ELECTRIC GLIDER LAB · EHELP GEN 2

eHelp

ELECTRIC ASSIST FOR HANG GLIDERS

Owner's & Builder's Manual

Android app · T-QT controller · eHelp harness power unit



EDITION 1.5 · APP 1.1.5 · FIRMWARE 1.1.4 · OCTOBER 2026 ELECTRICGLIDERLAB.COM

About this manual

This manual covers the eHelp electric assist system for hang gliders: the harness-mounted power unit, its T-QT controller and the eHelp Android app. Part A is for pilots: setting up, flying and caring for the system. Part B is for builders: wiring, firmware, the Bluetooth protocol and troubleshooting.

How to read it

YOU SEE	IT MEANS
3 blue badge	A numbered call-out on a screenshot. The list under the figure explains each number.
SAVE TO eHELP	A button or label exactly as it appears on screen.
R L	The right and left buttons on the T-QT controller.
Setup › Calibrate	A path through the app: the Setup page, then the Calibrate tab.
DANGER / WARNING / CAUTION / NOTICE	Safety messages, from most to least severe (see 1.2).

Versions

This is **Edition 1.5** of the manual, written for app 1.1.5 and eHelp firmware 1.1.4 (October 2026). The edition number is on the cover, at the foot of every page and in the file name (`eHelp_Manual_Ed1.5.pdf`), and goes up each time the manual is reissued. Screens are from an Android phone; numbers in the screenshots come from simulated data, so your readings will differ.

EDITION	APP / FIRMWARE	CHANGES
1.0	1.0.0 / 1.0.0	First issue.
1.1	1.1.0 / 1.1.0	Kill switch on a 4th throttle wire; motor temperature sensor with caution and cutoff; temperature sensor roles; SAVE CUTOFFS TO eHELP; ready-made app and firmware files.
1.2	1.1.1 / 1.1.0	The dashboard shows a MOTOR temperature only when a sensor has the Motor role; edition numbering.
1.3	1.1.2 / 1.1.0	One SAVE TO eHELP for the whole Setup area, with a warning when you leave Setup with unsaved changes; bench tests and demo data on a new Bench tab; ESC fan: one *Fan on at* setting (off a fixed 5 °C lower).
1.4	1.1.2 / 1.1.2	Throttle pots can be wired either way round, and the released end may sit at the very top or bottom of the range (cruise, motor test and storage no longer need it clear); pot pin-out; NO THROTTLE removed; wire-fault wording.
1.5	1.1.5 / 1.1.4	GPS moves to Settings: the phone GPS always runs and is the default, the vario's GPS is optional with automatic fallback; ESC temperature on

the dashboard; Sensor 3 row; fan also on at 25 % throttle and set in whole °F or °C; calibration wizard knows reversed pots.

WARNING

Experimental equipment. The eHelp is a home-built, uncertified power unit. Hang gliding and powered flight carry a risk of serious injury or death. You are the pilot in command and solely responsible for deciding whether the equipment, the weather and you are fit to fly. Read Part A completely before your first flight.

© 2026 Electric Glider Lab. The eHelp designs will be shared openly on GitHub. Product names (Hobbywing, MAD, LilyGO, Digifly, Android) belong to their owners.

Contents

PART A · FOR PILOTS

1 Welcome 8

1.1 What the system does 8

1.2 Safety first 8

2 System overview 10

2.1 The parts 10

2.2 What runs where 11

2.3 Specifications 11

3 Quick start 13

3.1 Install the app 13

3.2 Pair the eHelp 13

3.3 Tell it about your battery 13

3.4 Calibrate the throttle 13

3.5 Pre-flight checklist 14

3.6 Your first flight 14

4 The T-QT controller 15

4.1 Reading the screen 15

4.2 The two buttons 15

4.3 Status bar 16

4.4 The four pages 17

4.5 Starting battery storage from the T-QT 19

4.6 Storage progress and results 21

5 The dashboard 23

5.1 A tour of the dashboard 23

5.2 Link chips 24

5.3 Battery arc, run time and power 25

5.4 Throttle and cruise control 26

5.5 Available climb 27

5.6 Temperatures and the bottom row 27

5.7 Alerts 28

5.8 Closing the app 32

6 Data and flight logs 33

6.1 The Data screen 33

6.2 Automatic recording 34

6.3 Charts 34

6.4 Past flights 35
6.5 Sharing CSV and IGC files 35

7 Battery 37

7.1 The Battery tab 37
7.2 Battery settings 40
7.3 How the charge is measured 41
7.4 Storage discharge from the app 41
7.5 How storage discharge works 44

8 Calibration 46

8.1 Throttle calibration wizard 47
8.2 Gliders and available climb 49
8.3 How learning works 50
8.4 Power unit full-power curve 53

9 Bluetooth and vario 54

9.1 Pairing the eHelp 55
9.2 Connecting a vario 55

10 Settings 57

10.1 Pilot, units and alerts 57
10.2 Motor, ESC fan, sensors and display 60
10.3 GPS 63
10.4 The Bench tab: tests and demo data 64

11 Safety systems 66

11.1 What stops the motor 66
11.2 What Bluetooth can and cannot do 67

12 Care and maintenance 68

12.1 Before each flying day 68
12.2 After flying 68
12.3 Batteries 68
12.4 Updates 68

PART B · FOR BUILDERS

13 Hardware and wiring 70

13.1 Pin map 70
13.2 Fitting the T-QT 71
13.3 Throttle and kill switch 71
13.4 ESC setup 72
13.5 Temperature sensors and fan 72

14 Firmware 73
14.1 Build variants 73
14.2 Ready-made firmware (no compiling) 73
14.3 Flashing from source 74
14.4 Serial status line 74
14.5 Code map and tests 74
15 Building the app 76
16 Bluetooth protocol 77
16.1 Commands 77
17 Troubleshooting 79
18 Reference 81
18.1 Default settings 81
18.2 Glossary 81

PART A

For pilots

Setting up the eHelp, reading the controller and the app in flight, storing your batteries, and teaching the eHelp how your glider climbs.

CHAPTER 1

Welcome

The eHelp is an electric "self-launch helper" for hang gliders: a harness-mounted motor and propeller that gives you a powered climb off the hill or the flats, a boost to reach the next thermal, and a way home when the air dies. It is built from off-the-shelf parts around an ESP32 controller and talks to an Android app on your phone.

1.1 What the system does

- **Drives the motor safely.** A mouth throttle and a kill switch on its own wire feed the eHelp controller, which sends the ESC a clean, rate-checked throttle signal. A broken throttle wire, the kill switch OFF, an overheating pack or a crashed controller all bring the motor to zero.
- **Tells you what you have left.** Battery charge, run time at the power you are using, and *available climb* — how many feet the remaining energy can still lift you, learned from your own flights.
- **Works without the phone.** The small T-QT screen on the unit shows charge, power, pack and motor temperatures and available climb, and every safety cut-out lives on the eHelp itself.
- **Records every flight.** The app logs ten samples a second from the eHelp, your vario and GPS, and exports CSV and IGC files for analysis and flight-log software.
- **Looks after the batteries.** A storage-discharge mode runs the motor (prop on, harness tied down) to bring the packs down to a healthy storage voltage.

1.2 Safety first

Safety messages in this manual follow the ANSI Z535.6 style: the signal word tells you how serious the hazard is.

SIGNAL WORD	MEANING
DANGER	A hazard that *will* cause death or serious injury if not avoided.
WARNING	A hazard that *could* cause death or serious injury.
CAUTION	A hazard that could cause minor or moderate injury.
NOTICE	Risk of damage to the equipment, or information that matters but is not a hazard.



Spinning propeller. A propeller at power will cause severe injury or death. Never stand in line with or behind the propeller. Treat the motor as live whenever the battery is connected: switch the kill switch OFF and keep hands clear before touching the prop, the harness or the power unit.

WARNING

Lithium batteries. Damaged, over-discharged or overheated LiPo packs can catch fire. Never charge unattended, never use a puffed or damaged pack, store packs at storage voltage in a fire-safe container, and respect the eHelp’s temperature warnings.

WARNING

The motor can stop in flight. The eHelp cuts the motor by design if a pack or the motor reaches its temperature cutoff, if the throttle wire faults or the kill switch opens. The battery can also simply run out. Always fly as if the motor could stop at any moment: keep a landing option within glide.

WARNING

Storage discharge and the bench motor test run the motor without you on the throttle. Only start them with the propeller secured, the harness tied down so it can take full thrust, and the area behind and around the prop clear of people and loose items.

NOTICE

Available climb, run time and the learned curves are estimates. They depend on air, weight, prop and pack condition. IGC files from the app carry no security (G) record and are not valid for records or competitions.

CHAPTER 2

System overview

Four boxes work together. The eHelp controller is the boss: it owns the throttle and every safety cut-out. The phone is a big, friendly display, a flight recorder and the place where learning happens.

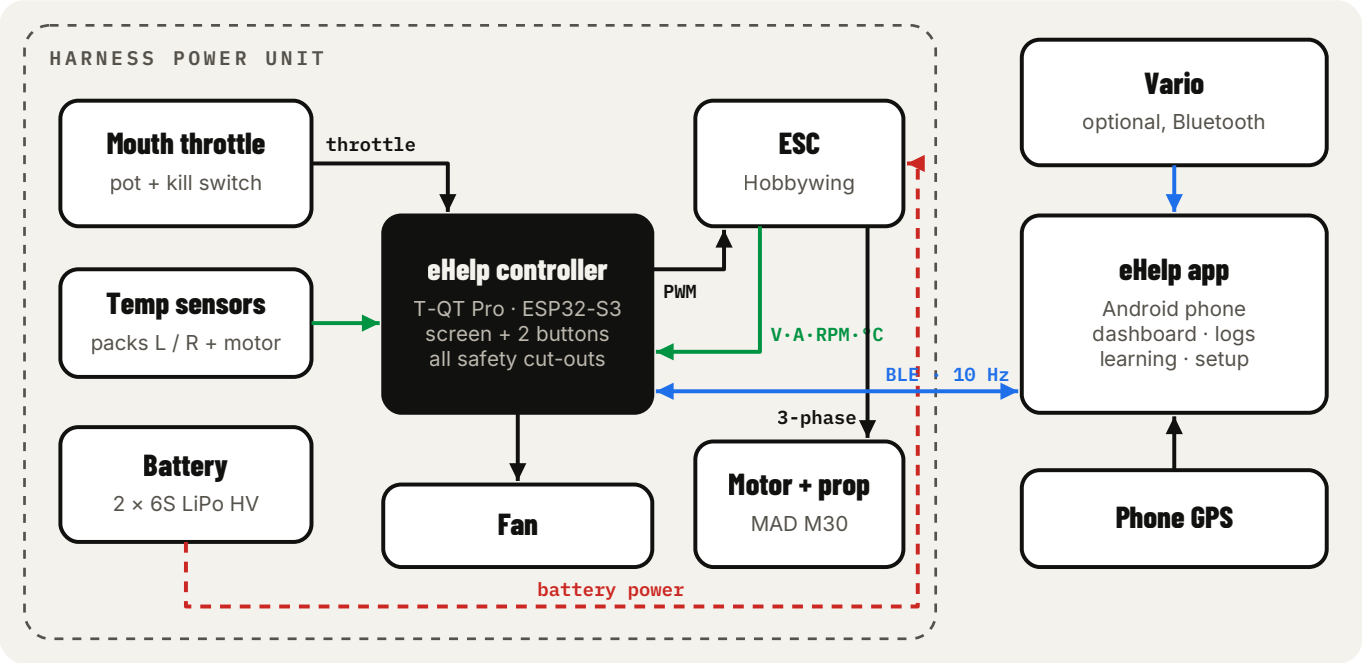


Figure 2.1 How the parts connect. The eHelp controller owns the throttle and every cut-out; the phone listens and configures.

2.1 The parts

PART	WHAT IT DOES
Mouth throttle	Spring-return potentiometer plus a kill switch on a separate (fourth) wire. Released = idle; switch OFF = motor off, whatever the pot does. A break in any of the four throttle wires also stops the motor.
eHelp controller	LilyGO T-QT Pro (ESP32-S3, 0.85" colour screen, two buttons) on the eHelp carrier board. Reads the throttle 100 times a second, drives the ESC, reads ESC telemetry and the pack and motor temperature sensors, runs the fan, and talks to the phone over Bluetooth LE.
ESC	Hobbywing Platinum-series HV speed controller. Its programming port sends voltage, current, RPM and temperatures back to the eHelp.
Motor + propeller	MAD M30, 100 KV (30 poles) — about 5,200 RPM on a full 12S HV pack.

Battery	Two 6S LiPo HV packs in series (12S, 52.2 V full, 42.0 V empty), 25 Ah each: 1,155 Wh. A DS18B20 temperature sensor sits on each pack (L and R).
Motor temp sensor (optional)	A third DS18B20 on the motor, wired onto the same three wires as the pack sensors. Shown between the pack temperatures and used for the motor temp cutoff.
Cooling fan	Switched by the eHelp from the ESC temperature.
eHelp app	Android app: live dashboard, flight logs (CSV + IGC), setup, calibration and learning.
Vario (optional)	Any Bluetooth vario that sends NMEA — for example a Digifly AIR BT. Adds barometric altitude, vertical speed and airspeed to the dashboard and the logs.

2.2 What runs where

Everything that can stop or start the motor lives on the eHelp, so it keeps working if the phone is switched off, dropped, or out of battery.

ON THE EHELP (WORKS WITHOUT THE PHONE)	ON THE PHONE
Throttle, kill switch, wire-fault and watchdog protection	Big dashboard, alerts and screen flash
Pack and motor over-temperature cut-outs	Cruise control (needs the app)
Battery charge (coulomb counting)	Flight recording, CSV + IGC export
Available-climb calculation from the saved glider curve	Learning the glider and power curves
Storage discharge started from the T-QT	Battery and throttle settings, the pack-temperature cut-out limit and the climb reserve (saved on the eHelp)
Fan control	Bench motor test, storage started from the app
All four T-QT pages	

2.3 Specifications

ITEM	VALUE
Pack	2 × 6S LiPo HV, 25 Ah each · 12S · 52.2 V full / 42.0 V empty · 1,155 Wh
Motor	MAD M30, 100 KV, 30 poles · ≈ 5,200 RPM at full pack voltage
Throttle signal to ESC	50 Hz PWM, 1,100 µs (0 %) to 1,940 µs (100 %) · 3 % dead band
Kill switch	Own wire to GPIO33; read every 10 ms, motor at 0 % in the same tick; power returns only after 50 ms ON and the throttle back at zero
Throttle sampling	100 Hz, median-of-5 + smoothing; wire faults act within one sample (10 ms)

Watchdog	Controller resets if its loop stalls for 2 s; the ESC sees no pulses and stops
Telemetry to phone	Bluetooth LE, 10 frames/s; available climb updated once a second
Controller	LilyGO T-QT Pro N8: ESP32-S3, 8 MB flash, 0.85" 128 × 128 LCD, 2 buttons
Temperature sensors	2 × DS18B20 on the packs + 1 optional on the motor, one 1-Wire bus, read once a second, plug-and-play
Glider profiles	4 stored on the eHelp, each with a saved and a previous (undo) curve
Phone	Android with Bluetooth LE (tested on Android 14)
Flight log	10 Hz SQLite on the phone · CSV (eHelp, vario and GPS channels) + IGC export

CHAPTER 3

Quick start

From a new phone to your first flight in six steps. Each step has its own chapter later for the details.

3.1 Install the app

1. Install the eHelp APK (`eHelp-app-1.1.5.apk` from the release files, 14.2) on your Android phone: allow installs from your file manager or browser when Android asks.
2. Open the app and allow **Bluetooth**, **Location** (for the phone GPS, and for Bluetooth scanning on older Android versions) and **Notifications**.
3. When asked, let the app ignore battery optimisation. The app keeps running in the background with a small hang-glider notification so it never stops recording mid-flight. Back does not close it; close it with the power button on the dashboard (5.8).

3.2 Pair the eHelp

1. Connect a battery to the ESC. The eHelp powers up, shows the Battery page and advertises as `eHelp-XXXX`.
2. In the app swipe to **Setup › Bluetooth**, scan, and tap your `eHelp-XXXX`.
3. The eHELP chip on the dashboard turns green when data is flowing; the ESC chip turns green when the ESC is reporting.

3.3 Tell it about your battery

In **Setup › Battery** pick the chemistry, packs in series, cells per pack and capacity (the factory default is 16,000 mAh, so enter your own packs, e.g. 25,000), then tap `SAVE TO eHELP`. If you just charged the packs, tap `SEND` next to *Battery just charged*.

3.4 Calibrate the throttle

In **Setup › Calibrate** tap `CALIBRATE` and follow the wizard (chapter 8): throttle closed, throttle full, sweep check and kill-switch test. The motor is held at 0 % for the whole wizard.

3.5 Pre-flight checklist

✓	CHECK
☐	Packs charged; app shows a sensible charge (tap *Battery just charged* after charging).
☐	Propeller, mount and harness hardware inspected; no cracks, nicks or loose bolts.
☐	Kill switch OFF → T-QT shows **KILL SW OFF** and the app's THR chip reads **KILL OFF**; kill switch ON → **ARMED** and THR follows the throttle.
☐	eHELP and ESC chips green; pack temperatures read on both packs (and the motor, if a motor sensor is fitted).
☐	Correct glider selected in Setup › Calibrate (available climb uses its curve).
☐	Short throttle run-up with the area behind you clear: smooth, no vibration.
☐	Phone mounted, screen on, app open on the dashboard.

3.6 Your first flight

Recording starts automatically after 5 seconds of motor or ground speed (over 5 mph) and stops after 60 seconds at rest. The app records how your glider climbs during the full-power takeoff; after landing it proposes a curve in Setup › Calibrate. Nothing changes on the eHelp until you tap `SAVE TO eHELP`.

> **TIP**
> For the best learning, take off at full throttle and keep it there in a straight line until you are at least 300 ft above launch.

CHAPTER 4

The T-QT controller

The small colour screen on the power unit is the eHelp's own display. It works with or without the phone, shows one big number per page, and tells you at a glance whether the motor is live.

4.1 Reading the screen

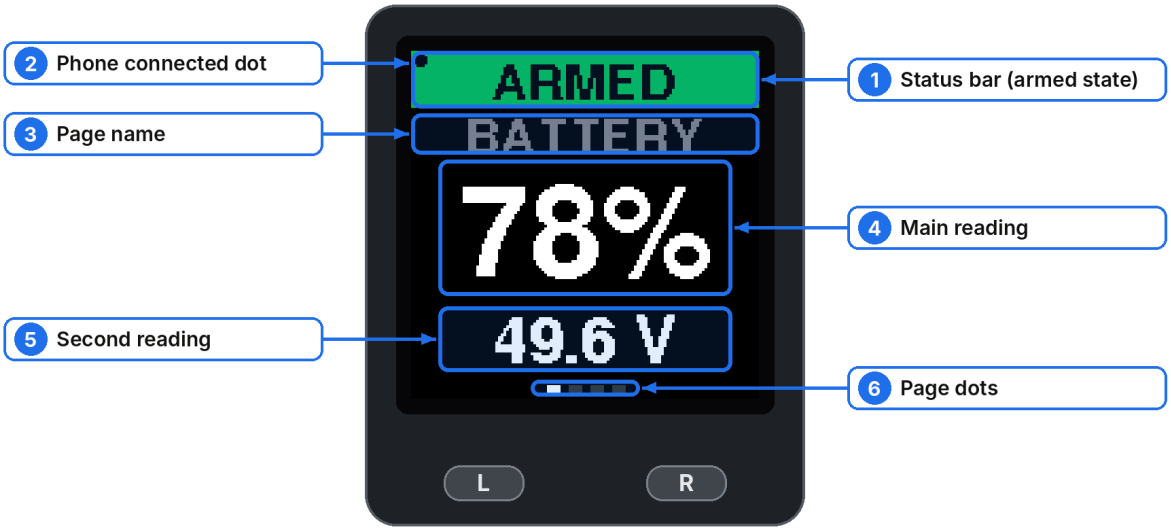


Figure 4.1 The T-QT on its Climb page. Every flight page has the same layout.

1. **Status bar.** Colour and word show the throttle state: green ARMED means the motor follows your throttle. See the table in 4.3.
2. **Phone dot.** A small dot in the top-left corner while the app is connected over Bluetooth.
3. **Page name.** BATTERY, POWER kW, PACK °F/°C or CLIMB ft/m.
4. **Main reading.** The one number that page is about, as large as the screen allows.
5. **Second reading.** Supporting detail: pack volts, throttle, ESC temperature or the climb mode.
6. **Page dots.** Four dots; the white one is the page you are on.

4.2 The two buttons

The buttons sit below the screen. L and R are as mounted on the carrier, with the USB-C socket toward the throttle plug. A short press acts when you let go; a long press acts while you are still holding.

BUTTON	SHORT PRESS	LONG PRESS
L		

	Next page On the storage steps: **NO** / cancel	1 s: back to the Battery page On the storage steps: cancel
R	Previous page On the storage steps: **YES**	1.5 s: **disarm**, or arm again (refused while PACK HOT) 3 s on storage step 3: **start**
L + R	Press both together: open the battery storage start (4.5), or leave it	
Any button	While a storage discharge or the bench motor test is running: **stops it at once**, on the press	

> TIP
> Disarming with a long R is the quickest way to make the motor safe on the ground without unplugging anything. Arm again with another long R; the motor only responds after the throttle has been back at zero.

4.3 Status bar

When more than one state applies, the bar shows the most important one, in the order of this table.

BAR	WHAT IT MEANS AND WHAT TO DO
PACK HOT	**A pack reached the temperature warning.** The eHelp holds the motor at 0 % whatever the throttle, cruise or a test asks for, disarms and jumps to the temperature page. Land. Power returns once the hotter pack is 3 °C below the limit and the throttle is back at zero (if the eHelp was armed when it cut; otherwise arm with a long R).
MOTOR HOT	**The motor sensor reached the motor temp cutoff.** Same as PACK HOT: the motor is held at 0 %, the eHelp disarms and shows the temperatures. Land. Power returns 3 °C below the cutoff, with the throttle back at zero.
KILL SW OFF	**Kill switch OFF**, or a break in the kill-switch wire or the throttle's ground wire. The motor is held at 0 % whatever the throttle does. Turn the switch ON; the motor responds once the throttle has been back at zero.
MOTOR TEST	The bench motor test is driving the motor (10.4). Any button stops it.
THR CAL	The throttle calibration wizard is running. The motor is held at 0 % while you move the throttle.
POT FAULT	**Throttle wire fault.** The throttle reads at its full-power end, which a broken ground wire would cause. Output was cut within 10 ms and stays at zero until the throttle is back at zero. Check the throttle cable and plug.
CRUISE	Cruise control is holding the throttle (5.4).
DISARMED	Output is off. Hold R 1.5 s to arm.

NO ESC	No data from the ESC for over a second. Battery readings show dashes. Normal for a moment after plugging in (the ESC only talks once it has armed); otherwise check the telemetry lead to the ESC programming port.
THR TO 0	Armed, but waiting for the throttle to return to zero before the motor will respond (after arming, a fault, a cut-out or calibration).
ARMED	Normal flight state. The motor follows your throttle. (ARMED SIM on simulator firmware.)

> **NOTE**
> The eHelp cannot tell the kill switch OFF from a broken kill or ground wire: both show KILL SW OFF and both keep the motor stopped. If the bar stays on KILL SW OFF with the switch ON, check the throttle cable.

