Revision history

Index	Description	Version	Date	Author
0	Document created.	V1.0	2017-04-10	WANG
1	MOSFET/Environment temperature in BMS-4820 is invalid.	V1.1	2017-05-27	WANG
2	Add register ID 0107~0112.	V1.2	2017-06-14	WANG
3	Add register ID 0170~0179 for PACK SN, and 0113\0114 for Charging OC-2 protection	V1.3	2017-06-27	WANG
4	Add register ID 0040~0043 for cumulative discharging AH & KWH.	V1.4	2017-09-25	WANG
5	Add register ID 0056~0058 for date, and register ID 0200~0233 for Read BMS LOG.	V1.5	2018-06-12	WANG
6				
7				
8				
9				

1. CRC parity

CRC parity range is the check of all bytes before CRC field. It uses 16 bit CRC parity.

1.1 High significant byte CRC value

```
static unsigned char auchCRCHi[] = {
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1,
0x81, 0x40, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01,
0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80,
0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00,
0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81,
0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1,
0x81, 0x40, 0x01,
0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01,
0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01,
0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40
};
```

1.2 Low significant byte CRC value

```
static char auchCRCLo[ ] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7,
0x05, 0xC5, 0xC4,
0x04, 0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB,
0x0B, 0xC9, 0x09,
0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE,
0xDF, 0x1F, 0xDD,
0x1D, 0x1C, 0xDC, 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2,
0x12, 0x13, 0xD3,
0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32,
0x36, 0xF6, 0xF7,
0x37, 0xF5, 0x35, 0x34, 0xF4, 0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E,
0xFE, 0xFA, 0x3A,
0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B,
0x2A, 0xEA, 0xEE,
0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27,
0xE7, 0xE6, 0x26,
0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1,
0x63, 0xA3, 0xA2,
0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD,
0x6D, 0xAF, 0x6F,
0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8,
0xB9, 0x79, 0xBB,
0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4,
0x74, 0x75, 0xB5,
0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0,
0x50, 0x90, 0x91,
0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94,
0x54, 0x9C, 0x5C,
0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59,
0x58, 0x98, 0x88,
0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D,
0x4D, 0x4C, 0x8C,
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83,
0x41, 0x81, 0x80, 0x40
};
```

1.3 Program reference of realization

```
unsigned short CRC16 (puchMsg, usDataLen)  /* The function returns the CRC as a unsigned short type
*/
unsigned char *puchMsg ;   /* message to calculate CRC upon */
unsigned short usDataLen ;  /* quantity of bytes in message */
{
    unsigned char uchCRCHi = 0xFF ;  /* high byte of CRC initialized */
    unsigned char uchCRCLo = 0xFF ;  /* low byte of CRC initialized */
    unsigned uIndex ;   /* will index into CRC lookup table */
    while (usDataLen--)  /* pass through message buffer */
    {
        uIndex = uchCRCLo ^ *puchMsg++ ; /* calculate the CRC */
        uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex] ;
        uchCRCHi = auchCRCLo[uIndex] ;
    }
    return (uchCRCHi<< 8 | uchCRCLo) ;
}
```

Code：《MODBUS over Serial Line Specification and Implementation Guide V1.02》

2. Communication Parameters

Baud Rate：9600(Default, Subject to the BMS Specification)

Parity Bit：No

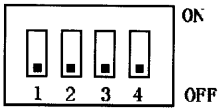
Data Bits：8

Stop Bit：1

Timeout: 200mS

Interval time of the frame: > 100mS

BMS Module ID:



NO.	Module Address	BMS Module ID	ID Arrangement			
			1#	2#	3#	4#
1	0x01	1	ON	OFF	OFF	OFF
2	0x02	2	OFF	ON	OFF	OFF
3	0x03	3	ON	ON	OFF	OFF
4	0x04	4	OFF	OFF	ON	OFF
5	0x05	5	ON	OFF	ON	OFF
6	0x06	6	OFF	ON	ON	OFF
7	0x07	7	ON	ON	ON	OFF
8	0x08	8	OFF	OFF	OFF	ON
9	0x09	9	ON	OFF	OFF	ON
10	0x0A	10	OFF	ON	OFF	ON
11	0x0B	11	ON	ON	OFF	ON

12	0x0C	12	OFF	OFF	ON	ON
13	0x0D	13	ON	OFF	ON	ON
14	0x0E	14	OFF	ON	ON	ON
15	0x0F	15	ON	ON	ON	ON
0	0x00	0	OFF	OFF	OFF	OFF

Remark: Subject to the BMS Specification.

