ES24TX Pro

Happymodel ExpressLRS 2.4 GHz TX module
User manual



Read the entire manual before first use, especially chapters 1 and 3 on safety and permitted transmit power.

Importer: Rotorama, s.r.o. · www.rotorama.com

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1. Safety instructions

1.1 Before you start

Read the entire manual before first use and keep it for future reference. The ES24TX Pro module is the transmitting part of a radio control system – its correct setup directly affects the safety of the controlled drone or model. Loss of link may cause a crash or uncontrolled movement of the model.

- Insert the module into the radio and remove it **only with the radio switched off**.
- Always screw on the supplied antenna before switching on. **Never transmit without an antenna connected** – the transmitter circuit may be damaged.
- Do not change module settings while the model is in the *Arm* state (motors enabled). Changing a parameter may briefly interrupt the link and trigger *failsafe*.
- Before every flight, check the link to the receiver and the failsafe settings on the receiver and flight controller (FC).
- The module is not a toy. Keep it out of the reach of children.

1.2 Radio transmission

- The module can transmit at a power that **exceeds many times over** the limits applicable in the Czech Republic and other EU member states. The user is responsible for setting the transmit power – see chapter 3.
- While transmitting, do not hold the antenna in the immediate vicinity of your body and do not point it at people at close range.
- Do not operate the module where the use of radio equipment is prohibited (aircraft, hospitals, areas with a risk of explosion).

1.3 Heat and cooling

- At higher transmit power the module heats up. Heat is dissipated by an aluminium heatsink and a fan – **do not cover the ventilation openings** or the fan.
- The housing and heatsink may be hot after prolonged operation. Let the module cool down before removing it.
- If the Lua script reports bad packets (see chapter 5.1), check whether the module is overheating.

1.4 Operating environment

- Protect the module from water, moisture, dust and drops. Do not use it in the rain.
- The module is powered from the radio. The supply voltage must not exceed the range given in the specifications (chapter 2.4).

- Do not modify the module beyond the procedures in chapter 6 and do not connect amplifiers to the antenna output.

2. Product description

2.1 What the module is for

The Happymodel ES24TX Pro is an external transmitter module of the **ExpressLRS** (ELRS) system for the 2.4 GHz band. It is inserted into the module bay of a radio transmitter (RC system) running EdgeTX or OpenTX firmware and is used to control drones, aircraft, cars and boats fitted with an ExpressLRS 2.4 GHz receiver. The manufacturer specifies it for radios with a **Micro JR** bay (5-pin JR-standard connector).

The module offers an update rate of up to 500 Hz, adjustable transmit power up to 1000 mW, firmware updates via Wi-Fi, cooling by an aluminium heatsink with a fan, a status RGB LED and a built-in **TX Backpack** (ESP8285) for wireless communication, for example with the video receiver in your goggles.



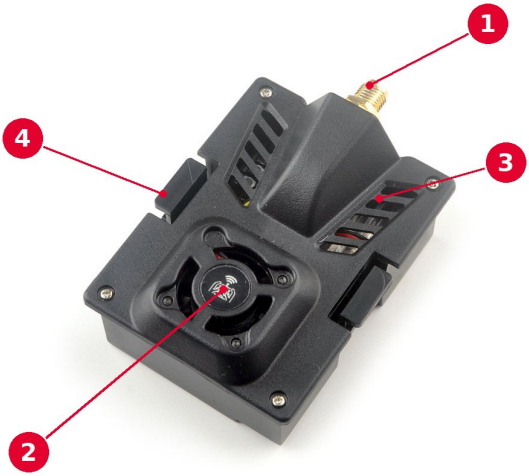
ES24TX Pro module in the radio's module bay

2.2 Package contents

Qty	Item
1	ES24TX Pro transmitter module
1	Happymodel 2.4 GHz Moxon antenna (SMA connector)

Not included: radio transmitter, receiver, USB cable or adapter for another type of module bay. According to the manufacturer, stickers are no longer included in newer shipments.

2.3 Parts description



Front view of the module

① SMA antenna connector – the supplied Moxon antenna screws on here.

② Fan; the status RGB LED shines through its centre (chapter 5.6).

③ Ventilation openings – do not cover.

④ Locking latch for securing the module in the bay (on both sides).

Under the front cover are the circuit board with heatsink, the micro USB port, the DIP switch and the service buttons. Access to them is only needed for firmware updates via USB (chapter 6.3).

