Lotek

LiteTrack, PinnaclePro and GlobalstarTrack Pro GPS Collars

USER MANUAL

REVISION 18
09 JUNE 2023
#MGPS006

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1. Introduction

Thank you for purchasing the LiteTrack GPS collar system. LiteTrack is a unique range of lightweight GPS collars with the ability to record the location of a collared or tagged animal over a long period of time. There are a number of variants available which include:

- LiteTrack 10, 20, 30, 40, 60, 140, 330, 360, 420, 800 and LR dataloggers (Storage on Board) with VHF beacons
- LiteTrack 10, 20, 30, 40, 60, 140, 330, 360,420 and 800 dataloggers (where data can be downloaded remotely via Hand held 'Commander' unit)
- LiteTrack Iridium 130, 130+150, 150+250, 250+330, 330+360, 420, 420+750, 750+, 800, 800+ (upload data through Iridium satellite system)
- PinnaclePro: all models
- GlobalstarTrack Pro S, M, L (upload data through Globalstar satellite system)

Each collar model is fitted with different battery size that can change the number of fixes that can be recorded in any one deployment, but the larger the battery the heavier the collar. This manual explains the user interface, how to set up the collar for deployment, and how to retrieve the data once the collar had been retrieved from the field.

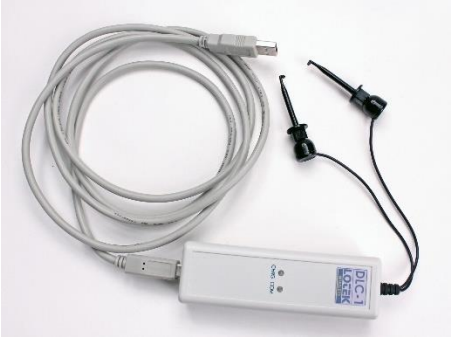
PinPoint Host utility software has been developed both for PinPoint avian tags and for LiteTrack collars which share core architecture. Therefore words "tag" and "collar" are interchangeably used throughout this manual.

2. Getting Started

We expect all researchers to test the collars before deployment, to learn about how they work and ensure you will be collecting the data you expect. For example, the collar needs activating with an uploaded schedule in it, before it will collect any data at all. If the collar is to communicate with satellites it also needs activation with appropriate satellite service (Iridium or Globalstar)

To program a PinPoint tag for testing or deployment, you will need the following items:

- DLC-1 or 2 USB Interface reader.
- A laptop or a desktop PC, running Windows 7, Windows 8.1 or 10
- PinPoint Host installation software (available via a USB flash drive or downloaded from the Lotek's Website).
- LiteTrack collar to be programmed.
- PinnaclePro collars need an adaptor interface to be able to connect with DLC-2.



DLC-1/2 Interface & USB Cable

PinnaclePro Interface for DLC-2

3. Installing the PinPoint Host Application

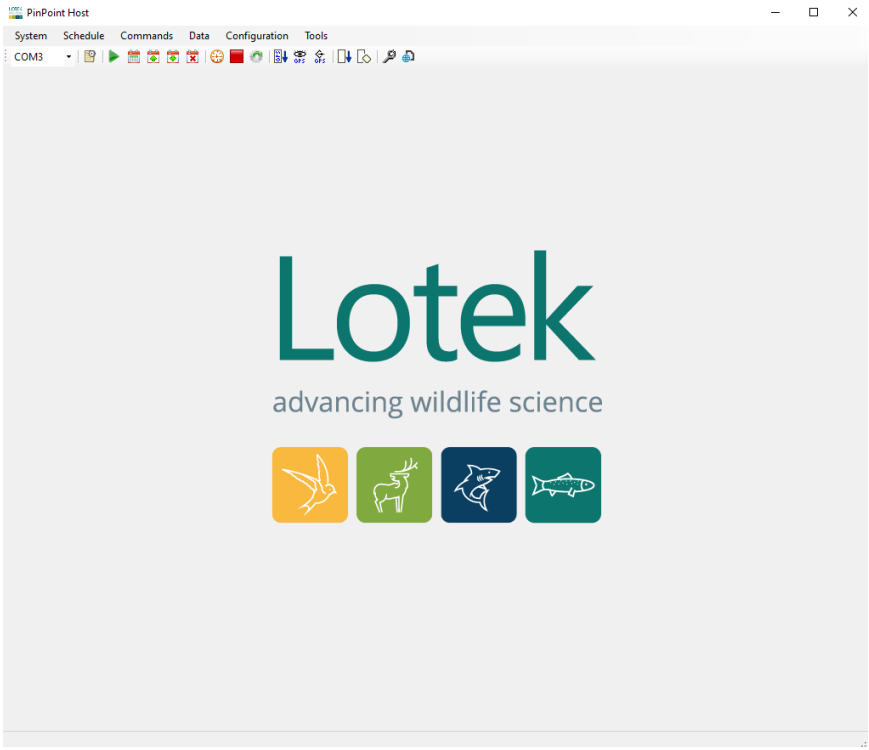
When a DLC1/DLC2 reader is connected to the PC running Windows 7 or 8.1 for the first time your computer should now automatically install the necessary drivers. Please make sure the internet connection is available because windows need to obtain the driver software from windows update. If the driver fails to load automatically refer to Appendix A.

Plug USB flash drive containing the PinPoint Host installation software into your USB Port. The installation will start automatically; in case it does not, please select Start, then Run and locate your USB drive. There you should find the PinPoint installation software icon. Double click on the icon and proceed through the installation wizard. The installation software will create a Lotek Wireless subfolder directory in your Program Files folder. PinPoint software will be installed in its own subfolder.

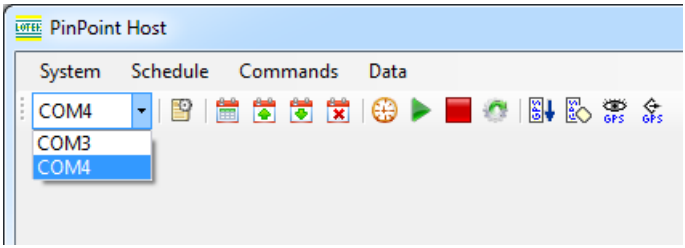
Important: If .Net Framework 4 is not installed on the PC, the installation program will download it from the internet and install it. Therefore, please make sure the PC has an internet connection available during installation.

4. Starting PinPoint Host

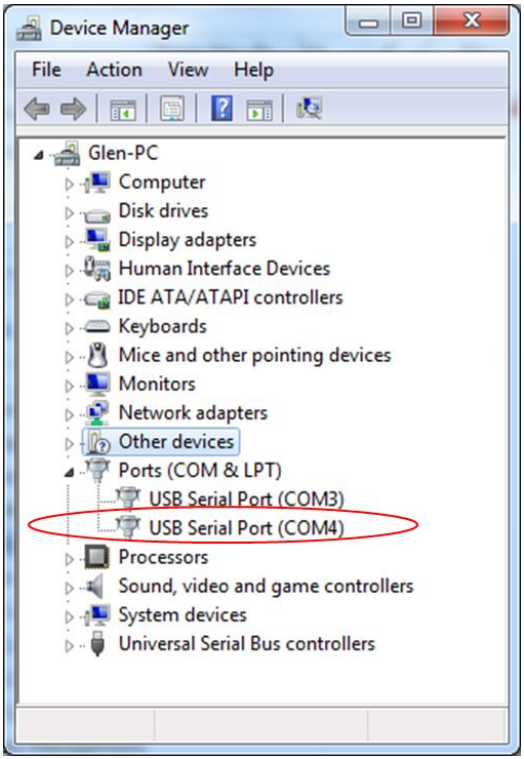
Connect the DLC-1 Interface USB cable to any USB port on your PC. Start the PinPoint Host application. The initial startup screen will look like this:



First, select the correct 'Com port' by clicking the down arrow and selecting the right port.

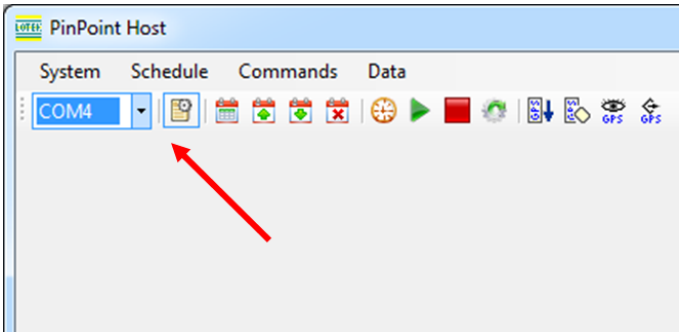


If you are unsure about which port to select, go to the Control Panel (select View by Small icons) Device Manager. Click on 'Ports (COM & LPT) and look for the USB Serial Port, which in this example is COM4

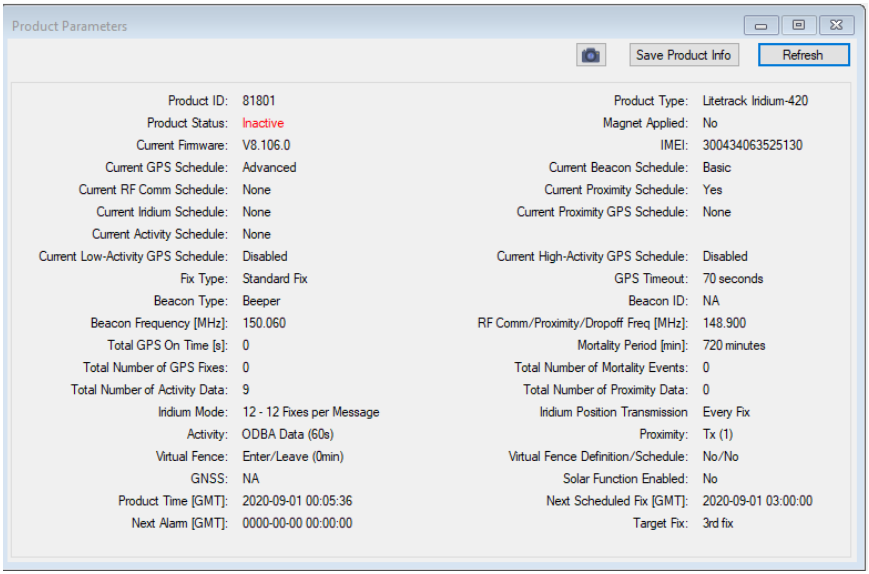


Connect the collar to the DLC-1 Interface by clipping the small retractable hooks onto each protruding connector on the collar. Location of the connectors may vary among models. On LiteTrack 10-140 and LiteTrack Iridium 130 and 150 they are on the side of the main body. On LiteTrack Iridium 250-750 and on Globalstar Pro models they or on the top assembly. On LiteTrack 330-800 dataloggers they are inside of the battery compartment. Call us if unsure.

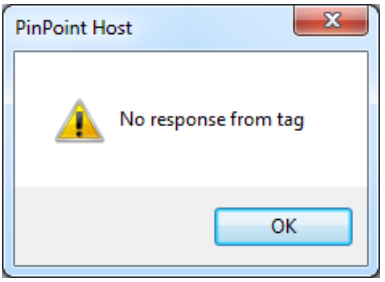
If this is successful, the 'COM' light on the Interface will turn green. To confirm that the collar is communicating, select the 'Show Product Parameters' Icon.



A small window showing the actual collar parameters will appear.



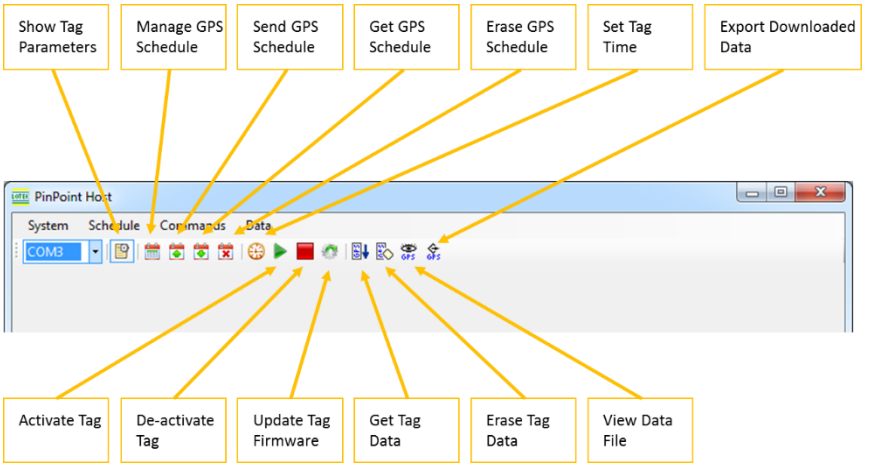
Or if the collar is not communicating then the following error message will appear.



If this is the case, check that the retractable hooks on the interface are making a good contact and try again.

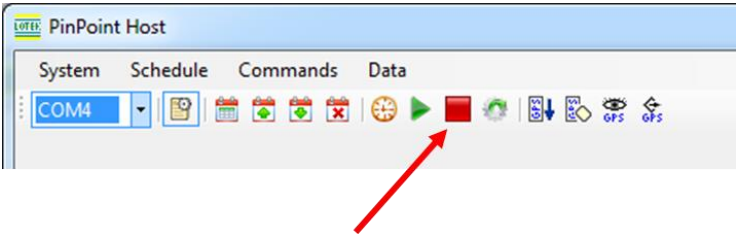
5. Initial setup before deployment.

On the PinPoint Host main window there are several selectable options which can be initiated either by using the 'Drop Down' menus or clicking on the Icons. The commands available are:

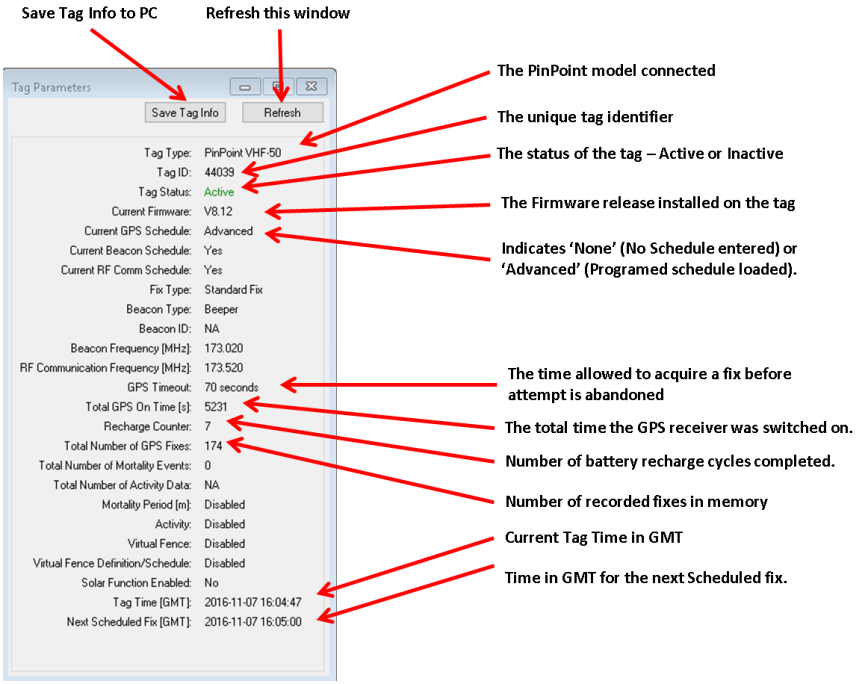


These commands will be described in later sections.

Before the tag is set up, make sure it is not 'Active' by clicking the Deactivate Tag icon or selecting the option from the drop down 'Commands' menu.



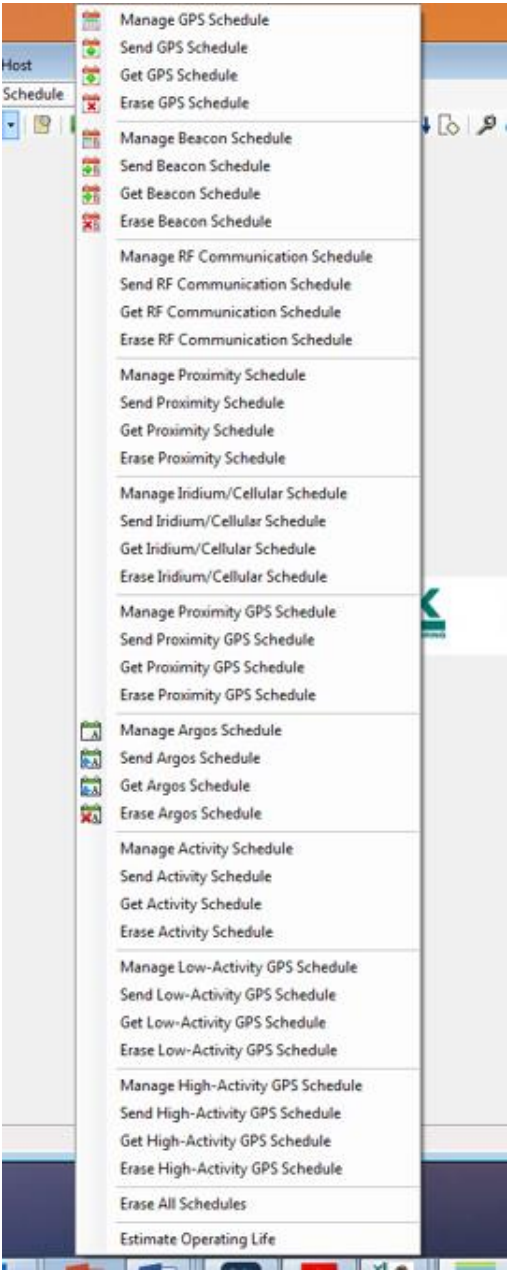
It is useful to understand the pre-set parameters that are configured on the PinPoint tag depending on which one is being used. If you click on the 'Show Tag Parameters' Icon, then the window below appears. The meaning of some important parameters is shown with the red arrows. This screen will also confirm that the collar is inactive.



Most of these parameters are non-configurable except for Tag/Collar Status and current Schedule.

5.1. Schedules

Preparation of a collar for deployment usually involves creating miscellaneous schedules that need to be uploaded to collars prior to their mission. Depending on collars options these schedules can be GPS schedule, VHF beacon schedule, RF communication schedule, Proximity schedule, Iridium/cellular schedule, Proximity GPS schedule, Activity schedule, Virtual fence schedule and animals' low activity/high activity GPS schedules.


Host
Schedule
Manage GPS Schedule
Send GPS Schedule
Get GPS Schedule
Erase GPS Schedule
Manage Beacon Schedule
Send Beacon Schedule
Get Beacon Schedule
Erase Beacon Schedule
Manage RF Communication Schedule
Send RF Communication Schedule
Get RF Communication Schedule
Erase RF Communication Schedule
Manage Proximity Schedule
Send Proximity Schedule
Get Proximity Schedule
Erase Proximity Schedule
Manage Iridium/Cellular Schedule
Send Iridium/Cellular Schedule
Get Iridium/Cellular Schedule
Erase Iridium/Cellular Schedule
Manage Proximity GPS Schedule
Send Proximity GPS Schedule
Get Proximity GPS Schedule
Erase Proximity GPS Schedule
Manage Argos Schedule
Send Argos Schedule
Get Argos Schedule
Erase Argos Schedule
Manage Activity Schedule
Send Activity Schedule
Get Activity Schedule
Erase Activity Schedule
Manage Low-Activity GPS Schedule
Send Low-Activity GPS Schedule
Get Low-Activity GPS Schedule
Erase Low-Activity GPS Schedule
Manage High-Activity GPS Schedule
Send High-Activity GPS Schedule
Get High-Activity GPS Schedule
Erase High-Activity GPS Schedule
Erase All Schedules
Estimate Operating Life

5.2. Configuring a regular GPS Schedule

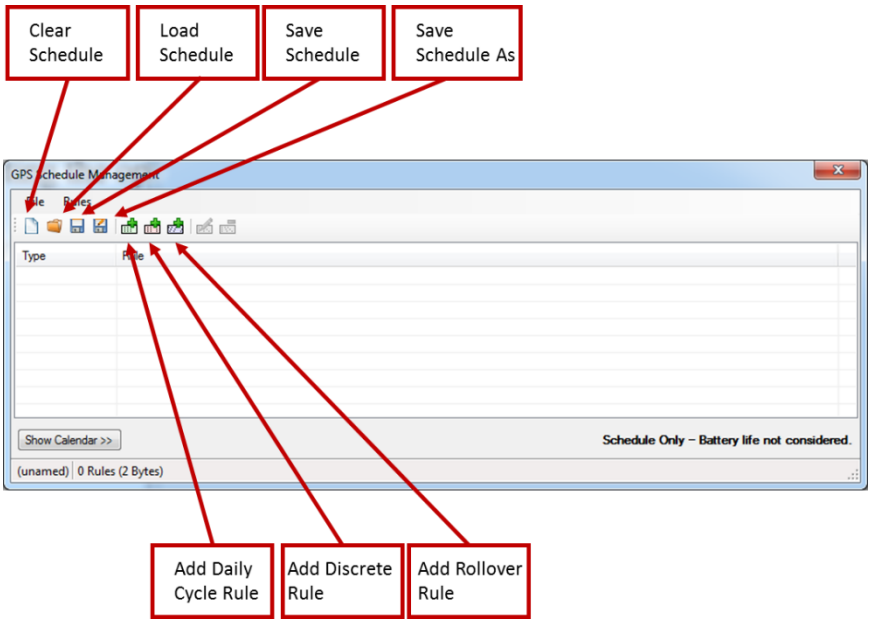
The next step is to create a GPS Schedule.

The collar schedule defines when the collar will record a location. The process can be either via a 'Cold Start' or 'Warm Start' function. When a collar is switched to take a fix, it has to download an almanac or map of the sky. This takes 10's of seconds depending on its view of the sky (The collar has a built-in timer of 70 seconds – if no fix is achieved within this period the collar is shut down to conserve battery). This is called a 'Cold Start'. Once a fix has been successfully taken, then if the next fix is scheduled within 2 hours, the collar does not need a new almanac and the time to take a fix is much faster (in ideal conditions).

By careful planning of the schedule, you could select much more rapid locations (e.g., every 5 minutes) to be taken during certain periods within the deployment, without sacrificing much battery capacity.

Creating schedule is done by selecting the 'Manage GPS Schedule' Icon or selecting the option from the drop down 'Schedule' menu.

This window will appear and has several options.

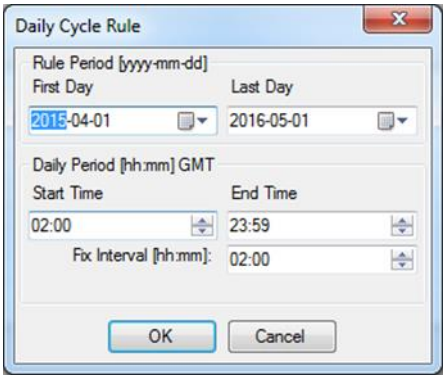


The first four icons are associated with the management of the Schedule such as load, save, etc. However, the setting up of the schedule is defined by a set of rules. Three rules can be applied to the LiteTrack collar.

- Daily Cycle Rule.
- Discrete Rule.
- Rollover Rule.

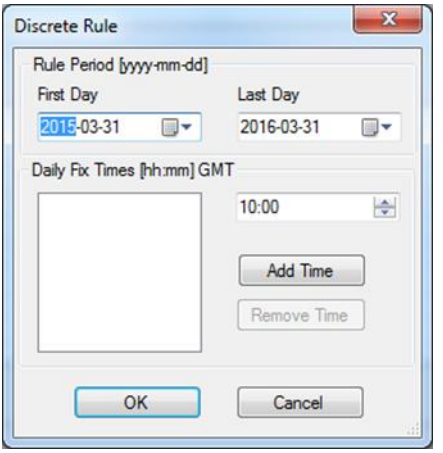
Please note that the time is always in GMT, because the satellite messages, and therefore the locations, are always in that zone. If you are in a different time zone, then all rules will need to take into account the difference. It is best to experiment by programming a schedule and checking that it is collecting locations at the correct time, before re-charging and deploying the tag in the field.

