Freen-BSL-N Energy Storage Unit

Installation and User Manual

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For the latest documentation, technical updates and warranty information, visit:

www.freen.com

This manual applies to the following products:

Energy Storage Unit Freen-BSL-N

All specifications and descriptions in this manual are verified to be accurate at the time of publication.
Due to continuous product improvement, Freen OÜ reserves the right to make changes to the product, documentation, or specifications without prior notice.

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Product overview

Low voltage sodium-ion battery systems

The new generation of energy storage systems is built on advanced NFPP (Sodium Iron Phosphate-Pyrophosphate) sodium-ion battery technology, delivering exceptional safety, ultra-long lifetime, and outstanding operational stability.

Designed for residential and small commercial applications, Freen-BSL-N provides reliable energy storage with industry-leading cycle life, broad temperature tolerance, and minimal maintenance requirements.

For the current list of compatible inverters, please refer to *www.freen.com/documentation/*

Exceptional Safety

NFPP chemistry contains no oxygen-releasing cathode materials, significantly reducing the risk of thermal runaway, fire, or hazardous overheating.

Stable Power Delivery

The NFPP cathode provides an exceptionally flat discharge profile, enabling stable operation of inverters, ensuring predictable system performance.

Advanced NFPP Technology

Based on sodium, iron, phosphate, and pyrophosphate, NFPP chemistry doesn't require critical minerals (cobalt and nickel) while providing exceptional structural stability, safety and sustainability.

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Ultra-Long Lifetime

Engineered for more than 14,000 charge-discharge cycles while retaining over 60% of original capacity, Freen-BSL-N systems deliver decades of reliable operation and extremely low lifetime ownership costs.

Broad Temperature Tolerance

Reliable operation even in challenging climates. Freen-BSL-N batteries can discharge at temperatures from -30℃ to +60C while maintaining dependable performance.

Low Upkeep Requirements

Intelligent battery management, CAN/RS485 communication, and advanced protection systems ensure reliable operation with minimal maintenance throughout the system lifetime.

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1. Safety information

(Compliant with EU Regulation 2023/1542 - general user-level requirements)

1.1. General Safety

- Do not open, disassemble, or modify the battery enclosure.
- Keep the product away from water, moisture, and chemically aggressive environments.
- Do not expose the system to direct sunlight, open flames, sparks, or heat sources.
- Do not stack heavy objects on top of the unit or apply mechanical shock (impact, dropping, crushing).
- Ensure that the unit is positioned on a level, stable surface before operation.
- Do not allow children or unauthorized people to operate or interact with the system.
- The system must be used only with compatible inverters and electrical equipment (see actual list on *freen.com*).

CAUTION: THIS EQUIPMENT MUST BE GROUNDED

The equipment must be connected to a protective earth (PE) in accordance with local electrical regulations.

NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

Do not open or disassemble the equipment. The system contains stored energy and high current circuits. Even at low voltage, improper handling may result in burns, arc flash, or equipment damage.

The exclamation mark within an equilateral triangle indicates important operating and maintenance instructions.

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1.2. Electrical Safety

- Always **turn off** the inverter and isolate the DC circuit before connecting or disconnecting the battery.
- Ensure correct polarity:
  Red/Orange = Positive (+), Black = Negative (–).
- Never short-circuit the DC terminals.
- Use only approved cables with appropriate current ratings and insulation.

Required minimum DC cable cross-section: 25 mm^2 copper

- Avoid loose connections - improperly tightened terminals can cause overheating or arcing.
- Do not touch exposed conductors with wet hands or conductive tools.
- Ensure that the system is properly grounded according to local electrical regulations.
- Avoid placing metal objects near the terminals.

1.3. Temperature and Environmental Requirements

Operating Temperature

- **Charging:** 0°C to +55°C
- **Discharging:** -30°C to +60°C

Storage Temperature

- Recommended: **-20°C to +45°C**
- Long-term storage should be at **25–50% state of charge (SoC)**.

