Applications

- Electric vehicles
- Drones
- Energy storage
- Research programs

Product summary

ENNOID-BMS is a configurable battery management system consisting of a Master board based on an STM32 microcontroller connected through an ISOSPI interface to several modular slave boards. ENNOID-BMS can monitor the specifics temperatures, currents & voltages that are critical for any lithium-ion battery packs. Based on the monitored inputs & the configured parameters, the master board can allow or interrupt the flow of energy from the battery pack by switching the state of external heavy-duty contactors. ENNOID-BMS can measure each cell voltage level & can trigger the passive balancing function during charging for cells above the configured limit to ensure that all cells have a similar State-Of-Charge (SOC). Parameters can be configured through the ENNOID-BMS-Tool software running on a USB connected host computer.

Features

- Modular with master/slave topology
- 12S, 15S & 18S slaves board options
- Up to 400V operation
- Up to 500A continuous operation
- Bolt-on isolated bi-directional current sensor
- Bolt-on heavy duty contactors with direct 12V drive coil outputs for charge, discharge & precharge circuits
- Isolation between high voltage & control circuits
- Communication between slaves & master through a two-wire daisy chained ISOSPI interface
- Isolated CAN bus interface
- Isolated voltage measurement for battery, load & charger
- USB interface for programming and firmware upgrades through an easy to use graphical user interface
- OLED Display & power button
- 0V to 5V cell voltage operation

Block diagram

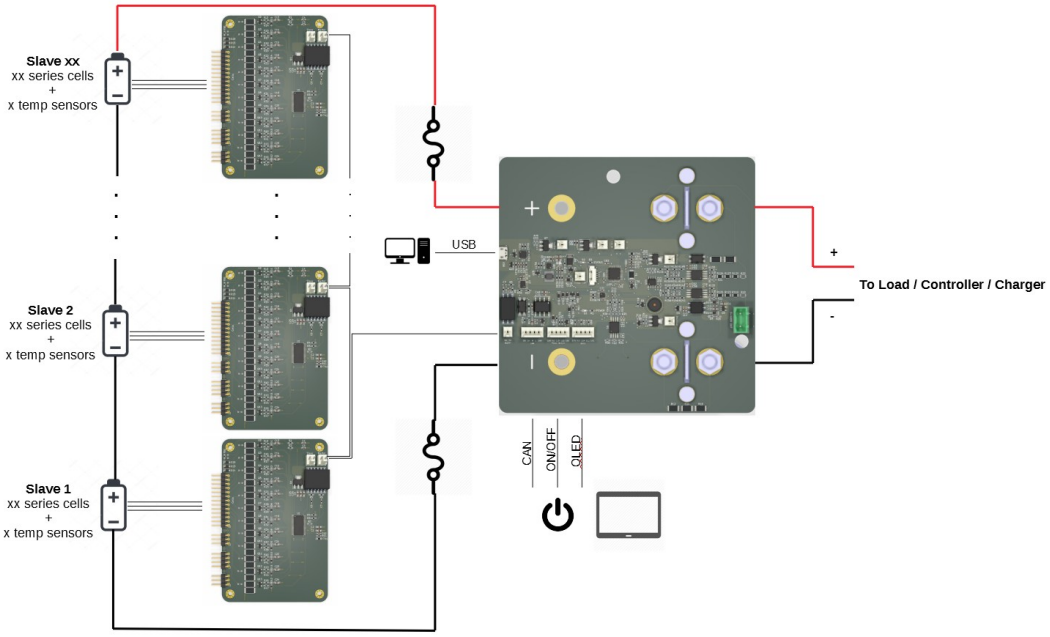


Figure 1: Simplified block diagram

Pinout information

Master board

The master board is equipped with an STM32F3 microcontroller which controls all functions of the battery management system.

