RS485 communication protocol between Sigineer solar inverter and lithium battery (BMS Port)

储能机与电池PACK之间RS485通讯协议

Works for below models:

M3048NC

M3048BP

M5000H-48BP

M6048D

M12048D

MS6048D

M6048DUL

M12048DUL

Protocol

Description:

This protocol is defined for communication between Inverter, Battery, and AP(Application Program), it uses standard Modbus protocol for normal communication and supports address register function to identify each inverter of a group.

Rev.	Change
Temp	Initial release.
1.01	2014/7/18: Update Voltage Record address by David Chou
1.03	2014/8/19: Add interpretation of error code
1.04	2014/10/6: Add new definition for status bits and error code
1.06	2014/12/8: Change definition of Addr. 0x0019
1.07	2015/1/27: Add content to event log
1.08	2015/2/4: Add content to event log
1.09	2015/4/10: Change the definition of event log to maximum the external EEPROM usage (By Jeff Ho)
1.10	2016/3/18:Added SOH Address 0x0020 and Modified Addr 0x001C 0x001D (By Enoch Chang)
1.11	2016/3/24: Added error code bit10 for unbalance ,status bit8 for Master box parallel control (By Enoch Chang)
1.12	2016/6/2: Modify the spec query & status query command to meet the F/W code setting (By Jeff Ho)
1.13	2016/7/20:Modify addr 0x000F to Using Cap, Modify Status bits 8:11 for master box using(By Enoch Chang)
1.14	2016/12/14:补充充电过流保护标志位，MOS、环境高低温保护标志位，
1.15	2016/12/23 增加告警标志位功能和 CV 电压，
1.16	2017/01/16 增加SOH的解析说明，PACK软件/硬件版本号说明（YW / SN/FW），
1.17	2017/02/08 定义寄存器地址 0x000D 和 0x000E 的 BMS/PACK 厂家和版本的定义，
1.18	2017/08/21 增加 Alpha 的 BMS 和 PACK 编号。
1.19	重新定义 Box 并联后上报 2 组电池信息协议，增加 0x0023、0x0024、0x0070 三组 Alpha 的内容,
1.20	增加对 0x001F 的 Box 是否在线的定义，
1.21	修改 0x0031~0x0052 的含义，
1.22	增加 0x001F 的 Alpha 电池 ID 识别，另外红色注释为 Alpha 修改定义，Alpha 上报并联的多组电池信息方式是通过区分电池 ID 来复用同一组寄存器；

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➢ 1 General information

This protocol is defined for communication between Inverter, lithium battery, and AP(Application Program), it uses standard Modbus protocol for normal communication and supports address register function to identify each Inverter of a group.

About the setting of communication, the data length is 8 bits; the parity is set to none and the stop bits is one. AP is master and Inverter is slave so that the Inverter can't actively send the instruction unless it receives instruction from AP. The Inverter can return data to AP or execute the command from AP.

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2 Modbus Function Format

2.1 Packet Format

Query "Read" & "Broadcast" & "Read、Force Coil"

Slave Address	Function Code	Starting Address (Hi)	Starting Address (Lo)	No. of Data (Hi)	No. of Data (Lo)	CRC16 (Lo)	CRC16 (Hi)

Query "Preset"

Slave Address	Function Code	Starting Address (Hi)	Starting Address (Lo)	No. of Data (Hi)	No. of Data (Lo)	Byte Count	Data1 (Hi)

Data1 (Lo)	Data2 (Hi)	Data2 (Lo)	…	Data N (Hi)	Data N (Lo)	CRC16 (Lo)	CRC16 (Hi)

2.2 Description

	Description
Slave Address	8-bit value representing the slave being addressed (1 to 247), 0, is reserved for the broadcast address. The SPR and Integra products do not support the broadcast address， 01 is Box Report stand-alone and parallel battery address.

Function Code	8-bit value telling the addressed slave what action is to be erformed. 1. Read Holding Registers (0x03). 2.Preset Multiple Registers (0x10).
Starting Address (Hi)	The top (most significant) eight bits of a 16-bit number pecifying the start address of the data being requested.
Starting Address (Lo)	The bottom (least significant) eight bits of a 16-bit number specifying the start address of the data being requested.
No. of Data (Hi)	The top (most significant) eight bits of a 16-bit number specifying the number of registers being requested.
No. of Data (Lo)	The bottom (least significant) eight bits of a 16-bit number specifying the number of registers being requested.
Byte Count	The bytes count of registers being requested.
Data (Hi)	The top (most significant) eight bits of a 16-bit number representing the register(s) requested int the query.
Data (Lo)	The bottom (least significant) eight bits of a 16-bit number representing the register(s) requested int the query.
CRC16 (Lo)	The bottom (least significant) eight bits of a 16-bit number representing the error check value.
CRC16 (Hi)	The top (most significant) eight bits of a 16-bit number representing the error check value.

