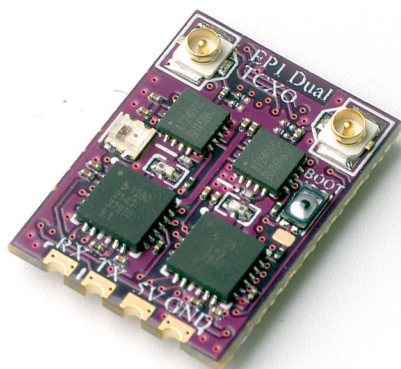




EP1 Dual TCXO

Happymodel ExpressLRS 2.4 GHz
Diversity receiver with TCXO



Read this manual carefully before installation and use, and keep it for future reference.

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1. Safety instructions

Read the entire manual before installation and first use. Keep the manual and pass it on together with the product if you hand the product over to another person.

1.1 General instructions

- The receiver is designed to be built into radio-controlled models (multirotors, airplanes, cars, boats). Installation should be carried out by a user experienced in soldering and wiring model electronics.
- This product is not a toy. It is not intended for children; keep small parts and antennas out of the reach of children.
- Do not modify the receiver and do not use it if it is mechanically damaged, corroded or wet.
- Protect the board from moisture, dust, metal shavings and static electricity. When handling, do not touch the components or solder pads.

1.2 Electrical installation

- Do all soldering and wiring **with the battery disconnected** and the USB cable unplugged.
- Power the receiver only from the **5 V** power output of the flight controller (FC). Never connect it directly to the model's battery.
- Before powering on for the first time, check that there are no short circuits between the pads and remove any flux residue.
- Do not power on the receiver without the antennas connected – the telemetry transmitter section could be damaged.
- U.FL connectors are fragile. Attach and detach the antenna perpendicular to the board, without levering or pulling on the cable.

1.3 Model operation

- Before every flight or drive, check the link to the radio (transmitter) and the failsafe function (chapter 5.5). A model that has lost signal must not remain in uncontrolled motion.
- Remove the propellers from the model when testing on the bench.
- Operate the model only where it is permitted and comply with the regulations of the country in which you operate it (chapter 3).

2. Product description

2.1 Intended use

The Happymodel EP1 Dual TCXO is a receiver for the **ExpressLRS (ELRS)** RC system in the 2.4 GHz band. ExpressLRS is an open-source RC system offering long range, low latency and a high update rate. The receiver passes commands from the radio (transmitter) to the flight controller (FC) over a serial link using the **CRSF** protocol and sends telemetry back (battery voltage, link quality and other data).

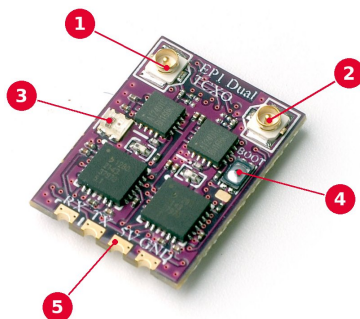
The receiver has two SX1280 (SX1281) radio chips and two antenna inputs (diversity reception). Ideally, the antennas should be oriented at 90° to each other; the receiver thus reduces dropouts caused by unfavourable polarization and provides a more reliable RC link – it is particularly suited to freestyle and long-range multirotors. **TCXO** stands for temperature-compensated crystal oscillator, which keeps the frequency stable even under large temperature changes.

2.2 Package contents

- 1× Happymodel EP1 Dual TCXO receiver
- 2× antenna with U.FL (IPEX1) connector

The package does **not** include a radio (transmitter), an ExpressLRS TX module, a flight controller (FC) or connecting wires.