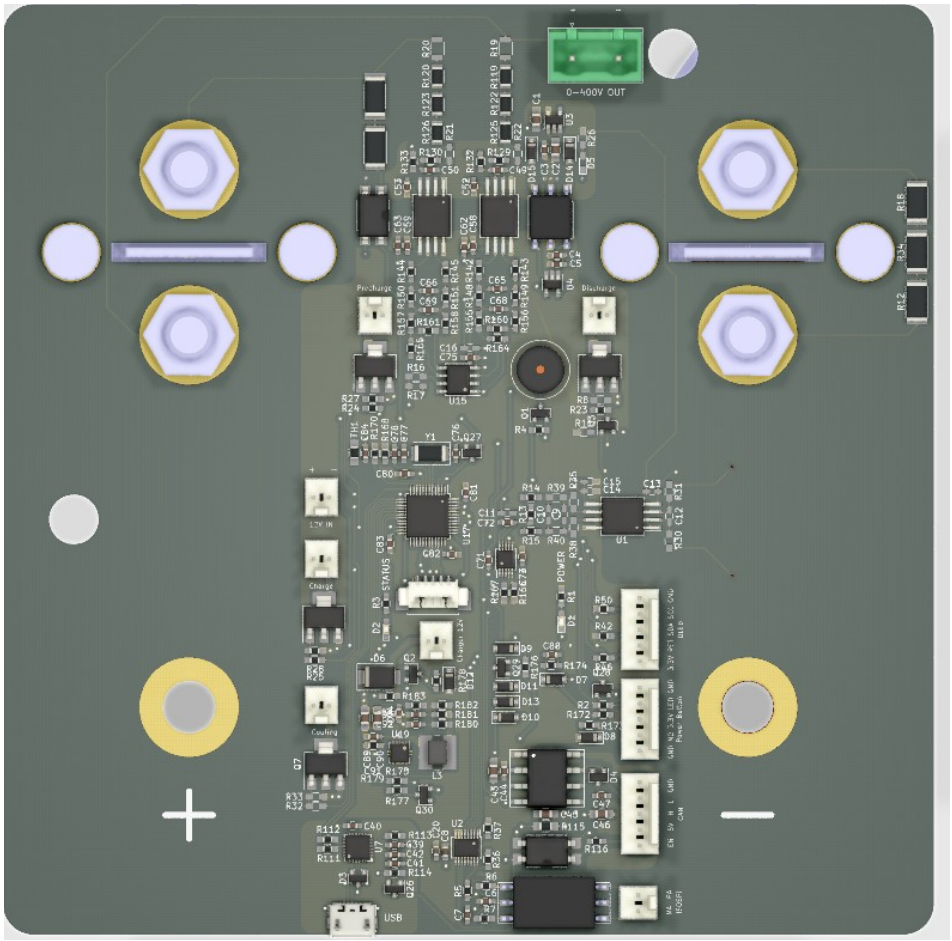


Figure 2 : Master board

Name	Description	
0-400V OUT*	+	Positive output for PSU
	-	Negative output for PSU
12V IN	+	Positive 12V input
	-	Negative 12V input
Master	PA	Isolated ISOSPI communication 2 wire interfaces with slave boards
	MA	Isolated ISOSPI communication 2 wire interfaces with slave boards
USB*	Micro-USB interface with ENNOID-BMS-tool software on a computer	
CAN*	EN	External enable signal
	5V	External 5V for CAN
	H	CANH
	L	CANL
	GND	CANGND

OLED*	3.3V	+3.3V
	RST	No connect
	SDA	SDA signal output for OLED display
	SCL	SCL signal output for OLED display
	GND	ISOGND
Power Button*	GND	ISOGND
	N.O.	Normally open pin for power button
	3.3V	No connect +3.3V
	LED	+3.3V for LED (optional)
	GND	ISOGND
Debug*	+3.3V	
	SWCLK	
	ISOGND	
	SWDIO	
	NRST	

*Not mandatory for operation

Slave board LTC68XX

The slave board are equipped with LTC68XX multicell battery monitor IC. The slave boards are powered directly by the lithium-ion cells they monitor.

