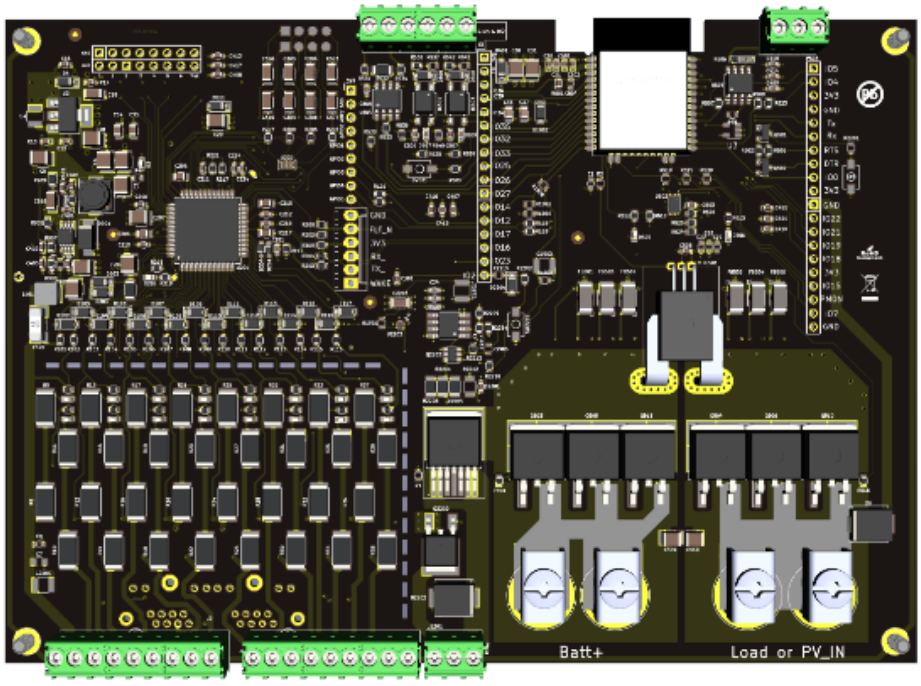
SONAL Renewable energy solutions

Moonitor16s

35A – 45A – 65A – 100A – 120A

Quick Start Guide



Thank you for purchasing Moonitor16s for your setup, we have been trying to put you on the safe side as much as possible with our engineering knowledge and expertise.

With our simplified design you will see only a single PCB board inside your box, there is nothing else coming with the board and its mate connectors. Connectors are already mounted to the board so you will find one piece hardware on your cargo.

When you receive the board make and eye check and be sure it is not humid or there is no liquid around. And all connectors should be placed.

Board is 8 layer high quality IPC Class II PCB with Molex or Phoenix Contact sockets, you will feel the difference of the quality not only on the PCB and even from the connectors.

First of all remove the 9P and 8P connectors from your board and connect all cells sense cables to the socket mate connector. If you are using less than 16cell, short the remaining cells on the mate connector. Don’t short anything on the PCB, just use the mate connector for shorting purposes.

This hardware supports 6-16cells, we are going to make this Quick start guide for 10s configuration and 15s configuration for demonstration. But you can make any connection you like to have

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, we don’t want our users to deal with cable resistance problems).

Recommendation: What else we would need for safety design:

- Automation grade Emergency contractor;
- Littelfuse 298900 Automotive Single Terminal Fuse Holder;
- Littelfuse MEG100XP MEGA Slo-Blo Automotive Bolt-Down Fuse;
- Precharge Resistor (https://www.youtube.com/watch?v=JH0JtEEIdKs&t=571s);
- Wire Copper Crimp Connector;
- DC DC converter for Emergency contactor.

1 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.

If you are DIY'ing your system, using Moonitor16s requires at least basic knowledge in electronics and electrical engineering. SONAL Renevable 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.

2 Hardware connection

Referring to the next picture, please follow these steps:

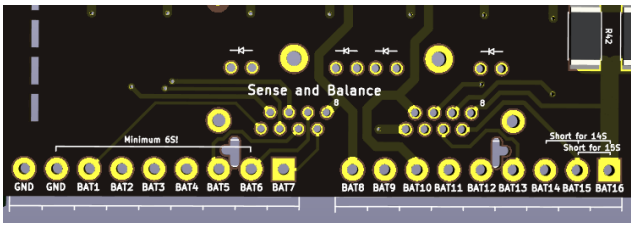


*Figure 1: **Bottom** view of the PCB*

Step 1: Remove the 9 and 8Pin connector from your hardware and connect the sensing/balancing cables to your connector.

Note: Turn your boards back side and check the silk screening for the pin numbers. Start with GND connection. Make all the connections while connectors are removed from the board.

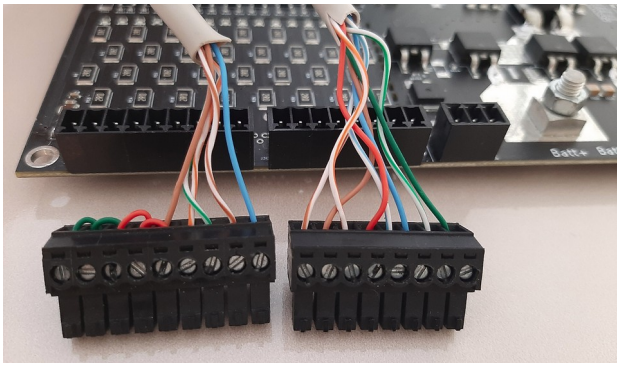


Figure 2:12S cable config (GND =Green)

GND means the lowest possible power domain on your network. It is the negative side of your “1s” cells.
BAT1 means the positive side of the “1s”,
BAT2 means the positive side of the 2s, and
BAT3 means the positive side of the 3s…

Moonitor16s equipped with variety of safety functions including wrong pin connection protection on sensing and balancing channels, You don’t need extra cable sequence correction circuitry for checking if the cables are correct. It will protect your battery if there is a wrong pin connection, but for a long time wrong cable connection can fire the boards protection circuitry.

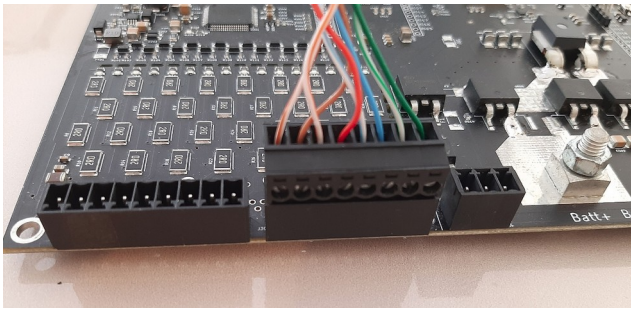


Figure 3: First attach the 8p connector to the board

From the start be sure the pin sequence are correct with a correct hierarchy. If you did a mistake, GUI will inform you with high or low voltage on the channel so you can see exactly on which channel there is a problem, and you can easily correct the mistake.

