VECTRONIC Aerospace

GPS Plus X

User Manual

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GPS Plus X

User Manual

	Name	Date	Signature
Prepared by			
Edited by	Marcel Butz	16.08.2016	
Checked by			
Approved by			
Authorized by			

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Table of Contents

1 Product overview

GPS Plus X is a tool to:

- organize and configure your collars
- create schedules for GPS localization
- configure communication between collars, computer and user
- create schedules for collar communication
- download and store data in an SQL database or in different data file formats

Refer to:

Software structure

1.1 Software structure

GPS Plus X is a software package which allows the user to manage and configure VECTRONIC Aerospace wildlife tracking collars and Handheld Terminals to download, process, and store collar-collected data. The package consists of three functionally distinct components: two background services, namely the Data Storage Service (DSS) and Data Collector Service (DCS) and a graphical user interface (GUI). The following graphic shows structure and relations between the components.

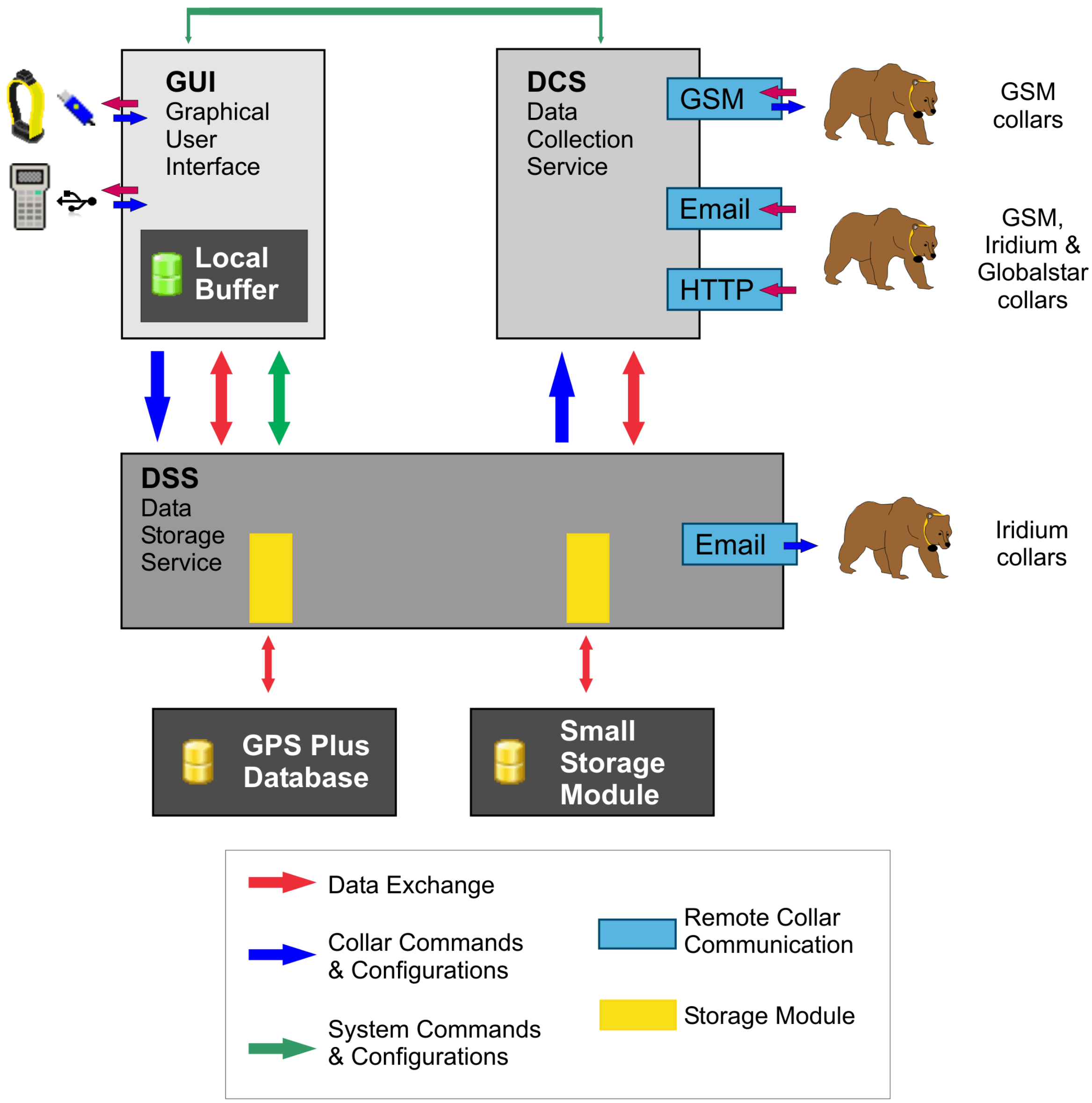


Figure 1: Schematic structure of the components of GPS Plus X

For detailed information of how the software works refer to Appendix J: Software Structure

2 Installation and configuration

Refer to:

Program Installation

Program Configuration

Registering and managing collars

2.1 Program Installation

There are three ways to start the installation:

- If you use the AutoRun CD which has been delivered with the collars, follow the instructions for "Set-up your system".
- You can start the installation manually from the VECTRONIC CD by starting the GPS Plus X setup file, then
  - follow the instructions in the automatically started GPS Plus X set-up program
  - or manually start the file Ressources\VECTRONIC Software\GPS Plus X Vxx.x.x setup.
- You can download the latest release version of the software on the VECTRONIC homepage (Wildlife Monitoring → Downloads) and start the set-up manually.

The installation procedure will ask you for a destination directory and suggest a default directory.

User Interface	GPS Plus X User Interface to services and collar control
Data Storage Service	Service that manages collected and stored collar data
Data Collector Service	Service that receives collar data via email
Colour Selector	Tool to select a colour for the belt of your collar
TeamViewerQS VAS	Tool for remote support by VECTRONIC Aerospace GmbH
GPS Plus X Manual	Manual for the GPS Plus X system (this document)

By default, GPS Plus X will be configured to run on a single computer without any network or data collectors. The next chapter will give you an overview of the configurations that might be necessary.

2.2 Program Configuration

The program is configured with the **Configuration** tree. This tree contains all commands to configure the entire GPS Plus X system. Depending on how many users/computers are in the system, and whether you are a user or administrator for the GPS Plus X system, you need to do certain configurations.

The commands in the **Configuration** tree are explained in detail in chapters System configuration, Data Storage Service configuration, and Data Collector Service configuration. The following section will tell you which chapters are important for you, and which components or nodes you should not / must not configure.

Note: If you are working on a GPS Plus X network, you are able to change the configuration of all system components, including the Collar List, the Data Storage Service, and the Data Collector Service. Please be very careful what you change in the **Configuration** tree, because these changes affect all users. **Before making any changes, make sure that you have permission to do so!**

Refer to:

Single user set-up

Network-user set-up

Network-administrator set-up

2.2.1 Single user set-up

If you are using GPS Plus X on one computer only, all components of the software will run on the same computer. To set-up your system, you need to follow the instructions in these chapters:

Data Storage Service (DSS) configuration, explains how you define where the data are stored. The subnode Communication is needed to configure:

1. The SMTP Server for outgoing messages, including system notifications, data forwarding emails and commands to IRIDIUM collars.
2. The GSM ground station (GSM-enabled Data Collector Service) if you are using your own station.

Additionally, you can program schedules for automatic back-ups, which are stored on your computer. We suggest to copy these files to a backup medium (external hard drive, DVD, etc.) or include them into your normal computer backup. The backup files are stored in your GPS Plus X working directory in the folder Backup (the complete path is shown in the list of backup files).

Data Collector Service (DCS) configuration, is needed if you will receive data through collector modules, which can be your own GSM ground station, the Autoread Email Client, or the HTTP Data Client to receive data emails from GSM, IRIDIUM, or GLOBALSTAR collars. If you are working on one computer, you only need to create one data collector which includes all collector modules (even if you have several email accounts, they all get their own module).

Registering and managing collars, gives you instructions on how to edit the collar list. You can only manage collars or receive data from collars that are registered in this list.

System Configuration, will configure your GPS Plus X software so you can comfortably work with it. To use the DSS and the DCS on your computer, you need to start both in the node System – Service Control. All USB devices (Link Managers, Handheld Terminals, USB Remote Sticks) need to be registered before they can be used. The remaining subnodes allow you to customise the software to your needs when it comes to formats of time, date, etc.

2.2.2 Network-user set-up

If you use GPS Plus X on a network with other researchers, but are not an administrator, you need to follow the instructions from these chapters:

(Data Storage Service) HTTP Configuration, is used to connect your computer to the Data Storage Service. You can send data that you download from collars or Handheld Terminals to the DSS, or you can view and export data from the storage.

Data Storage Service (DSS) configuration, the remaining subnodes of Data Storage refer to the DSS itself. All changes made at these nodes will affect the entire DSS. Do not change anything here without permission of the administrator or if you do not know what you are doing!

Registering and managing collars, gives you instructions on how to edit the collar list. You can only manage collars or receive data from collars that are registered in this list. The collar list is located on the DSS and is accessible for all users. All changes you make in this list involve the entire network, so do not delete collars from the list or make changes without the permission of the administrator or if you do not know what you are doing!

Data Collector Service (DCS) configuration, is only needed if a GSM ground station or the Autoread Email Client is running on your computer. If they are located on another computer/server in the network, you must not change anything in the node Data Collectors!

System Configuration, will configure your GPS Plus X software so you can comfortably work with it. You do not need to activate the services at Service Control, since these services will run on other computers. All USB devices (Link Managers, Handheld Terminals, USB Remote Sticks) need to be registered before they can be used. The remaining subnodes allow you to customise the software to your needs when it comes to formats of time, date, etc.

2.2.3 Network-administrator set-up

If you are an administrator on a GPS Plus X network, you need to follow these chapters:

Data Storage Service (DSS) configuration, explains how you define where the data are stored. The subnode Communication is needed to configure:

1. The SMTP Server for outgoing messages, including system notifications, data forwarding emails and commands to IRIDIUM collars.
2. The GSM ground station (GSM-enabled Data Collector Service) if you are using your own station.

You can program schedules for automatic back-ups, which are stored on your computer/server. The backup files are stored in your GPS Plus X working directory in the folder \Backup (the complete path is shown in the list of backup files). A backup of this folder to an external location is advisable.

Data Collector Service (DCS) configuration is needed if you will receive data through collector modules, which can be your own GSM ground station, the Autoread Email Client, or the HTTP Data Client to receive data emails from GSM, IRIDIUM, or GLOBALSTAR collars. One data collector can handle an unlimited number of communication modules (even if you have several email accounts, they all get their own module). However, if your network uses data modules running on different computers, and these modules are located in different institutes/buildings/locations, it might be easier to create different data collectors.

Registering and managing collars, gives you instructions on how to edit the collar list. GPS Plus X can only manage collars or receive data from collars that are registered in this list. Each user is able to edit the list, and add or erase collars. Erasing a collar from the list does not result in losing its data, but it is not possible to add new data for this collar until it is registered again.

System Configuration, applies to the computer and GPS Plus X copy you are working with. Changes in these nodes do not affect the network, so you only need to use these nodes if you are going to work with collar data on this computer (including downloading data from collars or Handheld Terminals). If this is the case, all USB devices (Link Managers, Handheld Terminals, USB Remote Sticks) need to be registered before they can be used (see 16.1). The remaining subnodes allow you to customise the software to your needs when it comes to formats of time, date, etc.

2.3 Registering and managing collars

Configuration ⇨ Collars

In order to work with the collars and their data, you need to register them in your system. This is done in the Configuration tree at the Collars node (Figure Configuration tree).

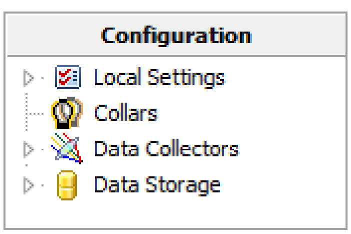
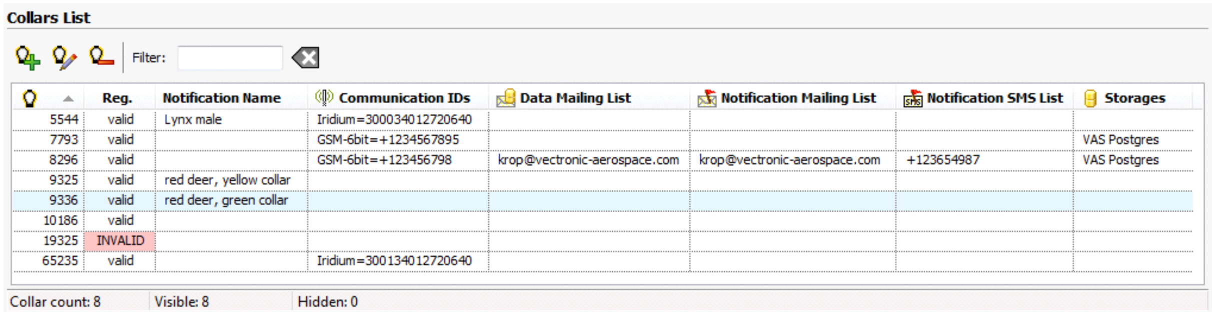


Figure 2: Configuration tree



Collars List

Filter:

	Reg.	Notification Name	Communication IDs	Data Mailing List	Notification Mailing List	Notification SMS List	Storages
5544	valid	Lynx male	Iridium=300034012720640				
7793	valid		GSM-6bit=+1234567895				VAS Postgres
8296	valid		GSM-6bit=+123456798	krop@vectronic-aerospace.com	krop@vectronic-aerospace.com	+123654987	VAS Postgres
9325	valid	red deer, yellow collar					
9336	valid	red deer, green collar					
10186	valid						
19325	INVALID						
65235	valid		Iridium=300134012720640				

Collar count: 8 Visible: 8 Hidden: 0

Figure 3: Collar list

If you open the Collar node, a table with all collars in the program's collar list is shown (Figure: Collar list). This table is used to register collars and fill in information on the collar's communication settings. The table includes the following information:

	ID number of the collar
Reg.	status of registration; if the valid registration key for the collar has been provided, the status will be valid, otherwise it will be INVALID
Notification Name	a name can be assigned for the collar for better identification, (e.g. the animal species or sex, or the collar colour); maximum length of this name is 50 characters
Communication IDs	phone number, IRIDIUM IMEI number, or GLOBALSTAR ESN; this information is needed to match incoming messages or outgoing commands to the collar
Data Mailing List	list of email addresses to which the incoming data from a collar will be forwarded
Notification Mailing List	list of email addresses to which notifications (mortality, low activity, Virtual Fence Event, etc.) from this collar will be forwarded
Notification SMS List	list of telephone numbers to which notifications (mortality, low activity, Virtual Fence Event, etc.) from this collar will be sent as SMS
Storages	list of storage modules (databases) to which the data from this collar will be sent for storage

The icon adds a new collar to the list, while the icon allows you to edit the settings for the highlighted collar.

You can highlight a collar by clicking on it once. If you click on one of these icons or double-click on a collar in the collar table, a new window will open (Collar Properties Editor). First, enter the ID number of the collar. To register this collar, press . An Open File dialog will pop up and you can select the collar registration key for the collar. This key is provided on the CD which has been delivered with the collar (in the folder `Ressources\Collar and Drop Off Keys`). The file name is `CollarXXXXX_Registration.keyx`, with the collar ID number replacing the `XXXXX`.

Open the KEY file for your collar and the box NOT Registered will change to Registered. If the KEY file is not available at the moment, you still can go ahead and enter all the other information and include the collar into the collar list.

Its registration status will then be shown as INVALID until you have registered it. In addition to the Collar ID, you can enter information about the collar and define its communication settings. To enter information, click on the desired field and it will be activated for editing (Figure: Window to register a collar and configure). Instead of a blank field, for the Communication IDs and the Data Storages there will be a drop-down list from which you can choose. For the other fields, you can simply type in a telephone number (format: + international code number, e.g. +4930...), email address, or the assigned for the collar. Your entries will be checked whether they are valid.

Press Apply to save the information and return to the collar list. Press Revert to return to the settings prior to the last saving. Press Cancel to return to the collar list without saving the changes.
To remove a highlighted collar, press . Once a collar is removed from the list to use it again, it has to be registered once more.

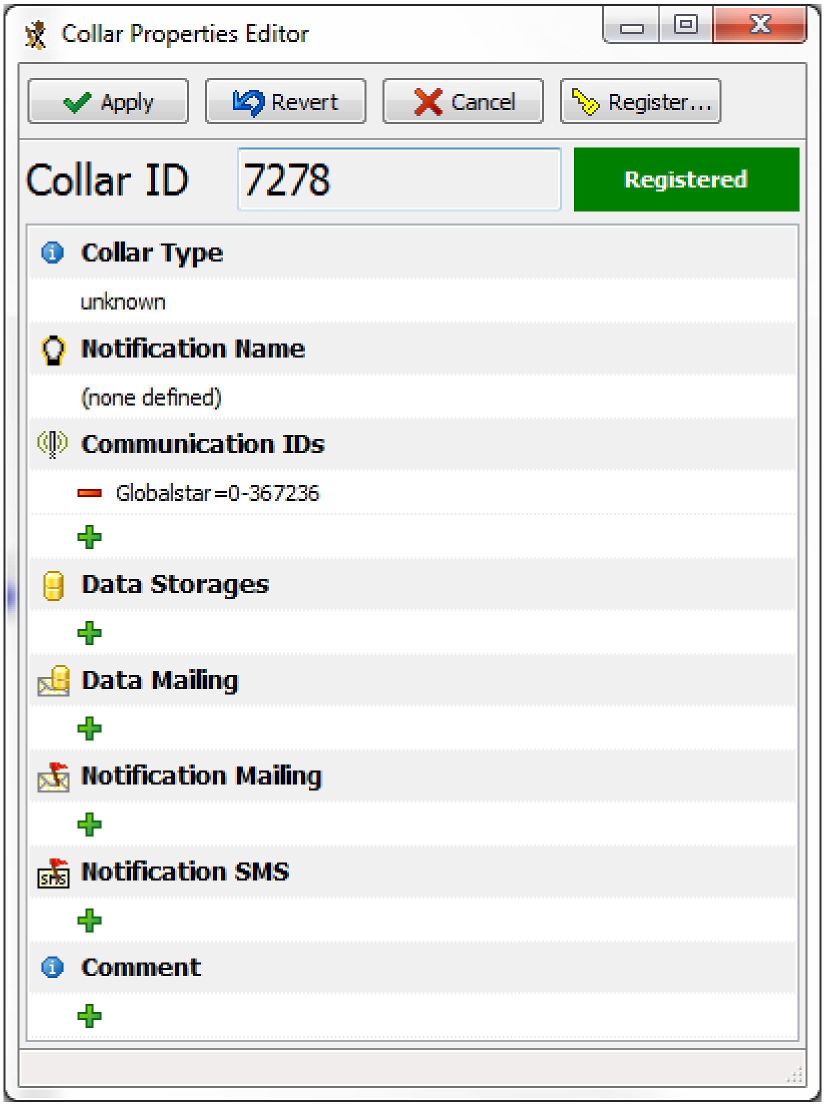


Figure 4: Window to register a collar and configure

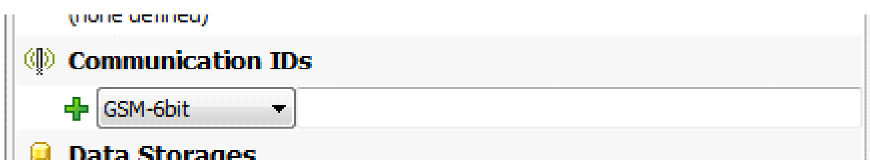


Figure 5: Communication ID list activated for editing the handling of its collected data

3 General use of the program

Refer to:

[Communication options]

[Editing times and dates](#)

[A guide to the most common program icons](#)

3.1 Communication options

There are different ways to communicate with your collars, depending on the collar model and equipment you have. To give you a quick overview which hardware you can use to upload commands and configure your collars, the chapter headings will show the icons of the available hardware. These icons will be visible in the Devices tree but not all of them are displayed at all times (see below for details). In each chapter we will also indicate the nodes at which you will find the command depending on the communication options you are going to use.

Symbol	Description
	Remote access of GSM collars through a GSM ground station connected to your GPS Plus X system or by email for IRIDIUM collars. This icon is always displayed. If you use the VECTRONIC Aerospace GSM ground station to communicate with your collar, you cannot use these frames. Instead, please contact VECTRONIC Aerospace to send the commands to your collar.
	Direct access via Link Manager USB interface is possible for all GPS Plus collars, **not for VERTEX collars**, and for Handheld Terminal. The Link Manager allows a wide range of commands, configurations, and downloads. The icon is only displayed, if a Link Manager is connected to your PC.
	Remote access via USB interface of VHF/UHF collars using the Handheld Terminal. This icon will only be displayed if a Handheld Terminal is connected to the PC. The icon will then also indicate whether the Handheld Terminal is connected directly via USB or via Link Manager.
	Direct access via USB interface of VHF/UHF Handheld Terminal. This icon will only be displayed if a Handheld Terminal is connected to the PC.
	Remote access of the Survey and VERTEX Lite collar via VECTRONIC remote stick. This remote stick can be used **only for all Survey collars** for configuration and data download as well as with UHF devices (UHF-ID Tags, Implants) to check the functionality of these devices.
	Direct access via cable connection "USB to Collar Interface" is possible for all VERTEX Plus collars. This specific cable allows a wide range of commands, configurations, and downloads. The icon is only visible, if a VERTEX Plus collar is connected to your PC.

3.2 Editing times and dates

There are several frames in the program, where you can enter times or dates. Times can be set by clicking on the hours, minutes, or seconds, and typing in new numbers, or using the up/down arrows. Dates can be set either by clicking on the days, months, and years, or by using the Windows calendar function.
.

3.3 A guide to the most common program icons

While working with the program, you will be guided by several icons. This section will give you an overview of the most common icons and what they refer to.

Symbol	Description
	Activity: indicates configurations, download options, or data storage for the activity sensor/data
	Add: is usually part of another icon, which then opens a frame to add something, e.g. a collar, to a list
	Beacon: indicates configurations and schedules for the VHF beacon transmitter
	Collar: indicates configurations and information related to a GPS collar
	Data: indicates actions concerning data collected by the collar
	Data Collector: indicates configurations concerning the plug-ins to receive data from GSM, IRIDIUM, and GLOBALSTAR collars
	Database: indicates nodes and commands related to the main storage or Data Storage Service
	Edit: is usually part of another icon, which then opens a frame to edit configurations or information
	Erase: is usually part of another icon, which then erases configurations or elements of a list
	Delete data: the eraser as part of an icon indicates that data will be deleted

Clear: clears a filter to search a list (e.g. collar list)

Export: exports data into an external file, e.g. ASCII, spreadsheet, Google Earth file (.kml)

External sensor: indicates configurations, download options, or data storage for the external sensor/data

Erase External Sensor Data: erases external sensor data

GPS: indicates configurations, download options, or data storage for the GPS schedules/ data

GSM: indicates characteristics, configurations, or commands related to GSM collars/ communication

IRIDIUM: indicates characteristics, configurations, or commands related to IRIDIUM collars/communication

Link Manager 1, Serial or USB: indicates configurations and commands related to the Link Manager 1 or a collar/device connected to it

USB Link Manager, indicates configurations and commands related to the Link Manager 2 or a collar/device connected to it

USB Remote Stick, indicates configurations and commands related to the USB Remote Stick and the Survey collar or UHF device which can be managed with the USB Remote Stick

Local buffer: indicates frames related to the local storage

Mortality: indicates configurations, download options, or data storage for the mortality sensor/data

Mortality implant: indicates configurations, download options, or data storage for the mortality implant/data

Options or Configurations: indicates frames related to system or collar configurations

Plug-In: indicates frames related to software plug-ins used for remote communication


Proximity sensor: indicates configurations, download options, or data storage for the proximity sensor/data


Recorded Data: indicates configurations, download options, or data storage for all kinds of recorded data


Print: Prints the output shown on the screen


Reload: reloads the information shown on the screen from the collar or Handheld Terminal


Schedule: indicates schedule editors to create new schedules


Save: saves the data shown on the screen to a file


Schedule: usually part of another icon. Opens a frame to create, edit, or erase a schedule for GPS or the VHF beacon.


Separation sensor: indicates configurations, download options, or data storage for the separation sensor/data


Telemetry: reads out telemetry data from a collar (refer to Appendix B: Collar Telemetry) or a Handheld Terminal


Handheld Terminal: indicates configurations and commands related to a UHF/VHF Handheld Terminal or to data stored on such


Vaginal implant: indicates configurations, download options, or data storage for the vaginal implant/data


Virtual Fence: indicates configurations, commands, or upload/download options for the Virtual Fence


Collar Reception Status: Status if collar stops transmitting or no more data is received from the collar


Unknown Collars: Unassigned collar IDs


GSM / Iridium Communication

4 The Main Window

The main window contains three areas, the menu bar on top, the three trees on the left side, and the display/input area on the right side, where the activated frames will appear.

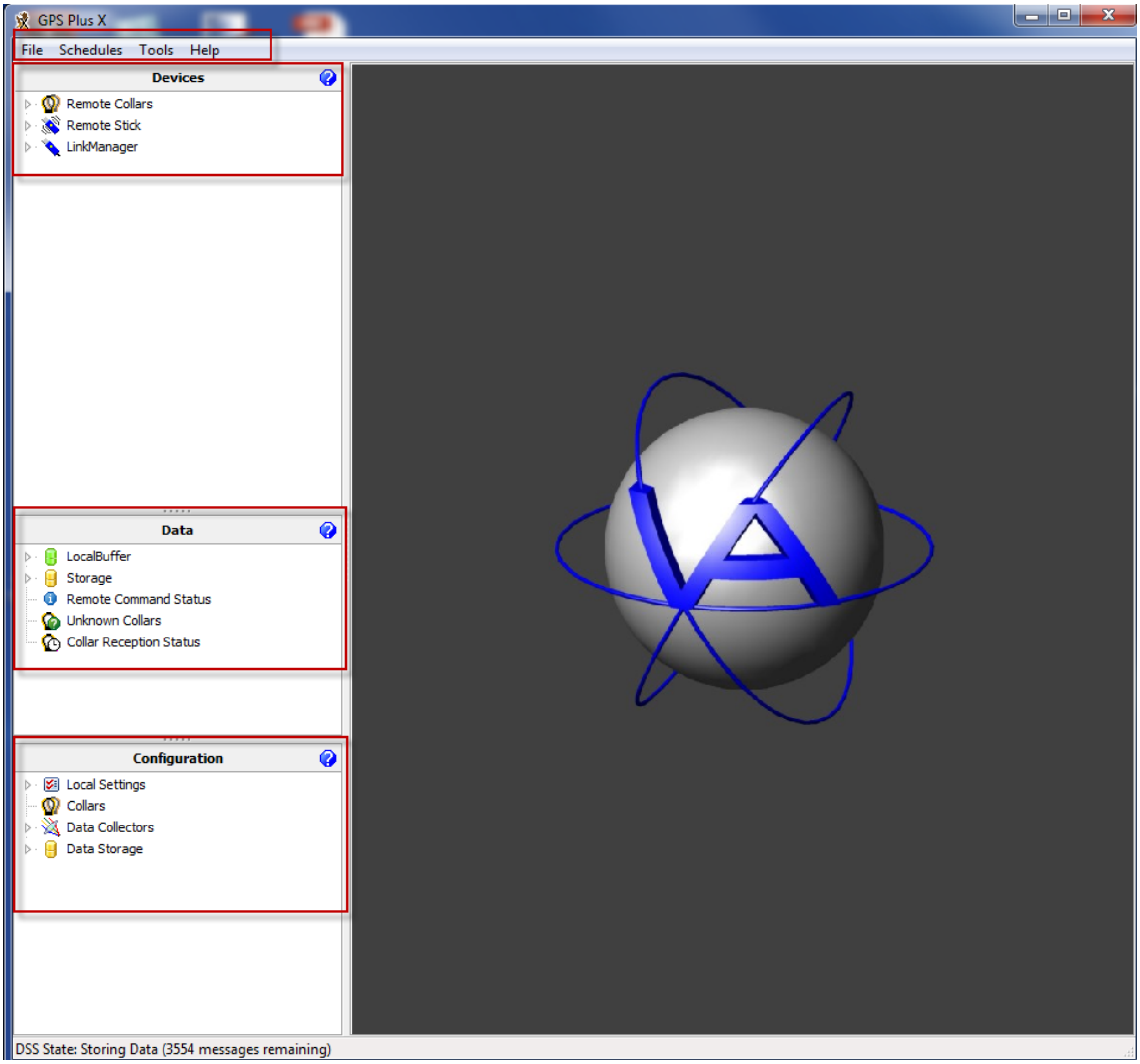


Figure 6: Main window

Refer to:

[The Menu Bar](#)

[The Devices Tree](#)

[The Data Tree](#)

[The Configuration Tree](#)

4.1 The Menu Bar

The menu bar contains of four menus: File, Schedules,Tools and Help.

1. The File menu allows you to import and view data files (.GDF, .ADF), e.g. data which have been downloaded with one of the older versions of GPS Plus. It also includes a PostgreSQL Database Creation Wizard.
2. The Schedules menu allows you to create and save different kinds of schedules for later use.
3. The Tools menu includes the lifetime calculation tool, virtual fences editor, and the beacon pattern examples.
4. The Help menu is linked to this GPS Plus X manual and the version number of your copy.

Figure 7: Menu Bar

4.1.1 The File Menu

Menu Bar ⇨ File

The File Menu contains of:

Import data files

Import collar list

PostgreSQL Database Creation Wizard

View GDF file

View ADF file

Exit

4.1.1.1 Import data files

Menu Bar ⇨ File ⇨ Import Data Files

Data downloaded from the collar with GPS Plus versions older than 10.0 cannot be read instantly with GPS Plus X, these need to be imported. This can be done from the menu bar with the commands **File ⇨ Import Data Files...** . You can add GPS Data files (.GDF), Activity Data files (.ADF), (.ADF3), GPS Data eXchange files (.GDX), Mortality and Proximity files (.TXT), SMS Zip Files (.ZIP) to the import list with the Add... . Use Remove to delete a single highlighted file from the list and Clear to erase the complete list of files. You can specify the origin of the import GDF/ADF data by opening the drop down menu. You can choose if the data originate from GLOBALSTAR, IRIDIUM, GSM, Terminal and Collar. Press Start to begin the import process. The progress for each file will be shown as a green bar (Processed File). If necessary, abort the import with Cancel. At the end of the import, a window with the message "Import finished" will appear. Press OK to proceed. Close the Import Data window by clicking on the button in the upper right corner.

