

BMS 与后台 MODBUS 通讯点表

版本号	修改内容	日期	作者
V2.0	通信规范	2017-02-25	吴红宇
V3.0	增加绝缘显示、温度报警区分充电和放电、增加从控故障报警	2017-04-25	吴红宇
V3.2	增加 BMS 控制寄存器	2018-1-29	吴红宇

1. 通信规范

1. This protocol is based on standard Modbus/RTU structure;
2. 本协议主要涉及对相关寄存器的解析以及规范基本读写方式, 其余涉及通信的时序、延时时间、超时时间均以 Modbus/RTU 通讯协议为准;
3. EMS works as Master, BMS works as Slave;
4. BMS default address is 0x1;
5. Each data transfer speed shall not be slower than 300ms;
6. Default baud rate is 57600;

2. Packet Basic Format

Application Specific Packet Basic Format:

Address	Function Code	Data	Check Code
1B	1B	NB	2B

Function Code Register

Here list the available function code registers with definition and function descriptions:

Function Code	Definition	Function Descriptions
03H	Read register	Read value from relevant register
06H	Write to single Register	Modify value in single register
10H	Write to multi Registers	Modify values in multi registers

Check Code Register

采用标准 MODBUS 协议中的 16 位循环冗余校验码(CRC)算法,生成多项式为 $X^{15}+X^{13}+1$, 传输时低 8 位在前, 高 8 位在后。从报文首字节(即地址域)到 CRC 码之前的所有报文字节都参与 CRC 码的计算。

生成 CRC 校验码的具体流程如下:

- 1) 预置 1 个 16 位的 CRC 寄存器为 0xFFFF (全 1)。
- 2) 把数据帧中的第 1 个字节和 CRC 寄存器中的低 8 位进行异或运算,结果存回到 CRC 寄存器中。
- 3) 将 CRC 寄存器右移 1 位, 最高位填 0, 最低位移出并检测。
- 4) 如果最低位为 0, 重复第 3 步(下一次移位)。

如果最低位为 1, 将 CRC 寄存器和生成多项式进行异或运算。

- 5) 重复第 3 步和第 4 步, 直到 8 次移位完成, 这样数据帧中的 1 个字节就处理结束了。
- 6) 重复第 2 步到第 5 步, 把数据帧中所有字节就处理完毕。
- 7) 最终, CRC 寄存器中的数值就是所求的 16 位 CRC 校验码。

3. Function Code Description

Read Register(03H)

Enquiry PDU Format:

Address	Function Code	Start Add High Add	Start Add Low Add	Register Number High Add High Byte	Register Number Low Add Low Byte	Check Code
1B	03H	1B	1B	1B	1B	2B

Response PDU Format:

Address	Function Code	Bytes	Register Value	Check Code
1B	03H	1B	2*NB	2B

Fault Response PDU Format:

Address	Fault Code	Fault Type	Check Code
1B	83H	1B	2B

Write to single register(06H)

Enquiry PDU Format:

Address	Function Code	Register Add High	Register Add Low	Register Value High	Register Value Low	Check Code
1B	06H	1B	1B	1B	1B	2B

Response PDU Format:

Address	Function Code	Register Add High	Register Add Low	Register Value	Check Code
1B	06H	1B	1B	2B	2B

Fault Response PDU Format:

Address	Fault Code	Fault Type	Check Code
1B	86H	1B	2B

Write to Multi Registers(10H)

Enquiry PDU Format:

Add	Function Code	Start Add High	Start Add Low	Register Numbers High High Byte	Register Numbers Low Low Byte	Bytes	Register Value	Check Code
1B	10H	1B	1B	1B	1B	1B	2*NB	2B

Response PDU Format

Add	Function Code	Start Add High	Start Add Low	Register Numbers High High Byte	Register Numbers Low Low Byte	Check Code
1B	10H	1B	1B	1B	1B	2B