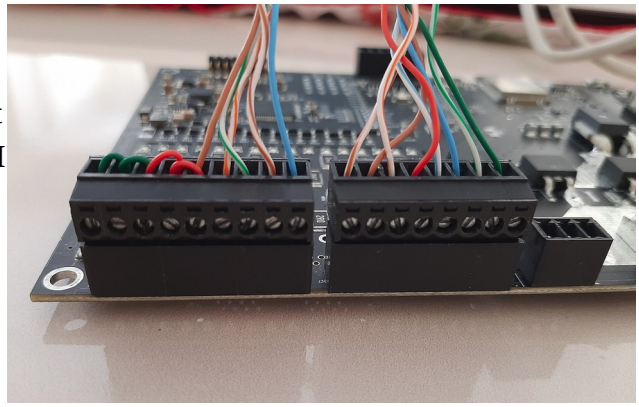


Figure 4: Then attach 9p connector to the board

2.1 First network connection

Your item doesn’t need any Internet or networking connection to work, but it needs network connection for Moonitoring and setting it up. For this Moonitoring 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 ready to connected 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.

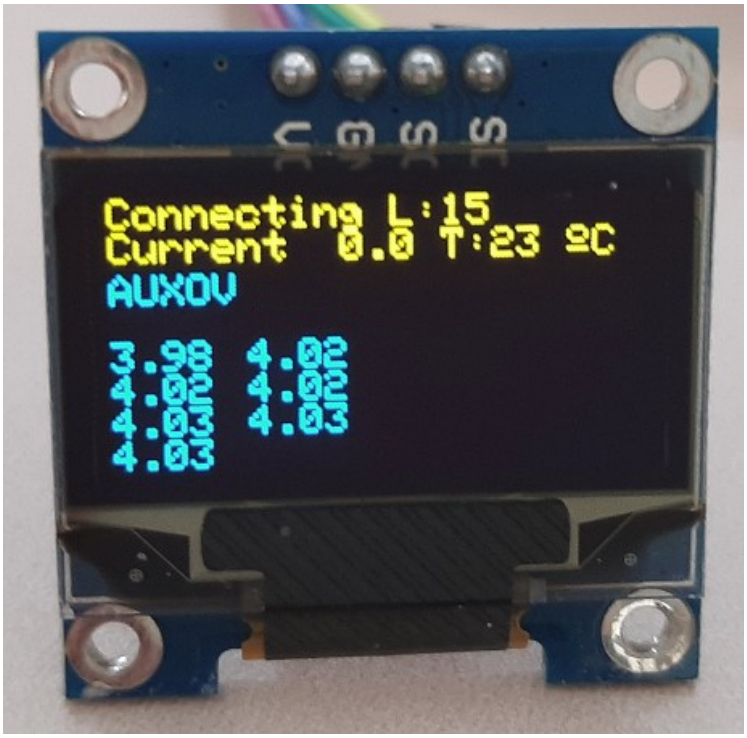


Figure 5: You must see "Connecting" on the screen

After placing 8P and 9P connectors to the right places you will see Oled display is working too. If you see this on your Oled display your Moonitor is working, but there is no right configuration inside. To configure it you will need to follow the next steps.

For the first network configuration you have 2 ways, For both options you need to power up the Moonitor board from 9pin and 8 pin connector. Without powering up, board wont get the first configuration.

1. First configuration with USB cable
2. First configuration without any physical connection (with Mobile Hotspot)

First option: With USB cable: (works with Linux and Windows, not tested for MacOs)

If you chose the first option with USB cable, please download the USB First Config Tool from this link: https://www.sarperonal.com/aas/MoonitorUSBConf-1.jar
i-) Place a USB Mini cable to the Moonitor USB port, then connect it to your computer.
ii-) Select your port and click connect, then place your routers SSID and Password, then pres "Save" button. (check the related figures on the bottom)

You don't need to restart, it will connect by itself and you will see the IP of your board on the Oled Display. Or you can check it from your routers "connected devices" menu.

iii-) Type the Ip number to your preferred browser (we make our tests for chrome and firefox only)

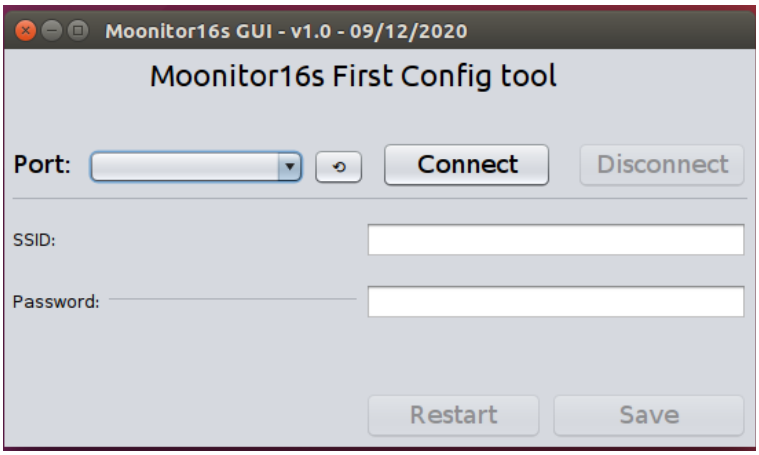


Figure 6: Open USB Configuration Tool

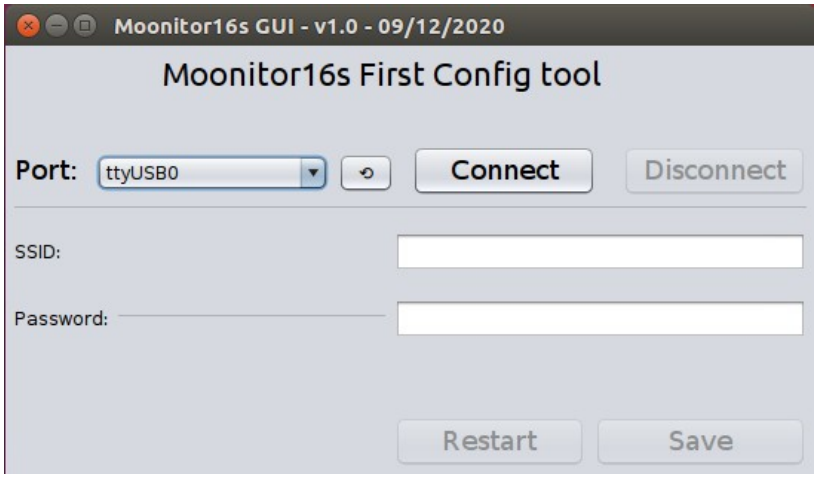


Figure 7 : Select the USB port that Moonitor is connected

Then you will see the Restart and Save buttons are activated as well as Disconnect button.