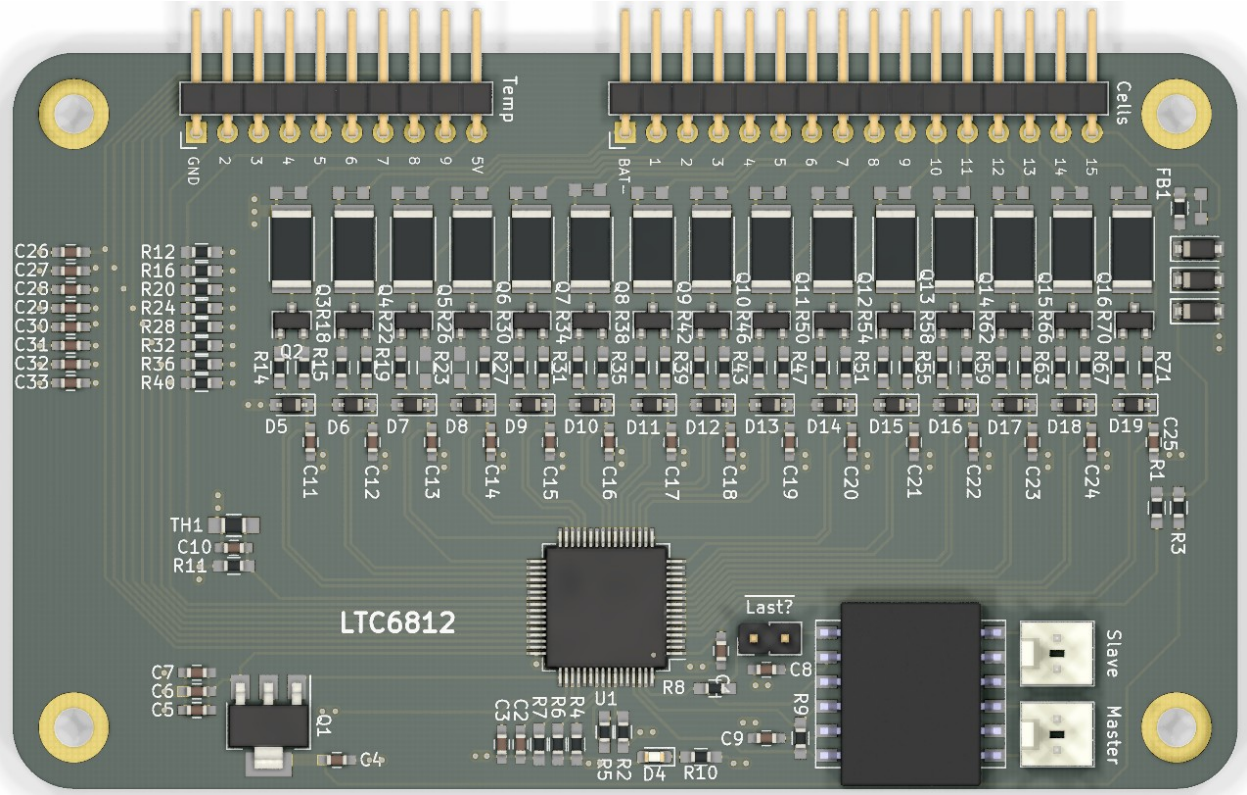


Figure 3: Slave board

Name	Description	
Master	Isolated ISOSPI communication 2 wire interfaces towards previous slave board or master board	
Slave	Isolated ISOSPI communication 2 wire interfaces towards next slave board	
LAST?	Leave pins unconnected for the last slave board in the battery pack. Otherwise, those pins must be shorted.	
Cells	BAT-	Connect to negative voltage of the battery module
	1 to XX	Connect all subsequent pins to the next cells positive voltage levels.
Temp	GND	Temperature sensor negative terminal
	1 to X	Temperature sensor positive terminal.

Other related hardware

Current sensor

We recommend using ENNOID-BMS integrated 500A current sensor.

Power supply

ENNOID-BMS require a 12V power supply which can supply power for the Master-BMS board. A peak current of 3A is required for a few milliseconds for closing the high current external contactors. Only a few milliamps are required afterward closing. The power supply must be able to handle contactors peak loads.

We recommend using our ENNOID-BMS PSU board: 0-400V input isolated with 12V-5A DC output

OLED display

SSD1306 compatible OLED display is not mandatory for operating ENNOID-BMS but is recommended.

