



# FES Quick Guide

Version 1.3



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## 1. Important notices

This guide contains essential information about the safety of the Front Electric Sustainer (FES) system, on the ground and during the flight. Even though FES is easy to operate, a basic understanding of the system and its operation is still required, as it is quite different from other propulsion systems.

FES Quick guide was prepared for pilots to read before their first flight with an FES equipped sailplane to use FES safely and adequately.

This guide should only be used as a help to refresh the knowledge before flying and not as a substitute for reading the complete system manuals. Users should check for the latest versions and review the complete system manuals at least annually.

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



**Caution:** *Yellow triangle is shown for parts of the manual which should be read carefully and are important for proper operation.*



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



**Note:** *A bulb icon is shown when a useful hint is provided to the reader.*

### 1.1 Limited Warranty

This LZ design FCU product is warranted to be free from defects in materials or workmanship for two years 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 repairs or replacement will be made at no charge to the customer for parts and labor. The customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alterations or repairs.

LZ design retains the exclusive right to repair or replace the unit or software, or to offer a full refund of the purchase price, at its sole discretion.

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

## 2. General

Before the flight, correctly fasten both batteries. Power cables connected to plus and minus terminals should be fully engaged and signal cable with two multipole connectors plugged into the battery packs.



**Warning:** Before trying to plug in the male connectors, make sure the orientation is correct. Do not use excessive force! If the connector does not fit the socket, the orientation of the connector is likely wrong. Insert it aligned straight with the socket; otherwise, pins could be damaged!

Pilots new to FES should respect the following procedures:

1. **When you are not using the glider on the ground, make sure that "Connecting cable" is NOT inserted** in the FES battery packs! For example, when you store the glider in a trailer, park it in the hangar or when you park the glider for extended periods before or after landing. By doing so, the FES system is not operational on the ground.
2. Install the "Connecting cable" of the FES battery packs for a preflight check. The DC/DC converter starts providing 12V to the FES system and other instruments, as well as charging any 12V batteries on board.

Switch ON the Battery Management System (BMS) by using the electronic BMS switches on top of each battery pack, after you have installed the "Connecting cable". This ensures that the FCU instrument receives temperature and cell voltage data. At this point, the system is "ready for flight", but high voltage supply to the motor is inactive.

3. **Turn ON the "Master switch"**. On some Schempp-Hirth gliders, a Klixon automatic circuit breaker acts as a "Master switch". Pressing it in, turns it ON, while pulling it out, turns it OFF. On most other types of gliders, "Master switch" is a toggle switch. By turning the Master switch on, power is available for onboard instruments.
4. Switch ON the FCU instrument with a toggle-pull switch on top right side of the FCU instrument. **FCU instrument must always be switched ON during flight** so that the pilot can monitor the status of the battery packs and receives warnings about any critical issues.

5. **A "Power Switch" is different from the "Master Switch"!**

The "Power switch" is usually located below the instrument panel. On early LAK gliders, "Power switch" is located on the right side of the cockpit, on more recent LAK glider it is located on instrument panel. A red safety guard cover protects the switch from being unintentionally turned ON.

The "Power Switch" is similar in function as the ignition switch on combustion powered aircraft! It is critical to understand that this switch is not a "Master switch" or vice versa. While the "Power switch" is OFF, you cannot start the electric motor.

Switching the "Power switch" ON activates the main contactor. It connects the FES battery packs to the motor controller and supplies the system with high voltage. The system is fully operational when the "Power switch" is ON.

6. **The "Power switch" should be ON only during powered flight.** After the motor stops and the propeller aligns horizontally with the fuselage, turn OFF the "Power switch", by pushing the red safety guard downwards.
7. All FES gliders come equipped with a safety "Canopy switch" from the factory. It prevents to start the motor when the canopy is open.
8. **Unplug the "Connecting cable" and turn OFF the BMS on each of the FES battery packs after landing!** This action ensures that the FES system is not operational.
9. Perform the following actions in the order described, to **start the electric motor**:
  1. Insert the "Connecting cable" in the front and rear FES battery pack before the flight. This connects the batteries in series.
  2. Switch the instrument's "Master switch" ON before the flight.
  3. Switch ON the FCU instrument before the flight. The instrument must be turned ON during the entire flight.
  4. Close and lock the canopy.
  5. Lift the red safety guard of the "Power switch" and turn it ON. The system becomes operational.
  6. Check that the propeller area is free of people or obstacles.
  7. Gently rotate the throttle knob clockwise -> the motor starts.
10. "Power switch" must be switched OFF before an air tow or winch launch, in order not to endanger the person attaching the towing rope to the glider!
11. Turn off the "Power switch" for aero-towing or winching!
12. Always **land with "Power switch" turned OFF.**

## 2.1 Important voltages and temperatures

You should know and memorize the following significant values before the first flight:

- first "Low voltage, reduce power" message appears at **95 V**
- second "Critical low voltage, stop FES motor" message appears at **90 V**



**Warning:** *Do not discharge the batteries below 90 V!*

- max. allowed motor and controller temperature is **90°C**, the first warning appears at 70°C
- max. allowed battery pack temperature is **55°C**, the first warning appears at 45°C
- level flight requires approximately 3000 RPM
- maximum motor RPM is 4700
- **propeller brake requires at least 1500 RPM to work.** Even without power, the windmilling provides enough RPM in flight for the brake to work.

## 2.2 Preflight Test Run



**Warning:** *Perform a short ground run with low RPM before the flight – as a part of a preflight inspection.*

Conduct a short motor run with low RPM, as part of a preflight inspection to check if the system works reliably and correctly by following the next steps:

1. Remove the tail dolly.
2. Close the canopy. The motor cannot start with an open canopy.
3. Make sure that nobody is around the propeller. Call "Clear prop!" loudly, before starting!
4. Check that the propeller brake works. It requires more than 1500RPM to activate.

For further details, please refer to the FES Flight manual, FES FCU instrument manual, FES GEN2 battery pack manual, and others available on our FES dedicated website at download section: <http://www.front-electric-sustainer.com/download.php>

### **3. Available FES manuals**

You can find a list of all available FES manuals in the FES system manual.

### **4. Technical data**

Check FES Maintenance manual, FES Flight manual, FES Motor manuals, FES propeller manuals etc. for detailed technical data.

### **5. FES drawings**

Check FES Maintenance manual, FES Flight manual, FES Motor manuals for technical drawings.

### **6. Maintenance**

Required maintenance is described in the FES maintenance manual.

### **7. Repair and service**

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

### **8. Revision history**

October 2016	The initial release of the quick guide, version 1.0
November 2016	Additional info about DATA connectors, version 1.1
October 2019	Minor updates, version 1.2
May 2020	Proofreading, version 1.3