Figure 8: Write correct SSID and Password for your router

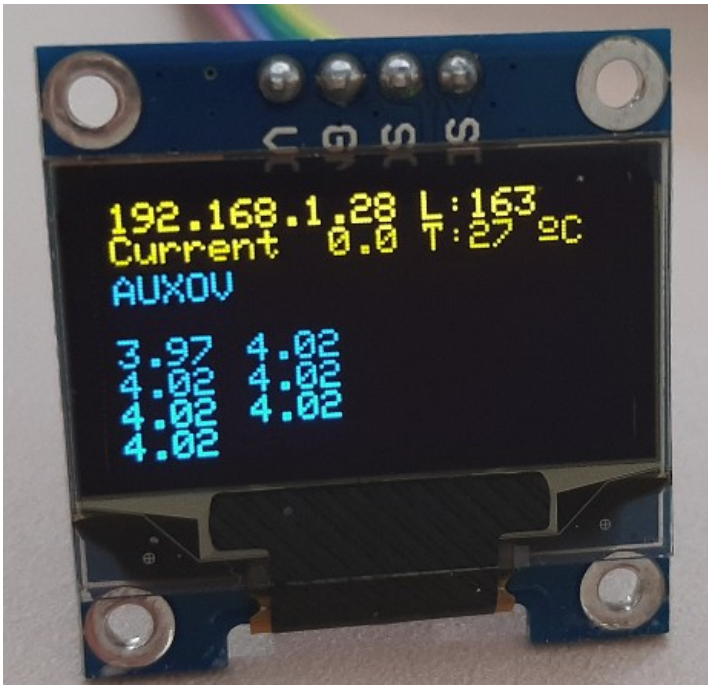
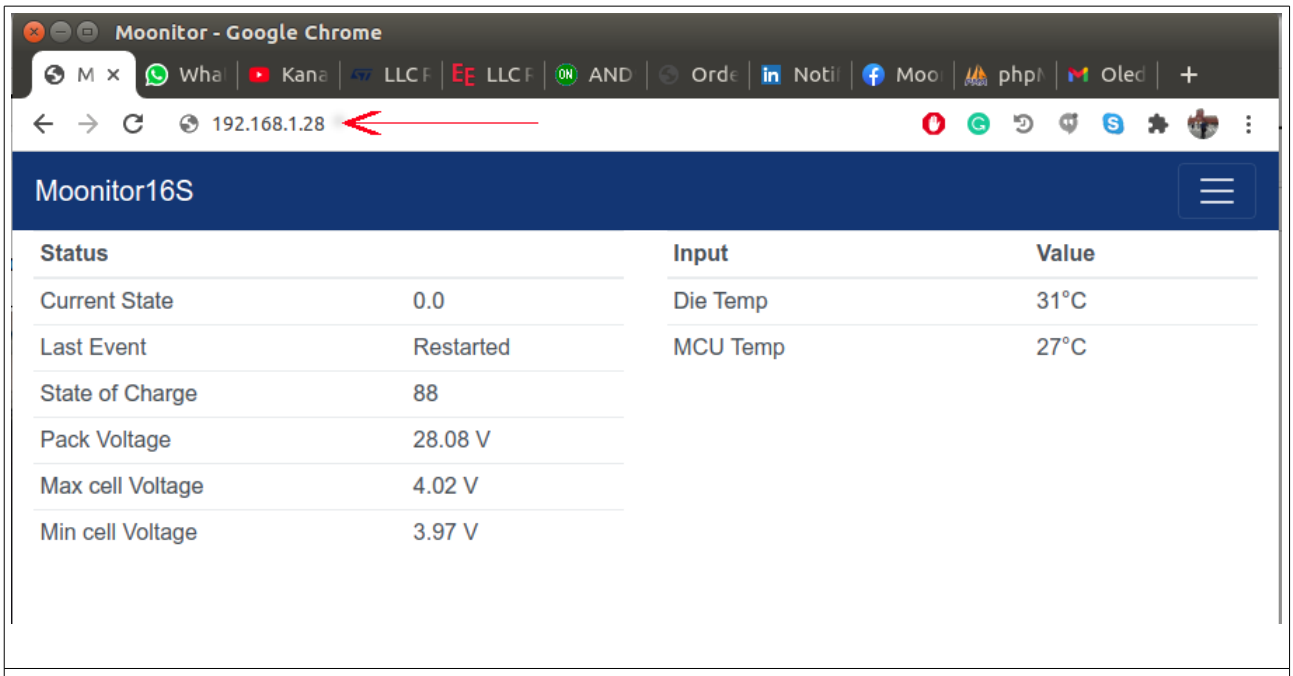


Figure 9: After saving the parameters you should see the IP number on the OLED Display

After this step please go to your computer, or a smart phone and open the browser. Be sure that you are connected to the same network and write down the same IP to your browsers input.



On the same network, if you type the same IP into your browser you will see the Graphic interface

The graphic interface will open and you can navigate from the top menu, you should go to the settings page and set your cell count and balancing voltage etc. Please be aware if you are not in the

same network with Moonitor, the IP won’t work. And you can’t connect. You need to be sure that you are connected to the same SSID.

Second Option: Without any physical conneciton (with Mobile Hotspot)

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

Hot-Spot Name (SSID): Moonitor16s
Password: Moonitor16s

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:

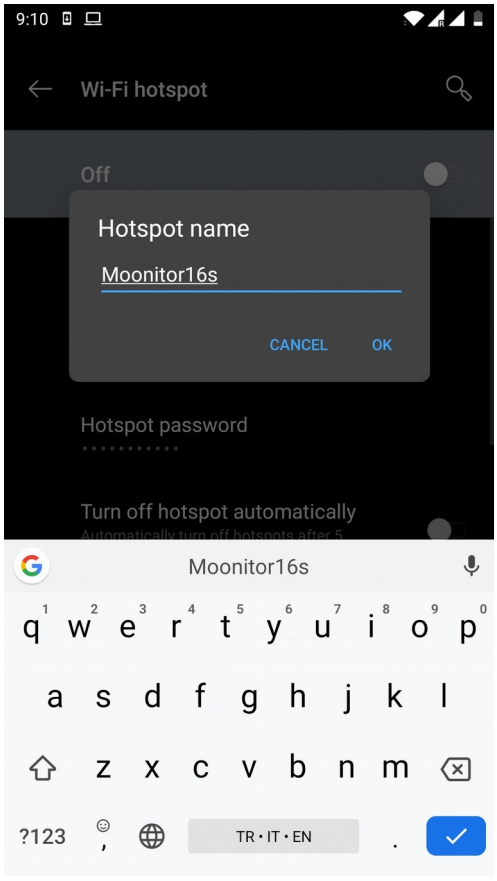
1. Open a WiFi Hot-Spot with **SSID:** Moonitor16s , and **Password:** Moonitor16s;
2. Wait until your hardware connects (2-3 seconds);
3. Find out your hardware’s IP with your phone, or from your router settings;
4. Open this Ip on your phones browser;
5. Open Settings page and change Wi-fi initials to your routers Wi-fi SSID and password.

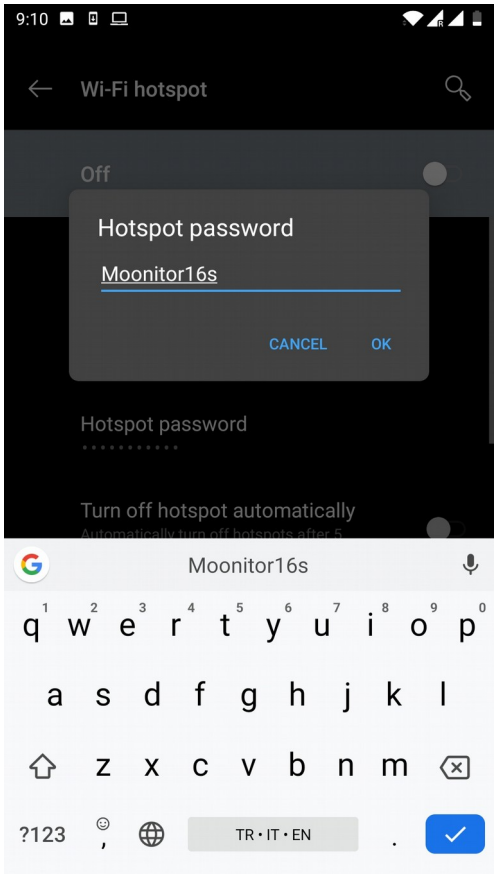
That's it, now you are up and ready for the configuration.

