

PYLON low voltage Protocol RS485

Version History

Date	Version	Chapter	Note	Author
2008/11/20	V2.2		初始版本 First version	
2008/12/23	V2.3		<ol style="list-style-type: none"> 1. 获取模块数量，相应的数据位置更改 2. 获取系统参数内数据，增加单体电池欠压门限和总电压欠压门限 3. 0x42, 0x44 命令中增加对 Command 不为 0xFF 的定义 4. 警告信息内的 State2 数据增加：使用 Pack 供电指示 	
2009/03/26	V2.4		<ol style="list-style-type: none"> 1. *命令格式内 ADR 都是指主机地址 2. 增加对 Buzzer 功能开关的命令--3.8 3. Buzzer 功能的指示--State3 的 bit0 	
2009/12/07	V2.4		<ol style="list-style-type: none"> 1. 在告警数据中增加两个字节 State4 和 State5，用来表示单个电池故障 2. 告警数据中字节 State3 的 bit6（有效放电电流指示）作为交流停电告警来解释 	
2016/06/20	V2.5		<ol style="list-style-type: none"> 1. 修改“4 说明”中关于电流单位的描述，统一修改为实际值 = 传递值 * 100 2. 增加“5 例程”实例解析 3. 增加通讯接口和传输速率的描述 4. 删除不支持的命令 	
2016/08/19	V2.6		<ol style="list-style-type: none"> 1. 增加命令“获取充放电管理信息”和“获取序列号信息” Add command: get information of charge and 	

			discharge information; get SN number	
2016/10/13	V2.7		1. 增加命令“设置充放电管理信息” Add command: set charge and discharge parameter	
2016/12/15	V2.8		1. 增加命令“关机” Add command: turn off	
2017/01/17	V2.9		1. 增加命令“获取软件版本” Add command: get firmware version	
2017/11/22	V2.9		优化翻译	
2018/03/08	V3.0	2.5.3 3.5-status 1-bit 1 3.3; 3.4; 3.5;	1. 增补 多组并联模式，扩展地址数量 Add multi group mode 2. 更正：单芯低压改为欠压 Correct cell low voltage to cell under voltage 3. 删除章节 4，将内容移至每个模拟量的 note 里，方便解析阅读 Delete old chapter 4, move all note info to each analog data.	王万祥 叶闻 王中鹤
2018/04/08	V3.1	3.6	1. 增加强充请求标志 2，增加满充请求 Add charge immediately 2, add full charge request	王亚坤 王中鹤
2018/06/04	V3.2	3.3 4 3.6 3.5	1. Add item to send capacity of battery bigger than 65Ah. 2. Modified examples 3. Add info to help reading.	叶闻 王中鹤
2018/08/21	V3.3	3.6	1. 增补 bit 含义说明 Add instruction of bit 6~ bit 7	王中鹤

For battery following this protocol:

- ◆ 当电池与上位机通信时，默认上位机为主机，第一台电池是从机，地址/ADR 从 2 开始

When battery communicate with inverter or upper computer, the inverter or upper computer is master, the first battery act as slave, and Address start from 2

- 当单组模式时。主机拨码开关需保持默认 X000。

When in single group mode, master battery dip address should be X000.

- 当多组级联模式时。主机地址拨码开关需要正确配置。XYYY

When in multi-group mode, master battery must have right dip switch address.

模块/电池模块/Module/Battery = 48V battery module with BMS

电芯/Cell = 3.2V cell

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1. 通讯协议说明/Protocol background

依据通信标准类技术报告《通信用后备式锂离子电池组》要求，蓄电池组提供通信设备或模拟装置正常工作所需的通讯项目见下表（蓄电池组与上位机的通讯项目应包括，但不限于表中的要求），并能对其进行实时的监控管理。

According to <Communication backup lithium iron battery>, battery should provide basic communicate function (between battery and upper computer), and provide live monitor.

内容及缩写含义

Part of the function item and abbreviation in this document.

