

# New functions and changes summary

---

A comparison of PitLab & Zbig FPV System versions 2.50 and 2.40

## Table of Contents

- New features .....2**
  - OSD and autopilot .....2**
    - Navigation modes .....2
    - Routes.....2
    - Takeoff.....2
    - Automatic landing.....3
    - Advanced stabilization options.....3
    - Course stabilization.....4
    - RC monitor.....4
    - Current airplane elevation.....6
    - Ignore RTH for time period.....7
    - Engine ON statistics.....8
  - Ground Station.....9**
- Changes in existing functions.....9**
  - OSD .....9**
  - Autopilot .....9**
  - Ground Station.....9**
- Bug fixes and resolved issues in this firmware release .....10**
  - OSD .....10**
  - Autopilot .....10**
  - Ground station .....10**
  - FPV\_manager .....10**
- Compatibility .....10**
- Known issues in firmware 2.50 at time of release .....11**

## New features

### OSD and autopilot

#### Navigation modes

New Navigation modes are available in manual and autonomous flight including a mode for avoiding high obstacles. Please see the document **Navigation modes in Pitlab & Zbig FPV System EN.pdf** available on PitLab's web page.

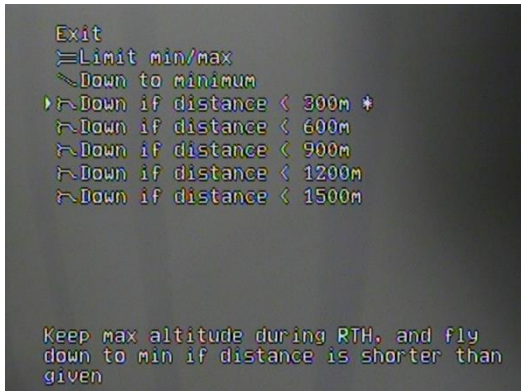


Figure 1 – OSD menu with new RTH modes

#### Routes

This version includes new functionality for defining long, multi-segment routes and then following these predefined paths during flight. Unlike waypoints each route has virtually no limit on its length or shape, and there is an easy method for defining routes. Please see the document **Routes in Pitlab & Zbig FPV System EN.pdf** available on PitLab's web page.

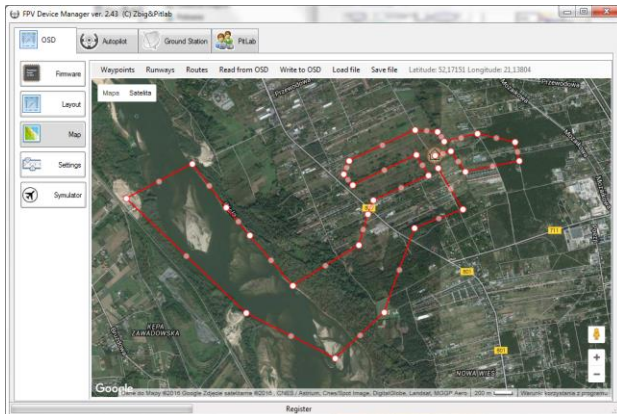


Figure 2 – Sample route defined in FPV\_manager

#### Takeoff

The new takeoff support functionality helps launch an airplane by keeping the plane level and climbing at a desired takeoff angle without unwanted roll or the risk of a stall – all without assistance from the pilot. Please see the document **Takeoff support in Pitlab & Zbig FPV System EN.pdf** available on PitLab's web page.

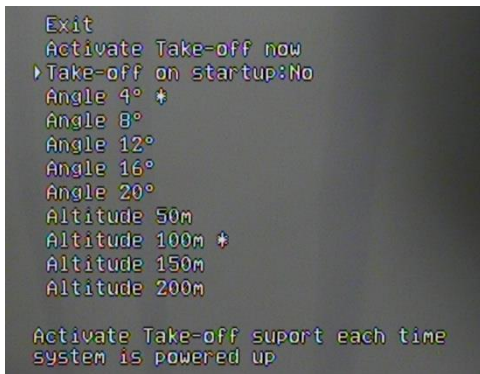


Figure 3 – OSD screen with takeoff submenu

### Automatic landing

The automatic landing feature in the Pitlab & Zbig FPV System allows for safe and accurate model airplane landings without direct pilot involvement. It may be used in regular landings, but is also a great emergency aid in the case of reduced or no visibility (e.g. fog, darkness, drops of rain on camera lens etc.) or video link failure. The feature supports multiple, possibly remote, runways. Please see the document **Automatic landing in Pitlab & Zbig FPV System EN.pdf** available on PitLab's web page.

