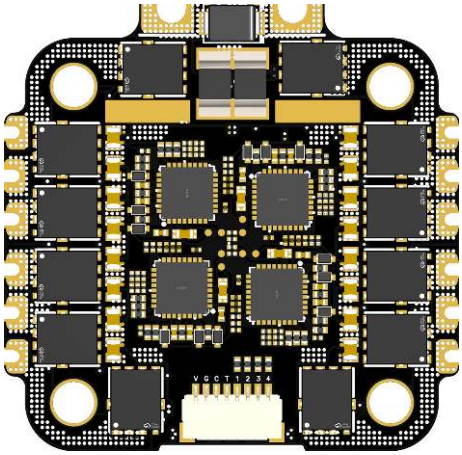
4v1 ESC 45 A AM32

User manual
4-in-1 electronic speed controller, 45 A, with AM32 firmware for FPV drones



Read the whole manual before assembly. The wrong signal cable wire order will destroy both the flight controller and the ESC.

Version 1.0 · Rotorama, s.r.o.

Contents

1. Safety instructions

1.1 Before you start

1.2 Handling the board

1.3 Li-Po and LiHV batteries

1.4 Rotating propellers and bench testing

1.5 Temperature and cooling

2. Product description

2.1 Package contents

2.2 Signal connector

2.3 Specifications

3. Legal conditions of operation in the CZ and the EU

3.1 The law of the country you fly in applies

3.2 The ESC is a component, not a finished drone

3.3 Operator registration and operational categories

4. Installation and wiring

4.1 What else you need

4.2 Mounting in the frame

4.3 Power supply and capacitor

4.4 Motors

4.5 Connecting to the flight controller

5. Setting up

5.1 ESC firmware

5.2 ESC parameters

5.3 Checking the motor order and direction

5.4 Voltage and current sensing

6. Operation

6.1 Pre-flight check

6.2 Monitoring the battery voltage

6.3 Temperature

7. Maintenance and troubleshooting

7.1 After every flight

7.2 Soldering and repairs

7.3 Storage

7.4 Troubleshooting

8. Information for the EU and Czech Market

9. Warranty and rights arising from defective performance

1. Safety instructions

1.1 Before you start

This product is an **electronic component of an unmanned aircraft**, not a finished product ready for use. The ESC becomes usable only after being built into an aircraft, wired to the flight controller and the motors, and configured.

- Read this entire manual before you start building and keep it for future reference.
- The ESC works with battery voltage and with currents of tens of amperes. A wiring error can cause a **fire** or destroy the board.
- Building requires experience with soldering and with model building. If you are not confident, ask an experienced modeller for help.
- This product is not a toy. It is not intended for children or for persons not familiar with this manual.
- Do not use a damaged ESC – after a crash, after overheating, with a cracked board or with a burnt component.

1.2 Handling the board

The board is sensitive to static electricity and to mechanical damage.

- Hold the board by its edges; do not touch the solder pads, the connector or the components.
- Discharge static electricity by touching a grounded metal object before handling.
- Do not place the board on metal or conductive surfaces, including the carbon parts of the frame.
- The SH1.0 connector is small. When plugging and unplugging, support the connector body with your fingers, otherwise you will tear it off the board.

1.3 Li-Po and LiHV batteries

The ESC is designed for a supply of **9–30 V**, i.e. **3–7S Li-Po** or **3–6S LiHV**. Connecting a battery with more cells will destroy the board immediately. Always match the configuration with the flight controller as well – the lower of the two figures applies.

State	Li-Po	6S Li-Po	4S Li-Po
fully charged	4.20 V/cell	25.2 V	16.8 V
end the flight	3.50 V/cell	21.0 V	14.0 V
storage	3.80 V/cell	22.8 V	15.2 V

- For LiHV batteries a full charge is **4.35 V per cell**; the other figures are the same as for Li-Po.

- Charge only with a charger intended for the given cell type and never leave it unattended.
- Do not use a battery with a swollen pouch, a damaged lead or after a hard crash.
- Never connect the battery with reversed polarity – reverse polarity destroys the ESC and such damage is not a product defect.

1.4 Rotating propellers and bench testing

Most of the setup can be done without propellers. Do not fit the propellers until the aircraft is fully configured.

