OrniTrack User Manual

Please read this user manual carefully before using the transmitters. This user manual contains important safety precautions as well as detailed instructions on transmitter operation, management and data download.

Transmitter start-up

Precautions/Warnings

Do not overheat the transmitter. This may happen especially quickly when exposed to direct sunlight without ventilation (e.g. the car dashboard is the most frequent place where transmitters are overheated) or near other heat sources (e.g. hot lightbulb, radiator, fireplace). The transmitter's temperature sensor allows the monitoring of its internal temperature. It is advisable not to exceed 50°C, even though technical characteristics define a slightly higher tolerance.

Avoid extreme sudden changes in temperature.

Do not place the device next to strong magnetic fields.

Although the transmitter is constructed of durable materials and has no moving parts, avoid dropping it onto solid surfaces.

Do not disassemble the device.

Do not turn on and use the transmitter in areas with poor GPS reception (e.g. indoors) – this may lead to rapid battery depletion, particularly at high GPS fixing rates.

The device contains lithium-polymer batteries – please dispose of the unit responsibly, following the local regulations.

Transmitter energy management

Logging GPS positions is a relatively expensive process in terms of energy use. When developing OrniTrack transmitters we paid particular attention to achieving the highest possible energetic efficiency of this task. Extensive transmitter testing in an open terrain revealed that a fully charged OrniTrack-20 is sufficient for logging about 1,000 GPS positions without additional recharge, OrniTrack-25 and OrniTrack-30 – approximately 1,500 positions, while OrniTrack-50 – about 5,000 positions. But please note that data transfer via GPRS/3G was set to infrequent intervals of one data upload per day during the testing.

Connection to the GSM network and data upload is by far the most energetically expensive process. Therefore, the GSM module is turned off most of the time and activated only at predefined intervals, when it searches for a network, connects, receives pending new settings (if any) and uploads the collected data. If no network is available, the GSM module switches off after a timeout period until the next scheduled connection attempt. The battery consumption of a single GSM session is equal to logging approximately 25 GPS positions. Obviously, energy consumption of data uploads depends on GSM signal strength and the amount of data uploaded.

In order to prevent excessive discharge of the internal battery, GPS position logging is discontinued when the battery is depleted to 0% (3675 mV). However, the battery retains a certain energy reserve, used for data transmission and basic functioning of the device until it is recharged by the solar panel. However, it is recommended to always maintain battery charge above 20% by managing transmitter operation accordingly.

Turning the transmitter ON and OFF

The transmitters are supplied turned off and charged (above 90% battery charge). The transmitter is equipped with a magnetic switch – the unit is turned off by placing the transmitter into a special holding pad that contains a built-in magnet. The transmitter turns on once it is taken out of the holding pad (Figure 1). After removing the transmitter from the holding pad, a red LED will flash at a slow rate several times, indicating correct start-up of the transmitter. Very rapid and brief flashing of a LED after removing the magnet indicates complete discharge of the battery. When the transmitter is placed back into the holding pad, the LED will light-up once, indicating that the transmitter was successfully turned off. Location of the LED differs on different models of OrniTrack transmitters – on OrniTrack-20 and OrniTrack-25 it is at the back of the transmitter (Figure 1A), on OrniTrack-50 it is at the front of the transmitter (Figure 1B), while in OrniTrack-30 LED is located near the right wall of the transmitter and could be a little hard to see in full daylight (Figure 1C). Some transmitter models (e.g. neck collars, leg-mount transmitters, patagial transmitters) do not have a magnetic pad and their switch is activated by attaching the magnet with a sticky tape or clip-on magnet holder. For example, magnet attachment location on the neck collar transmitter is on the upper part of the solar panel next to the LED (Figure 1D).

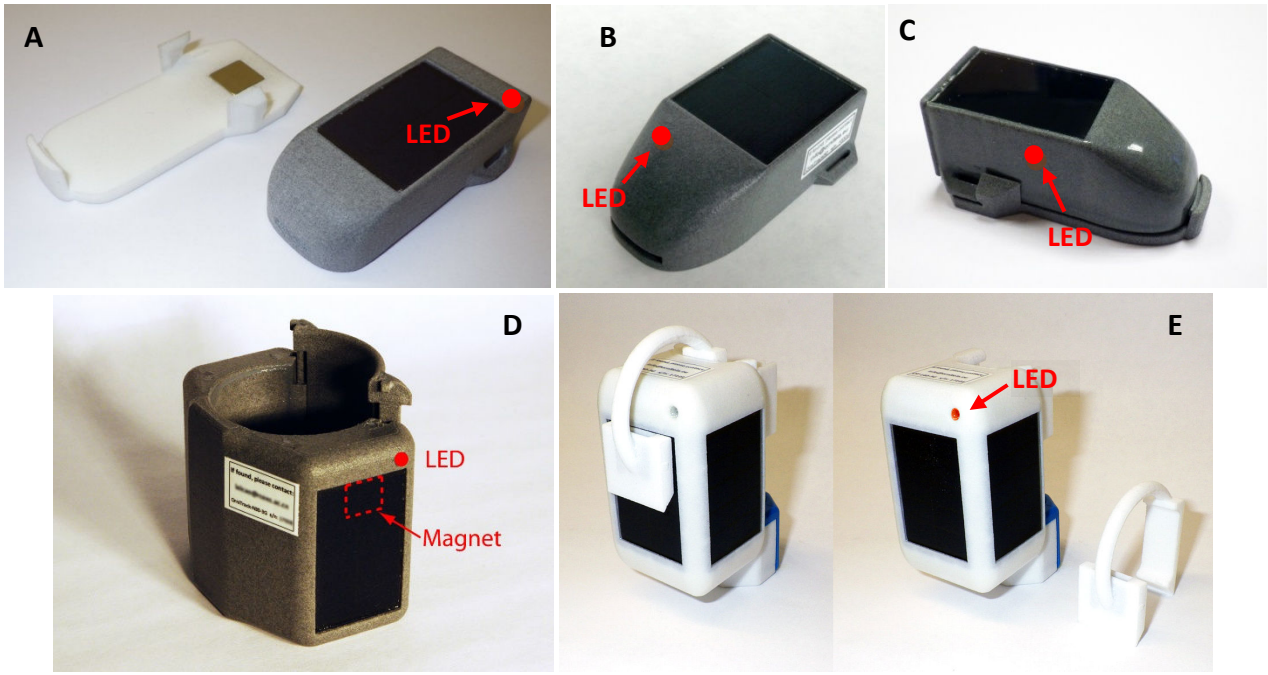

Figure 1 OrniTrack transmitters with shown position of LED indicator. The photos show A) OrniTrack-20 (next to a holding pad), B) OrniTrack-50, C) OrniTrack-30 (on a holding pad), D) OrniTrack-N30, and E) OrniTrack-L40 with clip-on magnet.

Starting the transmitter for the first time – initial test

The aim of the initial transmitter test is to verify correct operation of the unit – acquisition of GPS positions, data transfer via GSM network and the correct operation of internal sensors prior to the deployment of the transmitter on a bird. Please note that the initial transmitter test is a prerequisite for the fulfilment of warranty conditions.

The transmitter is supplied with pre-defined GPS and GSM settings (GPS fix interval – 60 s, data transmission interval – 600 s), which shall be used during the first start-up of the transmitter by the user. The initial start-up should preferably be carried out well in advance of the expected deployment of the transmitter. Please inform Ornitela at support@ornitela.eu of the approximate planned time of the initial transmitter test. The initial test should be carried out outdoors in an area with an open sky view and with good GSM coverage. For the test, please remove the transmitter out of the holding pad and place it on a level surface for at least 30 minutes. After 30 minutes, re-insert the transmitter into the holding pad and the transmitter will turn off. The initial test is complete. You will be informed of the successful test (or any detected problems) by Ornitela within 12 hours following the test.

