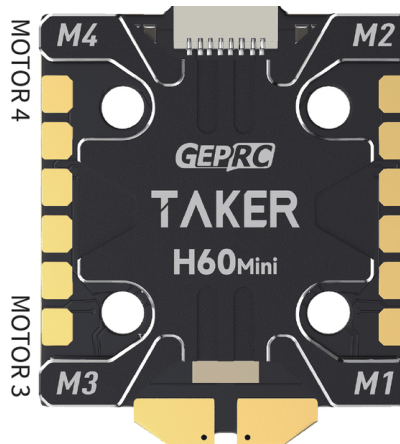




TAKER H60 Mini AM32 60A 4IN1

Electronic speed controller for an FPV drone
User manual



Read the whole manual before assembly. The board is a building component, not a finished ready-to-use product.

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1. Safety Instructions

1.1 Before you start

Read this manual in full before you take the board out of its antistatic bag. It describes the assembly, wiring and commissioning of a four-in-one electronic speed controller for building an unmanned aircraft (drone).

- The product is a **building component**, not a finished ready-to-use product. It assumes knowledge of soldering, Li-Po batteries and ESC firmware.
- The board is **not a toy** and is not intended for children. A drone built from these parts can cause serious injury.
- Responsibility for the safety, conformity and operation of the finished drone lies with the person who builds and operates it (chapter 3).
- Check the entire wiring before you connect the battery for the first time – most faults are caused by bad soldering, reversed polarity or a short circuit.

❗ Damage caused by incorrect wiring, reversed polarity, a short circuit or overvoltage is not a product defect.

1.2 Electrical hazards and hot components

- The ESC works with 3–8S batteries and currents of up to **60 A per channel**. At 8S the supply voltage reaches up to **33.6 V** (34.8 V with LiHV). A short circuit at this power level causes an arc, melts the wire and starts a fire.
- Never connect or disconnect connectors under load other than the main battery connector.
- Do not carry out any soldering work while the battery is connected.
- The power components and the heat sink **reach temperatures that can cause burns**. Do not touch them after a flight until they have cooled down.
- The board must not come into contact with conductive parts of the frame, with carbon dust or with moisture. Carbon fibre is electrically conductive.
- The heat sink is conductive and must not touch other electronics.

1.3 Li-Po and LiHV batteries

The board is designed to be powered from Li-Po or LiHV batteries in a 3–8S configuration. The battery is not included.

State	Li-Po	LiHV	3S	4S	6S	8S
Fully charged	4.20 V/cell	4.35 V/cell	12.6 V	16.8 V	25.2 V	33.6 V
End the flight	3.5 V/cell	3.5 V/cell	10.5 V	14.0 V	21.0 V	28.0 V
Storage	3.8 V/cell	3.8 V/cell	11.4 V	15.2 V	22.8 V	30.4 V

The pack voltages in columns 3S–8S apply to Li-Po. With LiHV, full charge is 13.05 V (3S), 17.4 V (4S), 26.1 V (6S) and 34.8 V (8S).

- **Never exceed 8S.** A higher voltage will destroy the board and there is a risk of fire.
- Always fit a **fully charged** battery to the drone.
- Charge the battery under supervision and in a fireproof container. Never charge a damaged, swollen or crashed battery.
- After a crash, leave the battery for at least 30 minutes in a safe place away from flammable materials.
- For a longer period of inactivity, set the storage voltage to **3.8 V per cell**.
- Batteries and electrical waste do not belong in unsorted waste (chapter 8.3).

✳ **Battery manufacturers' figures for discharging below 3.5 V per cell are not used for drone operation.**

1.4 Rotating propellers

- **Fit the propellers as the very last step**, after all setup is complete and the motor direction has been verified.
- Carry out all setup, calibration, firmware updates and motor testing **without the propellers fitted**.
- Before connecting the battery, check that the transmitter is on, the throttle is at minimum and the Arm switch is in Disarm.
- Rotating propellers cause deep cuts. Keep hands, face and bystanders at a distance.

