FLIGHTZOOMER
1.5

SENSORICS
APP REFERENCE

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2 Disclaimer

While FlightZoomer offers fantastic features, the following operation rules are strictly to be followed:

- The system is intended for hobby usage.
- Be familiar with the operation of RC aircraft having 1kg flying weight or more.
- Use FlightZoomer only aboard a proved combination of RC equipment, airframe, flight controller, motors, propeller, battery and ESCs.
- Operate FlightZoomer strictly within the safety boundaries of any other used components.
- Operate FlightZoomer strictly within the boundaries of any local regulatory requirement.
- Fully respect any disclaimer and safety note which is associated with any other used component.

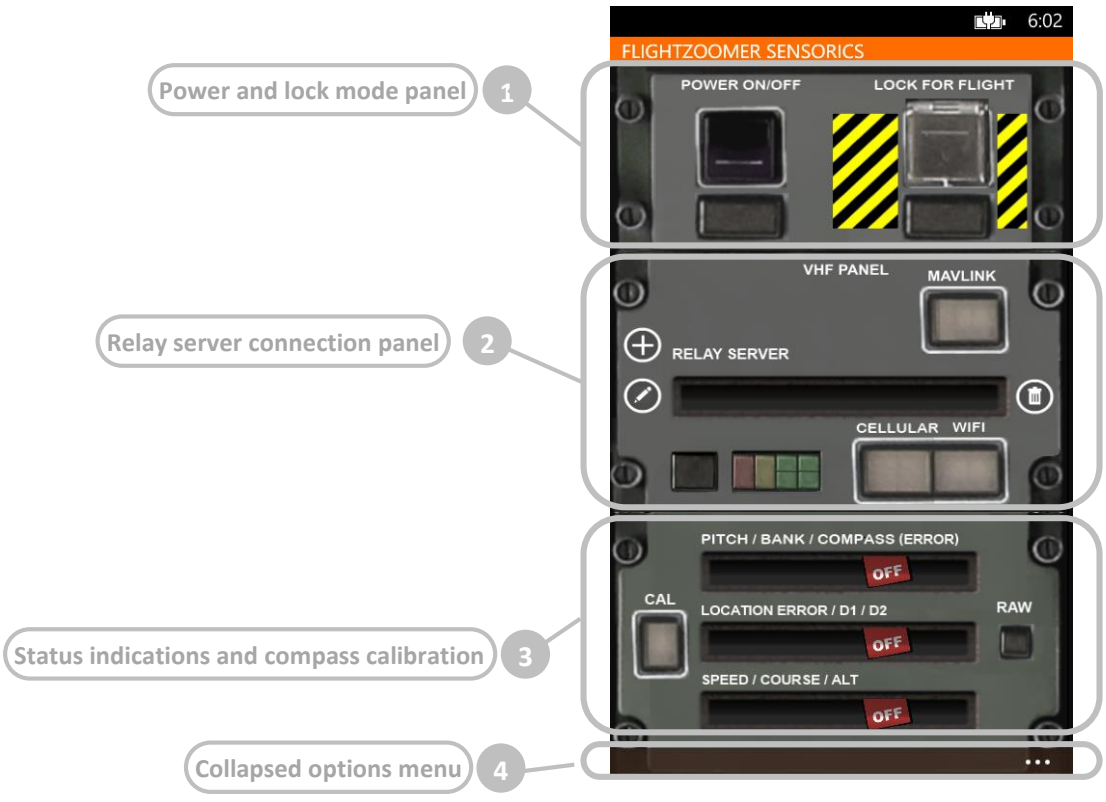
3 FlightZoomer Sensorics-app system reference

The FlightZoomer Sensorics-app runs on a smartphone, which is mounted aboard an RC aircraft. The app collects sensor data from the smartphone's internal sensor suite and transmits them to the groundstation (via relay server).