After the transmitter test, in the on-line control panel (see description below) you will see that the transmitter has transferred the acquired data. If the transmitter continues to connect to the GSM network (as seen from the timestamp of the "Last GPRS data" in the main page of the OrniTrack Control Panel) after the initial test, this may indicate incorrect placement of the transmitter into the holding pad.

Alternatively, you may choose to keep the transmitter on until deployment and test different settings, including a geofence feature (described below). However, GPS and GSM settings should be adjusted to longer intervals, as pre-set testing settings are of high frequency and would lead to rapid battery drain. If the transmitter is kept running, it is advisable to keep it outside in a sunny but well ventilated place. Keeping it indoors may lead to rapid depletion due to poor GPS reception and lack of sunlight.

When the transmitter is moved a large distance from its previous location or has been off for a long time, it might take a while for the GPS module to acquire a new position. Thus it should not come as a surprise if positions are not acquired on several connections during the initial start-up and testing.

Deploying the transmitter

OrniTrack solar GPS-GSM/GPRS/3G transmitters have been developed to be deployed as backpacks using harness on birds of appropriate size.

In case deployment of the transmitter is planned in an area with potentially poor GSM coverage, it is advisable to set the desired transmitter settings through the on-line control panel (GPS and GSM intervals, geofences, day/night regime) prior to the deployment (by entering the new settings, turning the transmitter on and off with a magnet and making sure that the transmitter has accepted the settings). The transmitter communicates with the server each time it is started by removing from the holding pad, and receives the settings that are pending on the server. However, during normal transmitter operation, new settings are delivered when transmitter connects to GPRS/3G network for uploading the data.

Turning the transmitter ON and OFF and deployment of neck collar transmitters

Turning the neck collar transmitter ON and OFF

The neck collar transmitters are supplied turned off and charged (above 90% battery charge). The transmitter is equipped with a magnetic switch, activated by a special clip-on holder (containing a magnet), which mounts on top of the transmitter (Figure 1-1). When the clip-on holder is attached – the unit if OFF. The transmitter turns on once the clip-on holder is removed (Figure 1-1). After removing the clip-on holder, a red LED will flash at a slow rate several times, indicating correct start-up of the transmitter. Very rapid and brief flashing of a LED after removing the magnet indicates complete discharge of the battery. When the clip-on holder is placed back on the transmitter, the LED will light-up once, indicating that the transmitter was successfully turned off.

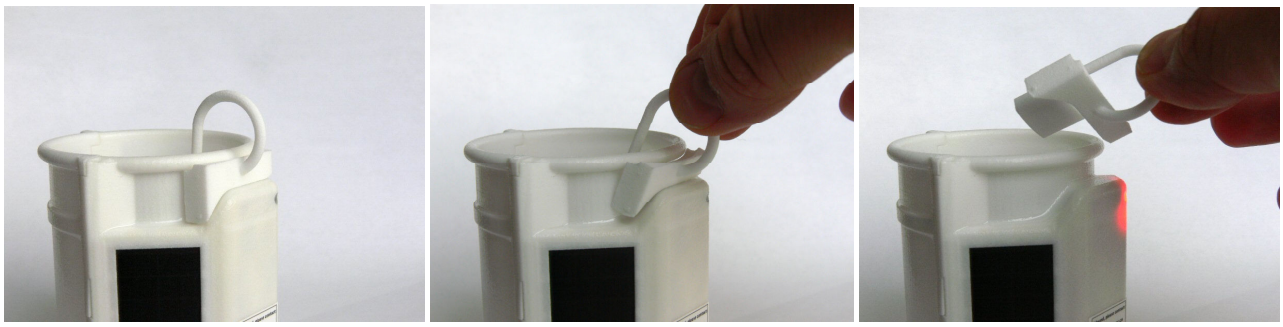

Figure 1-1 OrniTrack neck collar transmitter for swans with a clip-on holder placed on the transmitter and being removed. Photo on the right also shows the place of LED indicator.

Deployment of the neck collar transmitters

The neck collar transmitters are built with a sliding-in door that is pushed in from the top along the rails on the transmitter body (Figure 1-2). Both sides of the rail have the locking clip, which allows the door to go down and close the neck collar, but prevents from coming out. After the transmitter door is closed, it is important to check that the locking clips are pressed into place. Press them with a finder if necessary.

If needed, it is possible to open the transmitter door by slightly lifting the locking clips on both sides of the rail simultaneously with a sharp object, e.g. tip of a knife (Figure 1-2). **IMPORTANT**: Be careful though and do not damage the locking clips or bend them too much.

When the transmitter is deployed on a bird, we strongly recommend putting a drop of cyanoacrylate glue (fast drying "superglue") on each locking clip. This would seal the lock and prevent accidental opening of the neck collar.

