BMS communication protocol V82_1.4

Communication setting

Baud rate	9600 bps
Data	8 bit
Parity	None
Stop	1 bit
Flow control	None

Frame basic format

No.	1	2	3	4	5	6	7	8
Mode	SOI	Addr	Cmd	Ver	Len	Info	CRC	EOI
Length	1	1	1	1	2	N	1	1

SOI: start code0x3A

EOI: end code0x7E

Addr: device address (0 universal)

Cmd: Bit6～bit0 is command type， when bit7=0, it is query, when bit7=1, it is response

Ver: protocol version (82)

Len: whole frame length (2byte)

CRC: sum check, add up and negation except SOI and EOI

Data form:

Except SOI and EOI are explained with hexadecimal, and transmitted with hexadecimal, all the other mode are explained with hexadecimal, transmitted with HEX-ASCII, every byte is indicated by two ASCII code, for except when Length=0x4b, it should transmit two bytes, it is 34H (ASCII code of‘4’) and 42 H (ASCII code of 'B'). When in multibyte, the highest byte is at the front, the lowest byte is at the back.

//crc cala method of calibration (C Programming language) U

```
int8 crc=0;
for(j=1;j<i;j+
    +){
    crc += Rx485buf[j];
}
crc^=0xff;
```

Cmd = BIT6~BIT0	1	2	3	4	5	6	9	
Implication	Protection data	Real time data			Data setting	FET operation	Version	

Info Description:

1. read protection data: sendCmd=0x01, Info is empty; receiveCmd = 0x81, Info content is as below;

Modify protection data: Cmd=0x05, info content is as below; return successCmd=0x8A or return failedCmd=0x8B

No.	1	2	3	4	5	6	7	8	9
Content	Addr	CellNum	CSGLimitEn	EngDesign	Rsense	Vref	B.Mode	B.THDIS	B.TLDIS
Lengt	1	1	1	2	2	2	1	1	1

No.	10	11	12	13	14	15	*16*	*17*
Conten	B.VStart	B.VDiff	W.VCell.H	W.VCell.L	W. VBAT.H	W. VBAT.L	*W.TCell.H*	*W.TCell.L*
Length	2	2	2	2	2	2	*1*	*1*

No.	18	19	20	21	22	23	24	25
Conten	W.TENV.H	W.TENV.L	W.TFET.H	W.TFET.L	W.CURR.C	W.CURR.D	W.VDIFF.H	W.VDIFF.L
Length	1	1	1	1	2	2	2	2

No.	26	27	28	29	30	31	32	33	34
Content	OVPVAl	OVPDLY	OVPREL	UVPVAl	UVPDLY	UVPREL	BOVPVAl	BOVPDLY	BOVPREL
Length	2	2	2	2	2	2	2	2	2

No.	35	36	37
Content	BUVPVAl	BUVPDLY	BUVPREL
Length	2	2	2

No.	38	39	40	41	42	43	44	45
content	CTcellHPro	CTcellHRel	CTcellLPro	CTcellLRel	DTcellGHPro	DTcellHRel	DTcellLPro	DtcellLRel
length	1	1	1	1	1	1	1	1

No.	46	47	48	49	50	51	52	53
Content	TenvHPro	TenvHRel	TenvLPro	TenvLRel	TfetHPro	TfetHRel	TfertLPro	TfetLRel
length	1	1	1	1	1	1	1	1

No.	54	55	56	57
Content	CC.PRO.VAL	CC.PRO.PDLY	CC.PRO.RDLY	CC.PRO.LOCK
Length	2	2	2	2

No.	58	59	60	61
Content	CD1.PRO.VAL	CD1.PRO.PDLY	CD1.PRO.RDLY	CD1.PRO.LOCK
Length	2	2	2	2

No.	62	63	64	65
Content	CD2.PRO.VAL	CD2.PRO.PDLY	CD2.PRO.RDLY	CD2.PRO.LOCK
Length	2	2	2	2

No.	66	67	68	69	70	71
Content	SHORT.VAL	SHORT.RDLY	SHORT.LOCK	HEAT.EN	HEAT.TSTART	HEAT.TEND
Length	1	2	2	1	1	1

Addr: bms boardRS485 Address 1~255
CellNum: battery cells in series5~16S
CSGLimitEn: current-limiting enable
EngDesign：Design capacity
(0.1AH)
Rsense: Sampling resistor
(0.01mR）
Vref: voltage for reference mv
B.Mode：balance mode0~2，0：non-balance 1：charge balance 2: charge and static balance
B.THDIS: high temperature balance cutoff value 40: 0℃； 65: 25℃
B.TLDIS: low temperature balance cutoff value
B.Start：balance start voltage（mV）
BDVdiff：balance start dropout voltage（mV）