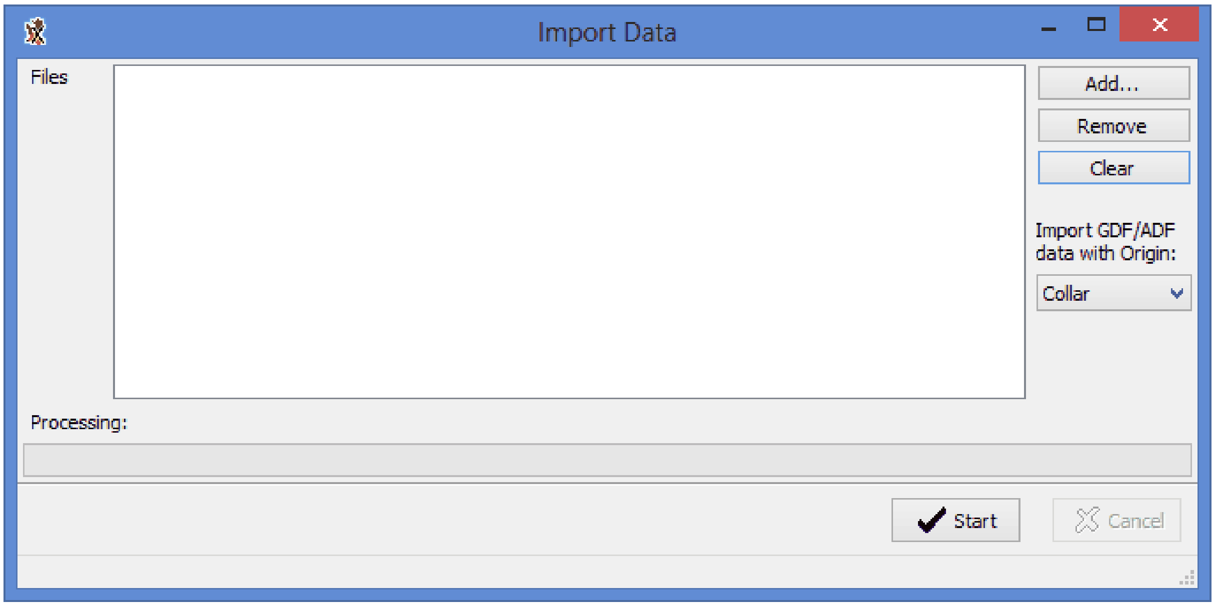


Figure 8: Import Data window

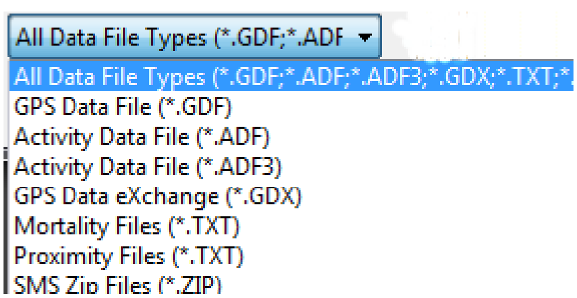


Figure 9: Import Data Files

Note: You can only import files from collars that are registered in the collar list.

4.1.1.2 Import collar list

Menu Bar ⇨ File ⇨ Import Collar List

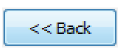
You can import the collar.INI files from the old GPS Plus software. Collar ID, Communication type and ID, Data mailing list (position mailing), notification mailing list (mortality mailing), notification SMS list (mortality SMS) are adopted. Be aware that you will loose the registration information (collar keys) because they are not compatible with the new system. You only can import a collar list if your current collar list is empty.

When the import is finished data storage has to be defined.

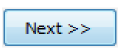
4.1.1.3 PostgreSQL Database Creation Wizard

Menu Bar ⇨ File ⇨ PostgreSQL Database Creation Wizard

The PostgreSQL Database Creation Wizard assists you in creating a new, empty database. Click **File ⇨ PostgreSQL Database Creation Wizard** to open a new window. To use this wizard successfully, you need a PostgreSQL (Version 8.2 or later) server with administration access. If you are not sure if this is available, you can use the wizard to find out if necessary components are missing, and abort the process without risking any problems.
On the bottom of each frame of the wizard, there are four buttons, which might be disabled if not applicable at the given moment:

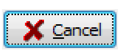


Returns to the previous frame.



Moves to the next frame.

Will only be enabled in the last frame; it will close the wizard after creating a database.



This will terminate the wizard at any stage.

In the next frame (Figure: PostgreSQL Server Access input frame in the Database Wizard), you need to enter the database administration access data:

Server Name or IP Address	The computer, on which the PostgreSQL server is running; if PostgreSQL is installed on the same computer as GPS Plus X, you can use "localhost"; otherwise enter a valid TCP/IP name or address. "VECTRONIC-Aerospace.com" as well as "127.0.0.1" would be syntactically valid entries.
PostgreSQL Port	The TCP/IP port of the PostgreSQL server. Usually this is 5432, but the server can be configured to use any value in the range of 0 to 65535
PostgreSQL Admin Username	Service that receives collar data via email
Colour Selector	Username of the PostgreSQL administration user

PostgreSQL Admin Password	Password of the PostgreSQL administration user

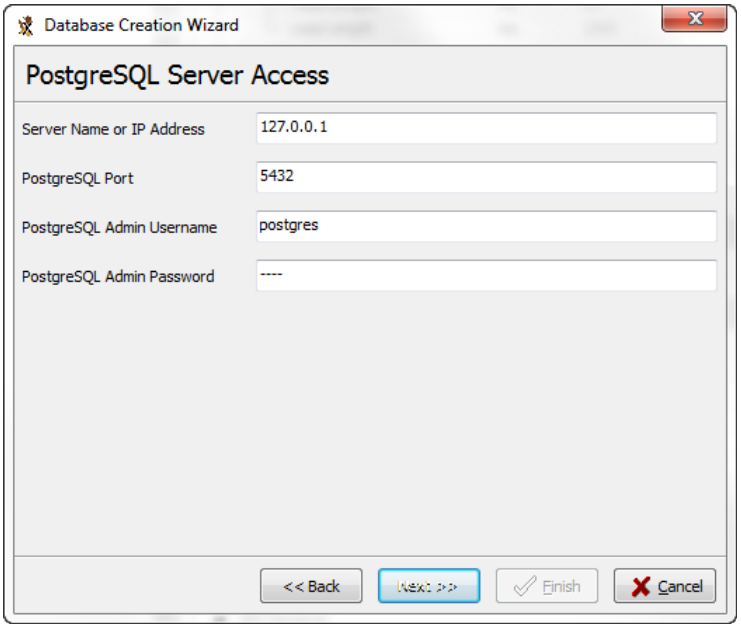


Figure 10: PostgreSQL Server Access input frame in the Database Wizard

In the next step you need to define the parameters of your new database (Figure: Database information input frame in the Database Wizard).

First, you need an owner of the database. Select if you want to create a new user as the owner of the database or if an existing user shall be the owner. In the first case, you have to enter a Database Owner Name that is not listed in the dropdown list, and enter a password twice to prevent typos. In the second case, just select a name from the Database Owner Name dropdown list as the owner of your new database.Database creation works in a similar pattern: Choose, whether you want to create an entirely new database or use an existing, but empty, PostGIS database. In the first case, you have to enter a new Database Name that is not listed in the dropdown list, and select a PostGIS Template from the dropdown list. The dropdown list includes all databases on the server that are PostGIS enabled. Not all of them are just templates. A good choice would be something like “postgis” or “postgis_template”. If you are unsure, ask the person responsible for the database server. If you want to use an existing, but empty database, simply select one from the Database Name dropdown list.

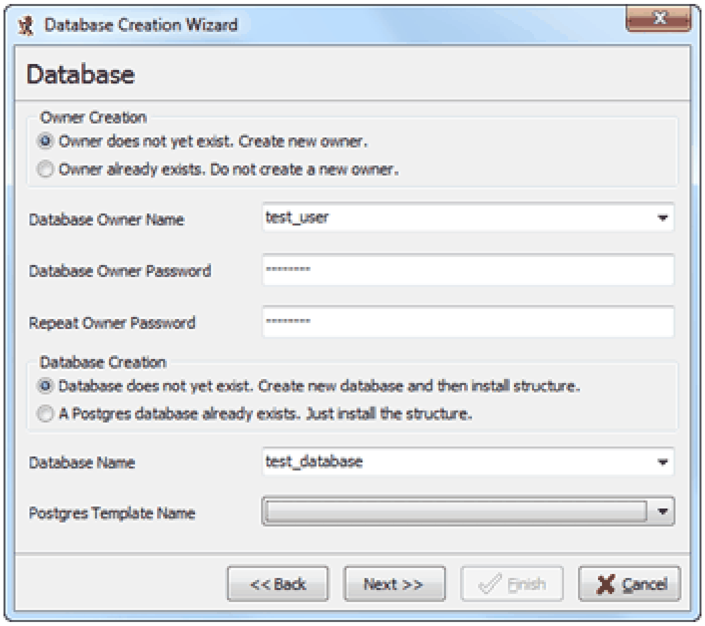


Figure 11: Database information input frame in the Database Wizard

The next frame (Figure: Database Summary frame in the Database Wizard) shows a summary of your selections.

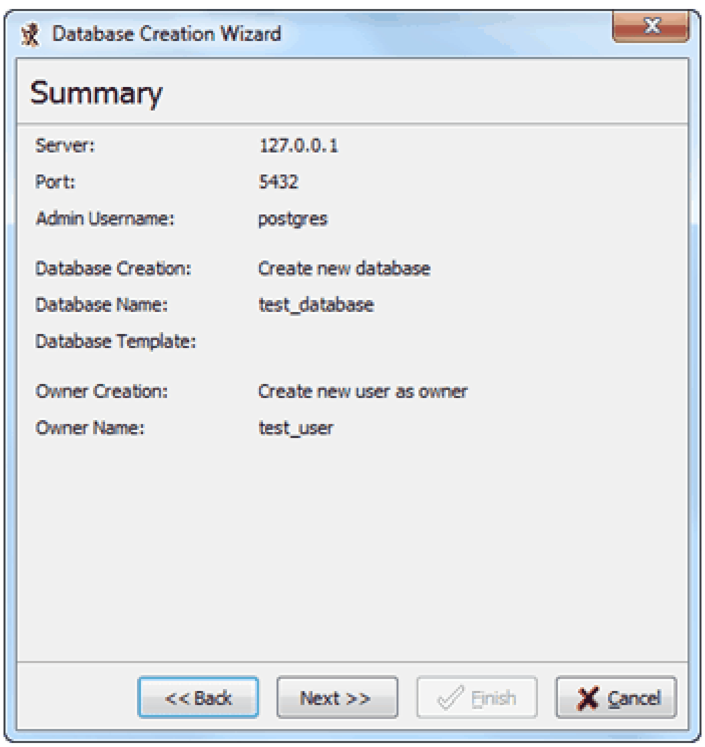


Figure 12: Database Summary frame in the Database Wizard

With the last frame (Figure Database Creation frame in the Database Wizard), you finally execute your configurations and create a database. You can view all commands and status messages during the process.

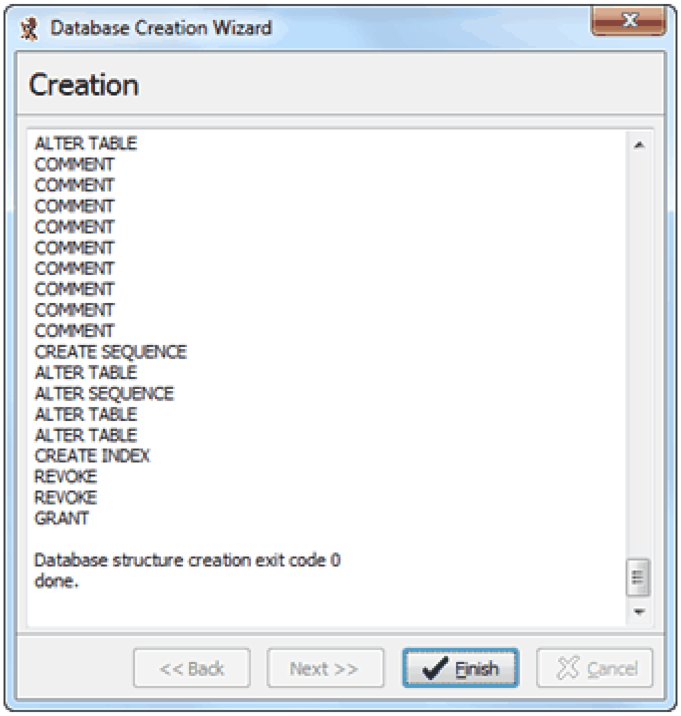


Figure 13: Database Creation frame in the Database Wizard

4.1.1.4 View GDF file

[Menu Bar](#) ⇨ [File](#) ⇨ View GDF file

In this window you are able to view and store GPS Data files (.gdf) which are read directly from the collar.

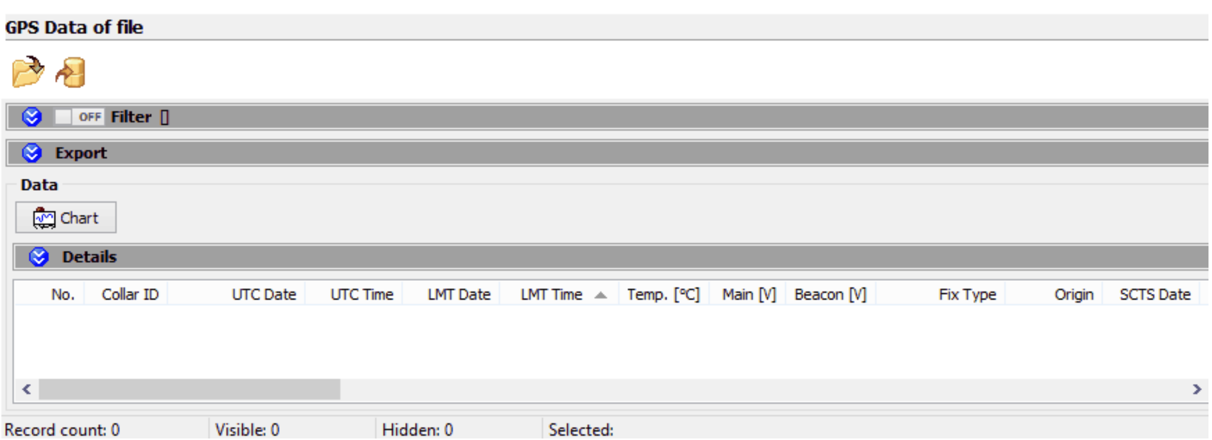


Figure 14: View GDF file

Read data from data collar by clicking on . Choose the .gdf file and open it.

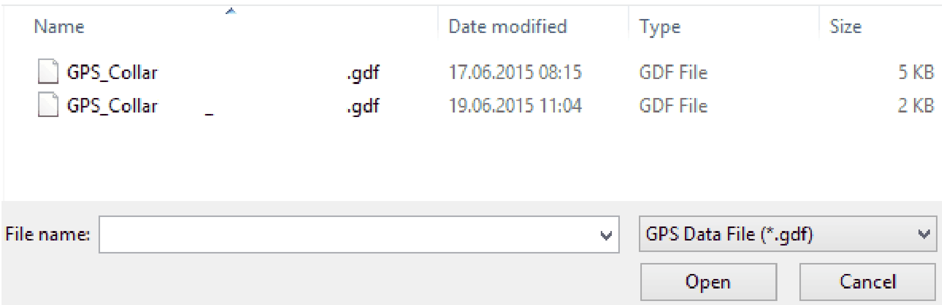


Figure 15: Open GDF file

The data read out from the collar can be send and stored in the Data storage by clicking . For this the collar have to be registered in GPS Plus X. Please refer to chapter [Registering and managing collars](#).

There is the option to set filter. Click on or to open and close this option. Switch the button to ON and choose the filter options. **Remember to switch the button to OFF again to see all data.**

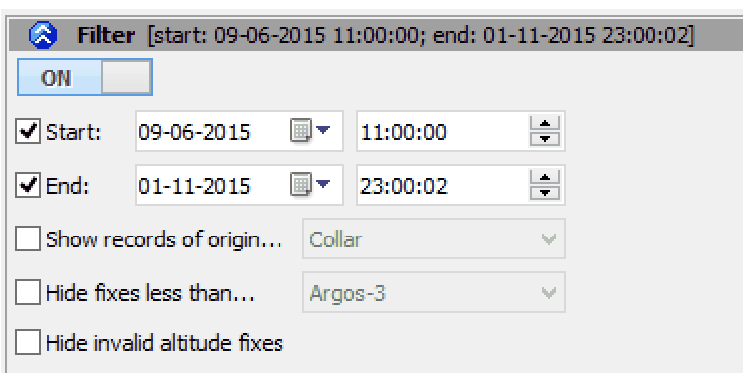


Figure 16: GPS Data Filter

There is the option to export data. Click on or to open and close this option. Press Export button Export and choose data type, file name and storage place.

You may safe the data as .kml file so you are able to open and view the data with google earth.

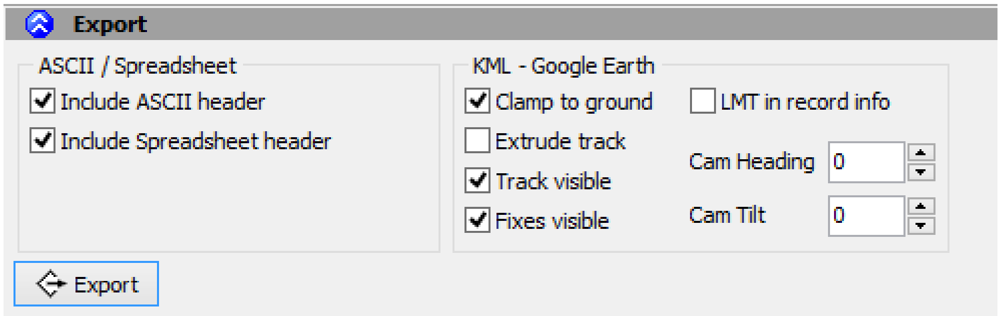


Figure 17: GPS Data Export

By clicking the button Chart [Chart] data are visualized with different parameters.

4.1.1.5 View ADF file

Menu Bar ⇨ File ⇨ View ADF file

In this window you are able to view and store Activity Data files (.adf) which are read directly from the collar.

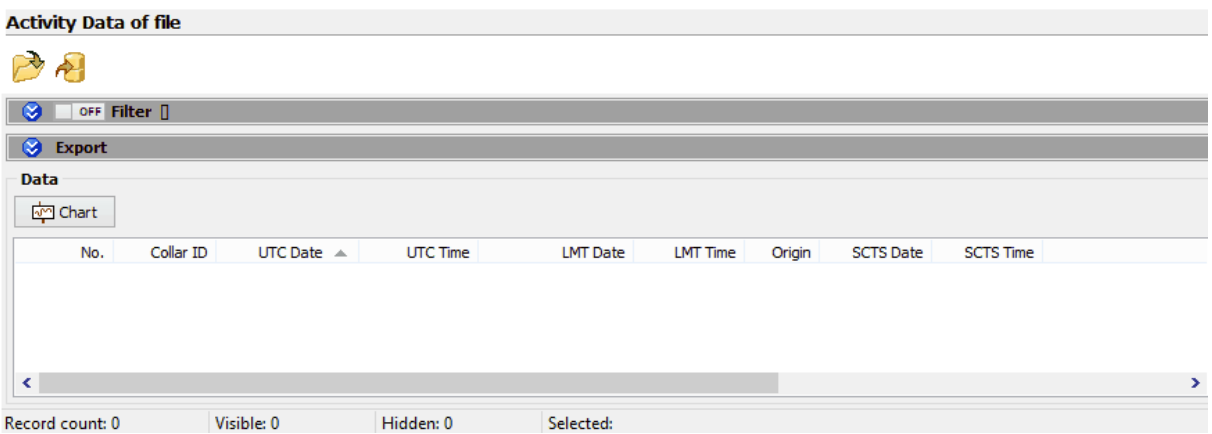


Figure 18: View ADF file

Read data from data collar by clicking on . Choose the .adf file and open it.

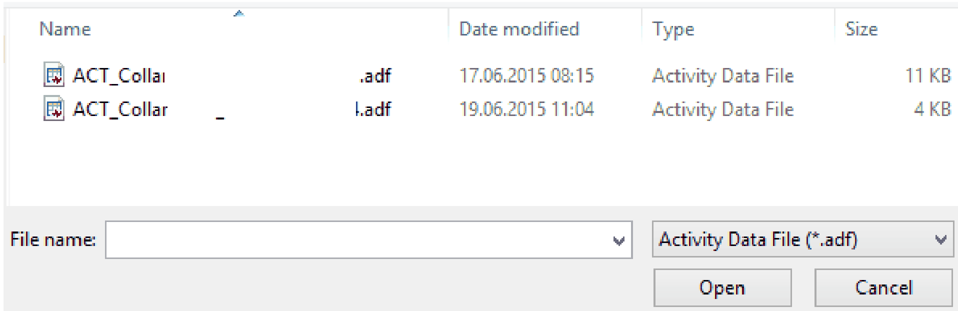


Figure 19: Open ADF file

The data read out from the collar can be send and stored in the Data storage by clicking . For this the collar have to be registered in GPS Plus X. Please refer to chapter Registering and managing collars.

There is the option to set filter. Click on or to open and close this option. Switch the button to ON ON and choose the filter options. **Remember to switch the button to OFF again to see all data.**

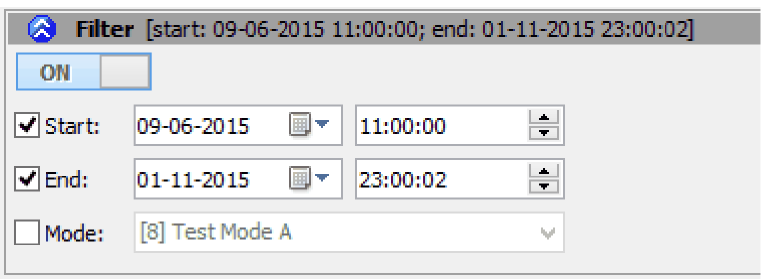


Figure 20: ADF Data Filter

There is the option to export data. Click on or to open and close this option. Press Export button Export and choose data type, file name and storage place.

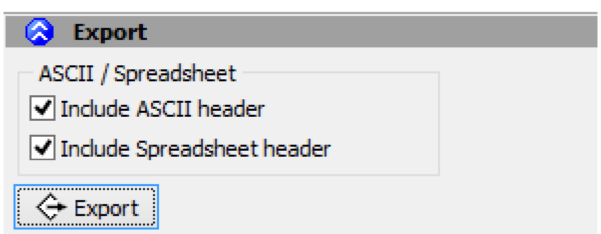


Figure 21: ADF Data Export

By clicking the button Chart Chart data are visualized with different parameters.

4.1.1.6 Exit

Menu Bar ⇨ File ⇨ Exit

This command closes GPS Plus X.

4.1.2 The Schedules Menu

Menu Bar ⇨ **Schedules**

This menu gives access to the schedule **editors** for:

1. GPS
2. VHF beacon
3. GSM/IRIDIUM
4. Camera
5. VERTEX GPS
6. VERTEX Beacon
7. VERTEX Communication
8. VERTEX External Sensors

Schedules created with these commands can only be saved, not immediately sent. When configuring a specific collar trough the Devices nodes press  to load the created schedule. For details on how to create schedules, please refer to chapter The Device Tree ⇨ Schedules or follow the links above.

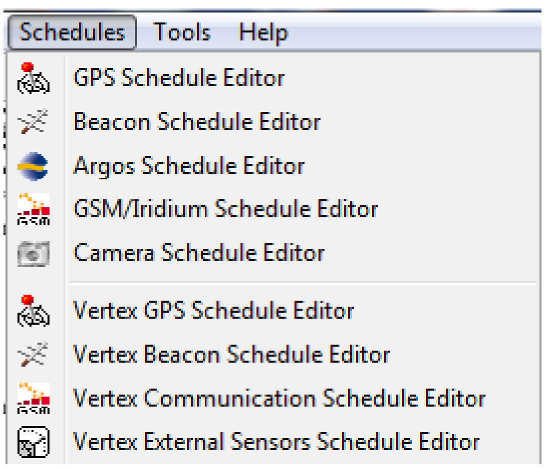


Figure 22: Schedules Menu

4.1.3 The Tools Menu

Menu Bar ⇨ **Tools**

The Tools Menu contains of:

Calculate Collar Lifetime

Calculate VERTEX Collar Lifetime

Virtual Fence Editor

Play Beacon Patterns

Create Geo Systems List

4.1.3.1 Calculate Collar Lifetime

Menu Bar ⇨ **Tools** ⇨ **Calculate Collar Lifetime**

Here you can estimate the battery lifetime of a GPS Pro / Plus collar.
Select the collar's attributes explained in Collar Tab Sheet

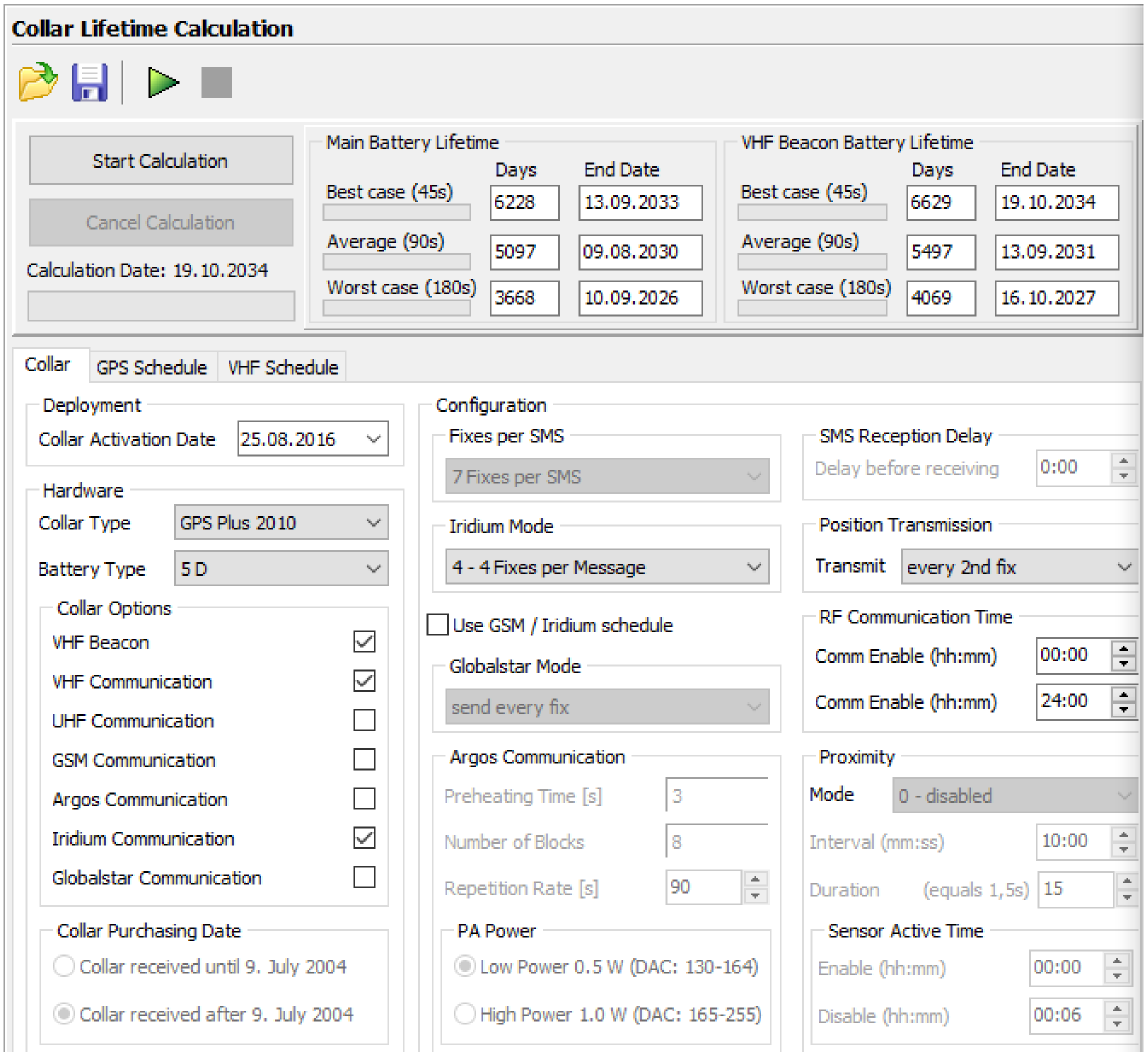


Figure 23: Lifetime Calculation dialog

From these inputs the program calculates a best, average, and worst case battery life time estimate, after pressing Start Calculation.

The lifetime calculation is based on an average temperature of 0°C. Please note, that lower temperature will drain the battery faster.

The icon bar at the top of the frame allows you to open a previously saved Lifetime Calculation, to save the current one, to start a calculation with the current settings, or to cancel a running calculation.

In the upper part of the Lifetime Calculation dialog, you have buttons to Start the Calculation Start Calculation and to Cancel the Calculation Cancel Calculation.

The Calculation Date changes during the calculation and gives you the date which is currently calculated; the process bar underneath shows you the battery charge while the calculation is done. On the right side, you will see the expected lifetimes for the main battery and the VHF beacon battery.

Best case assumes that the GPS receiver needs 45 seconds to get a GPS fix on average over the whole lifetime, Average assumes this time to be 90 seconds per fix, and Worst case calculates with 180 seconds per fix.

4.1.3.1.1 Collar Tab Sheet

Menu Bar ⇨ **Tools** ⇨ **Calculate Collar Lifetime** ⇨ **Tab: Collar**

There are three main groups (see picture below) in this tab sheet:

1. Deployment
2. Hardware
3. Configuration

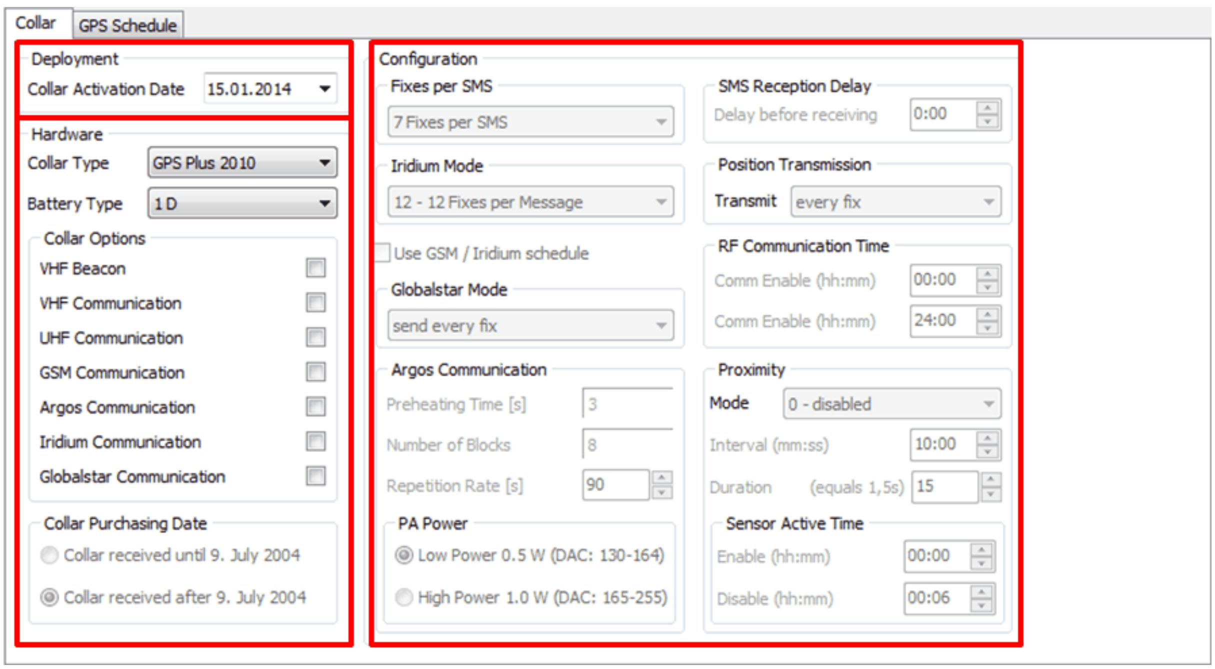


Figure 24: Lifetime Calculation dialog - Tab: collar

Under **Deployment**, select a Collar Activation Date. This can be the actual date you plan to deploy the collar. Please make sure that the starting points of the schedules are the same as the Activation Date you selected

Under **Hardware**, select the collar type and the Battery Type. Depending on the collar type, different collar options are available. Select all communication options your collar is equipped with. The Collar Purchasing Date is the delivery date of your collar.
With **Configuration**, you can select the configuration of your collar, effecting the collar lifetime.

