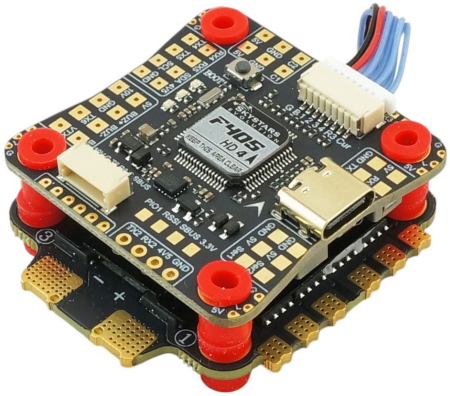
F4 V4 + KO50A II

Skystars F405 HD4 + KO50 II 50A BLHeli_S
Flight controller (FC) and electronic speed controller (ESC), 30.5 × 30.5 mm, 3–6S



Read the entire manual before installation and first connection. Always remove the propellers during setup.

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1. Safety instructions

1.1 Before you start

Skystars F4 V4 + KO50A II BLS is a stack consisting of the **Skystars F405 HD4** flight controller (FC) and the **Skystars KO50 II** 4-in-1 electronic speed controller (ESC), designed to be installed in an FPV drone. Installation requires experience with soldering electronics and wiring FPV components. This product is not a toy and is not intended for children. Before installation, read this entire manual as well as the manuals of all components you connect to the stack.

- Work on a dry, clean, non-flammable, well-lit workbench.
- Before each connection, check the pad descriptions in section 2.4 and the labels printed on the board – incorrect power wiring can permanently damage the flight controller, the ESC and any connected devices.
- Damage caused by incorrect wiring, reverse polarity, a short circuit or mechanical modification of the board is not a product defect.

1.2 Power supply and short circuits

- The stack is designed to be powered from a **3S to 6S** Li-Po battery. A higher voltage will destroy it. The ESC is marked with a voltage of **25 V** – therefore do not use 6S LiHV batteries (26.1 V when fully charged).
- Always connect the battery to the ESC power pads (+ and −), never directly to the flight controller pads. The flight controller is powered from the ESC via the interconnect cable with an SH1.0-8P connector.
- Before connecting the battery for the first time, use a multimeter to check that there is no short circuit between the positive and negative power pads. For the first power-up, we recommend a protective current limiter (smoke stopper).
- Never short-circuit or overload the 5 V, 10 V and 3.3 V outputs. Do not connect devices requiring a higher voltage to the 5 V and 3.3 V pads; do not connect devices that cannot withstand that voltage to the 10 V and BAT pads.
- The stack must not come into contact with water, moisture or conductive debris (e.g. metal filings, carbon dust from the frame).

1.3 Propellers during setup

Always remove the propellers during any setup, motor testing and firmware update. The motors may start spinning unexpectedly.

1.4 Li-Po and LiHV batteries

The battery is not included. Follow these rules when handling batteries:

- Charge only with a charger designed for the given battery type, under supervision and on a non-flammable surface.
- Do not use a swollen, mechanically damaged or overheated battery.

- Always fit a **fully charged** battery before flight. Do not discharge it below 3.5 V per cell during flight; for storage, set it to 3.8 V per cell.
- LiHV batteries are charged to 4.35 V per cell – use them only up to 5S and only if all drone components can withstand their voltage.

Configuration	Fully charged	End flight	Storage
1 Li-Po cell	4.20 V	3.5 V	3.8 V
1 LiHV cell	4.35 V	3.5 V	3.8 V
3S Li-Po	12.6 V	10.5 V	11.4 V
4S Li-Po	16.8 V	14.0 V	15.2 V
5S Li-Po	21.0 V	17.5 V	19.0 V
6S Li-Po	25.2 V	21.0 V	22.8 V

1.5 Soldering and static electricity

- The boards contain components sensitive to electrostatic discharge. Before handling, discharge yourself by touching a grounded object and hold the boards by their edges.
- Use a temperature-controlled soldering iron and quality flux-core solder. Do not overheat the pads – they may lift off.
- Solder thick power wires and motor wires with a sufficiently powerful soldering iron to avoid cold joints.
- After soldering, check that no solder bridges adjacent pads and remove flux residue.
- Do not solder close to the USB-C connector and do not apply lateral force to it.