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.

2.2 Step by step detailed explanations for first network connection with Hot-Spot:

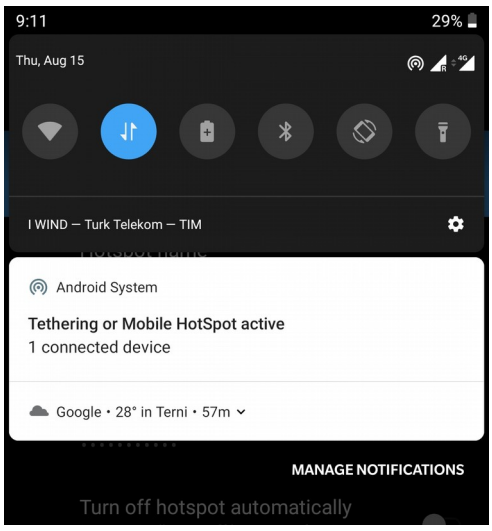
1. Open a WiFi network with Hot-Spot name: Moonitor16s , and Password: Moonitor16s. You can do this step with your cell phone’s tethering mode, just open your mobile phones WiFi tethering mode and set your SSID and Password both to: Moonitor16s

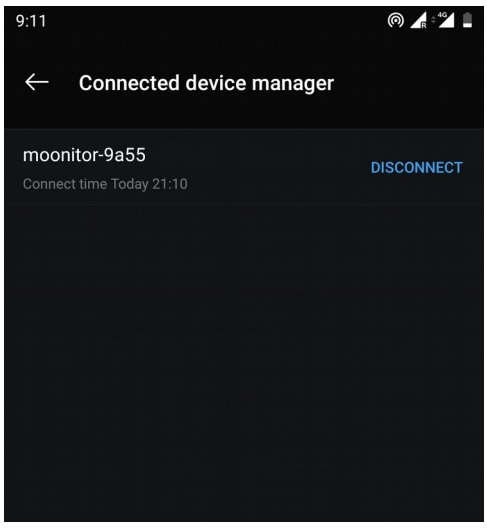




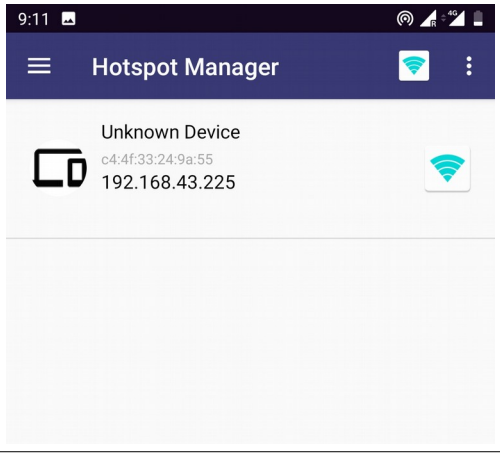
Open a WiFi network with **SSID:** Moonitor16s , and **Password:** Moonitor16s

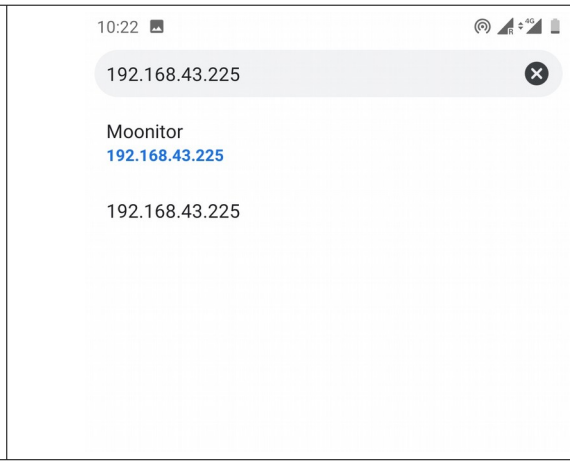
2. Wait until your hardware connects (2-3 seconds)
3. Find out your hardware's IP with your phone





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

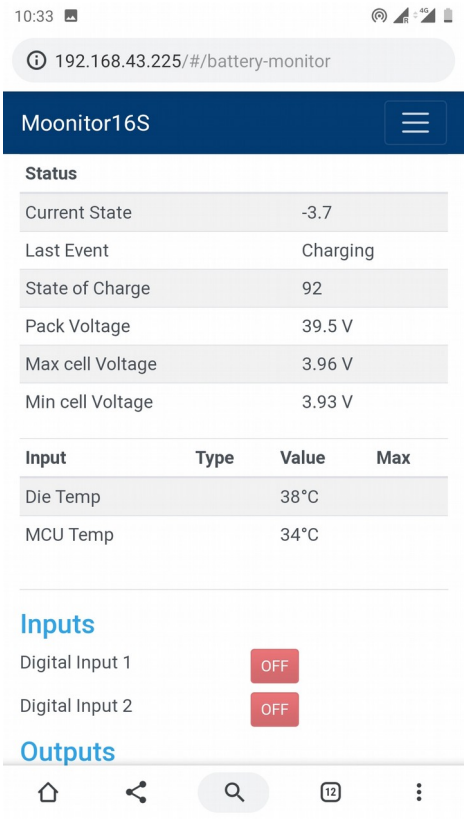


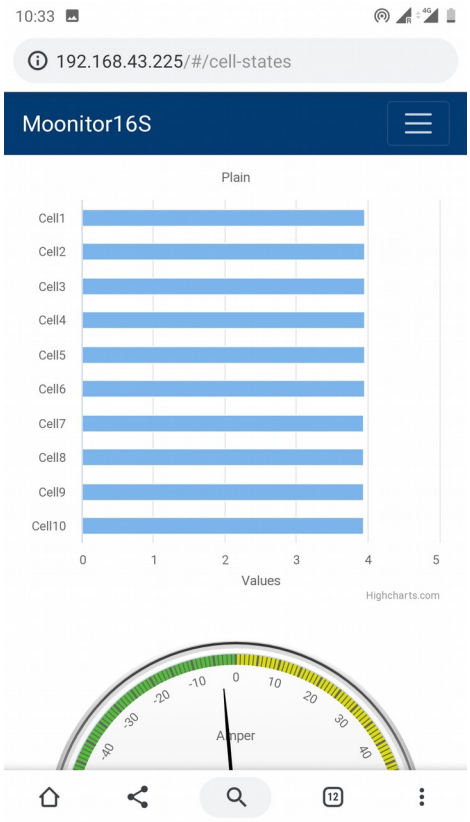


First find your devices IP number, and then type that IP to your browser on your phone

