

# ROLLS S48-100LFP ESS BATTERY OPERATING MANUAL

# Rolls

BATTERY ENGINEERING



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



**RENEWABLE  
ENERGY**



**BACKUP  
SYSTEMS**

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## ROLLS S48-100LFP ESS

Rolls S-Series S48-100LFP ESS 51.2-volt Lithium Iron Phosphate (LFP/LiFePO<sub>4</sub>) 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 S48-100LFP 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 S48-100LFP 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 the Rolls S48-100LFP 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 LFP**  
(S\_ \_ \_ \_ LFP)



**R-Series LFP**  
(R\_ \_ \_ \_ LFP)



**[Discontinued]**  
**24V & 48V ESS LFP Models**  
(S48-6650LFP ESS & S24-2800LFP ESS)



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

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

 **WARNING: Explosion, Electrocutation, 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 or external equipment.
- 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 S48-100LFP ESS battery below 0°C (32°F).
  - Never discharge a Rolls S48-100LFP ESS battery below -20°C (-4°F).
- Never charge a battery with a deformed or bulging case.
- Do not expose Rolls S48-100LFP ESS batteries to heat exceeding 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/cabinet 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 & servicing must be carried out by qualified personnel only.

# VERSION HISTORY/CHANGELOG

Rev.	Changelog	Author/Editor	Date
1.0	Release Version	Jordan Torrealba	2023/08/15
1.1	Updated connection graphics to provide additional detail. Updates to DIP tables and setup. Improved inverter compatibility list and connection protocols. Changed naming conventions.	Jordan Torrealba	2024/04/30

## PRODUCT DESCRIPTION

Rolls S48-100LFP 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 instructions are available at: Rolls S-Series LFP ESS Cabinet Assembly Manual.

For Rolls S48-100LFP ESS batteries with connectable PC Software, that Manual is located at: Rolls LFP Desktop Manual.

## PANEL FEATURES



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

# INSTALLATION

This section describes installation steps and considerations for your Rolls S48-100LFP ESS product.

Rolls S48-100LFP ESS rack-mount batteries are compatible with standard 19" rack hardware. The battery pack may be installed horizontally or vertically.

**NOTE:** Only trained electrical power system technicians (or equivalent) 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 shorting or inadvertent connection during 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 S48-100LFP ESS batteries do not require maintenance, routine inspection of cabling and terminal connections is recommended.

<b>Amperage</b>	25	30	40	55	75	95	130	150	170	195	260
<b>Wire Gage</b>	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. The above table is only meant to provide a quick reference, **ALWAYS** consult with the manufacturer's specification for conductor current and temperature.

## TERMINAL TORQUE

Terminal connections must be properly torqued. Rolls batteries using M6 fasteners should be torqued to **4-6 Nm**.

**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.

**NOTE:** On the Rolls S48-100LFP ESS, each terminal has a current limit of 100A through the terminal itself.

## SINGLE BATTERY INSTALLATION

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 connect more than 1 unit in parallel, Rolls recommends the use of a bus bar or combiner box (available in the Rolls LFP ESS Cabinet). Directly connect the positive and negative terminals of the battery pack to the bus bar or combiner box terminal.

## PARALLEL BATTERY INSTALLATION

Rolls S48-100LFP ESS batteries can be combined in parallel to increase system capacity and power delivery. Rolls S48-100LFP ESS batteries can support up to 16 battery packs in parallel and is certified to UL 1973. Parallel batteries may be installed in the modular Rolls LFP ESS Cabinet, and expandable up to 32U per cabinet (i.e., up to eight S48-100LFP ESS batteries may be installed & configured in a single cabinet).

The standard cabinet includes high current combiner boxes 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, gauge, material, and therefore resistance of all the cables connected in parallel must be the same.

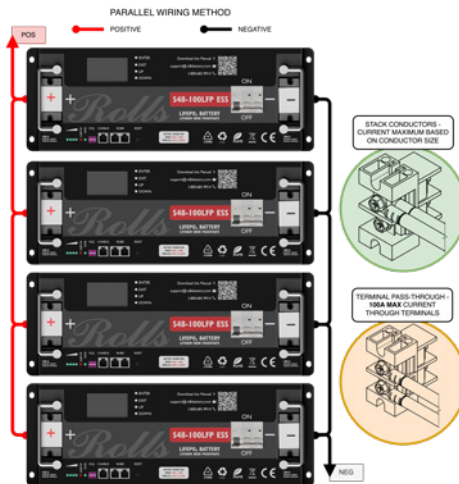
**NOTE:** Refer to the Communication Interface section for the parallel communication cable connections.