2. Product description

2.1 Package contents

Item	Quantity
Skystars F405 HD4 flight controller	1×
Skystars KO50 II ESC (4-in-1, 50 A)	1×
Accessory kit	1×

Motors, propellers, frame, receiver, video transmitter, camera, GPS module, battery and frame mounting screws are not included.

2.2 Specifications

▶ Skystars F405 HD4 flight controller

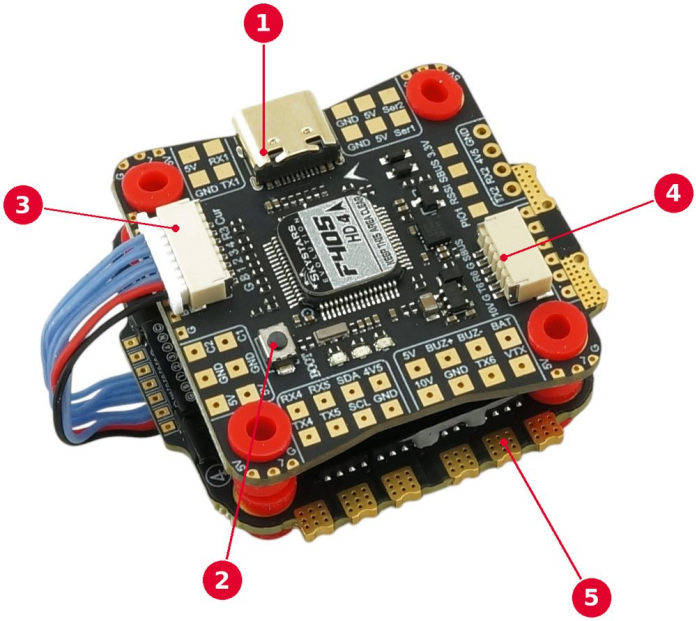
Parameter	Value
Processor (MCU)	STM32F405 (STM32F405RGT6)
Gyroscope and accelerometer (IMU)	ICM42688-P
Blackbox memory	16 MB
Barometer	yes
OSD	yes (for analog video)
Serial ports	6 × UART (UART1–UART6)
Power supply	3–6S Li-Po (from the ESC via the SH1.0-8P connector)
BEC 5 V	5 V / 3 A
BEC 10 V	10 V / 2 A ※
LED	WS2812 (pads in the board corners)
Buzzer	yes (BUZ+ / BUZ−)
USB	USB-C (USB 2.0)
Connectors	SH1.0-8P (ESC), SH1.0-6P (digital video transmitter)
Firmware	Betaflight – target **SKYSTARSF405** INAV – target **SKYSTARSF405HD**
Mounting pattern	30.5 × 30.5 mm, M3 screw holes with damping grommets

※ The rated current of the 10 V output differs in the available documentation (2 A or 3 A). Assume 2 A; the total draw of devices connected to the 10 V output (typically the video transmitter) must not exceed it.

▶ Skystars KO50 II ESC

Parameter	Value
Type	4-in-1 electronic speed controller (4-in-1 ESC)
Continuous current	50 A on each of the four channels (50A × 4)
Power supply	3–6S Li-Po, marked voltage 25 V
Firmware	BLHeli_S
Current sensor	yes – Scale 290, Offset 0
Filter capacitor	low ESR 560 µF / 35 V (according to the manufacturer's schematic)
Connection to FC	SH1.0-8P connector (GND, BAT, signals 1–4, NC, Curn)
Mounting pattern	30.5 × 30.5 mm

2.3 Parts description



Skystars F4 V4 + KO50A II stack – top view

① USB-C connector – connection to a computer
② BOOT button – enters bootloader (DFU) mode for firmware updates
③ SH1.0-8P connector – connects the flight controller to the ESC
④ SH1.0-6P connector – connects a digital video transmitter
⑤ Motor wire solder pads on the ESC (three pads per motor)

The arrow on the top of the flight controller indicates the direction of flight (forward). The battery power pads (+ and −) are on the side of the ESC, next to motor positions 3 and 1.