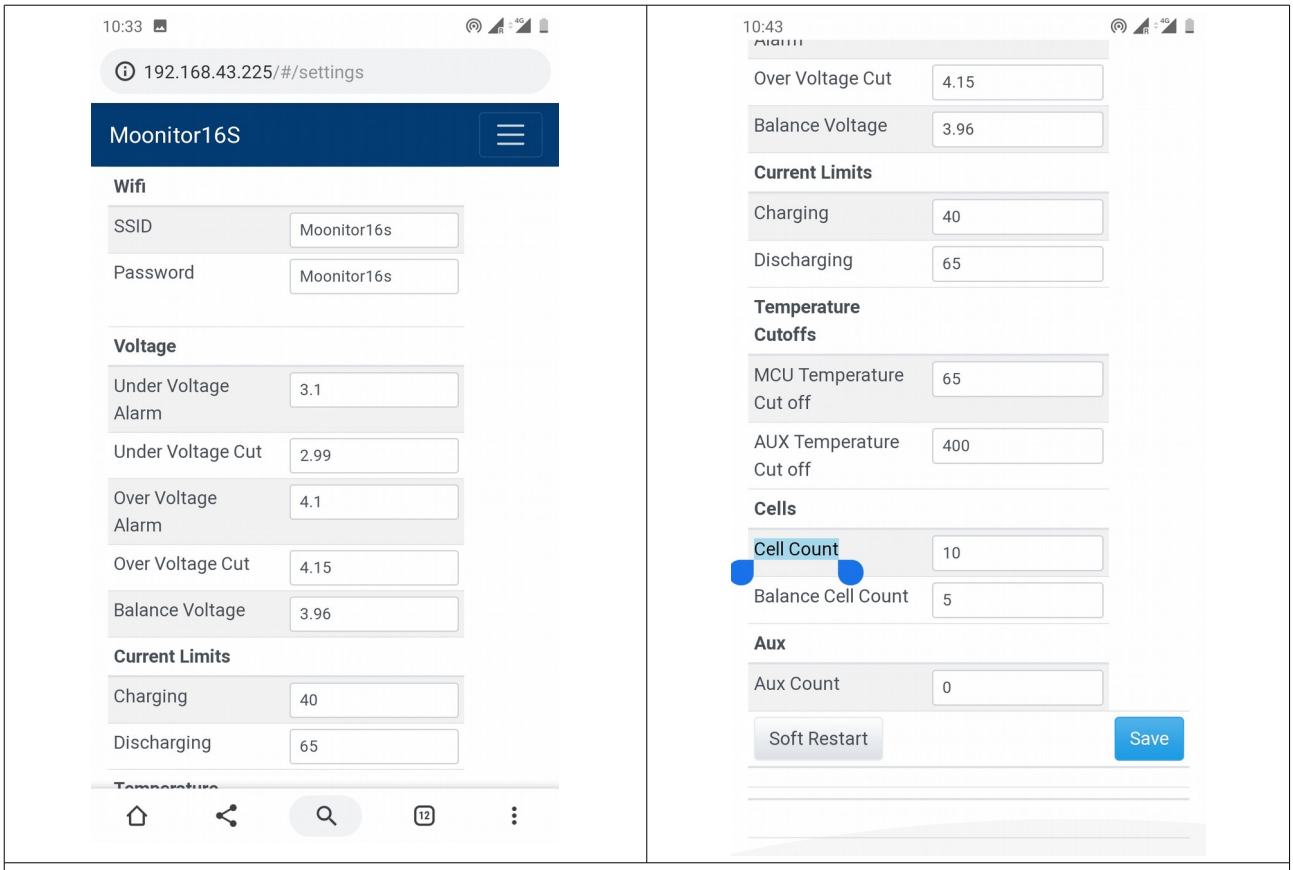
If you can't see connected devices IP on your cell phone please install Hot-Spot Manager to your phone to see your connected hardware's IP number. Some phones has this feature already built in and they show every device with its IP and mac address, be sure that your device's mac is same for the proper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

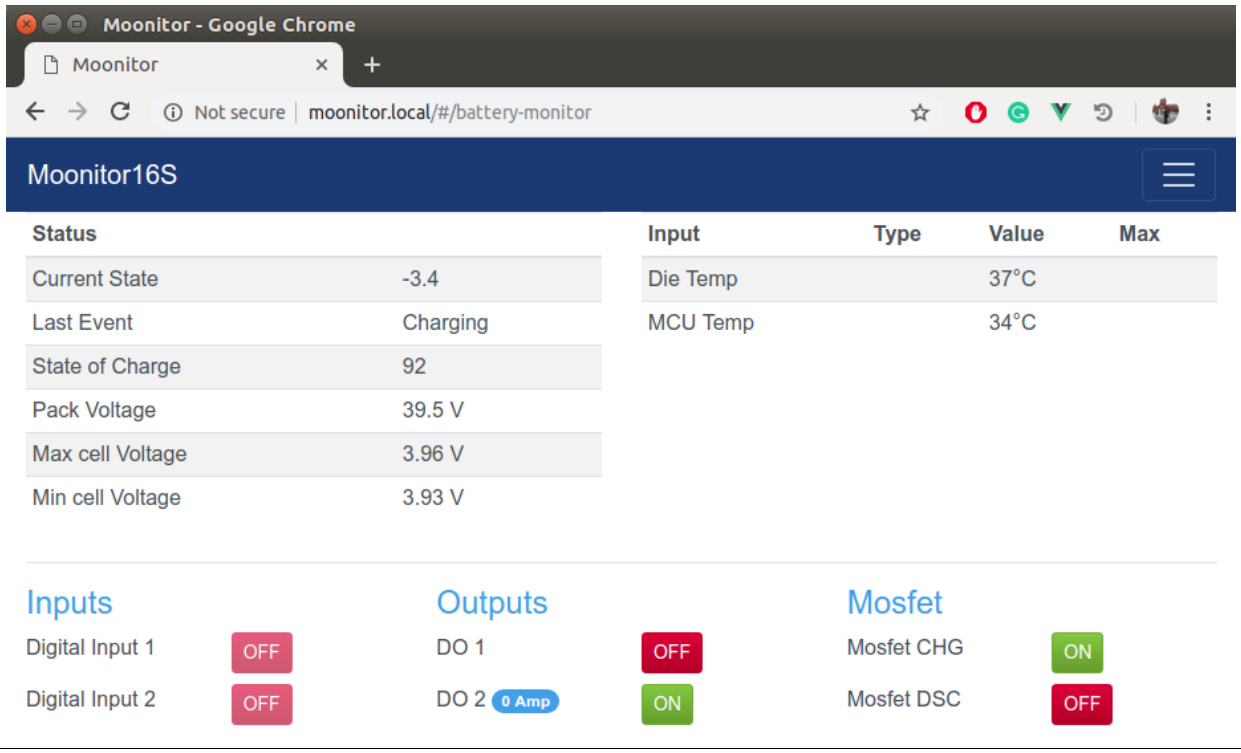
Whenever you see the dashboard you can start the configuration. From the top menu, navigate yourself to the Settings page.

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.