- **Always** remove the propellers before testing the motors or flashing the ESC firmware.
- Secure the aircraft mechanically during motor tests and never reach into the plane of the propellers.
- When tuning parameters or flashing firmware, power the ESC **from a battery**, not from USB – but always without propellers.
- Never stand, and never let others stand, in line with the propellers.

1.5 Temperature and cooling

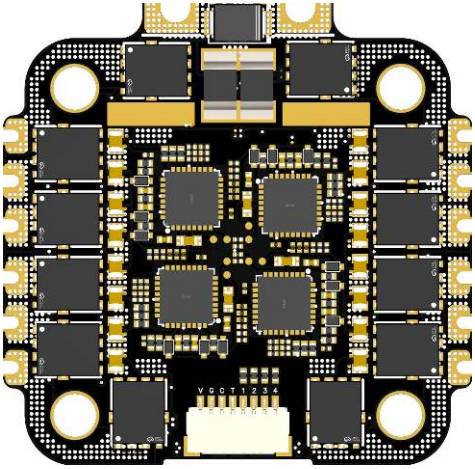
The ESC becomes very hot under load. The power MOSFETs and the copper areas around them get the hottest.

- The ESC **must not** be wrapped in heat-shrink tubing, potted or waterproofed in any way. Such modifications block heat dissipation and any damage caused by them cannot be claimed under warranty.
- Route the motor wires so that they do not touch any components of the ESC.
- The board must not touch the carbon parts of the frame, the battery connector or other boards – a short circuit may occur.
- Do not leave the aircraft standing with the battery connected and without airflow.
- Let the board cool down after a flight before you touch it.

When the ESC operates outside its rated conditions – higher ambient temperature, high humidity, low pressure or no airflow – its current capability drops and the continuous current is lower than the rated value.

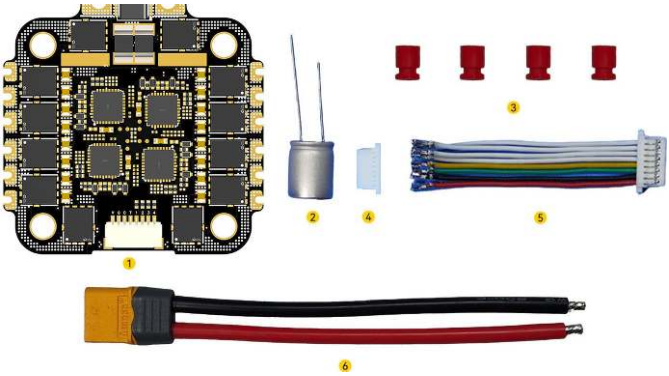
2. Product description

The **FlyingRC 4-in-1 ESC 45 A** is a 4-in-1 electronic speed controller for FPV drones running **AM32** firmware. The HYG011N04 power MOSFETs use a DFN 5 × 6 package with a large bottom thermal pad that conducts heat into the printed circuit board. Current is also carried by two gold and nickel-plated surface-mount copper strips. The board uses a 30.5 × 30.5 mm mounting pattern and the ESC supports sinusoidal startup.



Top side of the ESC with the connector and pin markings

2.1 Package contents



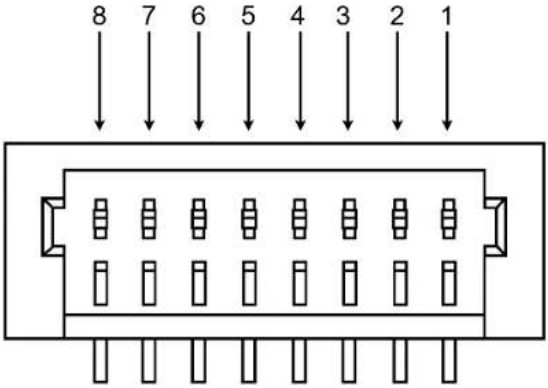
Package contents

① 1× FlyingRC 4-in-1 ESC 45 A
② 1× solid capacitor 35 V / 680 µF
③ 4× M3 anti-vibration standoff
④ 1× SH1.0 crimp connector
⑤ 1× SH1.0 8-pin signal cable
⑥ 1× XT60 power cable, 12 AWG, 12 cm

The battery, motors, frame, propellers and flight controller are not included.