3. Function Code

3.1 Read registers

Send by the master SMPS

Slave Address	Function Code	Starting Address(Hi)	Starting Address(Lo)	Num of register (Hi)	Num of register (Lo)	CRC (Lo)	CRC (Hi)
0x01-0x10	0x03	0x0000-0xFFFF		0x0001-0x007D		-	-

Response by slave (BMS)

Slave Address	Function Code	Byte Count	Data1 (Hi)	Data1 (Lo)	...	Data n (Hi)	Data n (Lo)	CRC (Lo)	CRC (Hi)
0x01-0x10	0x03	2*(Num of register)	...	...	...	...	...	-	-

3.2 Write registers

Send by the master SMPS

Slave Address	Function Code	Starting Address(Hi)	Starting Address(Lo)	Num of register (Hi)	Num of register (Lo)	Byte Count	
0x01-0x10	0x10	0x0000-0xFFFF		0x0001-0x007B		2*(Num of register)	
Data1 (Hi)	Data1 (Lo)			Data n (Hi)	Data n (Lo)	CRC (Lo)	CRC (Hi)
...	...	...		...	...	-	-

Response by slave (Write success)

Slave Address	Function Code	Starting Address(Hi)	Starting Address(Lo)	Num of register (Hi)	Num of register (Lo)	CRC (Lo)	CRC (Hi)
0x01-0x10	0x10	0x0000-0xFFFF		0x0001-0x007B		-	-

3.3 Error Code

Response by slave (BMS)

Slave	Function	Error Code	CRC	CRC

Address	Code		(Lo)	(Hi)
0x01-0x10	Cmd + 0x80	…	-	-

Error code

Error Code	Name	Remark
1	Illegal function code	Function that does not exist
2	Illegal function address	Register address that does not exist
3	Illegal data operation	Its operation is not allowed
4	-	-

4. Data information

4.1 Data acquisition

Register Address	Content	Length	RW/Data type	Unit	Remark
0000	Current	2byte	R/INT16	10mA	Positive: charging Negative: discharging
0001	Voltage of pack	2byte	R/UINT16	10mV	
0002	SOC	2byte	R/UINT8	%	0~100%
0003	SOH	2byte	R/UINT8	%	0~100%
0004	Remain capacity	2byte	R/UINT16	10mAH	
0005	Full capacity	2byte	R/UINT16	10mAH	
0006	Design capacity	2byte	R/UINT16	10mAH	
0007	Battery cycle counts	2byte	R/UINT16	Cyc.	
0008	-	-	-	-	Reserved
0009	Warning flag	2byte	R/UINT16	Hex	See description-1
0010	Protection flag	2byte	R/UINT16	Hex	See description-2
0011	Status/Fault flag	2byte	R/UINT16	Hex	See description-3
0012	Balance status	2byte	R/UINT16	Hex	
0013-0014	-	-	-	-	Reserved
0015-0030	Cell voltage	32byte	R/UINT16	mV	Voltage of 16 cells, 2 byte for each cell
0031-0034	Cell temperature	8byte	R/INT16	0.1℃	4 cell temperature, 2 byte for each cell
0035	MOSFET temperature	2byte	R/INT16	0.1℃	Or invalid
0036	Environment temperature	2byte	R/INT16	0.1℃	Or invalid
0037~0039	-	-	-	-	Reserved

0040~0041	Cumulative discharging AH	4byte	R/UINT32	10mAH	
0042~0043	Cumulative discharging KWH	4byte	R/UINT32	WH	
0044~0055	-	-	-	-	Reserved
0056	Year	1byte	RW/UINT8(Hi)		2018=18(Year)+2000
	Month	1byte	RW/UINT8(Lo)		
0057	Day	1byte	RW/UINT8(Hi)		
	Hour	1byte	RW/UINT8(Lo)		
0058	Minute	1byte	RW/UINT8(Hi)		
	Second	1byte	RW/UINT8(Lo)		
0059	-	-	-	-	Reserved
0060	Pack OV alarm	2byte	RW/UINT16	mV	
0061	Pack OV protection	2byte	RW/UINT16	mV	
0062	Pack OV release protection	2byte	RW/UINT16	mV	
0063	Pack OV protection delay time	2byte	RW/UINT8	0.1S	1~255
0064	Cell OV alarm	2byte	RW/UINT16	mV	
0065	Cell OV protection	2byte	RW/UINT16	mV	
0066	Cell OV release protection	2byte	RW/UINT16	mV	
0067	Cell OV protection delay time	2byte	RW/UINT8	0.1S	1~255
0068	Pack UV alarm	2byte	RW/UINT16	mV	
0069	Pack UV protection	2byte	RW/UINT16	mV	
0070	Pack UV release protection	2byte	RW/UINT16	mV	
0071	Pack UV protection delay time	2byte	RW/UINT8	0.1S	1~255
0072	Cell UV alarm	2byte	RW/UINT16	mV	
0073	Cell UV protection	2byte	RW/UINT16	mV	
0074	Cell UV release protection	2byte	RW/UINT16	mV	
0075	Cell UV protection delay time	2byte	RW/UINT8	0.1S	1~255
0076	Charging OC alarm	2byte	RW/UINT16	A	
0077	Charging OC protection	2byte	RW/UINT16	A	
0078	Charging OC protection delay time	2byte	RW/UINT8	0.1S	1~255
0079	Discharging OC alarm	2byte	RW/UINT16	A	
0080	Discharging OC protection	2byte	RW/UINT16	A	
0081	Discharging OC protection delay time	2byte	RW/UINT8	0.1S	1~255
0082	Discharging OC-2 protection	2byte	RW/UINT16	A	