Daily Cycle Rule



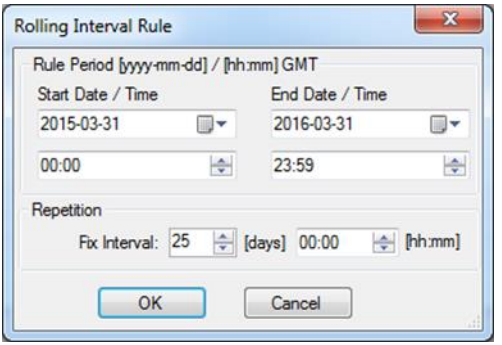
This rule sets up a daily schedule between two dates (Rule Period). Each day can be set up to take a defined number of fixes at a specific interval (Fix Interval) over a specified time period (Start Time to End Time).

Discrete Rule



This rule sets up a daily schedule of individual (discrete) fixes between two dates (Rule Period). Fixes can be scheduled at one or more specific times (Daily Fix Times).

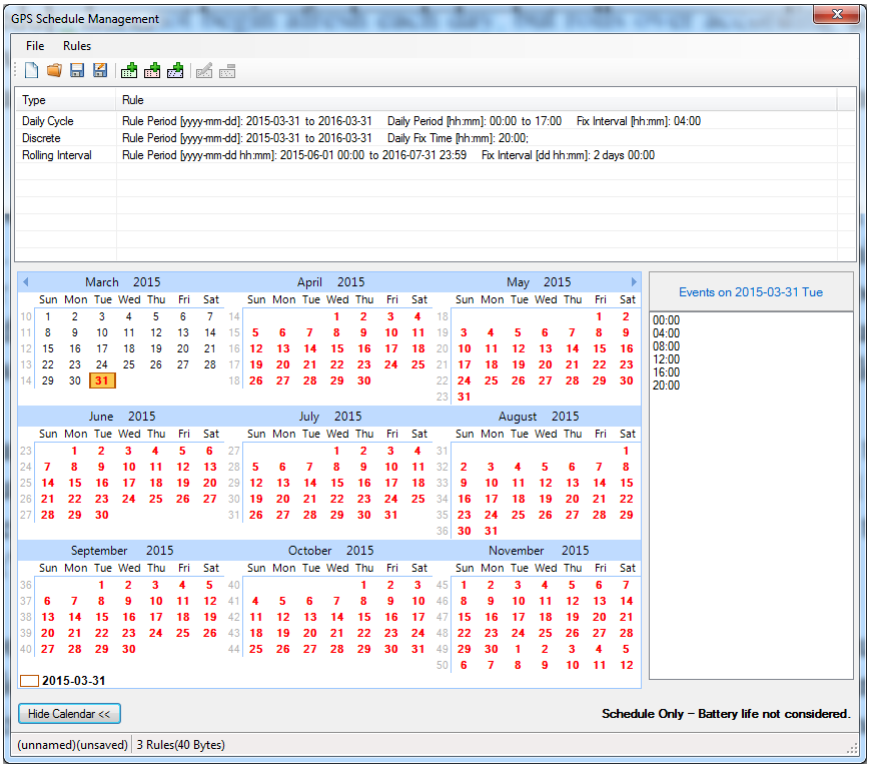
Rollover Rule



This rule sets up a rolling schedule between two dates. This differs from the Daily Cycle Rule in that the schedule does not begin afresh each day but rolls over according to the Repetition Fix Interval. A fix is taken at the Start Date /Time and thereafter at the specified Fix Interval until the End Date / Time. The interval can be set from 1 minute to 1000 days.

All three rules can be applied individually or together several times to support the needs of your study. You can add multiple Discrete, Daily Cycle or Rolling Interval rules to the Schedule. For example, you may want to monitor an animal over a one year period and take a fix on a specific day each month (Rollover rule) but then be able to take a number of fixes during the wintering period where more detail is required (Daily Cycle Rule).

On the Schedule Management Window, the Calendar can be displayed by clicking the 'Show Calendar' Button. If no Schedule has been specified, the calendar dates will be Black. If a Schedule has been entered, then the dates affected are marked Red with the details in the 'Event' pane. Click 'Hide Calendar' to remove Calendar display.



Once you have created your Schedule by adding the rules(s), save it by clicking the 'Save Schedule' Button.

If you have an existing Schedule already saved on your PC, you can load it by clicking the 'Load Schedule' button. This can then be edited if required and then saved using the existing name or another name (or location) using the 'Save Schedule As' button.

Important: When setting up the schedule, the battery life is not taken into consideration.

Once the Schedule is completed (and verified), it can be loaded onto the LiteTrack collar using the 'Send Schedule' button on the main PinPoint Host window (or use the Schedule pull-down). You will be asked for the location of the saved Schedule on your PC.

Another option is for a Schedule to be downloaded from an existing LiteTrack collar to your PC by clicking the 'Get Schedule' button on the main PinPoint Host window (or use the Schedule pull-down). You will be asked where you would like to save the Schedule on your PC.

When you load the schedule onto the collar/tag you may be asked to confirm if you wish to 'Erase previous data'.

A schedule can be erased from a unit by clicking the 'Erase Schedule' button on the main PinPoint Host window (or use the Schedule pull-down).

5.3. Configuring a VHF Beacon Schedule

The LiteTrack collars feature built in VHF beacons that can be scheduled to transmit when required to assist in collar location, using a standard radio-tracking receiver and a directional antenna.

The VHF beacon frequency is available between 145MHz to 212MHz. This is factory set to suit customer/country requirement. VHF beacon will allow the manual tracking of tagged animals using conventional direction-finding techniques. Each VHF beacon is distinguishable by its individual frequency, ensuring that tagged animals located within the same study area can be identified.

When the beacon is programmed to be active, and the collar is in **normal** operating mode, the pulse rate is configured for **40 bpm** with a pulse width of 12ms.

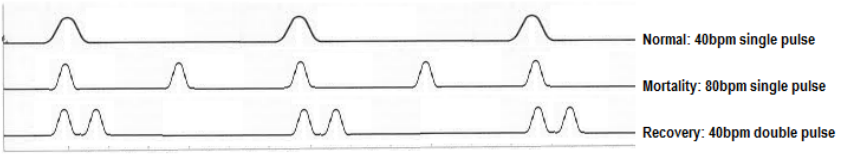
If **Mortality** occurs (more about it in chapter 5.5) beacon increases its rate to **80 bpm** and stays in this mode regardless of its current schedule.

When the animal is still active, but the main battery is exhausted the collar's beacon switches to its backup battery and beacon changes to **emergency** mode. In the **emergency** mode the beacon is always on regardless of its current schedule and it emits easily distinguishable by ear double pulses at 40 bpm.

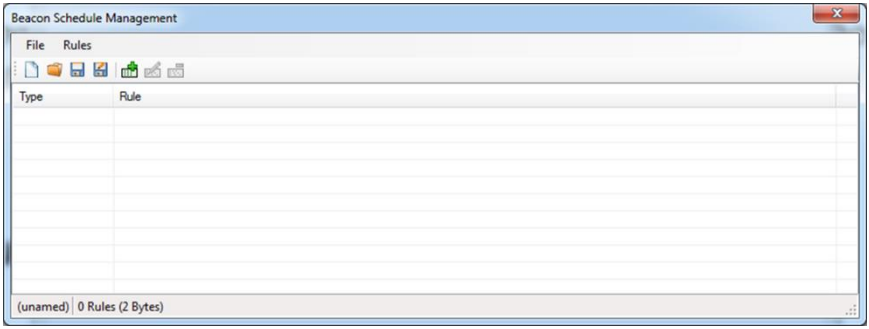
The beacon is turned OFF by the system when it is programmed to be off, and every time a satellite fix is being taken or when communicating with the collar.

VHF Beacon Modes

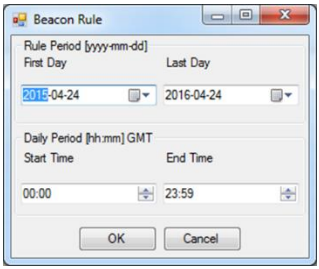
Beacon Mode	Pulse Rate	Pulse Width
Off	No pulse	---
Normal	40 bpm single pulse	12 ms each pulse
Recovery	40 bpm double pulse	6 ms each pulse
Mortality	80 bpm single pulse	6 ms each pulse



The Beacon schedule works in a similar way to the GPS Daily Cycle rule schedule; however, this is only applicable to the PinPoint Beacon/VHF tags or LiteTrack collars. When you click on the 'Schedule tab' within PinPoint Host you will see both the GPS and Beacon schedule options. If you select 'Manage Beacon Schedule' you will see only one rule icon is allowed (not greyed out) called 'Beacon Rule'



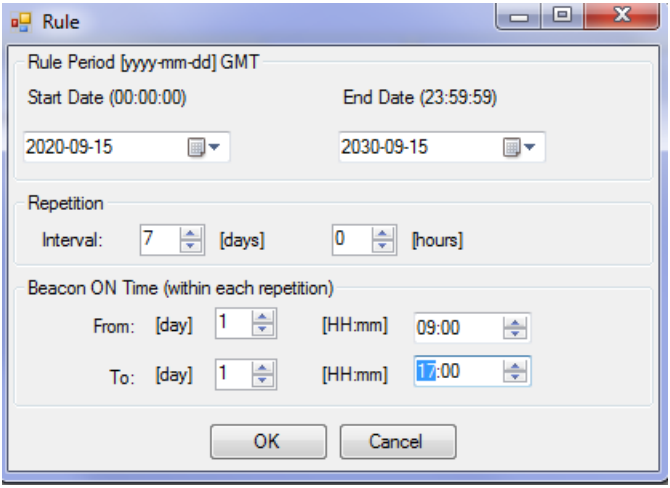
If you then select 'Add Rule' you will get



This will allow you to configure the Beacon to transmit for a configurable time period per day between two dates. Additional Beacon rules can be added if additional day/hours are required.

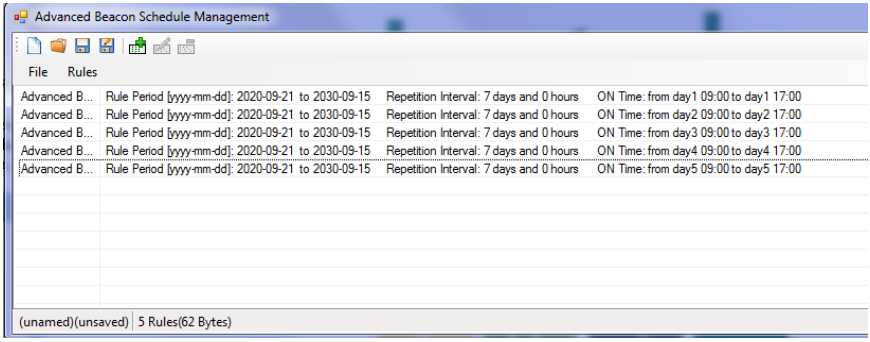
Configuring VHF advanced schedule.

Advanced schedule has been added to simplify creating beacon schedules in situations where the schedule periodically repeats itself. This can be also achieved using regular beacon schedule, however, less rules are needed when advanced schedule is used.



Using this type of schedule makes it quite straightforward to program VHF beacon, say, once or a few times a week and have it repeated throughout the deployment.

See below an example of a schedule consisting of the list of 5 rules to program the beacon to operate Monday to Friday from 9:00 to 5:00PM every week (please note that the time is in UTC!)



Coded Beacons

In areas suffering from a lot of equipment working on allowed frequencies, using coded beacons can be recommended. Coded beacons allow programming multiple number of collars with the same VHF frequency and encoding collars' ID within beacon's code. LiteTrack collars beacons can be programmed to use Lotek's proprietary coding technique. A code consists of 4 individual pulses and it is determined by 3 individual time distances between rising edges of these pulses. LiteTrack collars can be built using up to 512 unique codes per frequency. In practice however, to avoid code collisions, we do not recommend putting more than, say, 5-10 collars on the same frequency, unless the study area is very large, and collars will be spread over it.

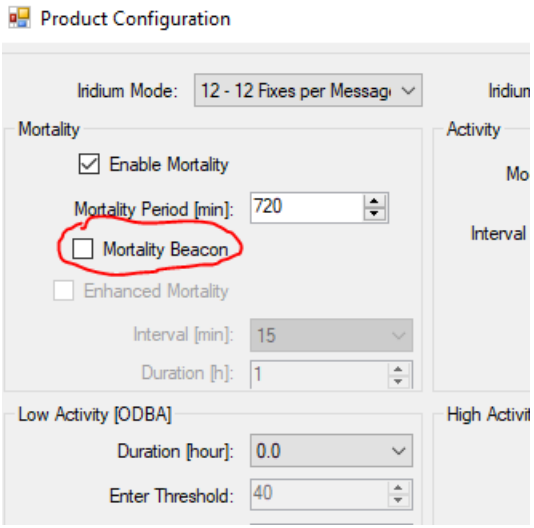
A beacon's normal mode is indicated by odd code and its mortality mode by the even code. For example, beacon codes 1,5,7, 17 constituting normal mode can be assigned to 4 collars operating on the same frequency (e.g. 149.500MHz). If the collars switch to mortality, they will be transmitting codes 2,6,8 and 18 respectively.

A burst of pulses that constitutes a code is transmitted by default with the rate of 15 bpm (every 4 seconds)
The emergency mode is indicated by slowing down the normal rate to 6s.

In order to be able to receive and discriminate codes a user must have Lotek's SRX 1200, 800, 600 or 400 receivers.

5.4. Configuring Beacon's Mortality schedule

In some situations, it may be beneficial to differently define beacon's schedule when mortality occurs. This feature is mostly useful when small collars and tags are used and there is a valid concern that beacon going on 24/7 after mortality happens will exhaust their small batteries faster than the collar can be located. To make it happen the 'Mortality Beacon Feature needs to ne enabled in Product Configuration menu, then a desired beacon schedule needs to be created and sent to the collar just like in case of a regular beacon schedule.



5.5. Configuring RF Communication schedule

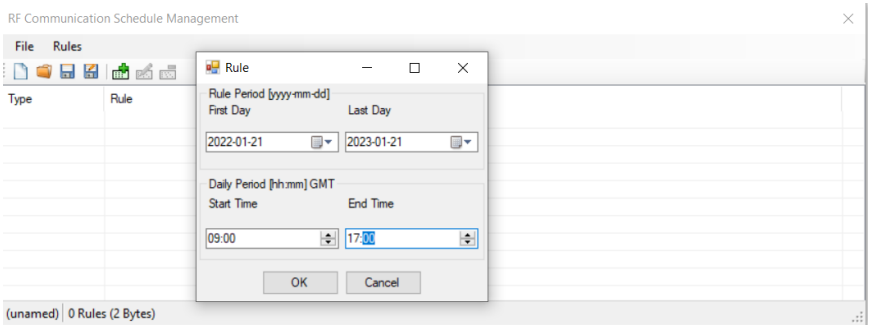
The LiteTrack collars can have

optional ability to remotely download data via a Handheld PinPoint Commander unit, using VHF signals while the collar is still on the animal.

LiteTrack collars models capable of RF communications to download collected data (LiteTrack RF xx) need to be configured with RF communication schedule. Due to the fact that the communication function consumes some energy it is advisable to schedule communication windows when there is very high

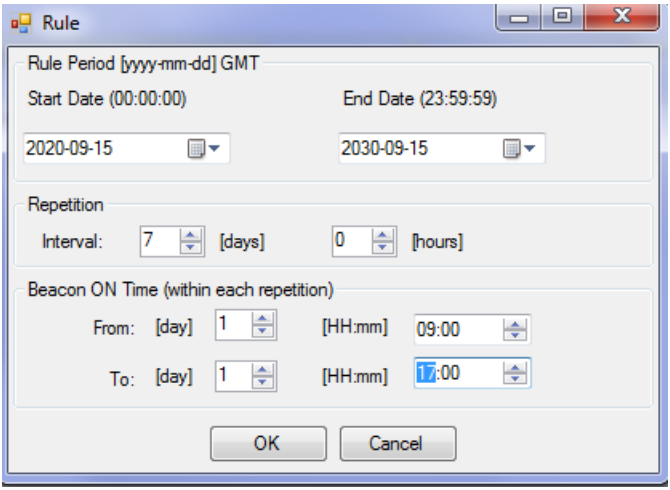
probability that someone will actually travel to the field to attempt data download.

To create an RF communication schedule click on Schedule than Manage RF Communication schedule.

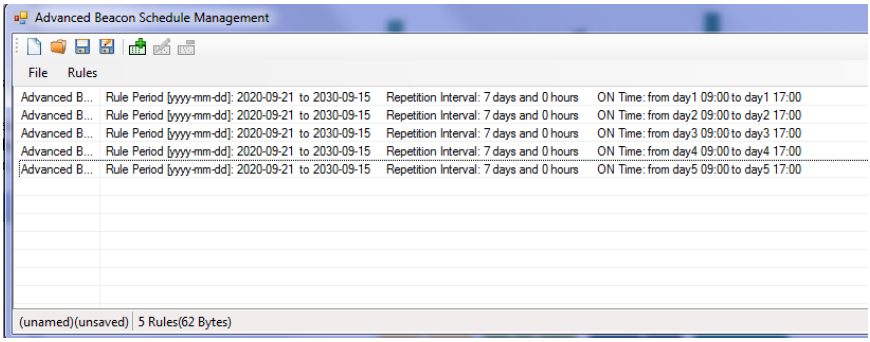


Details of the Commander unit and how to handle communication with roaming collars are available in the separate PinPoint Commander manual.

An advance RF communication schedule can also be created and send to the collar. This type of schedule operates the same way as advanced beacon schedule. The idea is to have the collar repeatedly listen for communication, say, a few times a week only. This can be achieved with a handful of simple rules.



See below an example of a schedule consisting of the list of 5 rules to program the collar to listen for communication attempts Monday to Friday from 9:00 to 5:00PM every week throughout the deployment (please note that the time is in UTC!)



5.6. Configuring Iridium Schedule

Introduction to Iridium Schedule

Iridium schedule is not required to transmit data via Iridium transmission. It is only useful when one wants to alter the Iridium transmission frequency or assure transmissions on exact time and dates.

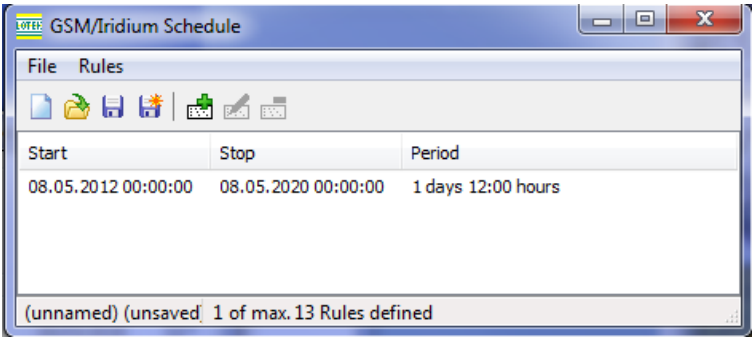
When Iridium schedule is not defined in a collar, it will transmit Iridium messages when the previously defined number of GPS fixes per message is reached. This is an Iridium Mode setting.

For example, when Iridium mode is set to 12 fixes per message and GPS fix is scheduled to happen every 2 hours, then the Iridium transmission will happen after all 12 fixes had been collected every 24 hours.

When Iridium schedule is created and sent to collar, /Iridium transmission period is defined in the schedule and Iridium transmission can be defined as more often or as less often as needed.

Creating Iridium Schedules

1. Go to the Schedule menu and select “Create GSM/Iridium Schedule”.



To clear the current schedule, click on the “clear” button or select “Clear Schedule” from the file menu. This will erase all rules and clear the filename.

To load a schedule, click on the “open” button or select “Load Schedule...” from the file menu. An “open file” dialog box will open. Here, you can select an appropriate schedule file.

To save a schedule, click on the “save” button or select “Save Schedule” from the File menu. This will save the current schedule to the current file name given in the title bar of the form. If a file name has not yet been specified, a “save file” dialog box will open and a new file name can be entered.

To save the current schedule with a new name, click on the “save as” button or select “Save Schedule as...” from the file menu. A “save file” dialog box will open and a new name can be entered.

To add a rule.

2. To create the first schedule “rule”, open the “Rules” menu or use the toolbar buttons in the Iridium Schedule window, select ”Add a rule” (green button). Unlike the GPS schedule options, Iridium schedules can only have a rule type.

3. Set the start date and end date for when the Iridium schedule is to apply. Set the period in number of "Days" and "Hours: Minutes". Which will define how often Iridium transmission is desired. For example, 1 Days and 12:00 hours would mean Iridium transmission every 36 hours. For time fields, the time can be increased or decreased by using the small "up and down" arrows to the right of the Start and End fields.

4. Select "OK" and the defined rule will appear in the Iridium schedule window.

5. To add another rule, repeat the previous four steps.

6. To save the schedule, in the "Iridium Schedule" window, open the "File" menu and select "Save Schedule". The file will be saved in the "Schedule Files" folder in the directory where the GPS Total Host program files were saved..

Note: If Iridium schedule ends before the collars' recovery, the collar will be checking its Iridium mailbox every 4 days. During this time it will send proximity data, virtual fence events and pending mortality cancellations. Also, this is the chance to modify GPS, VHF, and Iridium schedules.

5.7. Configuring Proximity schedule & Proximity GPS schedule

Proximity schedule determines when the collar will actively be listening for other collars in its vicinity and/or transmitting its own proximity IDs for other proximity collars to detect.

Mechanics of creating proximity schedule are identical to creating a beacon schedule. Given animal's behaviour and/or study objectives one may want the collar to watch for proximity events only during some parts of the year and/or some periods of the day.

The other reason for creating proximity schedule can be maximizing of the collar battery life as proximity function can be power hungry. To adjust the proximity schedule it is useful to run a life estimator with proximity tick marked on and off for comparison, Then the schedule can be optimized.

Proximity GPS schedule is a schedule that the collar will be executing when it detects proximity of another tagged animal. The collar will switch back to its regular GPS schedule 1 hour after the proximity event ends.

5.8. Configuring Activity schedule

Logging activity events, especially raw activity, can be demanding on collar memory. Therefore, we introduced another schedule according to which activity can be logged.

Once Activity schedule is created and send to the collar it will be logging activity only within periods and times of the day of interest as defined by the user. Mechanics of preparation of this schedule are identical to the mechanics of VHF beacon schedule.

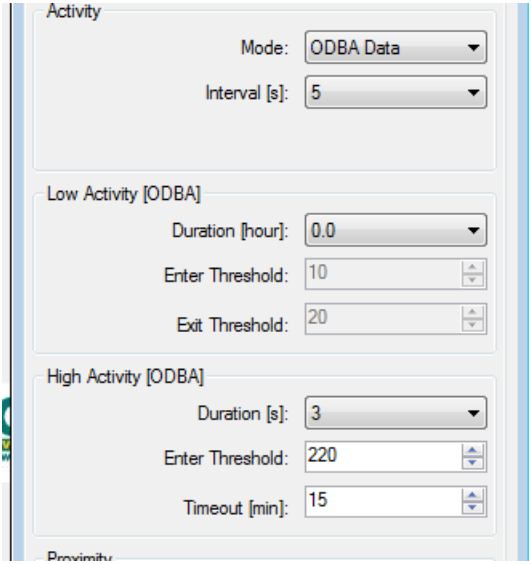
If no schedule is created and sent, and the collar is to log activity it will be doing so 24 hours a day, for 7 days a week.

5.9. Configure Low/High Activity GPS schedules

These schedules are intended to kick in when collared animal activity becomes lower (or higher) then user defined thresholds.