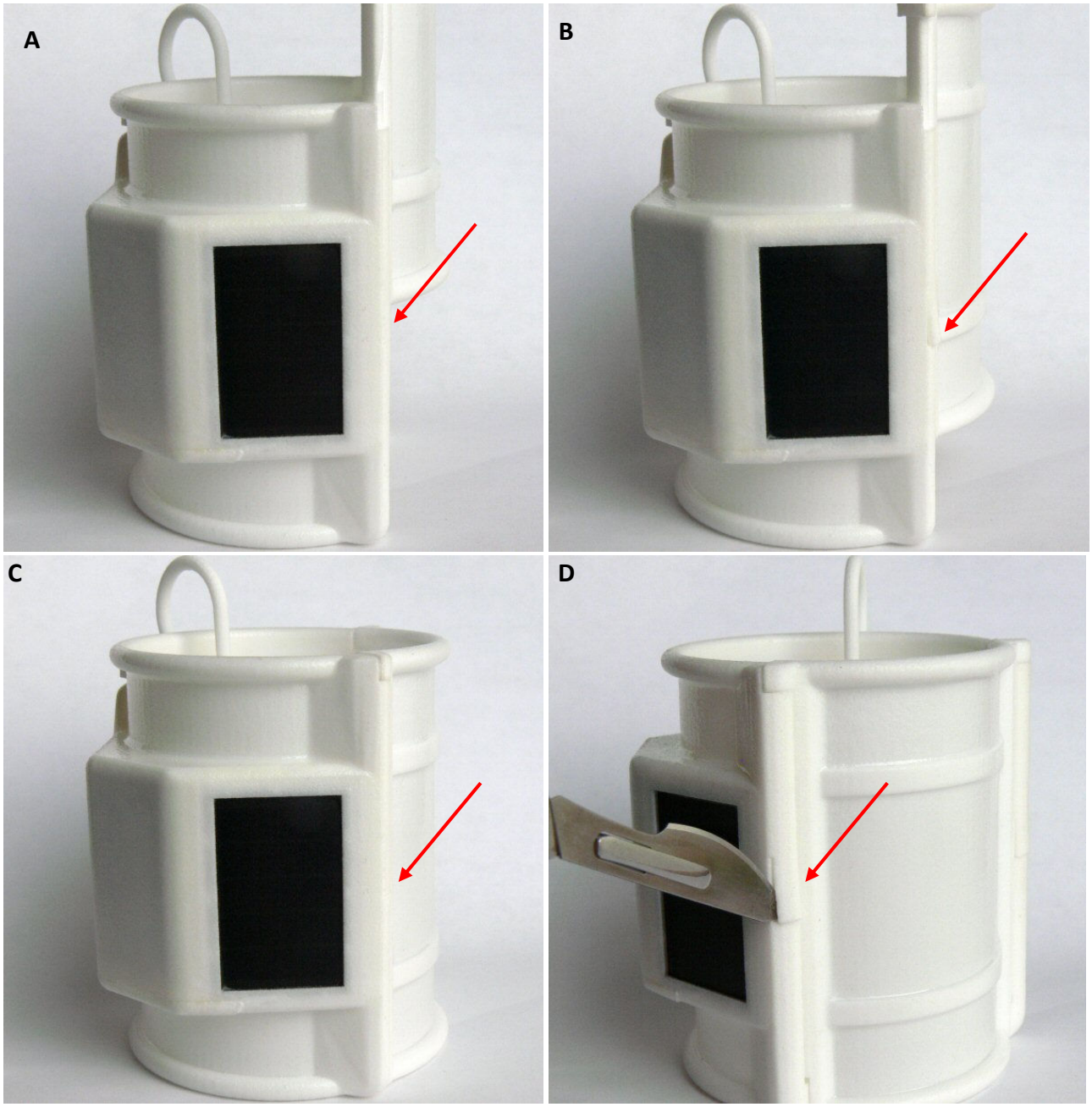

Figure 1-1 OrniTrack neck collar transmitter for swans is equipped with a locking clip for securing transmitter doors. Arrows point to the location of the locking clip. (A) The locking clip is closed at the beginning of transmitter doors being pushed-in; (B) the locking clip opens when the door slides though it; (C) the locking clip closes and locks the door once it is pushed to the end; (D) a thin object is used to slightly lift the clip (both sides simultaneously) if there is a need to open the transmitter door.

For securing the lock for the final deployment, we recommend putting a drop of cyanoacrylate glue (fast drying "superglue") on each locking clip.

Storing the transmitter

The transmitters should be stored turned off and, if stored for prolonged periods of time, their charge should be regularly checked (by turning the transmitter on and checking the battery voltage on the on-line control panel). A complete battery discharge should not be allowed, as in the long run this may compromise battery performance. The most effective way to recharge the transmitter is exposing it to the direct sunlight. The battery-charging control circuit is functioning even when the transmitter is turned off, therefore transmitters may be exposed to the light while in storage – there is no risk of overcharging them.

There could be situations when transmitters need to be stored for an extended period of time before they are deployed, e.g. until the next fieldwork season. We recommend storing the transmitters turned off (on a magnetic pad) with battery having ~60% charge at the start of the storing period. Transmitters should be kept at room temperature in a place without large temperature fluctuations. They should not be placed on a window or other place exposed to the sun as this would cause temperature fluctuations and full battery charge (the transmitter charges even when turned off). Continuous state of being fully charged or completely discharged may reduce the capacity or even damage internal lithium batteries.

When storing the transmitters, it is a good idea to turn them on once per two-three months, let them run briefly so that battery level could be checked. If the battery charge drops below 40%, the transmitters should be exposed to the sun and allowed to charge up to 60%.

IMPORTANT: transmitters should be fully charged prior to their deployment on birds!

Please note, that even when transmitters are not used and are stored on a shelf, the base service subscription fee of ~6 EUR/month is being charged because GSM subscription is kept active. However, the service subscription may be temporarily suspended (see below).

Temporary suspension of service subscription

Upon special request, service subscription may be suspended and reactivated later. The duration of service suspension cannot be shorter than 2 months and longer than 12 months. Once reactivated, the transmitter can be repeatedly suspended after no less than 2 months. It is important to note that battery charge level cannot be checked if the service subscription is suspended. A request for the temporary service subscription deactivation must be sent by e-mail to Ornitela (support@ornitela.eu) with indicated transmitter serial number, deactivation date and deactivation duration requested. Deactivation will be confirmed by Ornitela by e-mail. Device settings page of the deactivated transmitter will be inactive throughout the duration of the deactivation period.

Temporary suspension of service subscription should only be applied for transmitters that are not deployed on birds and are turned off.

Terminating transmitter operation

All transmitters reach the end of their life time at some point. Service subscription does not terminate automatically even when no data are received from a transmitter for a prolonged period of time.

IMPORTANT: It is sole obligation of the user to decide when service subscription of each transmitter should be terminated and to inform Ornitela of this decision. This will also permanently deactivate the transmitter.

This should be done by sending an email to support@ornitela.eu and providing serial number(s) of the transmitter(s) for which the subscription should be terminated and the requested date of the termination. We will acknowledge receiving such a request and terminate the service subscription. This will stop charges of data transfer fees. No data will be further received from the terminated transmitter and its reactivation will not be possible.

Before sending such a request users should consider carefully whether a transmitter stopped sending positions temporarily or not. Sometimes the transmitters may stop sending data for extended periods and come back to life later. Typical situations could be: a bird migrates to a region with no GSM coverage (e.g. Arctic or other remote areas) and stays there for months; or battery discharges during poor light conditions (e.g. winter at high latitudes), but recharges when light conditions subsequently improve. Thus, such factors and knowledge about species biology and habitats should be taken into consideration before requesting to terminate the subscription.

Upon termination of the transmitter operation, the data received from the transmitter throughout its lifetime will continue to be available for download from the OrniTrack Control Panel for another 3 months. Afterwards, the data will be transferred to a permanent archive and will be available for retrieval only upon special arrangement.

Online control panel and data server

The online control panel and data server can be accessed by clicking “Access my devices” in the bottom right corner of the Ornitela website (www.ornitela.com) or going directly to www.glosendas.net/users/. After entering your user name and password you will be taken to the OrniTrack devices main page (Figure 2).