Please find below a short explanation to the single points in the **Configuration** part:

Fixes per SMS	The number of fixes which can be transmitted in one SMS (GSM

	Mode).
IRIDIUM Mode	The number of fixes transmitted in one IRIDIUM message (IRIDIUM Mode).
Use GSM/IRIDIUM schedule	Check this box if you do not wish to transfer all the positions after the number of fixes per message is reached (e.g. after every 7th fix), but according to a schedule (e.g. every day at 07:00) refer to GSM/ IRIDIUM Schedule.
GLOBALSTAR Mode	The number of fixes transmitted in one GLOBALSTAR message (GLOBALSTAR Mode).
SMS Reception Delay	Time lapse between the sending of an SMS by the collar and the time of reading and checking received new schedules or commands from the provider (section SMS Reception Delay).
Position Transmission	Select whether you transmit every GPS position, or if you only transmit every Xth position to save energy and transmission costs for GSM or IRIDIUM only (section Position Transmission).
VHF/UHF Communication Time	The time in which the collar's RF data communication system is enabled. The collar can be programmed to reduce this time to save power (section RF Communication Time).
Proximity	The settings of the proximity sensor: listening interval and duration, and the time during which the sensor is enabled (section External Sensors).

4.1.3.1.2 GPS Schedule, VHF Schedule, GSM/Iridium Schedule

Menu Bar ⇨ Tools ⇨ Calculate Collar Lifetime ⇨ Tab: GPS Schedule
Menu Bar ⇨ Tools ⇨ Calculate Collar Lifetime ⇨ Tab: VHFSchedule

At these tabs you need to define the schedules you want to use for the lifetime calculation. You can either open stored schedules with  or create new ones.

The tab GPS Schedule is always visible. The other tabs will only appear after you have checked the associated option on the Collar tab.

For more details on the different schedule editors, please refer to chapter The Device Tree ⇨ Schedules.

4.1.3.2 Calculate VERTEX Collar Lifetime

Menu Bar ⇨ Tools ⇨ Calculate VERTEX Collar Lifetime

Here you can estimate the battery lifetime of a VERTEX Plus / Survey collar.
Select the collar's attributes explained in VERTEX Collar Tab Sheet.

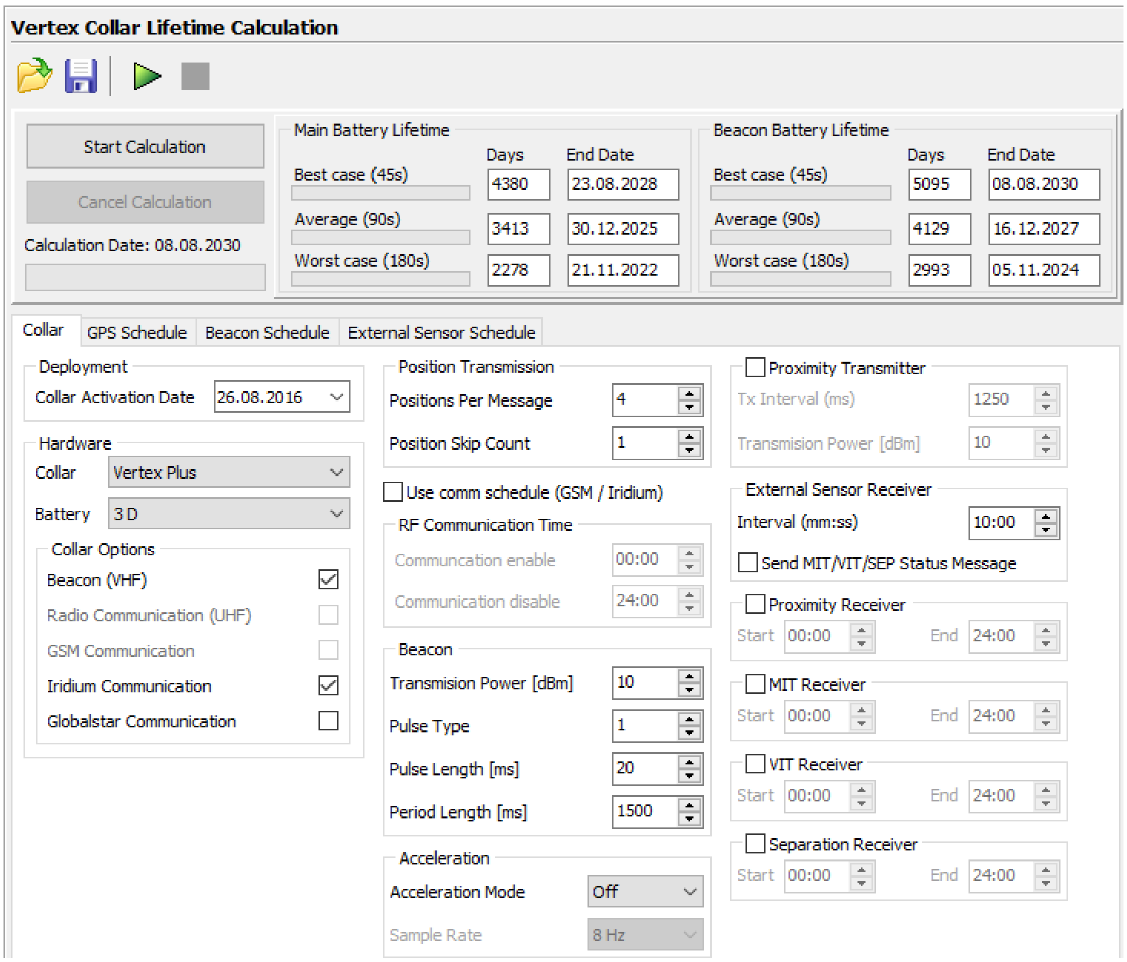
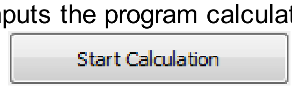


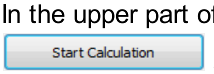
Figure 25: VERTEX Lifetime Calculation dialog

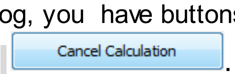
From these inputs the program calculates a best, average, and worst case battery life time estimate, after pressing 

.

The lifetime calculation is based on an average temperature of 0°C. Please note, that lower temperature will drain the battery faster.

The icon bar at the top of the frame allows you to open a previously saved Lifetime Calculation, to save the current one, to start a calculation with the current settings, or to cancel a running calculation.

In the upper part of the Lifetime Calculation dialog, you have buttons to Start the Calculation


and to Cancel the Calculation


.

The Calculation Date changes during the calculation and gives you the date which is currently calculated; the process bar underneath shows you the battery charge while the calculation is done. On the right side, you will see the expected lifetimes for the main battery and the VHF beacon battery.

Best case assumes that the GPS receiver needs 45 seconds to get a GPS fix on average over the whole lifetime, Average assumes this time to be 90 seconds per fix, and Worst case calculates with 180 seconds per fix.

4.1.3.2.1 VERTEX Collar Tab Sheet

There are three main groups (see picture below) in this tab sheet:

1. Deployment
2. Hardware
3. Configuration

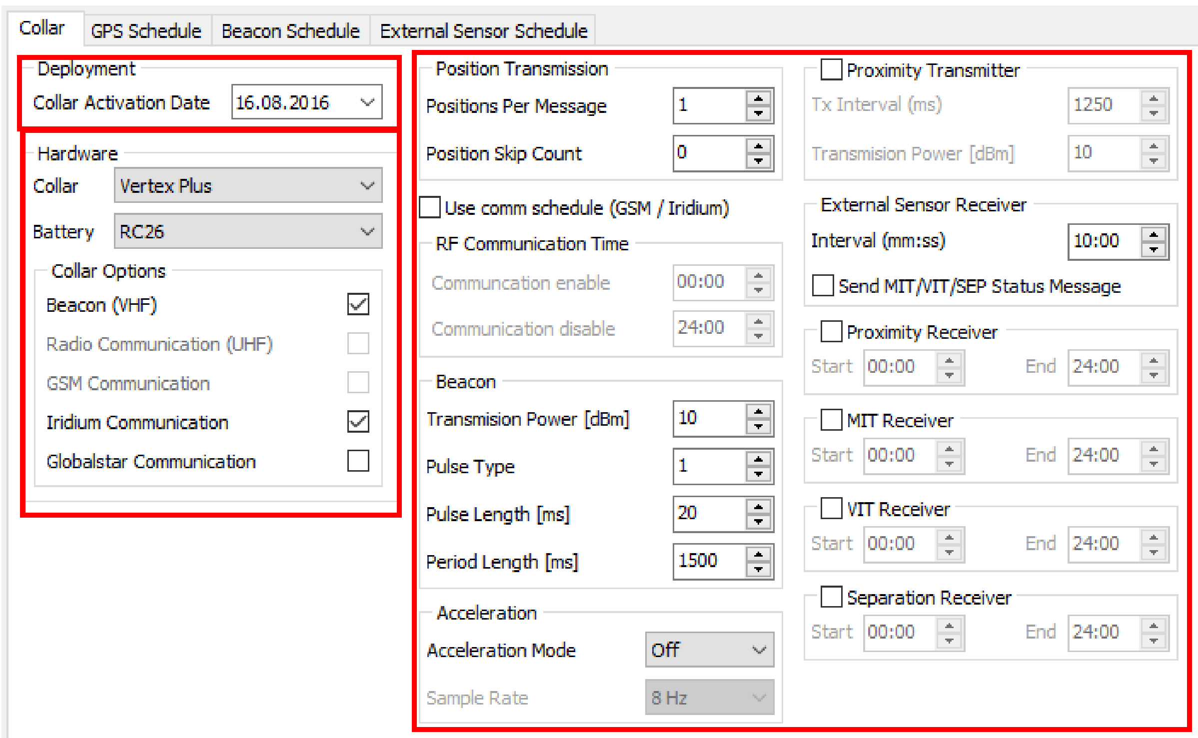


Figure 26: Collar Lifetime Calculation for the Survey collar

Under **Deployment**, select a Collar Activation Date. This can be the actual date you plan to deploy the collar or any date that is a good start date for the calculation.

Under **Hardware** is Survey select the collar type in the first drop down list.

With **Configuration**, you select the VHF Beacon settings if you have changed them in the User Configuration of your Survey collar (for information on the User Configuration, please refer to chapter Configuration ⇨ VERTEX collars ⇨ User Configuration (GPS Plus VERTEX Collars only).

Now you need to set the VERTEX GPS schedule in the tab VERTEX GPS Schedule and the VERTEX

Beacon Schedule in the tab VERTEX Beacon Schedule (refer to VERTEX GPS Schedule & VERTEX Beacon Schedule).

After you have selected all the options for the Survey collar, press Start Calculation or ▶ to start the calculation. When pressing Cancel Calculation or ■ while the calculation process is running, you will cancel the actual calculation.

4.1.3.2.2 VERTEX GPS Schedule & VERTEX Beacon Schedule

Menu Bar ⇨ Tools ⇨ Calculate VERTEX Collar Lifetime ⇨ Tab: VERTEX GPS Schedule
Menu Bar ⇨ Tools ⇨ Calculate VERTEX Collar Lifetime ⇨ Tab: VERTEX Beacon Schedule
Menu Bar ⇨ Tools ⇨ Calculate VERTEX Collar Lifetime ⇨ Tab: VERTEX External Sensor Schedule

At these tabs you need to define the schedules you want to use for the lifetime calculation. You can either open stored schedules with the folder icon or create new ones. Please make sure that the starting points of the schedules are the same as the Activation Date you selected.

Both tabs are always visible.

For more details on the different schedule editors, please refer to the chapter The Device Tree ⇨ Schedules

4.1.3.3 Virtual Fence Editor

Menu Bar ⇨ Tools ⇨ Virtual Fence Editor

This command enables you to create a Virtual Fence. For information about the preparation of the Virtual Fence, please refer to the chapter Virtual Fence.

4.1.3.4 Play Beacon Patterns

Menu Bar ⇨ Tools ⇨ Play Beacon Patterns

If your collar is equipped with a VHF beacon, you can choose out of four different beacon patterns (Mode 0, 1, 2, 3, see Figure Patterns of the four beacon modes). This can help you to distinguish individual collars in the field if their VHF frequencies are very close together.

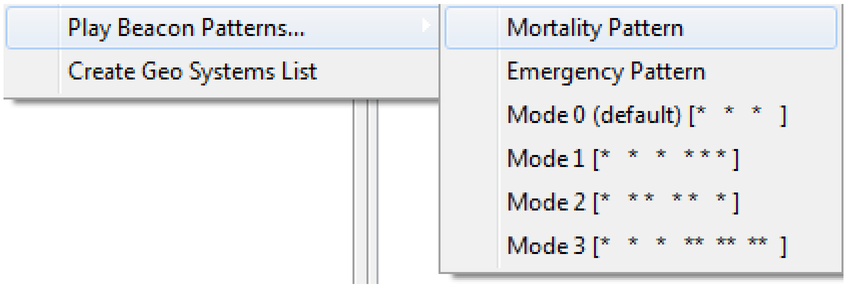


Figure 27: Play Beacon Patterns

The VHF beacon can also change its pattern in the field under certain circumstances. The two possible beacon patterns you might encounter are (Figure Patterns of the mortality and emergency mode):

Mortality Signal	If no activity has been detected for a user-defined time span (e.g. 24 hours), the signal will switch to the mortality mode: one 10 ms signal per 750 ms (only collars with enabled mortality sensor).
Emergency Signal	If the collar main power has run out, there will be a double signal of twice 10 ms at the beginning of the 1.5 s interval. At this stage, no GPS fixes and no communication is possible anymore.
Play Beacon Sound	Allows you to listen to the beacon patterns on your PC to help you identify them in the field.

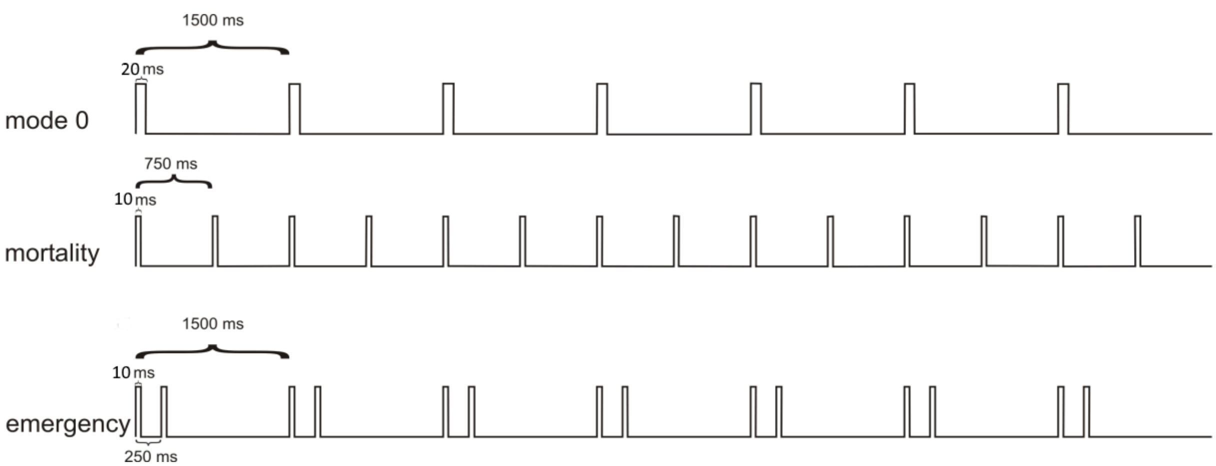


Figure 28: Patterns of the beacon modes

4.1.3.5 Create Geo Systems List

Menu Bar ⇨ Tools ⇨ Create Geo Systems List

With this command you can create a list in .html that gives you a general view of all available coordinate systems.

4.1.4 The Help Menu

The Help Menu contains of:

Open Help

About

4.1.4.1 Open Help

With this command you open the digital manual of your GPS Plus X software.

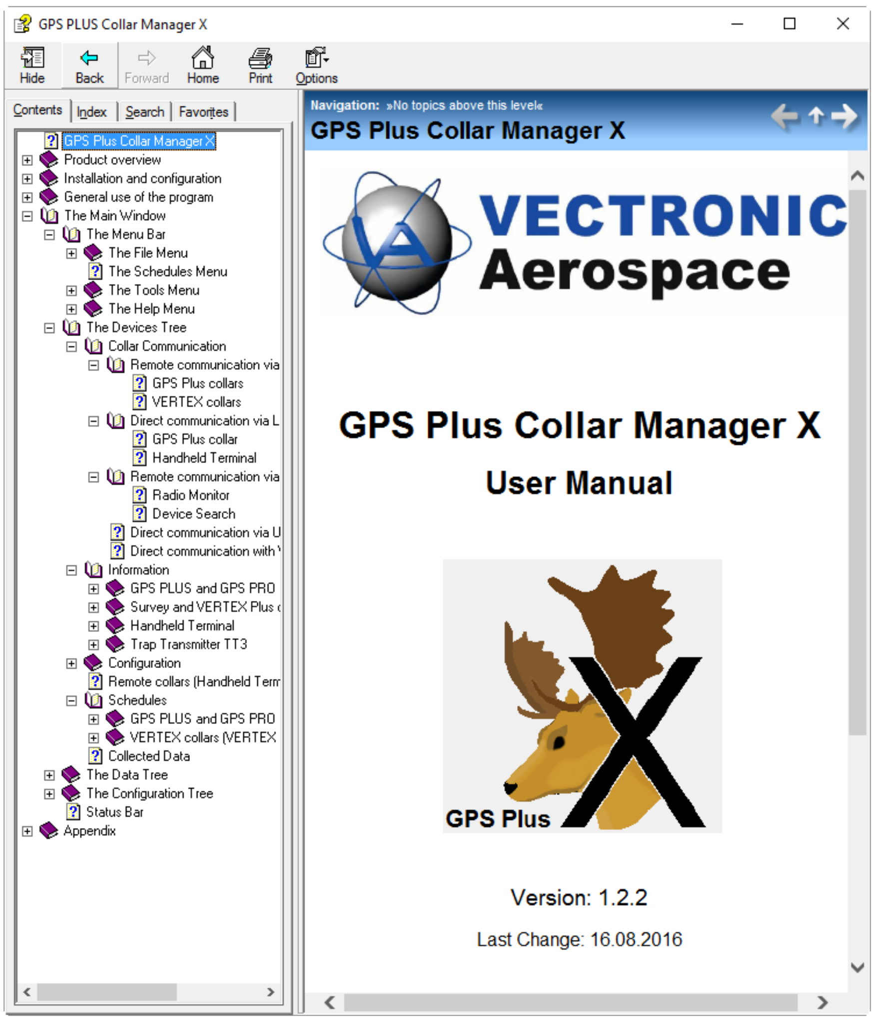


Figure 29: digital manual

4.1.4.2 About

With this command, a window will open with information on your copy of GPS Plus X. It will show you the version number of your copy, and the contact details for VECTRONIC Aerospace.

Figure 30: About window

4.2 The Devices Tree

The **Devices** tree includes the commands to access the collars and terminals.

It allows you to:

- read device Information
- change collar configurations
- create schedules as well as virtual fences and send them to the collar or the Handheld Terminal

The devices are connected to the software GPS Plus X in different ways:

- GPS Plus collars and VERTEX collars with Iridium communication have remote access.
- Via Link Manager you have direct access to GPS Plus collars and the Handheld Terminal.
- Via Remote Stick you have access to the Survey and VERTEX Lite collars.
- Via cable "USB to Collar interface" you have direct cable connection to the Handheld Terminal.
- Via cable "USB to VERTEX collar interface" you have direct cable connection to VERTEX Plus Collar.

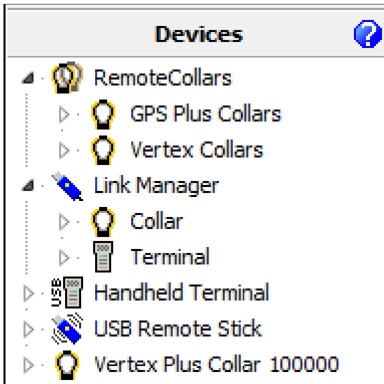


Figure 31: Devices tree - Overview

The device with its single nodes will be displayed in the Device Tree once it is connected to your PC (refer to table below).

Please note: To use a device, you need to register it first. The registration dialog will open automatically if a new device is detected.

For Registration and Removal of Devices please refer to Configuration ⇨ Local Settings ⇨ Device Registration

Symbol	Description
	The commands for Remote Collars are always be accessible. This node allows you to configure collars remotely per SMS via the GSM ground station or per email via IRIDIUM satellite link.
	The Link Manager 2 (USB interface) can be used to connect a GPS Plus collar or a Handheld Terminal. If a Link Manager is connected to the PC, both nodes for collar and Handheld are displayed regardless of which device, a collar or a Handheld Terminal, is connected.
USB SER	The Serial port, which would be used by the Link Manager 1, will always be visible with all nodes, but as long as no collar or Handheld Terminal is connected, you will not be able to send any commands or read out information from this node.
	This icon indicates a Terminal (Handheld Terminal) that is connected to the computer either directly via USB to collar Interface or via Link Manager. It is always a subnode for , USB, USB, or SER.
USB	UHF/VHF Handheld Terminals can be connected via USB to collar Interface. More than one Handheld Terminal can be connected to the PC at one time, and each will be displayed with its own icon. To make it easier to distinguish between Handheld Terminals, a name can be assigned to each Handheld Terminals (e.g. “Christians Handheld V5 UHF”).
	The USB Remote Stick (USB Interface) can be used with the Survey Collar remotely as well as with UHF devices (UHF-ID Tags, Implants).
	This icon indicates a Collar connected directly to the computer. Direct access via cable connection "USB to VERTEX Collar Interface" is possible for all VERTEX PLUS collars.

> Direct access via Link Manager is possible for all GPS Plus collars; in this case it is always a subnoder for , USB, or SER.

Also refer to the following sub chapters to learn how to handle the devices correctly.

Collar Communication

Information

Configuration

Schedules

Virtual Fence

Collected Data

4.2.1 Collar Communication

Devices ⇨ Remote Collars - for collars with Iridium communication or GSM communication in combination with our own ground station

Devices ⇨ Link Manager - for all GPS Plus and GPS Pro collars and Handheld Terminals

Devices ⇨ Remote Stick - for all Survey collars, VERTEX Lite collars and Trap Transmitter

Devices ⇨ Terminal - for all Handheld Terminals

Devices ⇨ VERTEX Plus Collar - for all VERTEX Plus collars

Refer to:

Remote communication via GSM and IRIDIUM

Direct communication via Link Manager

Remote communication via USB Remote Stick

Direct communication via UHF/VHF Handheld Terminal

Direct communication with VERTEX Plus Collar (via cable)

4.2.1.1 Remote communication via GSM and Iridium

Devices ⇨ Remote Collars

Only collars with GSM and IRIDIUM can be configured remotely using the commands in this part of the tree.

GSM Communication is done via a GSM ground station. You might have your own GSM ground station, or you use the station of VECTRONIC Aerospace in Berlin, Germany.

IRIDIUM Communication is done via email. To use it, you need to set up your IRIDIUM communication (see chapter Configuration tree).

The Remote Collar frames will always display a list of all registered collars which have a GSM or IRIDIUM communication ID entered in the collar list (see chapter Registering and managing collars).

For each collar, the communication option is given with the icons for GSM and for IRIDIUM.

Select collars by clicking on their checkboxes (Figure Remote collar list). Click all to select all collars, none to deselect all collars, and invert to invert selected and unselected collars.

For configurations regarding GSM or IRIDIUM functions, you should make sure that the command is **only** send to collars that have this communication option. Otherwise there may be problems with the collar's communications. The number of selected collars will be displayed below the list. To send a command, check the relevant collars, choose the settings for the parameter, and press Send. Press 'Send Clear' to delete changed settings and load default settings to your collar. For MAPI explanation, follow the link. A SMS or an IRIDIUM email will be compiled and sent. Press the button 'Store Outbox File' to store configurations / schedules / virtual fences for later access as a file on your computer.

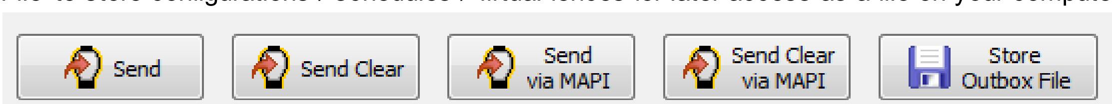


Figure 32: Remote sending options

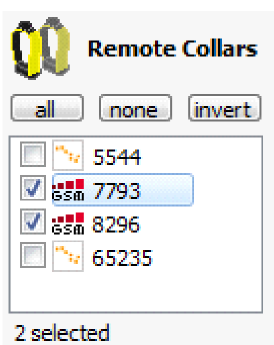


Figure 33: Remote collar list indicates IRIDIUM collars, indicates GSM collars

Note: To send a configuration via GSM, you need to have an active GSM ground station connected to a Data Collector Service which is running a GSM client collector module. In case an error occurs during the transmission of an SMS, you will not receive a direct warning, but a notification email will be sent to the administrator. Furthermore, the notification will be stored in the Data Storage Service Status frame. For details on how to set-up a GSM ground station, please refer to chapter Data Collector Service configuration.

Refer to:

Devices ⇨ Remote Collars ⇨ GPS Plus Collars
Devices ⇨ Remote Collars ⇨ VERTEX Collars

4.2.1.1.1 GPS Plus collars

Devices ⇨ Remote Collars ⇨ GPS Plus Collars

For GPS Plus collars with GSM or Iridium communication you can change Configurations and Schedules as seen in picture below.

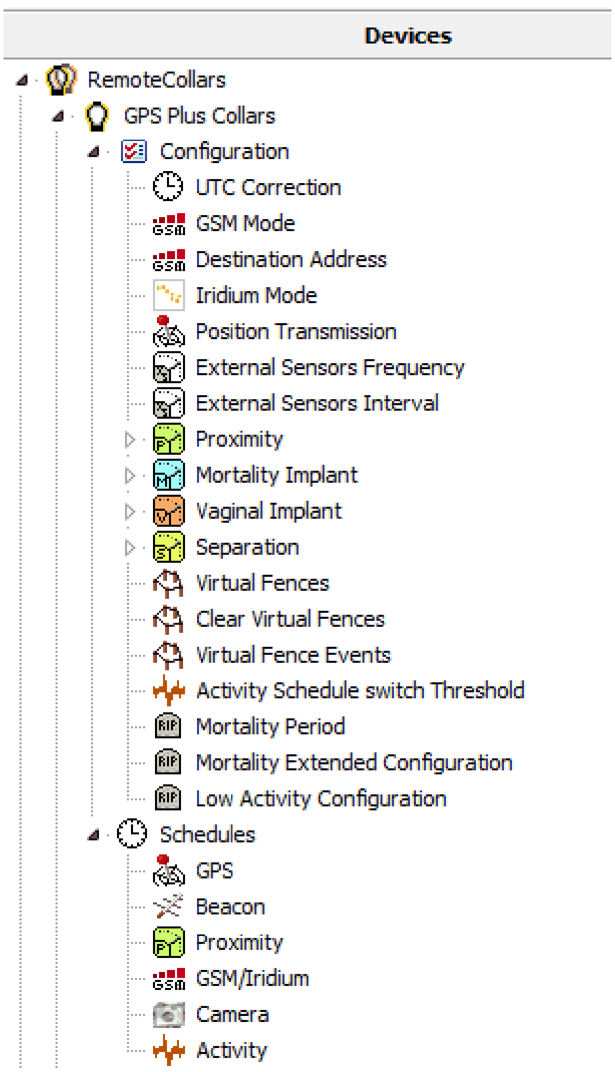


Figure 34 Device tree - Remote Collars - GPS Plus Collars

Refer to:

Devices ⇨ Configurations

Devices ⇨ Schedules

4.2.1.1.2 VERTEX collars

Devices ⇨ Remote Collars ⇨ VERTEX collars

For Survey, VERTEX Plus and VERTEX Lite collars with GSM or Iridium communication you can change Parameters and Schedules as seen in picture below.

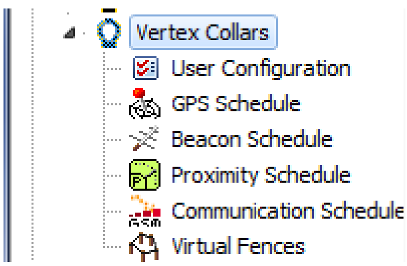


Figure 35 Device tree - Remote Collars - VERTEX Collars

In User Configuration you can change every single configuration listed. For recommendations and explanations please refer to User Configuration. To send the commands to the collar check the box(es), change the parameters and choose the collar where you want to change configurations.

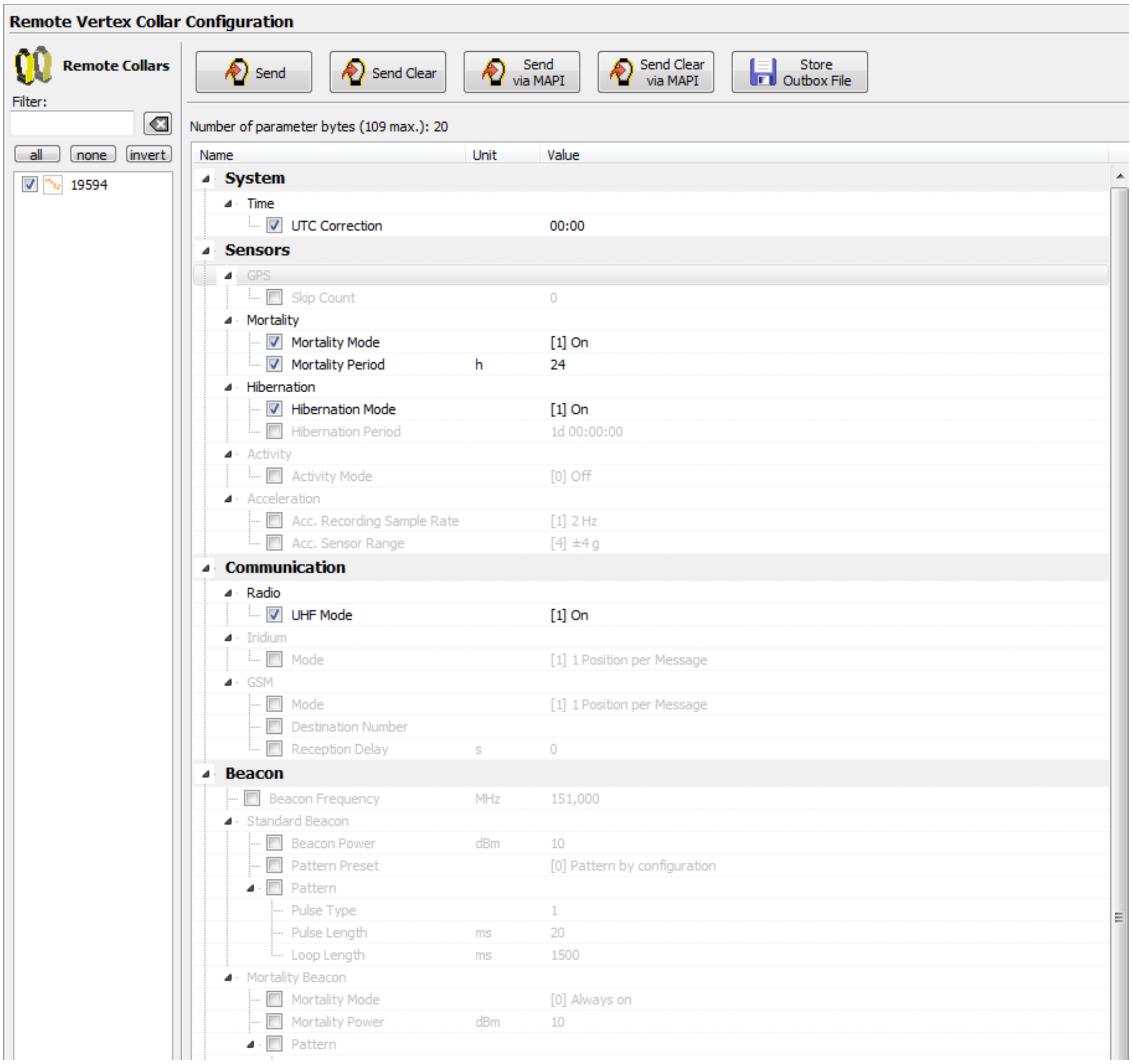


Figure 36: Remote VERTEX Collar Configuration

Press Send / Send via MAPI to send the changes to the collar. For MAPI explanation please refer to Local settings -> General. To clear settings on the collar please press Send Clear / Send Clear via MAPI. To safe settings to a local folder for later access press Store Outbox File and browse or create a folder to safe the file.

