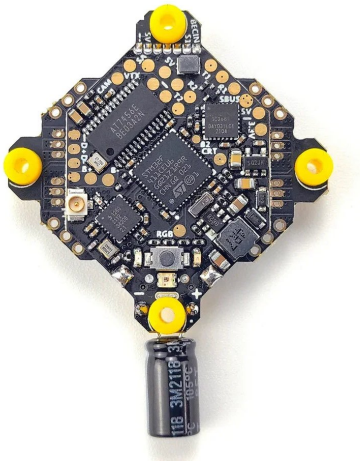
F411 15A AIO ELRS

DarwinFPV – flight controller, ESCs and ExpressLRS receiver on one board

User manual



Read the entire manual, especially the safety instructions, before installation and first connection of a battery. Keep this manual.

www.rotorama.com

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1. Safety instructions

1.1 Before you start

The DarwinFPV F411 15A AIO ELRS is an electronic component intended to be built into a small FPV drone. Installation and setup require soldering skills and experience with FPV equipment. Read the entire manual and keep it for future reference.

- This product is not a toy and is not intended for children. Keep it out of the reach of children – small parts (screws, dampers, connectors) may be swallowed.
- Use the board only within the technical data given in Chapter 2.3. Exceeding the supply voltage or the current load will permanently damage the board.
- Do not use a mechanically damaged board or a board with burnt components or traces of moisture.

1.2 Soldering and electrical safety

- Solder only with both the battery and the USB cable disconnected. Use a temperature-controlled soldering iron, quality solder and flux for electronics; work in a well-ventilated area.
- Observe the correct supply polarity (**+** and **−**). Reversing the battery polarity destroys the board immediately and cannot be claimed as a product defect.
- After soldering, check that there are no solder bridges between adjacent pads and that no solder balls or wire strands remain on the board.
- When connecting a battery for the first time after installation, we recommend using a current limiter (smoke stopper). Any short circuit will then show up without damaging the board.
- The board heats up during operation. Do not touch the ESCs immediately after a flight and ensure they receive airflow.

1.3 Rotating propellers

- **Always remove the propellers** when configuring the board on a computer, testing the motors and binding.
- Motors may spin up unexpectedly – for example after Arm (motors enabled) or due to a configuration error. Stay clear of the propellers whenever a battery is connected.
- Verify the failsafe function before the first flight (Chapter 5.4).

1.4 Li-Po and LiHV batteries

- The board is powered by a 1–3S Li-Po battery. Charge batteries only with a charger suitable for the cell type, never unattended and on a non-flammable surface.

- Do not use swollen, mechanically damaged or overheated batteries. Disconnect the battery after the flight and do not leave it connected in a stored drone.
- The binding voltage values for charging, ending the flight and storage are given in Chapter 6.2.

1.5 Operating environment

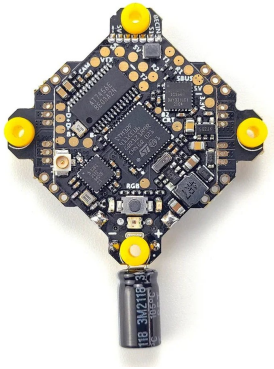
- Protect the board from water, moisture, dust and conductive contaminants (metal filings, carbon dust from the frame).
- A carbon frame is electrically conductive. Neither the board nor its wires may touch the frame directly – use the supplied dampers (soft mounts) and route the wires so that they cannot chafe against the frame edges.

2. Product description

2.1 Intended use

The DarwinFPV F411 15A AIO ELRS is an AIO (all-in-one) board that combines a **flight controller (FC)** with an STM32F411 processor, a **4-in-1 ESC** for four motors and an **ExpressLRS 2.4 GHz receiver**. It is intended primarily for small 2–3" drones powered by a 1–3S Li-Po battery.

The receiver is integrated directly on the board and connected to the flight controller processor – no separate receiver or wiring is needed. The board also includes a 5 V supply (BEC), an OSD overlay and two UART serial ports for connecting further devices.



