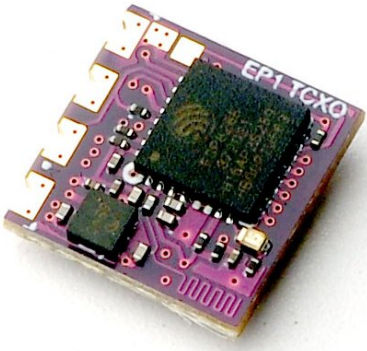
ROTORAMA

EP1 TCXO

ExpressLRS 2.4 GHz receiver
Happymodel · User Manual



Read the entire manual before installation. Power the receiver with 5 V only.

www.rotorama.com

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1. Safety instructions

1.1 General rules

- The receiver is intended to be installed in RC models (FPV drones, aircraft, cars, boats) by persons with basic knowledge of soldering and flight controller (FC) configuration. This product is not a toy – keep it out of the reach of children; small parts can be swallowed.
- Power the receiver **with 5 V only**, from a suitable flight controller pad or a regulated supply (BEC). Never connect it directly to a battery.
- Before switching on for the first time, check the wiring and make sure there is no short circuit between the pads. Incorrect wiring can permanently damage the receiver and the flight controller.
- Always operate the receiver with the antenna connected.

1.2 When working on the model

- When wiring, configuring, binding and bench testing, keep the **propellers removed** from the drone.
- Check the link and the failsafe function before every flight (chapter 6).
- Solder quickly and with a suitable tip temperature so that components do not overheat and pads do not lift. Secure the wires so that the pads are not under tension.
- Protect the receiver from moisture, water, dust, impacts and conductive debris (e.g. carbon dust).
- Flashing unsuitable firmware or modifying the board may cause the receiver to stop working.

1.3 Radio operation

- The product emits radio signals (telemetry, Wi-Fi). Use it in accordance with the regulations of the country in which you operate it (chapter 3).
- Do not use it where the operation of radio equipment is prohibited (e.g. on board an aircraft, in healthcare facilities).

2. Product description

2.1 Intended use

The Happymodel EP1 TCXO is a miniature RC receiver for the **ExpressLRS** (ELRS) system in the 2.4 GHz band. It receives control commands from a radio with an ExpressLRS transmitter module and passes them to the flight controller (FC) over a serial link using the **CRSF** protocol. In the opposite direction it sends telemetry (e.g. battery voltage) back to the radio. ExpressLRS is an open-source RC system with long range, low latency and a high refresh rate.

The TCXO version contains a temperature compensated crystal oscillator (TCXO), which keeps the frequency accurate and the link stable even with large temperature changes. Thanks to its 10 × 10 mm size the receiver is particularly suitable for smaller drones (2–4") and racing quads; the manufacturer also lists RC aircraft, cars and boats as applications. The receiver uses an ESP8285 chip with Wi-Fi, so its firmware can be updated wirelessly.

2.2 Package contents

1×	Happymodel EP1 TCXO receiver
2×	antenna with IPEX1 (u.FL) connector – 40 mm and 90 mm long

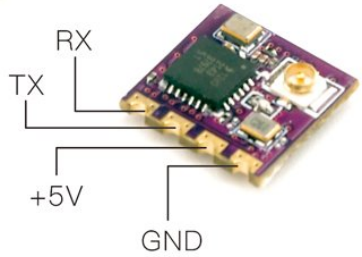
The package does **not** include a radio, an ExpressLRS transmitter module or connecting wires.

EP1 TCXO receiver with antennas

2.3 Specifications

System	ExpressLRS, 2.4 GHz ISM band
Processor (MCU)	ESP8285
RF module	SX1280 (SX1281) IMLTRT
Oscillator	TCXO (temperature compensated)
Antenna	omnidirectional, IPEX1 (u.FL) connector
Antenna gain (peak)	2.23 dBi
Receive refresh rate	25–500 Hz
Output protocol	CRSF
Supply voltage	5 V
Dimensions	10 × 10 × 6 mm
Weight	0.41 g (without antenna)
Factory firmware	HappyModel_EP_2400_RX

2.4 Pinout



Solder pads of the EP1 TCXO receiver

Pad	Function	Connect to FC
RX	telemetry input from the FC	TX pad of the selected UART
TX	control output (CRSF)	RX pad of the same UART
+5V	5 V power supply	5 V (4V5) pad
GND	ground	any GND pad

The IPEX1 (u.FL) connector is used to attach the antenna. The receiver status is indicated by the LED on the board (chapter 7.1).

