ROLLS S48-100LFP ESS BATTERY OPERATING MANUAL

Rolls

BATTERY ENGINEERING

Recommended safety, installation, operating, and troubleshooting procedures for Rolls S48-100LFP (Lithium Iron Phosphate) ESS (Energy Storage Systems).

RENEWABLE
ENERGY

BACKUP
SYSTEMS

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ROLLS S48-100LFP ESS

Rolls S-Series 48-volt Lithium Iron Phosphate (LFP/$LiFePO_4$) Energy Storage System (ESS) batteries are designed for use in larger-scale, 48V (51.2V nominal) systems, for grid-connected backup and off-grid purposes. Rolls S-Series 48V LFP ESS batteries are designed to scale in parallel capacity only at this voltage level, with communication between batteries and to externally connected equipment.

This manual provides detailed instructions for safe and proper installation, operation, and care specifically of Rolls S-Series 48V LFP ESS batteries. Please read carefully to clearly understand the operating instructions and any potential safety risks prior to installation.

Failure to install or use this battery as instructed may result in damage to the product that may not be covered under the manufacturer warranty. See warranty terms & conditions for full details.

NOTE: This manual offers installation, charging and troubleshooting guidance for Rolls S-Series 48V LFP ESS battery only.

See Rolls S24-2800LFP & S48-6650LFP ESS Battery Operating Manual for usage instructions specific to Rolls S24-2800LFP ESS and S48-6650LFP ESS (Energy Storage System) models.

See Rolls R-Series & S-Series Drop-in LFP Battery Operating Manual (Grey and Red plastic cases, BCI sizes) manual for usage instructions specific to Rolls R-Series & S-Series drop-in LFP models.

This document is NOT APPLICABLE to the following models		
S-Series 12V & 24V LFP (S12-___LFP & S24-___LFP)	**R-Series 12V & 24V LFP** (R12-___LFP & R12-___LFP)	**24V & 48V ESS LFP Models** (S48-6650LFP ESS & S24-2800LFP ESS)
		

Nominal voltage of an LFP battery differs from equivalent lead-acid batteries.

LFP Battery	Lead-Acid Battery
Cell Voltage = 3.2V	Cell Voltage = 2.0V
Battery Nominal Voltage 51.2V (16 cells)	Battery Nominal Voltage 48V (24 cells)

WARNING: Explosion, Electrocution, Or Fire Hazard

- A battery can present a risk of electric shock, burns from high short circuit current, fire, or explosion.
- Ensure cables are properly sized for the system current and cable runs are as short as possible, reducing line inductance and voltage spikes, which can damage the BMS.
- Ensure adequate airflow around batteries and that they are clear of debris.
- Never smoke or allow a spark or flame near the batteries.
- Always use insulated tools.
- Avoid dropping tools onto batteries or other exposed electrical parts.
- Cold temperatures can be especially damaging to batteries after even a single low temperature event.
    - Never charge a Rolls S-Series 48V LFP ESS battery below 0°C (32°F).
    - Never discharge a Rolls S-Series 48V LFP ESS battery below -20°C (-4°F).
- Never charge a battery with a deformed or bulging case.
- Do not expose a Rolls S-Series 48V LFP ESS batteries to heat more than 60°C (140°F) during operation, and do not store for extended periods of time above 45°C (113°F). Do not incinerate or expose to open flames.
- If a battery must be decommissioned/removed, always open the breaker first, then remove the grounded terminal from the battery. Make sure all devices are disconnected.
- When installing, leave adequate clearance between batteries consistent with local code requirements and or Rolls racking systems.
- When replacing batteries, use the same make, model & quantity of batteries.
- Do not mix old and new batteries.
- Avoid any fall or collision during the installation process.
- Do not dismantle or remove the battery components.
- Battery maintenance should be carried out by qualified personnel.

VERSION HISTORY/CHANGELOG

Rev.	Changelog	Author/Editor	Date
1.0	Release Version	Jordan Torrealba	2023/08/15

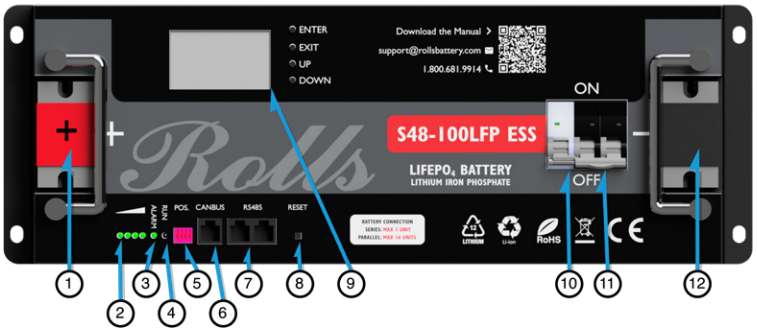
PRODUCT DESCRIPTION

Rolls S-Series 48V LFP ESS batteries are 19" rack-mount and wall-mount compatible. These batteries are intended for large-scale, higher capacity installations than our drop-in replacement lines.

