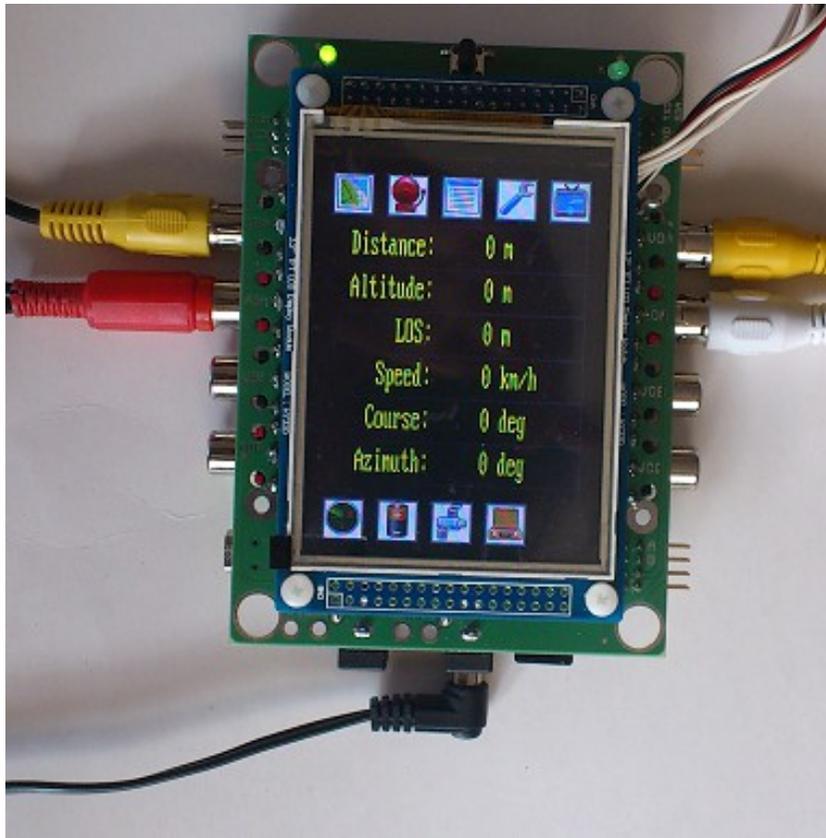## Intended Use

Ground Station is a device that supports modelers flying FPV. It works with a set of Pitlab OSD, realizing the features of the diversity driver with AV signal splitter and preview the received signal, telemetry receiver with log recording functions, tracking antenna controller and power manager of ground equipment.

Device Control and presentation of information is done using a color LCD with touch panel.

Diversity

The device is equipped with a dual-channel diversity driver for Audio / Video signals, making the automatic selection of AV signal of better quality, with two receivers connected to the device. The system works with composite video and audio signals, does not require any modifications to a video receiver.

The system continuously compares the quality of the video signals from two inputs and selects the input source with less noise. In contrast to the driver based on a comparison of the RSSI signal in this case the initial or periodic calibration of the system is not needed and connected receivers do no need to be identical (and even do not have to work on the same channel or in the same band). The only requirement is that both controlled video signals should come from a single source (the same camera).

The system has a built-in video splitter and allows you to connect up to 3 receivers of audio / video signal.

Telemetry receiver

The device receives the additional information encoded in the video signal by OSD. This information is used to determine the current position of the model, the direction of flight, state of power supply, as well as many additional information useful for the current flight control and allow for immediate indication of alarm.

The telemetry data from each flight can be saved on the SD card and can be used for later analysis of individual parameters change during the flight, or the flight route visualization on the map. Information on the last received value of GPS position makes it easier to find a lost model.

Tracking antenna controller

The device controls the receiving directional antenna by tracking the position of the model in the sky, thus providing a maximum range and highest quality audio / video transmission.

Aiming the antenna at the model is made based on the current GPS position of the model (distance, direction, altitude), transmitted in the telemetry data along with the video signal and does not require any additional devices (transceivers) for their transmission from the model to the ground.

Electromechanical system directly moving an antenna is a separate device that can be purchased or made by oneself.

Power Manager

The ground station controller is equipped with a system for measuring the voltage and current (up to 10A) and allows for controlling the power consumption of all devices connected to it, such as receivers, monitor, goggles, recorder, etc. In conjunction with settable alarms it increases flight safety.

Electrical connection

The electrical installation should be performed with extreme care, since it affects flight safety, and the quality of the signal being processed. Incorrect connection of the power and ground wires can cause damage to the controller or devices working with it.