Main page

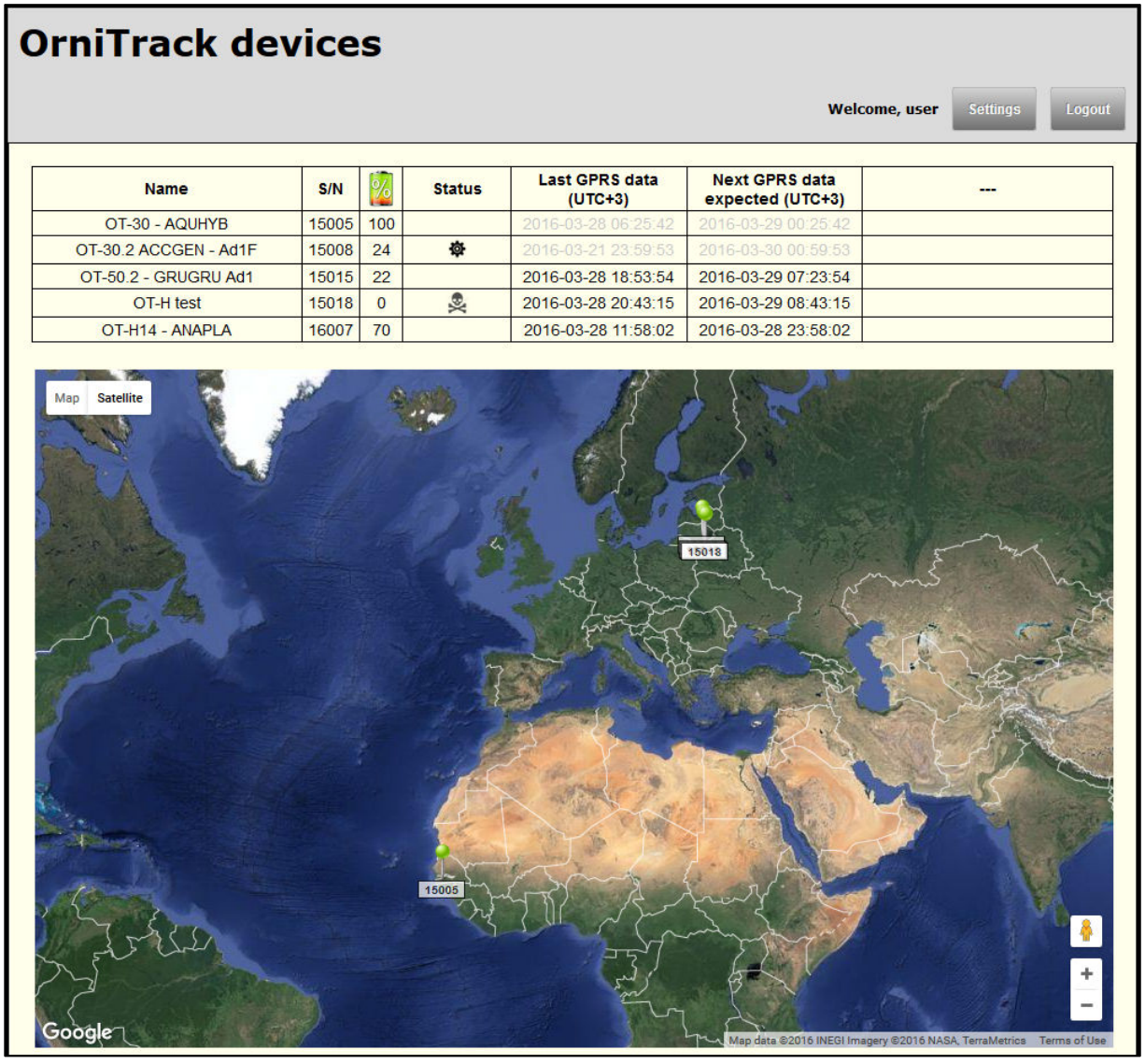

Figure 2 Main page of the user panel prior to selecting any particular device.

The main page lists all of your tracking devices in a table and has an embedded map below showing the last location of each of your OrniTrack transmitters. The table has several columns displaying key information about the devices:

- **Name** – the name of the device or tagged bird, which is set by the user under the *Device settings* menu (described below).
- **S/N** – the unique serial number of the device.

- **Battery icon** – shows the percent of the remaining battery charge that was registered during the last data connection.
- **Status** – displays warning/information icons. An explanatory text is displayed when hovering computer mouse over the icon. No icon means that the transmitter is functioning as expected and there are no new settings pending for transmission to the device. Currently, the following icons are used:
  -  **SMS** – indicates that the most recent data transmission occurred via SMS message, but not GPRS upload.
  -  **Exclamatory mark in yellow triangle** – indicates possibly invalid transmitter position based on accelerometer measurements (only used for backpack transmitters).
  -  **Skull and crossbones** – the transmitter is not moving, possible mortality of a bird.
  -  **Cogwheel** – indicates that there are new settings waiting to be sent to the transmitter.
- **Last GPRS data (UTC±x)** – date and time when last GPRS data were received. Text in black font indicates that the data were received according to the schedule, and text in grey font indicates that the last scheduled data upload was missed. Date and time can be displayed in UTC or in a time zone selected by the user under the*Settings* menu (described below).
- **Next GPRS data expected (UTC±x)** – date and time when next GPRS data uploading session is scheduled. Text colour follows the same rules as in the previous column described above.
- **---** – currently empty reserved field.

User settings menu

In the upper right corner of the main page there is a *Settings* button, which takes you to the general user settings page (Figure 3).

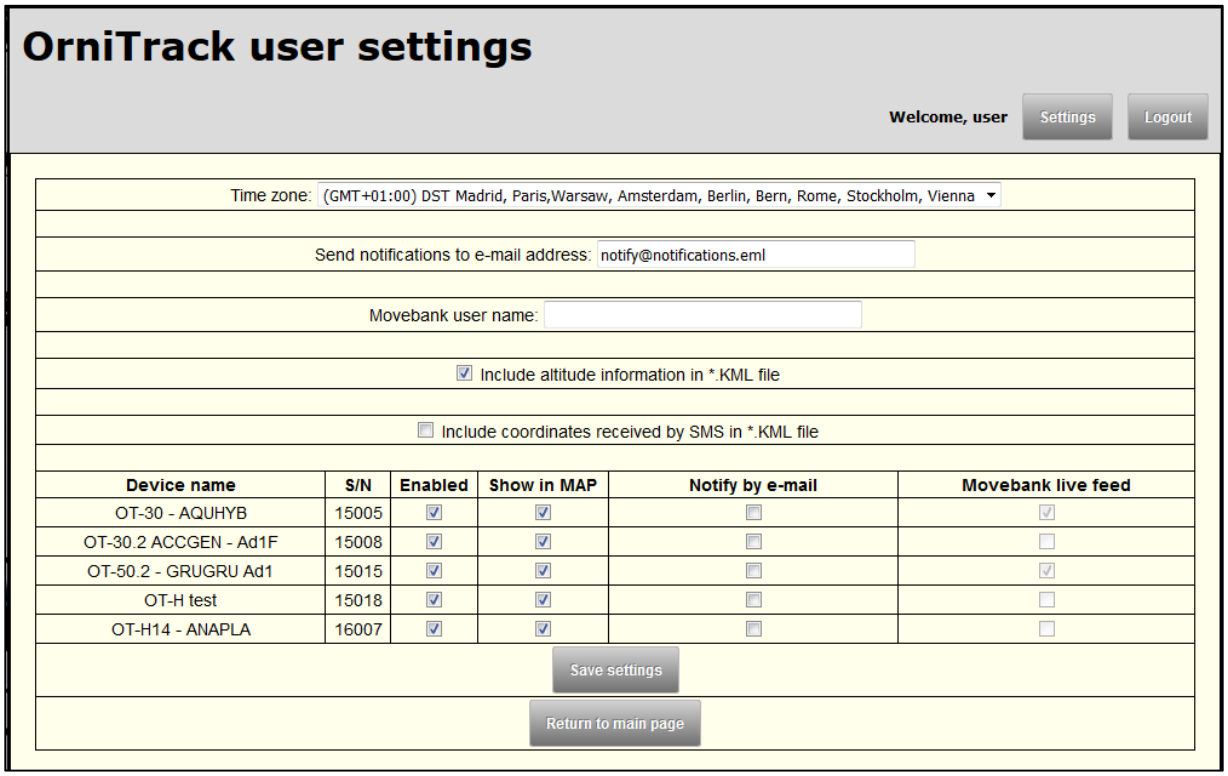

Figure 3 View of OrniTrack user setting page.

Here, the user can choose the desired time zone to be displayed on the Main Page.

An e-mail address can be entered here to which e-mail notifications are sent when new data is received from selected transmitters.

In order to enable live feed of tracking data into the www.movebank.org database, the user must provide Movebank user name in the following field and request activation of this feature by sending an email to support@ornitela.eu.

If check box *Include altitude information in *.KML file* is selected, KML files generated by the server display bird tracks in 3D. If not selected, bird position and tracks in KML files are displayed as clamped to the ground.

The following check box allows you to *Include coordinates received by SMS in *.KML file*.

