LV5200

RS485 Protocol

2020.01.14

Contents

1、Setting of port

Transmission rate:
RS485: 115.2kb/s (recommend), 9.6kb/s
Format: Start bit 1 bit
Data bit 8 bit
Stop bit 1 bit
Without parity

2、Basic format

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
Format	SOI	VER	ADR	CID1	CID2	LENGTH	INFO	CHKSUM	EOI

NO	Mark		
1	SOI	Start bit mark	
2	VER	Version of protocol	
3	ADR	Address	
4	CID1	Control identify code	
5	CID2	Command information: control mark code(show the data or control command type). Response information: return code	
6	LENGTH	Info length, including LENID and LCHKSUM	
7	INFO	Command information: command info Response information: data info	
8	CHKSUM	Checksum	
9	EOI	End code	CR(0DH)

2.1 Command INFO

Command group	1 byte	Group number of same types of device
Command type	1 byte	Different remote-control command or different control command in history data transmission
Command id	1 byte	Different monitoring point of same type device group

Command time	7 bytes	Time field, see table data time format

2.1.1 Data INFO flag format

	Bit 7	Bit 6	Bit 5	Bit 4		Bit 3	Bit 2	Bit 1	Bit 0	
value	0	0	0	0	1	0	0	0	0	1
statement				No unread	Exist unread				No unread	Exist unread

3、Data format

3.1 Basic data format

SOI and EOI are explained and transferred in HEX. Other items are explained in HEX, transferred in HEX-ASCII, each byte contains 2 ASCII.
g. CID2 = 4BH, transfer in 2 byte, 34H (“4” in ASCII), and 42H (“B” in ASCII).

3.2 LENGTH data format

High							Low							
CLHKSUM				LENID										
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

LENID means the number of bytes of ASCII in INFO, when LENID = 0, means INFO is empty.
LENID has 12 bits, data package should smaller than 4095 bytes.
While transmission, HIGH byte first, then LOW byte and divided into 4 ASCII to transmit.
To calculate LCHKSUM: D11D10D9D8+D7D6D5D4+D3D2D1D0, add the sum, modulus 16
take remainder, then do a bit wise invert and then plus 1.
e.g.: In INFO the number of ASCII is 18, then LENID = 000000010010B
D11D10D9D8+D7D6D5D4+D3D2D1D0＝0000B＋0001B＋0010B＝0011B，
LCHKSUM = 1101B。
LENGTH = 1101000000010010B，trans: D012
CHKSUM data format

Except for SOI, EOI and CHKSUM, add sum number of other characters in ASCII, the result

modulus 65536 take remainder, then do a bitwise invert and then plus 1.
E.g.:
If we have a character: “~1203400456ABCEFEFC72\R ” (“~” is SOI, “CR” is EOI) ，
The last 5 character” FC72\R”, the FC72 is the CHKSUM
Calculate:

‘1’＋ ‘2’＋ ‘0’＋ …＋‘F’＋ ‘E’＝31H＋32H＋30H＋…＋46H＋45H＝038EH
038EH modulus 65536 remainder = 038EH, do a bitwise invert and plus 1 = FC72H.
DATA INFO data format
Analog quantity is transmitted in form of fixed-point or floating-point.
Fixed-point (integer, 2 bytes),
this protocol uses fixed-point
signed integer: -32768 ~ +32767
unsigned integer: 0 ~ +65535

3.3 DATA TIME and COMMAND TIME format

Year	1-9999	Integer	2 bytes, HEX
Month	1-12	Char	1 byte, HEX
Day	1-31	Char	1 byte, HEX
Hour	0-23	Char	1 byte, HEX
Minute	0-59	Char	1 byte, HEX
Second	0-59	Char	1 byte, HEX

4、Encoding table

CID1

No	Content	CID1	Note
1	Battery data	46H	

CID2

NO	Content	CID2	Note
1	Obtain Cell Sample Data	42	
2	Obtain Alarm	44	
4	Obtain Charge/Discharge detail information	92	
5	Obtain SN	93	

6	Switch off	95	
7	Obtain Firmware version	96	
8	Read operating information	99	

5、Response information

No	Content	CID2	Note
1	Normal	00H	
2	VER error	01H	
3	CHKSUM error	02H	
4	LCHKSUM error	03H	
5	CID2 invalid	04H	
6	Command format error	05H	
7	Invalid data	06H	INFO data invalid
8	ADR error	90H	
9	Communication error	91H	Internal communication error

6、Fixed point type

No	Telemetering content	Data type
1	Cell voltage	Signed integer
2	Temperature	Signed integer
3	Module voltage	Unsinged integer
4	Module current	Signed integer, charge is +
5	System parameter	Signed integer
6	capacity	Unsigned integer

6.1 Obtain Cell Sample Data

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	42H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H

INFO is 1 byte command:

Command = 0x01 get data of battery 1

. . .