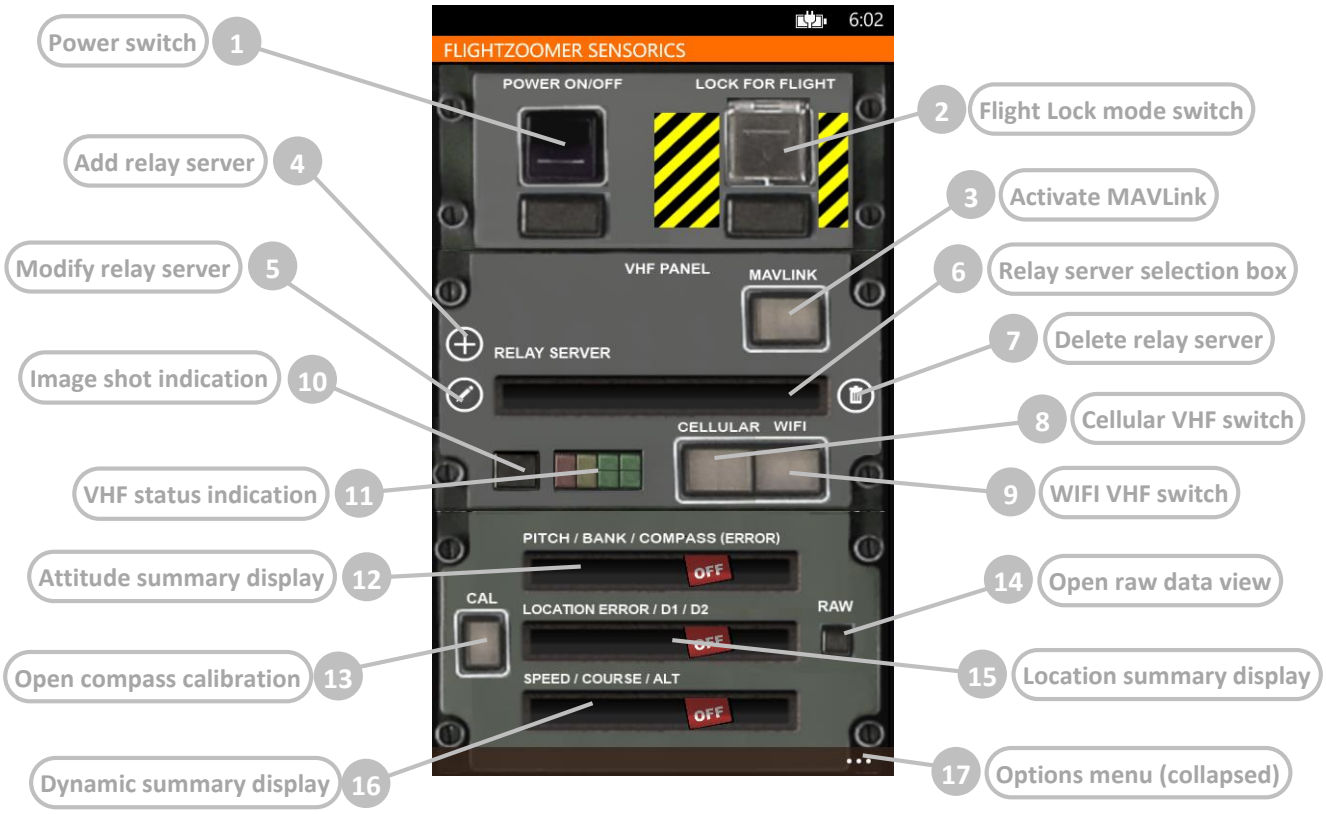
The app is rather simple. The main features are:

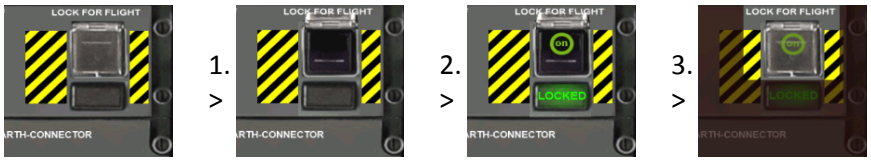
- Configure and control the connection to the relay server.
- Calibrate the compass.
- Send sensor and location data as a constant feed to the relay server.
- Raw data view.
- Geometry capturing (capture the attitude of the device aboard the aircraft).
- Configuration of the video or image recording.

3.1 Main screen – overview



3.2 Main screen – detailed view



	Element	Purpose
1	Power switch	Switches on the whole system
2	Flight Lock-mode switch	The button is simulated with a cap so pressing it three consecutive times toggles the Flight Lock-mode to locked and by pressing it another three times back to unlocked. The first tap raises the cap, the second actually actuates the switch and the third closes the cap again. This sequence protects the system from unintended mode changes. The transition sequence to locked by pressing three consecutive times looks as follows:  The transition sequence back to unlocked:  In locked mode an overlay mask is laid over the whole screen. As a result any user input is blocked on the entire touchscreen. Only in the area around the Flight Lock-mode switch there is a cutout in the overlay mask (allowing a transition back to the unlocked mode).

		The overlay mask looks as follows:  Alternatively the locked mode can also be commanded from the groundstation.
3	Activate MAVLink	This button switches on the MAVLink connection to the flight controller. The button is two-color lighted to indicate the state of the MAVLink connection. Using this button will try to establish a connection to the Bluetooth device which was successfully connected the last time. This requires that at least for the first time to use the *flight controller mating*-screen to pair, select and connect a particular device. Multiple devices can also be managed on that screen. The color of this button has the following meaning: [none] MAVLink switched off [yellow] MAVLink is being switched on [green] MAVLink switched on [green, blinking] MAVLink switched on, some packets are missed
4	Add relay server	The app allows to configure and store an unlimited number of relay servers. This button opens a menu to define and add a new relay server. A relay server definition is a combination of a plain text name, an URL (or an IP address) and a port number. Pressing on the button opens the screen described in chapter 3.4.
5	Modify relay server	This button opens a menu to modify the relay server which is displayed in the selection box. Pressing on the button opens the screen described in chapter 3.4.
6	Relay server selection box	This selection box shows the currently selected relay server. The box is empty as long as no relay server has been defined. After the connection to a relay server has been established, one of the following prefixes are added to the text in the selection box, which indicate the currently active interface type and the network quality: **2.5G>>** **3G>>** **3.5G>>** **WIFI>>**