The table listing all OrniTrack devices that belong to the user offers three check boxes for each device:

- **Enable** – displays the device on the main page.
- **Show in MAP** – displays the device on the map embedded on the main page.
- **Notify by e-mail** – sends e-mails to the provided e-mail address whenever new data are received from the transmitter.
- **Movebank live feed** – enables a possibility for live data feed into Movebank (this feature will be available shortly), which needs to be further configured on Movebank portal directly.

It is important to *Save settings* after making changes on this page.

Back to the main page. Accessing each transmitter is done by clicking on the device name in the table. Once clicked, a new menu with transmitter-specific information appears below the main table. This device menu provides more information about the device settings and allows you to download the data.

Device menu

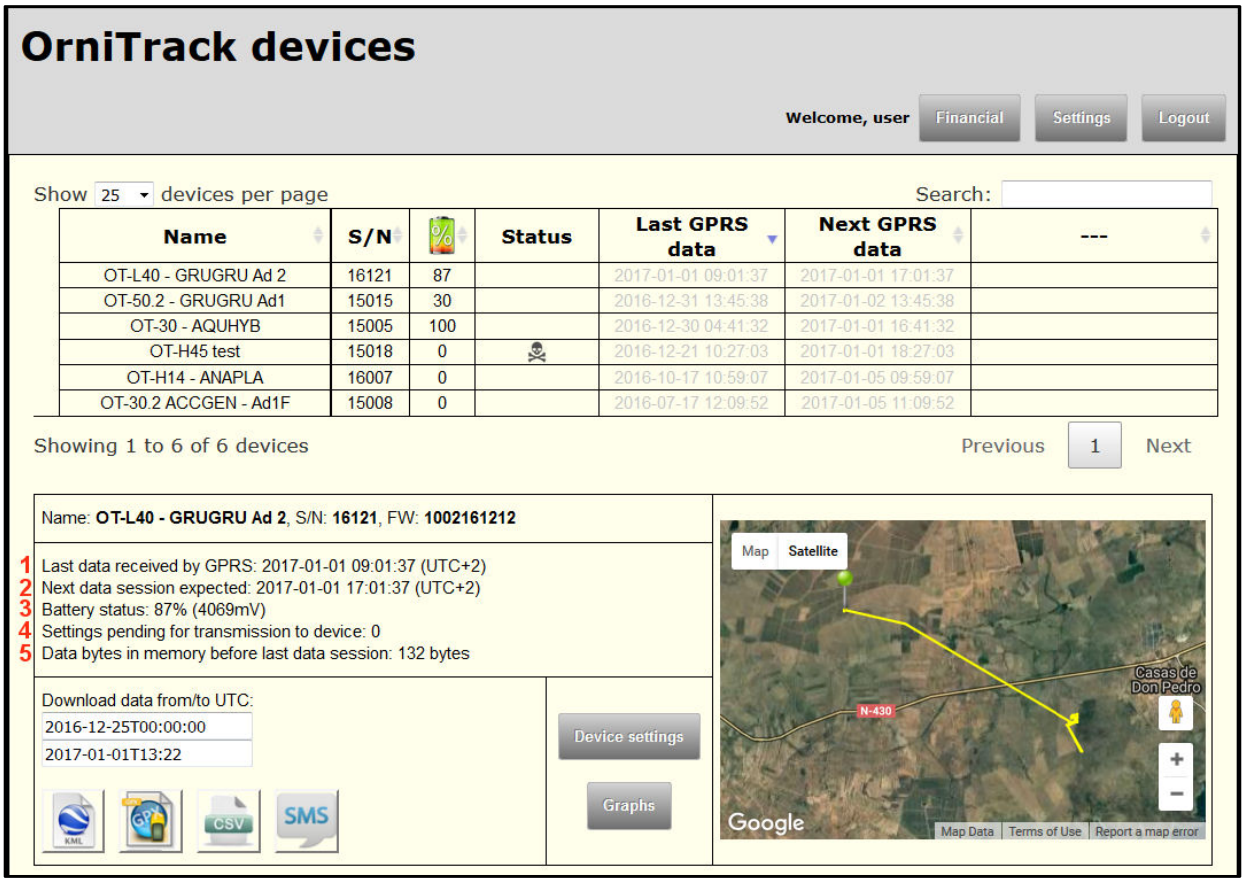

Figure 4 OrniTrack device menu that becomes available after selecting a particular device (by clicking the respective line in the available device list).

The top row contains transmitter **Name**, **sn** – serial number and **fw** – firmware version.

The lower section contains more technical information (for this manual numbered in **red font**):

1. States whether the last data were received by GPRS (irrespective of whether it was 2G or 3G data upload) or SMS and gives the date and time when that happened.
2. Date and time when the next data session is expected (the same as in the main table above).
3. Battery status as a percentage of the total voltage remaining and actual voltage.
4. Indicates how many new settings are pending, if any, for the transmission to the device. Settings are transmitted during GPRS data sessions. SMS connections do not transfer new settings.
5. Shows how many data bytes were in the transmitter memory before the last data session. Occasionally, only part of the data is transferred from the transmitter, which could happen due to an interrupted connection, poor GSM/GPRS signal strength, or low battery. A single GPS position and all the sensor information associated with this position occupy 66 bytes; if sensor-only data are also collected on a separate schedule, 66 bytes contain four data points of all sensors (accelerometer, magnetometer, light intensity and temperature) or 12 data points of accelerometer only.

The bottom section is for data downloading. The desired period for data download can be selected. The default is the most recent 7 days. Please note that the time in these fields and in the data files is always in UTC, irrespective of the selected time zone on the *Settings* page. Dates could be selected from the drop-

down menu, which is optimized for Internet Explorer and Google Chrome browsers. In other browsers you may need to type in the desired date. Once the period is selected, data can be downloaded in one of three formats by clicking the icons below: KML, GPS and CSV. If some of the data were received by SMS, then SMS data can be downloaded in CSV format by clicking the respective icon.

Data downloaded in CSV format is presented in 22 columns:

1. ***device_id*** – unique identification number of OrniTrack device
2. ***UTC_datetime*** – UTC date & time
3. ***UTC_date*** – UTC date
4. ***UTC_time***– UTC time
5. ***satcount*** – number of satellites during GPS fix
6. ***U_bat_mV*** – battery voltage in millivolts (mV)
7. ***bat_soc_pct*** – battery charge in percent
8. ***solar_I_mA*** – battery charging current by solar panel in milliamperes (mA)
9. ***hdop*** – horizontal dilution of precision of GPS fix
10. ***Latitude*** – Latitude in decimal degrees
11. ***Longitude*** – Longitude in decimal degrees
12. ***Altitude_m*** – GPS measured altitude above mean sea level in meters
13. ***speed_km_h*** – GPS measured ground speed in kilometres per hour
14. ***direction_deg*** – GPS measured movement direction in degrees
15. ***temperature_C*** – transmitter internal temperature in degrees Celsius
16. ***light*** – light intensity (0–2047, unitless)
17. ***mag_x*** – magnetometer X-axis measurement
18. ***mag_y***– magnetometer Y-axis measurement
19. ***mag_z***– magnetometer Z-axis measurement
20. ***acc_x***– accelerometer X-axis measurement
21. ***acc_y***– accelerometer Y-axis measurement
22. ***acc_z***– accelerometer Z-axis measurement

Data received by SMS is not integrated into the main dataset as SMS information is meant only to inform about the whereabouts of the tracked birds when a proper data download is not possible. Data transmitted by SMS remains on the transmitter's internal memory until it is uploaded via GPRS data transfer.