Power supply

The system is designed to be supplied by 12V (10V ... 16V), with a typical 12V gel battery, 3-cell LiPo / LiIon or 4 LiFe cells. It is also a typical voltage supply for other ground equipment, such as monitors, goggles, recorder or video receiver.
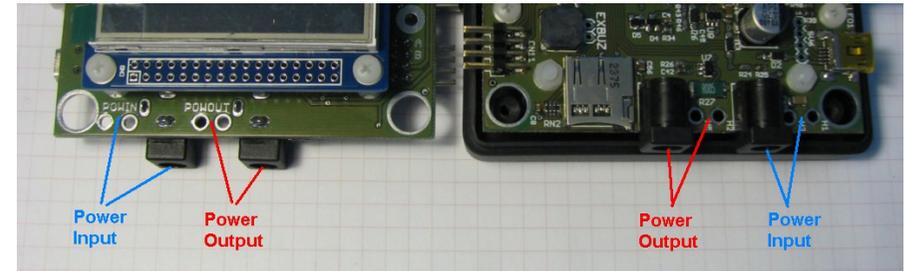

The controller has an input and the power output terminal, however, to improve safety and reliability, we recommend soldering power cables directly to the solder holes prepared for this purpose that are next to terminals, eliminating any connectors, or by using high quality model connectors (goldpin, Deans, etc.). It is important to use the connector that prevent reversing the polarity (+) and (-) of power supply.

Accidental swapping of the input and output power connectors does not cause problems, except for the lack of current measurements (current measuring circuit is unidirectional).

AV inputs and outputs

Please connect both inputs and outputs via standard RCA connectors AV (RCA). The system has two sets of AV inputs, where AV signals from two AV receivers should be connected.

Inputs / **Outputs**

Video A → Video 1
Audio A → Audio 1
Video B → Video 2
Audio B → Video 3
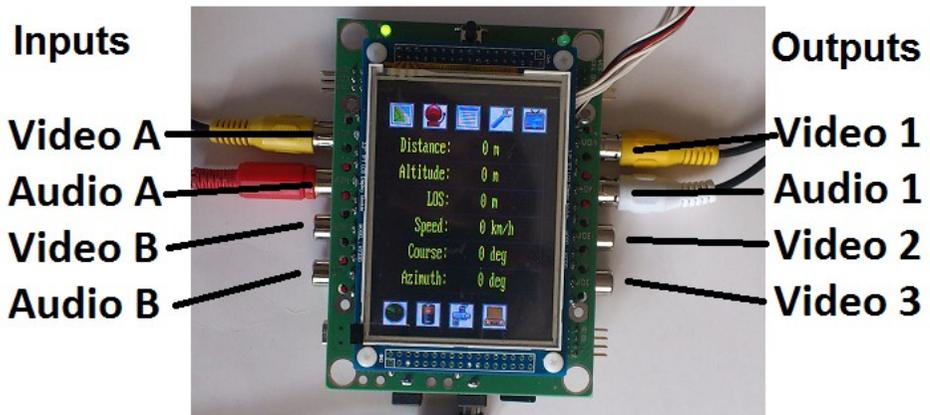
It is possible to connect only one receiver, in this case, the device detects the presence of the signal on one input, and selects this input. Video output signals of the controller are directly available at 3 outputs. Applied specialized integrated AV signal keying chips ensure the transmission of signals from input to output without lowering their quality or performance. The audio signal is available directly at one output. A set of audio, video and USB are also available on pin connectors mounted on the PCB. This method of connection may be convenient for building the device in a non-standard housing.

The audio output can be mixed with alarm signal from the telemetry receiver. The level of alarm signal can be determined by a potentiometer on the controller board.

Tracking antenna

The unit controls two servos of the tracking antenna (AV directional receiving antenna). The azimuth servo directs the antenna to the appropriate compass direction and the elevation servo to the desired height above the horizon. Servo leads (or their extensions) should be plugged into the pin connector on the controller board.

Azimuth servo
Elevation servo
+5V
Ground
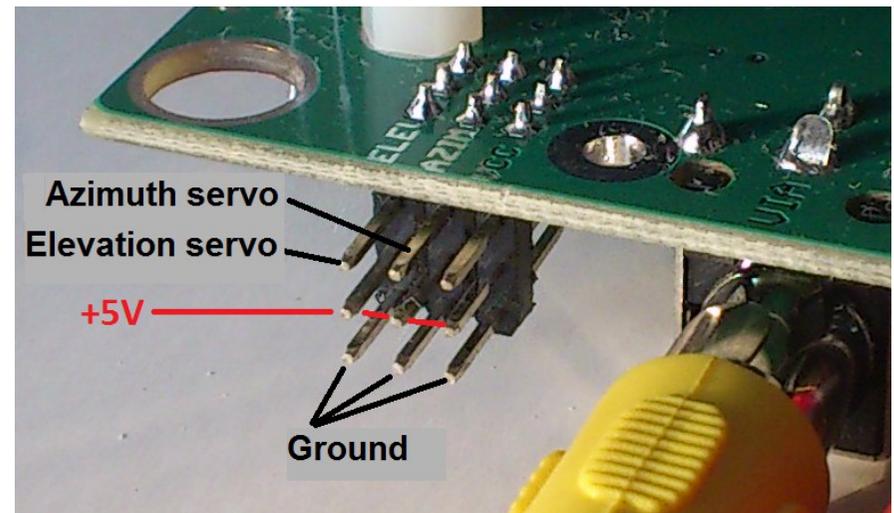
 Servos that control the antenna require additional power supply (5 .. 6V) from a separate voltage regulator (must be purchased separately), providing adequate current capacity to applied servos and dimensions of the receiving antenna. We recommend the use of the switched mode controller UBEC with a capacity of at least 3A. The controller output can be connected to the same connector like the servo, but in the case of large, loaded servos with long extensions we recommend placing the UBEC controller next to the servos, due to the possibility of the generation of interference.

