Raven2 PRO

Onboard air-data measuring system for R/C aircraft with telemetry.

Manual version: 1.1

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Contents

Introduction

The "Raven 2 PRO" is one component of RC Electronics model aircraft telemetry system. The unit is the "on-board" unit intended to be used with the "Snipe / Finch" "ground station". The unit is designed to measure many parameters of an R/C model aircraft and transmit them to the ground station via the telemetry link working on 433 MHz frequency. The unit is capable of measuring sink/climb rate (Vario), airspeed, altitude, acceleration of the plane in all axes, noise level, servo pulse on servo input, GPS data with 18Hz refresh rate and supply voltage. For storage it has internal fast solid state storage which is will record up to 20h of flying.

Key features of the Raven 2 PRO

- Integrated fast solid state memory for up to 20h of logging
- Latest pressure sensor for ultra fast detection of climb / sink
- Indicated airspeed sensor
- Two pressure sensors for altitude and Vario measuring
- 3 axes accelerometer
- Electronic Total energy compensation for Vario as an option.
- Model polar measurement algorithms.
- **Enl - E**nvironment **n**oise **l**evel detection to detect working electric, impeller or jet motor.
- **FHSS - F**requency **H**opping **S**pread **S**ystem on 433MHz telemetry channel to eliminate frequency conflicts.
- 18 Hz GPS working with GNSS, Glonass and prepared for Galileo global positioning satellites.
- Various telemetry protocol supported over one of servo input (JetiEx, PowerBox System, Hott ...)

Specifications

Unit Dimensions	68 mm x 26 mm x 16 mm
Weight	21 grams (without GPS antenna)
Temperature Range[1]	-10°C ~ +60°C
Input Voltage Range	4.0 – 12.0 volts DC
Input Current	80 milliamps @ 8V DC
Measured Voltage	4.0 – 12.0 volts DC
Memory capacity	Up to 20h of flying

[1] Specifications are taken from component ratings and system limits and may not have been tested to the full extent of the specified ranges.

Physical overview

Pictures bellow are showing the Raven 2 PRO unit. It has one SMA connectors for active GPS antenna, 3 pressure ports (Ptot – total pressure, Pst – static pressure, Pte – total energy compensated pressure from TEK probe) and a multi-color LED to show the status of the unit. It also has 3 connectors. The micro USB is used for future updates, settings and flight log download. The 4 pin connector is prepared for future use (extended bus). JR 3-pin servo input is used to measure normal PWM servo pulse or to transmit 3rd party telemetry protocol on it (depends on unit setting). The Raven 2 PRO gets power from USB or JR connector.
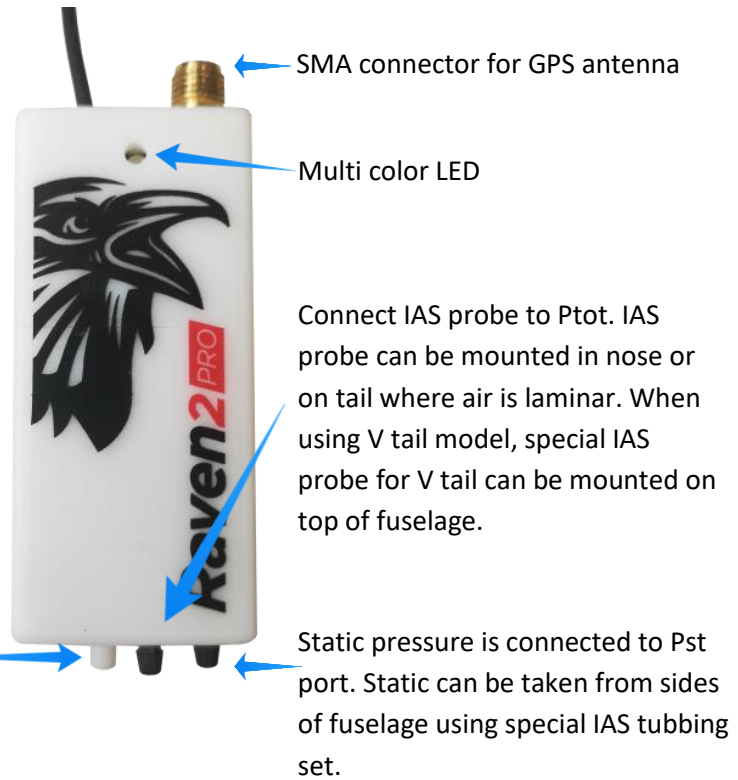
Important: Be careful on polarity when connecting power to the unit. Improper connection can damage unit! Correct polarization is marked on side of the unit by the servo connector!
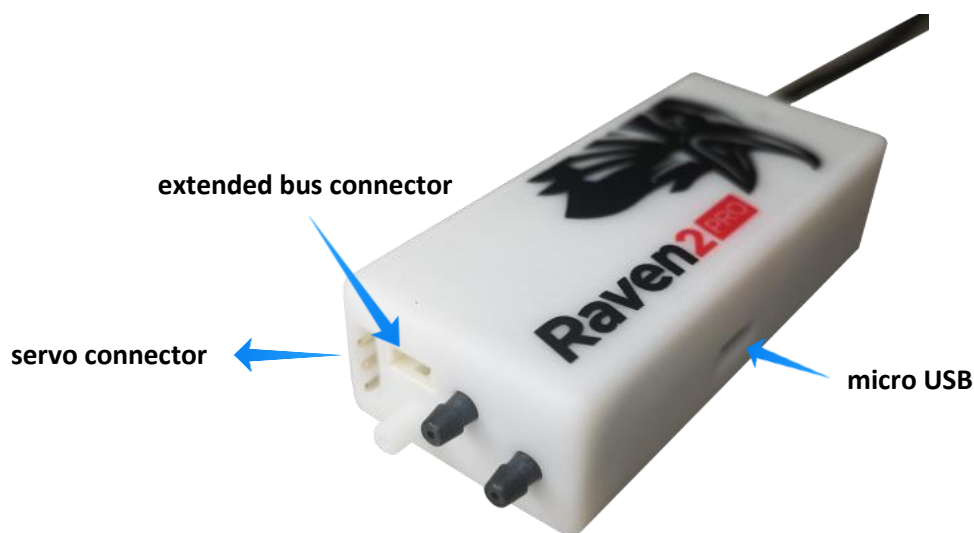
There are 2 ways of connection Pte port:

1: When using normal TEK probe, connect it to Pte port and vario will be calculated from measuring compensated pressure at TEK probe.

2: When using electronic compensation connect Pte port to Pst port. There is a T-joint in IAS tubbing set for that. Vario is based on measuring static pressure and then using mathematical equation of TEK probe to compensate it for changes in altitude due to elevator control. In order to enable electronic compensation, user must set TE level to around 98% and then fine tune it to get the best result by changing this TE level parameter. Refer to special chapter for electronics compensation and TE level.

SMA connector for GPS antenna

Multi color LED

Connect IAS probe to Ptot. IAS probe can be mounted in nose or on tail where air is laminar. When using V tail model, special IAS probe for V tail can be mounted on top of fuselage.

Static pressure is connected to Pst port. Static can be taken from sides of fuselage using special IAS tubbing set.

Using the Raven 2 PRO module

Powering the module

To power the module plug the 3 pin female connector cable into servo connector and the other end to the R/C aircraft receiver. **Be sure to observe proper polarity when plugging the connector into the module and receiver**. You can also power it directly from a battery. Please respect max voltage input of 12V and correct polarity.

When power on the LEDs will flash red, green, blue and white to confirm its operation.   During operation LED status is:

red – module is waiting for GPS signal

green – module is ready for flight

blue – onboard logger is running

white – not yet implemented.

Mounting the module

The Raven 2 PRO module and the gps antenna can be mounted using double-sided tape, cable ties or Velcro. Velcro is recommended, so that the module can be easily removed and interfaced with the PC for downloading flight data.

Be sure that the module is not touching any metal surfaces. Although unlikely, there is a possibility of shorting the metal contacts on the module, which could result in a radio system failure. The Raven 2 PRO RF antenna should be located so there is no carbon or large metal items blocking its line of sight to the ground station.

Do not mount the module on top of power batteries when using electric motors, because they get hot and this can affect the altitude readings by up to 30m.

Be sure to keep the module away from water, fuel and other liquids. Always range check and test the aircraft's radio systems before flying with the Raven 2 PRO module installed, to verify that all connections have been made correctly and there is no system interference.