状态量 Status	蓄电池组的充放电状态/Charge and discharge status 蓄电池组容量/Capacity: SOC 输出电压/Output voltage 输出电流/Output current
环境模拟量 Environment analog quantity	蓄电池组温度/Battery pack temperature 蓄电池组环境温度/environment temperature 单体电芯温度等/ Cell temperature
告警量 Alarm/ protect information	蓄电池组充电过压告警及保护/ Charge over voltage: COV 蓄电池组充电电流告警及保护/ Charge over current: COC 蓄电池组放电欠压告警及保护/ Discharge under voltage: DUV 蓄电池组极性反接告警及保护/ Transposition 蓄电池组放电过流告警及保护/ Discharge over current: DOC 蓄电池组高温告警及保护/ Battery high temperature 蓄电池组环境高温告警及保护/ Environment high temperature 蓄电池组容量过低告警及保护/ Low SOC 蓄电池组温度传感器失效告警/ Temperature sensor fail 蓄电池组电压传感器失效告警/ Voltage sensor fail 蓄电池组电流传感器失效告警等/ Current sensor fail 单体电芯高温告警及保护/ Cell high temperature 单体电芯充电过压告警及保护/ Cell over voltage 单体电芯放电欠压告警及保护/ Cell under voltage Etc.

2. 通信协议/Protocol

在《前端智能设备通信协议》中，详细定义了通信的通信协议，蓄电池检测仪 SM 和 SU 的数据协议 (B.12)，按照实际的应用和实际特点，对 SM 和 SO (Master Smart Pack) 的数据协议作具体定义。

In <Communication protocol of front-end smart devices>, it defined the protocol of SM/SO in B.12.

协议力求按照统一的数据协议基本格式。通信协议及命令等按照 7, 8, 9, 10 的规定。本协议参考 B.12 数据协议制订

This protocol refers to B.12

All these information above are basic background of protocol, and has no influence in protocol understanding.

2.1 协议设置/Setting of port

智能设备数据通信应提供异步串行通信方式。异步串行通信接口和传输速率有：

Use asynchronous serial communication mode, transmission rate:

RS485: 115.2kb/s, 500kb/s, 9.6kb/s

通信传输格式为：起始位 1 位，数据位 8 位，停止位 1 位，无校验。

Format: start bit 1 bit

Data bit 8 bit

Stop bit 1 bit

Without parity

2.2 基本格式/Basic format

2.2.1 帧基本格式/Basic format of frame

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

2.2.2 帧说明/Introduction of frame

No	Mark	Meaning
1	SOI	起始位标志/Start bit mark
2	VER	协议版本号/Version of protocol
3	ADR	地址（0、255 保留）/Address
4	CID1	控制标识码/Control identify code
5	CID2	命令信息：控制标识码（数据或动作类型的描述） Command information: control mark code (show the data or control command type) 应答信息：返回码 Response information: return code
6	LENGTH	INFO 字节长度，包括 LENID 和 LCHKSUM INFO length, including LENID and LCHKSUM

7	INFO	命令信息：控制数据信息 Command information: command INFO 应答信息：应答数据信息 Response information: data INFO	
8	CHKSUM	校验和码/CHECKSUM	
9	EOI	结束码/End code	CR(0DH)

Note:

1, ADR: start from 2

2, INFO: including command INFO and data INFO

■ Command INFO

Command group	1 byte	同一类型设备的不同组号 Group number of same type of device
Command type	1 byte	不同的遥控命令；历史数据传输中的不同控制命令 Different remote control command or different control command in history data transmission
Command id	1 byte	同一类型设备相同组内的不同监控点 Different monitoring point of same type device group
Command time	7 bytes	时间字段 Time field, see table data time format

■ Data INFO

DATAI	定点数应答信息（本协议不采用定点数） Fixed point number response information (not included in this protocol)
DATAF	浮点数应答信息 Floating point number response information
DATA FLAG	数据标识信息 Data flag information
RUN STATE	设备运行状态 Status of battery
WARN STATE	设备告警状态 Alarm information
DATA TIME	事件发生时间（本协议没有用到） Event time record (not included in this protocol)

■ 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				无未读取的 开关量变化 No unread switching value change	有未读取的 开关量变化 Exist unread switching value change				无未读取的 告警量变化 No unread alarm value change	有未读取的 告警量变化 Exist unread alarm value change

2.3 数据格式/Data format

2.3.1 Basic data format

除 SOI 和 EOI 是以 16 进制解释 16 进制传输外,其余各项都是以 16 进制解释,以 16 进制—ASCII 码方式传输,每个字节用两个 ASCII 码表示,如当 CID2=4BH 时,传输时传送 34H (‘4’的 ASCII 码)和 42H (‘B’的 ASCII 码)两个字节。

SOI and EOI are explained and transferred in HEX. Other items are explained in HEX, transferred in HEX-ASCII, each byte contains 2 ASCII.

