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User and Installation Manual

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Dear Customer,

Thank you for choosing Replus energy storage solution. We sincerely appreciate the trust you have placed in us. If this is your first Replus product, we look forward to building a long and rewarding partnership that creates lasting value for your organization. If you are an existing customer, we thank you for your continued confidence and support.

At Replus, we are committed to helping our customers achieve their business and sustainability goals through reliable, innovative, and high-performance energy storage solutions. This commitment is reflected in everything we do, from product design and manufacturing to service and support. We continuously strive to exceed customer expectations through technology, quality, and operational excellence. Your feedback is valuable to us and helps drive our journey of continuous improvement and innovation.

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ABOUT US

Replus Engitech Private Limited is a technology-driven energy storage company dedicated to developing advanced lithium-ion battery solutions for a rapidly evolving energy landscape. As a subsidiary of HEG Advanced Materials Limited, Replus combines engineering expertise, innovation, and manufacturing excellence to deliver reliable and sustainable energy storage solutions.

The company specializes in Battery Energy Storage Systems (BESS), lithium-ion battery packs, telecom power solutions, and e-mobility applications. With strong capabilities in battery design, Battery Management Systems (BMS), Energy Management Systems (EMS), and system integration, Replus delivers solutions that help customers improve energy reliability, efficiency, and performance.

Operating from its advanced manufacturing facility in Pune, Replus serves diverse sectors including telecommunications, renewable energy, commercial and industrial power infrastructure, and electric mobility. Backed by a team with deep industry experience, the company is focused on accelerating the adoption of clean energy technologies through innovative products and customer-centric solutions.

Driven by a commitment to quality, safety, and continuous innovation, Replus aims to play a key role in building a smarter, more sustainable energy future.

Powering Progress Through Advanced Energy Storage Solutions.

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1.0 Overview:

The continuous progress in lithium-ion battery technology has driven its increasing adoption as a replacement for traditional lead-acid battery systems in many energy storage and power applications. Lithium-ion batteries provide notable advantages such as greater energy storage capacity, compact design, lower weight, extended service life, and effective operation under diverse environmental conditions. Lithium Iron Phosphate (LFP) technology offers a highly attractive combination of safety, longevity, thermal stability, and overall performance, making it a preferred choice for modern battery systems.

Specification of Product:

No.	Item	Specification	Remarks
1	Nominal capacity	100 Ah	Rated at a constant 0.2C discharge to the pack's end-of-discharge voltage at 25 ± 2°C.
2	Nominal voltage	48 V	15 cells connected in series; each cell has a nominal voltage of 3.2 V.
3	Charging voltage	54 V	
4	Maximum continuous charging current	60 A	At 25°C
5	End-of-discharge voltage	45 V at 80% DOD	
6	Maximum continuous discharging current	60 A	At 25°C
7	Allowable operating temperature	Charging: 0 to 60°C Discharging: -20 to 60°C	Recommended: 15 to 35°C
8	Allowable relative humidity	Storage: ≤95% RH Operation: ≤85% RH	
9	Recommended storage temperature	0 to 45°C	Maximum storage period: 3 months
10	Ingress protection rating	IP20	
11	Weight	Approximately 41 ± 1 kg	

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2.0 Storage & freshening charge: Precautions to be taken during battery storage & dispatch

A) Store battery packs in a temperature-controlled environment between 0°C and 45°C.

B) Keep batteries in a clean, dry, and secure storage area to prevent environmental damage.

C) After inspection, retain the batteries in their original packaging until they are ready for installation or dispatch.

D) Do not stack battery packs on top of one another unless specifically approved for such storage.