2.4 Specifications

Parameter	Value
Designation	Happymodel ES24TX Pro (on the packaging: ES24TX Pro Micro TX)
System	ExpressLRS 2.4 GHz, factory regulatory domain ISM2400
Frequency range (manufacturer's data)	2400–2500 MHz
Max. transmit power	1000 mW (manufacturer states > 30 dBm)
Update rate (manufacturer's data)	25–500 Hz
Radio chip	SX1281IMLTRT
Processor	ESP32 (main), ESP8285 (TX Backpack)
Wi-Fi / Bluetooth	2.4 GHz – updates, configuration, BLE Joystick
Supply voltage	5–10 V
Connection to radio	5-pin JR-standard connector, Micro JR bay
Antenna	Moxon 2.4 GHz, gain 4.18 dBi, SMA connector
Dimensions	70 × 49 × 32.5 mm
Weight	51 g (without antenna)
Firmware target	HappyModel_ES24TX_Pro_Series_2400_TX

3. Legal conditions of operation

3.1 The law of the country of operation applies

Radio equipment and the operation of unmanned aircraft are governed by EU legislation (Directive 2014/53/EU, Regulations (EU) 2019/945 and 2019/947), but national implementing rules differ from country to country – permitted frequency bands, maximum transmit power, operator registration and operating rules. The information in this chapter describes the situation in the Czech Republic. **If you operate the module in another country, you must comply with the regulations of the country in which you use it.**

3.2 Frequency band and transmit power in the Czech Republic

In the Czech Republic the module is operated under the General Authorisation **VO-R/10** of the Czech Telecommunication Office (short-range devices), which explicitly covers remote control as well:

Frequency band	Max. radiated power	Regulation
2400–2483.5 MHz	25 mW e.i.r.p.	VO-R/10, Art. 3(2)(j)

- The limit applies to the **radiated power (e.i.r.p.)**, i.e. the module output power including antenna gain. The supplied antenna has a gain of 4.18 dBi; with it, the 25 mW e.i.r.p. limit corresponds to a module output power of approximately 9.5 mW.
- The *Max Power* setting in the Lua script (chapter 5.4) specifies the module output power, not e.i.r.p. The module's full power exceeds the limit many times over. Before operation, check that the selected setting complies with the limit.
- The device may only be operated with the antenna specified by the manufacturer, without additional amplifiers and without modifications. It is not entitled to protection from interference and must not cause interference to other stations.

3.3 Firmware regulatory domain

ExpressLRS firmware is built for a selected regulatory domain. For the 2.4 GHz band there are the **ISM_2400** and **EU_CE_2400** domains; the European domain uses the LBT function (*Listen Before Talk*). When updating the firmware (chapter 6), select the domain according to the country of operation. The module and the receiver must use the same domain, otherwise they will not connect.

3.4 Operating drones and models

The module itself does not entitle you to fly. When operating a drone or model aircraft, comply with Regulation (EU) 2019/947 and national regulations – in particular operator registration, pilot competency, maximum height, flying within visual line of sight and the prohibition of flying over assemblies of people. Current rules in the Czech Republic are published by the Civil Aviation Authority (www.caa.gov.cz).

4. Installation and radio setup

4.1 What else you need

- a radio transmitter with a Micro JR module bay and EdgeTX (recommended) or OpenTX firmware with CRSFShot / Mixer Sync support,
- an ExpressLRS 2.4 GHz receiver with the same major firmware version and the same regulatory domain as the module,
- the *elrs.lua* Lua script in the *SCRIPTS/TOOLS* folder on the radio's SD card (available for download at expresslrs.org),
- for firmware updates, a computer with ExpressLRS Configurator and, if needed, a micro USB data cable.

4.2 Antenna and module installation

① Switch off the radio.

② Screw the Moxon antenna onto the SMA connector by hand, without using tools.

③ Check the pins in the module bay – none may be bent or missing. The module uses three of them: power (VCC/VBAT), ground (GND) and data signal (S.Port).

④ Slide the module into the bay until both latches click into place.

⑤ Switch on the radio. After start-up, the module briefly shows a rainbow effect on the LED.

4.3 Model setup (CRSF)

ExpressLRS communicates with the radio using the CRSF protocol. The settings are stored separately for each model in the radio:

① Press *MDL* and open the *Model Setup* page.

② Set *Internal RF* to *Off*.

③ Under *External RF*, set *Mode* to *CRSF*. The *Baudrate* can also be set here (chapter 4.4).

④ Optionally set *Receiver ID* to a unique number (used by the Model Match function, chapter 5.3).