2.4 Solder pads and connectors

The silkscreen of the flight controller differs between production batches – both the layout and the names of some pads differ (e.g. the positions of UART1 and UART2). When wiring, always follow the labels printed on your board, not just the pad position in the pictures.

Pad label	Function
TX1, RX1, 5V, GND	UART1 – receiver with a serial protocol (e.g. CRSF)
TX2, RX2	UART2 (free); TX2 e.g. for FrSky receiver S.Port
SBUS, 5V, GND	receiver with SBUS output
RSSI	analog RSSI input
3.3V	3.3 V output
TX4, RX4	UART4 (free)
TX5, RX5, SCL, SDA	UART5 – GPS module; SCL/SDA – I2C bus (compass)
10V, GND, TX6, VTX	analog video transmitter: 10 V power, control (TX6), video signal
CAM	analog camera video signal (if the pad is present on the board)
BUZ+, BUZ−	buzzer
BAT	battery voltage
5V, L, G (board corners)	WS2812 LED strip

The pads labelled **PIO1, Ser1, Ser2, C1, C2** and **4V5**, present on some board batches, are not described by the manufacturer in the available documentation. Do not use them without verifying their function.

▶ SH1.0-8P connector (connection to the ESC)

Flight controller	GND	BAT	S1-S4	RX3	CURT
ESC	GND	BAT	1–4	NC	Curn
Function	ground	battery voltage	motor signals 1–4	ESC telem.	current

On some board batches, the connector is labelled in abbreviated form *G B 1 2 3 4 R3 Cur*. According to the manufacturer's schematic, the ESC's NC wire is connected to RX3 of the flight controller.

▶ SH1.0-6P connector (digital video transmitter)

Pin	10V	G	T6	R6	G	SBUS
Function	10 V power	ground	TX6	RX6	ground	SBUS

※ The wire order on the connector of an ESC or digital video transmitter from another manufacturer may differ. Before connecting, compare the pin labels at both ends of the cable and re-pin the cable if necessary.

2.5 Serial port (UART) assignment

Port	Recommended use	Pins
UART1	receiver (Serial RX)	TX1, RX1
UART2	free	TX2, RX2
UART3	ESC telemetry	RX3 in the 8P connector
UART4	free	TX4, RX4
UART5	GPS	TX5, RX5
UART6	video transmitter (DJI / VTX)	TX6; T6, R6 in the 6P connector

This port assignment is recommended by the manufacturer; the free ports UART2 and UART4 can be used for other peripherals.