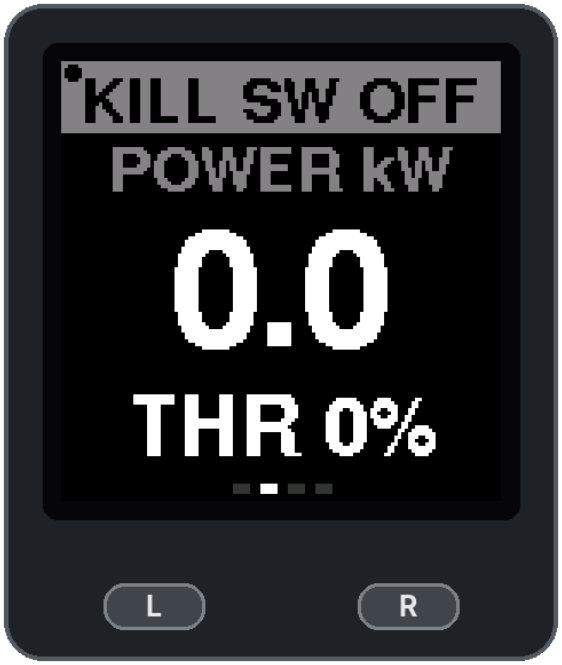
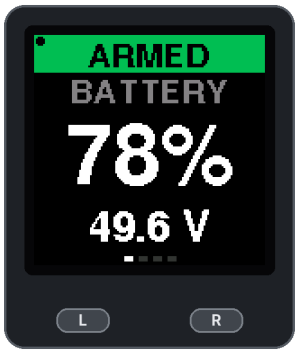


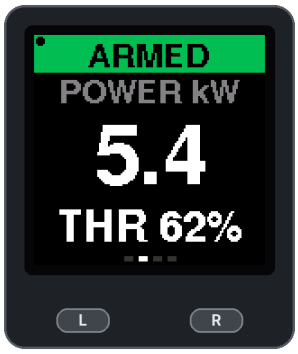
Figure 4.2 Kill switch OFF: the Power page shows THR 0 % whatever the throttle does.

4.4 The four pages

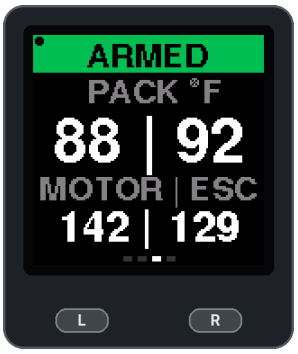
Press L to step forward through the pages and R to step back. Readings are lightly smoothed for reading (kW over 3 s, volts over 2 s, pack and motor temperatures over 5 s); the safety logic always uses the raw values.



Battery: charge % and pack volts



Power: kW and throttle output



Pack L / R, then motor / ESC



Climb: available climb

PAGE	BIG NUMBER	BELOW IT	COLOURS
BATTERY	State of charge, %	Pack voltage	Amber under 25 %, red under 15 %. Dashes in grey with no ESC data.
POWER kW	Electrical power, kW	THR — throttle sent to the ESC	—
PACK °F / °C	Left | right pack temperature	ESC temperature, or MOTOR | ESC when a motor sensor is fitted	Packs orange within 7 °C of the pack cutoff, red at it. Motor orange within 10 °C of the motor cutoff, red at it. ESC amber at 80 °C, red at 95 °C. A missing sensor shows --.
CLIMB ft / m	Available climb	AT FULL PWR (motor off) or AT THIS THR (motor on)	Grey while the curve is provisional (not yet learned).

Units follow the app: °F switches the T-QT to °F and feet, °C to °C and metres.



Provisional curve: grey



Motor running: at this throttle



PACK HOT jumps to the temperatures



With a motor sensor: MOTOR / ESC below the packs



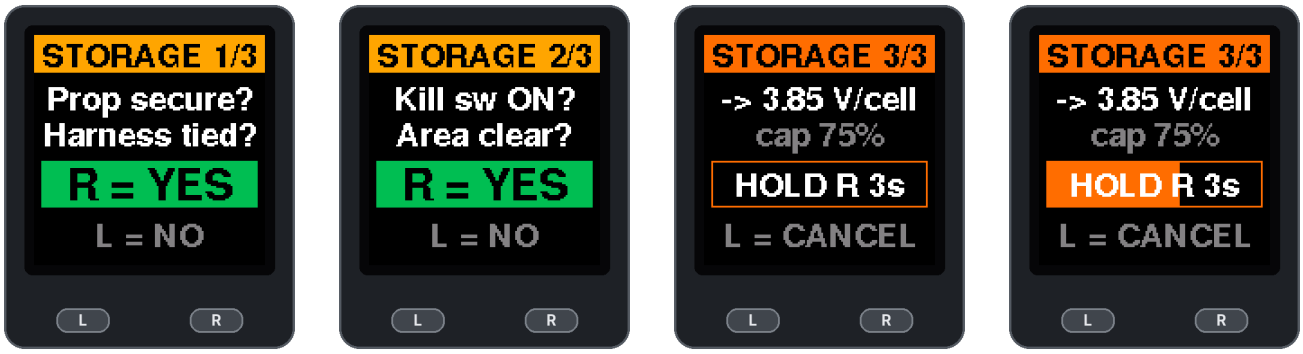
MOTOR HOT: the motor is at its cutoff

4.5 Starting battery storage from the T-QT

You can bring the packs down to storage voltage with no phone at all. The eHelp runs the motor, so the propeller must be fitted and the harness tied down to take full thrust. Chapter 7 explains what the discharge does.

> **WARNING**
>
> **The motor runs without you on the throttle.** Secure the harness so it cannot move under full thrust, and keep everyone clear of the propeller disc and the area behind it for the whole run.

1. Press L and R together. Step 1 asks *Prop secure? Harness tied?* Press R for yes.
2. Step 2 asks *Kill sw ON? Area clear?* Switch the kill switch ON and press R for yes.
3. Step 3 shows the target voltage per cell and the power cap. Hold R for 3 seconds: the bar fills, and the discharge starts when it is full.



1 / 3 safety question | 2 / 3 safety question | 3 / 3 hold R for 3 s | Hold in progress

L, a long L or both buttons cancel at any step. The target and power cap are the last ones you used in the app; if storage has never been run from the app, the eHelp uses the chemistry default (LiPo HV 3.85, LiPo 3.80, Li-ion 3.70 V per cell) at 75 % power.

If something is not right, the eHelp refuses with **NOT READY** and the reason:

REASON	FIX
KILL SW OFF	Switch the kill switch ON.
NO ESC DATA	No ESC telemetry: check the battery is connected and the ESC has armed.
MOTOR ON	Let go of the throttle and wait for the motor to stop.
AT STORAGE V	The pack is already at the target (within 0.02 V per cell) or below it. Nothing to do.
PACK HOT	Let the packs cool.
POT FAULT	Fix the throttle wiring.
BUSY	Cruise, the motor test or throttle calibration is running.

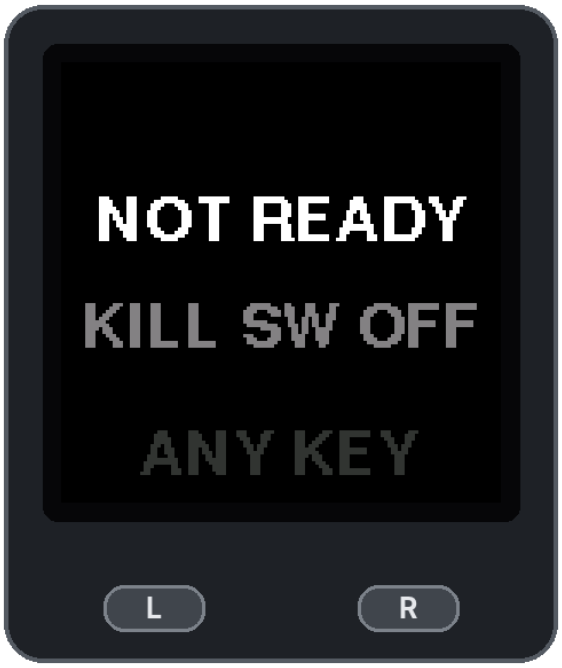


Figure 4.3 Refused: the reason is on the second line. Any key returns to the pages.

4.6 Storage progress and results

While it runs, the status bar names the phase and the screen shows the predicted resting voltage per cell, the target, a progress bar and the throttle. **Any button stops it.**



PROBING: measures pack resistance



STORAGE: discharging



REST CHECK: motor off 15 s



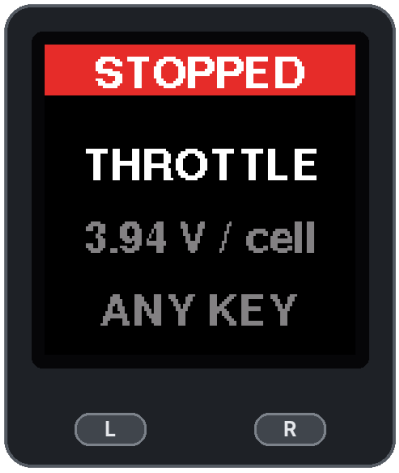
SETTLING: final 30 s rest



App start: press R (OK) within 30 s



DONE: rested voltage per cell



STOPPED: and why

When it finishes, DONE shows the measured resting voltage per cell in green. If it stops early, STOPPED shows the reason: BUTTON, APP TOUCH, PHONE LOST, THROTTLE, KILL SWITCH, NO ESC DATA, TOO HOT, TIME LIMIT, NO OK or NOT READY. Press any key to return to the pages.

CHAPTER 5

The dashboard

The app has three screens side by side: **Dashboard**, **Data** and **Setup**. Swipe left and right to move between them; the dots at the bottom show where you are. The dashboard is the one you fly with.

5.1 A tour of the dashboard

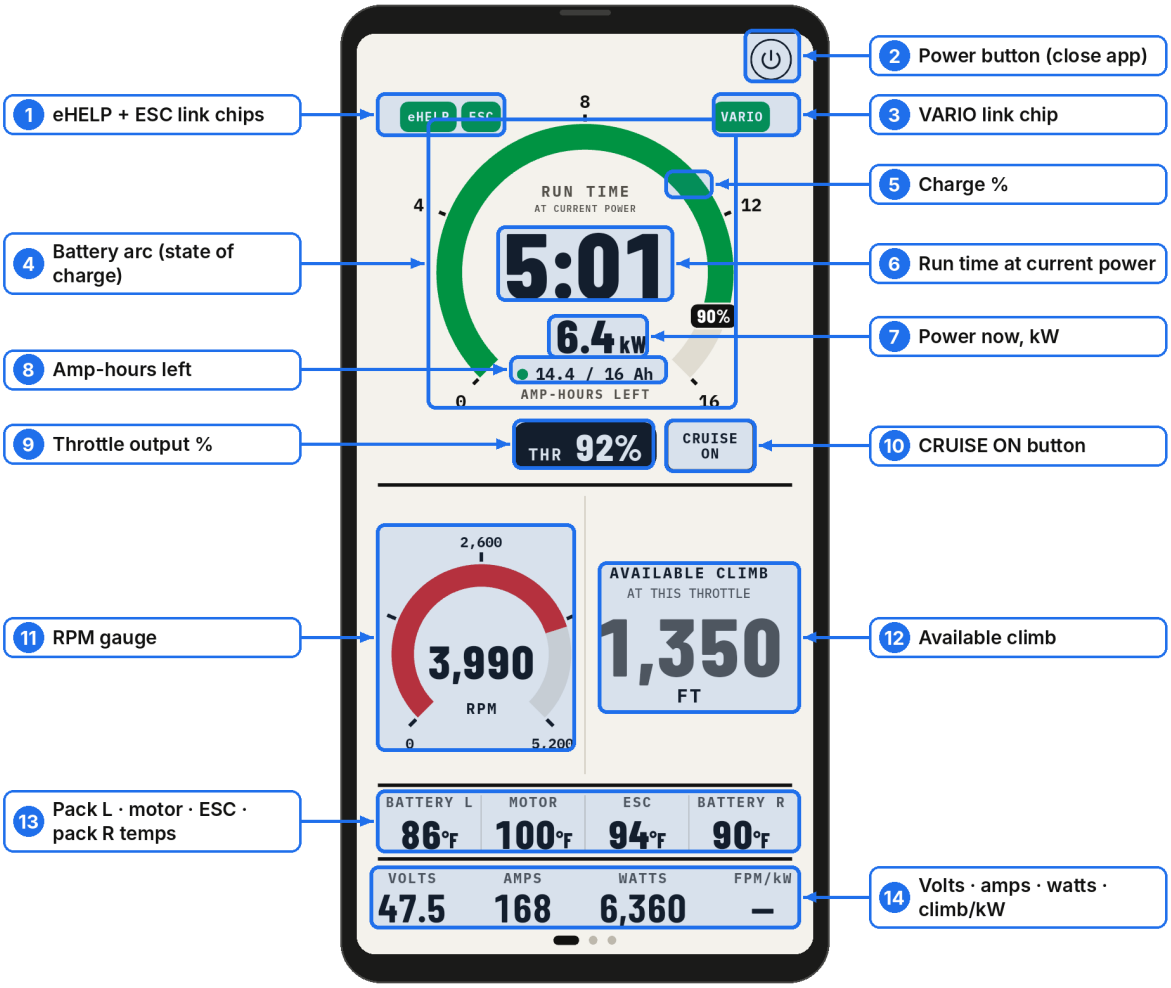


Figure 5.1 The dashboard during a powered climb.

1. **eHELP and ESC chips.** Green = connected with data; grey = not paired, connecting or no data (5.2).
2. **Power button.** The only way to close the app. It asks first and saves the flight.
3. **VARIO chip.** The Bluetooth vario's link, same colours.
4. **Battery arc.** Fills with the state of charge, scaled in amp-hours. Green, then amber and red as the pack gets low.

5. **Charge %.** State of charge from the eHelp's coulomb counter.
6. **Run time.** Minutes:seconds left at the power you are using now, averaged over 20 s.
7. **Power now.** Electrical power in kW, smoothed over 3 s.
8. **Amp-hours left** out of the pack capacity.
9. **THR.** The throttle the eHelp is actually sending to the ESC.
10. **CRUISE ON.** Holds the present throttle (5.4).
11. **RPM.** Motor speed from the ESC; the scale ends at the motor's full-voltage RPM.
12. **Available climb.** How much height the remaining charge can still buy (5.5).
13. **Temperatures**: pack L, motor (if a motor sensor is fitted) and pack R.
14. **Bottom row.** Volts, amps, watts and climb per kW.

5.2 Link chips

The chips at the top tell you what the app is hearing from. The eHELP and ESC chips sit on the left; VARIO is on the right.

CHIP	GREEN	GREY
eHELP	Telemetry arriving	Not paired, connecting, no data, or Bluetooth off
ESC	ESC data reaching the eHelp	No ESC data (battery and RPM readings are not live)
VARIO	Vario sentences arriving	Not paired, connecting, or no sentences

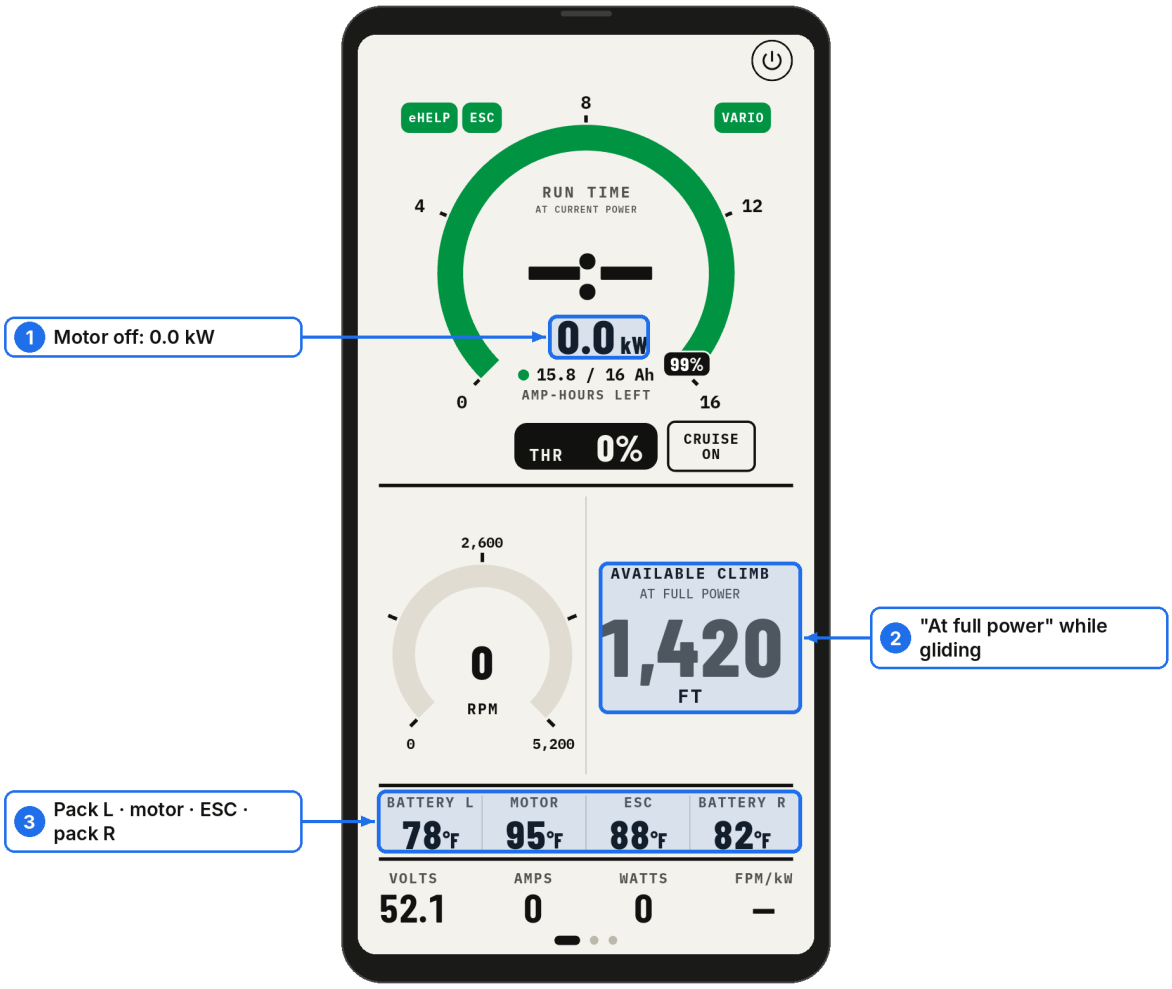


Figure 5.2 Gliding with the motor off.

1. Motor off: 0.0 kW, and the run time shows —:— (there is no power to divide by).
2. With the motor off, available climb is shown *at full power*: what you would get if you opened the throttle now.
3. Pack L, motor and pack R temperatures, all cool (MOTOR shows only when a motor sensor is assigned, 5.6).

If no vario is paired, the VARIO chip is grey; the dashboard still works from the eHelp and the phone GPS.

5.3 Battery arc, run time and power

The arc is the pack. Its scale runs from 0 to the pack capacity in amp-hours, with the charge % in the black tag at the end of the arc. The arc turns **amber** at the low-battery warning and **red** at 60 % of it (15 % with the default 25 %).

Run time divides the energy left by the power you are using, averaged over the last 20 seconds so that brief throttle changes do not make it jump. The average restarts once the motor has been off for 2 seconds, so a new climb is not mixed with the glide before it. With the motor off the run time shows —:—.

5.4 Throttle and cruise control

THR shows the throttle percentage the eHelp is sending to the ESC, after the dead band and smoothing. With the kill switch OFF the chip turns grey and reads **KILL OFF**.

Cruise lets you let go of the mouth throttle on a long climb. Set the power you want, tap `CRUISE ON`, then release the throttle. The eHelp keeps sending that throttle and the button turns red.



Figure 5.3 Cruise holding 55 %.

1. The held throttle.
2. The red CRUISE button shows cruise is holding. Tap anywhere on the screen to cancel.

The app can only ask the eHelp to "hold now" or "cancel"; it can never set a throttle level. Cruise needs at least 10 % throttle, and the eHelp cancels it, returning the motor to your mouth throttle, when:

- you touch the throttle again after letting go (more than 5 %), or push 5 % past the held level;
- the kill switch opens;
- you touch the phone screen anywhere;
- Bluetooth to the phone drops;
- a throttle wire fault, a disarm or a PACK HOT cut-out happens.

5.5 Available climb

Available climb answers the question "if I keep climbing, how much higher can this battery take me?" It is worked out on the eHelp, once a second, from the selected glider's learned climb curve, the power unit's full-power curve and the battery:

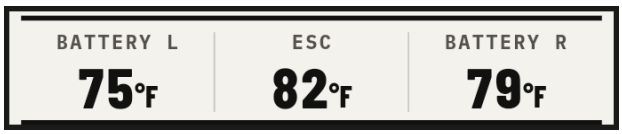
- The eHelp steps the pack down from the present charge to your low-battery reserve in 1 % slices.
- For each slice it works out the pack voltage, the power the motor can make at that voltage, the climb rate that power gives your glider, and how long the slice lasts.
- It adds up the height, stopping if the climb rate reaches zero.

With the motor **off** it assumes full power ("AT FULL POWER"). With the motor **on** it uses the power you are using, averaged over 10 seconds ("AT THIS THROTTLE"). It shows to the nearest 10 ft. Until the glider has been learned the number is shown **grey**: it comes from conservative starting values, not from your flights. Chapter 8 explains learning.

> **NOTICE**
>
> Available climb is an estimate in still air. Lift, sink, weight and a tired pack change it. Treat it as a guide, never a guarantee of reaching a field or a ridge.

5.6 Temperatures and the bottom row

The temperature row has the two packs at the outside and the ESC in the middle: **BATTERY L · ESC · BATTERY R**. As soon as a sensor has the Motor role (Settings › Temperature sensors), **MOTOR** joins the ESC in the middle: **BATTERY L · MOTOR · ESC · BATTERY R**.



No motor sensor: packs and ESC



Motor sensor assigned: MOTOR and ESC in the middle

Readings are smoothed over 5 seconds so they do not flicker. The pack readings turn orange at the *pack temp caution* and red at the *pack temp cutoff*; the motor reading uses the *motor temp caution* and *cutoff* (Settings, chapter 10); the ESC turns orange at 80 °C and red at 95 °C, like the T-QT, and shows a dash without ESC data. A sensor that stops reading shows a dash; if the motor sensor drops out in flight, MOTOR stays on the screen showing a dash until you reconnect.

FIELD	WHAT IT SHOWS	SMOOTHING
VOLTS	Pack voltage	2 s, reset when the motor starts or stops
AMPS	Pack current	1 s, reset when the motor starts or stops
WATTS	Electrical power (same as the kW in the arc)	3 s
FPM/kW	Climb per kilowatt, from the vario: how efficiently power becomes height	Ratio of 10 s averages; a dash unless power is over 1 kW and steady

5.7 Alerts

Alerts use colour and a flashing banner (and, for pack or motor temperature, a flashing red screen border), never sound or vibration, so they are easy to see in sunlight and do not compete with your vario.