E.g. CID2 = 4BH, transfer in 2 byte, 34H (“4” in ASCII), and 42H (“B” in ASCII).

2.3.2 LENGTH data format

高字节 HIGH								低字节 LOW							
校验码 CLHKSUM				LENID											
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

LENID 表示 INFO 项的 ASCII 码字节数,当 LENID=0 时,INFO 为空,即无该项。

LENID means the number of byte of ASCII in INFO, when LENID = 0, means INFO is empty.

由于 LENID 只有 12Bit, 所以, 要求数据包最大不能超过 4095 个字节。

LENID has 12 bits, data package should smaller than 4095 bytes.

LENGTH 传输中先传高字节, 再传低字节, 分四个 ASCII 码传送。

While transmission, HIGH byte first, then LOW byte and divided into 4 ASCII to transmit.

校验码 LCHKSUM 的计算: $D_{11}D_{10}D_9D_8+D_7D_6D_5D_4+D_3D_2D_1D_0$, 求和后模 16 余数 取反加 1

To calculate LCHKSUM: $D_{11}D_{10}D_9D_8+D_7D_6D_5D_4+D_3D_2D_1D_0$, add the sum, modulus 16 take remainder, then do a bitwise invert and then plus 1.

e.g.:

INFO 中 ASCII 码字节数为 18，即 LENID=00000010010B。

In INFO the number of ASCII is 18, then LENID = 00000010010B

D11D10D9D8+D7D6D5D4+D3D2D1D0=0000B+0001B+0010B=0011B,

模 16 余数为/ modulus 16 the remainder = 0011B,

取反加 1 为/do a bitwise invert and plus 1 = 1101B,

LCHKSUM = 1101B。

LENGTH = 110100000010010B, trans: D012

2.3.3 CHKSUM data format

CHKSUM 的计算是除 SOI、EOI 和 CHKSUM 外，其他字符按 ASCII 码值累加求和，所得结果模 65536 余数取反加 1。

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.:

收到或发送的字符序列是：“~1203400456ABCEFEFC72\R” (“~” 为 SOI, “CR” 为 EOI),

If we have a character: “~1203400456ABCEFEFC72\R” (“~” is SOI, “CR” is EOI)

则最后 5 个字符 “FC72\R” 中的 FC72 是 CHKSUM,

The last 5 character “FC72\R”, the FC72 is the CHKSUM

Calculate:

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

038EH 模 65536 余码是 038EH, 038EH 取反加 1 就是 FC72H。

038EH modulus 65536 remainder = 038EH, do a bitwise invert and plus 1 = FC72H.

2.3.4 DATA INFO data format

模拟量数据的传送采用定点数和浮点数两种形式，可任选一种。

Analog quantity is transmitted in form of fixed-point or floating-point.

Fixed-point (integer, 2 bytes),

本协议采用定点数/this protocol uses fixed-point

有符号整数/signed integer: -32768 ~ +32767

无符号整数/unsigned integer: 0 ~ +65535

2.3.5 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
Note	Year is transferred as integer, actual value = transfer value		

2.4 Module introduction

RS485 总线形式通信，默认速率 115200 BPS

Use RS485 bus with default communication rate 115200 BPS.

2.5 编码表/Encoding table

2.5.1 CID1

No	Content	CID1	Note
1	电池数据/battery data	46H	

2.5.2 CID2

■ 命令信息/command information

No	Content	CID2	Note
1	获取模拟量量化后数据，定点数 Get analog value, fixed point	42H	
2	获取告警 Get alarm info	44H	
3	获取系统参数，定点数 Get system parameter, fixed point	47H	
4	获取通信协议版本 Get protocol version	4FH	
5	获取厂商信息 Get manufacturer info	51H	
6	获取充放电管理信息 Get charge, discharge management info	92H	
7	获取序列号	93H	

	Get SN number of battery		
8	设置充放电管理信息 Set value of charge, discharge management info	94H	
9	关机 Turnoff	95H	
10	获取软件版本 Get firmware info	96H	

■ 响应信息/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

■ 定点数数据类型/ fixed point type

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

2.5.3 ADR settings / 地址设置

每组最多 8/12 台级联(参见电池产品说明书), 电池地址为:

Maximum 8/12 (please refer to product specification) batteries in one group, battery address is

(n)	Position
2	Master battery
3	Slave 1
4	Slave 2
5	Slave 3

6	Slave 4
7	Slave 5
8	Slave 6
9	Slave 7
10	Slave 8
11	Slave 9
12	Slave 10
13	Slave 11

主机的拨码开关第 2-4 位，用于地址设置规则如下

Dip switch 2-4 of **master battery** has the function of change the group address.