➢ 3 Function Codes

➢ 3.1 AP queries Battery Info. (Function Code:0x03)

Query

Slave Address	Function Code	Starting Address (Hi)	Starting Address (Lo)	No. of Data (Hi)	No. of Data (Lo)	CRC16 (Lo)	CRC16 (Hi)
0xXX	0x03	0x0X	0xXX	0x00	N		

Response

Slave Address	Function Code	Byte Count	Data1 (Hi)	Data1 (Lo)	Data2 (Hi)	Data2 (Lo)	…
0xXX	0x03	2N	…	…	…	…	…

Data N (Hi)	Data N (Lo)	CRC16 (Lo)	CRC16 (Hi)
…	…		

➢ 3.2 Read Holding Register 0x03

Spec Query

Address	Content	Comment
0x0001	MCU Software version	First byte (MCU FW Version) Second byte (MCU FW sub Version)
0x0002	Gauge Version	First byte (Gauge Version) Second byte (Gauge sub Version)
0x0003	Gauge FR Version	Gauge FR Version (Lo)
0x0004		Gauge FR Version (Hi)
0x0005	Date & Time	See ‘Date & Time bits’ Table below All first byte set to ‘0’ Second byte is the Date & Time data
0x0006		
0x0007		
0x0008		
0x0009	Bar Code	Bar Code 1~4 bytes
0x000A		
0x000B	Bar Code	Bar Code 5~6 bytes
0x000C	Bar Code	Bar Code 7~8 bytes
0x000D	Company Code	different BMS Company (Lo) See “Company bits” Table below
0x000E		different Batter PACK Company (Hi) See “Company bits” Table below
0x000F	Using Cap	5KW 3700WH /2.7KW 2000WH

‘Date & Time bits’ Table

Bit Index	Content	Comment
0 ~ 5	Second	0~59
6 ~ 11	Minute	0~59
12 ~ 16	Hour	0~23
17 ~ 21	Day	1~31
22 ~ 25	Month	1~12

26 ~ 31	Year	2000~2063

‘Company bits’ Table

	Bit Index	Content	Comment
0x000D	0	BMS company	00000000 : Darfon 00000001 : Peicheng 00000010 : self made 5KWh 00000011 Alpha 00000100 ATL 00001000
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8	BMS Ver.	00000001: first generation 00000002: second generation …..
	9		
	10		
	11		
	12		
	13		
	14		
	15		
0x000E	Bit Index	Content	Comment
	0	PACK company	000000000 : Darfon 000000001 : EVE 000000010 : self made 5KWh 000000011 Alpha 000000100 ATL
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8	PACK Ver	000000001: first generation 000000002: second generation
	9		
	10		
	11		
	12		

	13		
	14		
	15		

根据寄存器 0x000D 的 BMS 厂家信息来选择性的识别 0x0014 里面的内容。
According to the BMS manufacturer information in register 0x000D, the content in 0x0014 is selectively identified.

Status Query

Address	Content	Comment	Unit
0x0010	Gauge IC current		10mA
0x0011	Date & Time	Lo (See Table below)	
0x0012		Hi (See Table below)	
0x0013	Status	First byte set to ‘0’ See Box information	
0x0014	Error	Error code See Box information	
0x0015	SOC	First byte set to ‘0’ 0~100 See Box information	%
0x0016	Voltage	总压 Total voltage See Box information	10 mV
0x0017	Current	电流 Current See Current explain	10 mA
0x0018	Temperature	-127~127	℃
0x0019	Max. charge/discharge current	Charger/Discharger, must use this value to limit charge/discharge current.	
0x001A	Gauge RM	Remaining Capacity	10mAh
0x001B	Gauge FCC	Nominal Capacity	10mAh
0x001C	YW /FW	“YW / FW” Table below	
0x001D	Delta	Cell voltage	V
0x001E	Cycle Count		
0x001F	RSVD For Master Box	See Box Number information	
0x0020	SOH	Bit 0~ Bit6 SOH Counters Bit7:SOH Flag	
0x0021	CV Voltage	(CV Voltage List)	10mV
0x0022	Warning	Bit 0~ Bit13：Warning code, Bit 14~ Bit15：Battay type,	
0x0023	Alpha /Max. discharge current	Discharger, must use this value to	10 mA

