



Battery Management System User Manual

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1 Preface

GRNbms is a next-generation Battery Management System developed in-house by pro-LOX, designed to revolutionize energy storage solutions. This innovative system not only facilitates the use of batteries from modern electric vehicles but also integrates their cell monitoring hardware (CMUs), promoting cost-efficiency and sustainability. By maximizing the reuse of components, GRNbms enhances both the return on investment and the quality of energy storage, utilizing CMUs that are specifically tailored for these batteries.

Currently, GRNbms is compatible with the Volkswagen ID.series and the BMW I.series, with ongoing developments to extend support to more brands and models.

Equipped with flexible interfaces and a powerful dual-core processor, GRNbms stands at the cutting edge of battery management technology. Its commitment to continuous development and backed by technical support ensures reliable operation

GRNbms monitors and regulates battery parameters, ensuring maximum efficiency and reliability. It independently balances cells and interfaces with inverters to guarantee the utmost in operational dependability.

Moreover, GRNbms is designed for seamless integration into existing networks, accessible via Ethernet or Wi-Fi. Its intuitive web interface allows for straightforward control and configuration from any internet-enabled device, marking a significant advancement in energy management technology.

Embrace the future of energy storage with GRNbms by pro-LOX, where efficiency meets sustainability.

1.1 GRNbms: A World of Features

Web Dashboard and Online Updater: The user-friendly web interface provides real-time insights into battery status, allows for easy configuration, and facilitates seamless updates—all through a simple browser on your computer.

Build in Relays outputs: Both main and precharge outputs are integrated, making the system ideal for low voltage architectures. If using a HighVoltage system, the functionality goes over to HV extension.

MQTT Support: Integration with smart home systems or data tracking in databases is a breeze with MQTT, offering limitless communication possibilities.

Modbus: Modbus RTU und Modbus over TCP und Modbus RTU over TCP additional bridge function Modbus TCP / RTU o. TCP to Modbus RTU (RS485)

1.2 GRNbms Extensions

GRN HV extension: Tailored for high voltage setups, this extension provides advanced contactor control and isolation monitoring.

GRN distribution board: Distribute and monitor up to 8 DC components save and easily with adjustable fuses and short protection

GRN Relay extension: control up to 8 free programmable outputs over your GRNbms

Nextion Touchscreen Display + Cable: Keep critical system data within view for quick reference.

VE-Direct Extension Board: Seamlessly integrate your existing Victron current sensor into the GRNbms ecosystem.

2 Safety



The BMS is a component of a system not built by us, our BMS does not have an emergency stop, you must provide for an emergency power interruption/fuse in your system.



Upon receiving the BMS, inspect it for any signs of damage that may have occurred during transport. If any damage is found, contact the provider immediately.



Do not store the BMS with or near high-powered magnets, as this could interfere with the electronic components.



Before installation, please read the installation and commissioning instructions and follow the described instructions.



All activities described in the following may only be carried out by electrically instructed specialists.



The voltage level depends on the type of connection. Therefore, it is absolutely necessary to work with the corresponding care.



The BMS is used as part of a system. It is the responsibility of the customer or system manufacturer/operator to design the system according to relevant guidelines.



Components should be handled with care to avoid pressure, bending, or other physical stresses.



When handling batteries, please ensure they are operated within the approved limits as specified by the manufacturer's instructions and safety data sheets.



Please ensure that the connections are made according to the technical specifications of the device, and that the device is powered down before making any changes to the connections.



Ensure that no damaged components are used!



Before commissioning, the mechanical and electrical installation must be checked!



Please note that changes and errors are subject to possibility. If you have any uncertainties or inquiries, we recommend reaching out to your dealer for clarification.