### Advanced stabilization options

A new menu, **Advanced**, has been added for stabilization options under the **Pitch** and **Roll stabilization** submenus. This option is intended only for advanced users with knowledge of PID controllers, and for airplanes with special flight characteristics. The advanced settings are used in STAB and AUTO modes.

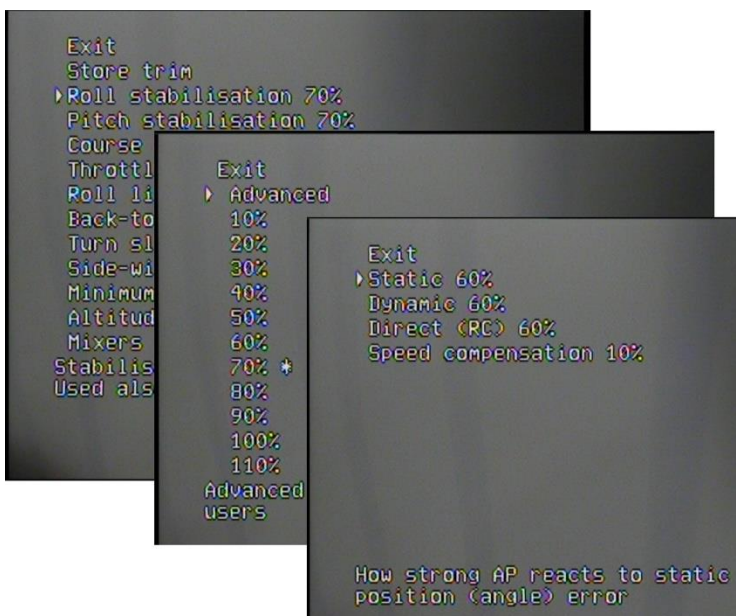


Figure 4 – OSD structure for advanced stabilization.

The new **Advanced** submenu consists of 4 settings:

- **Static** – determines the strength of the autopilot's reaction to position (angle) error. It is the **Proportional** part of PID.

- **Dynamic** – determines the strength of the autopilot’s reaction to unexpected airplane rotation (angular speed). It is the **Derivative** part of PID.
- **Direct (RC)** – scales how much signal from the transmitter is transferred directly to the servos (this is not a part of PID).
- **Speed compensation** – this parameter compensates for the higher efficiency of steering surfaces at high speeds. It is used for fast airplanes and eliminates the risk of oscillations at high speed.

*Note: for most airplanes there is no need to change the advanced options. Default values for static, dynamic and direct parameters are 60% and 10% for speed compensation. With these default values an airplane will behave the same way as in previous firmware releases.*

### Course stabilization

This new option helps keep a straight course in STAB mode. It is based on the gyroscope only and utilizes the rudder for keeping on course. This is not full heading hold functionality (for full course hold use the AUTO/HOLD mode), but significantly reduces course changes caused by wind gusts or pan/tilt movements.

*Note: course stabilization may be also used to verify rudder reverse. When reverse is properly set, if an airplane is rotated nose left or right, the rudder will react against this rotation.*

The Course stabilization level can be changed from 0 to 100% in 10 % increments.

### RC monitor

The RC monitor is a new OSD field which shows information about the state of up to 5 RC channels: Throttle, Aux2, Aux3, Aux4 and Aux5. This field gets information about RC channel states from the autopilot. (An autopilot is required to use this feature.)

The RC monitor displays channel information in a fixed vertical layout. Each field in the display has a name, optional graphical or numeric visualization of the current channel state, and a conditional requirement for when the field appears.