⑤ Exit the menu with the *RTN* button.

4.4 Baud rate (Baudrate)

Baudrate is the communication speed between the radio and the module. In EdgeTX it is set in *Model Setup → External RF → Baudrate*, in OpenTX in *SYS → Hardware → Baudrate*. After changing it, switch the radio off and on again.

Baudrate	Highest usable Packet Rate
400K	250 Hz – works with most radios
921K	500 Hz
1.87M	F1000

The ES24TX Pro module supports up to **3.75M**; however, the actual maximum is determined by the radio. Older radios (e.g. FrSky QX7, X9D) require modifications for higher speeds – do not exceed 400K with them. We recommend disabling the *ADC Filter* (*SYS → Hardware*, in EdgeTX also per model) if the flight controller (FC) filters the data itself; with PWM receivers, on the other hand, enable it.

4.5 Channels and the Arm switch

A new model in the radio has no auxiliary channels assigned. The first four channels are controlled by the sticks; auxiliary channels start at channel 5 (AUX1). In the *MDL → Mixes* menu, assign a two-position switch for *Arm* to channel 5. ExpressLRS uses it to detect that the model is armed (approximately 2000 µs) and activates link protection and dynamic power. In the Disarm state, channel 5 should be at approximately 1000 µs. Newer EdgeTX versions allow you to select *Arm using: Switch* in the External RF settings instead of channel 5.

5. Operation

5.1 ExpressLRS Lua script

All module settings are made using the Lua script. Press *SYS* (on older radios, hold *Menu*), select *ExpressLRS* in the *Tools* menu and confirm with *Enter*.

- The **header** shows the module name and the packet counter (bad/good). The second number should match the set Packet Rate. If bad packets keep increasing, check that the module is not overheating and has good contact with the radio.
- **Link indicator** in the top right corner: **-** = no link, *C* = connected to the receiver.
- *Model Mismatch* means you are connected to a receiver, but a different model is selected in the radio.
- *Armed* indicates that the Arm switch is active – do not change anything in this state.
- The **version line** at the bottom shows the firmware version and regulatory domain.

Script stuck on “Loading...”? Check the model setup according to chapter 4.3 and increase the Baudrate.

5.2 Binding with a receiver

The module and receiver will only connect if they share the same first digit of the firmware version and the same regulatory domain. Two methods are available:

▶ Binding phrase (recommended)

When building the firmware in ExpressLRS Configurator, or later in the web interface (chapter 6.4), enter the same phrase into both the module and the receiver, ideally at least 8 alphanumeric characters (e.g. your pilot nickname). Devices with the same phrase connect automatically after power-up. The phrase is not a password – it only serves to distinguish you from other pilots.

▶ Traditional binding

① Switch off the radio.

② Put the receiver into bind mode – power it on and off within 2 seconds three times, or hold its button for about 1.5 s. The receiver LED flashes rapidly twice.

③ Switch on the radio, run the Lua script and select *[Bind]*.

④ When the receiver LED is solid, binding is complete. *C* appears in the Lua script.

Receivers with older firmware that have a binding phrase set will not enter bind mode – use the same phrase. See the receiver manual for details.

5.3 Packet Rate, telemetry and Switch Mode

Packet Rate	Description
50, 150, 250, 500 Hz	LoRa modes. Higher rate = lower latency, but lower sensitivity and range.
F500, F1000	FLRC modes with the lowest latency, shorter range than LoRa.
D250, D500	FLRC modes with repeated transmission (Déjà Vu): higher latency, more stable link.
100Hz Full, 333Hz Full	LoRa modes with full 10-bit resolution on all channels (8/12/16 channels).

Never change the Packet Rate in flight – a change always forces the receiver to disconnect.

- *Telem Ratio* – proportion of packets used for telemetry (*Off*, *1:128* to *1:2*, *Std*, *Race*). *Race* disables telemetry while armed. Dynamic power requires telemetry to be enabled (neither *Off* nor *Race*).
- *Switch Mode* – how channels AUX1–AUX8 are transmitted (*Hybrid*, *Wide*); in Full modes, the number of channels. Can only be changed without a link to the receiver.
- *Model Match* – when *On*, the receiver only connects to a model with the same *Receiver ID*. Prevents flying with the wrong model selected.
- *Link Mode* – *Normal* (default) or *MAVLink* for connection to a ground station.

