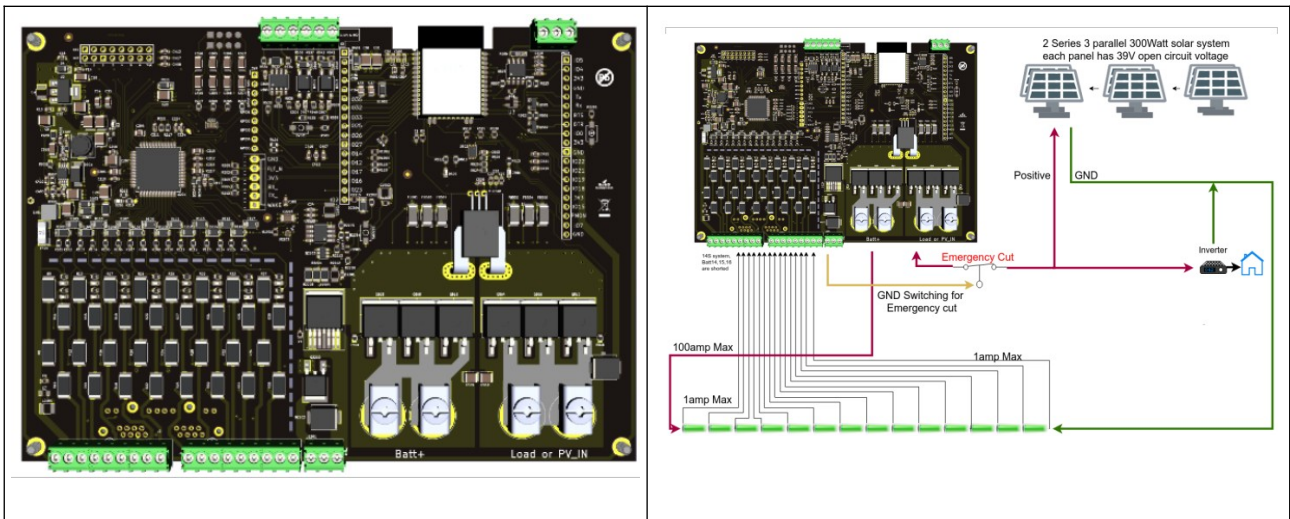**SONAL Renewable energy solutions**

Moonitor16s

35A – 45A – 65A – 100A – 120A

Quick Start Guide

Thank you for choosing Moonitor16s for your energy management needs. Our team at SONAL Renewable Energy Solutions is dedicated to ensuring your safety and satisfaction through our engineering expertise.

Product Overview:

The Moonitor16s is designed with simplicity and reliability in mind. Inside the package, you will find a single high-quality PCB board with pre-mounted connectors, providing a seamless integration experience. Please remove pre-mounted Phoenix connectors and start wiring them up while they are detached from the board.

**Precautions Before Installation:**

Upon receiving your Moonitor16s, perform a visual inspection to ensure there is no moisture or liquid present around the board. Verify that all connectors are securely in place.

Features:

8-layer IPC Class II PCB for superior quality and durability
Equipped with Molex or Phoenix Contact sockets for reliable connectivity
Supports configurations from 6 to 16 cells on a single board, can be connected with daisy chain up to 1200V

Installation:

Begin by removing the 9P and 8P connectors from the board.
Connect all cells to the socket mate connector. For configurations with fewer than 16 cells, short the remaining cells on the mate connector. Avoid shorting anything directly on the PCB; use the mate connector for shorting purposes. You can turn the PCB and you will see the silkscreen pin numbers behind the PCB. Please follow the instructions behind the PCB for shorting the cables.

Top view of cell contacts	Bottom view of cell contacts
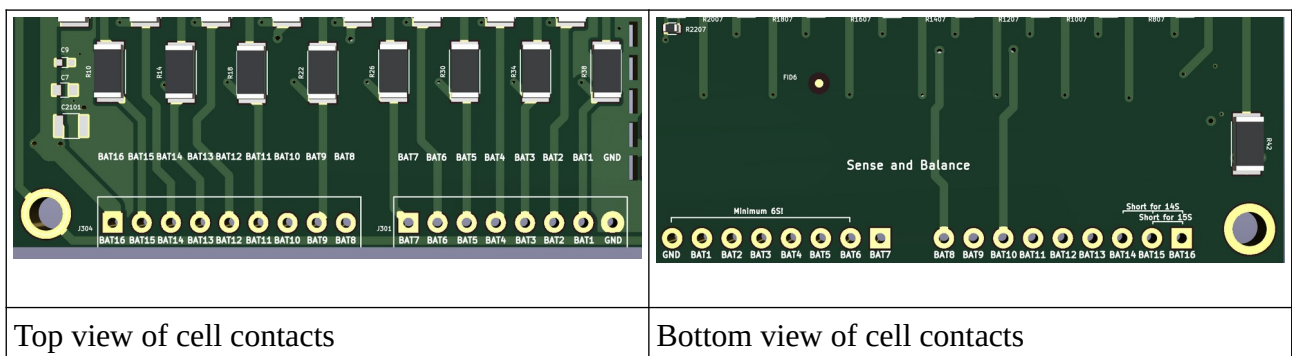
This hardware supports 6-16cells, we are going to make this Quick start guide for 10s configuration and 15s configuration for demonstration.

What we need for the quick start

- Moonitor16s hardware

- Mobile phone (hot-spot capable)

- 5 amp capable sense and balance cables (there will be 1 amp max on these cables, we advice for 5 amp capable cables since sensing and balancing works with the same cables, for this reason we don't want our user to deal with cable resistance problems).

What else we need for safety design

- Automation grade Emergency contractor;

- Littelfuse 298900 Automotive Single Terminal Fuse Holder;

- Littelfuse MEG100XP MEGA Slo-Blo Automotive Bolt-Down Fuse;

- Wire Copper Crimp Connector;

- DC DC converter for Emergency contactor.

2 SAFETY

To ensure the security of you and your surroundings, please read these rules and follow all the guidelines, contained installation instructions:

- DO NOT use the system in an explosive environment;

- The system is NOT resistant to the chemical environment and mechanical stress;

- All electrical equipment MUST be rated for the voltage of the battery and battery management system;

- Use redundant-insulated tools;

- DO NOT short-circuit the battery or battery management system terminals, this could cause the damage to the product or the personal property;

- Before establishing connections, make sure to verify polarity.

This list is not exhaustive, and it is the responsibility of the system designer / installer to conduct their own failure mode analysis and determine what is required.

