PATHFINDER BMS

Datasheet supplement

Serial API

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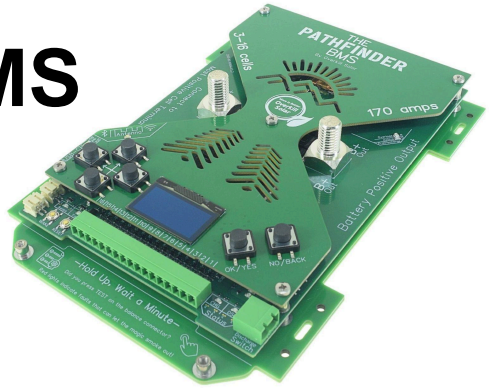
(incomplete)



This document details the Serial API (communication protocol) for the Pathfinder BMS.

Introduction

The Pathfinder BMS provides a serial API for communication with various external applications. This API is accessible via the USB-C port, the UART port, and the Bluetooth wireless connection.

We will not change the existing opcodes or register definitions. When new features are added we will append new opcodes.

When using wired communication, care should be taken to avoid differences in ground potential, which is common in battery systems. Neither of the Pathfinder's wired ports are isolated. Overkill Solar supplies an isolated USB-UART module that works well with the Pathfinder BMS.
When connecting the USB port, make sure that there is no voltage present between the cable shell and connector shell before plugging it in.
When connecting to the UART port, make sure there is no voltage between the grounds. This interface is not tolerant of voltage differentials. Voltage over 3.3v on either TX or RX pin will damage the user interface controller. An isolated interface is strongly recommended.

When communicating via Bluetooth, a passkey is used to prevent unauthorized communication. Bluetooth traffic is also encrypted via Bluetooth Low Energy (BLE) Secure Manager Protocol (SMP) with LE Secure Connections (LESC).
When communicating via the wired interfaces, the passkey is not used.

The UART uses standard 8-N-1 settings at 115200 baud, with no flow control. (not adjustable)

The USB port appears as a virtual COM port (CDC-ACM device) to the host. The same settings can be used with terminal programs using the virtual COM port.

Serial message format

The Pathfinder BMS will only listen and respond to requests via the serial API. The internal data registers are updated once per second (1Hz), so the host application should request new data once per second to stay up to date.
Both wired ports also stream system logs and/or CSV formatted logs if enabled. The host application should ignore any traffic without the proper framing bytes. If the user interface reboots, some system logs will be streamed on the UART only, even if system logs were disabled previously.

All streaming logs will be automatically silenced when the serial API is active on the same port.

Every exchange starts with a request from the host application.
Messages on the wired ports are composed of a start byte, length byte, opcode, checksum, and stop byte.

The BMS will respond with a start byte, length byte, opcode, data bytes, checksum, and stop byte.

Checksum is calculated on the length, opcode, and data bytes.

Numerical values are always padded to a fixed 4 bytes or 32 bits each regardless of their actual data type. String/ASCII values return the actual data without a null terminator.

The serial stream for numerical values uses little-endian format, meaning the least significant byte is sent first. For example, the 32-bit value 3100 (`0x00000C1C`) is transmitted as the byte sequence: `0x1C 0x0C 0x00 0x00`
When these bytes are reassembled in little-endian order, they form the 32-bit integer `0x00000C1C`, which equals 3100 in decimal.

Note: Bluetooth messages contain only the opcode and data, because the bluetooth layer has built in framing and error checking.

Example request and response

The host application requests the manufacturer name: `0x FE 01 05 6394 FD`

Start	Length	Opcode	Checksum	Stop
`0xFE`	`0x01`	`0x05 (read MFG name)`	`0x6394`	`0xFD`

The BMS responds with the same opcode and the requested data:
`0x FE 0F 05 5041544846494E44455220424D53 7A5E FD`
Length includes opcode+data.

Start	Length	Opcode	Data	Checksum	Stop
`0xFE`	`0x0F`	`0x05`	`0x50 41 54 48 46 49 4e 44 45 52 20 42 4d 53`	`0x7A5E`	`0xFD`
	15 bytes	MFG Name	PATHFINDER BMS (ASCII String, no terminator)		

Checksum

The checksum algorithm is **CRC-16-CCITT**

Checksum is calculated on the length, opcode, and data bytes.

