ES24TX Slim Pro

Happymodel · ExpressLRS 2.4 GHz transmitter module
User manual



Read the entire manual before first use. The module's maximum output power exceeds the limits applicable in the Czech Republic and the EU – set the transmit power according to chapter 3.

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

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1. Safety instructions

1.1 Before you start

Thank you for choosing the Happymodel ES24TX Slim Pro transmitter module. Read this entire manual before first use and keep it for future reference.

- The module is intended for remote control of models (FPV drones, aircraft, cars and boats) using the ExpressLRS system. Do not use it for any other purpose.
- This product is not a toy. Keep it out of the reach of children.
- A model controlled by this module may cause injury or property damage if the link is lost or the settings are incorrect. Before each use, check the link and the failsafe settings on the model side.
- Do not make any modifications to the module or its power supply that are not described in this manual or in the manufacturer's documentation.

1.2 Radio transmission and antenna

- **Never switch on the radio with the module installed without the antenna connected.** Transmitting without an antenna may damage the module's RF circuits.
- Tighten the antenna by hand only, and do not use a damaged antenna or an antenna with a damaged connector.
- Do not touch the antenna while transmitting and keep it away from your face and body.
- Set the transmit power according to the regulations of the country of operation (chapter 3); the user is responsible for this setting.
- Do not use the module where radio equipment is prohibited (aircraft, hospitals, near medical equipment, explosive atmospheres).

1.3 Heat and cooling

- The module heats up at higher transmit power; the aluminium housing acts as a heatsink and may be hot.
- Do not cover the vents or the fan opening and do not insert any objects into them.
- Do not operate the module in a closed case, in a bag or in direct sunlight.

1.4 Operating environment

- Protect the module from moisture, rain, dust, sand and impacts. Water must not enter the fan openings.
- Avoid sudden temperature changes; after moving the module from cold to warm, let it acclimatise before switching it on.
- Keep the radio connector clean and the pins undamaged.

2. Product description

2.1 What the module is for

The Happymodel ES24TX Slim Pro is an external RC transmitter module for the **ExpressLRS** (ELRS) system in the 2.4 GHz band. It slides into a “Lite” format external module bay and, according to the manufacturer, is plug and play in the FrSky X-Lite, X-Lite Pro, X9 Lite and TBS Tango2 radios. ExpressLRS firmware is pre-installed at the factory.

ExpressLRS is an open-source control link with low latency and a high update rate. The module supports telemetry from the model and features an aluminium housing, a cooling fan and a status RGB LED. In addition to the main ESP32 processor, it contains an ESP8285 chip that serves as the ESP backpack.

2.2 Package contents

1×	ES24TX Slim Pro transmitter module
1×	Happymodel Moxon 2.4 GHz antenna (SMA connector)

Not included: radio, ExpressLRS receiver, power adapter for the TBS Tango2, USB cable or radio battery.

2.3 Parts



Front and rear view

① SMA antenna connector
② Vents
③ Status RGB LED (chapter 5.4)
④ Cooling fan grille
⑤ USB connector (service, for wired firmware update – chapter 5.5)
⑥ 8-pin FrSky Lite connector to the radio
⑦ Product marking (ES24TX SLIM PRO)

2.4 Specifications

Parameter	Value
Manufacturer / model	Happymodel / ES24TX Slim Pro
System	ExpressLRS, 2.4 GHz
Regulatory domain (manufacturer)	ISM2400
Processor (MCU)	ESP32 (main), ESP8285 (ESP backpack)
RF chip	SX1280IMLTRT
Frequency range	2400–2500 MHz (manufacturer's data); ExpressLRS firmware transmits within 2400.4–2479.4 MHz
Max. output power	1000 mW (≤ 30 dBm)
Update rate	25–500 Hz
Supply voltage	5–12 V
Radio connector	FrSky Lite, 8-pin
Antenna connector	SMA
Cooling	aluminium housing, fan
Weight	50 g (without antenna)
Dimensions	67.5 × 30 × 20.5 mm (without antenna)
Firmware target (manufacturer)	HappyModel_ES24TX_Pro_Series_2400_TX
Device in ExpressLRS Configurator	HappyModel ES24 Slim Pro 2.4GHz TX

▶ Supplied Happymodel Moxon 2.4 GHz antenna

Frequency	2400 MHz
Gain	4.18 dBi
Directivity	7.12 dB
Efficiency	50.77 %
Dimensions	69 × 45 mm
Weight	5.83 g
Connector	SMA

2.5 Compatible radios

- According to the manufacturer, the module is plug and play in the **FrSky X-Lite, X-Lite Pro, X9 Lite** and **TBS Tango2** radios.
- The radio must run a current version of **EdgeTX** or **OpenTX** with CRSFShot / Mixer Sync support. The ExpressLRS project recommends EdgeTX.