Working around batteries is DANGEROUS. Risk associated with improper use of the battery with the Moonitor16s device includes: short-circuit, fire or explosion.
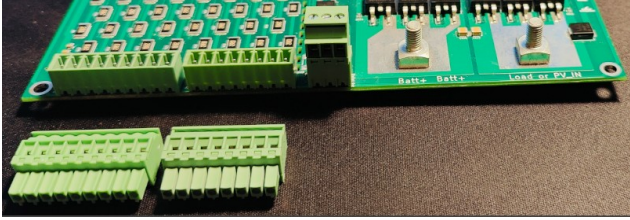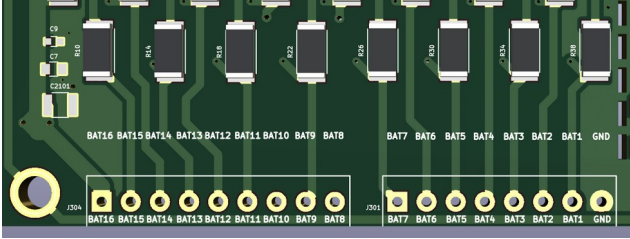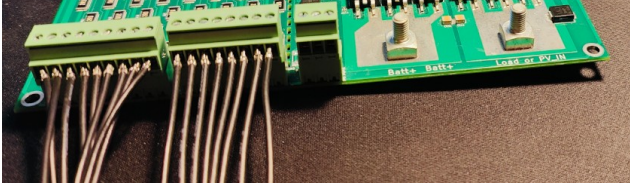
Read the ENTIRE documentation to become familiar with the Moonitor16s device and its features before operating. Failure to operate the product correctly and safely may result in damage to the product, personal property and cause serious injury.

Using Moonitor16s requires at least basic knowledge in electronics and electrical engineering. SONAL Renewable Energy Solutions will not be held responsible for damage to the battery or any consequence, if the Moonitor16s device is used improperly and no warranty is provided in such case.
For further assistance or inquiries, please contact our support team at info@battpulse.com

3 Hardware connection

Referring to the next picture, please follow these steps:

Step 1: Remove the 9p and 8p connector from your hardware and connect the sensing/balancing cables to your connector.	
Step 2: Check the pin numbers and be sure the connection is good with voltage levels before attaching mate connectors to the BMS.	
Step 3: Attach sense wire mate connectors to the board. Board is getting powered from GND and Top cell voltage. In this picture there are 16cells attached. If you are attaching 10 cells then 10th cell voltage will be shorted to the rest of the cells(10-11-12-13-14-15-16 are shorted)	

Your item doesn't need any Internet or networking connection to work, but it needs network connection for Monitoring and setting it up. For this Monitoring and setting up purposes we are using Wi-Fi connection.

After connecting all your cells to the "Sense and Balance socket" (you shouldn't connect high current, or digital IO cables just yet), you may see some lights on the circuit. They are power good indicators. First for 5V good indicator, then after initial checks for 5V you will see 3V3 light, this can take around 100ms.

After this step Moonitor16s will be connected to your router, and you can Moonitor whenever you like, it will be up and running 7/24 365 days. It will protect your system as much as possible with the parameters you provide to its settings page. After first configuration, you can leave Moonitor without Wi-Fi connection, it is totally fine working without any WiFi signal after the first initialization.

Your item is factory configured to connect a network with following Network credentials:

Hot-Spot Name (SSID):   MoonitorBMS
Password: MoonitorBMS

After the first communication you can easily change the SSID and Password to connect your router.

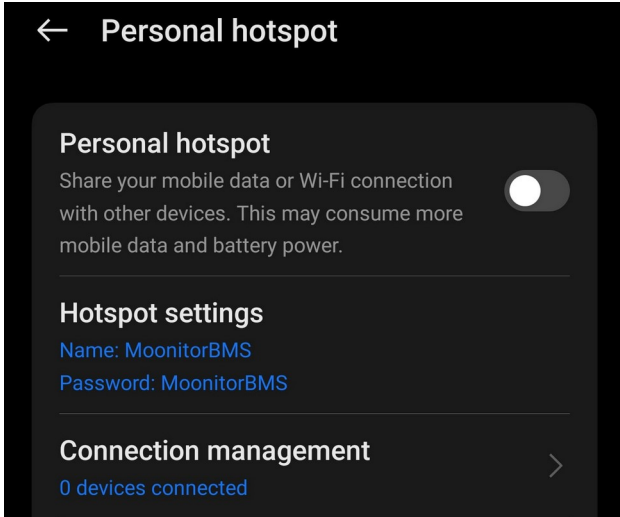To start using your hardware you need to open a Wi-Fi Hot-Spot and follow this instructions:

1. Open a WiFi Hot-Spot with **SSID:** MoonitorBMS , and **Password:** MoonitorBMS

2. Wait until your hardware connects (2-3 seconds);

3. Find out your hardware's IP with your phone, or from your router settings, and also from the Oled screen provided.

4. Open this Ip on your phones browser;

5. Open Settings page and change Wi-fi initials to your routers Wi-fi SSID and password.

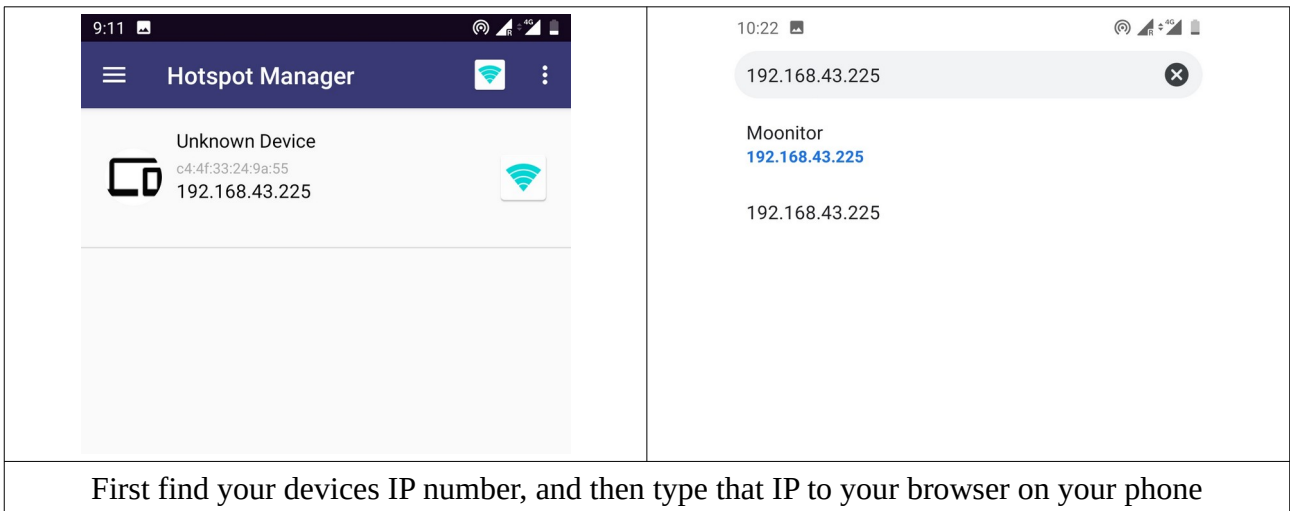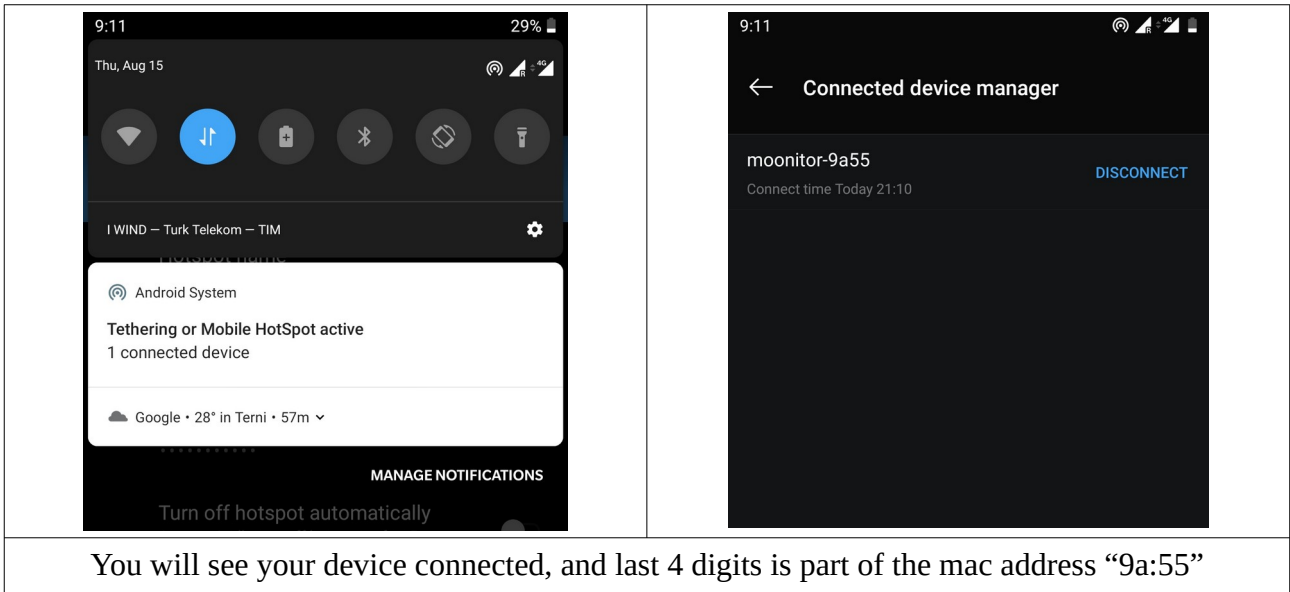That's it, now you are up and ready for the configuration.

Note: After changing your SSID and password, don't forget to restart your hardware by clicking **Soft Restart button** on the bottom of the Settings page.

3.1 Step by step detailed explanations for first network connection:

1. Open a WiFi network with Hot-Spot name: MoonitorBMS , and Password: MoonitorBMS. You can do this step with your cell phone's tethering mode, just open your mobile phones WiFi tethering mode and set your SSID and Password both to: Moonitor16s

|	
← **Personal hotspot** **Personal hotspot** Share your mobile data or Wi-Fi connection with other devices. This may consume more mobile data and battery power. ⚪ **Hotspot settings** Name: MoonitorBMS Password: MoonitorBMS **Connection management** ＞ 0 devices connected	After setting your mobile hotspot fom your phone please don't forget to connect also your computer to the same network. Otherwise you cannot reach the hardware from its IP
Open a WiFi network with **SSID:** Moonitor16s , and **Password:** Moonitor16s	

2. Wait until your hardware connects (2-3 seconds)

3. Find out your hardware's IP with your phone, or just check it from your Oled display

You will see your device connected, and last 4 digits is part of the mac address "9a:55"

First find your devices IP number, and then type that IP to your browser on your phone

If you can't see connected devices IP on your cell phone please install Hot-Spot Manager to your phone to see your connected hardware's IP number. Some phones has this feature already built in and they show every device with its IP and mac address, be sure that your device's mac is same for the proper connection.

After getting the IP address you are done, you can open a browser and connect to your device for working on the User Interface.