4.2.1.2 Direct communication via Link Manager

Devices ⇨ Link Manager

Devices ⇨ Link Manager

There are two Link Manager versions:

LM1: The serial version of the Link Manager. This version has to be connected to a serial com port or USB port. The LM1 is not in production anymore.

LM2: The USB version of the Link Manager is the current version. To connect the Link Manager to your PC, plug the Link Manager to the communication connector on the electronic housing of the collar and insert the USB plug of the Link Manager to the USB port of your PC.

When you use the Link Manager the first time you have to register the device first. For Display Name choose any name and press Register. The Devise appears in the Device tree.
For Registration and Removal of Devices please refer to Configuration ⇨ Local Settings ⇨ Device Registration

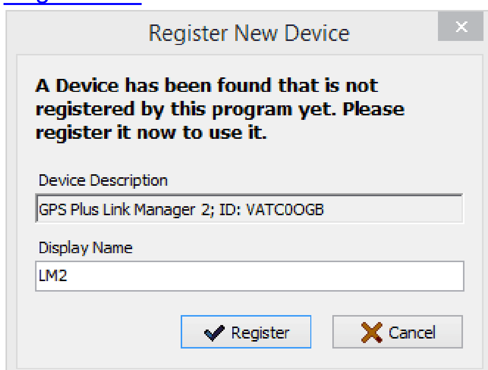


Figure 37: Registration Link Manager

Note: Do not leave the collar connected to the Link Manager if the PC is switched off or the Link Manager is not connected to a PC at all, because this will drain the collar's battery.

How communication between Link Manager and Collar works:
For communication with a collar open the Link Manager node and click on . If no collar is connected or you have not sent any command to the connected collar yet, Figure below on the left side, will appear. Connect the Link Manager (5 pin plugin) to the collar. If there is no battery attached to the collar connect the 3 pin plugin to the 3 pin connector for power consumption.
Now, you can load the general information of the attached collar by clicking on Reload. The collar's ID, time, date, and UTC correction will be displayed (Figure below, right). While the collar is connected to the PC, it should be in standby, which means the magnet should be attached to the electronic's housing of the collar.

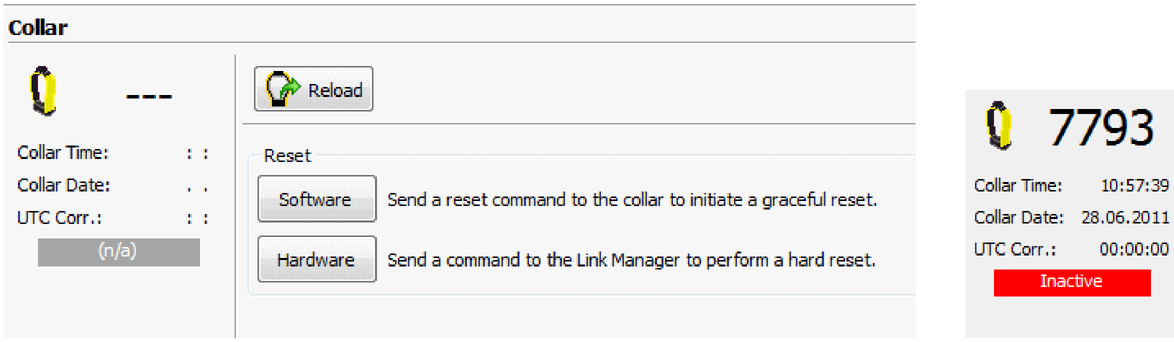


Figure 38: Collar information if no collar is connected, or does not respond (left). Complete collar information after communication with the collar has been established (right).

<u>**Note**</u>: To save battery, the collar wakes up only every 8 seconds to listen to commands from the Link Manager. Whenever you send a request or command to the collar, the program will not be responsive for a few seconds until it has received a signal from the collar.

The following buttons are used for the direct communication with the collar:

Reload — Reads and displays the configuration or data, which is currently saved on the collar. All changes or new schedules which have not been sent to the collar yet will be deleted in GPS Plus X.

Apply — Writes changed configuration to the collar. The prior configuration will be overwritten and cannot be restored.

This command is not available for all nodes. It deletes a schedule or Virtual Fence Collection currently stored on the collar.

4.2.1.2.1 GPS Plus collar

Devices ⇨ Link Manager ⇨ Collar

If you connected a GPS Plus collar via Link Manager you have access to the menu below.

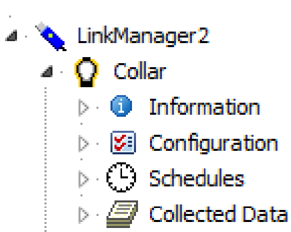


Figure 39 Device tree - Link Manager - Collar

Also refer to:

Devices ⇨ Information

Devices ⇨ Configuration

Devices ⇨ Schedules

Devices ⇨ Collected Data

4.2.1.2.2 Handheld Terminal

Devices ⇨ Link Manager ⇨ Terminal

When you have connected a Terminal via Link Manager you have access to the menu below.

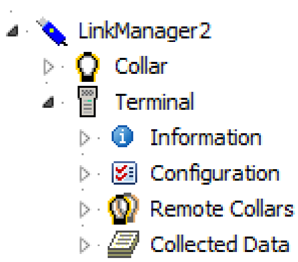


Figure 40 Device tree - Link Manager - Terminal

Please refer to the chapter Direct communication via UHF/VHF Handheld Terminal.

Also refer to:

Devices ⇨ Information

Devices ⇨ Configuration

Devices ⇨ Remote Collars

Devices ⇨ Collected Data

4.2.1.3 Remote communication via USB Remote Stick

Devices ⇨ Remote Stick

To configure the Survey and VERTEX Lite collars and to process data and messages with the GPS Plus X software, use the USB Remote Stick.

After plugging it in, the USB Remote Stick Symbol in the **Devices** tree will be displayed ( ). When you plug in the Remote Stick for the first time, you need to register it. A window will appear to inform you that this device has not been registered yet (see Figure Frame to register a new device). It will give you a Device Description and the possibility to choose a Display Name. Click Register after you have typed in a name which allows you to recognize your USB Remote Stick.

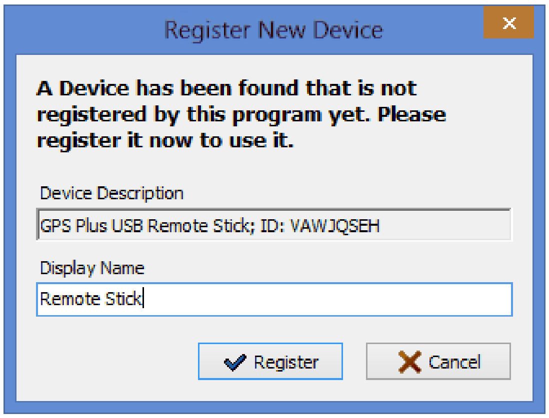


Figure 41: Frame to register a new device

After you have registered the USB Remote Stick, the device will appear in Configuration ⇨ Local Settings ⇨ Device Registration
Clicking on the Remote Stick symbol in the Devices tree, the USB Remote Stick Properties frame (Figure USB Remote Stick Properties) will open. Here you can see all the details of the Remote Stick. If the firmware of the USB Remote Stick is older than in the GPS Plus X resources it will update automatically.

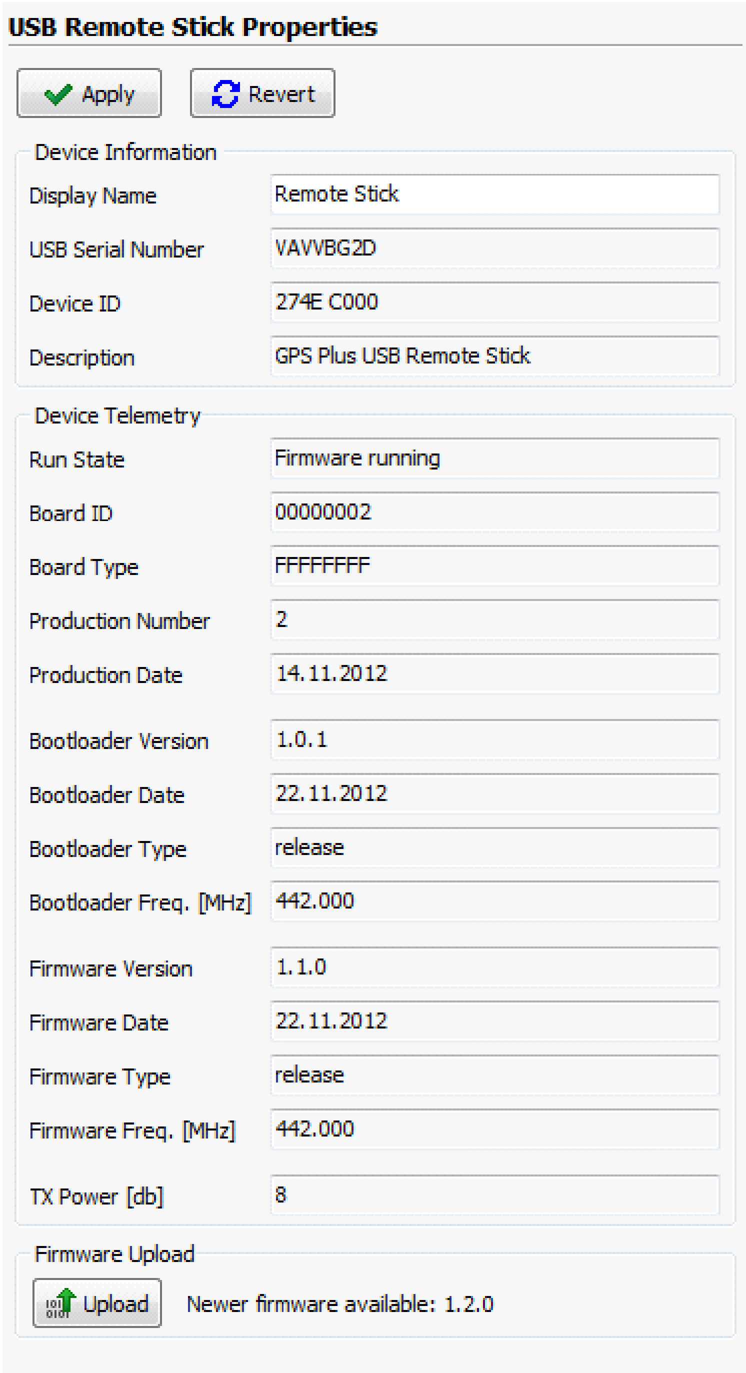


Figure 42: USB Remote Stick Properties

Refer to:

[Radio Monitor]

[Device Search]

Also refer to:

Devices ⇨ Information

Devices ⇨ Configuration

Devices ⇨ Schedules

Devices ⇨ Collected Data

4.2.1.3.1 Radio Monitor

Devices ⇨ Remote Stick ⇨ Radio Monitor

The node Radio Monitor (Figure USB Remote Stick Radio Monitor frame) in the Devices tree allows you to check if your devices work.
Here you can check ID / Separation Tag, Mortality Implant and Vaginal Implant by enabling one of these devices. For testing the device, take the magnet off the device and click on apply. The Listening Frequency [MHz] of the USB Remote Stick is preset but can be changed if necessary. If messages from this device are received, you will get a list with status messages of the corresponding device.

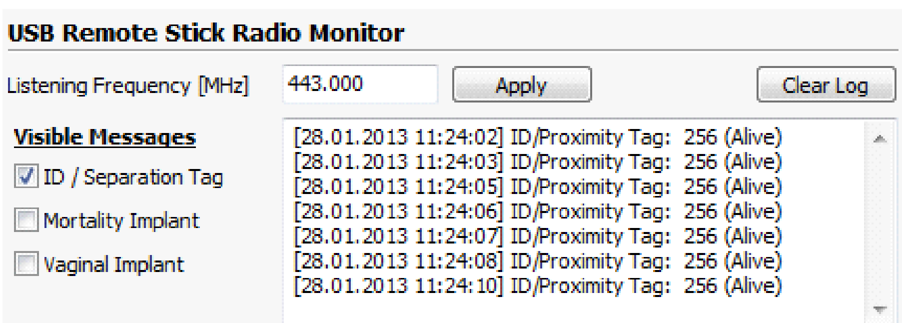


Figure 43: USB Remote Stick Radio Monitor frame

4.2.1.3.2 Device Search

Devices ⇨ Remote Stick⇨ Device Search

In the node Device Search you can search for the following devices:

1. Globalstar Survey collar
2. Prox / Sep Tag
3. Vaginal Implant

4. Mortality Implant
5. Beacon Transmitter
6. Iridium Survey collar
7. VERTEX Plus Collar
8. Trap Transmitter 3 Globalstar
9. Trap Transmitter 3 Iridium
10. VERTEX Lite Iridium
11. VERTEX Lite Globalstar

To do so, select a Device Type. If you want to search for a specific collar ID, please enable Specific Device ID and select the ID of your device. Click on Start Search, attach the magnet to your device within the next 10 seconds and detach it after one second. A list of all devices found will appear (Figure: USB Remote Stick Device Search frame).

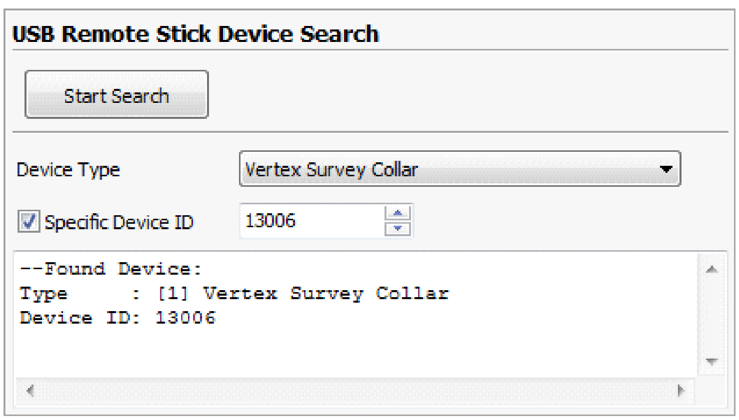


Figure 44: USB Remote Stick Device Search frame for Survey

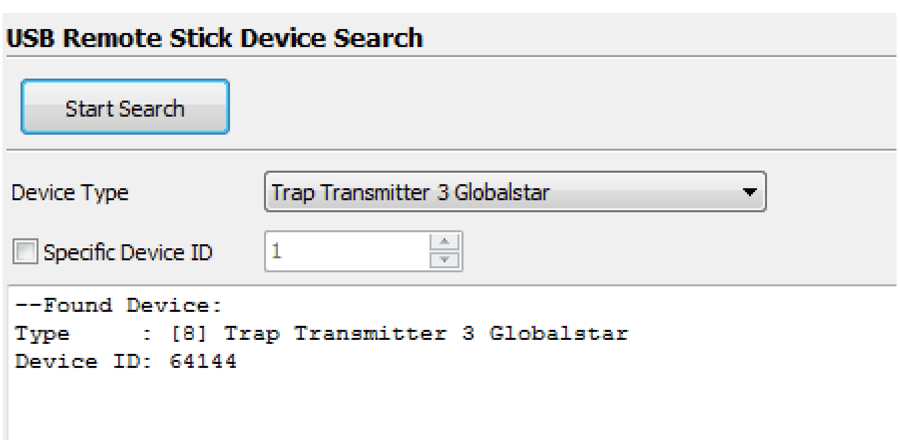


Figure 45: USB Remote Stick Device Search frame for Trap Transmitter

4.2.1.4 Direct communication via UHF/VHF Handheld Terminal

Devices ⇨ Terminal

Collars with VHF or UHF data communication can receive new commands via the Handheld Terminal. The commands and configurations have to be sent to the Handheld Terminal first. There are two nodes for the Handheld Terminal, depending on how you connect the Handheld Terminal to the PC.

The Handheld Terminal is connected directly via USB cable.

Each Handheld Terminal can be registered at Configuration – Local Settings – Device Registration. You can assign a name to the Handheld Terminal (e.g. "Christians Handheld") to tell different units apart.

After the Handheld Terminal has been connected via USB, the terminal icon ( ) and the Handheld Terminal's name will be displayed in the **Devices** tree.

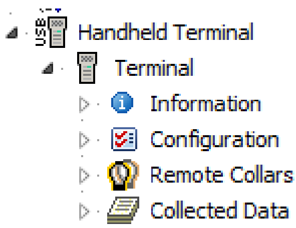


Figure 46: Device tree - Handheld Terminal

If you click on this node, the properties of the Handheld Terminal are displayed (Figure Properties of the USB interface, e.g Link Manager or Handheld Terminal). At this point, you can change the name of the Handheld Terminal. Store the new name to the Handheld Terminal with Apply or restore the original name with Revert (only if you have not pressed Apply yet, otherwise the original name has been overwritten). USB Serial Number and Device ID can be helpful for the VECTRONIC Aerospace team when trouble-shooting. These information's can later be viewed in the Devices List at the node Configuration ⇨ Local Settings ⇨ Link Managers (see Link Manager and Handheld Terminals).

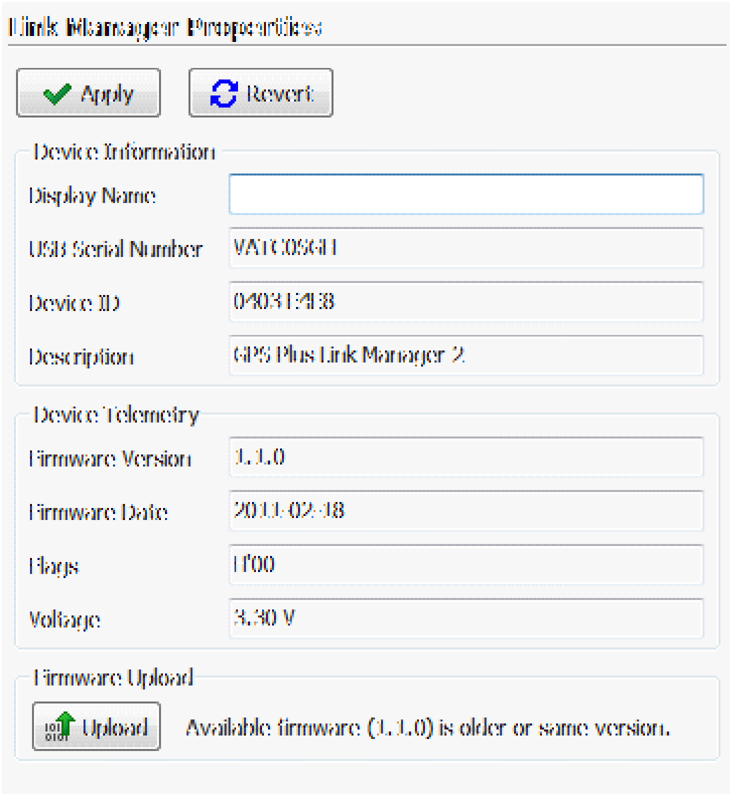
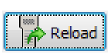
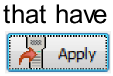


Figure 47: Properties of the USB interface, e.g Link Manager or Handheld Terminal

There are two buttons used for the direct communication with the Handheld Terminal:



Reads and displays the configuration or data currently saved on the Handheld Terminal. Any changes which have not been sent to the Handheld Terminal or new schedules that have not been saved will get lost.



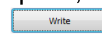
Writes changed configuration to the Handheld Terminal. The prior configuration will be overwritten and cannot be restored.

The configuration of and communication with the Handheld Terminal itself will be discussed in chapter Handheld Terminal Configuration.

To configure collars with the Handheld Terminal, you first need to upload the changed settings to the Handheld Terminal. This is done with the Terminal ⇨ Remote Collars ⇨ Collar Configuration frame (Figure Remote Collar Configuration frame). For each collar, up to five configurations can be defined and uploaded to the Handheld Terminal.

Two icons are important here:

This button opens a pop-up list of all collars for which configuration files are stored on the Handheld Terminal (Figure 25, left side). Select one collar ID to download and view these files. Up to five files can be stored in a Handheld Terminal for each collar.

This button opens a pop-up list with all collars registered on the Handheld Terminal (Figure Collar ID's are selected from a pop-up list, right side). Select one or more collars with the checkboxes and press Write 

to upload the new configurations to the Handheld Terminal. The configurations can then be sent to the collar when radio communication has been established (for details please refer to the VHF/UHF Handheld Terminal Manual).

To create a configuration, select a Parameter from the drop-down list. A Listed Name will appear automatically. This name will be shown in the Handheld Terminal to identify the configuration file. You can change the Listed Name; its maximum size is 14 characters. Depending on the selected parameter, new drop-down lists and checkboxes will appear. These will be discussed in the related chapters.

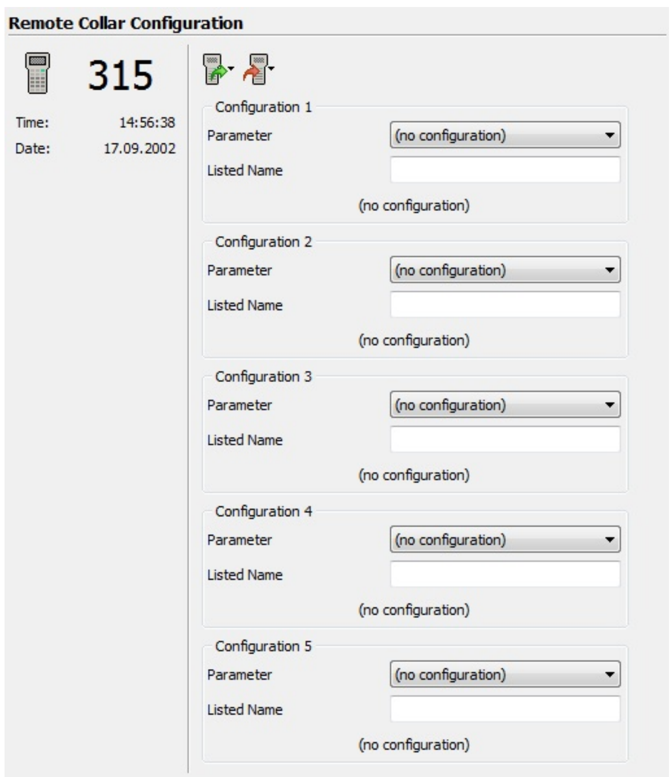


Figure 48: Remote Collar Configuration frame

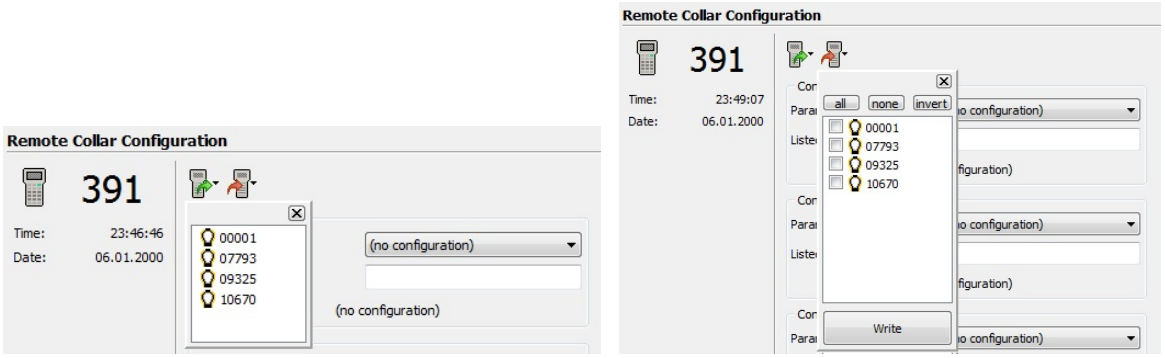


Figure 49: Collar ID's are selected from a pop-up list for one collar for download (left) and for several collars for upload (right).

Note: Configurations are always written to the Handheld Terminal in blocks of five configurations. All existing configurations stored in the Handheld Terminal for the selected collar will then be overwritten. Please always check what current configuration files are stored on the Handheld Terminal.

Refer to:

Devices ⇨ Information

Devices ⇨ Configuration

Devices ⇨ Remote Collars

Devices ⇨ Collected Data

4.2.1.5 Direct communication with VERTEX Plus Collar

Devices ⇨ VERTEX Plus Collar

To connect your VERTEX Plus Collar with your PC directly you have to have the cable "USB to VERTEX Collar Interface" (8pin).
Please note that it is not possible connect a VERTEX Plus collar with a Link Manager or a Remote Stick.

Via direct cable connection between VERTEX Plus collars and your PC you are able to:

- make a firmware update (cable obligatory)
- download collected activity data, GPS data and proximity data directly from the collar (cable obligatory)
- make a coldstart and warmstart, which is necessary e.g. when you changed battery (cable obligatory)
- change schedules and configurations

- check information and settings of the collar

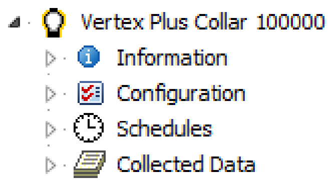


Figure 50 Device tree - VERTEX Plus Collar

Refer to:

Devices ⇨ Information

Devices ⇨ Configuration

Devices ⇨ Remote Collars

Devices ⇨ Collected Data

4.2.2 Information

This node allows you to read the configuration, status, and other information from a collar connected to the PC via Link Manager, via USB Remote Stick or directly via USB cable.

Refer to:

Information for GPS Plus and GPS PRO collar

Information for VERTEX collars (Survey, VERTEX Plus, VERTEX Lite)

Information for Handheld Terminal

Information for Trap Transmitter 3

4.2.2.1 GPS PLUS and GPS PRO collars

Devices ⇨ Link Manager ⇨ Collar ⇨ Information

Devices ⇨ Link Manager ⇨ Collar ⇨ Information

Refer to:

Telemetry

Status

[GPS Monitor](#)

[Info File](#)

4.2.2.1.1 Telemetry

Devices ⇨ Link Manager ⇨ Collar ⇨ Information ⇨ Telemetry

Devices ⇨ Link Manager ⇨ Collar ⇨ Information ⇨ Telemetry

For a detailed description of the single frames see Appendix B: Collar Telemetry Description. Only data which applies to the connected collar's configuration and sensors are displayed. All other frames are disabled.

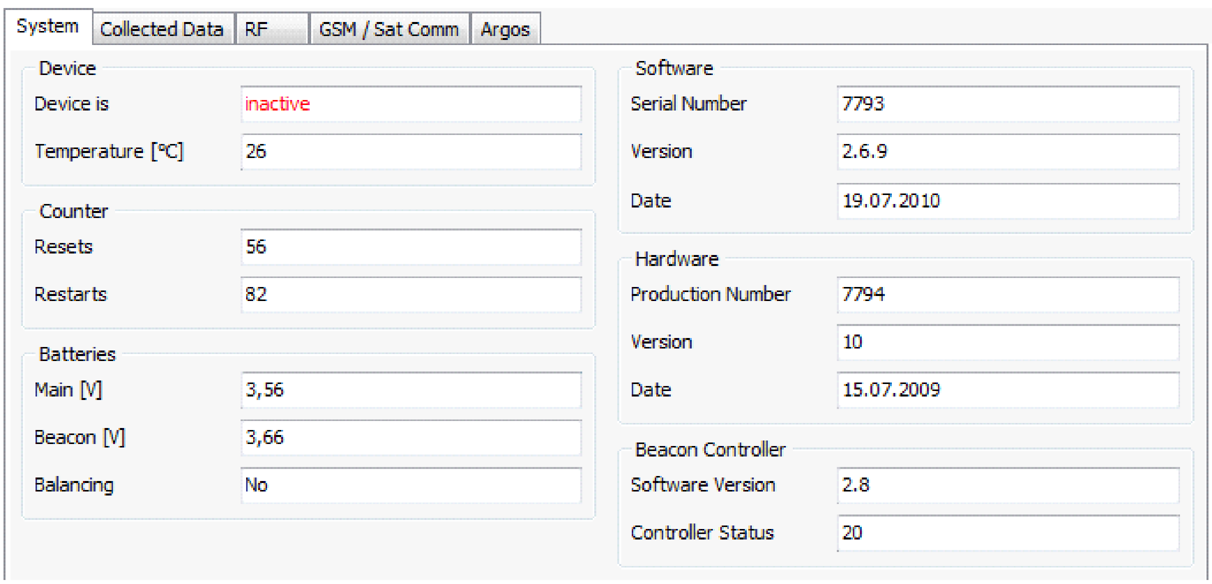


Figure 51: Telemetry System tab

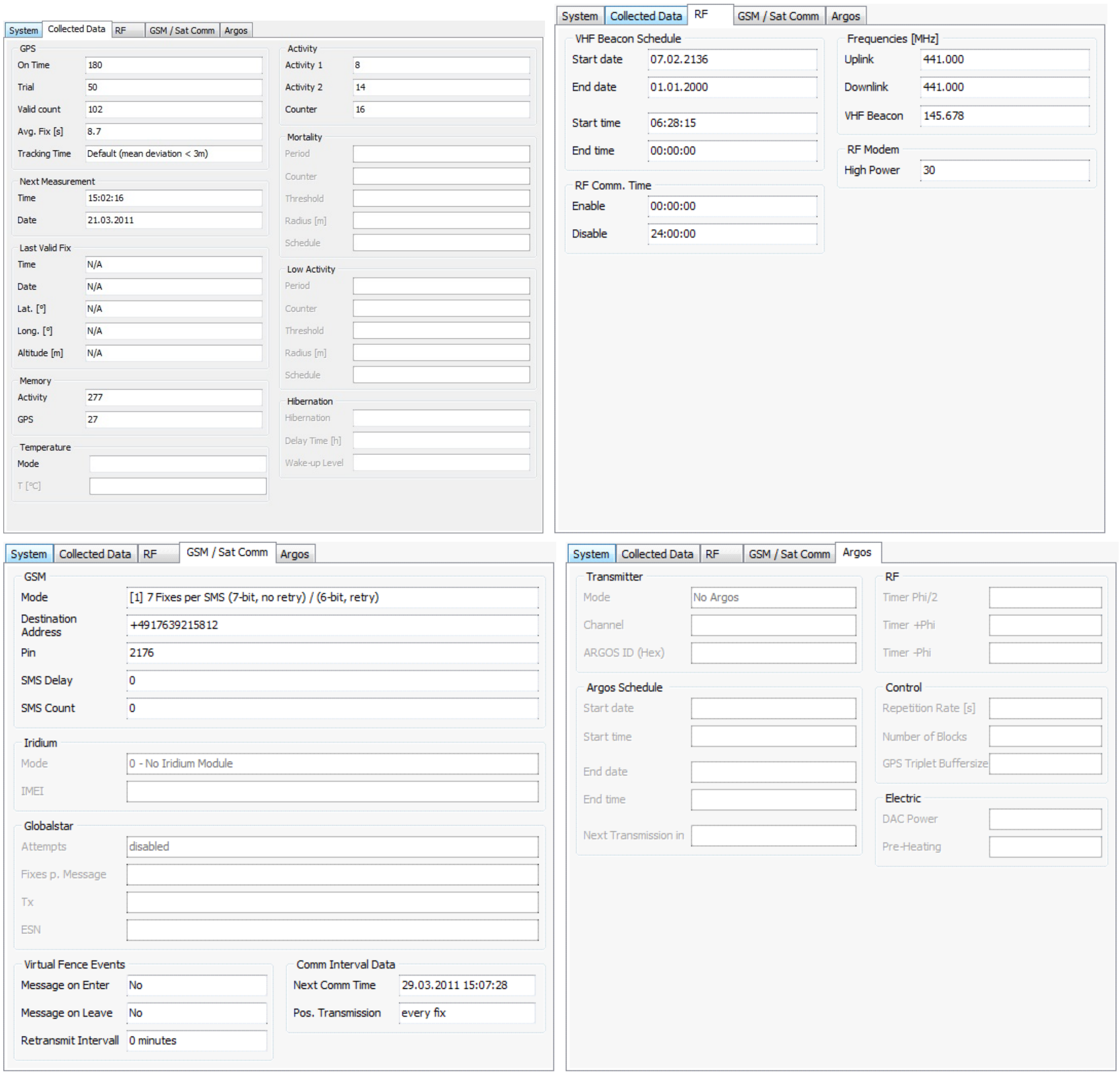


Figure 52: Telemetry tabs Collected Data, RF, GSM/Sat Communication

4.2.2.1.2 Status

Devices ⇨ Link Manager⇨ Collar ⇨ Information ⇨ Status

Devices ⇨ Link Manager ⇨ Collar ⇨ Information ⇨ Status

This command gives information on the current task performed by the collar. On starting this command, an empty window will appear (Figure Collar Status Output without the Standby Information).