Environmental Conditions

- Indoor installation only
- Keep the system away from humidity, dust, and corrosive agents.
- Maintain at least **5 cm** clearance around the enclosure for airflow.
- Prevent condensation - allow the battery to acclimate to room temperature before powering on if previously stored in a cold environment for not less than 24 hours.

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1.4. Emergency Procedures

Overheat, Smoke, Abnormal Noise or Smell

If any of the conditions above observed:

- Immediately turn off the inverter and disconnect the DC power circuit.
- Move away from the product and ensure ventilation of the room.
- Do not attempt to open the enclosure.
- Contact technical support.

Liquid Exposure

If exposed to water or other liquids:

- Disconnect the unit from all power sources
- Do not turn it back on
- Allow professional inspection before reuse

Physical Damage

If the unit has been dropped, severely shaken, or damaged:

- Do not operate the system
- Contact the manufacturer for inspection

Fire Safety

- Evacuate personnel if smoke becomes dense or the unit becomes abnormally hot.
- In case of fire, immediately contact local emergency services and inform them about the nature of the fire.
- Use only appropriate extinguishers for battery-related incidents.
- Do NOT use water.

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2. System Description

The Energy Storage Unit Freen-BSL-N uses Sodium-Ion (NFPP) battery cells.

Sodium-ion chemistry provides high cycle life, enhances thermal stability and does not rely on lithium-based components.

The resulting system voltage is compatible with most 48 V-class inverters and energy storage applications.

2.1. Scope of Supply:

2.1.1. Energy storage unit.
2.1.2. A set of connection plugs.
2.1.3. BMS RS485-USB cable.
2.1.4. User Manual and Warranty Conditions Quick Access
2.1.5. Product Safety Information List

2.2. Mechanical Features

The Energy Storage Unit is built using reinforced metal housing designed for indoor stationary installations. The enclosure provides structural rigidity, thermal stability and mechanical protection for the internal sodium-ion battery modules and the integrated **Battery Management System (BMS)**.

Key housing features:

- Powder-coated metal enclosure, corrosion-resistant
- Protection degree: **IP20** (indoor use only – no exposure to water, dust ingress limited)
- Side ventilation openings for natural air cooling
- Dedicated internal compartment for the BMS
- Front control panel with indicator, communication ports and main power terminals
- Lower structural frame for stable floor mounting

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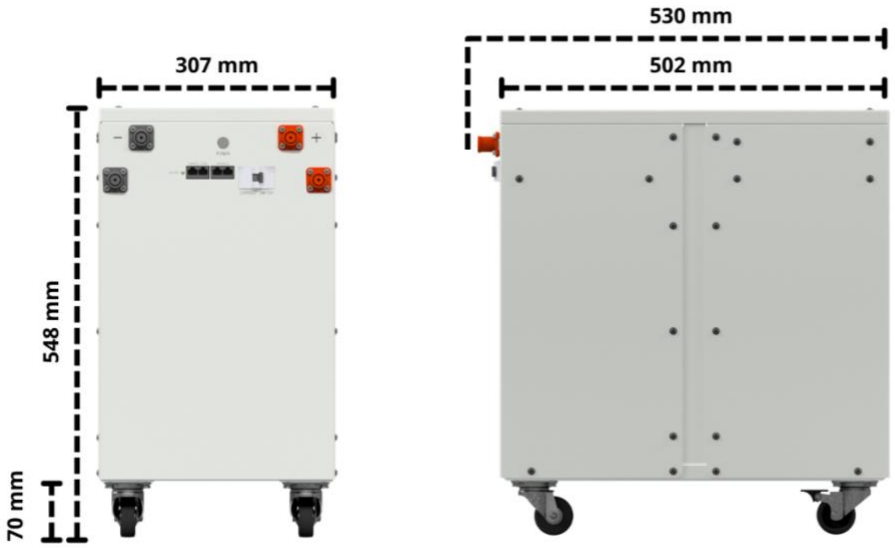

Figure 1. Dimensions of Energy Storage Unit

(The actual design of the unit may be different and changed by manufacturer.)

