

## Lithium-Ion Battery

12 V-100 Ah, 24 V-100 Ah

With integrated battery management system



## User manual




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## 1 About this Manual

Read this manual carefully and keep it in a safe place. This manual is intended for professionals in the automotive electrical field.

Throughout the manual, you will be alerted to warnings and safety notices about potential hazards associated with handling the device. The colours and signal words indicate the severity of the hazard:

Signal word	Meaning
 <b>DANGER</b>	Warns of imminent danger resulting in death or serious injury.
 <b>WARNING</b>	Warns of a potentially dangerous situation that can result in death or serious injury.
 <b>CAUTION</b>	Warns of a potentially dangerous situation that can result in moderate or minor injuries.
<b>NOTICE</b>	Warns of a potentially dangerous situation that can result in material and environmental damage.

In this manual you will find the following symbols:



Shows you useful tips and information about the device.



Indicates a mandatory requirement for the following instruction.



Shows the result of an instruction.

## 2 General Safety

This manual supports safe handling of the batteries. Use the batteries solely in accordance with its intended use:

Lithium-ion batteries are power sources with a particularly high energy density in a closed metal housing.

Any modifications to the device or its components are prohibited and do not conform to its intended use.

Lithium batteries are classified as hazardous to UN3480 Class 9. It is essential to observe the relevant national and international standards and guidelines as well as the instructions and notes in this manual during installation.

Observe the following safety instructions:

- Check the battery for transport damage before installation.
- Do not open battery housings, cells, or other system components.
- Do not connect the lithium-ion battery in series.
- Danger from damaged, frozen or deformed batteries: Before charging, make sure that the battery is undamaged and the electrolyte is not frozen.
- Fully charge the lithium-ion battery before use.
- Only charge batteries in well-ventilated rooms and away from ignition sources.
- Fully charge the lithium-ion battery every 6 months at the latest.

### 3 Technical Specifications

Battery type	12 V / 100 Ah	24 V / 100 Ah
Part number	012-00022GF	012-00024GF
Available capacity	80 Ah	80 Ah
Rated voltage	12 V	24 V
Lower operating voltage	9.2 V	18.4 V
Charge voltage	15 V	30 V
Min. cell voltage	2.3 V	
Max. cell voltage	4.2 V	
Continuous discharge current	100 A	
Max. pulse discharge current		
10 min.	200 A (temperature controlled)	
5 s.	>500 A	
10 $\mu$ s	>1000 A	
Continuous charge current	100 A	
Rated charge and discharge current	50 A	
Cycle life 80 % DOD	>3000	
Cycle life 70 % DOD	>5000	

Battery type	12 V / 100 Ah	24 V / 100 Ah
Part number	012-00022GF	012-00024GF
Rated temperature	-40 °C ... 50°C	
Cooling	Controlled fan	
Inputs	3	
Outputs	2	
Communication	CAN (SAEJ1939) – CP Single Wire	
Parallel connection	1 ... 20	
Internal consumption per month (sleep mode)	<3 %	
Internal consumption	350 mA	180 mA
Internal consumption (Sleep mode)	< 2 mA	
IP rating	IP20	
Connection	Screws, M8	
Weight	16.52 kg	31.22 kg
Dimension (L x W x H)	302 mm x 192 mm x 274 mm	558 mm x 192 mm x 274 mm

### Parallel connection / CAN bus connection parameters

Pin	Signal	Parameter	Value
1	CAN WakeUp	Output voltage	Battery voltage
		Output impedance	10 kΩ
		Maximum input voltage	60 V
		Trigger voltage (high/low)	3.5 V
		Input impedance	4.7 MΩ
2	CAN GND	Maximum current	250 mA
		Rated fuse size	300 mA (thermal)
3	CAN High	Connection speed	125 kbps
		Connection protocol	>MΩ
		Output impedance	SAE J1939-11
4	CAN Low	Connection speed	125 kbps
		Connection protocol	>MΩ
		Output impedance	SAE J1939-11

### Signal contact parameters

Pin	Parameter	Value
Output 1 Output 2	Maximum drain voltage	45 V
	Maximum current	300 mA
	Rated fuse size	300 mA (thermal)
	Design	Open collector
Input 1 Input 2	Maximum input voltage	45 V
	Input voltage level (High/Low)	TTL range
	Input impedance	4.7 M $\Omega$
Input 3	Maximum input voltage	45 V
	Input voltage level (High/Low)	3.8 V
	Input impedance (at +5 VDC)	2 M $\Omega$
SW DATA	Connection speed	9600 Baud
	Output impedance (at +12 VDC)	1 k $\Omega$
	Rated fuse size	300 mA (thermal)
SW GND	Maximum current	300 mA
	Rated fuse size	300 mA (thermal)
GND	Maximum current	300 mA
	Rated fuse size	300 mA (thermal)