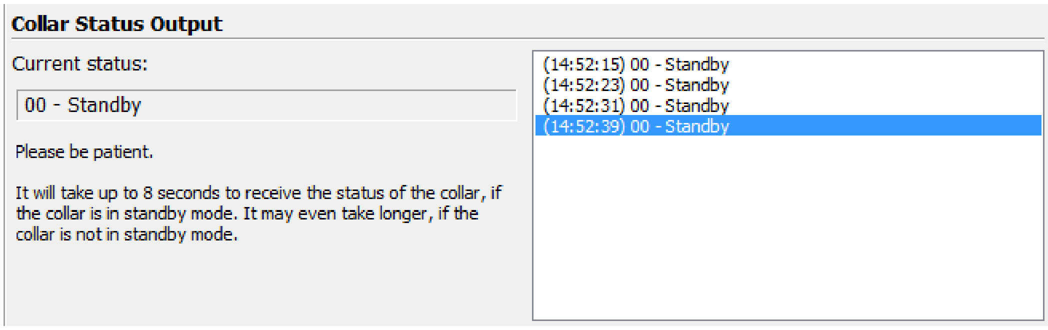


Figure 53: Collar Status Output

Each time the connected collar transmits its status; the time, the code, and the meaning of the code are displayed. The update frequency depends on the current mode of the collar. For example in standby mode the collar should transmit its status every eight seconds, in GPS Fix mode it varies between one and several seconds.

There are seven collar statuses that can be displayed:

00 - Standby
01 - Calculate Activity Memory Counter
02 - Calculate GPS Memory Counter
03 - Auto Page Rewrite
04 - GPS Fix
05 - GSM Idle
06 - GSM Active

All other IDs will be displayed as unknown status. If the status window is flooded with messages, most of them unknown, you probably have performed a Warmstart GPS or a Coldstart GPS (see Collar GPS Monitor) before; the collar now transmits GPS data. Just wait until it finishes the fix; this may take a few minutes. Only the last 1,000 status messages are displayed. If more than 1,000 messages are received, the oldest messages are erased.

4.2.2.1.3 GPS Monitor

Devices ⇨ Link Manager ⇨ Collar ⇨ Information ⇨ GPS Monitor

Devices ⇨ Link Manager ⇨ Collar ⇨ Information ⇨ GPS Monitor

There are two options in this frame, GPS Warmstart and a GPS Coldstart.

Please note: Both commands should only be used for diagnostics and outside of buildings with open view to the sky!

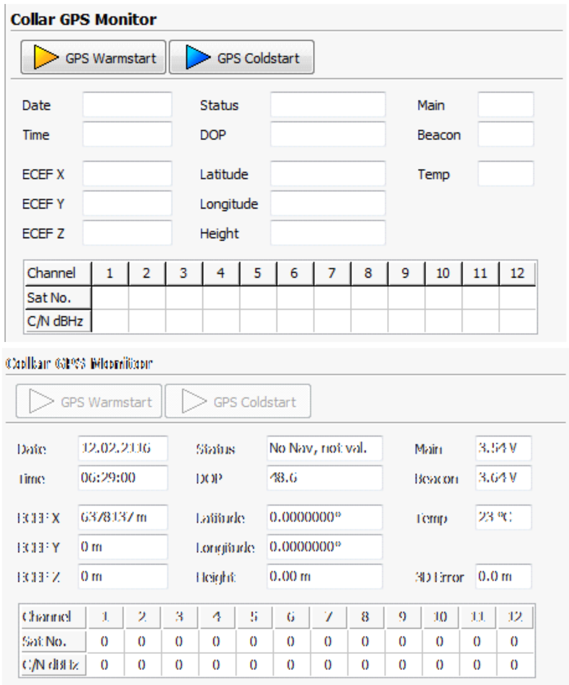


Figure 54: GPS monitor and commands for GPS warmstart and GPS coldstart, right frame after fix has been obtained.

GPS Warmstart:	This button will initiate a warmstart of the GPS device. The program will wait several seconds for data, which can take a while for the first data set. You can abort the warmstart by changing the node.
GPS Coldstart:	The command is quite similar to the GPS warmstart command, but will need much longer for the first data set and even longer to get a position fix because all data have to be acquired from the satellites again

A GPS Coldstart is necessary if you changed the battery pack of your collar or if the collar was inactive for a few weeks / months.

The fix data will be displayed in the form underneath the buttons:

Date and Time	date and time of the GPS receiver in UTC (Universal Time Coordinated)
ECEF X, Y and Z	the measured position in x, y, and z coordinates of the Earth Centred Earth Fixed coordinate system
Status	the navigation status of the displayed position
DOP	Dilution of Precision (in 2D mode it is only horizontal DOP [HDOP])

Latitude, Longitude and Height	the measured position in WGS84 coordinates
Main and Beacon	voltage of the corresponding battery
Temp	temperature of the collar

At the bottom is a table containing each satellite used for this position with satellite number (Sat No.) and their signal to noise ratio in dBHz (C/N dBHz).

4.2.2.1.4 Info File

Devices ⇨ Link Manager⇨ Collar ⇨ Information ⇨ Info File

Devices ⇨ Link Manager ⇨ Collar ⇨ Information ⇨ Info File

This command transfers all information on the collar configuration into text which can be saved as .TXT file or printed directly.
The different parameters are explained in Appendix C.1: Collar Information File Description.

We advise to create an info file each time the configuration of a directly connected collar has been changed. This way, you can look up the configuration and schedules while the collar is deployed.

An example for an info file is given in Figure below. Exemplary, values are given for IRIDIUM, GLOBALSTAR, and GSM communication; please note that in real info files, only one of these communication options will be given; the other parameters will be labelled as `N/A`. Schedules are written in XML standard. For explanation of this standard, please refer to Appendix G: XML Standard.

Information File of Collar No. 08296
Date of Readout: 28.06.2011 15:31:40
GPS Plus X Version: 10.0.7

Collar Date (UTC): 07.01.2000
Collar Time (UTC): 23:29:52
Software Version: 2.6.3
Serial Number: 8296
Software Date: 11.02.2010
Hardware Version: 10
Production Number: 8296
Production Date: 25.05.2011

```
Beacon Software Vers.: 2.8
Beacon Update Status:  0

Temperature logging:   1 - ON
Activity Mode:         Head Angle / Acceleration Threshold
Activity Interval:     64s
Angle Threshold:       128
Accel. Threshold:      128

Mortality logging:     1 - ON
M. Period:             24:00:00
M. Threshold:          15
M. Radius:             1000 m
M. Extended TX:        ON
Low Activity:          ON
L.A. Period:           1 h
L.A. Threshold:        21
L.A. Radius:           1000 m
L.A. Extended TX:      ON

Hibernation is:        Disabled
Hib. Wakeup Level:     N/A
Hib. Delay Time:       N/A

Uplink Frequency:      441.000 MHz
Downlink Frequency:    441.000 MHz
UHF Beacon Frequency:  441.000 MHz

UHF Beacon On Time:    05:00 min
UHF Period:            2.0 s

Com Enable Time:       12:00:00
Com Disable Time:      24:00:00

VHF Beacon Frequency:  151,000 MHz
VHF Beacon Pattern:    Mode 1 [*   *   *   * * * ]

Iridium Mode:          3 - 3 Fixes per Message
Iridium IMEI:          4916095691992

Globalstar Attempts:   1
Fixes per Message:     2
Transmission Mode:     send every 3rd fix
Globalstar ID:         4916095691992

GSM Mode:              4 - 6 Fixes per SMS (6-bit), no repetition
Destination Address:   +4916095691992F
GSM PIN Number:        0000
SMS Reception Delay:   32 seconds
```

Collar UTC correction:	Active
Correction term:	+01:00
Proximity Sensor:	Enabled
Prox. Interval:	64 seconds
Prox. RSSI Threshold:	-128 dBm
Prox. Duration:	1.5 seconds
Prox. Enable Time:	06:00:00
Prox. Disable Time:	19:00:00
Prox. Mode:	1 - enabled (100kBit FSK NRZ-I)
Prox. Frequency:	443.000
Prox. Transmission:	Enabled
Mortality Implant:	Disabled
M. Imp. Duration:	5.3 seconds
M. Imp. Enable Time:	00:00:00
M. Imp. Disable Time:	24:00:00
M. Imp. Mode:	0 - disabled
M. Imp. Transm. ID:	3
M. Imp. Transm.:	Enabled
Vaginal Implant:	Enabled
V. Imp. Duration:	5.3 seconds
VIT No Contact Delay:	1 hours
V. Imp. Enable Time:	00:00:00
V. Imp. Disable Time:	24:00:00
V. Imp. Mode:	1 - enabled (100kBit FSK NRZ-I)
V. Imp. Transm. ID:	100
V. Imp. Transmission:	Enabled
Separation Sensor:	Enabled
Separation Duration:	4.3 seconds
Sep. No Contact Delay:	2 hours
Sep. Enable Time:	00:00:00
Sep. Disable Time:	24:00:00
Separation Mode:	1 - enabled (100kBit FSK NRZ-I)
Sep. Transm. IDs:	100
Separation Transm.:	Enabled
Next Comm. Time:	29.03.2011 15:07:28
Pos. Transmission:	every 2nd fix
Message on VF enter:	No
Message on VF leave:	No
Retransmit Interval:	0 minutes
GPS Mode:	Solved
GPS Schedule is:	not locked
GPS Schedule:	

```
Cyclic Rule
  Start date         24.05.2012
  End date           22.05.2050
  Start time         00:00:00
  End time           23:59:58
  Period             02:00:00

UHF Schedule:
 N/A

VHF Schedule:
Beacon Rule
  Start date         01.01.2000
  End date           21.05.2013
  Start time         00:00:00
  End time           23:59:58

Argos Schedule:
 N/A

Proximity Schedule:
Cyclic Rule
  Start date         01.01.2010
  End date           01.01.2017
  Start time         00:00:00
  End time           23:59:58
  Period             02:00:00

GSM Schedule:
 N/A

Virtual Fence Collection:
<virtualFenceCollection >
  <virtualFence name="Fence 0">
    <insidePoint name="" latitude="-33.84407" longitude="151.24173"/>
    <post id="0" name="Post 0" latitude="-33.84195" longitude="151.24170"/>
    <post id="1" name="Post 1" latitude="-33.84189" longitude="151.24116"/>
    <post id="2" name="Post 2" latitude="-33.84174" longitude="151.23958"/>
    <post id="3" name="Post 3" latitude="-33.84154" longitude="151.23804"/>
    <post id="4" name="Post 4" latitude="-33.84315" longitude="151.23825"/>
    <post id="5" name="Post 5" latitude="-33.84351" longitude="151.23796"/>
    <post id="6" name="Post 6" latitude="-33.84379" longitude="151.23802"/>
    <post id="7" name="Post 7" latitude="-33.84438" longitude="151.23896"/>
    <post id="8" name="Post 8" latitude="-33.84489" longitude="151.23904"/>
    <post id="9" name="Post 9" latitude="-33.84548" longitude="151.23945"/>
  </virtualFence>
</virtualFenceCollection>

Virtual Fence Schedule:
Cyclic Rule
```

```
  Start date        25.05.2011
  Start time        00:00:00
  End date          25.05.2012
  End time          23:59:58
  Period            01:00:00

Camera Schedule:
N/A

Activity Schedule:
N/A

Schedules in XML format:

GPS Schedule:
<gpsSchedule>
  <cyclicRule startDate="2012-05-24" endDate="2050-05-22" dailyStartTime="00:00:00Z"
dailyEndTime="23:59:58Z" repetitionPeriod="P0DT2H0M0S"/>
</gpsSchedule>

UHF Schedule:
 N/A

VHF Schedule:
<beaconSchedule>
  <beaconRule startDate="2000-01-01" endDate="2013-05-21" dailyStartTime="00:00:00Z"
dailyEndTime="23:59:58Z"/>
</beaconSchedule>

Argos Schedule:
N/A

Proximity Schedule:
<proximitySchedule>
  <cyclicRule startDate="2010-01-01" endDate="2017-01-01" dailyStartTime="00:00:00Z"
dailyEndTime="23:59:58Z" repetitionPeriod="P0DT1H0M0S"/>
</proximitySchedule>

GSM Schedule:
 N/A

Virtual Fence Schedule:
<gpsSchedule>
  <cyclicRule startDate="2011-05-25" endDate="2012-05-25" dailyStartTime="00:00:00Z"
dailyEndTime="23:59:58Z" repetitionPeriod="P0DT2H0M0S"/>
</gpsSchedule>

Camera Schedule:
N/A
```

```
Activity Schedule:
N/A
```

Figure 55: Example for Collar Info File

4.2.2.2 Survey / VERTEX Plus / VERTEX Lite collars

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Information

Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar⇨ Information

Devices ⇨ VERTEX Plus Collar ⇨ Information

Please refer to

VERTEX Telemetry

VERTEX Monitor

VERTEX Info File

4.2.2.2.1 VERTEX Telemetry

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Information ⇨ Telemetry
Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar⇨ Information ⇨ Telemetry

Devices ⇨ VERTEX Plus Collar ⇨ Information ⇨ Telemetry

The telemetry frame for the VERTEX collar is shown in Figure below. On the left side of the frame, you can choose if you like to access the telemetry frame for **This Collar** or for **Any Collar**. If you select **Any Collar**, you can access the telemetry of several collars one after another by simply detaching and reattaching the magnet of the selected collar. (Survey, VERTEX Lite Collars)

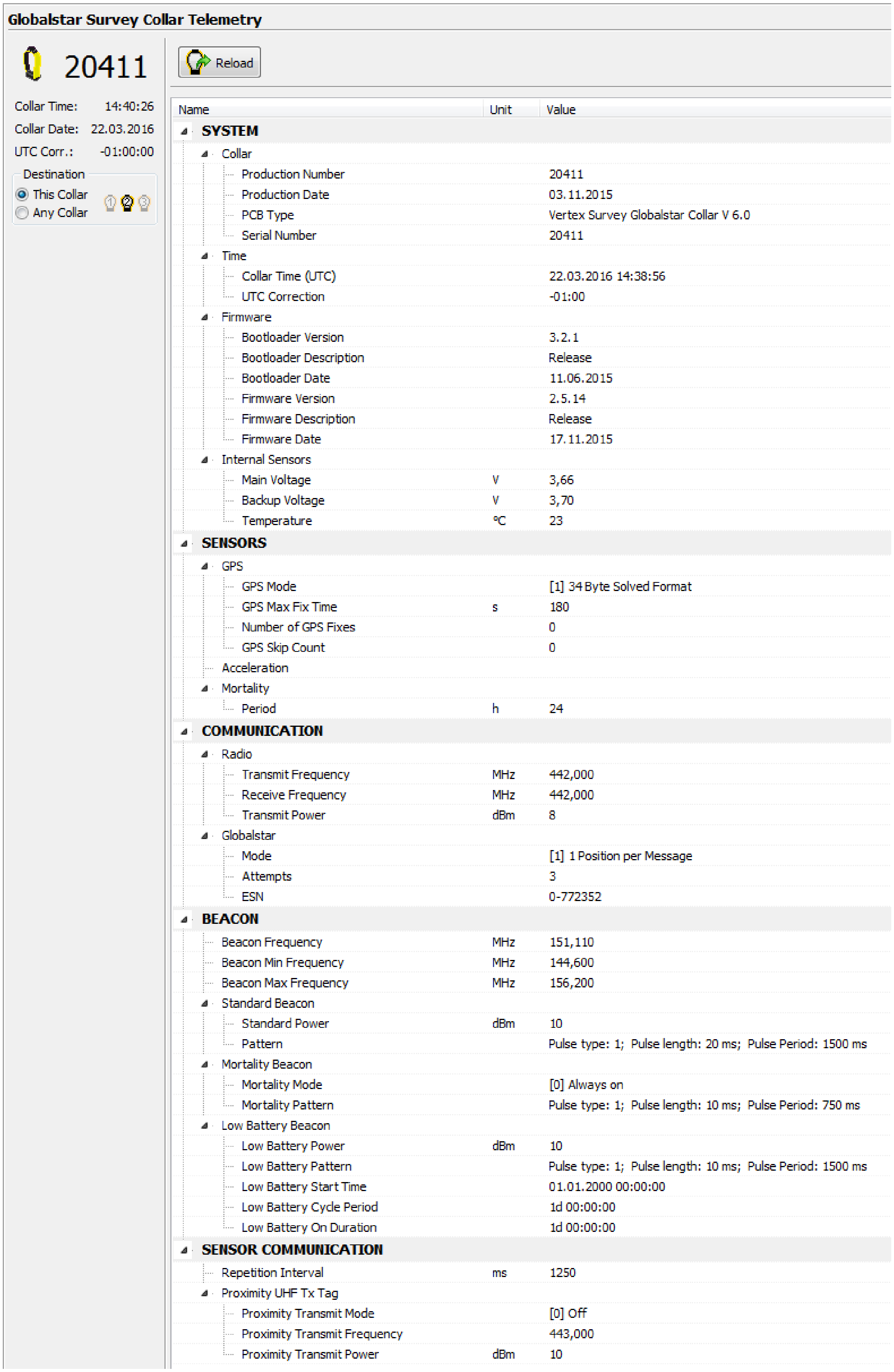

Globalstar Survey Collar Telemetry
20411
Reload
Collar Time: 14:40:26
Collar Date: 22.03.2016
UTC Corr.: -01:00:00
Destination
This Collar
Any Collar
Name Unit Value
SYSTEM
Collar
Production Number 20411
Production Date 03.11.2015
PCB Type Vertex Survey Globalstar Collar V 6.0
Serial Number 20411
Time
Collar Time (UTC) 22.03.2016 14:38:56
UTC Correction -01:00
Firmware
Bootloader Version 3.2.1
Bootloader Description Release
Bootloader Date 11.06.2015
Firmware Version 2.5.14
Firmware Description Release
Firmware Date 17.11.2015
Internal Sensors
Main Voltage V 3,66
Backup Voltage V 3,70
Temperature °C 23
SENSORS
GPS
GPS Mode [1] 34 Byte Solved Format
GPS Max Fix Time s 180
Number of GPS Fixes 0
GPS Skip Count 0
Acceleration
Mortality
Period h 24
COMMUNICATION
Radio
Transmit Frequency MHz 442,000
Receive Frequency MHz 442,000
Transmit Power dBm 8
Globalstar
Mode [1] 1 Position per Message
Attempts 3
ESN 0-772352
BEACON
Beacon Frequency MHz 151,110
Beacon Min Frequency MHz 144,600
Beacon Max Frequency MHz 156,200
Standard Beacon
Standard Power dBm 10
Pattern Pulse type: 1; Pulse length: 20 ms; Pulse Period: 1500 ms
Mortality Beacon
Mortality Mode [0] Always on
Mortality Pattern Pulse type: 1; Pulse length: 10 ms; Pulse Period: 750 ms
Low Battery Beacon
Low Battery Power dBm 10
Low Battery Pattern Pulse type: 1; Pulse length: 10 ms; Pulse Period: 1500 ms
Low Battery Start Time 01.01.2000 00:00:00
Low Battery Cycle Period 1d 00:00:00
Low Battery On Duration 1d 00:00:00
SENSOR COMMUNICATION
Repetition Interval ms 1250
Proximity UHF Tx Tag
Proximity Transmit Mode [0] Off
Proximity Transmit Frequency 443,000
Proximity Transmit Power dBm 10

Figure 56: Survey Collar Telemetry frame

4.2.2.2.2 VERTEX Monitor

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Information ⇨ GPS Monitor
Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar ⇨ Information ⇨ GPS Monitor

Devices ⇨ VERTEX Plus Collar ⇨ Information ⇨ GPS Monitor

There are two options in this frame, GPS Warmstart and GPS Coldstart.

Please note: Both commands should only be used for diagnostics and outside of buildings with open view to the sky!

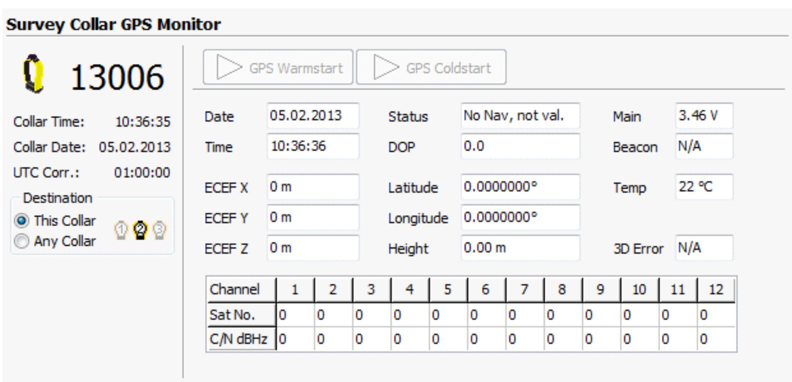


Figure 57: Survey Collar GPS monitor after fix has been obtained

GPS Warmstart:	This button will initiate a warmstart of the GPS device. The program will wait several seconds for data, which can take a while for the first data set. You can abort the warmstart by changing the node.
GPS Coldstart:	The command is quite similar to the GPS warmstart command, but will need much longer for the first data set and even longer to get a position fix because all data have to be acquired from the satellites again

A GPS Coldstart is necessary if you changed the battery pack of your collar or if the collar was inactive for a few weeks / months.

The fix data will be displayed in the form underneath the buttons:

Date and Time	date and time of the GPS receiver in UTC (Universal Time Coordinated)

ECEF X, Y and Z	the measured position in x, y, and z coordinates of the Earth Centred Earth Fixed coordinate system
Status	the navigation status of the displayed position
DOP	Dilution of Precision (in 2D mode it is only horizontal DOP [HDOP])
Latitude, Longitude and Height	the measured position in WGS84 coordinates
Main and Beacon	voltage of the corresponding battery
Temp	temperature of the collar

At the bottom is a table containing each satellite used for this position with satellite number (Sat No.) and their signal to noise ratio in dBHz (C/N dBHz).

4.2.2.2.3 VERTEX Info File

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Information ⇨ Info File
Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar⇨ Information ⇨ Info File

Devices ⇨ VERTEX Plus Collar ⇨ Information ⇨ Info File

The VERTEX collar Info file includes all information on the collar configuration. It can be saved as .TXT file or printed directly. It contains technical information of the collar as well as the schedules.

For the GPS as well as for the VHF beacon, you can see which schedule is used at the moment (in the example it is the User Defined Schedule). Every schedule can be in the .XML format which is machine readable. An example of an Info File of the Survey Collar is given in Figure below.

```
Information File of Survey Collar No. 13006
Date of Readout: 30.01.2013 14:05:04
GPS Plus X Version:     10.0.8.13025
------------------------------------
Production Number:                   13006
Production Date:                     22.11.2012
PCB Type:                            Survey Collar V 3.0

UTC Time:                            30.01.2013 13:05:04
```

UTC Correction:	+01:00
Default UTC Correction:	+01:00
User UTC Correction:	+01:00
Bootloader Version:	1.0.0
Bootloader Description:	
Bootloader Date:	22.11.2012
Firmware Version:	1.0.6
Firmware Description:	
Firmware Date:	09.01.2013
Main Voltage:	3.66 V
Temperature:	22 °C
GPS Max Fix Time:	180 s
GPS Fix Count:	20
Mortality Period:	24 h
Globalstar Attempts:	3
Globalstar ESN:	0-1234567
Beacon Frequency:	149.800 MHz
Beacon Minimum Frequency:	144.100 MHz
Beacon Maximum Frequency:	155.500 MHz
Beacon TX Power:	7 dBm
Beacon PLL Range:	8
Beacon Standard Pattern:	Pulse type: 1; Pulse length: 12 ms; Pulse Period: 1250 ms
Beacon Mortality Pattern:	Pulse type: 1; Pulse length: 6 ms; Pulse Period: 600 ms
Beacon Mortality Schedule:	[1] Controlled by schedule
GPS Schedule: User Defined Schedule used	
VERTEX GPS Rule	
Start date	01.01.2000
End date	31.12.2013
Period	1 day 00:00:00
Sequences	
Sequence	
Offset	12:30:00
Duration	01:00:00
Fix Rate	01:00:00
<vGpsSchedule>	
<vGpsRule startDate="2013-01-01" endDate="2013-12-31" period="P1DT0H0M0S" >	
<sequence offset="P0DT12H30M0S" duration="P0DT1H0M0S" fixRate="P0DT1H0M0S" />	

```
  </vGpsRule>
</vGpsSchedule>


Beacon Schedule: User Defined Schedule used
VERTEX Beacon Rule
  Start date         01.01.2013
  End date           09.01.2013
  Period             1 day 00:00:00
  Sequences
    Sequence
      Offset         08:00:00
      Duration       01:00:00
    Sequence
      Offset         10:00:00
      Duration       01:00:00

<vBeaconSchedule>
  <vBeaconRule startDate="2013-01-01" endDate="2013-01-09" period="P1DT0H0M0S" >
    <sequence offset="P0DT8H0M0S" duration="P0DT1H0M0S" />
    <sequence offset="P0DT10H0M0S" duration="P0DT1H0M0S" />
  </vBeaconRule>
</vBeaconSchedule>
```

Figure 58: Example of the Survey Collar Info File

4.2.2.3 Handheld Terminal

Devices ⇨ Handheld Terminal ⇨ Terminal ⇨ Information

Devices ⇨ Link Manager ⇨ Terminal ⇨ Information

The Handheld Terminal is a gadget to communicate with your collar.

Please refer to

Telemetry

Info File

4.2.2.3.1 Telemetry

Devices ⇨ Handheld Terminal ⇨ Information ⇨ Telemetry

Devices ⇨ Link Manager ⇨ Terminal ⇨ Information ⇨ Telemetry

This node reads out the information of the connected Handheld Terminal.

System Date	current date on the Handheld Terminal, usually set during a GPS fix
System Time	current time on the Handheld Terminal, usually set during a GPS fix
Software Version	version of the Handheld Terminal software
Software Date	release date of the Handheld Terminal software
Frequencies Uplink	frequency for the communication from the Handheld Terminal to the collar
Frequencies Downlink	frequency for the communication from the collar to the Handheld Terminal
Internal Voltage	current battery voltage; the Handheld Terminal will probably not work below 3.3 Volt, but this depends on the battery type
Internal Flag	internal status information needed for debugging

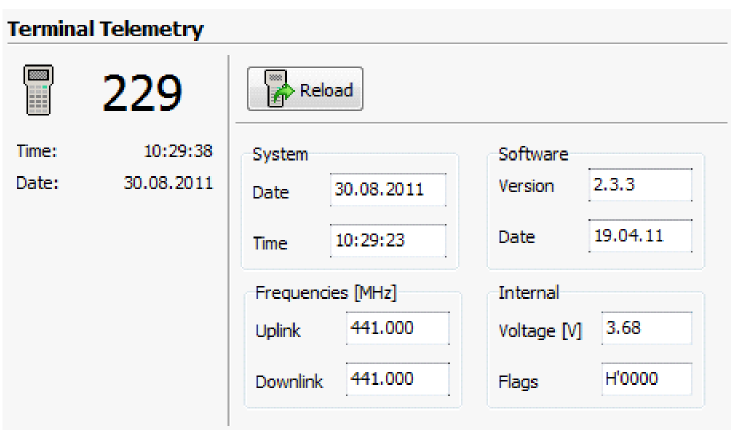


Figure 59: Frame with the Handheld Terminal telemetry

4.2.2.3.2 Info File

Devices ⇨ Handheld Terminal ⇨ Information ⇨ Info File

Devices ⇨ Link Manager ⇨ Terminal ⇨ Information ⇨ Info File

This node reads out the info file for the Handheld Terminal. It can be saved as .TXT file or printed directly.

Uplink/Downlink Frequency	frequency used for Handheld Terminal – collar communication; this will be either a VHF or a UHF frequency
Mark Positions	indicates if positions downloaded by VHF/UHF data communication will be marked as downloaded in the collar and not sent per GSM/IRIDIUM again (true), or if they will not be marked and sent later (false). For details see Configure positions

For more information please refer to Appendix C.2: Handheld Terminal.

```
Information file of Terminal No. 00229
Date of Readout                  30.08.2011, 12:54:29
-----------------------------------------------------
Terminal Date (UTC):    30.08.2011
Terminal Time (UTC):    10:48:29

Serial Number:          00229
Software Version:       2.3.3
Software Date:          19.04.11
Hardware Version:       4
Production Date:        02.04.2007

Uplink Frequency:       441.000 MHz
Downlink Frequency:     441.000 MHz

Mark Positions:         False
```

Figure 60: Terminal Info file

4.2.2.4 Trap Transmitter TT3

Devices ⇨ Remote Stick ⇨ Trap Transmitter ⇨ Information

Please refer to chapter Device Search for information on how to connect your TT3 to the PC.

Refer to:

Telemetry

Info File

4.2.2.4.1 Telemetry

Devices ⇨ Remote Stick ⇨ Trap Transmitter ⇨ Information ⇨ Telemetry

---

This node allows you to read the configuration and other information from a Trap Transmitter connected to the PC via USB Remote Stick.

Name	Unit	Value
SYSTEM		
Collar		
Production Number		64144
Production Date		2014-01-22
PCB Type		5 / 8 / 3 / 2
Collar ID		64144
Time		
Collar Time (UTC)		2000-01-01 00:29:53
Software		
Bootloader Version		1.0.5
Bootloader Description		Release
Bootloader Date		2014-01-29
Firmware Version		1.2.6
Firmware Description		Release
Firmware Date		2014-01-28
Power		
Remaining Battery Lifetime	d	55553
COMMUNICATION		
Globalstar		
Attempts		3
ESN		0-0737639
Channel		[2] C
BEACON		
Beacon Frequency	MHz	150,968
Beacon Min Frequency	MHz	145,000
Beacon Max Frequency	MHz	157,100
Standard Beacon		
Beacon Power	dBm	10
Pattern		Pulse type: 1; Pulse length: 20 ms; Pulse Period: 4000 ms
Start Time		2000-01-01 00:00:00
Cycle Period		1d 00:00:00
On Duration		1d 00:00:00
Triggered Beacon		
Triggered Beacon Power	dBm	10
Triggered Mode		[0] Always on
Triggered Pattern		Pulse type: 1; Pulse length: 20 ms; Pulse Period: 2000 ms
Triggered Start Time		2000-01-01 00:00:00
Triggered Cycle Period		1d 00:00:00
On Duration Triggered		1d 00:00:00

Figure 61: Telemetry Data for a Trap Transmitter

4.2.2.4.2 Info File

Devices ⇨ Remote Stick ⇨ Trap Transmitter ⇨ Information ⇨ Info file

This command transfers all information on the collar configuration into text which can be saved as .TXT file or printed directly.