2.3. Integrated BMS Functions

The system uses **Battery Management System** optimized for sodium-ion modules.

The BMS continuously monitors the battery state and ensures protection under all operating conditions.

Main BMS functions:

Monitoring

- Cell voltage monitoring (individual series cells)
- Pack voltage and current measurement
- Dual temperature sensing
- State of Charge (SoC) calculation
- Full charge-discharge cycle quantity monitoring

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Protection Features

- Overcharge protection
- Over-discharge protection
- Over-current protection (charge and discharge)
- Short-circuit protection
- Over-temperature protection for charge/discharge
- Low-temperature charge restriction
- Automatic shutdown under critical conditions

Balancing

- Active balancing between cells for optimal lifetime and improved cycle stability
- Balancing during charge and float modes

Communication

- CAN bus (for inverter/EMS connection)
- RS485 (Modbus-type communication for monitoring)

Compatibility of this function must be verified for the specific inverter model.

Automatic Modes

- Auto wake-up after power connection
- Sleep mode during long inactivity
- Fault memory storage for service diagnostics

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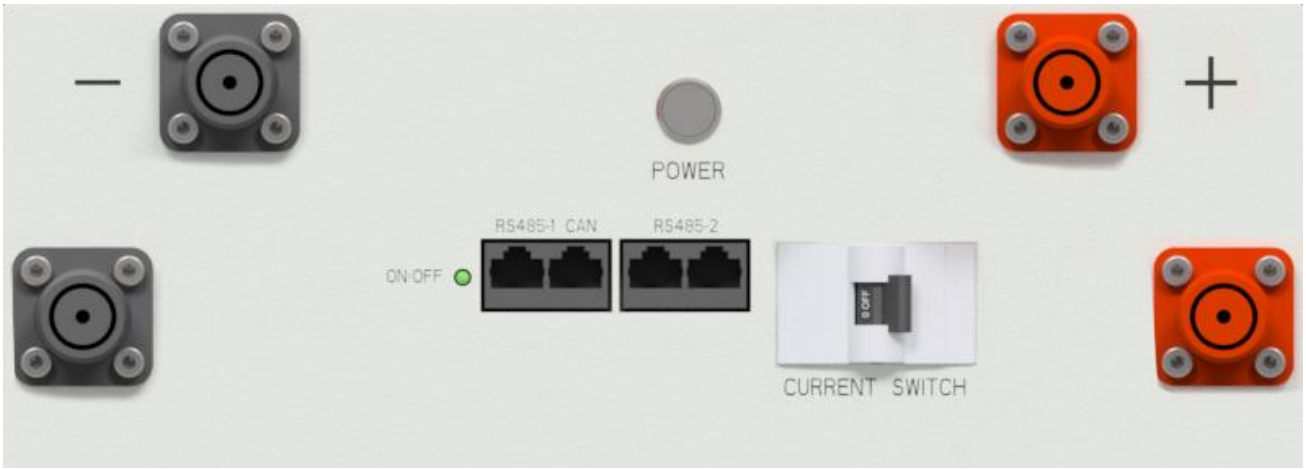
2.4. Ports, Interfaces and Terminals/ Indicators and Controls

The front panel (see figure 2) includes all user-accessible elements.

Figure 2. Energy Storage Unit Front Panel



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Interface	Function / Purpose
Power Button	Turns the BMS system ON or OFF. Used to power-up after connection or shut down safely.
Current Switch (ON/OFF breaker)	Main current isolation switch. Cuts battery output/input current. Must be ON for the BMS to operate.
POWER LED	Lights green when BMS is running normally.
RS485-1 / CAN	Communication port for CAN Bus or RS485 to inverter, computer, or another BMS.
RS485-2	Additional RS485 communication port.
Negative terminals (-)	Energy storage negative connection point.
Positive terminals (+)	Energy storage positive connection point.

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3. System installation

This section describes the required steps to install and commission the Energy Storage Unit Freen-BSL-N.

All installation work must be performed by qualified personnel.