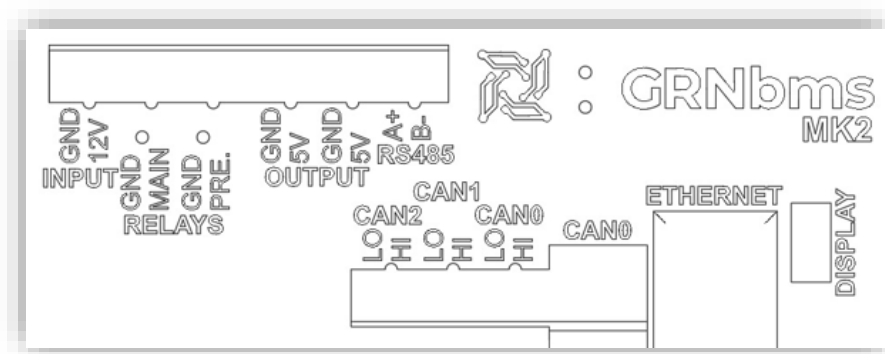
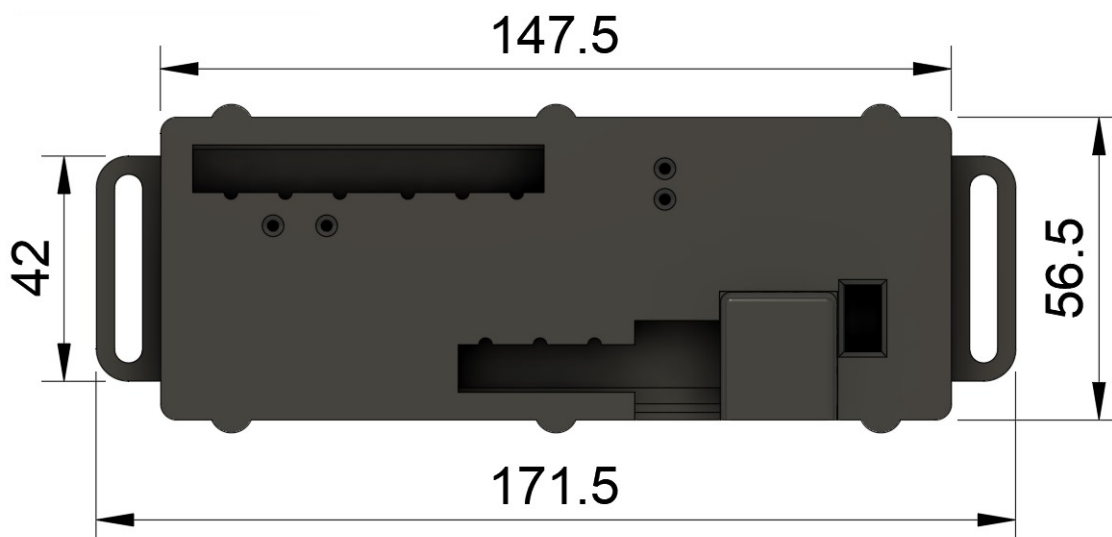
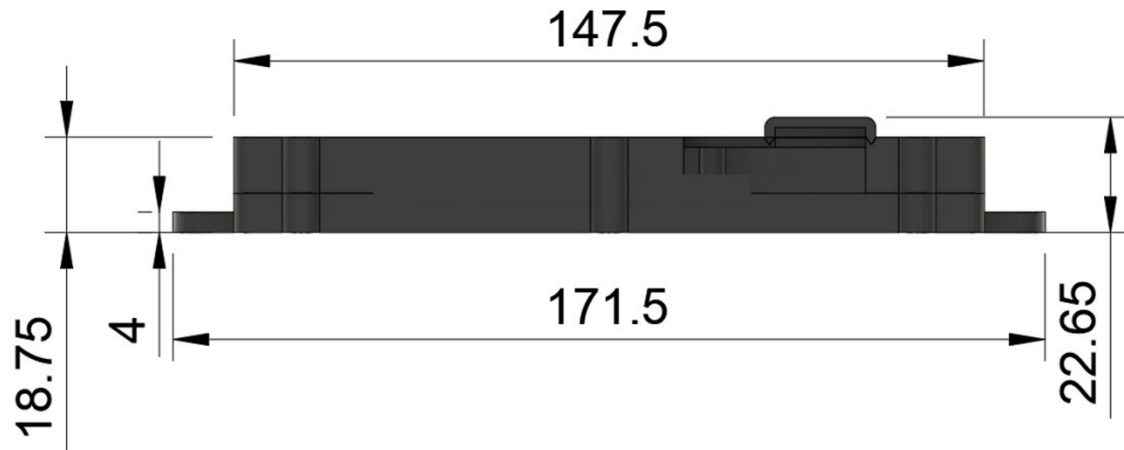
Kindly be aware that all statements provided are without guarantee.



The information provided is intended as suggestions and may need to be adjusted depending on the specific circumstances.

3 Machine Overview

3.1 Machine Overview



Dimensions:

Length: 171.5 mm

Height: 56.5 mm

Width: 22.65 mm

Power Connections:

INPUT: 12 V (Direct Current)

OUTPUT: 2x 5V (Direct Current)

Relays:

MAIN RELAY: The primary battery relay

PRECHARGE RELAY: A relay used to precharge the system

Network Interfaces:

CAN 1, CAN2, CAN3: These are Controller Area Network bus interfaces, which allow the unit to communicate with other devices within a automation system. V2.0B up to 1 Mbps.

CAN0/1: Features an additional RJ45 (Victron compatible BMS CAN) connection for enhanced connectivity options.

Data Connections:

ETHERNET: Provides a standard interface for an Ethernet connection, allowing network communication. 10/100, IEEE802.3/802.3u.

Wi-Fi: 802.11 b/g/n up to 150 Mbps.

DISPLAYPORT: A port designed for the GRNbms Display Extension.



Please ensure that the connections are made according to the technical specifications of the device, and that the device is powered down before making any changes to the connections.

