# Applications

* Electric vehicles
* Drones
* Energy storage
* Research programs

# Product summary:

Lithium-ion battery packs requires protection against temperatures, currents & voltages abuses during operation. ENNOID-BMS can accurately monitor temperatures, currents & voltages of lithium-ion battery packs and can allow or interrupt the flow of energy at any moment by switching externals heavy duty contactors. Furthermore, ENNOID-BMS can measure each cell voltage level & trigger the balancing function during the charging process to ensure that all cells have a similar State-Of-Charge (SOC) & voltages. Parameters for balancing, temperature, currents & voltages can be configured by the user through the ENNOID-BMS-Tool software.

# Features

* Modular with master/slave topology
* Isolation between battery pack & components
* Communication between slaves & master through a two-wire daisy chained ISOSPI interface
* Isolated CAN bus interface
* Charger detection circuit
* Isolated voltage measurement for Battery & load voltages
* Isolated bi-directional current monitoring via external delta-sigma current sensor
* 12-24V contactor coil outputs for charge, discharge & precharge
* USB interface for programming and firmware upgrades through an easy to use graphical user interface
* OLED Display & power button

# Block diagram

A screenshot of a cell phone

Description automatically generated

Figure : Simplified block diagram

# Pinout information

## Master board

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A circuit board

Description automatically generated

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12



11



Figure : Master board

|  |  |  |  |
| --- | --- | --- | --- |
| # | Name | Description | |
| 1 | ExtPower | + | 12V DC power input |
| - | ISOGND |
| 2 | Discharge | + | 12V DC output for discharge contactor |
| - | ISOGND |
| 3 | Precharge | + | 12V DC output for precharge contactor |
| - | ISOGND |
| 4 | Charge | + | 12V DC output for charge contactor |
| - | ISOGND |
| 5 | - Discharge + | + | 0-400V DC input for load voltage measurement |
| - | BATGND |
| 6 | - BAT + | + | 0-400V DC input for battery voltage measurement |
| - | BATGND |
| 7 | - Charge + | + | 0-400V DC input for charger detection |
| - | BATGND |
| 8 | Current | 3.3V | +3.3V |
| I+ | Delta-sigma signal from current sensor |
| I- | Not connected |
| GND | ISOGND |
| 9 | Shunt1\* | 3.3V | +3.3V |
| I+ | Differential input + from differential current sensor |
| I- | Differential input - from differential current sensor |
| GND | ISOGND |
| 10 | Master | PA | Isolated ISOSPI communication 2 wire interfaces with slave boards |
| MA | Isolated ISOSPI communication 2 wire interfaces with slave boards |
| 11 | USB | Micro-USB interface with ENNOID-BMS-tool software on a computer | |
| 12 | CAN | EN | External enable signal |
| 5V | External 5V for CAN |
| H | CANH |
| L | CANL |
| GND | CANGND |
| 13 | OLED | 3.3V | +3.3V |
| RST | No connect |
| SDA | SDA signal output for OLED display |
| SCL | SCL signal output for OLED display |
| GND | ISOGND |
| 14 | Power Button | GND | ISOGND |
| N.O. | Normally open pin for power button |
| 3.3V | No connect +3.3V |
| LED | +3.3V for LED |
| GND | ISOGND |
|  | Debug\*\* | +3.3V | |
| SWCLK | |
| ISOGND | |
| SWDIO | |
| NRST | |

\* Current & shunt1 ports requires different components for operating. User must choose which one is appropriate.

\*\*Debug port is not required for operation

## Slave board

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A circuit board

Description automatically generated

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Figure : Slave board

|  |  |  |  |
| --- | --- | --- | --- |
| # | Name | Description | |
| 1 | Master | Isolated ISOSPI communication 2 wire interfaces towards previous slave board or master board | |
| 2 | Slave | Isolated ISOSPI communication 2 wire interfaces towards next slave board | |
| 3 | LAST? | Leave pins unconnected for the last slave board in the battery pack. Otherwise, those pins must be shorted. | |
| 4 | Cells | BAT- | Connect to negative voltage of the battery module |
| 1 to 12 | Connect all pins to the next cells positive voltage levels. |
| 5 | Analog\* | Analog input that can be accessed & sampled if needed | |
| 6 | I2C | I2C communication channel for 8 temperature sensors through external ADC128 IC | |
| 7 | GPIO\* | GPIO for external signal if needed | |

\* Not mandatory for operation

# Software:

Download ENNOID-BMS-Tool software for windows: https://github.com/EnnoidMe/ENNOID-BMS-Tool/releases

A screenshot of a cell phone

Description automatically generated

# ENNOID-BMS configuration

1. Connect to ENNOID-BMS with a micro USB cable. (Be careful, some cheap USB cables cannot carry data and won’t work with ENNOID-BMS)
2. Go into firmware tab and upload latest firmware (this step is needed only for initial setup or uploading a new firmware version)
3. In *“Master Settings”* tab, user can define all parameters of the BMS (*“Slave Settings”* tab is not required for configuring ENNOID-BMS)
4. For real-time data logging & testing the BMS, the “*Data Analysis*” tab shows in real time the measured pack voltage, load voltage, current, Temperatures, BMS status & all cells voltages. You need to click on the “RT” button on the left side of the screen to activate real time communication.
5. Once properly configured, you can operate the ENNOID-BMS with the ON/OFF power button, & the OLED display will show your battery status.

Enjoy!