3.4. Electrical Connection Procedure

Before you start

- Ensure the inverter is powered OFF.
- Lock the unit's caster brakes.
- Verify correct cable size for DC current **(Minimum DC cable cross-section: 25 mm^2 copper. Ensure the same cable cross-section is used on both sides of the DC connection)**
- Confirm correct polarity on DC terminals.

Connection Steps (see figure 3)

1. **Connect the Ground**
   Attach the grounding cable to the designated grounding point of the battery enclosure.
2. **Connect the Negative (–) Terminal**
   Connect the black DC cable to the negative terminal. Tighten using an insulated tool. Ensure correct torque and firm contact
3. **Connect the Positive (+) Terminal**
   Connect the red DC cable to the positive terminal. Tighten using an insulated tool Ensure correct torque and firm contact.
4. **Secure all connections**
   Check for proper crimping, tightening, and insulation.
5. **Connect communication cables (if used)**
   Install CAN or RS485 cables between the battery and the inverter/energy controller.
6. **Recheck all wiring**
   Verify that no cables are under tension or touching sharp edges.

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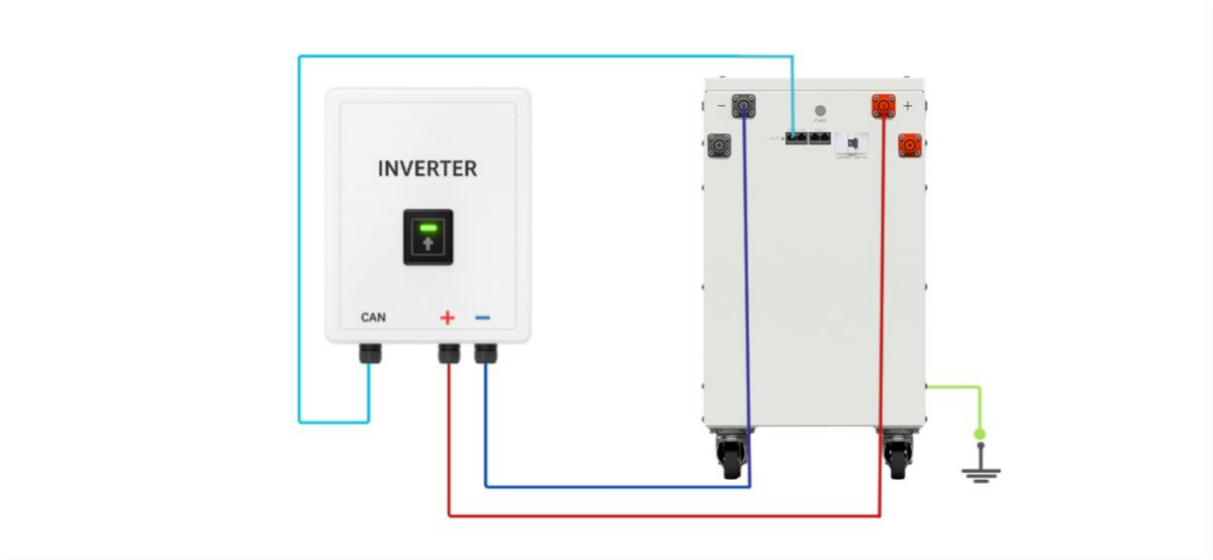

Figure 3. Inverter connection diagram

3.5. Communication Wiring (CAN / RS485)

The Energy Storage Unit supports optional communication protocols for closed-loop control.

General Guidelines

- Use shielded twisted-pair cables (max. recommended cable length: 20-25m indoors)
- Avoid routing communication cables next to high-current DC lines.
- Follow the inverter manufacturer's wiring diagram for pin assignments.
- Only connect **one** communication protocol at a time (CAN *or* RS485).

- **For CAN**: follow device-specific CAN mapping (termination resistor if needed).
- **For RS485**: verify Modbus device ID and baud rate if applicable.
  - Ensure connectors are fully seated and secured.