2.2 Signal connector

The signal connector is an 8-pin SH1.0 type. Pins are counted from the left when looking at the connector from the front:



SH1.0 8P connector pin numbering

Pin	Name	Function
1	VBAT	battery voltage
2	G	ground
3	CURR	analog current sensor output
4	TX	ESC telemetry
5	M1	motor 1 signal
6	M2	motor 2 signal
7	M3	motor 3 signal
8	M4	motor 4 signal

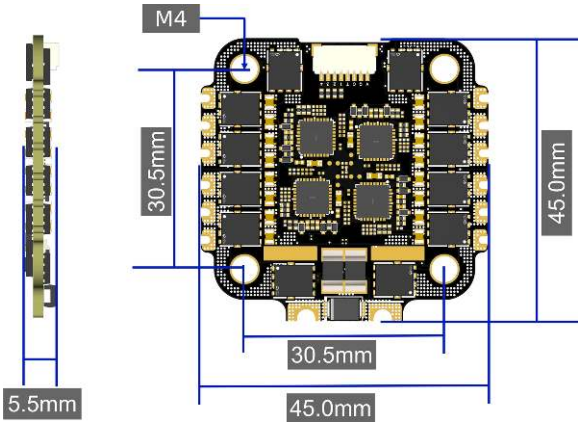
The signal cable is factory-crimped in the order matching the ESC. Before connecting the battery for the first time, always compare the wire order with the flight controller connector using the table in chapter 4.5.

2.3 Specifications

Model	FlyingRC 4-in-1 ESC 45 A
Microcontroller	QF32F4AK8U7, 32-bit, 120 MHz
Memory	64 kB Flash, 16 kB RAM
Gate driver	ID6288
Power MOSFETs	HYG011N04, DFN 5 × 6 package, 40 V
On-resistance	1.0 mΩ at 10 V
Power input	9–30 V, 3–7S Li-Po or 3–6S LiHV
Continuous current per channel	45 A for 5 s (tested on 4S)
Burst current per channel	50 A (tested on 4S)
Current meter scale	100 (1/10 mV/A) in Betaflight, 100 (A/V) in Ardupilot
Firmware	AM32
Input signal	DSHOT150/300/600, OneShot, PWM and others
Printed circuit board	6 layers, 2 oz copper, resin-filled vias, immersion gold finish
Dimensions	45 × 45 × 5.5 mm
Mounting holes	30.5 × 30.5 mm pattern, M3 screws
Weight	16.6 g
Operating temperature	−10 °C to 100 °C
Storage temperature	0 °C to 40 °C

※ The manufacturer's dimension drawing labels the mounting hole *M2*. The manufacturer's specification table, the product page and the supplied standoffs all correspond to M3 screws; follow the M3 figure.

※ The manufacturer states the continuous current for a period of 5 s when tested on 4S. The actual continuous current depends on cooling and is lower.



ESC dimensions

3. Legal conditions of operation in the Czech Republic and the EU

3.1 The law of the country you fly in applies

Regulations (EU) 2019/947 and 2019/945 apply in all Member States of the European Union, but the national implementing rules differ from state to state – registration portals, pilot age, geographical zones, insurance, frequency bands and transmit powers. The information in this chapter describes the situation in the Czech Republic. If you fly in another country, you must follow the rules of that state.

3.2 The ESC is a component, not a finished drone

The ESC is not an unmanned aircraft. Regulation (EU) 2019/945, which defines classes C0 to C6, applies to finished unmanned aircraft systems bearing a class identification label, not to individual parts. The board therefore cannot bear a class marking. It contains no radio equipment either.

Once the board is built into an aircraft, Regulation (EU) 2019/947 and the related Czech rules apply to the **operation** of that aircraft. Responsibility for compliance rests with the operator.

3.3 Operator registration and operational categories

These obligations apply to the finished aircraft you build the board into.

- The operator must **register** if the aircraft carries a sensor capable of capturing personal data, i.e. a camera – regardless of weight. In the Czech Republic registration runs at dron.caa.gov.cz and the number issued must be displayed on the aircraft.
- An aircraft without a class marking built after 1 January 2024 may be operated as a **privately built unmanned aircraft system** – in subcategory A1 below 250 g and 19 m/s, otherwise in subcategory A3; subcategory A2 is not available. A drone using this ESC usually weighs well over 250 g, so expect **subcategory A3**.
- The usual open-category limits apply: **up to 120 m** above ground, continuous visual contact and no flying over assemblies of people. Subcategory A3 also requires 150 m from residential, commercial, industrial and recreational areas.
- With FPV goggles, an **unmanned aircraft observer** must stand next to you and keep visual contact with the aircraft without optical aids.
- Before flying, check the geographical zones at dronemap.rlp.cz and weigh the actual take-off mass including the battery.
- Liability insurance is not compulsory for small aircraft in the open category, but we recommend it.