Cabinets installation instruction are available online at: Rolls S-Series LFP ESS Cabinet Assembly Manual.

For Rolls S-Series 48V LFP ESS batteries with connectable PC software, the manual is available online at: Rolls LFP Desktop Manual.

PANEL FEATURES



1. Positive Terminal (2*M6)
2. SOC LED
3. RUN Indication
4. Fault Indication
5. Parallel Address DIP
6. CAN bus Communication
7. RS-485 Communication
8. RESET Switch
9. LCD Display & Navigation
10. On/Off Breaker
11. Protection Breaker
12. Negative Terminal (2*M6)

INSTALLATION

This section describes installation steps and considerations for your Rolls S48-100LFP ESS product. The battery pack can be installed horizontally or vertically.

NOTE: Only trained electrical power system technicians should install the device. Before installing or removing the battery, make sure that the system is disconnected from any power source and that the battery device is turned off. Distribution cabling needs to be handled carefully with reasonable protective measures to avoid being touched during the maintenance and operation.

CABLE CONNECTION

All cable connections should be adequately sized, insulated, and undamaged. The cable connectors should be clean and properly mated with the battery terminals to ensure a snug connection. Terminal connections should be torqued to the recommended specification below. Although Rolls S-Series LFP ESS batteries do not require maintenance, routine inspection of cabling and terminal connections is recommended.

Amperage	25	30	40	55	75	95	130	150	170	195	260
Wire Gage	14	12	10	8	6	4	2	1	1/0	2/0	4/0

NOTE: Undersized cables may lead to cable and/or battery damage, charging issues, terminal heating, or fire.

TERMINAL TORQUE

Rolls batteries using M6 fasteners should be torqued to **8-10Nm**.

DO NOT OVERTORQUE: If a terminal is damaged, do not attempt to repair the terminal. Do not use the battery if the recommended torque specification cannot be met.

SINGLE BATTERY INSTALLATION

Rolls S-Series ESS rack-mount batteries are compatible with standard 19" rack hardware. For single battery installation, connect the positive and negative terminal of the battery pack to the positive and negative terminal of the system bus with the appropriately sized red and black cable, respectively. If you intend to use a combiner box, directly connect the positive and negative terminals of the battery pack to the combiner box terminals.

PARALLEL BATTERY INSTALLATION

Rolls S-Series ESS rack-mount batteries are compatible with standard 19" rack hardware. Rolls S-Series ESS batteries can be combined in parallel to increase system capacity and power delivery. Rolls S-Series S48-100LFP ESS can support up to 16 battery packs in parallel and is certified to UL 1973. Parallel batteries can be installed in the modular Rolls LFP ESS cabinet, and expandable up to 32U per cabinet (i.e., Eight S48-100LFP ESS batteries can be configured in a single rack).

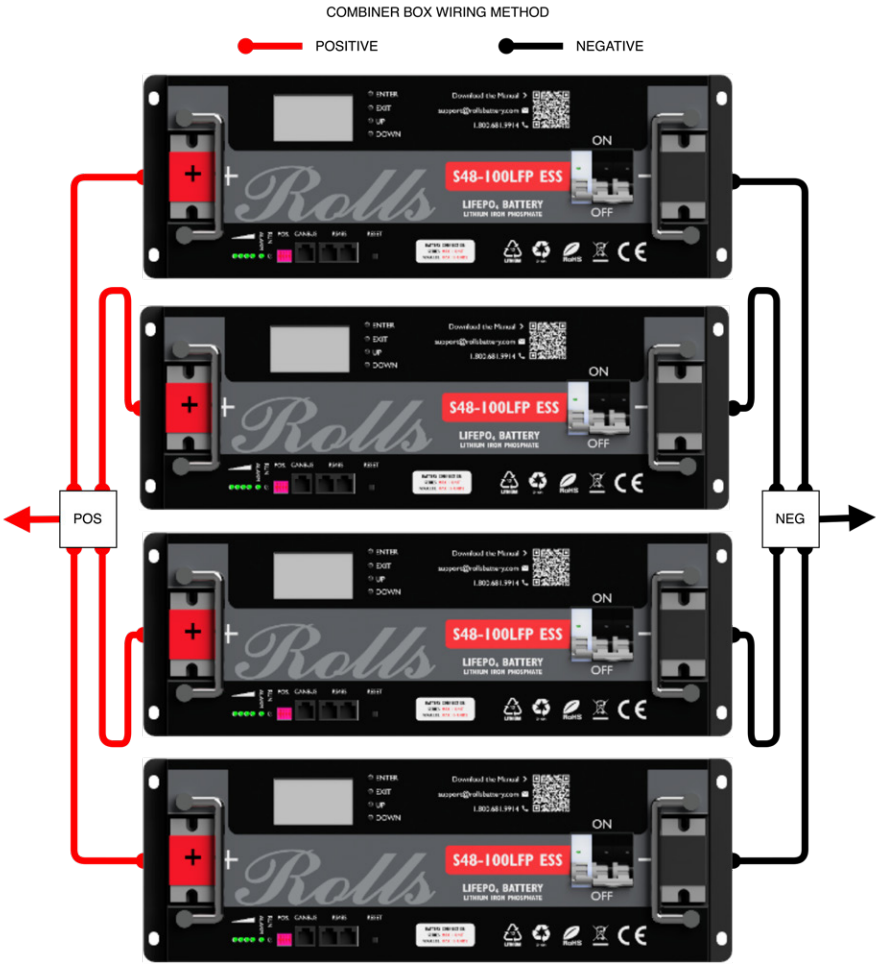
The standard cabinet comes with a high current combiner box to connect the positive and negative terminals from the battery to the outlet terminal at the top of the cabinet. Refer to the connection diagram below and use appropriate cable sizing and length during installation. The length, thickness, material, and resistance of all the cables connected in parallel must be the same.