## 4 Package Contents

Package Contents	No.
User manual	1
CAN communication cable	1
Lithium-ion battery	1
M8 spacer (plastic)	1
M8 screw	1
M8 snap ring	1
M8 washer	1
Phoenix connector, 3 pin	1
Phoenix connector, 5 pin	1
Fuse (CF8, 150 A)	1

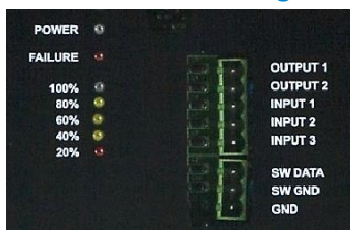
## 5 About the battery

### Front of lithium ion battery



No.	Part Name
1	Positive terminal
2	Negative terminal
3	DIP switch
4	Status indicator (for more information see page 7)
5	Status contacts (for more information see page 7)
6	CAN bus sockets (RJ10)

## Detail view of status indicator and signal contacts



### Status indicator (left)

LED	Indicator	Status
Power (blue)	Steady light	Device on
	Flashing	Charging
Failure (red)		See page 17
100% (green)	Steady light	> 90 %
	Flashing	80 % ... 90 %
80 % (green)	Steady light	> 70 %
	Flashing	60 % ... 70 %
60 % (green)	Steady light	> 50 %
	Flashing	40 % ... 50 %
40 % (green)	Steady light	> 30 %
	Flashing	20 % ... 30 %
20 % (red)	Steady light	> 10 %
	Flashing	0 % ... 10 %

### Signal contacts (right)

Signal contact	Description
Output 1	External alarm controller (active at <10% SOC)
Output 2	Protection against overload by an external charger (active at > 4.1 V cell voltage)
Input 1	Wake-up signal for vehicle ignition (active operating voltage, D+ signal)
Input 2	Wake-up signal for remote control signal (active operating voltage)
Input 3	Wake-up signal for 230 V network (active at low range) ground. Do not apply 230 V AC voltage.
SW data	Communication port for external device
SW GND	Communication port to ground
GND	Ground connection



## 6 Mounting

To mount the lithium-ion battery, perform the following step:



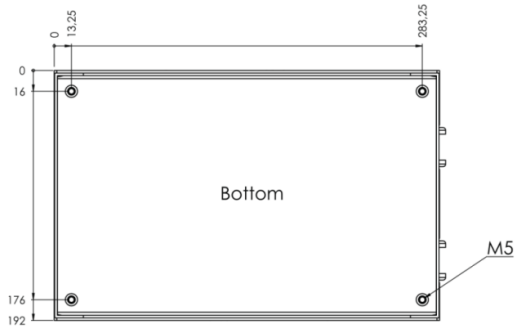
- Choose a cool, dry and well-ventilated mounting site.
- Always mount the lithium-ion battery upright or lying on its side, never upside down.
- Make sure the air circulation is unobstructed at the radiator.

1. Use screws to secure the device to the 4 holes on the underside of the battery (5 mm  $\varnothing$ ).



The device is mounted.

12 V /100 Ah




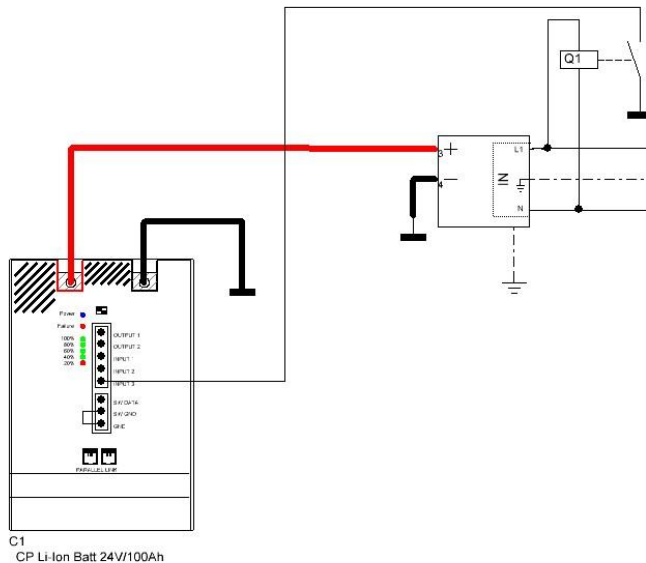
## 7 Installation


The lithium-ion battery can be used in a variety of ways. This chapter describes the most common installations.