Command = 0x08 get data of battery 8

Command should be matched with ADR

7、Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

INFO = INFOFLAG + DATAI

■ DATAI

No	Content	Data
1	Command value	1 byte
2	Data of battery	

■ **Data of battery**

NO.	Content	Data byte	Note	Accuracy
1	Number of cell: M	1		
2	Cell 1 voltage	2	V	3
3	Cell 2 voltage	2	V	3
///				
M+1	Cell M voltage	2	V	3
M+2	Number of Temperature: N	1		
M+3	1.Temperature of BMS board	2	Kelvin temperature: K Temp. below 0 , the value is negative. e.g.:25.5^{0}C= 25.5*10+2731=2986 -12.4^{0}C= -12.4*10+2731=2607	
M+4	2.Avg. temperature of cell 1~4	2		
M+5	3.Avg. temperature of cell 5~8			
M+6	4.Avg. temperature of cell 9~12			
M+7	5.Avg. temperature of cell 13~15/16			
///				
M+N+2	Temperature N**	2		
M+N+3	Current	2	Actual value(A)= transmission value*100. Positive is charge. Negative is discharge.	3

			e.g.:-4000mA= 0xFFD8	
M+N+4	Module voltage	2	V	3
M+N+5	Remain capacity 1	2	Ah	3
M+N+6	User defined items=2(battery capacity≦65Ah) User defined items=4(battery capacity>65Ah)	1		
M+N+7	Module total capacity 1	2	Ah	3
M+N+8	Cycle number			
M+N+9	**Remain capacity 2 (For battery capacity>65Ah)	3	Ah	3
M+N+10	**Module total capacity 2(For battery capacity >65Ah)	3	Ah	3

** **To be compatible with old version, we add more items. Used to show the capacity of battery bigger than 65Ah.**

For US2000B/US2000-Plus, still send user defined items=2.And use remain capacity 1 and module total capacity 1.

➢ Data of battery

No	Content	Data byte	Note	Accuracy
1	Number of cell: M	1		
2	Cell 1 voltage	2	V	3
3	Cell 2 voltage	2	V	3
///				
M+1	Cell M voltage	2	V	3
M+2	Number of temperature: N	1		
M+3	1: Temperature of BMS board	2	Kelvin temperature: **K** Temperature blow 0 the value is	1
M+4	2: Avg. temperature of cell 1~4	2		

M+5	3: Avg. temperature of cell 5~8	2	negative e.g.: 25.5℃ = 25.5*10+2731=2986 -12.4℃ = -12.4*10+2731=2607	
M+6	4: Avg. temperature of cell 9~12	2		
M+7	5: Avg. temperature of cell 13~15/16	2		
///				
M+N+2	Temperature N**	2		
M+N+3	Current	2	A Actual value = transmission value * 100 Positive is charge Negative is discharge e.g.: -4000mA = 0xFFD8	3
M+N+4	Module voltage	2	V	3
M+N+5	Remain capacity 1	2	Ah	3
M+N+6	User defined items = 2(battery capacity≤65Ah) User defined items = 4(battery capacity ＞65Ah)	1		
M+N+7	Module total capacity 1	2	Ah	3
M+N+8	Cycle number			
M+N+9	**Remain capacity 2 (For battery capacity ＞65Ah)	3	Ah	3
M+N+10	**Module total capacity 2 (For battery capacity ＞65Ah)	3	Ah	3

**To be compatible with old version, we add more items, used to show the capacity of battery bigger than 65Ah.

For US2000B/US2000B-Plus, still send user defined items = 2. And use remain capacity 1 and module total capacity 1.

For US3000 or big capacity (＞65Ah), the user defined items = 4, the value: remain capacity 1= FFFF, the module total capacity = FFFF. And please use remain capacity 2, and module total capacity

8、Obtain alarm info：

Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	44H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H

INFO is 1 byte command:

Command = 0x01 get data of battery 1

. . .