**⚠ WARNING: Series connection of Rolls S48-100LFP 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 Bus Bar or Combiner Box

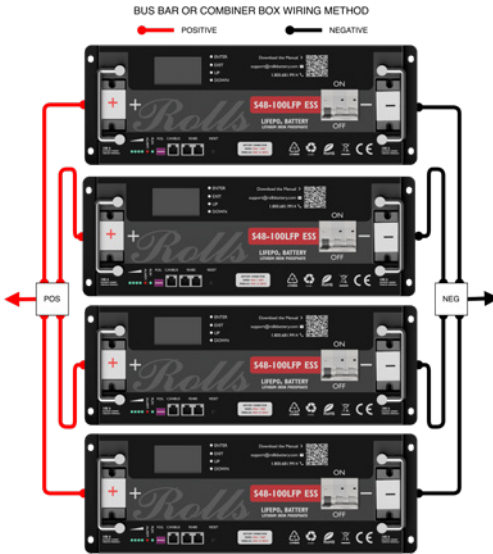
Due to the 2x M6 terminals present on each S48-100LFP ESS model, users have the option to install and connect by stacking conductors on a single terminal and using the second for accessories or other (green) or using the terminal itself as a passthrough (orange). When using the terminal as a conductor, the maximum throughput current is 100A.

Additionally, when wiring in this manner, the positive lead should run from the first battery, and the negative lead should leave from the last battery, or vice versa, improving current sharing between batteries.



## Connection using a Bus Bar or the included Combiner Boxes (Recommended Wiring Method)

Connecting multiple batteries using a busbar or the combiner box included with Rolls LFP ESS Cabinet assemblies will ensure equal current sharing between batteries and avoid an overcurrent condition at the terminals. Ensure that the cable lengths to the combiner box are the same before continuing.



## BATTERY OPERATION

**FIRST START:** When you have verified the connections, terminal torque, and external connections are made, the batteries may 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.

## PRECHARGE

Because of the highly capacitive DC inputs/outputs of large inverters, they may present electrically as a short circuit on initial connection. To accommodate the resulting current spike during startup, there is a programmed delay to the short circuit protection on the BMS. For large inverters (>5kW), users should start multiple batteries at once, by resetting them at the same time. If you still have issues with startup, contact Rolls Battery Technical Support.







## LED INDICATOR INSTRUCTIONS

● ● ● ●	●	●
<b>SOC</b>	<b>ALARM</b>	<b>RUN</b>

Rolls S48-100LFP 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.

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 S48-100LFP 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 the S48-100LFP ESS model 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.

Rolls S48-100LFP ESS batteries include secondary protection and UL1973 certification. In the event of a failure that cannot be managed by the BMS, the secondary protection device, a UL 489 shunt-trip breaker (NOARK-B1N 2D63 63A), will be opened to disconnect the battery from the external electrical system.

The BMS on all S48-100LFP 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 instructions to connect 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 optimal operating range require a reduction in charge/discharge current to prolong battery life.

**NOTE:** Cells are balanced internally. Rolls S48-100LFP ESS also has provisions for the addition of active balancers.

## BATTERY CHARGING

Although a lithium-specific charger is recommended, Rolls S48-100LFP ESS batteries 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 S48-100LFP ESS batteries may cycle or be stored in a partial state-of-charge (PSOC). The battery 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.