7	Delete relay server	This button deletes the relay server which is displayed in the selection box from the list of stored relay servers.
8	Cellular VHF Switch	This buttons switches on a cellular connection to the selected relay server. Precondition is the selection of a relay server, which has been configured using a public URL or IP address. A given relay server definition consisting of a public URL or IP address can be used to create both a cellular or a WIFI connection. With the cellular VHF switch you can enforce a WAN (internet) connection if both networks types are available. If there is only one network type available, the operating system will automatically pick the available one. The button becomes lighted while the connection is switched on.
9	WIFI VHF Switch	This buttons switches on a WIFI connection to the selected relay server. There is no precondition for the relay server definition. Ideally you would choose an IP address or URL which point to the local network. Contrary to the Cellular VHF Switch the WIFI VHF Switch allows setting the network preference to WIFI if both network interface types are available. This might be useful to download videos, while the device is connected to the relay server in the same LAN (over WLAN). The button becomes lighted while the connection is switched on.
10	Image shot indication	This light toggles between illuminated and dark each time an image has been shot (with the camera fix interval image recording feature).
11	VHF status indication	These LEDs indicate the operation status of the relay server connection. The LEDs are arranged in four columns: [1] Error indication - red [2] Transient state or warning indication - orange [3] Even message sent successfully - green [4] Odd (alternate) message sent successfully – green In addition [3] and [4] are split into an upper and lower half. During normal operation the odd and even message sent indications toggle on and off alternately (green light jumps from [3] to [4] to [3] to [4]…) If 10 messages have been sent in a row without successfully receiving a single response message, either [3] or [4] start toggling between the upper and lower half. This gives an indication, that the connectivity might be impaired (messages are still sent, but a roundtrip seems to be no longer possible).
12	Attitude summary display	This text box shows the current pitch, bank and compass angle at any time. In brackets the compass error is shown. This display can be used to verify the result of a geometry capturing run. The OFF flag disappears as soon as attitude and compass data is available.
13	Open compass calibration	This button opens the compass calibration screen. It is illuminated if the current calibration is insufficient.  The compass is calibrated. The compass accuracy is equal or smaller than 20°  The compass needs to be calibrated. This is required frequently and must be checked prior each take off. Pressing on the buttons opens the screen described in chapter 3.5.

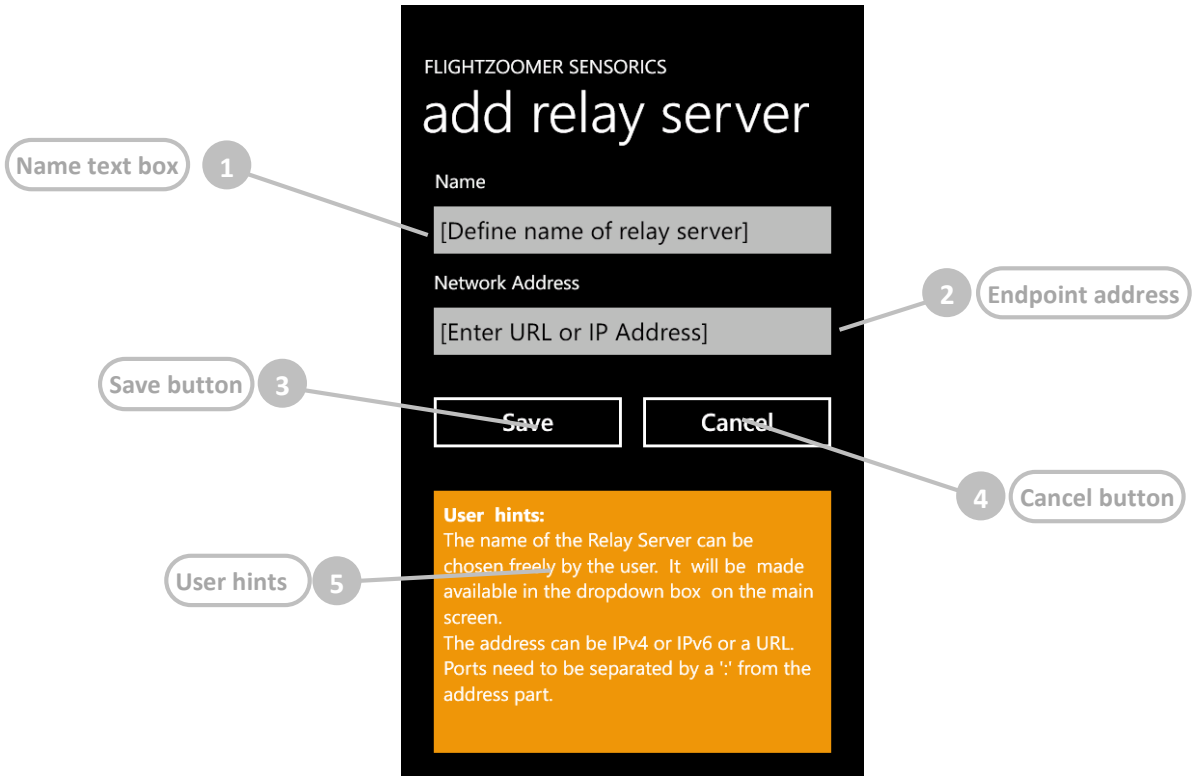
14	Open raw data view	This button opens the raw data screen. Pressing on the buttons opens the screen described in chapter 3.6.
15	Location summary display	This text box shows the status and summary of the location determination sensor suite. During normal operation the following numbers are displayed (in one line): [current location determination error in meter]/ [East/West offset in meter from the initial location]/ [North/South offset in meter from the initial location] During GPS initialization or in case of localization errors one of the following texts might be displayed (horizontally scrolling): > Device localization is switched off in this app, FlightZoomer does not work. > Device localization is not supported on this device, FlightZoomer might not work. > The GPS is not activated, please switch on the GPS. > The GPS is being initialized. > Currently the GPS is not able to extract the position. The OFF flag disappears as soon as location data is available.
16	Dynamic summary display	This textbox shows the current speed, track and altitude in meter per seconds, degrees and meters. The OFF flag disappears as soon as location data is available.
17	Options menu (collapsed)	Pressing on the collapsed menu symbol will show the full menu (see next chapter).