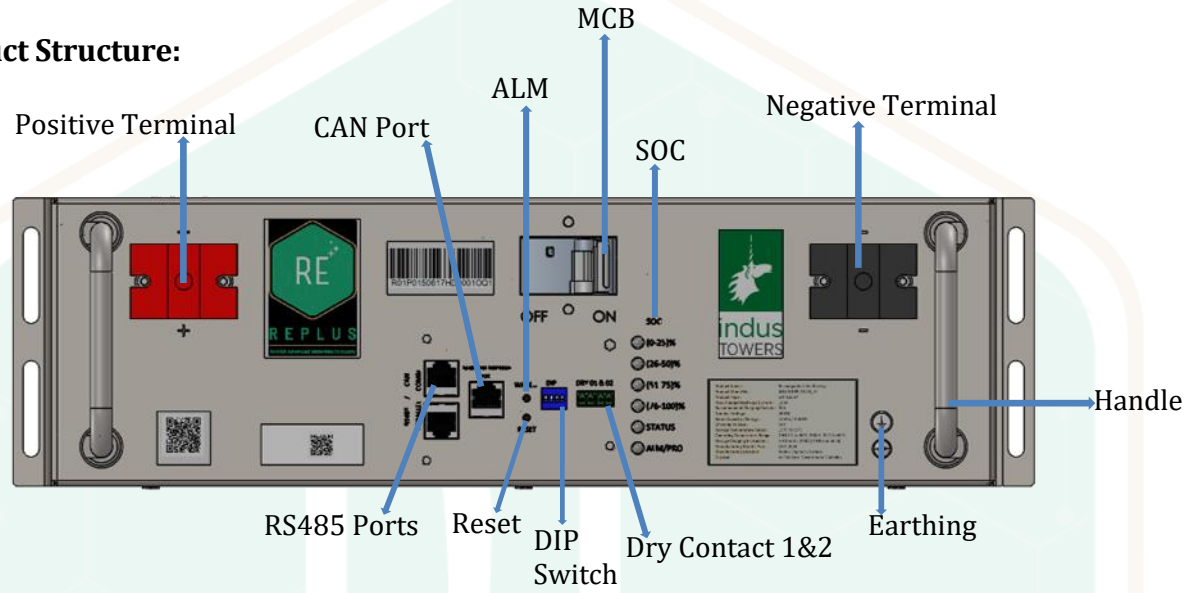
E) Protect batteries from direct sunlight, rain, dust, moisture, and nearby heat sources.

F) Do not place metal objects on the battery pack and remove metallic jewelry when handling or working near the batteries.

Pack Voltage Range	**Remarks**
> 42 to 46V	Connect with SMPS and charge the pack/module
< 42 V	Contact Replus Service representative for any support required.

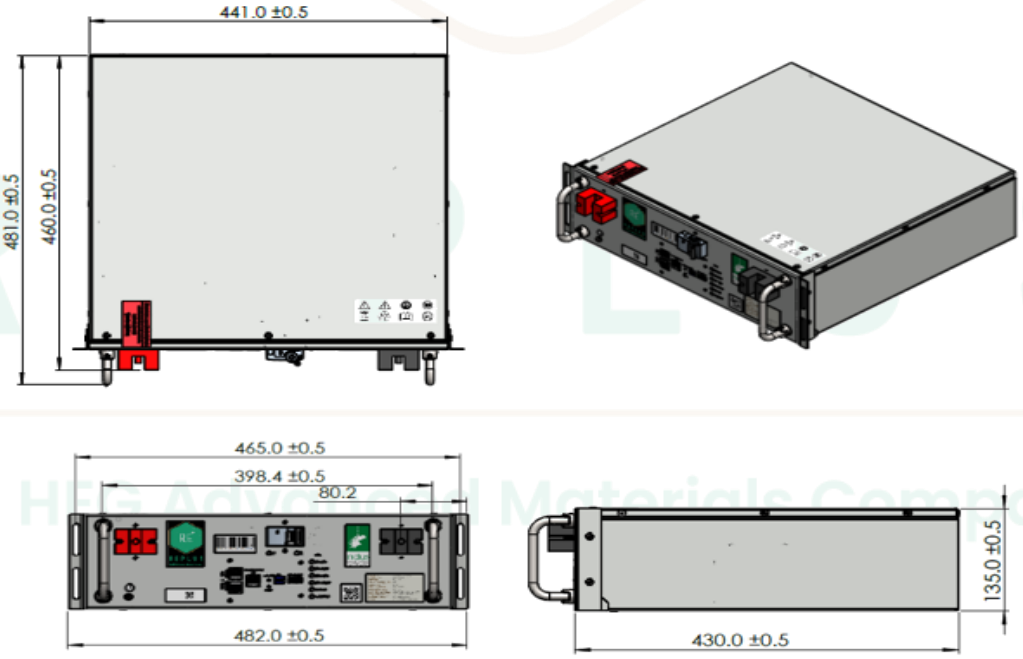
Safety Symbols	
Symbols	**Definition**
	Failure to follow the instructions associated with this symbol may result in serious injury or loss of life.
	Exposure to hazardous voltages may cause severe injury or fatal electric shock. Do not place tools, equipment, or any other objects on the battery.
	Carefully read and understand all installation, commissioning, and operating instructions before using the battery system.
	Always wear appropriate **personal protective equipment (PPE)**, including safety goggles and protective clothing, when handling batteries.
	Exposure to electrolyte may cause skin or eye burns. Avoid direct contact with leaked electrolyte.
	Prevent short circuits and avoid conditions that may generate sparks.
	Keep the battery away from open flames, ignition sources, and spark-producing equipment.
	End-of-life batteries that are not recycled must be disposed of in accordance with applicable local, state, and national regulations governing hazardous waste.
	Do not dispose of lithium-ion batteries in fire or expose them to excessive heat, as they may rupture or explode.