Device operation

The device is operated by a color LCD with touch panel. Screen size and applied methods of communication make operation possible by direct pressing the appropriate space on the screen with your finger and do not require additional accessories (pens). Applied resistance mechanism makes the screen able to be operated in gloves. In order to protect the screen from excessive damage (scratches), you can apply additional adhesive polycarbonate film used for the screens of mobile phones.

NOTE: The LCD screen is relatively gentle and powerful impact may cause its rupture. In the case of damage to the display screen it can be purchased as a spare part.

At the top of the screen there are icons of basic functionality, which are "pushed" to change the screen and the presented data. These screens are as follows (from left):

• The route and telemetry data logging screen

• The screen of active alarms

• The screen of telemetry data

• The screen of settings and configuration

• Diversity control and preview video screen

In the middle of the screen there are information specific to the selected features, and at the bottom of the screen there may be an icon or command causing additional features or information specific to the screen.

In the settings window, all changes are saved automatically when they are changed and do not require additional approval. Changing the numerical value (e.g. alarms) takes place in a special box with a numeric keypad and requires an approval process (close the window) click [OK].

NOTE: If the screen does not respond to pressing, or reacts in the wrong way (for example, choosing the wrong option), you must re-calibrate the touch panel.

Device Configuration

Most configuration settings are made in the settings window marked with a key icon in the top bar icons. Further selection of configuration options is made by pressing the appropriate lettering on a light background in the settings window.

Setting the alarm for telemetry data, and GPS data display format is made directly in the telemetry data window, by pressing the line presenting selected telemetry data.

Setting the audio mixer and video inputs balance is made by potentiometers on the controller board.

Range of motion of servos and reverses

For proper operation of the tracking antenna it is necessary to determine the appropriate range of the control pulses to get the servos move in the range of 180 degrees (+ / - 90 degrees from the neutral position). Some servos can provide movement in such range only by setting a range of pulses, others may require appropriate modifications (soldering additional resistors or removing the limiters of mechanical movement. We set the position of the minimum, maximum, neutral position, and reverse of the direction for elevation servo and azimuth servo separately. Servo calibration option includes diagnostic buttons that allow you to set the antenna presets, allowing for verification servos' reverses.

Binding Telemetry

Telemetry receiver receives telemetry data encoded by the OSD in the video signal. If during the flight a different set of FPV is activated near the receiver working on the same video channel, then in addition to "overlapping" the vision of the second transmitter, telemetry data can also be "overlapped", causing the antenna move in the wrong direction. To avoid this problem, since version 2.13 the OSD has the ability to provide telemetry data with a unique identifier, eliminating the problem of tracking antenna switch in the direction of another video transmitter (FPV kit) accidentally switched on the same video channel.

By default, this telemetry identifier is set to be compatible with earlier versions of the OSD (OSD M644 and Pitlab OSD firmware to version 2.12.) After establishing a unique identifier in the service menu of the OSD, turn on the video set and select telemetry binding option in the ground station driver d. The controller will automatically analyze the telemetry data, specify the unique identifier and capture it.

NOTE: The signal informing that the base station receives the video signal from the other, non-binded OSD is telemetry data CRC value equal to zero, and the lack of (or freeze) all telemetry data.

At any time you can change the telemetry binding, or set the default binding to an earlier version of the OSD.

Calibrating current and voltage

Current and voltage measuring systems are factory calibrated, but with the passage of time, or because of the limited linearity of the measuring elements may need to be re-calibrated in order to obtain accurate readings and measurements. To change the calibration you will need additional multimeter (voltmeter and ammeter with 10A range). The voltage measurement is made at the input of the device from the supply battery side. Keep in mind that long and thin wires can cause significant voltage drops, so the measurement directly on the battery will not be reliable. We also measure the current on the power wire of the unit (not at the output to other devices), because the measuring system measures the current consumed by the driver itself. For maximum accuracy, you should calibrate the current with the load all the devices that will be powered by the driver.

Calibrating the display

The device has factory calibrated touch screen, but if the screen does not respond to pressing, or reacts in the wrong way (for example, choosing the wrong option), it should be re-calibrated.

We call calibration settings in the menu, or by powering the unit with pressed-screen. The calibration function means to precisely touch three consecutive points on the display, marked with crosshair [+]. After calibration, the device switches to normal operation.