3.2 Batteries

VAG MEB 12S CMU full control and balancing, from 1-32 modules

VAG MEB 8S CMU full control and balancing, from 4-36 modules

VAG MEB 12 & 8S with GRNcmu MEB - 2 Port and 4 Port variant. 1- 93 modules

BMW i3 CMU full control and balancing 1-32 modules

BMW i8 CMU full control and balancing 1-36 modules

Any lithium system with modules from 1S to 18S with GRNcmu

3.3 Inverters

Inverters certified for the Pylontech Low voltage/high voltage protocol

Inverters certified to work with BYD high voltage protocol

Victron Energy low voltage

Victron Energy high voltage protocol for the upcoming Multi HS19 Solar

Deye Inverter- all generations high voltage + low voltage

Fronius GEN24 / Plus

Sofar Solar high voltage + low voltage

Goodwe high voltage + low voltage

3.4 Current Sensors

LEM CAB500 model CAB-SF 500-C/SP1-000

LEM CAB300 model

Victron SmartShunt 500 and Victron BMV-712 Smart (VE.Direkt to GRNbms extension required)

4 Transport, Handling and Storage

This section outlines the recommended procedures for the safe transport, handling, and storage of the GRNbms, a compact Battery Management System. Proper adherence to these guidelines will ensure the system's functionality and longevity.

4.1 Transport Instructions:

Packaging: The BMS should be transported in its original packaging to prevent damage.

The BMS should be transported in a stable and secure manner, avoiding any excessive force or pressure that could damage the device.

4.2. Handling Guidelines:

Handle the BMS with care. Avoid dropping, striking, or applying pressure to the device.

The BMS should be handled in a static-free environment to prevent electrostatic discharge (ESD) damage.

Handlers should be aware of the sensitivity of electronic devices and be trained in ESD precautions.

4.3. Storage Recommendations:

The BMS should be stored in a temperature-controlled environment, ideally between 15-30 °C.

Relative humidity should be maintained within 40-60 % to avoid condensation that could affect the components.

Avoid direct sunlight and store in a dark, dry place to prevent damage from UV exposure.

Additional Notes:



Upon receiving the BMS, inspect it for any signs of damage that may have occurred during transport. If any damage is found, contact the provider immediately.



Do not store the BMS with or near high-powered magnets, as this could interfere with the electronic components.

5 Assembly of the machine

The BMS has mounting holes for M5 screws for attachment.

Components should be handled with care to avoid pressure, bending, or other physical stresses.

For assembly, the temperature range should be between 15°C and 30°C. A relative humidity (RH) of about 40% to 60% is recommended.

Dust can damage electronic components and should therefore be minimized in the assembly environment.

For safety reasons, we recommend installation in a control cabinet

6 Installation



Components should be handled with care to avoid pressure, bending, or other physical stresses.

6.1 Technical Specifications:

Absolut Maximum Ratings are:

Input Voltage Max: 14,5 VDC

Input Voltage Min: 7V

Input Current: 3A

Temperature Range: -20°C – +80°C

Output Current 5V: 1.2A Continuous, 1.8A Peak

Relays Output Current: 1A

CAN Bus: $\pm 80V$ Fault Protection

RS485: -0.3V to 7V

6.2 Power Supply:



Please ensure that the connections are made according to the technical specifications of the device, and that the device is powered down before making any changes to the connections

It is crucial to establish a proper ground connection (GND, BAT-, etc.) that is linked to all interconnected devices (BMS, extensions, CMUs, converters, chargers).

Furthermore, it is highly recommended to establish a connection to the building's grounding system for added safety and efficiency.

The best thing is to connect all ground connections in a star configuration from a distribution strip.

It is essential to ensure that the power supply for all interconnected devices adheres to the specifications

outlined in the respective data sheet. Additionally, it is crucial to verify that the power supply being utilized not only delivers ample power but also provides the correct voltage required for optimal functionality.

Furthermore, it must be ensured that all cable cross-sections are adequately dimensioned.

At least 1mm² is recommended for Gmbh MK1 and MK2.

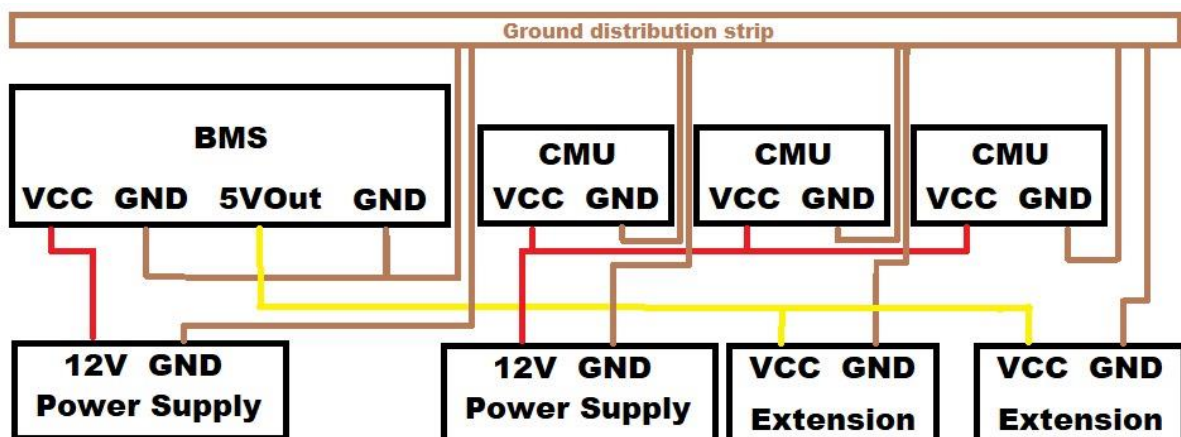
The voltage outputs of the GRNbmsMK1 & MK2 are intended solely for powering GRNExtensions.

