CRESLOW ENERGY SOLUTIONS

LOCOMOTIVE LITHIUM BATTERY CHARGER

User Manual

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This equipment is manufactured and supplied in accordance with the requirements of Section 21 of the mines Health and Safety Act which states that:

(1) Any person who-

(a) designs, manufactures, repairs, imports or supplies any article for use at a mine must ensure, as far as reasonably practicable-

(i) that the article is safe and without risk to health and safety when used properly; and

(ii) that it complies with all requirements in terms of this Act;

As the product is designed in a modular fashion, defective modules must be sent to the OEM (Original Equipment Manufacturer) for repair to electronic component level.

Attempts to repair replaceable modules by persons other than the OEM, or modifications without the OEM's written consent, or non-OEM modules, or using the equipment in a manner it was not intended to be used in, or not maintaining the equipment according to the OEM's specifications, or other unsafe practices, will result in the legal responsibility for the safe operation of the product reverting to the end user of the equipment.

Only use OEM components in the repair and maintenance of the system. Unauthorized components may cause the failure of the system and/or possible injury or death to the operators or bystanders.

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Approval and Revision Record

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List of Acronyms

ACRONYM	DESCRIPTION
ACK	Acknowledge Button
CAN	Controller Area Network
CAT	Cap Lamp Accumulator Tag
COP	Code of Practice
DCM	Driver Control Module
DCU	Driver Control Unit
D.E.	Development-end
E-stop	Emergency Stop
LED	Light Emitting Diode
LCD	Liquid Crystal Display
LMS	Locomotive Management System
HMI	Human Machine Interface
MCU	Master Control Unit
MMI	Man-Machine Interface
N.C.	Normally Closed
N.O.	Normally Open
OEM	Original Equipment Manufacturer
PAS	Proximity Alarm System
PC	Personal Computer
PCB	Printed Circuit board
PDS	Personnel Detection System
PPE	Personnel Protective Equipment
RTC	Real-Time Clock
SD CARD	Secure Digital (Memory card)
SEMB	Stored Energy Mechanical Brake
SOC	State of Charge
ToF	Time of Flight
VDS	Vehicle Detection System

1. Caution ⚠

- Please stow the charging plug/s – gun/s using the facilities provided.
- Please ensure that the charge cable is neatly stowed when not in use.
- No flammable or combustible materials are to be use in the vicinity of the charger.
- Unauthorised persons shall not attempt repairs or modifications to the product.
- In the case of any abnormality or malfunction, press the emergency stop button. Both the input power and output power will be disconnected.
- Locomotives must be parked, hand brake applied and powered down before connecting to the charger.

Please note:

- Input and output voltages are potentially lethal.
- Consult the user manual before use.
- Adhere to user manual instructions, cautions and procedures to mitigate risk.
- Do not operate the charger in an excessively hot environment or near to open flames.
- Regular air filter maintenance is imperative in a dusty environment.
- Do not use a high-pressure washer, steam cleaner or hose down (wipe with a damp cloth).
- All earth connections are clearly marked and are important to safe operation.
- The charging plugs must be kept clean and dry. Clean only when the charger is off with a clean dry cloth.
- Do not unplug the charging plug/s-gun/s during the charge.
- Caution shall be observed when charging in a wet environment.
- All panel doors shall be closed during operation.
- Unauthorised modifications to the charger are prohibited.
- All work must be carried out by trained personnel.

2. Introduction

Figure 1: LOC-40-2 Lithium Battery Charger

The LOC-40-2 Charger is an inverter charger capable of 40kW of constant power. The LOC-40-2 is a CAN controlled charger that is designed to receive instructions from the BMS (Battery Management System) of the battery under charge. The BMS will instruct the charger to provide the required voltage and current within the limits of the charger. The charger is fitted with integral input over voltage protection, input surge protection, over temperature protection and output short circuit protection.

The status of the charger is displayed on a clear LCD display (Item 1 on Figure 1 – Front View) fitted to the front of the charger. The output voltage and current levels are continuously displayed. Any errors or status information is also displayed on the LCD display.

The charger is provided with a wide input three phase input voltage range of 360VAC to 600VAC and an output voltage range of 60VDC to 200VDC.