In the above example request, the length 0x01 and opcode 0x05 go into the checksum calculation and the result is 0x6394

In the example response, the length 0x0F, opcode 0x05, and data 0x5041544846494e44455220424d53 go into the checksum calculation and the result is 0x7A5E

CRC Type: CRC-16-CCITT
Polynomial: 0x1021
Initial value: 0x0000
Endianness: Big-endian (most significant byte first)

For manual testing, this calculator produces the correct checksum:
https://crccalc.com/?crc=0105&method=CRC-16/XMODEM&datatype=hex&outtype=hex

List of Instruction Opcodes

The Pathfinder BMS will include the same instruction opcode in its response to indicate success.
In the case of a failure, one of the failure opcodes will be returned instead.
All messages include Length as the second byte and Opcode as the third byte.

Hex	Description	Request Format	Response Format (success only)
0x01	Request MFG data	Opcode only	Opcode + predefined data sequence
0x02	Request all settings	Opcode only	Opcode + predefined data sequence
0x03	Request basic info	Opcode only	Opcode + predefined data sequence
0x04	Request cell voltages	Opcode only	Opcode + predefined data sequence
0x05	Read device name	Opcode only	Opcode + data(string)
0x06	Passkey login (Bluetooth only)	Opcode, Data	Opcode only
0x0E	Write parameter register	Opcode, Address, Data	Opcode only
0x11	Set BMS Advertising Name	Opcode, Data(String)	Opcode only
0x16	Read MFG name	Opcode only	Opcode + data(string)
0x18	Set Idle Current	Opcode only	Opcode only

Hex	Description	Request Format	Response Format (success only)
0x19	Calibrate Current Gain	Opcode, data(integer)	Opcode, data(integer)
0x1A	Request Current Cal State	Opcode only	Opcode, data(string)
0x1B	Read MFG Build Data and Time	Opcode only	Opcode, data(string)
0x1C	Read BMS Advertising Name	Opcode only	Opcode, data(string)
0x1D	Reset Session Values	Opcode only	Opcode only
0x1E	Calibrate Stack Voltage	Opcode, data(integer)	Opcode, data(integer)
0x1F	Calibrate B+ voltage	Opcode, data(integer)	Opcode, data(integer)
0x30	Remote button press	Opcode, data(integer)	Opcode, data(integer)
0x31	Frame buffer chunk	Opcode only	Opcode, data
0x32	Reset Alarm Counts	Opcode only	Opcode only

List of Failure Response Opcodes

The BMS will respond with different opcodes to reflect the status of an operation.
For "success", it will respond with the same opcode (plus the requested data, when applicable).
For failure statuses, it will respond with one of the failure opcodes:

Hex	Description
0x20	Login required
0x21	Data out of range
0x22	String too long
0x23	Invalid or unknown register
0x24	Bad checksum
0x26	Bad i2c checksum
0x27	Wrong Password
0x2D	Value Clamped

Start and End bytes:

The start byte is always 0xFE
The end byte is always 0xFD

Data Type Abbreviations

U8 = 8 bit unsigned byte
I8 = 8 bit signed byte
U16 = 16 bit unsigned
I16 = 16 bit signed
U32 = 32 bit unsigned
I32 = 32 bit signed
bool = boolean - true or false

Opcode Details

0x01 Request MFG Data

Returns a preformatted sequence containing the lot code and firmware version.

Example:
The host sends `FE 01 01 23 10 FD`
The BMS responds `FE 0D 01 02 00 00 00 00 00 00 00 DF 00 00 00 52 CB FD`
The data breaks down to: lot code 2, version number 0.223

Data Type	Description	Example hex data	Example parsed data
I32	Lot_code	02 00 00 00	2
I32	Firmware_version_major	00 00 00 00	0
I32	Firmware_version_minor	DF 00 00 00	223

0x02 Request All Settings

Returns a preformatted sequence containing all of the BMS user configurable settings (parameters). Note: Each piece of data is transmitted as a 32 bit signed integer, regardless of its actual data type. The host's serial parser should convert to the original data type to avoid overflowing the values. See the Pathfinder datasheet for the min max ranges of each BMS parameter.