		limit discharge current.（positive value）	
0x0024	Alpha /Extended Error	See Alpha Extended Error code	
0x0025	…….	…….	…….
0x0026	…….	…….	…….
0x0027	…….	…….	…….
0x0028	…….	…….	…….
0x0029	…….	…….	…….
0x002A	…….	…….	…….
0x002B	…….	…….	…….
0x002C	…….	…….	…….
0x002D	…….	…….	…….
0x002E	…….	…….	…….
0x002F	…….	…….	…….
0x0030			

Date & Time bits

Bit Index	Content	Comment
0~5	Second	0~59
6~11	Minute	0~59
12~16	Hour	0~23
17~21	Day	1~31
22~25	Month	1~12
26~31	Year	2000~2063

Status bits

Bit Index	Content	Comment
0	status	00 : soft_starting 01 : stand by 10 : charging 11 : discharging
1		
2	Error bit flag	1 : “Error” byte valid 0 : “Error” byte Invalid
3	Cell balance PF status	0 : unbalance PF 1 : balance
4	Sleep status	0 : disable 1 : enable
5	Output Discharge status	0 : disable 1 : enable
6	Output Charge status	0 : disable 1 : enable
7	Battery terminal status	0 : terminal connected

		1 : terminal open
8	Master box Operation Mode	00: Single unit 01: Parallel 10: Preparing for Parallel
9		
10	SP Status	00:none 01 : stand by 10 : charging 11 : discharging
11		

Note : Sleep status bit enable 5s later, Battery power off

Error code

Address	Content (binary)	Description	Recovery Mechanism
0x0014	Bit 0	OCD(Over Current Discharge) protection	(Unloading(1)) && (charging || DG_ON command)
	Bit 1	SCD(Short Circuit Discharge) protection	(Unloading(1))&& (charging || DG_ON command)
	Bit 2	OV (Over Voltage)protection	(Stop charging) && (discharging)
	Bit 3	UV (Under Voltage)protection	(Unloading(1)) && (charging)
	Bit 4	OTD(Over Temperature Discharge) protection	(Unloading(1)) && (temperature turn down to 60℃)
	Bit 5	OTC (Over Temperature Charge)protection	(Stop charging) || (temperature turn down to 50℃)
	Bit 6	UTD (Under Temperature Discharge)protection	(Unloading(1)) && (temperature raise to -10℃)
	Bit 7	UTC (Under Temperature Charge)protection	(Stop charging) || (temperature raise to 0℃)
	Bit 8	Soft start fail	0 : disable 1 : enable
	Bit 9	Permanent Fault(hardware error)	0 : disable 1 : enable
	Bit 10	Delta V Fail	0 : disable 1 : enable
	Bit 11	OCC(Over Current Charge) protection	(Unloading(1)) && (Discharging || DG_ON command)
	Bit 12	OT(MOS Over Temperature) protection	MOS temperature turn down to x℃, X is the highest temp of MOS
	Bit 13	OT(Environment Over Temperature) protection	Environment temperature turn down to x℃, X is the highest

			ambient temp
	Bit 14	UT(Environment Under Temperature) protection	Environment temperature raise to x℃, X is the lowest ambient temp

Note 1 : Before turning on discharging MOSFET, ESS must process “soft start” first to prevent ESS from inrush current. If the load is still active when processing “soft start”, the “soft start” action will fail, and cannot turn on discharging MOSFET .

注明：只有达方依然识别0x0014寄存器中Bit0-Bit10之间的内容，其他电池识别Bit0-Bit14之间的内容。

See Current explain

Address	Content	Description	Comment
0x0017	Current	0x0000~0x7FFF	表示电流为正值 Positive Value
		0x8000~0xFFFF	表示电流为负值 Negative value

YW / SN/FW

Address	Content (binary)	Description	数值 Value
0x001C	BYTE1	硬件版本号 Hardware version	Scopt 范围：1~9
	BYTE2	软件版本号 Software version	Scopt 范围：1~9

See Box Number information

Address	Content (binary)	Description	Comment
0x001F	Bit 0	0	默认为没有接 Box 状态，default setting, Box unconnected
		1	表示有接 Box 状态，Box connected
	Bit 1~ Bit 7	x	预留 Reserved
	Bit 8	x	Battery ID 000000:默认 default； 000001:1#； 000010:2#； 000011:3#； 000100:4#； 000101:5#； 000110:6#；
	Bit 9	x	
	Bit 10	x	
	Bit 11	x	
	Bit 12	x	
	Bit 13	x	
	Bit 14	x	预留 Reserved
	Bit 15	x	预留 Reserved