Please refer to the output graph for the available maximum current at the required voltage

2.1 Product Specifications

Table 1: LOC-040-2 Specifications

	Rating	
	Min	**Maximum**
Three phase Input Voltage (VAC)	360	600
Input Current (Amps)		<80
Output Voltage (VDC)	60	200
Output Current (Amps)	>1A	See Graph
IP Rating		54
Operating Temperature (°C)	-20	+45
Weight (kg)		320
Full Load Efficiency (%)		>94

2.2 Output Graph

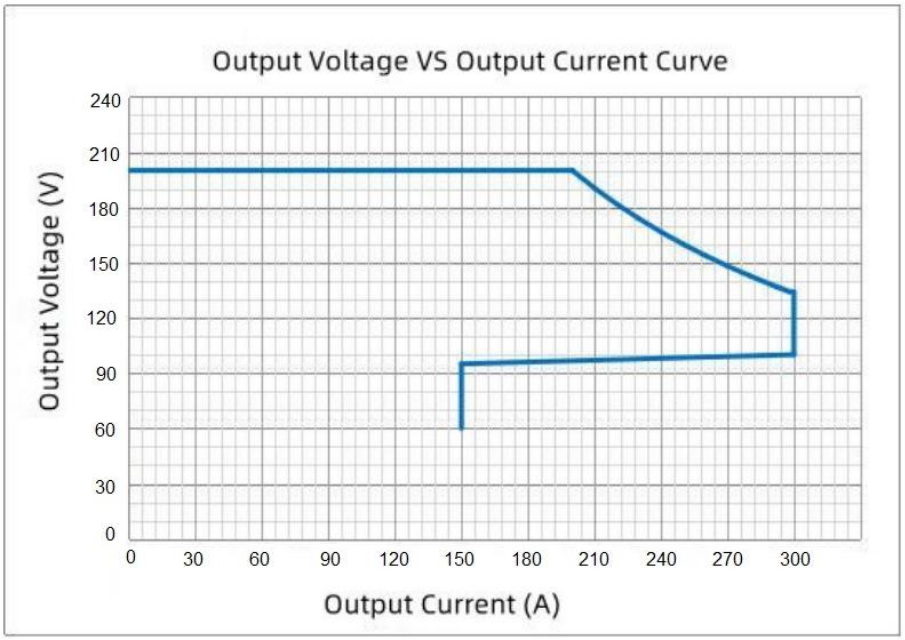
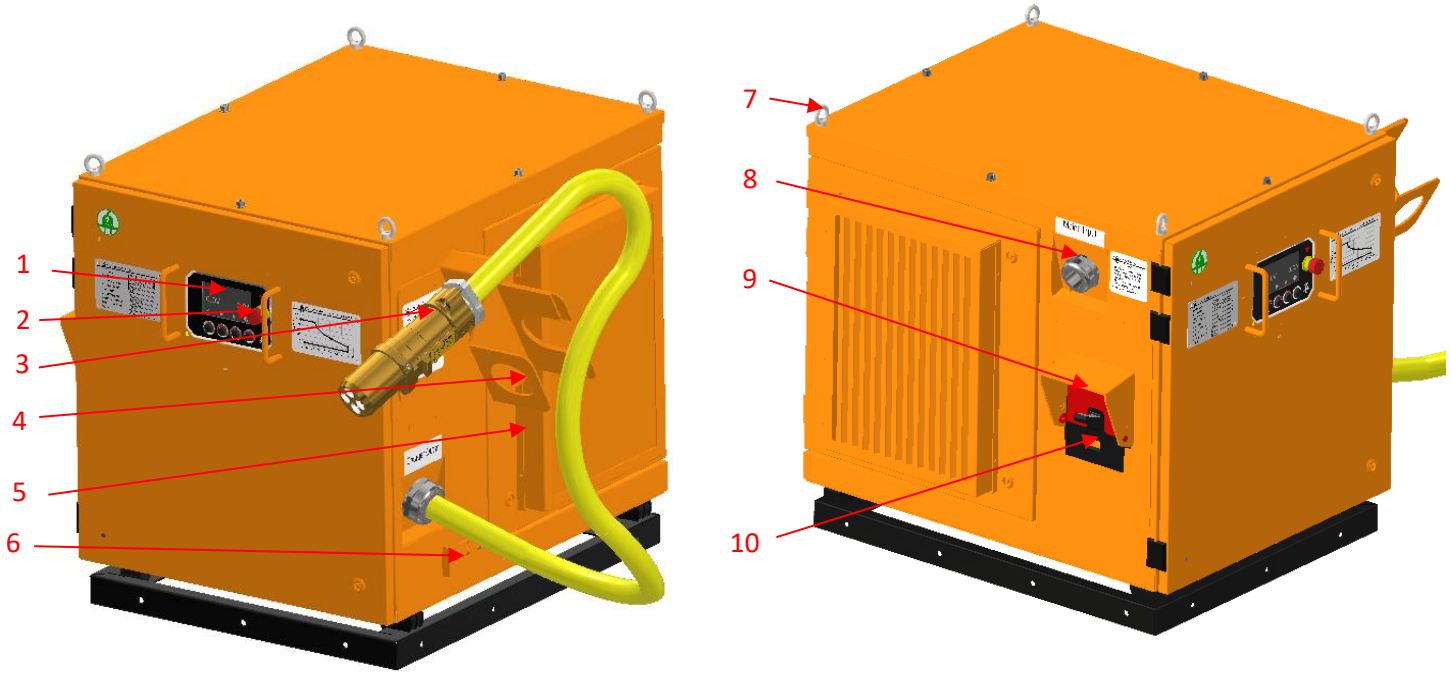