We advise to create an info file each time the configuration of a directly connected Trap Transmitter has been changed. This way, you can look up the configuration and schedules while the Trap transmitter is in the field.

An example for an info file is given in Figure below.

```
Information file of Trap Transmitter collar no. 64144
Date of readout: 12.02.2014 15:10:04
GPS Plus X Version:    10.0.19.14023
------------------------------------

SYSTEM:
  Collar:
    Production Number:                  64144
    Production Date:                    22.01.2014
    PCB Type:                           5 / 8 / 3 / 2
    Collar ID:                          64144
  Time:
    Collar Time (UTC):                  01.01.2000 00:22:40
  Software:
    Bootloader Version:                 1.0.5
    Bootloader Description:             Release
    Bootloader Date:                    29.01.2014
    Firmware Version:                   1.2.6
    Firmware Description:               Release
    Firmware Date:                      28.01.2014
  Power:
    Remaining Battery Lifetime:         55553 d

COMMUNICATION:
  Globalstar:
    Attempts:                           3
    ESN:                                0-0737639
    Channel:                            [2] C

BEACON:
  Beacon Frequency:                     150.968 MHz
  Beacon Min Frequency:                 145.000 MHz
  Beacon Max Frequency:                 157.100 MHz
  Standard Beacon:
    Beacon Power:                       10 dBm
    Pattern:                            Pulse type: 1;  Pulse length: 20 ms;  Pulse Period: 4000 ms
    Start Time:                         2000-01-01 00:00:00
    Cycle Period:                       1d 00:00:00
    On Duration:                        1d 00:00:00
  Triggered Beacon:
    Triggered Beacon Power:             10 dBm
    Triggered Mode:                     [0] Always on
    Triggered Pattern:                  Pulse type: 1;  Pulse length: 20 ms;  Pulse Period: 2000 ms
    Triggered Start Time:               2000-01-01 00:00:00
    Triggered Cycle Period:             1d 00:00:00
    On Duration Triggered:              1d 00:00:00
```

Figure 62: Info File for a Trap Transmitter

4.2.3 Configuration

Choose your device:

GPS Plus and GPS PRO light collars

VERTEX collars (VERTEX Plus, Survey, VERTEX Lite)

Handheld Terminal

Trap Transmitter

4.2.3.1 GPS PLUS and GPS PRO collars

Devices ⇨ Remote Collars ⇨ GPS Plus Collars ⇨ Configuration

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration

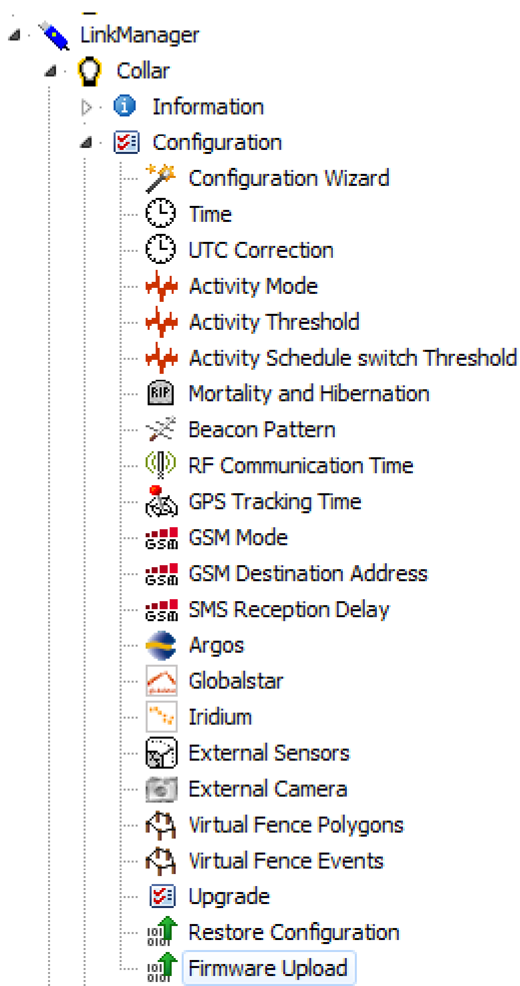


Figure 63: Collar Configuration

Refer to:

4.2.3.1.1 General Commands

Devices

Please familiarize yourself with the communication options before you deploy the collar to the animal (for an overview, please refer to Appendix E: Features).

Collar configuration includes communication and sensor options that might not be available for your collar. If the collar is connected to the PC via Link Manager, the settings for unavailable options will be greyed out. For remote collars or communication via Handheld Terminal, it is not possible to check whether an option is available, so you will be able to access all frames. However, sending commands to a collar will only be implemented if the collar has the abilities for it.

The device icons next to the chapter headings will inform you which communications are available to transmit the described command. You will find the commands in the respective device nodes at Configuration. The frames between the devices can differ, since the options for the single commands differ.

4.2.3.1.2 Notification panels

Not all collars are able to support each feature. Whenever you try to access a feature which is not supported by the collar that is currently connected via Link Manager, GPS Plus X will check whether the collar's hardware and software support this feature. If not, you will get one of these notifications in your frame:

If the hardware version of the collar is not able to support a feature (e.g. because the collar has no UHF communication needed for an external sensor or the hardware is too old), your frame will show an orange bar underneath the 

and 

buttons.

Figure 64: Collar does not support this feature

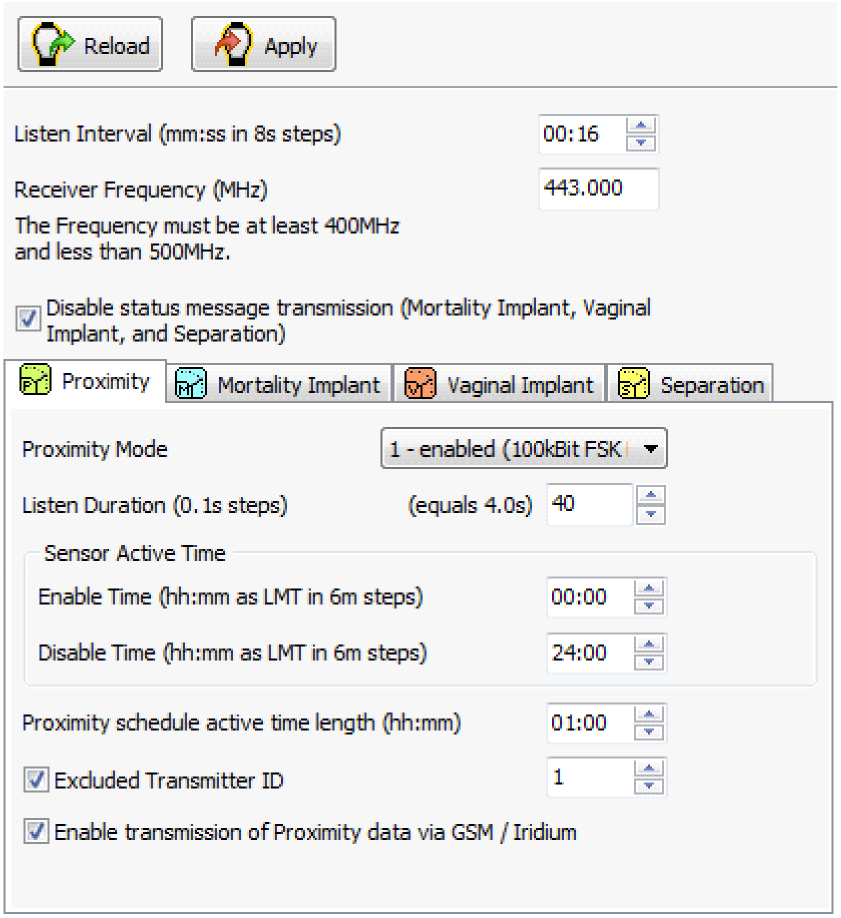


Figure 65: External Sensors frame

If the software version on the collar is not able to support a sensor, the tab of this sensor will show a yellow bar. In this case, a collar firmware update might enable you to use the feature, if the collar has the necessary hardware (please contact VECTRONIC Aerospace for details).

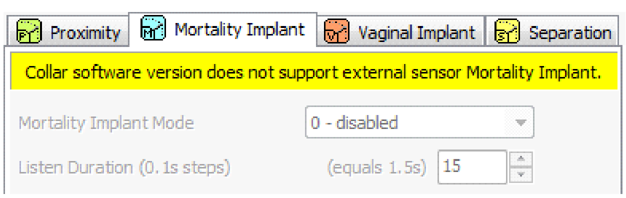


Figure 66: Mortality Implant tab accessed with a collar which software does not support the implant reception.

4.2.3.1.3 Configuration Wizard

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Configuration Wizard

The configuration wizard allows you to define the most common configurations for a collar connected via Link Manager. You will be guided through the process with the Help Area. For more information on single parameters, please refer to the explanation in the following chapters.

At the beginning, the wizard will read out the current configuration of the collar. Only those parameters which the collar is able to perform are displayed. For a GSM collar for example, no IRIDIUM configuration will be accessible.

With Next, you can move to the next parameter, read the current settings, and change them if necessary. Please see the example picture below for setting the collar time. You will find short explanation to the configuration made on this point in the yellow field. The input form will be similar to those in the remaining collar configuration node.

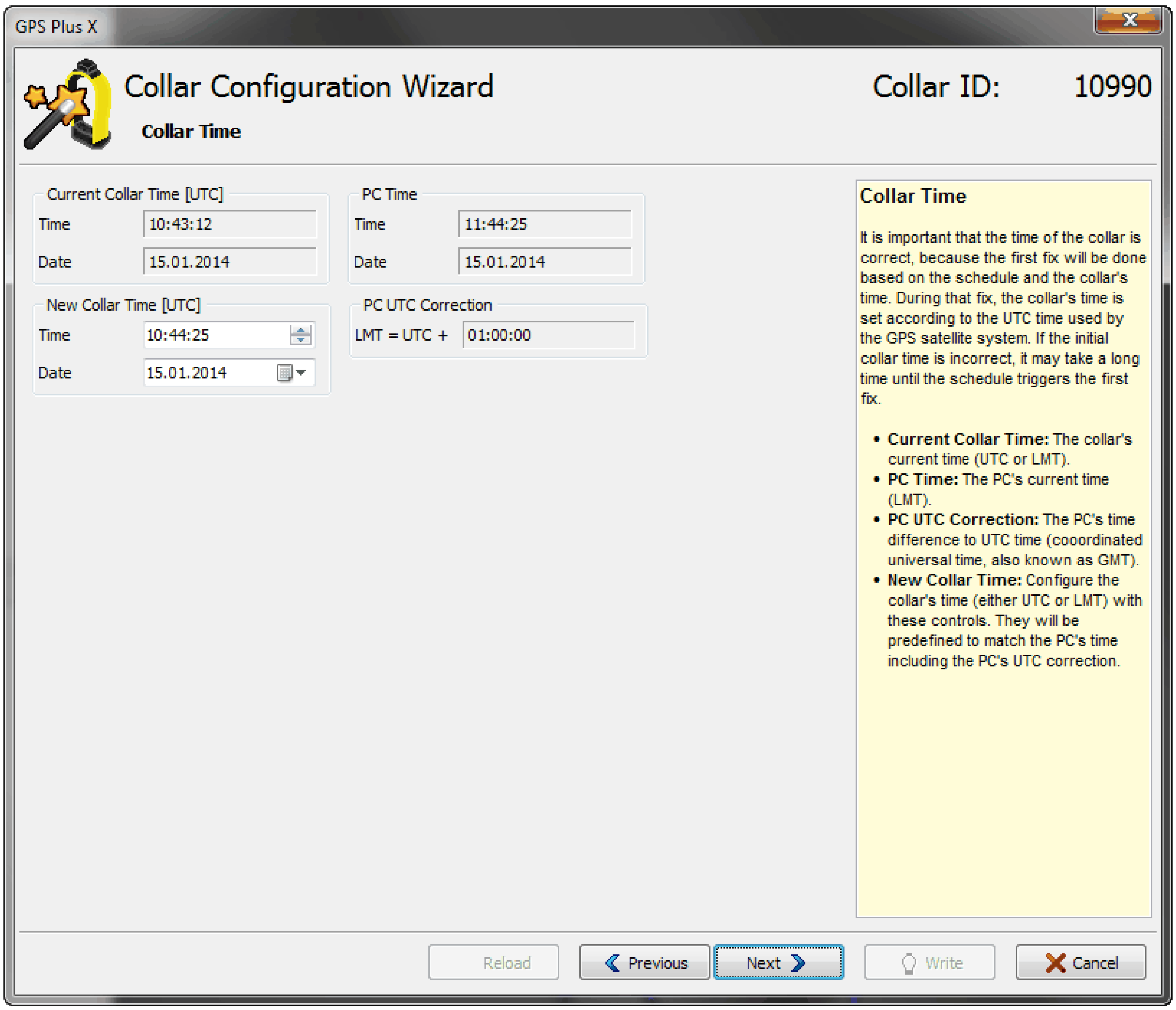
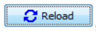


Figure 67: Collar Configuration Wizard - Collar Time

Cancel aborts the wizard and you return to the main window. With Previous, you can return to a parameter which has already been displayed. With Reload, you can read out the configuration for the currently displayed parameter from the collar again.

Note: If you press , your already made changes for this parameter will be lost.

The configuration will not be written to the collar before the very end of the configuration process.

After all available parameters have been configured, you will be prompted to write the new configuration into the collar.

Until now, nothing has been changed in the connected collar. If you press , a progress bar will appear. A window will inform you now that the collar will not be responsive for several seconds. After the new configuration has been received by the collar, an info file will be displayed and can be stored as .TXT file (picture below) or printed out.

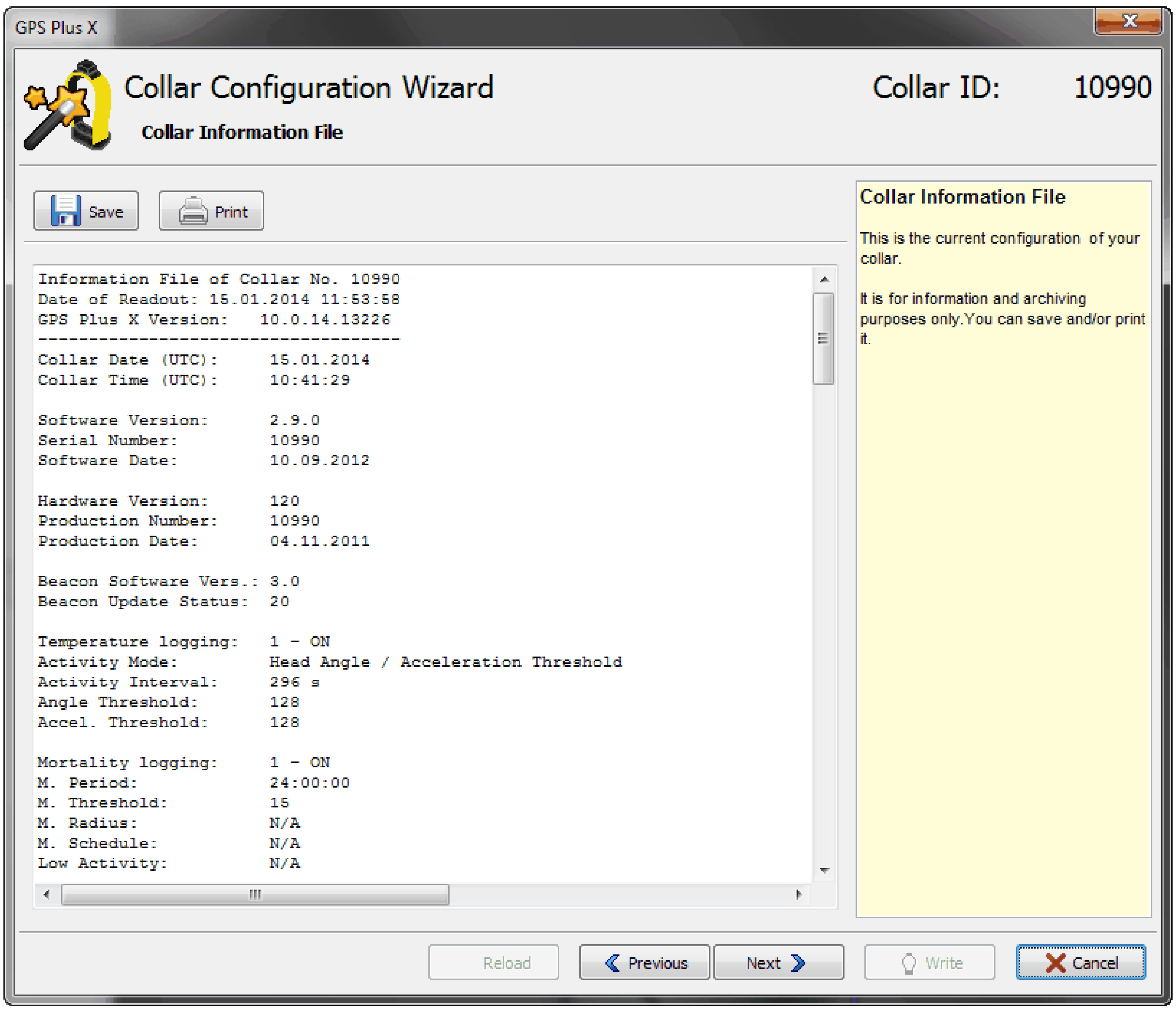


Figure 68: Collar Configuration Wizard - Collar Information file

<u>**Note**</u>: After the collar configuration has been changed, it might be advisable to delete the data still on the collar. In case of activity data this is necessary, because the existing data will be labelled according to the new activity mode and are therefore invalid. If you choose not to delete the old data, you take the risk to store the data in the wrong channels and with the wrong time stamp.

4.2.3.1.4 Time – Setting the collar's time

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Time

To have the correct time and date after battery replacement, it is important to set the correct time and date in every collar. The program suggests the time and date of the PC adjusted by the UTC correction configured at **Configuration** ⇨ System ⇨ UTC Correction (see System UTC Correction). You will notice that the displayed time continues to run. To change the time, click on the hours, minutes, or seconds and then click on the up or down arrows. To change the date click on the drop-down arrow and a calendar will open; select a date in the calendar. Finally, set the time by clicking Apply. While GPS Plus X contacts the collar, the time will continue internally until the moment in which the command is sent.

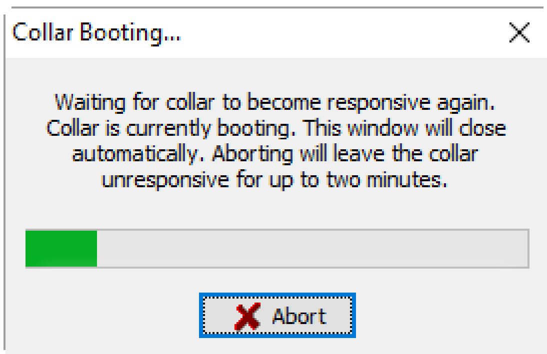


Figure 69: Collar Booting

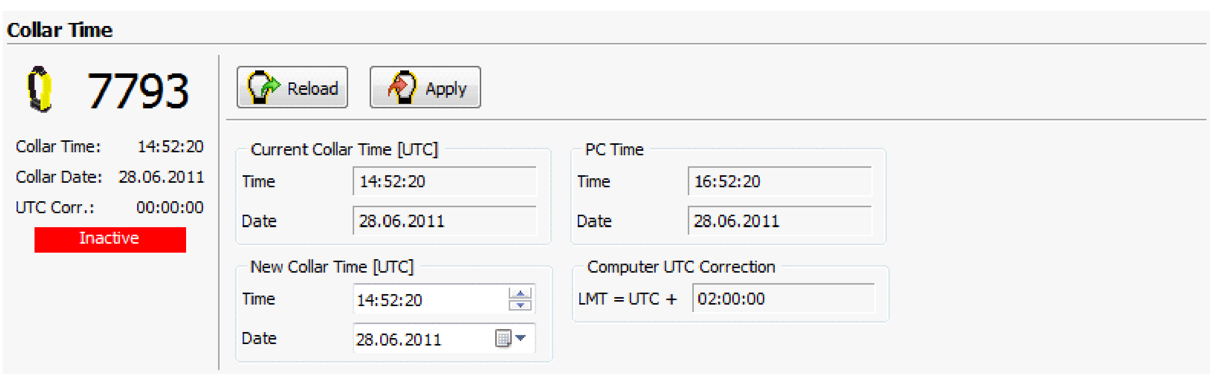


Figure 70: Frame to set the collar's time

Note: With each GPS fix, the collar time is reset to the correct UTC time. It is thus not possible to synchronise the collar with another time, e.g. a clock running in your office, than the GPS satellite system's time. Also, UTC correction in the collar cannot be enabled by sending the local mean time to the collar, but by sending the UTC correction command only.

4.2.3.1.5 UTC Correction

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ UTC Correction
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Collar Configuration

---

For technical reasons, the collars will always run on UTC (Universal Time Coordinated) which is also used by the GPS satellite system.

If you want to write schedules in LMT (Local Mean Time), you can set the UTC Correction.

The collar will then translate your schedules from LMT (as programmed by your UTC correction) to UTC (which the collar uses) and take the positions at the correct time. To set the UTC correction, check Enable Collar UTC Correction. Then enter the correction term by clicking on the hours or minutes and using the up/down arrows.

UTC corrections for time zones east of Greenwich are labelled with +, those west of Greenwich with –.

Upload via Link Manager: Press Apply to send the command to the collar. Upload via Handheld Terminal: Select the parameter Collar UTC Correction. Press to send it to the Handheld Terminal.

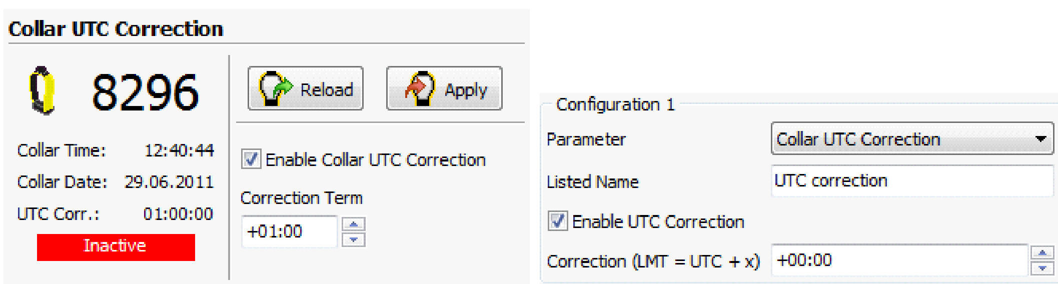


Figure 71: Frame to set the UTC correction with the Link Manager (left) or the Handheld Terminal (right)

4.2.3.1.6 Activity Mode

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Activity Mode

---

The activity sensor in the collar (optional) measures activity 4 to 8 times per second, depending on collar type and firmware version.

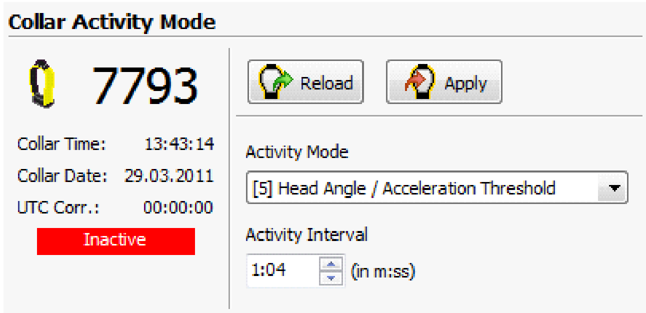


Figure 72: Frame to select the activity mode and interval

The first step in this frame is to select an activity mode. For details on activity modes and intervals, refer to the Activity Pattern software manual (You can find it on our website). Activity can be measured on three axes, forward-backward motion (X-axis), sideways motion (Y-axis), and up-down motion (Z-axis). There are also different sampling intervals to select.
The available activity modes are:

1 – 300s Activity Measurement:	Accumulated activity on the X and Y axis is stored in 296 s intervals, the time series is regularly corrected to 300 s intervals.
2 – 152s Activity Measurement:	Accumulated activity on the X and Y axis over a sampling interval of 152 seconds.
3 – 64s Activity Measurement:	Accumulated activity on the X and Y axis over a sampling interval of 64 seconds; it is the smallest storing interval available.
4 – Activity Measurement:	Accumulated activity on the X and Y axis over a predefined interval; intervals can be chosen in 8 second steps.
5 – Head Angle / Acceleration Threshold:	This mode measures two parameters and stores them in two channels: · Head Angle / Head up: Gives the ratio of measurements on the X axis within one sampling interval in which the head angle exceeds a user-defined angle towards the vertical axis. · Acceleration: Gives the ratio of combined measurements on all three axes within one sampling interval in which the acceleration exceeds a user-defined threshold.
6 – Acceleration Peak / Acceleration Threshold:	This mode measures two parameters and stores them in two channels: · The maximum acceleration measurements on all three axes within one sampling interval. · The ratio of acceleration measurements on all three axes within one sampling interval below and above a user-defined activity threshold.

7 – Forth-Back/Up-Down:	Accumulated activity on the X and Z axis over a predefined interval; intervals can be chosen in 8 second steps. The interval in which the activity data are stored is fixed for modes 1-3, but can be chosen in modes 4-7 in 8 second steps with the corresponding up-down control. You can also type in a number, but it will be automatically corrected to a multiple of 8 seconds. Press Apply to send the command to the collar.

If you change the activity mode or interval, all activity data will be erased from the collar. This avoids the mixture of data measured with different activity modes. The following messages will appear:

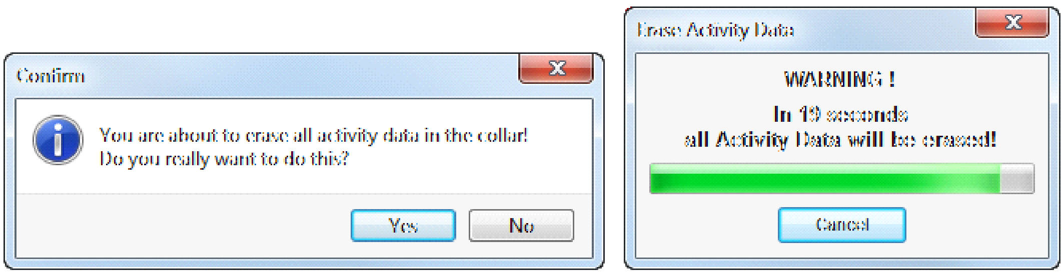


Figure 73: Changing the activity mode: warning before activity data is erased.

If you select No in the first window, the activity mode will not be changed. The second window will give you 20 seconds before the collar begins to erase the activity data. After these 20 seconds, there is no way to stop the deletion of the data, and they cannot be restored!

GSM This parameter can be configured in remote collars too, but you need a special configuration file which is sent to the collar. Please contact VECTRONIC Aerospace for details.

4.2.3.1.6.1 Activity: Head Angle and Activity Threshold

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Activity Threshold

For mode 5 (Head Angle / Acceleration Threshold) and mode 6 (Acceleration Peak / Acceleration Threshold) only, you need to define a head angle and an acceleration threshold. Both can be set by typing in a number or using the up-down control. Press Apply to send the command to the collar.

Angle-Threshold	sensor will log the ratio of measurements on the X axis within one sampling interval in which the head exceeds this angle towards the vertical axis
Acceleration Threshold	ratio of acceleration measurements on all three axes within one sampling interval below and above this threshold

To view values in relation to the position and movement of the collar, click Display Test Measurement. A new window will open (Figure below, right) which displays the values currently measured by the connected collar. Move the collar to see how the values change.

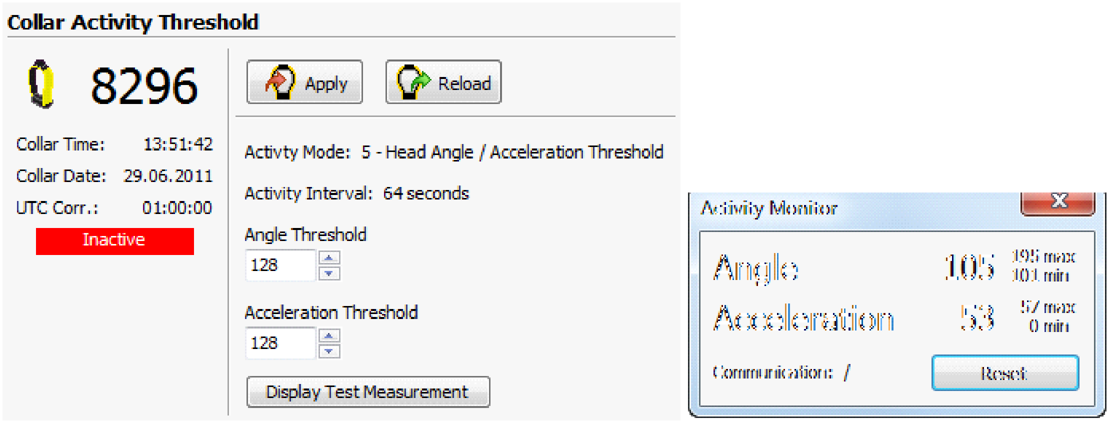


Figure 74: Frame to set the activity thresholds (left), real time monitor for collar angle and acceleration (right).

These parameters can be configured in remote collars too, but you need a special configuration file which is sent to the collar. Please contact VECTRONIC Aerospace for details.

4.2.3.1.7 Mortality Sensor and Hibernation Mode

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Mortality and Hibernation

This frame configures one sensor, but three different features. A mortality event is triggered if the collar has registered activity below the defined Mortality Threshold for the time span given as Mortality Period [h]. A low activity event is triggered if the collar has registered activity below the defined Low Activity Threshold for the time span given as Low Activity Period [h].

Please note that the Mortality Threshold needs to be smaller than the Low Activity Threshold.

The position at which the animal is assumed to be dead or showed low activity, will be fixed. Around this position a radius is set up which you can define (Mortality Radius or Low Activity Radius). You can define the radius in 10m-steps up to 2500 meters. Please use a value bigger than 10 meters as the GPS has an inaccuracy of up to 10 meters within position data. When the radius was set up, every position data has the additional information about the animal’s status and if it is positioned within the defined radius.

In case of a mortality or low activity event, the collar will take 14 consecutive positions which are sent via GSM or GLOBALSTAR. The amount of positions taken after the corresponding event, is at least 10 when using IRIDIUM communication. In case of mortality or low activity event, a message is sent via IRIDIUM or GSM. In addition, the VHF beacon signal will be changed to mortality pattern

If you enable the Mortality 30 Minute Schedule or Low Activity 30 Minute Schedule, the collar will take a

position fix every 30 minutes for 6 hours after the fixes triggered by the event were sent.
If the animal's activity exceeds the defined threshold for at least 15 minutes, the status is removed to the next higher level, e.g. from mortality to low activity.