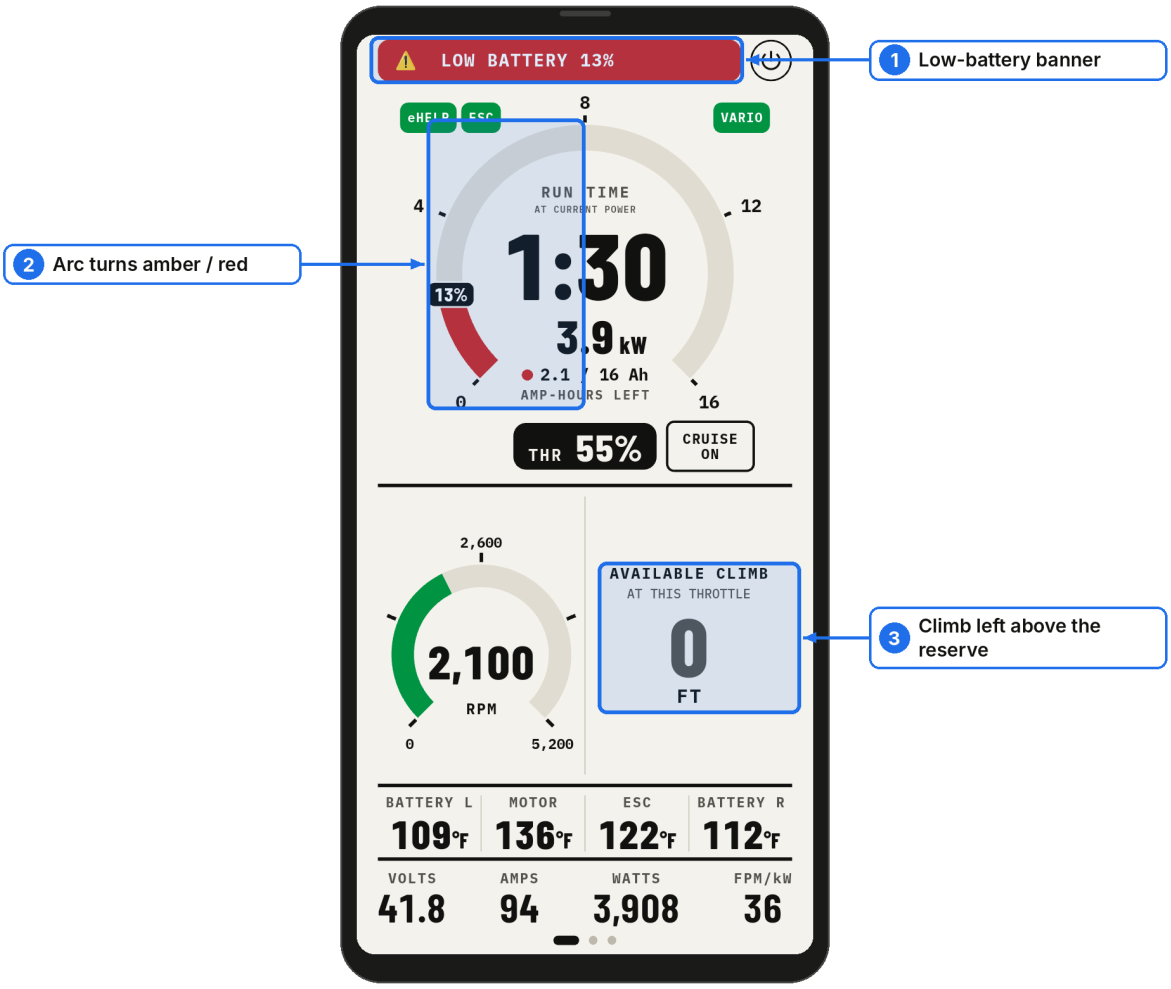


Figure 5.4 Low battery warning.

1. The low-battery banner.
2. The arc turns amber, then red.
3. Available climb counts only the charge above your reserve.



Figure 5.5 Pack temp cutoff: the eHelp has cut the motor.

1. Red banner: *PACK ... MOTOR CUT*.
2. The screen border flashes red.
3. Throttle output forced to 0 % by the eHelp.
4. Pack temperatures (smoothed over 5 s for display; the cut-out uses the raw readings).

ALERT	WHEN	WHAT YOU SEE
Low battery	Charge falls below the low-battery % (default 25 %); clears 2 % above it	Banner, amber arc (red below 60 % of the setting). Available climb counts down to this reserve.
Pack temp caution	Hotter pack at the caution temperature (default 48 °C / 118 °F)	Pack temperatures orange
Pack temp cutoff	Hotter pack at the pack temp cutoff (default 55 °C / 131 °F): the eHelp cuts the motor at once	Red banner *PACK ... — MOTOR CUT*, red flashing border, THR forced to 0 %. (If the eHelp has not cut, for example on older firmware, the app shows *PACK TEMP ... — REDUCE POWER* after 2 s at the limit.)
Motor temp caution		Motor temperature orange

	Motor sensor at the motor caution (default 80 °C / 176 °F)	
Motor temp cutoff	Motor sensor at the motor temp cutoff (default 100 °C / 212 °F): the eHelp cuts the motor at once	Red banner *MOTOR … — MOTOR CUT*, red flashing border, THR forced to 0 %; T-QT **MOTOR HOT**. (If the eHelp has not cut, the app shows *MOTOR TEMP … — REDUCE POWER* after 2 s at the limit.)



Figure 5.6 Motor at its temp cutoff (demo data): banner, flashing border and the motor reading in red.

1. Banner with the motor temperature. It reads *MOTOR … — MOTOR CUT* once the eHelp has cut the motor.
2. The screen border flashes red.
3. The motor reading turns red at the cutoff (orange at the caution).

The pack and motor temperature cut-outs happen on the eHelp itself, instantly, whether or not the phone is connected (see 11.1).

5.8 Closing the app

The app keeps running in the background with a hang-glider icon in the notification bar, so Android cannot stop it in the middle of a flight. The Back button does not close it. To close it, tap the **power button** at the top right of the dashboard and confirm; any flight being recorded is saved first. (Swiping the app away in Android’s recent-apps view also closes it; Android does not let an app prevent that.)

CHAPTER 6

Data and flight logs

Every flight is recorded on the phone ten times a second: the eHelp, the vario and GPS together on one clock. The Data screen charts any channel live or from a past flight, and exports CSV and IGC files.

6.1 The Data screen

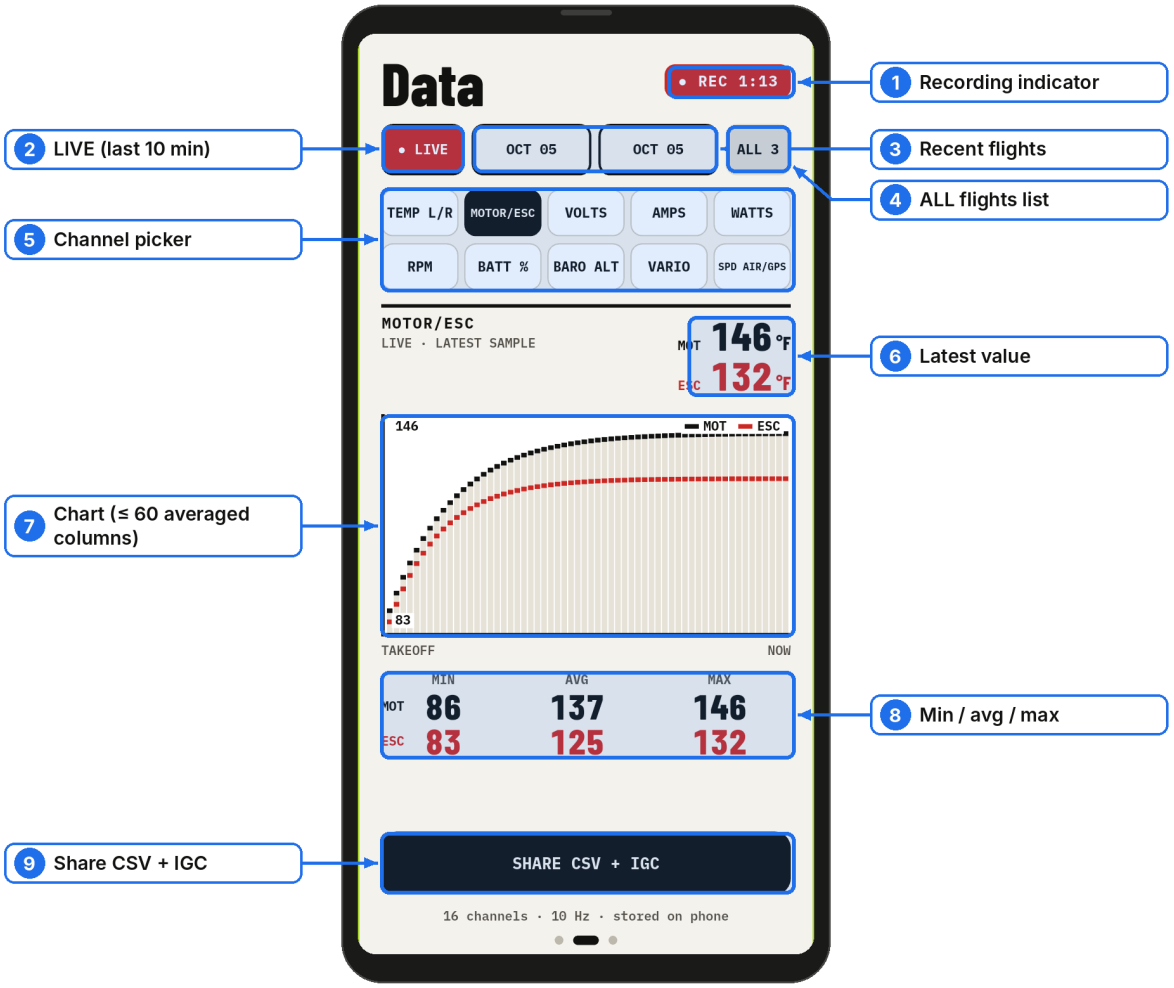


Figure 6.1 Data screen during a recorded flight.

1. **REC** and the flight time while a flight is being recorded.
2. **LIVE**: the last 10 minutes, updating.
3. **Recent flights** by date. Tap one to chart it.
4. **ALL** opens the full list of stored flights, with the count.
5. **Channel picker**: pack temperatures, motor/ESC temperature, volts, amps, watts, RPM, battery %, baro altitude, vario, and air/GPS speed.

6. **Latest value** (live) or last value (a past flight).
7. **Chart** from takeoff (or 10 minutes ago) to now, with up to 60 averaged columns.
8. **Min, average and max** over the period shown.
9. **SHARE CSV + IGC** sends both files for the flight shown.

6.2 Automatic recording

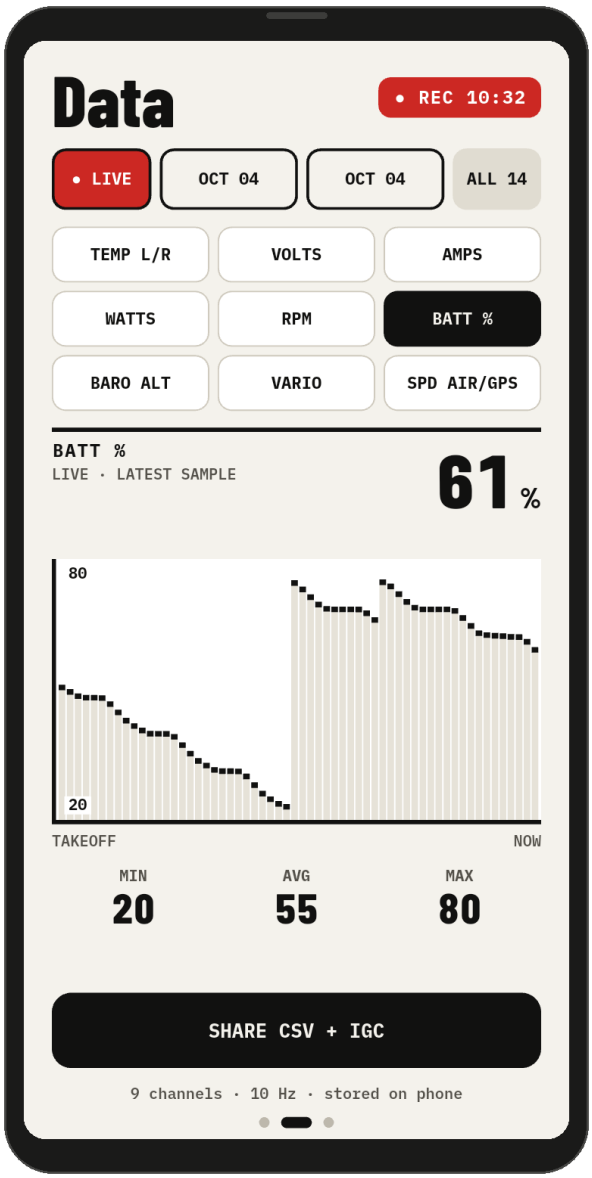
You never need to start or stop a recording. A flight starts after the motor has been running, or the ground speed has been over 5 mph, for 5 seconds. It stops after 60 seconds at rest. The phone keeps recording with the screen off.

SOURCE	RECORDED
eHelp	Volts, amps, watts, RPM, throttle sent to the ESC, charge %, pack L/R temperatures, motor temperature, ESC temperature
Vario	Barometric altitude, pressure altitude, vertical speed, airspeed, wind, vario GPS, vario battery
GPS	Latitude, longitude, GPS altitude, ground speed, heading, from the GPS in use (phone, or the vario when chosen in Settings › GPS)

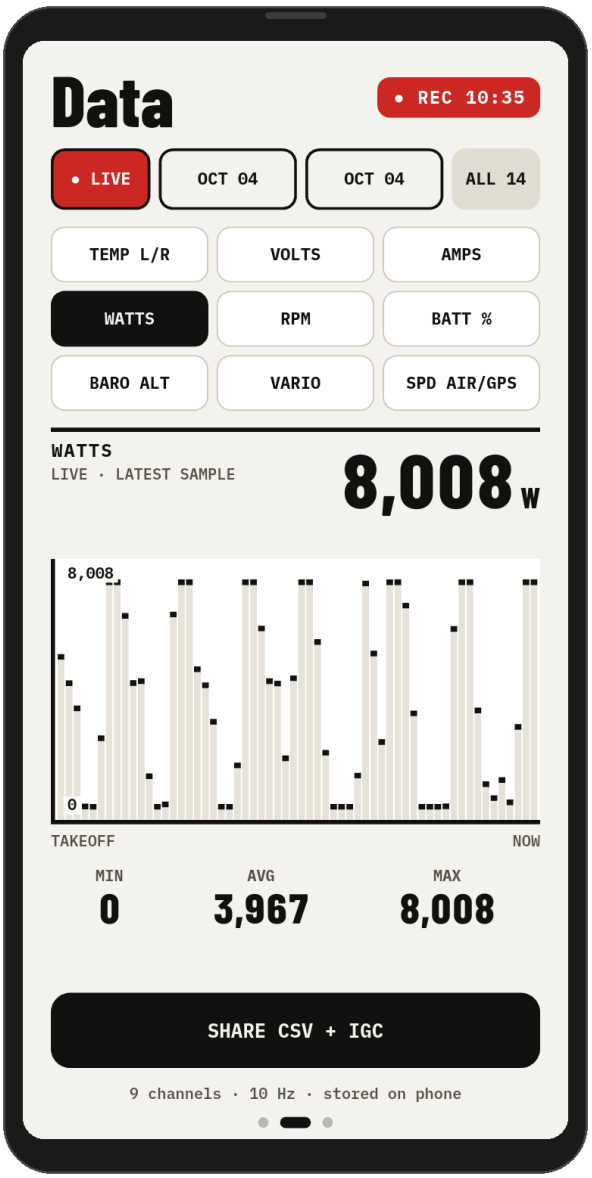
The vario updates as often as it sends; between its sentences the 10 Hz log repeats the last value.

6.3 Charts

Pick a channel to chart it. Each column is the average of its slice of the flight, so a one-hour flight still reads clearly. The raw 10 Hz samples are kept in the export.



Battery % over a flight



Watts: climbs and glides

6.4 Past flights

Tap a date chip to open a recent flight, or `ALL` for the full list. **Press and hold** a flight in the list to delete it; the app asks first. Flights stay on the phone until you delete them.

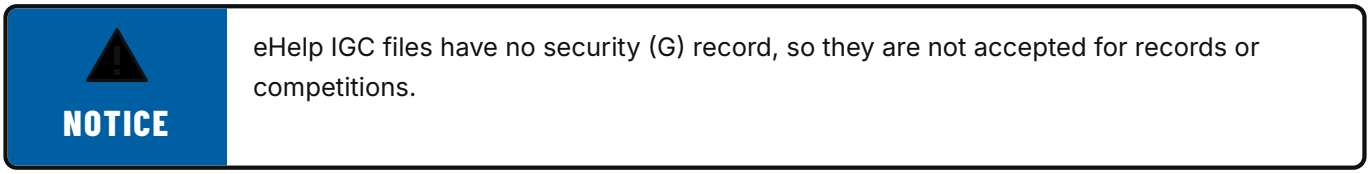
6.5 Sharing CSV and IGC files

`SHARE CSV + IGC` opens Android's share sheet with both files for the flight on screen: e-mail them, save them to Drive, or open them in another app.

CSV has the eHelp, vario and GPS channels at 10 Hz, one row per sample, for a spreadsheet or your own analysis.

IGC is the standard flight-log format read by SeeYou, XCSoar, XCTrack, Ayvri and online logbooks. It needs GPS positions, from the phone or the vario.

IGC RECORD	CONTENTS
Header (H)	Date, pilot (Setup › Settings › Pilot name (IGC)), glider (the selected glider), app and firmware versions
Fixes (B)	Once a second: position, pressure altitude (QNE from the vario) and GPS altitude
Fix extras (I)	`FXA` fix accuracy (999, not known) · `RPM` motor RPM · `CUR` amps · `VOL` pack volts ×10 · `LEB` battery % · `MOT` hottest pack °C — so tools that understand motor gliders can show engine use
Every 5 s (K)	Pack L and R temperatures, ESC temperature, watts, throttle and motor temperature



eHelp IGC files have no security (G) record, so they are not accepted for records or competitions.

CHAPTER 7

Battery

Setup › Battery is where you tell the eHelp about your packs, reset the charge after charging, and run the storage discharge. Swipe to the Setup screen and pick the BATTERY tab.

7.1 The Battery tab

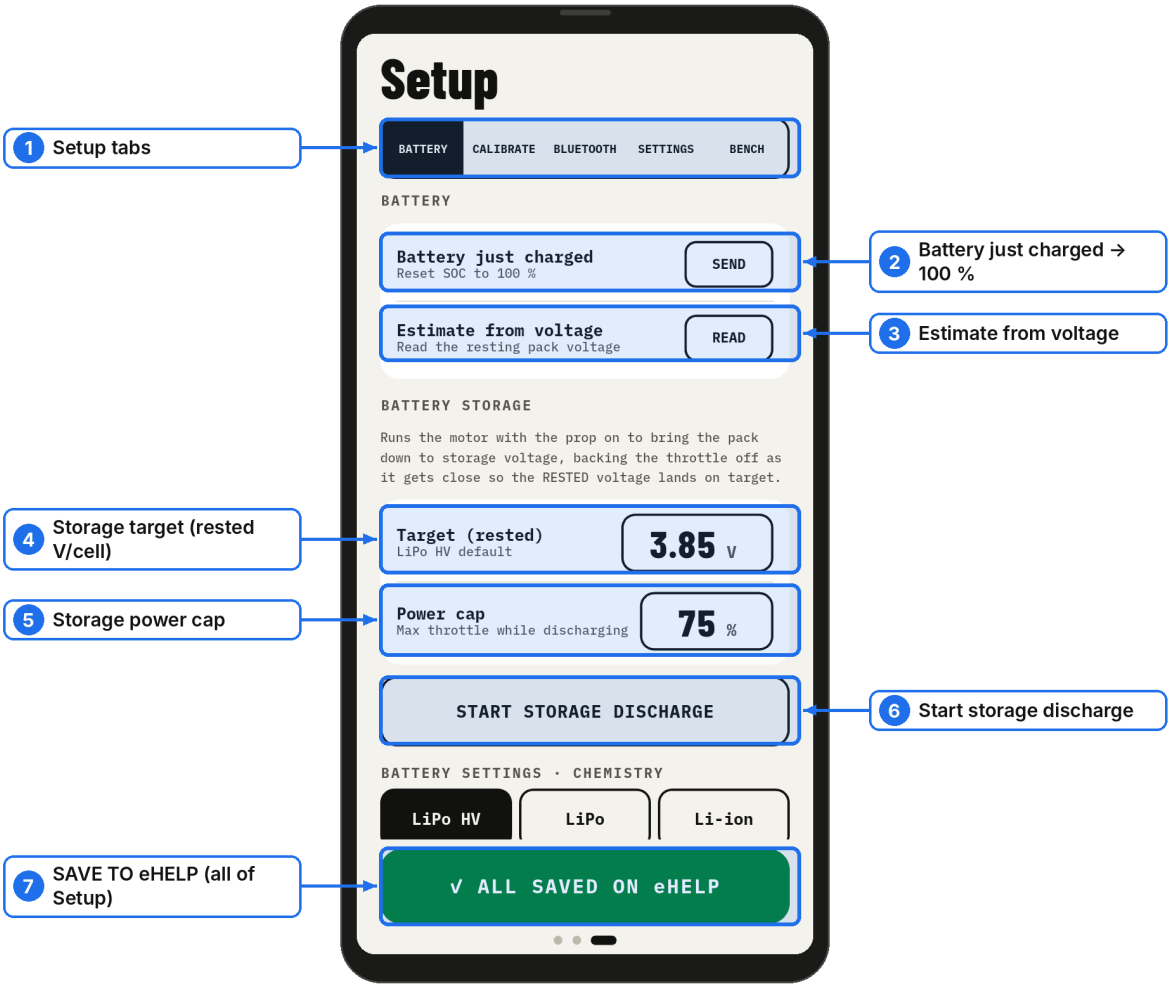


Figure 7.1 Setup › Battery: charge, storage and pack settings.

1. **Setup tabs**: Battery, Calibrate, Bluetooth, Settings, Bench.
2. **Battery just charged**: sets the charge to 100 %.
3. **Estimate from voltage**: sets the charge from the resting pack voltage.
4. **Storage target**: the resting voltage per cell to discharge to.
5. **Power cap**: the most throttle storage discharge may use.

6 `START STORAGE DISCHARGE` (7.4). It reads CONNECT eHELP FOR STORAGE until the eHelp is connected.

7 **SAVE TO eHELP**: one button for everything in Setup that lives on the eHelp (below).

One save for the whole Setup area

Everything you change in Setup is changed on the phone first. Nothing that the eHelp stores is sent until you tap `SAVE TO eHELP` at the bottom of the Battery and Settings tabs, and that one button writes all of it:

- battery chemistry, packs, cells and capacity (Battery tab);
- motor KV and poles, and the ESC fan temperature (Settings);
- the pack and motor temp cutoffs and the low-battery reserve (Settings);
- the °F / °C choice for the T-QT screen (Settings).

The button shows where you stand: `SAVE TO eHELP` with a count of the changes not yet on the eHelp, ✓ *ALL SAVED ON eHELP* in green when the eHelp has everything, and *CONNECT eHELP TO SAVE* when it is not connected. While anything is unsaved the button also appears on the other Setup tabs.

If you leave Setup with unsaved changes, the app lists them and asks: `SAVE TO eHELP`, `DISCARD` (put the phone back to what the eHelp has) or `BACK TO SETUP`. With the eHelp disconnected, `KEEP FOR LATER` keeps the changes on the phone until you can save them.