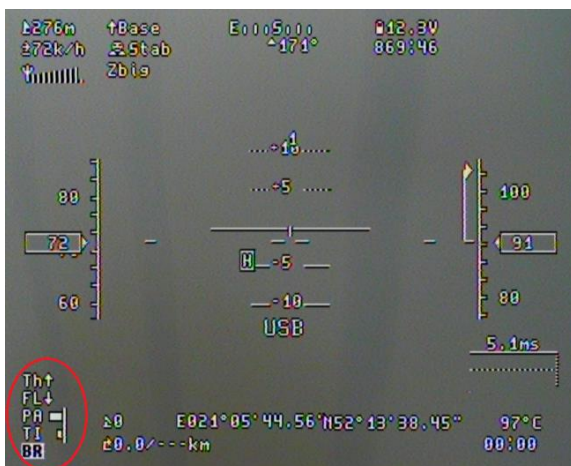


Figure 5 – OSD screen with an active RC monitor showing five fields

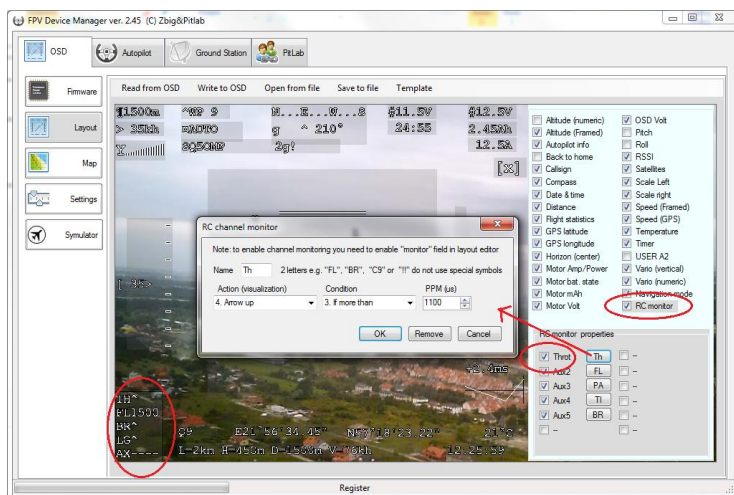


Figure 6 – Editing the RC monitor field using the Layout designer

To configure an RC monitor on the OSD screen follow these steps:

- Run FPV\_manager and open the OSD->Layout page.
- Read the current layout from the OSD or select a predefined layout template.
- Enable the **[v] RC monitor** field in the list of fields.
- In the **RC monitor properties** frame select the channels you want to monitor (e.g. **[v]Throt**).
- Click the small button next to the selected RC channel to open its configuration dialog.
- In the configuration dialog provide a 2 letter field name, visualization type and a condition for this visualization. Approve and close the dialog.
- Use the mouse to drag the **RC monitor** field to the desired position on the OSD screen. The field size will change according to the number of channels selected.
- Save the layout to the OSD.

The system provides different visualizations and conditions for controlling how and when the visualization appears on the OSD screen. The provided conditions allow for showing a field only in special cases e.g. flaps down or camera pan/tilt not in neutral position.

Possible conditions are as follows:

1. **Always** – Both the name and additional visualization are shown on the screen all the time.
2. **If less than** – The additional visualization is shown only when the current PPM pulse is shorter than the given value
3. **If more than** – The additional visualization is shown only when the current PPM pulse is longer than the given value
4. **If not close to** – The additional visualization is shown when the current PPM pulse is not within  $\pm 200$  microseconds of the provided value.
5. **If close to** – The additional visualization is shown when current PPM pulse is within  $\pm 200$  microseconds of the given value.

Possible RC monitor visualizations are as follow:

1. **Value ( $\mu$ s)** – The current PPM pulse length in microseconds is shown next to the field name. (e.g. TH1500)

2. **Percent** – The current PPM pulse as a percent of the nominal range is displayed next to the field name. (e.g. TH52)
3. **Arrow down** – Show the field name and a down arrow (e.g. FL↓).
4. **Arrow up** – Show the field name and an up arrow (e.g. LG↑).
5. **Auto up/down** – Show the field name and an up arrow, dash (–) or down arrow depending on the actual PPM value.
6. **Reversed up/down** – This is the same as **Auto up/down**, but the arrow direction is reversed (for reversed channels).
7. **Show name** – If the condition is true, show just the field name. Hide the name when the condition is false.
8. **White background** – show the field name in normal text mode when the condition false, but use black letters on a white background when the condition is met (alarm state).
9. **Bar** – show the field name and a horizontal bar proportional to the current PPM pulse for that channel (with a zero midpoint at 1500 microseconds).