Figure 2: LOC-40-2 Output Graph

2.3 Description



LOC-40-0-2 (Detailed View)

Item	Description	Item	Description
1	Charger Control Module	6	External earth point
2	'E-Stop' Button (Stop Charge)	7	Lifting eye
3	DC Charge plug	8	AC supply cable inlet
4	Charge plug holder	9	Circuit breaker lockout
5	Ventilation Grid	10	Main circuit breaker

Figure 4: LOC-40-2 Control Module

Item	Description
1	Menu Button
2	Run button (Start Charge)
3	Stop Button (Stop Charge)
4	Information Button (Display BMS requests)
5	Emergency-stop button
6	LCD display

3. Operations

The LOC-40-2 is an automatic charger. Once the charger is correctly connected, AC mains power connected and power is applied, the charger will immediately communicate with the onboard battery BMS and will be ready to charge. Once the 'Run' button is pressed the charger will begin charging at the required voltage and current levels requested by the BMS.

3.1 Starting Charge

1. Insert the charging plug (Item 3 on Figure 3) to the equipment requiring charging.
2. Turn on the main circuit breaker (Item 10 on Figure 3).
3. Ensure that the 'E-Stop' button is released (Item 3 on Figure 3 Front View).
4. Press the 'Run' button on the front of charger (Item 2 on Figure 4 Front View). The charger will begin charging at the voltage and current as requested by the BMS.

Figure 5: Charger screen while running

3.2 BMS Information

Press the Information button (Item 4 on Figure 4) to display all the BMS requested voltage and current and other extra information. This information will display for a set period before turning off.

Figure 6 Displaying the BMS information on the screen

3.3 Stopping Charge

1. Depress the 'Stop' button (Item 3 on Figure 1 Front View). The charger will immediately stop the charge process.
2. Turn off the main circuit breaker (Item 2 on Figure 2).
3. Remove the charging plug from the equipment being charged.

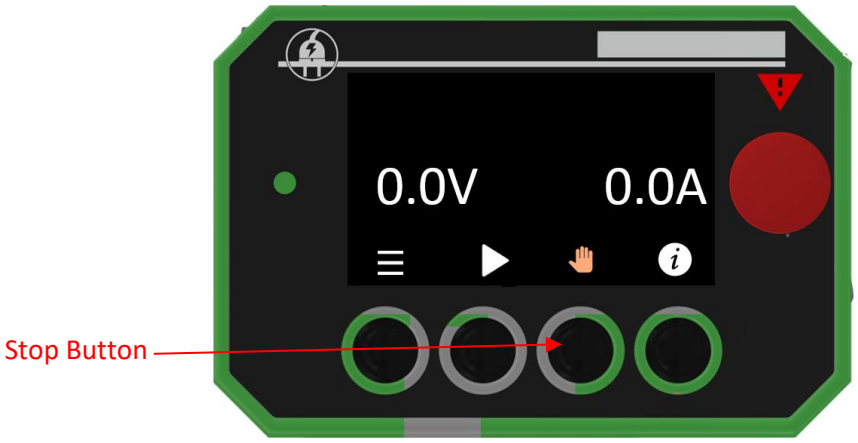


Figure 7: Charger screen when stopped

Ensure that the charge process has been stopped and the main circuit breaker has been switched off prior to removing the charging plug from the equipment.

3.4 Emergency Stop

When the charging process needs to be stopped immediately:

1. Depress the Emergency-stop button on the Control Module (Item 2 on Figure 3).
2. Turn off the main circuit breaker (Item 2 on Figure 2).

