ES900 Dual RX

Happymodel · ExpressLRS 868 MHz receiver
with true diversity



The TX module and the receiver must use the same EU868 regulatory domain and the same ExpressLRS major firmware version.

User manual · www.rotorama.com

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1. Safety instructions

1.1 Before you start

The ES900 Dual RX receiver is a component designed to be installed in an RC model or FPV drone. Installation requires soldering and a basic knowledge of flight controller (FC) setup. Before installation, read this entire manual as well as the manuals for the flight controller and TX module the receiver will be used with.

- This product is not a toy. It is not intended for children; keep small parts and antennas out of the reach of children.
- During any work on the model – soldering, wiring, configuration, binding – **remove the propellers** (on aircraft and boats, disconnect the drive) and disconnect the flight battery unless you need it for the step in question.
- Loss of the radio link means loss of control over the model. Always verify the failsafe function before the first flight (Chapter 6.3).

1.2 Electrical installation

- Power the receiver only from the 5 V output of the flight controller or another regulated 5 V source. **Never connect it directly to the flight battery.**
- Before applying power for the first time, check that there are no short circuits between the pads and remove any flux residue.
- Solder quickly and at a temperature suitable for small pads; overheating can cause the pads to lift off the board.
- Do not power on the receiver with an antenna disconnected – this may damage the telemetry transmitter and the link would have a very short range.
- When working with a LiPo flight battery, follow its manufacturer's instructions: do not charge it unattended, do not use damaged or swollen cells, and store batteries in a non-flammable place.

1.3 Radio operation

- The receiver contains a radio transmitter for telemetry. Use it only in accordance with the regulations of the country in which you operate the model (Chapter 3).
- The 868 MHz band is shared by many other devices (alarms, sensors, remote meter reading). Interference cannot be ruled out; end the flight at any sign of an unstable link.
- Always perform a link and range check before flying (Chapter 6.1).

2. Product description

2.1 Intended use

Happymodel ES900 Dual RX is an **ExpressLRS** (ELRS) receiver for the 868 MHz band. ExpressLRS is an open-source RC link system offering long range, low latency and a high update rate. The receiver connects to the flight controller via a serial link (UART) using the CRSF protocol and sends telemetry back to the radio (handset).

The receiver features **true diversity**: it contains two SX1276 radio chips, each with its own antenna, and uses whichever has better reception at any given moment. Ideally, the antennas should be oriented at 90° to each other. This allows the receiver to eliminate signal loss caused by unfavourable polarisation and makes it particularly suitable for freestyle and long-range models. A temperature-compensated crystal oscillator (TCXO) keeps the frequency stable even under large temperature changes. The manufacturer lists FPV drones, RC aircraft, cars and boats as applications.



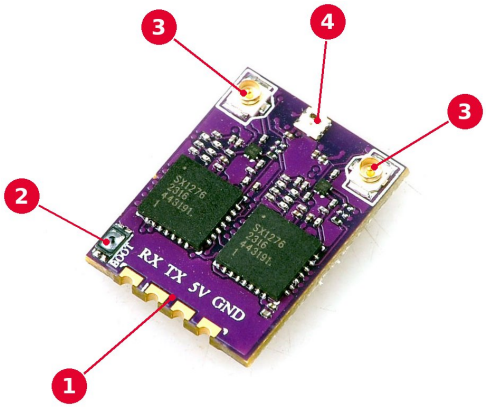
ES900 Dual RX receiver with both antennas

2.2 Package contents

Qty	Item
1×	Happymodel ES900 Dual RX receiver
2×	antenna with IPEX1 (U.FL) connector

Not included: ExpressLRS TX module or radio (handset) for the 868/915 MHz band, flight controller (FC), connecting wires, heat-shrink tubing and USB-UART adapter.

2.3 Parts description



Top side of the receiver

① **RX, TX, 5V, GND** solder pads – connection to the flight controller (Chapter 4.2).

② **BOOT** button – binding, WiFi mode and bootloader mode (Chapters 5.2, 5.4 and 5.5).

③ Two **IPEX1 (U.FL)** antenna connectors – one for each radio chip.

④ Status **LED** (Chapter 2.5).

The bottom side carries the ESP32-PICO-D4 MCU and the *ES900 RX Dual TCXO V1.0* marking; the pad labels are repeated here as well.