NOTE: Refer to the Communication Interface section for the parallel communication cable connections.

WARNING: Series connection of 48V S-Series LFP ESS batteries is not supported. Connecting batteries in series will directly lead to BMS failure under numerous conditions, risking cell health, user safety, and will void the product warranty.

WITHOUT COMBINER BOX

WITH COMBINER BOX

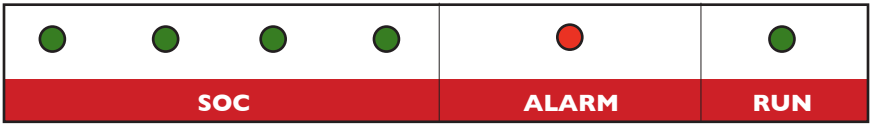


BATTERY OPERATION

FIRST START: When you have verified the connections, terminal torque, and external connections are made, batteries can be activated. For batteries with a breaker, this can be closed, which will electrically connect the terminals to the battery. The change in external voltage or load application will wake the BMS.

If the BMS does not wake immediately, press the RESET button located beside the display to wake the BMS from sleep mode.

LED INDICATOR INSTRUCTIONS



Rolls S-Series 48V LFP ESS batteries have four capacity indicator lights to display the current state-of-charge estimate and charging status, one alarm light for error indication, and one run light. This configuration is consistent across each LFP ESS model.

STATE	CHARGE	DISCHARGE
Run Light	ON	Flashing

When the battery is charging, the **RUN** light will be on. When the battery is discharging, the **RUN** light will be flashing.

STATE	CHARGE	DISCHARGE
Capacity Indicator		
75-100%		
50-75%		
25-50%		
0-25%		

LCD SCREEN

Use of the LCD screen is consistent with the on-screen instructions and provides quick and effective access to voltage, temperature, current, SOC, and fault information.

BMS PROTECTION SUMMARY

Rolls S-Series 48V LFP ESS batteries include a built-in battery management system (BMS) which offers protection in conditions where the battery voltage, current, and switch or cell temperature may be unsafe or damaging. The BMS in S-Series 48V LFP ESS models provides protection against cell and pack overvoltage and undervoltage, charge and discharge overcurrent, high and low temperature, and short circuit. The switch architecture of the BMS allows charge and discharge to be stopped independently. Under these undesirable operating conditions, the internal BMS will interrupt the current into or out of the battery independently, or disconnect it fully, as required.

For S-Series 48V LFP ESS batteries with secondary protection and UL 1973 certification, in the event of a failure that cannot be managed by the BMS, the secondary protection device, either a contactor or shunt-trip breaker, will be opened to disconnect the battery from the external electrical system.

Rolls S-Series 48V LFP ESS batteries without a secondary current-path breaker may include an external BMS switch. This will be noted on the datasheet for the specific model. The external BMS switch is not on the main current path but can be used to disconnect the battery from the terminals via the BMS. This is an effective way to reduce terminal arcing on initial connection.

The BMS on all S-Series 48V LFP ESS batteries also incorporates RS-485 and CANBUS communication ports. Data communication among connected batteries is carried out through RS-485 communication. The same bus can be connected to a computer for parameter configuration and data monitoring using the Rolls LFP Desktop PC software. Refer to the Communication Interface and Rolls LFP Desktop Manual for connection instructions to your PC.