1.5 Operating environment and electromagnetic compatibility

- The board is intended for installation in a model and for operation in a dry environment. It is neither waterproof nor dustproof.
- Protect the board against impact, vibration and cable strain.
- The ESC is a source of electromagnetic interference. To keep the model compliant with the electromagnetic compatibility requirements, observe the following:
 - always connect the supplied **1000 µF / 50 V capacitor** to the power input with the correct polarity, as close to the solder pads as possible,
 - route the motor wires by the shortest path, without loops, and do not bundle them with receiver, camera or video transmitter wiring,
 - route the signal wires away from the power section and do not use extension cables on the power input.

✳ **If the model does not meet the electromagnetic compatibility requirements for residential areas, operate it away from them.**

2. Product Description

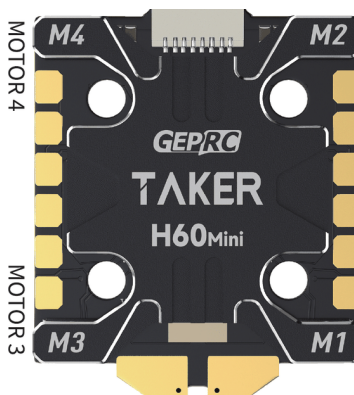
GEPRC TAKER H60 Mini AM32 60A 4IN1 is a four-in-one electronic speed controller (ESC) with a 20×20 mm mounting pattern, intended for building an FPV drone powered by a 3–8S battery. It runs AM32 firmware and is fitted with an aluminium heat sink, a current sensor and a protective TVS diode.

2.1 Package contents

- ① 1× TAKER H60 Mini AM32 60A 4IN1 electronic speed controller
- ② 1× 1000 µF / 50 V capacitor
- ③ 1× power cable with an XT60 connector (12 AWG, 55 mm long)
- ④ 1× accessory set

❖ **The flight controller, battery, motors, propellers and frame are not included.**

2.2 Technical data



TAKER H60 Mini AM32 60A 4IN1 ESC

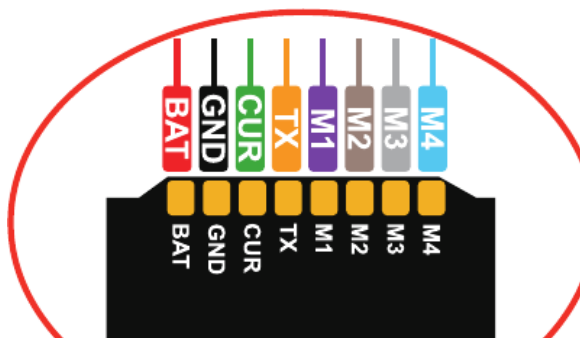
Input voltage	3–8S Li-Po
Continuous current	60 A per channel
Burst current	65 A (5 s)
Firmware	AM32, target AM32 GEPRC 4IN1 F421
Input protocols	DSHOT150 / DSHOT300 / DSHOT600
Bidirectional DShot	yes
PWM output frequency	adjustable
Current sensing	yes, on-board current sensor
Protective TVS diode	yes

Cooling	aluminium heat sink
Dimensions	36 × 43 mm
Mounting pattern	20 × 20 mm, M3 screws
Weight	17 g (including the aluminium heat sink)

❖ **The continuous current of 60 A per channel applies with sufficient airflow cooling. Without airflow the ESC will overheat even at a lower load.**

2.3 Pad and pin assignment

The motor solder pads **M1** to **M4** are at the corners of the board, the power pads for the battery and the capacitor along the bottom edge, and the eight-pin SH1.0 signal connector for the link to the flight controller along the top edge.



Pin layout of the signal connector

Pad	Meaning
BAT	battery supply voltage to the flight controller
GND	common ground
CUR	signal from the current sensor
TX	ESC telemetry; on the flight controller this pad is usually labelled R5
M1-M4	signals for motors 1 to 4

❖ **Each motor output has its own set of three pads on the board. The phase order does not matter with brushless motors - the direction of rotation is changed in the ESC configuration, not by swapping the wires.**

3. Legal Conditions of Operation in the Czech Republic and the EU

3.1 The law of the country in which you fly applies

Regulations (EU) 2019/947 and 2019/945 apply in all Member States of the European Union, but national implementing rules differ from country to country – registration portals, the minimum age of the pilot, geographical zones, compulsory insurance, permitted frequency bands and maximum transmit powers. The information in this chapter describes the situation in the Czech Republic. If you operate the drone in another country, you must comply with the rules of the state in which you fly.