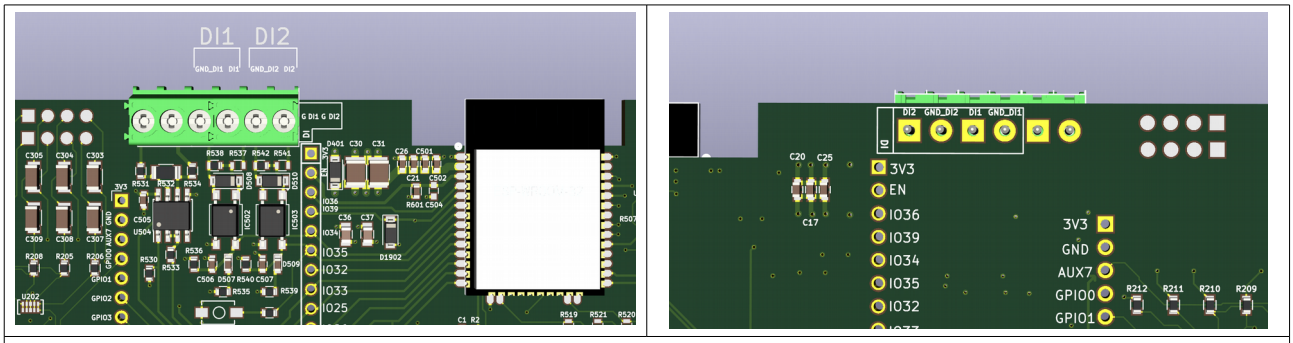


We are connected to the Router instead of Cell phones Hot-Spot

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.

2.2.1 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

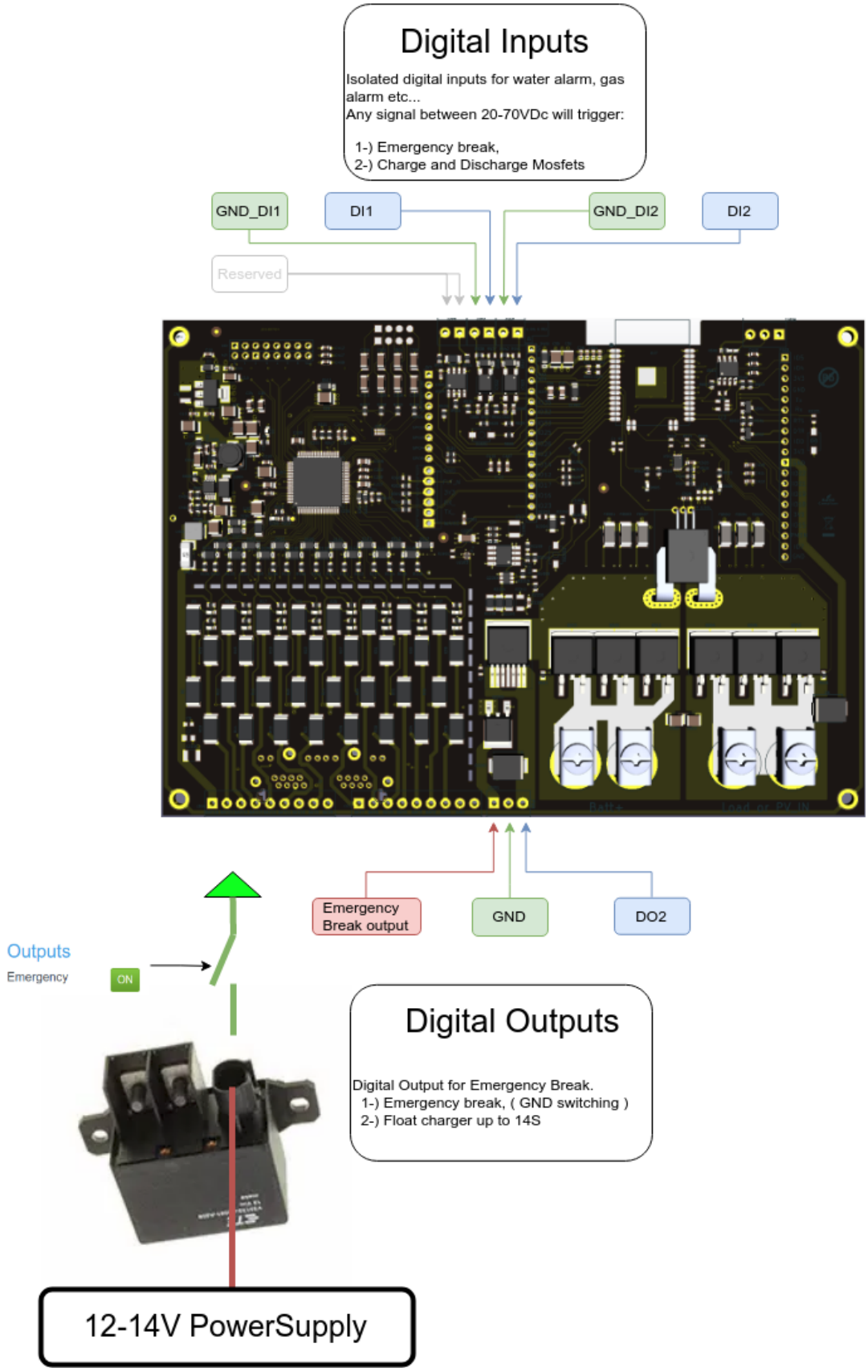


Figure 10: Digital Input and Outputs

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 (<16V) will break the Emergency contactor.