W.Vcell.H: single cell high voltage warning value mv
W.VCell.L ： single cell low voltage warning value
W.VBAT.H: battery pack high voltage warning value
W. VBAT.L: battery pack low voltage warning value

W.Tcell.H: battery high temperature warning value
W.Tcell.L ： battery low temperature warning value
W.Tenv.H: working environment high temperature warning value
W.Tenv.L: working environment low temperature warning value
W.Tfet.H: power high temperature warning value
W.Tfet.L: power low temperature warning value

W.CURR.C: charge current warning value 0.01A
W.CURR.D: discharge current warning value
W. VDIFF.H: dropout voltage warning value
W. VDIFF.L: dropout voltage warning release value

OVPVal：single cell over-charge voltage
OVPDLY：single cell over-charge delay time
OVPREL：single cell over-charge release voltage
UVPVal：single cell over-discharge voltage
UVPDLY：single cell over-discharge delay time
UVPREL：single cell over-discharge release voltage

OVPVal：battery pack over-charge voltage
OVPDLY：battery pack over-charge protection delay time
OVPREL： battery pack over-charge protection release voltage

UVPVal：battery pack over-discharge voltage
UVPDLY：battery pack over-discharge protection delay time
UVPREL： battery pack over-discharge protection release voltage
CTcellHPro：battery cell charge high temperature protection
CTcellHREL：battery cell charge high temperature protection release
CTcellHPro：battery cell charge low temperature protection
CTcellHREL：battery cell charge low temperature protection release
CTcellHPro：battery cell discharge high temperature protection
CTcellHREL：battery cell discharge high temperature protection release
CTcellHPro：battery cell discharge low temperature protection
CTcellHREL：battery cell discharge low temperature protection release
CTcellHPro：battery cell environment high temperature protection
CTcellHREL：battery cell environment high temperature protection release
CTcellHPro：battery cell environment low temperature protection
CTcellHREL：battery cell environment low temperature protection release
CTcellHPro：battery cell power high temperature protection
CTcellHREL：battery cell power high temperature protection release
CTcellHPro：battery cell power low temperature protection
CTcellHREL：battery cell power low temperature protection release

CC.PRO.VAL： charge current protection value
CC.PRO.PDLY： charge current protection delay time
CC.PRO.RDLY： charge current protection release delay time
CC.PRO.LOCK： charge current protection lock
CD1.PRO.VAL： first-grade discharge protection value
CD1.PRO.PDLY： first-grade discharge current protection delay time
CD1.PRO.RDLY： first-grade discharge current protection release delay time
CD1.PRO.LOCK： first-grade discharge current protection lock
CD2.PRO.VAL： second-class discharge protection value
CD2.PRO.PDLY： second-class discharge current protection delay time
CD2.PRO.RDLY： second-class discharge current protection release
CD2.PRO.LOCK： second-class discharge current protection lock

SHORT.VAL： charge current protection value
SHORT.RDLY： charge current protection delay time
SHORT.LOCK： charge current protection lock

HEAT.EN: warming function enable
HEAT.EN: warming turn on temperature
HEAT.EN: warming turn off temperature

Read protection data command
AscII
:000100000E09~
: (SOI)00(addr)01(cmd)00(ver)000E(len)09(crc)~ (EOI)
Related hex number：
3A 30 30 30 31 30 30 30 30 30 45 30 39 7E
30 30 30 31 30 30 30 30 30 45 the sum is F6
F6^FF=09 , hex->AscII 09

For example：cellnum，0x0D = 13 HEX-ASCII indicate as 0D
Return information： AscII code

:01815200EA010F0000A0006D0CE4025A230FA0001E10040CE4781E60AE5F285F2
8692806400DAC03E80384109A006410040AF000640CE47B0C00C8781E57E401F46
0AE5F5A282B6E6414196E641419786E000F064000640BB800030DAC00640BB8000
31194000A0BB800030103E8000300232DF2~

