



# FES 14S Discharging assistant

Suitable for FES GEN1 (14S) battery pack, and FES GEN2 (14S) battery pack

User manual, Version 1.2



LZ design d.o.o., • Brod 3D, 1370 Logatec, Slovenia • tel +386 59 948 898  
[info@lzdesign.si](mailto:info@lzdesign.si) • [www.front-electric-sustainer.com](http://www.front-electric-sustainer.com)

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## 1. Important notices

This user manual contains important information about proper and safe usage of “Discharging assistant” device.

If you need more information please contact the manufacturer LZ design.

Information in this document are subject to change without notice. LZ design reserves the right to change or improve this product and to make changes in the content of this material without obligation to notify any person or organization of such changes or improvements.



A Yellow triangle is shown for parts of the manual which should be read carefully and are important



Notes with a red triangle describe procedures that are critical and may result in reduced safety or may lead to critical situation



A bulb icon is shown when a useful hint is provided to the reader

### 1.1 Limited Warranty

This product is warranted to be free from defects in materials or workmanship for one year from the date of purchase. Within this period, LZ design will, at its sole option, repair or replace any components that fail in normal use. Such repair or replacement will be made at no charge to the customer for parts and labour, however the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorised alterations or repairs.

Usage of device is at user’s own risk. Manufacturer LZ design will not under any circumstances accept any responsibility or will be liable for possible damage on people, animals or things, which might directly or indirectly happen from using discharging assistant device.

With using of discharging assistant device user automatically agree with above listed terms.

To obtain warranty service, contact your local LZ design dealer or contact LZ design directly.

## 1.2 Invalid Warranty

Warranty becomes invalid in next cases:

1. Do not apply unknown loads to device output, to prevent possible over-current from battery pack, which can lead into damaging of battery pack, device or load.
2. Do not shorten device output, since this will lead to over-current from battery pack, which can lead into damaging of battery pack, device or load.
3. Do not try to discharge battery packs with **more or less** than 14 LiPo battery cells. Device is designed to be used only with FES GEN1 or FES GEN 2 battery packs which has 14 LiPo cells wired in serial.
4. Do not throw, drop or apply pressure on the device, since this can lead to damaging of the device. Use the device gently and with care.
5. Do not use the device in dusty, hot or humid environment, since this may lead to damaging of the device.
6. Device is not water-proof in anyway, consequently any liquid on the enclosure or high air humidity may lead into damaging of the device.
7. Do not push or pull cables from or into enclosure of the device, since this may lead to damaging of the device.
8. Device contains OLED display which can loose some of it's light output over working time, which can be prevented with disconnecting the device from the battery pack when not in use. Due to OLED technology some picture retention might happen during using of the device, but is not very common behaviour.

## 2. Description

FES discharging assistant (in further text word "device" will be used) is a device used for discharging a single FES GEN2 battery pack, (with 14 LiPo cells) down to 50% of pack capacity. Such capacity is suitable for longer time storage of battery packs.



It can only work in a combination with a suitable DC (direct current) load. Load **is not supplied** as part of FES discharging assistant.

As suitable load we recommend to use a standard electric oil radiator 230VAC, with EU plug, and rated as between 1.5kW and 2.5kW. Also US radiators rated as 110V and up to 1.5kW, could be used if a suitable plug or adaptor is used.



*Please check that radiator is not equipped with ventilator, as ventilator might need AC current, and as such it would not be suitable as DC load.*

Such suitable load need to be connected to the output side and is use as a safe load to discharge one LZ design LiPo 14 cells battery pack ( in further text words "battery pack" will be used) connected on the input.



This device is designed in a way to be as safe and as easy to use as possible. However it is still in under development, so some precaution at using it is recommended.

- current hardware version: 1.4
- current software version: 1.55

### 3. How to use device



Discharger is available with European, American or British outlet.

Connect an electric radiator to the output and connect battery pack to the input with correct polarity. Device will start working and welcome screen with software and hardware version of the device will be displayed:



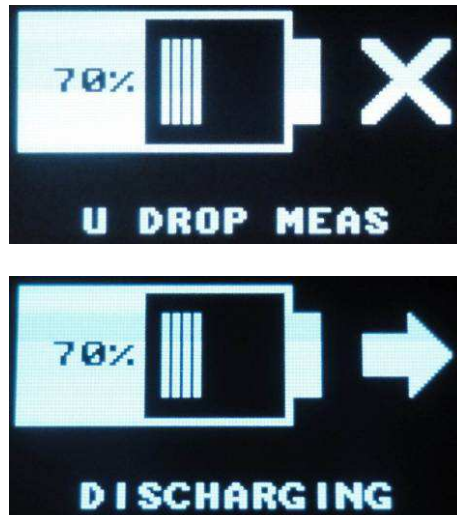
If battery pack is charged over 50%, a "NOT DISCHARGED" text, "X" symbol and battery pack percentage will be displayed. Battery pack percentage will be displayed with numbers from 50 to 100%, with 5% steps and also with different number of bars in battery symbol.