Parking the antenna

Parking tracking antenna servo causes a shift to the position of maximum, resulting in the folding of the mechanical components in a more comfortable position for transportation. In this state, the antenna does

not rack the model. Unparking the antenna and return to track mode can be performed manually by re-calling this function.
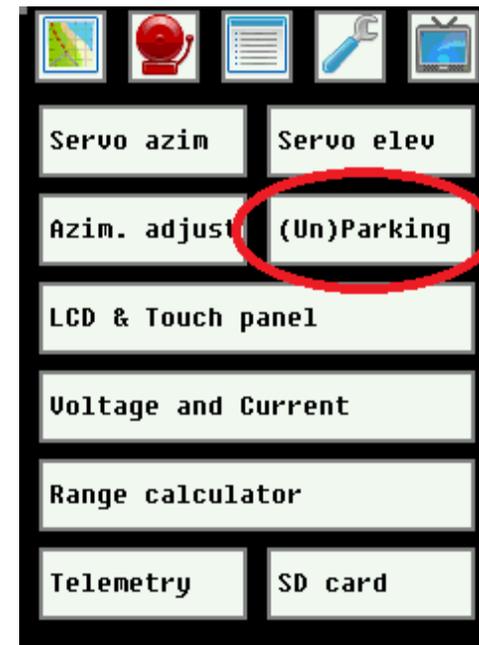

When you turn on the controller power, the antenna is ready for tracking and tracking starts automatically when telemetry data and GPS position of the model is received. It is not necessary to manually unpark the antenna.

Balancing AV inputs

Both video diversity inputs have identical characteristics and are interchangeable (it does not matter which receiver is connected to which input), but it may happen that different receivers have different output video signal level (whiteness level), then when switching of the input channels change in brightness may be visible. This problem can be compensated by using a multi-turn potentiometer on the controller board.

Switching (manually) video inputs and turning the potentiometer we choose such a position at which the brightness changes are minimal. After the calibration, remember to keep the same way of connecting receivers to video driver inputs, because after swapping the receivers connected to the inputs, the problem of the brightness changes will be even stronger.
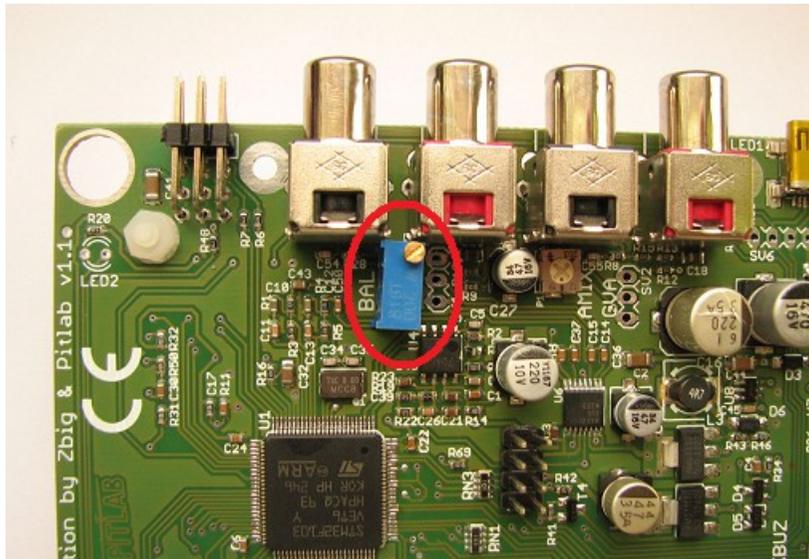
In most cases, when using the same sets from the same manufacturer, there is no need to balance the video inputs.

Audio mixer

The controller is equipped with an internal speaker that emits sound alarms. However, in many cases, the sound emitted by the internal speaker may be too weak (for example, when the driver is housed in a suitcase, placed on a mast or just away from the modeler. In this case, you can either connect additional external speaker (the wires should be soldered the solder pads on the PCB), or mix the alerts generated by the

controller to the received audio signal (e.g. played back through headphones in goggles). The level of mixed alarm to the output signal is adjusted via potentiometer on the controller board.

Prior to each use

Before each use of the driver you must take several steps necessary for its proper operation.

Tracking antenna setting

The mechanics of the tracking antenna must be positioned so that when the azimuth servo is set to the neutral position (zero) the antenna points north. Typically this is done by setting the appropriate antenna tripod, using a magnetic compass. You can also adjust antenna following these steps:

-set correct base position in the OSD (in a place of the tracking antenna)

-move away the model at a distance of 20-30m

-point the antenna towards the model.

The setting (adjustment) of antenna azimuth can also be done by software in the driver settings. After calling the azimuth correction options wheel symbol appears on the screen, where you can make a smooth adjustment of the position of (tracking) antenna. This is especially useful when you want to make adjustments already in flight, or when the antenna is mounted on a mast or roof of the car.

NOTE: The azimuth adjustment is not saved and after each turning on of the instrument power supply it must be set again.