Use this message to get any/all of the settings- the API does not provide individual read access yet. (We may add an opcode to read a single register in the future)

Some of these data registers have unusual units with formulas or multipliers because they are mapped directly to registers in the BQ76952 BMS chip or the BQ34Z100 fuel gauge chip.

Example:
The host sends `FE 01 02 13 73 FD`
The BMS responds

```
   FE C9 02 1C 0C 00 00 14 00 00 00 04 00 00 00 37 00 00 00 32 00 00 00
02 00 00 00 00 00 00 00 05 00 00 00 02 00 00 00 3C 00 00 00 37 00 00 00
02 00 00 00 EC FF FF FF F1 FF FF FF 02 00 00 00 48 00 00 00 02 00 00 00
2D 01 00 00 31 00 00 00 02 00 00 00 2D 01 00 00 AC 00 00 00 58 00 00 00
56 FF FF FF 02 00 00 00 0F 00 00 00 90 01 00 00 58 00 00 00 50 00 00 00
41 00 00 00 02 00 00 00 C2 01 00 00 00 00 00 00 1E 00 00 00 E8 03 00 00
01 00 00 00 24 FA FF FF 01 00 00 00 94 11 00 00 00 00 00 00 E8 03 00 00
00 00 00 00 6B 82 03 00 01 00 00 00 01 00 00 00 01 00 00 00 01 00 00 00
B8 0B 00 00 32 00 00 00 10 27 00 00 62 53 FD
```

Data definitions for 0x02 Request All Settings:

Index	Data Type	Description	Example hex data	Example parsed data
0	I16	Balancer Start Voltage	1C 0C 00 00	3100mV
1	U8	Delta to Balance	14 00 00 00	20mV
2	U8	Max Cells to Balance	04 00 00 00	4 cells
3	I8	Charge Overtemp Threshold	37 00 00 00	55c
4	I8	Charge Overtemp Recovery	32 00 00 00	50c
5	U8	Charge Overtemp Delay	02 00 00 00	2s

6	I8	Charge Undertemp Threshold	00 00 00 00	0c
7	I8	Charge Undertemp Recovery	05 00 00 00	5c
8	U8	Charge Undertemp Delay	02 00 00 00	2s
9	I8	Discharge Overtemp Threshold	3C 00 00 00	60c
10	I8	Discharge Overtemp Recovery	37 00 00 00	55c
11	U8	Discharge Overtemp Delay	02 00 00 00	2s
12	I8	Discharge Undertemp Threshold	EC FF FF FF	-20c
13	I8	Discharge Undertemp Recovery	F1 FF FF FF	-15c
14	U8	Discharge Undertemp Delay	02 00 00 00	2s
15	U8	Cell Overvoltage Threshold	48 00 00 00	72*50.6 = 3643mV
16	U8	Cell Overvoltage Recovery Hysteresis	02 00 00 00	2*50.6 = 101mV
17	U16	Cell Overvoltage Delay	2D 01 00 00	301*3.3+6.6 = 999.9ms
18	U8	Cell Undervoltage Threshold	31 00 00 00	49*50.6 = 2479mV
19	U8	Cell Undervoltage Recovery Hysteresis	02 00 00 00	2*50.6 = 101mV
20	U16	Cell Undervoltage Delay	2D 01 00 00	301*3.3+6.6 = 1000ms
21	I32	Charge Overcurrent Threshold	AC 00 00 00	172A
22	U8	Charge Overcurrent Delay	58 00 00 00	88*3.3+6.6 = 297ms
23	I32	Discharge Overcurrent Threshold	56 FF FF FF	-170A
24	U8	Discharge Overcurrent Delay	02 00 00 00	2*3.3+6.6 = 10ms
25	U8	Fault Recovery Time (shared)	0F 00 00 00	15s
26	U32	L2 Discharge Overcurrent Threshold	90 01 00 00	400A
27	U8	L2 Discharge Overcurrent Delay	58 00 00 00	88*3.3+6.6 = 297ms
28	U8	L2 FET Overtemp Threshold	50 00 00 00	80c
29	U8	L2 FET Overtemp Recovery	41 00 00 00	65c
30	U8	L2 FET Overtemp Delay	02 00 00 00	2s