1 is up, 0 is down

Dip 1	Dip 2	Dip 3	Dip 4	group address (m)
1: RS485 baud rate=9600	0	0	0	0: 单组电池使用时，请确保主机为 X000 ，从机不做限制/ single group only, master battery must follow this setting
0: RS485 baud rate=115200	1	0	0	1: 多组使用时，第一组需从 X100 开始以确保地址规则适用/ multi-group condition should use this for the first group
Restart to take effect/ 设置重启后 生效	0	1	0	2
	1	1	0	3
	0	0	1	4
	1	0	1	5
	0	1	1	6
	1	1	1	7

For battery information 获取单台电池的信息的方法

ADR = battery address + group address = 0x0n + 0x10*m

E.g.:

1) Single group slave 4:

n = 5; m = 0

ADR = 0x05 + 0x10*0 = 0x05; INFO of COMMAND = ADR = 0x05

2) multi group, group 3, slave 6;

n = 7; m = 3

ADR = 0x07 + 0x10*3 = 0x37; INFO of COMMAND = ADR = 0x37

For system information, 获取系统信息的方法

Only for get analog value and get alarm value.仅用于获取模拟量和获取告警量使用

ADR = 0x02 + 0x10*m ; INFO of COMMAND = 0xff

e.g.:

group 2

ADR = 0x02 + 0x10*2 = 0x22; INFO of COMMAND = 0xff

3. 通信命令/communication command

3.1 获取协议版本号/get protocol version

■ 命令/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	4FHJ	LENGTH	INFO	CHKSUM	EOI

VER: 任意值/arbitrary value

LENID = 00H

While receiving, battery ignore VER value

■ 响应/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

VER = version

V2.1, VER = 21H

3.2 获取厂商信息/get manufactory info

■ 命令/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	51H	LENGTH	INFO	CHKSUM	EOI

LENID = 0

■ 响应/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 = 40H

■ DATAINFO

No	Content	Data
1	设备名称/battery name	10, integer, ASCII
2	软件版本/software version	2
3	厂商名称/manufacturer name	20, integer, ASCII

3.3 获取模拟量量化数据，定点型/get analog value, fixed point

■ 命令/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	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 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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	单位及计算说明 Note	精度 Accuracy
1	电芯节数/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	温度点数量/number of temperature: N	1		
M+3	1: Temperature of BMS board	2	Kelvin temperature: K Temperature below 0 the value is negative e.g.: $25.5^{\circ}\text{C} = 25.5 \times 10 + 2731 = 2986$ $-12.4^{\circ}\text{C} = -12.4 \times 10 + 2731 = 2607$	1
M+4	2: Avg. temperature of cell 1~4	2		
M+5	3: Avg. temperature of cell 5~8	2		
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.: $-4000\text{mA} = 0\text{xFFD8}$	3
M+N+4	Module voltage	2	V	3
M+N+5	Remain capacity 1	2	Ah	3
M+N+6	用户自定义个数/ User defined items = 2(battery capacity $\leq 65\text{Ah}$) User defined items = 4(battery capacity $> 65\text{Ah}$)	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 $> 65\text{Ah}$)	3	Ah	3
M+N+10	**Module total capacity 2 (For battery capacity $> 65\text{Ah}$)	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 ($> 65\text{Ah}$), 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 2.