The hibernation mode is independent from the mortality mode. If activity values are below the Wakeup Activity Level, after a time span given as Hibernation Delay Time [h], the collar enters hibernation mode. In collars with firmware 2.8.4 or higher, a GPS fix will be taken once a day and sent according to the communication settings. In collars with older firmware, no attempts will be made to get a GPS fix. As soon as activity exceeds the Wakeup Activity Level, the collar will return to its standard GPS schedule. If you do not want to use the hibernation sensor, set the Hibernation Delay Time on OFF.

After selecting your settings, press Apply to send the command to the collar.

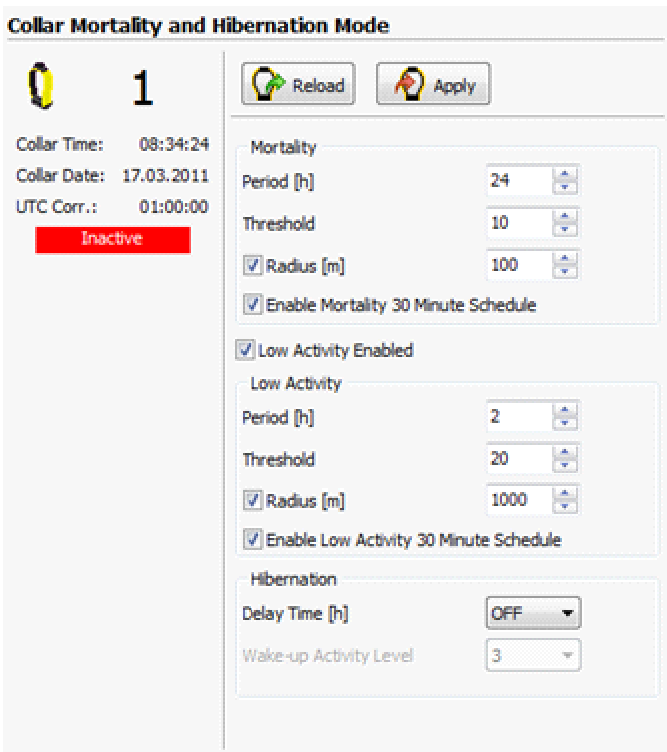


Figure 75: Frame for the mortality and hibernation settings

These parameters can be configured in remote collars too, but you need a special configuration file which is sent to the collar. Please contact VECTRONIC Aerospace for details.

Refer to:

Mortality Period Configuration

Mortality Extended Configuration

Low Activity Configuration

4.2.3.1.7.1 Mortality Period Configuration

Devices ⇨ Remote Collars ⇨ Configuration ⇨ Mortality Period

In this frame, you can send the settings for the mortality period remotely to the collar. The mortality period is a time span given in days and hours. If the registered activity is below the Mortality Threshold for the Mortality Period [h] which is you can set here, a mortality event is triggered.

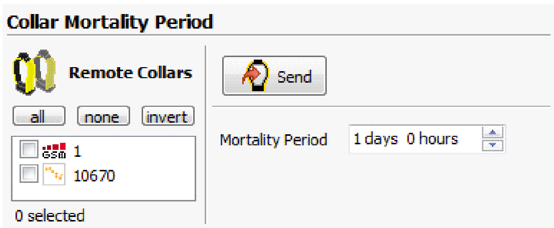


Figure 76: Frame for the mortality and hibernation settings

4.2.3.1.7.2 Mortality Extended Configuration

Devices ⇨ Remote Collars ⇨ Configuration ⇨ Mortality Extended Configuration

In this frame, you can configure the Mortality Threshold, the Mortality Radius and enable Extended Transmission.

Via GSM or IRIDIUM, the configurations can be sent to the collars remotely.

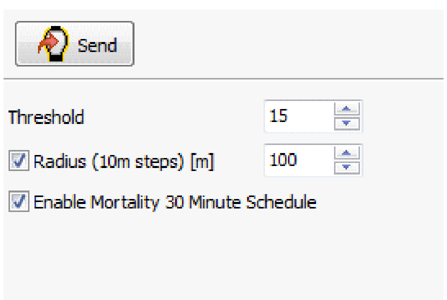


Figure 77: Mortality Extended Configuration frame

4.2.3.1.7.3 Low Activity Configuration

Devices ⇨ Remote Collars ⇨ Configuration ⇨ Low Activity Configuration

In this frame, you can enable the Low Activity function by clicking on Low Activity Enabled.

Afterwards, you can configure the Low Activity Period as well as the Low Activity Threshold, Radius and Extended Transmission.

Via GSM or IRIDIUM, the configurations can be sent to the collars remotely.

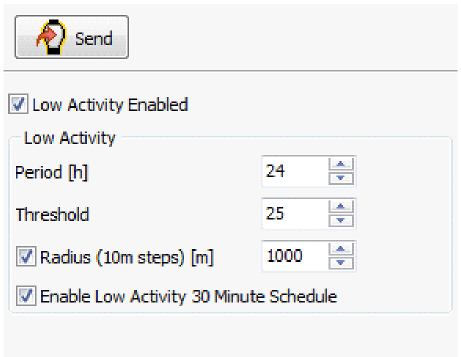


Figure 78: Low Activity Configuration frame

4.2.3.1.8 Beacon Pattern

[**Devices**]() ⇨ [Link Manager]() ⇨ Collar ⇨ [Configuration]() ⇨ Beacon Pattern

---

This option allows you to change the sound pattern of the collar's VHF beacon (if enabled) without changing the VHF frequency or the pulse duration. This feature can help you to distinguish different collars using the same VHF beacon frequency. You can choose from four different patterns (for more details refer to Play Beacon Patterns). Listen to the pattern by clicking on the speaker button. Press Apply to send the command to the collar. This pattern is independent form the Emergency and Mortality signal, which is sent by the collar if battery is low or in case of a mortality event.

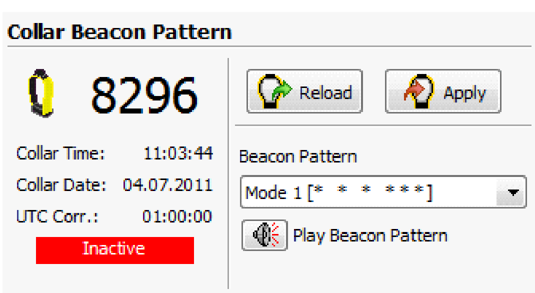


Figure 79: Frame to set the beacon pattern

4.2.3.1.9 RF Time for data communication

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ RF Communication Time
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Collar Configuration

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If your collar is equipped with VHF or UHF data communication, you can define the times of the day during which this communication will be switched on. By switching it off for several hours, e.g. at night, you can save battery. Set the time when the communication will be switched on (Communication Enable Time) and the time when it will be switched off (Communication Disable Time). You can define only one daily window. If you select an Enable Time later than the Disable Time, the communication time will start on one day (e.g. at 22:00), include midnight, and stop on the second day (e.g. at 05:00). Depending on your UTC correction, the communication time will be given in UTC or LMT.

Upload via Link Manager: Press Apply to send the command to the collar.

Upload via Handheld Terminal: Select the parameter RF Communication Time. Press to send it to the Handheld Terminal.

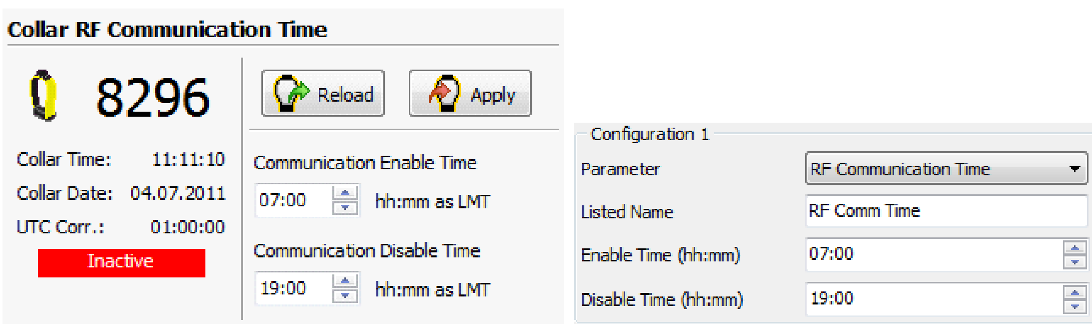


Figure 80: Frame to set the RF Communication Time with the Link Manager (left) or the Handheld Terminal (right).

4.2.3.1.10 GPS Tracking Time

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ GPS Tracking Time

---

For each scheduled GPS fix, the GPS device of the collar will take several positions in a predefined time and store the most precise of these positions. To increase the accuracy of a position (and thus decrease its mean deviation), the tracking time of the GPS device can be extended for up to 45 seconds. Though this will increase the accuracy of the stored fix, it will also increase the energy consumption of the collar. Select your Tracking Time Extension and press Apply to send the command to the collar.

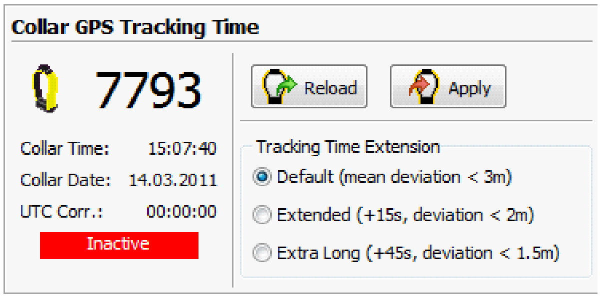


Figure 81: Frame to set the GPS Tracking Time

4.2.3.1.11 Number of fixes per SMS (GSM Mode)

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ GSM Mode
Devices ⇨ Remote Collars ⇨ Configuration ⇨ GSM Mode

This frame will configure your GPS fix transmission via GSM. The GSM Mode defines the number of fixes transmitted in one SMS and whether the collar will resend the SMS if the sending was not successful. In collars with firmware higher than 2.7.1, the collar will try to repeat the transmission in any case. For details on the different GSM modes please refer to Appendix F: F.1 GSM.

Upload via Link Manager: Press Apply to send the command to the collar. In the same process, you are able to configure the Position Transmission (see Position Transmission (GSM and IRIDIUM collars only).
Upload via Remote Collars: Select the receiving GSM collars and press Send (Figure 71, right). If you also want to change the Position Transmission in a remote collar, it has to be sent as an independent command (see Position Transmission (GSM and IRIDIUM collars only).

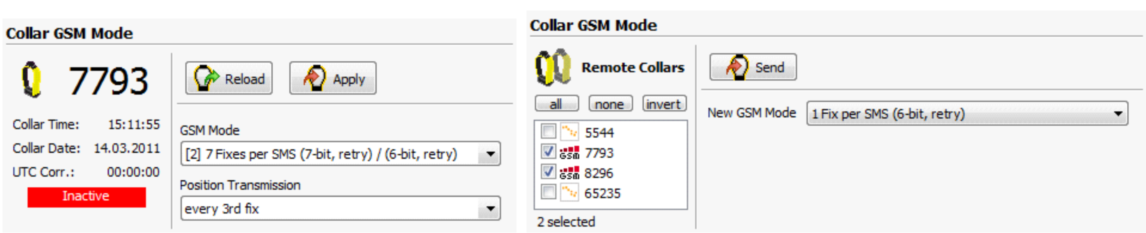


Figure 82: Frame to configure the GPS Mode with the Link Manager (left) and with GSM communication (right).

Note: Not all providers support the transmission of seven fixes per SMS. If in doubt, please contact VECTRONIC Aerospace or your GSM provider.

4.2.3.1.12 GSM Destination Address

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration⇨ GSM Destination Address
Devices ⇨ Remote Collars ⇨ Configuration ⇨ GSM Destination Address

This frame allows you to change the destination address of a GSM collar. This is the phone number to which the collar will send its SMS messages, which means either your own GSM ground station, or the GSM ground station of VECTRONIC Aerospace. GPS Plus X will only accept phone numbers with a leading + and at least five digits. Otherwise, the input field will remain red and the Apply/Send button will stay disabled.

Upload via Link Manager: Press Apply to send the new number to the collar.
Upload via Remote Collars: Select the receiving GSM collars and press Send.

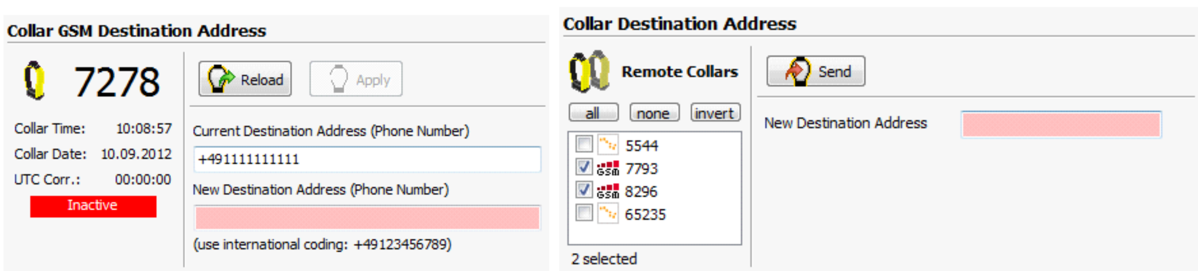


Figure 83: Frame to set the GSM destination address with the Link Manager (left) and with GSM / IRIDIUM communication (right).

4.2.3.1.13 SMS Reception Delay

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ SMS

Reception Delay by default, the collar's GSM engine will be switched on to send a SMS, listen to incoming messages immediately after all SMS have been sent, and switch off again. To increase the chance that the collar will receive new schedules or commands in real time, you can delay the interval for SMS reception. You can change the SMS Reception Delay in steps of eight seconds. Press Apply to send the command to the collar. The modem will stay switched on for this time to listen.

Please note that the SMS reception delay will shorten the lifetime of your collar.

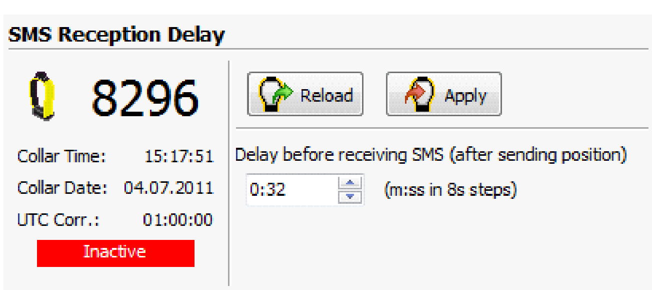


Figure 84: Frame to set the SMS reception delay

4.2.3.1.14 Number of positions per Iridium message (Iridium Mode)

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Iridium
Devices ⇨ Remote Collars ⇨ Configuration ⇨ Iridium Mode

This frame will configure your GPS fix transmission via IRIDIUM. The IRIDIUM Mode defines the number of fixes transmitted in one message.

Upload via Link Manager: Press Apply to send the command to the collar. In the same process, you are able to configure the Position Transmission (see Position Transmission (GSM and IRIDIUM collars only)).

Upload via Remote Collars: Select the receiving IRIDIUM collars and press Send. If you also want to change the Position Transmission in a remote collar, it has to be sent as an independent command (see Position Transmission (GSM and IRIDIUM collars only)).

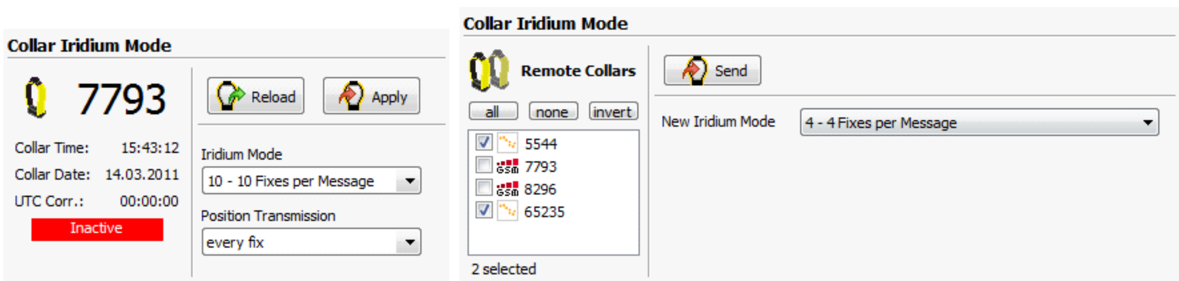


Figure 85: Frame to configure the IRIDIUM transmission with the Link Manager (left) and with IRIDIUM communication (right).

4.2.3.1.15 Position Transmission (GSM and Iridium collars only)

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ GSM Mode or Iridium Mode
Devices ⇨ Remote Collars ⇨ Configuration ⇨ Position Transmission

---

By default, each position taken by the collar is sent via GSM or IRIDIUM. With the Position Transmission you can program the collar to send only every second, third, fourth etc. The highest option is every 16th position. All positions obtained by the collar are stored in the collar’s memory and can be downloaded via VHF/UHF radio communication or Link Manager. By skipping positions, you can save energy and costs for transmissions, especially if you have short GPS intervals.

Upload via Link Manager: If your collar is connected via Link Manager, you can configure the Position Transmission at the GSM Mode or the IRIDIUM Mode node (Figure Frame to configure the GPS fix transmission with the Link Manager for a GSM collar (left) and a collar IRIDIUM (right).); make sure to select the correct communication, because the GSM/IRIDIUM Mode will be reconfigured with the Position Transmission. The drop-down list will give you the number of the GPS fix that will be sent. Press Apply to send the command to the collar.

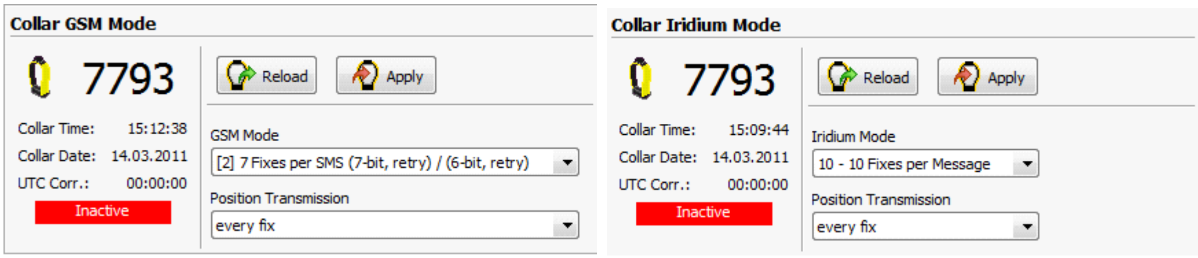


Figure 86: Frame to configure the GPS fix transmission with the Link Manager for a GSM collar (left) and a collar IRIDIUM (right).

Note: This command can also change the GSM or IRIDIUM Mode. Before making any changes on this parameter, refer to chapter GSM Mode.

Upload via Remote Collars: If you want to configure the Position Transmission remotely via GSM or IRIDIUM, you will find a special Position Transmission node at Remote Collars **Frame to configure the GPS fix transmission remotely via GSM or IRIDIUM.**. Simply select which fix will be sent, select the collar IDs from the remote collar list, and press [Send]. You can send the command to GSM and IRIDIUM collars in one step, since this command does not influence any other setting.

For more information please refer to Appendix F.1: GSM and Appendix F.2: IRIDIUM.

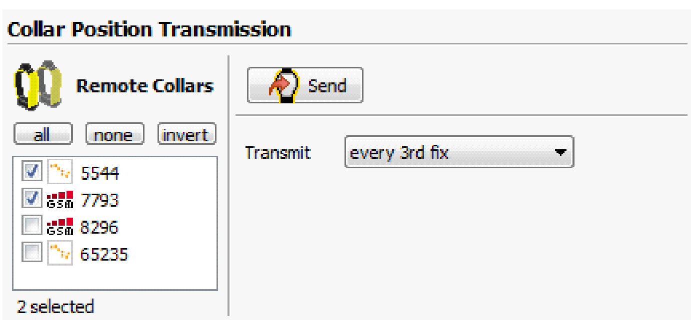


Figure 87: Frame to configure the GPS fix transmission remotely via GSM or IRIDIUM.

4.2.3.1.16 Number of positions per message and transmission mode for Globalstar (Globalstar Mode)

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Globalstar

This frame will configure the GPS fix transmission via GLOBALSTAR. The Transmission Mode defines whether every fix is transmitted, or only every second, third, fourth, etc. The remaining fixes can be downloaded after retrieving the collar or remotely with the VHF data communication (if available in the collar). Fixes per Message defines how many fixes are transmitted in one GLOBALSTAR message. You can transmit one or two fixes per message. Both settings work independent from each other. After selecting your settings, press [Apply] to send them to the collar.

For more information please refer to Appendix F.3: GLOBALSTAR.

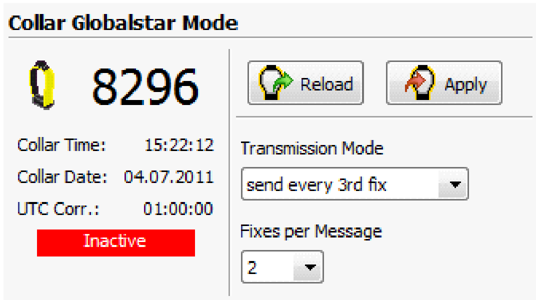


Figure 88: Frame to configure the GLOBALSTAR transmission

4.2.3.1.17 External Sensors

Devices ⇨ Remote Collars ⇨ Configuration ⇨ Proximity Mode (proximity only, all parameter are configured on separate nodes)
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Collar Configuration (proximity only, all parameters are configured separately)
Devices Link manag

All VECTRONIC GPS Plus collars with UHF communication (collars produced in 2012 or later, Firmware Version 2.8.3) can receive data from external transmitters.

A detailed explanation of the function of these sensors is given in Appendix A: External Sensors.

The available sensors are:

Proximity Sensor	This sensor records the numbers of UHF ID tags deployed on other animals and provides a list of encounters with time and strength of the UHF ID signal. These data can be downloaded via Link Manager, UHF communication,and (partly) GSM or IRIDIUM. If one or more ID signals are received by the collar, a proximity event will be recorded and the GPS schedule can be changed (optional).
Separating Sensor	This sensor records the numbers of UHF ID tags deployed on other animals, e.g. calfs. It works similar to the proximity sensor, but at each listen attempt the reception of all Separation ID tags is checked and stored as received (true) or missing (false). If the signal of one UHF ID tag has not been received for one hour, a separation message is sent by the VECTRONIC GPSPlus collar (optional). The list of received IDs can be downloaded via Link Manager or UHF communication, but not via GSM or IRIDIUM.

Mortality Implant	This sensor records signals from an implant inside the rumen or abdominal cavity of the animal. If no heart beat is registered anymore, a mortality message will be sent by the VECTRONIC GPS Plus collar (optional).
Vaginal Implant	This sensor records signals from an implant inside the vagina. During birth, the implant is pushed out of the vagina and the decrease in temperature triggers two event messages (birth and separation) from the VECTRONIC GPS Plus collar `(optional).

If you want to reconfigure the entire proximity sensor or any other external sensor, please contact VECTRONIC Aerospace for assistance.

4.2.3.1.17.1 External Sensors via Link Manger

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ External Sensors

Full configuration of the external sensors is only possible with the Link Manager. The proximity sensor can also be reconfigured with the UHF Handheld Terminal and via GSM or IRIDIUM.

It is possible to use all sensors simultaneously, because they are using the same hardware. For this reason, the Listen Interval and the Receiver Frequency are the same for all sensors.

Listen Interval	time span between two listening attempts by the sensor; in between these attempts, no ID tags are logged.
Receiver Frequency	frequency of the external transmitter; it is defined by VECTRONIC Aerospace and should not be changed, otherwise external data cannot be received!

If you are not interested in receiving status messages of the Mortality Implant, Vaginal Implant or Separation Sensor, you can check “Disable status message transmission” (for Mortality Implant, Vaginal Implant, and Separation). This way, you will not receive any status messages of these external sensors anymore.

The frames for the specific sensors will be described in the following section.

The External Sensors frame is shown in Figure below. If a sensor is disabled, its settings will be greyed out. In this case, you can enable the collar by changing the sensor mode on top of the sensor tab.

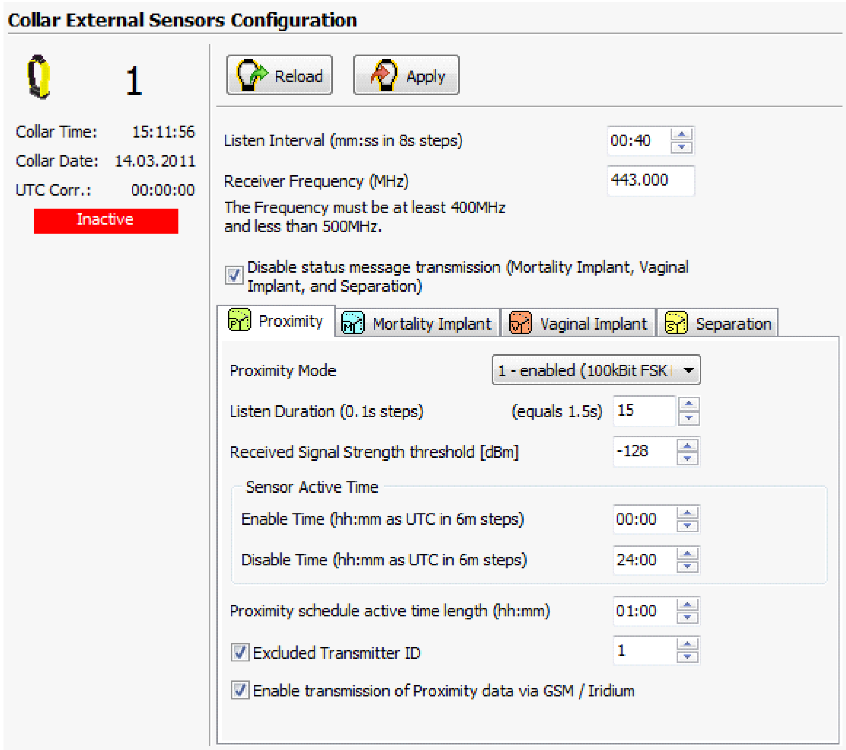


Figure 89: Frame to configure the external sensors available with VECTRONIC GPS Plus UHF collars. The different sensors can be configured on their specific tabs.

The remaining parameters can be configured for each sensor separately (Figure Tabs for the different external sensors Upload via Remote Collars (Proximity Sensor only), but since the same hardware is used for all sensors, some settings influence each other. Parameters used in all sensors are (SENSOR is used as place-holder for the respective sensor):

SENSOR Mode	this parameter enables or disables the sensor
Listen Duration	time span during which the specific sensor is listening in one attempt. The interval between attempts is defined with the Listen Interval. The Listen Duration can differ between sensors, but if more than one sensor is active at one time, the sensor will be switched on for the longest Listen Duration
Sensor **Active Time**	time of day, in which the specific sensor is active; this can differ between sensors, but the collar's sensor chip is active as long as one sensor is active.

Refer to:

[Proximity Sensor]

[Mortality Implant]

[Vaginal Implant]

[Separation Sensor]

Proximity sensor:

Received Signal Strength Threshold	threshold of the signal strength. When the signal strength exceeds this threshold, a proximity event is detected
Excluded Transmitter ID	you can select one transmitter ID which signal will be ignored by the proximity sensor; this setting is useful if the VECTRONIC GPS Plus collar has a UHF ID tag too
Enable transmission of Proximity data via GSM / IRIDIUM	If checked, the collar will send a proximity message with each position SMS or IRIDIUM message; this message contains the ID numbers of all encountered UHF ID tags and the time stamp of the message

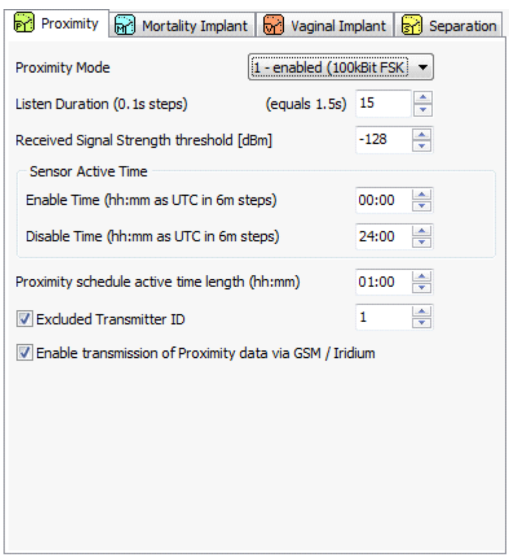


Figure 90: Tab for Proximity sensor

Mortality Implant:

Mortality Implant Transmitter ID	defines the ID number of the mortality implant to ensure that the collar receives data from the correct implant. If two individuals with implants are close to each other it is possible that a sensor receives the implant from the other individual

Enable transmission of mortality event message via GSM / IRIDIUM	If checked, the collar will send a mortality implant message and shortly thereafter a mortality event message via GSM or IRIDIUM if the implant has not detected any heart beat for at least 1.5 minutes

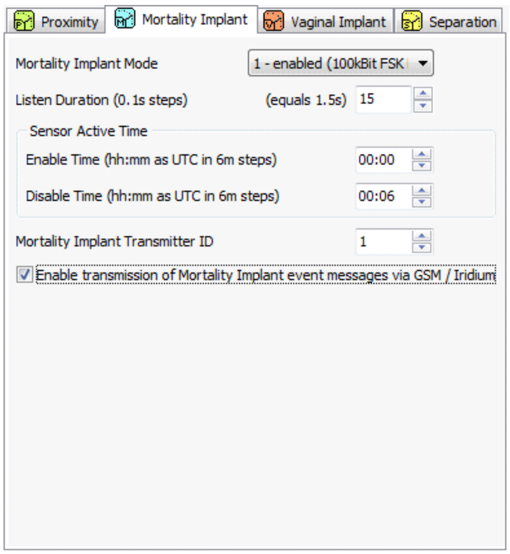


Figure 91: Tab for Mortality Implant

Vaginal Implant:

No contact detection delay	defines a delay time. You will be informed that the collar has no contact to the implant anymore after the delay time is over
Vaginal Implant Transmitter IDs	define the ID number of the vaginal implant to ensure that the collar receives data from the correct implant. If two individuals with implants are close to each other it is possible that a sensor receives the implant from the other individual
Enable transmission of vaginal event messages via GSM / IRIDIUM	If checked, the collar will send a vaginal message and a separation message is sent via GSM or IRIDIUM if the temperature measured by the implant falls below a pre-configured temperature (default 34°C)

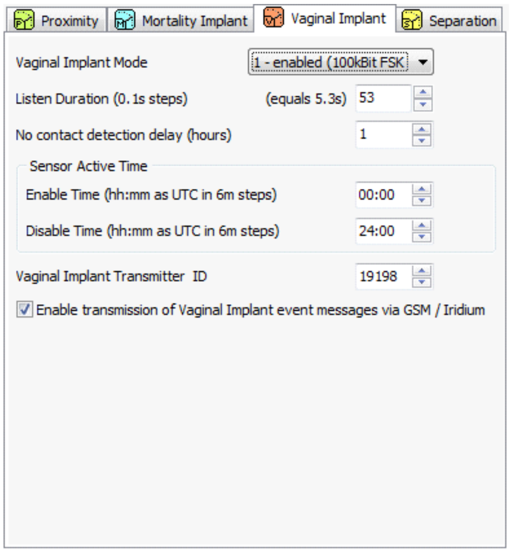


Figure 92: Tab for Vaginal Implant

Separation sensor:

No contact detection delay	defines a delay time. You will be informed about the separation event after the defined delay time has exceeded
Separation Transmitter IDs	you can define up to eight transmitter IDs, which will be monitored by the collar
Enable transmission of separation message via GSM / IRIDIUM	if checked, the collar will send a separation message via GSM or IRIDIUM if an ID tag’s signal has not been received for one hour

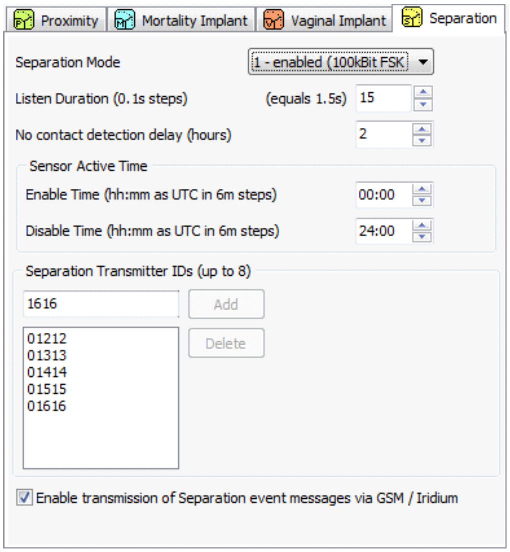
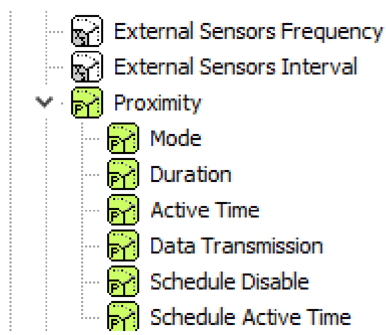


Figure 93: Tab for Separation sensor

4.2.3.1.17.2 External Sensors via GSM or Iridium



Devices ⇨ Remote Collars ⇨ Configuration ⇨

For GSM or Iridium collars, all proximity sensor settings have their own nodes (picture below).