However, CMUs can be powered using the same power supply as the GRNbms, but not directly from the voltage

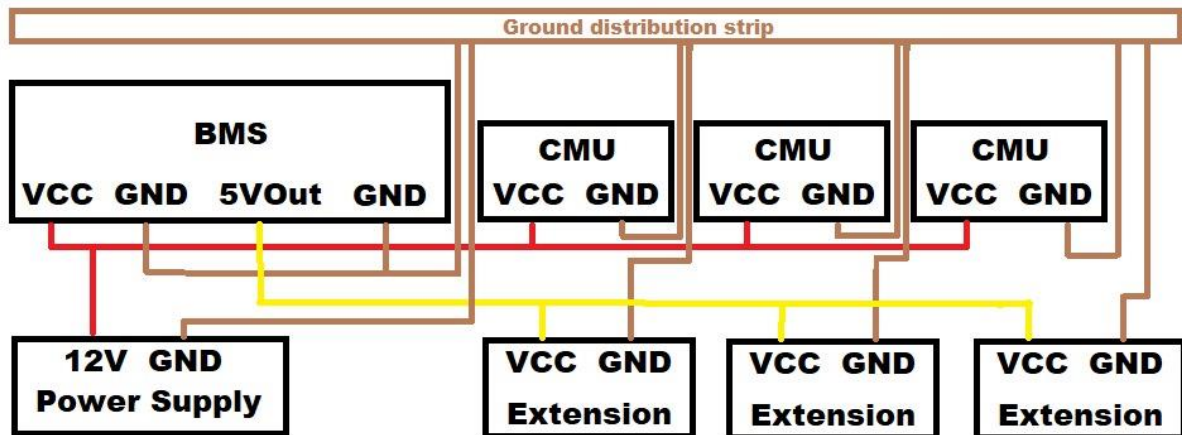
outputs of the BMS. It is important to ensure that the power supply meets the necessary voltage and power

requirements to provide adequate power for both the GRNbms and the CMUs.

Supply with single power supply:



Supply with separate power supplies:

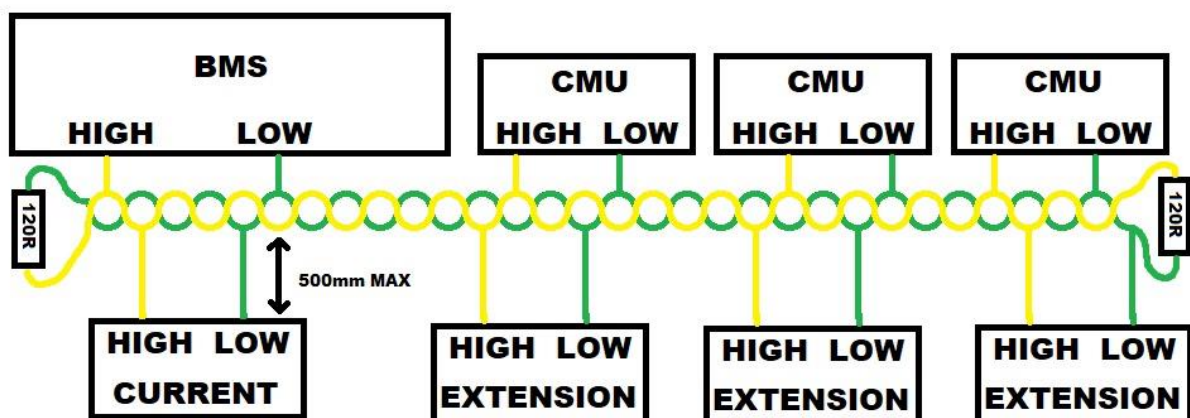


6.3 CAN Bus:

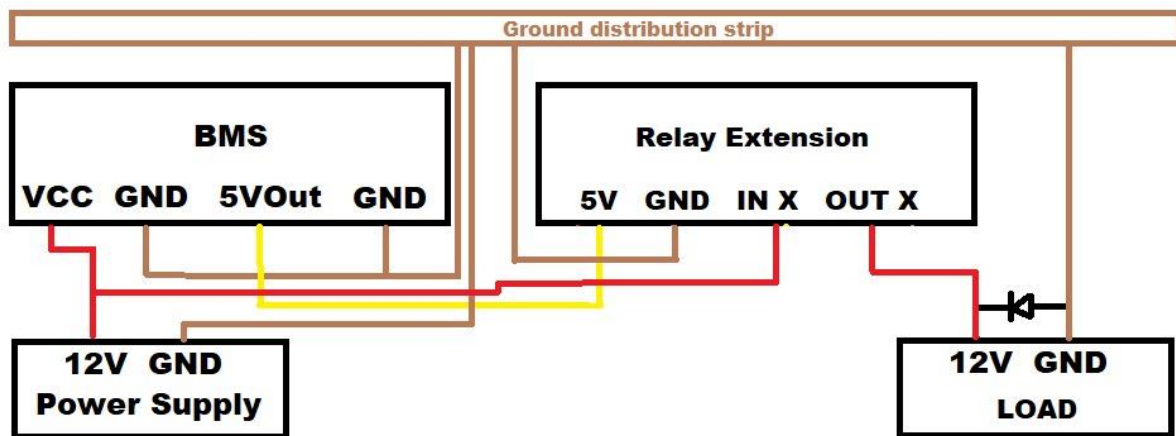
If possible, it is recommended to place extensions, current sensors and CMU'S on separate CAN's.

For proper functioning, the CAN bus should be constructed using a twisted pair trunk, with terminating resistors of 120R (0.25 watt) placed at each end. The recommended choice for the trunk cable is a 120R data cable, although a twisted 0.5mm² cable is generally acceptable as well.

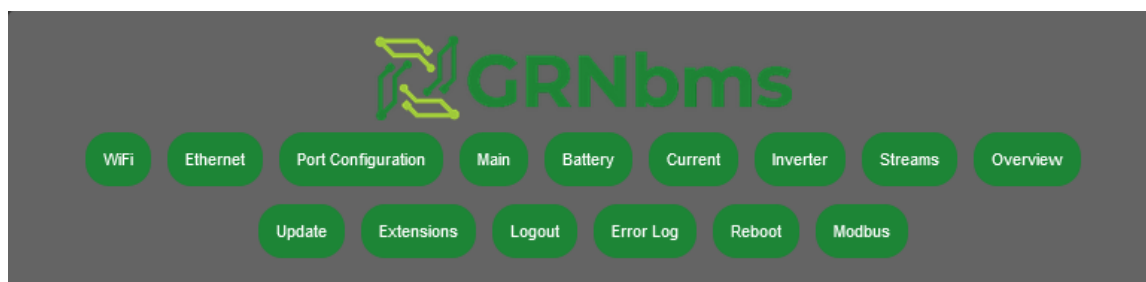
It is important to note that the maximum allowable length for the bus is 16 meters. To connect CAN devices to the trunk, twisted wire up to a length of 500 mm can be utilized.



Separate power supply & resistive loads:



7 Configuration (web interface)



7.1 Connect to web interface

Network name: GRNbms_MK2

Network key: 0123456789

Wi-Fi AP IP: <http://192.168.0.4/>

Note: For initial settings, which may vary depending on the connected system, please consult your dealer.

Connect to the GRNbms Wi-Fi AP using the password: 0123456789 Open the IP <http://192.168.0.4/> in your browser. You will be directed to the overview page, where you can see the status of your system. Important is to first check the firmware version and the unlocks

7.2 Updates

Online Check:

At the top section of the page, you'll find the "Online Check" area. Here, you can check for new firmware versions. Simply click the green button labeled "Check for newer versions". This action connects to a server, checks for updates, and saves them if available. You can then upload these files under "BMS Firmware" or "Display Firmware".

BMS Firmware:

The "BMS Firmware" section allows you to upload new firmware for the Battery Management System (BMS). Click the "Browse..." button to select a file and click the "Upload" button to upload the firmware. The file must have the filetype ".enc" or ".upd".

Display Firmware:

The "Display Firmware" section allows you to upload new firmware for the display. Click the "Browse..." button to select a file and click the "Upload" button to upload the firmware. The file must have the filetype ".tft".

Load Settings:

In the section, "Load Settings", you can load settings from a file. Click the "Browse..." button to select a file from your computer. After selecting the file, click the "Upload" button to load the settings.

With the button "Save Settings," you can save a file of the current configuration of the BMS

Important Notes

Make sure the files have the correct extensions as specified in each section. Ensure that there is enough storage space

Online Check

Check for newer versions

Free Storage: 5036 kB

BMS Firmware

Durchsuchen...

Keine Datei ausgewählt.

Filetype: .enc, .upd

Upload

Display Firmware

Durchsuchen...

Keine Datei ausgewählt.

Filetype: .tft

Upload

Load Settings

Durchsuchen...

Keine Datei ausgewählt.