Command = 0x08 get data of battery 8

Command should be matched with ADR

■ Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

INFO = DATAFLAG + WARNSTATE

■ WARNSTATE

No	Content	Data
1	Command value	1 byte
2	Module alarm info	

➢ Module alarm info

No	Content	Note
1	Number of cell: M	1
2	Cell 1 voltage	1
3	Cell 2 voltage	1
///		
M+1	Cell M voltage	1
M+2	Number of temperature: N	1
M+3	BMS Temperature	1
M+4	Cell temperature 1~4	
M+5	Cell temperature 5~8	
M+6	Cell temperature 9~12	
M+7	Cell temperature 13~15/16	
M+8	MOSFET temperature (US3000B only)	
///		
M+N+2	Temperature N	1
M+N+3	Charge current	1
M+N+4	Module voltage	1

M+N+5	Discharge current	1
M+N+6	Status 1	1
M+N+7	Status 2	1
M+N+8	Status 3	1
M+N+9	Status 4	1
M+N+10	Status 5	1

Note. for No. 1 ~ M+N+5
00H: normal
01H: below lower limit (act as protection)
02H: above higher limit (act as protection)
F0H: other error

- Status 1

Bit	Content	Note
7	Module under voltage: UV	0: normal；1: trigger
6	Charge over temperature	0: normal；1: trigger
5	Discharge over temperature	0: normal；1: trigger
4	Discharge over current: DOC	0: normal；1: trigger
3		
2	Charge over current: COC	0: normal；1: trigger
1	Cell under voltage	0: normal；1: trigger
0	Module over voltage: OV	0: normal；1: trigger

- Status 2

Bit	Content	Note
3	Using battery module power	1: using；0: not
2	Discharge MOSFET	1: on；0: off
1	Charge MOSFEET	1: on；0: off
0	Pre MOSFET（reserve, function not using）	1: on；0: off

- Status 3

Bit	Content	Note
7	Effective charge current (current detected by BMS＞0.1A)	1: effective；0: normal
6	Effective discharge current (current detected by BMS＜-0.1A)	1: effective；0: normal
5	heater (reserve, function not suing)	1: on；0: off

4		
3	Fully charged (SOC=1	1: full；0: normal
2		
1		
0	Buzzer	1: on；0: off

Statuse4,5 ： Cell alarm 0xffff, normal 0x00;

Obtain the battery charge/discharge information

■ Command

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	92H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H

INFO is 1 byte command:

Command = 0x01 get data of battery 1

. . .

Command = 0x08 get data of battery 8

Command should be matched with ADR

■ Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

INFO = DATAI

■ DATAI

No	Content	Data
1	Command value	1 byte
2	Charge and discharge management value	

➢ Charge and discharge management value

No	Content	Byte	Note	Accuracy
1	Charge voltage limit	2	V	3
2	Discharge voltage limit	2	V	3
3	Charge current limit	2	A	1
4	Discharge current limit	2	A	1
5	Charge, discharge status	1	-	-

➢ Charge, discharge status

Bit	Content	Note
7	Charge enable	1: yes；0: request stop charge
6	Discharge enable	1: yes；0: request stop discharge
5	Charge mmediately	1: yes；0: normal
4	Charge mmediately	1: yes；0: normal
3	Full charge request	1: yes；0: normal
2		
1		
0		

9、Obtain SN

■ Command

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	93H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H

INFO is 1 byte command:

Command = 0x01 get data of battery 1

. . .

Command = 0x08 get data of battery 8

Command should be matched with ADR

■ Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

INFO = DATAI

■ DATAI

No	Content	Data
1	Command value	1 byte
2	Module SN number	16 bytes, integer, ASCII

10、Switch Off

■ Command

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	95H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H
INFO is 1 byte command
Command = 0x01 turnoff battery 1
. . .
Command = 0x08 turnoff battery 8
Command should be matched with ADR

■ Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

LENID = 0

11、Obtain Firmware Version

■ Command

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	96H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H
INFO is 1 byte command
Command = 0x01 battery 1
. . .
Command = 0x08 battery 8

■ Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

INFO = DATAI

■ DATAI

No	Content	Data	
1	Command value	1 byte	
2	Module software version	5 bytes	
		2 bytes	3 bytes
		Manufacture version	Main line version