The quality of the telemetry link

Before takeoff of the model, please check the telemetry link in the box labeled CRC. A value of 100% means excellent link's quality, and full communication between the OSD and the controller. A value of 0% means no reception of telemetry. This could mean for example, incorrect binding the driver to the OSD.
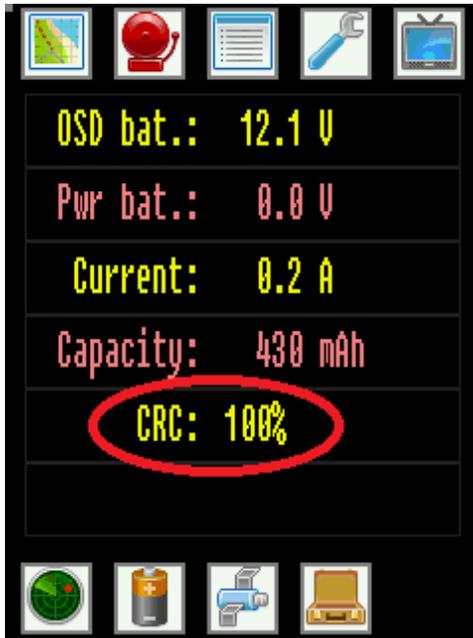

For convenience, you can set an alarm for a minimum acceptable level of link's quality (e.g., 10%), pressing the CRC line on the driver screen and displaying the calculator to set the alarm level.

Alarms

For safe operation, before every flight you should verify current alarm settings, according to the specifics of the planned operation (eg distance), the applied power (voltage, capacity) or local airspace restrictions (eg maximum flight level).

Alarm levels changes are made directly in the list of telemetry data, by touching a row of data. We also check the status of muting appropriate types of alarms in the alarms window, and we check which alarms are active and why.
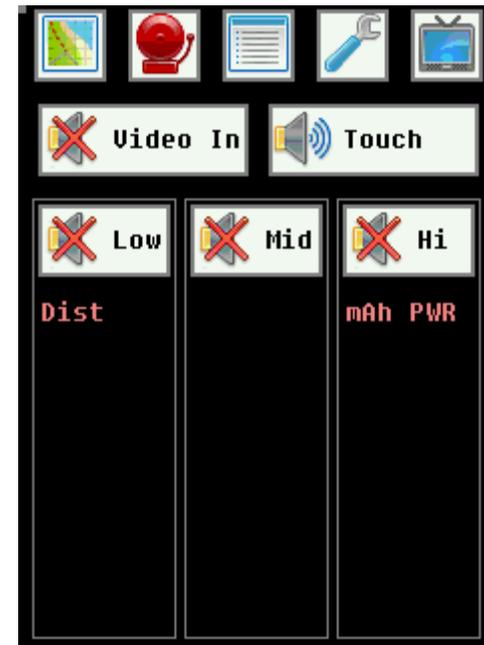
Recording logs

Full recording of telemetry data to the SD card must be activated manually by pressing the SD card icon on the window of flight route. Also stopping

recording telemetry data on the SD card is done manually by re-clicking the same icon.
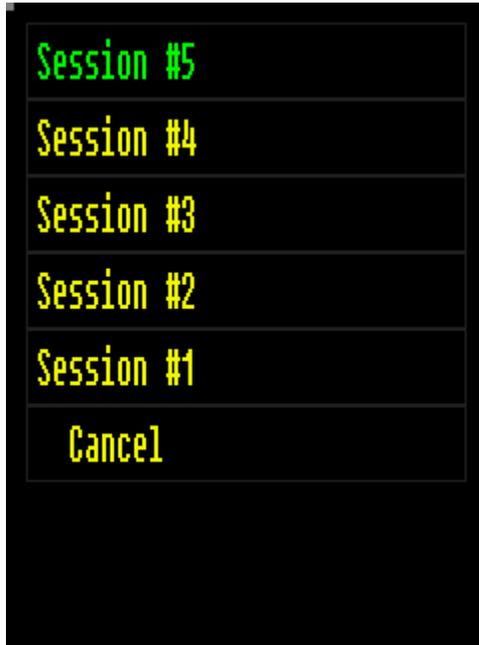
Screens and Features

All status information, current configuration, and received telemetry data are presented on the color LCD. Further, the active input of the diversity driver (of the selected video input) is indicated by lighting one of the two LEDs. The presentation of the data, the organization of screens and how to navigate is the solution protected by copyright, oriented to the simplicity and ease of use in the field conditions. All available functionality is available in five basic windows, and some of them include additional switching views.