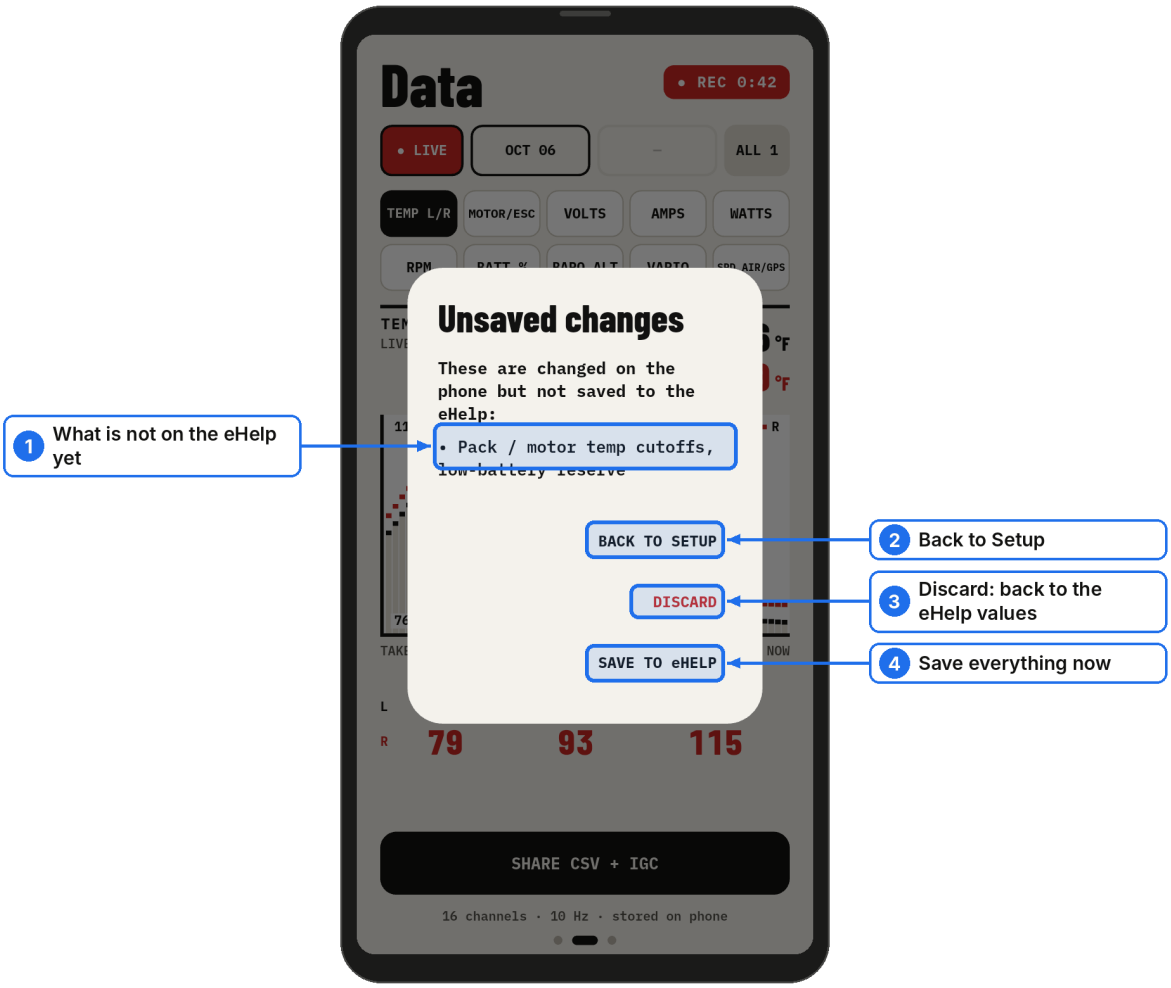


Figure 7.2 Leaving Setup with changes the eHelp doesn't have yet.

1. What is changed on the phone but not on the eHelp.
2. `BACK TO SETUP`: return and carry on editing.
3. `DISCARD`: put the phone back to what the eHelp has.
4. `SAVE TO eHELP`: write it all now.

Three things act on the eHelp straight away instead, because you use them live: the temperature sensor roles (10.2), the calibration wizards and glider saves (chapter 8), and the bench tests (10.4).

7.2 Battery settings

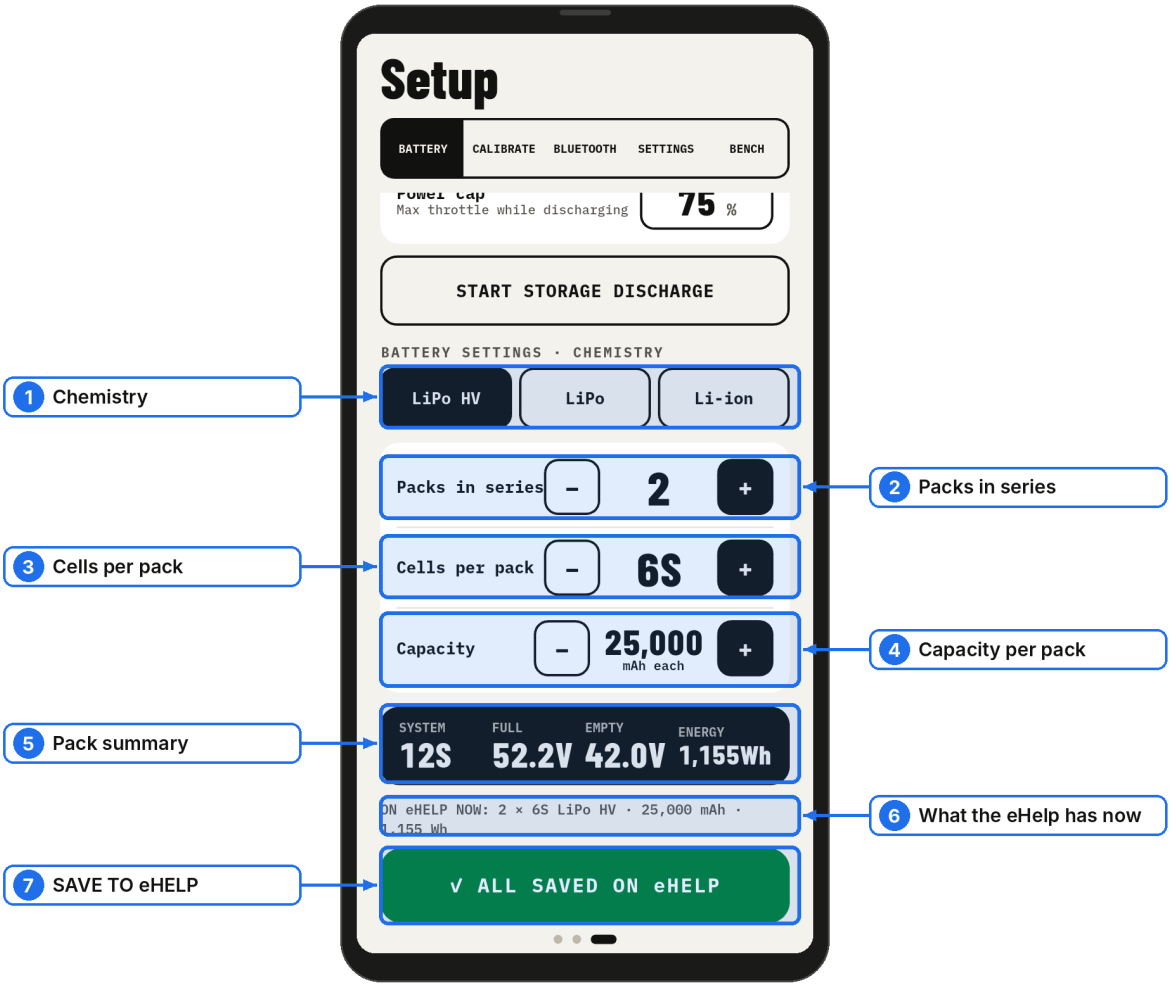


Figure 7.3 Battery settings and what the eHelp has now.

1. **Chemistry**: LiPo HV (4.35 V full), LiPo (4.20 V) or Li-ion. It sets the voltage curve used for charge and storage.
2. **Packs in series**, 1–3.
3. **Cells per pack**, 3–14 (6S = 6).
4. **Capacity per pack**, mAh.
5. **Pack summary**: total cells, full and empty voltage, and energy in Wh.
6. **ON eHELP NOW**: what the eHelp is actually using.
7. **SAVE TO eHELP** (7.1). Only a green "✓ SAVED ON eHELP" means the eHelp accepted it.

The eHelp refuses new settings while the motor is running. With two 6S packs in series, enter 2 packs × 6 cells and the capacity of *one* pack.

7.3 How the charge is measured

The eHelp counts every amp-hour that flows (coulomb counting) from the ESC's current reading. It needs a starting point:

- **At power-up** the eHelp reads the pack's resting voltage and looks it up on the chemistry's curve. A part-charged or aged pack therefore shows its real level, not 100 %.
- **Battery just charged** tells it the packs are full: charge 100 %, Ah used 0. Use it after every charge, before the first flight.
- **Estimate from voltage** re-reads the resting voltage at any time. The motor must be stopped (under 2 A).

> TIP
> Resting-voltage estimates are good to a few percent on a rested pack. Straight after a flight the voltage is still recovering and reads low; wait 15 minutes or use the counted charge.

7.4 Storage discharge from the app

LiPo packs last longest stored at about 3.8–3.85 V per cell. Storage discharge uses the motor itself, with the propeller fitted and the harness tied down, to bring the packs to that voltage in a few minutes.

> WARNING
> **The motor runs on its own for up to 20 minutes at up to the power cap.** Tie the harness to something that can take full thrust, keep people and loose items out of the propeller disc and the slipstream, and stay where you can see the unit.

1. Set the **target** (default by chemistry: LiPo HV 3.85, LiPo 3.80, Li-ion 3.70 V per cell) and the **power cap** (default 75 %), then tap `START STORAGE DISCHARGE`.
2. The first dialog shows what will happen: energy to remove, estimated time, and a reminder that the motor will run unattended. Tap `CONTINUE`.
3. The second dialog is the safety checklist. Tick all three, then **press and hold** `HOLD 3 s TO START` for 3 seconds.
4. The phone shows *PRESS OK ON THE eHELP*. Press `R` on the T-QT within 30 seconds. The run starts.

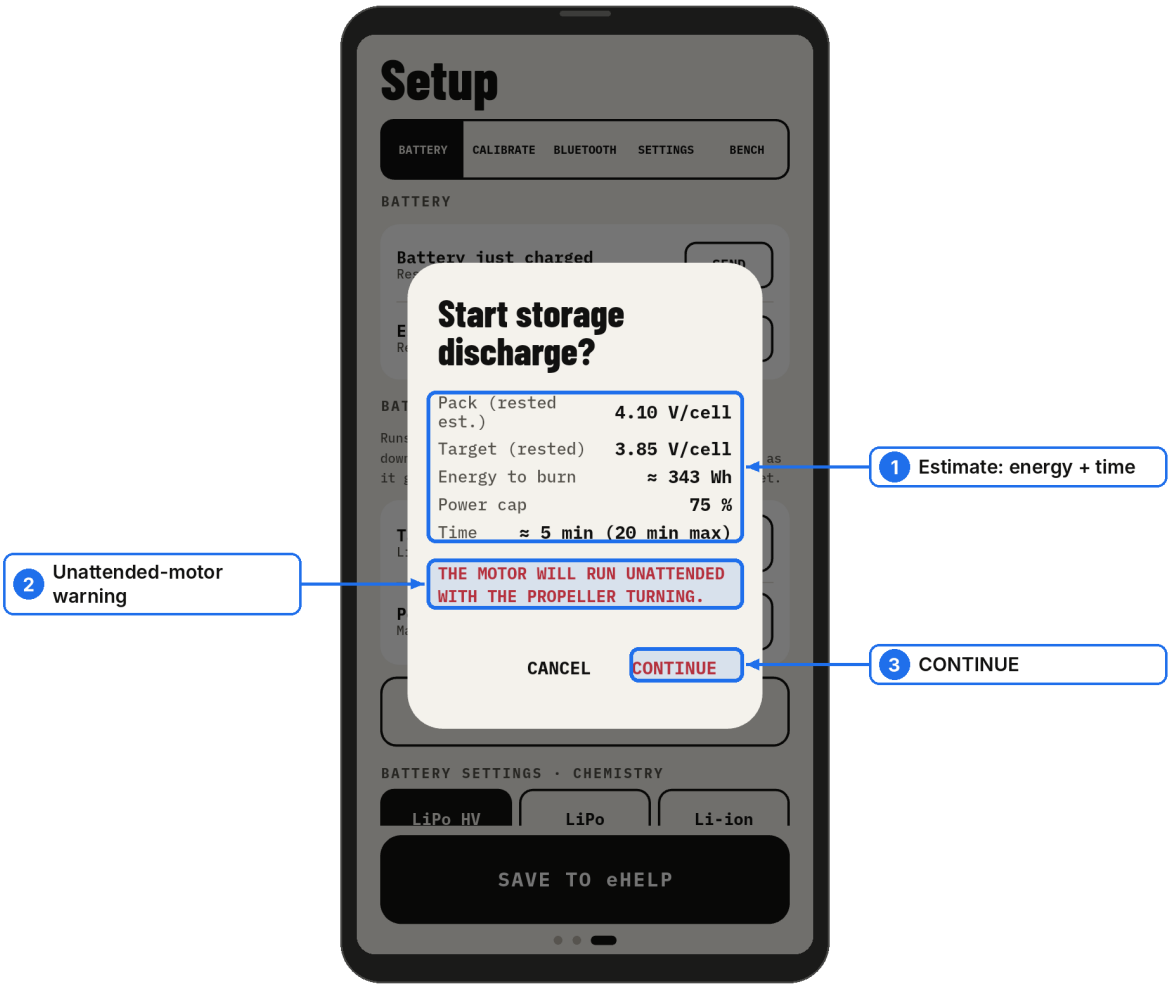


Figure 7.4 First dialog: the numbers.

1. Estimate: energy to remove and the time it should take at the power cap.
2. Reminder that the motor runs without you on the throttle.
3. `CONTINUE` to the checklist.

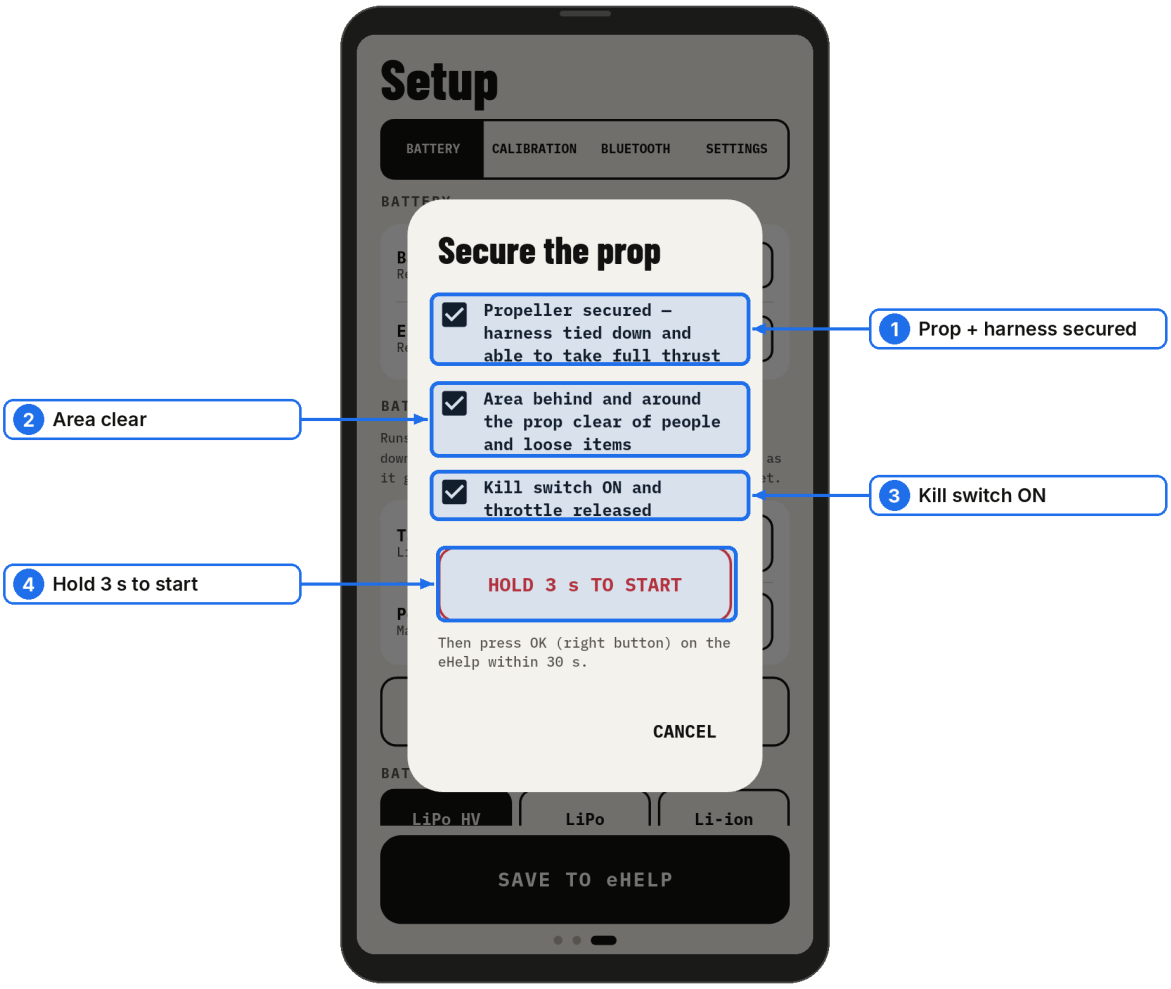
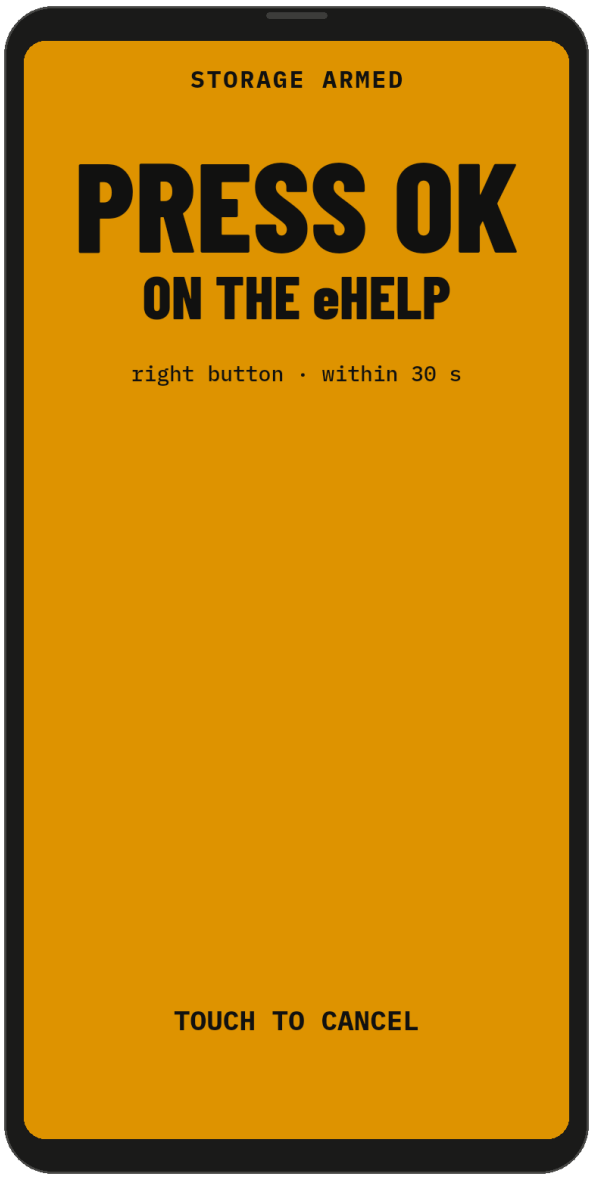


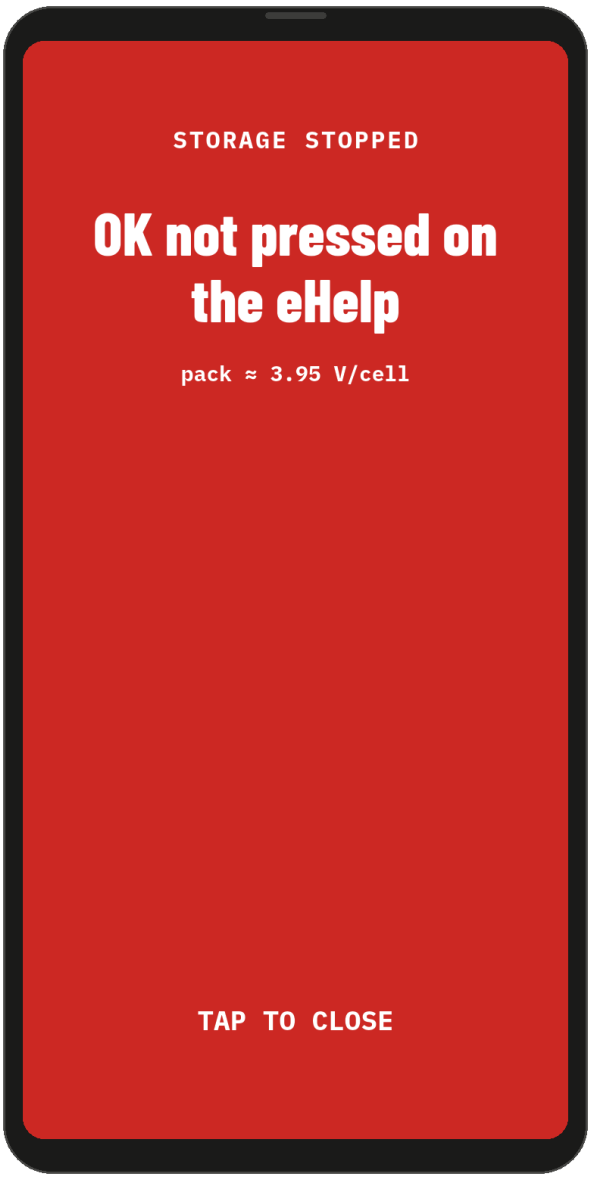
Figure 7.5 Second dialog: checklist and hold.

1. "Propeller secured — harness tied down and able to take full thrust."
2. "Area behind and around the prop clear of people and loose items."
3. "Kill switch ON and throttle released."
4. `HOLD 3 s TO START`, then press OK (R) on the T-QT within 30 s.

While it runs the phone shows a full-screen overlay with the predicted resting voltage per cell. **Touch the phone screen anywhere to stop.** Any T-QT button, the throttle, or the kill switch also stop it.



Armed: waiting for OK on the T-QT



Stopped, with the reason

7.5 How storage discharge works

Voltage under load reads lower than the voltage the pack will rest at, so stopping when the loaded voltage hits the target would leave the pack too low. The eHelp predicts the resting voltage instead:

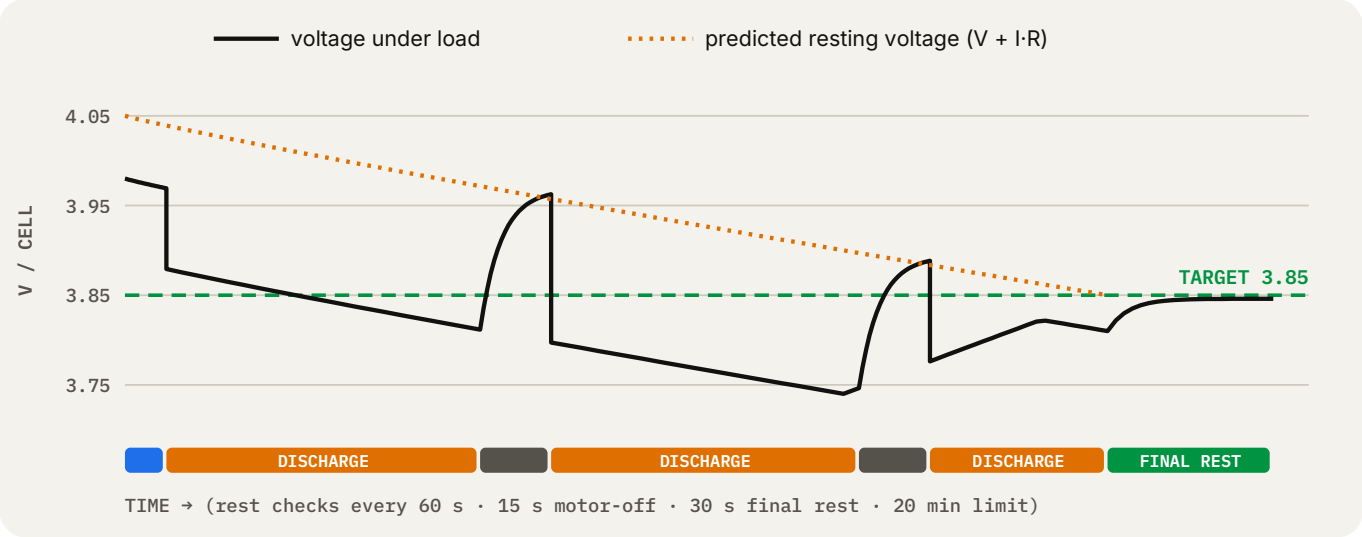


Figure 7.6 Storage discharge: the motor runs until the predicted resting voltage reaches the target, with rest checks along the way.