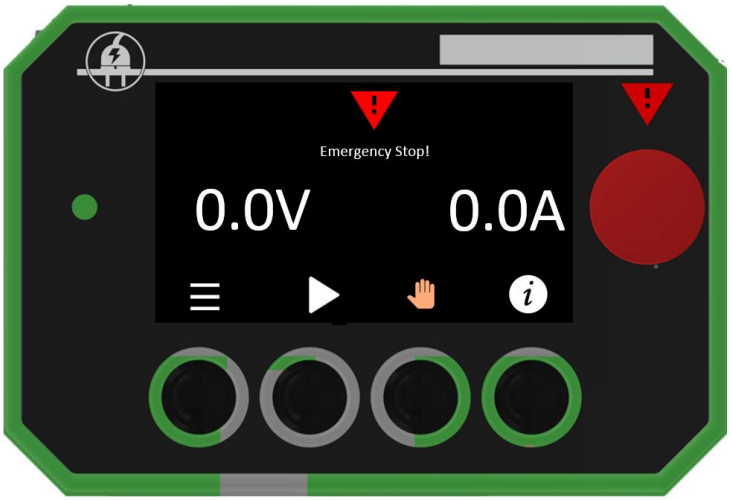


Figure 8: Charger screen when Emergency-stop button is pressed.

4. Fault Codes

Table 2: Fault Codes

Item	Fault	Resolution
1	Please connect battery and BMS	Check that the DC charger plug is inserted correctly and that the battery is on.
2	Battery error/polarity reversed	Check that the polarity of the battery socket is correct or that the battery is on and functioning correctly.
3	Charge module error	Contact OEM or technician.

5. Maintenance

The LOC-40-2 battery charger generally requires low maintenance if operated in a clean environment but does require more regular checks if operated in harsh environments like mines and construction sites.

Table 3. Maintenance Schedule

No.	Item	Maintenance	Period
Regular checks:			
1	Air Filters	Clean with soapy water when it's heavy clogged or dirty, install once dry	Weekly
2	Surge Arrestor	Replace if colour indicators have turned red	Weekly
3	DC plug	Check it's clean and clear of debris inside the terminals, and remove any obstructions	Weekly
Occasional checks:			
1	DC Cable	Check for general wear and tear or damage	Monthly
2	Earthing Points	Check for continuity on all the earth points inside and outside the charger	Monthly
3	Internal Housing	Blow out the internal area if any dust using an air hose	Monthly
4	Bolts and Nuts	Check all fasteners are tight	6 Months

5.1 General Care

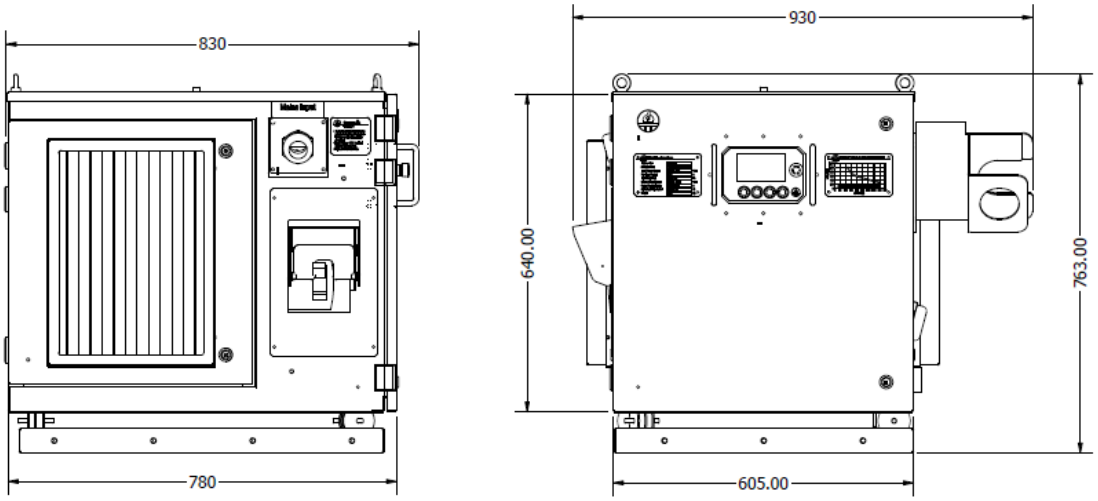
Never use water or a high-pressure hose to clean any parts of the charger!

Always store the charging cable on the provided cable hanger when not in use!

Check air filters regularly to prevent overheating of the charger due to poor air circulation!

6. Drawings

6.1 LOC-40-2 Charger



6.2 DC plug pinout

The DC Output Plug Type is specified by the customer.