CV Voltage List

Address	Battery Type	CV Voltage（V）
0x0021	磷酸铁锂电池 LiFePO4	57.6V
	三元锂电池	xx
	钛酸锂电池	xx

根据不同的电池类型，PACK厂商给出实际的CV电压值。

Warning Code

Address	Content (binary)	State	Description	Recovery Mechanism
	Bit 0	0	正常 Normal	放电或电压低于单体过压告警值

0x0022		1	单体过压告警 Cell Over Voltage alarm	恢复（磷酸铁锂/三元电池）
	Bit 1	0	正常Normal	充电或电压高于单体欠压告警值恢复（磷酸铁锂/三元电池）
		1	单体欠压告警 Cell under Voltage alarm	
	Bit 2	0	正常Normal	放电或电压低于总压过压告警值恢复（磷酸铁锂/三元电池）
		1	总压过压告警 Pack Over Voltage alarm	
	Bit 3	0	正常 Normal	充电或电压高于总压欠压告警值恢复（磷酸铁锂/三元电池）
		1	总压欠压告警 Pack Under Voltage alarm	
	Bit 4	0	正常Normal	电流低于放电过流告警值
		1	放电过流告警 Discharge over current alarm	
	Bit 5	0	正常Normal	电流低于充电过流告警值
		1	充电过流告警 Charge over current alarm	
	Bit 6	0	正常Normal	温度低于放电高温告警值（℃）
		1	放电高温告警 Discharge Over temp alarm	
	Bit 7	0	正常Normal	温度高于于放电低温告警值（℃）
		1	放电低温告警 Discharge low temp alarm	
	Bit 8	0	正常 Normal	温度低于充电高温告警值（℃）
		1	充电高温告警 Charge Over temp alarm	
	Bit 9	0	正常 Normal	温度高于充电低温告警值（℃）
		1	充电低温告警 Charge low temp alarm	
	Bit 10	0	正常 Normal	温度低于MOS高温告警值（℃）
		1	MOS 高温告警 MOSFET high temp alarm	
	Bit 11	0	正常 Normal	温度低于环境高温告警值（℃）
		1	环境高温告警 Ambient high temp alarm	
	Bit 12	0	正常 Normal	温度高于环境低温告警值（℃）
		1	环境低温告警 Ambient low temp alarm	
	Bit 13	0	正常 Normal	总压高于系统关机/锁住电压告警值（V）
		1	系统低压关机前告警 Low battery shut off alarm	
	Bit 14- Bit 15	电池类型		00: 磷酸铁锂电池 LifePO4 01: 三元电池

			10: 钛酸锂电池 11: 保留

根据不同的电池类型，PACK厂商给出具体告警值。

Alpha Extended Error code

Address	Content (binary)	Description	Recovery Mechanism
0x0024	Bit 0	并联模组拨码开关模式不一致 Discrepancy between parallel module DIP switches	
	Bit 1	模组软件版本不一致 Discrepancy between software verion	
	Bit 2	没有 SN 号 NO SN code	
	Bit 3	LMU 通信中断（主机丢失) Master Lost	
	Bit 4	LMU 通信中断（从机丢失）Slave Lost	

Box 并联时上报第 2 组电池 Spec and Status Query 信息
Spec and Status Query info from the second battery pack when box is paralleled

Address	Content	Comment	Unit
0x0031	MCU Software version	First byte (MCU FW Version) Second byte (MCU FW sub Version)	
0x0032	Gauge Version	First byte (Gauge Version) Second byte (Gauge sub Version)	
0x0033	Gauge FR Version	Gauge FR Version (Lo)	
0x0034		Gauge FR Version (Hi)	
0x0035	Date & Time	See ‘Date & Time bits’ Table below All first byte set to ‘0’ Second byte is the Date & Time data	
0x0036			
0x0037			
0x0038			
0x0039	Bar Code	Bar Code 1~4 bytes	
0x003A			
0x003B	Bar Code	Bar Code 5~6 bytes	
0x003C	Bar Code	Bar Code 7~8 bytes	
0x003D	Company Code	different BMS Company (Lo) See “Company bits” Table below	
0x003E		different Batter PACK Company (Hi) See “Company bits” Table below	
0x003F	Using Cap	5KW 3700WH /2.7KW 2000WH	
0x0040	Gauge IC current		10mA

