TinyApe 2S ELRS

DarwinFPV · 2.5" freestyle FPV drone
User manual · analog video transmission · ExpressLRS 2.4 GHz receiver



Read the entire manual before your first flight, especially the safety instructions and chapter 3 on the legal conditions of operation.

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Contents

1. Safety instructions

2. Product description

2.1 Package contents

2.2 Parts description

2.3 Specifications

2.4 Flight controller (FC) and receiver

2.5 Video transmitter and camera

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

4. Preparing for the first flight

5. Setup

5.2 Binding the ExpressLRS receiver

5.3 Video transmitter settings

5.6 Arm, Disarm and failsafe

5.7 Firmware and further guides

6. Flight

7. Maintenance and 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

The DarwinFPV TinyApe – 2S ELRS is a fast freestyle FPV drone intended for more experienced users aged 14 and over. It is not a toy. Read the entire manual before your first flight and keep it for future reference. If you pass the drone on to another person, hand over this manual as well.

- The drone is controlled entirely manually – it has no GPS, no automatic return and no position hold. Without prior training on a simulator, there is a risk of crashes and injury.
- Do not fly under the influence of alcohol or medication, or when tired.
- The drone contains small parts that could be swallowed. Keep it out of the reach of children and animals.

1.2 Rotating propellers and mechanical hazards

- The propellers spin at very high speed and can cause cuts. The drone has no prop guard (duct).
- Handle the propellers only with the battery disconnected. Before connecting the battery, always make sure the drone is in the Disarm state (motors off).
- Never hold the drone in your hand with the motors running, and do not approach it until the motors are off and the battery is disconnected.
- Keep a safe distance from people, animals, vehicles and buildings. Do not fly over people.
- Replace a damaged or cracked propeller immediately.

1.3 Li-Po and LiHV batteries

The battery is not included. The drone is designed for two-cell (2S) Li-Po or LiHV batteries. If handled improperly, these batteries can catch fire.

- Charge only with a Li-Po/LiHV balance charger, on a non-flammable surface and under supervision. Do not leave a charged battery unattended.
- Do not exceed the charging voltage: Li-Po 4.20 V/cell (8.40 V for 2S), LiHV 4.35 V/cell (8.70 V for 2S).
- Do not discharge the battery below 3.5 V/cell (7.0 V for 2S) – see chapter 6.3.
- Stop using a mechanically damaged, swollen or overheated battery and dispose of it safely.
- After a crash, disconnect the battery immediately and inspect it. Never leave the battery connected in the drone after the flight.
- For storage, set the voltage to 3.8 V/cell (7.6 V for 2S) and store the battery in a fireproof bag.

1.4 Operating environment

- Do not fly in rain, snow, fog, strong wind or reduced visibility.
- The drone is not waterproof. Moisture, grass, dust and metal debris can damage the electronics.
- Do not fly near high-voltage power lines, transmitters or airports, or in places where flying is prohibited (see chapter 3).
- Radio interference can interrupt the link to the radio transmitter as well as the video transmission. Always be aware that the drone may crash if the signal is lost.

2. Product description

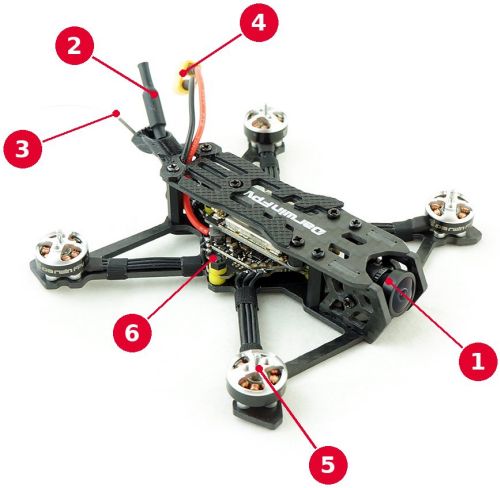
The TinyApe is a small freestyle drone with 2.5" propellers, suitable for flying in a garden or park. It is powered by 1103 8000Kv motors with Gemfan 2512 propellers. Flight is controlled by the DarwinFPV F411 15A AIO board, which combines the flight controller (FC), four electronic speed controllers (ESC) and an ExpressLRS receiver on a single PCB. Video is provided by a RunCam Nano 4 camera and a DarwinFPV analog video transmitter (VTX) with up to 600 mW output.