31	I32	L3 Short Circuit Threshold	C2 01 00 00	450/0.5 = 900A *note 1
32	I32	L3 Short Circuit Delay	00 00 00 00	0µs
33	U8	L3 Short Circuit Recovery	1E 00 00 00	30s
34	I32	PF Charge Overcurrent	E8 03 00 00	1000A
35	U8	PF Charge Overcurrent Delay	01 00 00 00	1s
36	I32	PF Discharge Overcurrent	24 FA FF FF	-1500A
37	U8	PF Discharge Overcurrent Delay	01 00 00 00	1s
38	I16	PF Cell Overvoltage Threshold	94 11 00 00	4500mV
39	U8	PF Cell Overvoltage Delay	00 00 00 00	0s
40	I16	PF Cell Undervoltage Threshold	E8 03 00 00	1000mV
41	U8	PF Cell Undervoltage Delay	00 00 00 00	0s
42	U32	Design Capacity	6B 82 03 00	229,995mAh
43	bool	NTC1 Active	01 00 00 00	true
44	bool	NTC2 Active	01 00 00 00	true
45	bool	NTC3 Active	01 00 00 00	true
46	bool	NTC4 Active	01 00 00 00	true
47	U32	Predischarge Timeout	B8 0B 00 00	3000ms
48	U8	Predischarge Target Percent	32 00 00 00	50%
49	U32	Predischarge Retry Time	10 27 00 00	10,000ms

Note 1:

L3 Short Circuit Threshold (SCD) is in shunt millivolts. The Pathfinder shunt resistance is 0.5mΩ. The value is set by a lookup table. Possible values are 0-15, representing 10mv to 500mv. Write this value in mV, and divide by 0.5 to display amps.
Lookup Table: {10,20,40,60,80,100,125,150,175,200,250,300,350,400,450,500}mV

0x03 Request Basic Info

Returns a preformatted sequence containing BMS live data.

This is the largest preformatted message. The host must be able to handle 218 bytes in its receive buffer.

Example:

The host sends `FE 01 03 03 52 FD`

The BMS responds

```
    FE D5 03 BC 14 00 00 00 00 00 00 00 00 00 00 6B 82 03 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 DF 00 00 00 00 00 00 00
01 00 00 00 01 00 00 00 01 00 00 00 01 00 00 00 01 00 00 00 10 00 00 00
01 00 00 00 01 00 00 00 01 00 00 00 01 00 00 00 A2 0B 00 00 A1 0B 00 00
A8 0B 00 00 E3 0B 00 00 FF FF 00 00 6C CF 00 00 4E CF 00 00 00 00 00 80
12 00 00 00 00 00 00 80 BB 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 4F 00 00 00 00 00 00 00
FF FF 00 00 FF FF 00 00 00 00 00 00 E5 00 00 00 00 00 00 00 7A 14 00 00
E0 F3 FD
```

Data definitions for 0x03 Request Basic Info:

Index	Data Type	Description	Example hex data	Example parsed data
0	I16	Stack Voltage (10mV)	`BC 14 00 00`	53080mV
1	I32	Pack Current (mA)	`00 00 00 00`	0mA
2	U32	Remaining Capacity (mAh)	`00 00 00 00`	0mAh
3	U32	Reserved	`6B 82 03 00`	Reserved
4	U32	Cycle Count	`00 00 00 00`	0
5	U16	Cell Balancer Status (bitfield)	`00 00 00 00`	1 = balancing. 16 bits
6	U32	Current Errors 1 (bitfield) (note 3)	`00 00 00 00`	none
7	U32	Current Errors 2 (bitfield) (note 3)	`00 00 00 00`	none
8	I32	firmware_version_major	`00 00 00 00`	0