BATTERY LIMIT	PROTECTION	RESET METHOD	COMMENTS
Cell/Pack Overvoltage	Charge Interruption	1. The cell voltage drops to the overvoltage recovery point (3.4V). 2. When the remaining capacity is lower than 96% of the intermittent charging capacity or discharge current >1A.	If occurring more than 3 times in 2 minutes, discharge is required.
Cell/Pack Undervoltage	Discharge Interruption	Shut down after undervoltage protection and maintain communication for 1 minute. Charging current detected (>1A).	If occurring more than 3 times in 2 minutes, charge is required.
Extended Pack Undervoltage (Stored While Empty)	Battery Cannot be Recovered	Always charge S-Series ESS LFP Batteries within 72 hours of full discharge.	—
Pack Overcurrent or Short Circuit	Charge and Discharge Interruption	Automatically reset after time delay.	If occurring more than 3 times in 2 minutes, charge is required.
High temperature at BMS or Cell*	Charge and Discharge Interruption	Automatically reset after cooling.	BMS will display alarm when approaching disconnect.
Low temperature at BMS or Cell*	Charge Interruption	Automatically reset after warming.	BMS will display alarm when approaching disconnect.
Extreme low temperature at BMS or Cell	Charge and Discharge Interruption	Automatically reset after warming.	BMS will display alarm when approaching disconnect.

*Temperatures outside of the ideal operating range require a reduction in charge/discharge current for optimal battery life.

NOTE: Cells are balanced internally, some S-Series LFP ESS models have provisions for the addition of active balancers.

BATTERY CHARGING

Although a lithium-specific charger is recommended, Rolls S-Series ESS LFP models are compatible with most common lead-acid battery chargers for nominal voltage of the pack. Programming should adhere to the LFP charging requirements, noting the recommended and maximum charge and discharge rates. These are specified on the product label and datasheet.

Rolls S-Series LFP ESS batteries may cycle or be stored in a partial state-of-charge (PSOC). Rolls S-Series LFP ESS batteries should be cycled from 0% depth of discharge (DOD) or 100% state of charge (SOC), to 80% DOD or 20% SOC for optimal cycle life. To prevent over-discharge, the BMS will disconnect the battery when the low voltage cut-off is reached, protecting the battery from over-discharge.

NOTE: The reset button can be used if chargers that require the detection of voltage at the battery terminals for use fail to wake battery from a state of under-voltage protection.

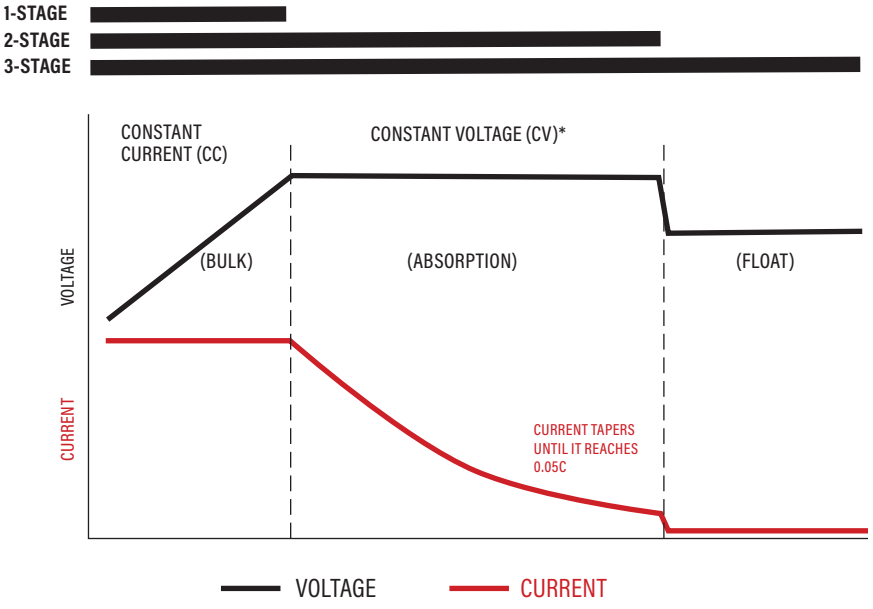
NOTE: LFP cells do not need maintenance charges like equalization, pulse charge, overcharge, or any others typically recommended or required for lead-acid batteries.

NOTE: The recommended and maximum continuous charge and discharge rates are specific to each S-Series 48V LFP ESS model by cell and BMS technology. This is specified on the product label.

CHARGING GUIDELINES

Rolls S-Series 48V LFP ESS batteries may be charged in a 1, 2, or 3-stage charge profile, shown below. The specifics and recommended setpoints for these charge regimes are explained in this section, with the recommended charge profile being a 2-stage charge.

Representation of 1, 2, and 3-Stage Charging Profiles



Representation of recommended 2-stage Constant Current/Constant Voltage (CC/CV) charging. The dotted line represents the transition from CC to CV when the voltage limit is reached. Once the battery reaches the constant voltage limit, the battery is held by the charger at this voltage until the current decreases to 0.05C. At this point the battery is at 100% state-of-charge (SOC). Any current continuing to flow in the float stage is attributable to balancing activity of the BMS.

CHARGING SOURCE: LEAD-ACID BATTERY CHARGER

Customers may choose to replace lead-acid batteries with lithium models. Most leadacid battery chargers may be used to charge Rolls LFP batteries if the charger is properly configured to operate within recommended charge current and voltage limits.