0x0041	Date & Time	Lo (See Table below)	
0x0042		Hi (See Table below)	
0x0043	Status	First byte set to ‘0’ See Box information	
0x0044	Error	Error code See Box information	
0x0045	SOC	First byte set to ‘0’ 0~100 See Box information	%
0x0046	Voltage	总压 Total voltage See Box information	10 mV
0x0047	Current	Current	10 mA
0x0048	Temperature	-127~127	℃
0x0049	Max. charge/discharge current	Charger/Discharger, must use this value to limit charge/discharge current.	10 mA
0x004A	Gauge RM	Remaining Capacity	10mAh
0x004B	Gauge FCC	Nominal Capacity	10mAh
0x004C	YW /FW	“YW / FW” Table below	
0x004D	Delta	Cell voltage	V
0x004E	Cycle Count		
0x004F	RSVD For Master Box	See Box Number information	
0x0050	SOH	Bit 0~ Bit6 SOH Counters Bit7:SOH Flag	
0x0051	CV Voltage	(CV Voltage List)	10mV
0x0052	Warning	Bit 0~ Bit13：Warning code, Bit 14~ Bit15：Battay type,	
…….	…….	…….	…….
0x0070	Alpha /battery ID	用于识别同一个BMS下的不同电池组的信息to identify different battery packs info under one BMS	

Cell Voltage Status

Address	Content	Comment	Unit
0x0071	Cell 1 Voltage		1 mV
0x0072	Cell 2 Voltage		1 mV
0x0073	Cell 3Voltage		1 mV
0x0074	Cell 4Voltage		1 mV

0x0075	Cell 5 Voltage		1 mV
0x0076	Cell 6 Voltage		1 mV
0x0077	Cell 7Voltage		1 mV
0x0078	Cell 8 Voltage		1 mV
0x0079	Cell 9 Voltage		1 mV
0x007A	Cell 10 Voltage		1 mV
0x007B	Cell 11 Voltage		1 mV
0x007C	Cell 12 Voltage		1 mV
0x007D	Cell 13 Voltage		1 mV
0x007E	Cell 14Voltage		1 mV
0x007F	Cell 15 Voltage		1 mV
0x0080	Cell 16 Voltage		1 mV

Box 并联时上报第 2 组电池单体电压信息：
Spec and Status Query info of cells from the second battery pack when box is paralleled

0x0081	Cell 1 Voltage		1 mV
0x0082	Cell 2 Voltage		1 mV
0x0083	Cell 3Voltage		1 mV
0x0084	Cell 4Voltage		1 mV
0x0085	Cell 5 Voltage		1 mV
0x0086	Cell 6 Voltage		1 mV
0x0087	Cell 7Voltage		1 mV
0x0088	Cell 8 Voltage		1 mV
0x0089	Cell 9 Voltage		1 mV
0x008A	Cell 10 Voltage		1 mV
0x008B	Cell 11 Voltage		1 mV
0x008C	Cell 12 Voltage		1 mV
0x008D	Cell 13 Voltage		1 mV
0x008E	Cell 14Voltage		1 mV
0x008F	Cell 15 Voltage		1 mV
0x0090	Cell 16 Voltage		1 mV

Box information

类型 type	说明 description	备注 Note
Slave Address	01 是 Box 功率/能量型并联上报的电池帧地址，01 is the battery address when boxes are paralleled	

Error	非并联和 Box 接入单台后是单台电池的错误信息； Box 功率型并联除过压和欠压保护其它只要有触发报错就上报，	功率型并联时单台电池过充过放储能机不动作，其它报错储能机停止充放电，
SOC (%)	非并联和 Box 接入单台则为单台电池 SOC， Box 功率型并联后两台电池上报的最低电池 SOC 值， Box 能量型并联两台电池后上报的平均 SOC 值，	
Voltage(10mV)	非并联和 Box 接入单台则为单台电池电压值， Box 接入两台电池并联后上报的最低电池电压值，	
Current	Box 上传的两组电池电流之和，	
Else Content	非并联和 Box 接入单台则为单台电池信息， Box 功率型并联：1）、初始阶段报高电压信息，并联准备阶段报实际充放电单台信息，并联阶段上报 A、B 两电池信息。 Box 能量型并联：1）、初始阶段报高电压信息，充/放电阶段报当前单台电池信息，	
详细参考《储能机—BOX—电池组之间关于 RS485 通信规范》		