PYLON low voltage Protocol CAN Bus Version 2.0

Version History

Date	Version	Chapter	Remark	Author
2016/11/03	1.0		我司协议 BMS Protocol_CAN_20161103，视为 1.0 版本	
2017/11/14	1.1	0x359 0x35C	1、 修正协议描述错误，0-bit1 应为过压保护。 Modified wrong description of byte 0 bit 1 2、 修改排版，提高可读性，增加协议内容解释。 Add assistant note. 3、 增加强充标志 2 Add force charge bit4	王万祥 王中鹤
2018/04/08	1.2	0x35C	1、 增加满充请求标志 Add full charge bit3	王亚坤 王中鹤
2019/07/02	1.3	0x351 0x1001	1. 增加放电电压 Add discharge voltage. 2. 增加握手指令。 Add heart beat signal.	王亚坤 王中鹤
2019/09/02	1.4 beta	0x370-0x373	1.扩展 CAN 协议，增加容量，最大最小电压温度值及所在模块，增加模块输出状态	邹慧兴
2019/12/23	1.5		增补升级协议 After 2.0 released, V1.5 cancellated 冲突的部分以 V2.0 为准。	王亚坤
2020/10/28	1.6 草稿		增补 SOC 不均衡，mosfail，关机等命令。 增加触发条件和建议动作描述。供参考。 部分安规对保护动作的解除有限制，以产品手册为准。	王中鹤
2021/1/5	1.7 草稿		增加了问答形式的命令，共两条， 0x4000000 指示模拟量状态等更新量； 0x5000000 指示 sn 号与版本号等固定量； 0x4000000 中删除重复项电流，对一致性差做出定义；	叶闻
2021/3/16	2.0	[2.3,2.4,2.5]	Latest design.	王中鹤

1 目录

1. 说明/Protocol info

小端。
Little endian.

采用标准帧，速率 500kbps，*BMS 上传数据间隔：1 或 2s。
Standard Frame, 500kbps, *BMS data transmission cycle: 1or2s

**逆变器每秒发送数据：0x305：00-00-00-00-00-00-00-00

*，**：
非强制：US2000，US3000，V2.4 之前版本若不持续发送，则 BMS 上传数据间隔会延迟至 1~10s 不等。其间会有非本协议内容上传。如逆变器对旧版本电池间隔有要求，则建议发送此命令。
Optional：For US2000, US3000 version earlier than V2.4, if not sending 0x305, then BMS data transmission cycle will between 1~10 seconds. And will send info do not belongs to this protocol. If inverter needs to be compatible with older version batteries by 1-2s, then this command is suggested to use.

本协议适用于派能：US、US-C、Force L、UP、LV-HUB 等 24、48V 产品和工具。协议及软件版本对应情况详询派能技术支持人员。
This protocol is designed for US, US-C, Force-L, UP, LV-HUB etc., for further information please contact us.

电池的拨码开关或连接器的 pin 序可能对 CAN 通信质量有影响。详见各产品说明书。
The settings of dip switch or pin definition may influence the CAN communication. Please refer to user manual.

非特殊说明，建议外部设备如逆变器的 CAN 端口终端电阻为 120Ω。
Unless otherwise noted, the inverter CAN resistance suggested to be 120Ω.

Cell	1 串电芯，1 serial of cell(s)
Module	1 个电池模块，1 battery module。24 or 48 or 51.2V
Group/pile	1 簇电池，several battery module connect in parallel
Master	1 簇电池的主机，定义参见产品手册，master battery of 1 group, refer to manual

2 协议/Protocol

2.1 标准/standard

BMS 主动上传。
These frames will be sending by BMS automatically.

2.1.1 0x351/operation limit

		Unit		Suggestion
Byte 0 Byte 1	Charge voltage limit	0.1V	16 bits unsigned int	不超过本数值 Lower than limit
Byte 2 Byte 3	Charge current limit	0.1A	16 bits signed int, 2`s complement	当=0 时，停止充电。 Stop charge when current=0
Byte 4 Byte 5	Discharge current limit	0.1A	16 bits signed int, 2`s complement	当=0 时，停止放电。 Stop discharge when current=0
Byte 6 Byte 7	Discharge voltage limit	0.1V	16 bits unsigned int	不低于本数值 Higher than limit