2.1 Package contents

1×	DarwinFPV TinyApe – 2S ELRS drone (BNF version with ExpressLRS receiver)

❊ Not included: radio transmitter (RC radio) with ExpressLRS 2.4 GHz, FPV goggles for 5.8 GHz analog video, batteries and charger.

2.2 Parts description



Main parts of the drone

① RunCam Nano 4 camera

② Video transmitter (VTX) antenna – linear

③ ExpressLRS receiver antenna

④ Power lead with battery connector

⑤ 1103 8000Kv motor (4×)

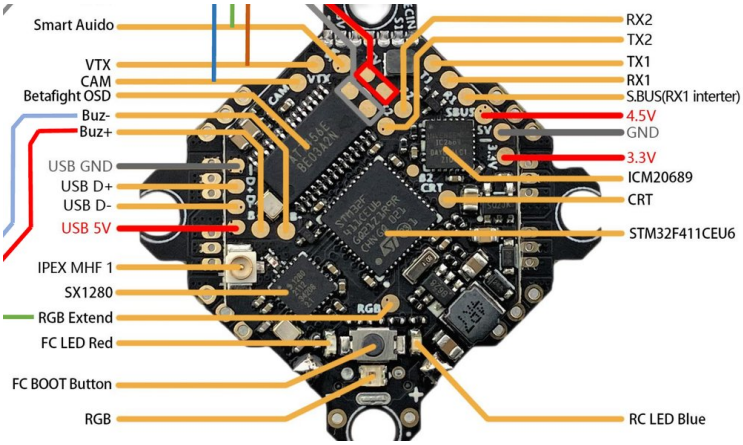
⑥ DarwinFPV F411 15A AIO board (FC + ESC + ELRS receiver)

2.3 Specifications

Parameter	Value
Type	2.5" freestyle FPV drone, BNF version
Motor-to-motor diagonal	108 mm
Weight without battery	54 g
Recommended battery	2S Li-Po, 380–500 mAh
Battery connector	XT30
Motors	1103 8000Kv, 9N12P, 1.5 mm shaft, 3.7 g, for 1–2S
Propellers	Gemfan 2512 (2.5")
Flight controller (FC) and ESC	DarwinFPV F411 15A AIO
Receiver	ExpressLRS 2.4 GHz, integrated (SPI)
Video transmitter (VTX)	DarwinFPV, 25/200/400/600 mW, 5.8 GHz
Camera	RunCam Nano 4
FC firmware	Betaflight, target **BETAFPVF4SX1280**
ESC firmware	Bluejay

2.4 Flight controller (FC) and receiver

The DarwinFPV F411 15A AIO board contains the flight controller, a 4-in-1 electronic speed controller and an ExpressLRS 2.4 GHz receiver connected directly to the processor (SPI). The receiver is therefore configured and bound in Betaflight Configurator, not via Wi-Fi.



AIO board pinout (source: DarwinFPV)

Flight controller (FC)	Value
Processor	STM32F411CEU6 (100 MHz)
Gyroscope	ICM-20689 (SPI)
OSD	AT7456E (Betaflight OSD)
Barometer / blackbox	no / no
Interfaces	2× UART (1, 2), 1× SBUS (RX1, inverter), Softserial TX, USB, CRT, BUZZ, RGB
Receiver	ExpressLRS 2.4 GHz, SX1280 chip, IPEX MHF1 antenna connector
Indicators	FC LED red, RC LED blue, BOOT button

Electronic speed controllers (ESC)	Value
Input voltage	3.0–13.5 V (1–3S Li-Po)
Continuous / peak current	15 A / 17 A
BEC output	no
Protocol	DShot, Oneshot, Multishot
Telemetry / current sensor	no / no

※ The board can handle up to 3S, but according to the manufacturer the 1103 8000Kv motors are designed for 1–2S. Use 2S batteries only.

2.5 Video transmitter and camera

The DarwinFPV analog video transmitter operates in the 5.8 GHz band with 40 channels and adjustable output power of 25, 200, 400 or 600 mW. It is powered with 5 V from the flight controller and controlled via the SmartAudio protocol, so you can set both the channel and the power from the radio in the Betaflight OSD menu (chapter 5.3). The image is captured by a RunCam Nano 4 camera.

