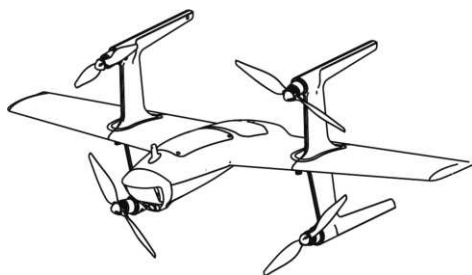




Swan K1 Pro PNP

VTOL unmanned aircraft
User manual



Read the whole manual before first use. The product is intended for experienced users.

Rotorama, s.r.o. · www.rotorama.cz

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1. Introduction

1.1 About this manual

This manual describes the **HEQ Swan K1 Pro** unmanned aircraft in the **PNP** version. It is based on the original manufacturer's documentation, extended with safety and regulatory information applicable to the European Union and the Czech Republic.

Read the whole manual before you assemble the aircraft for the first time. It contains information without which the aircraft cannot be operated safely, as well as operating limitations that the pilot is required to observe under European regulations.

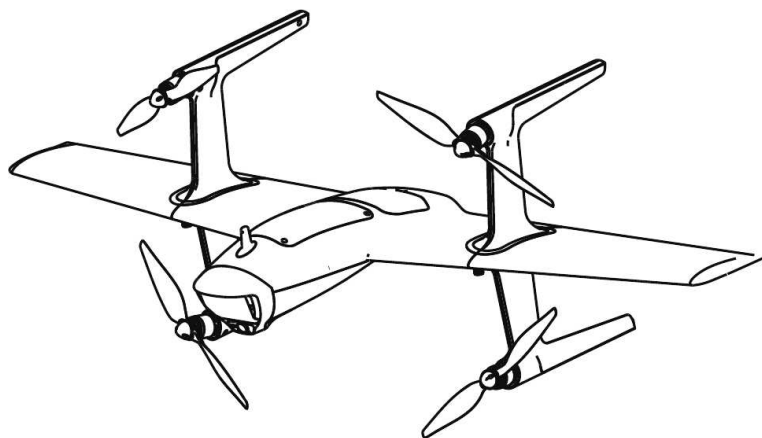
The PNP version is intended for experienced builders. It assumes practice with fixed-wing models, with building FPV equipment and with configuring a ground control station. This is not a ready-to-fly drone.

1.2 Product description

The **Swan K1 Pro PNP** is a fixed-wing unmanned aircraft with vertical take-off and landing (VTOL). It takes off and lands in multirotor mode, then transitions to aeroplane mode and flies on the wing. It has vertical take-off and landing function and has no flight field restrictions.

The airframe has no control surfaces. The aircraft has no ailerons, elevator, rudder or servos and is controlled in both modes solely by the **differential thrust of four motors**. There are no other moving parts except the 4 motors. The airframe consists of the fuselage, a pair of arms with motors, a pair of wings, a counterweight and the propellers, and no additional tools are required for disassembly.

The fuselage contains a factory-fitted **flight controller (FC)** running PX4 firmware, an **electronic speed controller (ESC)**, a **GPS module**, an **airspeed sensor** and a **wireless link module** used for configuration from the ground control station. Propulsion is provided by four **2212 980KV** motors with **9060** propellers, fitted in the arms.



Swan K1 Pro PNP assembled

1.3 Package contents

The PNP package contains the aircraft only:

- fuselage with flight controller, electronic speed controller, GPS module, airspeed sensor and wireless link module,
- a pair of arms with motors,
- a pair of wings,
- a counterweight,
- a set of propellers.

The package does not include a battery, a charger, an RC system (transmitter and receiver), a video transmitter, a camera or a carrying case. These parts must be purchased separately.

Before you assemble the aircraft for the first time, check that the delivery is complete and inspect all parts. Never use a cracked part, a loose motor or a damaged propeller.

2. Safety instructions

2.1 General rules

- The aircraft is a machine with rotating propellers and a high-energy battery. Improper handling may cause serious injury or fire.
- Never operate the aircraft under the influence of alcohol, medication or any other substance affecting attention and reaction time.
- Before every flight make sure the aircraft is in perfect technical condition and that all parts are correctly fitted and secured.
- Do not modify the aircraft or its parts beyond the scope of this manual. Interfering with the structure or with the flight controller settings may lead to a crash.
- The aircraft is not a toy and does not belong in the hands of children.