Fault Response PDU Format

Add	Fault Code	Fault Type	Check Code
1B	90H	1B	2B

Fault Type Description

Fault Value	Description
01	Function Code illegal
02	Register Address illegal
03	Register Value Numbers wrong or Illegal
04	Function Code Processing Abnormal

4. Registers Definition

BMS Control Registers

Address	Data Function	Attribute	Descriptions
0x1024	EMS Communication Timeout	R/W	Unit: S, Default 90s
0x1025	EMS Address	R/W	Default: 1
0x1026	EMS Baud Rate	R/W	1:9600, 3:19200, 4:57600 Note: Only three above approval
0x10C3	One Key Parallel Switch for parallel multi clusters	R/W	0x1: Switch On, 0x2: Shut Down Note: One Key to parallel all available clusters to DC Bus
0x10C4	第一簇是否使用 Cluster #1 is usable	读写 R/W	0x1: usable, 0x2: unusable Note: When set it as unusable, the main contactor of this cluster will not be used and cannot be paralleled to DC Bus upon One Key Parallel Command, which is only applied when this cluster has fault and Master BMS can bypass this cluster to let all other useable clusters running.

0x10C5	第二簇是否使用 Cluster #2 is usable	读写 R/W	Same as above
0x10C6	第三簇是否使用 Cluster #3 is usable	读写 R/W	Same as above
0x10C7	第四簇是否使用 Cluster #4 is usable	读写 R/W	Same as above
0x10C8	第五簇是否使用 Cluster #5 is usable	读写 R/W	Same as above
0x2010	Get Cluster #1 ShutDown	R/W	0x0:Shut Down(Other Value Invalid)
0x3010	Get Cluster #2 ShutDown	R/W	0x0:Shut Down(Other Value Invalid)
0x4010	Get Cluster #3 ShutDown	R/W	0x0:Shut Down(Other Value Invalid)
0x5010	Get Cluster #4 ShutDown	R/W	0x0:Shut Down(Other Value Invalid)
0x6010	Get Cluster #5 ShutDown	R/W	0x0:Shut Down(Other Value Invalid)

BMS System Running Status Registers

Address	Data Function	Attribute	Descriptions
0x1044	System charge&discharge status	R	0x0: Standby; 0x1: Discharge; 0x2: Charge
0x1045	System Total Current	R	Int 16 Signed Range: -500A~500A E.g. CUR=1234, relevant discharge current is 123.4A CUR=-1234, relevant charge current is 123.4A
0x1046	Reserved	R	
0x1047	System SOC	R	Range: 0%~100%
0x1048	System Running Status	R	0: Normal (System can Charge and discharge) 1: Full (System can discharge, but cannot charge) 2: Empty (System can charge, but cannot discharge) 3: Standby (System cannot charge &discharge) 4: Shutdown (System cannot charge &discharge)
0x1049	System Total Voltage	R	E.g. VOL =6912, the relevant system voltage is 691.2V

0x104A	System Total Insulation Value	R	Minimum Insulation Value among all parallel clusters
0x104E	System Maximum Charge Current	R	Unit: 0.1A
0x104F	System Maximum Discharge Current	R	Unit: 0.1A
0x1081	Master BMS Alarm Registers	R	Bit3-bit15: Reserved Bit2: EMS Communication Failure Bit1: PCS Control Failure Bit0: PCS Communication Failure
0x1082	Sub Master Communication Failure Registers	R	Bit4: Sub-Master #5 Communication Failure Bit3: Sub-Master #4 Communication Failure Bit2: Sub-Master #3 Communication Failure Bit1: Sub-Master #2 Communication Failure Bit0: Sub-Master #1 Communication Failure
0x1083	Cluster #1 cannot be paralleled to DC Bus reasons	R	Bit5: Level2 Alarm existed Bit4: PCS Control Failure Bit3: Communication to Master BMS Failure Bit2: Hardware Failure Bit1: Too big circulating current among clusters(>4A) Bit0: Too big voltage different among clusters(>50V)
0x1084	Cluster #2 cannot be paralleled to DC Bus reasons	R	Same as above
0x1085	Cluster #3 cannot be paralleled to DC Bus reasons	R	Same as above
0x1086	Cluster #4 cannot be paralleled to DC Bus reasons	R	Same as above
0x1087	Cluster #5 cannot be paralleled to DC Bus reasons	R	Same as above
0x1093	<p>Pre-Alarm Summary</p> <p>Temperature Alarm can be used for current limitation, while all other alarms are just for alarm.</p> <p>Note: Alarm for all clusters</p>	R	Bit15: Discharge less temperature alarm Bit14: Discharge over temperature alarm Bit13: System voltage difference too big alarm Bit12: Insulation Value too low alarm Bit11: Cell Voltage difference too big alarm Bit10: Power pole over temperature alarm Bit9: Temperature difference too big alarm Bit8: SOC too low alarm Bit7: Charge less temperature alarm Bit6: Charge over temperature alarm Bit5: Discharge over current alarm Bit4: System less voltage alarm bit3: Cell less voltage alarm bit2: Charge over current alarm