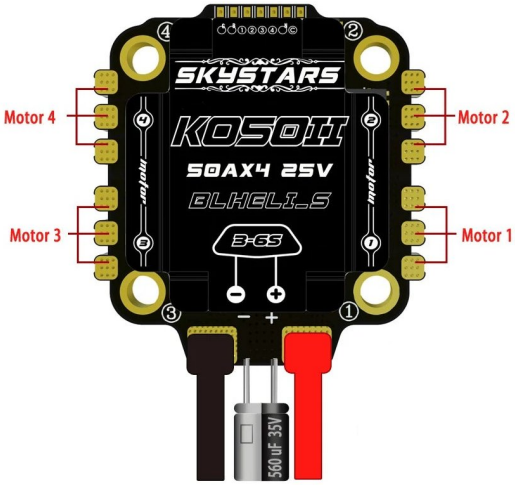
3. Installation and wiring

3.1 Mounting in the frame

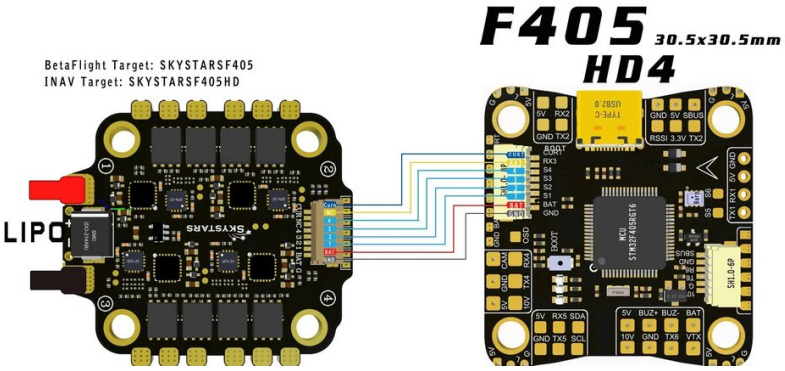
- Mount the stack in a frame with a 30.5 × 30.5 mm hole pattern – ESC at the bottom, flight controller above it, with the arrow on the flight controller pointing in the direction of flight. If you have to rotate it, set the orientation in the configuration software (section 4.3).
- Use rubber damping grommets – they reduce the transmission of vibrations to the gyroscope. Tighten the screws only lightly so that the grommets are not fully compressed.
- The boards must not touch the carbon frame or any metal parts – carbon is conductive. The boards must not touch each other either.
- Keep the USB-C connector accessible so that you can configure the flight controller without disassembly.

3.2 Power supply and ESC

- Solder the power leads with the battery connector to the ESC power pads (+ and −). **Observe the correct polarity** – reverse polarity will destroy the ESC.
- Solder a **low-impedance (low ESR) capacitor** to the ESC power pads, as close as possible. The manufacturer explicitly stresses its use; the schematic specifies a 560 µF / 35 V capacitor. Observe the capacitor polarity (the negative lead is marked with a stripe).
- Solder the motor wires to the three-pad groups of motors 1–4 (see the picture below). The order of a motor's three wires only determines its direction of rotation, which can later be changed in the settings (section 4.5).
- Connect the flight controller to the ESC with the supplied SH1.0-8P cable. This cable powers the flight controller and carries the motor signals, ESC telemetry and current measurement.



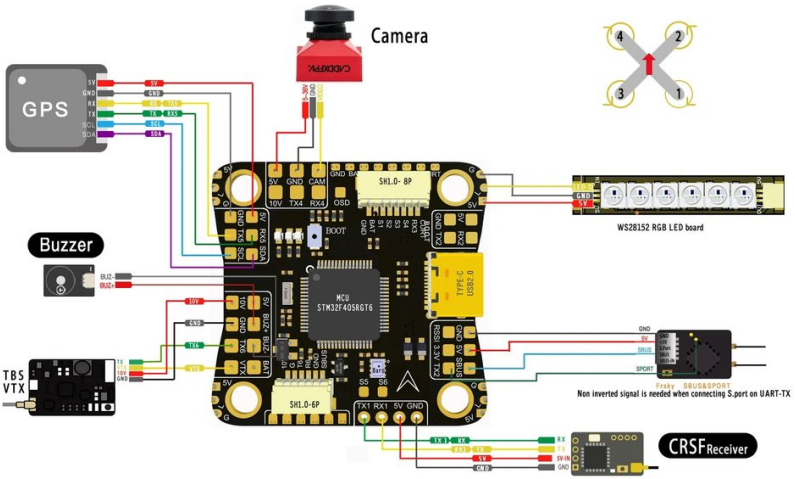
KO50 II ESC – motor positions 1–4, power supply and capacitor (source: Skystars)



Connecting the ESC and the flight controller with the SH1.0-8P cable (source: Skystars; the flight controller silkscreen may differ from your board)

