BLUE NOVA energy

a Reinert Company

USER MANUAL

SBB™ Series
Single Box Batteries

26V 52V

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Congratulations on purchasing a high quality BlueNova® product.
This document contains information on the structural specifics, installation, troubleshooting, safety & maintenance procedures, storage guidelines as well as emergency / first aid procedures relevant to the following product(s):

BlueNova® 26V & 52V SBB™ (Single Box Battery) Series

If you are unsure whether this document is applicable to your specific product, or if you have any technical questions, kindly contact BlueNova® Technical Support:

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Table of Contents

01 SAFETY FIRST

⚠ Please read this product manual carefully before commencing with product installation & use. Apart from possibly incurring irreversible damage to products and voiding the associated product warranties, failure to adhere to the safety and operational guidelines in this document may also result in electrical shock, serious personal injury, or even death.

1.1 Summary of safety requirements

- Batteries stored for extended periods should be recharged at least once every 3 (three) months. In such cases, a calibrated product-compatible charger should be used to recharge each battery individually to ±40~60% SoC.
- Do not connect battery terminals in reverse polarity to any inverter, charger, load, or other peripheral device.
- Do not connect batteries to AC power source(s) directly.
- Do not connect batteries to PV panels and/or -configurations directly. Always install the appropriate fusing & compatible supplier pre-approved MPPT module(s) between batteries and PV panel configurations.
- All conductive wiring & connection points in battery-integrated systems should be electrically insulated. Do not install batteries in systems where any of the conductive cabling and/or connection points remain non-insulated.
- Batteries should be switched off before being connected to inverters, chargers and/or other compatible devices.
- Do not connect batteries to inverters, chargers or other peripheral devices while such devices are connected to the grid and/or any load(s). Disconnect all external connections from such devices before connecting to batteries.
- Do not connect batteries in series. Failure to do so will result in immediate irreparable damage to the integrated BMS of each subjected battery & void the associated product warranties.
- Do not connect batteries to incompatible and/or faulty inverters, chargers or other peripheral devices.
- Do not open batteries to attempt fault finding or repair procedures, or for any other purposes. Do not physically modify battery enclosures and/or battery-integrated components in any way, unless such modifications are explicitly allowed & described in this document (such as the installation methods detailed in chapter 4).
- Do not store batteries without protective packaging. Batteries should be enclosed in the packaging material originally supplied by the manufacturer (including original padding) and sealed accordingly before being stored.
- Do not install batteries in outdoor environments, or in locations where the environmental temperatures and/or humidity will exceed the operational ranges specified in the product's data sheet.
- Do not install or store batteries near external heat sources and/or in locations exposed to direct sunlight.
- Do not install or store batteries in environments where contact with water and/or other fluid may occur.
- Batteries should be stored in cool, dry locations & in accordance with any other relevant requirements potentially listed in additional supporting documentation & official publications.
- Do not install batteries to power life support devices or in any other application(s) where over-discharge and/or battery failure might cause personal injury or death

IMPORTANT: Some of the above requirements are specific only to the batteries covered in this document. Apart from the requirements listed above, the minimum industry standard requirements associated with electrical installations (especially those including DC power sources such as batteries) are not covered in this document but should also be adhered to, as well as those imposed by any duly authorised local governing authorities of the region in question. Additionally, further requirements might also be listed in the product's warranty & other official supporting documents.

02 ABOUT THIS DOCUMENT

2.1 Terminology

The following table lists industry-specific terminology, units of measurement & abbreviations used in this document as well as in other official supporting documentation:

Term / abbr.	Meaning
A	**Ampere.** The unit of measurement of electrical current.
AC	**Alternating current**. Electrical current that changes direction several times per second, such as supplied by utility grids, inverter output to loads & other devices. Incompatible with batteries directly.
Ah	**Ampere-hour**. The unit of measurement of cell capacity. Battery capacity is not specified in Ah as a rule, but instead in Wh / kWh / MWh.
BMS	**Battery management system**. Battery-integrated electronic circuitry that adds functionality to batteries such as cell balancing, protection against adverse operation, serial communication & others.
BR	BlueNova **Battery Rack Series** batteries.
C(n)	Battery **rate of charge** and/or discharge (where n = the number of hours required to hypothetically recharge the battery in question from 0-100% SoC at constant current).
CAN	**Controller Area Network.** A widely used serial communication protocol.
DC	**Direct current**. Electrical current that flows in one direction only, such as supplied by batteries and solar PV panels/-arrays.
DoD	**Depth of discharge.** Refers to a specific percentage of the total available capacity of a chargeable energy source, such as a battery.
EoL	**End-of-life.** The point at which a battery reaches a predetermined number of cycles. Normally specified alongside the minimum capacity retained at this point.
FW	**Firmware.** Specialised software normally programmed directly onto one or more hardware-integrated ROM modules to establish (or extend upon) specific functionality in the hardware / device.
HC	BlueNova **High Current Series** batteries.
HVAC	**Heating, ventilation & air conditioning.** Normally refers to the equipment necessary to establish these functions, and not to each function in itself.
IP(xy)	**Ingress protection rating.** Indicates how well an electrical device's enclosure protects the device from contamination by foreign matter (where x = numerical rating for solids, and y = for liquids).
kWh	**Kilowatt-hour**. The unit of measurement of energy (and by extension, also battery capacity).
LiFePO4	**Lithium iron phosphate**. Part of the lithium-ion family of battery chemistries. Unlike almost all other lithium battery chemistries, LiFePO4 (sometimes also: LFP) is inherently safe.
MOS	**Metal oxide semiconductor.** Refers to the transistor assembly integrated in each battery.
Ω	**Ohm**. The unit of measurement of electrical resistance.
ROM	**Read only memory.** Refers to a type of electronic module on which software / firmware data can be programmed permanently (i.e. retained even if the associated hardware device is powered off).
RS485	**Recommended Standard #485.** A serial communication protocol standard for multi-node systems.
SBB™	**Single Box Battery.** The BlueNova product covered in this user manual.
SoC	Battery **state of charge.** Expressed as a percentage.
SoH	Battery **state of health**. Expressed as a percentage of the maximum remaining usable capacity in comparison to the original usable capacity of a battery.
V	**Voltage**. The unit of measurement of an electrical source's potential to deliver energy.
VAC	The **voltage** of an electrical component / source with **alternating current.**
VDC	The **voltage** of an electrical component / source with **direct current.**
Wh	**Watt-hour**. The unit of measurement of energy (and by extension, also battery capacity).