2.2 Propellers and motors

- **Do not fit the propellers before connecting the battery** if the aircraft is within reach of people. Fit them at the take-off site.
- Never bring your hands, face or loose clothing near spinning propellers.
- Always replace a damaged, cracked or deformed propeller. An unbalanced propeller causes vibration that degrades the flight controller sensors.
- After landing, switch off the motors first and only then approach the aircraft.

2.3 Li-Po batteries

The aircraft is powered by a Li-Po battery, which is not included in the package. Li-Po batteries are dangerous when handled improperly.

- Use only a battery matching the recommended specification (chapter 3.1) and fitted with an **XT60** connector.
- A fully charged Li-Po cell has **4.20 V**, i.e. **16.8 V** for a 4S pack. End the flight at **3.5 V per cell** at the latest, i.e. **14.0 V** for a 4S pack.
- For storage longer than a few days, charge the battery to **3.8 V per cell**, i.e. **15.2 V** for a 4S pack.
- Charge only with a charger designed for Li-Po, on a non-flammable surface and **never unattended**.
- Do not charge or use a swollen, mechanically damaged or over-cooled battery.
- After a hard landing or a crash, disconnect the battery and watch it for at least 30 minutes for signs of heating.

Always fit a fully charged battery. A partly discharged battery significantly shortens the flight time and may cause a loss of thrust under load in multirotor mode.

2.4 Environment and flight conditions

- Fly only in good visibility and out of reach of precipitation. The aircraft is not waterproof.
- Do not fly in strong wind or in gusts. The wind resistance of the aircraft corresponds to **level 5** of the Beaufort scale.
- Do not fly over assemblies of people, near airports, railway stations, buildings, in woods or indoors.
- During take-off and landing, make sure there are no obstacles and no persons around the aircraft.
- Do not fly close to high voltage lines, transmitters and metal structures — they interfere with GPS reception and with the wireless link.

3. Technical parameters

3.1 Aircraft

Parameter	Value
Wingspan	1.1 m
Empty weight	1 kg
Maximum take-off weight	2.2 kg
Flight speed	10–25 m/s
Range	35–40 km
Maximum flight altitude	500 m
Wind resistance	Level 5 of the Beaufort scale
Motors	4x 2212 980KV
Motor dimensions	Ø27 x 26.45 mm
Motor shaft diameter	5 mm
Motor mounting holes	4x M3 (16 and 19 mm spacing) 4x M2 (9 x 13 mm spacing)
Propeller	9060
Recommended battery	4S Li-Po 5500 mAh or official HEQ battery
Battery compartment size	7.5 x 3.5 x 6.5 cm
External power supply voltage	16.8 V
Power plug model	XT60
Flight controller sockets	GH1.25
Supported remote control protocol	SBUS
Supported remote control channels	7 channels or more
Supported image transmission	analog / digital
Compatible sports cameras	GoPro 5/6/7/8, DJI Action 1/2
Parameter adjustment interface	built-in wireless link module

The flight time depends on the battery used, on the weight of the equipment carried and on the weather conditions. The actual control and image transmission range is determined by the equipment you install, not by the aircraft itself.