- The **Jumper T-Lite** and **TBS Tango2** radios require an external power supply for operation at 1000 mW (chapter 4.4).



Module in an X-Lite type radio

3. Legal conditions of operation

3.1 The law of the country of operation is decisive

The Radio Equipment Directive 2014/53/EU (RED) applies in all EU member states, but the conditions for frequency use – permitted bands, maximum radiated power and other restrictions – are set by each country individually. 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 operate it.**

3.2 Frequency band and transmit power

Frequency band	2.4 GHz; ExpressLRS firmware transmits within 2400.4–2479.4 MHz (80 channels)
Max. output power	1000 mW (≤ 30 dBm) at the module output
Gain of supplied antenna	4.18 dBi

Transmit power limits are specified as **radiated power (e.i.r.p.)**, i.e. including the antenna gain. With the supplied Moxon antenna (4.18 dBi gain), the radiated power in the direction of maximum radiation is approximately **2.6× higher** than the power set in the module.

3.3 Conditions in the Czech Republic

In the Czech Republic, use of the 2.4 GHz band is governed by the general authorisations of the Czech Telecommunication Office (ČTÚ):

Band	Limit	Regulation
2400–2483.5 MHz	25 mW e.i.r.p.	VO-R/10 (short-range devices), Art. 3
2400–2483.5 MHz	100 mW e.i.r.p.	VO-R/12 (wideband data transmission), subject to a spectrum-sharing mechanism according to ČSN ETSI EN 300 328

- **The module's maximum power (1000 mW) significantly exceeds these limits.** Higher power settings are not permitted under the general authorisations in the Czech Republic or in other EU countries.
- For operation in the EU, build the firmware with the EU regulatory domain (*EU_CE_2400* in ExpressLRS, shown as *CE_LBT* in the Lua script). This domain enables LBT (Listen Before Talk). However, it does not limit the transmit power by itself.
- Set the transmit power in the Lua script (chapter 5.3) so that the radiated power, including the antenna gain, does not exceed the limit applicable at the place of operation.
- The limits apply to any combination of module and antenna. Amplifiers and modifications of the equipment are not permitted.

- The current wording of the general authorisations is available on the ČTÚ website: www.ctu.cz.

3.4 Operation of models and drones

The module is part of an RC system. The operation of unmanned aircraft (drones) in the EU is governed by Regulations (EU) 2019/947 and 2019/945 and by national regulations – operator registration, pilot competency, operational limits and geographical zones. Details can be found in your drone's manual and on the website of the Civil Aviation Authority (www.caa.gov.cz), or outside the Czech Republic from the competent authority of the country concerned.

4. Installation in the radio

4.1 What else you need

- a compatible radio with a Lite format external module bay running EdgeTX or OpenTX (chapter 2.5),
- an ExpressLRS 2.4 GHz receiver in the model with the **same major firmware version** (first number of the version) as the module,
- for firmware updates, a computer with ExpressLRS Configurator, or a Wi-Fi device with a web browser.

4.2 Fitting the antenna

Before inserting the module into the radio, screw the Moxon antenna onto the SMA connector ① and tighten it by hand. Never tighten the antenna with a tool and **never switch on the radio with the module installed without the antenna.**

4.3 Inserting the module

- Switch off the radio.
- Remove the external module bay cover (if the radio has one).
- Slide the module into the bay so that the 8-pin connector on the back of the module mates with the radio connector. Do not use force – the module must slide in freely. Check that no pin is bent.
- Switch on the radio and continue with the settings in chapter 4.5.



Module in the TBS Tango2 radio

4.4 Power supply and higher power levels

The module is powered by the radio via the bay connector (5–12 V). The TBS Tango2 radio is powered by a single cell (1S) and, according to the manufacturer, cannot reliably power the module at 1000 mW, or may not even switch it on. For this case, Happymodel offers a separately sold power adapter for the Tango2 – installing it is a modification of the radio and you do so at your own risk. The Jumper T-Lite radio also requires an external power supply for 1000 mW.