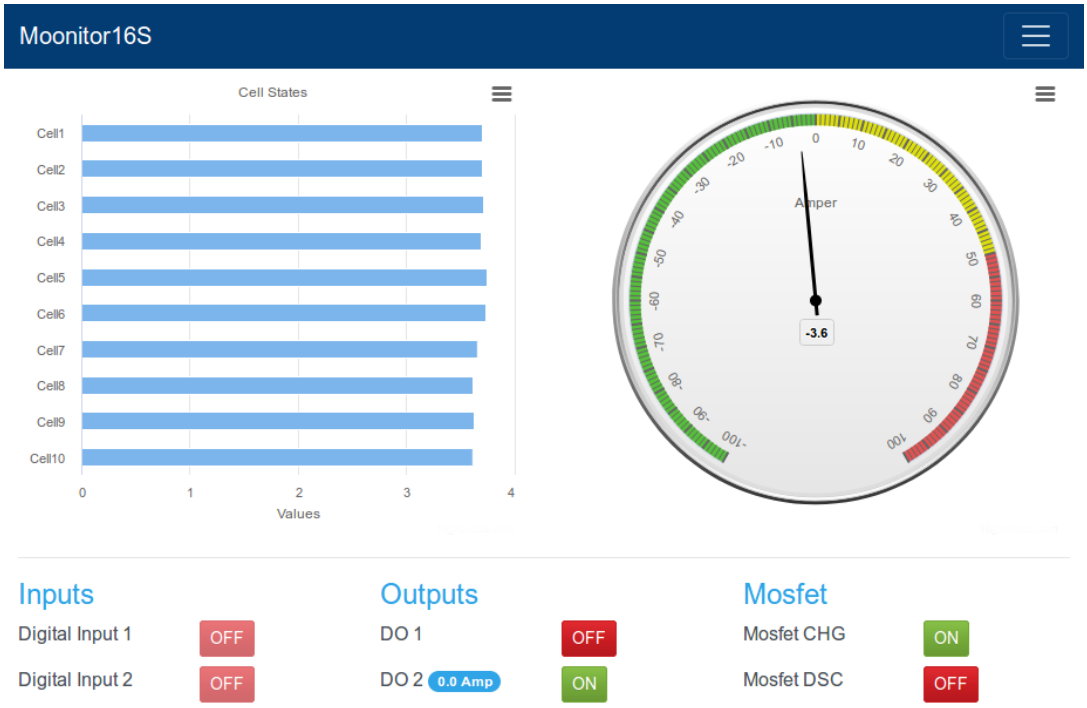


Figure 11: There are 2 digital inputs for external circuits

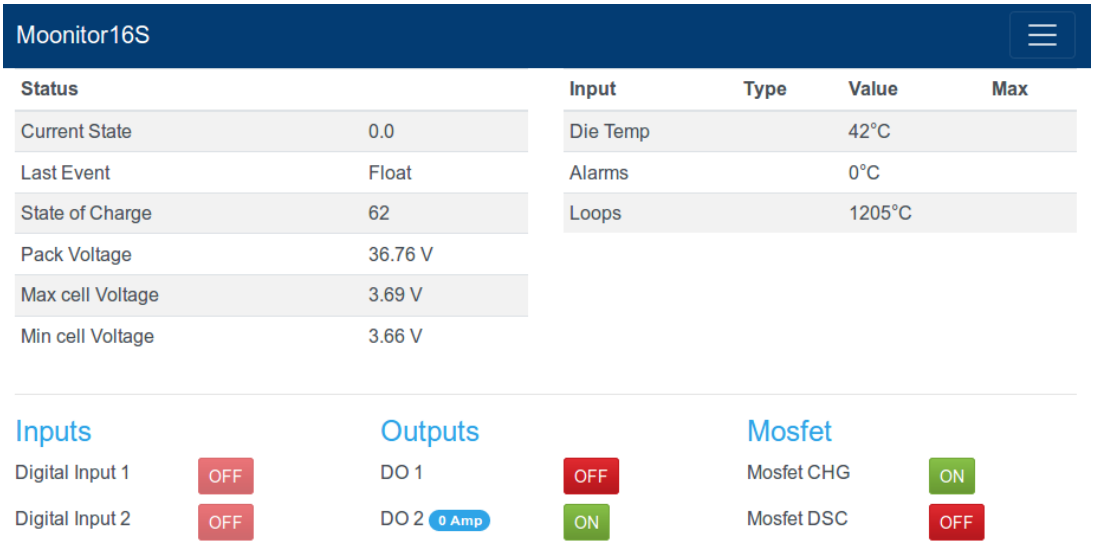
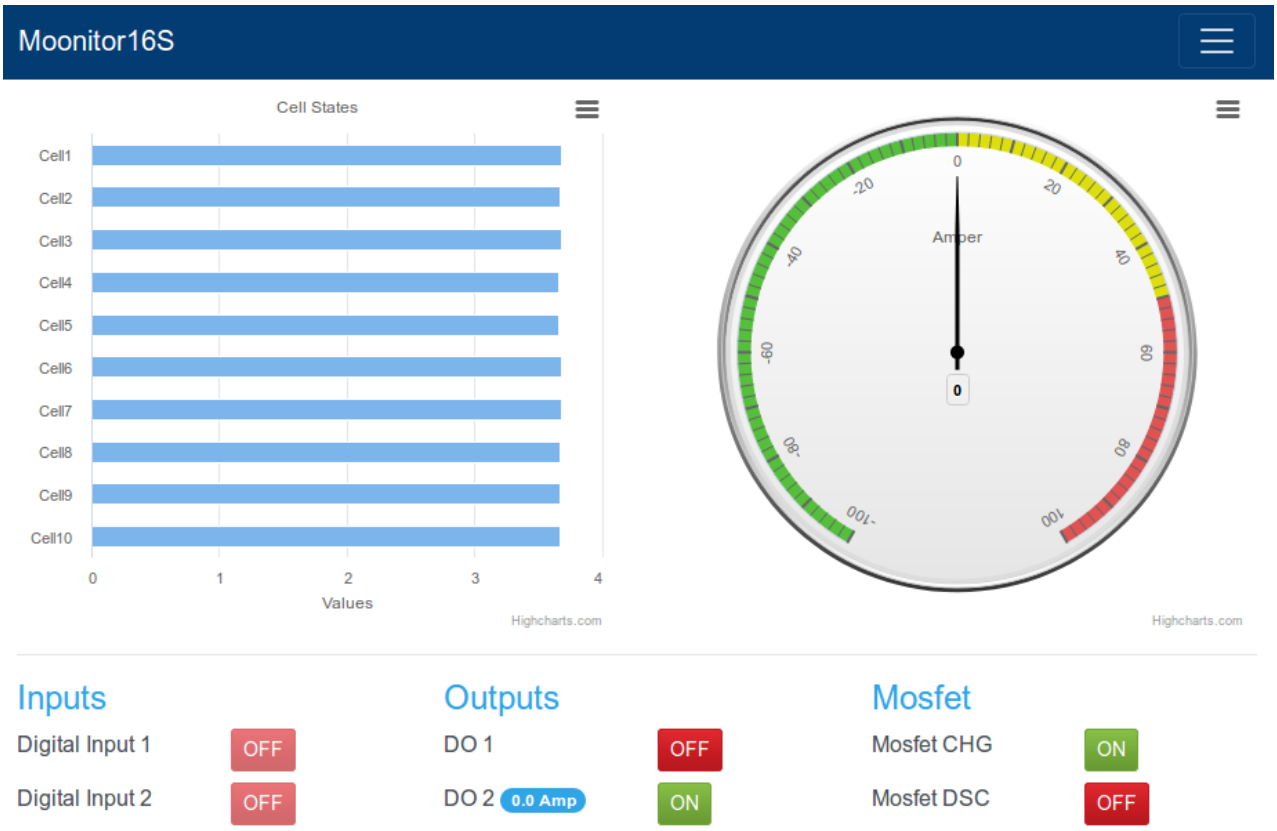


Figure 12: You can access Digital Output states from each page



2.2.2 Digital Outputs

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

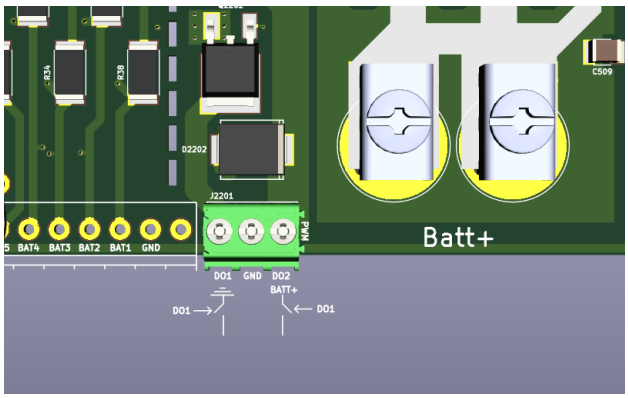


Figure 13: Front and Back Silk Screen for Digital output connections

2.2.3 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

Figure 14: Front and Back Silk Screen for Digital output connections

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.

2.2.3.1 WiFi

WiFi settings are pretty straight forward, On the beginning SSID and Password: Moonitor16s

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

2.2.3.2 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.

2.2.3.3 Current Limits

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

2.2.3.4 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 7 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.

3 High current connection

First of all you don’t need to use high current connection, if you don’t connect any cables to the high current line, moonitor will still allow you to monitor all your cells but it cant disconnect your batteries if there is an emergency!.

