30 30 (ADR, the battery address is 0)

34 36 (CID1, 46H)

30 30 (RTN, 00H)

46 30 37 41 (LENGTH, F07A, LENID is 07AH, DATAINFO length is 122 , LCHKSUM is FH)

30 30 (INFOFLAG is 00H。other information is DATAI)

30 30 (COMMAND, as ADR, 00H)

31 30 (battery cell number M, is 10H, that has 16 cell)

30 44 33 37 (first cell voltage: 0D37H, that's 3383mV)

30 43 45 35 (second cell voltage: 0CE5H, that's 3301mV)

30 44 30 38 (third cell voltage: 0D08H, that's 3336mV)

30 43 45 44 (forth cell voltage: 0CEDH, that's 3309mV)

30 44 30 36 (fifth cell voltage: 0D06H, that's 3334mV)

30 43 45 37 (sixth cell voltage: 0CE7H, that's 3303mV)

30 44 31 44 (seventh cell voltage: 0D1DH, that's 3357mV)

30 43 45 42 (eighth cell voltage: 0CEBH, that's 3307mV)

30 43 46 38 (ninth cell voltage: 0CF8H, that's 3320mV)

30 43 46 41 (tenth cell voltage: 0CFAH, that's 3322mV)

30 43 46 42 (eleventh cell voltage: 0CFBH, that's 3323mV)
30 44 30 37 (twelfth cell voltage: 0D07H, that's 3335mV)
30 43 45 31 (thirteenth cell voltage: 0CE1H, that's 3297mV)
30 43 46 31 (fourteenth cell voltage: 0CF1H, that's 3313mV)
30 43 43 32 (fifteenth cell voltage: 0CC2H, that's 3266mV)
30 44 30 36 (sixteenth cell voltage: 0D06H, that's 3334mV)
30 36 (temperature number N, 06H, has 6 temperatures)
30 42 41 41 (first temperatur: 0BAAH, that's 2986, 25.6℃)
30 42 41 43 (second temperature: 0BACH, that's 2988, 25.8℃)
30 42 41 36 (third temperature: 0BA6H, that's 2982, 25.2℃)
30 42 41 37 (forth temperature: 0BA7H, that's 2983, 25.3℃)
30 42 41 39 (fifth temperature (MOS): 0BA9H, that's 2985, 25.5℃)
30 42 42 32 (sixth temperature (environment): 0BB2H, that's 2994, 26.4℃)
30 30 30 30 (PACK current, 0000H, unit10mA, range: -327.68A-+327.67A)
43 46 39 34 (PACK total voltage, CF94H that's 53.140V)
30 36 44 36 (PACK remain capacity, 06D6H that's 17.50AH)
30 33 (user define number P, 03H)
31 33 38 38 (PACK full capacity, 1388H that's 50.00AH)
30 30 30 30 (cycle times, 0000H)
31 33 38 38 (PACK design capacity, 1388H that's 50.00AH)
45 32 36 35 (CHKSUM, E265H)
0D (EOI)

Remark:

when communication debugging between monitoring equipment and BMS by RS485,we should pay attention to this situation:

1、 We should know the BMS is working or not, which can be judged by LED. if all LED is closed , we can push the key at 3-6 seconds to wake up the BMS.
2、 Whether the address dialing switch is set correctly. The address setting range is 0-15 . Avoid setting the address to the same situation . For products without address dialing switch , the default address is 0 . The DIP switch is binary . For more information ,see product specifications.
3、 Corfirm whether RS485 connection is correct ?
4、 We should confirm that the monitoring equipment's RS485 baud is suitable with specification.
5、 When parsing data , be careful to distinguish whether it is signed data ,and do not miss parsing INFOFLAG when obtaining PACK analog quantity and alarm quantity response information.
6、 。

1、Physical interface and Communication mode

1.1 Physical interface

The serial communication mode is adopted for Physical Interface,which is adopted by standard RS485 communication mode.It provides a information transmission methods by Asynchronous mode,a start bit,8data bits, a stop bit,no check bit .The data transmission rate is 9600。

1.2 Communication mode

The Communication mode adopts the Master-Slave response mode.when the PC software or monitoring equipment initiates communication command as the host,the BMS responds the return command as the slave.All

battery packs are slave PACK, and their address rangs from 0 to 15.When you need to communicate with the external monitoring device through the RS485 interface of BMS, the external monitoring device is the host, and the host cyclically polls each PACK of data. if the host don't receive the response caomand or error information in 500 ms when the host has sent the command.in this case,this communication will be failed。