3.0 Product Structure:



S.NO	Name	Function	Remarks
1	RS485	RS485 Communication interface	
2	SOC	State of charge	LED bar consisting of four LED's (each 25%)
3	ALM	Indicates RED LED	Alarm: Blink periodically Protection: Glow Continuously
4	RUN	Indicates Green LED	Standby & Charge: Blink periodically Discharge: Glow Continuously
5	DRY1 & DRY2	PFC contact for Alarm Extension	

4.0 Dimensional overview of Pack and Mechanical Characteristics:



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Sr.No.	Mechanical Characteristics	
1	Battery Enclosure Material	CRCA
2	Dimension (D x W x H)	(482 x 430 x 135) mm ± 2mm
3	Weight	41Kg ±1Kg
4	Terminal Type	M8
5	IP Grade of Module	20
6	Suitable for Installation of Modules In	19" Rack
7	Cell Type - Chemistry	LiFePO4

LED Serial Number	Feature Status	Functions	Frequency	Condition
LED 1	1	SOC INDICATION LED1	Constantly On	0 to 25% SOC
LED 2	1	SOC INDICATION LED2	Constantly On	26 to 50% SOC
LED 3	1	SOC INDICATION LED3	Constantly On	51 TO 75% SOC
LED 4	1	SOC INDICATION LED4	Constantly On	76 TO 100% SOC
LED 5	1	BMS Status	Toggle (Green, 500 mS)	BMS in Normal/Active state
LED 6	1	ALARM/PROTECTION	Alarm: Toggle (RED, 500 mS) Protection: Constantly On (RED)	BMS in Normal/Active state

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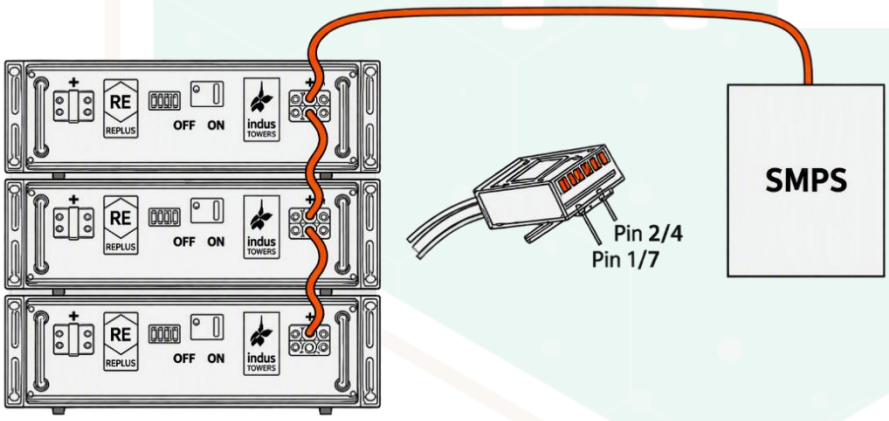
Table 2. SOC LED Indicator Description

1 light	0%<SOC≤25%
2 lights	25%<SOC≤50%
3 lights	50%<SOC≤75%
4 lights	75%<SOC≤100%

5.0 Communication PIN Configuration (RS485):

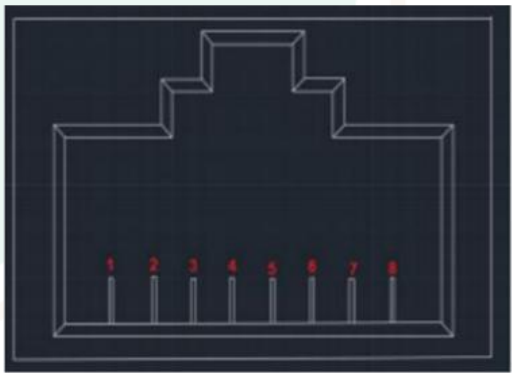
The system uses/through 8Pin straight PCB welding socket (RJ45) to provide RS-485 protocol, the pin assignment of RJ45 is defined as follows.