Low activity schedules intent is to slow down GPS schedule when animal is hibernating, resting or exhibiting really low activity. High activity schedule is intended to capture the animal's path once it started exhibiting higher activity. Both High and Low activity schedules preparation mechanics are identical to GPS regular schedule.

Further configuration of other settings must be performed after executing Product Configuration command in the Commands menu.



To configure low activity schedule setting, one must set a threshold (enter threshold) below which the collar enters low activity state. To enter this state the collar must remain below this threshold for a defined (in the Duration setting) number of hours. The collar will exit its low activity state and thus terminate its low activity GPS schedule once the animal becomes more active again and collars' activity exceeds user defined exit threshold. When it happens, the collar reverts to its regular GPS schedule.

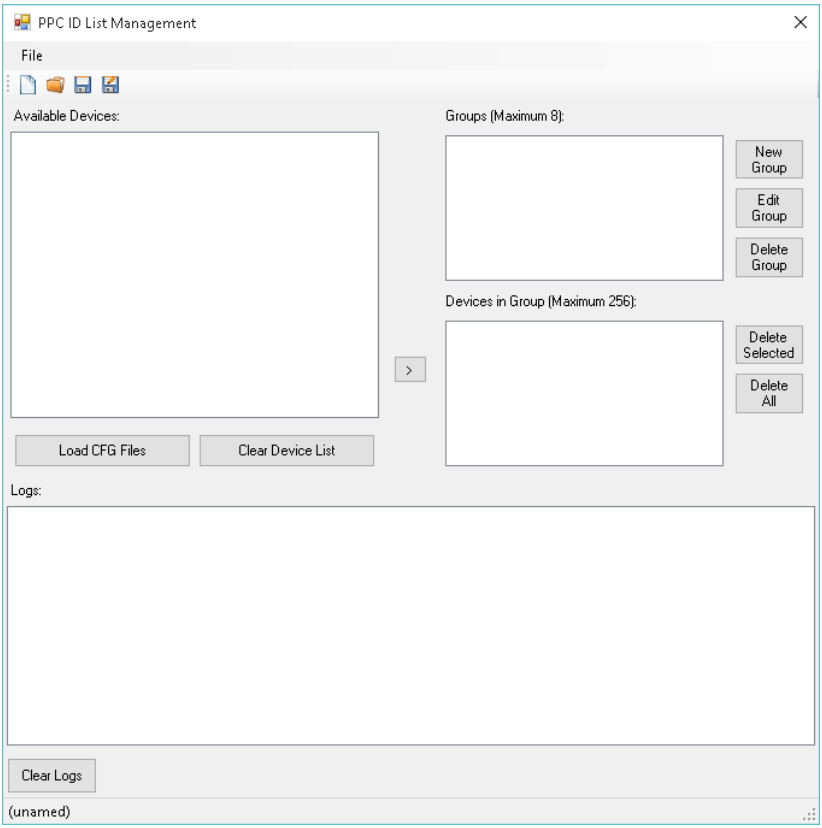
To configure high activity schedule setting, one must set a threshold (enter threshold) above which the collar enters high activity state. To enter this state the collar must remain above this threshold for a defined (in the Duration setting) number of seconds. Once the collar enters this state it immediately collects GPS fix regardless of its schedule then it switches to high activity GPS schedule. The collar will exit its high activity state and thus terminate its high activity GPS schedule once its activity falls under a user defined enter threshold and stays below this threshold for a user define time (timeout in minutes). When it happens, the collar reverts to its regular GPS schedule.

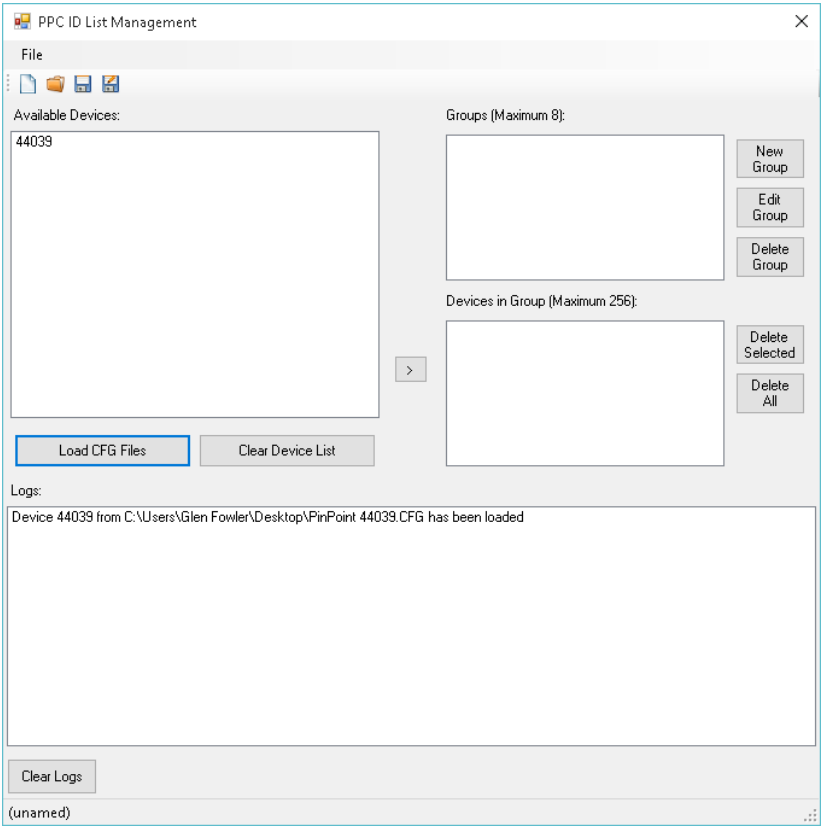
5.10. Configuring LiteTrack RF collars.

As can be seen above, the LiteTrack RF collars can be set up with at least three schedules, GPS, Beacon and RF. In addition, the PinPoint Commander handheld terminal needs to be configured with ID information about the collars/tags it will be communicating to. This is done using an IDList.PPC file.

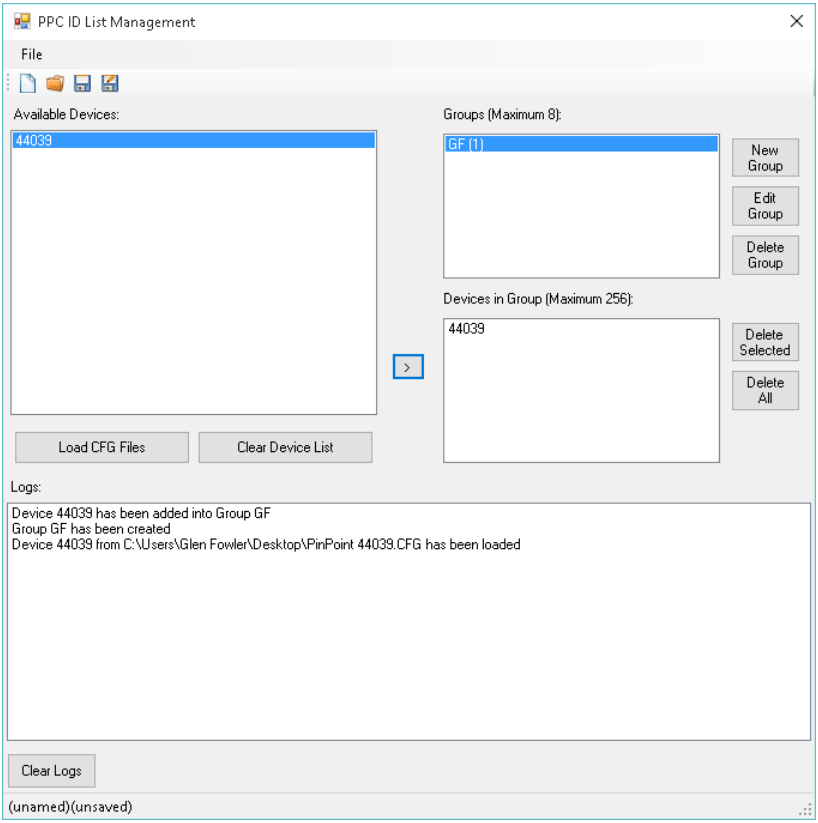
Prior to delivery of the units, an email will be sent with config files for all LiteTrack collars being supplied. This will have the naming convention of <Collar ID>.CFG. Store these files into a folder on the PC where PinPoint Host is located. These files are used to create the IDList.PPC file.

Using PinPoint host, select the pull down under the list 'Tools' and select 'PPC ID List Management'





Create a new group, in this case it is called 'GF'. Highlight the tag ID on the left and click the '>' button.

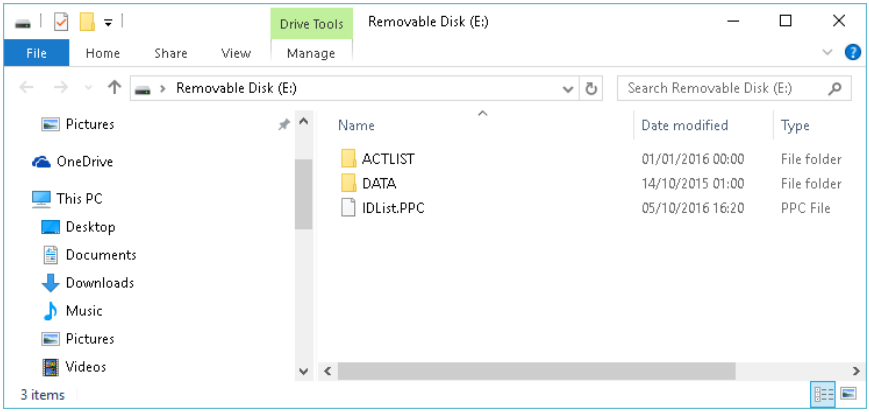


More collars can be added this group or additional groups can be created and tag ID added to that (different groups for different locations, etc.). Once complete, click the Disk symbol to 'Save ID List'. This will save a file called IDList.PPC.

The process for loading the IDList.PPC file into the PinPoint Commander is explained in the document 'Pinpoint Commander Quick Guide'. However, to summarize the process:

- Connect the PinPoint Commander using the supplied USB, to your PC.
- Switch on the PPC and select 'Tools'.
- Select USB Mass Storage.

On your PC you should see a folder with a new Drive letter. Copy the new IDList.PPC file you created into the Root directory of the PPC.



On the PPC exit from the USB mode. On the PPC, go to the Main Menu, select Download>Group> You should see you group name with the tag ID within it.

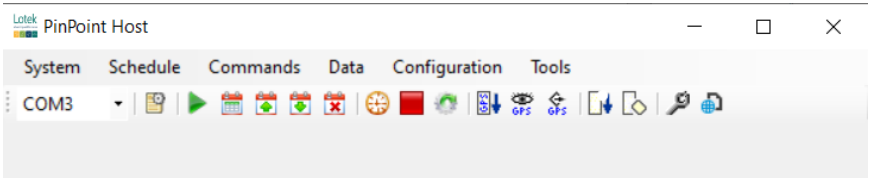
5.11. Setting Up Iridium Enabled Collars (LiteTrack Iridium and PinnaclePro models only)

This procedure allows the Iridium mode of the collar to be changed. The Iridium mode defines how many data sets will be transmitted with one SMS message. Changing the number of fixes per SMS may alter the battery lifetime of the collar since a lower number of fixes per Iridium message will lead to more frequent Iridium messages which, in turn, will consume more power. However, a lower number of fixes per Iridium message will also lead to a faster update rate regarding the collar's current position.

Iridium Mode defines how many GPS location data should be packed in each message.

> **Note:** LiteTrack Iridium collars are shipped "Deactivated". Please contact the company to activate the Iridium Service. Data sent via Iridium system before activation, will not be available on web service.

1. Click on the menu Commands then > Tag Configuration.



2. Select Iridium mode, how many fixes per message, from the drop down list.

Mode:

0	no GPS positions will be sent, only mortality or virtual fence alerts.
1	1 fix per message
2	2 fixes per message
3	3 fixes per message
4	4 fixes per message*
5	5 fixes per message
6	6 fixes per message
7	7 fixes per message
8	8 fixes per message
9	9 fixes per message
10	10 fixes per message
11	11 fixes per message
12	12 fixes per message* (Default: Recommended)
13	13 fixes per message
14	14 fixes per message
15	15 fixes per message
16	16 fixes per message
17	17 fixes per message
18	18 fixes per message*

Note: "12 fixes per message" is default and recommended. Where "*" indicate 4, 12 and 18 fixes per message will optimize operational costs.

3. Select "Iridium Position Transmission" from the drop down list.
Transmit: "every fix", will result every fix being sent through Iridium. Up to "every 16th fix", will result in only 1 fix being sent through Iridium system for every 16 GPS fixes collected
Iridium Position Transmission defines which GPS location (all or part of all) should be transmitted.

Warning: Leave the default setting as “every fix”. Any other option will result not all fixes being sent remotely through Iridium system. However, all GPS fixes will be stored on collar.

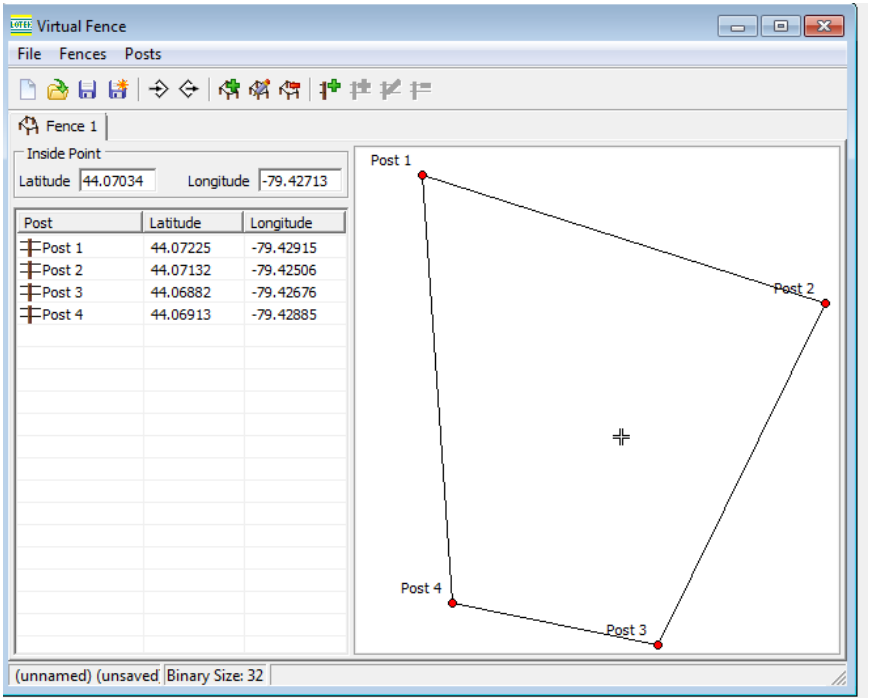
4. Click on “Write Selected Parameters” to set the new Iridium Mode.

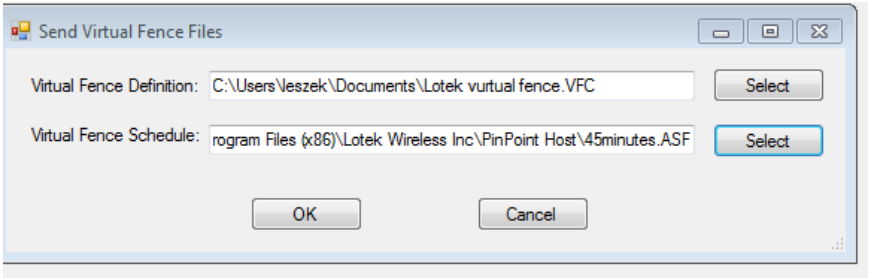
For instructions on how to access collected data remotely please refer to chapter 11.

Setting up virtual fence

Setting up a virtual fence, for collars with this feature enabled, can be done in Commands -> Edit Virtual Fence menu.
Posts can define a unique area, or they can define several multiple non-contiguous areas. Up to 62 posts can be defined. A virtual fence can be defined as the inside of a polygon or as its outside. Therefore, one needs to define an inside point.

After a fence has been defined it needs to be saved and send to the collar. At this moment the Host software asks for a virtual fence schedule to be identified as it will send it to the collar. A new GPS schedule needs to be decided on and created beforehand and selected at this point. After crossing the virtual fence, the collar will send an alert and its regular GPS schedule switches to the GPS schedule sent as a virtual fence GPS schedule.



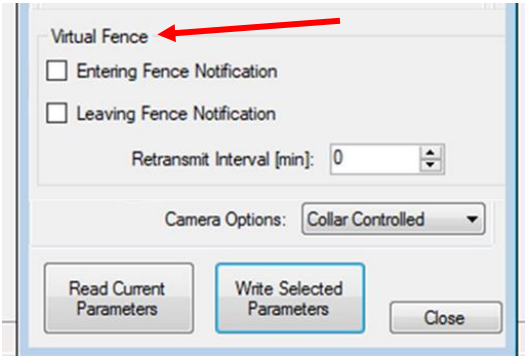


More settings which define if alerts are sent upon leaving or entering the virtual fence are available in Commands-> Tag Configuration:

Check send message on entering fence: Send virtual fence event alert after a successful GPS fix, after virtual fence area entry.

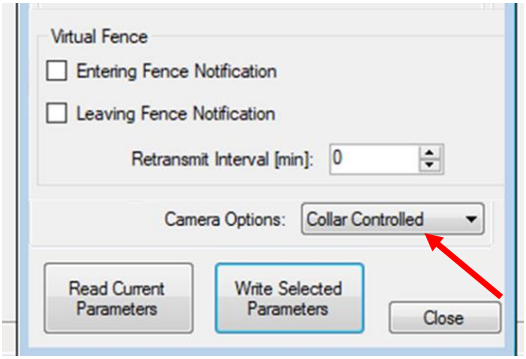
AND/OR

Check send message on leaving fence: Send virtual fence event alert after a successful GPS fix, after the collar left virtual fence area

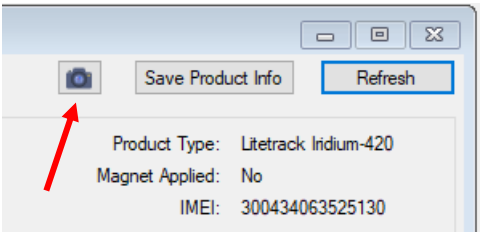


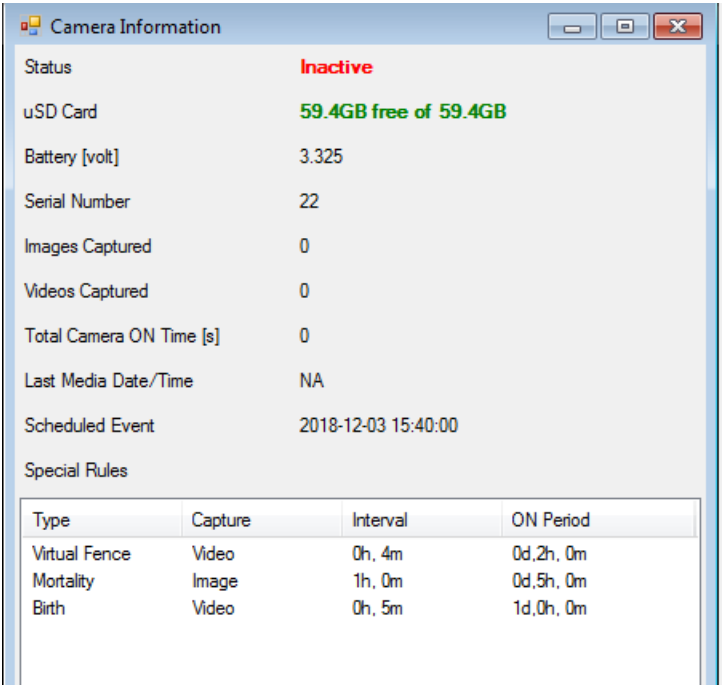
Camera Controls (for Iridium collars and dataloggers)

If your collar is equipped with a video camera and you wish the collar to trigger the camera during special events like: low activity, high activity, mortality, birth, proximity or virtual fence, you need to make sure that collar camera controls are turned on.



Camera needs to be programmed using its own programming software (InSight Host). However, its settings can be viewed after clicking the marked below camera icon.





5.12. Mortality option

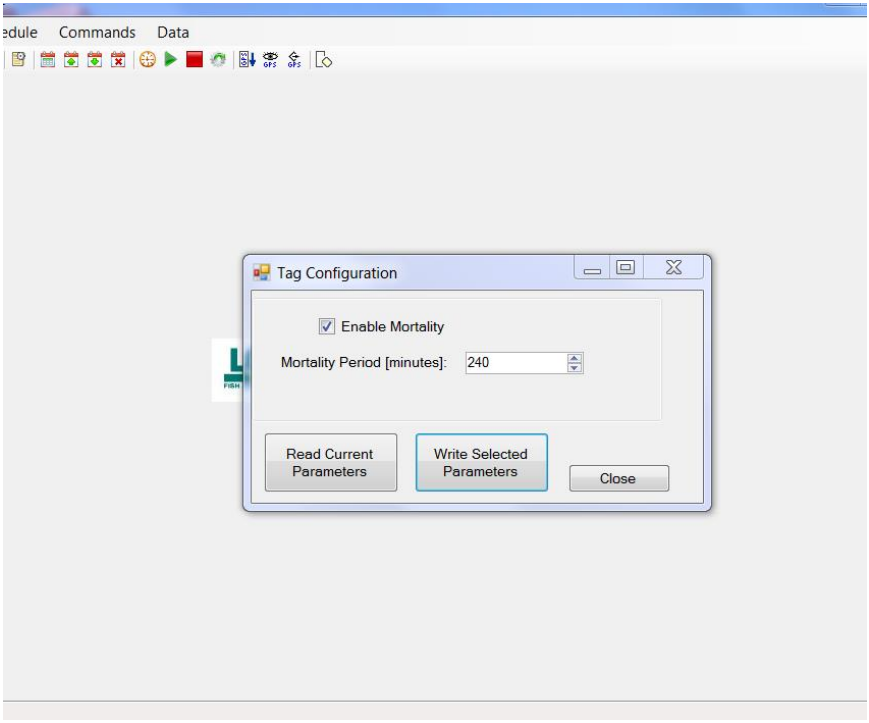
All LiteTrack collars are fitted with an optional Mortality feature that can be activated if desired. This feature samples movement (6 times a second) and analyses the average value over 5-minute periods waiting for mortality event. The user can program a time period (default 4 hours) for mortality to be declared. Should the activity fall below a factory pre-set value for the mortality time period, the collar declares mortality. This causes the beacon to change its rate and transmit quick pulses to alert anyone radio-tracking the animal. The

VHF beacon changes its rate from 40bpm to 80bpm, but pulses are half their original width, which produces unique audible sound.
Mortality mode has the highest priority and once it occurs it overrides VHF schedule.

The mortality event exact time and date is stored in the tag memory and can be read upon collar recovery by issuing 'Get Mortality Events' command located under 'Data' tab.

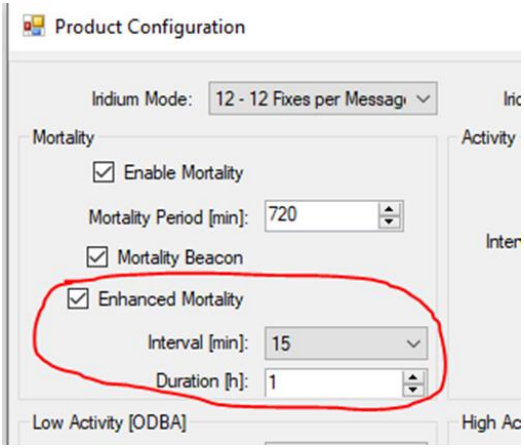
In case of 'false' mortality, when activity resumes, the unit's beacon will revert to normal mode, however the mortality event time stamp and its cancellation will be stored in memory.