3.2 Wireless link module

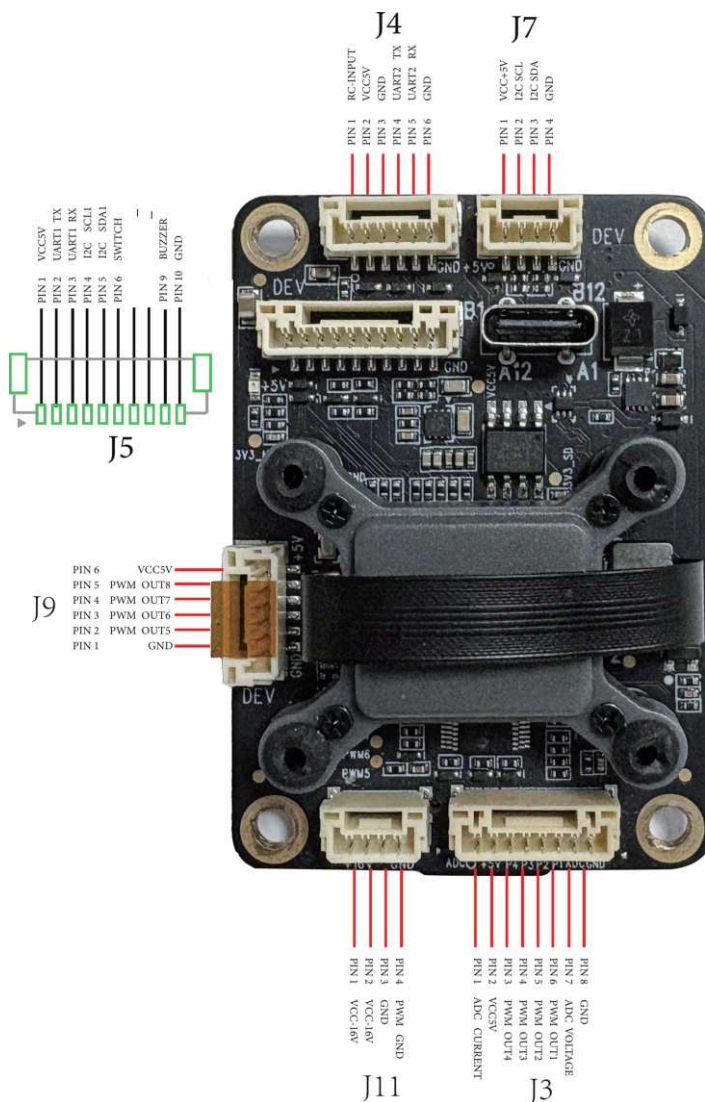
The aircraft is equipped with a built-in module used to connect the ground control station and to adjust parameters. Depending on the production batch it may be a Wi-Fi module or a conventional data transmission radio.

Parameter	Value
WIFI network name	Drone
WIFI password	12345678
IP address	192.168.4.1
Subnet mask	255.255.255.0
Gateway	192.168.4.1
Port number	6789
Serial port baud rate	57600 Bd
Communication protocol	TCP
Operating voltage	4-9 V DC (5 V recommended)

✳ **The specific specifications are subject to the actual product received. If there are any subsequent updates, the manufacturer will not notify you separately.**

3.3 Flight controller

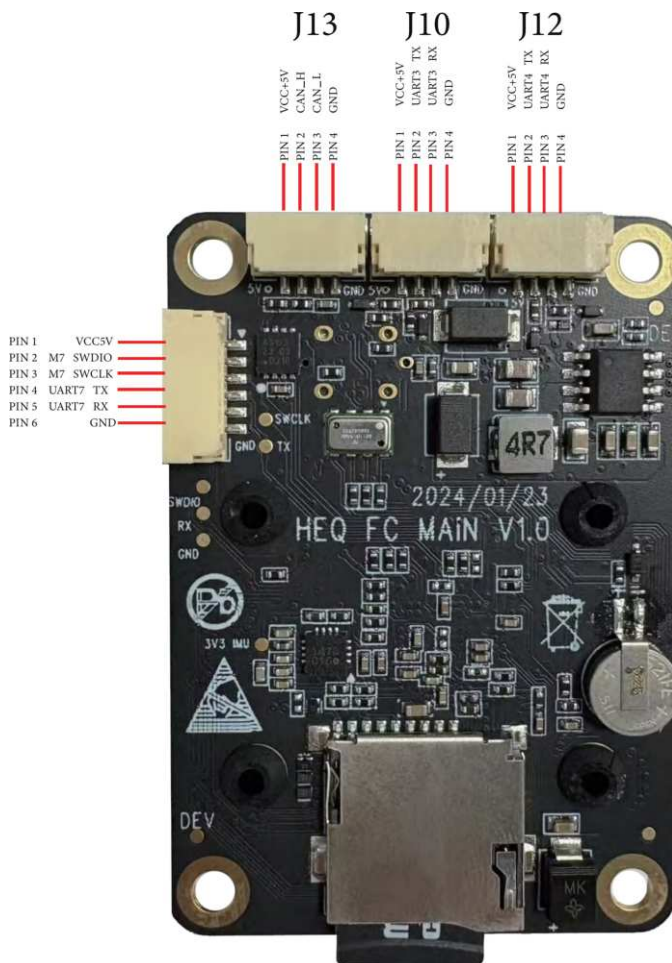
The flight controller is compatible with **PX4** firmware and supports link products from mainstream manufacturers such as SIYI and Skydroid. All sockets on the flight controller are the **GH1.25** model plug.