Typical Functions

- Charge/discharge control
- Voltage/current telemetry

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3.6. Initial Power-On Procedure

1. Verify that the housing is not damaged.
2. Ensure the unit is placed on a level floor surface.
3. Check ambient temperature: **+10 °C to +35 °C recommended**.
4. Connect protective earth (PE).
5. Connect DC cables to the inverter observing polarity.
6. Connect CAN or RS485 communication cable if required.
7. Turn on Battery current switch
8. **Turn on** the inverter or system controller.
9. The BMS will automatically wake up; Power LED should illuminate.
10. Check that no Fault indication is active.

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4. System Operation

The Unit operates automatically under normal conditions. The BMS and inverter coordinate charging and discharging.

4.4. Normal Power Modes

- **Standby:** BMS active, inverter idle, no current flow.
- **Charge Mode:** Pack voltage rising, active thermal monitoring.
- **Discharge Mode:** Inverter supplies connected loads.
- **Protection Mode:** System isolates battery until safe recovery conditions are met.

4.5. Charge/Discharge Behavior

- Operating voltage: 40-60 V
- Max charge/discharge current: 80 A
- Max power: 4 kW

The BMS automatically reduces or stops charging if:

- Temperature is below 0 °C or above +55 °C
- Current exceeds permitted limits
- Voltage reaches maximum

4.6. Standby and Sleep Modes

The unit enters Sleep Mode after long inactivity without communication or current flow.

Wake-up occurs automatically when:

- Inverter requests current
- Communication becomes active
- DC voltage applied

Sleep mode minimizes internal consumption and protects the battery during long idle periods.

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4.7. Full Charge–Discharge Cycle Monitoring (via PC)

The integrated JK (Jikong) Battery Management System records the total number of completed full charge-discharge cycles **(Full Equivalent Cycles).**

The JK BMS MONITOR software is available only for Windows PC, if you have MacOS computer, please install Windows App at the App Store to proceed.

To check the cycle count using PC and BMS Software:

4.7.1. Install the official JK BMS monitoring software

JK BMS MONITOR Software Download link - https://www.jkbms.com/wp-content/uploads/2025/12/jkbms.com-monitor-3.4.0-setup.zip

4.7.2. Open the installed JK BMS MONITOR program.

4.7.3. Connect the supplied RS485-USB communication cable.

4.7.4. Verify communication readiness:
- Confirm that the computer recognizes the USB device.
- Make sure the CH340 driver is installed correctly.

4.7.5. In the software, press “Connect”,
- Ensure that the correct COM port is selected.

4.7.6. After successful connection you can navigate in the software to monitor and count all the parameters

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4.8. System Scalability and Parallel Expansion

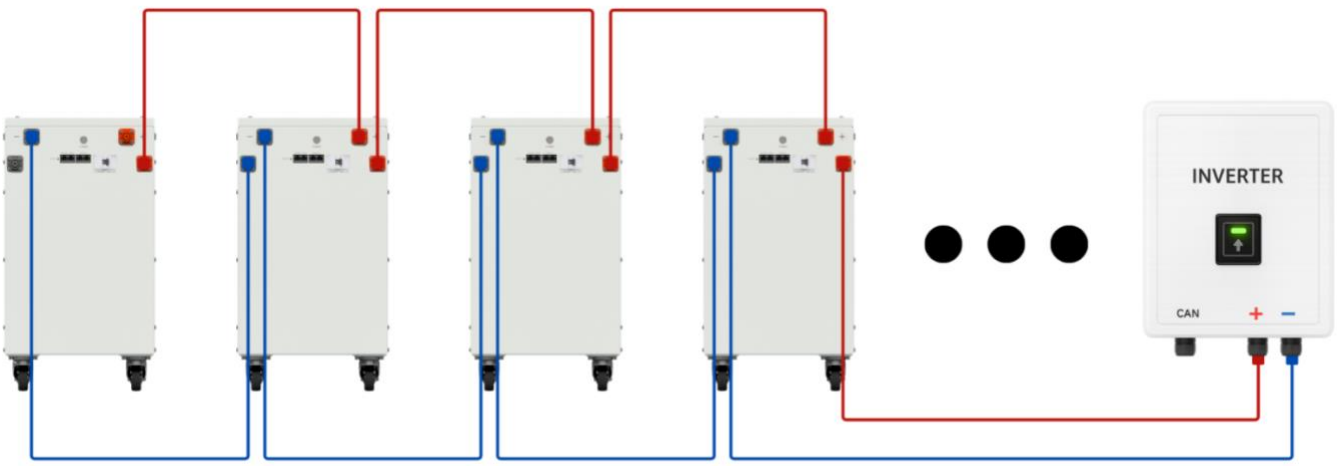

Figure 4. Parallel connection between units.