9	I32	firmware_version_minor	DF 00 00 00	223
10	U8	State of Charge (SOC)	00 00 00 00	0%
11	U8	CHG FET status (0=off 1=on)	01 00 00 00	on
12	U8	DSG FET status (0=off 1=on)	01 00 00 00	on
13	U8	CHG FET command (0=off 1=on)	01 00 00 00	on
14	U8	CHG FET command (0=off 1=on)	01 00 00 00	on
15	U8	DSG switch state (0=off 1=on)	01 00 00 00	on
16	I32	Cell Count (3 to 16)	10 00 00 00	16
17	U8	NTC1 active (0=disabled 1= active)	01 00 00 00	active
18	U8	NTC1 active (0=disabled 1= active)	01 00 00 00	active
19	U8	NTC1 active (0=disabled 1= active)	01 00 00 00	active
20	U8	NTC1 active (0=disabled 1= active)	01 00 00 00	active
21	I32	NTC1 temperature (.1 kelvin)	A2 0B 00 00	297.8k
22	I32	NTC2 temperature (.1 kelvin)	A1 0B 00 00	297.7k
23	I32	NTC3 temperature (.1 kelvin)	A8 0B 00 00	298.4k
24	I32	NTC4 temperature (.1 kelvin)	E3 0B 00 00	304.3k
25	U16	Active cell inputs (0=disabled 1= active)	FF FF 00 00	0b1111111111111111
26	I32	Session values Max Voltage	6C CF 00 00	53,100mV
27	I32	Session values Min Voltage	4E CF 00 00	53,070mV
28	I32	Session values Max Charge Current	00 00 00 80	Invalid mA (note 2)
29	I32	Session values Max Discharge Current	12 00 00 00	18mA
30	I32	Session values Max Charge Power	00 00 00 80	Invalid mW (note 2)
31	I32	Session values Max Discharge Power	BB 03 00 00	955mW

32	U16	alarm_count_charge_undertemp	00 00 00 00	0
33	U16	alarm_count_discharge_undertemp	00 00 00 00	0
34	U16	alarm_count_internal_undertemp	00 00 00 00	0
35	U16	alarm_count_charge_overtemp	00 00 00 00	0
36	U16	alarm_count_discharge_overtemp	00 00 00 00	0
37	U16	alarm_count_internal_overtemp	00 00 00 00	0
38	U16	alarm_count_fet_overtemp	00 00 00 00	0
39	U16	alarm_count_cell_undervolt	00 00 00 00	0
40	U16	alarm_count_cell_overvolt	00 00 00 00	0
41	U16	alarm_count_charge_overcurrent	00 00 00 00	0
42	U16	Alarm count L1 DSG over current	00 00 00 00	0
43	U16	Alarm count L2 DSG over current	00 00 00 00	0
44	U16	alarm_count_discharge_short_circuit	00 00 00 00	0
45	U16	Reset count	4F 00 00 00	79
46	U8	State of Charge SOC confidence %	00 00 00 00	%
47	U16	Time to Full	FF FF 00 00	minutes
48	U16	Time to Empty	FF FF 00 00	minutes
49	U8	State of Health SOH %	00 00 00 00	%
50	U32	Design Capacity	E5 00 00 00	229Ah
51	U32	Measured Capacity	00 00 00 00	0Ah
52	I16	B+ terminal voltage (10mV)	7A 14 00 00	52,420mV

Note 2:

Integer min/max values indicate unavailable or invalid data.
Example- *Session values Max Charge Current* at int32_min indicates no data or unavailable data.

Note 3:

Current errors (alarms) are packed into 2 bitfields.
Current Errors 1:

Bit Position	Alarm Label	Description
0	SCD	DSG Short circuit
1	OCD2	(unused)
2	OCD1	Level 2 DSG overcurrent
3	OCC	CHG Over Current
4	COV	Cell over voltage
5	CUV	Cell under voltage
6	OTF	FETs over temperature (NTC3)
7	OTINT	Internal over temperature (NTC4)
8	OTD	DSG over temperature (NTC1 & NTC2)
9	OTC	Charge over temperature (NTC1 & NTC2)
10	UTINT	Internal under temperature (NTC4)
11	UTD	DSG under temperature (NTC1 & NTC2)
12	UTC	CHG under temperature (NTC1 & NTC2)
13	OCD3	Level 1 DSG over current
14	SCDL	(unused)
15	OCDL	(unused)
16	COVL	(unused)
17	PTO	(unused)
18	HWDF	(unused)
19	CUDEP	(unused)
20	SOTF	(unused)
21	SOT	(unused)
22	SOCD	PF DSG over current