In case of Iridium or Globalstar collars mortality alerts are transmitted as text messages to the phone numbers provided in webserver's account settings.



5.12.1. Enhanced Mortality option

We also offer slightly enhanced mortality algorithm whereby after mortality is sensed by the collar it starts collecting GPS fixes at the defined 'Fix Interval' and will continue to do so for the defined "Duration'. At the end of 'Duration' it will revert to its original GPS schedule. Some users find it helpful to collect many fixes after mortality happened to observe a cluster on the map to ensure that the mortality is real.



In the above example, after mortality occurred, the collar will switch to collecting fixes every 15 minutes for 1 hour. After this hour is up it will revert to whatever GPS fix collection schedule has been applied originally.

5.13. Activity and Temperature

Temperature read is presented with every GPS data record stored and with every activity record logged, if activity logging is enabled. Accuracy of temperature reading is +/- 0.5C. The temperature sensor is located on board inside of the housing so in case of rapid ambient temperature changes reported temperature will follow seconds or minutes later after a thermal equilibrium is reached.

Collars enabled to log activity do so by reading on-board 3 axis accelerometer. Accelerometer can measure both dynamic acceleration, resulting from motion or shock, and static acceleration, such as tilt (future mode that we do not

support yet)). The accelerometer used in LiteTrack collars and PinPoint tags measures acceleration from -4G to +4G.

Activity detection can be configured as averaged (X and Y only – to be consistent with our previous collars families) or in a new mode - absolute (X,Y,Z - raw data). When using absolute activity detection, acceleration samples are read at a user specified interval (1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60, 90, 120, 150, 180, 240, or 300 seconds) and stored in the memory.

In the picture below, actual acceleration is read on all 3 axes every 1 second.

(In order to have values represented in acceleration true units [m/s^2] one needs to multiply below numbers by 0. 31392. (a unit of acceleration displayed represents 32 mili g's and one g equals 9.81m/s^2).)

View Activity Data --- C:\Program Files (x86)\Lotek Wireless Inc\PinPoint Host\

Index	GMT Time	X	Y	Z	Temperature (C)
1	04/11/2016 6:53:10 PM	-2	-34	-2	19.5
2	04/11/2016 6:53:11 PM	22	-34	-6	19.5
3	04/11/2016 6:53:12 PM	-28	-4	-1	19.5
4	04/11/2016 6:53:13 PM	-39	38	16	19.5
5	04/11/2016 6:53:14 PM	5	33	12	19.5
6	04/11/2016 6:53:15 PM	0	36	13	19.5
7	04/11/2016 6:53:16 PM	0	36	13	19.5
8	04/11/2016 6:53:17 PM	0	36	13	19.5
9	04/11/2016 6:53:18 PM	-2	5	1	19.5
10	04/11/2016 6:53:19 PM	-24	-16	52	19.5
11	04/11/2016 6:53:20 PM	8	-36	7	19.5
12	04/11/2016 6:53:21 PM	26	-9	0	19.5
13	04/11/2016 6:53:22 PM	-4	3	2	19.5
14	04/11/2016 6:53:23 PM	-11	1	-8	19.5
15	04/11/2016 6:53:24 PM	-1	3	7	19.5
16	04/11/2016 6:53:25 PM	39	25	53	20
17	04/11/2016 6:53:26 PM	15	-25	-6	20
18	04/11/2016 6:53:27 PM	-19	-80	-13	20

When a collar is stationary, and its accelerometer oriented perfectly horizontally its X and Y axis should read 0 whereas its Z axis should read 31-32 (1G) Typically, a collar, even if stationary, is not perfectly horizontal and X, Y, Z numbers reported represent fractions of gravity exerted along these axis'.

In PinPoint Host one can observe collar's/tag's accelerometer behaviour under Tools-> Sensor readings menu. After pressing the start button activity and temperature sensors numbers will be read and updated every second. In this menu activity is represented with full 12-bit numbers (as opposed to stored values which are truncated to 8 bits to save memory) therefore scaling factor (to present the numbers in m/s^2) is 0.01962.
Stationary unit oriented perfectly horizontally should display X and Y as zeros and Z as 500.

When using averaged activity its stored values represent changes of acceleration (read at 6Hz rate) over the set sampling period. Sampling periods available are the same as in case of raw activity data mode.

Conversion into m/s^2 can be done by multiplying X and Y by 0.31392.

View Activity Data --- C:\Program Files (x86)\Lotek Wireless Inc\PinPoint Host\

Index	GMT Time	X	Y	Temperature (C)
1	02/11/2016 9:02:00 PM	12	9	20.5
2	02/11/2016 9:03:00 PM	4	3	20.5
3	02/11/2016 9:04:00 PM	4	4	19.5
4	02/11/2016 9:05:00 PM	2	3	18.5
5	02/11/2016 9:06:00 PM	0	1	18
6	02/11/2016 9:07:00 PM	1	2	17.5
7	02/11/2016 9:08:00 PM	1	5	17.5
8	02/11/2016 9:09:00 PM	1	4	17.5
9	02/11/2016 9:10:00 PM	1	4	17.5
10	02/11/2016 9:11:00 PM	1	4	17.5
11	02/11/2016 9:12:00 PM	1	6	17.5
12	02/11/2016 9:13:00 PM	1	4	17.5
13	02/11/2016 9:14:00 PM	0	2	17.5
14	02/11/2016 9:15:00 PM	1	4	19
15	02/11/2016 9:16:00 PM	1	4	20
16	02/11/2016 9:17:00 PM	1	4	19.5

XYZ axis' orientation varies among models. Please refer to the appendix C to check the orientation in your model.

Logging activity at fast sample rates fills up assigned memory very fast (e.g. logging raw data at 1 second will fill memory up from 5-30 days depending on collar type and model). It can be advisable to schedule activity data collection to

log activity within times and periods of interest. A schedule for activity logging can be created and sent to the collar from within Schedule Tab of Pinpoint Host. It is also advisable to verify and reconcile the amount of memory available for activity logging with preferred activity collection schedule. It can be done within operating life estimator (Schedule – Estimate Operating Life). You need to select a proper model from a proper family, create a desired schedule, enable activity collection, and calculate 'activity memory usage' located within the 'activity schedule' tab (up top)

Activity data can be collected from the collar by downloading directly to the PC or by downloading remotely via PinPoint Commander. It can be viewed in the PinPoint Host, and exported to a spreadsheet format.

There are also 2 more activity data collection modes ODBA (Overall Dynamic Body Acceleration) and VeODBA.

This method is gaining more and more recognition in scientific community and multiple papers have been generated that describes its function. In summary, Dynamic Body Acceleration (DBA) has been used as a proxy for energy expenditure or oxygen consumption of tagged animals. ODBA is presented as one number per selected time period (1-300s). It is calculated as follows:

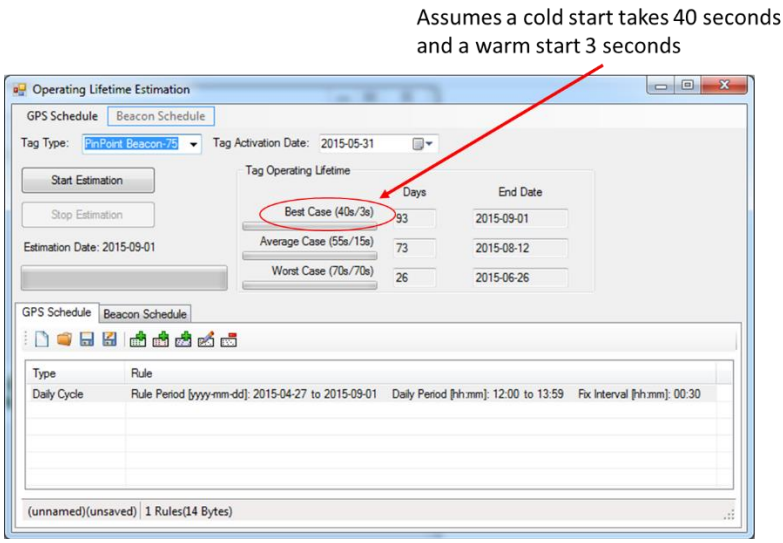
> ODBA = [Ax (acceleration along axis X read as a spot sample)-Ax (acceleration along X averaged over previous 1-4 seconds)] + [Ay (acceleration along axis y read as a sample in time)-Ay (averaged over 1-4 seconds)] + [Az (acceleration along axis Z read as a sample in time)-Az (averaged over 1-4 seconds)]

VeDBA Data or Vector ODBA is a method where VeODBA = SQRT{[Ax (acceleration along axis X read as a spot sample)-Ax (acceleration along X averaged over previous 1-4 seconds)]^2+ [Ay (acceleration along axis y read as a sample in time)-Ay (averaged over 1-4 seconds)]^2 + [Az (acceleration along axis Z read as a sample in time)-Az (averaged over 1-4 seconds)]^2}

Please refer to various papers to establish which is the best option for your study. Raw data mode uses the most memory compared to the others (3 axis records) with ODBA and VeDBA mode taking up the least (1 value).

5.14. Operating Lifetime Estimation

Under the Schedule tab there is an option to select the Operating Lifetime Estimation calculator. This will allow the researcher to enter their proposed schedule(s) and the calculator will estimate the lifetime of the collar/tag based on best, normal and worst case conditions.



5.15. LiteTrack GPS collars with Swift fixes

Swift fixes are available due to a creative way of capturing and manipulating information coming from GPS receivers. GPS receivers need at least 40 seconds to provide standard fixes when scheduled at least 2 hours apart or slower (cold starts every time). To obtain a 'swift' fix GPS receivers need to be powered for only a few seconds every time regardless of schedule. The price to pay for this reduced energy requirement is somewhat reduced accuracy which is about half that of the conventional cold start locations. (for conventional fixes it is 5-7m for swift it is 10-15m). It can be an issue for someone attempting to do a microhabitat analysis over a small area and within very short period of time but it should be less of an issue over a long-term deployment and on animals with larger home ranges, or during potential migration. Collars operating in the 'Swift' mode can operate 3-4 longer at the same GPS fix schedule as in conventional mode.

Collars mode of operation 'Conventional fix' versus 'swift fix' is configured at the factory and cannot be changed by the user.

6. Proximity feature

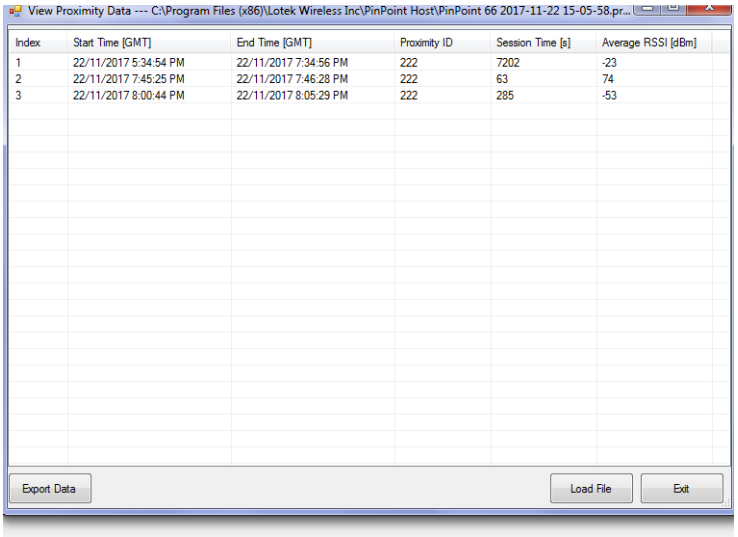
This optional feature is available on all LiteTrack and PinnaclePro collars (Iridium, RF, and store on board versions, Globalstar collars, PinPoint tags and microGPS+ tags. It is not available on Lifecycle collars!

The idea behind proximity feature is that 2 (or more) collars that are within a communication distance from each other exchange their respective IDs and log the durations of their contacts.

The screen capture below illustrates proximity data downloaded from 2 collars that were tested in house. Collars 66 and 77 were within a few meters from each other. Interpretation of the first screen capture: data was downloaded from collar 66 with proximity ID111. This collar was within a contact range with the collar proximity ID 222 (collar ID 77) on 3 occasions.

Their first proximity session lasted 7202 seconds (just over 2 hours). Then both collars lost their contact (Were moved further apart) for over 8 minutes and they came into contact again which lasted 63 seconds.

Then again, they were separated from each other for about 14 minutes and again they established contact (by being moved closer) for 285 seconds (almost 5 minutes).

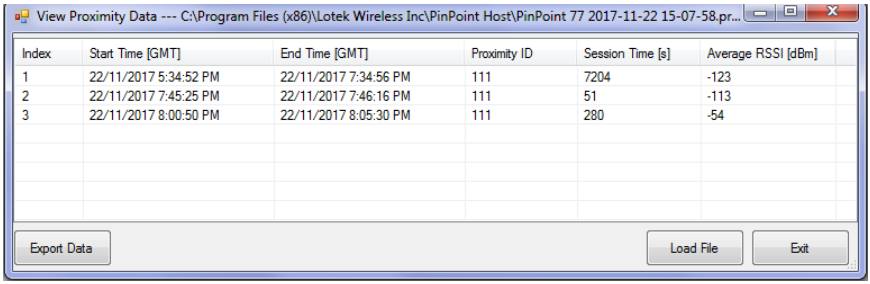


Interpretation of the second screen capture:

Data was downloaded from collar 77 with proximity ID222. This collar was within a contact range with the collar proximity ID 111 (collar ID 66) on 3 occasions. Their first proximity session lasted 7204 seconds. Then both collars lost their contact (Were moved further apart) for over 8 minutes and they came into contact again which lasted 51 seconds.

Then again they were separated from each other for about 14 minutes and again they established contact (moved closer together) for 280 seconds (almost 5 minutes).

Due to inherent differences among collars (antennas, neck sizes, sensitivities of receivers, their orientation on animals) data reported by 2 collars that are in contact may somewhat vary, which is evident by slightly different time stamps, sessions duration and signal strengths.

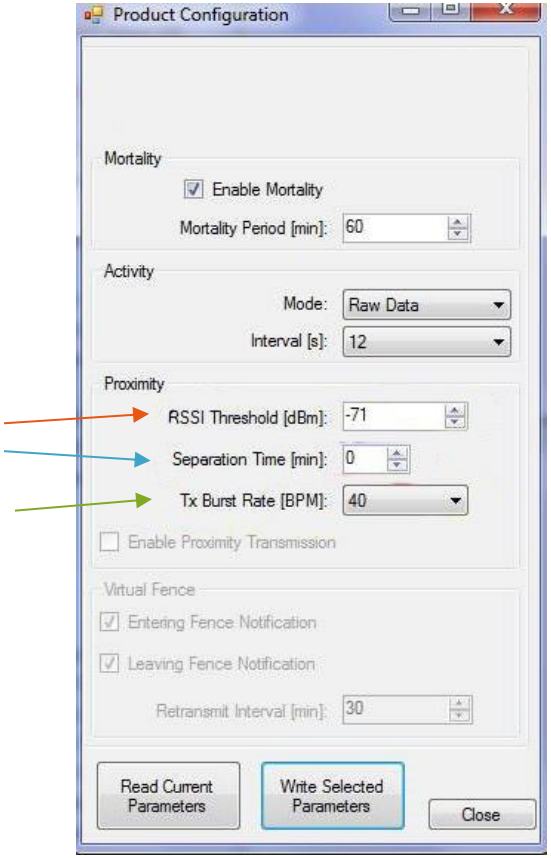


In both cases the collars were set to accumulate records unless they were separated for at least 3 minutes. If the collars were NOT in contact for less than 3 minutes and re-established contact, the record continues.

If they were apart for longer than 3 minutes a new record is created. In the described test both collars were separated twice for longer than 3 minutes hence 3 separate records.

Proximity Configuration

In regard to proximity configuration there are three important settings to be aware of. These settings are RSSI Threshold, Separation Time, and Tx Burst Rate.



RSSI Threshold (dBm)

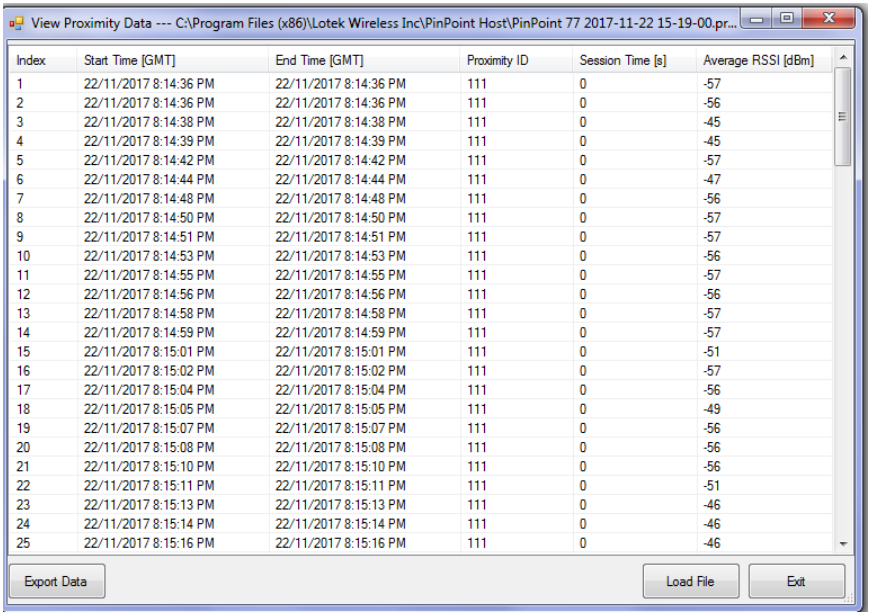
It is very important to estimate how average recorded RSSI (relative signal strength indicator) translates into distance. If the goal of the study is to record contacts within 3 meters only and disregard contacts when distance is larger than 3 meters then the collars must be individually calibrated (preferably in the study area, and preferably on the animals or their proxies) to determine how distance between collars corresponds to received RSSIs. It will vary among product types, neck sizes, antenna lengths, species, vegetation and other environmental factors. It is the only way though to get some idea about RSSI received and the distance between collars.

If, for example, a test determines that when collars are 1.5 meters apart and the RSSI setting reads consistently -50dBm then when the distance apart is increasing the RSSI will be decreasing (for example -51, -55 etc. etc). If the distance apart is decreasing then RSSI will be increasing (-45, -40 etc). In this example if the user only wants to log events that happened within 3 meters radius and disregard events outside the 3 m radius, he should set RSSI (see red arrow in Product Configuration screenshot above) to -50dBm.

Separation Time (min)

This variable (see blue arrow in Product Configuration screenshot above) can be set by the user from zero to 30 minutes. If it is set to zero then every single detected ping is recorded like in the screen capture below. If it is set to N minutes (N=<30) than all events will continue being accumulated in the same record unless a separation between collars for at least N minutes happens – just like in discussed examples above.

The zero setting results in many events (proximity pings) being logged separately which is probably not necessary for a normal operation as it results in large proximity files.



Index	Start Time [GMT]	End Time [GMT]	Proximity ID	Session Time [s]	Average RSSI [dBm]
1	22/11/2017 8:14:36 PM	22/11/2017 8:14:36 PM	111	0	-57
2	22/11/2017 8:14:36 PM	22/11/2017 8:14:36 PM	111	0	-56
3	22/11/2017 8:14:38 PM	22/11/2017 8:14:38 PM	111	0	-45
4	22/11/2017 8:14:39 PM	22/11/2017 8:14:39 PM	111	0	-45
5	22/11/2017 8:14:42 PM	22/11/2017 8:14:42 PM	111	0	-57
6	22/11/2017 8:14:44 PM	22/11/2017 8:14:44 PM	111	0	-47
7	22/11/2017 8:14:48 PM	22/11/2017 8:14:48 PM	111	0	-56
8	22/11/2017 8:14:50 PM	22/11/2017 8:14:50 PM	111	0	-57
9	22/11/2017 8:14:51 PM	22/11/2017 8:14:51 PM	111	0	-57
10	22/11/2017 8:14:53 PM	22/11/2017 8:14:53 PM	111	0	-56
11	22/11/2017 8:14:55 PM	22/11/2017 8:14:55 PM	111	0	-57
12	22/11/2017 8:14:56 PM	22/11/2017 8:14:56 PM	111	0	-56
13	22/11/2017 8:14:58 PM	22/11/2017 8:14:58 PM	111	0	-57
14	22/11/2017 8:14:59 PM	22/11/2017 8:14:59 PM	111	0	-57
15	22/11/2017 8:15:01 PM	22/11/2017 8:15:01 PM	111	0	-51
16	22/11/2017 8:15:02 PM	22/11/2017 8:15:02 PM	111	0	-57
17	22/11/2017 8:15:04 PM	22/11/2017 8:15:04 PM	111	0	-56
18	22/11/2017 8:15:05 PM	22/11/2017 8:15:05 PM	111	0	-49
19	22/11/2017 8:15:07 PM	22/11/2017 8:15:07 PM	111	0	-56
20	22/11/2017 8:15:08 PM	22/11/2017 8:15:08 PM	111	0	-56
21	22/11/2017 8:15:10 PM	22/11/2017 8:15:10 PM	111	0	-56
22	22/11/2017 8:15:11 PM	22/11/2017 8:15:11 PM	111	0	-51
23	22/11/2017 8:15:13 PM	22/11/2017 8:15:13 PM	111	0	-46
24	22/11/2017 8:15:14 PM	22/11/2017 8:15:14 PM	111	0	-46
25	22/11/2017 8:15:16 PM	22/11/2017 8:15:16 PM	111	0	-46

TX Burst Rate (BPM)

Another important setting is Tx Burst rate (see green arrow in Product Configuration screenshot above). It determines the rate at which proximity Id's are transmitted. The rule of thumb would be that the higher the rate the better chance of not missing any proximity pings but the higher drain of energy.

Our default rate is set at 20 bpm, which is somewhat a compromise between decent detection rate and operating life. This value has to be less than beacon rate in a normal mode. This parameter is present in life estimator and can be manipulated to observe how operating life changes when Tx rate changes.

7. LiteTrack, Pinnacle + models

All LiteTrack and Pinnacle collars with + sign in their model name perform exactly the same functions and are programmed identically as other collars. Collars with "+", however, use a multi-constellation GNSS engine (Global Navigation Satellite System) and are capable of using 4 positioning satellite systems. They are GPS, GLONASS, Galileo and Beidu. These models leave Lotek with a default setting to use GPS satellites only but the end user can change it in Product Configuration and can use any satellite system and/or any combination of systems at the same time. Up to 3 of 4 satellite systems may be used concurrently. The immediate advantage of using more than 1 system is greater number of satellites available, and potentially better collar performance under canopies or in urban canyons or valleys. The price to pay is slightly elevated current consumption, thus slightly reduced maximum operating life. This can be checked using Life estimator. After determining GPS, VHF and other schedules operating life can be estimated with different GNSS settings.

8. Battery Management.

LiteTrack collars monitor the battery and will allow the tag to operate and take fixes (according to the schedule) until it cannot guarantee any more successful fixes. The GPS timeout is pre-configured to be 70 seconds, which is the maximum time period the unit will spend trying to get a fix. If no fix is obtained within this period, the receiver will shut down to conserve battery until the next scheduled attempt. If a successful fix is obtained before the 70 second timeout, the receiver will shut down earlier.

For example, a device will stop taking fixes on three conditions:

- The maximum scheduled number of successful fixes have been obtained
- The current battery capacity has reached a level that will likely not result in a successful fix before it is deemed to be depleted.
- If there is not enough space to store a fix. This could happen if on previous deployments, the data was not erased and a large number of fixes are stored on board the tag.

Collars configured with Swift fixes take a lot less time to collect enough data for a fix. The exact algorithm is somewhat more complicated but the absolute maximum time the collar will stay on a try can be as long as 40 seconds.