GPS antenna has to be mounted where there is no metal or carbon above it and must be turned in such direction that GPS label written on antenna is facing towards the sky.


Correct position of GPS antenna

Static tube installation

In order to utilize the full capability of the Raven 2 PRO an Indicated Airspeed (IAS) probe must be install in the aircraft. The IAS probe must have two components, Ptot (total air pressure) and Pst (Static Air pressure). Tubing from the Ptot probe and Pst probe needs to be connected to the Ptot and Pst ports on the unit. Use only soft silicon tubing to connect to ports of the unit!

Inside IAS tubing set user can find one 3mm brass fitting where IAS probe can be connected. This fitting must be installed in nose or on tail as high as possible to get as laminar air flow as possible. It must point to the flight direction. Additionally, 2 x 2.5mm brass tubes for static intake on sides of fuselage are located in IAS tubing set. Those tubes must be located where airflow around fuselage is in non-turbulent area. We advise to install it in canopy area in front of wing on each side of fuselage. To connect all together a silicone tubes and 2 x plastic T-jonts are included. Figure shows an example of how to connect all components and to use electronic compensation for vario (Pte is connected to Pst). When normal TEK probe is used then connect Pte to TEK probe and do not use 2nd T-joint.
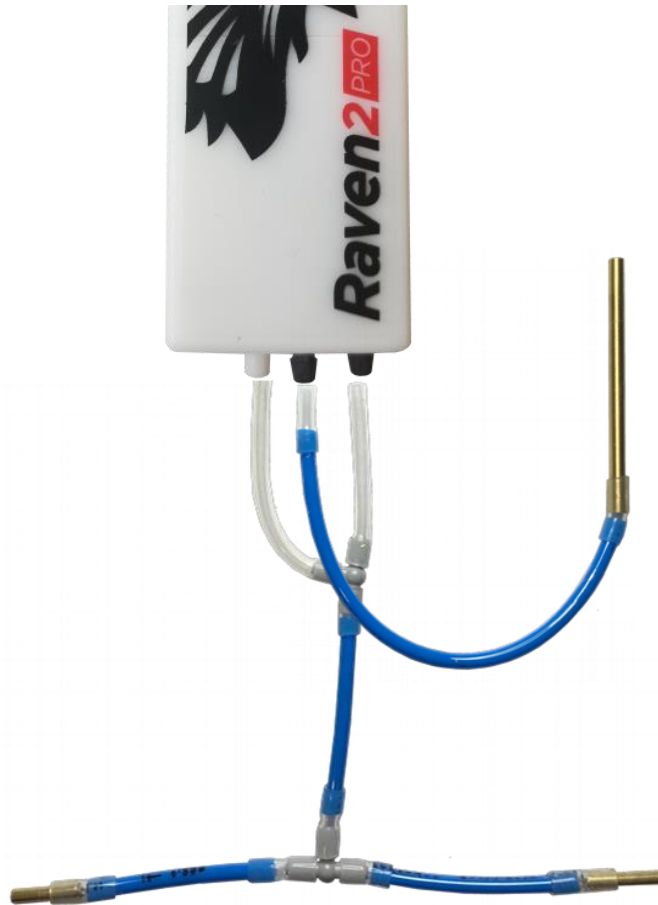

Left side of fusalage   Right side of fusalage

Example how to connect tubbing with electronic vario compensation

Connecting module to Android RC electronics app

Connect the unit to any Android device where RC electronics app was installed from Google Play using a USB cable which has OTG mode supported on Android device side. Such cables (micro USB or USB-C can be purchased from www.rc-electroncis.eu web-shop)