3.3 Receiver

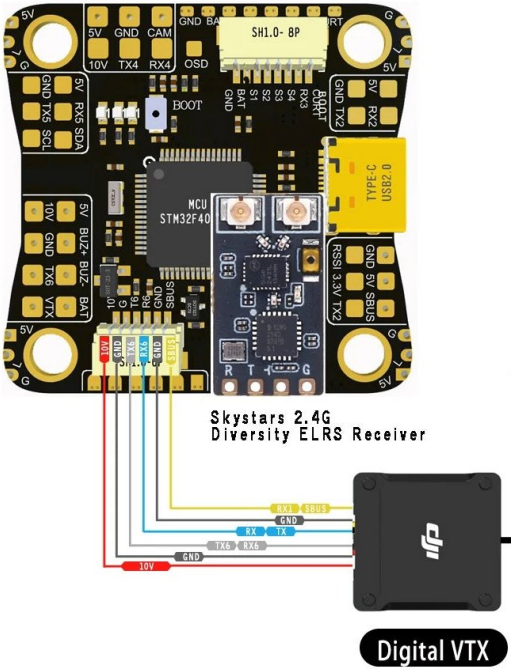
- Receivers with a serial protocol (e.g. CRSF – ExpressLRS, TBS Crossfire): receiver TX to **RX1**, receiver RX to **TX1**, power from the 5V and GND pads next to UART1.
- SBUS receivers: SBUS signal to the **SBUS** pad, power from the 5V and GND pads next to it. Connect the S.Port telemetry of FrSky receivers to **TX2** – the manufacturer notes that S.Port on UART-TX requires a non-inverted signal.
- Check the receiver's supply voltage in its manual – the receiver pads supply 5 V.



Peripheral wiring (source: Skystars): GPS, camera, buzzer, analog VTX, LED strip, FrSky receiver (SBUS and S.Port) and CRSF receiver; motor order at top right. The silkscreen may differ from your board.

3.4 Video transmitter (VTX)

- **Digital VTX** (e.g. DJI): connect with a cable to the SH1.0-6P connector. The connector carries 10 V power, UART6 (T6, R6) and SBUS. Before connecting, check the wire order on the VTX side (section 2.4).
- **Analog VTX**: power from the 10V and GND pads (make sure the VTX can handle 10 V), VTX video input to the **VTX** pad, control wire (SmartAudio / Tramp) to **TX6**.
- Never power up the video transmitter without an antenna attached – it may be damaged.



Connecting a digital VTX to the SH1.0-6P connector; the optional Skystars ELRS receiver placed on the board is not included (source: Skystars)

3.5 GPS, camera, buzzer and LED

- **GPS module**: 5V, GND, module TX → **RX5**, module RX → **TX5**. If the module has a compass, connect SCL to SCL and SDA to SDA.
- **Analog camera**: power from the 5V and GND pads, camera video output to the **CAM** pad. If the camera requires a different supply voltage, follow its manual. If your board has no CAM pad, check the camera wiring with the seller.
- **Buzzer**: positive lead to BUZ+, negative to BUZ−.
- **WS2812 LED strip**: 5V, L (signal) and G (ground) pads in any corner of the board. Do not overload the strip – it draws current from the 5 V output.

3.6 Electromagnetic compatibility

To ensure that the stack works reliably and does not interfere with other devices, follow these rules during installation:

- A low-impedance capacitor on the ESC power pads is required – it suppresses voltage spikes that interfere with the gyroscope, video and receiver.

- Keep the battery power leads and motor wires as short as possible and route them away from signal wires, the receiver antenna and the GPS module.
- Place the receiver and video transmitter antennas as far as possible from each other and from the stack boards.
- Place the GPS module with compass as far as possible from the power leads and motors.
- Do not stretch the cables between the boards and secure them against vibration.

4. Setup and firmware

4.1 Connecting to a computer

The flight controller is configured with Betaflight Configurator (Betaflight firmware) or INAV Configurator (INAV firmware). Both programs can be downloaded free of charge from the official Betaflight and INAV project websites.

① Remove the propellers.