Dashboard and Cell Status page
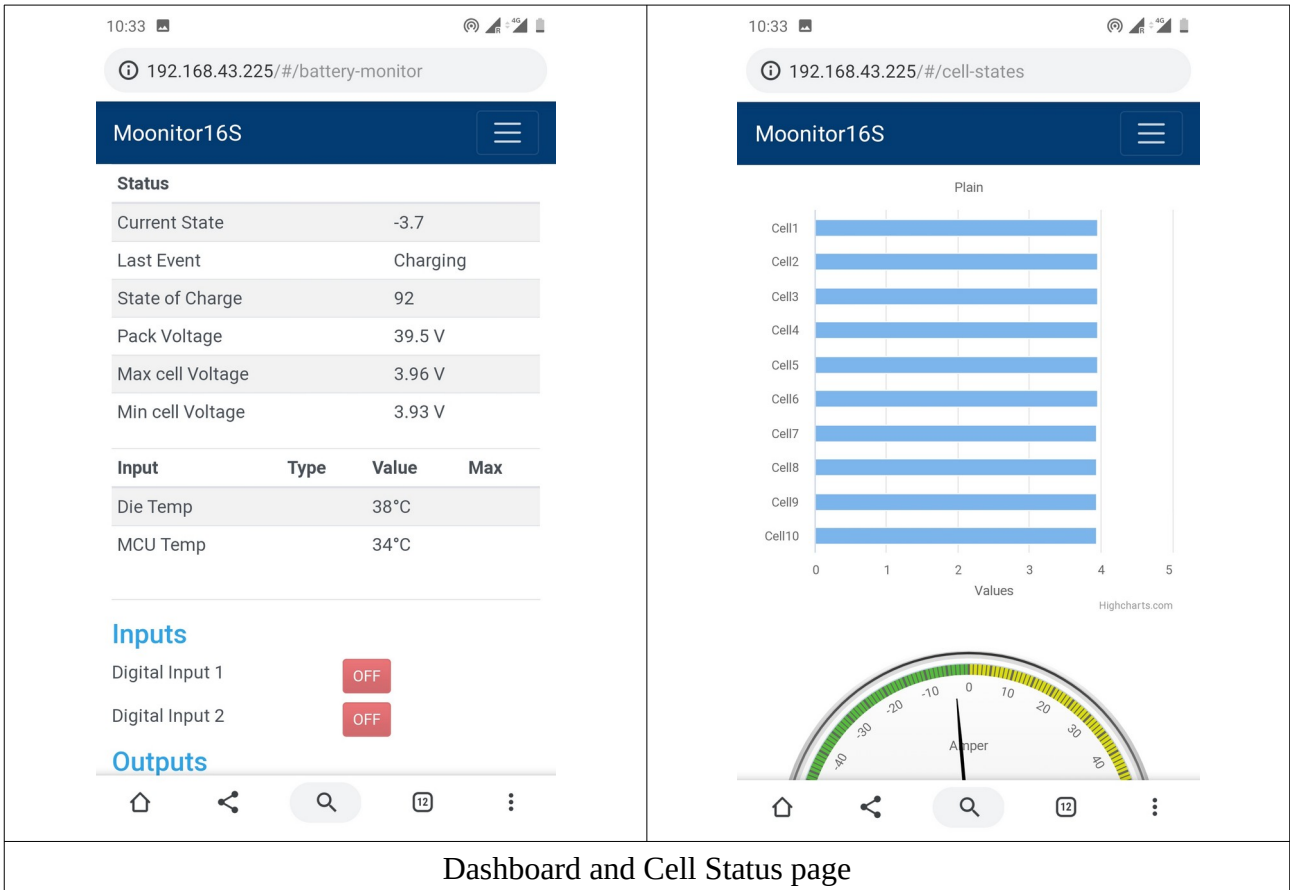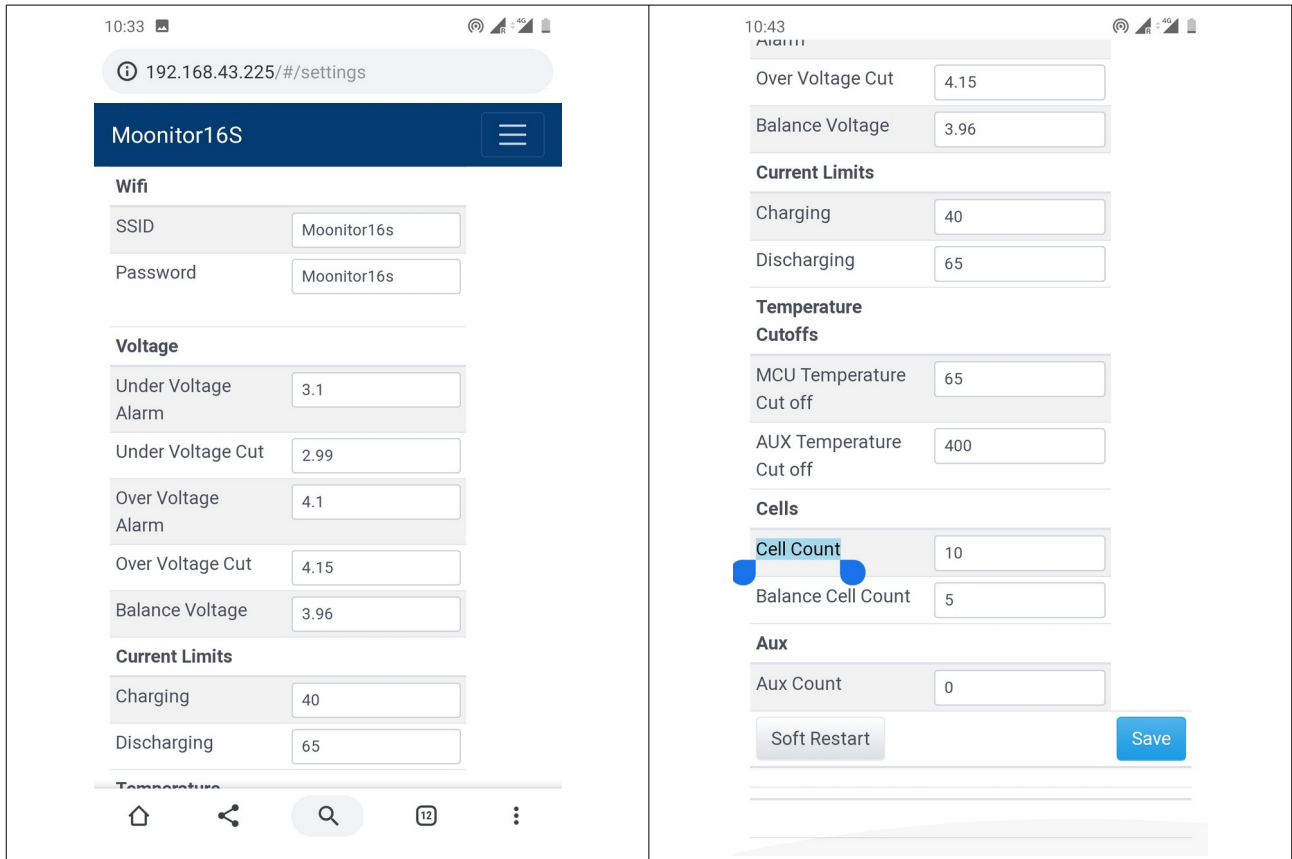
Change your cell settings values to meet with your setup variables

Whenever you see the dashboard you can start the configuration. From the top menu, navigate yourself to the Settings page.

You may see some "0" V on your system if your cell count doesn't match factory default 16cell configuration, From the settings page you can configure and select your cell count. After saving the new configuration your dash panel and cell states page will show you the correct values.

You can change your SSID and Password to connect another router

After changing your SSID and password, don't forget to restart your hardware by clicking **Soft Restart button** on the bottom of the Settings page. Otherwise hardware will stay connected to the default SSID.

After the Soft Restart your device will connect to the new network, If your computer is connected to the same network, you can type Moonitor.local on your browser and this will open the dashboard without knowing the IP.

We are connected to the Router instead of Cell phones Hot-Spot

If your router has some firewall features which blocks URL binding you can't find "Moonitor.local" URL, please find the IP address of the hardware, you can find the IP from routers "Connected devices" menu. Whenever you type your IP on your browser you will be inside the Dashboard page.

3.1.1 Digital Inputs

There are 2 digital inputs for external circuits, This Digital inputs can get signals from 16Vdc to 67.2Vdc. Over this limits are not recommended.