2.3 Parts overview

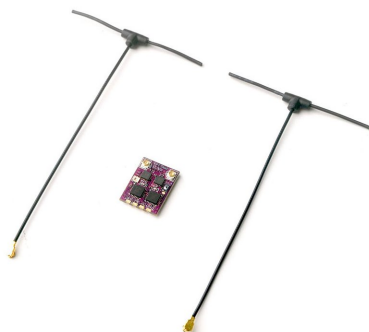


Top view

- ① U.FL antenna connector (IPEX MHF1) – antenna 1
- ② U.FL antenna connector (IPEX MHF1) – antenna 2
- ③ RGB LED – status indication (chapter 6.3)
- ④ BOOT button – binding mode (chapter 5.3)
- ⑤ RX, TX, 5V, GND solder pads – connection to the flight controller (chapter 4.2)

2.4 Specifications

Parameter	Value
Manufacturer	Happymodel (Quzhou Yunduan Intelligent Technology Co., Ltd.)
Model	EP1 Dual TCXO
System	ExpressLRS, ISM 2.4 GHz
Frequency band	2400–2480 MHz
Telemetry power	> 19 dBm (manufacturer's data)
Processor (MCU)	ESP32 PICO D4
Radio chips	2× SX1280 (SX1281)
Oscillator	TCXO (temperature-compensated)
Output protocol	CRSF
Supply voltage	3.5–5 V; 5 V DC to the 5V (+) pad recommended
Antenna connectors	2× IPEX MHF1 / U.FL
Board dimensions	19 × 14 mm
Weight	1 g (without antennas)
Factory firmware	ExpressLRS, target <i>Unified_ESP32_2400_RX</i>
Firmware update	via UART or Wi-Fi



EP1 Dual TCXO receiver with two antennas (package contents)

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

3.1 The law of the country of operation is decisive

European Union regulations apply in all member states, but national implementing regulations differ from country to country – permitted frequency bands, maximum transmit power, registration obligations and rules for operating models and drones. The information in this chapter describes the situation in the Czech Republic. If you operate the model in another country, you must comply with the regulations of the country in which you operate it.

3.2 Radio frequencies and transmit power

The receiver operates in the 2.4 GHz band and transmits telemetry back to the radio (transmitter). In the Czech Republic, the following general authorizations of the Czech Telecommunication Office (ČTÚ) apply to the 2400–2483.5 MHz band:

Band	Equipment category	Limit	Regulation
2400–2483.5 MHz	Wideband data transmission systems (ČSN ETSI EN 300 328)	100 mW e.i.r.p.	VO-R/12/11.2021-11
2400–2483.5 MHz	Non-specific short-range devices	25 mW e.i.r.p.	VO-R/10/05.2025-5

- The e.i.r.p. limit applies to the **transmitter including the antenna**. Do not use additional amplifiers and do not modify the transmitter section.
- The manufacturer states the receiver's telemetry power as > 19 dBm. The user is responsible for setting the power of the entire RC system (TX module and receiver) so that the limit valid in the country of operation is not exceeded.
- Outside the Czech Republic, the frequencies and limits of the respective country apply.

3.3 Operation of models and drones

The receiver is part of a model. In the EU, drone operation is governed by Regulations (EU) 2019/947 and 2019/945 and by national regulations (operator registration, pilot competency, operational limits). Details can be found in your drone's manual and on the website of the Civil Aviation Authority of the Czech Republic (www.caa.gov.cz).

4. Installation

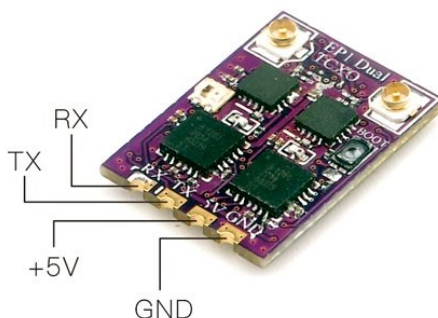
4.1 What else you need

- a radio (transmitter) with an ExpressLRS 2.4 GHz TX module (internal or external) and the ExpressLRS Lua script,
- a flight controller (FC) with a free full UART (RX and TX pair) and a 5 V output,
- a soldering iron, solder, thin connecting wires and heat-shrink tubing,
- a computer with a flight controller configurator (e.g. Betaflight Configurator).