Flight Path

The Flight Path window shows a graphical flight path traveled by the model. Each cycle of the device (from its power-on till the power-off) creates a single, sequentially numbered session, which is stored in non-volatile memory of the device. the information about the last 3 hours of flight is stored. Red flag on the center of the screen represents the position of the base, and the aircraft icon shows the current position of the model in relation to the base. Color of trace route varies depending on the altitude of the model at that point.
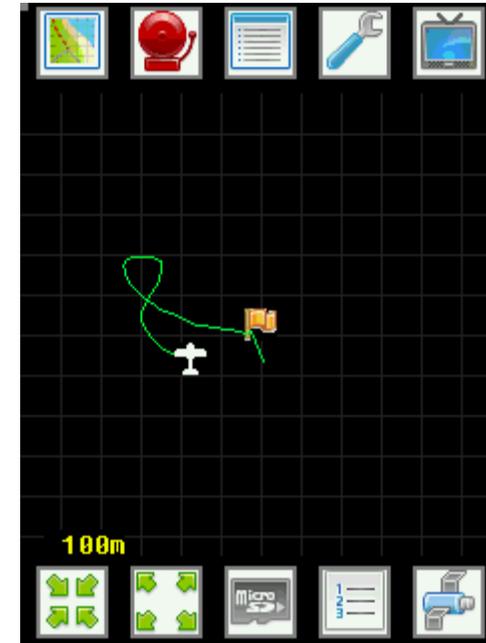
History of recorded routes (the last 7 routes, in the last 3 hours flight) is available at any time from the list.

```
Session #5
Session #4
Session #3
Session #2
Session #1
   Cancel
```

```
Last location #5
GPS Lon:  E021 04'02.07
GPS Lat:  N52 14'48.94'
Azimuth:  215 deg
Distance: 132 m
   Close
```

For each selected route, you can view the last known GPS coordinates of the location of the model. This information does not disappear when you turn off power to the controller. With it you can easily locate the lost model (or quite precisely specify the search area)
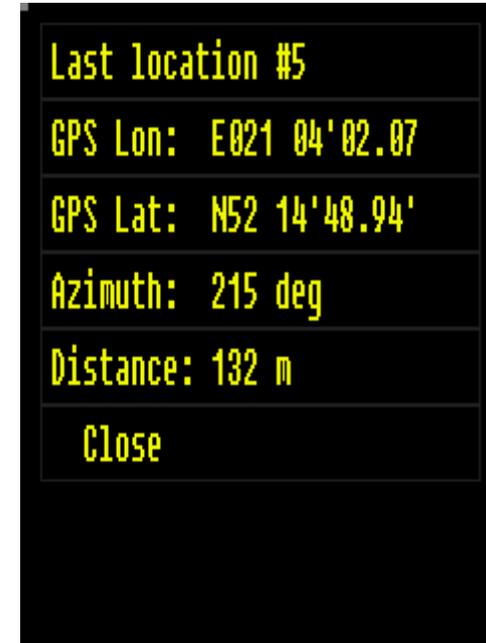
The sessions are always recorded and are initiated automatically when the model is at least 20 meters away from the base and its altitude exceeds 10m.

NOTE: Auto log is available only in the driver level and it is not transmitted to the PC and FPV_manager applications.

In the flight path, you can change the scale (grid) of the 'map', ranging from 50m to 5km, but always with the base at a central point (you cannot move the section of the path).

On the route we initiate the record of full log of telemetry to the microSD card. This operation is made by pressing the card icon. Proper record of telemetry data on the card is shown by the red dot on the SD card icon.

If there is no SD card the icon shows the symbol of crossed SD card.

Power failure during a log registration should not result in the loss of the log and previously recorded data from the currently registered flight, neither in an error on the SD card, but we recommend to manually stop recording the log, before the power is turned off.

Alerts and Sounds

Alarms and sounds page allows for quickly finding the cause of the alarm, and if necessary, exclude certain categories of alerts. Furthermore, the icon of choice of the alarm changes color to red when an alarm is activated.

Alarms are divided into three categories, listed according to the degree of severity of the alarm. In addition, each alarm level has its own individual sound pattern, which allows to distinguish the alarm category without looking at the screen.

LOW - low-priority alarms, information and warnings have no direct effect on flight safety

MID - medium priority alarms, about exceeding values which could affect flight safety

HIGH - the highest priority alarms, which have a direct impact on the safety of the flight (eg, discharge of fuel or video package) Under the mute button for each alarm category is a list of data that have reached an alarm status.

In the alarms and sounds, you can also mute touching the screen, and sound of audio / video input switching (diversity)
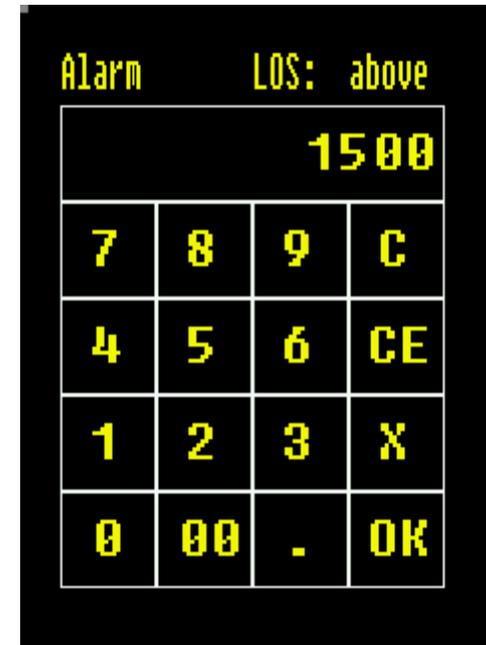
Telemetry

Telemetry window is the primary window that appears when you start the machine. It contains four sub-pages selectable by icons on the bottom navigation bar. These are the following pages: the position of the model,

the drive battery status, GPS information, and the power status of the base station.