Power button

Power button N.O. type toggle switch is required for turning ON/OFF ENNOID-BMS. External activation of ENNOID-BMS is possible through CAN bus or with USB.

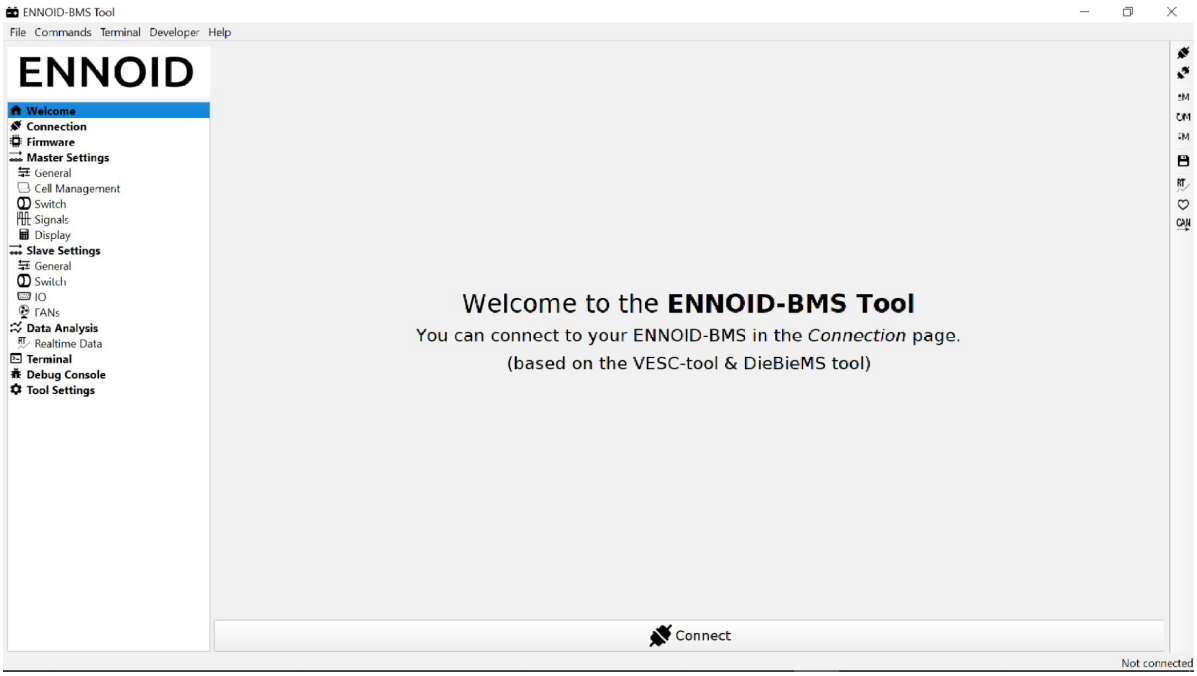
Contactor

LEV200, EV200 or EVC500 contactors with built-in economizer are required.

Software

Download ENNOID-BMS-Tool software for windows:

https://github.com/EnnoidMe/ENNOID-BMS-Tool/releases



ENNOID-BMS configuration

1. Connect at minimum a 12V power supply to ENNOID-BMS Master board.
2. Connect a host computer running the ENNOID-BMS-Tool to the ENNOID-BMS master board with a micro USB cable. (Warning: some cheap USB cables cannot carry data and won't work with ENNOID-BMS) Power LED indicator should light up. Click connect on the connection page. The app should now shows "connected" in the right side bottom corner.
3. Go into firmware tab and upload latest firmware (this step is needed only for initial setup or uploading a new firmware version)
4. Under *"Master Settings"* tab, user can define all parameters of the BMS (Tabs under *"Slave Settings"* are not required for configuring ENNOID-BMS). Modified parameters can be read, applied & saved by clicking on the associated buttons on the right-side panel.
5. 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.
6. Once properly configured, you can operate the ENNOID-BMS with the ON/OFF power button, & the OLED display will show your battery status.
7. For specific projects, power button & OLED display can be bypassed by using CAN bus communication with an appropriate motor controller & vehicle control unit.

Enjoy!