The pre-programmed voltage settings for AGM or OPzV GEL models may be in line with LFP charge voltage settings and can sometimes be used if direct voltage control is not possible for your charger. However, flooded lead-acid batteries often require higher charge voltage settings. If left configured for charging flooded batteries, the higher charge voltage can trigger the BMS to restrict charging to protect the battery, effectively resulting in a 1-stage charge. If this occurs repeatedly, or the charger cannot be configured at a lower charge voltage, it may be necessary to replace the charger.

1-STAGE CHARGING – CC (CONSTANT CURRENT)

When charging with a single-stage constant current charger, charge at the recommended charge current until the battery reaches its termination voltage.

1-STAGE CHARGE PROFILE	
Recommended Charging Current for Optimal Life	
Temperature Range	**Optimal Current**
0-10°C (32-50°F)	≤ 0.2C
10-35°C (50-95°F)	≤ 0.5C
35-55°C (95-131°F)	≤ 0.2C
Maximum Continuous Charging Current	
S-Series	0.5C

SYSTEM	24V NOMINAL	48V NOMINAL
TERMINATION VOLTAGE	28.8V	57.6V

NOTE: 1-Stage CC Charging may be required if charging from a source which is not efficient to run at lower power. However, it may only charge the battery to 90-95% SOC. 1-Stage charging also offers very little time to balance cells. For these reasons, 2-Stage CC/CV charging is recommended to ensure the battery reaches full SOC.

2-STAGE CHARGING – CC/CV

When charging with a two-stage constant current/constant voltage (CC/CV) charger, charge at the recommended charge current, by operating temperature, until the battery reaches the "absorption" voltage or constant voltage (CV) limit. The charger then holds the battery at CV until the charge current decreases to ≤0.05C (termination current).

The recommended absorption (constant voltage) voltage is shown below. If the charger has a pre-set voltage setting or cannot be programmed, an absorption voltage in the range below is also acceptable. Note: lower voltage will lead to longer charge times.

2-STAGE CHARGE PROFILE	
Recommended Charging Current for Optimal Life	
Temperature Range	**Optimal Current**
0-10°C (32-50°F)	≤ 0.2C
10-35°C (50-95°F)	≤ 0.5C
35-55°C (95-131°F)	≤ 0.2C
Maximum Continuous Charging Current	
S-Series ESS	0.5C

SYSTEM	24V NOMINAL	48V NOMINAL
RECOMMENDED ABSORPTION VOLTAGE	28.8V	57.6V
ABSORPTION RANGE (ACCEPTABLE)	28.0V - 29.2V	56.0V - 58.4V
TERMINATION CURRENT	≤0.05C	

NOTE: If charge time is not a concern within your system architecture, reducing the absorption voltage will increase charge time, but allows the BMS more time to ensure all cells remain balanced. As batteries age, small changes in manufacturing or due to uneven wear may present themselves, requiring more time to maintain balance.

3-STAGE CHARGING - LEGACY LEAD-ACID SYSTEMS, INVERTER/CHARGER HARDWARE

When programming an inverter/charger or charge controller equipment using a 3-stage charge sequence (2-stage with an additional "float voltage" after the charge is terminated), the following charging parameters should be programmed to properly charge Rolls S-Series ESS batteries:

3-STAGE CHARGE PROFILE	
Recommended Charging Current for Optimal Life	
Temperature Range	**Optimal Current**
0-10°C (32-50°F)	≤ 0.2C
10-35°C (50-95°F)	≤ 0.5C
35-55°C (95-131°F)	≤ 0.2C
Maximum Continuous Charging Current	
S-Series ESS	0.5C

SYSTEM	24V NOMINAL	48V NOMINAL
BULK to ABS VOLTAGE	28.8V	57.6V
ABSORPTION VOLTAGE	28.8V	57.6V
ABS to FLOAT	≤0.05C	≤0.05C
FLOAT VOLTAGE	27.2V	54.4V

Temperature Compensation: If the inverter/charger or charge controller uses temperature compensation this should be turned off when charging Rolls R-Series and S-Series models. Turn off the temperature compensation settings and disconnect the sensor to ensure the correct voltage regulation from the charging device.

Equalization: Equalization should never be used; elevated charge voltages are unacceptable for LFP batteries and will simply lead to the BMS disconnecting the charging path. It should be turned off, or the equalization voltage setpoint should be reduced to the appropriate system float voltage, above.

Some charger models may require additional firmware, programming, or parameters. Please contact your inverter/charger or charge controller manufacturer for assistance with these settings, if required.

CHARGING TEMPERATURE

Due to the chemistry of Lithium-ion cells, these batteries cannot accept high charge current at lower operating temperatures without risking cell damage and permanent loss of capacity.