9. Final checks before Deployment.

Once the schedules (GPS, beacon, and RF communication (if applicable)) have been sent to the collar, the collar is ready for deployment. **Prior to attaching the collar to the animal, connect it to the interface and click on the 'Activate Tag' Icon to activate the collar. Confirm the collar is activated by the 'Show Tag Parameter' screen (Section 5) and looking at Tag Status.** Remove the collar from the Interface and attach to the animal.

If the collar has been used before, it is recommended that you erase the existing tag data. This is done by clicking on the 'Erase Tag Data' Icon.

It is also very important that you initially set the 'Tag Time' from your PC by clicking the  Icon or 'Set Tag Time' from the 'Command' pull-down menu. In order to make sure the collar starts taking fixes as scheduled, you need to make sure its initial time is fairly accurate.

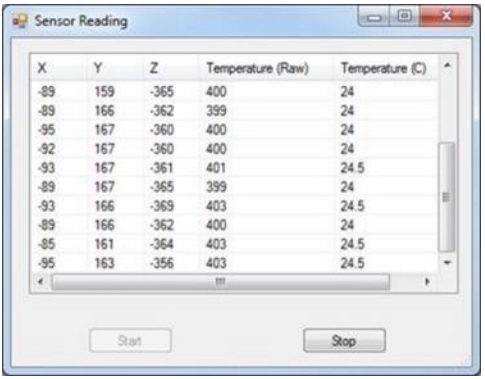
After the final checks are complete the collar is ready for deployment. For instructions on how to fit it on animals please refer to the Appendix 2.

In most collars' models starting from LiteTrack Iridium 130 through LiteTrack 140 and higher, GlobalstarTrack Pro and PinnaclePro one can use magnets to temporarily suspend collars operations (no GPS data will be collected, and no VHF beacon will operate). The magnets must be placed with a tape in a marked spot on the collar housing. When the magnet is removed the collar, operation is restored.
LiteTrack 10,20,30,40,60 models do not feature magnetic switches and they must be activated/deactivated only with DLC2 and PinPoint Host.

Important: All collars **that arrive with their battery packs disconnected** need to have a following test/setup performed to verify that mortality/activity/temperature sensor(s) perform properly.

After connecting batteries to the collar and then connecting DLC1/2 to the communication terminals select "Configuration->Sensor Reading". The window as shown just below will pop up. Please select Start button. The unit will start reading sensors and presenting information in the window. New row with retrieved sensor values will be available every second. Move board around and make sure values on XYZ are changing. The temperature sensor reading should

also be in the ballpark of what is expected. Please select Stop button when this test is complete.



Please note: If the activity XYZ readings are all zeros, to recover activity sensor the unit has to be powered down and up again. That can be effectively done by disconnecting the battery pack, waiting approximately 5 minutes and then connecting the battery pack again and reading sensor values again. If the sensors values are not zeros and they change with motions then everything is OK.

Note: It is recommended that you test the collar prior to final deployment. This can be done by setting the schedule to take fixes over a shorter time. After the test schedule has expired, extract data from the tag and confirm the locations recorded are valid. It is also recommended that you save the Tag info before deployment.

9.1. Open air test

1. Prepare and upload test GPS and VHF schedules to the collar. For the sake of expediency, the test schedule may be fairly frequent with GPS fixes being collected even as often as every 5 minutes. Activate the collar.

2. If the collar happens to be 'solar' it may be a good idea to set it in direct sunlight for an hour or so before starting the test.

3. Place the collar outside in an open area, where the collar can have a full view of the sk

4. Using a VHF receiver, verify that the beacon is in 'normal' mode at 40 bpm single pulse

5. Wait until a sufficient amount of data has been acquired. In case of data loggers without or with RF capability it would be time needed to collect 3-4 GPS positions. For Iridium collars it is the time needed to acquire the sufficient amount of GPS fixes that trigger an Iridium transmission (1-18 depending on the Iridium mode set)

6. After the test bring the collar inside, deactivate it, and check the data that has been received by downloading it either by cable, by RF or with Web Service (depending on the collar model and its available communication features)

7. Before the actual deployment do not forget to send proper GPS and VHF schedules intended for your study.

10. Downloading data

At the end of the study period the LiteTrack collars that do not feature remote download data capabilities must be retrieved for its data to be downloaded. Clean the collar and make sure the two wire communication connectors are clear of any debris that would affect good connectivity with the interface box.

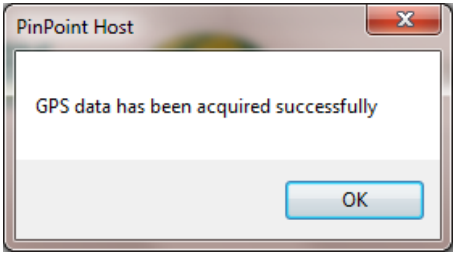
When the collar is connected using the Retractable Hook connectors, confirm that the collar is communicating with the interface by selecting the 'Show Tag Parameters' Icon. If successful, the 'Show Tag Parameters' window will appear. If you get a 'No response from Tag' Error window, then check the connections and try again. If you continue experiencing connection issues, contact Lotek/Sirtrack for assistance.

In the 'Show Tag Parameters' window, the information will be able to indicate the number of fixes in memory. This could be a figure greater than or less than maximum depending on the number of successful fixes. It is recommended that the collar be stopped or de-activated before any data is extracted. Do this by clicking the 'De-activation' Icon. Confirm the tag is de-activated by using 'Show Tag Parameters' command.

Note: If the recovered collar's battery is nearly or entirely flat, DLC-1 may not start communicating with it right away. The collar may need to stay connected to DLC-1 for a few minutes. During this time the COM and CHRG lights will be both red, but after about 5 minutes the COM light will blink and come on solid green. From this moment on communication is possible.

11. Accessing Data

Data will need to be downloaded from the tag via the DLC-1 or Commander unit. If you are connected using the DLC-1, click on the 'Get Tag Data' Icon or use the drop-down menu on the 'Data' Command. You will be asked to confirm the folder where the data file is to be saved (this can be changed from the default). The file saved will have a default name that will include the Tag ID, Date and Time with a .tag suffix. If the download is successful the following tile will appear

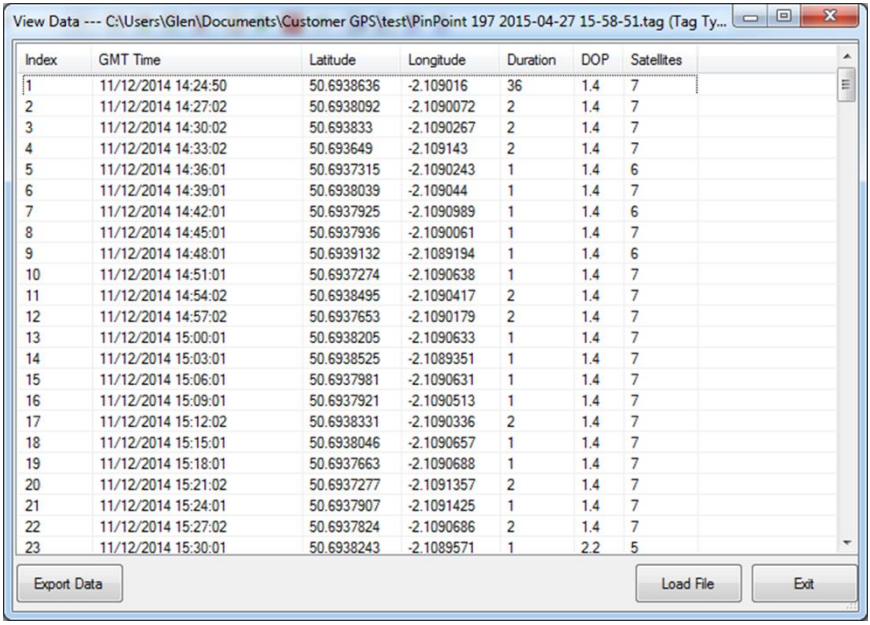


Once the data has been downloaded it can be viewed by clicking on the 'View Data File' Icon or using the drop-down menu on the 'Data' Command. It will then ask you for the file location (or use the default), which you need to select/confirm prior to clicking the Open button.

A window will open showing the following information.

- Date of Fix
- Time of Fix
- Latitude
- Longitude
- Duration
- DOP
- Satellites

An example is shown below



Index	GMT Time	Latitude	Longitude	Duration	DOP	Satellites
1	11/12/2014 14:24:50	50.6938636	-2.109016	36	1.4	7
2	11/12/2014 14:27:02	50.6938092	-2.1090072	2	1.4	7
3	11/12/2014 14:30:02	50.693833	-2.1090267	2	1.4	7
4	11/12/2014 14:33:02	50.693649	-2.109143	2	1.4	7
5	11/12/2014 14:36:01	50.6937315	-2.1090243	1	1.4	6
6	11/12/2014 14:39:01	50.6938039	-2.109044	1	1.4	7
7	11/12/2014 14:42:01	50.6937925	-2.1090989	1	1.4	6
8	11/12/2014 14:45:01	50.6937936	-2.1090061	1	1.4	7
9	11/12/2014 14:48:01	50.6939132	-2.1089194	1	1.4	6
10	11/12/2014 14:51:01	50.6937274	-2.1090638	1	1.4	7
11	11/12/2014 14:54:02	50.6938495	-2.1090417	2	1.4	7
12	11/12/2014 14:57:02	50.6937653	-2.1090179	2	1.4	7
13	11/12/2014 15:00:01	50.6938205	-2.1090633	1	1.4	7
14	11/12/2014 15:03:01	50.6938525	-2.1089351	1	1.4	7
15	11/12/2014 15:06:01	50.6937981	-2.1090631	1	1.4	7
16	11/12/2014 15:09:01	50.6937921	-2.1090513	1	1.4	7
17	11/12/2014 15:12:02	50.6938331	-2.1090336	2	1.4	7
18	11/12/2014 15:15:01	50.6938046	-2.1090657	1	1.4	7
19	11/12/2014 15:18:01	50.6937663	-2.1090688	1	1.4	7
20	11/12/2014 15:21:02	50.6937277	-2.1091357	2	1.4	7
21	11/12/2014 15:24:01	50.6937907	-2.1091425	1	1.4	7
22	11/12/2014 15:27:02	50.6937824	-2.1090686	2	1.4	7
23	11/12/2014 15:30:01	50.6938243	-2.1089571	1	2.2	5

The additional information recorded is described below.

Duration – The time taken before a successful fix was acquired.

Dilution of Precision (DOP) - An indicator of the quality of a GPS position, which takes account of each satellite's location relative to the other satellites in the constellation, and their geometry in relation to the GPS receiver. A low DOP value indicates a higher probability of accuracy.

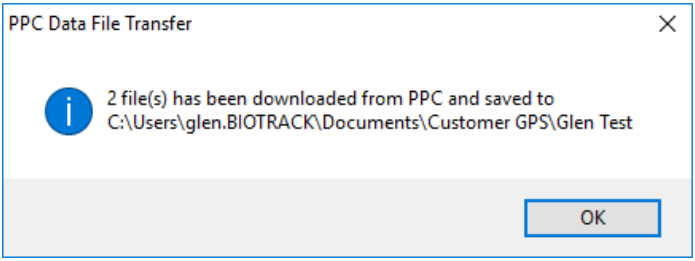
< 1	Ideal precision
1-2	Good to moderate quality
3+	Poor quality

Satellites - The number of available satellites visible at the time of the fix.

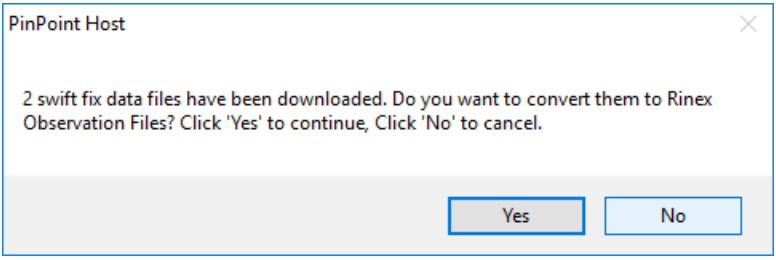
11.1. Accessing Data – RF versions of collars

In most cases data from the LiteTrack RF collars will be downloaded via the PinPoint Commander. Details on extracting the data from the PPC is described in the document 'Pinpoint Commander Quick Guide'.

Once the data is on the PPC, use the PinPoint Host application to transfer the data to your PC. Connect the PPC to the PC via the supplied USB cable. Switch on the PPC and enable USB Drive mode (Tools>USB Drive). On the main PinPoint Host window, select the 'Tools' pulldown and select 'PPC Data File Transfer'. Browse to the folder you wish to transfer the data to and select 'OK'. The following window confirm successful file transfer.



If the data on the PPC contains 'Swift' data, then the following appears

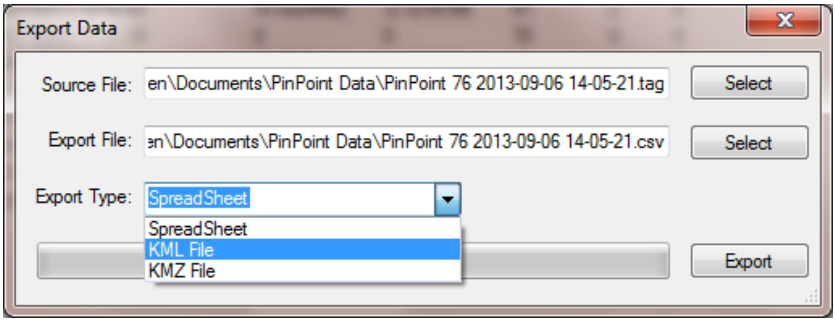


This will convert to the PPC data file(s) to .obs file format. Refer to the section (Swift data downloaded via the PinPoint Commander) in the chapter 11 for the next steps.

12. Exporting Data

Data can be exported using the Export button on the data window shown when in the main PinPoint Host window by clicking on the 'Export Downloaded Data' Icon or using the drop-down menu on the 'Data' Command. One can export GPS data or Activity data.

The following window is displayed:



Select the Source File, <.tag > in case of GPS data or <*.adf> in case of activity data and the Export File, then select either a Spread Sheet (.csv) or KML/KMZ file format for importing into Google Earth (GPS data only) , before clicking on the Export button.

13. Post processing and exporting Data from Swift enabled collars

The Swift fix option is optionally available on LiteTrack collar versions. There are a few methods of downloading the data depending on the collar type and configuration, via the DLC-1,the PinPoint Commander unit (applicable only to LiteTrack RF) and via webservice (available to iridium and Globalstar versions).

Swift data downloaded via the DLC-2.

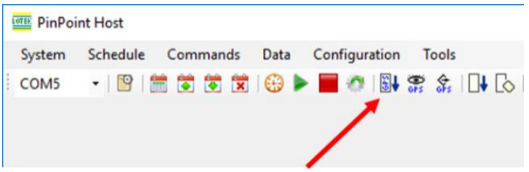
Once a Swift enabled collar has been retrieved, prior to downloading the data, check the following:

1. The PC clock is accurate (best if the PC is synchronised to Internet time).

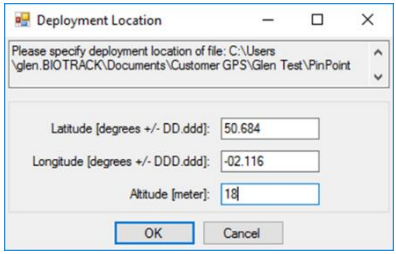
2. Get and store tag info taking note of the PC clock and collar's clock (difference between them might be important).

3. The PC is connected to the Internet.

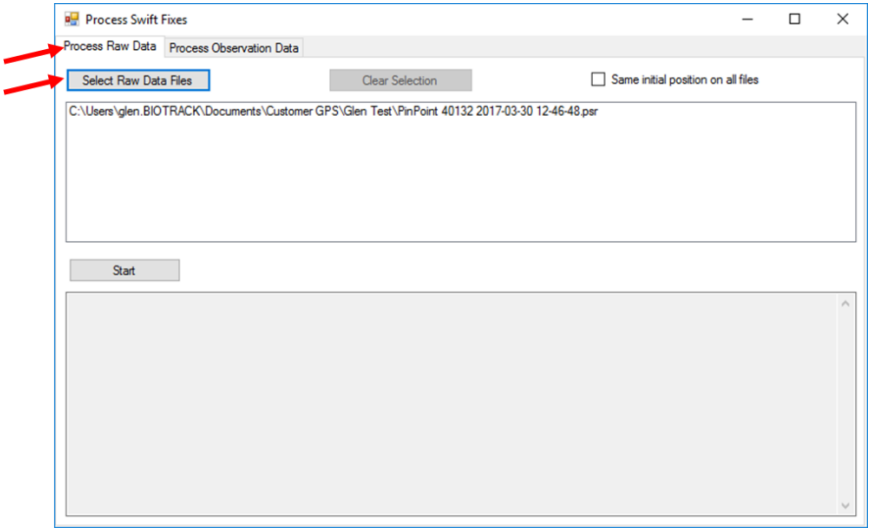
4. Download the tag data



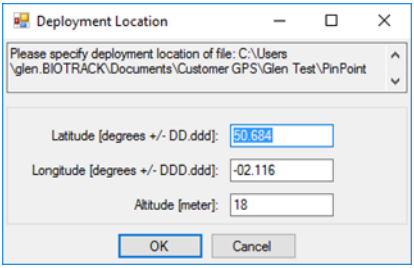
Select Get Tag Data menu item in the Data menu (or the icon shown above). PinPoint Host will save the tag data as a .PSR file (Example: PinPoint 40132 2017-03-31 10-10-33.psr). During the data download, the following Deployment Location window will pop up to enter the location where tag has been deployed. The following Figure is one of Lotek's companies GPS location. The program will save the location for the consecutive downloads. After your collar's first fix location has been entered, please select OK.



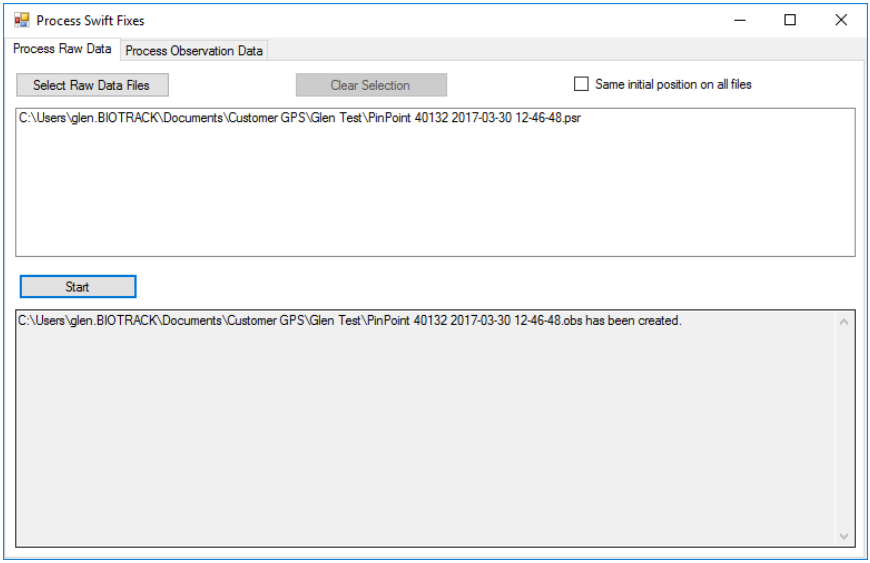
To convert the data to fixes, select “Process Swift Fixes” option under “Tools” menu. From the following window, select ‘Process Raw Data, then click the Select Raw Data Files’, find the directory where the .PSR file is and select ‘OK’.



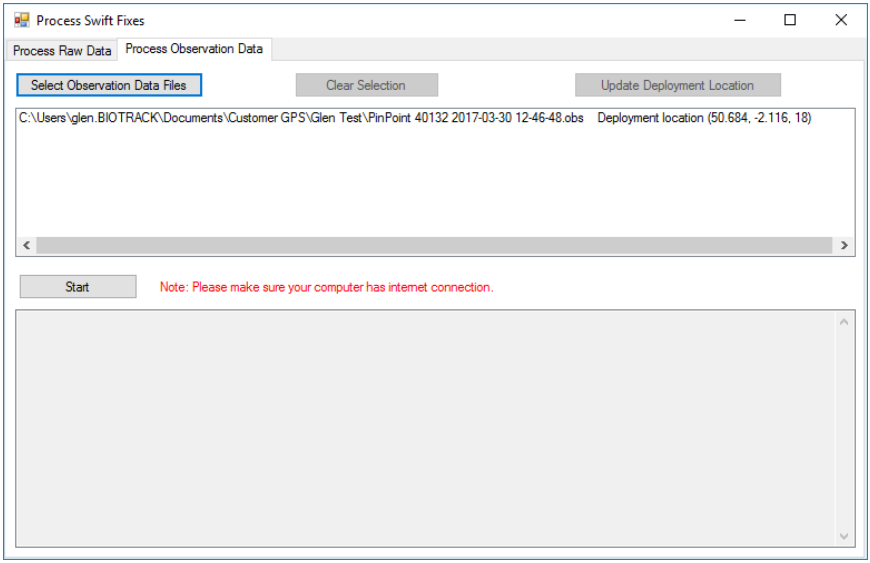
Click the start button. Enter the deployment location for this tag.



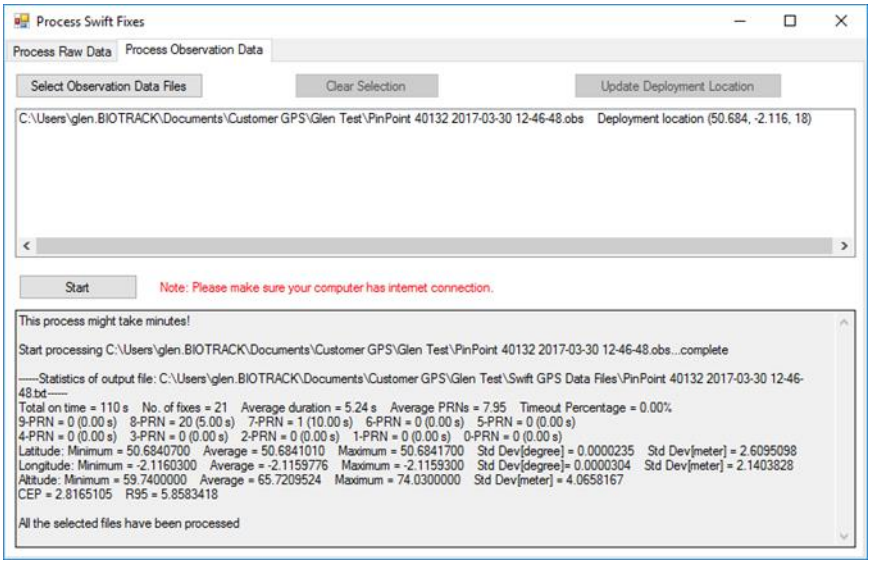
Click OK. The .obs file (Observation data) is then created.



To decode the data, select the collar 'Process Observation Data', then the 'Select Observation Data Files' button. Locate the directory where the (Rinex) observation file is, select the .obs file(s) and click start. The following window appears, click start.



Depending on the speed of your internet connection and PC, this will take a few seconds (or longer if processing multiple files).



Note 1: This process cannot be complete without Internet access.

Note 2: If you test 'swift tags' prior to deployment, then downloads data and tries to post process immediately, you may not be successful as the information PP Host is accessing via the internet may not be available for up to 16 hours.

Once the data process is complete, the final output is saved in the sub directory (where the .obs file(s) were) 'Swift GPS Data Files' where a text and KML file is created for each tag.

Note: The 'Swift GPS Data Files' folder is automatically created by Host.

These files cannot be opened within the Host since we do not provide a .TXT or .KML file viewer.

Swift data downloaded via the PinPoint Commander.