5.4 Transmit power and fan

In the *TX Power* folder of the Lua script:

- *Max Power* – the highest power the module may transmit at. The script only offers levels supported by the module (up to 1000 mW). **Observe the limits according to chapter 3.2.**
- *Dynamic* – *Off*: always transmits at Max Power; *Dyn*: the module reduces power according to link quality; *AUX9–AUX12*: dynamic power is enabled by a switch. If telemetry is lost while armed or LQ drops below 50 %, power jumps to Max Power.
- *Fan Thresh* – the power level from which the fan starts after a short delay (default 250 mW). The fan keeps running for a while after the power drops; the run-on time can be set in the web interface (*Fan Runtime*).

5.5 Backpack and VTX Administrator

The built-in TX Backpack communicates via the ESP-NOW protocol with the VRX Backpack in the goggles or video receiver (supported are e.g. ImmersionRC Rapidfire, SkyZone SteadyView, HDZero). If you change the video channel in the Lua script, both the video transmitter (VTX) and the receiver in the goggles are set automatically once the link is established.

- *VTX Administrator* – *Band*, *Channel*, *Pwr Lvl* and *Pitmode* of the video transmitter; send with *[Send VTX]*. The settings are sent each time a link is established and overwrite changes made by other means (e.g. in the OSD). Requires telemetry to be enabled.
- *Backpack* – enabling the function, control of DVR and head tracking on supported goggles.
- Backpacks bind using the same binding phrase, or manually: put the VRX Backpack into bind mode (double flash) and select *Bind* in the Lua script.

The Backpack only works with the DIP switch in the Normal Operation position (chapter 6.3).

5.6 Status LED

Meaning of the RGB LED states according to the ExpressLRS documentation for TX modules:

LED indication	Status
Rainbow colour fade	Starting up
Green, slowly pulsing	Wi-Fi mode (update)
Blue, slowly pulsing	Bluetooth joystick mode
Red, flashing rapidly	Radio chip not detected
Orange flash every second	No connection to the radio
Solid single colour	Connected to receiver; colour = Packet Rate
Single colour, slowly fading in and out	No link to receiver; colour = Packet Rate

Colour	Packet Rate
Red / Yellow	F1000 / F500
Yellow-green / Green	D500 / D250
Cyan	333 Full
Light blue / Blue	500 / 250
Violet	150
Purple / Magenta	100 Full / 50

6. Firmware and further guides

The module ships with factory ExpressLRS firmware. The version varies with the production batch. Before first use, we recommend updating both the module and the receiver to the same current version.

6.1 Checking the firmware version

The version is shown on the last line of the ExpressLRS Lua script or on the *Information* tab of the web interface (chapter 6.4).

6.2 Updating via Wi-Fi

① In ExpressLRS Configurator, select *Official Releases*, the required version, the *Happymodel 2.4 GHz* category, the *HappyModel ES24 Pro 2.4GHz TX* device and the *WiFi* method.

② Set the regulatory domain (mandatory, chapter 3.3), the binding phrase and, optionally, access to your home Wi-Fi. Click *Build*. A folder containing the *firmware.bin* file opens.

③ On the radio, run the Lua script and select *WiFi Connectivity* → *Enable WiFi*. *WiFi Running* is displayed.

④ Connect to the **ExpressLRS TX** Wi-Fi network (password **expresslrs**) and open **http://10.0.0.1** in your browser.

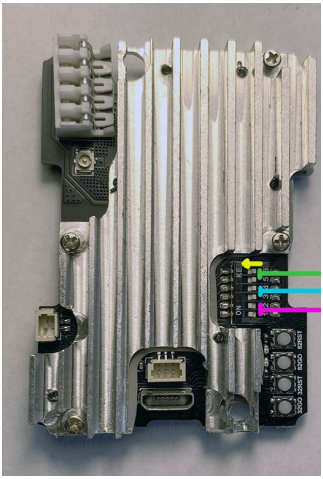
⑤ On the *Update* tab, select the *firmware.bin* file and click *Update*. Wait for the success message.

⑥ Do not switch off the module until the Lua script returns to the main menu. Then exit the script, run it again and check the version.

- If a home Wi-Fi network is stored in the module, the ExpressLRS TX network is not created – the interface is available at **http://elrs_tx.local**, or use the *Flash* button in the Configurator.
- A module removed from the radio enters Wi-Fi mode automatically if powered via USB or from an external source (2S) and it receives no data from the radio for about 60 s. The LED then pulses green.
- If your router's page opens at 10.0.0.1, disconnect the computer from the wired network or use a phone.
- When first updating from factory or older firmware to a new major version via Wi-Fi, the update may fail with the error *Not enough space* / *Bad Size Given*. The procedure using the *Repartitioner* tool is described on the ExpressLRS page for Happymodel ES24TX modules. This step is not needed when updating via USB.