1. **Probe**: a few seconds at 20 % and 40 % throttle measure the pack's internal resistance.
2. **Discharge** at up to the power cap. Predicted resting voltage = loaded voltage + current × resistance. Within 50 mV of the target the throttle tapers off.
3. **Rest checks**: every 60 seconds the motor stops for 15 seconds and the eHelp watches the voltage recover, to correct its prediction.
4. **Final rest**: 30 seconds motor-off. If the pack is still more than 8 mV per cell above the target it tops up with another short run; otherwise DONE.
5. Throughout, the throttle is backed off so that no cell is pulled below 3.50 V under load.

IT STOPS BY ITSELF IF…	SHOWN AS
a T-QT button is pressed	BUTTON
the phone screen is touched (app start)	APP TOUCH
the app's heartbeat stops for 3 s or Bluetooth drops (app start only)	PHONE LOST
the throttle is moved over 5 %	THROTTLE
the kill switch is turned OFF	KILL SWITCH
ESC data is lost	NO ESC DATA
a pack reaches 55 °C, the ESC 100 °C, or the motor its temp cutoff	TOO HOT
20 minutes have passed	TIME LIMIT
OK was not pressed on the T-QT within 30 s	NO OK

CHAPTER 8

Calibration

Setup › Calibrate holds everything the eHelp learns about your equipment: the throttle's range, each glider's climb curve, and the power unit's full-power curve.

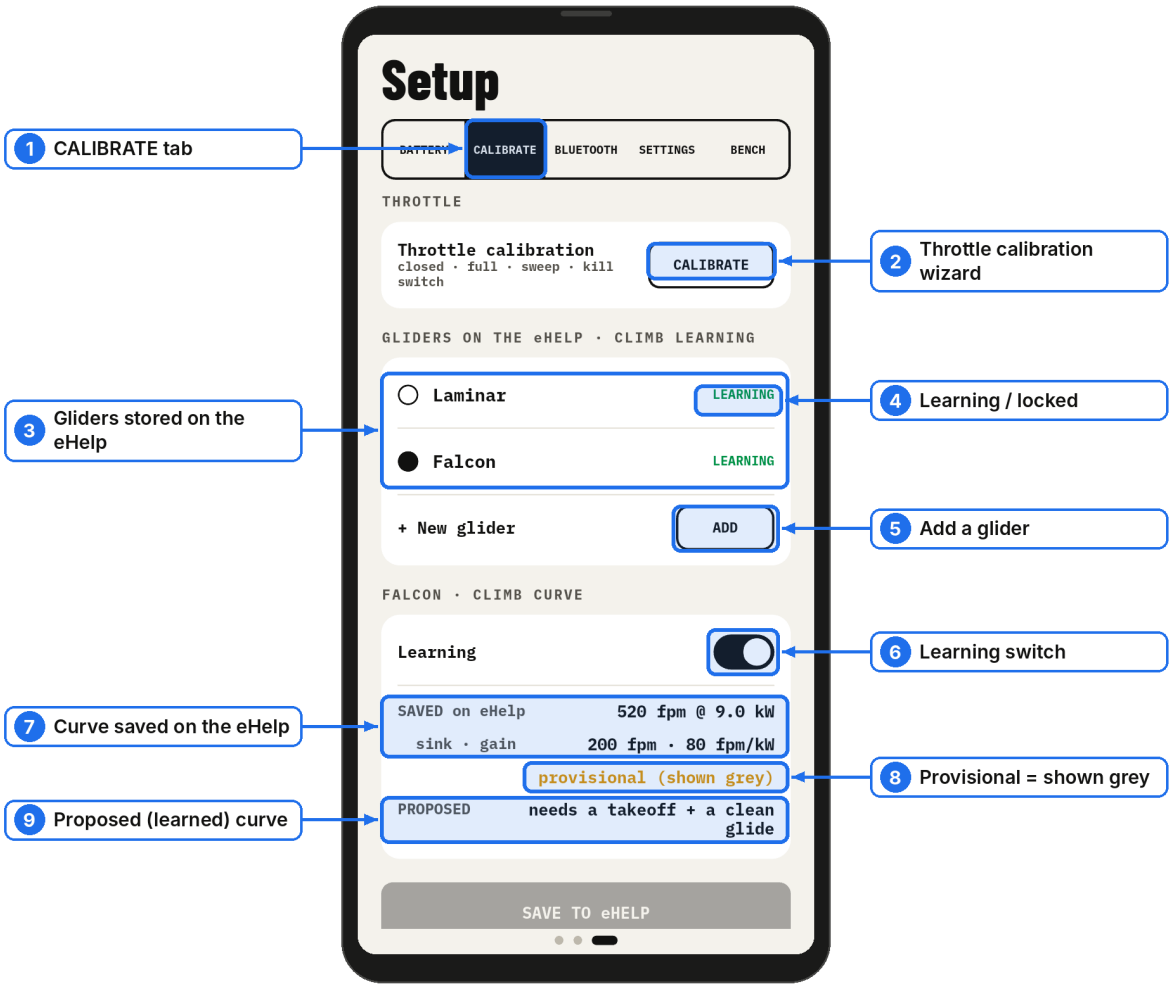


Figure 8.1 Setup › Calibrate.

1. **CALIBRATE** tab.
2. **CALIBRATE** opens the throttle wizard (8.1).
3. **Gliders on the eHelp**: up to four. The filled circle is the selected glider; tap a glider to select it.
4. **LEARNING** or **LOCKED** for each glider.
5. **ADD** a new glider.
6. **Learning** switch for the selected glider.
7. **SAVED on eHelp**: the curve the eHelp is using, as climb at full power, sink and gain per kW.
8. **Provisional**: not yet learned from enough flights, so available climb shows grey.
9. **PROPOSED**: the curve learned from your flights, waiting for you to save it.

8.1 Throttle calibration wizard

The wizard teaches the eHelp the two ends of your throttle's travel and checks the kill switch. Run it when you first set up, and whenever you change the throttle, its cable or the pot.

> **NOTICE**
>
> During the wizard the eHelp holds the motor at 0 % whatever the throttle does (status bar THR CAL), so you can open the throttle fully with the battery connected. Leaving the wizard, or losing Bluetooth, ends it; the motor then stays off until the throttle is back at zero.

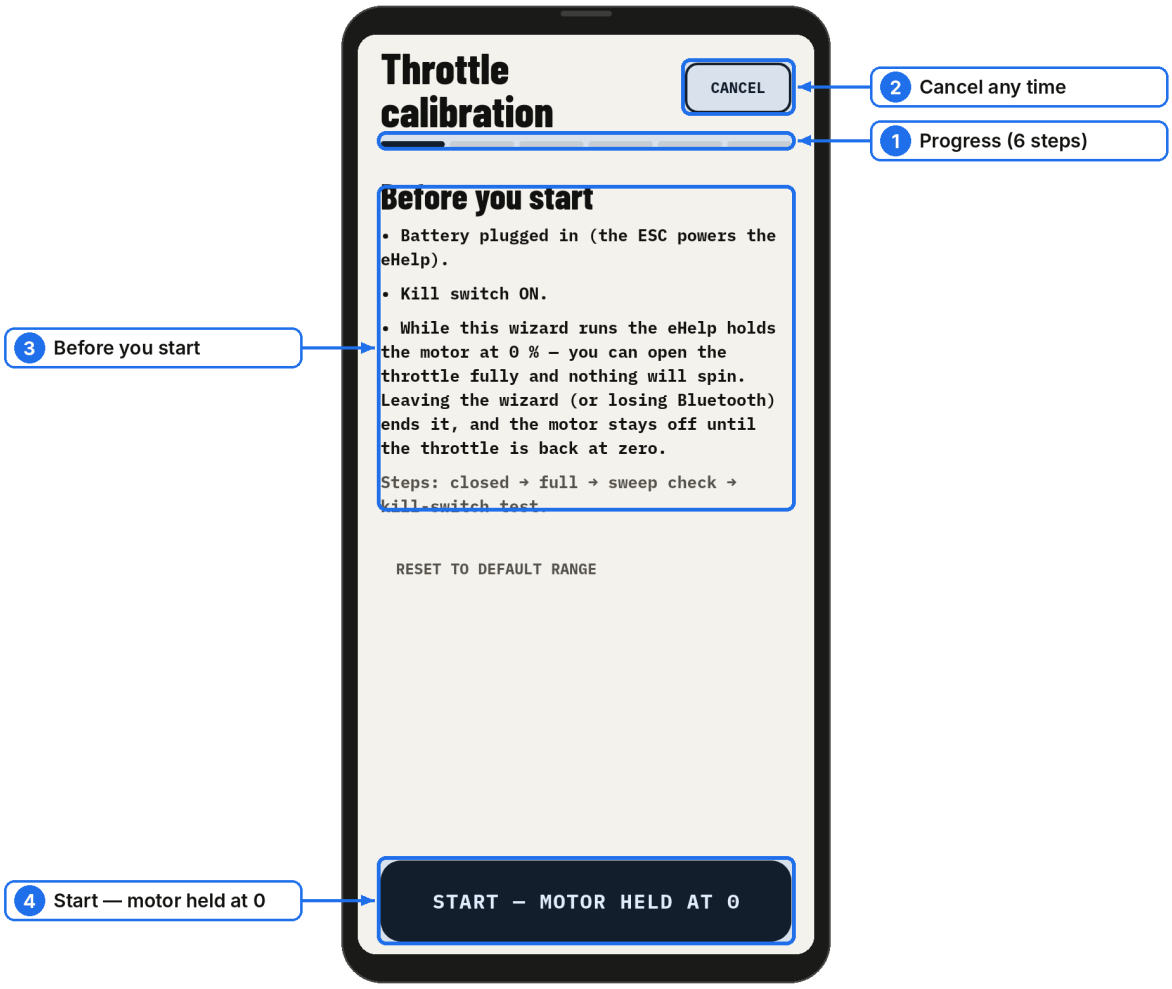


Figure 8.2 Wizard start page.

1. Progress: six steps.
2. `CANCEL` at any time.
3. What you need: battery plugged in, kill switch ON.
4. `START — MOTOR HELD AT 0`. The motor is held at 0 % from now on.

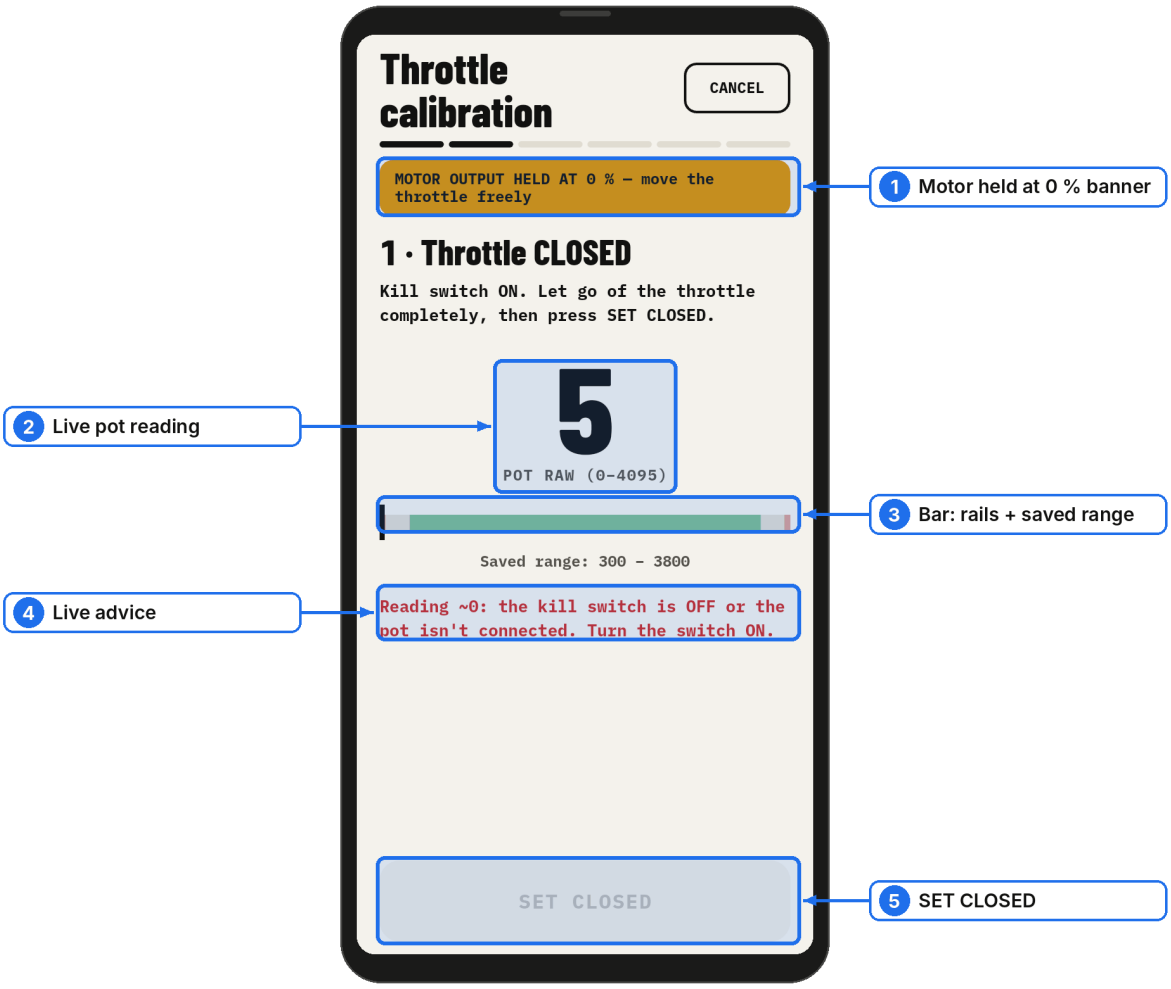


Figure 8.3 Step 1: throttle closed.

1. Banner: the motor is held at 0 %.
2. Live raw throttle reading from the eHelp.
3. The reading between the two rails, with the saved range marked.
4. Live advice, for example if the reading is at a rail.
5. `SET CLOSED` stores this reading as 0 %.

1. **Closed.** Kill switch ON, throttle fully released. Tap `SET CLOSED`. (Refused if the reading is near 0 V: the pot or its signal wire is not connected. A pot wired the other way round, whose released end reads 3.3 V (4095), is fine: the wizard sets it up reversed.)

2. **Full.** Hold the throttle fully open and tap `SET FULL` while holding it. The button waits until the reading has moved well away from closed (the wizard knows which way your pot is wired). A reading at either end of the range (within about 160 counts of 0 or 4095) is refused, because the eHelp treats that as a broken wire.

3. **Sweep.** Move slowly from closed to full and back. It should read 0 % to 100 % smoothly; the first 3 % is a dead band.

4. **Kill switch test.** Turn the switch OFF. The eHelp must see it open (the screen shows *eHelp sees the switch: OFF*) and keep it open for 2 seconds with the motor at 0 %: **PASS**. Then turn the switch back ON and tap `FINISH`. If the eHelp never sees the switch, check the fourth wire to EXP pad 33.

5. **Done** shows the saved range and the kill-switch result.

> **WARNING**
>
> Do not fly if the kill switch test shows **FAIL** or never sees the switch. The switch connects the fourth wire to the throttle's ground: ON = closed = run, OFF = open = motor at 0 %.

`RESET TO DEFAULT RANGE` on the first page restores the factory range (300–3800).

8.2 Gliders and available climb

Each glider climbs differently on the same power. The eHelp stores up to four gliders, each with its own climb line:

```
climb rate = gain × power − sink
```

Sink is how fast the glider sinks with the motor off; *gain* is how many ft/min each kilowatt adds. Pick the glider you are flying before take-off: available climb uses the selected glider's curve.

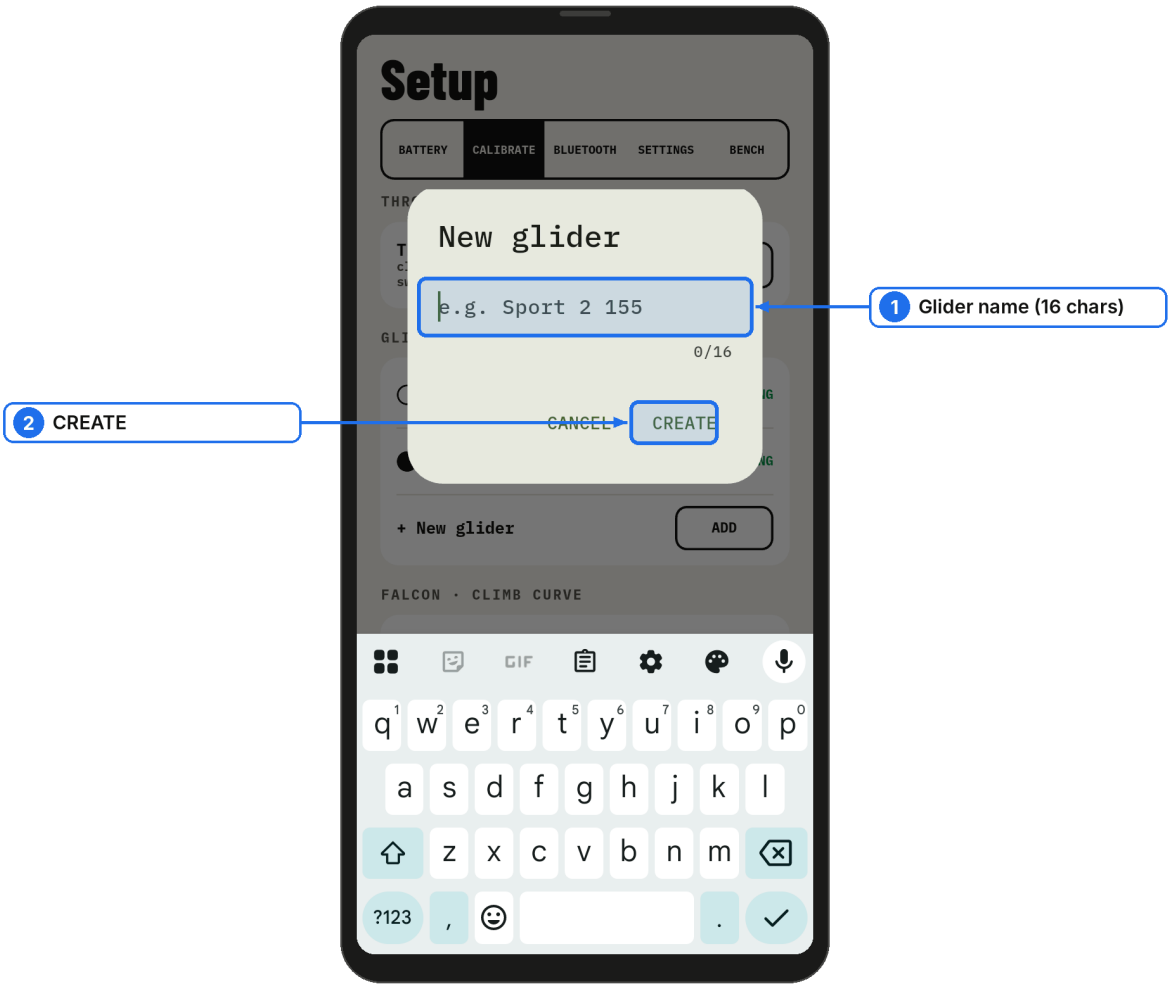


Figure 8.4 Adding a glider.

1. Name, up to 16 characters. It also goes into the IGC header.
2. **CREATE**. The new glider starts with learning on and a provisional curve.

8.3 How learning works

The phone learns; the eHelp calculates. After each recorded flight the app looks for two kinds of clean data:

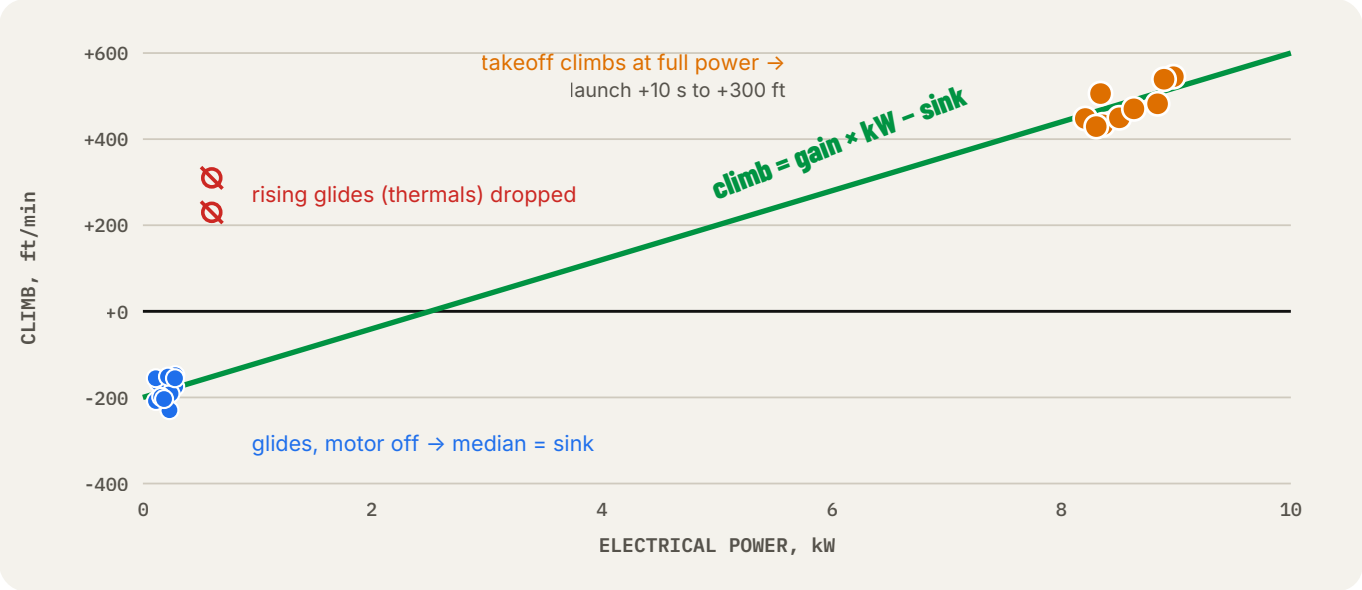


Figure 8.5 Learning a glider: glides give the sink at zero power, takeoff climbs give the climb at full power; the line joins them.

DATA	TAKEN FROM	RULES
Takeoff climb	Launch + 10 s up to 300 ft above launch, at full power	Throttle ≥ 85 % · at least 20 s · power steady within ±7 % · no turning (under 5°/s). Gives the climb at full power.
Glide	Motor-off stretches, 20 s windows	Motor off ≥ 10 s · straight (under 3°/s) · not within 10 s of circling · more than 300 ft above launch · not the last 60 s · windows going up (thermals) dropped. The median per flight gives the sink.