※ In the Czech Republic and most EU countries, the maximum permitted power in the 5.8 GHz band is 25 mW e.i.r.p. You must not use 200, 400 or 600 mW there without a special authorisation (chapter 3.6).

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

3.1 The law of the country where you fly is decisive

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 the drone in another country, you must follow the regulations of the country where you fly.

3.2 Drone classification and category of operation

- The drone does not bear a C0–C4 class identification label under Regulation (EU) 2019/945. Subcategory A2 is therefore not available.
- A drone without a class label can be operated in the open category as a privately built UAS – in subcategory A1 if its maximum take-off mass (MTOM) is below 250 g and its speed does not exceed 19 m/s, otherwise in subcategory A3 – or within a model aircraft club or association under Article 16 of Regulation (EU) 2019/947.
- The drone weighs 54 g without the battery. **Actually weigh** the take-off mass including the battery and accessories (e.g. an action camera).
- The interpretation of how a particular product is classified may evolve. If in doubt, contact the Civil Aviation Authority of the Czech Republic (ÚCL, www.caa.gov.cz).

3.3 UAS operator registration and pilot competency

- The drone is equipped with a camera, i.e. a sensor capable of capturing personal data. The UAS operator must therefore **register** regardless of the drone's mass (Article 14 of Regulation 2019/947). In the Czech Republic, registration is with the ÚCL.
- The UAS operator registration number must be displayed visibly on the drone.
- Operation in subcategory A3 requires the A1/A3 online training and test. We recommend completing it for flying in subcategory A1 as well.

3.4 Operational limits of the open category

- Maximum flight height of 120 m above ground.
- Flight only within visual line of sight (VLOS) of the pilot or of a UA observer.
- No flying over assemblies of people.
- In subcategory A3, flight at a distance of at least 150 m from residential, commercial, industrial and recreational areas and without uninvolved persons

present.

- Respect geographical zones – in the Czech Republic they are shown in the ŘLP app and map (dronview.rlp.cz).

3.5 Flying with FPV goggles

When flying with FPV goggles, the pilot does not see the drone directly. In the open category, such a flight is permitted only with a **UA observer** who stands next to the pilot, watches the drone with the naked eye (without binoculars) and warns the pilot of any hazards.

3.6 Radio frequencies and transmit power

The drone contains two radio devices: an ExpressLRS 2.4 GHz receiver (which also transmits telemetry back to the radio) and a 5.8 GHz analog video transmitter. In the Czech Republic, the following applies under ČTÚ general authorisation VO-R/10:

Band	Max. power	Use in the drone
2400–2483.5 MHz	25 mW e.i.r.p.	ExpressLRS control link
5725–5875 MHz	25 mW e.i.r.p.	video transmission (VTX)

- Set the video transmitter to **25 mW** and use only channels with frequencies in the 5725–5875 MHz range. Channels outside this band (e.g. most of band E) must not be used in the Czech Republic.
- Set the power of the ExpressLRS transmitter module in the radio so that it does not exceed the permitted limit.
- The user is responsible for the power and channel settings. Outside the Czech Republic, the limits of the respective country apply.

3.7 Personal data protection and insurance

- Respect the privacy of others. Do not record or publish footage of people without their consent, and do not fly over other people's property without the owner's permission.
- In the Czech Republic, liability insurance is not mandatory for a small drone up to 4 kg in subcategories A1 and A3. Nevertheless, we strongly recommend it.

4. Preparing for the first flight

4.1 What else you need

- A radio transmitter (RC radio) with an **ExpressLRS 2.4 GHz** transmitter – built-in or as an external module.
- FPV goggles or a monitor for 5.8 GHz **analog** video.
- **2S Li-Po** batteries with a capacity of 380–500 mAh and an XT30 connector.
- A Li-Po/LiHV balance charger.
- A computer with Betaflight Configurator and a USB data cable.
- Spare Gemfan 2512 propellers and a small Phillips screwdriver.