3.3 Main screen – options menu expanded

Pressing on the right corner at the bottom, the jump menu appears. This menu offers the following commands:

	Element	Purpose
1	Flight controller mating…	This menu opens the *flight controller mating*-screen (see chapter 3.7).
2	Videos…	This menu opens the video screen, where recorded videos can be watched, deleted and also downloaded to the relay server.
3	Geometry capturing…	This menu command opens the screen, where the geometry of the attached device on the aircraft can be captured (see chapter 3.80).
4	Lag time test…	This menu opens the *lag time test*-screen, where the complete lag between the sensor device and groundstation can be measured for each transmitted package (see chapter 3.9).
5	Options…	This menu command opens the options screen (see chapter 3.10).
6	Info…	This menu command opens the info screen, which shows the version, the build date and links for support purposes.

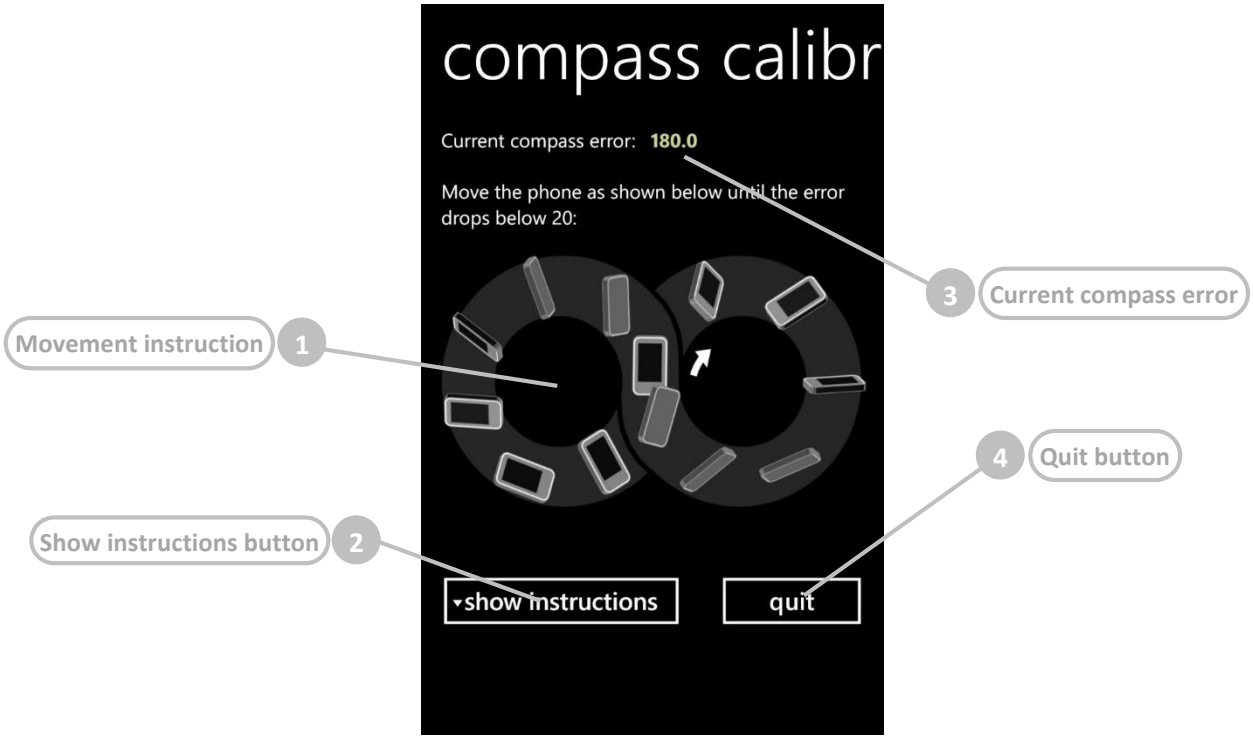
3.4 Add/modify relay server screen



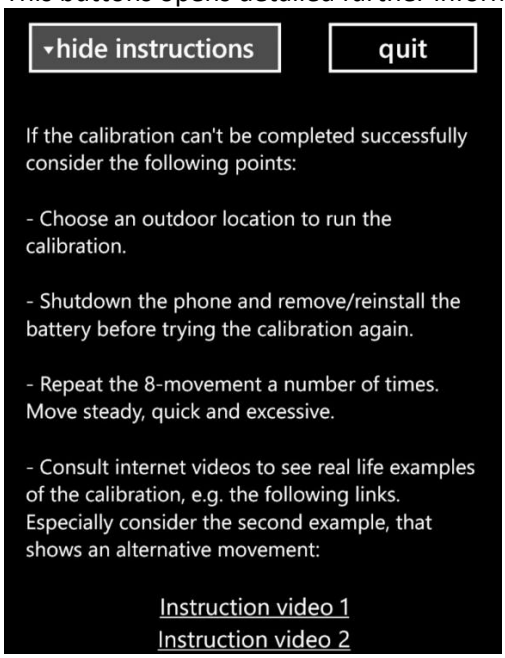
This screen is shown in order to add or modify a relay server.