12、Read operating data

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	99 H	LENGTH	INFO	CHKSUM	EOI

LENID = 02H
INFO is 1 byte command
Command = 0x01 battery 1
. . .
Command = 0x08 battery 8

■ Response

No	1	2	3	4	5	6	7	8	9
Byte number	1	1	1	1	1	2	LENID/2	2	1
format	SOI	VER	ADR	46H	RTN	LENGTH	INFO	CHKSUM	EOI

INFO = INFOFLAG + DATAI

■ DATAI

No	Content	Data
1	Command value	1 byte
2	Running Data	

12.1 Running Data

NO	Content	byte	Remarks	Accuracy
1	Cell Qty16	1		
2	Cell 1 voltage	2	V	3
3	Cell 2 voltage	2	V	3
///				
	Cell 16 voltage	2	V	3

	Temperature：7	1		
	Cell Temp1	2	Kelvin temperature: K Temperature blow 0 the value is negative E.g.: 25.5= 25.5*10+2731=2986 -12.4=-12.4*10+2731=2607	1
	Cell Temp2	2		1
	Cell Temp3			
	Cell Temp4	2		1
	DSG_MOSFET TEMP	2		1
	CHG_MOSFET TEMP	2		1
	EVN TEMP	2		1
	Current	2	A： Positive is charge Negative is discharge	1
	Stack Volt	2	V	3
	Battery Remain Capacity	2	Ah	1
	Self-define qty 4	1		
	Rev	2		
	Rev	2		
	Rev	3		
	Pack Volt	2	V	3
	SOC	2	%	
	Max Cell Volt	2	V	3
	Min Cell Volt	2	V	3
	Max Cell Volt Num	1		
	Min Cell Volt Num	1		
	Max Cell Temp	2	Kelvin	1
	Min Cell Temp	2	Kelvin	1
	Max Cell Temp Num	1		
	Min Cell Temp Num	1		
	Cell Delta Volt	2	V	3
	I/O STATUS1	1		
	I/O STATUS2	1		
	Afe Balance status	2		
	Warning Status	2		
	Alarm Status	3		

12.2 I/O STATUS1

Bit	Description（1：High Level 0：Low Level）
7	Hct Power On Status
6	5V Power On Status
5	3.3V Power On Status
4	Freq Derat Status
3	Comm wake up Status

2	Charge wake up Status
1	Power Key Status
0	MCU Lock Status

12.3 I/O STATUS2

Bit	Description（1：High Level 0：Low Level）
7	REV
6	REV
5	REV
4	EM STOP Status
3	12V Power On Status
2	Pre discharge Mos Status
1	Discharge Mos Status
0	Charge Mos Status

12.4 Afe Balance status

Bit	Description（balance charge 1：ON 0：OFF）
15	Cell 16 balance charge status
14	Cell 15 balance charge status
13	Cell 14 balance charge status
12	Cell 13 balance charge status
11	Cell 12 balance charge status
10	Cell 11 balance charge status
9	Cell 10 balance charge status
8	Cell 9 balance charge status
7	Cell 8 balance charge status
6	Cell 7 balance charge status
5	Cell 6 balance charge status
4	Cell 5 balance charge status
3	Cell 4 balance charge status
2	Cell 3 balance charge status
1	Cell 2 balance charge status
0	Cell 1 balance charge status

12.5 Warning status

Bit	Description（Warning 1：En 0：Dis EN）
15	Dsg Under Temp
14	DsgOT
13	ChgUT
12	ChgOT
11	Stack Volt Under Limit
10	StackOV
9	Cell Volt Under Limit
8	CellOV
7	rev
6	CellDeltaTemp
5	CellDeltaV
4	Dsg Over current
3	ChgOC
2	PowerOT
1	EnvUT
0	EnvOT

12.6 Warning Alarm

Bit	Description（Alarm 1：En 0：Dis EN）
23	DsgUT
22	DsgOT
21	ChgUT
20	ChgOT
19	StackUV
18	StackOV
17	CellUV
16	CellOV
15	PreChg
14	CellDeltaTemp
13	CellDeltaV
12	DsgOC
11	ChgOC
10	PowerOT
9	EnvUT
8	EnvOT
7	Inverter Comm Error
6	Charge Failure
5	AFE Fault
4	CurrentSample Fault
3	HwCellOV
2	HwDsgOC
1	HwChgOC
0	ForbidChgUV_Alarm