# **LithiumBMS AT Instruction Set**

Version 1.4

TeamBMS 2018

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# Revision history

|  |  |  |
| --- | --- | --- |
| **Version** | **Date** | **Changes** |
| 1.0 | 15.4.2018 | Initial version |
| 1.1 | 15.4.2018 | Fixed AT+BAL command description, added revision history |
| 1.2 | 24.4.2018 | Added more states to fuse status, added AT+P command |
| 1.3 | 24.4.2018 | Added save and load commands |
| 1.4 | 29.4.2018 | Added status and percent commands |

# Overview

This document provides AT commands used by LithiumBMS board and shows examples on how to use them.

### Communication parameters

The LithiumBMS board communicates via two wire serial interface – UART. Pins are labeled on the board (RX, TX). Default speed of communication is 115200bps, with eight data bits, one stop bits and no parity.

# Commands

## Basic configuration commands

### AT+VCUTOFF – Set cutoff voltages per cell

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+VCUTOFF=<min>,<max> | AT+VCUTOFF? |
| **Response** | OK | +VCUTOFF:<min>,<max> |
| **Parameters** | * <min> Lower threshold of voltage per cell * <max> Higher threshold of voltage per cell | |
| **Notes** | * If voltage of any cell is outside of these boundaries, accupack is disconnected (SW fuse triggered) * All values are in volts, floats are accepted | |
| **Examples** | AT+VCUTOFF=3.5,4.25 | AT+VCUTOFF? |

### AT+ICUTOFF – Set cutoff current for software fuse

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+ICUTOFF=<current> | AT+ICUTOFF? |
| **Response** | OK | +ICUTOFF:<current> |
| **Parameters** | * <current> Current threshold | |
| **Notes** | * If current exceeds set value, accupack is disconnected (SW fuse triggered) * All values are in amperes, floats are accepted | |
| **Examples** | AT+ICUTOFF=16 | AT+ICUTOFF? |

### AT+TCUTOFF – Set cutoff temperature of accupack

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+TCUTOFF=<current> | AT+TCUTOFF? |
| **Response** | OK | +TCUTOFF:<temp> |
| **Parameters** | * <temp> Temperature threshold | |
| **Notes** | * If accupack temperature exceeds set value, accupack is disconnected (SW fuse triggered) * All values are in degrees Celsius, floats are accepted | |
| **Examples** | AT+TCUTOFF=45 | AT+TCUTOFF? |

### AT+VBAL – Set min/max delta voltage between cells to turn on/off balancer

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+VBAL=<onValue>,<offValue> | AT+VBAL? |
| **Response** | OK | +VBAL:<onValue>,<offValue> |
| **Parameters** | * <onValue> Turn on delta voltage between cells * <offValue> Turn off delta voltage between cells | |
| **Notes** | * If a cell voltage is different from others more than <onValue>, balancer is turned on * If a cell voltage is different from others less than <offValue>, balancer is turned off * All values are in volts, floats are accepted | |
| **Examples** | AT+VBAL=0.3,0.2 | AT+VBAL? |

### AT+RSENSE – Set current sensing resistor value

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+RSENSE=<resistance> | AT+RSENSE? |
| **Response** | OK | +RSENSE:<resistance> |
| **Parameters** | * <resistance> Current sense resistor value | |
| **Notes** | * All values are in ohms, floats are accepted | |
| **Examples** | AT+RSENSE =0.3,0.2 | AT+RSENSE? |

## Advanced configuration commands

### AT+LED – Enable/disable LED indication

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+LED=<enable> | AT+LED? |
| **Response** | OK | +LED:<enable> |
| **Parameters** | * <enable> Led indication status | |
| **Notes** | * Value of 1 means enabled, value of 0 means disabled | |
| **Examples** | AT+LED=1 | AT+LED? |

### AT+BTN – Enable/disable reset of software fuse using button

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+BTN=<enable> | AT+BTN? |
| **Response** | OK | +BTN:<enable> |
| **Parameters** | * <enable> SW fuse can/cannot be reset with button | |
| **Notes** | * Value of 1 means enabled, value of 0 means disabled | |
| **Examples** | AT+BTN =1 | AT+BTN? |

### AT+EBAL – Enable/disable automatic balancer

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+EBAL=<enable> | AT+EBAL? |
| **Response** | OK | +BTN:<enable> |
| **Parameters** | * <enable> Balancing enabled/disabled | |
| **Notes** | * Value of 1 means enabled, value of 0 means disabled | |
| **Examples** | AT+EBAL=1 | AT+EBAL? |

### AT+VSTIME – Set cell voltage measurement period

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+VSTIME=<period> | AT+VSTIME? |
| **Response** | OK | +VSTIME:<period> |
| **Parameters** | * <period> Period of voltage measurement | |
| **Notes** | * All values are in seconds, floats are accepted | |
| **Examples** | AT+VSTIME=5.0 | AT+VSTIME? |

### AT+ISTIME – Set current measurement period

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+ISTIME=<period> | AT+ISTIME? |
| **Response** | OK | +ISTIME:<period> |
| **Parameters** | * <period> Period of current measurement | |
| **Notes** | * All values are in seconds, floats are accepted | |
| **Examples** | AT+ISTIME=0.25 | AT+ISTIME? |