By pressing button device will start discharging the battery pack through electric radiator. A text "DISCHARGING" and an arrow symbol will be displayed.

Each button press will sound buzzer with short alarm and functionality will be switched between discharging and not-discharging state.

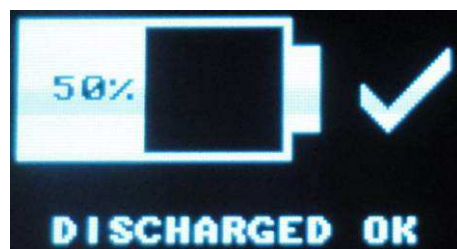
When button will be pressed for the first time, device will measure voltage drop on input elements and text "U DROP MEAS" will be displayed. Scaled voltage drop value will later be used in measuring correct voltage of battery pack, without the voltage drop error, which is produced by supply wire resistance and discharging current.



When battery pack voltage will reach 50% of charge (51.8V, 3.7V/cell) a device will automatically disconnect electric radiator from the battery pack, which will prevent further discharging of the battery pack.

Buzzer will sound the alarm and text "DISCHARGED OK" and tick symbol will be displayed. Pressing button again will not start further discharging of battery pack.

If somehow battery pack voltage will rise after discharging has been stopped "DISCHARGED OK" and tick symbol will remain until 60% of battery pack due to applied hysteresis.



When battery pack is discharged bellow 49V, buzzer will start with slow on/off buzzing, a text "UV CHECK FOR SC" and "X" symbol will be displayed. This scenario can happen when battery pack is undercharged at connection or in case when internal switch would be damaged (in short circuit) and so battery pack would be still discharging through electric radiator.



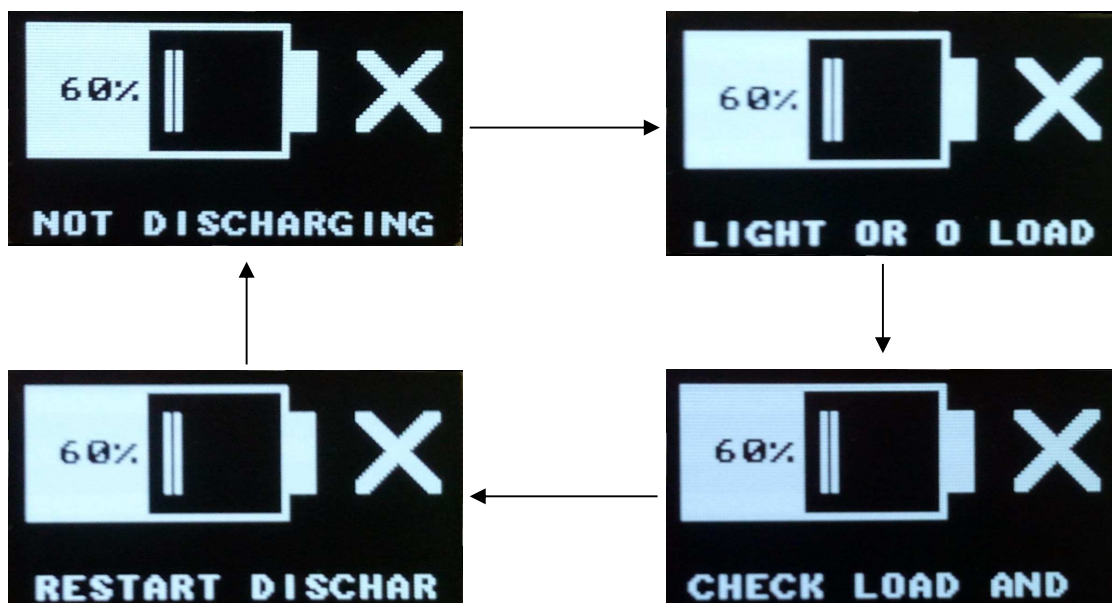
### 3.2 No load at start of discharging or load disconnection during discharging

From SW version 1.55 further load disconnection detection at start or during discharging is implemented.