Flight controller — top side

► Ports on the top side

Port	Pin assignment
J4	1 RC-INPUT · 2 VCC5V · 3 GND · 4 UART2 TX · 5 UART2 RX · 6 GND
J7	1 VCC+5V · 2 I2C SCL · 3 I2C SDA · 4 GND
J5	1 VCC5V · 2 UART1 TX · 3 UART1 RX · 4 I2C SCL1 · 5 I2C SDA1 · 6 SWITCH · 7 SWITCH_LED · 8 VCC3V3_SD · 9 BUZZER · 10 GND
J9	1 GND · 2 PWM OUT5 · 3 PWM OUT6 · 4 PWM OUT7 · 5 PWM OUT8 · 6 VCC5V
J11	1 VCC-16V · 2 VCC-16V · 3 GND · 4 GND
J3	1 ADC CURRENT · 2 VCC5V · 3 PWM OUT4 · 4 PWM OUT3 · 5 PWM OUT2 · 6 PWM OUT1 · 7 ADC VOLTAGE · 8 GND



Flight controller — bottom side

► Ports on the bottom side

Port	Pin assignment
J13	1 VCC+5V · 2 CAN_H · 3 CAN_L · 4 GND
J10	1 VCC+5V · 2 UART3 TX · 3 UART3 RX · 4 GND
J12	1 VCC+5V · 2 UART4 TX · 3 UART4 RX · 4 GND
J8	1 VCC5V · 2 M7 SWDIO · 3 M7 SWCLK · 4 UART7 TX · 5 UART7 RX · 6 GND

4. Assembly and wiring

4.1 Airframe assembly

The aircraft consists of only a few parts and no tools are required for assembly. Always work with the battery disconnected and with the propellers removed.

- ① Place the fuselage on a flat surface and check that all cables inside run freely and cannot be pinched.
- ② Fit both arms with motors into their seats in the wing and secure them.
- ③ Slide on both wing halves and check that they seat fully and that the motor connectors are mated.
- ④ Fit the counterweight. It balances the aircraft and must not be omitted.
- ⑤ Fit the propellers. Observe the correct direction of rotation of each motor.
- ⑥ Check that all propellers turn freely and do not rub anywhere.

Never omit the counterweight or any part of it. Without correct balance the aircraft is uncontrollable in aeroplane mode.