4.2 Choosing and connecting the battery

- Use 2S batteries only. A 3S battery exceeds the voltage the motors are designed for – see chapter 2.4.
- Always fit a **fully charged** battery before flying: Li-Po 4.20 V/cell (8.40 V), LiHV 4.35 V/cell (8.70 V).
- Secure the battery firmly with a strap so that it cannot shift in flight and the leads cannot reach the propellers.
- Connect the battery only just before the flight, with the motors off and the radio switched on.

4.3 Propellers

- The drone uses Gemfan 2512 (2.5") propellers. Two propellers rotate clockwise and two counter-clockwise.
- Disconnect the battery before changing propellers. Fit each propeller on a motor that rotates in the direction the propeller is designed for. You can check the motor rotation direction in Betaflight on the *Motors* tab (chapter 5.5).
- The propellers must sit fully against the motor bell and be properly tightened. Do not overtighten.

4.4 Securing the receiver antenna

After unpacking the drone, secure the ExpressLRS receiver antenna (③ in the figure in chapter 2.2). Route the antenna away from the propellers, ideally vertically or angled upwards, and attach it to the frame, e.g. with a cable tie or heat-shrink tubing. A loose antenna can be caught by a propeller and torn off – the drone then loses its link to the radio.

※ The supplied linear video transmitter antenna is sufficient for short-range flying. For longer range, we recommend a circularly polarised antenna.

5. Setup

5.1 Connecting to a computer

- Install **Betaflight Configurator** (betaflight.com).
- **Remove** the propellers when working with the computer.
- Connect the drone to the computer with a USB cable and click *Connect* in the program. Most settings do not require the battery to be connected; checking the motors and the video transmitter does.
- Before changing anything, back up the settings: on the *CLI* tab, enter the command *diff all* and save the output.

5.2 Binding the ExpressLRS receiver

Procedure according to DarwinFPV (transmitter module controlled via the ExpressLRS script in EdgeTX/OpenTX):

① On the radio, open *SYS* → *Tools* → *ExpressLRS* and press *[Bind]*. The transmitter module enters binding mode.

② Connect the drone to Betaflight Configurator, open the *Receiver* tab and click the receiver bind button (*Bind*) in the bottom right corner. The blue RC LED changes from slow blinking to double blinking – the receiver is in binding mode.

③ Once the LED returns to slow blinking and the link is then established, binding is complete. The radio usually announces that telemetry has been recovered, and the channels on the *Receiver* tab start moving.

▶ Binding with a binding phrase

If your transmitter module uses a *binding phrase*, convert it to a UID string (e.g. with the tool on expresslrs.org or “ELRS Binding Phrase to UID Bytes”). Paste the generated command into the *CLI* tab in Betaflight, confirm it and save with the *save* command.

※ The receiver is part of the Betaflight firmware. The major ExpressLRS versions in the transmitter module and in the receiver must be compatible with each other – if you have binding problems, check the versions on expresslrs.org.

5.3 Video transmitter settings

① Switch on the radio, connect the battery and switch on the FPV goggles.

② Open the Betaflight OSD menu with the radio sticks (Betaflight default: throttle centred, yaw left, pitch up).

③ In the *Features* → *VTX SA* menu, set the band, channel and power **25** (mW) and save the selection (*Save*).

④ Tune the FPV goggles to the same channel.

The same can be set in Betaflight Configurator on the *Video Transmitter* tab.

5.4 Accelerometer calibration

Place the drone on a flat, level surface and click *Calibrate Accelerometer* on the *Setup* tab. Do not move the drone during calibration. The model in the 3D view must then follow the drone's movements.

5.5 Checking motors and propellers

- Perform the check **without propellers** and with the battery connected.
- On the *Motors* tab, acknowledge the safety warning and briefly spin up each motor using its slider. Check that the order and direction of rotation match the diagram in Betaflight.
- Fit the propellers according to the rotation direction found (chapter 4.3).

5.6 Arm, Disarm and failsafe

- **Arm** (motors on) and **Disarm** (motors off) are controlled by a switch on the radio. You can see which switch (AUX channel) and position is assigned, and change it if needed, on the *Modes* tab.
- The drone will only arm when the throttle is at minimum, the drone is roughly level and no other arming blocks are active. These are listed on the *Setup* tab (Arming Disable Flags).
- Choose an Arm switch that you cannot flip by accident.
- **Failsafe**: if the signal from the radio is lost, Betaflight stops the motors and the drone falls. Test this without propellers – when you switch off the radio, the motors must stop. The settings are on the *Failsafe* tab.