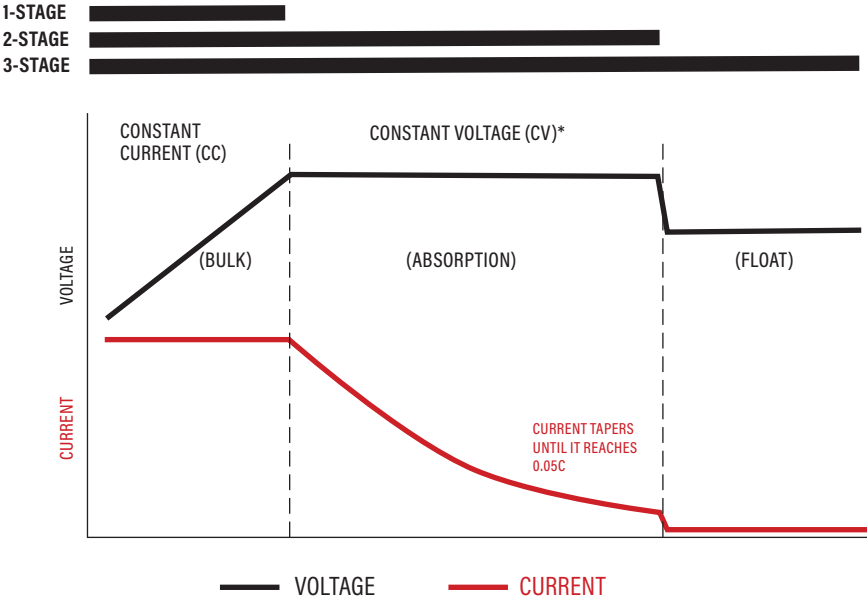
**NOTE:** The reset button can be used if chargers that require the detection of voltage at the battery terminals for use fail to wake the battery from a state of under-voltage protection.

**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 for cell and BMS are specified on the top label found on the battery.

# CHARGING GUIDELINES

Rolls S48-100LFP 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 lead-acid 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.

### I-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	
S48-100LFP ESS	0.5C

SYSTEM	48V (51.2V) NOMINAL
TERMINATION VOLTAGE	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  $\leq 0.05C$  (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 but will also increase balancing performance.

2-STAGE CHARGE PROFILE	
Recommended Charging Current for Optimal Life	
Temperature Range	Optimal Current
0-10°C (32-50°F)	$\leq 0.2C$
10-35°C (50-95°F)	$\leq 0.5C$
35-55°C (95-131°F)	$\leq 0.2C$
Maximum Continuous Charging Current	
S48-100LFP ESS	0.5C

SYSTEM	48V (51.2V) NOMINAL
RECOMMENDED ABSORPTION VOLTAGE	57.6V
ABSORPTION RANGE (ACCEPTABLE)	56.0V - 58.4V
TERMINATION CURRENT	$\leq 0.05C$

**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 S48-100LFP 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	
S48-100LFP ESS	0.5C

SYSTEM	48V (51.2V) NOMINAL
BULK to ABS VOLTAGE	57.6V
ABSORPTION VOLTAGE	57.6V
ABS to FLOAT	≤0.05C
FLOAT VOLTAGE	54.4V

**Temperature Compensation:** If the inverter/charger or charge controller uses temperature compensation this should be turned off when charging Rolls S48-100LFP ESS batteries. 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 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 S48-100LFP ESS 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), charge current should be limited to 0.2C (20% of battery capacity) for optimal longevity. Similarly, at high temperatures, charge current should be limited to  $\leq 0.2C$  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 S48-100LFP ESS batteries, the following recommended charge current limits should be followed:

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

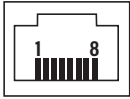
## COMMUNICATION INTERFACE

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

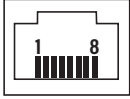
PIN	DESCRIPTION	 (Port)
1,2,7,8	NC	
4	Can-H	
5	Can-L	
3,6	Ground	