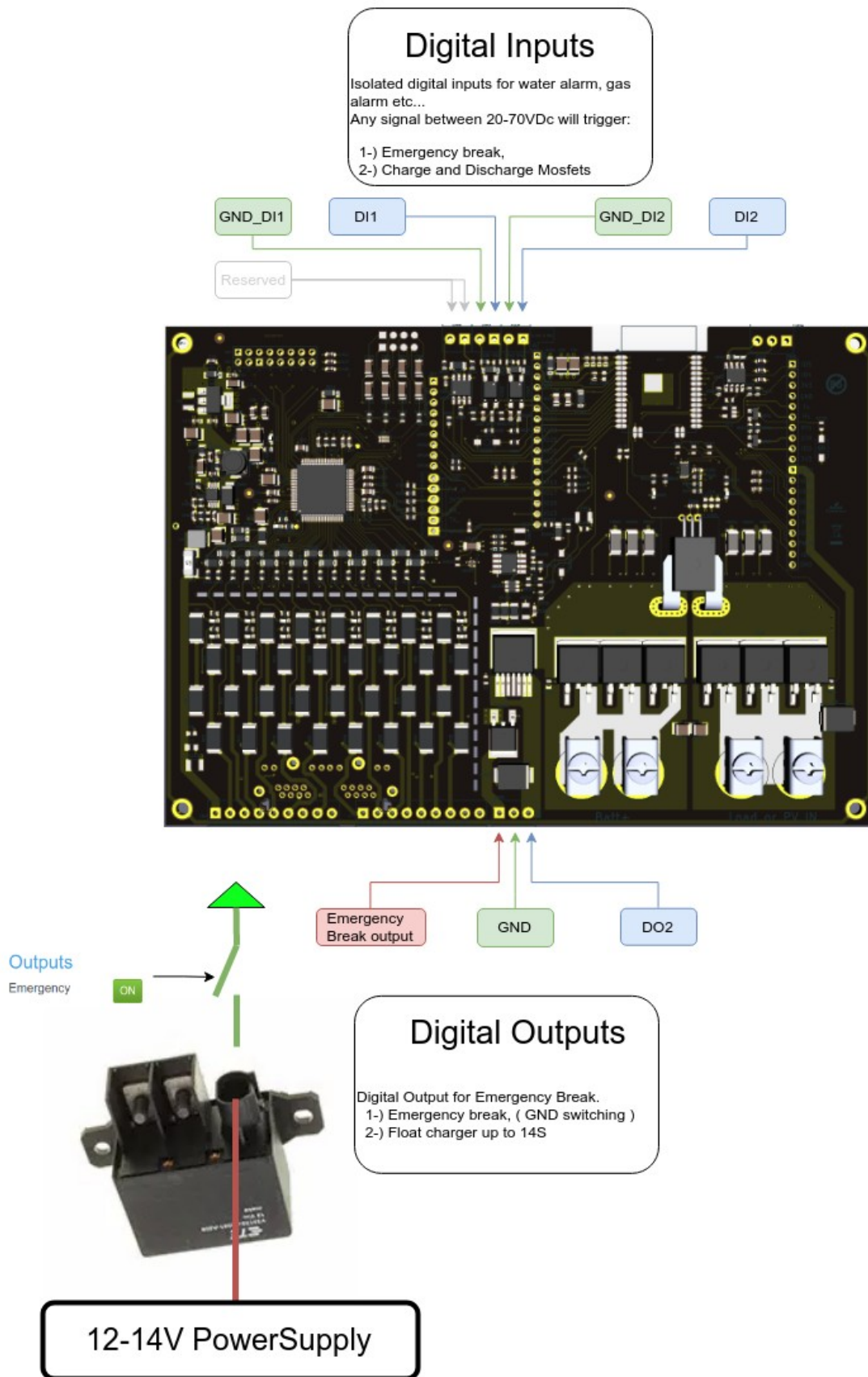Front and Back Silk Screen for Digital input connections

Digital Inputs

Isolated digital inputs for water alarm, gas alarm etc...
Any signal between 20-70VDc will trigger:

1-) Emergency break,
2-) Charge and Discharge Mosfets

| GND_DI1 | DI1 | | GND_DI2 | DI2 |

Reserved

| Emergency Break output | GND | DO2 |

Outputs

Emergency   ON

Digital Outputs

Digital Output for Emergency Break.
1-) Emergency break, (GND switching)
2-) Float charger up to 14S

12-14V PowerSupply

Figure 1: Digital Input and Outputs

Digital Inputs are placed next to the Wi-Fi connection provider MCU, There are silk screen markings for Galvanic Isolated Digital input pins. You can connect different GND than the battery circuit, you can use your AC GND here for your Alarm signals.

Any signal here in Digital inputs (DI>16V) will trigger the related function defined internally
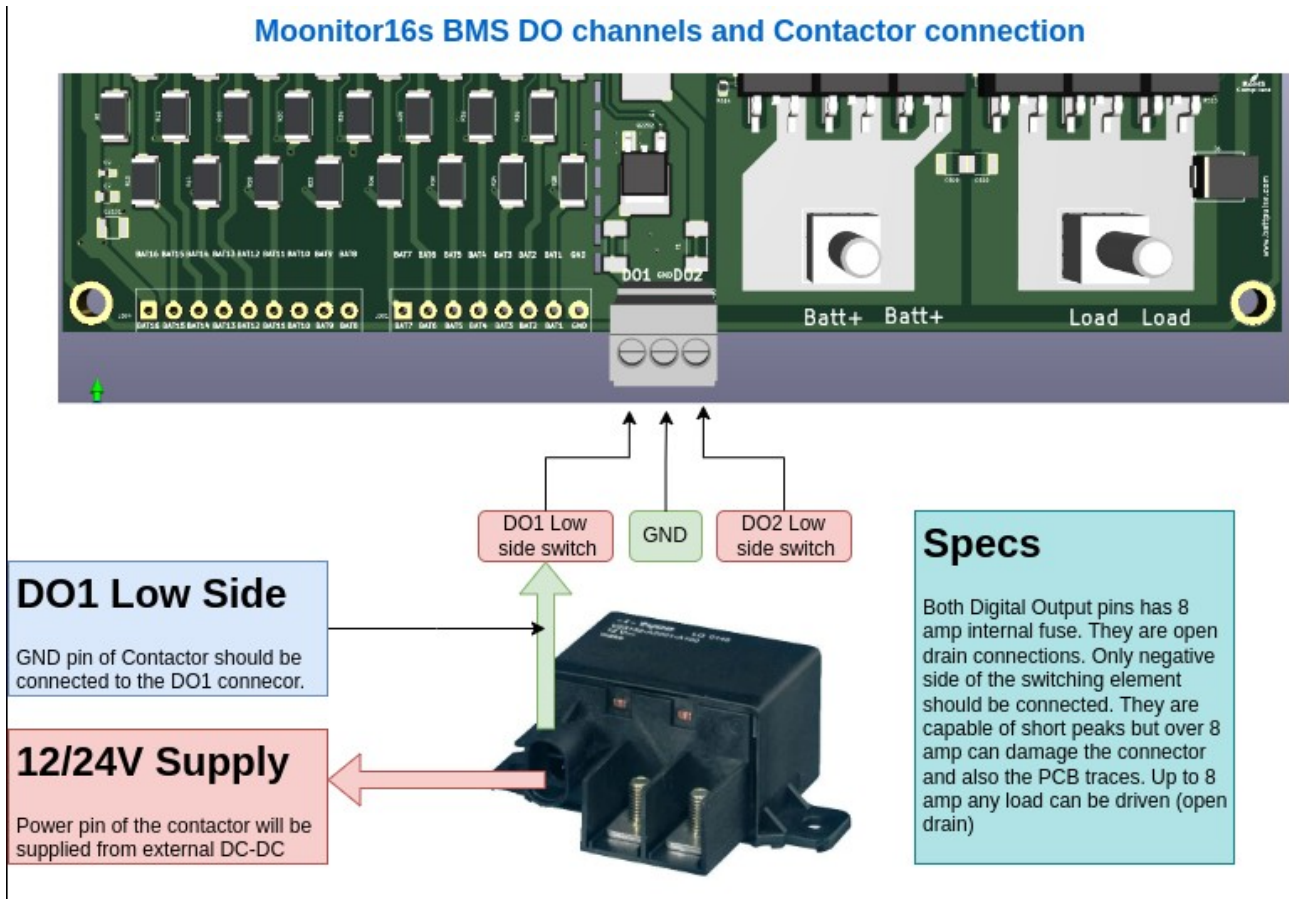