Once a Swift tag has been retrieved, prior to downloading the data, check the following:

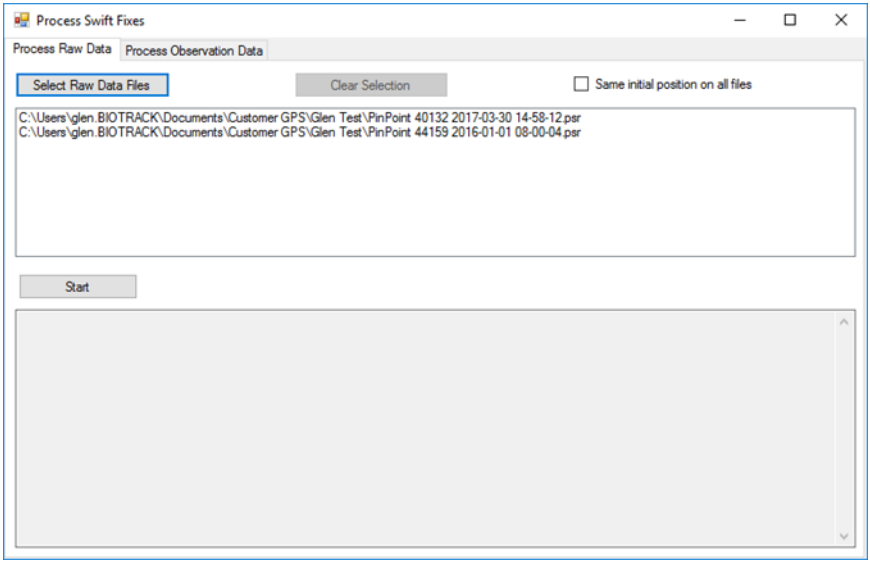
5. The PC clock is accurate (best if the PC is synchronized to Internet time).

6. Get and store tag info taking note of the PC clock and tag's clock (difference between them might be important).

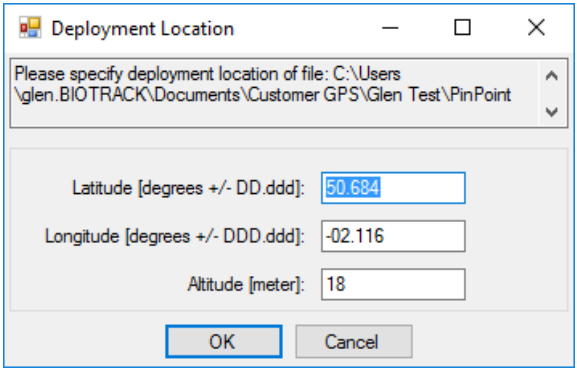
7. The PC is connected to the Internet.

8. Download the tag data via the PPC

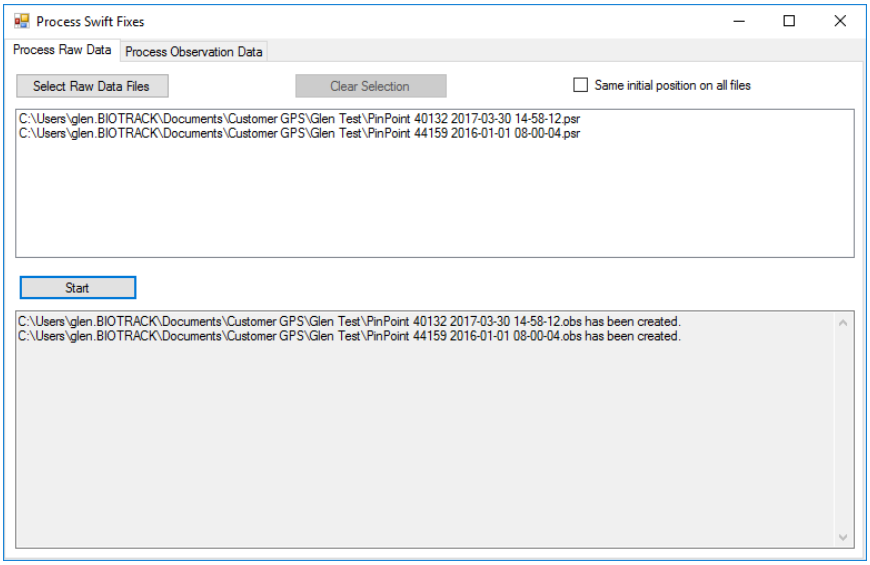
To download the data from the PPC, refer to section 10.2 above. If Swift data is present, eventually the following window will appear



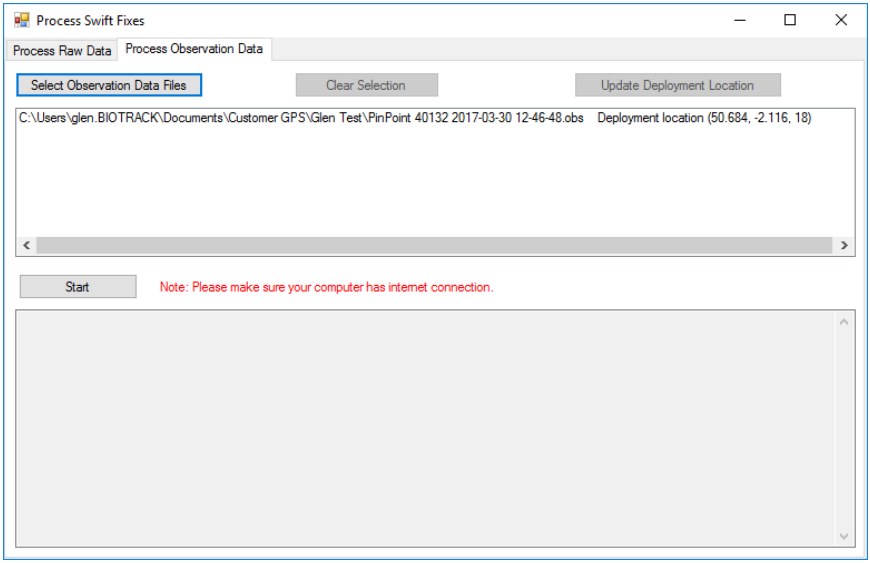
Click the start button. Enter the deployment location for each tag in this case.



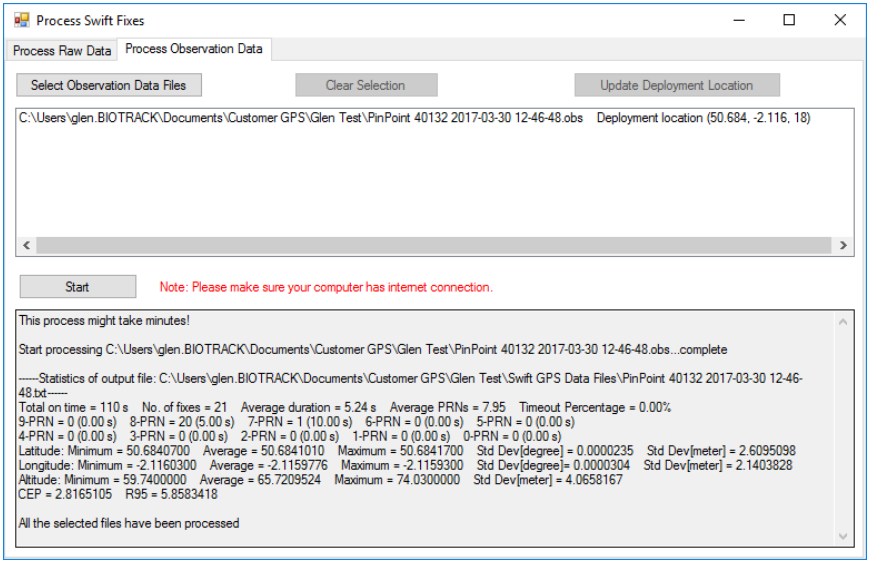
Click OK. The .obs file (Observation data) is then created.



To decode the data, select the tag 'Process Observation Data', then the 'Select Observation Data Files' button. Locate the directory where the (Rinex) observation file is, select the .obs file(s) and click start. The following window appears, click start.



Depending on the speed of your internet connection and PC, this will take a few seconds (or longer if processing multiple files).



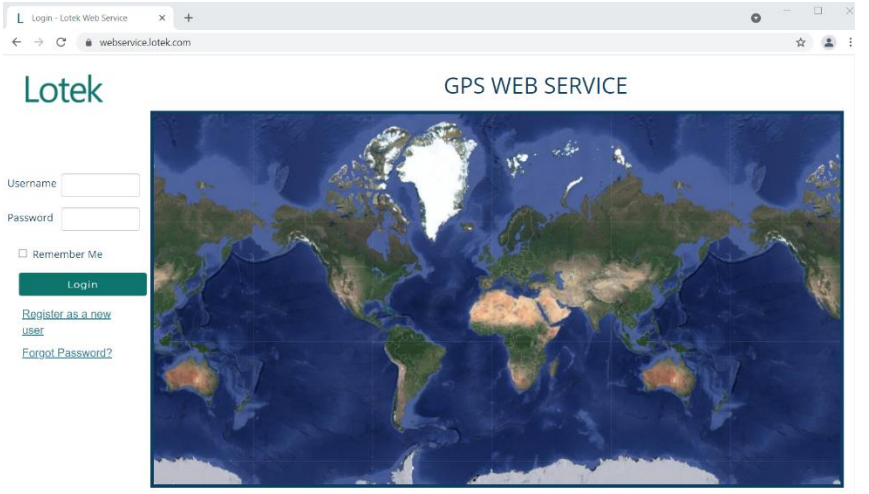
Please note: This process cannot be complete without Internet access.

Once the data process is complete, the final output is saved in the sub directory (where the .obs file(s) were) 'Swift GPS Data Files' where a text and KML file is created for each tag.

Note: The 'Swift GPS Data Files' folder is automatically created by Host.

These files cannot be opened within the Host since we do not provide a .TXT or .KML file viewer.

14. Web Service - Viewing LiteTrack Iridium and PinnaclePro Data



Web Service is a web-based user interface that allows viewing and downloading GPS collars data.

Remote data sent from collars are received and processed at a central server, the data is then sent to a data farm via internet connection. The end user only needs an internet connection and web browser to access the collar data and collar configuration.

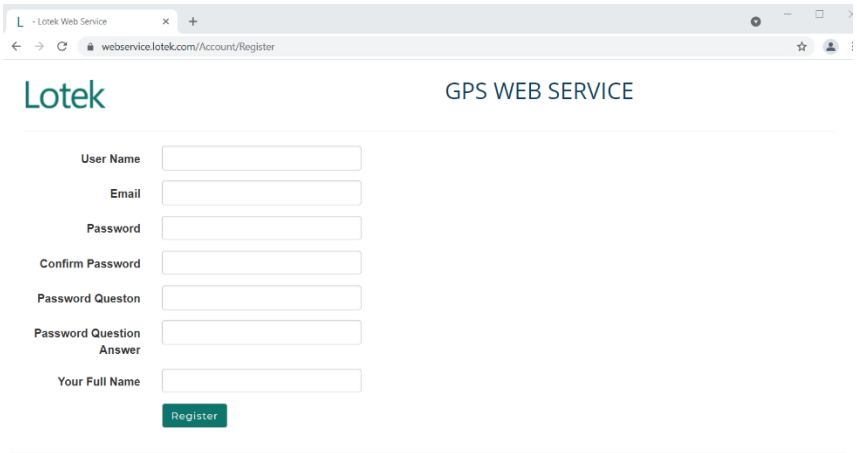
Note: Google Chrome, Microsoft Edge or Firefox are recommended, a minimum screen resolution of 1280 x 1024 is recommended

Note: LiteTrack Iridium and PinnaclePro collars are shipped “Deactivated”. Please contact the company you purchased your collars from to activate the Iridium Service. Data sent via Iridium system before activation, will not be available on web service.

14.1. Setup Web Service Account

Please use the following address to access web service
http://webservice.lotek.com

To create a new web service account, click on “Register as a new user”



User Name: No restrictions, please keep it easy to remember.

E-mail: This e-mail address that will be used to manage your account and reset password if needed. Regular email accounts, no restrictions.

Password: a mix of letters and numbers only. It needs to have a mix of CAPS and lowercase plus at least one number. Also, it needs to be at least 8 characters long. The password is case sensitive.

Password Questions and Answer: The question and answer should be something to which you will know the answer when asked but it is unlikely that anyone else would know the answer. Ex.: Your first car, pet, etc. The answer is case sensitive; it will be needed for reset password.

Full Name: The real name of the account holder.

Fill in all the information, and then click on “Register”. New account will be logged in automatically for the first time.

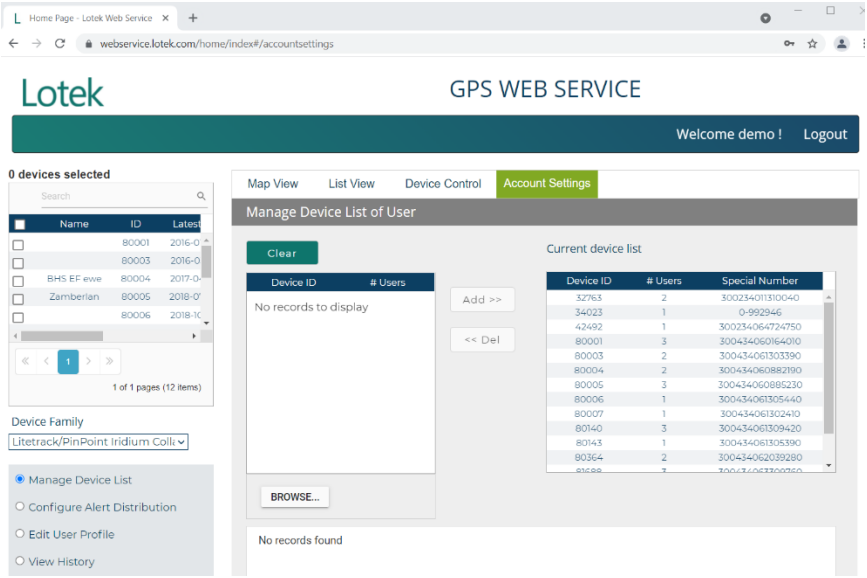
14.2. Account Settings

Once logged in, click “Account Settings” to manage the account. A new account does not have any collars associated to it. A “CFG” file is needed to access to the new collar and link the collar to your account.

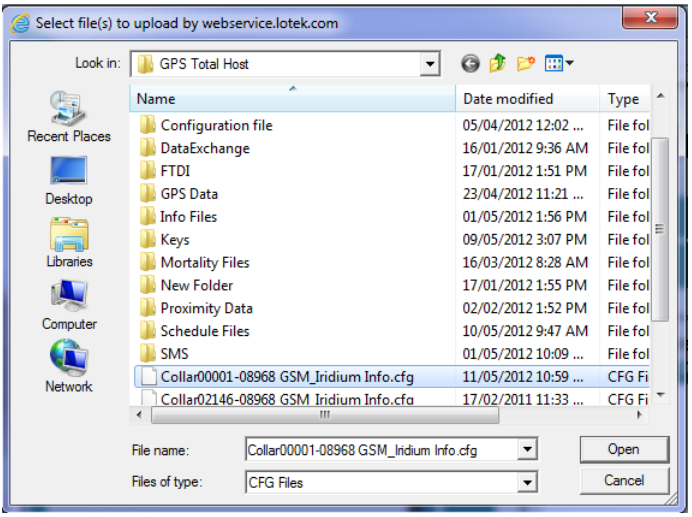
> Note: New user account holder need to use “Manage Collar List” and CFG file to associate collar to the new account. A CFG file will be emailed to client once the collar had been shipped.

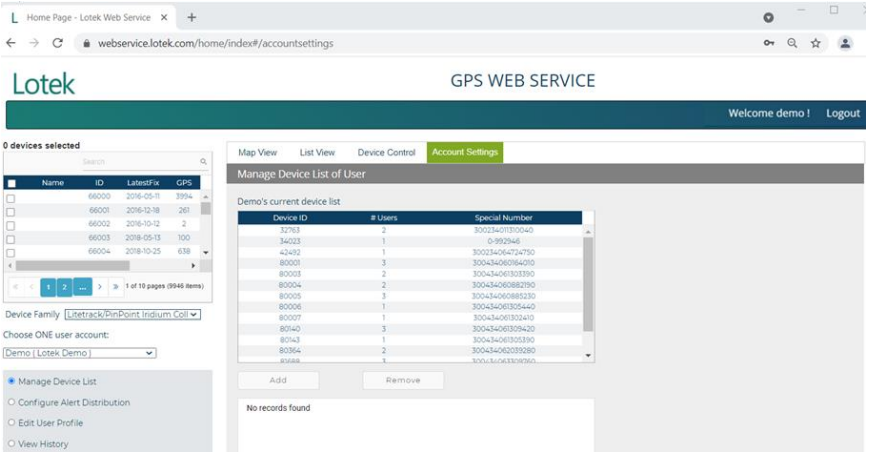
Manage Collar/Device List

Manage collar list allow user to link the collar IDs to the account so it will be available to map or download the GPS data.



To add collar to available collars, click “Browse”. And then browse to and select the CFG file, click “Open”

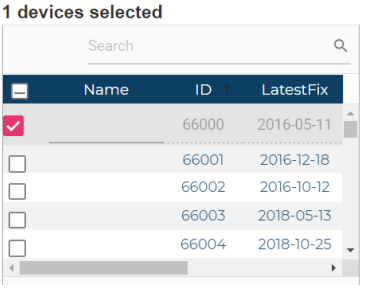




Select the collar that need to be linked to this account from the “Available Collars” window and then click “Add” to add this collar to the collar list

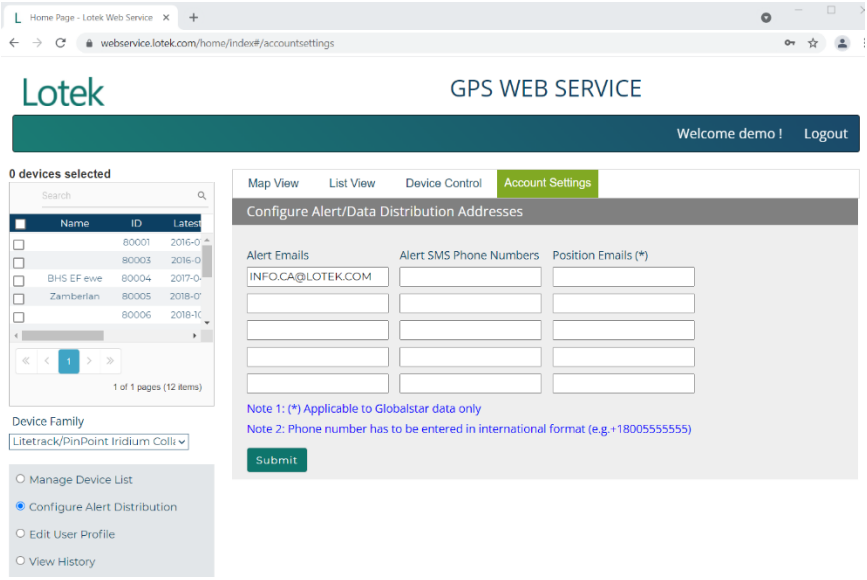
Add Name/Rename a Collar

To do so, double click on the Name box beside the Collar ID, and a checkmark will appear as well as line underneath the box. Now you are able to add a name or rename your collar.



Configure Alert/Data Distribution Addresses

Configure Alert/Data distribution address allow user to define email accounts where mortality alerts can be sent.



Alert Email: When a mortality event is received from a collar which is linked under the current user's account, an email will be sent out as plain text to inform of the time when mortality happened to those listed emails under "Alert Email" window.

Alert SMS Phone number: When a mortality event is received from a collar which linked under the current user's account, an SMS message will be sent out as plain text to inform of the time when mortality happened to those listed phone number under "Alert SMS Phone Number" window.

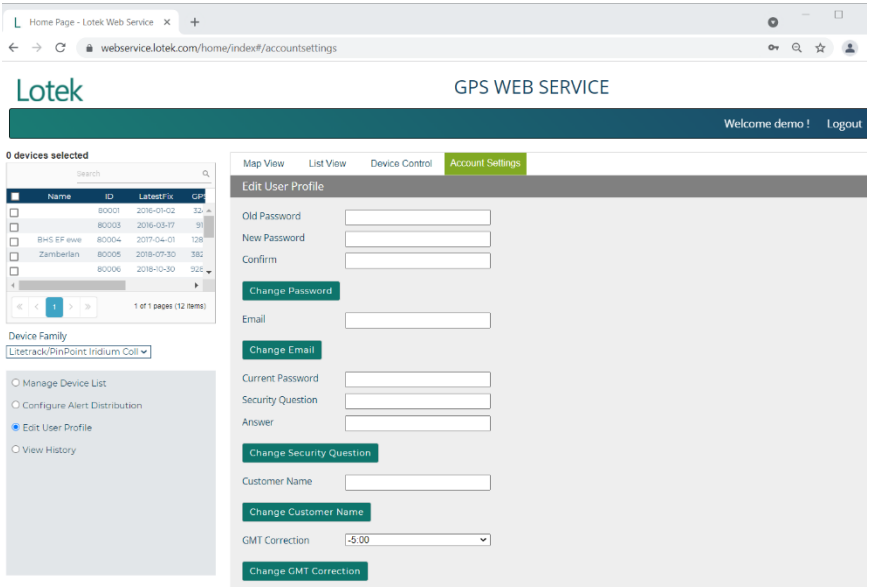
> Note: Please leave those fields blank, or contact Lotek Wireless before fill in the "Alert SMS Phone Numbers", additional charges apply.

Position Email: Please leave those fields blank, or contact Lotek Wireless before fill in those fields.

After create the user account and link the collar IDs to the account, web service account setup is finished and web service is ready to be used.

Edit User Profile

Edit user profile allows user to change the password, update the account management email address, change the security question and answer, update the account holder name and input GMT correction.



Change Password: Input the old password, new password and confirm the new password, then click "Change Password".

Change Email: Input new email address and click "Change Email". Note: This is the account management email which used to inform user about changes to the account. This is not the mortality notification email address.

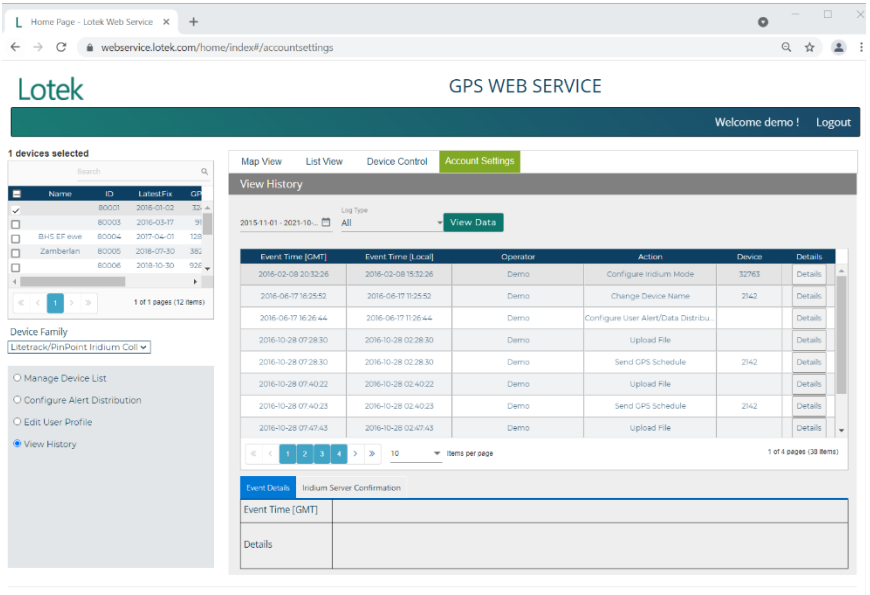
Change Security Questions: Input the password, new security question and the answer, then click "Change Security Question". Note: Answer is case sensitive

Change Customer Name: Input the new customer name, and then click "Change Customer Name".