Bit Position	Alarm Label	Description
23	SOCC	PF CHG over current
24	SOV	PF over voltage
25	SUV	PF under voltage
26	SCDLPF	(unused)
27	VIMA	(unused)
28	VIMR	(unused)
29	2LVL	(unused)
30	DFETF	(unused)
31	CFETF	(unused)

Current Errors 2:

Bit Position	Alarm Label	Description
0	CMDF	(unused)
1	HWMX	(unused)
2	VSSF	(unused)
3	VREF	(unused)
4	LFOF	(unused)
5	IRMF	(unused)
6	DRMF	(unused)
7	OTPF	(unused)

0x04 Request Cell Voltages

Returns a preformatted sequence containing the voltage of all 16 cell voltage inputs

Example:
The host sends `FE 01 04 73 B5 FD`
The BMS responds `FE 41 04 0e 0d 00 00 05 00 00 00 05 00 00 00 05 00 00 00 05 00 00 00 05 00 00 00 05 00 00 00 11 0d 00 00 10 0d 00 00 05 00 00 00 05 00 00 00 05 00 00 00 05 00 00 00 05 00 00 00 05 00 00 00 11 0d 00 00 17 B3 FD`

This example has only 4 active cells at cell inputs 1,8,9,16 (data word index 0,7,8,15)
The voltage of unused cell inputs may be reported as +/- a few millivolts and should be ignored.

0x05 Read device name

Returns an ASCII string containing the device name, without a null terminator.

Example:
The host sends `FE 01 05 6394 FD`
The BMS responds
`FE 0F 05 50 41 54 48 46 49 4E 44 45 52 20 42 4D 53 7A5E FD`

In ASCII, the payload is “PATHFINDER BMS”

0x06 Passkey login (Bluetooth only)

This opcode is only used for bluetooth. The serial API does not request passkeys on wired ports.

0x0E Write parameter register

Write to a single data register. This opcode includes a target register and a 32 bit payload. All data is padded to 32 bits regardless of the register data type.

Example:
The host application writes 56c to charge over temp threshold (register 03):
`FE 06 0E 03 38 00 00 00 667E FD`

Start	Length	Opcode	target	Data	Checksum	Stop
FE	06	0E	03	38 00 00 00	667E	FD

The BMS responds with the same opcode and no data to indicate success:
`0x FE 01 0E D2FF FD`

Target register definitions:

Reg	Description	Type	Min	Max	Units
0	Balancer Start Voltage	I16	0	5000	mV
1	Delta to Balance	U8	0	255	mV
2	Max Cells to Balance	U8	0	16	count
3	Charge Overtemp Threshold	I8	-40	120	°C
4	Charge Overtemp Recovery	I8	-40	120	°C
5	Charge Overtemp Delay	U8	0	255	s
6	Charge Undertemp Threshold	I8	-40	120	°C
7	Charge Undertemp Recovery	I8	-40	120	°C
8	Charge Undertemp Delay	U8	0	255	s
9	Discharge Overtemp Threshold	I8	-40	120	°C
10	Discharge Overtemp Recovery	I8	-40	120	°C
11	Discharge Overtemp Delay	U8	0	255	s
12	Discharge Undertemp Threshold	I8	-40	120	°C
13	Discharge Undertemp Recovery	I8	-40	120	°C
14	Discharge Undertemp Delay	U8	0	255	s