DarwinFPV F411 15A AIO ELRS – top side (flight controller and receiver).

2.2 Package contents

Package contents according to the manufacturer:

Qty	Item
1×	DarwinFPV F411 15A AIO ELRS board
5×	motor connector socket (SH1.25)
1×	power cable 20 AWG, length 70 mm
1×	XT30 connector
5×	damper (soft mount) M2 × 6.6 mm
1×	2.4 GHz RF113 antenna with IPEX1 connector, length 86 mm
1×	bag of spare screws M2 × 8 mm
1×	sticker

Not included: frame, motors, propellers, camera, video transmitter (VTX), battery, charger, USB cable or radio transmitter.



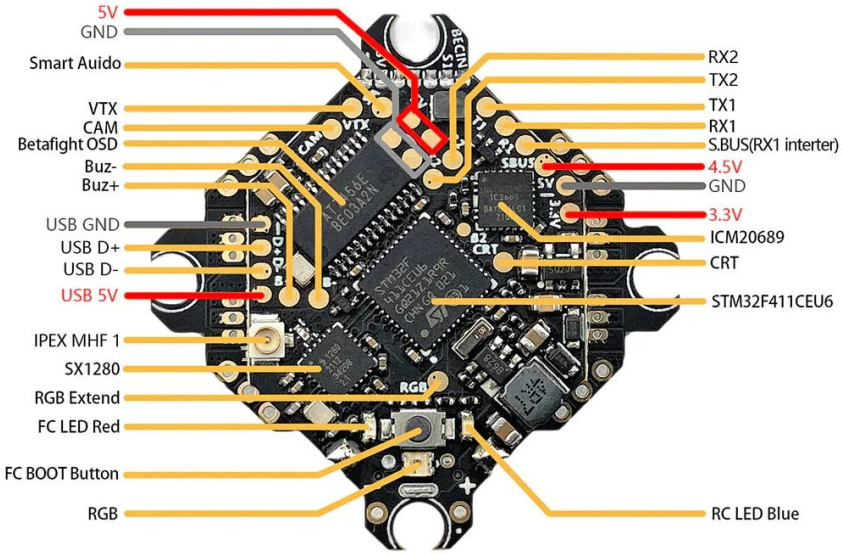
Illustrative photo of the accessories from the manufacturer. The actual package contents may differ in minor details.

2.3 Technical data

Parameter	Value
Manufacturer	DarwinFPV
Flight controller (FC) processor	STM32F411CEU6
Gyroscope / accelerometer	ICM20689
OSD	AT7456E (Betaflight OSD)
FC firmware	Betaflight, target **BETAFPVF4SX1280**
Receiver	ExpressLRS 2.4 GHz, SX1280 chip, connected via SPI
Receiver antenna connector	IPEX MHF1
ESC	4-in-1, 15 A; maximum current up to 17 A (manufacturer's data)
ESC firmware	Bluejay
Power supply	1–3S Li-Po
BEC	5 V / 2.5 A
Serial ports	2× UART; SBUS input (inverted RX1); softserial
Current sensor	none
USB	micro USB (bottom side of the board)
Mounting pattern	25.5 × 25.5 mm, M2 holes
Dimensions	37 × 36 mm
Weight	5.5 g

※ The data come from the DarwinFPV product page and the Rotorama product page. The firmware version differs between production batches and is therefore not stated in this manual.

2.4 Top side – solder pads and board elements

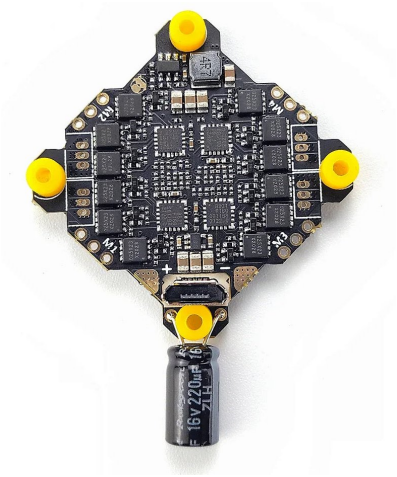


Top side wiring according to the manufacturer (original labels in the image).