The line through the sink point and the takeoff points is the **proposed** curve. It stays *provisional* until there are at least 5 takeoffs and 10 glides.

Nothing changes on the eHelp until you tap `SAVE TO eHELP`. Compare the proposal with the saved curve (the app shows the change in climb at full power) and save when you are happy.

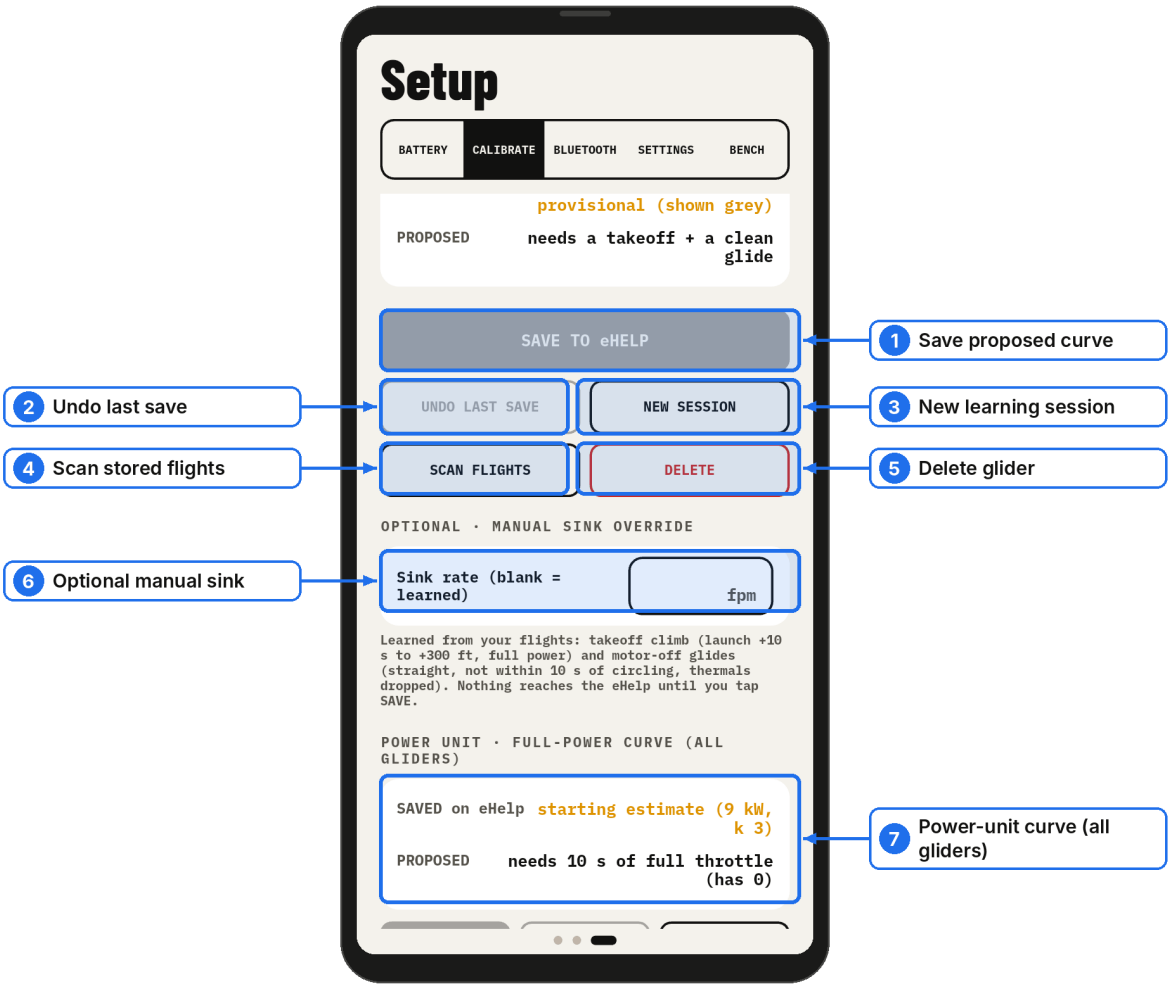


Figure 8.6 Learning actions for the selected glider.

1. **SAVE TO eHELP**: the proposed curve becomes the saved one.
2. **UNDO LAST SAVE**: swaps back to the previous saved curve.
3. **NEW SESSION**: forget the learned takeoffs and glides (new prop, different weight). The saved curve stays in use.
4. **SCAN FLIGHTS**: learn from flights already stored on the phone.
5. **DELETE** the glider and its curve from the eHelp.
6. **Manual sink**: optional; overrides the learned sink if you know it.
7. The power-unit curve, shared by all gliders (8.4).

Locked gliders do not learn, but each flight is still checked against the saved curve. If a takeoff climbs 10 % or more away from what the curve predicts, the app shows a note at the top of Setup › Calibrate ("Today's takeoff climb was … % below/above the saved … curve"): something has changed (prop, weight, pack, trim).

> **TIP**
> For the best data, take off at full throttle, fly straight to 300 ft above launch, and on the way down fly a few straight glides at trim away from lift.

8.4 Power unit full-power curve

As the pack drains its voltage falls and the motor makes less power at full throttle. The eHelp models this with one curve for the power unit, shared by every glider:

$$\text{full power} \approx c \times V^{k}$$

It is learned automatically from every second spent at 95 % throttle or more, along with the pack's internal resistance. It needs 10 such seconds; *k* stays at 3 until the flights cover enough of the voltage range.

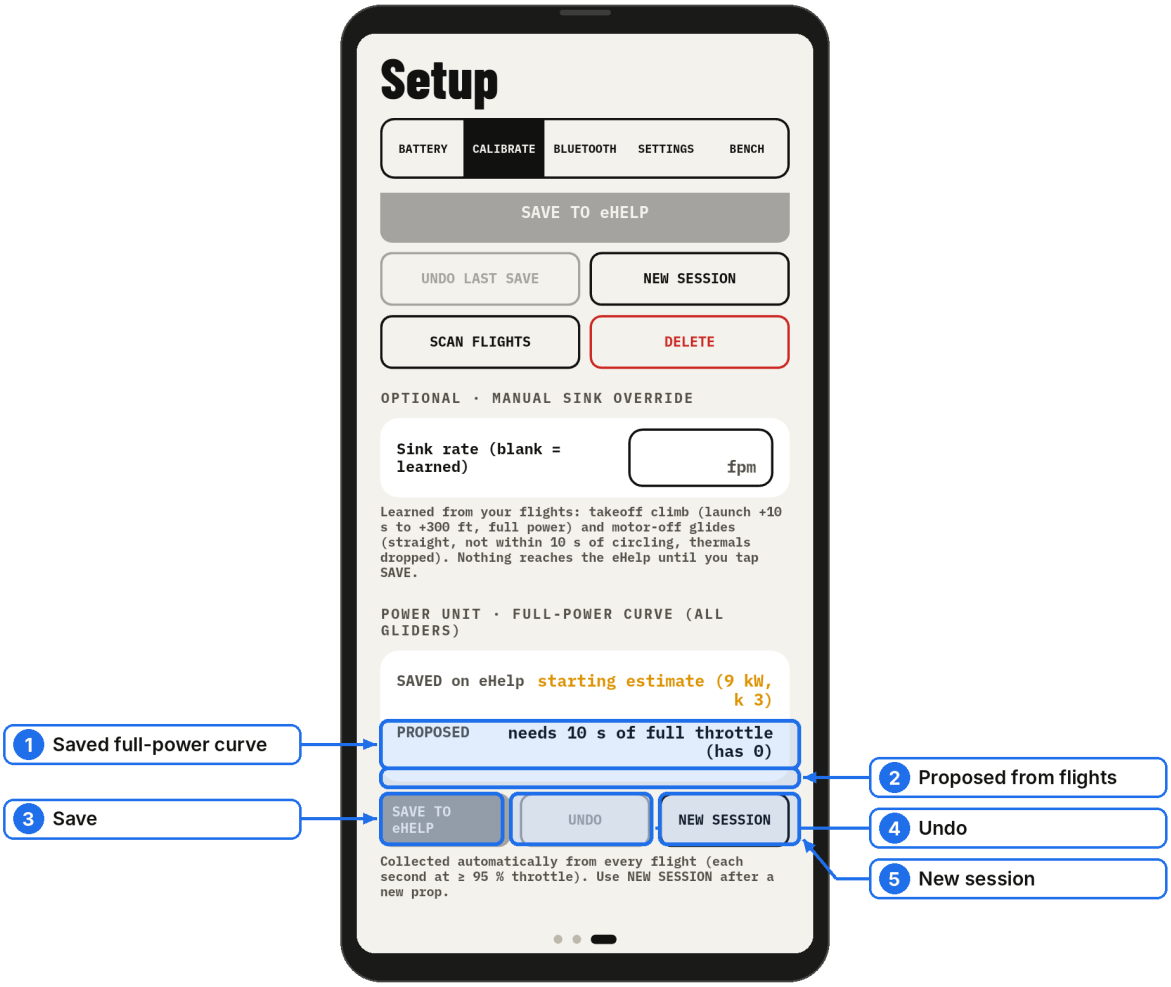


Figure 8.7 Power unit section.

1. **SAVED**: what the eHelp uses, shown as kW at full and at 3.6 V per cell, with k and the pack resistance.
2. **PROPOSED** from your flights.
3. `SAVE TO eHELP`.
4. `UNDO` to the previous curve.
5. `NEW SESSION` after changing the propeller, motor or packs.

Until it is learned, the eHelp uses a starting estimate: 9 kW on a full pack, *k* = 3.

CHAPTER 9

Bluetooth and vario

Setup › Bluetooth pairs the eHelp and your vario. Everything paired here is time-synced and logged together. The phone's GPS is set up under Settings › GPS (10.3).

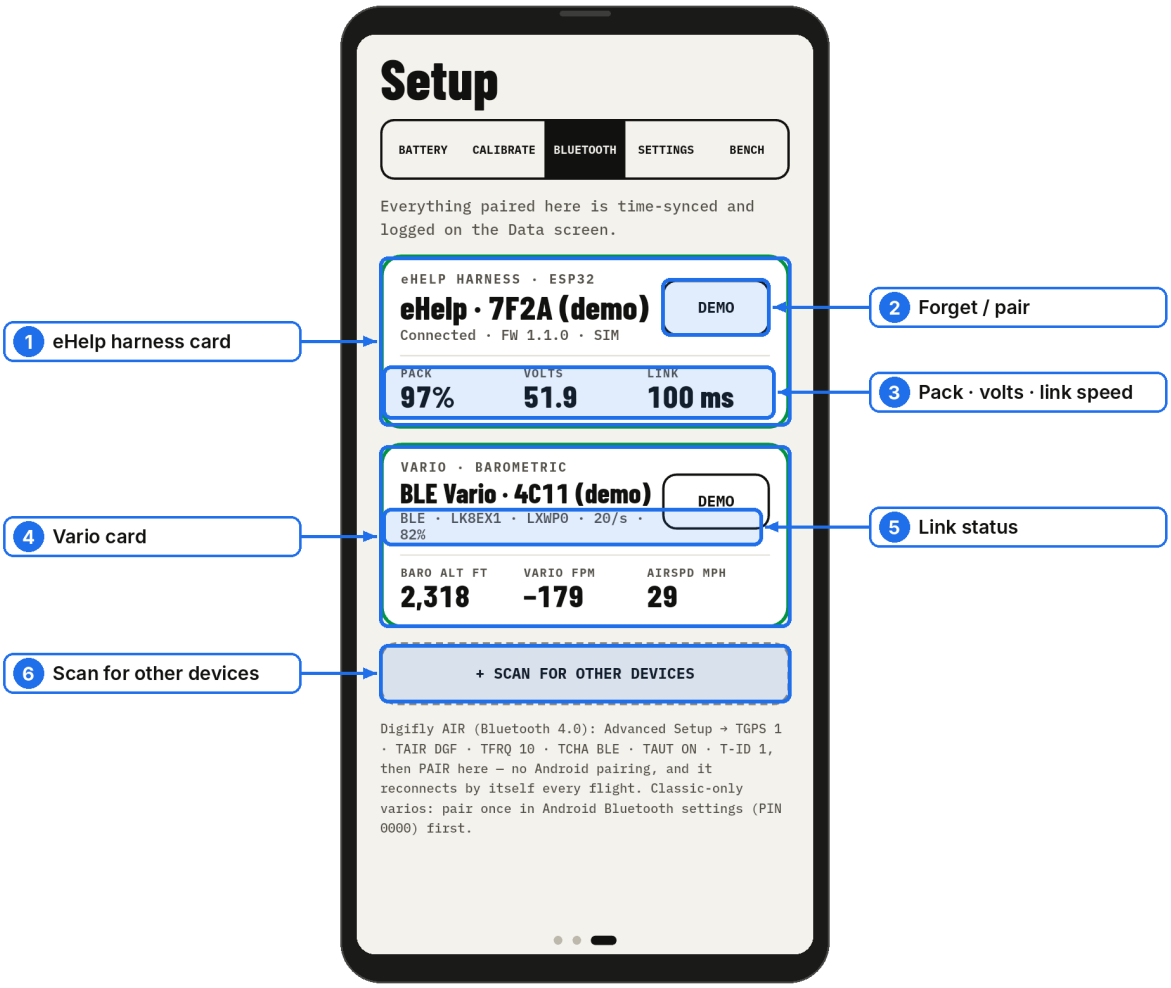


Figure 9.1 Setup › Bluetooth.

1. **eHELP HARNESS** card: link state, firmware, and whether it is simulator or bench firmware.
2. `FORGET` the paired eHelp or `PAIR` a new one.
3. Charge, volts and the Bluetooth link time.
4. **VARIO** card: barometric altitude, vario and airspeed.
5. Link status: transport, detected sentence type and sentences per second.
6. `+ SCAN FOR OTHER DEVICES`.

9.1 Pairing the eHelp

Power the eHelp (battery connected), tap **PAIR** on the eHelp card and pick `eHelp-XXXX` from the list. The app remembers it and reconnects by itself every time both are on. If the link drops in flight, it keeps retrying; the eHelp keeps flying normally (only cruise is cancelled).

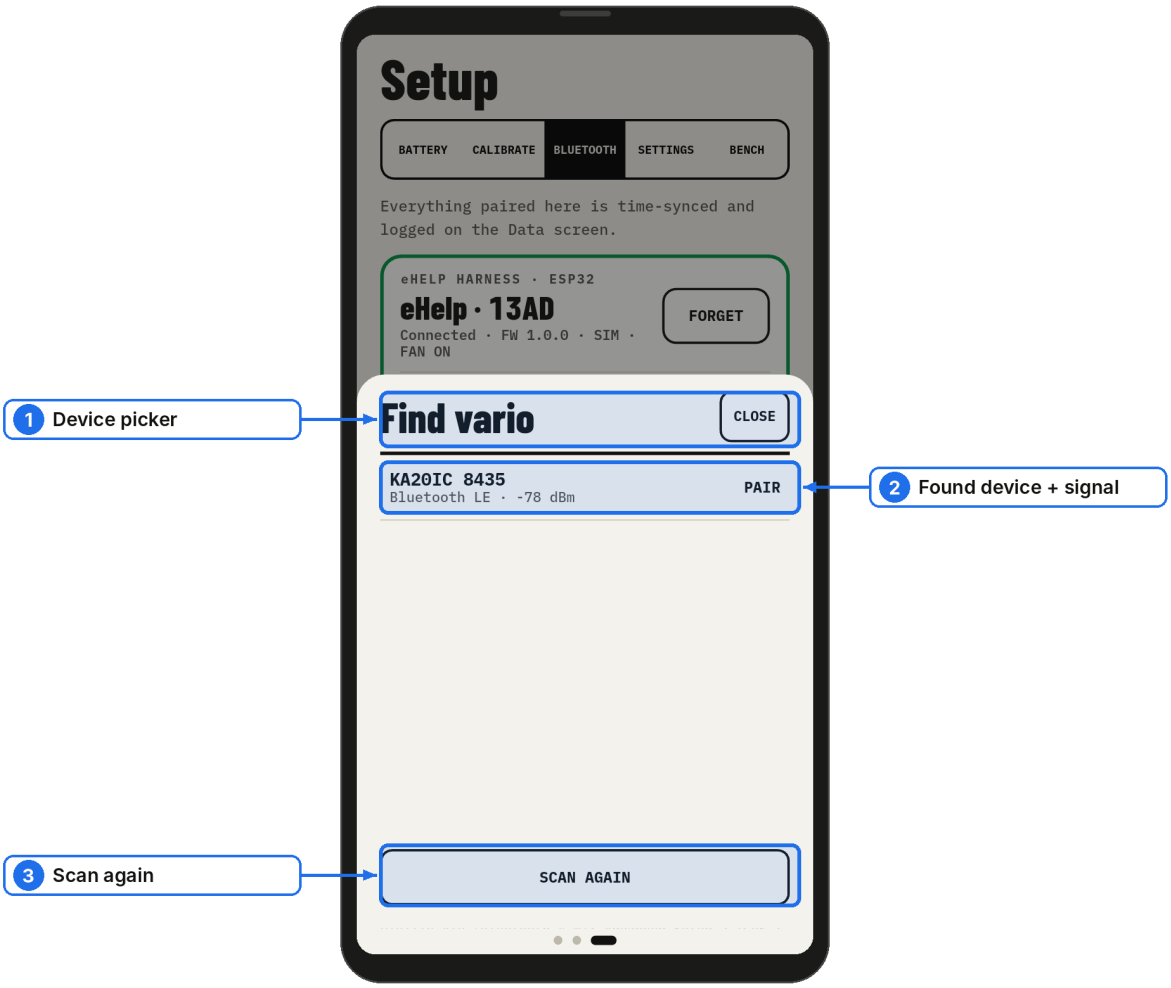


Figure 9.2 The device picker.

1. The device picker scans for a few seconds.
2. Each device with its signal strength; varios are marked *likely vario*.
3. **SCAN AGAIN** if yours is missing.

9.2 Connecting a vario

Any vario that sends NMEA over Bluetooth works; the app recognises the sentence format by itself.

VARIO LINK	HOW TO PAIR
Bluetooth LE	

	XC Tracer, BlueFly, SkyDrop, OpenVario, Skytraxx, Digifly AIR (BLE)… appear directly in the scan.
Classic Bluetooth	Flytec 6030, older Flymaster…: pair once in Android Bluetooth settings (PIN usually 0000), turn on the vario’s Bluetooth/NMEA output, then scan in the app.

Digifly AIR

In the AIR’s *Advanced Setup* set:

TGPS	TAIR	TFRQ	TCHA	TAUT	T-ID
1	DGF	10	BLE	ON	1

Then **PAIR** in the app. No Android pairing is needed, and it reconnects by itself every flight. (TCHA is OFF from the factory, so the AIR is invisible until you change it.)

Recognised sentences: `$PDGFTL1` (Digifly), `$VMVABD`, `$BRSF`, `$FLYSEN` (Flytec / Bräuniger), `$LK8EX1`, `$LXWP0`, `PRS` (BlueFly), `$POV` (OpenVario), `$PTAS1`, `$XCTRC`, `$VARIO` (Flymaster), `$PGRMZ`, `$GPGGA` and `$GPRMC`. If a vario only sends altitude, the app derives the climb rate from it.

CHAPTER 10

Settings

Setup › Settings holds your preferences and the motor, fan and sensor setup; the Bench tab holds the bench tests and demo data. Settings marked *on the eHelp* are written with `SAVE TO eHELP` (7.1) and saved there, so they work without the phone.

10.1 Pilot, units and alerts

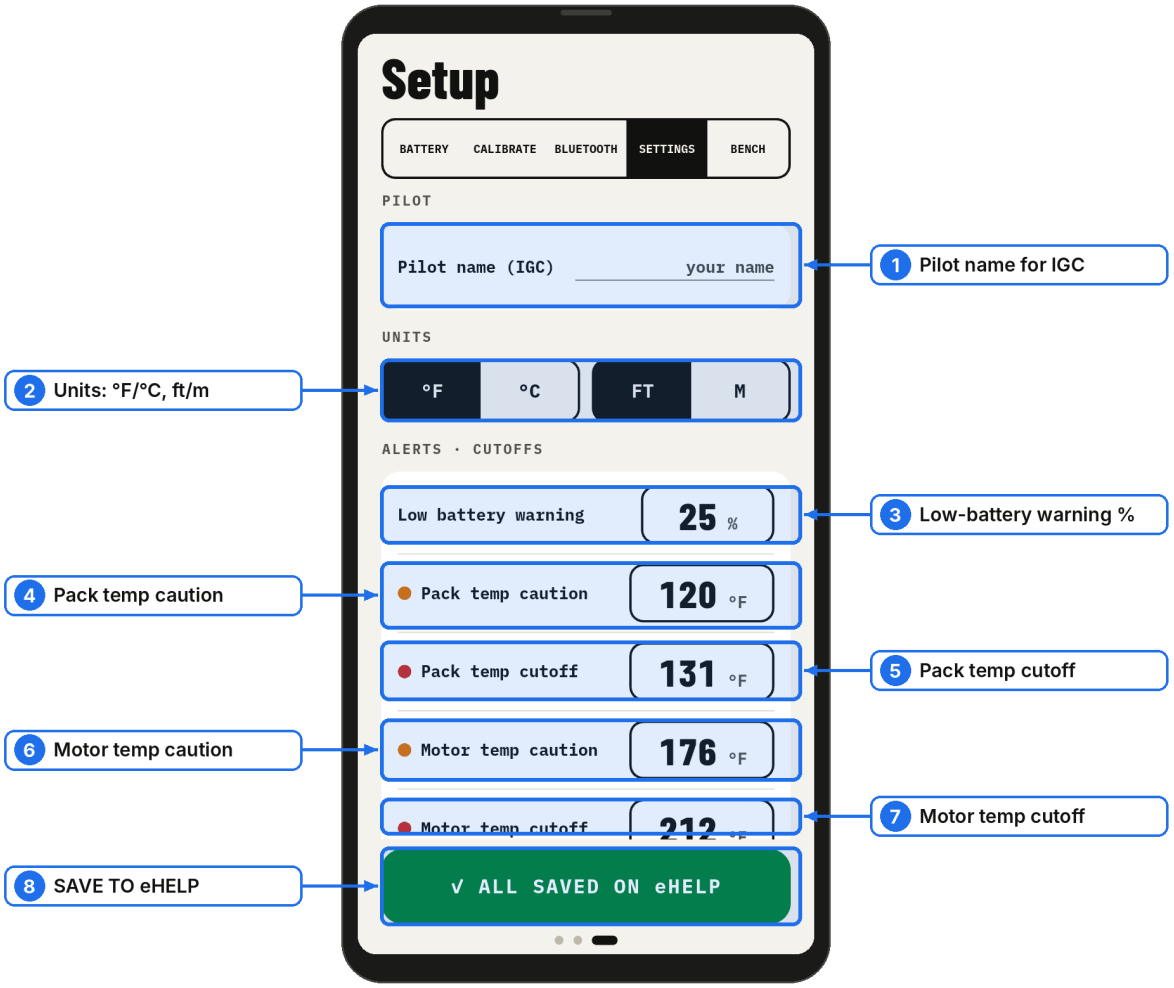


Figure 10.1 Settings, top section.

1. **Pilot name** for the IGC file header.
2. **Units**: °F / °C and ft / m. The °F / °C choice also sets the T-QT (on the eHelp), which then shows climb in ft with °F and m with °C.
3. **Low battery warning**, % (default 25). Also the reserve that available climb stops at (on the eHelp).
4. **Pack temp caution** (default 48 °C / 118 °F): orange on the dashboard.