2.1.2 0x355/SOC and SOH

		Unit	Design
Byte 0 Byte 1	SOC	1%	Average value of all modules（off-line slave battery is also calculated）
Byte 2 Byte 3	SOH	1%	Average value of all modules. Minimum value (For Force L only)
Byte4~7			

2.1.3 0x356/analog quantity

		Unit	
Byte 0 Byte 1	Average module voltage	0.01V	16 bits unsigned int
Byte 2 Byte 3	Total current	0.1A	16 bits signed int, 2`s complement
Byte 4 Byte 5	Average cell temperature	0.1℃	16 bits signed int, 2`s complement
Byte6~7			

2.1.4 0x359/protect and alarm

*：
除特殊说明外，保护和告警 flag 的含义为：电池系统内≥1 台电池模块发生相关保护或告警。相关模块条件满足后自动解除。
Unless otherwise noted or required, the protection and alarm flag: exist 1 module in battery system has protection or alarm. The module able to recover from protection or alarm by itself.

**:
除特殊说明外，保护和告警 flag 建议逆变器动作为，跟随 BMS 建议电流。
Unless otherwise noted, when protection or alarm flag rise, inverter is supposed to follow the current limit of battery system.

			Design	Suggestion
Byte 0 Protect 保护	Bit 0			
	Bit 1	过压/Cell or module over voltage	*	**
	Bit 2	欠压/Cell or module under voltage	* 依靠充电恢复。 Need charge	** Pay attention to force charge flag.
	Bit 3	过温/Cell over temperature	*	**
	Bit 4	欠温/Cell under temperature	*	**
	Bit5~6			
	Bit 7	放电过流/Discharge over current	*	**
Byte 1 Protect 保护	Bit 0	充电过流/Charge over current	*	**
	Bit 1			
	Bit 2			
	Bit 3	故障/System error	* 需重启、故障排查。 Need restart or trouble shooting.	=1：停止充放电。 Stop charge/discharge =0：可恢复运行。 Recover.
	Bit4~7			
Byte 2 Alarm 告警，无保护动作	Bit 0			
	Bit 1	高压/Cell or module high voltage	*	**
	Bit 2	低压/Cell or module low voltage	*	**
	Bit 3	高温/Cell high temperature	*	**
	Bit 4	低温/Cell low temperature	*	**
	Bit5~6			
	Bit 7	放电大电流/Discharge high current	*	**
Byte 3 Alarm 告警，无保护动作	Bit 0	充电大电流/Charge high current	*	**
	Bit1~2			
	Bit 3	从机掉线，从柜掉线 Slave battery or slave group communication off-line	从机/柜因低电量或故障关机。或主从通信不良。 Slave battery/pile communication off-line, because of low capacity or error or lost communicate connection.	** 尝试充电、重启或故障排查 Try charge the system，restart the system or do trouble shooting.
	Bit4~7			
Byte 4		Module numbers: 8 bits unsigned char	装机电池总数 Total battery numbers in system	After system turns on and running normally, this is a

				fixed number.
Byte 5		“P”，0x50		
Byte 6		“N”，0x4E		
Byte 7				

2.1.5 0x35C/BMS request

		Design	Suggestion:
Byte 0	Bit 0		
	Bit 1		
	Bit 2		
	Bit 3	Full charge 1=charge; 0=normal SOC 需要校准、电芯需要均衡 SOC needs recalculation, cell needs balance	将电池充电至 100% Full charge battery system to 100%
	Bit 4	Force charge: 1=charge; 0=normal 低电量、低压时触发 Triggered when capacity too low	【高优先级】[High priority] 给电池系统充电直到标记=0。 Charge the battery system until these 2 flags = 0
	Bit 5		
	Bit 6	Discharge enable 1=enable; 0=stop	【高优先级】[High priority] Inverter shall follow
	Bit 7	Charge enable 1=enable; 0=stop	

2.1.6 0x35E/brand

Byte0~4	Brand	“PYLON”	ASCII

2.2 控制/Control

如果不需要，请不要发送或响应。
Inverter that don`t need please ignore [chapter 2.2] and do NOT send or response.

2.2.1 0x4800/turn off

电池收到后不回复信息。主机收到后会关闭本组电池。注意：远程关机操作的必要条件：无开机信号，无外部电压，无并柜。

BMS have no response message. After master battery received will turn off all batteries in this group. Note: this operation request: no wakeup signal on, no DC voltage, no parallel pile connection.