2、Protocal format

2.1 Frame format

Chart A.1 Frame format

Item	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

2.2 basic format explanation

Chart A.2 Basic format

Item	symbol	meaning	remark
1	SOI	START OF INFORMATION	(7EH)
2	VER	Protocal version (2.5)	(25H)
3	ADR	Device address (0－15)	
4	CID1	Device indication code (device type description)	
5	CID2	Command information: control indication code (data or action description) Response information: return code RTN	
6	LENGTH	INFO length of bytes (including LENID and LCHKSUM)	
7	INFO	Command information: control data infaomation (COMMAND_INFO) Response information: response data information(DATA_INFO)	
8	CHKSUM	Check sum	
9	EOI	END OF INFORMATION	CR (ODH)

Remark: VER-means communication veision, usually uses V2.5, as 25H。

ADR- battery pack address, the master PACK address is always set to 1,the salve pack address range is 2~15, Address 0 is used as a stand-alone machine。When the pack is used in parallel, avoid setting the address to the same. The slave pack only responds to commands that match its address。

2.3 Data Format

2.3.1 Basic data Format

Beyond that the SOI and EOI is transmitted by 16-hex format,other items is transmitted by 16-hex ascii format.every byte uses two ascii,for example,when the CID2 = 4BH,the 34H and 42H will be transmitted in two bytes.

2.3.2 LENGTH data Format

Chart A.3 LENGTH data Format

MSB								LSB							
LCHKSUM				LENID (means the information' s ascii bytes)											
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

2.3.3 LEDID

LENID means the ascii byte number of INFO,when LENID = 0,that means INFO is not.all data bytes is not uppt to 4096.

High byte is sent at first and low byte is sent at second for LENGTH information with four ASCII code

2.3.4 LCHKSUM

The calculation method of check code: D11D10D9D8+D7D6D5D4+D3D2D1D0

After sum, module 16 takes inverse plus 1

For example:

INFO:ASCII code number is 18, that' s LENID＝0000 0001 0010B。

D11D10D9D8+D7D6D5D4+D3D2D1D0＝0000B＋0001B＋0010B＝0011B, module 16 is 0011B, 0011B takes inverse plus 1 is 1101B, so LCHKSUM is 1101B。

so: LENGTH is 1101 0000 0001 0010B, that' s D012H.

2.4 CHKSUM data Format

CAll char ascii code is calculated for sum without SOI,EOI and CHKSUM, the result module 65536 takes inverse plus 1。

For example:

When send or receive the data sequence:

“~1203400356ABCEFEFC72\R” (“~” is SOI, “CR” is EOI),

So the last five char “FC72\R” FC72 is CHKSUM,

Calculation method:

‘1’ + ‘2’ + ‘0’ + …+ ‘F’ + ‘E’ ＝31H＋32H＋30H＋…＋46H＋45H＝038EH

038EH module 65536 is 038EH, 038EH take inverse plus 1 is FC72H.

2.5 DATA_INFO data Format

This protocal use the fixed point data type to send information 1) Format (INTEGER, 2bytes)

1) int format (INTEGER, 2byte)

Signed int －32768－＋32767

Unsigned int 0－＋65535

High byte is send first,and the low byte is send second.

2) unsigned char (CHAR, 1byte, 0－255)

Chart A.4 Fixed point data type

Ordinal	Telemetry content	Data type	Transmission unit

1	Battery cell voltage	Unsigned int	mV
2	temperature	Unsigned int	0.1K 25.5℃ = 25.5 * 10 + 2730 = 2985 (0.1K) -12.4℃ = -12.4 * 10 + 2730 = 2606 (0.1K)
3	Total battery voltage	Unsigned int	mV
4	Charge or discharge currnet	Signed int	10mA (the charge current is positive,the discharge current is negative)
5	Battery pack capacity	Unsigned int	10mAH (include the remain capacity,the fullcapacity and designed capaticy)

2.6 data time

DATA_TIME and COMMAND_TIME format can see as the chart:

Chart A.5 Data time format

items	range	Data type	remark
year	(0－99)	CHAR	(one byte,decimal-format)
month	(1－12)	CHAR	(one byte,decimal-format)
data	(1－31)	CHAR	(one byte,decimal-format)
hour	(0－23)	CHAR	(one byte,decimal-format)
minute	(0－59)	CHAR	(one byte,decimal-format)
second	(0－59)	CHAR	(one byte,decimal-format)

Remark:the year is transmitted by char-format, real value = data + 2000。The range is 2000-2099.