3. Radio frequencies and regulations

3.1 The law of the country of use applies

Radio equipment is subject to Directive 2014/53/EU (RED) throughout the European Union, but the conditions for using frequencies – permitted bands and maximum transmit power – are set by national regulations and may differ from country to country. The information in this chapter describes the situation in the Czech Republic. If you use the product in another country, you must follow the regulations of the country in which you use it. When used in a drone, the rules for operating unmanned aircraft also apply – Regulation (EU) 2019/947 and national implementing regulations.

3.2 Frequencies and transmit power

The receiver contains two transmitters: the ExpressLRS radio module (telemetry to the radio) and the Wi-Fi of the ESP8285 chip (only in Wi-Fi mode, see chapter 5.3). Both operate in the 2.4 GHz band. Limits in the Czech Republic:

Band	Type of use	Max. power (e.i.r.p.)
2400–2483.5 MHz	wideband data transmission, incl. Wi-Fi (VO-R/12)	100 mW
2400–2483.5 MHz	non-specific short range devices (VO-R/10)	25 mW

- The manufacturer does not state the maximum transmit power of the telemetry or Wi-Fi in its public documentation. Conformity information is available from the importer (chapter 8).
- When flashing firmware, select the regulatory domain for the country of use – for the EU *Regulatory_Domain_EU_CE_2400* (with LBT – “listen before talk”).
- The user is responsible for the power setting and for complying with the limits. Outside the Czech Republic, the limits of the respective country apply.

4. Installation

4.1 What else you need

- a radio with an ExpressLRS 2.4 GHz transmitter module (internal or external) – the major firmware version must match the receiver (chapter 5.2),
- a flight controller (FC) with a free full UART and a 5 V output,
- soldering equipment, thin stranded wires and heat-shrink tubing,
- a computer with the flight controller configurator (e.g. Betaflight, INAV) and, for updates, the ExpressLRS Configurator.

4.2 Connecting to the flight controller

① Receiver **GND** → any GND pad on the FC.

② Receiver **+5V** → 5 V (or 4V5) pad on the FC.

③ Receiver **TX** → **RX** pad of the selected UART (e.g. RX2).

④ Receiver **RX** → **TX** pad of the same UART (e.g. TX2).

Use a full UART (RX and TX pair). UARTs that the FC manufacturer intends for SBUS receivers often have a pull-down resistor on the RX pad, which can put an ESP-based receiver into bootloader mode (LED solid). It is best to avoid such UARTs. Always check the wiring in the manual of your flight controller.

Before switching on, check that there is no short circuit between the pads and clean off flux residue. Do not heat-shrink the receiver yet – first carry out the check described in chapter 4.4.

4.3 Antenna

- Press the antenna onto the IPEX1 (u.FL) connector straight down, without levering. The connector is mechanically fragile.
- Choose the antenna (40 mm or 90 mm) according to the space in the model.
- Route the active end of the antenna away from carbon parts, power wires and the propellers – ideally out of the frame.
- Do not bend the antenna cable sharply and secure it so that it cannot pull out the connector.

4.4 First power-up

With the propellers removed, connect the battery to the model – this tests the receiver under the same conditions as in flight. With the radio switched off, the receiver LED should **blink slowly** (waiting for connection). If the LED does not light up at all, disconnect the power immediately and check the wiring. If the LED is solid, the receiver is in bootloader mode – proceed according to chapter 7.2. Only after a successful check heat-shrink and mount the receiver.

5. Configuration and binding

5.1 Flight controller configuration

① On the *Ports* tab, enable *Serial RX* on 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* (in INAV on the *Configuration* tab).

④ With analog video or a system with MSP DisplayPort, set *RSSI Channel* to *Disabled* and disable *RSSI ADC*.

⑤ In the CLI, use *get serialrx* to check that *serialrx_inverted* and *serialrx_halfduplex* are OFF. Otherwise set them (*set serialrx_inverted = off*, *set serialrx_halfduplex = off*) and store them with *save*.

The names and locations of the settings may differ between configurator versions. After configuration, close the configurator and unplug the USB cable.

5.2 Binding to the transmitter

The major (first) firmware version number of the transmitter module and the receiver must be the same, otherwise the devices will not bind. You can check the version in the ExpressLRS Lua script on the radio and in the receiver's web interface (chapter 5.3).

▶ Binding with a binding phrase (recommended)

If you enter the same *Binding Phrase* in the transmitter module and in the receiver – when flashing firmware with the ExpressLRS Configurator or in the receiver's web interface – the devices connect automatically. The phrase is used to distinguish you from other pilots; it is not a password. Choose a unique phrase of at least 8 characters.