② Launch the configuration software and connect the flight controller with a USB-C data cable.

③ Select the serial port and click *Connect*.

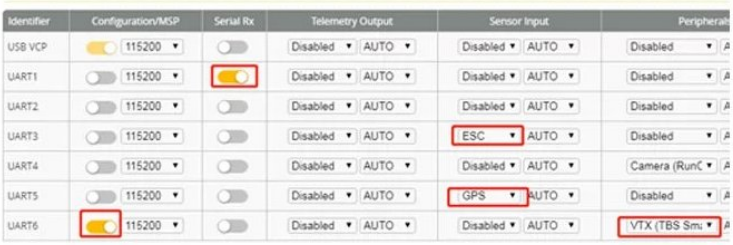
④ To work with the ESC, video transmitter and receiver powered from the battery, connect the battery as well.

※ If the computer does not recognize the flight controller, try a different cable or USB port and install the drivers offered by the configuration software.

4.2 Ports tab

On the *Ports* tab, set the serial port functions according to your wiring. The manufacturer specifies the following settings:

Port	Setting on the Ports tab
UART1	*Serial Rx* enabled (receiver)
UART3	*Sensor Input* → *ESC* (ESC telemetry)
UART5	*Sensor Input* → *GPS*
UART6	DJI digital VTX: *Configuration/MSP* enabled; other VTX: *Peripherals* → *VTX* (e.g. TBS SmartAudio)



Example of the Ports tab in Betaflight Configurator (source: Skystars)

After saving (*Save and Reboot*), set the receiver protocol (e.g. CRSF or SBUS) on the *Receiver* tab and check that the radio stick movements are displayed correctly.

4.3 Board orientation and motor order

- The default orientation corresponds to the arrow on the flight controller pointing in the direction of flight. If the board is rotated, set the angle in *Configuration → Board and Sensor Alignment* and check on the *Setup* tab that the on-screen model follows the movement of the drone.
- Motor order in Betaflight (top view, arrow forward): **1 rear right, 2 front right, 3 rear left, 4 front left**.
- On the *Motors* tab (without propellers), spin up each motor in turn and check its position and direction of rotation.

4.4 Voltage and current measurement

- The flight controller measures the battery voltage via the BAT pin. On the *Power & Battery* tab, compare the displayed voltage with a multimeter reading and adjust the voltage scale if necessary.
- Current is measured by a sensor in the ESC (CURT pin). For the KO50 II ESC, the manufacturer specifies **Scale 290** and **Offset 0** in the *Amperage Meter* section. Verify the accuracy by comparing the measured consumption with the amount of charge put back into the battery.
- Set the low-voltage warning according to the values in section 1.4.



Current measurement settings for the KO50 II ESC (source: Skystars)

4.5 ESC and motor direction

- The ESC uses **BLHeli_S** firmware. Set the ESC communication protocol (e.g. DShot) on the *Configuration* tab.
- If a motor spins in the wrong direction, change it in the ESC configuration software (e.g. ESC Configurator) or in the Betaflight settings – do not resolder wires blindly.
- Update the ESC firmware only when you really need to, and only with firmware intended for this ESC. Incorrect firmware can permanently damage the ESC.

4.6 Arm, Disarm and failsafe

- On the *Modes* tab, assign Arm (motors enabled) and Disarm (motors disabled) to a switch on the radio – not to a stick combination.
- On the *Failsafe* tab, set the behaviour on signal loss. Test the function without propellers: after Arm, switch off the radio – the motors must stop.
- Disarm immediately after every crash or impact.

4.7 Flight controller firmware update

Firmware is flashed on the *Firmware Flasher* tab. In Betaflight Configurator select the target **SKYSTARSF405**, in INAV Configurator the target **SKYSTARSF405HD**.

① Before updating, back up your settings (CLI command *diff all*).

② Select the target and firmware version and click *Load Firmware [Online]*.

③ Click *Flash Firmware* and wait for it to finish.