### 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.

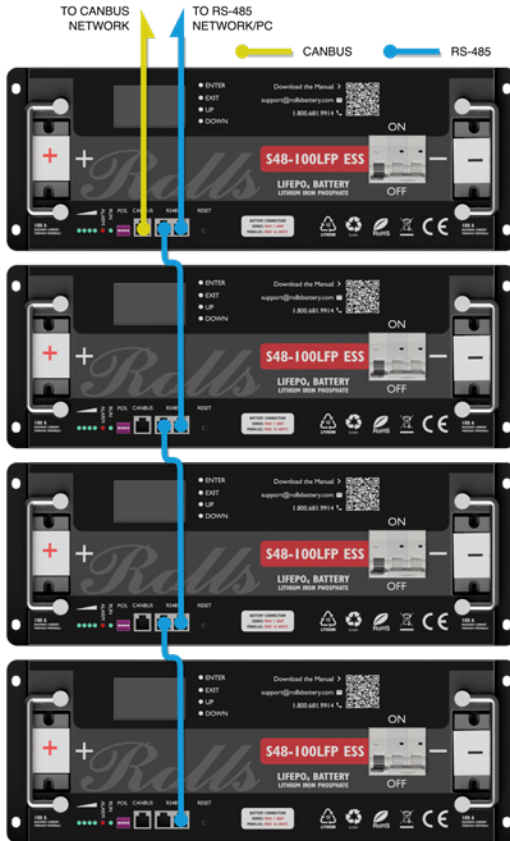
**NOTE:** the DIP Table for RS-485 operation to the Rolls LFP Desktop Software is different than for CAN communication to inverters; please refer to Appendix B.

COMMUNICATION STANDARD	BAUD RATE
RS-485	19200

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

## 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:

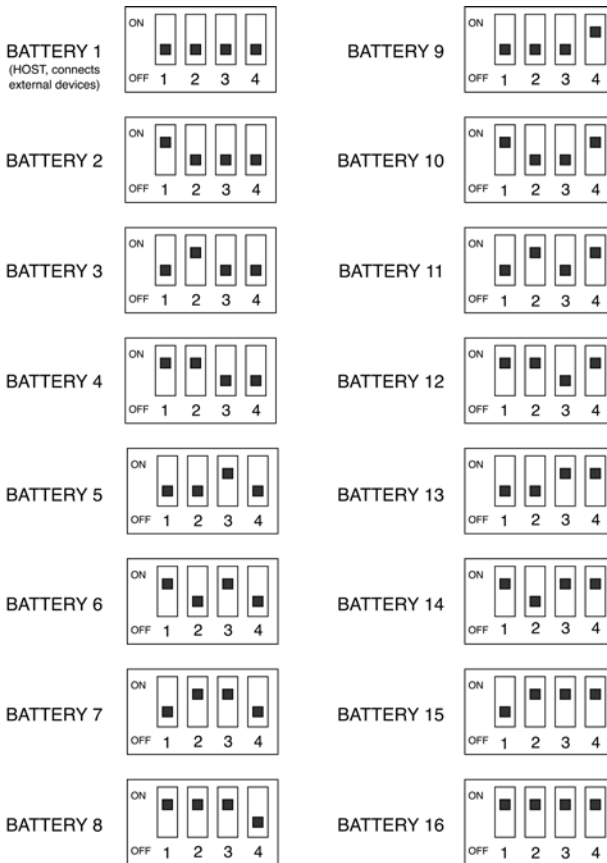


## BMS STORAGE FUNCTION

The battery management system (BMS) in the Rolls S48-100LFP ESS 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 S48-100LFP ESS model can store historical data records that may be read by the host computer and saved as a spreadsheet.

# CAN BUS 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 C lists some of the common errors that may occur during normal operation. When the alarm indicator is ON, the type of error is displayed on the LCD screen of the battery pack. Additionally, when the battery is connected to Rolls LFP Desktop via PC, the warning or error message is displayed in the software.

## STORAGE

Rolls S48-100LFP ESS 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 S48-100LFP ESS batteries do 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 S48-100LFP ESS batteries at temperatures above 45°C (113°F).

## RECYCLING

Rolls S48-100LFP 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 unless instructed otherwise. 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 batteries protects them from unsafe voltage, current, and temperature conditions, and balances cells for optimal pack performance. 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