RJ45 Pin	Definition Description
1/7	RS485_B
2/4	RS485_A



- From Battery side Pin **2/4** need to connect to **A/High** in **SMPS** converter.
- From Battery side Pin **1/7** need to connect to B/Low in **SMPS** converter.

RS485 connectors definition:



RJ 45 Port for RS485 Communication

Status of PFC Contact

PFC Contact	Condition	Status
DRY CONTACT 1	No Alarm Exist Related to Low SOC	Normal Open (NO)
	Alarm Exist Related to Low SOC	Normal Close (NC)
DRY CONTACT 2	No Alarm & Protection Exist Related to Remaining Parameters (V, I & T)	Normal Open (NO)
	Any Alarm & Protection Exist Related to Remaining Parameters (V, I & T)	Normal Close (NC)

6.0 DIPADDRESS:

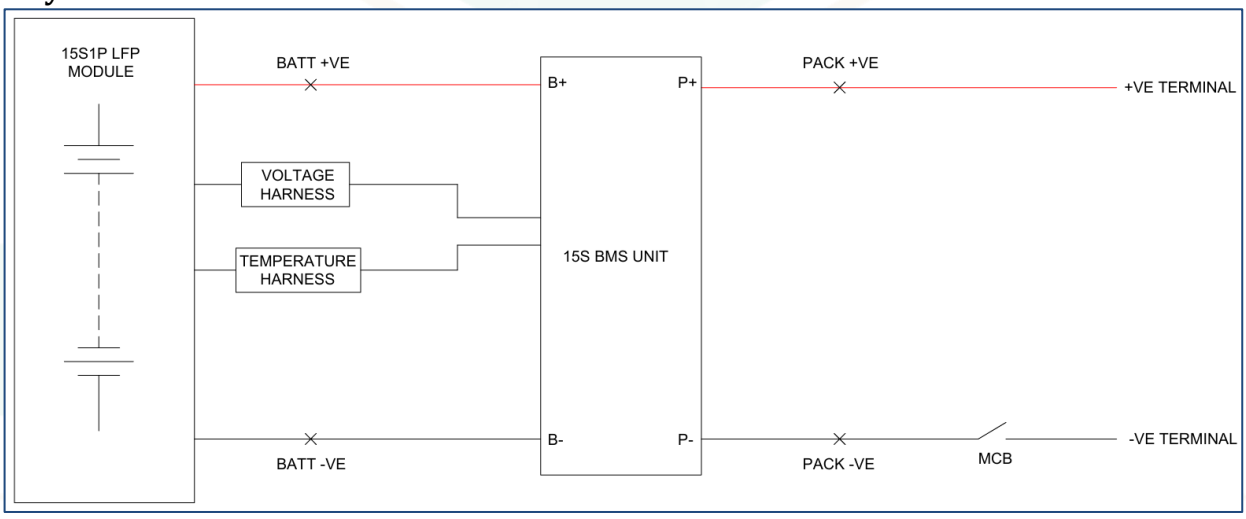
If the battery packs are connected in parallel, the DIP address identifies each pack with different addresses. Bit 1 to 4 for different addresses of paralleled packs. Bit 5 to 8 for the quantity of slave packs.



RS485 DIP address set:

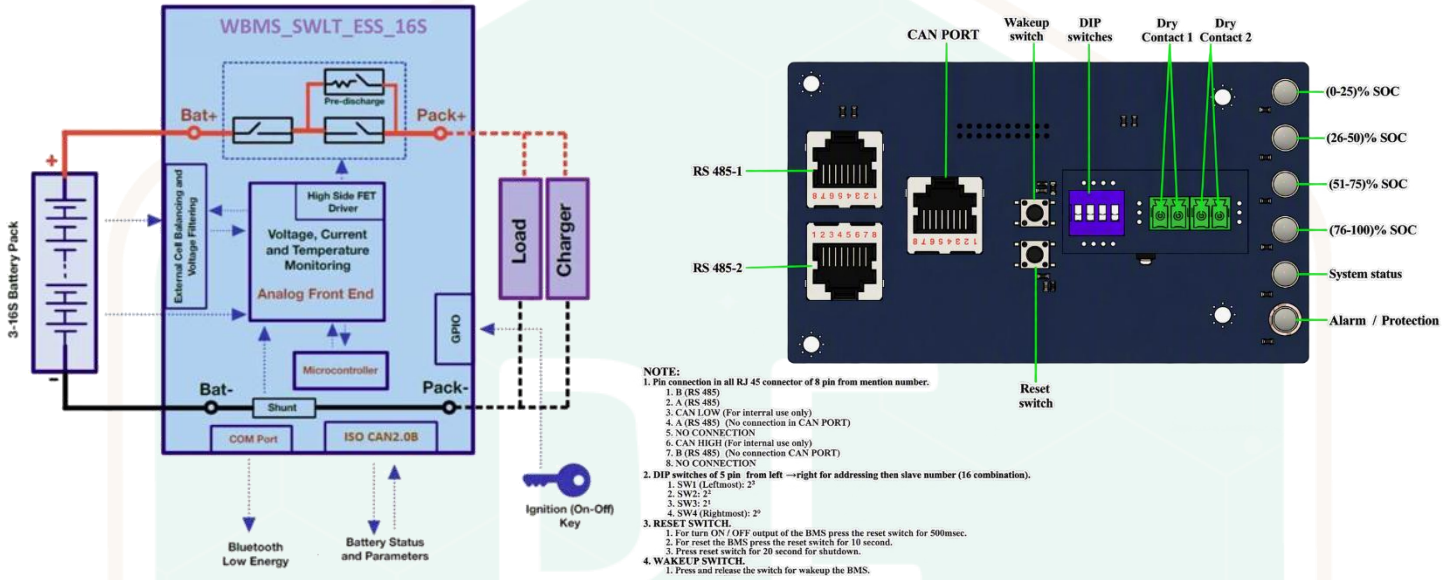
RS 485 Communication Parallel pack address setting				
Column 1	1	2	3	4
1st PACK	OFF	OFF	OFF	ON
2nd PACK	OFF	OFF	ON	OFF
3rd PACK	OFF	OFF	ON	ON
4th PACK	OFF	ON	OFF	OFF
5th PACK	OFF	ON	OFF	ON
6th PACK	OFF	ON	ON	OFF
7th PACK	OFF	ON	ON	ON
8th PACK	ON	OFF	OFF	OFF
9th PACK	ON	OFF	OFF	ON
10th PACK	ON	OFF	ON	OFF
11th PACK	ON	OFF	ON	ON
12th PACK	ON	ON	OFF	OFF
13th PACK	ON	ON	OFF	ON
14th PACK	ON	ON	ON	OFF
15th PACK	ON	ON	ON	ON

Battery Pack Architecture:



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7.1 BMS Overview:



7.2 Safety instructions and safety precautions during Installation:

- For safety purposes, all installers and users should thoroughly read and understand these safety guidelines and precautions before operating or handling the lithium-ion battery.
- Conditions such as overvoltage, incorrect wiring, reversed terminal connections, or short circuits can cause severe damage to the lithium-ion battery and may create hazardous situations.
- Lithium-ion batteries should not be installed near combustible materials, storage areas containing flammable substances, or locations that present a potential fire risk.
- Under no circumstances should the lithium-ion battery be opened, disassembled, modified, or subjected to any form of physical damage.
- Lithium-ion batteries must be kept away from excessive heat sources and open flames. During storage, they should also be shielded from direct sunlight exposure.
- The battery should remain in its original packaging until it is ready to be installed or put into service.
- Care must be taken to protect lithium-ion batteries from shocks, impacts, or any other mechanical stress.
- Batteries that differ in manufacturer, capacity rating, size, or chemistry/type should not be connected or used together.
- Lithium-ion batteries should always be maintained in a clean, dry condition to ensure safe operation and storage.
- All warning labels, hazard markings, and safety instructions provided on the battery must be strictly followed and must not be removed, altered, or obscured.

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8.0 Tools & Measuring Instruments Required:

Sr.N.	Tools Required
1	Screwdriver Set
2	Multimeter
3	Clamp Meter
4	Torque Wrench
5	Laptop with 64 Bit OS
6	BMS CAN Tool
7	GUI Software installed
8	Crimping tool
9	Insulation electrical tape
10	Any Other tools (If required)

8.1 DO's and DONT's:

i. DO's:

- Store batteries in the designated area after receipt.
- Read the Operation & Maintenance Manual before installation.
- Clean batteries with dry cloth when required.
- Ensure adequate ventilation for proper heat dissipation.
- Tighten any loose external fasteners.
- Keep batteries away from heat, sparks, and open flames.
- Monitor battery SOC during storage and recharge when needed.
- Recharge batteries promptly after use.
- Use only approved CC-CV chargers/SMPS with recommended settings.
- Use correctly rated cables and properly crimped lugs.

ii. DONT's:

- Do not expose batteries to direct sunlight, rain, dust, or water.
- Do not open, dismantle, or tamper with the battery pack.
- Do not install damaged battery packs.
- Do not wash or immerse the battery pack in water.
- Do not place metal objects on or across battery terminals.
- Do not mix batteries of different capacities, make, or types.
- Do not use unauthorized chargers.
- Do not use spray cleaners on the battery pack.
- Do not handle severely damaged batteries with bare hands.
- Do not dispose of batteries with regular waste; use OEM-approved or authorized recycling/disposal channels.