3.4 获取系统参数，定点数/get system parameter, fixed point

■ 命令/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	47H	LENGTH	INFO	CHKSUM	EOI

LENID = 0

■ 响应/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 byte	单位及计算 Note	精度 Accuracy
1	单芯高压上限/cell high voltage limit	2	V	3
2	单芯低压/cell low voltage limit	2	V (alarm)	3
3	单芯欠压/cell under voltage limit	2	V (protect)	3
4	充电温度上限/charge high temperature limit	2	K (calculation refer to 3.3)	1
5	充电温度下限/charge low temperature limit	2	K (calculation refer to 3.3)	1
6	充电电流限值/charge current limit	2	A, with symbol, value= transmission value*100	3
7	模块高压上限/module high voltage limit	2	V	3
8	模块低压/module low voltage limit	2	V (alarm)	3
9	模块欠压/module under voltage limit	2	V (protect)	3
10	放电温度上限/discharge high temperature limit	2	K (calculation refer to 3.3)	1
11	放电温度下限/discharge low temperature limit	2	K (calculation refer to 3.3)	1
12	放电电流限值/discharge current limit	2	A, with symbol, value= transmission value*100	3

3.5 获取告警信息/get alarm info

■ 命令/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	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 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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	电芯节数/number of cell: M	1
2	Cell 1 voltage	1
3	Cell 2 voltage	1
///		
M+1	Cell M voltage	1
M+2	*温度点数量/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	总压欠压/module under voltage: UV	0: normal; 1: trigger
6	充电过温/charge over temperature	0: normal; 1: trigger
5	放电过温/discharge over temperature	0: normal; 1: trigger
4	放电过流/discharge over current: DOC	0: normal; 1: trigger
3		
2	充电过流/charge over current: COC	0: normal; 1: trigger
1	单芯欠压/cell under voltage	0: normal; 1: trigger
0	总压过压/module over voltage: OV	0: normal; 1: trigger

➤ Status 2

Bit	Content	Note
3	使用模块供电/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	有效充电电流/effective charge current (实际检测到的电流 > 0.1A;	1: effective; 0: normal

	current detected by BMS>0.1A)	
6	有效放电电流/effective discharge current (实际检测到的电流<-0.1A; current detected by BMS<-0.1A)	1: effective; 0: normal
5	加热膜启动/heater (reserve, function not suing)	1: on; 0: off
4		
3	充满状态指示/fully charged (SOC=100%)	1: full; 0: normal
2		
1		
0	蜂鸣器功能/buzzer	1: on; 0: off

➤ Status 4

Bit	Content	Note
7	Cell voltage 8	1: error; 0: normal
6	Cell voltage 7	1: error; 0: normal
5	Cell voltage 6	1: error; 0: normal
4	Cell voltage 5	1: error; 0: normal
3	Cell voltage 4	1: error; 0: normal
2	Cell voltage 3	1: error; 0: normal
1	Cell voltage 2	1: error; 0: normal
0	Cell voltage 1	1: error; 0: normal

➤ Status 5

Bit	Content	Note
7	Cell voltage 16	1: error; 0: normal
6	Cell voltage 15	1: error; 0: normal
5	Cell voltage 14	1: error; 0: normal
4	Cell voltage 13	1: error; 0: normal
3	Cell voltage 12	1: error; 0: normal
2	Cell voltage 11	1: error; 0: normal
1	Cell voltage 10	1: error; 0: normal
0	Cell voltage 9	1: error; 0: normal

单芯电压判定为异常。

Error means cell voltage is above threshold value, and supposed to be a failure.

Cell voltage>4.2V(Battery charge MOS off) or cell voltage<1V(Battery shut down by itself)

3.6 获取电池充放电管理信息/get charge, discharge management info

■ 命令/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 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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	充电电压建议上限/charge voltage limit	2	V	3
2	放电电压建议下限/discharge voltage limit	2	V	3
3	最大充电电流/charge current limit	2	A	1
4	最大放电电流/discharge current limit	2	A	1
5	充放电状态/charge, discharge status	1	-	-

➤ 充放电状态/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	强充 1, 立即充电/charge immediately	1: yes; 0: normal
4	强充 2, 立即充电/charge immediately	1: yes; 0: normal
3	满充请求/full charge request	1: yes; 0: normal
2		
1		
0		

Bit 5: for US2000B, it is SOC 15~19%,
for US2000B-Plus/US3000B, it is SOC 5~9% (design for inverter which has active battery by given DC voltage function or inverter which has discharge low SOC/voltage limit by itself)

Bit 4: for US2000B-Plus/US3000B, it is SOC 9~13%(design for inverter doesn't have active function or inverter doesn't want battery shut down)

We suggest inverter to use both charge immediately bit, this two is compatible.