4. Installation and wiring

4.1 What else you need

In addition to the package contents you will need:

- a frame with a 30.5 × 30.5 mm mounting pattern and four motors,
- a flight controller with outputs for a 4-in-1 ESC,
- a 3–7S Li-Po or 3–6S LiHV battery and a charger,
- a temperature-controlled soldering iron, solder, wires and heat-shrink,
- a computer with AM32 ESC Tools and the flight controller configurator.

4.2 Mounting in the frame

The board uses a 30.5 × 30.5 mm mounting pattern with M3 screws. The ESC is usually mounted **at the bottom**, closer to the battery, with the flight controller above it.

① Insert the supplied M3 anti-vibration standoffs into the holes of the board.

② Place the ESC in the frame and secure it with M3 screws.

③ Tighten the screws only lightly – overtightening compresses the standoffs and stops them damping vibration.

④ Check that the board does not touch the frame or another board with any component.

An insulating gap must remain between the board and the carbon parts of the frame – carbon is conductive.

4.3 Power supply and capacitor

The battery is connected to the power pads of the ESC; the VBAT pin of the signal connector then also powers the flight controller.

① Solder the supplied XT60 cable to the power pads. Observe the polarity – **+** is positive, **−** negative.

② Solder the supplied **35 V / 680 µF capacitor** to the same pads. The red stripe on the can marks the **negative** terminal.

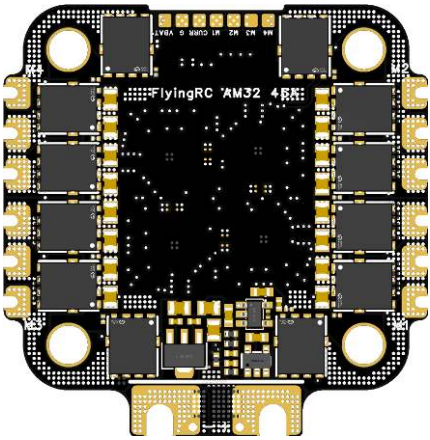
③ Once cool, check the joints and make sure the solder does not bridge adjacent pads.

The capacitor suppresses voltage spikes from the motors. Without it you risk gyro noise, video transmitter dropouts and destruction of the ESC.

- The solder pads are large and gold-plated, so they conduct heat well. Use a soldering iron with enough power, ideally with a T12 or 936 series tip, and solder with about 63 % tin content.
- If you do not have suitable equipment, have the cable and the capacitor soldered for you.

4.4 Motors

The motor wires are soldered to the **M1** to **M4** pads in the corners of the board. The pad markings are printed on the bottom side of the board.



Bottom side of the ESC with the M1 to M4 motor pads

- The order of the three motor wires does not matter – the direction of rotation is set in the firmware.
- The motor wires **must not touch any components of the ESC** or the pads of other channels.
- Route the wires so that they cannot reach the propellers and secure them in the frame.
- Check the assignment of motors to the outputs in the configurator before fitting the propellers.

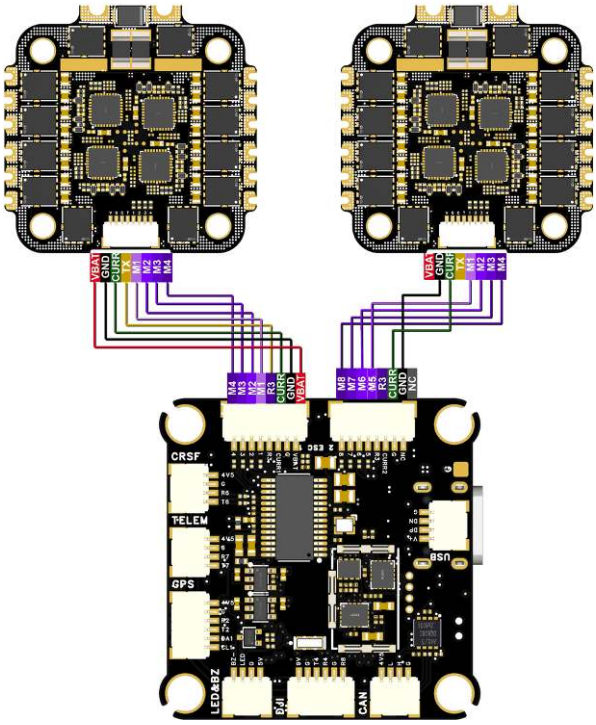
4.5 Connecting to the flight controller

‼ The signal cable must have the wire order matching the flight controller you use. The wrong order will destroy both the flight controller and the ESC. Always check the order before you connect the battery for the first time.