5. **Pack temp cutoff** (default 55 °C / 131 °F): the eHelp cuts the motor when either pack reaches it (on the eHelp).
6. **Motor temp caution** (default 80 °C / 176 °F): the motor reading turns orange.
7. **Motor temp cutoff** (default 100 °C / 212 °F): the eHelp cuts the motor when the motor sensor reaches it (on the eHelp; needs a motor sensor).
8. `SAVE TO eHELP` (7.1): writes the cutoffs and reserve with everything else in Setup.

Saving the cutoffs

Typing a new number changes it on the phone only. The cutoffs are what actually stop the motor, so they reach the eHelp only when you tap `SAVE TO eHELP`. The line under the alerts always shows what the eHelp has now, and turns red with *changed, tap SAVE TO eHELP* while the phone and the eHelp disagree. The app also re-sends your cutoffs every time it connects.



Figure 10.2 A cutoff changed on the phone but not yet saved to the eHelp.

1. The new number, so far only on the phone.
2. What the eHelp is using right now, in red until you save.
3. SAVE TO eHELP, with the number of unsaved changes; it turns green once the eHelp confirms.

WARNING

Both cutoffs stop the motor. Set the pack cutoff from your battery maker’s maximum discharge temperature with some margin, and the motor cutoff from the motor maker’s limit for where your sensor sits (a sensor on the case reads cooler than the windings). Setting it too high removes the protection; too low can stop the motor in a climb.

10.2 Motor, ESC fan, sensors and display

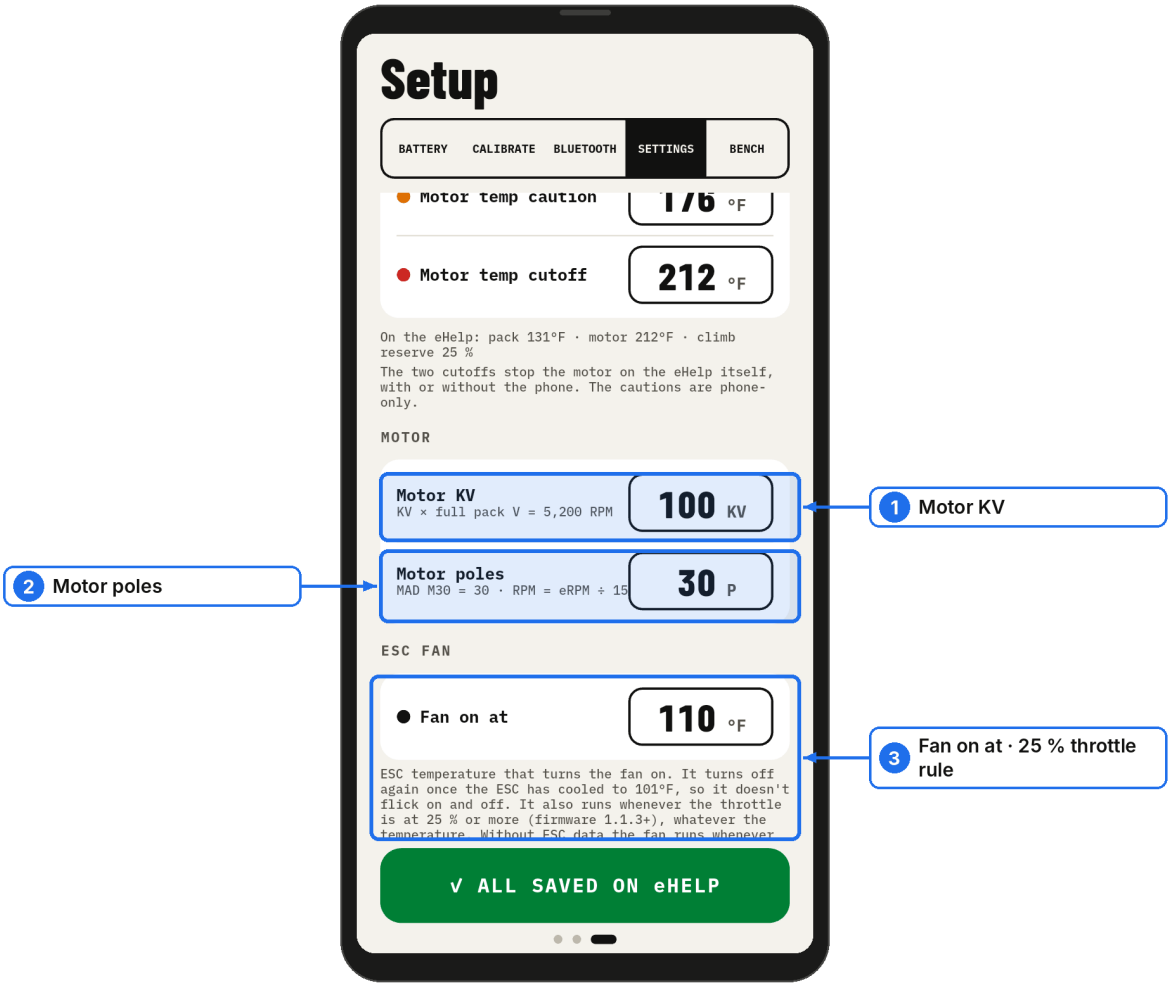


Figure 10.3 Settings, middle section.

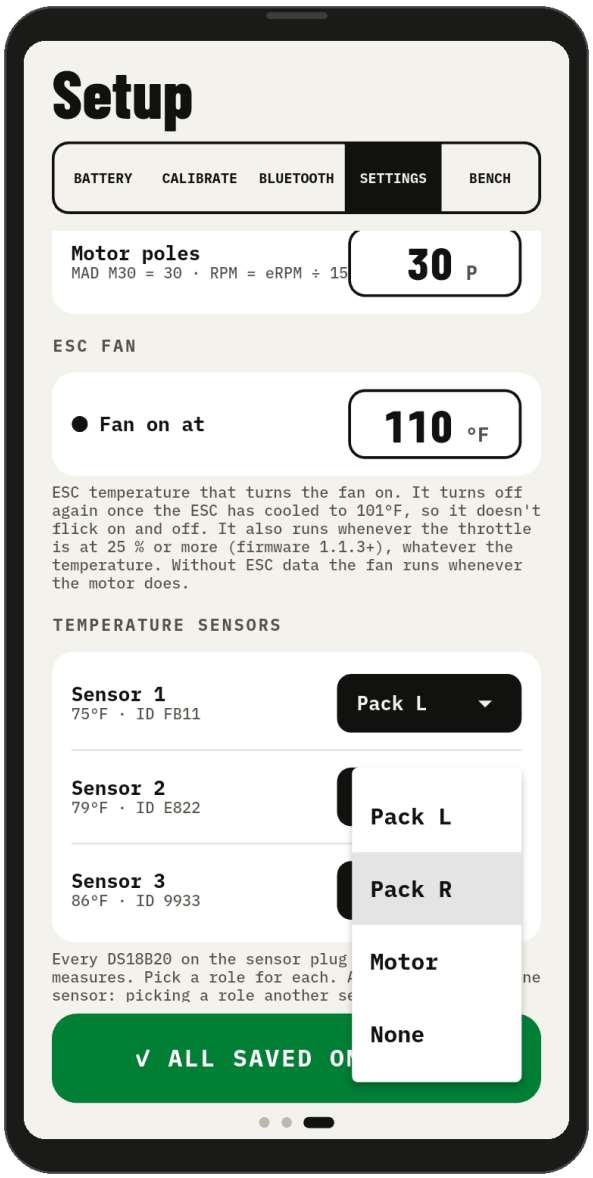
1. **Motor KV** (MAD M30 = 100). Sets the RPM gauge's full scale: KV × full pack voltage.
2. **Motor poles** (MAD M30 = 30). Converts the ESC's electrical RPM to real RPM.
3. **Fan on at** (default 45 °C): the ESC temperature that turns the fan on. One setting: the fan turns off again once the ESC has cooled 5 °C below it (the line under the box shows that temperature), so it does not flick on and off around a single point. Set it in whole degrees in either °F or °C. The fan **also runs whenever the throttle is at 25 % or more**, whatever the temperature, to stay ahead of the heat (off again below 20 % unless the ESC is still warm). Without ESC data the fan runs whenever the motor does.

Temperature sensors

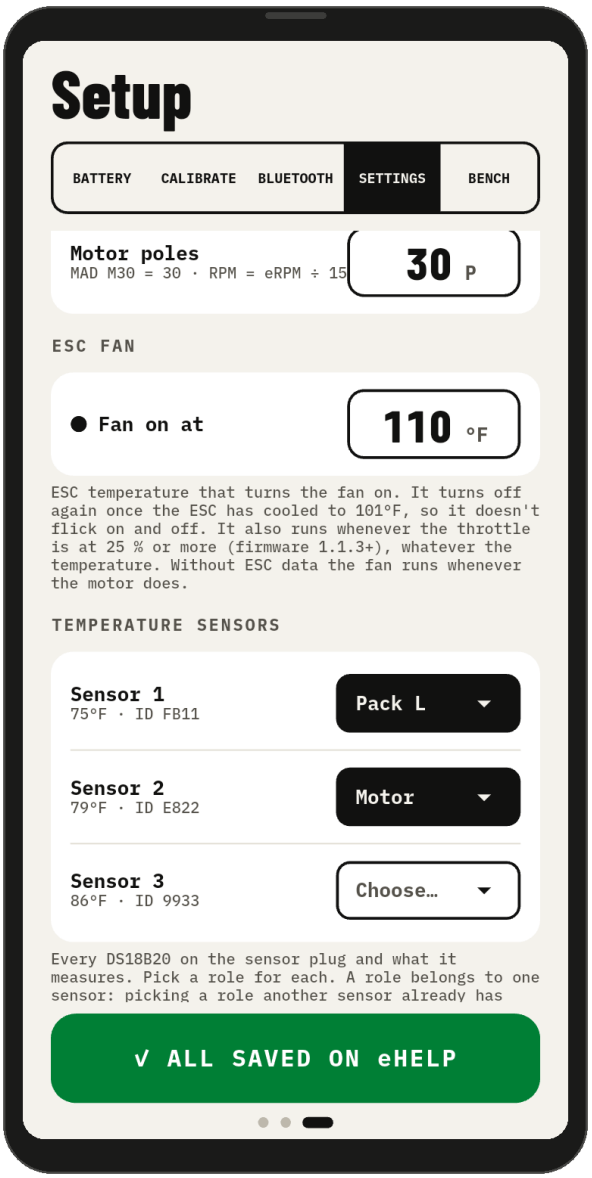


Figure 10.4 Settings › Temperature sensors.

1. Three rows, Sensor 1, 2 and 3, each with its live reading and a short ID. A sensor the eHelp can't see shows *not detected*; plug it in and it appears within about 30 s.
2. The role selector beside each sensor: Pack L, Pack R, Motor or None. Saved on the eHelp straight away.
3. A reminder of how roles work.



Tap a selector to see every role



Sensor 2 set to Motor: Sensor 3, which had it, now shows Choose…

Further down: **Keep screen on, max brightness** while the app is open, and a line with the eHelp firmware version and serial number.

The temperature sensors are plug-and-play: a sensor keeps its role while it is connected, and a new sensor fills the first empty role by itself (pack L, pack R, then motor). To change one, warm a sensor in your hand to see which row moves, tap its selector and pick the role. Each role belongs to one sensor only: if Sensor 1 is the motor and you set Sensor 2 to Motor, Sensor 1 shows **Choose…** until you give it a role. A sensor left on Choose… or set to None is not used.

10.3 GPS

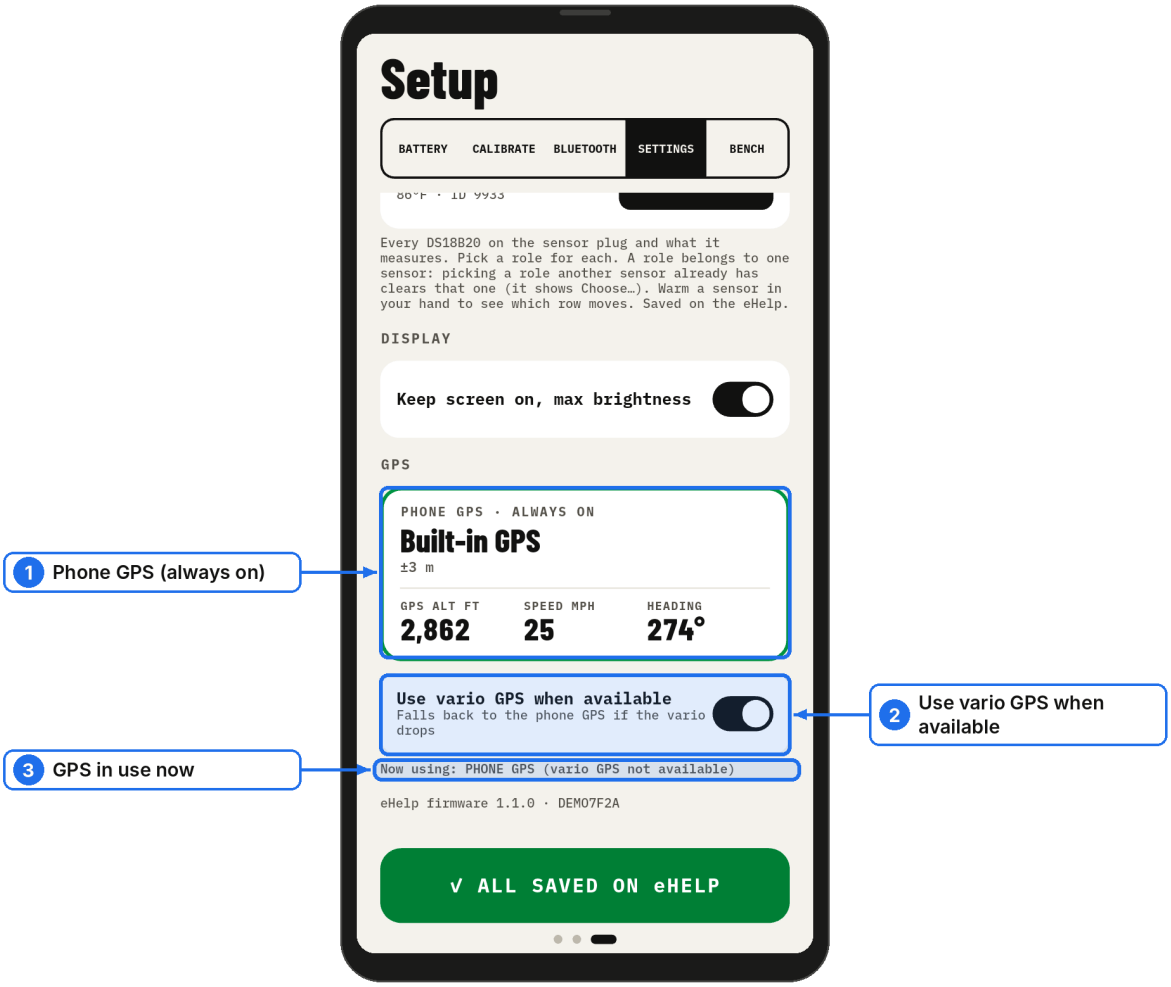


Figure 10.5 Settings › GPS.

1. **Phone GPS**: always on. Accuracy, GPS altitude, ground speed and heading.
2. **Use vario GPS when available**: off by default.
3. **Now using**: the GPS feeding the log right now.

The phone’s built-in GPS is the default and always runs. It gives position, ground speed and heading for the logs, for automatic recording and for the IGC file. If your vario has its own GPS and you turn on *Use vario GPS when available*, the app uses the vario’s fixes while they keep arriving. If Bluetooth to the vario drops, or the vario loses its fix, the app is back on the phone GPS within 3 seconds, with no gap in the log. If the phone has no fix but the vario does, the app uses the vario’s fix rather than none.

10.4 The Bench tab: tests and demo data

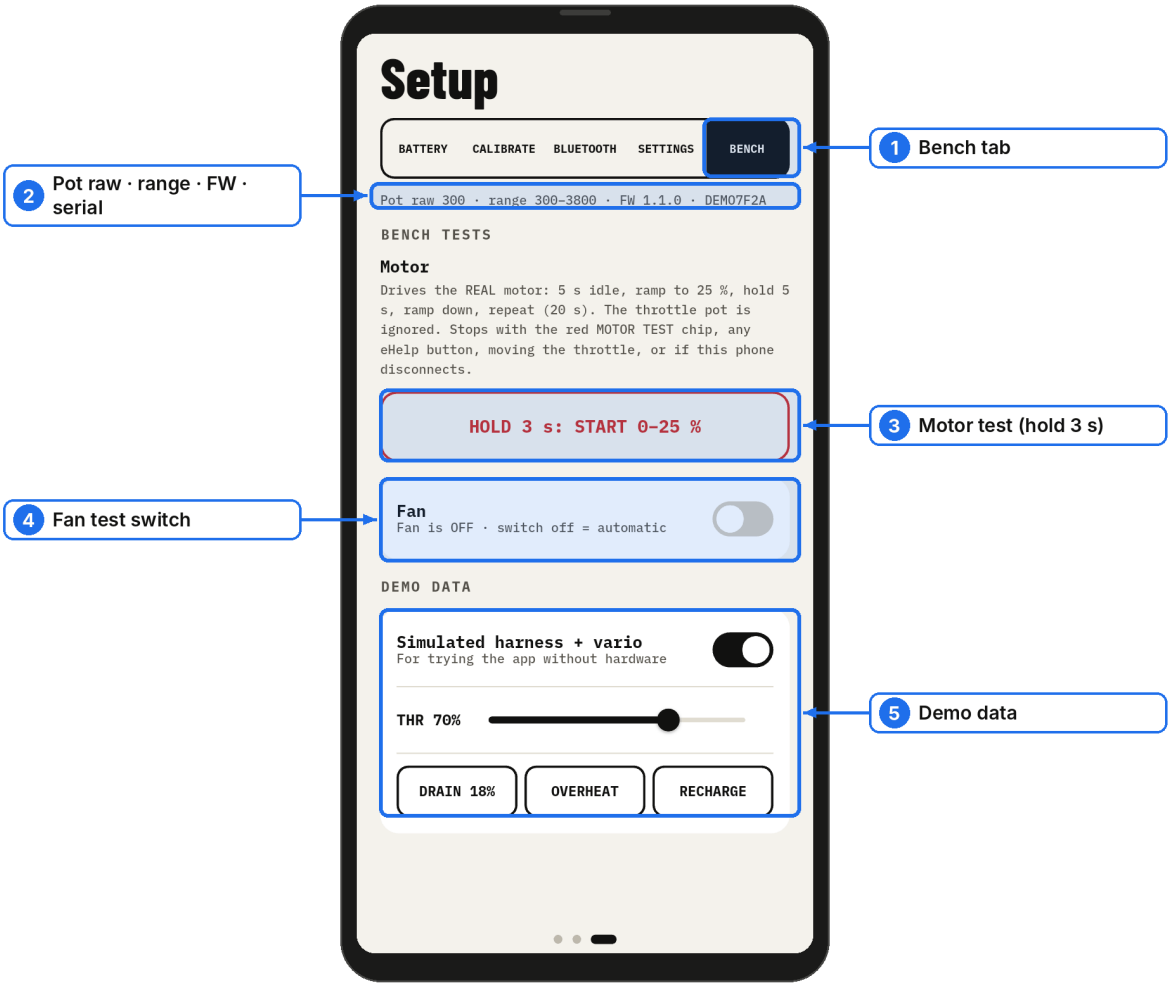


Figure 10.6 Setup › Bench.

1. **Bench** tab.
2. The throttle raw reading and range, firmware version and serial number.
3. **Motor test**: press and hold 3 s.
4. **Fan test**: forces the fan on; off = automatic.
5. **Demo data**: a simulated eHelp and vario for trying the app without hardware.

Bench motor test

The motor test checks the motor, ESC and wiring without the throttle. The eHelp drives the motor 0 → 25 % → 0 every 20 seconds (5 s idle, 5 s up, 5 s hold, 5 s down). A red `MOTOR TEST nn% · TAP = STOP` chip appears at the top of every app screen.

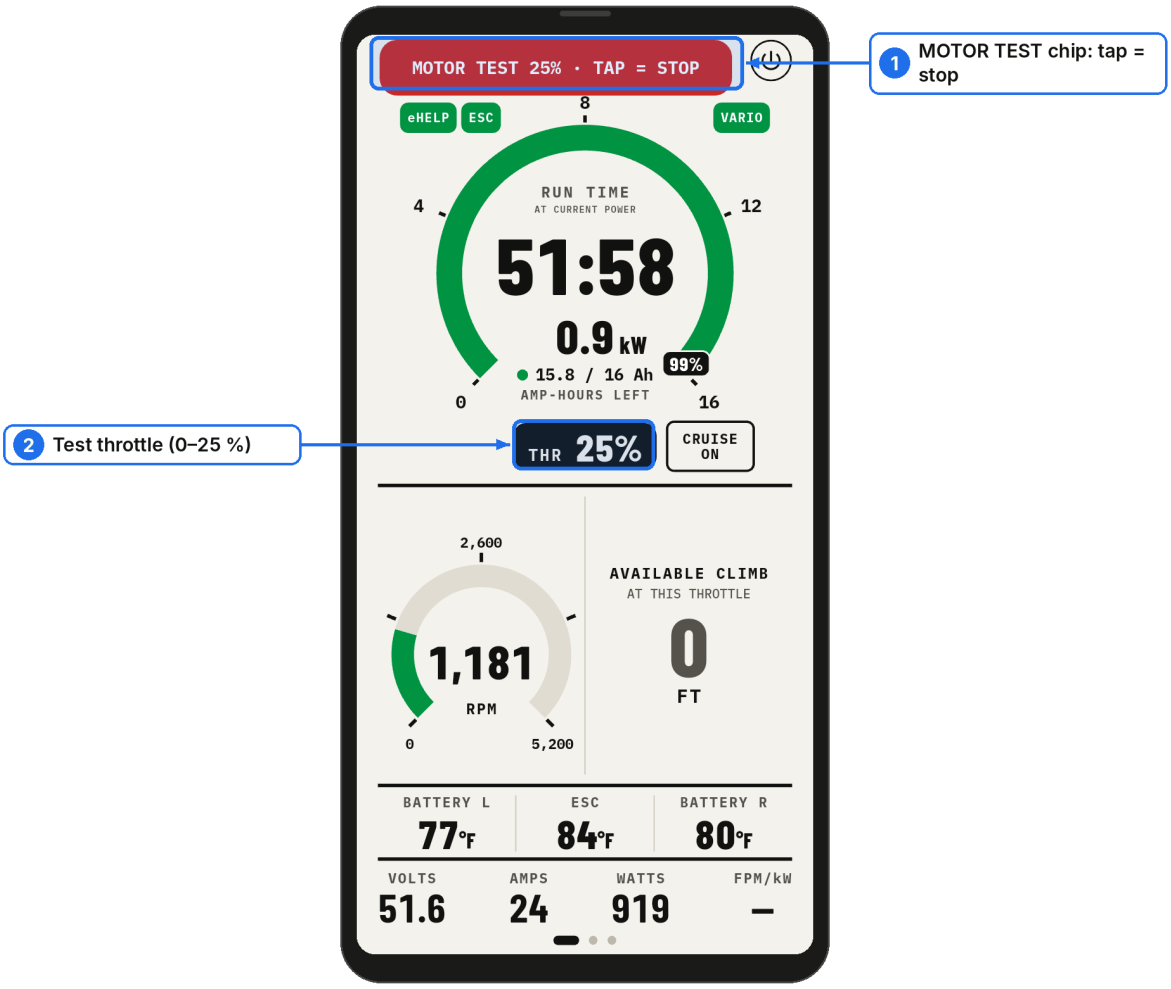


Figure 10.7 Motor test running.

