Li510 LITHIUM-ION BATTERIES
INSTALLATION AND OPERATING INSTRUCTIONS

Previously LiFT FORCE LPX 2.0

WARNINGS AND GENERAL INFORMATION

Observe these Instructions and keep them located near the battery for future reference. Work on the battery should only be carried out by qualified personnel.

While working on batteries wear protective eye-glasses and clothing.

Caution – parts of the battery may carry dangerous voltages. Be careful when handling cables.

Keep battery dry.

DO NOT smoke.
DO NOT dispose of the batteries in a fire.
DO NOT dispose of the battery in normal waste.
DO NOT include battery with lead acid battery recycling.

Explosion and fire hazard. Avoid short circuits. Avoid electrostatic charges and discharges/sparks.

Keep children away from batteries.

DO NOT pressure wash.

- Lithium Batteries are heavy. Make sure they are installed securely.
- Handle with care, avoid mechanical shock.
- Do not lift or pull up on power or communication cables.
- Avoid wearing any loose metallic items such as jewelry, watches, or bracelets
- Corrosive contents! Do not open. Avoid contact with contents of a damaged battery.
- To avoid the release of harmful gases, avoid deeply discharging, charging when damaged, and improperly charging the battery.
- Use certified insulated safety tools for installation. Any work procedures and tools used should be in compliance to EN 60900 or similar standard.

Battery may require recycling in accordance with local laws.
Contact Stryten Energy or regulatory authorities for further information. DO NOT include battery with lead acid battery recycling.

Tray lifting at this area.

GENERAL INFORMATION

Thank you for choosing a Li510 Lithium Material Handling Battery. This battery system is completely self-contained and can be used as a direct replacement for the most current in-use lead acid and lithium-ion systems.

Scope of supply

The following parts are included:

- Li510 Lithium Material Handling Battery Documentation (installation and operation manual)
- External display (optional)
- Stryten Energy Charger (optional)

After unpacking the parts, please examine them for possible damage. If any damage is found, please do not use the product; if in doubt, please contact the manufacturer.

The described product is a Lithium rechargeable battery system for use in material handling applications.

SAFETY INSTRUCTIONS

Information and instructions attached directly on the Li510 Lithium Material Handling Battery system must always be followed. These instructions contain basic information and guidance to be noted and followed during operation and maintenance and must be read by all personnel.

The Stryten Energy Lithium-ion battery system may not be operated without precise knowledge of these Installation and Operating Instructions or without strict adherence to all safety instructions. Knowledge of the contents of the Installation and Operating manual is a fundamental requirement to protect people from danger, to avoid errors and to operate the system safely and fault-free.

The Installation and Operating Instructions must be accessible to operating and maintenance personnel at all times. Each person given the task of operating or maintaining the system must have read and understood the instructions.

INSTALLATION/OPERATION

Quick Start Guide

- Check the battery housing, the cables and connectors for damages.
- Switch the battery on by pressing the ON/ OFF button for one second, observe the button.
- In normal operation the button will rapidly flash green for a few seconds while the battery powers up, and will then steadily flash green once per second. Flashing red color indicates a warning or failure state. Please refer to the section Warning and Alarms in this case.
- At the delivery state the battery SOC display should indicate a State of Charge of 30% or higher.
- The battery must be fully charged prior to first usage.

The Li510 Lithium Material Handling Battery communicates status to the vehicle via the CAN bus and to the operator via an external Stryten Energy display.

Deep Discharge Protection

When charge level is low, the buzzer beeps once per second. The battery must be charged immediately. If the battery becomes deeply discharged, the buzzer will beep rapidly (3 times per second), indicating that the battery will turn off in 15 seconds.

WARNING:

DEEP DISCHARGE SHOULD BE AVOIDED AT ALL COSTS AS THE SUDDEN CUT OFF OF THE BATTERY CAN LEAD TO DAMAGE AND HAZARDS, SUCH AS SPONTANEOUS STOP OF THE VEHICLE.