#### 3.2.1 No load at start of discharging

If no load will be detected after voltage measurement, device will not start discharging and will sequentially display text "NOT DISCHARGING" → "LIGHT OR 0 LOAD" → "CHECK LOAD AND " → "RESTART DISCHAR".

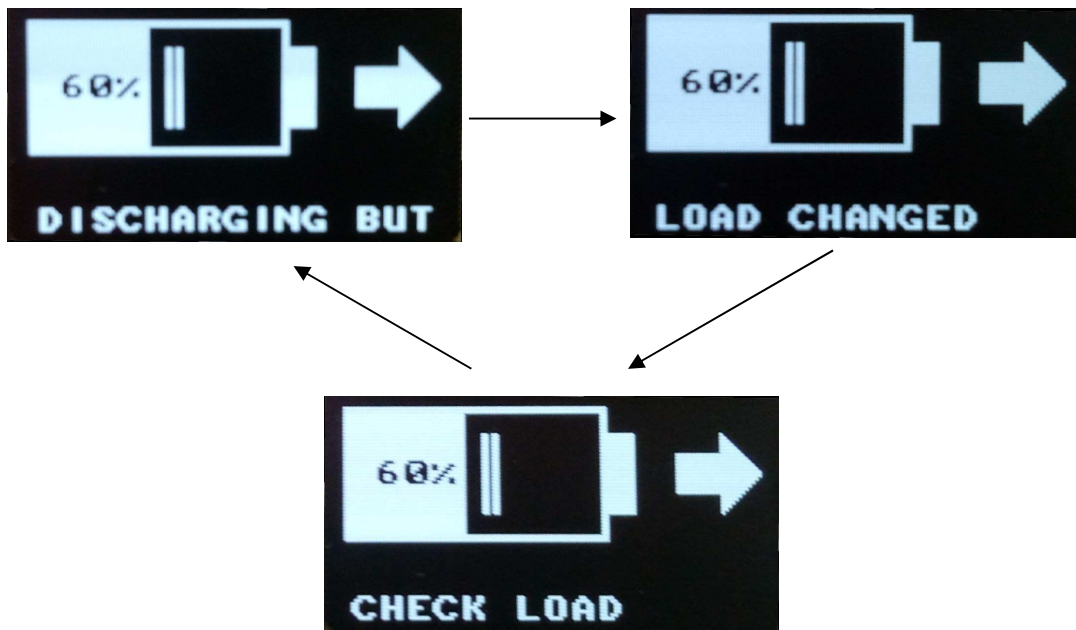
User has to check load and in case load was disconnected, load has to be connected, button has to be pressed to cancel current discharging procedure and after another button pressing device will start usual voltage drop measurement and normal discharging behavior.



### 3.2.2 Load disconnection during discharging

If load reduction or disconnection will be detected during discharging, device will still discharge battery pack ( in case of load reduction ), but will sequentially display text "DISCHARGING BUT" → "LOAD CHANGED" → "CHECK LOAD".

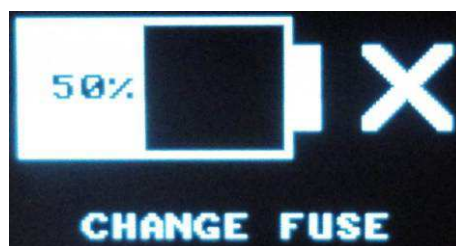
Device will stop sequentially display text after load will be re-connected or raised to normal load measured at the beginning of discharging process ( this scenario is possible in case of electric radiator with multiple load switches ).



### 4. Fuse replacement

In case of over-current situation Discharging assistant has a removable standard 5x20 mm fast acting 10A fuse, which can be replaced with dismantling device enclosure.

Replacement is only needed when buzzer is alarming with fast on/off buzzing and text "CHANGE FUSE" is displayed on the display. User has to take special care when dismantling the enclosure, to prevent any possible damage to internal elements. Usage of ESD protection is obligatory when dismantling the enclosure. Device has to be disconnected from input and output before dismantling the enclosure.





**5. Repair and service**

In case of a fault or damage(s), contact manufacturer LZ design.

**6. Revision history**

March 2017	Initial release of user manual v1.0
May 2017	Update regarding new software version 1.54, manual v1.1
Oktober 2017	Update regarding new software version 1.55, manual v1.2