2.4 Specifications

Parameter	Value
Type	ExpressLRS receiver with true diversity
Frequency band	868 MHz
MCU	ESP32-PICO-D4
Radio chips	2× SX1276
Oscillator	TCXO (temperature-compensated)
Telemetry power	17 dBm (50 mW)
Protocol to FC	CRSF
Power supply	5 V DC on the 5V pad
Antenna connectors	2× IPEX MHF1 (U.FL)
Board dimensions	21.5 × 16 mm
Weight	1.5 g (without antennas)
Firmware	ExpressLRS, target *HappyModel ES900 Dual RX*

2.5 LED status indication

The receiver has a colour (RGB) status LED. The meaning of its states according to the ExpressLRS documentation:

LED	Receiver status
rainbow colour fade	starting up
slow blinking (500 ms)	waiting for a connection to the transmitter
orange double blink and pause	binding mode (bind)
orange triple blink and pause	connected, but Model Match does not match
green “breathing” (heartbeat)	WiFi mode (update, web interface)
fast red blinking (100 ms)	radio chip not detected
solid single colour	connected to the transmitter; the colour indicates the packet rate (Chapter 6.2)
off	powered off or bootloader mode

3. Regulations in the Czech Republic and EU

3.1 The law of the country of operation applies

EU regulations on radio equipment and on the operation of unmanned aircraft apply in all member states, but national implementing rules differ from country to country – permitted frequency bands, maximum transmit power, registration and mandatory insurance. This chapter describes the situation in the Czech Republic. If you operate the receiver in another country, you must comply with the regulations of the country in which you operate the model.

3.2 Frequency band and transmit power

The receiver receives the control signal and also transmits telemetry. It operates in the **868 MHz** band; in the **EU868** regulatory domain of ExpressLRS it uses **863.275–869.575 MHz**. The manufacturer specifies a maximum telemetry power of **17 dBm (50 mW)**.

In the Czech Republic, short-range devices in the 863–870 MHz band are governed by ČTÚ general authorisation **VO-R/10** (Czech Telecommunication Office), which sets the maximum radiated power (e.r.p.) and duty cycle for each sub-band. Selected conditions (Art. 3(2)):

Sub-band	Max. power	Duty cycle / condition
863.0–870.0 MHz	25 mW e.r.p.	0.1 %; FHSS with occupied bandwidth ≤ 100 kHz
868.0–868.6 MHz	25 mW e.r.p.	1.0 %
869.4–869.65 MHz	500 mW e.r.p.	10 %

- Full text of the general authorisation: Czech Telecommunication Office, www.ctu.gov.cz. Conditions may change; the current version always applies.
- The **FCC915** domain (903.5–926.9 MHz) **must not be used** in the Czech Republic – this range is not permitted here. Set both the TX module and the receiver to **EU868**.
- The user is responsible for the receiver and TX module settings (regulatory domain, power, packet rate) and for operation in line with the rules of the country of operation.
- Do not modify the equipment or use additional RF amplifiers.

3.3 Operation of models and drones

The receiver is a radio component. The rules for unmanned aircraft (Regulation (EU) 2019/947, operator registration, operational categories and limits) apply to the model as a whole and to its pilot – see the manual for your model or the aviation authority of the country of operation; in the Czech Republic, the Civil Aviation Authority (ÚCL, www.caa.gov.cz).

4. Installation

4.1 What else you need

- A radio (handset) with an **ExpressLRS 868/915 MHz** (900 MHz) TX module. The receiver does not work with 2.4 GHz ExpressLRS modules.
- The TX module and the receiver must run firmware **with the same major version** (same first version number) and **the same regulatory domain** (EU868).
- A flight controller (FC) with a free full UART (a pair of RX and TX pads) and a 5 V output.
- A fine-tip soldering iron, solder, thin wires and heat-shrink tubing.
- A computer with *ExpressLRS Configurator* and a flight controller configurator (e.g. Betaflight or INAV).

4.2 Connecting to the flight controller

CRSF uses two wires: the receiver's **TX** sends the control channels to the FC, the receiver's **RX** receives telemetry from the FC (voltage, current, GPS…). The signal wires are therefore **crossed**:

Receiver pad	Connect to flight controller
RX	TX pad of the selected UART (e.g. T2)
TX	RX pad of the same UART (e.g. R2), non-inverted
5V	any 5 V pad
GND	any GND pad

- Both signal wires must go to **the same UART**. Note the UART number – you will need it when configuring the FC.
- Do not use the SBUS pad or a UART that the FC manufacturer has designated for SBUS receivers. Such UARTs often have a pull-down resistor that puts the receiver into bootloader mode (LED off, receiver unresponsive).
- On flight controllers running KISS firmware, the UART labelling may be reversed. Always follow the manual for your FC.
- With digital FPV systems (e.g. DJI) connected by six wires, disconnect the SBUS/DJI HDL wire so that it does not conflict with the receiver.
- Do not heat-shrink or mount the receiver yet – first perform the check described in Chapter 5.1.