Run RC electronics App and confirm USB connection.
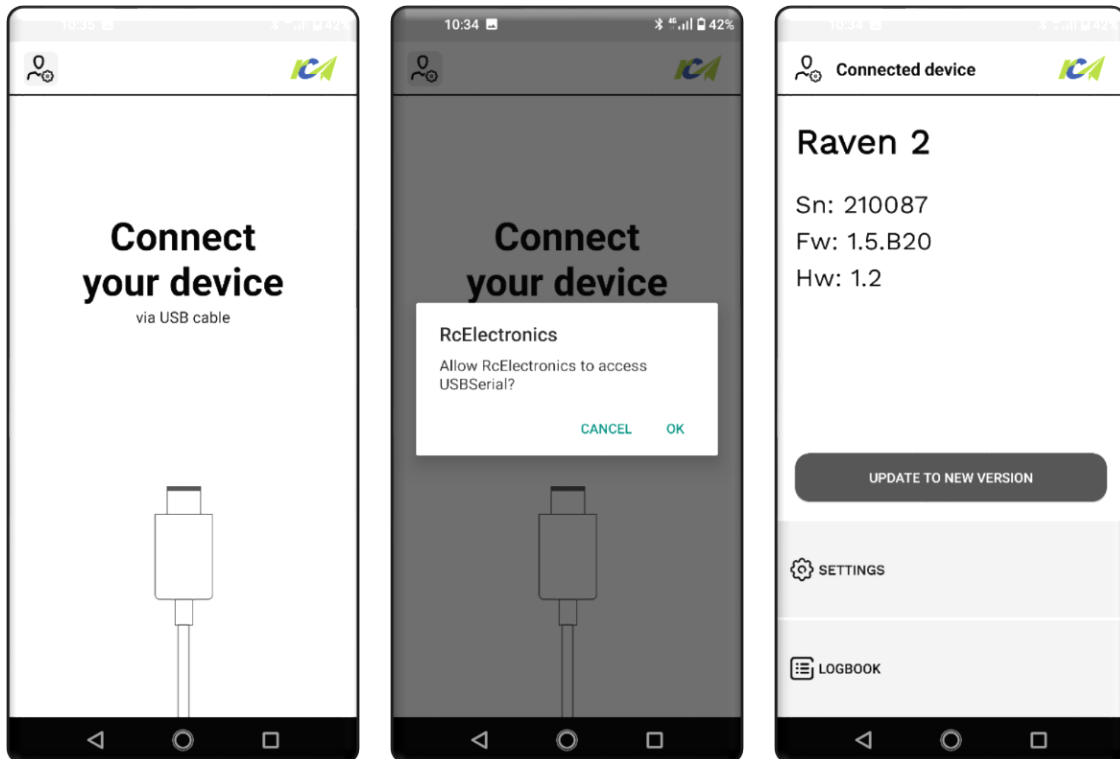
You will be able to see basic info of the connected device, set the settings and download the IGC flight from device if needed.

Important settings:

Telemetry pair key:

Enter your ground unit serial nr to have a valid RF link.

Telemetry:

Select which 3rd party telemetry protocol will be used on Servo connector.

Servo channel:

Servo channel for servo control. If disabled then normal PWM servo input on device is used, else *servo channel* from 3rd party telemetry data will be used for servo pulse measurements.

Other settings are set in Albatross and will be synced via RF link. Set them only in case of standalone usage or no RF link usage.
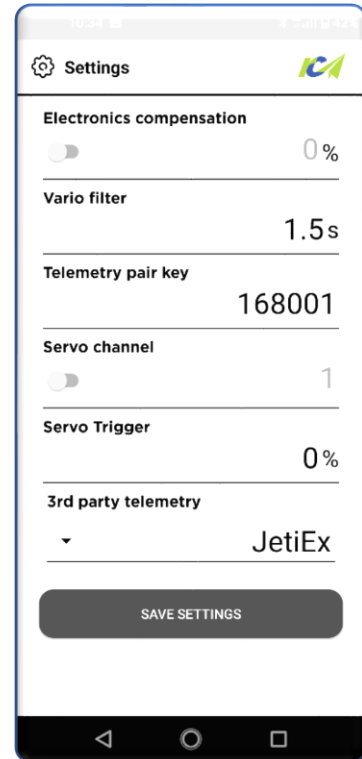
Electronics compensation:

Level of electronics compensation used. Start with 98% and then fine tune if needed.

Vario filter:

Vario response time in seconds.

Servo trigger:

Servo trigger in % for arming the task for GPS triangle flying. When such level of servo pulse is detected, additional record is stored in IGC file

Modes of operations

Electronic compensation

Electronic compensation can work only when an IAS probe (Indicated Airspeed) is installed in aircraft and connected to Raven 2 PRO. It is used when the user wishes to fine tune the TEK probe (TEK probe can be over or under compensating dynamic change of plane). For fine tuning of TEK probe set TE level in range of -5% to +5%. When TEK probe is over compensating then reduce the value and if not compensating enough then increase the value.