To the right from the data download panel there is a *Device settings* button (described below).

A small embedded map shows a track using 250 most recent GPS positions.

OrniTrack device settings

The device settings page is accessed by clicking the *Device settings* button on the Device menu page (Figure 5).

This page is for setting the operational schedules for each transmitter. The available menu might differ in the number of features available depending on the transmitter type.

Setting general GPS and GSM schedules

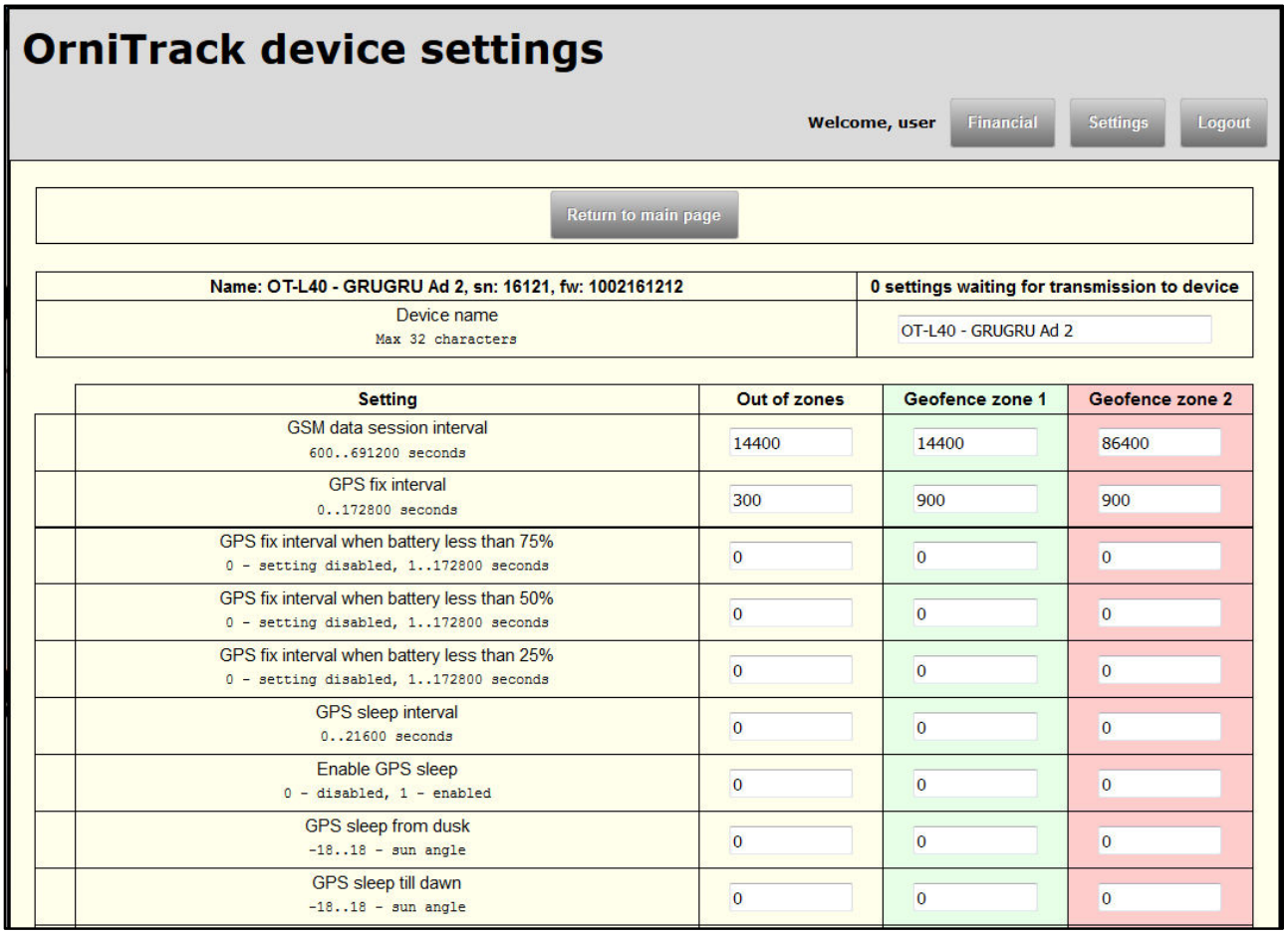

Figure 5 Part of the Device settings menu for defining GSM and GPS schedules.

In the first editable cell you can name the transmitter using up to 32 characters. This name will appear in the device list on the *Main page*.

Three columns in the setting page allow defining three sets of the device settings described below: general transmitter settings “Out of zones”, and separate settings for “Geofence zone 1” and “Geofence zone 2”. Please read *Geofence explained* on the last chapter of this manual.

The rows in the user settings page are used for defining key operational settings of the transmitter.

The first line “*GSM data session interval*” is for defining GSM data upload intervals in seconds, which can range from 600 to 691200 (10 min to 8 days). We recommend setting data uploads to once or twice per day, i.e. every 43200 or 86400 seconds. GSM connections are more energetically expensive compared to GPS position fixes and thus result in higher battery drain. Furthermore, every connection to the GSM

network has associated charges by telecommunication companies, and frequent connections may result in increased consumption of data transfer fees.

The second line "*GPS fix interval*" is for defining GPS fix intervals in seconds, which could range from 1 to 172800. For example, if 60 is entered in the field, the transmitter will be logging GPS positions every 60 seconds. While GPS fix intervals may be automatically adjusted according to the battery charge level (see below), it is important to consider the expected solar exposure of the transmitter, based on bird's behaviour, daylight duration, weather conditions, etc., when setting the initial GPS fix intervals. If a transmitter is exposed to direct sunlight several hours per day, we recommend to start by selecting 600–900 second intervals (10–15 minutes) and monitor battery voltage for several days. If the solar panel charges transmitter battery more than it spends on operations, GPS fixing interval could be shortened. We experienced that for some species it was sustainable to log GPS positions every 60 seconds for months. But there are also situations when solar panel provides very little charge, e.g. when birds cover solar panels with feathers, constantly hide in a shade, live in conditions with very little sunlight or during prolonged periods of poor weather. In such instances GPS positions should be fixed less frequently.

Line "*GPS fix interval when battery less than 75%*" is optional and could be used for defining an automatic change of GPS logging intervals when battery level drops below 75%. This could be useful when standard GPS fix interval is short and could drain the battery fast if not adjusted. When a value of this field is set to 0, GPS logging interval remains unchanged when the battery level drops below 75%.

Line "*GPS fix interval when battery less than 50%*" is optional and could be used for defining an automatic change of GPS logging intervals when battery level drops below 50%. When a value of this field is set to 0, GPS logging interval remains unchanged when the battery level drops below 50%.

Line "*GPS fix interval when battery less than 25%*" is optional and could be used for defining an automatic change of GPS logging intervals when battery level drops below 25%. When a value of this field is set to 0, GPS logging interval remains unchanged when the battery level drops below 25%. However, we do recommend setting GPS fixing interval to a higher value here, particularly if the normal GPS fixing interval is rather short.

Line "*GPS sleep interval*" is for setting GPS logging interval during the night, if transmitter night-sleeping is enabled in the following line. Many bird species are not active at night, therefore logging GPS positions is often not needed or is sufficient at infrequent intervals during the dark period. Turning the transmitter off or slowing down GPS recording at night reduces unnecessary battery drain. Important to note that a value of 0 in this field means that no GPS positions will be logged during the night sleep period. Of course, for nocturnal species GPS sleep interval may be set to be more frequent than the normal (day) GPS fix interval, but it cannot be automatically adjusted according to the battery charge level.