### Single operation with APP power supply

To connect the lithium-ion battery in single operation to 12V or 24 V consumers, you need a suitable power pack. LEAB recommends an APP series power pack. To connect the APP and the 12 V or 24 V consumers, perform the following steps:

- 
 For installation you need an installation relay. LEAB recommends the Eltako R12-110-230V relay (part no.: 9905043791).
- Before installing, make sure that the power pack is turned off.



- 
 The wiring diagram shows the lithium-ion battery connected to a power pack.

1. Connect the negative terminal of the battery to a common ground.
2. Secure the positive lead of the battery with the CF-8 fuse supplied.
3. Connect the negative terminal of the power pack to a common ground.
4. Connect the positive terminal of the battery to the positive terminal of the power pack.
5. To enable automatic charging of the battery, connect the input 3 of the battery to the terminal 1 of the relay with a signal cable.
6. Connect the terminal 3 of the relay to ground.
7. Connect the L conductor of the AC wire of the power pack to the +A1 terminal of the relay.
8. Connect the N conductor of the AC wire of the power pack to the +A2 terminal of the relay.
9. Bridge the SW GND connection of the battery with the GND connection of the battery with a signal line.
10. Connect the negative lead of the 12 V or 24 V consumers to a ground.
11. Connect the positive lead of the 12 V or 24 V consumers to the positive terminal of the battery.



When installing the 12 V or 24 V consumers, pay attention to the manufacturer information.



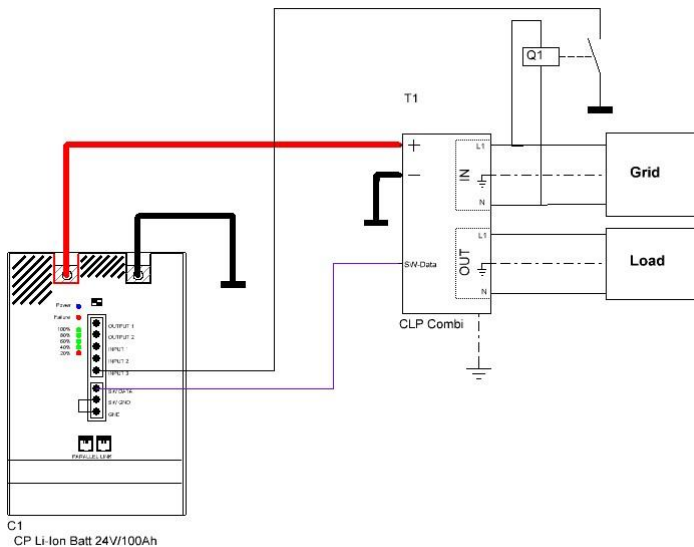
In single operation the battery is connected to the power pack and the 12 V or 24 V consumers.

## Single operation with CLP combi

In order to connect the lithium-ion battery in single operation with 230 V consumers, you need a suitable inverter. LEAB recommends the CLP combi inverter. To connect the CLP combi and the 230 V consumers, perform the following steps:



- For installation you need an installation relay.  
LEAB recommends the Eltako R12-110-230V relay (part no.: 9905043791).
- Before installation, make sure that the combi is switched off.



The wiring diagram shows the lithium-ion battery connected to CLP combi.

1. Connect the negative terminal of the battery to a common ground.
2. Connect the negative terminal of the combi to a common ground.
3. Secure the positive lead of the battery with the CF-8 fuse supplied.
4. Connect the positive terminal of the battery to the positive terminal of the combi.
5. Connect the SW data connector of the battery to a signal cable to the SW data connector of the combi.
6. To enable automatic charging of the battery, connect the input 3 of the battery to the terminal 1 of the relay with a signal cable.
7. Connect terminal 3 to the ground.
8. Connect the L conductor of the AC wire of the combi to the + A1 terminal of the relay.
9. Connect the N conductor of the AC wire of the combi to the + A2 terminal of the relay.
10. Bridge the SW GND connection of the battery with the GND connection of the battery with a signal line.
11. Connect the 230 V consumer to the output of the combi.



