ES09MD HV

EMAX – metal gear digital servo
User manual



Read the entire manual before first use. The servo supply voltage must not exceed 8.4 V.

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1. Product description

1.1 Intended use

The **EMAX ES09MD HV** is a small digital servo with metal gears and two ball bearings, designed for high-voltage (HV) operation up to 8.4 V. It converts the PWM control signal from a receiver, flight controller (FC) or servo tester into precise rotation of the output shaft, onto which the servo horn is fitted.

The servo is used to drive the control surfaces and flaps of RC aircraft and gliders, mechanisms in other RC models, moving camera mounts and FPV head trackers. With a weight of about 13.5 g, it is also suitable for smaller models that need higher torque and the durability of metal gears.



EMAX ES09MD HV servo with cable terminated by a JR connector

1.2 Technical data and package contents

All data in this chapter are taken from the manufacturer's EMAX datasheet published on the product page.

Parameter	Value
Product designation	EMAX ES09MD HV (manufacturer code 0102003036)
Servo type	digital, metal gears
Bearings	2 ball bearings (2BB)
Control signal	PWM
Neutral position	1500 µs
Pulse width range	500–2500 µs
Operating travel	90° ± 8° (at 1000–2000 µs)
Maximum travel	175° ± 10° (at 500–2500 µs)
Direction of rotation	counter-clockwise when the pulse changes from 1500 to 1900 µs
Weight	13.5 ± 1 g

Parameter	Value
Dimensions (L × W × H)	23.2 × 12.0 × 27.6 mm (height incl. output shaft, see section 1.3)
Output shaft	21 teeth (21T), Ø 4.95 mm, horn screw M2
Cable	250 ± 8 mm (without connector), JR connector
Operating temperature	−10 °C to 50 °C
Storage temperature	−20 °C to 60 °C

▶ Parameters by supply voltage

Parameter	6.0 V	8.4 V
Speed (no load)	0.17 s/60°	0.12 s/60°
Stall torque	max. 2.3 kg·cm	max. 3.1 kg·cm
Running current (no load)	max. 200 mA	max. 280 mA
Maximum current	max. 0.65 A	max. 0.9 A
Idle current	9.5 mA	9.5 mA

The maximum supply voltage is **8.4 V** – the highest voltage for which the manufacturer specifies parameters.

▶ Package contents

- EMAX ES09MD HV servo with cable and JR connector,
- set of plastic servo horns of various shapes,
- mounting screws.

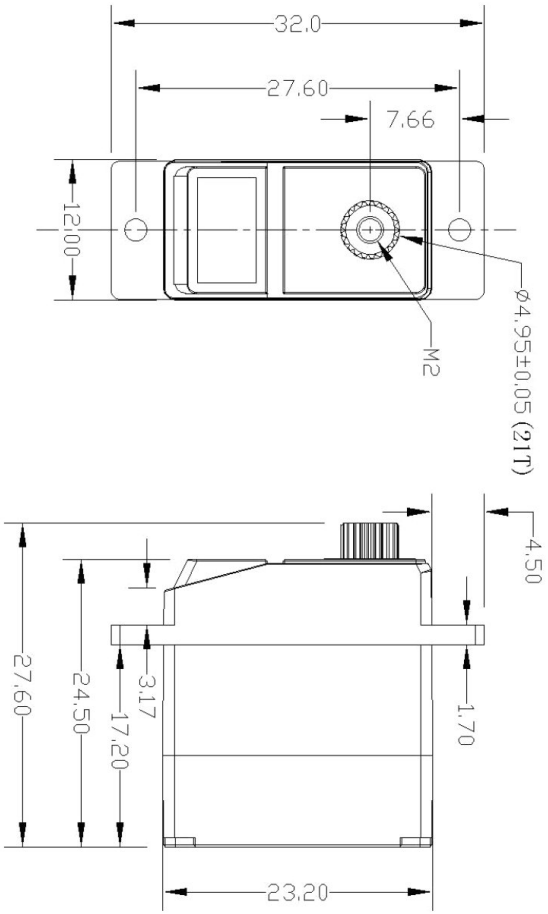
Not included: receiver, flight controller (FC), radio transmitter, power supply (BEC) or battery, pushrods and extension cables.



Package contents (illustrative manufacturer photo)

1.3 Dimensions

Manufacturer's drawing, dimensions in millimetres. The mounting hole spacing is 27.6 mm, the overall length across the mounting lugs is 32.0 mm, and the height of the servo body without the output shaft is 24.5 mm.



Dimensional drawing of the servo (top and side view), dimensions in mm

2. Use

2.1 Connection

The servo has a three-wire cable terminated by a JR connector. It is connected to a servo output of a receiver, a servo output of a flight controller (FC) or a servo tester.

Wire	Function
black	negative supply (−, GND)
red	positive supply (+)
white	control signal (S, PWM)

- Before connecting, check the connector orientation against the marking on the receiver or flight controller (usually **−**, **+** and **S**). The signal wire must be on the signal pin.
- Insert and remove the connector by holding its body; never pull on the wires.
- Keep extension cables as short as possible and of sufficient cross-section; long thin cables increase voltage drop and susceptibility to interference.
- On flight controllers (FC), the power for the servo outputs is often separate from the power of the board itself. Check the flight controller documentation to see whether its BEC powers the servo outputs or whether a separate power source must be connected.