Bit 3:

Reason: when battery is not full charged for long time, the accumulative error of SOC calculation will be too high and may not able to be charged or discharged as expected capacity.

Logic: if SOC never higher than 97% in 30 days, will set this flag to 1. And when the SOC is \geq 97%, the flag will be 0.

How to: we suggest inverter to charge the battery by grid when this flag is 1.

3.7 获取设备序列号/get module SN number

■ 命令/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 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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

3.8 设定充放电管理信息/setting charge/discharge management info

■ 命令/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	94H	LENGTH	INFO	CHKSUM	EOI

LENID = 12H

INFO is 9 bytes = command + DataF

Command = 0x01 get data of battery 1

...

Command = 0x08 get data of battery 8

Command 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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

➤ DataF

No	Content	Byte	Note	Accuracy
1	充电电压建议上限/charge voltage limit	2		
2	放电电压建议下限/discharge voltage limit	2		
3	最大充电电流/max charge current	2		

4	最大放电电流/min discharge current	2		
---	------------------------------	---	--	--

NOTE:

需要手动设定充放电管理信息时，按周期发送此命令，电池如果 10 秒未再次收到此命令，电池则按当前条件自动设定充放电管理信息。

未明确 PYLON 关于电流的建议值策略前请勿使用该命令。

Send this command periodically, if the battery doesn't receive this command again in 10 seconds, battery will automatically change setting value using latest command value.

Please contact PYLONTECH first, before doing any change on these settings.

3.9 关机/turn off module

■ 命令/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 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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

3.10 获取软件版本/get software version

■ 命令/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 turnoff battery 1

...

Command = 0x08 turnoff battery 8

Command 内容和 ADR 内容应保持一致

Command should be matched with ADR

■ 响应/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
		厂商软件版本 Manufacture version	软件主线版本 Main line version

4. 例子/Example of a 74Ah battery

获取模拟量量化数据（定点型）

Get analog quantity data, fixed point.

下发命令/send command:

7E 32 30 30 32 34 36 34 32 45 30 30 32 30 32 46 44 33 33 0D

回复数据/receive data

7E 32 30 30 32 34 36 30 30 46 30 37 41 31 31 30 32 30 4630 44 34 35 30 44 34 34 30 44 34 35 30
44 34 34 30 44 34 35 30 44 34 34 30 44 33 45 30 44 34 35 30 44 34 41 30 44 34 41 30 44 34 42 30
44 34 41 30 44 34 41 30 44 34 41 30 44 34 41 30 35 30 42 43 33 30 42 43 33 30 42 43 33 30 42 43
44 30 42 43 44 30 30 30 30 43 37 32 35 46 46 46 46 30 34 46 46 46 46 30 30 30 32 30 30 43 41 35
38 30 31 32 31 31 30 45 31 41 32 0D

对应取出数据解析如下表/analysis

No	content	original data	HEX and decimal	meaning
1	Cell number	30 46	(0FH)15	15 cells
2	Cell1 voltage	30 44 34 35	(0D45H)3397	3397mV
3	Cell2 voltage	30 44 34 34	(0D44H)3396	3396mV
.....	30 44 34 35 30 44 34 34 30 44 34 35 30 44 34 34 30 44 33 45 30 44 34 35 30 44 34 41 30 44 34 41 30 44 34 42 30 44 34 41 30 44 34 41 30 44 34 41		
M+1	CellM voltage	30 44 34 41	(0D4AH)3402	3402mV
M+2	Temperature number N	30 35	(05H)5	5
M+3	温度 1	30 42 43 33	(0BC3H)3011	28℃
.....	30 42 43 33 30 42 43 33 30 42 43 44		
M+N+2	Temperature N	30 42 43 44	(0BCDH)3021	29℃
M+N+3	Current	30 30 30 30	(0000H)0	0
M+N+4	Module total voltage	43 37 32 35	(C725H)50981	50981mV
M+N+5	Remain capacity	46 46 46 46	(FFFFH)65535	-
M+N+6	User defined number=4	30 34	(04H)4	4
M+N+7	Module total capacity	46 46 46 46	(FFFFH)65535	-
M+N+8	Cycle number	30 30 30 32	(0002H)2	2
M+N+9	Remain capacity	30 30 43 41 35 38	CA58	51.800Ah
M+N+10	Module total capacity	30 31 32 31 31 30	12110	74.000Ah