Upload

Save Settings

available before uploading a file. By carefully following these instructions, you can ensure that the firmware or settings are uploaded and saved correctly, maintaining the functionality of your system.

7.3 WIFI

Wi-Fi Configuration

This section allows you to configure the settings for the Wi-Fi Access Point (AP) and the Wi-Fi Station of your device. Follow the instructions below to ensure proper setup and security.

The Wi-Fi Access Point (AP) is the point through which your devices connect to the network. You can configure the network name (SSID), password, and network settings. It is recommended to change the default password 0123456789 for security reasons. Please note that the password must be kept secure as it cannot be reset if lost. If the password is lost, the device must be sent back to the manufacturer for repair.

The IP address of the Wi-Fi AP is set to 192.168.0.4 by default, the gateway IP to 192.168.0.1, and the subnet mask to 255.255.255.0.

The Wi-Fi Station allows your device to connect to an existing Wi-Fi network. Enable the "Station Use DHCP" option to allow the device to automatically obtain an IP address from the router, which is recommended for most users. Enter the SSID of the Wi-Fi network you want the device to connect to. Leave this field blank to turn off Wi-Fi Station mode. Enter the network password and, if necessary, configure the IP address, gateway IP, subnet mask, and DNS IP. By default, the IP address of the Wi-Fi Station is set to 192.168.0.4, the gateway IP to 192.168.0.1, the subnet mask to 255.255.255.0, and the DNS IP to 192.168.0.1.

After making all necessary adjustments, click the "Save" button at the bottom of the page to save the changes.

WiFi AP:

WiFi AP SSID

GRNbms_MK2_2

WiFi AP Password

0123456789

WiFi AP IP

192.168.0.4

WiFi AP Gateway IP

192.168.0.1

WiFi AP Subnet Mask

255.255.255.0

WiFi Station:

Station Use DHCP

☒

WiFi Station SSID (Clear to turn OFF)

WiFi Station Password

WiFi Station IP

192.168.0.4

WiFi Station Gateway IP

192.168.0.1

WiFi Station Subnet Mask

255.255.255.0

WiFi Station DNS Mask

192.168.0.1

Save

Important Security Note:

Ensure you change the default Wi-Fi AP password to a secure one and keep it safe. If the password is lost, it cannot be reset through the interface and the device must be sent back to the manufacturer for repair.

7.4 Port Configuration

To adjust the communication settings, first open the "Port Configuration" menu. Here, you can enter upgrade codes for the Battery-Software and Extension-Software. Information about which battery types, inverters, extensions, and extras are unlocked can be found in the "Overview" menu.

In the "Communication" section, you can also set the data transfer speed for the CAN BUS relay and RS485.

After making all necessary adjustments, click the "Save" button at the bottom of the page to save the changes.

Communications:

CAN BUS 1 Speed

500 kbps

CAN BUS 2 Speed

200 kbps

CAN BUS 3 Speed

500 kbps

RS485 1 Baud

Data: 8, Stop: 1, Parity: none

115200 BPS

RS485 Mode

OFF

Upgrade Code

Save

7.5 Battery

To adjust the battery settings, open the "Battery" menu. Select the battery type that is connected to your BMS. Check if the battery number is the same as the CAN number the battery is connected with.

Ensure to save your changes using the "Save" button at the bottom of the page.

BMS 1:
BMS Type
BMS - Simulator
No Settings Available :)

BMS 2:
BMS Type
Deactivated
No BMS Selected!

BMS 3:
BMS Type
Deactivated
No BMS Selected!

Save

7.6 Main

7.6.1 Main configuration

This section provides instructions on how to configure the Battery Management System (BMS) parameters.

The fields are expandable for a better overview.

Configurable Parameters:

BMS Parameter: Configure general settings related to the BMS, such as operational modes and thresholds.

Cell Voltage Limits: Set the minimum and maximum voltage limits for individual cells to avoid overcharging or deep discharging.

Balancing: Adjust settings for cell balancing to ensure even charging of all cells, prolonging battery life.

Main Settings:

BMS Parameter

Cell Voltage Limits

Balancing

Temperature

Pack configuration

Relays

Others

Save

Temperature: Configure temperature thresholds to prevent overheating and undercooling.

Pack Configuration: Define the configuration of the battery pack, including the number of cells in series and parallel and total capacity.

Relays: Set up relay controls for managing external devices based on BMS status.

Others: Access additional settings, including logging options, communication settings, or firmware updates.

In the System Name field, enter a unique name for the BMS system to differentiate between multiple systems. Set a password for accessing the configuration page in the Config Page Password field. For IT security purposes, it is recommended to set a strong password. Leave the field empty if you do not want to set a password.

After configuring all necessary parameters, click the “Save” button at the bottom of the page.

7.6.2 Configuration errors

List of configuration errors that can occur and where you may need to change your input.