			bit1: System over voltage alarm bit0: Cell over voltage alarm
0x1094	Level1 Alarm Summary	R	Bit15:Discharge Less Temperature Alarm[Level1] Bit14:Discharge Over Temperature Alarm[Level1] Bit13:System Voltage Difference too big alarm[Level1] Bit12:Insulation Value too low Alarm[Level1] Bit11:Cell Voltage Difference too big Alarm[Level1] Bit10:Power Pole Over Temperature Alarm[Level1] Bit9: Temperature Difference too big Alarm[Level1] Bit8: SOC too low Alarm [Level1] Bit7:Charge Less Temperature Alarm[Level1] Bit6:Charge Over Temperature Alarm[Level1] Bit5:Discharge Over Current Alarm[Level1] Bit4:System Less Voltage Alarm[Level1] bit3:Cell Less Voltage Alarm[Level1] bit2:Charge Over Current Alarm [Level1] bit1:System Over Voltage Alarm[Level1] bit0:Cell Less Voltage Alarm[Level1]
0x1095	Level2 Alarm Summary	R	Bit15:Discharge Less Temperature Alarm[Level2] Bit14:Discharge Over Temperature Alarm[Level2] Bit13:System Voltage Difference too big Alarm[Level2] Bit12:Insulation Value too low Alarm[Level2] Bit11:Cell Voltage difference too big Alarm[Level2] Bit10:Power Power Over Temperature Alarm[Level2] Bit9:Temperature Difference too big Alarm[Level2] Bit8: SOC too low alarm[Level2] Bit7:Charge Less Temperature Alarm[Level2] Bit6:Charge Over Temperature Alarm[Level2] Bit5:Discharge Over Current Alarm[Level2] Bit4:System Less Voltage Alarm[Level2] bit3:Cell Less Voltage Alarm[Level2] bit2:Charge Over Current Alarm[Level2] bit1:System Over Voltage Alarm[Level2] bit0:Cell Over Voltage Alarm[Level2]

Each Cluster Status Registers

Register Address= Base Address + Offset Address

Base Address of each cluster

Cluster NO.	Base Address
Cluster #1	0X2000
Cluster #2	0X3000
Cluster #3	0X4000
Cluster #4	0X5000
Cluster #5	0X6000

Cluster X(X=1,2,3,4,5) represents Cluster #1/#2/#3/#4/#5

Single Cluster Control Registers (running without Master BMS)

Offset Add	Data Function	Attribute	Descriptions
0x0010	Pre-Charge Control	W	0x1:Active pre-charge(switch on main contactor) 0x0:Shut down main contactor and pre-charge contactor
0x000B	EMS Address	R/W	Default: 1
0x000C	EMS Baud Rate	R/W	1:9600 3:19200 4:57600 Note: Only three above baud rates approval
0x00F4	EMS Communication timeout	R/W	Unit: S, Default: 90

Single Cluster Control Registers (General)