The package contains a double-ended SH1.0 8P cable. One end is crimped to match the ESC, the other is loose; the supplied SH1.0 8P connector lets you re-order the wires for your flight controller.

ESC	Flight controller	Function
VBAT	VBAT	battery voltage
G	G	ground
CURR	CURR	current sensor

ESC	Flight controller	Function
TX	telemetry RX	ESC telemetry
M1	output 1	motor 1 signal
M2	output 2	motor 2 signal
M3	output 3	motor 3 signal
M4	output 4	motor 4 signal



Example of wiring to a FlyingRC H7D Pro flight controller, based on the manufacturer's documentation

- Pin markings differ between flight controllers – follow your own board's manual.
- The **TX** telemetry line goes to the receive line of a serial port on the flight controller.

5. Setting up

5.1 ESC firmware

The ESCs ship with AM32 firmware pre-flashed and are tested at several voltages before dispatch.

‼ Do not use the ESC configurator running in a web browser. Flashing firmware this way may destroy the ESC microcontroller.

To flash the firmware and set the parameters, use the AM32 ESC Tools application, which you download from the manufacturer's website and run locally. The ESC is connected to the computer through the flight controller.

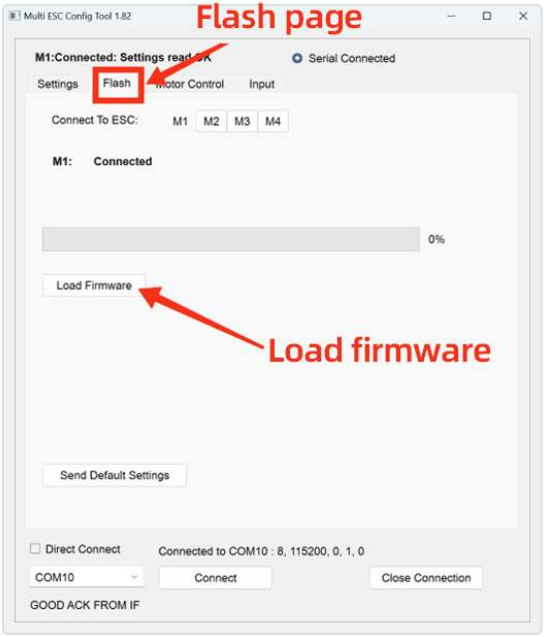
① Remove the propellers.

② Close the flight controller configurator so that its serial port is released.

③ Connect the flight controller to the computer and **connect a battery to the ESC**.

④ Start AM32 ESC Tools, select the COM port of the flight controller in the bottom right corner and press *Connect*.

⑤ If no error message appears, the application is connected.



The Flash tab in AM32 ESC Tools

⑥ Go to the *Flash* tab, select **M1** and press *Load Firmware*.

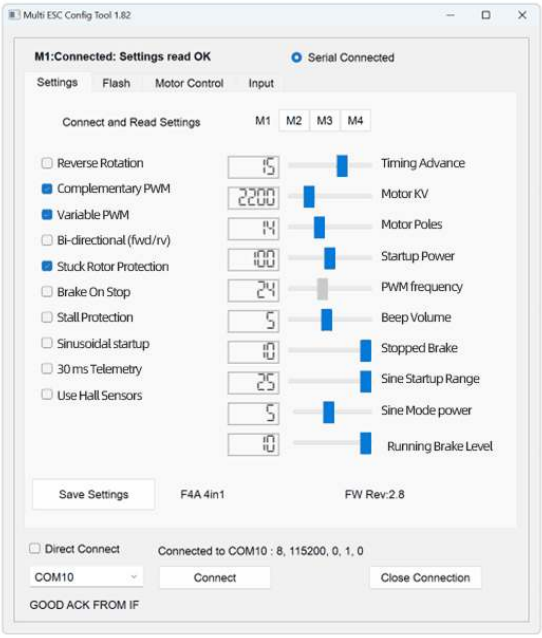
⑦ Select the downloaded firmware file in the dialog and press *Flash Firmware*. Wait until the progress bar completes.