Figure 2: Contactor Connection

Moonitor16s has 2 contactor outputs. DO1 and DO2. You can connect Charge contactor to DO1 and Discharge contactor to DO2. If you are using one contactor please short DO1 and DO2 and connect your contactor to one of the outputs.
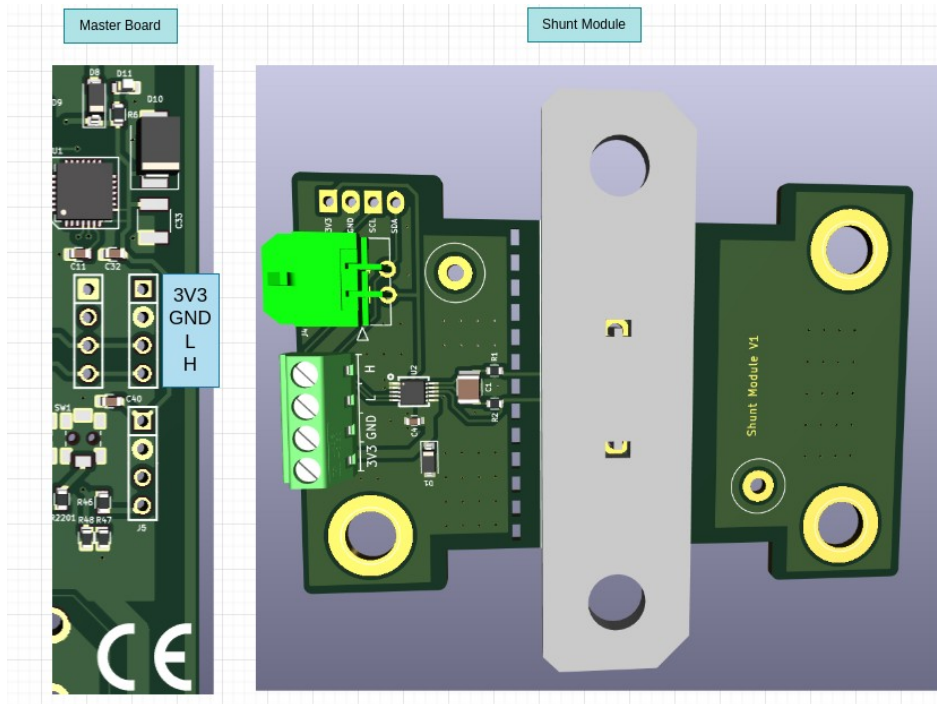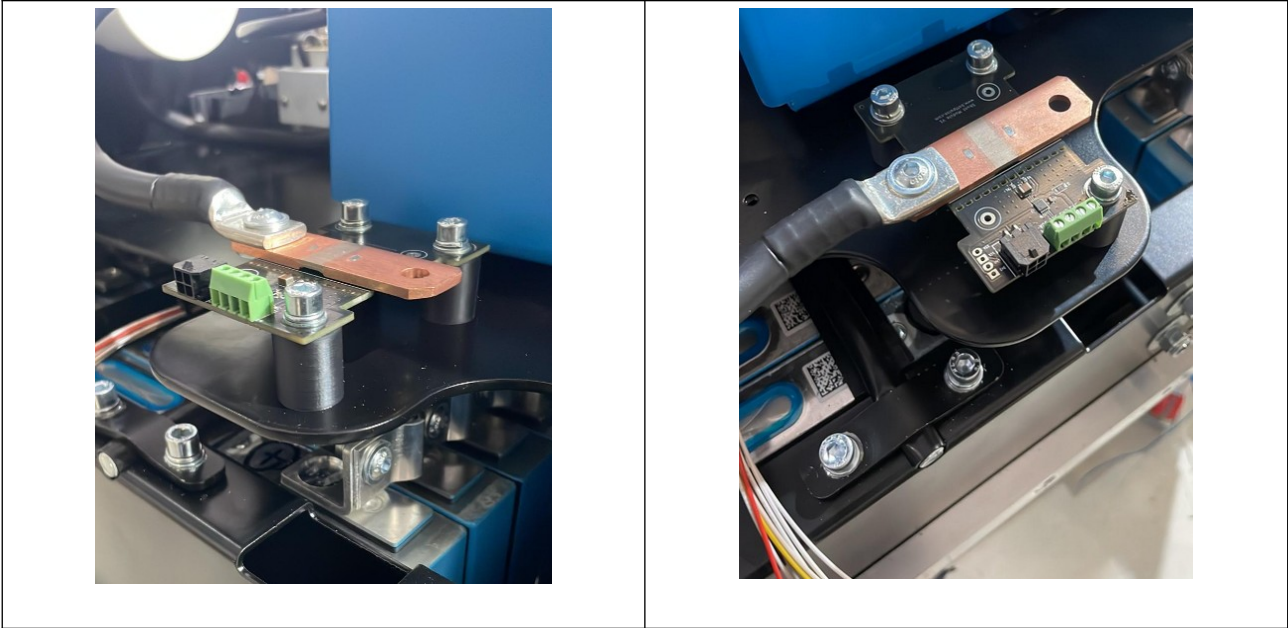
Shunt Connection:

Figure 3: Shunt Connection

Shunt has 4 pin connection. It gets its power from main board. Don't supply power to the shunt from external sources. Power cables should be twisted eachother and signal cables should be twisted each other as well.