Rolls S-Series ESS LFP batteries may be safely charged between 0°C to 55°C (32°F to 131°F). However, because cycle wear is accelerated below 10°C (50 °F) the charge should be limited to 0.2C (20% of battery capacity) for optimal longevity. Similarly, at high temperatures, charge current should be limited to ≤0.2C when operating at temperatures from 35°C to 55°C (95°F to 131°F) as noted below.

To maintain optimum performance and durability of Rolls S-Series ESS LFP batteries, the following charge current limits should be followed:

TEMPERATURE	RECOMMENDED CHARGE CURRENT
< 0°C (< 32°F)	DO NOT CHARGE
0-10°C (32-50°F)	≤ 0.2C
10~35°C (50-95°F)	≤ 0.5C
35~55°C (95-122°F)	≤ 0.2C
> 55°C (> 122°F)	DO NOT CHARGE

NOTE: Due to the internal chemistry, batteries can be discharged at lower temperatures than they can be charged at. So, at low temperatures between -20°C and 0°C, batteries can still be effective energy storage, if no energy is put into the batteries.

The recommended and maximum continuous charge current is specified for each Rolls S-Series ESS LFP model as a function of capacity. This information is noted in the product label and datasheet.

COMMUNICATION INTERFACE

The BMS of the battery pack has one CAN bus communication port and two RS-485 communication ports for closed loop communication. Using closed loop communication is not required. All inverters, when set with proper voltage and current setpoints for charge and discharge, can be used with our batteries. A list of inverters which can take advantage of closed loop communication can be found in Appendix A.

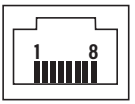
CAN COMMUNICATION

The CAN bus port pinout is below. See Appendix A for compatible inverters.

COMMUNICATION STANDARD	BAUD RATE
CAN	500k Standard

PIN	DESCRIPTION
1,2,7,8	NC
4,5	Can-L, Can-H
3,6	Ground

(Port)



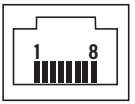
RS-485 COMMUNICATION

The RS-485 port pinout is below. See Appendix A for compatible inverters.
When connecting between batteries over RS-485, a standard network cable is used.

COMMUNICATION STANDARD	BAUD RATE
RS-485	19200

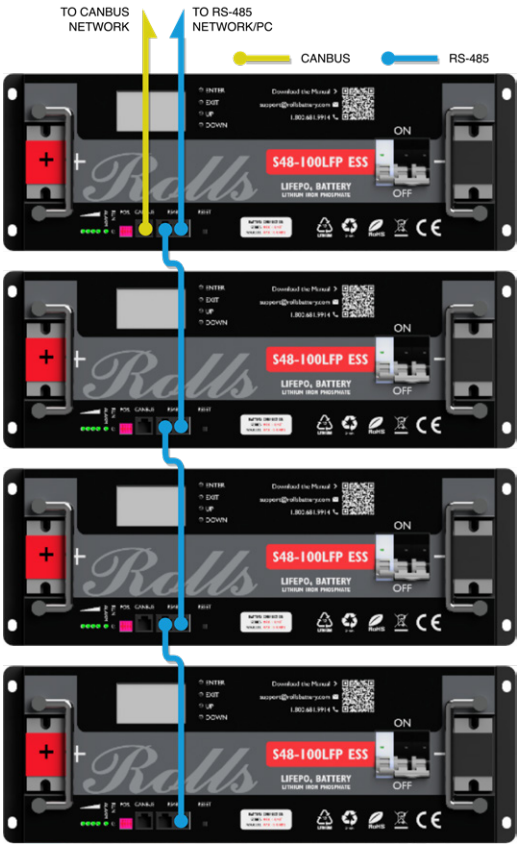
PIN	DESCRIPTION
1,8	RS-485-B
2,7	RS-485-A
3,6	Ground
4,5	NC

(Port)



PARALLEL COMMUNICATION

When multiple batteries are connected in parallel, the RS-485 interface is used as the parallel communication interface and host computer interface. The host computer can read the sum of the battery data of all parallel packs through the RS-485 interface. An example connection is shown in the figure below:

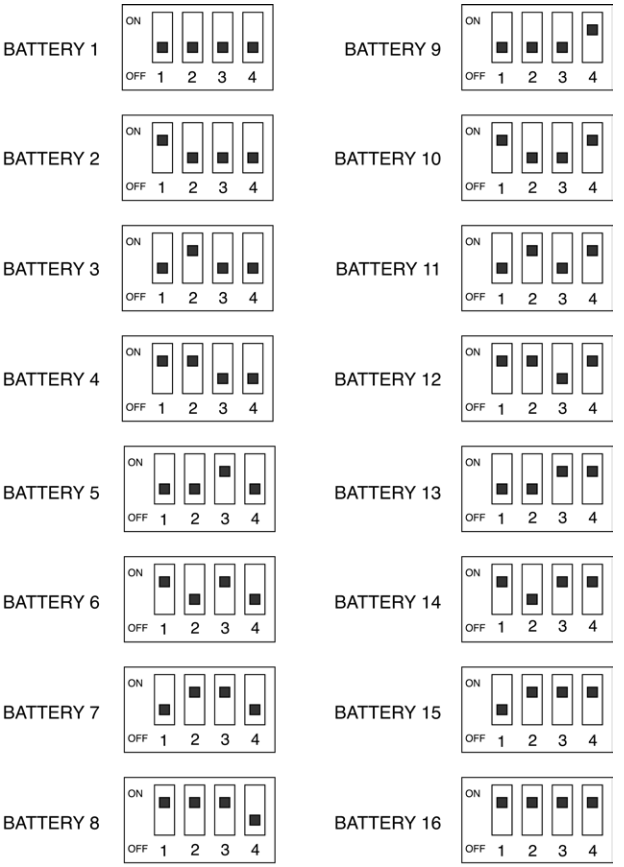


BMS STORAGE FUNCTION

BMS in the Rolls S-Series 48V ESS LFP batteries have built-in storage which provides real-time storage of measurement data of various events such as alarms, protection triggers. It can be stored by setting the record start time, record end time, and record interval from the PC software settings. The BMS in the Rolls S-Series 48V ESS LFP can store up to 100 historical data records, which can be read by the host computer and saved as a spreadsheet.

PARALLEL PACK SELECTOR SWITCH 4-DIP

When multiple battery packs are connected in parallel, each battery pack should be properly addressed through the DIP switches on the front of each battery. Depending on how many batteries are connected, you will use a given amount of DIP switches up to 16, but the first address will always be first, the second address will always be second, etc. Each battery has 4 DIP switches. See the figure below for addressing each pack.



TROUBLESHOOTING

Appendix B lists some of the common errors that could occur during the operation of the battery. When the alarm indication in ON, the type of error is displayed on the LCD screen of the battery pack. Also, when the battery is connected to Rolls LFP Desktop, the warning or error message is displayed in the software.

STORAGE

Rolls S-Series ESS LFP batteries should be stored in an environment with temperatures between -5°C (23°F) and 45°C (113°F).

For seasonal applications, the battery should not be stored in a space where ambient temperatures fall below -5°C (23°F). In cold climates like these, **charge/discharge** the battery to between 60-80%, **disconnect** the battery from any external system and **store** the battery off site, above -5°C (23°F).

Rolls S-Series ESS batteries self-discharge and should be charged once per year, at minimum when stored for extended periods. For temperatures above 40°C (104°F) the battery should be charged every 3 months. Do not store Rolls S-Series LFP ESS batteries at temperatures above 45°C (113°F).

RECYCLING

Rolls S-Series LFP ESS batteries should be properly disposed of at an authorized lithium recycling facility. Do not remove product labels and/or recycling information from the battery case.

The battery should be fully discharged before disposal. To prevent a possible short circuit, the terminals should be covered with a protective cap or non-conductive tape before disposal.

LFP GLOSSARY

AMP, AMPERE
Unit of electrical current. Abbreviated “A”.

AMP-HOUR
Unit of electrical energy, one amp of current flowing for one hour. Abbreviated “Ah”.

BMS (BATTERY MANAGEMENT SYSTEM)
The BMS, or Battery Management System, is an electronic device which protects the cells inside a battery. The BMS used in Rolls R-Series and S-Series LFP batteries protects them from unsafe voltage, current, and temperature conditions. It keeps cells balanced to ensure pack capacity is maintained. A BMS is required for any lithium-ion battery system with series-connected cells due to the safety requirements and performance characteristics of the cells.

C-RATE

Battery charge and discharge rates are often described as a "C-Rate", defined as:

$$C - Rate = \frac{(Rated\ Capacity)}{(Charge/Discharge\ Current)}$$

For example, if a 100Ah battery was charged at 50A, but discharged at 100A, it would be charged at a rate of C/2 and discharged at a rate of C. This rate is independent of system voltage.

CANBUS

Controller Area Network (CAN) bus is a communication protocol which allows multiple devices to send and receive relevant information between them without the need for a host to manage the communication.

CELL

A single battery, independent of chemistry. Each cell is at the base voltage for the given chemistry; 2.0V for flooded lead acid, 3.2V for lithium iron phosphate. Many cell form factors exist, resulting in different capacities and performance characteristics. These may be combined in series to form a battery of higher voltage.

CC/CV (CONSTANT CURRENT / CONSTANT VOLTAGE)

The typical charge profile of a LFP battery. CC/CV or Constant Current/Constant Voltage charging is a 2-stage charge, first at constant current until the battery voltage reaches a given limit, and then at constant voltage as the current accepted by the battery naturally reduces until the battery is full.

CYCLE

A "cycle" is a somewhat arbitrary term used to describe the process of discharging a fully charged battery down to a particular state of discharge. For Rolls R-Series Batteries, a cycle is defined as 90% depth of discharge, or going from full charge down to 10% state-of-charge.