03 PRODUCT OVERVIEW

3.1 Introduction

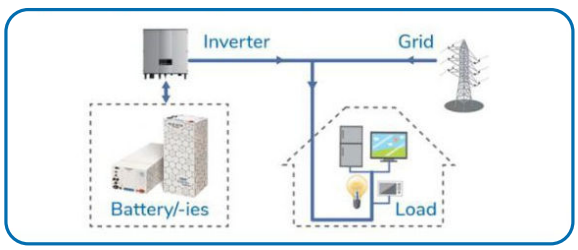
BlueNova SBB™ batteries are suitable for installation in residential and small commercial scale applications. Each SBB™ battery module is built with 16 x newly manufactured (non-refurbished) premium grade LiFePO4 cells with a nominal voltage of 3.2V and a cell capacity of 280Ah @C2 each. Cell configuration in the 26V version SBB™ battery is 8S2P, and in the 52V version 16S1P, both of which amount to a total installed capacity of 14 560Wh @C2.

SBB™ batteries have been developed to allow for the easy installation of 14.5kWh of high performance battery capacity in single-module installations as well as for expanded capacities in increments of 14.5kWh. Up to 9 x SBB™ modules can be connected in parallel for a total installed capacity of >130kWh. The integrated BMS in SBB™ batteries is a completely redesigned version of the BMS integrated in our High Current & Battery Rack Series (discontinued but still supported since April 2024). Several new improvements have been made in the new SBB™ BMS without compromising legacy compatibility with previous product ranges. This ensures that:

- SBB™ batteries are officially approved to be installed in parallel with existing High Current & Battery Rack configurations, provided that all the conditions listed in this user manual (summarised in section 3.8) are met.
- SBB™ batteries are serial (CAN) communication compatible with the inverters & other relevant peripheral devices of industry-leading manufacturers, some of which might require the addition of a BMAC module.

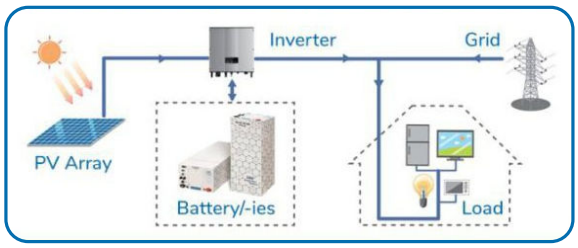
3.2 Applications

SBB™ batteries are suitable for installation in the following applications:



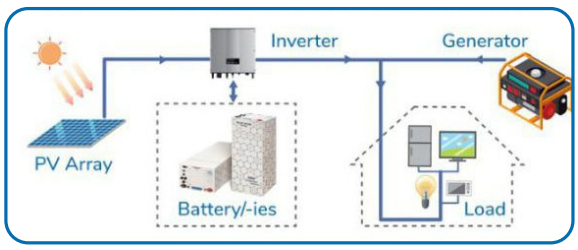
Backup / standby applications:

Backup / standby applications include systems wherein batteries are installed to provide uninterrupted power in the event of the disruption or failure of the default power source (i.e. utility grid) of the connected load. Renewable power sources are typically absent in such systems, and batteries are cycled on demand only.



Daily cycling applications:

Daily cycling systems are grid-connected and also include one or more renewable power sources such as PV arrays from which the load is supplied first. Surplus renewable energy is either directed to the batteries while SoC < 100% or fed back into the grid, while batteries are included to power the load at night.

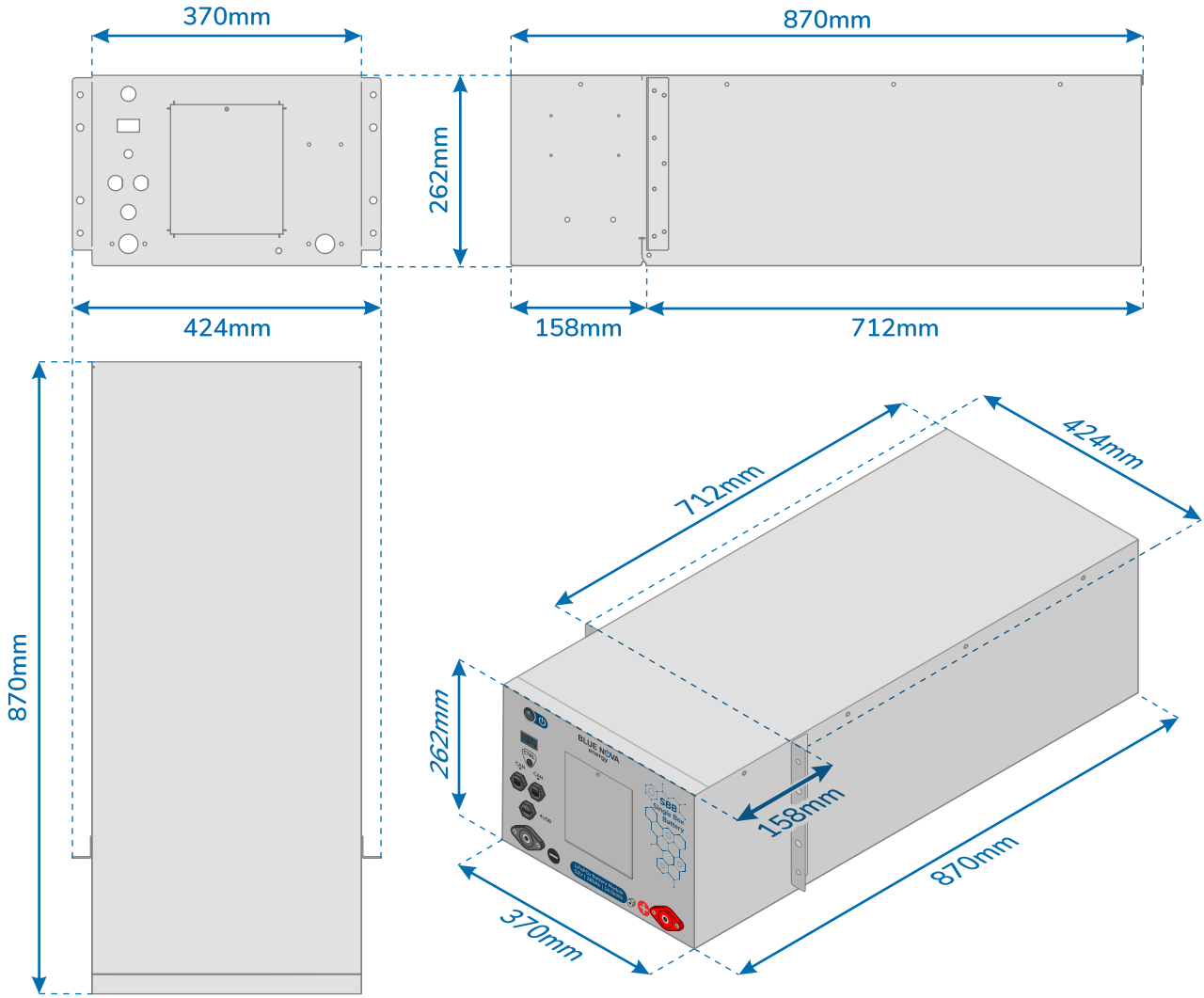


Off-grid applications:

Off-grid systems exclude connection to any utility grid. The load of each such system is powered primarily from a PV array or other renewable source, sized sufficiently to carry the load as well as to recharge potentially discharged batteries (the secondary source) in a timely manner. Generators are often included as a final failsafe.

