ELRS Gemini RX 2.4G

HGLRC · ExpressLRS 2.4 GHz true diversity receiver
User Manual



Read the entire manual before installation and first use, especially the safety instructions.

Rotorama, s.r.o. · www.rotorama.com

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1. Safety instructions

1.1 Before you start

The HGLRC ELRS Gemini RX 2.4G receiver is an electronic component designed to be installed in a drone or RC model. Installation requires basic knowledge of electronics and soldering. Read the entire manual before installation and keep it for future reference.

- This product is not a toy. It is not intended for children or for persons who are not familiar with operating RC models and drones.
- The receiver is responsible for controlling the model. Incorrect installation, wrong wiring or improper configuration may lead to loss of control of the model, a crash, personal injury or property damage.
- The operator is responsible for the safe operation of the model in which the receiver is installed.

1.2 Installation and wiring

- Carry out all wiring and soldering **with the battery disconnected** and without USB power.
- Observe the supply voltage range given in the specifications (Chapter 2.4). Never connect the receiver directly to the flight battery voltage.
- Before connecting the battery for the first time, check the wiring of the pins and make sure there is no short circuit. We recommend using a current limiter (smoke stopper).
- Do not operate the receiver without the antennas connected. The IPEX1 antenna connectors are mechanically fragile – attach and remove the antennas straight up and down without levering, and secure the cables against being pulled out.
- During installation, make sure the BOOT button is not permanently pressed (e.g. by heat-shrink tubing or a cable tie).

1.3 Operation

- Before every flight, check the link to the radio and the failsafe function (Chapter 5.6).
- When working on a model with propellers fitted, always expect the motors to spin up unexpectedly. Carry out configuration and bench tests **with the propellers removed**.
- Never change the packet rate in flight – the change forces the receiver to disconnect.
- Protect the receiver from moisture, dust, conductive debris and mechanical damage.

2. Product description

2.1 Intended use

The HGLRC ELRS Gemini RX 2.4G is an **ExpressLRS** (ELRS) receiver for the 2.4 GHz band. ExpressLRS is an open-source RC link with long range, low latency and a high packet rate.

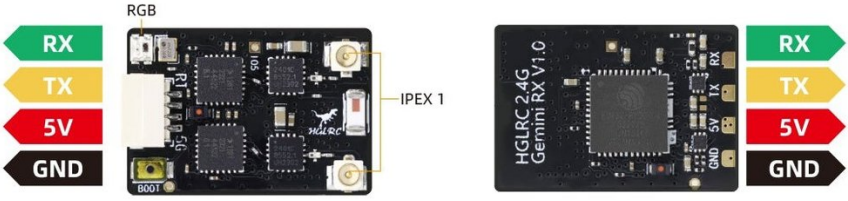
The receiver offers **true diversity** – it contains two SX1281 radio chips, each with its own antenna, and supports **Gemini** mode, in which both antennas receive simultaneously on two different frequencies (Chapter 5.4). A temperature-compensated crystal oscillator (TCXO) keeps the frequency stable even under large temperature changes. The receiver connects to the flight controller (FC) via a serial link (CRSF protocol) using the connector or the solder pads. The firmware can be updated via WiFi.

2.2 Package contents

Qty	Item
1	HGLRC ELRS 2.4G Gemini RX receiver
1	Long 2.4 GHz antenna (T type, IPEX1 connector)
1	Short 2.4 GHz antenna (T type, IPEX1 connector)
1	Heat-shrink tubing

※ The package does **not** include a flight controller (FC), a radio (transmitter) or an ExpressLRS TX module. The manufacturer's product photos additionally show connection cables and stickers; these are not listed in the manufacturer's written list of package contents.

2.3 Parts and pins



Top side (left) and bottom side of the receiver with solder pads (right). Image: HGLRC.

Label	Function
RX	Receiver serial input – connect to **TX** of the selected UART on the flight controller.
TX	Receiver serial output – connect to **RX** of the same UART on the flight controller.
5V	Receiver power supply (range 3.6–5.5 V).

Label	Function
GND	Ground.
IPEX 1	Two IPEX1 (u.FL) antenna connectors – one for each radio chip.
RGB	Colour status LED (Chapter 5.5).
BOOT	Button for binding, factory reset and firmware flashing.

The RX, TX, 5V and GND pins are available both on the connector on the top side and on the solder pads on the bottom side of the board. Always use only one connection method.

2.4 Specifications

Product designation	HGLRC ELRS 2.4Ghz GEMINI RX Dual Receiver
System	ExpressLRS, factory firmware 3.x or later
Firmware target	HGLRC Gemini 2.4Ghz RX
Frequency band	2.4 GHz
Packet rate	50–1000 Hz
Chips	ESP32 + 2× SX1281 + TCXO
Telemetry output power	up to 100 mW (manufacturer states 2× 100 mW)
Supply voltage	3.6–5.5 V
FC communication	UART, CRSF protocol
Antenna connectors	2× IPEX1 (u.FL)
Antenna type	T
Long antenna	total cable length 150 mm, weight 2.4 g
Short antenna	total cable length 90 mm, weight 1.8 g
Dimensions (without antennas)	22 × 15.24 mm
Weight (without antennas)	1.36 g
Indication	RGB LED
Colour	black

3. Legal requirements for 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 – in particular the permitted frequency bands, maximum transmit power and the rules for operating drones. The information in 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 use it.