Each page presents information in the form of a list of parameters and their current values. For most of the parameters alarms can be attributed, above which the alarm is triggered, and the item will be displayed in red.
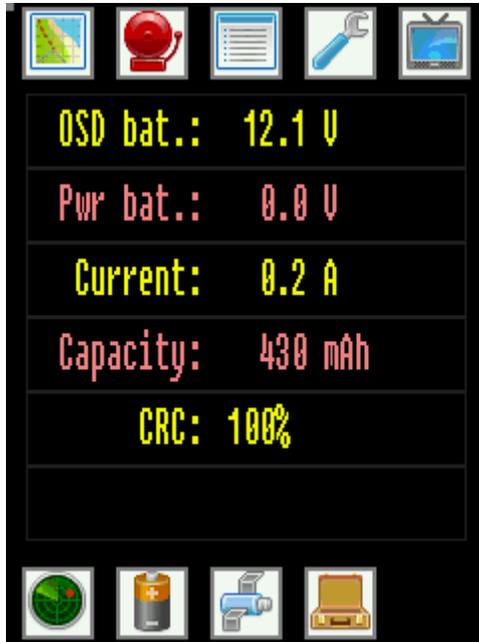
Changing the alarm value is done by pressing a selected row of data, and the numeric keyboard is displayed that allows changes to the alarm. After setting a new alarm values confirm the selection with [OK.].

Assignment of each telemetry data to category alarms (LOW, MID, HIGH) is permanent, as well as exceeding the value from up or down triggers an alarm (e.g. the battery alarm is activated when the value goes below the set point and the alarm of distance when the value goes beyond the set distance).

Settings

Driver configuration options, such as servo calibration, display, and electrical measurements are described in the chapter on configuration.

The device allows the diagnosis of a microSD card. This function writes 200 data sectors on the card, and then reads them, setting the minimum, average and maximum duration of the card operation. This option allows the assessment of the quality of the SD card. Although the log record on the SD card does not impose specific requirements on the card, but this option can be useful for diagnosis of the causes of the problems of the video recorder or camera that record on the microSD memory card. Another helpful feature is the converter maximum radio coverage in open space. Calculations are made on the basis of the stated transmitter power, receiver sensitivity, gain of directional antennas and transmission frequency. The values should be regarded as the maximum obtainable with the equipment. The actual range is affected by the mutual arrangement of antennas, signal obstacles, etc.

Diversity and video preview

Diversity screen presents a preview (monochrome) of both video input channels, graphical indicators of the quality of signals (in the form of bars), and shows the currently selected video input. The page also contains fields (keys) for automatic selection of the input [Auto] or manual selection of input [A] or [B]. The selected video input is indicated by a yellow color border strip of preview and signal quality bar.

No input on a specific input is indicated by the string [No Signal] in the appropriate pane of the video preview.

NOTE: If you manually choose input of very poor quality, or input without a signal it causes the image in the preview window to be unsynchronized (horizontal or diagonal stripes will be displayed). This is the natural behavior of the signal preview window.

Cooperation with PC

A base station controller can be configured and updated via the USB port using the FPV manager software, running on a computer that is running Windows XP, Vista, Win7 and Win8, in both 32 and 64 bit versions. Configuration application (executable file FPV_manager.EXE) requires for operation the NET Framework version 3.5 software, which is delivered with the new versions of Windows and does not require any additional installation. But it is possible that with the older versions of Windows XP, the software is not available, then it must be downloaded from the Microsoft site and installed on your system:

http://www.microsoft.com/downloads/pl-pl/details.aspx?FamilyID=333325fd-ae52-4e35-b531-508d977d32a6

latest version of the configuration software can always be found on the manufacturer's website:

http://www.pitlab.com/osd-software.html

The configuration application is ready for use immediately after downloading to a local drive or removable drive and does not require installation on Windows. The application can be run from anywhere, even from removable media such USB flash drive or directly from a network location, on any Windows computer.