THE RESET BUTTON CAN BE PRESSED ONCE TO GET THE VEHICLE TO THE CHARGER. AFTER THAT, THE BATTERY REMAINS TURNED OFF IN ORDER TO AVOID FURTHER DAMAGE. THE VEHICLE NOW HAS TO BE TOWED TO THE CHARGER WITH AUXILIARY MEANS.

IF THE BATTERY HAS SHUT OFF DUE TO A LOW DISCHARGE LEVEL, IT MUST BE CHARGED IMMEDIATELY. LONG SHELF TIMES OF DISCHARGED BATTERIES ARE TO BE AVOIDED AT ALL COSTS! (SEE STORAGE) NON-OBSERVANCE CAN LEAD TO BATTERY DAMAGE.

Charging

The Li510 Lithium Material Handling Battery may only be charged with a Stryten Energy certified battery charger. Please also refer to the Installation and Operating Instructions for the Stryten Energy certified battery charger.

To extend battery life we recommend charging at each opportunity which means each break e.g. lunch, coffee etc. This will increase the battery lifetime and your productivity.

The Li510 Lithium Material Handling Battery system is charged as follows:

- Bring the vehicle to the Stryten Energy certified battery charger.
- Check that all cables and plug-in connections are in working condition, and plug the charger into the battery.
- If the battery is needed before charging is complete, press the stop button on the charger before disconnecting.

Stryten Energy certified chargers are equipped to control and terminate the charge cycle automatically. After charging, the vehicle can be put back into service immediately. A rest phase or cooling is not required for the Li510 Lithium Material Handling Battery.

Warnings and Alarms

A warning buzzer (one beep per second) will be active under the following conditions:

- Under Voltage
- Over Voltage
- Over Current
- Under Temperature
- Over Temperature
- Communication Error

However, if the condition causing the warning worsens, an alarm will be generated and the frequency of the beeping will increase to three times per second. After 15 seconds, the Battery Management System will shut down the battery. If this occurs, please push the on/off button to drive to the charger. If driving is no longer possible, stop working and contact Stryten Energy Service.

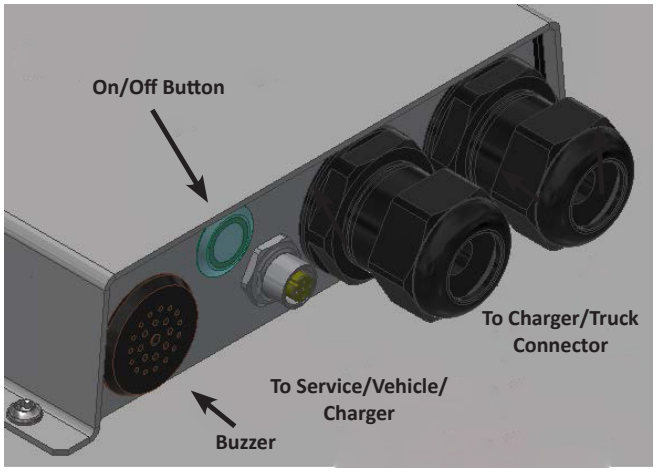
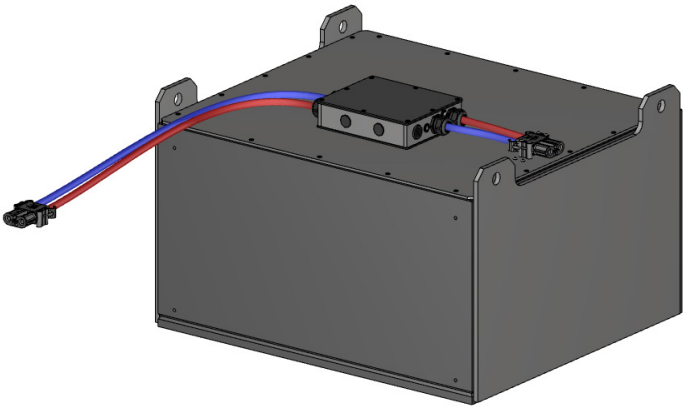