4.2 Connecting to the flight controller

The receiver communicates with the flight controller using the CRSF protocol over two wires – one carries the control signal, the other returns telemetry. The signal wires are connected **crosswise**:

Receiver pad	Flight controller (FC) pad
GND	any GND (ground) pad
5V	5 V output
TX	RX of the selected UART (e.g. RX1)
RX	TX of the same UART (e.g. TX1)



Receiver solder pads

- Use any free UART according to your flight controller's pinout. UARTs that the FC manufacturer has reserved for SBUS receivers often have a pull-down resistor because of the inversion – the ExpressLRS receiver then lights up solid and does not work. Avoid such UARTs.
- KISS flight controllers may label UARTs differently – follow your FC's manual.
- If you use a digital FPV system (e.g. DJI) connected with all six wires, disconnect the SBUS/DJI HDL wire.

4.3 Antenna placement

- Route the antennas as far as possible from carbon parts, motors, the video transmitter (VTX) and power wires, and out of reach of the propellers.
- Ideally, orient the active elements of the two antennas at 90° to each other (e.g. one vertical, the other horizontal).
- Do not bend the antenna coaxial cables sharply or crush them; secure the U.FL connectors against pulling out (e.g. with a drop of glue or heat-shrink over the cable).

4.4 First power-on and check

Do **not wrap the receiver in heat-shrink** or mount it yet – first verify that it works. After checking for short circuits, power on the model, preferably from the battery (with the propellers removed), and watch the LED:

- rainbow colour fade – the receiver is starting,
- slow blinking (500 ms) – waiting for a connection to the radio: the wiring is correct,
- LED does not light at all – the receiver may be in bootloader mode, or there is a wiring fault. Disconnect power immediately and follow chapter 7.2.

❖ **The heat-shrink tubing must not press permanently on the BOOT button – the receiver would start in bootloader mode and not work.**

5. Setup and binding

5.1 Flight controller setup (Betaflight)

- ① On the *Ports* tab, enable *Serial RX* for the UART the receiver is connected to.
- ② On the *Receiver* tab, set *Receiver Mode* to *Serial* and *Serial Receiver Provider* to *CRSF*.
- ③ Enable *Telemetry*.
- ④ Set *RSSI Channel* and *RSSI ADC* to *Disabled*.
- ⑤ In the *CLI* tab, use the *get serialrx* command to verify that *serialrx_inverted* and *serialrx_halfduplex* are turned off (*off*). If necessary, set them with *set serialrx_inverted = off* and *set serialrx_halfduplex = off* and save with *save*.

In INAV, the same options are on the *Ports*, *Receiver* and *Configuration* tabs. The location of the options may vary between configurator versions. After setup, close the configurator and unplug the USB cable.

5.2 Firmware compatibility

The TX module and the receiver will connect only if they run the **same major version** of the ExpressLRS firmware (the first number of the version matches). With a different major version, no binding method will work and the firmware must be updated (chapter 6). You can find the version in the ExpressLRS Lua script or in the receiver's web interface.

5.3 Binding to the radio

► Method A - Binding Phrase (recommended)

When updating the firmware in ExpressLRS Configurator, enter the same phrase in the *Binding Phrase* field as your TX module uses (at least 8 characters, e.g. your pilot nickname). The phrase can also be changed in the receiver's web interface. Devices with the same phrase connect automatically. The phrase does not provide security; it keeps your system from interfering with other pilots.

► Method B - binding mode

- ① Switch off the radio.
- ② Put the receiver into binding mode in one of these ways: **3 times in a row** power the receiver on and off again within 2 s, then power it on permanently; or hold the **BOOT** button on the receiver for about 1.5 s; or use the *Bind Receiver* button on the *Receiver* tab in Betaflight Configurator (or the *bind_rx* command in the CLI), if your FC firmware supports it.
- ③ The receiver LED blinks orange twice followed by a pause – binding mode is active.
- ④ Switch on the radio, run the ExpressLRS Lua script and select *[Bind]*.
- ⑤ As soon as the LED lights solid in one colour, the receiver is bound.

※ A receiver with older firmware that has a Binding Phrase set may not enter binding mode – in that case use method A. To cancel binding mode, restart the receiver; the previous binding then remains valid.