Pad / element	Function
5V, GND	5 V BEC output (e.g. for VTX or camera)
4.5V, GND	4.5 V power output
3.3V	3.3 V power output
CAM	video input from the camera
VTX	video output (with OSD) to the video transmitter
Smart Audio	video transmitter control (SmartAudio)
Buz+, Buz−	buzzer connection
TX1, RX1	UART1 serial port
S.BUS	SBUS input – inverted RX1
TX2, RX2	UART2 serial port
CRT	pad labelled CRT by the manufacturer
USB 5V, D+, D−, GND	USB pads for an external connector
RGB, RGB Extend	LED / LED strip
IPEX MHF 1	receiver antenna connector
SX1280	ExpressLRS receiver chip

Pad / element	Function
FC BOOT Button	flight controller bootloader button
FC LED Red	red flight controller status LED
RC LED Blue	blue receiver status LED

2.5 Bottom side – ESCs and power



Bottom side: ESCs, motor outputs M1–M4, power pads + and − and micro USB connector.

- **M1–M4** – outputs for the four motors. Each output accepts the supplied SH1.25 socket or the motor wires soldered directly.
- **+ and −** – power pads for the power cable with the XT30 connector.
- **Micro USB** – connection to a computer for configuration and firmware updates.

※ The manufacturer's photos show an electrolytic capacitor connected to the power input. The capacitor suppresses voltage spikes from the ESCs – keep it connected with the correct polarity when installing the board.

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

3.1 The law of the country where you fly applies

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

3.2 Radio equipment

The integrated ExpressLRS receiver receives control commands and also transmits telemetry back to the radio transmitter. The board is therefore radio equipment within the meaning of Directive 2014/53/EU (RED).

Item	Value
Frequency band	2400–2483.5 MHz
Maximum transmitted power	not stated in the manufacturer's public documentation – the value is given in the EU declaration of conformity available from the importer (Chapter 8)
Limit in the Czech Republic	25 mW e.i.r.p. (CTU general authorisation No. VO-R/10, Art. 3(j))

The user is responsible for the transmitting power settings of the entire radio link (transmitter module and telemetry). Outside the Czech Republic, the limits of the respective country apply.

3.3 Operating a drone built with this board

- A drone assembled from parts is usually a **privately built UAS** without a class label. It can be operated in the open category – in subcategory A1 with a take-off mass below 250 g (and a speed below 19 m/s), otherwise in subcategory A3; subcategory A2 is not available. Always actually weigh the take-off mass including the battery and accessories.
- If the drone carries a camera, the operator must **register** regardless of the drone's mass (Art. 14 of Regulation 2019/947). Display the registration number on the drone.
- Fly no higher than 120 m, within visual line of sight (VLOS) and never over assemblies of people. When flying with FPV goggles, an **observer** must stand next to the pilot and keep the drone in direct sight.
- Respect geographical zones and flight bans. In the Czech Republic, insurance for a small drone in subcategory A1/A3 is not compulsory, but we strongly

recommend it.

- Respect the privacy of other people and data protection rules when flying.

4. Installation

4.1 What else you need

- a frame with a 25.5 × 25.5 mm mounting pattern (M2 holes), four motors and propellers suitable for 1–3S,
- a 1–3S Li-Po battery with a connector matching the power cable,
- a radio transmitter with an ExpressLRS 2.4 GHz module,
- a camera and a video transmitter (VTX), optionally a buzzer and LEDs,
- a soldering iron, solder, flux, a micro USB cable and a computer with Betaflight Configurator.

4.2 Mounting the board

① Insert the supplied dampers (soft mounts) into the board's mounting holes.

② Place the board on the frame so that outputs M1–M4 match the motor positions; the board orientation can be adjusted in Betaflight if needed (Chapter 5.1).

③ Tighten the screws only lightly – the dampers must not be fully compressed, otherwise they lose their damping effect and vibrations are transferred to the gyroscope.

④ Check that no component or solder joint touches the frame.