4.3 Antennas and receiver placement

- Connect **both** antennas. Press the IPEX1 connector on straight and carefully, without levering – it withstands only a limited number of mating cycles.
- Ideally route the antennas **at 90° to each other**, as far as possible from carbon parts, high-current cables, motors, ESCs and the video transmitter (VTX).
- The active ends of the antennas must not be covered by carbon or metal and must not reach into the propellers.
- Use only antennas designed for the 868/915 MHz band with an IPEX1 connector. Replace a damaged antenna.
- Mount the receiver so that the BOOT button is not pressed – heat-shrink tubing or tape can keep it permanently pressed.

4.4 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 Set *RSSI Channel* and *RSSI ADC* to **Disabled** – signal strength and link quality (LQ) are transmitted directly in the CRSF protocol.

⑤ On the *CLI* tab, use the *get serialrx* command to check that *serialrx_inverted* and *serialrx_halfduplex* are **off**; if necessary, set them (*set serialrx_inverted = off*, *set serialrx_halfduplex = off*) and save with the *save* command.

⑥ Close the configurator and disconnect the FC from USB to release the serial port.

The receiver's default baud rate is 420000 Bd. Only KISS firmware uses 400000 Bd (set in the receiver's web interface, *UART Baud* item). Tab and item names may differ between configurator versions.

5. Getting started

5.1 Check after wiring

Check that there are no short circuits between the pads, remove the propellers and connect the flight battery (when powered from USB only, the receiver may not receive power). Watch the receiver LED:

- After the rainbow fade it **blinks slowly** – the receiver is working and waiting for a connection.
- **It does not light up at all** – disconnect power immediately and check the wiring. If the wiring is correct, the receiver is in bootloader mode: check that the BOOT button is not pressed, disconnect the RX and TX wires from the FC and try again. If the LED then starts blinking, move the receiver to a different UART.
- After about 60 s without a connection, **WiFi mode** is enabled automatically (green “breathing”). This is normal.

5.2 Binding with the transmitter

The receiver and the TX module can be bound in one of the following ways:

▶ Binding phrase (recommended)

Choose a short unique phrase (at least 8 characters recommended, e.g. your pilot nickname) and set it in both the TX module and the receiver – in *ExpressLRS Configurator* when flashing the firmware, or in the receiver's web interface (*Binding* tab). Devices with the same phrase connect automatically after power-up. The phrase is not a password; it only serves to distinguish your devices from other people's.

▶ Bind mode

① Switch off the radio.

② Put the receiver into bind mode: power it on **3 times in a row**, switching it off within 2 s the first two times and leaving it on the third time; or hold the **BOOT** button for about **1.5 s**; or use the *Bind Receiver* button on the *Receiver* tab in Betaflight Configurator (CLI command *bind_rx*).

③ The LED must blink orange twice and then pause.

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

⑤ Once the LED lights up solid, the receiver is bound.

To cancel bind mode, restart the receiver; the previous binding then remains valid.

5.3 Link check and Model Match

When connected, the ExpressLRS Lua script shows the letter **C** in the top right corner. If the message *Model Mismatch* appears instead and the receiver LED blinks orange three times with a pause, the receiver has connected but **is not sending any data to the FC**, because the receiver number in the model settings of the radio does not match the number stored in the receiver (*Model Match* function). If you do not use this function, set *Model Match* to *Off* in the Lua script (with the receiver powered on, briefly set it to *On* and back to *Off*; this clears the number stored in the receiver).

5.4 WiFi mode and web interface

In the web interface you can change the binding phrase, regulatory domain, baud rate and other options, and upload new firmware. To enable WiFi mode, use one of the following methods:

- power on the receiver without a connection to the transmitter and wait about 60 s,
- hold the BOOT button for about 5 s (longer than the 1.5 s used for binding),
- on a bound receiver, in the ExpressLRS Lua script: *Wifi Connectivity → Enable RX WiFi*.

The LED switches to green “breathing” and the link to the transmitter is interrupted. Use a phone or laptop to connect to the **ExpressLRS RX** network with the password **expresslrs** and open **http://10.0.0.1** in your browser. If you have stored your home WiFi credentials in the receiver, it will join that network and the interface can be found at **http://elrs_rx.local**. The receiver has a small WiFi antenna – keep your phone close to it.