5.4 Checking the link

When the link is established, the ExpressLRS Lua script shows the letter **C** (Connected) in the top right corner. If *Model Mismatch* appears instead and the LED blinks orange three times followed by a pause, the model ID in the receiver does not match the current model in the radio. If you do not use the Model Match feature, briefly set the *Model Match* item to *On* and then back to *Off*.

5.5 Failsafe

When the signal is lost, the receiver stops sending data to the flight controller, which then activates failsafe (emergency mode). Failsafe settings are found in the FC configurator (in Betaflight, the *Failsafe* tab). Test the function without propellers: after Arm (motors enabled), switch off the radio – the motors must stop or the model must behave according to the configured failsafe.

6. Firmware and further guides

6.1 Wi-Fi mode and web interface

- ① Switch off the radio and power on the receiver. After 60 s without a link, the receiver automatically enters Wi-Fi mode – the LED pulses green. On a bound receiver, Wi-Fi can also be enabled in the Lua script: *Wifi Connectivity* → *Enable RX WiFi*.
- ② On your phone or computer, connect to the **ExpressLRS RX** network, password **expresslrs**.
- ③ Open **http://10.0.0.1/** in a browser. In the web interface you can check the firmware version, change the Binding Phrase and upload new firmware.

While working, make sure the video transmitter (VTX) is cooled, or disconnect it.

6.2 Firmware update

The firmware is updated using **ExpressLRS Configurator** via Wi-Fi (by uploading the file in the web interface) or via the flight controller's UART (passthrough). The manufacturer ships the receiver with the *Unified_ESP32_2400_RX* target; it can be updated to the *HappyModel EP1 Dual 2400 RX* target. The major firmware version of the receiver and the TX module must match.

6.3 RGB LED indication

LED	Status
rainbow fade	receiver starting
slow blinking 500 ms	waiting for connection to the radio
orange, 2 blinks and pause	binding mode
orange, 3 blinks and pause	connected, but Model Match mismatch
green pulsing	Wi-Fi mode (web interface)
red fast blinking 100 ms	radio chip not detected
solid single colour	connected; colour indicates the packet rate
off	powered off or bootloader mode

6.4 Further guides

Detailed guides to the ExpressLRS system and the EdgeTX radio firmware (including the Lua script) are available on the official project websites:



ExpressLRS official documentation

www.expresslrs.org



EdgeTX official website

edgetx.org

- ExpressLRS official documentation: www.expresslrs.org
- EdgeTX official website: edgetx.org

7. Maintenance and troubleshooting

7.1 Maintenance

- After a crash, check the antennas, their cables and the U.FL connectors; replace a damaged antenna.
- Check the solder joints and the receiver's insulation; the receiver must not be subjected to mechanical stress.
- Store the model in a dry place at room temperature.

7.2 Troubleshooting

Problem	Cause and solution
LED lights solid (no link) or does not light	Bootloader mode: check that the BOOT button is not pressed or damaged (e.g. by heat-shrink). Disconnect the RX and TX wires from the FC and power on the model – if the LED blinks slowly, move the receiver to a different UART. If no other UART is free, a 300 Ω to 1 k Ω pull-up resistor can be connected between the RX pad of that UART and 5 V or 3.3 V.
Receiver cannot be bound	Different major firmware version or a different Binding Phrase. Check the versions (chapter 5.2) and match the phrase, or use binding mode.
Bound, but FC does not respond	Check the crosswise wiring (TX → RX, RX → TX) and the <i>Serial RX</i> , <i>CRSF</i> and <i>CLI</i> settings (chapter 5.1).
Model Mismatch, LED blinks 3x	Model ID does not match – see chapter 5.4.
Short range, dropouts	Check the antennas and their placement (chapter 4.3) and the TX module power.
LED blinks fast red	Radio chip not detected – contact your dealer.

8. Information for the EU and Czech Market

8.1 Importer and responsible person in the EU

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

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

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@rotorama.cz.
- **Product identification:** the type designation (EP1 Dual TCXO) is printed on the receiver's circuit board; the firmware version can be found in the ExpressLRS Lua script or in the receiver's web interface (Chapter 6).

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.