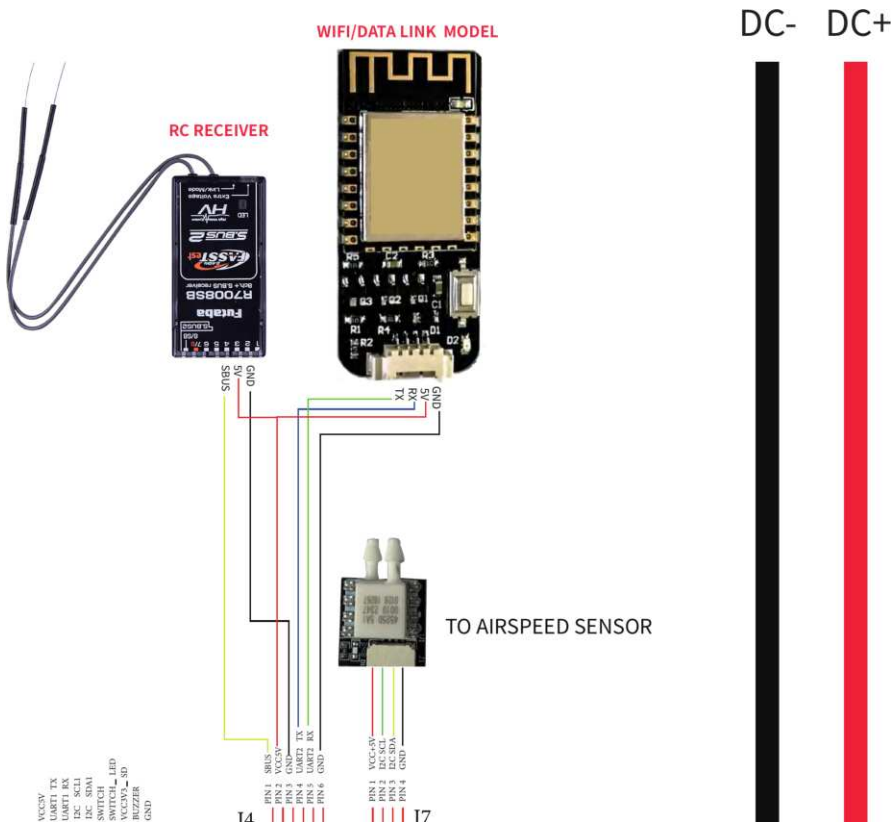
4.2 Power supply and connectors

- For convenience, the power plug model used by the aircraft is **XT60**.
- The input voltage corresponds to a 4-cell Li-Po pack, i.e. **16.8 V** when fully charged.
- All signal sockets on the flight controller must be adapted to the **GH1.25** model plug. Connect optional equipment only with cables using this connector.
- Connect the battery as the last step before take-off and disconnect it immediately after landing.

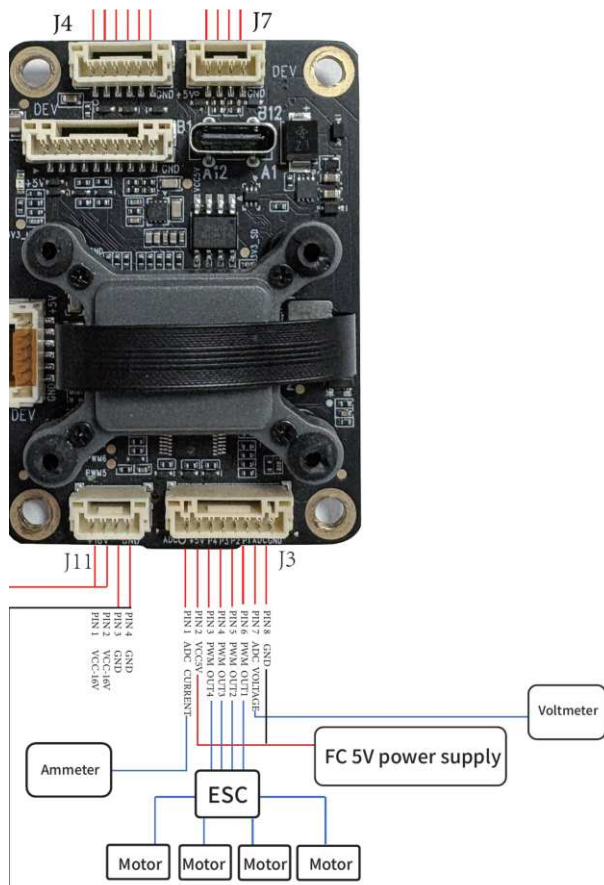
4.3 Wiring diagram

The following diagrams show the wiring of the RC receiver, the wireless link module, the airspeed sensor, the electronic speed controller and the voltage and current measurement, followed by the wiring of analog and digital image transmission.

The diagrams are dense. The pin assignment of the individual flight controller ports is also listed in a clearer form in chapter 3.3.