▶ Traditional binding

① Switch off the radio.

② Power-cycle the receiver three times: when the LED lights up, disconnect the power within 2 s; 3 times in total.

③ After the third power-up the LED double-blinks quickly – the receiver is in binding mode.

④ Switch on the radio, run the ExpressLRS Lua script and select *[Bind]*.

⑤ Once bound, the receiver LED stays solid.

With newer firmware versions, binding mode can also be started with the *Bind Receiver* button on the *Receiver* tab of Betaflight Configurator or with the CLI command *bind_rx* (requires a newer Betaflight version). If a receiver with older firmware has a binding phrase set, traditional binding does not work – use the phrase.

5.3 Web interface and firmware update

The receiver has Wi-Fi, so the firmware can be updated and settings changed in the web interface:

① Switch off the radio and power up the receiver. After about 60 s without a connection it enters Wi-Fi mode (LED blinks fast). With a bound receiver, the mode can also be enabled in the ExpressLRS Lua script: *WiFi Connectivity* → *Enable RX WiFi*.

② Connect to the **ExpressLRS RX** network, password **expresslrs**.

③ Open **http://10.0.0.1/** in a browser.

④ Upload the firmware file built with the ExpressLRS Configurator using the *Update* button.

⑤ Do not switch off the power until the update is complete. Wait until the LED blinks again.

The factory firmware of the receiver is labelled **HappyModel_EP_2400_RX**. In the ExpressLRS Configurator, select the target matching this receiver and the regulatory domain for the country of use (chapter 3.2). The receiver's Wi-Fi antenna is small – keep your computer or phone close during the update.

5.4 Further guides

The official project documentation is available at www.expresslrs.org and edgetx.org. Detailed procedures for the ExpressLRS system and for radios running EdgeTX can be found there:

ExpressLRS documentation
www.expresslrs.org

EdgeTX documentation
edgetx.org

6. Before flying

6.1 Failsafe check

Failsafe (the behaviour of the model after signal loss) is configured in the flight controller – in Betaflight on the *Failsafe* tab. Check it with the propellers removed: Arm the model (motors on) and switch off the radio. The motors must stop, or the model must enter the configured failsafe mode. Then switch the radio back on and Disarm (motors off).

6.2 Pre-flight check

- The receiver LED is solid and the radio shows telemetry (RSSI, LQ).
- The antenna is firmly attached, undamaged and its end is out of reach of the propellers.
- The wires and the receiver are secured and insulated.
- The channels in the configurator (*Receiver* tab) respond to stick movements in the correct direction.
- Failsafe has been checked (chapter 6.1).
- Before the first longer flight, check the link at a short distance and watch the telemetry values.

7. LED indication and troubleshooting

7.1 LED indication

Indication	Status
solid on	connected to the transmitter, or bootloader mode
double blink, then pause	binding mode
slow blink (500 ms)	waiting for connection from the transmitter
triple blink, then pause	connected, but *Model Match* setting mismatch
medium blink (100 ms)	radio chip not detected
fast blink (25 ms)	Wi-Fi mode

7.2 Troubleshooting

Problem	Cause and solution
LED does not light up	Power or wiring fault. Disconnect the power immediately and check the +5V and GND pads.
LED solid even with the radio off	Bootloader mode – the UART pulls the receiver's RX pad to ground. Disconnect the RX and TX wires and power up the model again. If the LED starts blinking slowly, connect the receiver to a different UART. Alternatively, fit a 300 Ω to 1 kΩ resistor between the RX pad of this UART and a 5 V or 3.3 V pad. With digital systems (DJI, Caddx Vista) connected with all six wires, disconnect the SBUS/DJI HDL wire.
Cannot bind	Different major firmware version or different binding phrase. Align the firmware and the phrase (chapter 5.2).
LED triple-blinks	*Model Match* setting mismatch – adjust it in the ExpressLRS Lua script.
Connected, but the FC does not respond	Check the port and protocol settings (chapter 5.1) and the TX → RX, RX → TX wiring (chapter 4.2).
Short range, dropouts	Damaged or poorly placed antenna, loose connector, low transmitter power.

7.3 Maintenance and storage

- After every crash, check the antenna, the connector and the solder joints.
- Replace a damaged antenna – with a 2.4 GHz antenna with IPEX1 (u.FL) connector.
- Store in a dry place, away from direct sunlight and heat sources.

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 (EP1 TCXO) is printed on the receiver's circuit board.

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.