:(SOI) 01(addr)81(cmd)52(ver82)00EA(len)01(addr)0F(CellNum)
00(CSGLimitEn)00A0(EngDesign 16Ah)006D(Rsense 109)0CE4(Vref 3300)
02(B.Mode)5A(B.THDIS)23(B.TLDIS)0FA0(B.VStart)001E(B.VDiff)
1004(W.VCell.H)0CE4(W.VCell.L)781E(W. VBAT.H)60AE(W.VBAT.L)5F(W.TCell.H)
28(W.TCell.L)5F(W.TENV.H)28(W.TENV.L)69(W.TFET.H)28(W.TFET.L)
0640(W.CURR.C)0DAC(W.CURR.D)03E8(W.VDIFF.H)0384(W.VDIFF.L)
109A(OVPVAl)0064(OVPDLY)1004(OVPREL)0AF0(UVPVAl)0064(UVPDLY)0CE4(UVPR
EL)
7B0C(BOVPVAl)00C8(BOVPDLY)781E(BOVPREL)57E4(BUVPVAl)01F4(BUVPDLY)60A
E(BUVPREL)
5F(CTcellHPro)5A(CTcellHRel)28(CTcellLPro)2B(CTcellLRel)
6E(DTcellGHPro)64(DTcellHRel)14(DTcellLPro)19(DTcellLRel)
6E(TenvHPro)64(TenvHRel)14(TenvLPro)19(TenvLRel)
78(TfetHPro)6E(TfetHRel)00(TfetLPro)0F(TfetLRel)
0640(CC.PRO.VAL)0064(CC.PRO.PDLY)0BB8(CC.PRO.RDLY)0003(CC.PRO.LOCK)
0DAC(CD1.PRO.VAL)0064(CD1.PRO.PDLY)0BB8(CD1.PRO.RDLY)0003(CD1.PRO.LOCK)
1194(CD2.PRO.VAL)000A(CD2.PRO.PDLY)0BB8(CD2.PRO.RDLY)0003(CD2.PRO.LOCK)
01(SHORT.VAL)03E8(SHORT.RDLY)0003(SHORT.LOCK)
00(HEAT.EN)23(HEAT.TSTART)2D(HEAT.TEND)F2(CRC)~(EOI)

2. request real time info Cmd=0x02, info is empty; return Cmd=0x82, info content as below:

No.	1	2	3	4	5	6	7	8	9	10	11	12
Content	Time_t	Vbat	Vcell_num	Vcell[n]	Curr[2]	Temp Num	Temp[m]	VState	CState	TState	Alarm	FETState
Length	7	2	1	2*n	2*2	1	1*m	2	2	2	2	1
No.	13	14	15	16	17	18	19	20	21	22		
Content	WARN_VOV	WARN_VUV	WARN_VHIGH	WARN_VLOW	BlanceState	DchgNum	ChgNum	SOC	CapNow	CapFull		
Length	2	2	2	2	2	2	2	1	2	2		

Time_t: time, 7bit: year, month, day, week, hour, minute, second;
Vbat：battery voltage, output is 0.5 times of the total voltage;
Vcell_num: battery cells in series, 1-16；
Vcell[n]：every single battery cell voltage mV;
Curr[2]: Curr[0] charge current，Curr[1] discharge current;
TempNum: temperature sampling numbers;
Temp[m]: every temperature data，65 indicates 25℃，Temp+40；
Vstate , Cstate, Tstate,：data structure as below

```
struct _VSTATE_
{
        uint16_t VOV:1; //single cell overvoltage
        uint16_t VUV:1; //single cell undervoltage
        uint16_t BVOV:1//battery pack overvoltage
        uint16_t BVUV:1; //battery pack undervoltage
        uint16_t wVOV:1; //single cell overvoltage warning value
        uint16_t wVUV:1; //single cell undervoltage warning value
        uint16_t wBVOV:1; //battery pack overvoltage warning value
        uint16_t wBVUV:1; //battery pack undervoltage warning value

        uint16_t VDIFF:1; //dropout voltage protection
        uint16_t VBREAK:1; //disconnection
        uint16_t CSGDIS:1; //low voltage，prohibit charging
};
struct _CSTATE_
{
        uint16_t CING:1; //charge status
        uint16_t DING:1; //discharge status
        uint16_t OCCSG:1; //over-current charge
        uint16_t SHORT:1; //short-circuit protection
        uint16_t OCDSG1:1; //over-current discharge first-grade
        uint16_t OCDSG2:1;//over-current discharge second-class
        uint16_t wOCCSG:1; //charge current warning value
        uint16_t wOCDSG:1; //discharge current warning value
};

struct _TSTATE_
{
        uint16_t TCELL_CSGH:1; //charge high temperature
        uint16_t TCELL_CSGL:1; //charge low temperature
        uint16_t TCELL_DSGH:1; //discharge high temperature
        uint16_t TCELL_DSGL:1; //discharge low temperature
        uint16_t TENV_H:1; //environment high temperature
        uint16_t TENV_L:1; //environment low temperature
        uint16_t TFET_H:1; //power high temperature
        uint16_t TFET_L:1; //power low temperature

        uint16_t wTCELL_H:1; //battery cell high temperature warning
        uint16_t wTCELL_L:1; // battery cell low temperature warning
        uint16_t wTENV_H:1; // environment high temperature warning
        uint16_t wTENV_L:1; // environment low temperature warning
        uint16_t wTFET_H:1; // power high temperature warning
        uint16_t wTFET_L:1; // power low temperature warning
        };
```