3.3 Dimensions

The external dimensions of a single SBB™ battery module enclosure is specified below:



3.4 Technical Specifications

The technical specifications of both 26V and 52V SBB™ batteries are summarised in the table below:

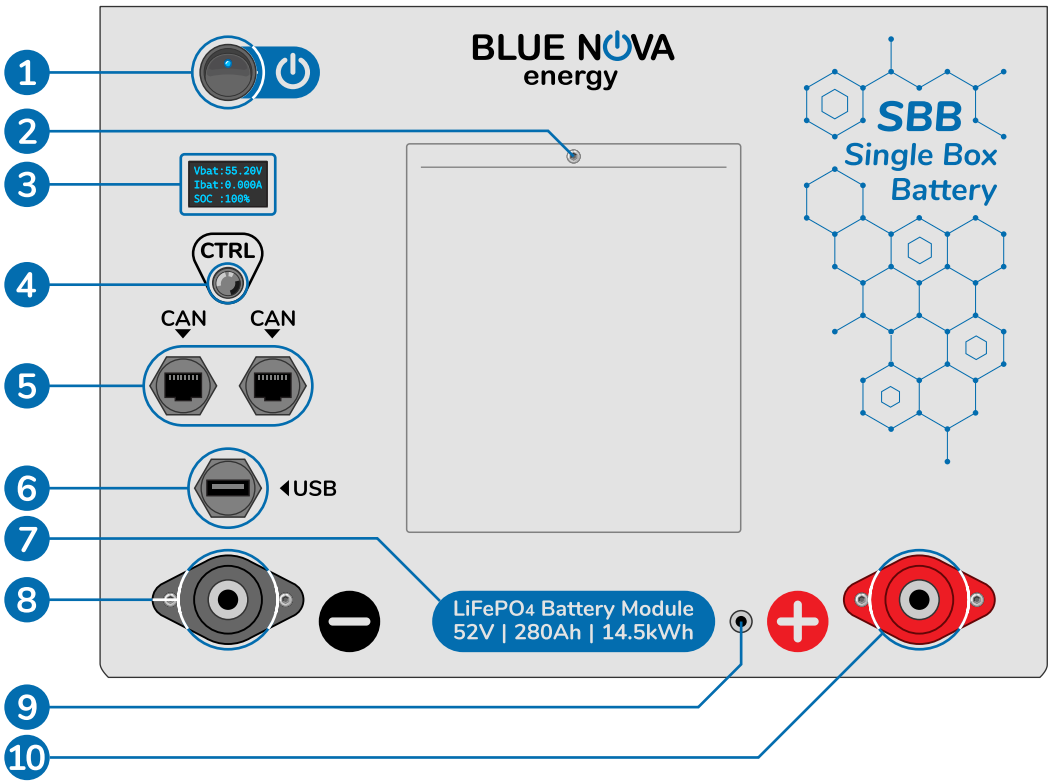
Specification	26V SBB™	52V SBB™
Cell chemistry	Lithium iron phosphate (LiFePO4 / "LFP")	
Operating voltage range	24V ~ 27.6V	48V ~ 55.2V
Capacity @V(nom), C2, 25°C	Installed: 14 560Wh | Max. recommended usable: 11 650kWh (80% DoD)	
Operating temperature range	@Charge: 0°C ~ 50°C / @Discharge: (-10°C) ~ 50°C	
Cycle life @100% DoD, C2, 25°C	> 3600 cycles (<20% capacity fade) or > 7000 cycles (<40% capacity fade)	
Cycle life @80% DoD, C2, 25°C	> 5000 cycles (<20% capacity fade) or > 9000 cycles (<40% capacity fade)	
Cycle life @70% DoD, C2, 25°C	> 7000 cycles (<20% capacity fade) or > 12000 cycles (<40% capacity fade)	
Dimensions & weight (net)	370 x 262 x 870mm (W x H x D) excl. mounting extrusions | ±104kg / module	
IP rating	IP20 (for indoor use only)	

(3.4 Technical Specifications, continued from previous page...)

Specification	26V SBB™	52V SBB™
Max. charge current @25°C	≤ 240A (continuous)	
Max. discharge current @25°C	≤ 240A (continuous) | ≤ 300A (for < 60sec) | ≤ 750A (for < 2sec)	
Max. charge power @25°C	Maximum: 7280W (C2) | Recommended: 3640W (C4)	
Max. discharge power @25°C	Maximum: 7280W (C2) | Recommended: 1248W (C10)	
Charge / discharge efficiency	≥ 96% @C2, 25°C / ≥ 98% @C10, 25°C	
Self-discharge rate (cells)	<2% per month	
Isolator	400A	
Inline fuse	500A	
Current over-charge protection	280A	250A
Voltage over-charge protection	< 29.2VDC (or at $V_{(cell)}$ ≥ 3.65V)	< 58.4VDC (or at $V_{(cell)}$ ≥ 3.65V)
Voltage over-discharge protection	> 22.8VDC (or at $V_{(cell)}$ ≤ 2.85V)	> 45.6VDC (or at $V_{(cell)}$ ≤ 2.85V)

3.5 Front panel components

The diagram below illustrates the front panel component layout of a 52V version SBB™ battery:



The table below lists the designation and function of each correspondingly numbered component in the diagram above:

No.	Component:	Function:
1	On/off switch	Switch the battery ON or OFF off at this button.
2	Front panel aperture	Provides easy access to the battery's BMS & other electronic components.
3	OLED display	UI component. Displays information specific to the battery module in question (either by default whenever the battery is switched on, or in response to user interactions). See 05. USER INTERFACE for more information.

(3.5 Front panel components, continued from previous page...)

No.	Component:	Function:
4	CTRL button	UI component. The primary means by which users can interact with the product for various purposes. Results are normally displayed on the OLED display. See **05. USER INTERFACE** for more information.
5	CAN ports	The 2 x ports on each SBB™ battery module from which serial communication connections may be established to compatible hardware included in the system.
6	USB port	Reserved for connecting hardware devices from which technical / administrative / maintenance tasks may be performed on the module.
7	Product composition details (summary)	Specifies battery chemistry, voltage, cell- and installed capacity.
8	Negative terminal	The negative terminal (cathode) of the battery.
9	External antenna jack	Attach the external antenna (supplied) for the BMS-integrated OTA module here.
10	Positive terminal	The positive terminal (anode) of the battery.