❊ In the Czech Republic and the EU, the radiated power may not exceed 25 mW or 100 mW e.i.r.p. respectively (chapter 3.3). An external power supply is not needed for operation within these limits.

4.5 Radio settings

ExpressLRS communicates with the radio using the CRSF protocol. In the settings of the selected model (*MDL → Model Setup*):

- set *Internal RF* to **Off**,
- set *External RF* to **CRSF** mode,
- select the *Baudrate*: **400K** is sufficient for packet rates up to 250 Hz, **921K** is required for 500 Hz. In EdgeTX the external module baudrate is set in the model settings, in OpenTX in the system menu *SYS → Hardware*. After changing it, switch the radio off and on again.

The ExpressLRS project also recommends disabling the *ADC filter* in EdgeTX/OpenTX if you fly a model with a flight controller (FC) that smooths the commands itself.

5. Setup and configuration

5.1 ExpressLRS Lua script

The module is configured with the *ExpressLRS Lua* script directly in the radio. Press the **SYS** button (long-press **Menu** on older radios), open the *Tools* menu and run the *ExpressLRS* script. If it is not on the radio, download it from www.expresslrs.org and save it to the *SCRIPTS/TOOLS* folder on the SD card.

- The script header shows the module name, a packet counter and a link indicator: **C** = connected to the receiver, **-** = no link.
- The bottom line shows the firmware version and the module's regulatory domain (e.g. *ISM2G4* or *CE_LBT*). The domains of the module and the receiver must match.
- If the script stays on the *Loading...* screen, check the settings in chapter 4.5 and increase the baudrate.

5.2 Binding with a receiver

The module and the receiver will only connect if they have the **same major firmware version** (first number of the version) and the same regulatory domain. There are two ways to bind:

① **Binding phrase (recommended)** – when building the firmware in ExpressLRS Configurator (or in the web interface), enter the same phrase for both the module and the receiver. Devices with the same phrase connect automatically. The phrase is not a password; it only distinguishes you from other pilots – use your nickname, for example.

② **Conventional binding** – put the receiver into bind mode (as described in the receiver manual, e.g. by power-cycling it three times; the receiver LED blinks twice and pauses) and select **[Bind]** in the Lua script. When the receiver LED lights up solid, binding is complete.

You can verify the link by the letter **C** in the top right corner of the Lua script. If *Model Mismatch* is displayed, the Model Match setting does not match – disable it, or briefly disable and re-enable it.

5.3 Power and packet rate

- **TX Power** – folder with the power settings: *Max Power* (highest permitted power) and *Dynamic* (dynamic adjustment of power to link quality). Choose the *Max Power* value with regard to the limits in chapter 3.3.
- **Packet Rate** – a higher packet rate means lower latency but shorter range.
- **Telem Ratio** – the proportion of packets used for telemetry from the model.
- **Switch Mode** – how the AUX switch channels are transmitted. It can only be changed while not connected to the receiver.

※ Do not change parameters while the model is in the Arm state (motors enabled), and never change the packet rate in flight – the change forces a link drop and the model enters failsafe.

※ With the manufacturer's factory firmware, the Lua script displays the power incorrectly: a value of 250 mW in the script corresponds to an actual output power of 1000 mW. The manufacturer recommends updating the firmware to the official ExpressLRS release.

According to the manufacturer, the cooling fan switches on automatically when the module operates at 250 mW.

5.4 RGB LED indication

With current ExpressLRS firmware, LED ③ indicates the following states:

LED	State
rainbow colour cycle	starting up
green “heartbeat”	web update mode (Wi-Fi)
blue “heartbeat”	Bluetooth joystick mode enabled
red flashing (100 ms)	radio chip not detected
one orange blink per second	module not communicating with the radio
solid single colour	connected to the receiver, colour indicates packet rate
slowly pulsing single colour	not connected to the receiver, colour indicates packet rate

▶ Colour by packet rate (2.4 GHz)

Colour	Packet rate
red	F1000
yellow	F500
chartreuse	D500
green	D250
cyan	333 Full
light blue	500 Hz
blue	250 Hz
blue-violet	150 Hz
violet	100 Full
magenta	50 Hz

The packet rates offered by the module are shown in the Lua script; they depend on the firmware version.