Line "*Enable GPS sleep*" is for enabling or disabling night settings for GPS logging. Settings for sleep period affect only GPS position fixing, whereas GSM connections take place following standard settings.

Line "*GPS sleep from dusk*" is for setting when GPS sleep period starts in the evening depending on Sun angle above or below the horizon. Available settings for Sun angle range from -18 to 18° defining the position of the Sun relative to the horizon, which is automatically calculated using transmitter geographic location and date. Negative angles indicate Sun position below the horizon, e.g. civil (Sun angle = -6), nautical (Sun angle = -12) or astronomical twilight (Sun angle = -18) (see illustration in Figure 6). Positive angles indicate Sun position above the horizon (could be useful when studying species that become inactive some time before sunset).

Line "*GPS sleep till dawn*" is for setting when GPS sleep period ends in the morning depending on Sun angle above or below the horizon. The same as above, available settings for Sun angle range from -18 to 18° defining the position of the Sun relative to the horizon. Positive angles indicate Sun position above the horizon (could be useful when studying species that do not become active at first light).

Please pay attention when setting Sun angles for night-time transmitter sleep! Values with negative sign indicate Sun angle below the horizon and values with positive sign indicate Sun angle above the horizon. At high latitudes (e.g. northern Europe) Sun does not even reach 18 degrees above the horizon in winter time and similarly it does not go down to -18 degrees below the horizon in summer. Thus, wrong settings may prevent the transmitter functioning altogether!

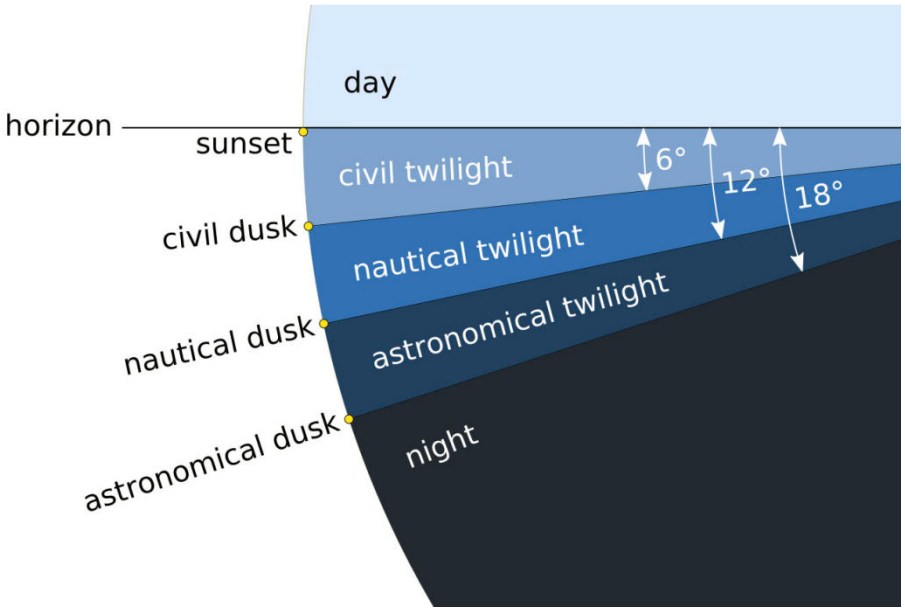

Figure 6 Illustration showing twilight classification according to Sun angle below the horizon. Taken from Wikipedia (https://en.wikipedia.org/wiki/Twilight).

Logging GPS positions in bursts (optional)

Setting	Out of zones	Geofence zone 1	Geofence zone 2
GPS burst 0..600 - seconds	0	0	0
Disable GPS burst when battery less than x% 10..90 %	50	50	50

Figure 7 Part of the Device settings menu for controlling GPS burst logging.

Line "*GPS burst*" is an optional field for setting GPS logging in bursts. It is a possibility to define that more GPS positions are logged (up to 600) at standard GPS fix intervals instead of one. GPS positions are logged at 1 Hz, i.e. 1 position every second. For example, if "*GPS burst*" is set for 60, the transmitter will log 60 consecutive GPS positions at defined GPS fix intervals. Zero value in *"GPS burst"* field means that the feature is disabled and GPS position logging follows general schedule of position logging.

Please note that using GPS bursts is an energetically expensive procedure and could drain the transmitter battery fast!

Line "Disable *GPS burst when battery less than x%*" could be used to set the battery level between 10-90% below which GPS logging in bursts would be disabled and only single GPS positions would be logged at predefined intervals.

Logging sensor information

All OrniTrack transmitters are equipped with several sensors: 3-axial accelerometer, 3-axial magnetometer, temperature sensor and light intensity sensor. Instantaneous values of these sensors are recorded together with each GPS position fix.

It is possible, however, to log sensor data at higher frequencies and independently from GPS position fixing.

Please note, that data logging using sensors is the feature for advanced users who need such information and understand limitation and associated risks. Sensor data logging at high frequencies may fill up the transmitter memory fast, drain battery power and result in higher data transfer fees. Please consult Ornitela if you are uncertain about sensor use and settings (support@ornitela.eu).

Setting	Out of zones	Geofence zone 1	Geofence zone 2
Sensors log interval -1 - log after GPS fix, 0 - log disabled, 1..172800 seconds	-1	0	0
Sensors burst time 0..600 seconds	5	0	0
Sensors burst frequency 1..50 Hz	20	1	1
Sensors logging options 0 - log only accelerometer, 1 - log all sensors	1	0	0
Disable sensors burst when battery less than x% 10..90 %	50	50	50
Disable sensors burst when free memory less than x% 10..90 %	50	50	50

Figure 8 Part of the Device settings menu for controlling sensor logging.

Line "*Sensor log interval*" sets interval at which sensors will turn on and start logging the data. Possible values range from -1 to 172800 seconds. As indicated in the explanatory notes, value -1 means that sensor data will be logged following each GPS position fix (thus, it is not independent schedule but linked to GPS logging). Value 0 means that sensor logging is disabled. Values between 1 and 172800 are available for setting an interval at which sensor logging will be turned on.

Line "*Sensor burst time*" is for setting how long sensor data will be recorded once sensors are activated at intervals defined in the line above. Possible values range from 0 to 600 seconds. Zero meaning that the feature is deactivated.

Line "*Sensors burst frequency*" is for setting frequency in Hertz, which will be used for logging sensor data. E.g., selected 20 Hz frequency means that sensor data will be recorded 20 times per second.

Line "Sensor logging options" is for defining which sensor data will be saved in the transmitter memory: value 0 means that only accelerometer data will be saved (this is most commonly used sensor) and value 1 means that all sensor data (accelerometer, magnetometer, light intensity and temperature) will be saved. Recording all sensors occupies more memory and uploading larger volume of data might be difficult in areas with poor telecommunication network coverage.

Line "*Disable sensor bursts when battery less than x%*" is for defining a battery charge threshold below which intensive sensor logging will be automatically turned off. The threshold can be set by a user entering values between 10 and 90% of battery charge. The default is 50%. This setting could be useful aiming to save battery and reserving resources for standard GPS logging and data transfer.

Line *"Disable sensor bursts when free memory less than x%"* is for defining a memory used threshold below which intensive sensor logging will be automatically turned off. The threshold can be set by a user entering values between 10 and 90% of memory used. The default value is 50%. This setting could be useful aiming to save memory for standard GPS logging, when, for example, a bird is outside of telecommunication areas and thus cannot upload the recorded data and free up its memory. It is important to note that if the transmitter memory is completely filled up, no additional data will be recorded until all the data from the memory are downloaded.