After the initial setup and the first configuration, and also being comfortable with the Moonitor on your system. (preferably after a week of usage and being advance user) You can start using the high current line. For this you can follow different scenarios. We will explain here with some schematics but there are many more possibilities than we are describing here. You just need to get comfortable with Moonitor and after DIY’ing one system with Moonitor you will be comfortable for the next projects and it will take less time and effort for the future projects.

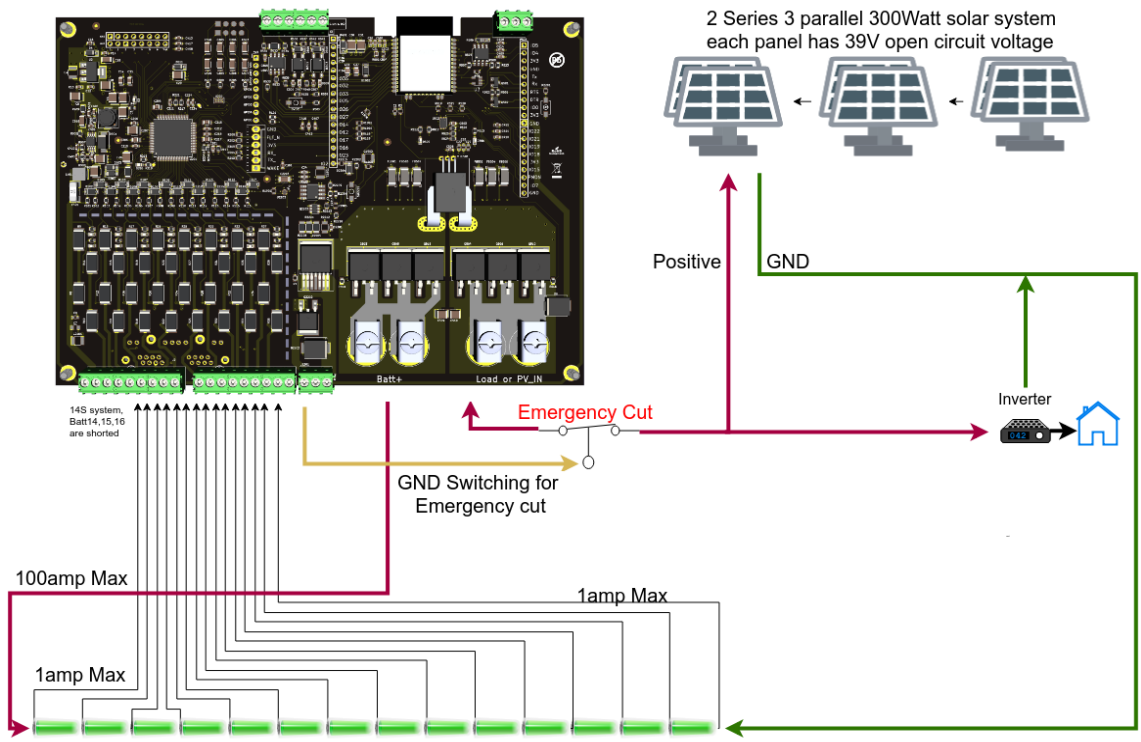


Figure 15: High current connection with Mosfet Channel (Redundant protection with Emergency contactor)

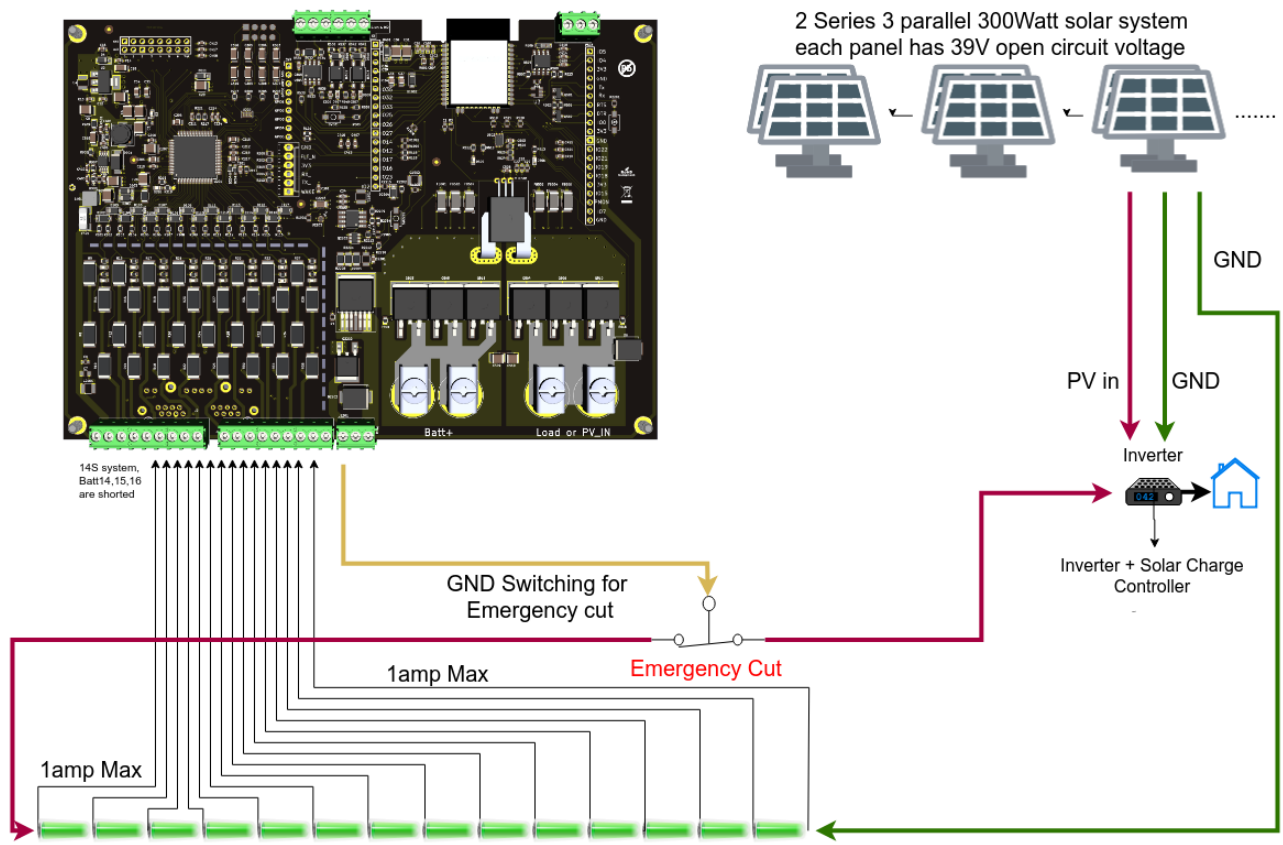


Figure 16: High current connection without mosfet channel

Mosfet channel allows you up to 100 amp, after 100 amp using mosfet channel will harm the board and the batteries. If you are planning to use over 100 amp (250amp, 400amp,600amp) you can still use Moonitor for Monitoring and protecting your system, For protection you can use automotive grade contactors from varios brands we prefer TE brand for the high current contactors.

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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.

Change Log: Rev. A.165 - 2019-09-23 initial Release Rev. B.165 - 2020-11-29 Some recommendations added 9P to 8P Connector binding changed	