	Element	Purpose
1	Name text box	This text box allows to define the name of the relay server. The name of the relay server can freely be chosen by the user. It will be available in the selection box on the main screen.
2	Endpoint address	This text box allows to define the IP address (IPV4 or IPV6) or an URL for the relay server. In addition the destination port can be specified (if it is missing 57778 is taken as default). If specified the port must be separated by a colon-character (:) from the IP address/URL. The FlightZoomer Sensorics App will connect to this endpoint when building up UDP connectivity with the relay server.
3	Save button	Store the definition/changes.
4	Cancel button	Leave this screen without saving the definition or modification.
5	User hints	Usage and instruction summary

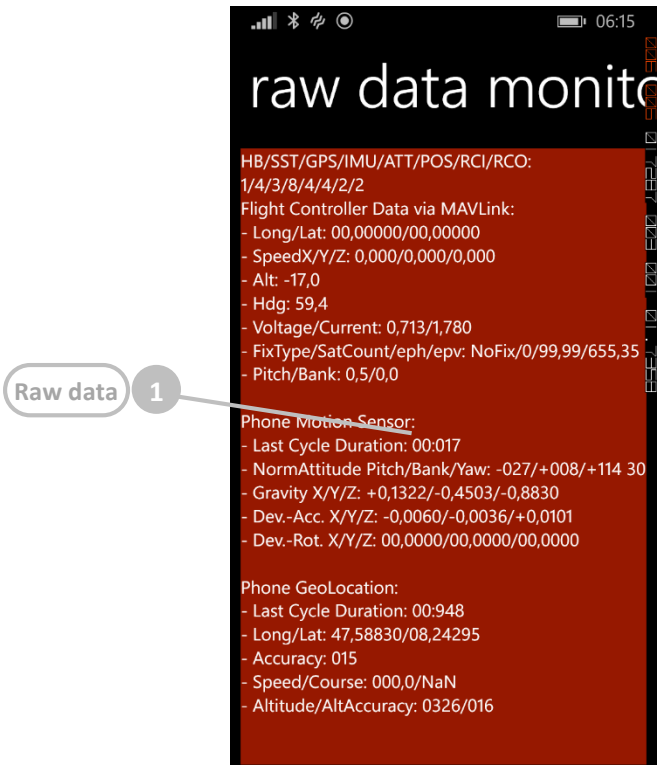
3.5 Compass calibration screen



This screen is shown while the compass is going to be calibrated. After the screen is displayed the device needs to be rotated in all three axis as shown. Take the device in one hand and perform fluently the 8. This movement needs to be continued until the compass error will become less than 20°. At the moment when this happens the device will vibrate for 100ms.

	Element	Purpose
1	Movement instruction	This image shows the movement and rotation, which is needed to calibrate the compass.
2	Show instructions	This buttons opens detailed further information: 
3	Current compass error	Store the definition/changes.
4	Quit button	Leave this screen.

3.6 Raw data screen



This screen shows the raw data. The output of each and every sensor as well as everything related to the MAVLink connection is shown in real time.

This feature can be used for system monitoring purposes and for trouble shooting.

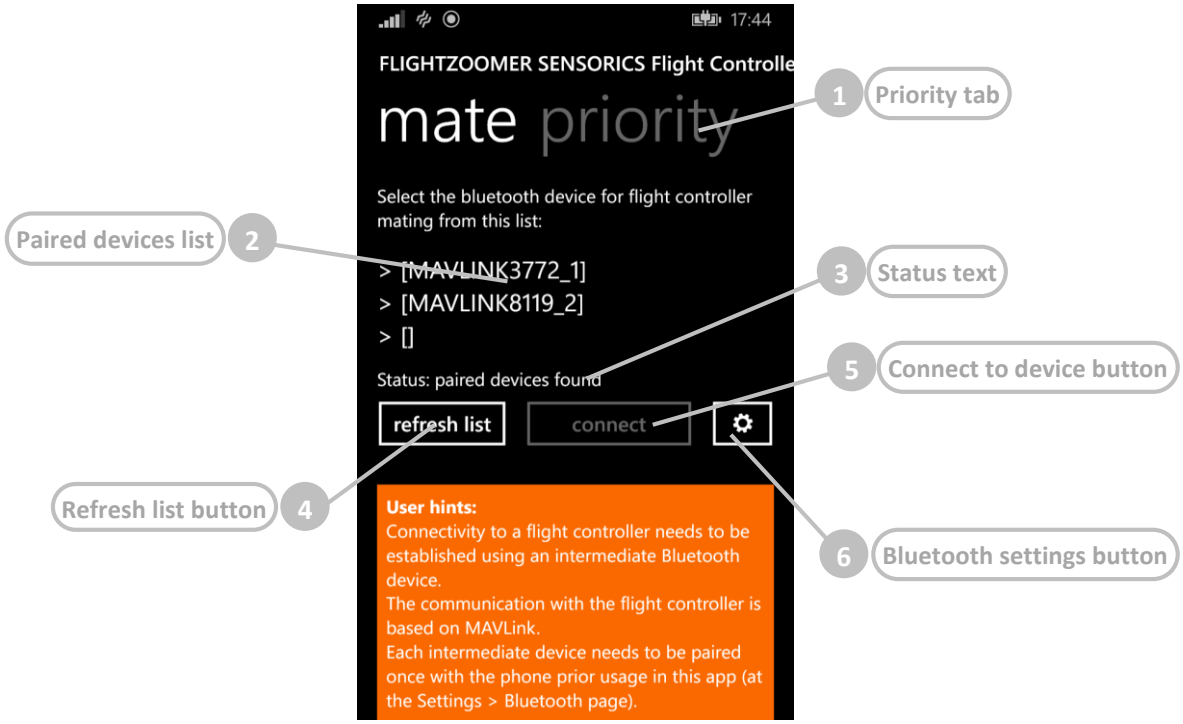
Leave the screen with the BACK button of the device.