Figure 1

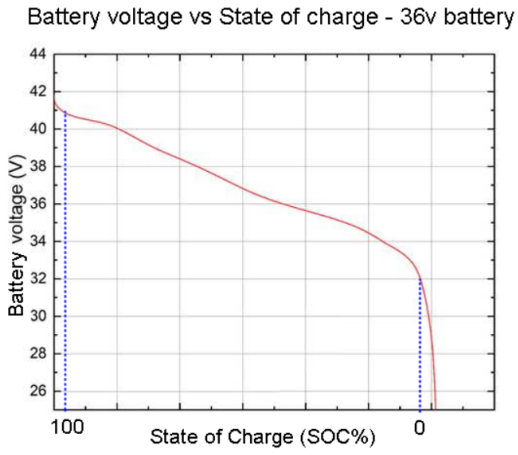
On / Off button	LED Green	LED Red
System in Standby mode	Off	Off
System active, no alarm or warning detected	Once per second	Off
Warning	Off	Once per second
Alarms	Off	Three per second
Button pressed for less than 5s to Reset Warnings / Alarms	On as long as button is pressed	Off
Button pressed for more than 5s to move from active to Standby mode	Off	On as long as button is pressed
Button is pressed in standby mode and the system is moved into active mode	On as long as button is pressed	Off

Li510 batteries feature “EZ Charge” - 2 separate connectors for truck and charger, with internal automatic control offering drive-away protection.

When installing batteries with the Easy Charge option, make sure that the battery is oriented in the vehicle so that the charger connector is accessible.



Li510 batteries use NMC chemistry. If the Forklift uses a Battery Discharge Indicator (BDI), it should be configured for NMC, or with the appropriate parameters so that the SOC displayed by the Opus matches the SOC displayed by the forklift BDI. A typical graph of state of charge vs battery voltage for a 36v battery is shown below:



Nominal Voltage	0% SOC	100% SOC	Undervoltage alarm	Overvoltage alarm
24V	22.4 V	28.8 V	20.3 V	29.8 V
36V	32.0 V	41.2 V	29.0 V	42.5 V
48V	44.8 V	57.7 V	40.6 V	59.5 V
72V	64.0 V	82.4 V	58.0 V	85.0 V
80V	67.2 V	86.5 V	60.9 V	89.3 V
96V	89.6 V	115.4 V	81.2 V	119.0 V

The above table should be used when setting up a Forklift BDI to be used with Li510 batteries:

BATTERY MAINTENANCE

Do not open the battery. This can only be done by Stryten Energy service personnel. Only authorized Stryten Energy personnel are allowed to open the battery system. Otherwise warranty will be void. The user should verify the condition of all external cables and connections prior to each operation. Before carrying out any inspection of the cables, the battery must be turned off and unplugged from the charger and the vehicle. In the case of any issues please contact your local service engineer.

Storage

Before being placed in storage, the battery should be charged to 50% SOC, powered off, and disconnected from both the vehicle and the charger. The Li510 Lithium Material Handling Battery system has a very low self-discharge and can be put into storage for up to 12 months. It must then be recharged. If batteries are taken out of service, they should be stored in a dry and frost free room. Please find the minimum and maximum storage temperature in Technical Specifications on page 7.

ATTENTION:

RISK OF DAMAGED DEVICE

- **NEVER CLEAN THE SYSTEM OR SYSTEM PARTS USING A VAPOR JET OR SPRAY WATER.**
- **DIRT AND WATER MAY ENTER THE SYSTEM AND CAUSE MAJOR DAMAGE.**
- **USE ONLY A MOIST AND CLEAN COTTON CLOTH FOR CLEANING.**
- **AVOID CHLORINE-BASED DISINFECTANT WIPE-DOWNS.**

Display

The display indicates the State of Charge (SOC) of the battery from 100 to 0%. (Figure 2) The LED on the right of the gauge will flash when SOC is low and will stay on as an indicator to the operator to charge the battery. If the operator ignores this warning, the battery will automatically shut down at 0% SOC. The wrench symbol will flash if there is a battery fault. If this occurs, please contact a Stryten Energy Service Engineer. The advanced display can be seen in Figures 3, 4, 5, and 6 below. This display shows more detailed information (voltage, current, temperature, SOC) and can be fitted anywhere with a display mount.