9.0 Installation process:

A) Unboxing and Inspection (Pre-Installation):

1) Read the manual thoroughly and follow all safety instructions before handling the battery.
2) Inspect the battery after unboxing for any signs of damage, deformation, loose components, or defects. Report any issues to the service representative immediately.
3) Installation and commissioning must be carried out only by trained and qualified personnel.

B) Preparation for Installation:

1) The battery installation area or cabinet shall be clean, dry, and well-ventilated to ensure safe operation and prevent moisture accumulation.
2) Verify that the installation surface is level, structurally sound, and capable of supporting the total battery system weight. The location should be free from excessive vibration.
3) Ensure adequate clearance around the battery system for installation, inspection, maintenance, and proper airflow. Confirm that the rack, bracket, or cabinet is rated to support the battery weight.
4) Do not install batteries in locations exposed to direct sunlight or near heat sources, sparks, open flames, or other ignition hazards.
5) Provide sufficient ventilation and cooling arrangements to facilitate effective heat dissipation. Where applicable, cooling fans should be installed in the enclosure or rack.
6) Use appropriately sized cables and approved termination methods for all battery connections. Cable ratings shall be suitable for the maximum operating current as specified in the electrical design.
7) Battery racks or cabinets may be supplied based on project requirements. For outdoor installations, the use of an IP55-rated 19-inch enclosure is recommended for environmental protection.
8) Before starting installation, wear the required PPE and use insulated tools. Remove metallic personal items such as rings, watches, bracelets, and necklaces to minimize electrical hazards.
9) For optimum battery performance and service life, maintain the ambient temperature between 15°C and 32°C.
10) Where required, secure the battery unit, rack, or cabinet using suitable floor anchoring arrangements to enhance stability and safety.
11) During handling and installation, take precautions to prevent impacts, collisions, or falling objects that could damage the battery system.

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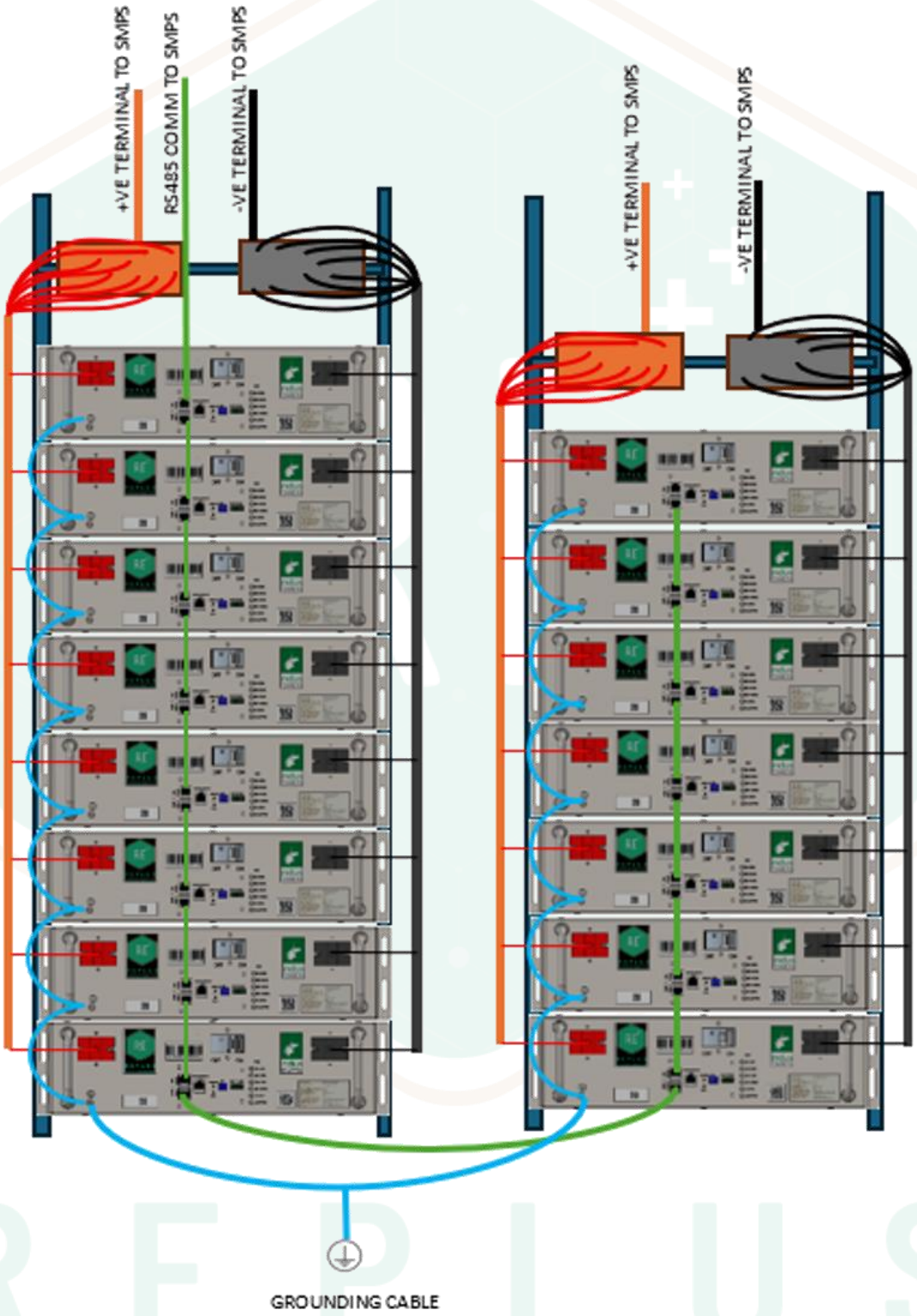
C) Installation & fixation of Modules:

1) Before installation, ensure the battery MCB is OFF and disconnect the SMPS power supply to prevent any energized work during installation.
2) Lift the battery pack in a horizontal position using the front-panel handles and carefully slide it into the 19-inch rack or cabinet.
3) Verify that the battery is properly seated in its designated slot and adequately supported.
4) Secure cage nuts on the rack mounting points and align the battery front panel for fastening.
5) Install battery packs one at a time and firmly secure each pack to the rack using the appropriate screws.
6) **Ground Connection:**
   Connect a suitably sized flexible grounding cable between the battery pack grounding (GND) terminal and the cabinet ground busbar.

D) Connecting Power cables:

1) Ensure all battery module MCBs are in the OFF position before making any power connections.
2) Before connecting cables to the battery terminals, ensure the opposite cable ends are properly insulated.
3) Connect the positive (+) terminal of each battery pack to the positive busbar and the negative (-) terminal to the negative busbar. Verify polarity before tightening connections to prevent short circuits.
4) Observe the following precautions during cable installation:
5) Battery modules must be connected only in parallel and never in series.
6) Use power cables of equal length for all battery modules to ensure balanced current sharing and voltage distribution.
7) Avoid accidental short circuits while making parallel connections.
8) Keep the cable length between the battery bank and power plant as short as practical to minimize voltage drop. Positive and negative cables should be of equal length.
9) For easy identification, use red cables for positive connections and black cables for negative connections.
10) Connect the main SMPS output cables to the battery bank busbars, ensuring correct polarity at all connection points.
11) After completing the installation, switch ON the battery pack breaker. The battery will transition from dormant mode to normal operating mode and will be ready for charging and discharging operations.

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Schematic Electrical & Communication connection of packs

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E) Connecting communication cables:

1) To enable communication between battery modules and the SMPS controller, connect the modules using RS485 communication cables (Cat 6).
2) Interconnect adjacent battery modules by connecting an RJ45 cable between the designated communication ports of each module.
3) Connect the final RS485 communication cable from the battery string to the SMPS Controller or CBMS, where applicable.

F) Commissioning of batteries:

1) After powering up the battery module, verify that the Normal/No Alarm LED indication is active. Refer to the LED status section for detailed interpretation of LED indications.
2) Using a calibrated multimeter, measure the battery pack output voltage and confirm that it is within the specified operating voltage range before placing the system into service.