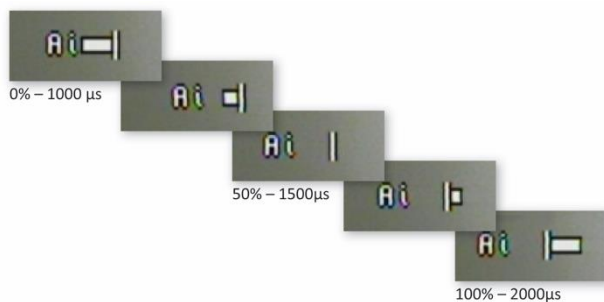


Figure 7 – RC Monitor Bar visualization at different PPM pulse widths

*Note: channels Aux2 to Aux5 are available only when using a CPPM or SBUS connection. These signals are unavailable with a parallel receiver connection.*

The name for each field is optional and may consist of one or two letters, numbers or basic symbols available on your keyboard. Except in the case of **Show name**, the name field is always displayed on the OSD regardless of the state of the condition. The name serves to differentiate channels on the OSD screen and should be given a useful mnemonic, e.g. **TH** for throttle, **FL** for flaps etc. If the name field is empty only the additional visualization will be presented on the screen.

To save screen space use just the **Show Name** or **White background** modes with an appropriate condition to indicate just the alarm state for particular channels (e.g. landing gears in retracted position). Using the condition in this way keeps OSD screen space clear when the channel is not in an alarm state.

### Current airplane elevation

This function shows the current airplane elevation and glideslope angle.

*Note: This is an experimental function. Experimental functions are implemented in this version of the firmware but for some reason are not yet officially released. Experimental functions may not be finished, have awkward visualizations or configurations, and may not be fully tested yet. But they may still be interesting for some users. Experimental functions may be changed or even removed in future releases. We invite feedback on these features.*

To activate this information enable the second (unlabeled) property field [V]----- in the **Vario (numeric)** field in the layout designer.

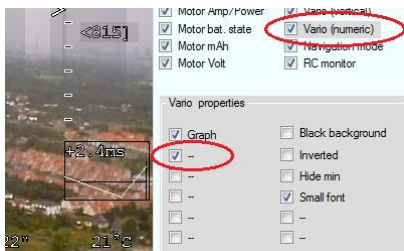


Figure 8 – Layout designer with elevation field active

This field presents two numbers with a slash between them. The first number is the current airplane elevation angle, and the second is the current glideslope angle. When the airplane is flying down, the glideslope angle is positive; when climbing, the glideslope is negative.



Figure 9 – Vario field with experimental elevation information

Comparing these fields during gliding will allow determining whether an airplane will be able to reach the base point (when current glideslope is lower than current elevation), or not.

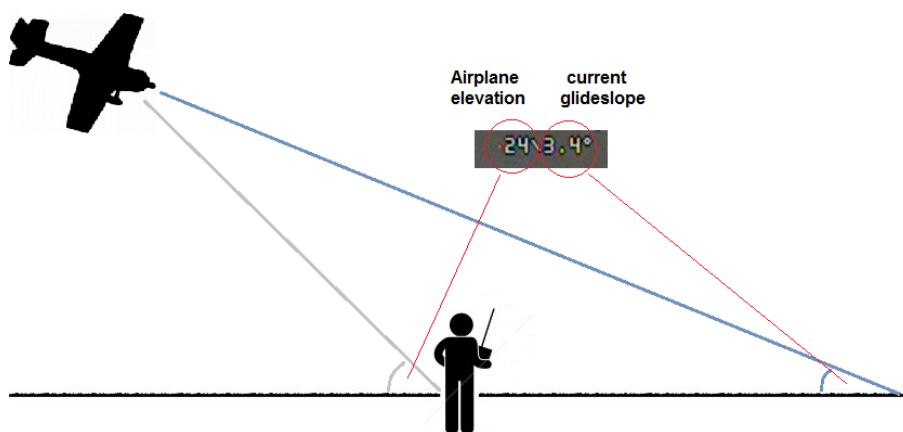


Figure 10 – Meaning of Current Airplane Elevation fields

### Ignore RTH for time period

This option allows for temporarily disabling RTH/RTR functionality. During the time period when this option is active, the autopilot will continue in the present Auto mode (Hold, Route or Waypoints),

even if the RC link is lost or there is a system failure. For the given period of time, **throttle down** commands from the receiver will be ignored.