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

PERIODIC MAINTENANCE

Fully charging the battery

In order to keep all the cells in the battery balanced, it should be fully charged to 100% State of Charge (SOC) at least once per week and ideally once per day, as shown on the M-Series X-3 or X-7 charger screen below.

In order to make sure that the battery is fully charged, plug the battery into the charger and do not disconnect the battery until the “Complete” status is shown on the charger. Make sure that the weekly charging schedule allows adequate time for the battery to get a full charge once per week and ideally once per day.

Keeping power and aux contacts on charger connector clean

Make sure that the blue coding key is installed properly and that the interior mating surfaces of the 2 power pins and 4 aux pins on the charger connector are clean. Clean the interior of the pins with either 95% ethanol or 91% isopropyl alcohol and swabs. This should be done at least every six months in a clean facility and more often for facilities with large amounts of airborne material.

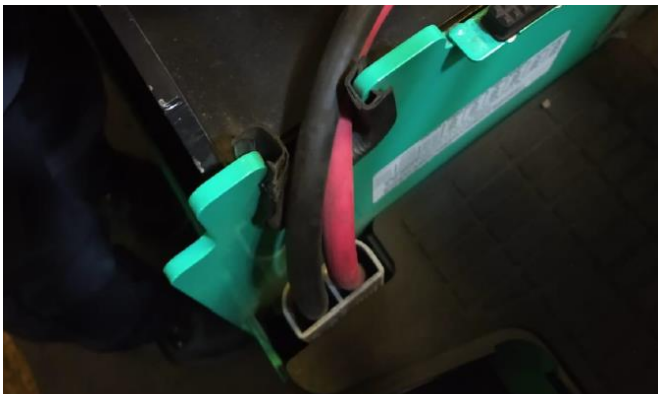
REMA640 Charger connector contacts

REMA320 Charger connector contacts

When the blue coding key is inserted properly, the battery voltage will be visible through the hole in the top of the connector. See the section on servicing the charger connector if the coding key is not installed properly.

Checking cable from battery to Forklift

Check the connector to the forklift to make sure that it is inserted tightly. Also check the exit point of the battery compartment to make sure that the power cables to the forklift are not rubbing on any metal surface where they could be abraded.



TECHNICAL SPECIFICATIONS

Voltage	See battery label
Capacity	See battery label
Charger	Stryten Energy recommends M-Series X-3 and X-7 chargers for best performance, but ELI series also approved. For max charge voltage, see battery label.
Maximum Charge Rate	Not to exceed 0.7 C (70 Amps per 100Ah capacity)
Operating Conditions* Storage Temperature	-4ºF to 140ºF (-20ºC — 60ºC)
Communication	CAN Open Communication(optional customized Communication available)
Display	Curtis Engage II (Figure 2) or Opus A3 (Figure 3)
Weight	See battery label

*Notes:

Discharge:

- If the internal battery temperature falls below -4ºF (-20ºC) the battery will issue alarm (3/sec) beeps for 15 seconds and then disconnect
- If the battery internal temperature reaches 140ºF (60ºC) the battery will issue alarm (3/sec) beeps for 15 seconds and then disconnect.
- Derating message is transmitted at 131ºF (55ºC)

Charge:

- Charging is forbidden below an internal battery temperature of 32ºF (0ºC)
- If the battery internal temperature reaches 122ºF (50ºC) the battery will issue alarm (3/sec) beeps for 15 seconds and then disconnect.
- Charge current derating occurs at 113ºF (45ºC)

For cold store operations or operations in a cold environment, please contact Stryten Energy.

STRYTEN ENERGY

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