Offset Add	Data Function	Attribute	Descriptions
0x00CC	System Total Capacity	R/W	Unit: Ah
0x0015	Set Cluster Address	R/W	From 0
0x00F3	Cell Less Voltage Protection Value	R/W	Default: 2650mV

Single Cluster Status Registers

Offset Add	Data Function	Descriptions
0x0100	Cluster#X Total Voltage	E.g. VOL =6912, relevant cluster total voltage is 691.2V

0x0101	Cluster#X Current	Int 16 Signed, range: -500A~500A E.g. CUR=1234, relevant discharge current is 123.4A CUR=-1234, relevant charge current is 123.4A
0x0102	充放电指示 ClusterX Charge State	0x0: Standby; 0x1: Discharge; 0x2: Charge
0x0103	Cluster#XSOC	Range: 0%~100%
0x0104	Cluster#XSOH	Range: 0%~100%
0x0105	ClusterX Max Cell Voltage ID	Range: 1#~512#
0x0106	ClusterX Max Cell Voltage	E.g. VOL=3201, relevant cell voltage is 3.201v
0x0107	ClusterX Min Cell Voltage Id	Range: 1#~512#
0x0108	ClusterX Min Cell Voltage	E.g. VOL=3201, relevant cell voltage is 3.201v
0x0109	ClusterX Max Cell Temperature ID	Range: 1#~512#
0x010A	ClusterX Max Cell Temperature	Int 16 Signed, range: -40~150℃ Unit: 0.1℃
0x010B	ClusterX Min Cell Temperature ID	Range: 1#~512#

0x010C	ClusterX Min Cell Temperature	Int 16 Signed, range: -40~150℃ Unit: 0.1℃
0x010D	Average Cell Voltage	Unit: mV
0x010E	Cluster Insulation Value	Unit: KΩ
0x010F	Cluster Maximum Charge Current	Unit: 0.1A
0x0110	Cluster Maximum Discharge Current	Unit: 0.1A
0x0111	Insulation Value at Positive Pole	Unit: KΩ
0x0112	Insulation Value at Negative Pole	Unit: KΩ
0x0113	Cluster Running Status	<p>0x0: 正常 Normal</p> <p>0x1: 充满 Full</p> <p>0x2: 放空 Empty</p> <p>0x3: 待机 Standby</p> <p>0x4: 停机 Stop</p> <p>Note:</p> <p>Standby↔Forbid charge and discharge, but main contactor switch on;</p> <p>Stop↔Forbid charge and discharge, while main contactor shutdown</p>
0x0114	Average Temperature Value	Unit: 0.1℃
0x018b	Project ID	Project Firmware Version
0x018c	Major Version	
0x018d	Sub Version	
0x018e	Modify Version	

System Warning/Shut Down Status Registers

Offset Address	Data Function	Descriptions
0x0140	Level2 Alarm (BMS Self-protect, main contactor shut down)	Bit15: Discharge Less Temperature Alarm[Level2] Bit14: Discharge Over Temperature Alarm[Level2] Bit13: Reserved Bit12: Insulation Failure Alarm [Level2] Bit11: Reserved Bit10: Power Pole Over Temperature Alarm[Level2] Bit9: Reserved Bit8: Reserved Bit7: Charge Less Temperature Alarm[Level2] Bit6: Charge Over Temperature Alarm[Level2] Bit5: Discharge Over Current Alarm[Level2] Bit4: System Less Voltage Alarm[Level2] bit3: Cell Less Voltage Alarm[Level2] bit2: Charge Over Current Alarm[Level2] bit1: System Over Voltage Alarm[Level2] bit0: Cell Over Voltage Alarm[Level2] 0-Normal, 1-Alarm Active
0x0141	Level1 Alarm (EMS Control to stop charge, discharge, charge&discharge)	Bit15: Discharge Less Temperature Alarm[Level1] Bit14: Discharge Over Temperature Alarm[Level1] Bit13: Reserved Bit12: Insulation Failure Alarm [Level1] Bit11: Reserved Bit10: Power Pole Over Temperature Alarm[Level1] Bit9: Reserved Bit8: Reserved Bit7: Charge Less Temperature Alarm[Level1] Bit6: Charge Over Temperature Alarm[Level1] Bit5: Discharge Over Current Alarm[Level1] Bit4: System Less Voltage Alarm[Level1] bit3: Cell Less Voltage Alarm[Level1] bit2: Charge Over Current Alarm[Level1] bit1: System Over Voltage Alarm[Level1] bit0: Cell Over Voltage Alarm[Level1] 0-Normal, 1-Alarm Active
0x0142	Pre-Alarm	Bit15: Discharge Less Temperature Alarm Bit14: Discharge Over Temperature Alarm Bit13: Total Voltage Difference too big Alarm