Shunt can be connected max to 80V, If your system is a HV system you need to connect shunt module on the GND side of the system.

Digital Inputs are placed next to the Wi-Fi connection provider MCU, There are silk screen markings for Galvanic Isolated Digital input pins. You can connect different GND than the battery circuit, you can use your AC GND here for your Alarm signals. Any signal here in Digital inputs (<16V) will break the Emergency breaker.
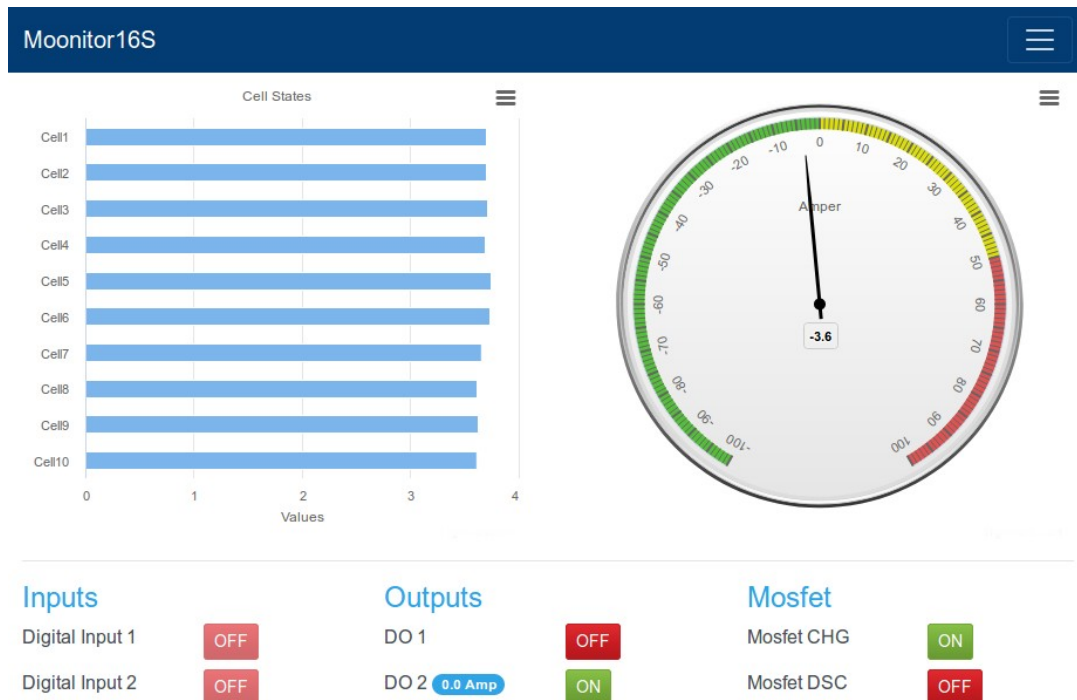

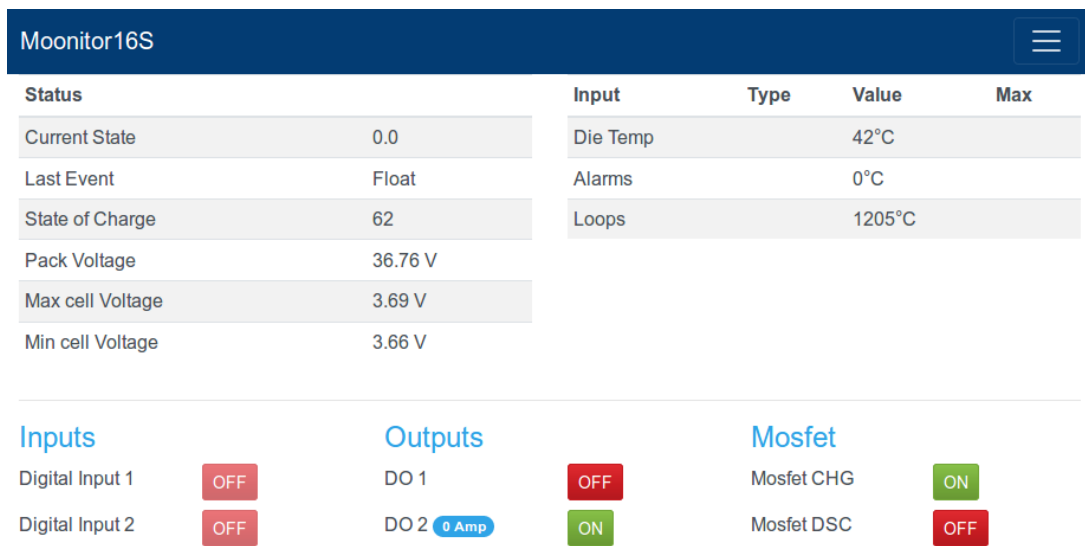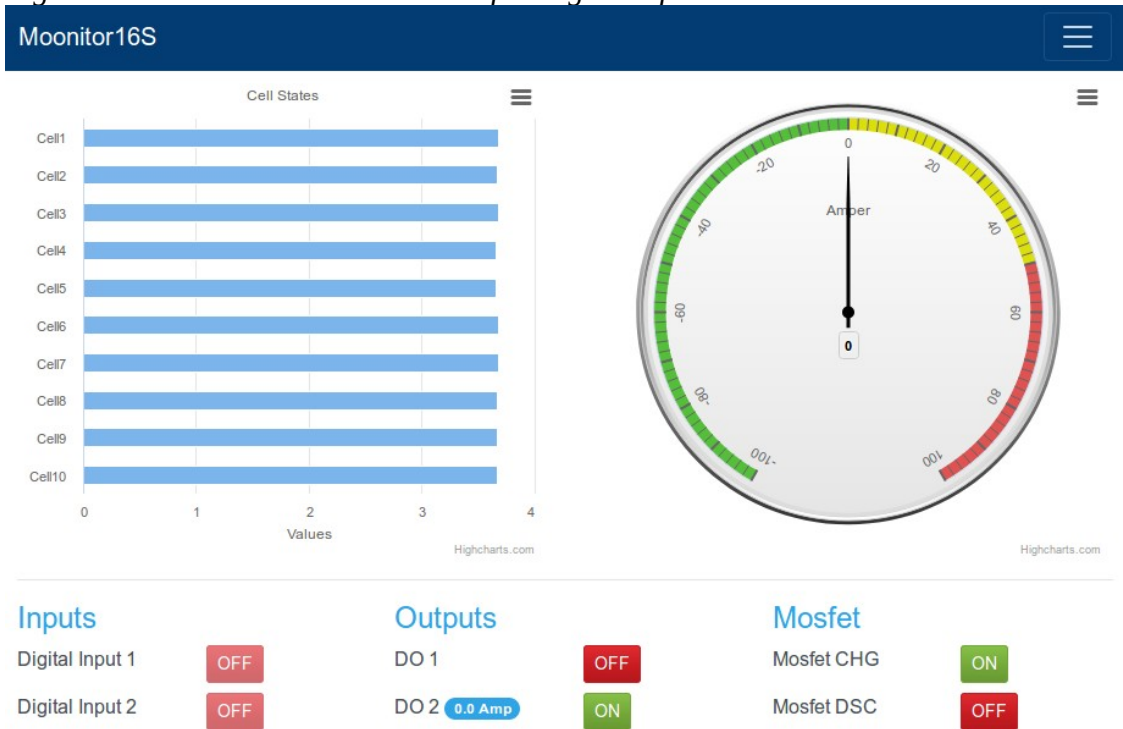*Figure 4: There are 2 digital inputs for external circuits*