2.2.2 0x1001/heartbeat signal

电池收到后不回复信息。主机若收到了此 ID，逆变器需要至少五分钟发送两次，否则电池会关机。

BMS have no response message. After master battery turn on, if battery received this CAN ID, the heart- beat function is ON. In 5 minutes, if battery does not receive the ID, the master battery will turn off all batteries.

2.2.3 0x0020，0x0060/protocol change

收到后，BMS 将自动切换协议。
After received these ID, the protocol send by BMS will change.

2.3 定制/customized flags

特定版本支持本命令。详询派能技术支持人员。
Implemented on latest version, please contact us for further information.

0x350

		Design	Suggestion:
Byte 0	Bit0~5		
	Bit 6	Exist 1 module charge MOSFAIL 0=normal; 1=error	Stop charge and discharge. Trouble shooting.
	Bit 7	Exist 1 module discharge MOSFAIL 0=normal; 1=error	
Byte 1	Bit0~5		
	Bit 6	0=normal; 1= trigger Module SOC max-SOC min≥25	Customized
	Bit 7	float charge request 0=normal,1=trigger Trigger: Vmax ≥3.63v and SOC ＜100 Release: Vmax-Vmin＜40mv and SOC = 100	保持充电状态 Keep charge the system

2.4 增补系统信息 /extend system level

特定版本支持本命令。详询派能技术支持人员。
Implemented on latest version, please contact us for further information.

BMS 主动上传。
These frames will be sending by BMS automatically.

0xFF…FF：暂不支持本命令。Do not support this command.

2.4.1 0x35A

In this message, each warning and alarm is implemented to consist of two bits.

Bit N	Bit N+1	Design:
0	0	Reserved
1	0	触发 Alarm/warning **active**
0	1	解除 Alarm/warning **inactive** (status = OK)
1	1	Reserved

			Definition
Byte 0	Bit0~1	General Alarm:	Function reserved（bit0：0 bit1：1）
	Bit2~3	Battery high voltage protect	=0x359 byte 0 bit 1: Over voltage
	Bit4~5	Battery low voltage protect	=0x359 byte 0 bit 2: Under voltage
	Bit6~7	Battery high temperature protect	=0x359 byte 0 bit 3: Over temperature
Byte 1	Bit0~1	Battery low temperature protect	=0x359 byte 0 bit 4: Under temperature
	Bit2~3	Battery high temperature charge protect	Function reserved（bit2：0 bit3：1）
	Bit4~5	Battery low temperature charge protect	Function reserved（bit4：0 bit5：1）
	Bit6~7	Battery high current protect	=0x359 byte 0 bit 7:discharge over current
Byte 2	Bit0~1	Battery high charge current alarm	=0x359 byte 1 bit 0:charge current
	Bit2~3	Contactor error	有电池发生 MOSFET 或继电器失效 Exist≥1 module with：MOSFAIL, relay error
	Bit4~5	Short circuit protect	有电池发生短路保护 Exist≥1 module with short circuit
	Bit6~7	BMS protect or error	反接、外部输入过压、硬件错误，传感器错误、板内错误等 Reversed connection, input overvoltage, hardware failure, sensor error, BMS error
Byte 3	Bit0~1	Cell imbalance protect	Function reserved（bit0：0 bit1：1）
	Bit2~3	Reserved	
	Bit4~5	Reserved	
	Bit6~7	Reserved	
Byte 4~7		Reserved	

2.4.2 0x372/module status

		Design	
Byte 0 Byte 1	Number. 在线的正常运行的电池数量 Number of batteries running normally 充放电建议电流不为 0 的在线的台数。 They are batteries that allowed charge and discharge.	跟随系统状态变化 Will change based on system status.	16 bits unsigned int
Byte 2 Byte 3	Number 禁止充电的模块数量 Number of modules under charge protection or limit=0		
Byte 4 Byte 5	Number 禁止放电的模块数量 Number of modules under discharge protection or limit=0		
Byte 6 Byte 7	Number 通信掉线的模块数量 Number of modules that communication offline 通信掉线告警后上传。After 0x359, byte 3 bit 3, this number will be sent.		