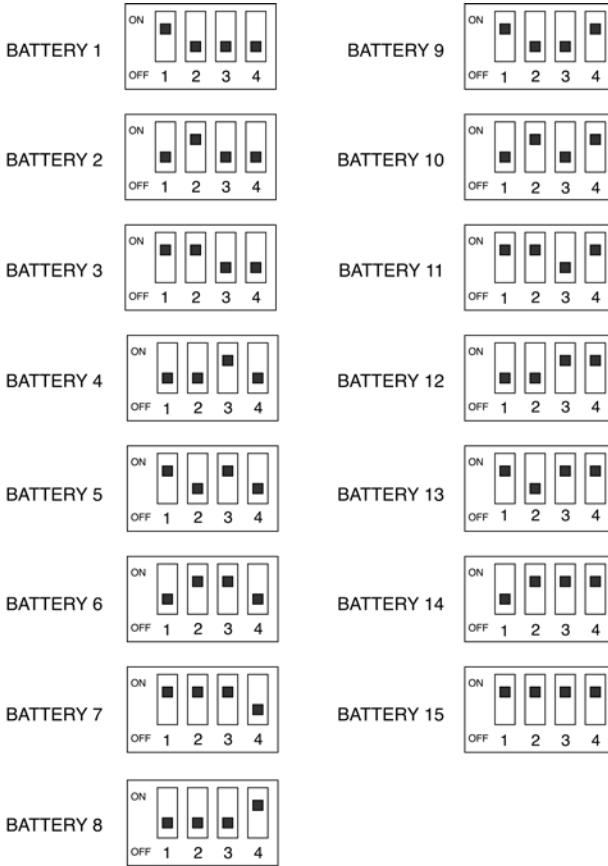
The unit of electrical potential or “pressure”. For the LFP cell chemistry, these are multiples of 3.2V, sometimes simplified to 12V, 24V, 36V, and 48V to match with compatible lead-acid systems.

## APPENDIX A: INVERTER COMPATIBILITY LIST

Compatibility details and the communication standard used for compatible inverters are provided below. All inverters, when set with proper voltage and current setpoints for charge and discharge, can be used with Rolls S48-100LFP ESS 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 Rolls LFP Desktop PC Software instructions for details on how to update these communication protocols.

Inverter Brand	Type	Protocol Selection in Rolls LFP Desktop	Baud
Deye	 CAN	CAN → PN-GDLT	500K
Goodwe	 CAN	CAN → PN-GDLT	500K
Growatt-SPF	 CAN	CAN → GRWT	500K
	RS-485	DEFAULT	9600
Growatt-SPH	 CAN	CAN → GRWT	500K
LuxPower	 CAN	CAN → PN-GDLT	500K
Pylontech	 CAN	CAN → PN-GDLT	500K
	RS-485	DEFAULT	9600
SMA	 CAN	CAN → SMA-SF	500K
SOFAR Solar	 CAN	CAN → SMA-SF	500K
Solis	 CAN	CAN → GINL	9600
SRNE	 RS-485	DEFAULT	9600
Studer	 CAN	CAN → STUD	500K
TBB Power	 CAN	CAN → PN-GDLT	500K
Victron	 CAN	CAN → VCTR (DEFAULT)	500K
Voltronic Power	 RS-485	DEFAULT	9600

# APPENDIX B: RS-485 DIP TABLE



## APPENDIX B: TROUBLESHOOTING REFERENCE

Problem	Troubleshooting	Solution
<b>Unable to start</b>		
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.
<b>Unable to charge</b>		
The battery cannot be charged even though it is not fully charged.	<ol style="list-style-type: none"> <li>1. Confirm that the battery is turned on.</li> <li>2. Check the power cable. Confirm that the power cables are correctly connected, and the charging circuit is correct.</li> <li>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.</li> <li>4. Check if the charging voltage meets the battery charging requirements. If not, adjust the power supply voltage to the proper range.</li> </ol>	If the battery still does not charge properly after following the steps, please contact the local reseller or contact support at Rolls Battery.
<b>Unable to discharge</b>		
The battery is full but cannot be discharged properly.	<ol style="list-style-type: none"> <li>1. Confirm that the battery is turned on.</li> <li>2. Check the power cables to ensure that they are properly connected.</li> <li>3. Unplug the battery power cable and measure the battery power output voltage. If the battery voltage is too low, charge it immediately.</li> <li>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.</li> </ol>	If the battery still does not charge properly after following the steps, please contact the local reseller or contact support at Rolls Battery.
<b>Fault Indication in ON</b>		
The ALARM indicator is constantly red, other indicators are off.	<ol style="list-style-type: none"> <li>1. Check the power cables to ensure that they are properly connected.</li> <li>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.</li> </ol>	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.

## CONTACTS

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