3.6 Serial communication

The integrated BMS in SBB™ batteries include serial (CAN) communication functionality with select batteries from other BlueNova product ranges, as well as with the inverters and other relevant CAN-compatible devices of global industry-leading manufacturers. The RJ45 pin configuration of SBB™ batteries is illustrated below:

Pin #	Description
1	–
2	–
3	–
4	–
5	–
6	–
7	CAN-H
8	CAN-L

Illustration: RJ45 connector & pin numbering sequence

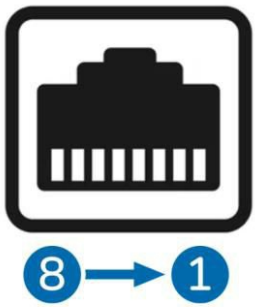


Illustration: RJ45 port & pin numbering sequence

3.7 Integrated safety features

The BMS in SBB™ batteries will trigger the following protective measures automatically under the specified conditions:

Description	Protective measure triggered	Condition
Voltage over-charge	Over-voltage cutout	As soon as the cell voltage (continuously measured) over any cell reaches or exceeds 3.65V during charge.
Voltage over-discharge	Under-voltage cutout	As soon as the cell voltage (continuously measured) over any cell reaches or subceeds 2.85V during discharge.
High temperature	Over-temperature cutout	As soon as the temperature inside the battery's enclosure (continuously measured) exceeds 60°C.
Low temperature	Low temperature cutout	As soon as the temperature inside the battery's enclosure (continuously measured) subceeds 0°C.
Current over-charge	Over-current cutout	As soon as the charge current exceeds 240A.

(3.7 Integrated safety features, continued from previous page...)

Description	Protective measure triggered	Condition
Current over-discharge	Over-current cutout	As soon as the discharge current exceeds: • 240A continuously for extended periods, or • 300A for longer than 60 seconds, or • 750A for longer than 2 seconds.
Short circuit protection	Firmware-triggered cutout	As soon as the charge current exceeds the maximum predefined (I^2t) limitation of the battery.

3.8 Multi-battery configurations

a. Series configurations

⚠ SBB™ batteries should **NOT** be connected in series with other batteries. The integrated electronics of SBB™ batteries are rated for 24V (for 26V SBB™ batteries) and 48V (for 52V SBB™ batteries) systems respectively. Connecting SBB™ batteries in series will void the warranties & may cause serious injury and peripheral damage.

b. Parallel configurations

SBB™ batteries can be installed in parallel with additional SBB™ batteries, as well as with select BlueNova HC & BR batteries under certain conditions. The following requirements are applicable to such parallel configurations:

- No more than **9 x BlueNova batteries** should be interconnected in any single parallel configuration. HC/BR Series batteries included in the configuration should be pre-approved by BlueNova & feature MultiCap™ technology.
- The maximum default **charge current** should not exceed the specified maximum charge current limitation of the smallest BlueNova battery (i.e. the battery with the lowest charge current limitation) included in the parallel configuration (typically equal to the C2 rate of the battery). For prolonged battery operation, the recommended charge current should not exceed the current @C4 of the smallest battery in the configuration.
- The maximum default **discharge current** should not exceed the specified maximum discharge current limitation of the smallest BlueNova battery (i.e. the battery with the lowest charge current limitation) included in the parallel configuration (typically equal to the C2 rate of the battery).
- The inverter(s), chargers & other relevant peripheral hardware included in the system must be compatible in terms of voltage, current, performance and serial (CAN) communication with each BlueNova battery in the parallel configuration individually, as well as with the parallel configuration as a whole.
- The interconnecting cable connecting the positive terminal of each battery to the positive terminal of the next battery in sequence should be of the same length, diameter, material & quality. Likewise, the interconnecting cable connecting the negative terminal of each battery to the negative terminal of the next battery in sequence should be of the same length, diameter, material & quality. In short, all interconnecting cables should be identical. The same requirements apply for cables connecting the terminals of each SBB™ battery to a DC bus bar.
- Each BlueNova battery included in a parallel configuration should be charged individually to the bulk voltage setpoint applicable to the battery whenever the parallel battery configuration is assembled and/or changed.
- The entire parallel battery configuration should be connected to the inverter / charger configuration only from the positive terminal of the first battery in the configuration and the negative terminal of the last battery in the configuration (or vice versa). The same principle applies to parallel battery configurations connected to peripheral devices via DC bus bars. See installation diagrams in section **04. INSTALLATION** for further clarity.
- The latest applicable firmware should be installed on each BlueNova battery included in the configuration, as well as on the inverter(s) and other relevant peripheral devices.

3.9 Firmware

a. Overview of functionalities

Firmware is specialised software usually developed exclusively for one or more predetermined electronic hardware devices for the purposes of establishing new functionalities (or improving existing ones) in such devices. In lithium-ion type batteries, firmware is typically applied with best results among the battery's BMS components.

The BMS used in each SBB™ Series is a multi-functional electronic control system consisting of several different interconnected components distributed throughout the entire enclosure of its allocated battery. Primary control functions reside on the master board of each battery. Each BMS is programmed with the product-specific data of its associated battery (i.e. model name, serial number, manufactured date etc.) as well as with the latest firmware.

At the time of this publication, some of the functionalities driven by the SBB™ Series BMS & firmware, included: continuous **measurement of performance** & health variables (i.e. cell & pack voltages, SoC, SoH, current in/out, total energy discharged, etc.), **cell voltage balancing** during charge cycles, **autonomous self-protection** against out-of-range operation, **serial communication** functionality & **compatibility** with a wide range of peripherals. The latest new hardware to be integrated with the SBB™ Series BMS, however, is an **OTA (over-the-air)** module through which SBB™ Series firmware can now be updated remotely & on-demand (setup instructions below).

b. OTA module - Connecting to local Wi-Fi

Complete the below **steps 1-6** to connect an SBB™ Series OTA module to a local on-site Wi-Fi network.

⚠ **NOTE:** In order to successfully complete the below procedure, the following should be in place beforehand: (1) An existing internet-connected Wi-Fi network on site & within connection range of the battery's OTA module. (2) The password to connect to the above Wi-Fi network. (3) Installation of the OTA module's external antenna.

1. The OTA module in each SBB™ Series battery is internally powered by the battery itself. To switch the OTA module on, simply switch the battery (in which the module is installed) on.

2. If the OTA module is not connected to any on-site Wi-Fi network, it will broadcast its own SSID (or Wi-Fi access point) below. Connect to this SSID from your laptop / smartphone with the following password:

   SSID: **BluenovaOTA** / Password: **bluenova**

3. While connected to the OTA module's above SSID, open a web browser on the same laptop / smartphone. Type the below address exactly as displayed into the web browser's address bar, then hit Enter / Proceed.

   http://192.168.4.1

4. In the Wi-Fi configuration interface, locate the section where new / existing connections may be configured. Click / tap on the **REFRESH NETWORKS** button to initiate a scan for available Wi-Fi networks within range.

5. Once the scan is complete, select the chosen Wi-Fi network that the OTA module should be connected to from the **CHOOSE NETWORK** drop-down, then enter the password in the **NETWORK PASSWORD** textbox.

6. Click / tap on the **CONNECT** button to save the above configuration and initiate the connection procedure. Upon connecting successfully to the on-site network, the OTA module will stop broadcasting its own SSID.