	Element	Purpose
1	Raw data	Show the output of all used sensors.

3.7 Flight controller mating screen (MAVLink connection)

From this screen the Sensorics-app can be connected to a HC-06 Bluetooth transceiver, which provides MAVLink connectivity with the flight controller. The screen offers the capability to connect to a particular Bluetooth transceiver for the first time, select one among multiple devices and display detailed status information.

Whenever a connection is established successfully, the respective transceiver is stored. The stored transceiver is also used whenever the *Activate MAVLink*-button is pressed on the main screen.

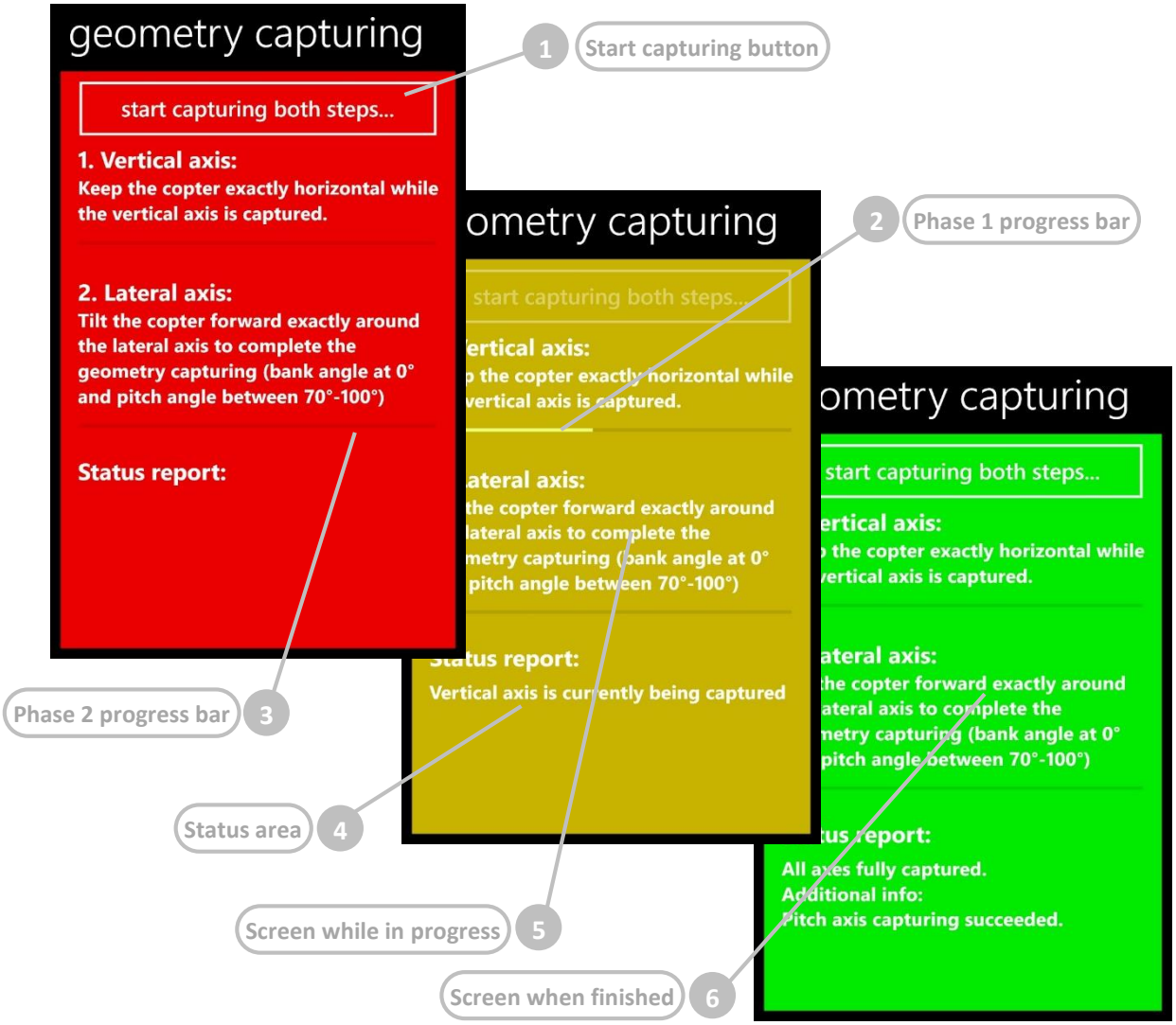


	Element	Purpose
1	Priority tab	Opens the second pivot screen where the sensor source priority can be configured. For details about the four options consult the respective chapter in the functional document.
2	Paired devices list	List of all the paired Bluetooth devices. The list shows the name of each Bluetooth device (which is either HC-06 or LINVOR per default or MAVLINKnnnn_s if the transceiver was configured using the *Bluetooth Configuration Utility* of the Relay Server-application).
3	Status text	The status text shows the connection progress. The following states are possible: - Searching for paired devices - No paired devices found - Paired devices found - Paired devices found, connecting... - Connected with device - Connected with device, MAVLink available
4	Refresh list button	With this button the list of paired devices can be refreshed at any time.
5	Connect to device button	By pressing this button a connection to the selected device in the list can be established. The button is only enabled if one item in the devices list is selected.