④ If the flight controller does not connect, unplug the USB, hold down the BOOT button, reconnect the USB and release the button. The flight controller is now in bootloader (DFU) mode and can be flashed.

⑤ Restore your settings and check the orientation, ports, motors and failsafe again.

※ Do not disconnect the USB while flashing firmware.

5. Operating the drone

5.1 The law of the country where you fly applies

Regulations (EU) 2019/947 and 2019/945 apply in all member states of the European Union, but national implementing rules differ from country to country – registration portals, minimum pilot age, geographical zones, mandatory insurance, permitted frequency bands and maximum transmit power. The information in this chapter describes the situation in the Czech Republic. If you operate a drone in another country, you must follow the regulations of the country in which you fly.

5.2 A drone built with this stack

The stack itself is a component and drone regulations do not apply to its sale. However, a drone you build with it is an unmanned aircraft and its operation is governed by Regulation (EU) 2019/947:

- A drone assembled from individual components is a **privately built unmanned aircraft system** without a class identification label. In the open category it may be operated in subcategory A1 if its take-off mass is less than 250 g and its maximum speed is lower than 19 m/s; otherwise in subcategory A3.
- If the drone has a camera, the operator must register (in the Czech Republic with the Civil Aviation Authority) and display the registration number on the drone.
- The maximum flight height is 120 m above ground. Do not fly over assemblies of people and respect geographical zones.
- When flying with FPV goggles, an observer who keeps the drone in direct sight must stand next to the pilot.
- We recommend taking out liability insurance for damage caused by operating the drone.
- Actually weigh the take-off mass of the finished drone, including the battery.

6. Maintenance and storage

- After every crash, check the boards, solder joints, motor wires, power leads, cables and connectors. Repair any loose or cracked joint before the drone flies again.
- Check that the capacitor on the power pads is not mechanically damaged or swollen.
- Remove dirt with a dry soft brush. Do not wash the boards with water or solvents.
- If the boards get wet, disconnect the battery immediately and let them dry thoroughly before powering up again.
- Check the condition of the damping grommets – replace any that are hardened or torn.
- Store the drone and the stack itself in a dry place, out of direct sunlight and with the battery disconnected. Store loose boards in an antistatic bag.
- Back up your settings regularly (CLI command *diff all*).

7. Troubleshooting

Problem	Possible cause and solution
Computer does not recognize the flight controller	Charge-only cable – use a data cable. Driver missing – install it. Try DFU mode (BOOT button, section 4.7).
Nothing lights up after connecting the battery	Check the ESC power leads and the SH1.0-8P cable. If anything is heating up, disconnect the battery immediately.
Receiver does not respond	Check the TX/RX wiring (crossed over), the *Serial Rx* setting on the correct UART and the protocol on the *Receiver* tab.
OSD does not work in DJI goggles	Enable *Configuration/MSP* on UART6. Check the SH1.0-6P cable.
VTX channel cannot be changed	On UART6, set *Peripherals* → *VTX* with the protocol matching the VTX; control wire to TX6.
Motor spins in reverse or a different motor spins	Adjust the output order or the direction of rotation in the ESC (sections 4.3 and 4.5).
Measured current is inaccurate	Check *Scale 290* and *Offset 0* in the *Amperage Meter* section (section 4.4) and the CURT wire in the 8P cable.
GPS does not find satellites	Check TX/RX (crossed over) and the UART5 settings. Place the GPS further away from the VTX and power leads and leave it under open sky.
Drone cannot be armed	On the *Setup* tab, find the reason Arm is blocked (e.g. tilt, active failsafe, USB connected, throttle above minimum).
Video interference, unsteady flight	Check the capacitor on the ESC power supply, the damping grommets and the wire routing (section 3.6).

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.com

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 boards – the text “F405 HD 4” on the top of the flight controller; according to the manufacturer, the ESC bears the designation KO50II. The installed firmware version is shown by the configuration software (e.g. Betaflight Configurator) after connecting via USB.

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 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.