Reg	Description	Type	Min	Max	Units
15	Cell Overvoltage Threshold	U8	20	110	50.6mV
16	Cell Overvoltage Recovery Hysteresis	U8	2	20	50.6mV
17	Cell Overvoltage Delay	U16	1	2047	val*3.3+6.6ms
18	Cell Undervoltage Threshold	U8	20	90	50.6mV
19	Cell Undervoltage Recovery Hysteresis	U8	2	20	50.6mV
20	Cell Undervoltage Delay	U16	1	2047	val*3.3+6.6ms
21	Charge Overcurrent Threshold	U8	2	62	A
22	Charge Overcurrent Delay	U8	1	127	val*3.3+6.6ms
23	Discharge Overcurrent Threshold	I16	-32768	0	A
24	Discharge Overcurrent Delay	U8	0	255	val*3.3+6.6ms
25	Fault Recovery Time (shared)	U8	1	255	s
26	L2 Discharge Overcurrent Threshold	U8	2	100	A
27	L2 Discharge Overcurrent Delay	U8	1	127	val*3.3+6.6ms
28	L2 FET Overtemp Threshold	U8	0	150	°C
29	L2 FET Overtemp Recovery	U8	0	150	°C
30	L2 FET Overtemp Delay	U8	0	255	s
31	L3 Short Circuit Threshold (Note 1)	U8	0	15	val/0.5A
32	L3 Short Circuit Delay	U8	1	31	Val-1 *15µs
33	L3 Short Circuit Recovery	U8	0	255	s
34	PF Charge Overcurrent	I16	-32768	32767	10mA
35	PF Charge Overcurrent Delay	U8	0	255	s
36	PF Discharge Overcurrent	I16	-32768	32767	10mA
37	PF Discharge Overcurrent Delay	U8	0	255	s
38	PF Cell Overvoltage Threshold	I16	0	32767	mV
39	PF Cell Overvoltage Delay	U8	0	255	s
40	PF Cell Undervoltage Threshold	I16	0	32767	mV

Reg	Description	Type	Min	Max	Units
41	PF Cell Undervoltage Delay	U8	0	255	s
42	Design Capacity	U32	0	uint32_max	mAh
43	NTC1 Active	U8	0	1	boolean
44	NTC2 Active	U8	0	1	boolean
45	NTC3 Active	U8	0	1	boolean
46	NTC4 Active	U8	0	1	boolean
47	(Reserved)				
48	FET Command (bitfield)	U8	0	0x03	Bit 0 = DSG cmd Bit 1 = CHG cmd
49	Pre-discharge Timeout	U32	200	10,000	ms
50	Pre-discharge Percent	U8	10	90	%
51	Pre-discharge Retry time	U32	10,000	600,000	ms

0x11 Set BMS Advertising Name

Set a new advertising name for the BMS. Max length is 29 char.
Longer strings will return opcode 0x21 Data out of range.

Example: Change the advertising name to “Zoidberg, MD”
The host sends `FE 0D 11 5A 6F 69 64 62 65 72 67 2C 20 4d 44 53 78 FD`

The BMS responds `FE 01 11 31 21 FD`

0x16 Read MFG name

Returns the Manufacturer name. Same procedure as 0x05 Read device name.

0x18 Set Idle Current

Starts the idle current calibration routine

0x19 Calibrate Current Gain

0x1A Request Current Cal State

0x1B Read MFG Build Data and Time

0x1C Read BMS Advertising Name

0x1D Reset Session Values

0x1E Calibrate Stack Voltage

0x1F Calibrate B+ voltage

0x30 Remote control command

Used by the BMS remote control to send a button press, discovery message, or keep-alive message.
The remote sends 0-5 for a button press, or 0xFF for a discovery request.
If the BMS chooses to respond to a discovery request, it will return its WiFi channel number in the first 4 bytes, plus the BMS advertising name string.

The MAC addresses are also exchanged by the transport layer if using the ESP-NOW.

Start, Length, Opcode, data, checksum, stop.

0x31 Frame buffer chunk

When sent as a request this serves as the keep-alive message for the remote control. The BMS will respond with a series of frame buffer chunks if the display has changed, or with an ack if the frame buffer has not changed.
Used by the BMS to stream the OLED frame buffer to a remote control display. The max message size is 250 bytes including framing and checksum, so the ~1kB frame buffer must be split into 5 messages and reassembled by the remote.

Start, Length, Opcode, index, data, checksum, stop.

0x32 Reset alarm counts

Instructs the BMS to reset all the alarm event counts.

Revision History

Aug 1 2025: first revision.