When installing the 230 V consumers, pay attention to the consumer manufacturer's information and to the combi manufacturer's information.

12. Connect the negative lead of the 12 V or 24 V consumers to a ground.
13. Connect the positive lead of the 12 V or 24 V consumers to the positive terminal of the battery.



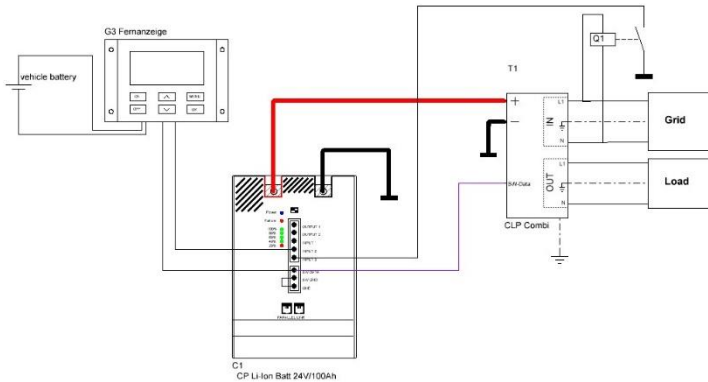
When installing the 12 V or 24 V consumers, pay attention to the manufacturer information.



In single operation the battery is connected to the CLP combi and the consumers.

### Optional: Connecting the remote display

To connect the remote display (part no.: 0200600001), perform the following steps.



The wiring diagram shows the remote display connected to the lithium-ion battery with CLP combi.

1. Connect the GND port of the remote display to a ground.
2. Connect the '+Batt' port of the remote display to the positive terminal of the starter battery.
3. Connect the remote port of the remote display to the input 2 of the lithium-ion battery with a signal cable.
4. Use a signal cable to connect the SW data port of the remote display to the SW data port of the lithium-ion battery.



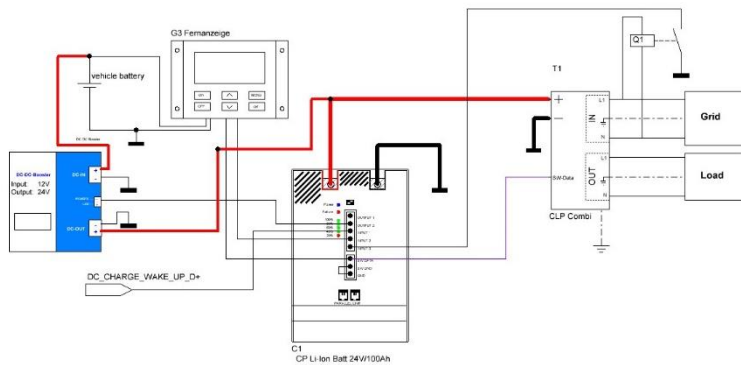
When installing the 12 V or 24 V consumers, pay attention to the manufacturer information.



The remote display is connected.

### Optional: Connecting the charger booster (12 V / 24 V)

To charge the lithium-ion battery via the alternator, you need a suitable charge booster. For the 12 V battery you need a 12 V DC-DC charge booster, LEAB recommends the BPC 12-12 (part no.:1041003001). For the 24 V battery you need a 24 V DC DC charge booster, LEAB recommends the PP 12/24 DC/DC converter (part no. : 1042004326) or the 12 V/29 V charge booster (part no.: 0404002424).



The wiring diagram shows the connection of a charge booster for the 24 volt lithium-ion battery. The lithium-ion battery is also connected to the remote display and the CLP combi.

To connect the charge booster, perform the following steps:

1. Connect the negative terminal of the charge booster to a common ground.
2. Connect the positive terminal of the charge booster to the positive terminal of the starter battery.
3. Connect the other positive terminal of the charge booster to the positive terminal of the battery.
4. For the charge booster 12/12: Connect the CAN terminal of the charge booster to the CAN terminal of the battery with a signal cable.
5. For the 12/24 charge booster: use a signal wire to connect the D + signal connector to the vehicle D + signal.



The charge booster is connected.