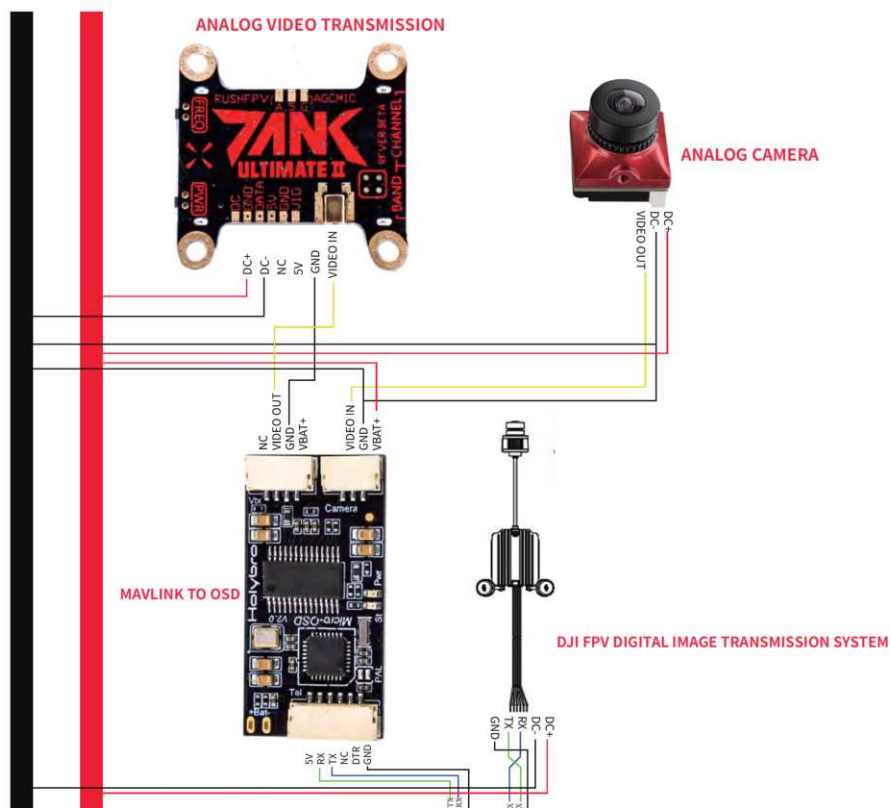


RC receiver, wireless link module and airspeed sensor



Flight controller, ESC, motors and voltage and current measurement

DC- DC+



Analog and digital image transmission wiring

4.4 Image transmission and OSD

The PNP version is supplied without a camera and without a video transmitter. The aircraft supports analog and digital image transmission; both systems have to be purchased and installed separately.

- Port **J10** can output regular **MAVLINK** data, which is converted by an OSD conversion module and then input into the regular analog image transmission for image overlay display.
- Port **J12** can directly output OSD data that can be adapted to the DJI digital image transmission system.
- Power optional equipment according to the wiring diagram. Do not connect it to the battery voltage unless it is designed for it.

The aircraft is designed for the **GoPro 5/6/7/8** and **DJI Action 1/2** sports cameras. When choosing equipment, always respect the maximum take-off weight of 2.2 kg.

4.5 Battery selection

A **4S Li-Po 5500 mAh** battery or the official HEQ battery is recommended. Any other battery may be used provided it fits the **7.5 x 3.5 x 6.5 cm** compartment and does not exceed the maximum take-off weight of **2.2 kg** after being added to the fuselage.

Always secure the battery in the compartment against movement. A battery shifting in flight changes the centre of gravity and degrades handling.

5. Configuration

5.1 Ground control station

The aircraft is configured from the **QGroundControl** (QGC) ground control station. Both the computer version and the mobile phone version can be used.

The PNP version requires the dedicated QGroundControl build from the manufacturer's website. The regular build from the official QGC website may not be compatible with the aircraft.

Download the software from the manufacturer's Download Center → Rudderless VTOL Flight Platform → Swan K1 Pro PNP: www.hequavtech.com/download

Using QGC on a tablet may cause incomplete parameter display. We recommend configuring the aircraft from a computer or a mobile phone.

5.2 Connecting to the aircraft

- ① Connect the battery and wait until the flight controller has finished starting up.
- ② Turn on Wi-Fi on your phone or computer and connect to the aircraft's network (the name and password are listed in chapter 3.2).
- ③ Start QGroundControl.
- ④ Open *Application Settings* → *Comm Links* and add a new link.
- ⑤ Select **TCP** as the link type.
- ⑥ Enter server address **192.168.4.1** and port **6789**, tick automatic connection at startup and confirm.
- ⑦ Return to the main screen and wait for the connection to complete.