0083	Discharging OC-2 protection delay time	2byte	RW/UINT8	0.025S	1~255
0084	Charging OT alarm	2byte	RW/INT16	0.1℃	
0085	Charging OT protection	2byte	RW/INT16	0.1℃	
0086	Charging OT release protection	2byte	RW/INT16	0.1℃	
0087	Discharging OT alarm	2byte	RW/INT16	0.1℃	
0088	Discharging OT protection	2byte	RW/INT16	0.1℃	
0089	Discharging OT release protection	2byte	RW/INT16	0.1℃	
0090	Charging UT alarm	2byte	RW/INT16	0.1℃	
0091	Charging UT protection	2byte	RW/INT16	0.1℃	
0092	Charging UT release protection	2byte	RW/INT16	0.1℃	
0093	Discharging UT alarm	2byte	RW/INT16	0.1℃	
0094	Discharging UT protection	2byte	RW/INT16	0.1℃	
0095	Discharging UT release protection	2byte	RW/INT16	0.1℃	
0096	MOSFET OT alarm	2byte	RW/INT16	0.1℃	Or invalid parameters in BMS-4820
0097	MOSFET OT protection	2byte	RW/INT16	0.1℃	
0098	MOSFET OT release protection	2byte	RW/INT16	0.1℃	
0099	Environment OT alarm	2byte	RW/INT16	0.1℃	
0100	Environment OT protection	2byte	RW/INT16	0.1℃	
0101	Environment OT release protection	2byte	RW/INT16	0.1℃	
0102	Environment UT alarm	2byte	RW/INT16	0.1℃	
0103	Environment UT protection	2byte	RW/INT16	0.1℃	
0104	Environment UT release protection	2byte	RW/INT16	0.1℃	
0105	Balance start cell voltage	2byte	RW/UINT16	mV	
0106	Balance start delta voltage	2byte	RW/UINT16	mV	
0107	Pack full-charge voltage	2byte	RW/UINT16	mV	
0108	Pack full-charge current	2byte	RW/UINT16	mA	
0109	Cell sleep voltage	2byte	RW/UINT16	mV	
0110	Cell sleep delay time	2byte	RW/UINT16	min	
0111	Short circuit protect delay time	2byte	RW/UINT8	25uS	Max 500uS
0112	SOC alarm threshold	2byte	RW/UINT8	%	0~100%
0113	Charging OC-2 protection	2byte	RW/UINT16	A	
0114	Charging OC-2 protection delay time	2byte	RW/UINT8	0.025S	1~255

0115-0149					Reserved
0150-0159	Version information	20byte	R/UINT16	ASCII	
0160-0169	Model SN	20byte	RW/UINT16	ASCII	BMS Manufacturer
0170-0179	PACK SN	20byte	RW/UINT16	ASCII	PACK Manufacturer

Remark: Each register store two bytes; Register data type is one byte of data (UINT8/INT8), it is required to store in (LSB), MSB is 00H. And each register store two ASCII characters.

4.2 LOG Register Tab

Register Address	Content	Length	RW/Data type	Unit	Remark
0200	LOG read control	2byte	RW/UINT16		Through the command (0x10), write register ID (0200) with the record index (0~65535), then read register ID (0201~0233). Sea the example.
0201	Year	1byte	R/UINT8(Hi)		2018=18(Year)+2000
	Month	1byte	R/UINT8(Lo)		
0202	Day	1byte	R/UINT8(Hi)		
	Hour	1byte	R/UINT8(Lo)		
0203	Minute	1byte	R/UINT8(Hi)		
	Second	1byte	R/UINT8(Lo)		
0204	Current	2byte	R/INT16	10mA	Positive: charging Negative: discharging
0205	Voltage of pack	2byte	R/UINT16	10mV	
0206	Remain capacity	2byte	R/UINT16	10mAH	
0207	Full capacity	2byte	R/UINT16	10mAH	
0208-0223	Cell voltage	32byte	R/UINT16	mV	Voltage of 16 cells, 2 byte for each cell
0224-0227	Cell temperature	8 byte	R/INT16	0.1℃	4 cell temperature, 2 byte for each cell
0228	MOSFET temperature	2byte	R/INT16	0.1℃	
0229	Environment temperature	2byte	R/INT16	0.1℃	
0230	Battery cycle counts	2byte	R/UINT16	Cyc.	
0231	Warning flag	2byte	R/UINT16	Hex	See description-1
0232	Protection flag	2byte	R/UINT16	Hex	See description-2
0233	Status/Fault flag	2byte	R/UINT16	Hex	See description-3