## Software use control commands

### AT+SWFRES – Reset software fuse

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+SWFRES | - |
| **Response** | OK | - |
| **Parameters** | - | |
| **Notes** | * Reset SW fuse, if triggered | |
| **Examples** | AT+SWFRES | - |

### AT+SWFAUTORES – Enable/disable automatic software fuse reset

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+SWFAUTORES=<enable> | AT+SWFAUTORES? |
| **Response** | OK | +SWFAUTORES:<enable> |
| **Parameters** | * Enable/Disable SW fuse reset with button | |
| **Notes** | * Value of 1 means enabled, value of 0 means disabled | |
| **Examples** | AT+SWFAUTORES=1 | AT+SWFAUTORES? |

## Basic status commands

### AT – Check communication

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT? |
| **Response** | - | OK |
| **Parameters** | - | |
| **Notes** | * Check for communication | |
| **Examples** | - | AT? |

### AT+STATUS – Read current board status

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+STATUS? |
| **Response** | - | +STATUS:<stat> |
| **Parameters** | * <stat> Board status | |
| **Notes** | * 0 – OUTPUT OFF * 1 – DISCHARGING * 2 – CHARGING * 3 – CHARGING/REBALANCING * 4 – CHARGING FINISHED * 5 – CAN NOT CHARGE (INPUT VOLTAGE TOO LOW) * 6 – CAN NOT CHARGE (INPUT VOLTAGE TOO HIGH) | |
| **Examples** | - | AT+STATUS? |

### AT+PERCENT – Read current percentage charge of pack in percent

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+PERCENT? |
| **Response** | - | + PERCENT:<percent> |
| **Parameters** | * < percent > Accupack charge | |
| **Notes** | * All values are in percent, floats accepted | |
| **Examples** | - | AT+PERCENT? |

### AT+VPACK – Read accupack voltage

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+VPACK? |
| **Response** | - | +VPACK:<voltage> |
| **Parameters** | * <voltage> Accupack voltage | |
| **Notes** | * All values are in volts, floats accepted | |
| **Examples** | - | AT+VPACK? |

### AT+I – Read output current value

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+I? |
| **Response** | - | +I:<current> |
| **Parameters** | * <current> Current to/from accupack | |
| **Notes** | * Positive if charging, negative otherwise * All values are in amperes, floats accepted | |
| **Examples** | - | AT+I? |

### AT+P – Read output power value

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+P? |
| **Response** | - | +P:<power> |
| **Parameters** | * <power> Power to/from accupack | |
| **Notes** | * Positive if charging, negative otherwise * All values are in watts, floats accepted | |
| **Examples** | - | AT+P? |

### AT+T – Read accupack temperature

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+T? |
| **Response** | - | +T:<temp> |
| **Parameters** | * <temp> Temperature of accupack | |
| **Notes** | * All values are in degrees Celsius, floats accepted | |
| **Examples** | - | AT+T? |

## Advanced status commands

### AT+NCELLS – Read number of cells connected

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+NCELLS? |
| **Response** | - | +NCELLS:<num> |
| **Parameters** | * <num> Number of detected cells | |
| **Notes** | - | |
| **Examples** | - | AT+NCELLS? |

### AT+VCELLS – Read voltages of all cells

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+VCELLS? |
| **Response** | - | +VCELLS:<v1>,<v2>,…,<v6> |
| **Parameters** | * <vX> Voltage of Xth cell | |
| **Notes** | * All values are in volts, floats accepted | |
| **Examples** | - | AT+VCELLS? |

### AT+BAL – Read balancer status

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+BAL? |
| **Response** | - | +BAL:<b1>,<b2>,…,<b6> |
| **Parameters** | * <bX> Status of balancer for Xth cell | |
| **Notes** | * Value of 1 means on, value of 0 means off * All values are in volts, floats accepted | |
| **Examples** | - | AT+BAL? |

### AT+HWFUSE – Read hardware fuse status

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+HWFUSE? |
| **Response** | - | +HWFUSE:<state> |
| **Parameters** | * <state> Status of HW fuse | |
| **Notes** | * 0 – OK * 1 – OVER CURRENT | |
| **Examples** | - | AT+HWFUSE? |

### AT+SWFUSE – Read software fuse status

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | - | AT+SWFUSE? |
| **Response** | - | +SWFUSE:<state> |
| **Parameters** | * <state> Status of SW fuse | |
| **Notes** | * 0 – OK * 1 – OVER CURRENT * 2 – UNDER VOLTAGE * 3 – OVER VOLTAGE * 4 – OVER TEMPERTATURE | |
| **Examples** | - | AT+SWFUSE? |

## Save and load commands

### AT+SAVE – Save module configuration to EEPROM

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+SAVE | - |
| **Response** | OK | - |
| **Parameters** | - | |
| **Notes** | - | |
| **Examples** | AT+SAVE | - |

### AT+LOAD – Load module configuration from EEPROM

|  |  |  |
| --- | --- | --- |
|  | **Set command** | **Query command** |
| **Command** | AT+LOAD | - |
| **Response** | OK | - |
| **Parameters** | - | |
| **Notes** | - | |
| **Examples** | AT+LOAD | - |