Illustration: OTA module - Wi-Fi configuration interface

c. OTA module - Updating firmware

This section includes instructions on how to access the firmware update interface of a local Wi-Fi connected OTA module and subsequently initiate firmware updates & other procedures.

1. Confirm the local IP address assigned to the OTA module. This IP address can be found by pressing the **CTRL** button on the battery's front panel to page through the OLED display until "OTA IP" is displayed.

2. Connect your laptop/smartphone to the same local Wi-Fi network (SSID) that the OTA module is connected to.

3. Type the OTA module's assigned IP address (step 1) into a web browser's address bar on your phone / laptop [in the following exact format **http://123.456.789.000**], then hit Enter. This should open the below interface:

Illustration: OTA module - Firmware update interface

Check this box to enable automatic FW updates.

> ⚠ **WARNING!** Updating firmware requires batteries to be rebooted. Enabling this option may lead to unforeseen system downtime.

Displays the Wi-Fi SSID currently connected to.

Displays the currently installed firmware version.

Click/tap to verify currently installed FW version.

Click/tap to check whether new firmware is available and (if available) initiate the update.

Click/tap to roll back to the default firmware.

Click/tap to disconnect from the Wi-Fi network currently connected to & delete saved credentials. Note: The OTA module will revert to broadcasting its own SSID again upon forgetting this network.

04 INSTALLATION

4.1 Site requirements

In the interest of personal safety & prolonged system performance, please ensure that each location at which SBB™ batteries are installed meets the following requirements:

- There are no flammable or explosive materials in close proximity to the installation.
- The surface (or structures, such as wall mount brackets) on which each battery is installed is solid & level.
- There are no heat sources, either permanent or occasional, within at least 2 meters of the battery.
- The building/room is completely waterproof.
- Temperature and humidity levels are maintained in accordance with battery datasheet specifications.
- The area is dust- and dirt-free as far as possible.
- The ambient temperature in the location is expected to remain between 0°C ~ 50°C.
- Humidity levels at the location are expected to remain between 5% ~ 95% relative humidity.
- Natural ventilation is present & all materials which might compromise ventilation to/from the battery is absent. For sites where natural ventilation is not possible, appropriate measures should be taken, such as installing and configuring the necessary HVAC equipment appropriately.
- All inverter outlets are located at least 50cm or more from any part of the battery.
- The area is not exposed to direct sunlight, even occasionally.
- The area is not exposed to high salinity and/or other metal oxidation accelerants.

4.2 Service requirements

- SBB™ batteries should only be installed by suitably qualified BlueNova® registered installers. SBB™ batteries that have been installed by individuals not registered or pre-approved by BlueNova will result in the product warranty being void. This applies to all other BlueNova batteries which may be included in such installations.
- Industry standard- as well as product-specific safety requirements must be met during battery installation and maintenance procedures.
- The correct PPE must be worn when installing and/or performing maintenance on SBB™ batteries.
- Further requirements which may be imposed by one or more duly authorised regional governing bodies (if any) should also be adhered to. In South Africa, obtaining a certificate of compliance for newly installed (or newly modified existing) electrical systems is required by law.

4.3 Installation procedure

4.3.1 Principles of battery assembly & installation

The following principles are applicable whenever SBB™ batteries are installed with other batteries / peripheral devices:

a. All batteries and peripheral equipment should be switched off whenever new connections are established.

b. For single battery installations:
   - Connect the **positive and negative terminals** of the battery to the inverter / charger / peripheral device **first**.

(4.3 Installation procedure, continued from previous page...)

- Connect the **battery's BMS** to the inverter / charger / peripheral device from either one of the two available CAN ports on the front panel of the battery only after the terminal connections have been established.
- Terminate the remaining CAN port on the front panel of the battery with an RJ45 terminating connector (included with the supply of each SBB™ battery).

c. For parallel battery configuration installations:

- Assemble the parallel battery configuration first by connecting the **terminals** of all batteries in parallel.
- Interconnect the **BMS string of** the parallel configuration by connecting one of the two available CAN ports on the front panel of each battery to one of the two CAN ports of the next battery in sequence. This should leave a single open CAN port remaining on the front panel of the configuration's first and last batteries respectively.
- Connect the entire parallel battery configuration to the inverter(s) / charger(s) / peripheral device(s) only from the **positive terminal of the first battery** and the **negative terminal of the last battery** in the configuration (or vice versa). DO NOT connect parallel battery configurations to peripheral devices from the positive and negative terminal of the same single battery module in any configuration.
- Connect the parallel configuration's **interconnected BMS** to the appropriate CAN port of the inverter / charger / peripheral device from the open CAN port on the front panel of the first battery in the configuration. The final remaining open CAN port on the front panel of the last battery in the configuration should be terminated with an RJ45 terminating connector (included with the supply of each SBB™ battery).

d. Switch on the inverter(s) / charger(s) / other peripheral device(s) first, before switching on the battery/-ies.

4.3.2 Principles of disassembly

The following principles are applicable to uninstalling & disassembling SBB™ batteries:

a. All batteries and peripheral equipment should be switched off before any existing connections are disconnected.

b. For single battery installations:

- Disconnect the battery's **BMS (CAN connection)** from all integrated CAN-compatible peripheral device(s) first.
- Disconnect the battery's **positive and negative terminals** from connected inverters / chargers / peripheral devices only after all BMS / CAN connections have been disconnected.

c. For parallel battery configuration installations:

- Disconnect the battery configuration's **collective BMS (CAN)** from all connected peripheral device(s) first.
- Disconnect the parallel battery configuration's **positive and negative terminals** from all connected inverters / chargers / peripheral devices only after all BMS / CAN connections have been disconnected.
- Disassemble the parallel battery configuration itself by disconnecting all CAN-to-CAN connections first.
- Disconnect the terminal-to-terminal connections between each battery.

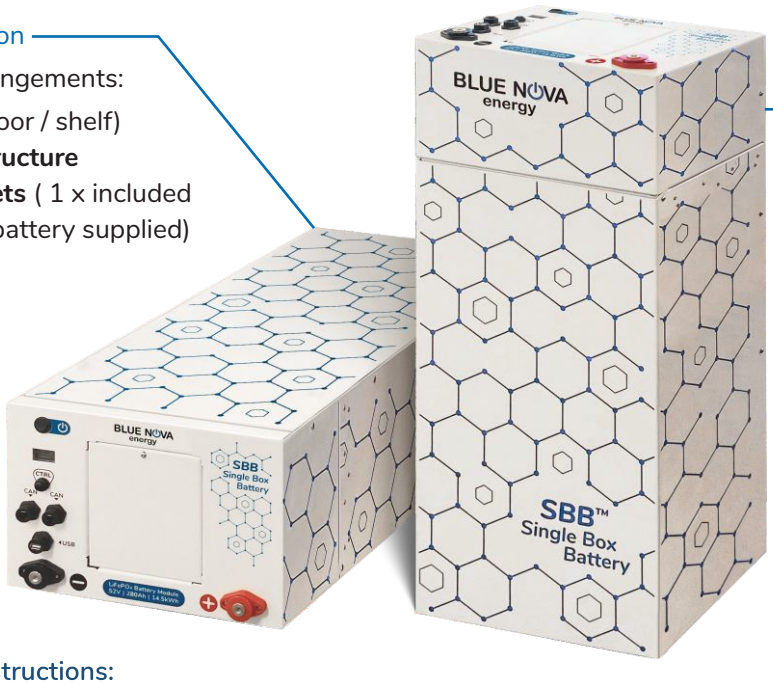
4.3.2 Battery orientation

SBB™ batteries can be installed in the following 2 x orientations:

Horisontal orientation

Typical module arrangements:

- **Side-by-side** (floor / shelf)
- **Vertical rack structure**
- **Stacking brackets** (1 x included with each SBB battery supplied)



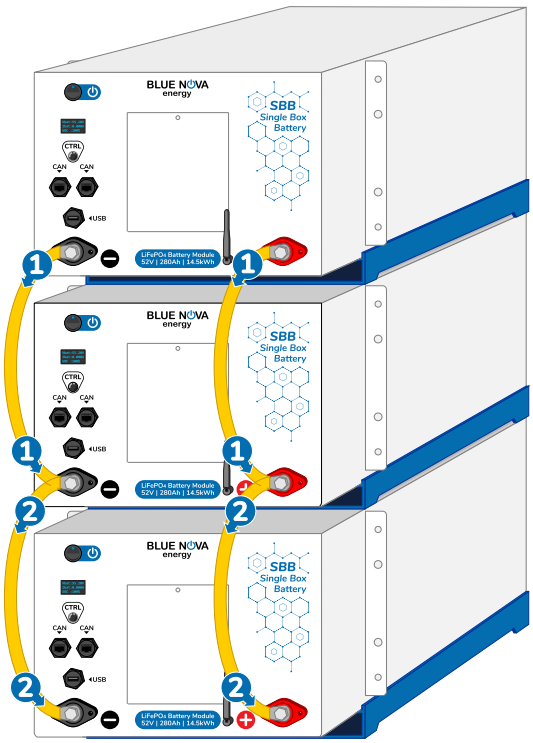
Vertical orientation

Typical module arrangements:

- **Side-by-side** (floor)
- **Wall-mounted** (not from battery enclosure directly i.e. custom frame required).

4.3.3 Step-by-step instructions:

This section provides step-by-step instructions on the assembly and subsequent installation of SBB™ batteries. In the interest of brevity, a parallel configuration of 3 x SBB™ batteries (incl. stacking brackets) is used as an example below.
NOTE: While up to 9 x SBB batteries can be connected in parallel, vertically-arranged SBB battery configurations built with stacking brackets should not exceed 3 x battery modules. This is a structural (not performance) limitation.



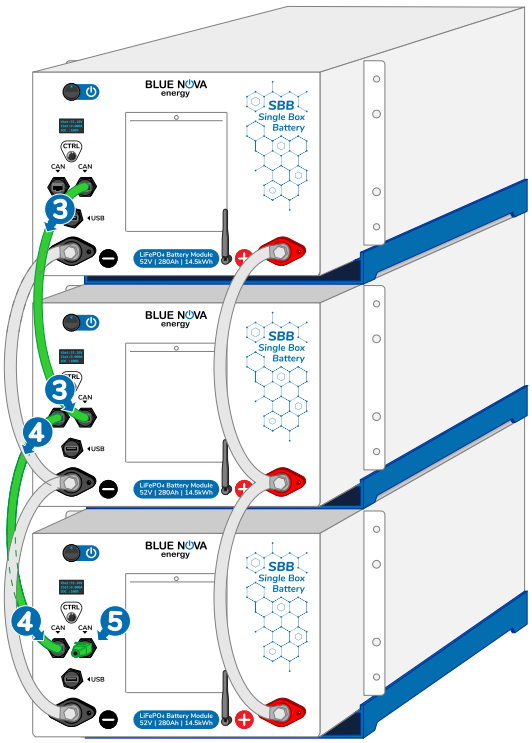
⚠ Before commencing with the assembly of parallel battery banks: SBB™ batteries to be included should be within on-site Wi-Fi access point range, and configured to receive firmware updates automatically. Each battery (incl. SBB™ Series) should be recharged individually to the relevant **bulk voltage** setpoint first before being parallel-connected. (26V SBB™ battery $V_{(bulk)}$ = 27.6V / 52V SBB™ battery $V_{(bulk)}$ =55.2V).

1. Connect the **positive** terminal of the first (master) battery to the **positive** terminal of the second battery. Connect the **negative** terminal of the first (master) battery to the **negative** terminal of the second battery.

2. Connect the **positive** terminal of the second battery to the **positive** terminal of the third battery. Connect the **negative** terminal of the second battery to the **negative** terminal of the third battery.

IMPORTANT: Each terminal-to-terminal cable should be of the same length, diameter, conductive material and quality. Washers & spring washers should also be included at each terminal connection, and the bolt securing each connection should be torqued to at least 16Nm.

(4.3.3 Step-by-step instructions, continued from previous page...)



3. Connect one of the two CAN ports of the first (master) battery to one of the two CAN ports of the second battery.

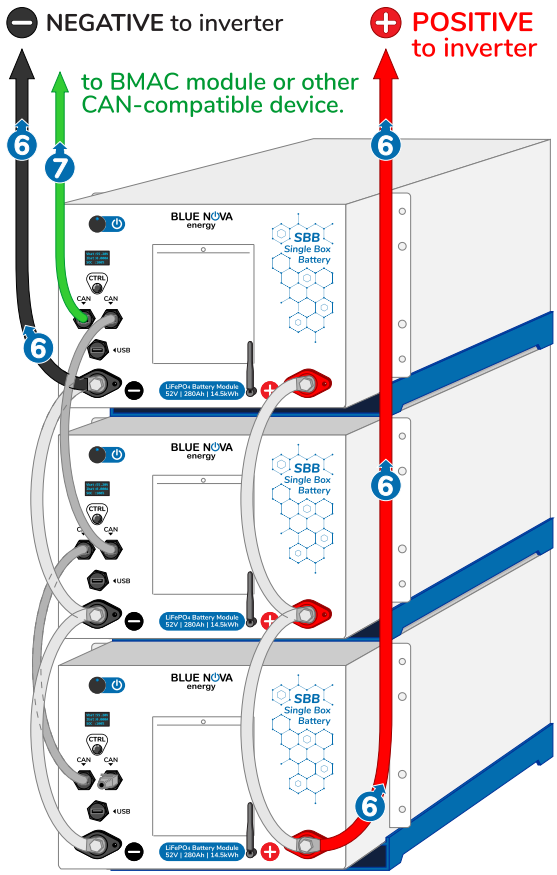
4. Connect the remaining open CAN port of the second battery to one of the two CAN ports of the third battery.