Warning flag

Warning	BIT0	1: battery cell overvoltage alarm	

		0: not occurring	
	BIT1	1: battery cell low voltage alarm 0: not occurring	
	BIT2	1: battery pack overvoltage alarm 0: not occurring	
	BIT3	1: battery pack low voltage alarm 0: not occurring	
	BIT4	1: charging over current alarm 0: not occurring	
	BIT5	1: discharging over current alarm 0: not occurring	
	BIT6	reserve	
	BIT7	reserve	
	BIT8	1: charging high temperature alarm 0: not occurring	cell temperature
	BIT9	1: discharging high temperature alarm 0: not occurring	cell temperature
	BIT10	1: charging low temperature alarm 0: not occurring	cell temperature
	BIT11	1: discharging low temperature alarm 0: not occurring	cell temperature
	BIT12	1: environment high temperature alarm 0: not occurring	
	BIT13	1: environment low temperature alarm 0: not occurring	
	BIT14	1: MOSFET high temperature alarm 0: not occurring	
	BIT15	1: SOC Low alarm 0: not occurring	

Protection flag

Protection	BIT0	1: battery cell over voltage protection 0: not occurring	
	BIT1	1: battery cell low voltage protection 0: not occurring	
	BIT2	1: battery pack over voltage protection 0: not occurring	
	BIT3	1: battery pack low voltage protection 0: not occurring	
	BIT4	1: charging over current protection 0: not occurring	
	BIT5	1: discharging over current protection	

		0: not occurring	
	BIT6	1: short circuit protection 0: not occurring	
	BIT7	1: charger overvoltage protection 0: not occurring	
	BIT8	1: charging high temperature protection 0: not occurring	cell temperature
	BIT9	1: discharging high temperature protection 0: not occurring	cell temperature
	BIT10	1: charging low temperature protection 0: not occurring	cell temperature
	BIT11	1: discharging low temperature protection 0: not occurring	cell temperature
	BIT12	1: MOSFET high temperature protection 0: not occurring	
	BIT13	1: environment high temperature protection 0: not occurring	
	BIT14	1: environment low temperature protection 0: not occurring	
	BIT15	reserve	

Status/Fault flag

Fault	BIT0	1: charging MOSFET fault 0: not occurring	
	BIT1	1: discharging MOSFET fault 0: not occurring	
	BIT2	1: temperature sensor fault 0: not occurring	
	BIT3	reserve	
	BIT4	1: battery cell fault 0: not occurring	
	BIT5	1: front end sampling communication fault 0: not occurring	
	BIT6	reserve	
	BIT7	reserve	
Status	BIT8	1: state of charge 0: not occurring	
	BIT9	1: state of discharge 0: not occurring	
	BIT10	1: charging MOSFET is ON 0: charging MOSFET is OFF	

	BIT11	1: discharging MOSFET is ON 0: discharging MOSFET is OFF	1
	BIT12	1: charging Limiter is ON 0: charging Limiter is OFF	
	BIT13	reserve	
	BIT14	1: charger inversed 0: not occurring	
	BIT15	1: heater is ON 0: heater is OFF	

For example:

Two steps are required to read the LOG (the device address is 1).

Step1:

Command: 01 10 00 C8 00 01 02 00 00 B6 18 (SMPS→BMS)

Response: 01 10 00 C8 00 01 80 37 (BMS→SMPS)

If the error code is equal to 0x05, indicates no corresponding record.

Step2:

Command: 01 03 00 C9 00 21 55 EC (SMPS→BMS)

Response: 01 03 42 6B 05 12 0C 03 3A 00 00 14 81 02 58 07 D0 0C FD 0C AE 0C D5 0C B7 0C D6 0C D3 0C F1 0C C5 0C CA 0C DE 0C CB 0C DE 0C C4 0C C4 0C CD 0C D0 00 C5 00 C1 00 C1 00 C2 00 D4 00 D0 00 00 00 00 00 00 0C 00 B4 E9 (BMS→SMPS)