2.2 Power supply

The manufacturer specifies the servo parameters for a supply voltage of **6.0 V** and **8.4 V**. The voltage of **8.4 V** must not be exceeded.

- The servo can be powered directly from a two-cell Li-Po battery (2S): a fully charged 2S Li-Po has 8.4 V (4.20 V/cell).
- **Do not use a 2S LiHV battery for direct power** – when fully charged it has 8.7 V (4.35 V/cell), which is above the maximum servo voltage.
- Never power the servo directly from a three-cell or larger battery (3S or more); always use a regulated power supply (BEC) set to no more than 8.4 V.
- The power supply (BEC) must deliver the current for all connected servos at the same time. A single servo draws up to 0.9 A when stalled (at 8.4 V). An insufficient supply causes voltage drops that can lead to a receiver reset and loss of control of the model.

2.3 Installation in the model and fitting the horn

① Fasten the servo in the model with two screws through the holes in the mounting lugs (spacing 27.6 mm). Tighten the screws gently so that the plastic lugs do not crack.

② Connect the servo and switch on the radio transmitter and receiver so that the servo receives a neutral signal (1500 µs, transmitter stick centred, trim at zero). The servo moves to its neutral position.

③ Fit the horn onto the splined shaft (21 teeth) in the position closest to perpendicular to the pushrod. Correct any remaining deviation electronically (subtrim) – see section 2.4.

④ Secure the horn with the M2 screw in the shaft axis. Do not overtighten the screw.

⑤ Connect the pushrod and check that the controlled surface or mechanism moves freely over the full range without binding.

※ Do not turn the output shaft by force by hand and do not use the horn as a lever. Forcing the shaft can damage the gears, even metal ones.

2.4 Setting travel, neutral and direction

The rotation range of the servo depends on the pulse width sent by the receiver or flight controller:

- with the standard range of **1000–2000 µs** the servo rotates approximately **90°** (90° ± 8°),
- with the extended range of **500–2500 µs** the servo rotates up to **175°** (175° ± 10°); the extended range must be enabled in the radio transmitter or flight controller (endpoints, output limits).
- The servo neutral corresponds to a pulse of **1500 µs**. Fine-tune the neutral with the *subtrim* function in the radio transmitter or flight controller.
- When the pulse changes from 1500 to 1900 µs, the servo rotates counter-clockwise. Set the opposite direction with the *reverse* function in the radio transmitter or flight controller.

※ Set the endpoints so that the servo does not hit a mechanical stop at its end positions. A servo blocked by a stop or pushrod draws high current, heats up and may be damaged.

The manufacturer does not specify the maximum refresh rate of the control signal. If your flight controller allows the servo output frequency to be changed, keep the standard setting for conventional servos.

3. Safety, maintenance and troubleshooting

3.1 Safety instructions

- The product is intended for model-making use. Keep it out of the reach of children without adult supervision; small parts (screws, horns) may be swallowed.
- Do not exceed the maximum supply voltage of 8.4 V and observe the supply polarity.
- When power is connected, the servo may move suddenly to the position given by the control signal. Keep your fingers away from the horn and moving parts of the model when switching on.
- Install and adjust pushrods with the power disconnected, or at least with the model's drive (motor, propeller) disconnected.
- The manufacturer does not specify an ingress protection rating. Protect the servo from water, moisture, dust and sand.
- Operate the servo only within the operating temperature range of −10 °C to 50 °C. Disconnect an overheated servo (hot to the touch, smell) immediately.
- Before each operation of the model, check the function and direction of movement of all servos and the attachment of horns and pushrods. A servo failure can lead to loss of control of the model.
- The operation of models in which the servo is installed is governed by the regulations of the country in which you operate the model. The information in chapters 4 and 5 describes the situation in the Czech Republic.

3.2 Maintenance and storage

- The servo requires no regular maintenance. After a crash of the model, check that the servo moves smoothly, without clicking or skipping teeth, and that the horn, cable and lugs are not damaged.
- Do not disassemble the servo and do not interfere with its electronics or gears.
- Store in a dry place at −20 °C to 60 °C, away from direct sunlight.

3.3 Troubleshooting

Problem	Possible cause and solution
Servo does not respond	Connector inserted the wrong way round – check the polarity (section 2.1). The flight controller servo output is not powered – connect a BEC. The output is not assigned to a channel in the receiver or flight controller.
Servo rotates the wrong way	Change the direction with the *reverse* function in the radio transmitter or flight controller.
Small range of movement	A pulse range of 1000–2000 µs gives about 90°. For more travel, extend the endpoints (up to 500–2500 µs) or adjust the horn and pushrod geometry.
Servo heats up or buzzes at an end position	The servo is hitting a mechanical stop. Reduce the endpoints or adjust the pushrod. A quiet holding buzz at rest is normal for digital servos.
Servo jitters, receiver resets	Insufficient power supply (BEC) or long thin cables – use a more powerful supply and shorter cables with a larger cross-section.
Servo clicks, skips	Damaged gears (e.g. after a crash). Stop using the servo and contact the retailer.

4. Information for the EU and Czech Market

4.1 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

4.2 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.

5. 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 4.1.
- 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.