	Temperature Alarm will active current limitation	Bit12: Insulation Failure Alarm Bit11: Cell Voltage Difference too big Alarm Bit10: Power Pole Over Temperature Alarm Bit9: Temperature different too big Alarm Bit8: SOC too low Alarm Bit7: Charge Less Temperature Alarm Bit6: Charge Over Temperature Alarm Bit5: Discharge Over Current Alarm Bit4: System Less Voltage Alarm bit3: Cell Less Voltage Alarm bit2: Charge Over Current Alarm bit1: System Over Voltage Alarm bit0: Cell Over Voltage Alarm 0-Normal, 1-Alarm Active
0x01A5	Other Hardware Alarm Info	Bit0: Com. Failure to Master BMS Bit1: Com. Failure to Slave BMS Bit2: Com. Failure between Slave BMS and Temperature Sensors Board Bit3: Slave BMS Hardware Failure 0-Normal, 1-Alarm Active

Slave BMS Fault Message Registers

0x0185	Slave BMS Hardware Fault Message	Bit12: Slave BMS Initialization Failure Bit11: EEPROM Fault Bit10: Internal COM Fault Bit9: Temperature Sensors Fault Bit8: Balance Module Fault Bit7: Temperature Board COM Fault Bit6: Power Pole Temperature Sensor Fault Bit5: Temperature Sensors Fault Bit4: Temperature Sensor Cables Fault Bit3: Voltage Sensors Fault Bit2: LTC6803 Fault Bit1: Power Cable Fault Bit0: Voltage Sensor Cables Fault 0-Normal, 1-Alarm Active
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Voltage Registers

Offset Address	Data Function	Descriptions
0x0800	NO. 1 Cell Voltage of Current Cluster ClusterX #1 Cell Voltage	E.g. VOL=3201, the relevant cell voltage is 3.201v;
...	...	
0x08D7	NO. 216 Cell Voltage of Current Cluster ClusterX #216 Cell Voltage	

Maximum 512 Voltage sensors approval in one single cluster

Temperature Registers

Offset Address	Data Function	Descriptions
0x0C00	NO. 1 Cell Temperature under current Cluster ClusterX #1 Cell Temperature	Int 16 Signed, Range: -40~150°C Unit: 0.1°C
...	...	
0x0C6b	NO. 108 Cell Temperature under current Cluster ClusterX #108 Cell Temperature	

Maximum 256 Temperature Sensors Approval in one Single Cluster

If not specify defined, the default data type of each register is unsigned int

WARN_LEVEL_ Pre Alarm(Pre Alarm Configuration Register R/W)