The application communicates with the controller PCB via USB and standard mini-USB cable. Windows automatically recognizes the connected device, without the need to install additional drivers. The device is seen in Windows as Pitlab & Zbig GS.
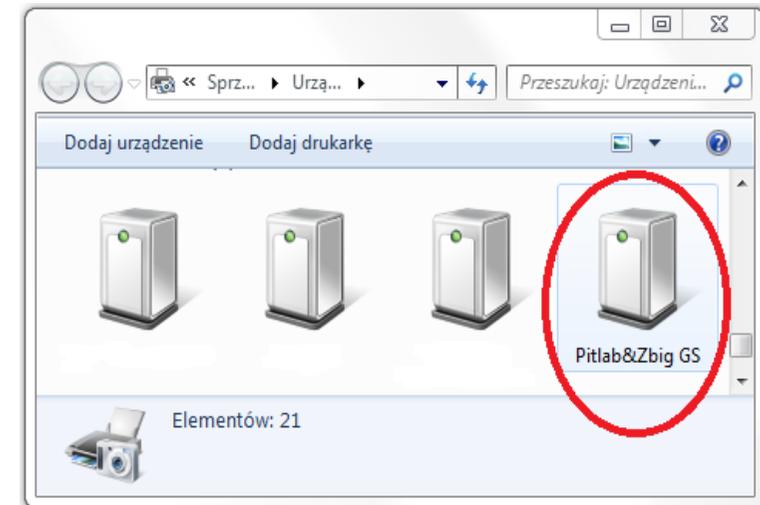

Once the FPV manager application is started, go to the Ground Station tab. If the device is connected to your computer, it will be the automatically identified and the Firmware sub page displays basic information about the device.

On its website manufacturer shall make available updated software, including functional enhancements and patches to driver software (firmware). To update the software, the file with the new firmware version (with .GS extension) should be copied to the local disk, and then please click [Upload Firmware], then in the dialog box, select the new firmware file. The update process takes from a few to several seconds, and the progress is indicated by a progress bar in an FPV manager application.

Log subpage allows for management of logs recorded on the SD memory card of the device. Logs should be transferred (copied) to the computer.

This can be done by using an additional microSD card reader or directly from the device via the USB port – use import to do it.
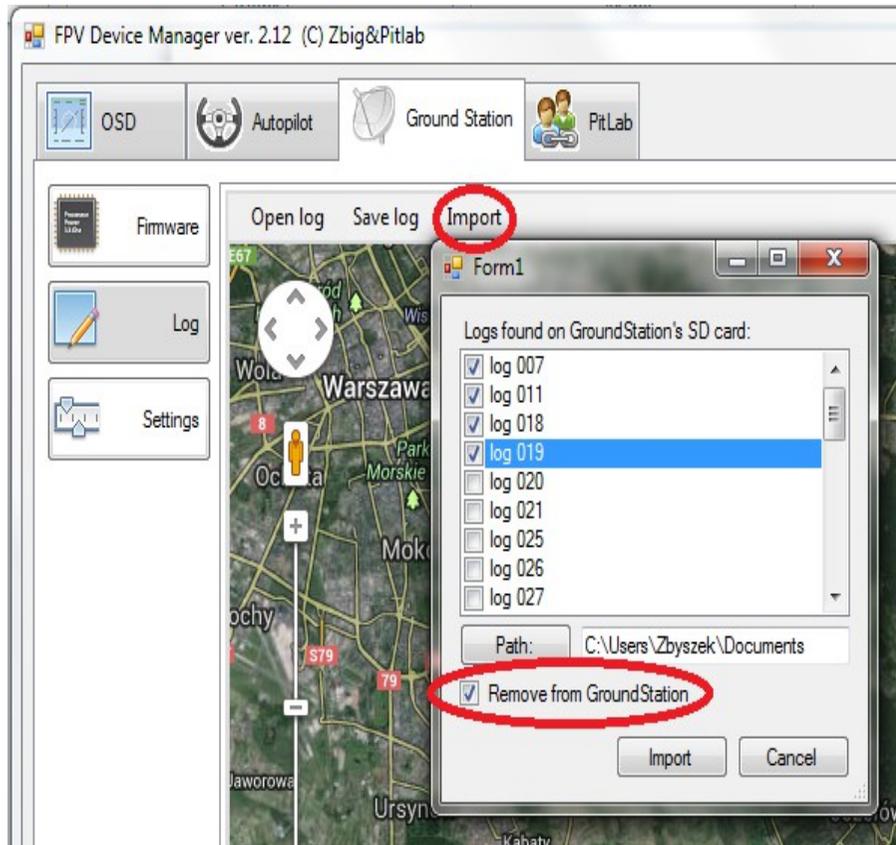
In the Import window select the logs that are to be copied to your computer and perform the import. In the next step, indicate the destination directory logs. The copying process can last from a few to several minutes, depending on the size of the logs. We recommend checking the **[x] Remove from GroundStation** option because the import window only shows the first 16 log files stored on the SD card

Logs stored on your computer can be presented against the Google Maps application. For each point along the route, you can read the basic telemetry data retrieved for the location model.

Troubleshooting

In case of problems with the use of the kit in the first place, check if the connection and configuration of the device was carried out as described in the manual.

Modelers' FPV discussion groups are an effective way to solve many of the problems associated with the operation of the system, bringing together other users on the system. Many of the questions, issues and concerns were already answered and solved.

In other cases you should contact the manufacturer of the system.