2.4.3 0x373/max-min analog quantity

		Unit		Design
Byte 0 Byte 1	最低单芯电压 Minimum cell voltage	0.001V	16 bits unsigned int	
Byte 2 Byte 3	最高单芯电压 Maximum cell voltage	0.001V	16 bits unsigned int	
Byte 4 Byte 5	最低单芯温度 Minimum cell temperature	1 Kelvin	16 bits unsigned int	Kel = ° C /1000 + 273
Byte 6 Byte 7	最高单芯温度 Maximum cell temperature	1 Kelvin	16 bits unsigned int	

2.4.4 0x374~377/address of module in 0x373

NOTE:
if more than 1 module has same value at same time, the smallest address will be sent.

0x374	Minimum cell voltage address	e.g.: 01 03 00 00 00 00 00 00: Group 1st, the 3rd battery
0x375	Maximum cell voltage address	
0x376	Minimum cell temperature address	
0x377	Maximum cell temperature address	

2.4.5 0x379/total capacity

		Unit		Design
Byte 0 Byte 1 Byte 2 Byte 3	装机总容量 Total capacity	Ah	32 bits unsigned int	This is the total installed capacity e.g.: 50+50+74+100 = 274Ah

2.4.6 May use in future

Under develop.
0x35F, battery model, firmware version
0x378, energy in/out
0x380, 381 etc, SN

2.5 增补模块信息/extend module level

特定版本支持本命令。详询派能技术支持人员。
Implemented on latest version, please contact us for further information.

本段落采用询问制发送，需构造发送包获取电芯详细内容
Ask command to get feedback from BMS

For debug, trouble shooting, after sale service.

扩展帧。
Extended frame.

有定义的情况下 FF 占位，表明目前产品不支持此命令。For defined byte。 FF： not support.
无定义的情况下 00 占位。 For undefined byte：00：undefined

建议最快 2s 发送一次；
Sending interval shall ≥2 seconds.

Inverter send Command：0x4000000： 00-00-00-00-00-00-00-00

N = the address in one group, master battery = 1
M= group number. First group = 1
e.g.: Single module: n=1, m=1

Response of BMS:

			Unit	
0x4000001 + N * 0x100 + M * 0x10000	Byte 0	最低单芯电压 Min cell voltage of this module	0.001V	16 bits unsigned int
	Byte 1			
	Byte 2	最高单芯电压 Max cell voltage	0.001V	16 bits unsigned int
	Byte 3			
	Byte 4	电流 Current	0.1A	16 bits signed int
	Byte 5			
	Byte 6	总压 Module voltage	0.01V	16 bits unsigned int
	Byte 7			
0x4000002 + N * 0x100 + M * 0x10000	Byte 0	最高单芯温度 Max cell temp	0.1℃	16 bits signed int
	Byte 1			
	Byte 2	最低单芯温度 Min cell temp	0.1℃	16 bits signed int
	Byte 3			
	Byte 4	Mos 温度 MOSFET Temp	0.1℃	16 bits signed int
	Byte 5			
	Byte 6	Bms 温度 BMS temp	0.1℃	16 bits signed int
	Byte 7			
0x4000003 + N * 0x100 + M * 0x10000	Byte 0			
	Byte 1			
	Byte 2	SOC	1%	
	Byte 3			
	Byte 4	SOH	1%	
	Byte 5			
	Byte 6	额定容量 Nominal capacity of this module	Ah	
	Byte 7			
0x4000004 + N * 0x100 + M * 0x10000	Byte 0	本台状态情况 Status of this module		Table: [status]
	Byte 1			
	Byte 2	本台 flag 情况 Flag of this module		Table:[flag]
	Byte 3			
	Byte 4	本台故障代码 Error code of this module		32 bits unsigned int
	Byte 5			
	Byte 6			
	Byte 7			

[status]

Bit 15	Reserved	Bit 7	Refer to error code
Bit 14	Lock, forbidden charge or discharge	Bit 6	Reserved
Bit 13	Discharge over current, short circuit	Bit 5	Discharge high current
Bit 12	Charge over current	Bit 4	Charge high current
Bit 11	Cell under temperature	Bit 3	Cell high temperature
Bit 10	Cell over temperature	Bit 2	Cell low temperature
Bit 9	Cell or module under voltage	Bit 1	Cell or module high voltage
Bit 8	Cell or module over voltage	Bit 0	Cell or module low voltage

[flag]