BMS Parameter:	- BMS Parameter -
Max cell voltage to high	Cell charge end voltage
Max cell voltage to low	4.100
	Cell discharge end voltage
	3.330
	SOC calculation
	Voltage based ▾
	SOH calculation
	Off ▾

Cell Volatges: Max cell voltage warning too high Max cell voltage warning too low Max cell voltage error too high Max cell voltage error too low Min cell voltage too high Min cell voltage too low Min cell voltage warning too high Min cell voltage warning too low Min cell voltage error too high Min cell voltage error too low	- Cell Voltages - Cell overvoltage warning 4.200 Cell overvoltage error 4.250 Cell undervoltage warning 3.200 Cell undervoltage error 3.150
Balancing: Cell delta too high Cell delta too low Cell delta warning too low Cell delta warning too high Cell delta error too low Cell delta error too high Balance start voltage error too low Balance start voltage error too high Balance current too high Balance current too low	- Balancing - Battery chemistry: Other Target cell balance delta 0.005 Balance start cell Voltage 3.40 Cell delta warning 0.800 Cell delta error 1.000

Temperature:

Overtemperature warning too low.

Overtemperature warning too high

Overtemperature error too low

Overtemperature error too high

Under temperature warning too low

Under temperature warning too high

Under temperature error too low

Under temperature error too high

- Temperature -

Overtemperature warning

50.0

Overtemperature error

55.0

Undertemperature warning

10.0

Undertemperature error

5.0

Charge- Discharge Current vs. Temperature

Info:

Temperatures not in order in map
line: x

INFO

Temperature °C 5 to 55	Charge % 10A	Discharge % 10A
5	10	10
10	50	50
15	100	100
20	100	100
30	100	100
40	75	75
50	50	50
55	0	0

Pack configuration:

Cell count incorrect, please check your settings

- Pack configuration -

Strings in parallel

1

Cells in string

48

Max charge current

10

Max discharge current

10

Battery capacity of one String (Ah)

157

7.7 Inverter

Inverter Type Dropdown: This dropdown menu allows you to select the specific type of inverter you are using.

CAN BUS Dropdown: This dropdown menu lets you select the appropriate CAN BUS channel for the inverter.

Ensure to save your changes using the "Save" button at the bottom of the page.

Inverter:

Inverter Type

Inverter - Victron

CAN BUS:

CAN 0

Save

7.9 Streams

This interface consists of various fields and options that allow you to configure the necessary settings for establishing an MQTT connection.

To enable the MQTT connection, check the "Enable" checkbox. This action activates the configuration options for the MQTT connection. You will need to enter the server address of the MQTT in the "Server" field. The server address is essential as it specifies the location of the MQTT you wish to connect to.

Next, specify the port number used to connect to the MQTT in the "Port" field.

If the MQTT requires authentication, enter the username in the "Username" field and the associated password in the "Password" field. These credentials ensure secure access to the MQTT.

The "Publish Topic" field is for specifying the MQTT topic to which messages will be published.

In the "Publish Interval (ms)" field, set the interval, in milliseconds, at which messages will be published to the MQTT topic.

Select the type of encryption for the MQTT connection from the "Encryption" dropdown menu, depending on your security requirements.

The "Reconnect" button allows you to manually reconnect to the MQTT if the connection is lost or needs to be reestablished.

Click the "Save" button to save your MQTT configuration and apply the settings.

MQTT:

Enable
☐

Server:

Port:

Username:

Password:

Publish Topic:

Publish Interval (ms):

Encryption

Reconnect

Save

7.8 Extension

This dropdown menu allows you to select from a list of available extensions. After choosing an extension from the dropdown menu, clicking the "Select" button to confirm your choice and load the selected extension.

If the dropdown field is empty, it indicates that no extensions are currently available for selection. In such cases, the extension must first be unlocked via the communications settings before it can be selected.

Extension Select:

▼

Select

7.10 Current Sensor

Current sensor: This dropdown menu allows you to select the specific type of current sensor you are using.

Invert Checkbox: This checkbox option provides the ability to invert the sensor's readings. If the box is checked, the output readings from the sensor will be inverted.

Ensure to save your changes using the "Save" button at the bottom of the page.

Current Sensor:

Type

Deactivated

▼

Invert

☐

Save

7.11 Ethernet

Under the menu point "Ethernet," you can set the connection information.

Ensure to save your changes using the "Save" button at the bottom of the page.

Ethernet:

Use DHCP



Hostname

GRNbms_MK2

IP Address

192.168.10.2

Gateway IP

192.168.10.1

Subnet Mask

255.255.255.0

DNS Server

192.168.10.1

Save

7.12 Modbus

Modbus Settings

Slave ID: This field displays the unique identifier assigned to the Modbus slave device.

RTU over TCP Slave Configuration

Activated: Check this box to enable the RTU over TCP Slave mode.

Port: This field specifies the TCP port number used for RTU over TCP communication.

Protocol: Select the communication protocol from the dropdown menu.