1. The MOTOR TEST chip: tap it to stop.
2. The throttle the test is sending.

It stops when you tap the chip, press either T-QT button, move the throttle, or the phone disconnects, and on a throttle the kill switch, a fault, a disarm, or the ESC reaching 100 °C. The kill switch must be ON, the throttle at zero and the eHelp armed to start.

DANGER

The motor test spins the propeller with nobody on the throttle. Remove the propeller or secure the unit and keep clear of the propeller disc.

Demo data

Turn on *Simulated harness + vario* to explore the app with no hardware. A slider sets the throttle, and buttons drain the pack 18 %, overheat (or cool) the packs, and recharge. Turn it off before flying.

CHAPTER 11

Safety systems

Everything that can stop the motor lives on the eHelp, so it works whether or not the phone is connected.

11.1 What stops the motor

PROTECTION	TRIGGER	RESPONSE	RECOVERY
Kill switch	Switch OFF, or the kill or throttle-ground wire broken	0 % in the same 10 ms tick · KILL SW OFF	Switch ON for 50 ms and throttle back at zero
Wire fault	Throttle at its full-power rail (a broken throttle wire; which one depends on which way the pot is wired)	0 % within 10 ms · POT FAULT	Throttle back to zero
Pack over-temperature	Either pack at the pack temp cutoff	0 % at once, disarm · PACK HOT	3 °C cooler and throttle at zero
Motor over-temperature	Motor sensor at the motor temp cutoff (only if fitted)	0 % at once, disarm · MOTOR HOT	3 °C cooler and throttle at zero
Disarm	Long R (1.5 s)	0 % · DISARMED	Long R, throttle at zero
Watchdog	Controller stalls for 2 s	Controller resets; the ESC's throttle-loss protection stops the motor while there are no pulses	Automatic restart, armed; the throttle position goes straight to the ESC
Cruise cancel	Throttle, kill switch, screen touch, Bluetooth loss, fault	Back to the mouth throttle	—
Storage discharge	T-QT button, throttle, kill switch, phone screen touch, lost link (app start), pack 55 °C / ESC 100 °C, 20 min	0 %	—
Bench motor test	T-QT button, throttle, kill switch, MOTOR TEST chip, lost link, ESC 100 °C, pack hot, fault, disarm	0 %	—

After the kill switch, a wire fault, a disarm, a pack or motor over-temperature cut or throttle calibration, the eHelp waits for the throttle to return to zero before power comes back, so the motor never surges when the cause clears. A controller restart (watchdog) is the exception: the throttle position goes straight to the ESC again.

> **NOTE**
> A **missing** temperature sensor (unplugged or broken wire), pack or motor, never cuts the motor: losing a reading in flight is not the same as an overheating pack. Check both temperatures read before every flight.

11.2 What Bluetooth can and cannot do

The app cannot set a throttle level. It can only: ask the eHelp to hold the present throttle (cruise), and start the bench motor test or a storage discharge, both of which need the app’s heartbeat every 0.4 s and stop within 3 s without it. A storage run started from the app also needs R pressed on the T-QT.

CHAPTER 12

Care and maintenance

12.1 Before each flying day

- Charge the packs and tap *Battery just charged*.
- Inspect the propeller for nicks, cracks and delamination; check the hub bolts.
- Check all plugs and cables for damage and strain relief, especially the throttle cable and kill switch.
- Run the pre-flight checklist (3.5).

12.2 After flying

- Let the packs cool before charging.
- If you will not fly for more than a few days, run a storage discharge.
- Share and back up your flights.

12.3 Batteries

- Store packs at storage voltage, in a fire-safe bag or box, away from heat.
- Retire any pack that is puffed, damaged, or noticeably weaker (its full-power curve will show it).
- After changing packs, check the battery settings and start a new power-unit session.

12.4 Updates

The firmware and app are developed openly on GitHub. Update both together: they share the Bluetooth protocol, and the firmware version is shown under Settings and on the Bluetooth tab.

PART B

For builders

Wiring the controller, flashing the firmware, building the app, the Bluetooth protocol, and finding faults.

CHAPTER 13

Hardware and wiring

The eHelp controller is a LilyGO T-QT Pro plugged into the eHelp carrier board, which breaks its pins out to four connectors: J1 ESC, J2 fan, J3 temperature sensors and J4 throttle pot.

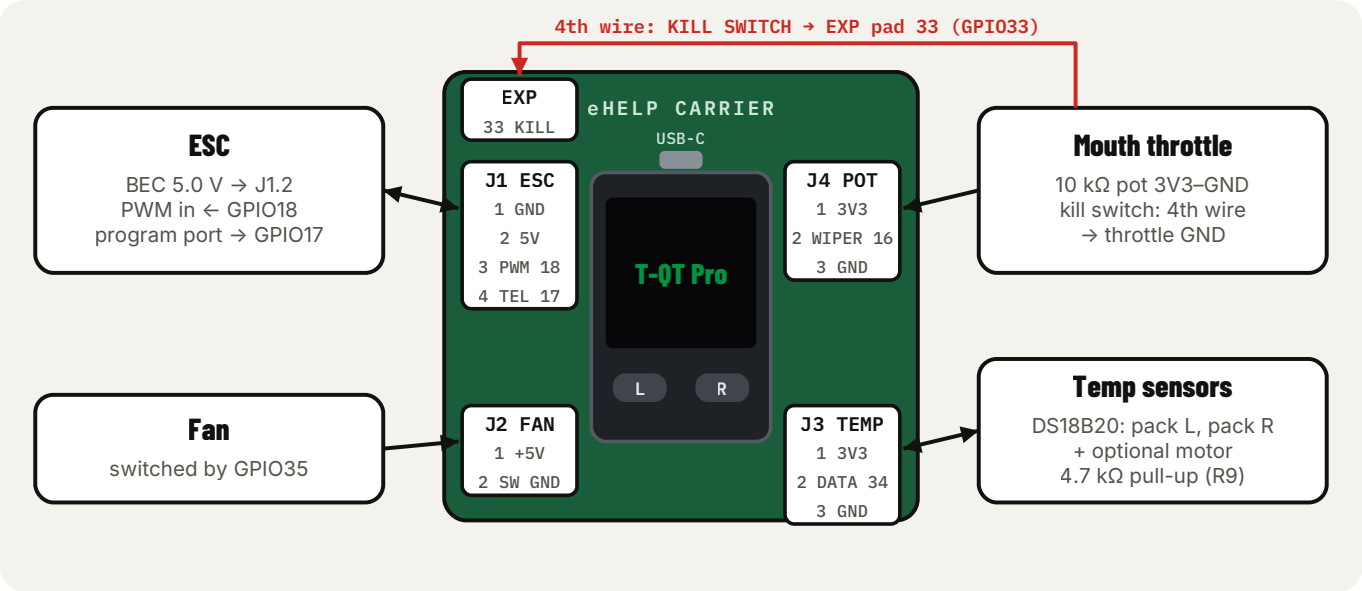


Figure 13.1 Carrier board connectors (T-QT fitted with USB-C toward the throttle plug). The kill-switch wire bypasses J4 and is soldered into EXP pad 33.

13.1 Pin map

SIGNAL	GPIO	CONNECTOR	NOTES
Throttle pot wiper	16	J4.2	ADC2 channel 5, internal pull-down on (a broken wiper wire reads 0, not floating). Read with `adc2_get_raw`.
ESC telemetry in	17	J1.4	From the ESC **programming port**, not the RPM lead. HW4 19200 or HW5 115200 baud, detected automatically.
ESC throttle PWM	18	J1.3	50 Hz, 1,100–1,940 µs, 14-bit LEDC.
DS18B20 1-Wire	34	J3.2	Both pack sensors and the optional motor sensor on one bus; 4.7 kΩ pull-up (R9).
Kill switch	33	EXP pad "33"	Fourth throttle wire, soldered into the EXP breakout (not on J4). Internal pull-up: switch closed to the throttle's GND = run, open = motor at 0 %.
Fan MOSFET gate	35	J2	Switched ground for the fan.

Buttons	47 / 0	on module	IO47 = L, IO0 (BOOT) = R as mounted.

13.2 Fitting the T-QT

With the carrier in portrait (FAN, ESC and TEMP plugs on the left, THROTTLE plug on top): screen up, **USB-C toward the THROTTLE plug**. The 5V · GND · NC · 16 · 17 · 18 · 48 row goes in socket H2 (silkscreen "T-QT R") and the 34 · 33 · 39 · 38 · 37 · 36 · 35 row in socket H1 ("T-QT L"). Mounted this way, LilyGO's pin-map picture is upside down, which is why IO47 is the left button. Check the 5V pin against the board before powering up.

> **NOTICE**
>
> **Set the ESC's BEC to 5.0 V before connecting J1.** The carrier has no regulator in the 5 V path; a higher BEC voltage will damage the T-QT.

13.3 Throttle and kill switch

- Use a spring-return potentiometer (about 10 kΩ) between 3.3 V and ground, wiper to J4.2. On the Alps slide pot the **wiper is pin 2** and the track ends are pins 1 and 3 (check with a meter: the two ends read a steady 10 kΩ between them; the wiper reading changes as you slide). Either end can go to 3.3 V: the calibration wizard (8.1) works out which way round it is.
- The cable has **four wires**: 3V3, signal (wiper) and GND to the 3-pin J4 plug, plus the kill-switch wire, which bypasses the plug and is soldered into the EXP breakout hole labelled **33** (GPIO33). Check with a meter that the hole beeps through to pin 33 on the T-QT socket before soldering.
- Inside the mouth throttle, wire the kill switch between the fourth wire and the **same GND terminal as the pot**. Switch ON pulls GPIO33 to ground (run); OFF lets the internal pull-up hold it high (motor at 0 %).
- Because the switch returns through the throttle's own ground wire, a broken ground (the one fault that makes the pot read high) also opens the kill loop and stops the motor. A broken kill wire reads as OFF. A broken signal wire (the input has a pull-down) or 3V3 wire reads 0 V: that is 0 % on a pot whose released end is at 0 V, and a latched POT FAULT on a pot wired the other way round. Either way the motor gets 0 %.
- Never wire the switch to 3V3 or into the signal line: only the ground connection gives every single wire break a safe result.
- The released position may sit right at the end of the range (0 V or 3.3 V, the zero rail): it simply reads 0 %, and cruise, the motor test and storage discharge all work.
- Full travel must **not** reach the other end of the range (the full-power rail, within about 60 counts of 0 V or 3.3 V), or full throttle reads as a broken wire (POT FAULT). If it does, limit the travel or add a small series resistor on that end of the pot.

13.4 ESC setup

- Hobbywing Platinum HV (260A V5 tested). Telemetry comes from the programming port; the ESC only sends it once it has armed.
- BEC 5.0 V.
- Leave the ESC’s throttle-loss protection on: without pulses it stops the motor, which backs up the eHelp’s watchdog.
- Volts and amps can be trimmed in the config characteristic if they disagree with a meter (`volt_scale` and `curr_scale` ×10000, `curr_offset` A×100). There is no app screen for these yet.

13.5 Temperature sensors and fan

Two DS18B20 sensors share the 1-Wire bus on J3, one taped to each pack. An optional third DS18B20 on the motor is wired onto the same three wires (3V3, data, GND) and becomes the **motor** sensor. They are found by their factory IDs; nothing to set up. A new sensor fills the first empty slot (pack L, then pack R, then motor); if one lands in the wrong slot, pick the right role for each sensor in Settings › Temperature sensors (warm a sensor with your hand to see which is which). Bond the motor sensor to the motor’s stator end or case where it cannot touch the rotating bell. Analog sensors such as the TMP36 will not work on this bus. The fan on J2 runs whenever the throttle output is 25 % or more (off below 20 %), and otherwise from the ESC temperature: on at the *Fan on at* setting (45 °C by default) and off again 5 °C below it (an eHelp that has never been set uses 38 °C). The fan temperatures are stored in 0.5 °C steps, so whole-degree settings in °F or °C are kept exactly.

CHAPTER 14

Firmware

The firmware is a PlatformIO project for the Arduino-ESP32 framework (espressif32 6.5.0, Arduino 2.0.14). The core logic is plain C++ with unit tests that run on a PC.

14.1 Build variants

ENV	SENSORS	ESC SIGNAL	USE
`tqt`	Real	**Live**	Flight build. Also needed for the bench motor test.
`tqt_bench`	Real	Held low	Wiring checks: throttle, temperatures, ESC telemetry, fan.
`tqt_sim`	Simulated flight	Held low	Testing the app over real Bluetooth with nothing wired. All screenshots in this manual.
`native`	—	—	Unit tests on the PC.

14.2 Ready-made firmware (no compiling)

Each release ships merged firmware images, so you can flash without installing PlatformIO. They are in `release/v1.1.6/` in the project (and on the GitHub Releases page), with a README and SHA-256 checksums.

FILE	USE
`eHelp-firmware-1.1.4-flight.bin`	The `tqt` flight build (drives the ESC)
`eHelp-firmware-1.1.4-demo-sim.bin`	The `tqt_sim` build: simulated data, ESC signal held low
`eHelp-app-1.1.5.apk`	The Android app

Each `.bin` holds the bootloader, partition table and firmware together: write it at address **0x0**.

1. **In a browser** (Chrome or Edge): open `espressif.github.io/esptool-js`, click Connect and pick the T-QT, set the address to `0x0`, choose the file and click Program. Unplug and replug when it finishes.
2. **Or with esptool**: `esptool.py --chip esp32s3 write_flash 0x0 eHelp-firmware-1.1.4-flight.bin`

Settings stored on the eHelp (battery, cutoffs, glider curves, sensor roles) are kept. The packaging script is `release/make_release.ps1`.

14.3 Flashing from source

```
pio run -e tqt -t upload --upload-port COM3
pio device monitor -b 115200
```

If the board does not appear as a COM port, hold R (BOOT, IO0) while plugging in USB-C, and make sure the cable carries data. If the screen stays blank or garbled, the board has the older panel: build with `-DLCD_PANEL_V3=0`.

> **WARNING**
>
> The `tqt` build drives the ESC. Remove the propeller before flashing or testing on the bench.

14.4 Serial status line

Once a second the firmware prints one line at 115200 baud. Opening the port normally resets the board; open it with DTR and RTS off to watch without a reset.

FIELD	MEANING
`pot`	Raw throttle ADC reading
`in / out`	Throttle after filtering / sent to the ESC, %
`armed fault cruise`	Throttle state flags
`V A rpm fet`	ESC telemetry
`esc age rx bad`	ESC link type, ms since the last good frame, bytes received, bad frames
`tL tR tM fan`	Pack L / R and motor temperatures, fan on/off
`st est R`	Storage phase, predicted resting V/cell, measured pack resistance
`mt hb`	Motor test on; ms since the app's last heartbeat
`kill`	1 = kill switch open (motor held at 0 %)

14.5 Code map and tests

FILE	ROLE
`src/main.cpp`	100 Hz throttle loop, 10 Hz telemetry, buttons, supervision
`src/ble_link.cpp`	NimBLE services, command queue
`src/esc_link.cpp`	Hobbywing telemetry hunt and decode
`src/temps.cpp`	Own 1-Wire driver in a FreeRTOS task (GPIO34 on the S3)

`src/display.cpp`	T-QT screens
`lib/core/`	throttle, cruise, fan, SOC, climb, profiles, pack guard, storage discharge, motor test, protocol
`test/test_core`	Unity tests against golden vectors from `protocol/ehelp_protocol.py`

`pio test -e native`

CHAPTER 15

Building the app

The app is Flutter (Dart) with two small Kotlin parts: a Classic Bluetooth bridge for older varios and the foreground recording service.

```
flutter pub get
flutter test
flutter build apk --release
adb install -r build/app/outputs/flutter-apk/app-release.apk
```

PATH	ROLE
lib/protocol/	BLE packets (mirrors the protocol), profiles, NMEA vario parser
lib/sources/	eHelp link, vario link (BLE and Classic), phone GPS, demo fakes
lib/state/	10 Hz clock, display filters, alerts, recorder, learning, climb maths, IGC
lib/ui/	Dashboard, Data, Setup tabs, throttle wizard, storage UI

> **NOTE**
> `flutter_blue_plus` 2.x needs a licence flag; the app uses the non-profit licence. Commercial distribution needs a commercial licence for it.

CHAPTER 16

Bluetooth protocol

The full byte-level specification is `protocol/packets.md` in the repository. This chapter is the overview.

- The eHelp advertises as `eHelp-XXXX` (last two MAC bytes) with the telemetry service UUID.
- All fields are little-endian. CRC is CRC-16/CCITT-FALSE. Temperatures use −32768 for "not available".
- UUIDs share the base `cd69XXXX-91c9-42f5-bacb-acedbd861ba5`.

CHARACTERISTIC	UUID	ACCESS	CONTENTS
telemetry	0002	notify 10 Hz	46 bytes: volts, amps, watts, RPM, throttle in/out, SOC, Ah, pack temps, flags, storage state, available climb, glider, kill switch and motor-hot (status2), motor temp
config	0011	read / write	20 bytes: battery, motor, fan and trim settings with CRC
ack	0012	notify	Result of each config write or command
device_info	0013	read	Firmware version, build flags, serial, throttle calibration and raw reading
command	0014	write	Opcode + arguments, up to 40 bytes
profiles	0015	read	179 bytes: four gliders, power unit, reserve, CRC
sensors	0016	read	Up to 4 temperature sensors: ID, role and reading, refreshed every second

16.1 Commands

OP	NAME	EFFECT
01	SOC_FULL	Battery just charged
02	SWAP_TEMP_SENSORS	Swap two sensor slots (older apps; kept for compatibility)
04	SET_SENSOR_ROLE	Role (0 none, 1 pack L, 2 pack R, 3 motor) + 8-byte sensor ID; the previous holder of that role goes blank (saved)
03	SOC_FROM_VOLTAGE	Estimate charge from resting voltage
10–13	THROTTLE_CAL_*	Set closed / full, reset range, calibration mode on/off
20	CURRENT_ZERO	Treat present current as 0 A
30 / 31	CRUISE_ON / OFF	Hold the present throttle / release
40 / 41	STORAGE_ARM / ABORT	Arm with cap % and target mV/cell / stop
42	HEARTBEAT	Every 400 ms during storage, motor test and calibration; not ACKed

50–52	SET_*	Temperature unit, pack temp cutoff (0x51), climb reserve (0x52), motor temp cutoff (0x53)
60–62	MOTOR_TEST / FAN_TEST	Bench motor test start/stop, force fan
70–76	GLIDER_* / POWER_UNIT_*	Select, save, undo, learning, delete; power-unit save and undo

The app waits up to 3 s for each acknowledgement. Results: OK, CRC_ERROR, OUT_OF_RANGE, BUSY, BAD_LENGTH, UNKNOWN_COMMAND. Config writes are refused (BUSY) while the motor is running.

CHAPTER 17

Troubleshooting

SYMPTOM	LIKELY CAUSE	WHAT TO DO
T-QT shows **NO ESC**, battery dashes	No ESC telemetry	Connect the battery; the ESC must arm (needs throttle pulses) before it sends data. Check the lead goes to the programming port, J1.4.
POT FAULT	Throttle reading at its full-power end of the range: a broken wire (ground on a pot whose released end is 0 V; 3V3 or signal on a pot wired the other way), or full travel reaching the rail	Check the throttle wires and plug, then recalibrate (8.1). If full travel reaches the rail, limit it or add a series resistor.
THR TO 0 won't clear	Throttle not reading zero	Release the throttle fully; check the closed point in the wizard.
KILL SW OFF with the switch ON	Kill wire or throttle ground broken, or the wire not on GPIO33	Check the fourth wire at EXP pad 33 and the switch's ground connection in the throttle. Serial line `kill=1`.
Motor test refused on a bare bench	No kill switch fitted, so it reads OFF	Fit the throttle, or jumper EXP pad 33 to GND for bench tests only.
Motor doesn't respond, bar ARMED	Throttle not calibrated, or reading 0 %	Run the calibration wizard; check THR follows the throttle.
Bar ARMED SIM, or NO ESC on a bench build	Simulator or bench firmware	Both hold the ESC signal low. Flash the `tqt` build.
Pack or motor temperature shows a dash	Sensor missing or bad joint (no motor sensor fitted also shows a dash)	Check J3 and the sensor lead. A new sensor is picked up within 3 s.
Temperatures in the wrong places (L, R, motor)	Sensor order	Settings › Temperature sensors: set each sensor's role (Pack L, Pack R, Motor).
MOTOR HOT with a cool motor	Motor sensor in a pack slot, or cutoff set low	Check each sensor's role, and the motor temp cutoff in Settings.
Charge looks wrong at power-up	Pack not rested, or wrong settings	Check Battery settings; after charging tap *Battery just charged*.
Storage won't start	See NOT READY reason (4.5)	Kill switch ON, ESC data present, motor stopped, pack above target, packs cool.
	App heartbeat interrupted	

Storage stops with PHONE LOST		Keep the phone close with the app open, or start storage from the T-QT instead.
Vario not found	Vario not advertising	Digifly AIR: TCHA = BLE, TAUT = ON. Classic varios: pair in Android settings first.
No IGC file / empty track	No GPS fixes	Allow the app Location permission and give the phone a view of the sky; Settings › GPS shows the fix.
Available climb stays grey	Glider not learned yet	Fly with learning on; save the proposal after enough takeoffs and glides.
App slow or buttons laggy	Slow phone	Close other apps; the dashboard redraws 10 times a second.
Blank or garbled T-QT screen	Older LCD panel	Rebuild with `-DLCD_PANEL_V3=0`.
No COM port	Charge-only cable or boot mode	Use a data cable; hold BOOT (R) while plugging in.

CHAPTER 18

Reference

18.1 Default settings

SETTING	DEFAULT	STORED ON
Chemistry · packs · cells · capacity	LiPo HV · 2 · 6S · 16,000 mAh	eHelp
Motor KV · poles	100 · 30	eHelp
Fan on at (off 5 °C lower)	45 °C	eHelp
Low battery warning (climb reserve)	25 % (eHelp uses 20 % until the app has connected)	Phone + eHelp
Pack temp caution	48 °C (118 °F)	Phone
Pack temp cutoff	55 °C (131 °F)	Phone + eHelp
Motor temp caution	80 °C (176 °F)	Phone
Motor temp cutoff	100 °C (212 °F)	Phone + eHelp
Units	°F, ft	Phone; °F/°C also on the eHelp
Storage target · power cap	Chemistry default · 75 %	Phone + eHelp
Throttle range (raw)	300 – 3800	eHelp
Starting climb curve	520 ft/min at 9 kW, 200 ft/min sink	Built in, used until learned
Starting power curve	9 kW full, k = 3	Built in, used until learned

18.2 Glossary

TERM	MEANING
Arm / disarm	Whether the eHelp passes your throttle to the ESC.
Available climb	Height the remaining charge (above the reserve) can still give you.
BEC	The ESC's built-in regulator that powers the eHelp.
Coulomb counting	Measuring charge by adding up the current over time.
Cruise	The eHelp holding a throttle setting so you can let go.
ESC	Electronic speed controller: drives the motor from the battery.
IGC	Standard flight-log file format.

Kill switch	Switch on the fourth throttle wire to GPIO33; OFF, or a broken kill or ground wire, always means 0 %.
NMEA	Text sentence format used by GPS units and varios.
Provisional	A curve not yet learned from enough flights; shown grey.
QNE	Pressure altitude referenced to standard pressure (1013.25 hPa).
SOC	State of charge, %.
Storage voltage	The resting cell voltage LiPo packs keep best at, about 3.8–3.85 V.
T-QT	The LilyGO T-QT Pro controller with its screen and two buttons.

Sources consulted for layout and safety-message style: the Digifly AIR user manual, ANSI Z535.6 product-safety message guidance, and current practice for annotated software documentation.