Bit 15	This module is communication offline.	Bit 7	
Bit 14	Charge MOS status	Bit 6	
Bit 13	Discharge MOS status	Bit 5	
Bit 12		Bit 4	
Bit 11		Bit 3	Reserved-cell voltage difference
Bit 10		Bit 2	Reserved- balance charge
Bit 9		Bit 1	Reserved- full charge
Bit 8		Bit 0	Reserved- force charge

Inverter send Command: 0x5000000: 00-00-00-00-00-00-00-00

Response of BMS:

<table>
<tr><td colspan="2">0x5000001 + N * 0x100 + M * 0x10000</td><td>SN1~8</td><td>Acsii</td></tr>
<tr><td colspan="2">0x5000002 + N * 0x100 + M * 0x10000</td><td>SN9~16</td><td>Acsii</td></tr>
<tr><td colspan="2">0x5000003 + N * 0x100 + M * 0x10000</td><td>SN17~24—reserved</td><td>Acsii</td></tr>
<tr><td colspan="2">0x5000004 + N * 0x100 + M * 0x10000</td><td>SN24~32—reserved</td><td>Acsii</td></tr>
<tr><td rowspan="8">0x5000005 + N * 0x100 + M * 0x10000</td><td>Byte 0</td><td rowspan="4">Master battery firmware version</td><td rowspan="4">Byte0:0x01
Byte1:0x04
=1.4</td></tr>
<tr><td>Byte 1</td></tr>
<tr><td>Byte 2</td></tr>
<tr><td>Byte 3</td></tr>
<tr><td>Byte 4</td><td rowspan="4">Master battery firmware version 2(internal ID)</td><td rowspan="4">Byte4:0x38
Byte5:0x03
=56.3</td></tr>
<tr><td>Byte 5</td></tr>
<tr><td>Byte 6</td></tr>
<tr><td>Byte 7</td></tr>
</table>

2.6 升级/upgrade

特定版本支持本命令。详询派能技术支持人员。
Implemented on latest version, please contact us for further information.
升级过程中，需要按照顺序下发命令。
The command shall send by order.
Firmware: .bin file
分包：将固件按照顺序和固定大小拆解。
Block: divide firmware file into many packages in order, each one is one block.

2.6.1 command 1：固件大小 / size of firmware

Command	Content	Bytes
0x4610	固件大小 / size of firmware	4

Response of BMS: 0x4620

	Item	Content
Condition 1	1	0xA1：size OK
	2	支持的最大分包大小 / the max size of block
Condition 2	1	0x01：固件大小错误 / size error

2.6.2 command 2：传输数据 / transfer data

send these 3 commands one by one and wait for response, until all data block finish.
循环发送此 3 条指令，直到数据正确传输完成。

Command	Content	Bytes
0x4630	分包序号 / block number 从 1 开始 / starts from No.1	2
0x4650	分包数据 / block data	128
0x4670	分包 CRC/ CRC of 0x4650 CRC16 modbus x16+x15+x2+1	2

Response of BMS of these 3 commands: 0x4680

	Content
Condition 1	0xA2：all OK
Condition 2	0x02：分包 CRC 不匹配/ CRC of block unmatched
Condition 3	0x03：分包序号错误 / block number error
Condition 4	0x04：分包数据写入错误 / block data write in error
Condition 5	0x05：分包数据大小错误 / block data size error

2.6.3 commend 3：校验固件 / CRC of firmware

Command	Content	Bytes
0x4690	固件的 CRC / CRC of firmware CRC16 modbus x16+x15+x2+1	2

Response of BMS: 0x46A0

	Content
Condition 1	0xA3：all OK
Condition 2	0x06：CRC 数据写入错误 / CRC data write in error
Condition 3	0x07：固件总大小异常 / firmware size error
Condition 4	0x08：固件 CRC 不匹配 / CRC of firmware unmatched

2.6.4 commend 4：重启更新 / restart to upgrade

Command: 0x46B0
Response of BMS: 0x46C0

	Content
Condition 1	0x0A：转发固件/transfer firmware to lower level module
Condition 2	0x0B：升级 / upgrade
Condition 3	0x09： 无效固件 / unvalued firmware

2.6.5 commend 5：获取状态 / check upgrade process

Command: 0x46D0
Response of BMS: 0x46E0

	Content
Condition 1	0x0C：转发中 / transferring
Condition 2	0x0D：从机升级中 / lower level module upgrading
Condition 3	0x0E：转发错误 / transfer error
Condition 4	0x0F：升级失败 / upgrade error