⑧ Press *Send Default Settings* to restore the default parameters. This step is required when several firmware versions have been skipped.

⑨ Repeat the whole procedure for M2, M3 and M4.

5.2 ESC parameters

The parameters are set in the same application on the *Settings* tab; the connection procedure is the same as in chapter 5.1.



The Settings tab in AM32 ESC Tools

- **Motor KV** – set the value as close as possible to the actual KV of the motor. The deviation must not exceed 30 %. With a deviation above 100 % the motor may not run at all and the ESC may be damaged.
- **Timing Advance** – **do not change**. An incorrect setting will destroy the ESC and such damage is usually beyond repair.
- **Stall Protection** – enable it for low-KV motors (below 500) and always when sinusoidal startup is used.
- **Sinusoidal Startup** – not required for ordinary FPV drones.
- Save the changes with *Save Settings* and set the same values for all four motors.

5.3 Checking the motor order and direction

Always carry out this test without propellers and with the aircraft mechanically secured.

① Remove the propellers and connect the battery.

② Open the *Motors* tab in the flight controller configurator and enable motor testing.

③ Spin up motors 1 to 4 one by one and check that the intended motor runs.

④ Check the direction of rotation; if it is wrong, change it in AM32 ESC Tools with *Reverse Rotation*.

⑤ Fit the propellers according to the flight controller firmware diagram only after a successful test.

5.4 Voltage and current sensing

The ESC provides the analog current sensor signal on the **CURR** pin and the battery voltage on the **VBAT** pin. The flight controller processes the values; set the following scale in it:

Firmware	Parameter	Value
Betaflight	current meter scale	100 (1/10 mV/A)
Ardupilot	current meter scale	100 (A/V)

- The voltage divider is part of the flight controller, not of the ESC – set its ratio according to that board's manual.
- After the first power-up, compare the voltage shown in the configurator with the voltage measured directly on the battery and recalibrate the ratio if it differs.

Manufacturer's notes: every ESC is tested before dispatch, and flashing the firmware requires a locally installed application, not the web configurator.

6. Operation

6.1 Pre-flight check

Go through this checklist before every flight:

- The propellers are undamaged, correctly oriented and tightened.
- The board is firmly secured and no wire is loose or chafed.
- The motor wires do not touch any components of the ESC.
- The capacitor is soldered in place and undamaged.
- The radio is switched on, its battery is charged and the Arm switch is in the off position.
- A **fully charged** battery is fitted in the aircraft – 4.20 V per cell for Li-Po, 4.35 V for LiHV.
- The battery connector is secured and the battery is strapped down.
- You have verified the range and the failsafe function.

6.2 Monitoring the battery voltage

The ESC passes the measured current to the flight controller, which shows it in the on-screen display and telemetry.

- End the flight at **3.50 V per cell** at the latest – 21.0 V for a 6S pack and 14.0 V for a 4S pack.
- Deep discharge damages the battery permanently and reduces its capacity.
- The voltage reading fluctuates under load; what matters is the voltage at rest after landing.
- Let the battery cool down after the flight before charging it.

6.3 Temperature

Under high load the ESC becomes hotter than any other part of the aircraft.

- Disconnect the battery between flights and let the board cool down.
- Do not leave the aircraft standing in the sun with the battery connected.
- If the temperature rises excessively, check that the motors are not seized, that the propellers are undamaged and that the KV setting is correct.
- Never cover the board with tubing or foam – the heat must escape into the surrounding air.

7. Maintenance and troubleshooting

7.1 After every flight

- Disconnect the battery and let the board cool down.
- Check the solder joints, the motor wires and the capacitor mounting.
- Remove dirt with a soft brush; do not use solvents.
- After a crash, always inspect the board against the light – look for cracked joints and loose components.

7.2 Soldering and repairs

- Use a temperature-controlled soldering iron with enough power; the ESC pads conduct heat very well.
- Do not overheat the pads – a lifted pad cannot be repaired.
- Always disconnect the battery before soldering.
- Desoldering a component or modifying the board is not a product defect and cannot be claimed under warranty.