3.2 The board is a component, not a complete unmanned aircraft system

This electronic speed controller is a component. It becomes an unmanned aircraft system (UAS) only as the drone you build from it together with a frame, motors, propellers, a receiver and a battery. The product requirements of Regulation (EU) 2019/945 – the C0 to C4 class identification label, conformity assessment and the information notice – apply under its Article 2 only to complete unmanned aircraft systems bearing a class identification label. They do not apply to a separately sold board.

- The conformity and safety of the finished drone are the responsibility of the person who built it and who operates it.
- A drone built from components sourced from several suppliers is generally a **privately built unmanned aircraft system** within the meaning of Article 3(22) of Regulation (EU) 2019/945. This interpretation is not undisputed; in case of doubt, contact the Civil Aviation Authority.

3.3 Operating category and drone classification

A privately built drone has no class identification label, and therefore the following restrictions apply to it in the open category:

- **Subcategory A1** – only if the maximum take-off mass of the drone is **less than 250 g** and its maximum operating speed is less than 19 m/s.
- **Subcategory A3** – in all other cases, with a maximum take-off mass of up to 25 kg. You must fly at least **150 m away from residential, commercial, industrial and recreational areas**.
- **Subcategory A2 is not available for a privately built drone.**
- An alternative is operation within a model aircraft club or association under Article 16 of Regulation (EU) 2019/947.

✱ **Weigh the drone's maximum take-off mass carefully - battery, camera, propellers and all accessories included. The 250 g limit is easily exceeded.**

3.4 Operator registration and pilot competence

- Registration is compulsory at a maximum take-off mass of 250 g and above, and always when the drone is equipped with a **sensor able to capture personal data** – that is, a camera – regardless of its mass.
- In the Czech Republic, registration is carried out with the Civil Aviation Authority at dron.caa.gov.cz. Mark the operator registration number assigned to you on every drone you operate.
- For subcategory A3 you must complete the online training and the remote pilot examination.

3.5 Operating limits of the open category

- Maximum flight height **120 m** above the closest point of the surface of the earth.
- Continuous visual line of sight (VLOS) with the drone throughout the flight.
- No flying over assemblies of people.
- Compliance with geographical zones; in the Czech Republic these are published by the Civil Aviation Authority.
- The drone must not carry dangerous goods or drop anything.

3.6 Flying with FPV goggles

If you fly using the image in FPV goggles, you have no direct view of the drone. Such a flight is permitted in the open category only if you are accompanied by an **unmanned aircraft observer** who keeps the drone in continuous unaided visual contact and is in direct communication with you.

3.7 Radio transmitters on the drone

The electronic speed controller itself contains no radio transmitter. For the transmitters on the finished drone – the RC control link and the video transmitter – the general authorisations of the Czech Telecommunication Office apply in the Czech Republic:

Band	Maximum power	Authorisation
2400–2483.5 MHz	100 mW e.i.r.p.	VO-R/12 (wideband data transmission, e.g. Bluetooth and Wi-Fi)
2400–2483.5 MHz	25 mW e.i.r.p.	VO-R/10 (non-specific short range devices, e.g. the RC control link)
5725–5875 MHz	25 mW e.i.r.p.	VO-R/10 (e.g. an analogue video transmitter)

- The equipment may only be operated with an integral antenna or with an antenna specified by the manufacturer; additional amplifiers are not permitted.

- Setting the transmit power of the connected transmitters is the responsibility of the user.
- Outside the Czech Republic, the limits of the country concerned apply.

3.8 Insurance and protection of personal data

- In the Czech Republic, liability insurance is compulsory in subcategory A2 and in subcategory A3 for drones over 4 kg. It is not compulsory for a smaller drone, but we strongly recommend it.
- If your camera records footage in which people can be identified, you are processing personal data. Do not stop at the aviation rules – comply with the data protection rules as well.

4. Assembly

4.1 What else you need

- a frame with a 20×20 mm mounting pattern,
- a flight controller for a 3–8S battery with DShot protocol support,
- four brushless motors matched to the battery voltage and to the current rating of the ESC, and propellers,
- a Li-Po or LiHV battery in a 3–8S configuration with an XT60 connector,
- a temperature-controlled soldering iron, solder, flux and desoldering braid,
- good quality cables (at least 12 AWG for the power leads) and heat-shrink tubing,
- a computer with the AM32 firmware configurator.