Change GMT Correction: Select the GMT correction term, and then click "Change GMT Correction".

View History

All activities on the web service, including changes to the user account settings, management of collar list, remote configuration will be recorded and stored.



To view logs or errors, select the start date and end date, leave those date blank will list all log and error available in system. From drop down menu, select “Log” or “Error” to view, and then click “View Data”.

Map View

After creating the user account and linking the collar IDs to the account your web service account setup is finished and web service is ready to be used. Log out and log back in to the account or click on “Map View” to navigate to Google Earth / Google Map interface.

To map collar data, select the collar and then define the time period in the Start/End Date field. Alternatively, you can use the default setting and then use the date/time slider which allows you to reduce your data set visually.

Click “View data” to map GPS fixes on the Google Map Interface.

You have a choice of viewing all data within your selected time frame or you can select recent positions and narrow them further down to see just a subset of data.

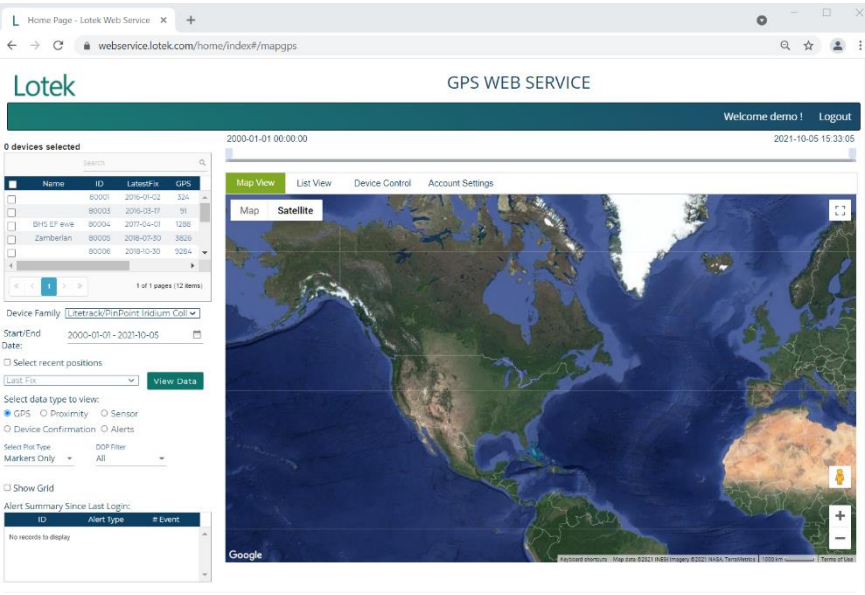
You can select data type to view GPS only or sensor data or alerts.

Select Plot Type: There are 3 options, “1. Markers Only”, “2. Path Only” or “3. Path and Markers”.

Check “Show Grid” if you would like to see grid on Google Earth Interface.

Mortality Events Since Last Log In: In this widow, all mortality events that happened after last user login will be listed.

If you want to assign a specific name to the collar you need to double click in the field ‘Name’ to the left of the collar ID and type it there.



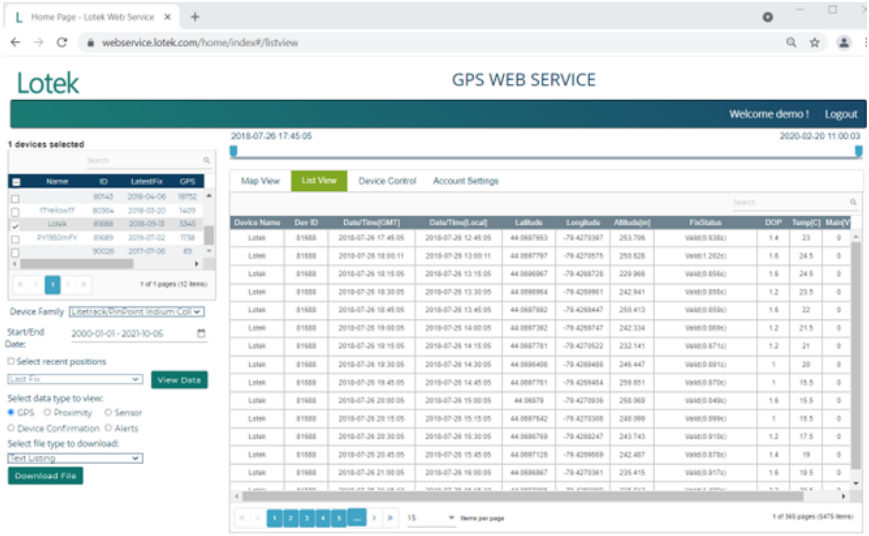
List View

Click on “List View” to switch to list and download view

To view or download collar data select the collar and then define the time period by click on “Start/End Date”. Or check the “Select most recent positions” and further select the time range from the drop-down list.

After selecting the date select the data type to be “GPS”, “Sensor”, “Alerts” or Proximity”, and then click “View Data” to view the data on the screen.

To download data, first select “File type to download” to set the file format to be “Text List”, “Spread Sheet (CSV)” , Google “KML file”, Google “KMZ file” or “Lotek Binary Format” (GDF), and then click “Download File” to start download the data.



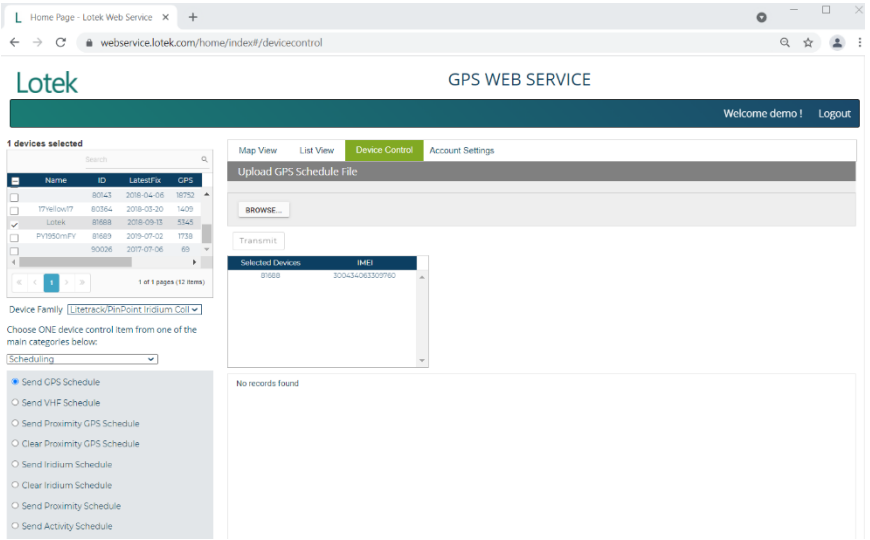
14.3. Device Control (LiteTrack Iridium and PinnaclePro models only)

Device Control is only valid for Iridium enabled collars/tags. Globalstar collars do not support 2-way communication, so these features are not available for Globalstar collars.

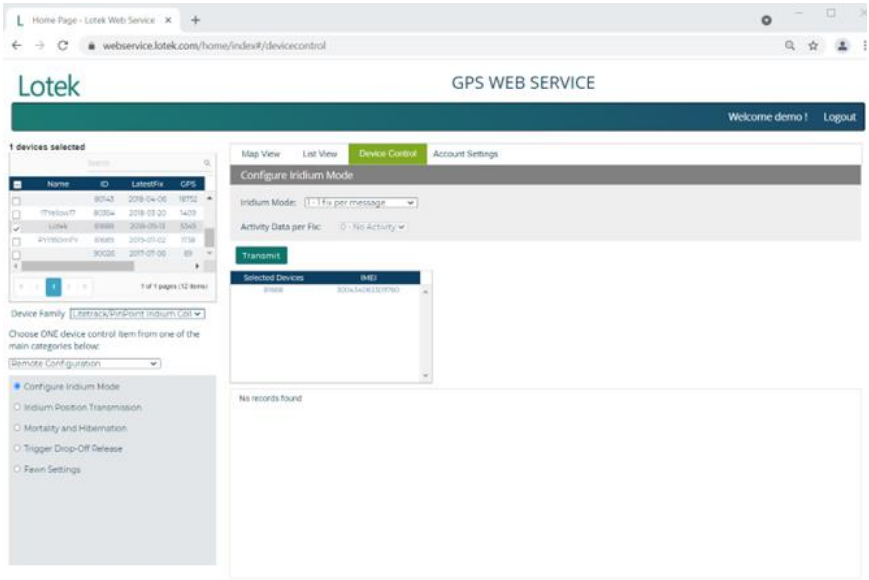
Click on the drop down list to select “Scheduling”, “Remote Configuration”, “Proximity Remote Setup” or “Virtual Fence Setup”.

Scheduling

To Send, Clear or Disable schedule, select the ID from “Device ID”, and then select the schedule file by browsing previously prepared schedules, and then click “Transmit” to Send, Clear or Disable a certain schedule

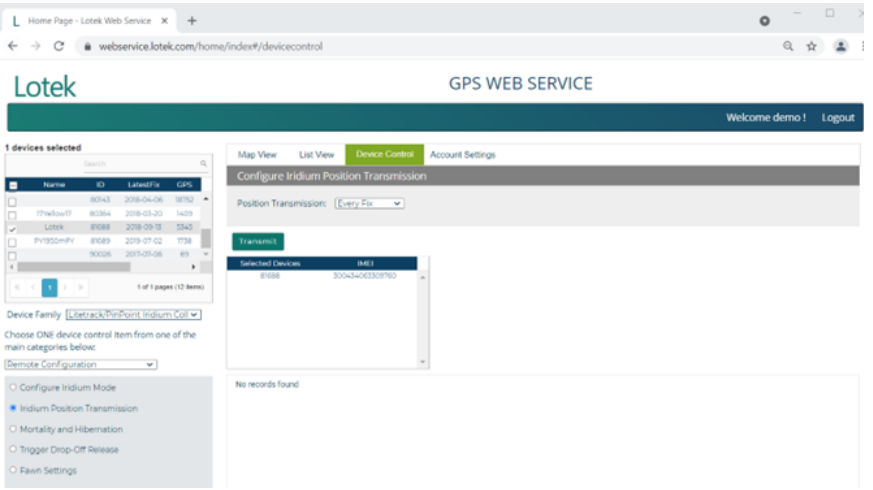


14.3.1. Configure Iridium Mode



Select the ID from “Device ID”, click “Include”, and then select the Iridium mode, how many fixes per message and then click “Transmit” to send the new Iridium Mode.

14.3.2. Iridium Position Transmission

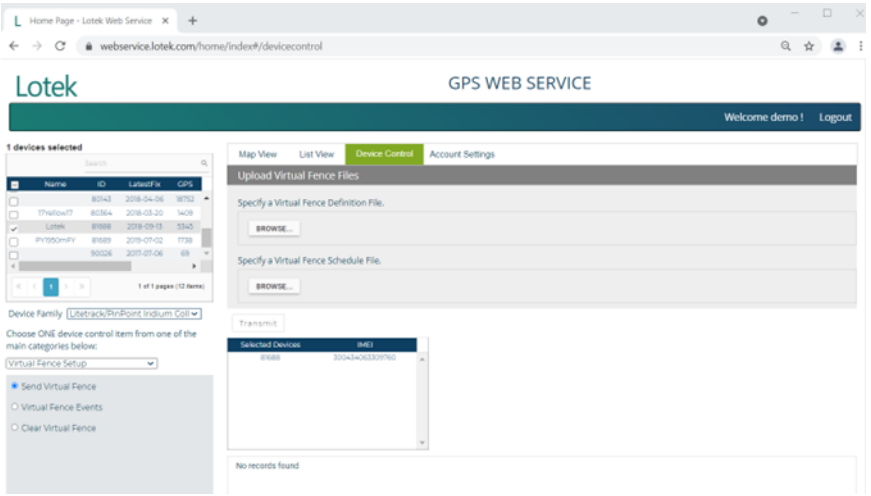


Select the ID from “Device ID”, click “Include”, and then select the Iridium “Position Transmission” , then click “Transmit” to send the new Position Transmission setting.

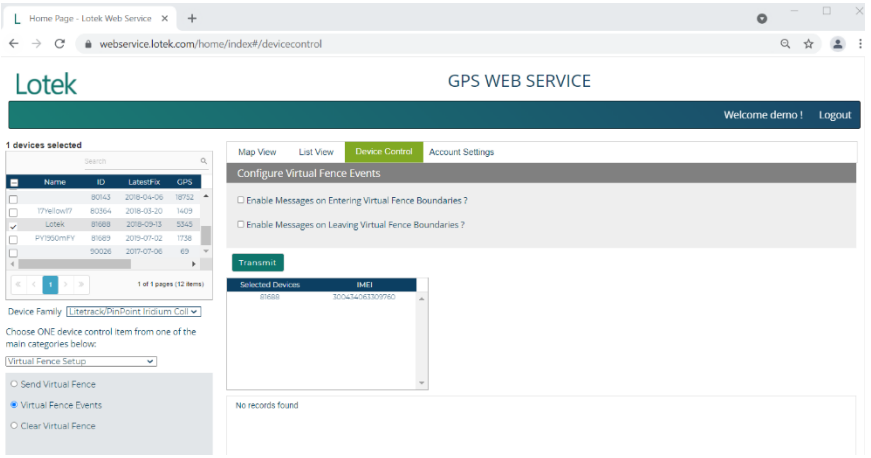
14.3.3. Trigger Drop-Off Release and Fawn Settings

These commands are separately described in manuals describing drop offs and VIT/Fawn monitoring system.

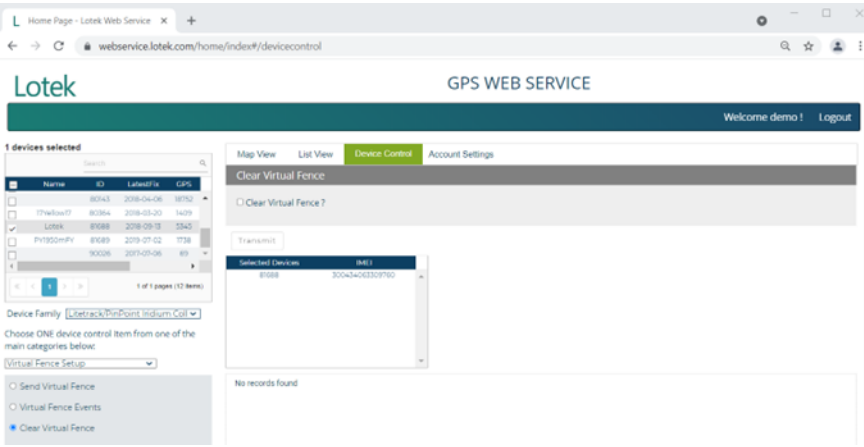
Virtual Fence Remote Setup



Select the ID from “Device ID” and select the Virtual Fence file and Virtual Fence schedule , then click “Transmit” to send the new Virtual Fence.



Select the ID from “Device ID”, click and select to enable or unselect to disable the Virtual Fence event message, then click “Transmit” to send the new virtual fence event message setting.



Select the ID from “Device ID”, tick mark the box and click “Transmit” to clear the Virtual Fence.

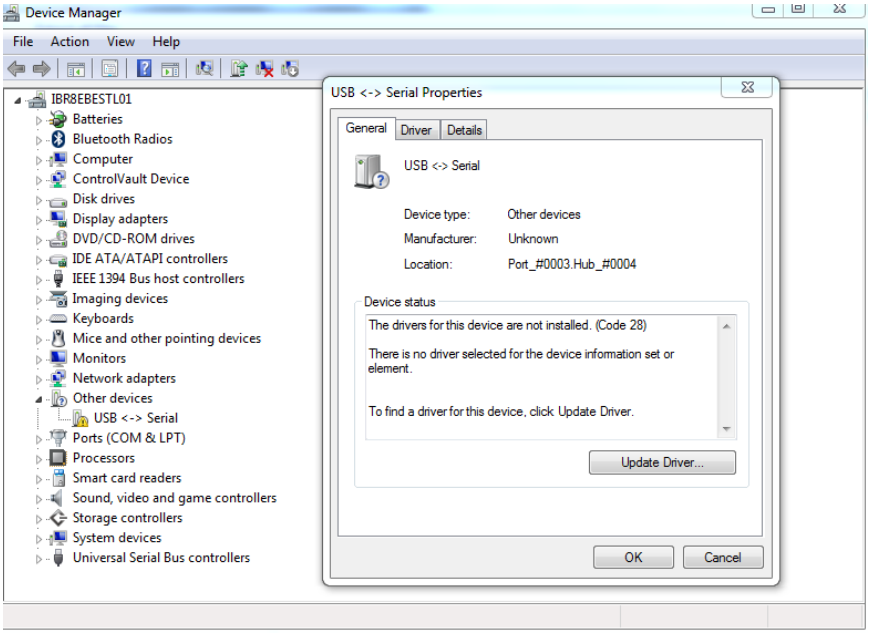
Appendix A Driver Install

If the Driver fails to install automatically, open 'Device Manager' (from Control Panel). If you see a warning symbol under Other Devices\USB <-> Serial, this indicates that the driver has not been located. Right click USB <-> Serial and select Update Driver. Select 'Browse my Computer for driver Software'. Select the location:

1. If it is 32-bit operating system, the folder will be "C:\Program Files\Lotek Wireless Inc\PinPoint Host"

2. If it is 64-bit operating system, the folder will be "C:\Program Files (x86)\Lotek Wireless Inc\PinPoint Host".

Tick 'Include Subfolders' before you click 'Next'.



Once the driver has installed, open up 'Device Manager' and confirm the Interface has been allocated a COM port under Ports (COM & LPT).

Appendix B Collar Fitting and Deployment

To Fit a LiteTrack Collar that has Nyloc Nuts and Bolts

Nyloc Nut & Bolt

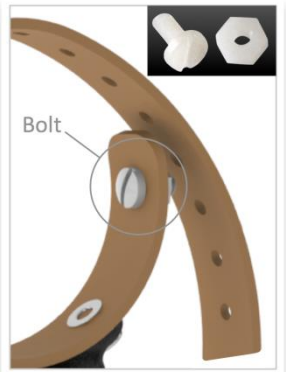
1. Undo the nuts and remove the cover plate
   A fastening tool is supplied by Lotek with each order

2. Fit the collar around the animal's neck
   Ensure that the collar is oriented correctly. If you need to punch a new set of holes in the strap, ensure they are not too close to existing holes or stitching.

3. Place the cover plate and nuts back on the bolts and tighten
   Do not over tighten the nut

4. (If relevant) Cut off any excess strap
   If the strap is too long for the animal, it may become a hindrance. As a guide, the length of strap in the photo (above) is sufficient.

To Fit a LiteTrack Collar that has a Nylon Nut and Bolt



Nylon Nut & Bolt

1. **Undo the nut**
   The nylon nut can be loosened with finger and thumb

2. **Place the collar around the animal's neck**
   Ensure the collar is oriented correctly. If you need to punch a new set of holes in the strap, ensure they are not too close to existing holes or edges.

3. **Place the nut back on the bolt and tighten**
   Hand tighten with finger and thumb

4. **Crimp the excess thread**
   Use pliers to crimp / deform the thread. Deform the thread sufficiently to prevent the nut from loosening. Alternatively, a drop of Loctite (supplied) will hold the nut in place

5. **(If relevant) Cut off any excess strap**
   If the strap is too long for the animal, it may become a hindrance. As a guide, the length of strap in the photo (above) is sufficient.
   Do not cut the antenna. Cutting the antenna will reduce its performance.

Deployment of LiteTrack Iridium 330,360,420 and LiteTrack RF 330,360,420 models

Before proceeding with deploying the collar on an animal ensure that all the procedures in the previous section of the manual have been followed.

Using torque screwdriver to the correct amount of torque

Torque screwdrivers (purchased separately) are supplied with two factory preset adaptors (5.3 and 8 lb.in), one hex power bit 3/32" and one nut setter 5/16".

Use brown adapter (marked 8.0 lb.in or 0.9Nm) and nut setter 5/16" to tighten the locknuts after adjusting the collar around animal's neck.

Use red adapter (marked 5.3 lb.in or 0.6Nm) and hex power bit 3/32" to tighten the battery screws.

Replacing/Attaching Battery Packs (LiteTrack Iridium330, 360, 420 and LiteTrack RF 330,360,420 models)

First, place the magnet on the collar and make sure VHF beacon is stopped before disconnecting the battery, except if the VHF is in double beep (Recovery mode). Connect DLC2 to the collar and deactivate it.

The battery pack for this collar models is already equipped with a greased O-ring, self-locking screws and flat washers. Visually examine the O-ring prior to closing the battery pack and make sure it didn't collect dirt and/or debris during handling/transportation.

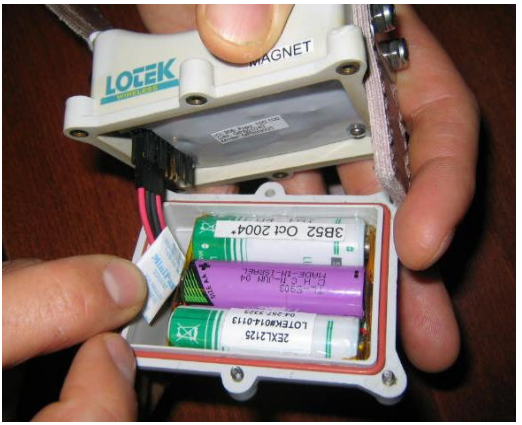
In addition, the following parts will be received:

- One spare set of 6 self-locking screws (with blue Nylock patch on them). The self-locking screws are equipped with nylock patch that prevents them from unfastening. They are designed to be used once and should be reserved for final assembly (before mounting on the animal). These screws can be removed and reused only once at MOST (and only if necessary).
- One spare set of 6 flat washers
- 1 desiccant pack
- 1 Allen hex bit (3/32")
- 1 magnet
- 2 spare nylock nuts
- 1 spare mini clamping plate
- 1 hex nut driver bit (5/16")
- 1 battery aluminum bezel (if ordered)

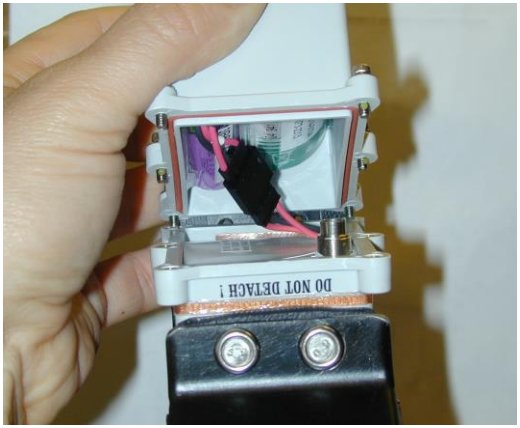
Note: Using a torque wrench for final assembly is STRONGLY recommended. Torque wrenches are available for purchase from Lotek.

Follow these steps to attach the battery pack for final deployment:
Having gone through the initialization procedure, the collar is already being powered by the battery.

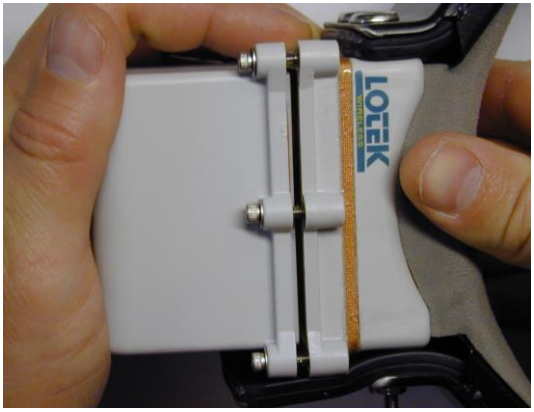
1. Insert the desiccant bag into the battery housing. The desiccant provides protection against moisture.