5.7 Firmware and further guides

The flight controller firmware (target **BETAFPVF4SX1280**), a backup CLI configuration and the video transmitter channel table are provided by the manufacturer on its support page: darwinfpv.com/blogs/news/tinyape-freestyle. Update the firmware only when necessary, and back up your settings first (chapter 5.1).

Detailed documentation for the radio system and for ExpressLRS is available on the official websites edgetx.org and expresslrs.org.

6. Flight

6.1 Pre-flight check

- The battery is **fully charged** (Li-Po 4.20 V/cell – 8.40 V, LiHV 4.35 V/cell – 8.70 V), undamaged and firmly secured.
- The propellers are intact, correctly oriented and tightened. The frame, motors and wiring are undamaged.
- The receiver antenna is secured away from the propellers; the video transmitter antenna is in place.
- The radio is charged, the correct model is selected and the Arm switch is in the off position.
- The video transmitter is transmitting on a permitted channel at 25 mW; the goggles are tuned.
- The flying site is safe with no people nearby, and the observer is standing next to you.

6.2 Take-off and basic control

① Switch on the radio first, then connect the battery to the drone. Place the drone on a flat surface and keep it still until the gyroscope calibration is complete.

② Switch on the FPV goggles and check the image and OSD data.

③ With the throttle at minimum, flip the Arm switch. The motors spin up to idle.

④ Smoothly increase the throttle and take off. Make your first few flights in an open area and low above the ground.

⑤ After landing, lower the throttle to minimum, switch to Disarm, disconnect the battery and only then switch off the radio.

6.3 Monitoring voltage and ending the flight

- Monitor the battery voltage in the OSD. End the flight at 3.5 V/cell at the latest, i.e. **7.0 V** for 2S (applies to both Li-Po and LiHV).
- Under load the voltage drops briefly – what matters is the voltage in calm flight.
- Deep discharge permanently damages the battery and increases the risk of fire during subsequent charging.

6.4 Finding the drone after a crash

- After a crash, switch to Disarm immediately so that the motors do not overheat. Once you find the drone, disconnect the battery immediately and inspect it.
- Betaflight can make the motors beep on command from the radio (the *BEEPER* function on the *Modes* tab, and on signal loss also *DShot beacon* in the buzzer settings). Set up and test this function in advance.

7. Maintenance and troubleshooting

7.1 After every flight

- Disconnect the battery and let the motors and electronics cool down.
- Check the propellers, frame, motor and cable mounting, and antenna position.
- Remove grass, hair and dirt from the motors. Do not spray water or solvents into the motors.
- Check screw connections regularly and tighten any that are loose.

7.2 Replacing propellers and motors

Replace a damaged propeller with a new Gemfan 2512 of the same rotation direction – a damaged propeller causes vibration and can damage the motor. A replacement motor must be a 1103 8000Kv; replacing it requires disassembling the frame and possibly soldering. After replacement, check the rotation direction (chapter 5.5).

7.3 Storage

- Store the drone in a dry place at room temperature, out of direct sunlight and out of the reach of children.
- Store batteries disconnected, at a storage voltage of 3.8 V/cell (7.6 V for 2S), in a fireproof bag.

7.4 Troubleshooting

Problem	Possible cause and solution
Drone will not arm	Throttle not at minimum, drone not level, USB connected or no signal. The cause is shown on the *Setup* tab (Arming Disable Flags) or in the OSD.
Channels do not move	Receiver not bound or ExpressLRS versions do not match – repeat the procedure in chapter 5.2.
Drone flips over on take-off	Propellers fitted the wrong way round or on the wrong motor, or motor rotation direction incorrect – check according to chapters 4.3 and 5.5.
No video or noisy video	Goggles and video transmitter on different channels, VTX antenna missing or damaged. Check the settings in chapter 5.3.
Strong vibration, jittery image	Damaged propeller, bent motor shaft or dirt in the motor. Replace the propeller; clean or replace the motor.
Short flight time	Worn or insufficiently charged battery, damaged propellers. Use a fully charged battery in good condition.

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 (DarwinFPV TinyApe – 2S ELRS) is given on the product packaging and in the proof of purchase.

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.