5.3 Remote control channels

The aircraft accepts the **SBUS** protocol. We recommend a remote controller with 7 channels or more to fully utilise the functions of the aircraft. The channel assignment is configured in QGroundControl.

Function	Channel
Roll	1
Pitch	2
Throttle	3
Yaw	4
Mode switch — Altitude / Position	5
Attitude switch — Rotor / Fixed-wing	7
Return	8

5.4 Calibration

Before the first flight and after every change of the setup, calibrate the accelerometer, gyroscope, horizon, airspeed meter and compass in QGroundControl.

- If the absolute value of the airspeed at rest is greater than 5, recalibration of the airspeed sensor is required.
- If the location is changed, the magnetic compass needs to be recalibrated. If the location environment is not changed, it is not necessary.
- Calibrate on a level surface, away from metal structures and sources of interference.

6. Operation

6.1 Pre-flight check

- ① The joystick of the aircraft is switched to the position mode.
- ② The aircraft and the remote controller are fully charged.
- ③ The wireless link is connected and the map has been loaded in the ground control station.
- ④ GPS signal is available from at least **9 satellites**.
- ⑤ The propellers are undamaged, correctly fitted and turn freely.
- ⑥ The counterweight is fitted and all equipment is secured in the aircraft.
- ⑦ There are no obstacles and no uninvolved persons around the take-off site.

6.2 Take-off, transition and landing

The aircraft takes off vertically in multirotor mode. To ensure safety, it is recommended to take off vertically to more than **20 metres** before switching to the fixed-wing mode.

- The take-off can also be started with the one-key take-off function.
- Perform the transition to fixed-wing mode at a sufficient altitude and with clear space ahead of the aircraft.
- Before landing, switch back to multirotor mode and let the aircraft stabilise, only then descend.
- In multirotor mode the aircraft holds its position using GPS.

We recommend performing the first flights on an open area, in calm conditions and with a sufficient battery reserve.

6.3 Flight controller safety protections

The flight controller provides several safety protections:

Function	Meaning
Low voltage protection	response to a drop in battery voltage
Intelligent return home	automatic return to the take-off site
Dangerous attitude protection	intervention in a dangerous attitude
Stall protection	intervention when a wing stall is imminent
Lose control protection	response to the loss of the RC signal
Geographical fencing	limitation of the flight area

The flight altitude and distance can be customized with geo-fence restrictions in the ground station. We recommend setting them before the first flight according to local regulations.

6.4 Rules during flight

- During take-off and landing, make sure there are no obstacles around the drone to avoid collision accidents.
- During the flight, comply with relevant flight regulations, fly in legal areas, and ensure flight safety.
- During flight, pay attention to the flight attitude and flight altitude of the drone to ensure flight stability.
- Do not fly in crowds, woods, airports, train stations, buildings, and indoors.

6.5 Maintenance and storage

- After every flight, inspect the airframe, the propellers and the motor seats. Repair cracks and loose joints before the next flight.
- Clean the aircraft with a dry or slightly damp cloth. Do not use solvents and do not allow water to enter the fuselage.
- Before longer storage, disassemble the aircraft, disconnect the battery and store it at the storage charge level.
- Store the aircraft in a dry place, away from direct sunlight and at normal room temperature.
- Always check the propeller tightness and the condition of the wiring after a hard landing.

6.6 Troubleshooting

The ground control station does not connect

- Check that the phone or computer is connected to the aircraft's network and that mobile data is not taking over the connection.
- Verify the server address and port according to chapter 3.2.
- Use the QGroundControl build from the manufacturer's website.

The aircraft does not acquire a GPS signal

- Move to an open area away from buildings and metal structures.
- Wait longer — after moving to a distant location the first position fix takes more time.
- Start the take-off only with a sufficient number of satellites.

The aircraft is unsettled in multicopter mode

- Check the balance and the condition of the propellers.
- Verify that the battery is secured in the compartment and does not move.
- Repeat the accelerometer and horizon calibration on a level surface.