2. Before closing the collar, check to ensure the wires and connector are in their proper positions.



3. Tighten the screws alternately, a little at a time, to ensure an even seal. Over-tightening is neither necessary nor desirable. Not tightening the screws enough must also be avoided, as this could result in potential water leakage. The necessary torque to be applied is 5.3 lb-in (0.6 N-m).



Replacing/Attaching Battery Pack for LiteTrack Iridium 250

To prevent short circuit, the battery for this model is supplied with the terminals protected with silicone tubing. Prior attempting to connect battery to the collar the tubes must be removed.

The battery has a factory installed rectangular silicone rubber gasket around the pins. Visually examine the gasket prior to closing the battery pack and make sure it did not collect dirt and/or debris during handling/transportation.

Note: Touching battery terminals with electrically conductive materials will short the battery. To avoid this occurrence, please connect the battery as soon as the silicone tubes have been removed!

Follow these steps to attach the battery pack for final deployment

1. Plug battery into socket at the end of the belt and tighten locknuts using nut setter 5/16 from the order kit. It is recommended to use a torque screwdriver, available for purchasing from Lotek with a preset torque to 5.3 lb.in (a torque up to 6 lb.in is acceptable for a screwdriver purchased from a different source).

2. Use the same red 5.3 lb.in adapter to tighten the locknuts on the other side when collar is fitted around animal's neck.

Replacing/Attaching Battery Pack for LiteTrack Iridium HD

Before attaching the battery pack make sure the soft rubber gasket is installed in the channel of the top battery housing. There is no need to add grease on this battery gasket.

1. For battery replacement, use a Phillips screwdriver to remove the grounding screw from ground wire pigtail attached to one of the posts inside aluminium housing. Remove the old gasket, clean the channel with a cotton swab and isopropyl alcohol and install a new gasket supplied along with the new battery.

2. Tighten grounding screw back to the threaded post (spare screws are provided in the kit).

3. Insert desiccant bag into battery housing. The desiccant provides protection against moisture.

4. Plug battery connector and attach battery housing to collar using the screws provided. The top and bottom housings are keyed and they will fit together when the profiled portion from the top overlaps the similar one from the bottom housing. Tighten the screws alternately, a little at a time, to ensure an even seal. It is recommended to use a torque screwdriver available for purchase from Lotek with a preset torque setting of 8 lb.in.

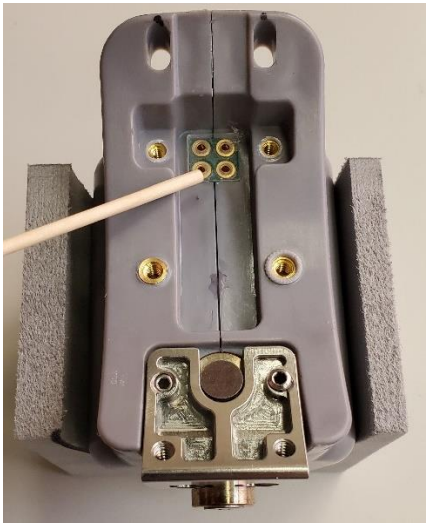
Note: It is normal to see the soft rubber gasket slightly extruding out after the screws were tighten using the above specified torque.
Collars purchased prior to February 2023 don't have the upper housing corner post threaded therefore they will have to be sent to Lotek prior battery replacement.

Replacing/Attaching Battery Pack for LiteTrack Iridium 420 ED+

1. Detach old battery pack from collar by removing four Phillips screws and two locknuts. The screws can be accessed via open ports through bottom foam. To open the locknuts, use the 5/16 nut driver provided with kit per order.

2. Once detached from the belt, remove the connector attachment screws. Unplug the connector from the battery by gently prying it up. Do not use metal tool for this operation.

3. Before plugging the connector into the new battery, make sure the battery has the sealing square silicone rubber gasket affixed over the connector sockets. If the gasket is missing, contact Lotek.



4. To connect the new battery, follow the same steps in reverse order. Plug the connector and press it down all the way until seated over the gasket. It is recommended to use a torque screwdriver, available for purchasing from Lotek with a preset torque to 5.3 lb. Attach the belt by tightening the locknuts; use the new screws with thread locker and cup washers provided in the kit and tighten to 8 lb.in torque. If the old cup washers remained captive under the foam, they can be reused.

5. Remove the magnet taped on the side of the battery prior deployment (only for batteries with timer release backup). The LED light visible through the open port must flash 5 times. This means that the backup timer release is initialized properly and timer countdown started. Please note that LED light is very dim and may not be visible in bright sunlight. Try looking directly at it and shade it from the outside light.

Appendix C Charging/Attaching Battery Packs for LiteTrack LR collars

The battery pack is supplied with a battery kit that contains:

- Non-pelletized screws 6-32 x ½" – 12 pcs.
- Flat washers -12pcs.
- Silicone O-ring – 1pc.
- Cotton Tipped Applicators – 2pcs.
- Desiccant bags- 3pcs.
- Vacuum grease 6 gr. pouch – 1 pc.

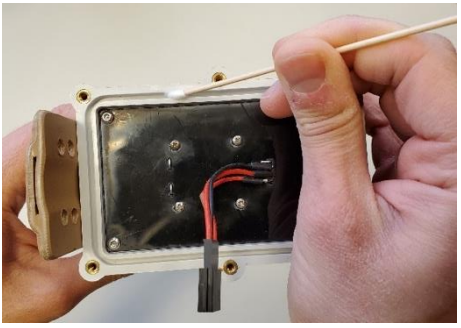
In addition to the kit supplied with each battery pack, with every purchase of LiteTrack LR collars a kit per order is included and this contains:

- Allen hex bit (7/64")
- Hex nut driver bit (11/32")

Note: Using a torque wrench for attaching the battery pack is STRONGLY recommended. Torque wrenches are available for purchase from Lotek.

1. In preparation for cleaning the O-ring groove, slightly loosen the end of a cotton swab by rolling it between the thumb and forefinger.

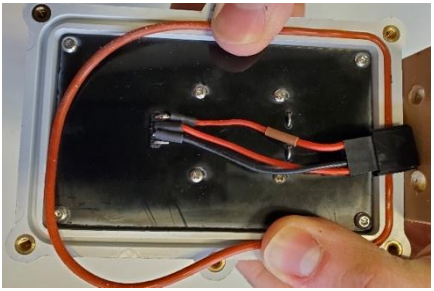
2. Insert the swab into the O-ring groove and clean all around the perimeter.



3. Cut the grease pouch and squeeze out a 1/2 "long line of grease onto your finger.

4. Grasp the O-ring and begin spreading the grease uniformly over the O-ring. Three or four rotations of the O-ring through grease between your fingers will apply a uniform layer over O-ring.

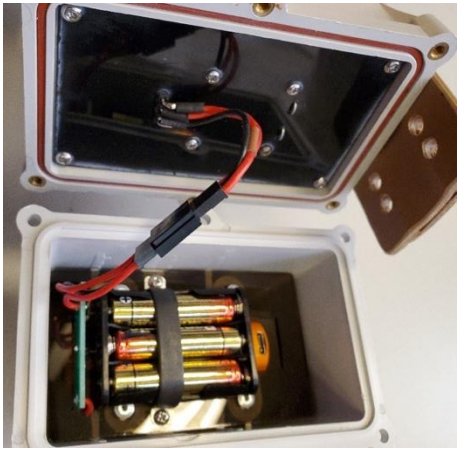
5. Insert the O-ring into the groove by pressing it with vertical push. The O-ring is custom made to fit the perimeter without the need to stretch it.



6. Visually inspect the battery pack housing to ensure there is no dirt and/or debris on the surface that may get in contact with the O-ring.

7. Insert one desiccant bag into battery housing.

8. Plug the battery and close the collar. Make sure the power wires are not pinched while closing the collar.

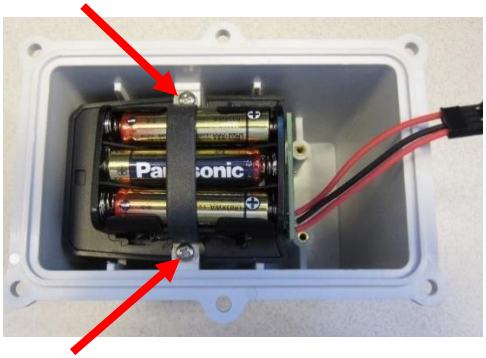


9. Insert and tighten six screws and flat washers using the 7/64" Allen hex bit. The recommended torque for this model is 8.0 lb.in (0.9 N.m). Tighten screws alternately, a little at the time, to ensure an even seal. Over or under tightening may result in damaging the threaded inserts or potential water leakage.

Charging battery packs in collars purchased prior to March 2021:

1. Remove the screws using 7/64" Allen hex bit and unplug the battery pack.

2. Remove the two screws that hold the clamp over AAA batteries using a Phillips screwdriver.

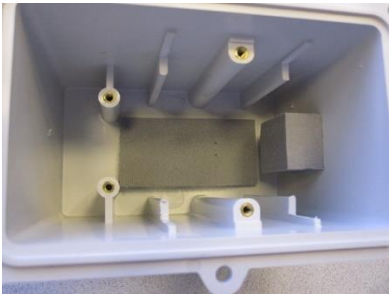


3. Remove the battery pack from the housing and unplug rechargeable battery from battery adapter plate.

4. Charge battery until LED light turns green.


5. Upon battery charging, plug battery back into the battery adapter plate.

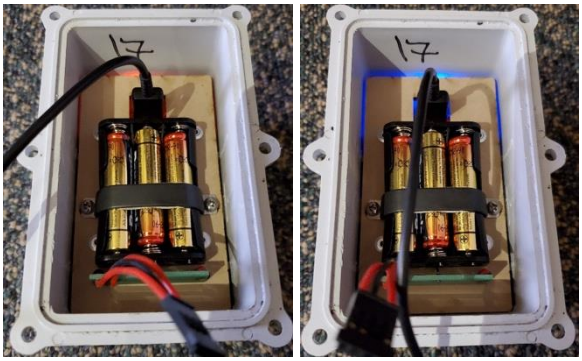
6. Before inserting the battery back into the housing, make sure the two pieces of foam are in place.



7. Insert battery pack into housing, place clamp over AAA batteries and tighten with Phillips screws. The battery pack must be placed in the housing in a similar position with the one in the picture with the wire harness towards the center of the housing.

Charging battery packs in collars purchased after March 2021:

1. Plug USB-C cable into battery charging port accessible through the rectangular cutout in the battery support plate. Plug the cable into the wall charger. A red light projected on the housing wall is visible and indicates the battery is currently charging. Upon full charging the light will turn blue.



Appendix D PinnaclePro solar collars recharge instructions

The collars leave our manufacturing site fully charged but they will have consumed a small amount of their battery capacity during transit, storage, and any testing you will have done to them.

Interfaces DLC1 and DLC2 continuously top up the battery when the collar is plugged in to the computer – the 'CHRG' light on the DLC unit will light up red indicating that the process has begun and will change to green as soon as the battery is fully charged.

However, solar capabilities of the collars can be alternatively used to recharge the batteries prior to or after a deployment.

To utilize the solar function simply make sure the collar is deactivated and leave it in a sunny position, such as window in full sun or outside on a sunny day.

Bear in mind that the Lithium Polymer cell may take 2 to 5 days to fully charge depending on climate and latitude.

Appendix E Protocol for Long-Term Storage of Lotek Collars & Batteries

The following are best practices for storing your Lotek collars and batteries to maintain their condition in instances where you will not be deploying for several months.

1. If the battery is user-replaceable, disconnect the battery from the collar and follow the protocol for battery storage in Step 3. If you are unsure if this applies to your product, please contact your Lotek customer support representative for clarification.

2. If the battery is not user-replaceable, please make sure the collar has been deactivated in PinPoint Host and the protocol outlined in Step 3 is applicable to the unit as whole.

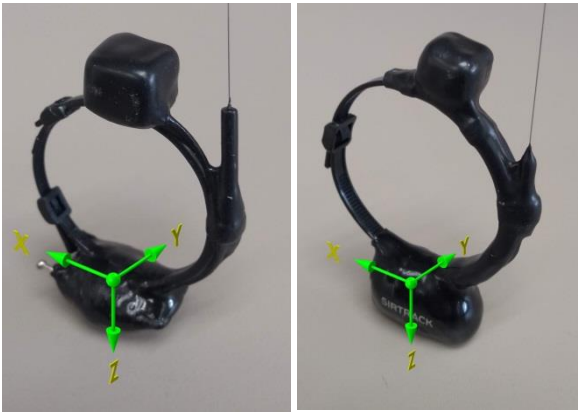
3. Keep the batteries in a cool, dry, humidity-controlled and well-ventilated location. Storage temperatures should be below 22°C. Exceeding this temperature can result in shortened battery life and degrade performance. Sources of heat (lights, sun, electronic equipment etc) can have a negative impact on long-term battery health.

Note: It is highly recommended that collars and tags are tested upon receipt of shipment and prior to deployment. If you are storing long-term, another test prior to deployment is also recommended as well as checking for applicable firmware updates.

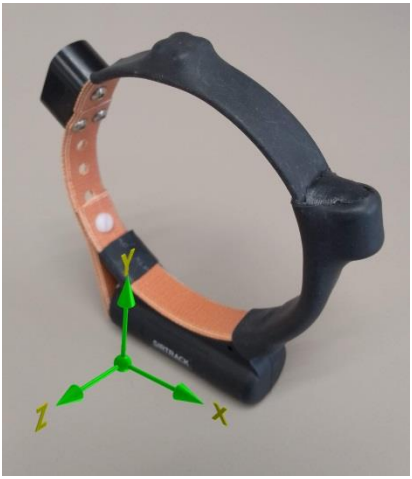
Appendix F Accelerometer's XYZ orientation

Orientation of XYZ axis' among collar models

PinnaclePro S, M, L



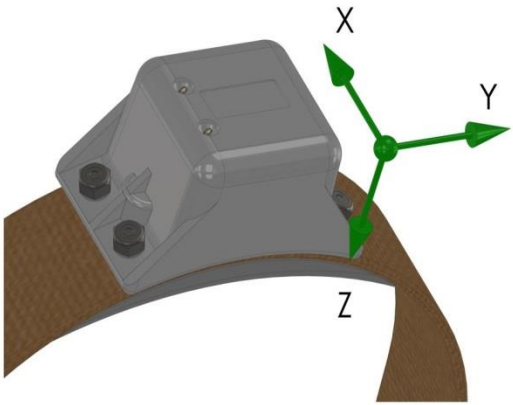
LiteTrack 10, 20, 30 and 40



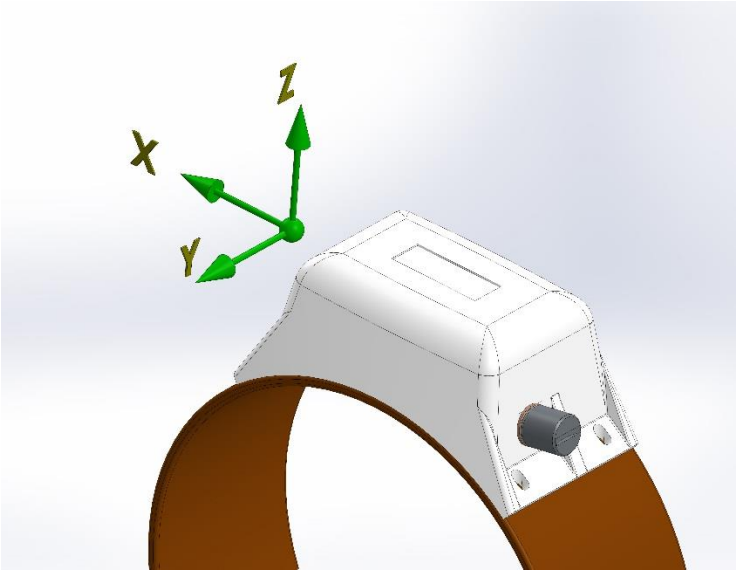
LiteTrack 60

LiteTrack 140

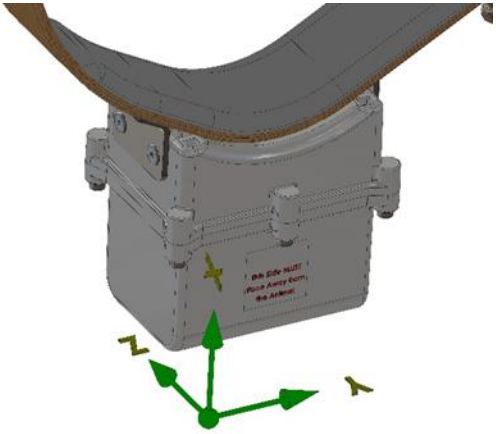
LiteTrack Iridium 130, 150



LiteTrack Iridium 250, 330, 360, 420



Globalstar Pro S,M,L



LiteTrack Iridium TL

Appendix G System augmented with VITs and/or monitored fawn collars

Research projects examining birth rates, fawn mortality and recruitment will benefit from augmenting GPS system with VITs and /or fawn collars.

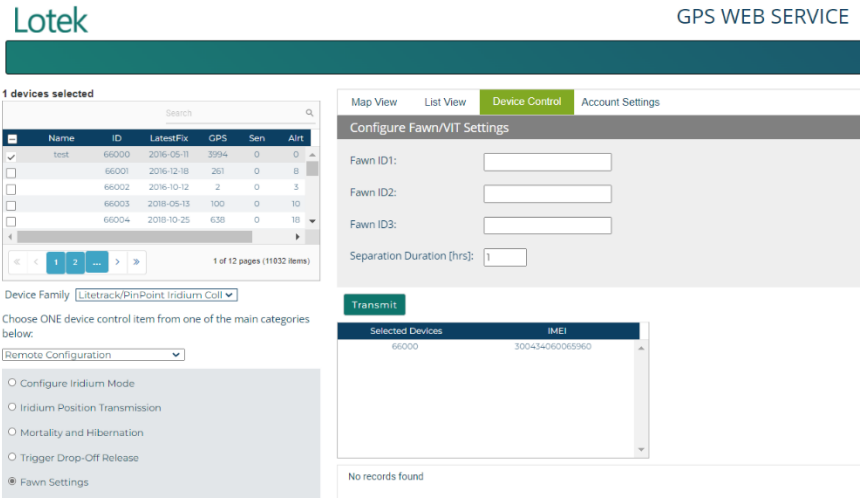
1. VIT (Vaginal Implant Transmitter)

    a. VIT standard –units work as simple VHF transmitters and in the background they monitor ambient temperature and activity. When temperature drops and activity stops for a user defined time period the unit declares birth and transmits it to the collar. The corresponding collar detects it and sends a birth alert through the Iridium system to Lotek's database, which in turn generates an alert text message with the information about birth and its geographic position, and sends it to the user's phone. Typically, users set VIT inactivity to 1 hour which means that after 1 hour of tag inactivity (caused by being expelled by the newborn fawn) combined with a drop of temperature the tag sends birth alert. The assumption is that the female and the newborn fawn stick around the birth site for at least an hour before they move away further from the fallen VIT.
    Birth alert is being sent for 24 hours after which the tag goes through a reset and continues its operation in a normal mode.

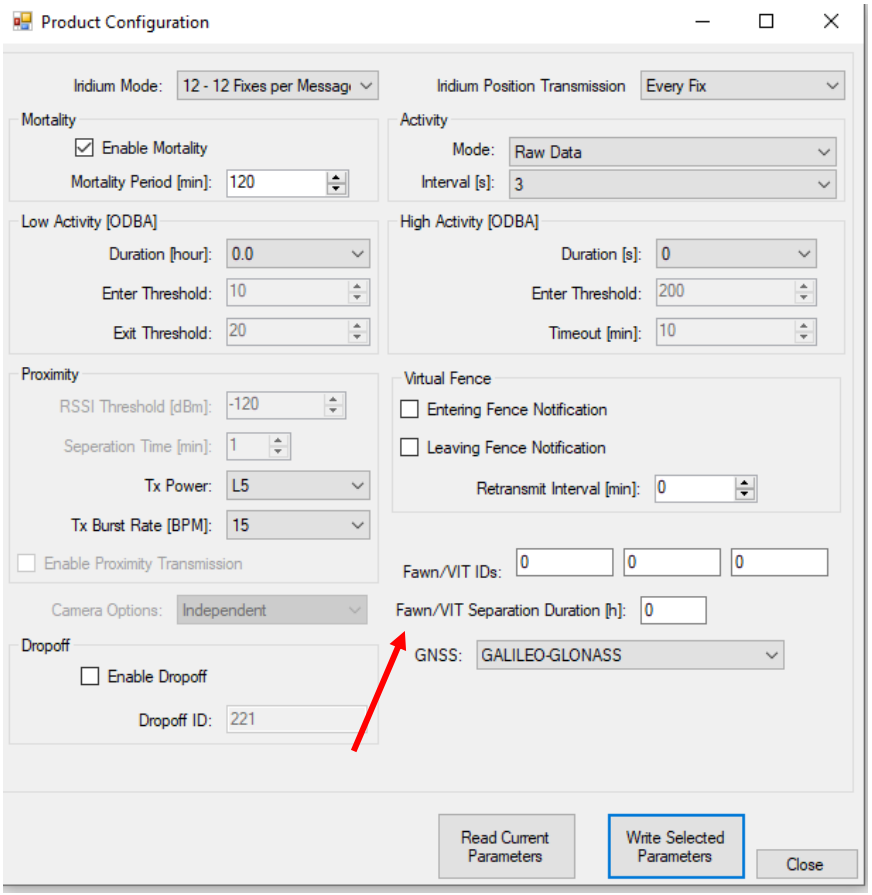
    b. VIT with separation. The tag works just like a standard VIT but also periodically sends its IDs to the paired collar (worn by the female). If the VIT falls out or a stillbirth occurs, and the animal moved away beyond communication distance, the collar sends a separation alert after X minutes (user defined) of not hearing the incoming transmission from its VIT. Separation alert does not include a position, just an information about separation. Separation alert can also be used as a proxy for birth alert if the animal happened to move far from the expelled VIT within the initial time period when it tries to determine if birth happened.

2. Fawn Mortality/Separation tags/collars work similarly to VITs with separation, described in 1b but instead of birth they monitor mortality of fawns. There is no 24h reset like in VITs but Mortality can be reset by collar movement.
   If actual fawn mortality occurs the collar will send mortality signal to the paired doe collar, which in turn will send fawn mortality alert to the end user.
   In case where separation is monitored, fawn collars (or VITs) must be paired with the collar worn by the doe. It can be done in advance prior to the capture or it can be done after the capture through Iridium commands or through PinPoint Commander.
   Iridium collar can be paired with up to 3 fawn collars.

Pairing programmed remotely into the collar with the WebService



Pairing programmed directly into the collar via PinPoint Host prior to deployment



Appendix H API Legend for Dataset

Data Field Name	Description
Device ID	Collar Serial Number
UploadTimeStamp	Datetime of Iridium Upload in GMT
Latitude/Longitude	Position Data
PDOP	Positional Dilution of Precision; see: https://gisgeography.com/gps-accuracy-hdop-pdop-gdop-multipath/
ECEFx/ECEFy/ECEFz	Activity data for each axis; only applicable to certain collar models
MainV	Voltage of main battery; only present with certain collar models
BcUpV	Voltage of backup battery; only present with certain collar models
Temperature	Temperature in OC
Fix Duration	Time taken for GPS fix attempt; only present with certain collar models
bHasTempVoltage	Does the collar record both temperature and voltage? Only present with certain collar models
DevName	User-assigned name for the collar; this setting is configured on Web Service
DeltaTime	Applies to Swift Fix collars only; the difference between the satellite time and the time of the clock on-board the collar
Fix Type	Numeric indicator to differentiate between IridiumTrack, LiteTrack and Swift Fix collars
CEP Radius	Applies to Swift Fix collars only; Circular Error Probable for location data
CRC	Applies to Swift Fix collars only; pertains to the handling of location data
RecDateTime	Datetime of GPS fix attempt in GMT

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