Connecting Multiple Units in Parallel

Multiple Freen-BSL-N units can be connected in parallel to increase the total system capacity and available current, with no BMS interconnection between units.

The state of charge of each unit can be monitored individually by connecting to its RS485/CAN port, or collectively at the system level via the inverter's display.

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To connect units in parallel, follow the procedure below:

4.5.1. Switch Off All Units
Make sure all circuit breakers on the batteries and the inverter are in the "OFF" position before making any connections.

4.5.2. Connect Units Positive-to-Positive (+)
Connect the positive terminal (+) of the first unit to the positive terminal (+) of the second unit. Repeat for each unit along the row.

4.5.3. Connect Units Negative-to-Negative (−)
Connect the negative terminal (−) of the first unit to the negative terminal (−) of the second unit. Repeat for each unit along the row.

4.5.4. Connect to the Inverter
From the last unit in the chain, connect the positive terminal (+) to the positive input (+) of the inverter.

Connect the negative terminal (−) to the negative input (−) of the inverter.

4.5.5. Verify Polarity
Before switching the system on, double-check that all positive terminals are connected to positive and all negative terminals to negative throughout the entire chain.

4.5.6. Switch On
Turn on the circuit breakers on the batteries first, then switch on the inverter.

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5. Maintenance

5.4. Visual Inspection (Every Month)

- Check for damage to housing or connectors
- Ensure ventilation slots are not blocked
- Confirm no signs of overheating or smell
- Verify power LED for normal operation
- Check cabling for wear, corrosion or loose connections

5.5. Recommended Service Intervals

Every 2-3 months:

- Check and restore tightening terminal connections
- Clean ventilation zone surface

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6. Storage and Transport

Storage Requirements

- Store at approximately 25-50% State of Charge (SoC) for long-term storage.
- Store at 0 – +25°C and ≤60% relative humidity for long-term storage (over 3 months); short-term storage range is -20 – +45°C, ≤60% RH.
- Avoid direct sunlight and high humidity.
- Recharge the battery every 3 months if stored idle, to prevent over-discharge.

Transport

- Transport upright and secure in the original packaging.
- Do not expose to excessive shock, vibration, or dropping.
- Ensure power is turned off before transport.
- Follow regional battery transport regulations.
- For safety reasons, the storage units are shipped with a SoC of approximately 30%

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7. Datasheet

Technical specifications	
Cell type:	Sodium-ion (NFPP)
Rated capacity:	150.06 Ah
Usable Energy:	7.5 kWh
Nominal voltage:	50 V
Operating voltage:	40-60 V
Max. charging/discharging current:	80 A
Max. charging/discharging power:	4 kW
Dimensions, mm (L / W / H):	530 x 307 x 548
Weight:	108.6 kg
Mounting method:	Floor stand
Installation location:	Indoor
Storage temperature range:	-20 ºC to +45 ºC
Operating temperature range:	Charge 0 ºC to +55 ºC Discharge -30 ºC to +60 ºC
Degree of protection:	IP20
Cooling concept:	Natural convection
Communication:	CAN, RS485
Relative humidity:	< 60%
Round-trip efficiency:	> 97%
Life cycle:	> 14000 times (SOH 60%)
Warranty:	10 years

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8. Warranty and Service Information

For any technical support and warranty-related inquiries, please contact us via:

Phone: +372 58 7878 25
E-mail: support@freen.com

For the warranty terms and conditions, please refer to the attached warranty documentation.

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