3.2 Frequencies and transmit power

The receiver operates in the 2.4 GHz band and, in addition to receiving commands from the radio, transmits telemetry itself. In the Czech Republic this band may be used under a general authorisation issued by the Czech Telecommunication Office (ČTÚ):

Band	Limit	Regulation
2400–2483.5 MHz	100 mW e.i.r.p.	ČTÚ general authorisation VO-R/12 (wideband data transmission)

- The e.i.r.p. limit applies to the combination of transmitter power and antenna gain. Use only antennas intended for this receiver; additional amplifiers are prohibited.
- The radio's transmit power is set on the TX module side (ExpressLRS Lua script, *Max Power* item). **The user is responsible for setting the power in compliance with the regulations.**
- For operation in the EU, use firmware built with the **EU_CE_2400** (LBT) regulatory domain. The TX module and the receiver must use the same domain.
- Outside the Czech Republic, the bands and limits of the respective country apply.

3.3 Drone operation

The receiver is part of a drone or RC model. Drone operation in the EU is governed by Regulation (EU) 2019/947 and, in the Czech Republic, by the rules of the Civil Aviation Authority (www.caa.gov.cz). Before flying, check the obligations that apply to your model – in particular operator registration, pilot competency, the operational category and geographical zones.

4. Installation

4.1 What else you need

- a flight controller (FC) with a free UART (a full RX/TX pair),
- a radio with an ExpressLRS 2.4 GHz TX module running the same major firmware version (3.x or later),
- for Gemini mode, a TX module with Gemini support (two radio sections),
- a soldering iron and a computer with Betaflight Configurator and ExpressLRS Configurator.

4.2 Connecting to the flight controller

Connect the receiver to any free UART on the flight controller. The signal wires are connected **crosswise**:

Receiver		Flight controller (FC)
GND	→	GND
5V	→	5V
TX	→	RX (e.g. R2)
RX	→	TX (e.g. T2)

Make sure the FC 5V pad supplies 3.6–5.5 V. Mount the receiver away from carbon and conductive parts; the supplied heat-shrink tubing must not press on the BOOT button.

4.3 Antennas

- Attach both antennas to the IPEX1 connectors. The receiver has two radio chips, each with its own antenna – always connect both.
- Ideally, orient the antennas at 90° to each other to compensate for polarisation and model orientation losses.
- Route the active antenna elements outside the frame, away from carbon, metal, high-current wires and the VTX antenna.
- Do not kink the coaxial cables and secure them out of reach of the propellers.

4.4 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 (via UART)* and *Serial Receiver Provider* to *CRSF*; enable *Telemetry*.

③ Set *RSSI Channel* and *RSSI ADC* to *Disabled*. For the OSD, use the *Link Quality* and *RSSI dBm value* elements.

④ The CRSF protocol requires a non-inverted full-duplex link: in the CLI, *serialrx_inverted* and *serialrx_halfduplex* must be OFF. Save the settings (*save*).

5. Getting started

5.1 Firmware compatibility

The receiver ships with ExpressLRS firmware 3.x or later. **Firmware 3.x and 2.x are not compatible** – the major version (first number) of the TX module and the receiver must match. Update the TX module accordingly before binding; with incompatible versions no binding method works.

5.2 Binding

▶ Binding phrase

Recommended method. When building the firmware in ExpressLRS Configurator, or in the receiver's web interface (*Binding* tab), enter the same binding phrase as on the TX module. Devices with the same phrase and compatible firmware connect automatically. Use a unique phrase of Latin letters and digits (at least 8 characters); it separates your system from others and is not a password.

▶ Binding with the Bind button (manufacturer's procedure)

① Switch off the radio. Power the receiver on and off three times in a row (disconnect power each time as soon as the LED lights up).

② After the fourth power-up, watch the RGB LED: after the rainbow fade it must change to an **orange double blink** – the receiver is in binding mode.

③ Switch on the radio and run the *[Bind]* item in the ExpressLRS Lua script.

④ If the double blink changes to a **solid light**, binding was successful.

※ In newer ExpressLRS firmware versions, the receiver can also be put into binding mode by pressing the BOOT button for approx. 1.5 s or with the *Bind Receiver* button on the *Receiver* tab in Betaflight Configurator (requires a newer Betaflight version). To cancel binding mode, restart the receiver.

5.3 Model Match

Model Match prevents the radio from controlling a model other than the one selected on the radio. On a mismatch, the receiver connects but **sends no data to the flight controller** and the LED blinks **orange three times**, then pauses. Toggle the function in the ExpressLRS Lua script (*Model Match* On/Off), only while the receiver is connected with a high link quality (LQ).