6	Bluetooth settings button	Pressing this buttons opens the device's Bluetooth settings.

3.8 Geometry capturing screens

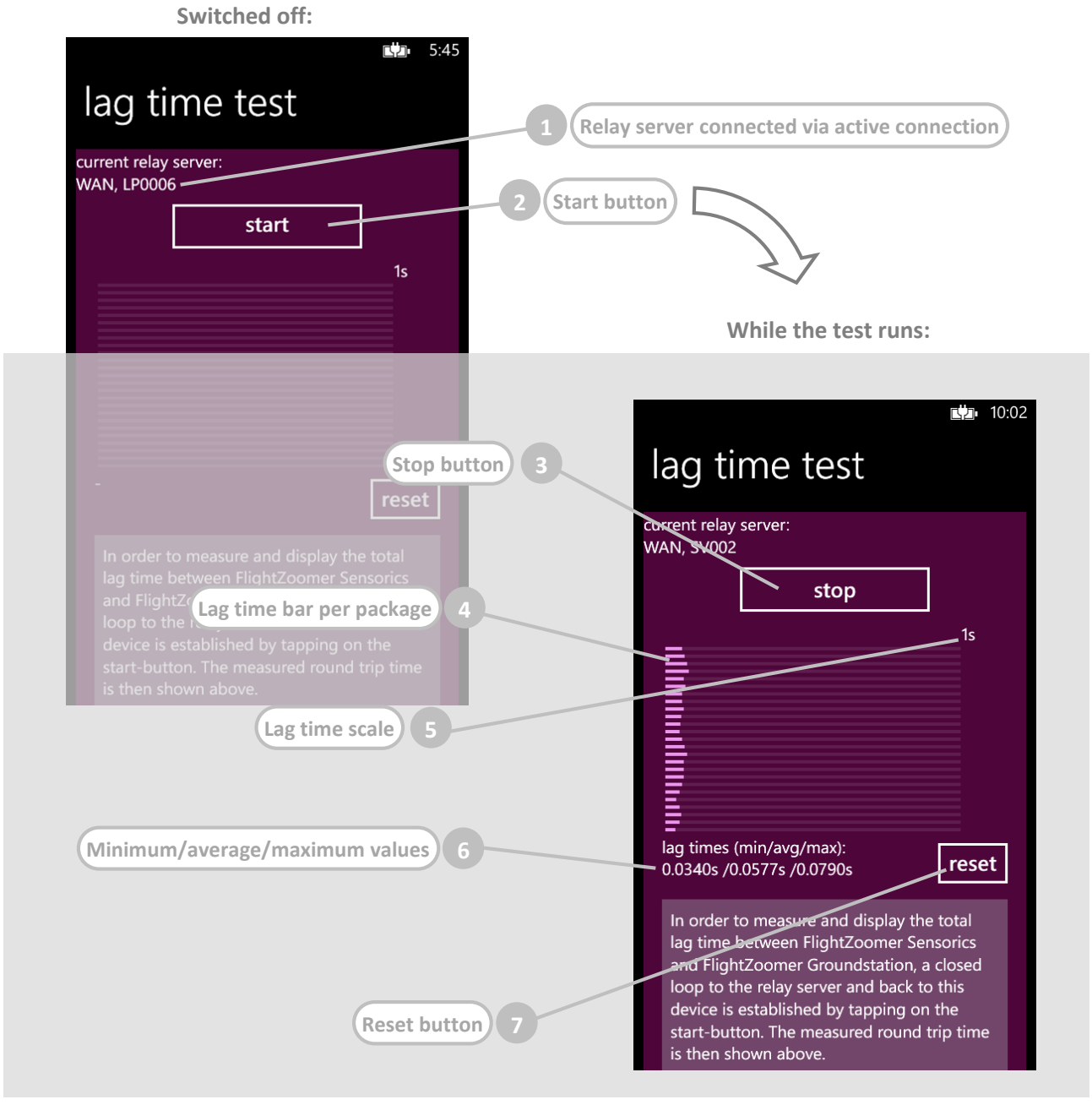
The geometry capturing is needed to measure the attitude of the device as it is mounted on the aircraft. Each time the position relative to the aircraft changes the geometry needs to be captured again.



	Element	Purpose
1	Start capturing button	This buttons initiates a geometry capturing sequence.
2	Phase 1 progress bar	The aircraft needs to be kept exactly horizontal during the first phase of the measurement. The phase 1 takes 20 seconds. During that time the average gravity vector is measured and stored.
3	Phase 2 progress bar	After the first phase is completed tilt the aircraft forward by about 90° during the second phase to complete the measurement. It is less important that the aircraft is pitched exactly 90° forward than doing so exactly around the lateral axis (which goes from left to right). In fact any pitch forward angle starting from 0° is valid and does not affect the measurement.