This allows for the completion of waypoints or a route flight in locations where the RC link may be lost (behind hills, distant flight at low altitude, etc.).

When using this function, if the autopilot is in manual (STAB, OFF) mode and a failsafe condition occurs, the autopilot will engage AUTO mode. But instead of invoking RTH, it will force AUTO Hold, Route or Waypoint mode depending on the current manual navigation mode.

*Note: In "Ignore RTH" mode when the failsafe condition is detected (AUTO mode and throttle down), the autopilot will invoke AUTO mode and simply replace the "throttle down" signal with "half throttle".*

The duration of the Ignore RTH mode can be set from 1 minute up to 2 hours in 11 steps. At any time you may cancel this mode by selecting "No" for the time period.

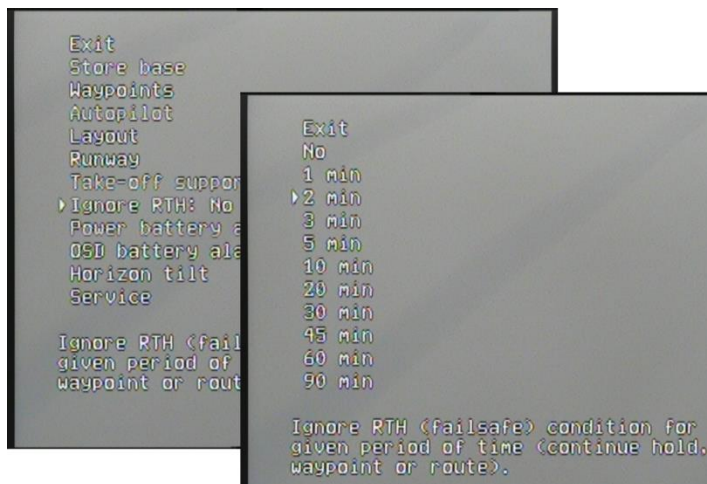


Figure 11 – Options for the duration of Ignore RTH

When Ignore RTH mode is activated, the system will start counting down the time until RTH control returns. This remaining time will be displayed on the OSD in a field with a blinking background.



Figure 12 – Blinking background for remaining time

### Engine ON statistics

This is a new field shown in post flight statistics. It counts the time the engine was on (PPM pulse on throttle channel is greater than 1150 microseconds) since the OSD was powered on. It takes into account the time the engine was on in AUTO mode as well. This information may be especially helpful for gliders. This statistic (as well as all others) is reset when the plane is not flying and the **Store base** command is executed from the OSD.



## Ground Station

- Added an option for controlling the Comtech 1.2Ghz RF modules (video receiver) and other compatible receivers (e.g. Fox, Rangevideo). It allows for manual channel setting and can scan channels in the range from 1100MHz to 1300MHz in 10MHz steps. More than one module may be controlled at a time.
- Added 7 speed options for tracking antenna servos and active acceleration/deceleration characteristics. This functionality is meant for use with heavy antennas such as Yagis and helicals.

## Changes in existing functions

### OSD

- In **Waypoint** mode the icon next to **distance** was changed from a generic up arrow to a waypoint.
- In **ILS** mode the icon next to distance was changed from an up arrow to a runway icon: **#**.
- The OSD menu **Language and units** was moved into the **Layout** menu.
- The OSD menu **GPS settings** was moved into the **Service** menu.
- In HOLD mode deflecting elevation stick more than 30% will change actual HOLD altitude.
- In HOLD mode deflecting aileron stick more than 30% will change actual HOLD course.
- Distance displayed on OSD screen is extended beyond 99999 (meters or feet). Above this value OSD will change display into kilometers or miles with 0.1 km (or mile) resolution

### Autopilot

- In all AUTO modes the autopilot will now follow a straighter line to the destination point regardless of side winds and other disturbances.
- When in AUTO **Circling** at GPS point mode the autopilot will fly in a regular circle with a radius of about 100m centered on the GPS point, rather than loitering above the point in a figure-8. The pilot can change the circling direction by moving the aileron stick to the maximum position left or right.
- In AUTO RTH/RTR mode, when the airplane reaches the destination point the autopilot will fly in a figure-8 shape centered on this point.
- SBUS input values are converted into PPM outputs with extended range (+/- 135% or 860-2160 microseconds).
- Some minor changes were made in the algorithms used for maintaining altitude.