5. Terminate the remaining open CAN port of the third battery with an RJ45 terminating connector (included with the supply of each SBB™ battery).

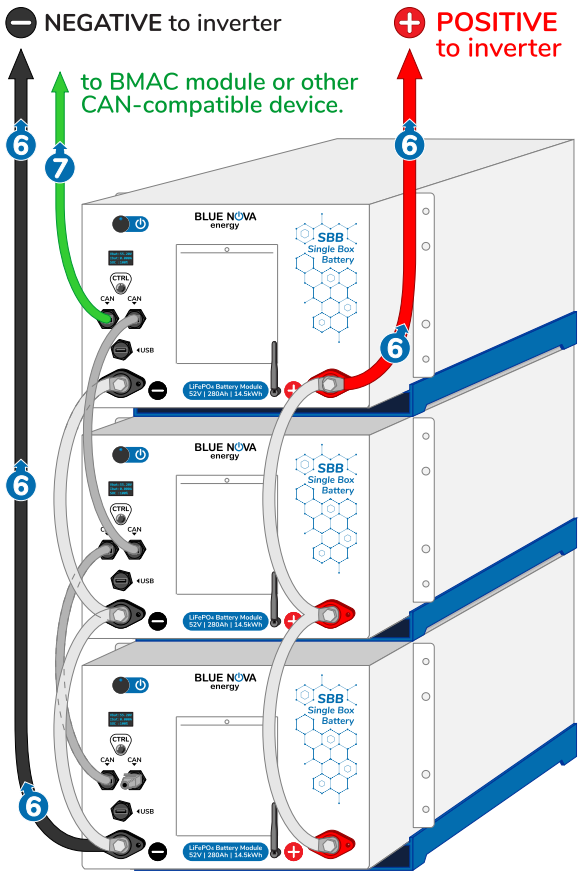
6. Connect the entire parallel battery configuration only from the negative terminal of the first (master) battery and the positive terminal of the last battery, or vice versa. DO NOT connect the parallel battery configuration from the positive and negative terminal of a single SBB™ battery module only.

7. Connect the parallel battery configuration's interconnected BMS string to a CAN-compatible peripheral device from the remaining open CAN port on the first (master) battery.

8. (Not illustrated here) Switch the inverter(s), charger(s) & other connected peripherals on first, then switch each SBB™ battery on in sequence, starting with the master (top) battery.



Either or



05 USER INTERFACE

The following table illustrates the various messages displayable on the integrated OLED display of SBB™ batteries along with an explanation of each. Upon switching SBB™ batteries on, the following splash screens will be displayed:

Splash screen #1:	BLUE NOVA energy BMMC v3.5	The BlueNova® logo is displayed, as well as the currently installed firmware version of the battery's BMS (in this case, version 5.3).
Splash screen #2:	52V SBB 52V_280_14.5 VICTRON 500	Line 1 & 2 : Abbreviated product/model information. Line 3: Inverter firmware details. Note: Victron 500kbps firmware will be installed by default (for optimum BMAC integration, if included), unless specified otherwise.
Splash screen #3:	Parallel Batteries N = 1	Displays the currently set parallel configuration. For single batteries not connected in parallel, N should be 1.

After the above splash screens have been displayed, the display will revert to displaying page 1 below. Pressing the **CTRL button** will cycle through the following pages on the display:

Page 1:	Vbat:53.14V Ibat:0.000A SOC :99.99%	<< The battery's actual voltage at the time. << The current flowing into (xA > 0) or out of (xA < 0) the battery at the time. << The battery's estimated state-of-charge at the time.
Page 2:	Energy out: 0.446kWh SOH:99.99%	<< Displays the page heading, with content: << The total amount of energy that the battery has supplied since its first deployment. << The calculated state-of-health percentage applicable to the battery at the time.
Page 3:	Vch: 3.325V Vcl: 3.320V VC info ->	<< The highest voltage measured over any single cell of the battery at the time. << The lowest voltage measured over any single cell of the battery at the time. << Press & hold **CTRL** for ±4 secs to access the submenu listing $V_{(cell)}$ for all cells.
Page 4:	Tmax:20.00C MCU ID:321f	<< The maximum internal temperature measured among the battery's integrated temperature sensors for the current predetermined interval. << The unique identifying number assigned to the battery's micro-controller unit.
Page 5:	State OK	Indicates the overall operating status of the battery at any given time: - If **State OK** is displayed, no internal errors are detected by the battery's BMS. - If **State Err** is displayed, error(s) have been detected. See **6. Troubleshooting.**
Page 6:	FW:BMMC 3.5 G#:8eb7c95e PO:N=1 I=1	<< The name / type and version of the firmware currently installed on the battery. << The unique G# code of the battery (used for verification & other purposes). << The parallel configuration of the battery (where N = total batteries / I = this battery)
Page 7:	OVERRIDE? PRESS+HOLD	Press & hold the **CTRL** button to force the battery's main contactor to close. For over-discharged batteries, the connected charger should be set to charge immediately upon reconnection & the **CTRL** button may have to be kept depressed for several seconds.

IMPORTANT: SBB™ batteries subjected to **over-charge / over-temperature** conditions to the extent of BMS-triggered auto-disconnection can autonomously reconnect to the connected system after a while under certain conditions (where the battery's voltage and/or temperature drops naturally over time due to battery inactivity and the connected system peripherals don't explicitly prevent autonomous battery reconnection). Autonomous reconnection is however disabled for SBB™ batteries that have been disconnected due to **over-discharge** to prevent further potential damage from being inflicted in systems where the inverter/charger cannot be set to recharge batteries immediately upon reconnection.

(05 USER INTERFACE, continued from previous page...)

SBB Series cell voltages are individually measured by each battery's BMS on a continuous basis. To view the individual cell voltages of an SBB battery, press the battery's **CTRL** button until the below page is displayed on the OLED display:

Page 3:	Vch: 3.325V Vcl: 3.320V VC info ->	<< The highest voltage measured over any single cell of the battery at the time. << The lowest voltage measured over any single cell of the battery at the time. << The -> arrow on this line signifies that a submenu is accessible from this page.

While the above page 3 is displayed on the OLED, press & hold the **CTRL** button for ±2 seconds to enter the cell voltage submenu. The first page of the submenu (listing the voltages of cells 1-3 respectively) should then be displayed:

Page 3.1:	Vc1: 3.320V Vc2: 3.320V Vc3: 3.321V	<< Voltage measured over cell #1. << Voltage measured over cell #2. << Voltage measured over cell #3.
Page 3.2:	Vc4: 3.321V Vc5: 3.321V Vc6: 3.321V	<< Voltage measured over cell #4. << Voltage measured over cell #5. << Voltage measured over cell #6.
Page 3.3:	Vc7: 3.321V Vc8: 3.321V Vc9: 3.321V	<< Voltage measured over cell #7. << Voltage measured over cell #8. << Voltage measured over cell #9.
Page 3.4:	Vc10:3.321V Vc11:3.321V Vc12:3.321V	<< Voltage measured over cell #10. << Voltage measured over cell #11. << Voltage measured over cell #12.
Page 3.5:	Vc13:3.322V Vc14:3.322V Vc15:3.322V	<< Voltage measured over cell #13. << Voltage measured over cell #14. << Voltage measured over cell #15.
Page 3.6:	Vc16:3.322V	<< Voltage measured over cell #16.