CYCLE LIFE

The total energy throughput of a battery, defined in terms of the amount of equivalent charge/discharge cycles it can withstand before its effective capacity is reduced to a certain amount, usually 80% of original/rated capacity.

LFP (LITHIUM IRON PHOSPHATE)

LFP, or Lithium Iron Phosphate is a specific type of Lithium-ion battery chemistry. Referring to the cathode material of the battery, this chemistry is characterized by its long cycle life, long calendar life and safety, in overcharge conditions, compared to other battery chemistries.

RS-485

RS-485 is a serial communication standard, which defines the electrical transmission characteristics which enable multiple devices to connect over the same network (multipoint).

SOC (STATE-OF-CHARGE)

State-of-charge (SOC) represents the fullness of the battery from 0%-100%.

VOLT

The unit of electrical potential or "pressure". For the LFP cell chemistry, these are multiples of 3.2V, sometimes simplified to 12V, 24V and 48V to match with compatible lead-acid systems.

APPENDIX A: INVERTER COMPATIBILITY LIST

Compatibility details and communication standard used for compatible inverters are posted below. All inverters, when set with proper voltage and current setpoints for charge and discharge, can be used with our batteries. This list only refers to inverters which can read battery data over CAN bus or RS-485 from connected batteries. Please refer to the PC Software instructions for details on how to update these communication protocols.

Inverter Brand		Protocol	Type	Baud	Version
Deye	Deye	ENQ CAN protocol V1.0	CAN	500K	V1.0
Goodwe	GOODWE	Goodwe Communication Protocol	CAN	500K	V1.5
Growatt-SPF	GROWATT	Growatt BMS CAN-Busprotocol-low-voltage	CAN	500K	V1.05
		SPF BMS RS-485 protocol	RS-485	9600	V2.01
Growatt-SPH	GROWATT	Growatt BMS protocol	CAN	500K	V1.01
LuxPower	LUXPOWERTEK	Luxpowertek Battery CAN Protocol	CAN	500K	V1.0
Must Power Systems	MUST	1-PV1800F-CAN Protocol1.04.04	CAN	500K	V1.3
Pylontech	PYLONTECH	CAN-Bus-protocol-PYLON	CAN	500K	V1.3
		RS-485-protocol-pylon-lowvoltage	RS-485	9600	V3.5
SMA	SMA	SMA-BMZ-Protocol-en	CAN	500K	
SOFAR Solar	SOFAR	SoFar CAN Protocol	CAN	500K	V1.0
Solis	solis	CAN communication protocol	CAN	9600	V1.0
SRNE	SRNE	PACE BMS Modbus Protocol for RS-485	RS-485	9600	V1.3
Studer	STUDER	Technical specification Studer BMS Protocol	CAN	500K	V1.03
TBB Power	TBB POWER	TBB CAN communication protocol V1.02	CAN	500K	V1.02
Victron	victron energy	can-bus-bms-protocol	CAN	500K	V1.0
Voltronic Power	Voltronic Power	Voltronic Inverter and BMS 485 protocol	RS-485	9600	V1.0

APPENDIX B: TROUBLESHOOTING REFERENCE

Problem	Troubleshooting	Solution
Unable to start		
Power switch ON, RUN Indication OFF.	Press the RESET SWITCH in the front panel and check if the LEDs turn ON. If the charge is LOW, the battery will move into Under Voltage protection and ALARM indication will be ON.	The battery will return to normal working condition after charging.
Unable to charge		
The battery cannot be charged even though it is not fully charged.	1. Confirm that the battery is turned on. 2. Check the power cable. Confirm that the power cables are correctly connected, and the charging circuit is correct. 3. Check the battery indicator LED to see if the battery is under Protection state. If so, unplug the battery power cable, find the cause of the protection, and fix the problem, then restart the battery. 4. Check if the charging voltage meets the battery charging requirements. If not, adjust the power supply voltage to the proper range.	If the battery still does not charge properly after following the steps, please contact the local reseller or contact support at Rolls Battery.
Unable to discharge		
The battery is full but cannot be discharged properly.	1. Confirm that the battery is turned on. 2. Check the power cables to ensure that they are properly connected. 3. Unplug the battery power cable and measure the battery power output voltage. If the battery voltage is too low, charge it immediately. 4. Check the battery indicator LED to see if the battery is under "Protection" state. If so, unplug the battery power cables, find the cause of the protection, and fix the problem, then restart the battery.	If the battery still does not charge properly after following the steps, please contact the local reseller or contact support at Rolls Battery.
Fault Indication in ON		
The ALARM indicator is constantly red, other indicators are off.	1. Check the power cables to ensure that they are properly connected. 2. Check whether the charging voltage, charging/discharging current, battery/cell voltage and temperature meet the relevant protection conditions and release the "protection" state to ensure that the voltage, current and temperature are within the normal working range.	If the battery protection state cannot be released, or the ALM indicator is constantly on when the battery is properly charged after it is restarted, please contact your reseller or support.

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NOTES:

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