## Parallel connection

To switch several lithium-ion batteries in parallel, note the following:

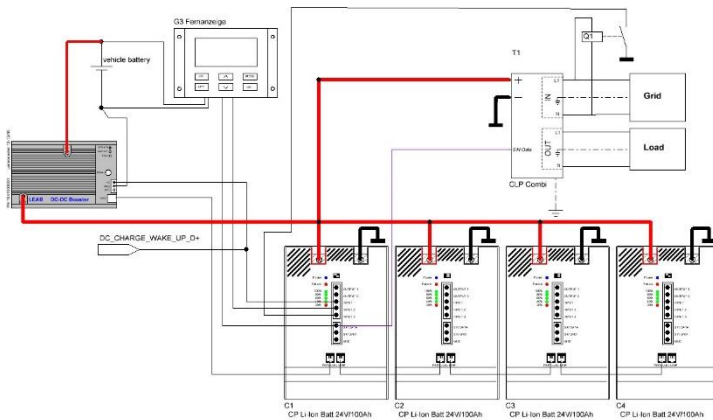


- Make sure all devices are turned off before installation
- Connect a maximum of 20 lithium-ion batteries in parallel
- Never connect the lithium-ion batteries in series
- Do not connect lithium-ion batteries from other manufacturers to the lithium-ion battery

To switch several lithium-ion batteries in parallel, perform the following steps.



- For installation you need an installation relay. LEAB recommends the Eltako R12-110-230V relay (part no.:9905043791).
- You have connected the CLP combi.
- You have connected a charge booster.



The wiring diagram shows the lithium-ion battery connected to CLP combi, a booster and a remote display.



1. Connect the negative terminals of the batteries to a common ground.
2. Connect the positive terminals of the batteries to a busbar.

Make sure that the cable lengths are identical. The maximum tolerance of the cable lengths among each other is  $\pm 20\%$ .

Depending on the cable length, the following cable cross sections result:



35 mm <sup>2</sup>	< 2 m
50 mm <sup>2</sup>	< 3 m
70 mm <sup>2</sup>	< 5 m

3. Connect the CAN bus sockets of the batteries to CAN communication cables as shown in the circuit diagram.
4. For batteries with only one CAN communication cable connected, set the upper DIP switch to 'ON' and the lower to 'OFF'.
5. For the batteries with two CAN communication cables connected, switch both DIP switches to 'OFF'.



The batteries are connected in parallel.

## 8 Normal operation

### Switching on the battery

The lithium-ion battery switches on as soon as a wake-up signal is present for a wake-up input.

The lithium-ion battery switches off as soon as all wake-up signals are removed.

### Charging the battery in sleep mode

To charge the lithium-ion battery, connect a suitable charger and start charging within 30 seconds.

The lithium-ion battery protects itself against deep discharge by disconnecting the power ports and starting sleep mode. In this mode, the lithium-ion battery can be activated for 30 seconds to starting charging with min. 1 A.

### Charging a deeply discharged battery

To charge a deeply discharged lithium-ion battery, connect a suitable charger and start the battery within 3 seconds with min. 1 A.

## 9 Error code display

Failure (red LED)	Error	Error Description
Flashing x 1	Battery discharged	Restart battery and apply charge current (>1 A) within 30 s
Flashing x 2	Battery temperature too high	Wait until the battery has cooled down
Flashing x 3	Battery overload or short circuit	Battery starts in 'Sleep Mode' after 30 s, remove load and restart.
Flashing x 4	Precharge error	Battery starts in 'Sleep Mode' after 30 s, remove load and restart
Flashing x 5	Battery overloaded	Check charger, battery is in compensation mode
Flashing x 6	Internal error: Cell voltage monitor	Battery starts in 'Sleep Mode' after 30 s, contact dealer
Flashing x 7	Internal error: Cell temperature monitor	Battery starts in 'Sleep Mode' after 30 s, contact dealer
Flashing x 8	Internal error: Communication error	Battery starts in 'Sleep Mode' after 30 s, contact dealer
Flashing x 9	Internal error: other	Battery starts in 'Sleep Mode' after 30 s, contact dealer

## 10 Maintenance

Check the battery as follows each time before using it:

- Check the battery for external damage.
- Ensure that the wiring between the charger cable and the charger is secure.

## 11 Disposal

Dispose of the lithium-ion battery in accordance with the Waste Electrical and Electronic Equipment Regulations (WEEE).



The lithium-ion battery must not be disposed of with household waste. Take it to a recycling point or send it to your point of sale.

## 12 EU Declaration of Conformity

The **lithium-ion battery**

types **12 V-100 Ah** and **24 V-100 Ah**

complies with the requirements of the following directives:

2014/30/EU: EMC  
2014/35/EU: NRL  
2011/65/EU: RoHS



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