Logging diving sensor data (optional)

If a transmitter is equipped with the optional diving sensor, device settings will have menu options for such sensor. Diving sensor continuously measures pressure once per second and when it senses the pressure indicating that the transmitter is submerged below 0.3 m underwater, it starts recording the data into transmitter memory. Depth data recording stops once the bird crosses the same 0.3 m threshold and resurfaces.

Setting	Out of zones	Geofence zone 1	Geofence zone 2
Enable diving sensor 0 - disabled, 1..10 Hz	10	0	0
Diving sensor options 0 - log only diving sensor, 1 - log all sensors	0	0	0

Figure 9 Part of the Device settings menu for controlling diving sensor operation.

Line "*Enable diving sensor*" is used for enabling the diving sensor and setting the desired frequency of data recording. Available values are 0 to 10 where 0 means that the sensor is disabled, 1 that data are recorded at frequency of 1 Hz (once per second) and 10 that data are recorded at frequency of 10 Hz (10 times per second). All integer values are possible within that range.

Line "Diving sensor options" is for defining whether only diving sensor value will be recorded (option 0) or values of all sensor (accelerometer, magnetometer, temperature and light) – option 1. Logging all sensors would occupy more transmitter memory and require more data to be uploaded, which might influence transmitter battery use and data transfer costs.

Geofence setting

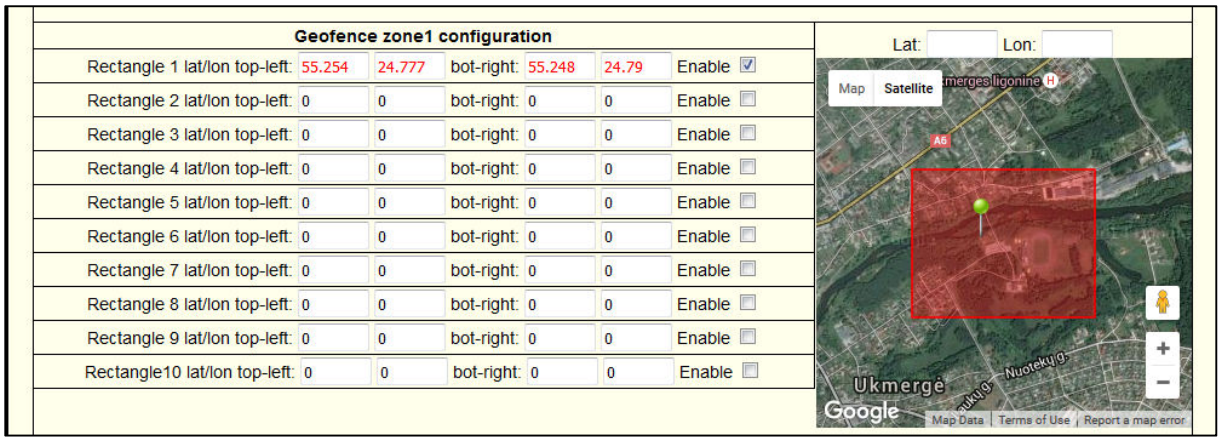

Figure 10 Part of the Device settings menu for defining geofenced areas.

Geofence settings are only activated if geofence areas are defined and enabled. This is done using the Geofence zone configuration menu. Each geofence zone can be defined using up to 10 rectangles. Rectangles are defined by typing in the latitude and longitude of the top-left and bottom-right corners. The coordinates should be entered as decimal degrees. Once the corner coordinates are entered, a rectangle is displayed in the index map on the right. The index map can also be used for finding out the coordinates: when clicked on the desired position on the map – the coordinates of that position are displayed above, and could be used for looking up and typing in as rectangle defining coordinates.

In order to activate the geofence(s), the defined rectangles need to be enabled by clicking the "Enable" check box.

For new settings to take an effect, they need to be saved by clicking the "Save settings" button. If saving has been successful, all pending setting are displayed in red font, allowing you to review them and adjust if needed before transmission to the device (Figure 11).

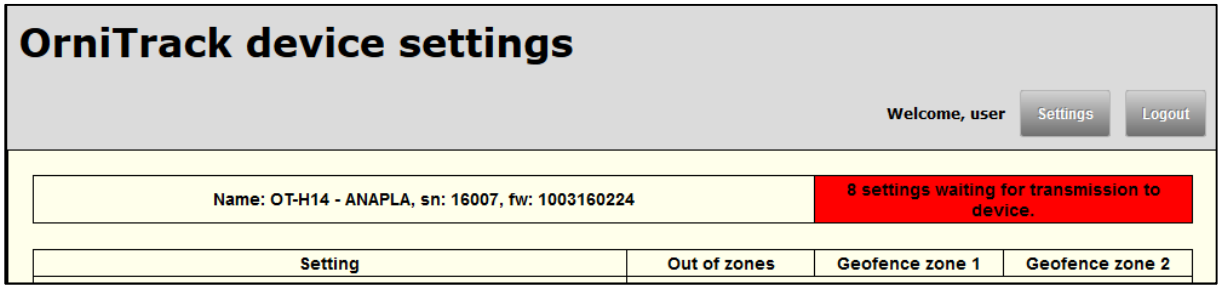

Figure 11 Part of the Device settings menu showing an example of new settings waiting for the transmission.

Important: new settings are sent to a transmitter during the next GSM session. It is advisable to limit the number of new settings to 10 that are uploaded during a single GSM session.

Finally, at the bottom of the page there is a field labelled *Device notes* for making text notes about the device. They need to be saved separately by pressing the "Save notes" button.

Despite the rather lengthy description above, we believe that the online user panel is intuitive and easy to navigate. However, if you encounter difficulties using it please contact us by email: ***support@ornitela.eu***

Geofence explained

Geofence is a virtual perimeter defined by geographic coordinates inside which a transmitter can be set to operate at different position logging and data transmission rates as well as different day/night activation periods. OrniTrack transmitters can support two geofences with different settings. Each geofence can be comprised of up to 10 rectangles, which can be used to construct one complex area or can be located separately.

This feature allows maximizing data collection from areas where it is most needed and saving battery power when intensive position logging is unnecessary.

Geofence is only sensed by GPS, thus if positions are logged infrequently outside of the geofence or in a certain geofence zone, it will take until the next position fix for the transmitter to sense that it has moved to a different geofence zone and change its duty cycle accordingly.

The two geofence zones may overlap, in which case their settings follow a hierarchy: geofence 1 settings are superior to geofence 2 settings. For example, if a geofence 1 zone is placed within the geofence 2 zone, the geofence 2 zone will create a buffer with different settings around the geofence 1 zone.

Geofence settings can be controlled remotely by the user through the online control panel (described above in this manual).

CAUTION: Please consider battery power when setting a geofence with frequent data logging. It does not take long to completely drain the transmitter battery at high logging rates. Uploads of large volumes of data via GSM/GPRS network is also energetically expensive. If the battery is drained, it can take a while until the transmitter recharges, depending on available sunlight. Battery power monitoring and selecting appropriate duty cycles, including geofence use, is the sole responsibility of the user. The geofence feature should only be used by experienced users who are well familiar with bird telemetry and using OrniTrack transmitters.

For a more detailed explanation on the geofence feature, transmitter power management and other details please consult the Frequently Asked Questions section on the Ornitela website at www.ornitela.com.