Start Up Offset Address: 0x0080

Offset Add	Data Function	Unit	Description
0x0080	Cell Over Voltage Protection	mV	E.g. VOL=3201, relevant cell voltage is 3.201V;
0x0081	Cell Over Voltage Protection Recovery		
0x0082	System Over Voltage Protection	0.1V	E.g. VOL=6000, relevant system voltage is 600.0V;
0x0083	System Over Voltage Protection Recovery		
0x0084	System Charge Over Current Protection	0.1A	Range: 0.0A~500.0A E.g. CUR=123, the relevant charge current is 12.3A
0x0085	System Charge Over Current Protection Recovery		
0x0086	Cell Less Voltage Protection	mV	E.g. VOL=3201, relevant cell voltage is 3.201V;
0x0087	Cell Less Voltage Protection Recovery		
0x0088	System Less Voltage Protection	0.1V	E.g. VOL=6000, relevant system voltage is 600.0V;
0x0089	System Under Voltage Protection Recovery		
0x008A	System Discharge Over Current Protection	0.1A	Range: 0.0A~500.0A E.g. CUR=123, the relevant charge current is 12.3A
0x008B	System Discharge Over Current Protection Recovery		
0x008C	Cell Charge Over Temperature Protection	0.1℃	Int 16 Signed, Range: -40~140℃
0x008D	Cell Charge Over Temperature Protection Recovery		
0x008E	Cell Charge Less Temperature Protection	0.1℃	Int 16 Signed, Range: -40~140℃
0x008F	Cell Charge Less Temperature Recover		
0x0090	SOC too low protection	1%	Range: 0%~100%
0x0091	SOC too low protection recovery		
0x0092	Reserved	-	
0x0093	Reserved		
0x0094	Power Pole Over Temperature Protection	0.1℃	Range: -40~140℃

0x0095	Power Pole Over Temperature Protection Recovery		
0x0096	Insulation Abnormal Protection	Ω/V	
0x0097	Insulation Abnormal Protection Recovery		
0x0098	Cell Voltage Difference too big Protection	mV	
0x0099	Cell Voltage Difference too big Protection Recovery		
0x009a	System Voltage Difference too big Protection	0.1V	
0x009b	System Voltage Difference too big Protection Recovery		
0x009c	Discharge Over Temperature Protection	0.1℃	
0x009d	Discharge Over Temperature Protection Recovery		
0x009e	Discharge Less Temperature Protection		
0x009f	Discharge Less Temperature Protection Recovery		
0x00a0	Temperature difference too big Protection		
0x00a1	Temperature difference too big Protection Recovery		

WARN_LEVEL1(Level1 warning registers R/W)

Start Up Offset Address: 0x0040

Offset	Data Function	Unit	Description
0x0040	Cell Over Voltage Protection [Level1]	mV	E.g. VOL=3201, relevant cell voltage is 3.201V;
0x0041	Cell Over Voltage Protection Recovery [Level1]		
0x0042	System Over Voltage Protection [Level1]	0.1V	E.g. VOL=6000, relevant system voltage is 600.0V;
0x0043	System Over Voltage Protection Recovery [Level1]		
0x0044	System Charge Over Current Protection [Level1]	0.1A	Range: 0.0A~500.0A E.g. CUR=123, relevant charge current is 12.3A
0x0045	System Charge Over Current Recovery [Level1]		
0x0046	Cell Less Voltage Protection [Level1]	mV	E.g. VOL=3201, relevant cell voltage is 3.201V;
0x0047	Cell Less Voltage Protection Recovery [Level1]		
0x0048	System Less Voltage Protection [Level1]	0.1V	E.g. VOL=6000, relevant system voltage is 600.0V;
0x0049	System Less Voltage Protection Recovery [Level1]		
0x004A	System Discharge Over Current Protection [Level1]	0.1A	Range: 0.0A~500.0A E.g. CUR=123, relevant discharge current is 12.3A
0x004B	System Discharge Over Current Protection Recovery [Level1]		
0x004C	Cell Charge Over Temperature Protection [Level1]	0.1℃	Int16 Signed, Range: -40~140℃
0x004D	Cell Charge Over Temperature Protection Recovery [Level1]		
0x004E	Cell Charge Less Temperature Protection [Level1]	0.1℃	Int16 Signed, Range: -40~140℃
0x004F	Cell Charge Less Temperature Protection Recovery [Level1]		
0x0050	SOC too Low Protection	1%	Range: 0%~100%
0x0051	SOC too Low Protection Recovery		
0x0052	Reserved	-	