7.3 Storage

- Store the board in an antistatic bag, in a dry place and out of the reach of children.
- Store batteries charged to **3.80 V per cell**, i.e. 22.8 V for a 6S pack.
- Check the batteries regularly during longer storage.

7.4 Troubleshooting

Problem	Possible cause	Solution
Nothing lights up after connecting the battery	wrong wire order of the signal cable, reverse polarity	disconnect the battery immediately and check the cable against the table in chapter 4.5
A motor does not run or runs the wrong way	swapped wires, reversed direction in the ESC firmware	check the order on the *Motors* tab, change the direction with *Reverse Rotation*
A motor starts jerkily or beeps and stops	incorrect motor KV setting	set *Motor KV* to the actual KV of the motor
The ESC overheats	no airflow, overload, seized motor	check the motors and propellers, make sure there is airflow, never wrap it in tubing
The application does not connect to the ESC	flight controller configurator open, no battery connected	close the configurator and connect a battery to the ESC
Voltage fluctuates, the gyro is noisy	missing or badly soldered capacitor	solder the supplied capacitor to the power pads
The displayed current does not match reality	wrong current meter scale	set the scale to 100 as described in chapter 5.4
The ESC does not communicate after a crash	damaged microcontroller or broken trace	inspect the board against the light and contact your dealer

8. Information for the EU and Czech Market

8.1 Importer and responsible person in the EU

The product is placed on the European Union market by the importer stated below, who is at the same time the responsible person within the meaning of Article 16 of Regulation (EU) 2023/988 of the European Parliament and of the Council on general product safety (GPSR).

Importer / responsible person in the EU	Rotorama, s.r.o.
Company ID (IČO)	051 57 692
VAT ID (DIČ)	CZ05157692
Registered office	Okrajová 1351, 674 01 Třebíč, Czech Republic
E-mail	info@rotorama.cz
Phone	+420 252 252 098
Website	www.rotorama.cz

8.2 Product conformity

CE

- The product bears the **CE** marking and complies with the requirements of the applicable European Union harmonisation legislation.
- A copy of the **EU Declaration of Conformity** is available from the importer at the address stated above or at the e-mail address info@rotorama.cz.
- **Product identification:** the type designation is printed directly on the board.

8.3 Disposal of electrical equipment

- The crossed-out wheeled bin symbol on the product, its packaging or in the documentation means that at the end of its service life the product **must not be disposed of together with mixed municipal waste**.
- Hand it over at a take-back point for electrical equipment – at a collection yard, at a take-back point of a collective system, or at the retailer when purchasing a new equivalent product. Take-back is free of charge for the end user.
- The obligations under Act No. 542/2020 Coll., on end-of-life products, are fulfilled by the importer through a collective take-back system.
- Proper disposal helps prevent negative impacts on the environment and human health and contributes to the reuse of secondary raw materials.

Through its contractual partner **ASEKOL a.s.**, the company ensures the take-back of waste electrical equipment from households and the separate collection of waste electrical equipment, batteries and accumulators in accordance with the applicable legislation. The customer is entitled to hand over old electrical equipment or a battery or accumulator at any collection point of the above contractual partner. The addresses of these take-back points are listed at www.asekol.cz, www.ecobat.cz and also https://visoh2.mzp.cz/RegistrMistZO/RegistrMistZOPublic/MapaMistZpetOdberu.

9. Warranty and rights arising from defective performance

The rights and obligations of the contracting parties are governed by Czech law, in particular by Act No. 89/2012 Coll., the Civil Code, and Act No. 634/1992 Coll., on consumer protection. The manufacturer does not issue its own warranty terms for this product.

- The seller is liable to the buyer for the product being free of defects on receipt. If the buyer is a consumer, a defect may be notified **within two years of receipt** of the product (Section 2165 of the Civil Code).
- If a defect appears within **one year** of receipt, the product is deemed to have been defective already at the time of receipt (Section 2161(5) of the Civil Code).
- When purchasing online, a consumer has the right to **withdraw from the contract within 14 days** of receiving the goods without giving a reason (Section 1829 of the Civil Code).
- Claims should be made with the retailer from whom you purchased the product. The importer's contact details are given in Chapter 8.1.
- The competent body for out-of-court settlement of consumer disputes is the **Czech Trade Inspection Authority**, Štěpánská 796/44, 110 00 Prague 1, www.coi.cz.