Alarm data structure as below:

```
struct _ALARM_
{
        uint16_t bit0:1;  //voltage warning, dropout voltage protection, disconnection protection
        uint16_t bit1:1;  //charge fet damage warning
        uint16_t bit2:1;  //SD ERR 1,error 0,normal
        uint16_t SPI_ERR:1;      //ML5238 communication
        uint16_t E2PROM_ERR:1;          //external storage: E2PROM ERR 1,error 0,normal
        uint16_t bit5:1;   //reserved
        uint16_t FCC_UPDATING:1;      //charge study turn on status
        uint16_t FCC_DSGLEARN:1;     // discharge study turn on status
};
```

FETState data structure as below

```
struct _FETSTATE_
{
        uint8_t DFET:1;      //discharge on/off status，1 means on，0 means off
        uint8_t CFET:1;  //charge on/off status, 1 means on
        uint8_t SDFET:1; // discharge on/off，1 means on，0 means off
        uint8_t SCFET:1; // charge on/off, 1 means on

        uint8_t DFET_DAMAGE:1; //discharge MOS status，1 means damaged
        uint8_t CFET_DAMAGE:1; //charge MOS status ，1 means damaged
        uint8_t CCFET:1;  //reserved，1 means on

};
```

WARN_VOV：single cell high voltage warning value mV
WARN_VOV：single cell undervoltage warning value
WARN_VHIGH：battery pack high voltage warning value
WARN_VLOW：battery pack undervoltage warning value
BlanceState： balance status, indicate which battery cell balance function on
DchgNum：discharge number
ChgNum：charge number
SOC : battery soc ， percentage 0-100
CapNow: current capacity
CapFull: full charge capacity

Example as following

Send data

:000200000ee8~

: (SOI),00(addr),02(cmd),00(ver),000e(len),e8(crc),~ (EOI)

Received data

: (SOI),01(addr),82(cmd),52(ver),0090(len), 00000000000000(time_t)
48F8(Vbat),0A(cell_num=10),0EA9(v1),0EB3(v2),0EB6(v3),0EB4(v4),0E8C(v5),0EB4(v6),0E45(v7)
,0E9E(v8),0E9E(v9),0E6A(v10),0000(curr[0]),0000(curr[1]),02(TempNum),47(temp[0]),
45(temp[1]),0000(Vstate),0000(Cstate),0000(Tstate),0000(Alarm),0F(FetState),
0000(WARN_VOV),0000(WARN_VUV),0000(NUM_WARN_VHIGH),0000(NUM_WARN_VLOW),00
00(BlanceState),0000(DchgNum),0000(ChgNum),2D(soc),0048(CapNow),00A0(CapFull),
4E(CRC),~ (EOI),

3. FET operation requestCmd=0x06, info as below

BIT0	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7
DFET	CFET	NC	NC	NC	NC	NC	NC

SFET: FET operation,
BIT0 is the status of DFET 1 means on, 0 means off.Discharging swtich
BIT1 is the status of CFET, 1 means on, 0 means off. Charging swtich

Send data
:000652001002AF~
:(soi)00(addr)06(cmd)52(ver)0010 (len)02(info)AF(crc)~(eoi)

Reievece data
:018A5200100697~

:(soi)01(addr)8A(cmd_ret)52(ver)0010(len)06(info)97(crc)~(eoi)

4. Get version information Cmd=0x09, info is the version no. information, txt format.
For example: V1.1 version, which means returns to V1.1 version.

5. Return value
Cmd = 0x8A return successful
Cmd = 0x8B return failed

5. Get cap of battery Cmd = 0x10(the unit is 0.1AH)
:001000000ee9~except soi,crc,eoi and the data is: 001000000e the hex code 30 30 31 30 30 30 30 30 30 65 the crc =16, 0x16^0xff= e9 the AsII code crc=e9 , So ,the cmd is :001000000ee9~
Example:
:001000000ee9~ send data
:019052001E000000FA01F401F49B~ receive data
: (SOI)01(addr)90(cmd)52(ver) 001E(len)
0000(cap_study)00FA(cap_now)01F4(cap_full)01F4(cap_design)9B(crc)~ (EOI)