Distorted airspeed reading

- Check that the sensor tubing is not kinked or blocked.
- Calibrate at rest, without air flowing around the aircraft.

7. Operation of unmanned aircraft

7.1 Regulations differ by country

Regulations (EU) 2019/947 and 2019/945 apply in all Member States of the European Union, but national implementing rules differ from state to state — registration portals, the minimum age of the pilot, geographical zones, compulsory insurance, permitted frequency bands and maximum transmit powers. The information in this chapter describes the situation in the Czech Republic. If you operate the aircraft in another country, you must comply with the regulations of the state in which you fly.

7.2 Product classification

The PNP version is supplied without an RC system and is therefore not an unmanned aircraft system within the meaning of Regulation (EU) 2019/945. It **does not bear a class C identification label** and this label cannot be obtained for it retrospectively.

- An aircraft assembled from this platform and completed with your own RC system, battery and further equipment may be operated in the open category in subcategory **A3** as a privately built unmanned aircraft system under point UAS.OPEN.040 of the Annex to Regulation (EU) 2019/947.
- Subcategories **A1** and **A2** are not available for this aircraft. A1 is limited to a mass below 250 g for privately built systems, A2 requires a class C2 label.
- Another option is operation within a model aircraft club holding an authorisation under Article 16 of Regulation (EU) 2019/947, or operation in the specific category on the basis of an authorisation issued by the Civil Aviation Authority.

Assigning the aircraft to a particular category of operation is the responsibility of the operator. In case of doubt, contact the Civil Aviation Authority.

7.3 Operator registration

- Operating an aircraft with a take-off mass of 250 g or more requires **operator registration**. The operator is registered, not the aircraft.
- In the Czech Republic, registration is carried out with the Civil Aviation Authority at dron.caa.gov.cz.
- The assigned registration number must be **displayed on the aircraft** so that it is legible while the aircraft is on the ground.
- Registration is carried out in one Member State only, according to the operator's residence or registered office.
- Any change to the registered data must be reported within 15 days.

7.4 Pilot competence

- The pilot must be familiar with the manufacturer's instructions and with this manual.
- Operation in subcategory A3 requires completion of the **online training and the online theoretical knowledge examination A1/A3**. The proof of competence is valid for five years.
- The minimum age of the remote pilot in the Czech Republic is **16 years**.

7.5 Operating limitations of subcategory A3

- Fly **within visual line of sight** of the pilot at all times.
- Maximum height of **120 m** above the closest point of the surface of the earth.
- A horizontal distance of at least **150 m** from residential, commercial, industrial and recreational areas.
- No uninvolved person may be endangered within the area of operation. Flying over assemblies of people is prohibited.
- Carriage of dangerous goods and dropping any material is prohibited.
- Check the applicable geographical zones before the flight. In the Czech Republic the digital map of the Civil Aviation Authority serves this purpose.
- In the Czech Republic the consent of the landowner is required for take-off and landing.
- Before the flight, verify that the mass of the payload does not exceed the maximum take-off mass specified by the manufacturer.

When flying with image transmission (FPV), visual line of sight must be maintained by an unmanned aircraft observer standing next to the pilot and not using optical aids. Responsibility for the safety of the flight remains with the pilot.

7.6 Liability insurance

For operation in subcategory A3, liability insurance is compulsory in the Czech Republic only from a take-off mass exceeding 4 kg. At the maximum take-off mass of this aircraft it is therefore not compulsory.

Nevertheless, **we recommend taking out liability insurance**. The operator is responsible for the actual take-off mass; if it exceeds 4 kg with added equipment, insurance becomes compulsory.

7.7 Privacy protection

The PNP version is supplied without a camera. If you add a camera or another recording device to the aircraft, you are obliged to comply with personal data protection regulations. Do not record persons without their consent and do not photograph or film objects where this is prohibited.

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@rotorاما.cz
Phone	+420 252 252 098
Website	www.rotorاما.cz

8.2 Product conformity



- 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@rotorاما.cz.
- **Product identification:** the type designation (Swan K1 Pro PNP) and the serial number are stated on the label on the product or on its packaging.

8.3 Disposal of electrical equipment and batteries



- 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 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.