It is also possible to use electronic Total Energy compensation exclusively with the unit. In this case the TEK probe is not needed and can be removed. Pte static port on Raven must be then connected to Pst port measuring static pressure. When using only electronic compensation the user should set TE level somewhere between +90% to +105%.

Setting the right value takes some time, after a new value is set, a test flight should be made in still conditions. When properly adjusted, diving and pulling up should not produce any change in Vario tone. This goes to using fully electronic compensation or fine tuning TEK probe.

Each aircraft will have a different TE level setting, time spent adjusting and testing will be beneficial.

Firmware update

For updates, please use Android RcElectonics app. Provide internet access and app will automatically download latest firmware from our cloud.

Connect the unit to any Android device where RC electronics app was installed from Google Play using a USB cable which has OTG mode supported on Android device side. Such cables (micro USB or USB-C can be purchased from www.rc-electroncis.eu web-shop)

Run RC electronics App and confirm USB connection.

If there is any newer version available, then "UPDATE TO NEW VERSION" button will be visible. Click on it and update will start. Unit will reset 2 times in this process so you will need to confirm USB connection to the Android device for 2 times. During update blue LED is turned on. After update, the update button will disappear.
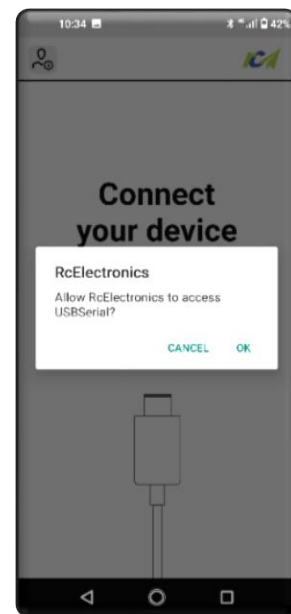
Bellow is an example of what user will see during update process. Update from v1.5.B20 to 1.5.B30 for example:
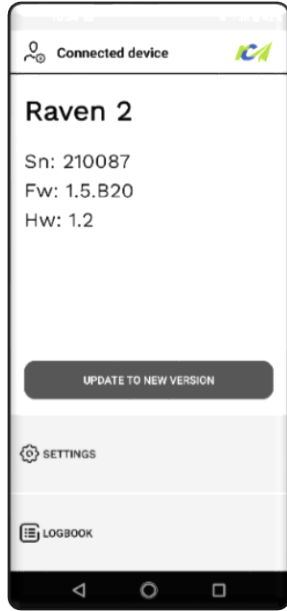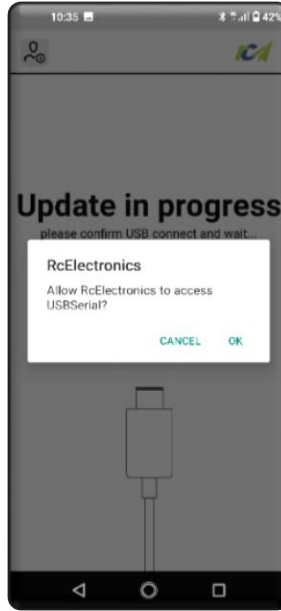

Welcome screen   Connect the device   Confirm USB connect
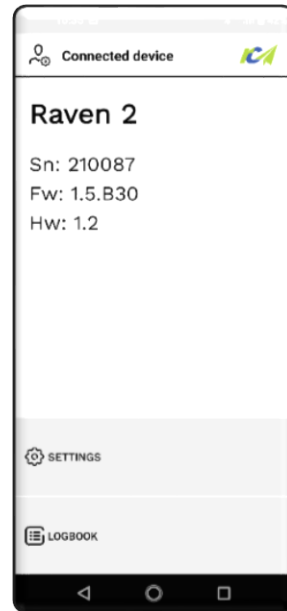
Click "UPDATE" button

Confirm USB connect

Wait ….

Confirm again after update

New version is installed

Revision history

28.03.2023	v1.1	- RC electronics app is replacing RC electronics PC tool
03.01.2023	v1.0	- initial version