0x0053	Reserved		
0x0054	Power Pole Over Temperature Protection [Level1]	0.1℃	Range: -40~140℃
0x0055	Power Pole Over Temperature Protection Recovery [Level1]		
0x0056	Insulation Abnormal Protection [Level1]	Ω/V	
0x0057	Insulation Abnormal Protection Recovery [Level1]		
0x0058	Cell Voltage Different too big Protection [Level1]	mV	
0x0059	Cell Voltage Different too big Protection Recovery [Level1]		
0x005a	System Voltage Different too big Protection [Level1]	0.1V	
0x005b	System Voltage Different too big Protection Recovery [Level1]		
0x005c	Discharge Over Temperature Protection [Level1]	0.1℃	Int16S, Range : -40~140℃
0x005d	Discharge Over Temperature Protection Recovery [Level1]		
0x005e	Discharge Less Temperature Protection [Level1]		
0x005f	Discharge Less Temperature Protection Recovery [Level1]		
0x0060	Temperature Difference Too Big Protection [Level1]		
0x0061	Temperature Difference Too Big Protection Recovery [Level1]		

WARN_LEVEL2(Level2 Protection Register R/W)

Start Up Offset Address: 0x0400

Offset Add	Data Function	Unit	Description
0x0400	Cell Over Voltage Protection [Level2]	mV	E.g. VOL=3201, relevant cell voltage is 3.201V;
0x0401	Cell Over Voltage Protection Recovery [Level2]		
0x0402	System Over Voltage Protection [Level2]	0.1V	E.g. VOL=6000, relevant system Voltage is 600.0V;
0x0403	System Over Voltage Protection Recovery [Level2]		
0x0404	System Charge Over Current Protection [Level2]	0.1A	Range: 0.0A~500.0A E.g. CUR=123, relevant charge current is 12.3A
0x0405	System Charge Over Current Protection Recovery [Level2]		
0x0406	Cell Less Voltage Protection [Level2]	mV	E.g. VOL=3201, relevant cell voltage is 3.201V;
0x0407	Cell Less Voltage Protection Recovery [Level2]		
0x0408	System Less Voltage Protection [Level2]	0.1V	E.g. VOL=6000, relevant system voltage is 600.0V;
0x0409	System Less Voltage Protection Recovery [Level2]		
0x040A	System Discharge Over Current Protection [Level2]	0.1A	Range: 0.0A~500.0A E.g. CUR=123, relevant discharge current is 12.3A
0x040B	System Discharge Over Current Protection Recovery [Level2]		
0x040C	Cell Charge Over Temperature Protection [Level2]	0.1℃	Int16 Signed, range: -40~140℃
0x040D	Cell Charge Over Temperature Protection Recovery [Level2]		
0x040E	Cell Charge Less Temperature Protection [Level2]	0.1℃	Int16 Signed, range -40~140℃

0x040F	Cell Charge Less Temperature Protection Recovery [Level2]		
0x0410	SOC too Low Protection [Level2]	1%	Range: 0%~100%
0x0411	SOC too Low Protection Recovery [Level2]		
0x0412	Reserved	-	
0x0413	Reserved		
0x0414	Power Pole Over Temperature Protection [Level2]	0.1℃	Range : -40~140℃
0x0415	Power Pole Over Temperature Protection Recovery [Level2]		
0x0416	Insulation Abnormal Protection [Level2]	Ω/V	
0x0417	Insulation Abnormal Protection Recovery [Level2]		
0x0418	Cell Voltage Different too big Protection [Level2]	mV	
0x0419	Cell Voltage Different too big Protection Recovery [Level2]		
0x041a	System Voltage Difference too big Protection [Level2]	0.1V	
0x041b	System Voltage Difference too big Protection Recovery [Level2]		
0x041c	Discharge Over Temperature Protection [Level2]	0.1℃	
0x041d	Discharge Over Temperature Protection Recovery [Level2]		
0x041e	Discharge Less Temperature Protection [Level2]		
0x041f	Discharge Less Temperature Protection Recovery [Level2]		

0x0420	Temperature Difference Too Big Protection [Level2]		
0x0421	Temperature Difference Too Big Protection Recovery [Level2]		