4.2 Mounting in the frame

- ① Fit and solder the board while it is freely accessible. Once the stack is screwed together you will not reach its pads.
- ② Fit the ESC into the frame as the bottom board. The signal connector must face forward so that the cable does not obstruct the routing of the motor wires.
- ③ Insert M3 dampers into the mounting holes and push the M3 screws through.
- ④ Secure the assembly with M3 nylon lock nuts. Tighten the nuts only so far that the dampers remain flexible.

✱ **No conductive debris may be left between the board and the frame - no wire clipping, no drop of solder and no carbon dust. The aluminium heat sink is conductive.**

4.3 Connecting the motors

- Each motor is connected with three wires to the set of three pads labelled **M1** to **M4**.
- The motor numbering must match the layout you set in the flight controller.
- Shorten the wires to the shortest sensible length and secure them carefully so that they cannot reach the propellers.
- Do not deal with the direction of rotation by swapping wires – change it in the ESC configuration (chapter 6.3).

4.4 Power supply and capacitor

- ① Solder the power cable with the XT60 connector to the power pads of the ESC. Observe the correct polarity – **reversed polarity will destroy the board** and is not grounds for a claim.
- ② Solder the supplied **1000 µF / 50 V** capacitor to the same pads. The longer lead is positive, the negative one is marked by a stripe on the case.

- ③ Place the capacitor as close to the solder pads as possible and shorten its leads to the smallest reasonable length. Long leads reduce the effectiveness of the capacitor considerably.
- ④ Secure the capacitor mechanically against vibration – a loose capacitor will tear its leads off in flight.

❖ The capacitor is not an optional accessory. Without it, voltage spikes may damage the ESC and the flight controller and the image quality is significantly degraded.

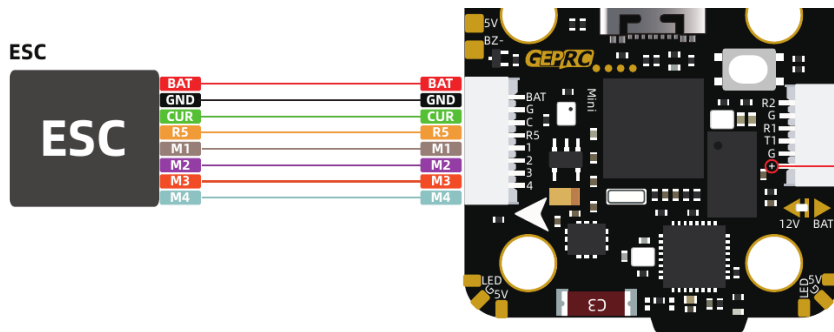
4.5 Soldering and wire routing

- Tin the pads first, then apply the tinned wire. The joint should be shiny and domed.
- Use a sufficiently powerful iron on the power pads – a cold joint will heat up at 60 A and fall off.
- After soldering, check all joints carefully, remove any solder and flux residue and make sure there is no short circuit anywhere.
- Secure the wires so that they cannot reach the propellers or chafe against the frame.

5. Connecting to the Flight Controller

5.1 Signal connector

The ESC is connected to the flight controller with an eight-core SH1.0-8P cable. The order of the signals must match on both sides.



Connecting the ESC to the flight controller

- The **BAT** pad feeds the battery voltage to the flight controller - the flight controller has no power cable of its own.
- The **M1** to **M4** pads carry the DShot signal from the flight controller to the ESC.
- The **CUR** pad passes on the value from the current sensor; in the flight controller you use it to measure the capacity drawn.
- The **TX** pad is the ESC telemetry output; on the flight controller it is connected to the receive pad of the corresponding UART port.

❖ **Before wiring, check that the order of the signals on the connector of your flight controller matches the order on the ESC. A reversed order can destroy both boards.**

5.2 Current sensing and telemetry

- The on-board current sensor lets the flight controller monitor the current drawn and the capacity used. In the configurator, enable current sensing and select the ESC as the source.
- The ESC telemetry transmits rpm, voltage and temperature. Set the port it is connected to as the ESC telemetry input in the flight controller.
- **Bidirectional DShot** sends the motor rpm back to the flight controller without a separate telemetry wire and is used by rpm-based filters. It is enabled in the flight controller settings.