5.4 Gemini mode and diversity

In **Gemini** mode, the TX module transmits each packet simultaneously on two frequencies (40 MHz apart in the 2.4 GHz band) and the receiver receives it with both antennas at the same time. Gemini does not increase range, but it helps maintain a higher link quality (LQ) right up to the failsafe limit.

- Full use of Gemini mode requires a TX module with Gemini support. In the Lua script, set the antenna mode to *Gemini* on **both** the TX module and the

receiver.

- With a standard TX module (one radio section), the receiver still listens with both antennas (true diversity), but synchronises on only one of them.
- In *Diversity* mode, the receiver switches to the antenna with the stronger signal. The menu may differ depending on the firmware version.

5.5 Status LED (RGB LED)

LED	Status
Rainbow colour fade	Power-up, self-test
Alternating green / orange blinking	WiFi update mode
Fast red blinking	Radio chip not detected
Orange double blink	Binding mode
Orange triple blink	Connected, but Model Match setting does not match
Slow orange blinking	Waiting for connection to the radio
Solid light	Connected; the colour indicates the packet rate
Off	Powered off or bootloader mode – check that the BOOT button is not permanently pressed

5.6 Packet rate and failsafe

The packet rate, telemetry ratio and transmit power are set in the ExpressLRS Lua script on the radio. The following modes are available in the 2.4 GHz band:

Mode	Characteristics
50, 150, 250, 500 Hz	LoRa modulation. Higher rate = lower latency at the cost of lower sensitivity.
100 Hz Full, 333 Hz Full	LoRa, full 10-bit channel resolution.
F500, F1000	FLRC modulation – lowest latency, shorter range than LoRa.
D250, D500	FLRC with repeated packet transmission (DVDA) – higher LQ and less fluctuation, higher latency.

Failsafe. Configure the behaviour on signal loss in the flight controller (Betaflight, *Failsafe* tab), not in the receiver. Test the function before the first flight **with the propellers removed**: Arm the model (start the motors), briefly apply throttle and switch off the TX module on the radio. After the configured delay, the motors must stop and the model must Disarm (stop the motors).

6. Firmware and further guides

6.1 Updating via WiFi

① In ExpressLRS Configurator, select the target **HGLRC Gemini 2.4Ghz RX**, the *WiFi* method, the regulatory domain and the binding phrase, and build the firmware (*Build*).

② Put the receiver into WiFi mode: with the radio switched off, power up the receiver and wait approx. 60 s, or select *WiFi Connectivity* → *Enable Rx WiFi* in the Lua script while the receiver is connected. The LED blinks alternately green and orange.

③ Connect to the **ExpressLRS RX** WiFi network (password **expresslrs**) and open **10.0.0.1** in your browser.

④ On the *Update* tab, upload the built firmware file (do not unpack the .bin.gz file) and press *Update*.

⑤ Do not disconnect the receiver from power during the update. When finished, the LED returns to slow blinking.

※ If your home WiFi network is stored in the receiver, the access point will not appear and the web interface can be found at elrs_rx.local. The firmware can also be flashed via the flight controller (*BetaflightPassthrough* method; the flight controller configurator must be closed).

6.2 Factory reset

With the receiver powered on and **not** connected to the radio, hold the BOOT button for more than 6 seconds. The receiver returns to its factory settings.

6.3 Further guides

Detailed information about the ExpressLRS system and the EdgeTX radio firmware is available in the official documentation. Scan the QR code or follow the link:

ExpressLRS documentation – binding, Lua script, configuration and updates.

www.expresslrs.org

EdgeTX documentation – radio operation, models and Lua scripts.

edgetx.org

7. Maintenance and troubleshooting

7.1 Maintenance

- After a crash, check the antennas, their connectors and the coaxial cables. Replace a damaged antenna – a damaged antenna significantly reduces range.
- Check for loose solder joints and chafed wires.
- Protect the receiver from moisture; after flying in damp conditions, let the model dry thoroughly.

7.2 Troubleshooting

Problem	Cause and solution
LED is off	Check the 5V/GND power supply. Check that the BOOT button is not pressed (e.g. by the heat-shrink tubing) – the receiver is then in bootloader mode.
Receiver does not bind	Make sure the TX module and the receiver have the same major firmware version and the same regulatory domain. Check the binding phrase or repeat the procedure from Chapter 5.2.
Orange triple blink	Model Match mismatch – adjust the setting in the Lua script (Chapter 5.3).
Connected, but the FC does not respond to commands	Check that the TX/RX wires are crossed, that *Serial RX* is enabled on the correct UART and that the CRSF protocol is selected (Chapter 4.4).
Fast red blinking	Radio chip not detected – contact the retailer.
Short range, low LQ	Check the antennas and their placement (Chapter 4.3), the transmit power and the selected packet rate.

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 (HGLRC 2.4G Gemini RX V1.0) is printed on the receiver's circuit board; the firmware version can be found in the ExpressLRS Lua script on the radio or in the receiver's web interface.

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.