6.3 Updating via USB and the DIP switch

The micro USB port and the six-position DIP switch are located under the module's front cover. Remove the module from the radio and take off the cover (mind the fan wires and the antenna lead). Set only the pair of switches for the required function to ON and leave the others OFF:



Module board under the cover: DIP switch (right), service buttons and micro USB port (image source: ExpressLRS documentation)

Switches ON	Function
1, 2	**Normal Operation** – normal use (also required for the Backpack to work)
3, 4	Backpack Flashing – flashing the TX Backpack firmware (ESP8285)
5, 6	TX Module Flashing – flashing the module firmware (ESP32)

① Set switches 5 and 6 to ON and the others to OFF. Connect the module to the computer with a USB cable. It must appear as *USB to UART Bridge*; otherwise install the CP210x driver (Silicon Labs).

② In ExpressLRS Configurator, select the *HappyModel ES24 Pro 2.4GHz TX* device and the *UART* method, set the options and click *Flash*.

③ After the *Success* message, disconnect the USB, set switches 1 and 2 back to ON and the others to OFF.

④ Refit the cover so that no wire is pinched and the antenna lead is connected. Insert the module back into the radio.

The TX Backpack firmware is updated in a similar way in the *Backpack* section of the Configurator: switches 3 and 4 to ON; while the firmware is being built, hold the *GO* service button, press and release *RST*, then release *GO* (the buttons on the board are labelled 32GO, 32RST, 82GO and 82RST; the Backpack uses the ESP8285 chip). If the Backpack has working firmware, it can also be updated via Wi-Fi using *Enable Backpack WiFi* (network **ExpressLRS TX Backpack**, password **expresslrs**, address http://10.0.0.1).

6.4 Web interface

In Wi-Fi mode, a web interface is available at http://10.0.0.1 (or http://elrs_tx.local). It provides device information (version, regulatory domain, UID), binding phrase change, operating options (e.g. *WiFi Auto On Interval*, *UART Inverted* – leave enabled for EdgeTX/OpenTX, *Fan Runtime*), export and import of model settings, Wi-Fi settings and firmware updates. The *Hardware Layout* and *Continuous Wave* tabs are for advanced users only – do not change them.

6.5 Further guides

Official documentation: www.expresslrs.org (ExpressLRS, including the “Happymodel ES24TX” page with update procedures) and www.edgetx.org (EdgeTX).

7. Maintenance and troubleshooting

7.1 Maintenance and storage

- Keep the ventilation openings and fan free of dust; remove dirt with a dry brush or compressed air.
- Regularly check that the antenna is tight and inspect the condition of the SMA connector and the JR pins.
- Store the module in a dry place, out of direct sunlight, preferably removed from the radio and with the antenna fitted or in its original packaging.
- Do not use solvents or water.

7.2 Troubleshooting

Problem	Cause and solution
Lua script stuck on “Loading...”	The model is not set up for the external module (chapter 4.3) or the Baudrate is too low. Check *External RF → CRSF* and that the internal module is off.
No “C” in the Lua script, no telemetry	The receiver is not bound (chapter 5.2), the major firmware version or regulatory domain differs, or *Telem Ratio* is set to *Off*.
“Model Mismatch” message	A different model is selected in the radio than the one the receiver is bound to (Model Match). Select the correct model.
Cannot set F1000 or 333 Hz and higher	A Baudrate of 400K is not sufficient. Increase it (chapter 4.4) and restart the radio.
Cannot change Switch Mode or Full mode	Switch off the receiver, change the setting and switch the receiver on again.
Bad packets increasing	Overheating or poor contact with the radio. Check the fan, ventilation and pins.
ExpressLRS TX network does not appear	The module is connected to a stored home Wi-Fi network, or your device does not support 2.4 GHz Wi-Fi. Move the device closer.
Update reports Not enough space	See chapter 6.2 – Repartitioner tool or update via USB.
Backpack does not work	The DIP switch is not in the Normal Operation position (1, 2 ON).
VTX Administrator does not change the channel	Enable telemetry in the flight controller (FC) and in the Lua script; rediscover the sensors on the radio.

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 (ES24TX Pro, on the packaging ES24TX Pro Micro TX) is given on the product packaging; the firmware version and regulatory domain are shown by the ExpressLRS Lua script (version line) or the module's web interface (chapter 6.1).

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.