6. Commissioning and Configuration

6.1 AM32 firmware

The ESC uses **AM32** firmware with the target **AM32 GEPRC 4IN1 F421**. It is configured with the AM32 configurator, to which the ESC is connected through the flight controller (pass-through mode) or directly with a programmer.

- Always carry out the configuration **with the propellers removed**.
- During configuration the ESC must be powered from the battery; the power section is not supplied from the flight controller USB.
- Note down the original values before changing any settings so that you can return to them.

6.2 The DShot protocol

- The ESC accepts the **DSHOT150**, **DSHOT300** and **DSHOT600** protocols. Set one of them in the flight controller; a higher number means faster transmission.
- Analogue protocols and throttle endpoint calibration are not used with DShot.
- The PWM output frequency can be changed in the ESC configuration. Do not change it without a specific reason – the default value is suitable for common motors.

6.3 Checking the motors and the direction of rotation

- ① **Remove the propellers.**
- ② Connect the battery and, in the flight controller configurator, spin up each motor in turn at the lowest speed.
- ③ Check that the motor matching the output number is the one that spins.
- ④ Correct a wrong direction of rotation in the ESC configuration, not by swapping the motor wires.
- ⑤ Only after this check may you fit the propellers and tighten them as prescribed.

❖ **A motor that stutters, squeals and fails to start indicates a cold solder joint or a damaged winding. Stop the test immediately.**

6.4 Firmware updates

- The ESC and the flight controller have their own firmware and are updated separately.
- Note down the ESC settings before updating.
- Never carry out an update with the propellers fitted.
- After an update, check the direction of rotation of all four motors again.

7. Operation, Maintenance and Troubleshooting

7.1 Pre-flight check

- The propellers are undamaged and tight, the motors turn freely.
- The motor wires and the power cable are secured and not chafed.
- The capacitor is firmly fixed and its leads are not under strain.
- The battery is **fully charged**, undamaged and mechanically secured in the model.
- The radio transmitter is switched on and charged, the throttle is at minimum, the Arm switch is in the Disarm position.
- The area is clear, there are no people or animals nearby and you know the applicable geographical zones.

7.2 Monitoring the voltage and ending the flight

- End the flight at **3.5 V per cell** under load at the latest – with a 6S pack that means 21.0 V.
- Monitor the voltage and the capacity drawn in the OSD or by the audible alarm.
- After landing, disarm and only then disconnect the battery.

7.3 After every flight

- Disconnect the battery and let the board and the heat sink cool down.
- Check whether the ESC has become unusually hot – this is usually the first sign of an undersized motor and propeller combination.
- Check the motor joints and the condition of the power cable.
- Remove any dirt; do not use water or aggressive solvents for cleaning.

7.4 Storage

- Store the board in a dry place, in an antistatic bag, at normal room temperatures.
- Store batteries separately, at **3.8 V per cell**, in a fireproof container.
- Disconnect the battery from the model before a longer period of inactivity.

7.5 Troubleshooting

Symptom	Possible cause and solution
Nothing happens after the battery is connected	reversed polarity or a short circuit – disconnect the battery immediately ; check the power joints and the polarity of the capacitor

Symptom	Possible cause and solution
A motor does not spin or spins jerkily	a cold joint on a motor wire; a damaged motor; check the DShot protocol setting
A motor spins the wrong way	change the direction of rotation in the ESC configuration, not by swapping the wires
The ESC overheats	insufficient airflow; too large a propeller or a motor with a high current draw; check that the heat sink sits properly
The flight controller resets in flight	voltage spikes; check the capacitor and its position
The camera image has interference lines	a missing or badly placed capacitor; motor wires routed in parallel with signal wires
Telemetry or current sensing is missing	the TX pad is not connected; the port in the flight controller is not set as the telemetry input; current sensing is not enabled
A motor stops in flight	ESC overheating; a loose motor joint; a damaged motor winding

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@rotorاما.cz
Phone	+420 252 252 098
Website	www.rotorاما.cz

8.2 Product conformity



- 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@rotorاما.cz.
- **Product identification:** the type designation **TAKER H60 Mini** is printed directly on the printed circuit board.

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.