5.5 Firmware update

Firmware is built in **ExpressLRS Configurator**. Select *Device Category* **Happymodel 2.4 GHz** and *Device* **HappyModel ES24 Slim Pro 2.4GHz TX**. Do not confuse it with other modules of the ES24TX series. Setting the regulatory domain for the country of operation (chapter 3.3) is mandatory; setting a binding phrase is recommended.

▶ Update via Wi-Fi (recommended)

① In Configurator, select the *WiFi* method and click *Build*. A folder containing the *firmware.bin* file opens.

② In the Lua script, select *WiFi Connectivity* → *Enable WiFi*. The module enters Wi-Fi mode (LED green “heartbeat”).

③ Connect to the **ExpressLRS TX** Wi-Fi network (password **expresslrs**) and open **10.0.0.1** in a browser.

④ On the *Update* tab, upload the *firmware.bin* file and click *Update*. Wait for the success message.

⑤ Exit the Lua script with a long press of **RTN**, run it again and check the firmware version.

※ The first Wi-Fi update from factory or older firmware to the current major ExpressLRS version requires an intermediate step – flashing a transitional version and the Repartitioner. Follow the module page on expresslrs.org and the manufacturer's page exactly (chapter 5.6). A wired (UART) update does not require this intermediate step.

▶ Update via USB cable (UART)

Remove the module from the radio and connect it to a computer with a USB data cable. To access the USB port or the module's switches, it may be necessary to remove the front cover; set the switches to the UART update position as shown on expresslrs.org. In Configurator, select the *UART* method and click *Flash*. If the computer does not recognise the module, install the CP210x drivers. After the update, return the switches to the normal operation position, refit the cover (take care not to pinch any cables and make sure the antenna cable is connected correctly) and insert the module back into the radio.

5.6 Further guides

Official ExpressLRS and EdgeTX documentation (in English) is available online:

Links:

- ExpressLRS: www.expresslrs.org – module page: expresslrs.org/quick-start/transmitters/es24tx
- EdgeTX: www.edgetx.org
- Manufacturer: www.happymodel.cn

6. Operation

6.1 Pre-flight check

- The antenna is firmly tightened and undamaged.
- The module is properly seated in the bay and the radio battery is charged.
- The correct model is selected and the transmit power complies with the limits at the place of operation.
- The module LED is solid and the Lua script shows a link (C).
- Failsafe is correctly set and verified on the model side.
- Range check: on the ground, with the motors disabled or the propellers removed, check that the model responds to commands.

6.2 During operation

- The Moxon antenna is directional – it radiates mostly in one direction. During flight, keep it pointed towards the model and do not cover it with your hand or body.
- Monitor the link quality telemetry (LQ, RSSI) and return with the model if it deteriorates.
- Do not switch off the radio or remove the module while the model is armed (Arm state) or powered on.
- When finished, disconnect the model's battery first and only then switch off the radio.

7. Maintenance and troubleshooting

7.1 Maintenance and storage

- Clean the module with a soft dry cloth. Do not use solvents and do not spray any liquids into the fan openings.
- Remove dust from the vents carefully with a brush or a gentle stream of air.
- Regularly check the connector pins, the antenna connector and the antenna cable.
- Store in a dry place at room temperature, preferably with the antenna unscrewed, out of the reach of children.

7.2 Troubleshooting

Problem	Possible cause and solution
Lua script stays on *Loading...*	External RF is not set to CRSF or Internal RF is enabled; baudrate too low (chapter 4.5).

Problem	Possible cause and solution
LED blinks orange once per second	The module is not communicating with the radio – check that the module is inserted correctly and the CRSF settings.
Receiver does not connect	Different major firmware version, regulatory domain or binding phrase; receiver not in bind mode.
Model Mismatch	Model Match does not match – disable the function, or briefly disable and re-enable it.
Bad packets in the counter	Module overheating or poor contact with the radio; check ventilation and the connector.
Module restarts or does not switch on at high power	The radio (e.g. Tango2, T-Lite) cannot supply enough current – reduce the power (chapter 4.4).
LED flashes red	Radio chip not detected – contact your dealer.
ExpressLRS TX Wi-Fi network not visible	The module is connected to your home Wi-Fi (address http://elrs_tx.local) or your device does not support 2.4 GHz Wi-Fi.

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 Slim Pro) is given on the back of the module; the firmware version is shown by the *ExpressLRS Lua* script in the radio (Chapter 5.1).

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.