To use the Bridge mode, ensure the following setting:

Modbus Settings:

Slave ID:

1

RTU over TCP Slave:

Activated



Port:

502

Protocol:

RTU over TCP

Set Communication -> RS485 Mode to 'Modbus Master' to use the Bridge mode.

Save

Set Communication -> RS485 Mode to Modbus Master.

After configuring the settings, click the Save button to apply the changes.

7.13 Error Log

The "Error Log" is a feature that records all errors detected by the system.

7.14 Reboot

After saving all changes, the system has to reboot before they take effect. Therefore, you should select the menu point "Reboot," and click the "Confirm" button. The system will shut down and restart, this process will take a few seconds. Afterward, reload the page.

Rebooting?

Are you sure you want to restart?
This can lead to a power cut!

Your system will restart upon confirmation to apply the settings.

GRNbms sets the charge and discharge limits to 0 during the process.

The reboot is only carried out when the current is below 10A in order to shut down the system safely.

Confirm

7.15 Logout

If you have set a password for the config page in the main settings, don't forget to log out.

Logout

8 Product or capacity Change

Energy Switch or Data Changes: Modify the data in the configuration (Configuration link) according to your changes.

BMS Device Change: Remove the old BMS and Start the installation and configuration of the new device from scratch.

Retrofitting: Power down the device install the necessary extensions or the new batter(6 installation link). Modify the configuration data according to the new components.(Some components need to be enabled by a unlock code from your supplier you can insert the code under communications,(communication 8)

Restoring Operation: perform a system reboot to return the BMS to operational status after configuration changes or hardware upgrades.

9 Inspection, Testing and Maintenance

Regular Inspections: Conduct regular inspections of connected parts for damage, loose connections or dirt.

Software Updates: Regularly check for software updates to ensure your system is up to date and functioning optimally. (8.2)

Password Security: Ensure that your configuration password is secure and changed regularly to prevent unauthorized access. Set a Password.

Warnings and Errors: Check the web interface for warnings/errors in "Overview" and if configuration errors occur. (13)

Documentation: Safely keep this manual and all relevant documents for future reference.

10 Cleaning

Tools: Soft brushes, non-abrasive cloths, compressed air spray.

Dusting: Use a brush or compressed air to gently remove loose particles.

Guidelines:

Water Avoidance: Avoid using water on electronic components to prevent short circuits.

No Aggressive Chemicals: Steer clear of cleaners that could harm the electronic components.

Battery Caution: Handle battery cells with care, as they are susceptible to damage from physical impacts and moisture.

11 Troubleshooting/ Fault Clearance and Repair



It is important that these checks are carried out by a qualified electrician to ensure the safety and functionality of the system.

Please check whether the wiring to the BMS is correctly installed and undamaged, as well as whether the BMS itself or its connections have any damage. If the cables are

damaged, replace them immediately. If the BMS is damaged, it should be taken out of operation and returned to your dealer for repair.

Error messages:

Cell overvoltage: 0/0

Immediately stop charging the battery. Check the cell balancing functions and inspect for defective cells or incorrect charger settings.

Cell undervoltage: 0/0

Stop discharging the battery. Check for aged or damaged cells, and ensure that the battery is correctly charged before use.

Overtemp: 0/0

Cease battery usage to allow cooling. Verify environmental conditions and cooling systems are within operational limits.

Undertemp: 0/0

Halt battery operation until temperature returns to a safe range. Check the battery's placement and environmental controls to ensure proper operating temperature.

Cell delta: 1/0

Check for inconsistencies between cell voltages. Perform cell balancing and replace cells that significantly deviate from others.

Internal: 0/0

Conduct a diagnostic check of the BMS and consider replacing or servicing if necessary.

Extensions: 0/0

Verify all connected modules or additional sensors are functioning correctly. Look for loose connections or faulty extension modules

Current Sensor: 0/0

Inspect the current sensor for accuracy and connection integrity. Calibration or replacement may be required.

Charge current: 0/0

Ensure the charge rate does not exceed the specified limit. Adjust the charger output and inspect for possible faults in the charging circuit.

Discharge current: 0/0

Monitor and adjust the load to ensure it is within safe limits. Inspect the discharging circuits for faults or damage.

Internal Error Text:

Provides specific information about the errors.

12 Disassembly and Disposal



Please ensure that the device is powered down before disassembly.



We cannot give technical instructions, it depends on how your system is built, the disassembly should be done by a qualified electrician.

The BMS is an electronic device; please dispose of it in accordance with your local laws and regulations.

Congratulations on successfully configuring your GRNbms system. Please ensure that you regularly perform the steps mentioned in section 11, "Inspection, Testing, and Maintenance," to guarantee optimal performance and longevity of your system.

For further assistance or technical issues, please contact your dealer or technical support. Thank you for choosing GRNbms. We wish you a safe and efficient use of your system.

www.grnbms.com

<https://www.grnbms.com/contact/>

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