## Ground Station

- SD card logging will now start automatically only when the GPS is ready and the base position has been stored in the OSD. This is the point when FIX appears on the OSD. (Previously logging started automatically when the first telemetry data was received.)
- The SD card speed test has been removed.

## Bug fixes and resolved issues in this firmware release

### OSD

- In some cases, the GPS was not properly initialized during startup. (OSD showed **baud error** in GPS field.)
- In **Vario** text field, when **[v]graph** option was enabled the vario numbers could overlap graphics.

### Autopilot

- When an airplane was flying directly away from the base point (180 deg) and AUTO/RTH mode was turned ON, sometimes the autopilot wobbled several times to the left and right before finally making a full turn towards the base.
- In AUTO mode when the autopilot was above the desired altitude (maximum altitude limit) the elevator moved with significant steps (not smoothly).
- In SBUS input mode trim in STAB/AUTO mode was shifted slightly (12 microseconds) from OFF mode

### Ground station

- When entering the SD card **mass storage** option without a USB connection the Ground Station would hang without an **exit** option.
- In some cases log file has no proper date and time set.

### FPV\_manager

- In the layout designer when **[v]small font** was selected, the field size remained unchanged and the field could not be moved to the maximum right or down positions.

## Compatibility

Firmware 2.50 is compatible with **all OSD** boards (v2.0, v2.1, v2.2 and v2.3).

Firmware 2.50 is compatible with **all autopilot** boards (v2.0, v2.1 and v2.2).

Firmware 2.50 is compatible with **all Ground Station** boards (v1.0 and 1.1).

*Note: This is the last firmware version that will be compatible with OSD boards v2.0 and 2.1. All future major releases will work only with board v2.2 and v2.3 (produced and sold since July 2013).*

The FPV\_manager can be used to determine the version of the OSD board if you are using bootloader version 1.2 or later. In the FPV\_manager, hardware version 2 means v2.2, and value 3 means v2.3. Any other value (0 or "unknown") means boards v2.0 or v2.1.

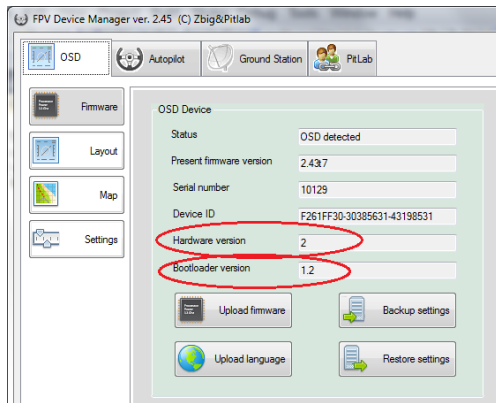


Figure 13 – FPV\_manager with hardware and bootloader version

Alternatively, during OSD startup when using firmware 2.50, the hardware version is presented on the screen regardless of the bootloader version. The text **(hw 2)** means v2.2, **(hw 3)** means v2.3 and the text **(hw 0)** means boards v2.0 or v2.1.

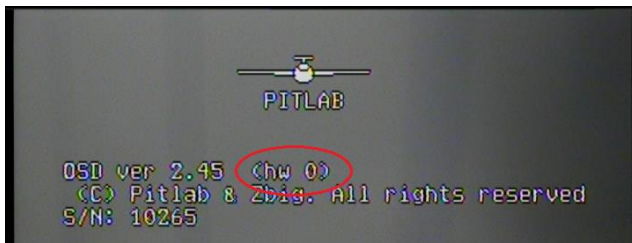


Figure 14 – OSD screen during startup with firmware 2.50

## Known issues in firmware 2.50 at time of release

- In French and German systems, some menu items and on screen help text for new functionality may not be fully translated from English. The same may apply for other language translation files available on Pitlab's web page (Russian, Hungarian, Netherlands, Portugal)