4	Status area	The status area display information about the progress and the outcome.
5	Screen while in progress	During measurement execution the screen becomes yellow.
6	Screen when finished	After measurement completion the screen becomes green.

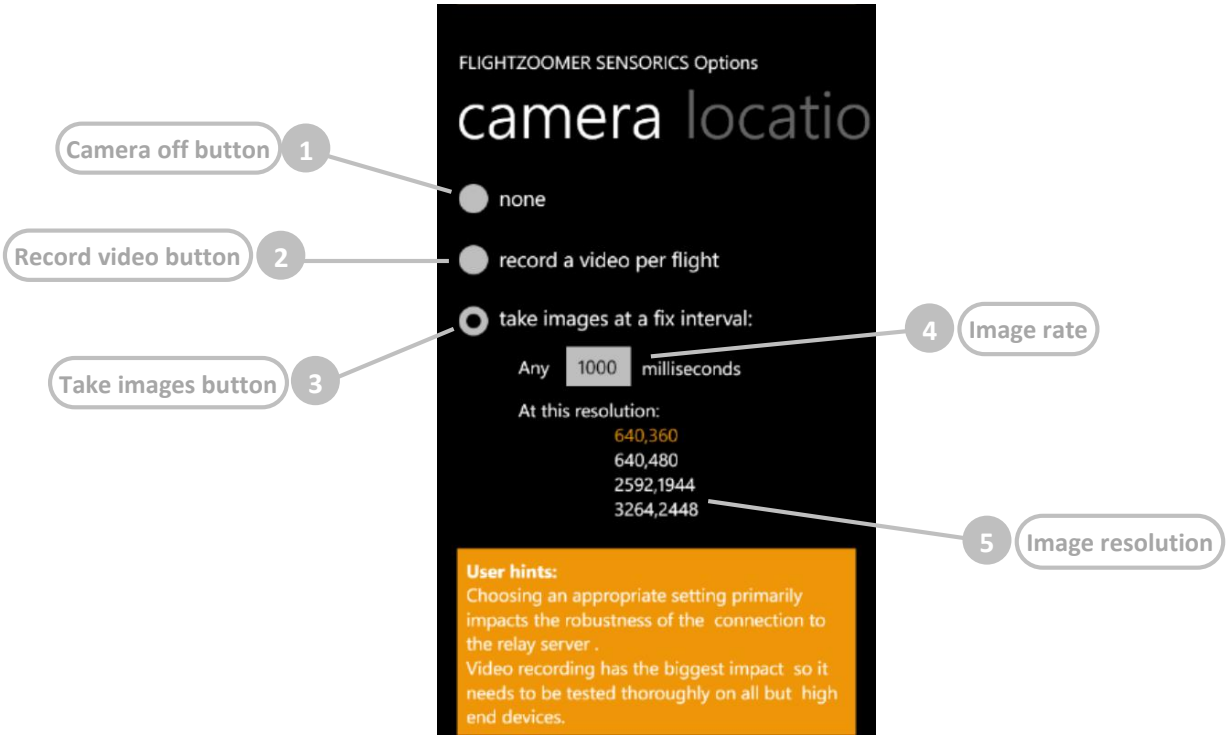
3.9 Lag time test screen



The lag time test allows to measure and display exactly how long it takes for each single transmitted package over the entire communication channel from the sensor device to the groundstation device. This test is accomplished solely by the Sensorics-app and the relay server. The Groundstation-app Is not needed. Once the test is started, a second connection from the sensor device to the relay server is established which is used to simulate the complete end-to-end connection.

	Element	Purpose
1	Relay server connected via active connection	This text label shows the relay server to which the currently active connection is built up. If no connection is activated, the label shows “Not connected”. In that case starting the lag test is not possible.
2	Start button	With this button the lag test is started. After pressing on the button, a second connection to the relay server is established and the time for the whole roundtrip of each transmitted package is measured and displayed.
3	Stop button	This button stop an ongoing lag test.
4	Lag time bar per package	For each received package the length of the lag time bar changes in order to reflect the overall transmission time. There are 25 bars so after 25 received packages the bars are reset and the animation of the lag time starts again from the top.
5	Lag time scale	The scale of the time lag bar means that full width matches 1 second.
6	Minimum/average/maximum values	This text labels shows the shortest, the longest and the average observed time lag. The labels are updated as long as the lag test runs.
7	Reset button	With this button the minimum, average and maximum values can be reset and in addition a new lag test session can be triggered.

3.10 Camera options screen



The camera options screen defines the usage of the camera while in Flight Lock mode. Choosing an appropriate setting primarily impacts the robustness of the connection to the relay server. Video recording has the biggest impact so it needs to be tested thoroughly on all but high end devices.

	Element	Purpose
1	Camera off button	Switches off the camera.
2	Record video button	Switches on video recording.
3	Take images button	Switches on image capturing at a fix interval.
4	Image rate	This number determines the image capturing interval in ms (1000 = 1s).
5	Image resolution	This list allows to select the wished image resolution.

4 Appendix

4.1 Glossary

	Abbreviation/term	Description	Real aviation term
	FMS	Flight Management System	X
	ILS	Instrument Landing System	X
	IM	Inner Marker	X
	LNAV	Lateral Navigation Auto flight mode where the loaded flightplan is being followed.	X
	MM	Middle Marker	X
	ND	Navigation Display	X
	OM	Outer Marker	X
	PFD	Primary Flight Display	X
	VOR	VHF omnidirectional range	X