4.3 Connecting the motors

Connect the motors to outputs **M1–M4** on the bottom side of the board – either via the supplied SH1.25 sockets or by soldering the motor wires directly to the pads. The motor order must match the diagram in Betaflight Configurator (*Motors* tab). The direction of rotation is set in software (Chapter 5.3), so the order of the three wires of a motor does not matter.

4.4 Power supply

① Solder the 20 AWG power cable to the **+** and **−** pads on the bottom side of the board. The red wire goes to +, the black wire to −.

② Solder the XT30 connector (or a connector matching your batteries) to the other end, observing the polarity.

③ Keep the capacitor connected to the power input and observe its polarity.

④ Before connecting a battery for the first time, check with a multimeter that there is no short circuit between + and −, and use a current limiter (smoke stopper).

The supply voltage must not exceed 3S Li-Po. A battery with more cells will destroy the board.

4.5 Receiver antenna

- Connect the supplied antenna to the **IPEX MHF 1** connector on the top side of the board. The connector is tiny – press it on perpendicularly without levering.
- **Never power the board without the antenna connected** – the receiver transmits telemetry, and without an antenna it may be damaged and the range will be significantly reduced.
- Route the active part of the antenna away from the carbon frame and the power wires, ideally pointing down or sideways beyond the frame. Secure the antenna cable against being pulled out and against contact with the propellers.

4.6 Camera, VTX and other peripherals

- **Camera:** video signal to the **CAM** pad, power from the 5V or 4.5V pad according to the camera's requirements, ground to GND.
- **Video transmitter (VTX):** video with OSD from the **VTX** pad, channel and power control from the **Smart Audio** pad, power according to the VTX requirements. Check that the selected power output matches the VTX input voltage.
- **Buzzer:** to the **Buz+** and **Buz−** pads.
- **LED:** LED strip data wire to the **RGB** or **RGB Extend** pad.
- **Other devices** (e.g. GPS or a digital video transmitter): to the free UART1 (TX1/RX1) or UART2 (TX2/RX2). The board's TX connects to the device's RX and vice versa. Then enable the port in Betaflight on the *Ports* tab.

❋ The total current drawn by all devices powered from the 5V output must not exceed 2.5 A.

5. Setup

5.1 Connecting to a computer

① Remove the propellers.

② Start Betaflight Configurator (betaflight.com) and connect the board with a micro USB cable.

③ Select the serial port and click *Connect*. If the board does not connect, install the USB driver for Betaflight and try another cable – some cables are for charging only.

④ On the *Setup* tab, check that the model on the screen moves in the same way as the board. Otherwise adjust the board orientation (*Configuration → Board and Sensor Alignment*).

⑤ Place the board on a level surface and calibrate the accelerometer (*Setup → Calibrate Accelerometer*).

※ When powered from USB only, the ESCs and motors do not start. For motor tests and full-function binding, connect a battery (without propellers).

5.2 Binding the ExpressLRS receiver

The receiver is connected via SPI and controlled directly by the Betaflight firmware. The settings are on the *Receiver* tab, where the *SPI Rx* mode with the *EXPRESSLRS* protocol must be selected.

▶ Binding with a binding phrase (recommended)

① On the *Receiver* tab, enter the same binding phrase in the binding phrase field as is used by your ExpressLRS transmitter module.

② Save the settings (*Save*) and restart the board. When the transmitter is switched on, the receiver connects automatically.

▶ Binding in bind mode

① Put the receiver into bind mode with the *Bind* button on the *Receiver* tab, or with the **bind_rx** command on the *CLI* tab.

② On the radio transmitter, select *Bind* in the ExpressLRS Lua script.

③ Verify a successful connection on the *Receiver* tab – the channels must respond to the movement of the sticks and switches.

The transmitter module and the receiver must use mutually compatible versions of the ExpressLRS protocol (same major version). If binding fails, first check the firmware versions of the transmitter module and of Betaflight on the board.

5.3 Motor and direction check

① Remove the propellers and connect a battery.