5.5 Firmware update

Firmware is flashed with **ExpressLRS Configurator**. Select *Official Releases*, the **Happymodel 900 MHz** category and the **HappyModel ES900 Dual RX** device. In the firmware options, set **Regulatory Domain: EU868** and, optionally, the binding phrase and your home WiFi credentials. Flashing methods:

- **WiFi** – use the *Build* button to create the *firmware.bin* file and upload it on the *Update* tab of the receiver's web interface; when connected via home WiFi, you can use *Flash* directly.
- **BetaflightPassthrough** – via the flight controller's USB port. The FC must be configured as described in Chapter 4.4 and the FC configurator must be closed.
- **UART** – via a USB-UART adapter; disconnect the receiver from the FC, connect it to the adapter and hold the BOOT button while applying power (LED off).

Do not disconnect the receiver while flashing. After a successful update, the LED blinks slowly again. Update the TX module to the same major version.

5.6 Further information

The official documentation for ExpressLRS and for the EdgeTX radio firmware (Lua script, binding, configuration) is available at www.expresslrs.org and edgetx.org.

6. Operation

6.1 Link and range check

- With the propellers removed, place the radio about 1 m from the receiver, orient the antennas of both devices the same way and switch both on. For 900 MHz devices, the radio's telemetry should show a signal strength of around −20 dBm.
- Check in the FC configurator (*Receiver* tab) that the channels respond to the sticks and switches and that the channel order is correct.
- Check the telemetry: the **1RSS** and **2RSS** values (signal strength at antenna 1 and 2) should be similar. A significantly worse value on one antenna indicates a faulty or poorly connected antenna.
- Before the first flight, perform a range check on the ground, and monitor link quality (LQ) and signal strength during flight.

6.2 Packet rate

The packet rate is set in the TX module (ExpressLRS Lua script). A higher packet rate means lower latency but lower sensitivity and therefore shorter range. The receiver adapts to the setting automatically. The following modes are available for SX1276 radio chips:

Packet rate	Sensitivity limit	Receiver LED colour
200 Hz	−112 dBm	red
100 Hz Full	−112 dBm	yellow-green
100 Hz	−117 dBm	green
50 Hz	−120 dBm	light blue
25 Hz	−123 dBm	blue
D50	−112 dBm	purple

Never change the packet rate in flight – the change forces the link between the transmitter and the receiver to drop.

6.3 Failsafe

When the signal is lost, the receiver stops sending new data to the flight controller, and **failsafe** is evaluated and executed by the flight controller according to its settings (*Failsafe* tab in Betaflight and INAV). Configure failsafe so that the model safely stops the motors or lands when the signal is lost, and always verify the function with the propellers removed: Arm the model (motors enabled), switch off the radio and check that the motors stop and the FC reports failsafe.

7. Maintenance and troubleshooting

7.1 Maintenance and storage

- After a crash, check the antennas, IPEX1 connectors and solder joints. Replace a damaged antenna.
- Protect the receiver from moisture, dust and conductive contamination (carbon dust). The electronics are not waterproof.
- Store the receiver in a dry place at room temperature, out of the reach of children.

7.2 Troubleshooting

Problem	Possible cause and solution
LED off	No power – check 5V and GND. The receiver is in bootloader mode – BOOT button pressed or pull-down on the FC RX pad; move it to a different UART.
LED blinks slowly, no connection	Different binding phrase, regulatory domain (EU868) or major firmware version on the TX module and receiver. Bind again (Chapter 5.2).
Connected, but the FC does not respond	Model Match (LED blinks orange 3×) – Chapter 5.3. Swapped RX/TX wires, wrong UART or FC settings – Chapters 4.2 and 4.4.
No telemetry	Telemetry disabled in the FC, or the receiver RX → FC TX wire not connected.
Short range, dropouts	Disconnected or damaged antenna, antennas close to carbon or cables, high packet rate. Compare 1RSS and 2RSS.
WiFi cannot be enabled	The receiver is connected to the transmitter – switch off the radio and wait 60 s, or hold BOOT for 5 s.
LED blinks red rapidly	Radio chip not detected – contact your retailer.

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 (ES900 Dual RX) is given by the *ES900 RX Dual TCXO V1.0* marking on the bottom side of the receiver board; the firmware version can be found in the receiver's web interface (*Information* tab).

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.