3、code allocation

3.1 equipment type code allocation table (CID1)

Chart A.6 CID1 table

item	content	CID1	remark
1	Iron lithium battery	46H	(suitable for ternary lithium)

3.2 command information cade allocation chart (CID2)

Chart A.7 CID2 table

item	content	CID2	remark
1	Pack number	90H	
2	Pack analog information	42H	

3	Pack warn information	44H	
5	Software veision	C1H	define
6	Product information	C2H	define

Chart A.8 response information (RTN)

item	symbol	RTN	remark
1	normal	00H	
2	undefine	01H	
3	Undefined	02H	
4	Undefined	03H	
5	CID2 undefine	04H	define

4、command explanation

4.1 getting pack address

Chart A.9 Getting pack number information

Item	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	90H	LENGTH		CHKSUM	EOI

Remark: LENID = 00H。

This command is used to confirm whether the slave PACK exists. PC monitoring software or external monitoring equipment can poll the slave PACK with addresses 0-15 in turn by changing the ADR field

Chart A.10 Response information

item	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	DATAINFO	CHKSUM	EOI

Remark: LENID = 02H, DATAINFO is the pack number information。

4.2 getting pack analog information

Chart A.11 Command information

Item	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		CHKSUM	EOI

Remark: LENID = 02H

INFO has one byte, as COMMAND COMMAND = ADR ,getting all BMS analog information。

COMMAND = 0FH, getting 15’s pack analog information

Chart A.12 response information

Item	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	DATAINFO	CHKSUM	EOI

remark: DATAINFO is up INFOFLAG with DATAI, DATAI as A.13:

INFOFLAG is 00H。

Chart A.13 DATAI data transmit order

item	content	DATAI bytes	Remark
1	Command	1	As ADR
2	PACK number M / COMMAND value	1	
3	PACK 1 battery data	2	
4	PACK 2 battery data	2	
5	……	……	
M + 2	PACK M battery data	2	
M + 3	Temperature’s number N	1	When N = 6, the fist 4 are battery temperature; The N-1 is MOS temperature; The N is ambient temperature.
M + 4	Temperature 1	2	
M + 5	Temperature 2	2	
M + 6	……	……	
M + N + 3	Temperature N	2	
M + N + 4	PACK current	2	the charge current is positive,the discharge current is negative (uint:10mA)
M + N + 5	PACK total voltage	2	
M + N + 6	PACK remain capacity	2	uint: 10mAH
M + N + 7	Define number P = 3	1	
M + N + 8	PACK full capacity	2	uint: 10mAH
M + N + 9	Cycle number	2	
M + N + 10	PACK design capacity	2	uint: 10mAH

4.3 getting warn information

Chart A.14 Getting pack warn command information

Item	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		CHKSUM	EOI

Remark: LENID = 02H。

INFO has one byte, as COMMAND:

COMMAND = 02H, getting PACK1 warn information。

……

ADR =0FH, getting PACK15 warn information。

Chart A.15 Getting pack warn command response information

Item	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	DATAINFO	CHKSUM	EOI

Remark : DATAINFO is consist of INFOFLAG and WARNSTATE, WARNSTATE can see at chart A.16

INFOFLAG can be 00H。

Chart A.16 Response DATAI data transmittion order

item	content	DATAI bytes	Remark
1	Command	1	As ADR
2	PACK number M	1	
3	PACK 1 warn information	1	
4	PACK 2 warn information	1	
5	……	……	
M + 2	PACK M warn information	1	
M + 3	Temperature number N	1	
M + 4	Temperature 1 warn	1	
M + 5	Temperature 2 warn	1	
M + 6	……	……	
M + N + 3	Temperature N warn	1	
M + N + 4	PACK charge current warn	1	
M + N + 5	PACK total voltage warn	1	
M + N + 6	PACK discharge current warn	1	
M + N + 7	Protect state 1	1	See at chart A.17
M + N + 8	Protect state 2	1	See at chart A.18

M + N + 9	Instructions state	1	See at chart A.19
M + N + 10	Control state	1	See at chart A.20
M + N + 11	Fault state	1	See at chart A.21
M + N + 12	Balance state1	1	Balance state for 1-8
M + N + 13	Balance state2	1	Balance state for 9-16
M + N + 14	Warn state1	1	See at charA.22
M + N + 15	Protect state 2	1	See at charA.23

description:

—— 00H: normal;

—— 01H: below lower limit;

—— 02H: above upper limit;

—— 80H—EFH: user define;

—— F0H: other fault。

Chart A.17 Protect state1 explanation

BIT	content	Remark
7	undefine	
6	Short circuit	1: Short circuit protect 0: normal
5	Discharge current protect	1: Discharge current protect 0: normal
4	charge current protect	1: charge current protect 0: normal
3	Lower total voltage protect	1:Lower total voltage protect 0:normal
2	Above total voltage protect	1:Above total voltage protect 0:normal
1	Lower cell voltage protect	1:Above total voltage protect 0:normal
0	Above cell voltage protect	1: Above cell voltage protect 0: normal

Chart A.18 Protect state 2 explanation

BIT	content	Remark
7	Fully	1: Fully 0: normal
6	Lower Env temperature protect	1: Lower Env temperature protect 0: normal
5	above Env temperature protect	1: above Env temperature protect 0: normal
4	Above MOS temperature protect	1: Above MOS temperature protect 0: normal
3	Lower discharge temperature protect	1: Lower discharge temperature protect

		0: normal
2	Lower charge temperature protect	1: Lower charge temperature protect 0: normal
1	above discharge temperature protect	1: above discharge temperature protect 0: normal
0	above charge temperature protect	1: above charge temperature protect 0: normal

Chart A.19 Instructions state explanation

BIT	content	remark
7	Heart indicate	1: ON 0: OFF
6	undefine	
5	ACin	1: ON 0: normal
4	Reverse indicate	1: ON 0: normal
3	Pack indicate	1: Pack indicate 0: unuse
2	DFET indicate	1: ON 0: OFF
1	* CFET indicate	1: ON 0: OFF
0	Current limit indicate	1: ON 0: OFF

If either of the charging MOS or the current limiting circuit is ON ,it is displayed as ON ; If both are OFF ,it is displayed as OFF 。

Chart A.20 Control state explanation

BIT	Content	Remark
7	Undefined	
6	Undefined	
5	LED warn functiuon	1: unenable 0: enable
4	Current limit function	1: unenable 0: enable
3	Current limit gear	1: low gear 0: high gear
2	undefine	
1	undefine	
0	Buzzer warn function	1: enable 0: unenable

Chart A.21 Fault state explanation

BIT	content	remark
7	undefine	

6	undefine	
5	Sample fault	1: fault 0: normal
4	Cell fault	1: fault 0: normal
3	Undefined	
2	NTC fault (NTC)	1: fault 0: normal
1	Discharge MOS fault	1: fault 0: normal
0	Charge MOS fault	1: fault 0: normal

Chart A.22 Warn state1 explanation

BIT	Content	Remark
7	undefine	
6	undefine	
5	Discharge current warn	1: warn 0: normal
4	charge current warn	1: warn 0: normal
3	Lower tatal voltage warn	1: warn 0: normal
2	above tatal voltage warn	1: warn 0: normal
1	Lower cell voltage warn	1: warn 0: normal
0	above cell voltage warn	1: warn 0: normal

Chart A.23 Warn state2 explanation

BIT	Content	Remark
7	Low power warn	1: warn 0: normal
6	High MOS temperature warn	1: warn 0: normal
5	low env temperature warn	1: warn 0: normal
4	high env temperature warn	1: warn 0: normal
3	low discharge temperature warn	1: warn 0: normal
2	low charge temperature warn)	1: warn 0: normal
1	above discharge temperature warn	1: warn 0: normal
0	above charge temperature warn	1: warn 0: normal

4.4 software version information

Chart A.24 getting software version information command

Item	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	C1H	LENGTH		CHKSUM	EOI

Remark: LENID = 00H。

Chart A.25 response information for version command

Item	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	C2H	LENGTH		CHKSUM	EOI

Remark: LENID = 28H。

DATAINFO is consist of software version, includes of 20 char, if not 20 char, you can set space。

4.5 getting product information

Chart A.26 getting product information command

Item	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	C2H	LENGTH		CHKSUM	EOI

remark: LENID = 00H。

4.6 response for getting product information

Item	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	DATAINFO	CHKSUM	EOI

Remark: LENID = 50H or 28H。

DATAINFO is consist of product information, includes of 20 char, if not 20 char, you can set space。