② On the *Motors* tab, confirm the warning and briefly spin up each motor with the individual sliders. Check that the correct motor spins in the correct position.

③ Check the direction of rotation against the diagram in the Configurator. Reverse the direction in software – in Betaflight Configurator or in ESC Configurator (esc-configurator.com), which supports the Bluejay firmware.

④ Check that the DShot ESC protocol is selected on the *Configuration* tab.

5.4 Arm, Disarm and failsafe

- Assign **Arm** (motors enabled) and **Disarm** (motors disabled) on the *Modes* tab to a dedicated two-position switch of the radio. Never assign Arm to the throttle stick.
- Before Arm, the throttle must be at minimum and the drone must be at rest on a level surface.
- After signal loss, the **failsafe** function stops the motors or performs the configured procedure. Test it without propellers: after Arm, switch off the transmitter – the motors must stop.
- Check that the channel end points on the *Receiver* tab match the range of the radio.

5.5 Firmware update

- **Flight controller:** in Betaflight Configurator, select the **BETAFPVF4SX1280** target on the *Firmware Flasher* tab. Before updating, back up the configuration with the **diff all** command on the *CLI* tab.
- If the board cannot be connected, put it into bootloader (DFU) mode: hold the **FC BOOT** button and connect the USB cable.
- **ESCs:** the Bluejay firmware is configured and updated in ESC Configurator via Betaflight (passthrough) – with a battery connected and without propellers.
- Firmware updates are carried out at your own risk. An unsuitable target or an interrupted update may render the board inoperable.

5.6 Further documentation

The official documentation for ExpressLRS and for the EdgeTX radio system is available at www.expresslrs.org and edgetx.org.

ExpressLRS documentation
www.expresslrs.org

EdgeTX documentation
edgetx.org

6. Flying

6.1 Pre-flight check

- Insert a **fully charged** battery and check its voltage.
- Check the mounting of the board, antenna, propellers and all wires; no wire may reach into the propellers.
- Check the link to the radio, the Arm switch and the failsafe function.
- Make sure that flying is permitted at the location and that there are no unauthorised persons nearby.

6.2 Battery voltages and ending the flight

Binding Rotorama values for Li-Po and LiHV batteries:

Condition	per cell	1S	2S	3S
fully charged Li-Po	4.20 V	4.20 V	8.40 V	12.6 V
fully charged LiHV	4.35 V	4.35 V	8.70 V	13.05 V
end the flight	3.5 V	3.5 V	7.0 V	10.5 V
storage	3.8 V	3.8 V	7.6 V	11.4 V

Display the battery voltage in the OSD and set the warnings on the *Power & Battery* tab. The board has no current sensor and therefore does not measure the consumed capacity directly – rely on the voltage. End the flight at the latest when the voltage drops to 3.5 V per cell.

7. Maintenance and troubleshooting

7.1 Maintenance and storage

- After every flight, disconnect the battery and check the board, solder joints, antenna and wires.
- Remove dirt with a dry soft brush. After contact with water, disconnect the board from power immediately and let it dry thoroughly.
- Store in a dry place, away from direct sunlight and out of the reach of children. Store batteries at 3.8 V per cell.

7.2 Troubleshooting

Problem	Possible cause and solution
The board does not connect to the computer	charge-only cable – use a data cable; USB driver missing; as a last resort, bootloader mode with the FC BOOT button
The receiver does not bind	different binding phrase; incompatible ExpressLRS versions in the transmitter module and on the board; antenna missing
Motors do not respond on the Motors tab	board powered from USB only – connect a battery; wrong ESC protocol
A motor spins in the wrong direction	change the direction in Betaflight or ESC Configurator (Chapter 5.3)
Arm is not possible	throttle not at minimum; board not level; failsafe active; the reason is shown on the Setup tab or in the OSD
No video or OSD in the goggles	check the CAM and VTX wiring and the camera and VTX power supply
Short RC range	damaged or poorly placed antenna; antenna shielded by the carbon frame

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 F411 15A AIO ELRS) is given in this manual and on the proof of purchase; the board carries the DarwinFPV manufacturer print.

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.