Figure 5: You can access Digital Output states from each page

Figure 6: Front and Back Silk Screen for Digital input connections

3.1.2 Digital Outputs

There are 2 digital outputs for external circuits, one of them for Emergency Break, and other one is general purpose output.
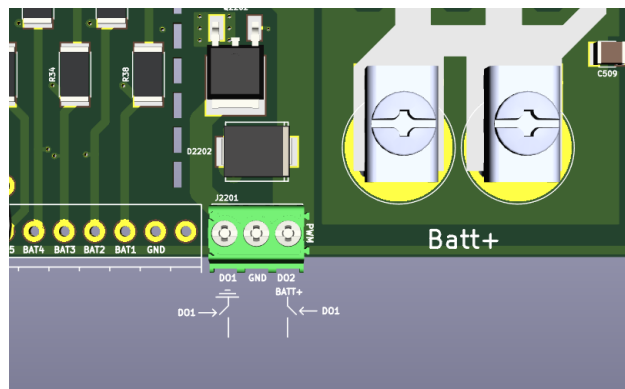

Figure 7: Front and Back Silk Screen for Digital output connections

3.1.3 Emergency Break

For the Emergency break we are using DO1, this output is Ground Switching output, for this reason you will power your Emergency breaker contactor with its satisfied voltage level, we will keep the GND signal on during the normal operation, when there is an emergency situation, we will disconnect the GND signal so contactor will break the current path. With this scenario, you only need one pin of the DO module, please check the Image for the cable input for DO1, and power your Emergency breaker with its satisfied voltage level.

1. Dashboard page

2. Cell States page

3. Settings page

At the settings page you will see all the parameters that you can configure including OV_Fault, UV_Fault and temperature settings. After the proper connection you should chose the correct cell count from **Cells → Cell Count** This way you can see correct values on Dashboard and Cell States page.

Figure 8: Front and Back Silk Screen for Digital output connections

3.1.3.1 WiFi

WiFi settings are pretty straight forward, On the beginning SSID and Password: MoonitorBMS

Whenever you change them after saving the new values you need to click Soft Restart button to connect the new WiFi.

3.1.3.2 Voltage

Voltage part has 5 variables, Under Voltage Alarm/Cut, Over Voltage Alarm/Cut, Balance Voltage.

Alarms are indicated with red bars on the Cell States page, When your cells are on the level of "Cut" related mosfet and emergency output gets triggered. You can turn on the Emergency and Mosfets manually from the Gui, but if your system is still on the level of "Cut" this button will switch off again.

3.1.3.3 Current Limits

Current limits are not implemented yet, please wait for firmware upgrade for current limit options.

3.1.3.4 Temperature Cutoff

Moonitor16s has 2 temperature sensors on board, one of them is on the right side of the board and other one is on the left side, this temperature sensors are keeping the temperature data of the board, if it goes higher than the desired value, we cut the power of most of the modules on the hardware, balancing doesn't work, mosfets are off, Emergency is triggered.

Moonitor16s has 8 temperature probe inputs on board. You can measure your room, battery cells or ambient temperature seperately, and can place alarms and safe state definitions with your GUI.

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Frequently Asked Questions:

1. Do we need internet to work with Moonitor16S

    No!, it works without the internet at all. It doesn't need any data connection to outside. To configure it you need a WiFi connection(which you can use your cellphone hot-spot easily) and this WiFi connection doesn't need to be connected to the internet at all. All the web panel is inside of the MCU and it is serving the web page that you are going to Moonitor! After setting up the parameters like underVoltage, overVoltage and temperature break, you are done. You can turn off your WiFi. WiFi is just for configuring and monitoring when it needs. No emergency data has been transferred throughout WiFi for obvious reasons.

2. Can I open a port to configure and Moonitor it from outside of my network?

    Yes, but security is your issue this time. We are working on a software that you will have username and password (if you like) and you can login to your admin panel to configure and Moonitor your system. But this feature will be added on the future firmware updates. You will get the update as soon as we open the firmware update.

3. Can I get firmware upgrades whenever you have?

    Yes, it is pretty straight forward with a user interface. Just type http://{yourIP)/update, then you will have the browse button for the new firmware files. Moonitor16S Firmware upgrades are possible even with the cell phone. Yes, we have more firmware upgrade than Apple :) We need to make it as simple as possible.

4. I don't want to use the redundancy with Mosfet on-off and emergency breaker, can I bypass them?

    Yes, sure, but we made this hardware to be redundant with mechanical and solid-state emergency functions. You should benefit from them. It is your decision to use them. Board will work with only the sense and balance cables connected. You can balance and monitor your cells even if you don't connect the safety features.

Moonitor16s Balancing function: We have an aggressive balancing on a not balanced system, we have a soft balancing for a pretty balanced system. Everything works automatically with the parameters you provide for the system.

Moonitor16s: Emergency Cut off on UnderVoltage Fault and OverVoltage Fault. It also cuts off temperature limit fault and Low power Down detection, We are adding the capability for GND Loss cut off. Check out "Ground Lose cut off " on the next firmware upgrades.

For the high current cables, please use this kind of connectors.