10.0 Routine Maintenance & Service:

- Recharge batteries every 3 months when stored for extended periods to maintain battery health.
- Remove accumulated dust from the battery pack using a suitable dust-cleaning method or vacuum cleaner.
- Clean the cabinet or enclosure using clean, dry cloth. If additional cleaning is required, use a neutral cleaning agent. Do not use cleaners containing alcohol, ammonia, or other harsh chemicals.
- Handle battery packs carefully during transportation and maintenance to avoid impacts, drops, or mechanical damage.
- Periodically inspect power terminal connections and ensure they remain secure. Avoid over-tightening terminal screws.
- Regularly verify that cabinet or rack cooling fans are operating correctly and clean fan filters to prevent dust buildup.
- During scheduled maintenance, isolate the battery system and remove any dust or debris from the battery surfaces using a dry cloth.
- Where air filters are installed in the cabinet or rack, clean them at least once every two months to maintain proper airflow and cooling performance.

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11.0 Warning!

It must be ensured that no water can enter the lithium-ion battery and that the battery is not soiled.

- **If the battery does not start up normally or the ALM light on the display is on, press reset button if required, if this does not solve the problem, contact Replus service personnel in a timely manner to avoid damaging the device or causing safety accidents.**

Caution!

- Batteries gradually lose charge while in storage. Storing the battery at elevated temperatures (above 45°C) can negatively affect its shelf life.
- Protect the battery from shocks, impacts, crashes, or any other form of mechanical abuse.
- The battery enclosure must not be opened, disassembled, or subjected to physical damage under any circumstances.
- Ensure the charging current remains within the maximum limit specified in the technical datasheet.
- Do not attempt to dismantle the battery pack. The enclosure contains no components that require user maintenance.
- Before carrying out any cleaning activity, disconnect the battery from all charging sources and connected loads.
- Install protective terminal covers to prevent accidental contact with exposed battery terminals.
- The battery should be charged before being placed into service. Always use a charger configured according to the voltage and current parameters defined in the technical datasheet.
- Charging shall only be performed within the temperature range of 0°C to 45°C. Charging outside this range may affect battery performance, safety, and service life.
- Battery discharge shall be limited to the temperature range of −10°C to 60°C. Operation beyond these limits may reduce performance and accelerate battery degradation.
- Batteries are supplied from the factory at approximately 60% to 65% State of Charge (SOC). When stored for extended periods, they should be recharged at least once every three months to avoid excessive self-discharge.

12. Trouble Shooting:

Type of Fault	Observations	Corrective action
Battery does not charge	Charging inhibited due to voltage or current protection.	Use the GUI to check the pack alarms for a charging protection fault, then resolve the fault or clear the protection condition.
	Under-temperature or over-temperature protection is active when the ambient temperature is below 0°C or above 65°C.	Adjust the surrounding temperature to within the specified charging limits of **0°C to 55°C**.
	Battery output voltage is below **40 V**.	The battery may be in a deep-discharge condition. Contact the Replus Service team for assistance.
Battery does not discharge	Voltage or current protection is active.	Use the GUI to check the pack alarms for an overcurrent fault, then resolve the fault or clear the protection condition.
	Ambient temperature is outside the allowable discharge range (below -20°C or above 60°C).	Restore the operating temperature to within the specified discharge range of **-20°C to 60°C**.
	Short circuit condition detected at the battery output.	Remove the short circuit, verify the wiring, and recharge the battery if required.
	Overcurrent protection has been activated.	Reduce non-essential loads and restore the battery to normal operating conditions.
	Internal system malfunction.	Shut down the system safely and contact maintenance personnel for inspection.
Communication failure	Communication cable fault or loose connection.	Inspect the communication cable and ensure all connections are secure.
	Incorrect DIP switch configuration.	Verify and set the DIP switches according to the specified configuration.
	Communication interface issue between modules.	Check the RS485 communication cable and verify proper module-to-module connectivity.
	Compatibility issue between SMPS and battery system.	Confirm that the SMPS software/protocol supports the battery communication requirements and both systems are compatible.
Back-up issues	Extended storage without recharging	Recharge the battery using the SMPS charger or contact a Replus representative for assistance.
	Insufficient Li-ion modules in the battery bank	Ensure the battery bank has enough Li-ion modules to support the load and provide the required backup time.
	Incorrect SMPS settings	Verify the LVDS and BLVD settings in the SMPS.

13.0 When to Call OEM (Battery manufacturer Service support):

- Any dents, cracks, or physical damage to the battery enclosure are identified during unloading or unpacking.
- Any components are found to be incorrectly positioned, damaged, or if any supplied accessories are missing.
- Any signs of leakage are noticed on or around the battery module.
- The battery module exhibits any unusual behavior, indication, or operating condition.
- The battery has remained in storage for a prolonged period and appears deeply discharged, requiring guidance before reuse.
- Communication between the battery modules and the SMPS Controller or CBMS is interrupted or not functioning properly.

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