Submenu Navigation Instructions:

For both 26V and 52V batteries:

- Press the **CTRL** button to display the next submenu page in sequence.

NOTE: 26V batteries will not display any cell data beyond this point.

For 26V batteries, from page 3.3:

- Press the **CTRL** button to return to the first page (3.1) of the submenu.

NOTE: 52V batteries will not display any cell data beyond this point.

For 52V batteries, from page 3.6:

- Press the **CTRL** button to return to the first page (3.1) of the submenu.

To exit the cell voltage submenu:

For both 26V and 52V batteries:

- Press & hold the CTRL button for ±2 seconds to exit the submenu and return to page 3 of the main menu.

06 TROUBLESHOOTING

The following table lists the most common issues that may be experienced with SBB™ installations, along with the recommended remedial steps in each case:

Main issue:	Potential causes of issue:	Remedial steps:
Charge / discharge	The connected inverter(s) are not connected to the grid and/or other active power source.	Check whether inverter-to-grid connections are correctly connected and active.
	Inverter-to-battery terminal connections are disconnected or damaged.	Test inverter-to-battery connections for continuity and check all connection points.

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Main issue:	Potential causes of issue:	Remedial steps:
Charge / discharge	For both 26V and 52V SBB™ batteries: BMS-triggered over-charge / -discharge protection triggered.	Check the following: • Battery-to-inverter connections. • Ambient environment variables. • Inverter voltage configuration. • Load power demand.
	Battery BMS damaged / malfunctioning.	Contact BlueNova Technical Support to arrange replacement of the BMS electronics.
Serial communication	Inverter-integrated serial communication circuitry damaged / malfunctioning.	Replace the installed inverter with another inverter known to have working serial communication to verify whether the original inverter's serial communication is operational. Contact the OEM to replace if necessary.
	Incorrectly wired RJ45 connector(s).	Verify that the pinout configurations of all installed RJ45 cables correspond to the required pinouts described in this manual and supporting documents of peripheral hardware.
	Inverter serial communication port(s) and/or -circuitry is damaged.	Check inverter serial communication ports for visible damage (i.e. bent contact points, etc.)
Temperature	For both 26V and 52V SBB™ batteries: The measured internal temperature of the battery is out-of-range.	• Ensure that the site of installation meets all requirements listed in section 4.1 of this supporting document. • Install the necessary HVAC equipment if required & configure the equipment to maintain ideal ambient conditions at the site (25°C) on an ongoing basis. • Ensure that any newly installed HVAC equipment is serviced on a regular basis in accordance with requirements listed in the OEM documentation.
Over-voltage	For 26V SBB™ batteries: One or more charge voltage setpoints on the inverter / charger is set to >29.2V. For 52V SBB™ batteries: One or more charge voltage setpoints on the inverter / charger is set to >58.4V. Battery auto-disconnection is triggered by the BMS as soon as the voltage over any one cell exceeds 3.65V.	• Check the voltage setpoint configuration of the inverter / charger to ensure that it is configured correctly. • Measure the actual output voltage at the end of the inverter-to-battery connectors (i.e. at the point where each will be connected to the relevant battery terminal) with a calibrated voltmeter.

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Main issue:	Potential causes of issue:	Remedial steps:
Under-voltage	For 26V SBB™ batteries: One or more connected batteries have been over-discharged to below 22.8V. For 52V SBB™ batteries: One or more connected batteries have been over-discharged to below 45.6V. Battery auto-disconnection is triggered by the BMS as soon as the voltage over any one of its cells subceeds 2.85V.	• Check energy input sources & connections to the inverter to ensure that it is receiving sufficient power to be able to recharge all connected batteries. • Switch the system off, disconnect any load(s) from the inverter, switch the inverter(s) on, then switch the battery / parallel battery configuration on. • Verify that inverter-to-battery recharge has recommenced. Recharge all batteries to 100% SoC before reconnecting load(s).
Over-current	For both 26V and 52V SBB™ batteries: Inverter-to-battery charge current has • exceeded 240A for too long, or • 300A for 60 seconds or more, or • 750A for 2 seconds or more. Battery auto-disconnection is triggered by the BMS under the above conditions.	Check the output current configuration of the inverter to verify that it has been configured correctly.

07 MAINTENANCE

7.1 Product storage & transportation

The following environment variables and battery parameters should be maintained for all transported/stored batteries:

Variable	Stored period	Required variable range:
Ambient temperature	< 1 month	-10°C ~ 45°C
	1-3 months	-10°C ~ 35°C
	> 3 months	0°C ~ 30°C
Humidity	Any period	≤ 75% RH
State-of-charge	Any period	40 – 60% SoC

7.2 General maintenance

Please also take note of the following requirements relevant to the storage & transportation of SBB™ batteries:

- SBB™ batteries stored for prolonged periods should be recharged individually at least once every 3 months to 40-60% SoC each. A calibrated inverter/charger should be used for such procedures. Inverter charge current output should be set to ±50A to ensure that the recharge period for each battery amounts to 0.5~1 hour.
- Installed SBB™ batteries due to remain non-operational for prolonged periods should be disconnected from the inverter/load, regardless of whether the inverter/load will remain inactive as well. The same maintenance requirements applicable to stored batteries are applicable to installed but disconnected batteries.

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- SBB™ batteries that are transported for any reason and/or distance should be packaged in its original packaging (incl. shock absorbent padding materials) or, if replaced, should match or exceed all the attributes of the original.
- Batteries should not be subjected to continued vibration, direct sunlight and/or moisture during transportation.

08 EMERGENCY & FIRST AID

Emergency condition:	Procedure to follow:
8.1 Ruptured / leaking components	• **Inhalation:** Evacuate the area. Seek medical attention immediately. • **Eye contact:** Rinse eyes with clean water continuously for 15 minutes. Seek medical attention immediately afterwards. • **Skin contact:** Wash the affected area thoroughly with soap and water. Seek medical attention immediately afterwards if irritation persists. • **Ingestion:** Induce manual (non-medicinal) vomiting if possible. Seek medical attention immediately.
8.2 Thermal events	• Evacuate the area immediately. Inform local firefighting authorities. • Extinguish any fires with CO_2 fire extinguishers if it is safe to do so.
8.3 Water contact	• Avoid making physical contact with batteries damaged by water/other fluid as well as the fluid itself. Disconnect such batteries only when safe to do so.
8.4 General damage	• Visibly damaged and/or malfunctioning batteries should not remain in use but be safely removed & replaced as soon as possible.

NOTES