You need to configure the parameter, which needs to be changes. Than choose the GSM and/or IRIDIUM collar IDs and press Send.

External Sensor Frequency	radio frequency of the communication between collar and external sender
External Sensor Interval	time span between two listening attempts by the sensor
Proximity Mode	here you can enable or disable the Proximity Mode
Proximity Duration	listening duration of the collar

Proximity Active Time	time over the day, where the collar proximity is active
Proximity Data Transmission	If enabled, the collar will send a proximity message with each position SMS or IRIDIUM message; this message contains the ID numbers of all encountered UHF ID tags and the time stamp of the message
Proximity Schedule Disable	This command disables the proximity schedule on the collar. The schedule can only be enabled again by sending a new proximity schedule. For collars directly connected via Link Manager, you can delete the proximity schedule at the Schedule node
Prox. Schedule Active Time	In this frame you can set up the time in which the Proximity Schedule is active after the proximity event. The configured time span will always start after a proximity event was detected.
Separation Transmitter ID's	you can define up to ten transmitter IDs, which will be monitored by the collar

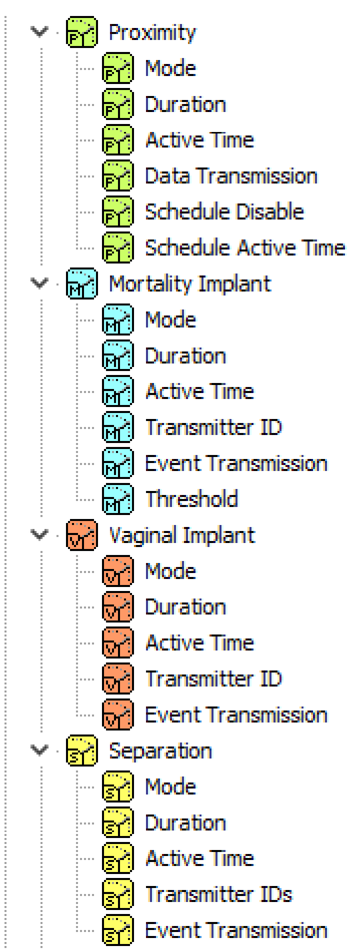


Figure 94: Nodes for external sensors using GSM or IRIDIUM communication

4.2.3.1.17.3 External Sensors via Handheld Terminal

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Collar Configuration (proximity only, all parameters are configured separately)

Upload via Handheld Terminal is only available for Proximity Sensor.

You can also store a configuration file for each parameter (max. 5 parameters per collar) on the UHF Handheld Terminal (Figure below). Define all parameters and settings in the frame, press , select the collar, and press Write .

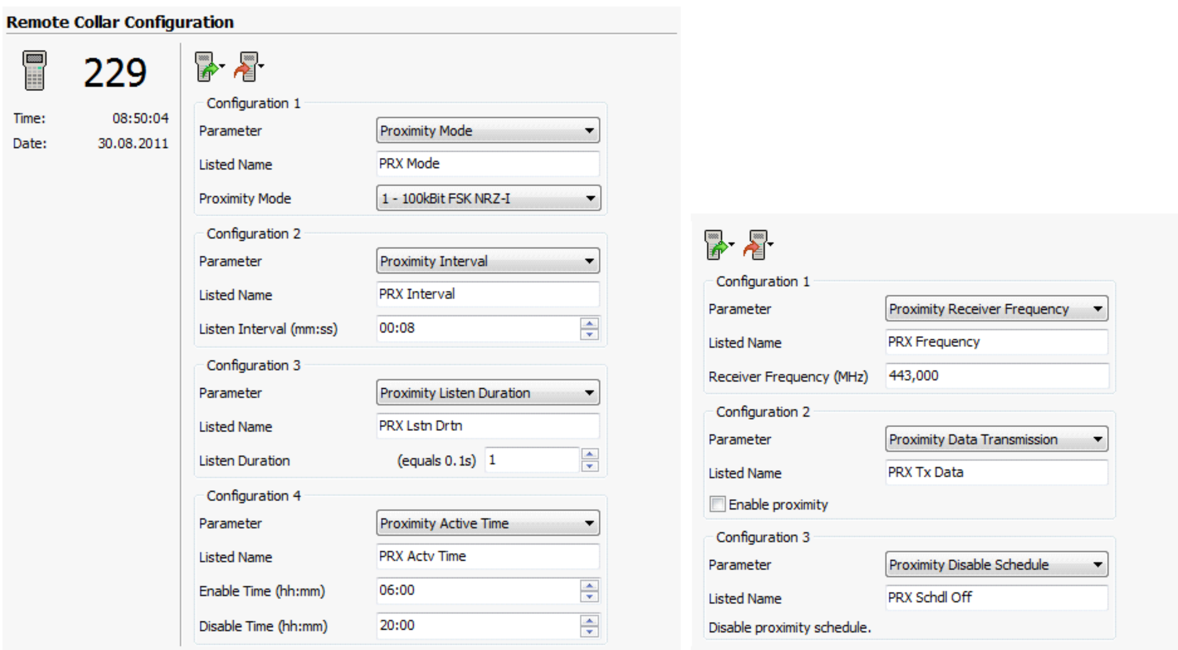


Figure 95: Frames for configuration of the proximity sensor with the UHF Handheld Terminal. Each setting is sent as single configuration, up to five parameters can be changed with one communication session.

4.2.3.1.18 External Camera

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ External Camera

In this frame, you can activate the camera. For activating the camera, please check Use External Camera and type in the Camera ID. After activating the camera, you will be able to take photos and videos. Press Apply to send the configuration to the collar.

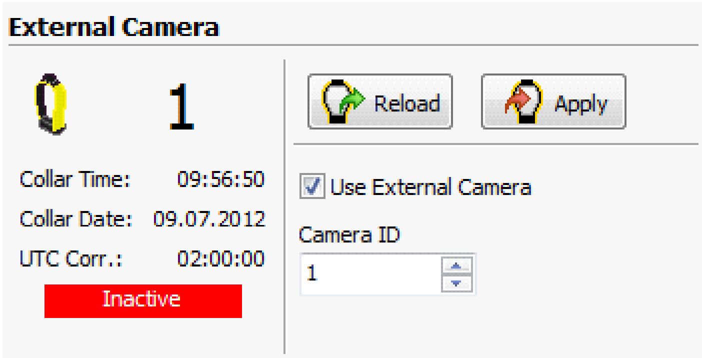


Figure 96: External Camera Configuration

4.2.3.1.19 Virtual Fence

For configuration of the Virtual Fence, please refer to chapter [Virtual fence](#).

4.2.3.1.20 Collar Firmware Upgrade

[Devices](#) ⇨ [Link Manager](#) ⇨ Collar ⇨ [Configuration](#) ⇨ Upgrade

---

It is possible to purchase and activate certain collar features, e.g. the activity, mortality, or temperature sensors, after you have received the collar. To do this, please contact us for a upgrade file with the respective code. Connect the collar to your PC via Link Manager and select Upgrade. Select the collar upgrade file (.CUF) with .... GPS Plus X will display the Collar ID for which the file is valid, its Property (the feature that will be upgraded) and the New Value for this feature. Send the upgrade to the collar with Apply.

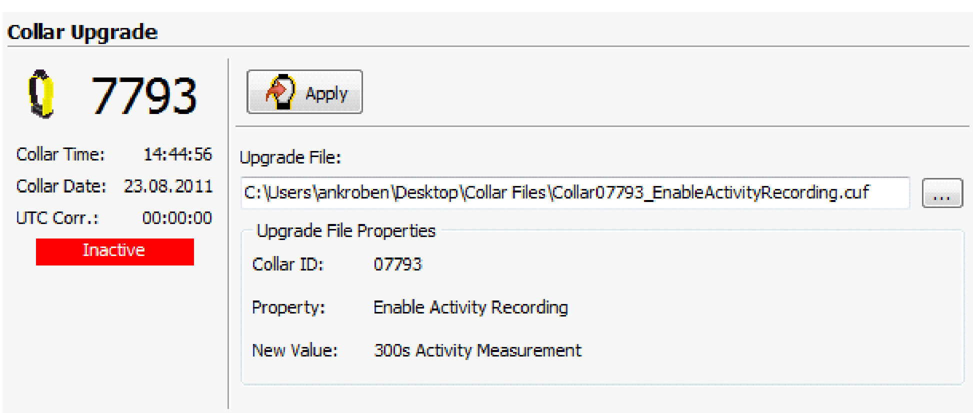


Figure 97: Frame to upgrade the collar firmware

4.2.3.1.21 Restore Collar Configuration

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Restore Collar Configuration

This feature is not available for all collars. For collars that have been manufactured or refurbished at VECTRONIC Aerospace in the last years, a file containing the original configuration of the collar (no schedules) can be provided by VECTRONIC Aerospace on request only.

Select the appropriate .CCF file with ... and send the configuration to the collar with Apply. The file will be sent to the collar and the original configuration will be restored. Since all configurations can be changed with the Collar Configuration commands and the original configuration is reported in the info file delivered with the collar, you usually will not need this command.

Note: To keep track of the collar's configurations during time, we strongly advise to always save an info file after changing the configuration.

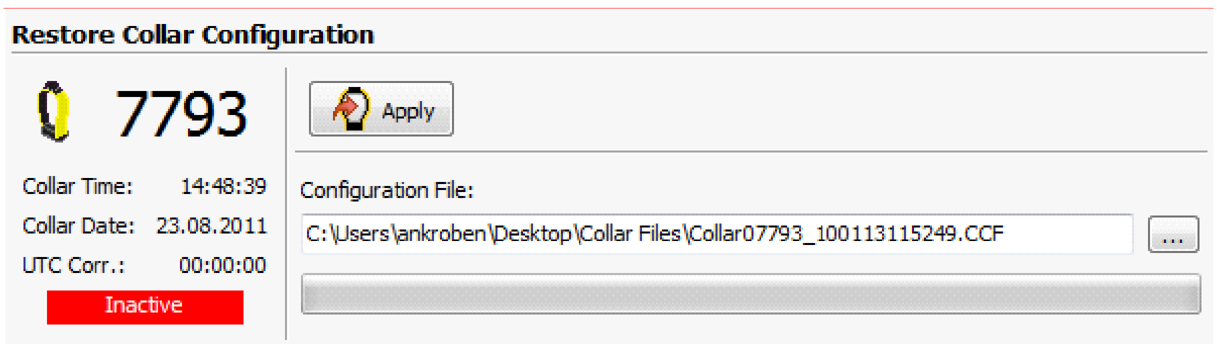


Figure 98: Frame to upload the collar restoration file

4.2.3.1.22 Firmware Update

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Firmware Upload

Under certain circumstances it might be necessary to update the firmware of your collar.

You should not do this unless you experience problems with the current collar firmware or need a feature only available in a newer version than the present one. In this case, get the appropriate file from VECTRONIC Aerospace. Select the update (.COL) file with ... and send the upgrade to the collar with Apply. The upload will be verified automatically while it is progressing.

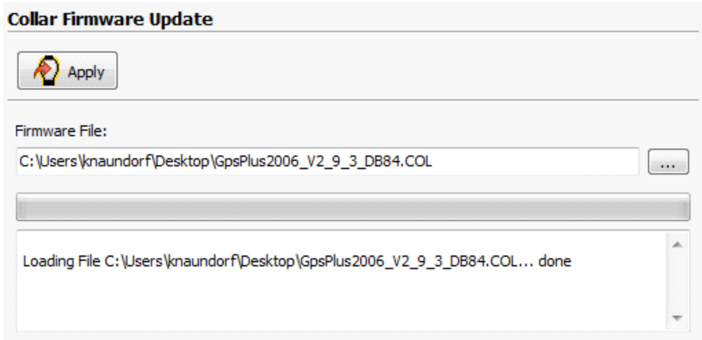


Figure 99: Frame to upload the collar firmware file

4.2.3.2 VERTEX collars (VERTEX Plus, Survey, VERTEX Lite)

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Configuration

Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar⇨ Configuration

Devices ⇨ VERTEX Plus Collar ⇨ Configuration

Please refer to chapter Device Search for information on how to connect your Survey collar to the PC.

Refer to:

User Configuration

Time

Firmware Update

4.2.3.2.1 User Configuration

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Configuration ⇨ User Configuration

Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar⇨ Configuration ⇨ User Configuration

Devices ⇨ VERTEX Plus Collar ⇨ Configuration ⇨ User Configuration

In this frame you can change the user-definable configurations of your Survey / VERTEX Lite / VERTEX Plus collar.

The actual configurations can be seen in the collar's Telemetry and in the collar's Info File (see chapter GPS Plus Survey Collar Info File).
If the user-defined configuration would lead to problems in the data transfer (e.g. wrong UTC correction), the collar will automatically switch back to the factory settings defined by VECTRONIC Aerospace. Settings changed by the user will be displayed in black, while the factory setting is displayed in grey.

You can define the following parameters at a **Survey collar**:

System	
UTC correction	For technical reasons, the collars will always run on UTC (Universal Time Coordinated) which is also used by the GPS satellite system. If you want to write schedules in LMT (Local Mean Time), you can set the UTC Correction. The collar will then translate your schedules from LMT (as programmed by your UTC correction) to UTC (which the collar uses) and take the positions at the correct time. To set the UTC correction, use the up- and down arrows.
Sensors	
Mortality Period	Here you can set a time span using the up- and down arrows. If the activity is under the user defined threshold for this time span, the animal is assumed to be dead.
Beacon	
Beacon Frequency	Choose the frequency of your VHF beacon by simply typing it into the field. You can only select frequency values between the minimum and maximum value.
Beacon Power	Choose the beacon output power in dBm by using the up-and down arrows.
Beacon Mortality Mode	Here you can choose, if in case of a mortality event the mortality pattern should be active always or only active within the VHF schedule.
Beacon Patterns **(Standard & Mortality Pattern)**	In this frame you can configure the VHF beacon patterns. You can set the pulse type, the pulse length in ms and the Loop Length in ms. These settings can be configured for the Standard Pattern of the VHF beacon as well as for the Mortality Pattern.

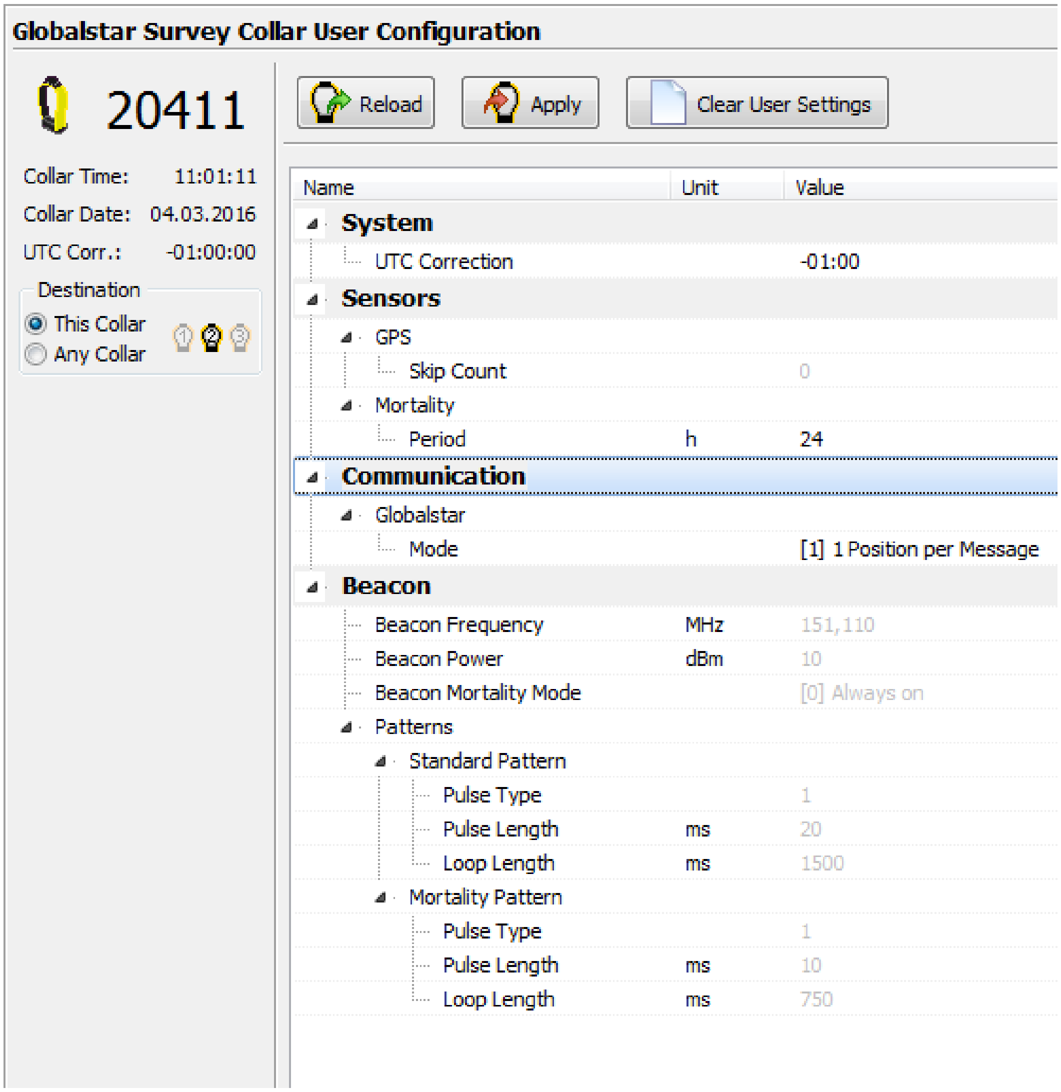


Figure 100: Survey Collar User Configuration

You can define many parameters at a **VERTEX Plus collar**. Not all of them are listed here, many of them are self explainable.

System

UTC correction

The collars use the UTC (Universal Time Coordinated) time which is also used by the GPS satellite system. It differs to your LMT (Local Mean Time). To give an example: LMT in Germany is +2 hours to UTC, UTC correction: +2 hours. You can set the UTC Correction in GPS Plus X and the collar will then translate your in LMT programmed schedules internally.

Recommendation: Stick to either way (UTC correction **or** UTC schedules) for all collars and document it carefully. It easily happens to get confused especially if you ask us to do some changes.

Sensors

GPS Skip Count

GPS skip count refers to the satellite communication enabling you to set a number of GPS location which will be conducted and stored but are not added to the transmission pool.

Acceleration

Here you can define the accuracy of your acceleration data (Sensor Range). The more accurately your data, the more storage you need.

You also can select a Recording Sample Rate. You can choose between 2, 4, 8, 16, 32 records per second.

Mortality Period

Here you can set a time span using the up- and down arrows. If no activity is recorded during the set time span the animal is assumed to be dead and a mortality event is triggered. The default value is 24h which has been successfully used in many studies.

NOTE: Please consider which values might reflect animal behavior at best. A short period might lead to false alarms as the animal is only resting.

Hibernation Period

You can define the time after which the collar switches back to normal mode if the activity is higher than the wake-up threshold.

Communication

Globalstar

You can change the positions per message.

Recommendation: 1 Fix per message

Iridium

The Iridium Mode (1-18) defines the number of fixes per Iridium message. Mode (0): Disabled.

Recommendation: 4 Fixes per message

GSM

GSM Mode defines number of fixes per SMS.

Recommendation: 8 fixes per message with VAS SIM chips, 7 fixes per message with SIM cards of your own provider.

Destination Number: You can change the destination address of all incoming messages. By default it will be the number of VECTRONIC ground station. If you are using your own ground station your own mobile number is setup here.

Reception Delay: Some providers need more time than usual to deliver SMS messages to the collar. You can extend the time the collar waits for new SMS to be delivered to it. That time is called Reception Delay

Beacon

Beacon Frequency

Choose the frequency of your VHF beacon by simply typing it into the field. You can only select frequency values between the minimum and maximum value which are hardware defined (shown in the small pop up window).

NOTE: Signal strength is best with the primarily set value (hardware dependent), signal strength will slightly decrease at the rim.

Beacon Power

Recommendation: Stick to the default value of 10dBm in Standard and Mortality Beacon Mode as it offers the optimum balance between signal strength and energy consumption. Do not hesitate to ask us if you have questions.

Mortality Beacon

The Mortality beacon is switched on during the defined beacon schedule. The Default setting is: [0] always on.

Beacon Patterns

In both Beacon Modes, (Standard and Mortality) you can configure the patterns. You can set the pulse length in milliseconds (ms) and the Loop Length in ms.

NOTE: The default settings have been successfully used in many studies. Changes will effect battery consumption.

NOTE: The Emergency Pattern is not user definable.

Sensor Communication

Transmit Power

Recommendation: Stick to the default value of 10dBm. It offers the optimum balance between signal strength and energy consumption.

External Sensors

Listen Interval

You can choose the time interval when the collar listens for a signal.

Status Transmission

The status includes temperature and latest receive (current state) of data sent from an external sensor.

Proximity Receiver

Listen Duration: The collar listens for e.g. 1500ms (1.5s) every 10 min (listen interval).

Start/Endtime: Shows at which times of the day the sensor listens for a signal.

Shows the sensitivity of the proximity receiver in dbm.

ID Blacklist: Shows which ID Tags will be ignored if a signal is received.

ID Whitelist: Shows which ID Tag contact will create a reaction immediately.

(change of GPS schedule)

Active Duration: Shows the activity time of the schedule once the collars (IDTags) are separated again.

Skip Count: How many proximity GPS fixes actually will be sent (Skip Count 3: Every third fix will be sent).

Sample Count: Shows how many Proximity data are stored.

NOTE: ID Tags which are not on Blacklist/ Whitelist: contact is recorded but no reaction is created. If no ID Tags are listed, every contact will create a reaction.

MIT / VIT / SEP Receiver

Start/ End time: Shows at which times of the day the sensor listens for a signal.

No Contact Delay: Defines the delay when the contact has been lost. (e.g. (VIT) set a delay to **finally** know when mother leaves birthplace)

ID: fill in the ID's of your external sensors.

Listen Duration: Low value- Expend less battery power but lower chance to receive a signal.

High value- Requires more battery power and high chance of receiving signal.

Recommendation: Stick to the default settings.

Virtual Fence

Mode

Shows 1 out of 5 modes: [0] Off, [1] On -No Message, [2] On -Message On Enter, [3] On -Message On Leave, [4] On -Message On Enter And Leave the Virtual Fence.

Retransmit Interval

Defines when a second message is sent, just to secure it will be received.

Recommendation: If you urgently need the information that your animal enters an area do not wait too long to secure your message will be received. Do not hesitate to ask us for further information.

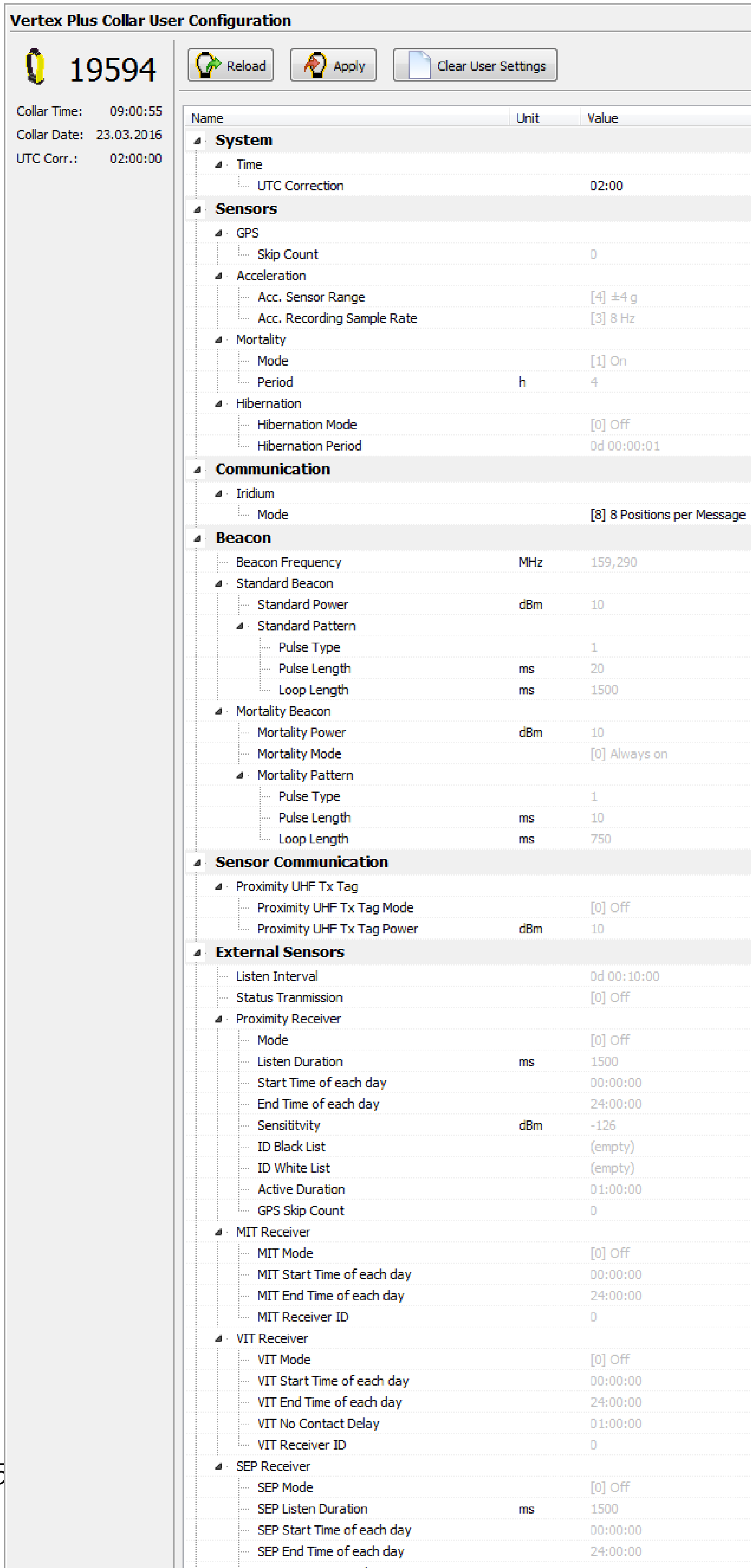

Vertex Plus Collar User Configuration
19594
Reload
Apply
Clear User Settings
Collar Time: 09:00:55
Collar Date: 23.03.2016
UTC Corr.: 02:00:00
Name
Unit
Value
System
Time
UTC Correction 02:00
Sensors
GPS
Skip Count 0
Acceleration
Acc. Sensor Range [4] ±4 g
Acc. Recording Sample Rate [3] 8 Hz
Mortality
Mode [1] On
Period h 4
Hibernation
Hibernation Mode [0] Off
Hibernation Period 0d 00:00:01
Communication
Iridium
Mode [8] 8 Positions per Message
Beacon
Beacon Frequency MHz 159,290
Standard Beacon
Standard Power dBm 10
Standard Pattern
Pulse Type 1
Pulse Length ms 20
Loop Length ms 1500
Mortality Beacon
Mortality Power dBm 10
Mortality Mode [0] Always on
Mortality Pattern
Pulse Type 1
Pulse Length ms 10
Loop Length ms 750
Sensor Communication
Proximity UHF Tx Tag
Proximity UHF Tx Tag Mode [0] Off
Proximity UHF Tx Tag Power dBm 10
External Sensors
Listen Interval 0d 00:10:00
Status Tranmission [0] Off
Proximity Receiver
Mode [0] Off
Listen Duration ms 1500
Start Time of each day 00:00:00
End Time of each day 24:00:00
Sensititvity dBm -126
ID Black List (empty)
ID White List (empty)
Active Duration 01:00:00
GPS Skip Count 0
MIT Receiver
MIT Mode [0] Off
MIT Start Time of each day 00:00:00
MIT End Time of each day 24:00:00
MIT Receiver ID 0
VIT Receiver
VIT Mode [0] Off
VIT Start Time of each day 00:00:00
VIT End Time of each day 24:00:00
VIT No Contact Delay 01:00:00
VIT Receiver ID 0
SEP Receiver
SEP Mode [0] Off
SEP Listen Duration ms 1500
SEP Start Time of each day 00:00:00
SEP End Time of each day 24:00:00
SEP No Contact Delay 01:00:00

Figure 101: VERTEX Plus Collar User Configuration

When configuring different settings, a small window will appear when you have marked the value you like to change (see below).

In this window, you will get the information which values you can put there (Min value and Max value). This window appears in the User Configuration frame for every value you can configure. Depending on the kind of data which is edited, the window shows different values.

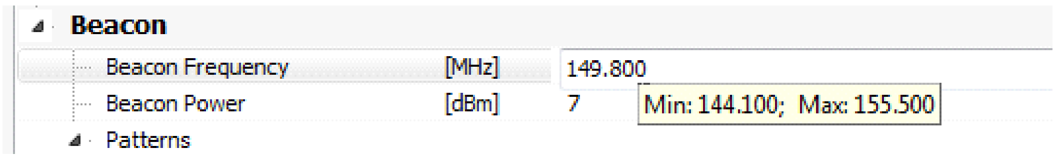


Figure 102: Window with Min and Max value for Beacon Frequency

After you have provided your changes in the configuration, you can choose if you like to send the new configuration only to the selected collar or to all collars found in the Device Search by setting up the Destination on the left side of the frame.

Press [Apply] to send the settings to the collar. Press [Reload] to reload the configuration from the collar.

Pressing the button [Clear User Settings], all settings in the collar except the schedules are deleted. Afterward, the default settings defined by VECTRONIC Aerospace are applied.

4.2.3.2.2 Time

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Configuration ⇨ Time
Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar⇨ Configuration ⇨ Time
Devices ⇨ VERTEX Plus Collar ⇨ Configuration ⇨ Time

To have the correct time and date after battery replacement, it is important to set the correct time and date in every collar.

The program suggests the time and date of the PC adjusted by the UTC correction configured at **Configuration** ⇨ System ⇨ UTC Correction (see System UTC Correction).

You will notice that the displayed time continues to run. To change the time, click on the hours, minutes, or seconds and then click on the up or down arrows. To change the date click on the drop-down arrow and a calendar will open; select a date in the calendar.

In the Survey Collar time frame, you can additionally choose if you like to send the new configuration only to the selected collar or to all collars found in the Device Search by setting up the Destination on the left side of the frame .

Finally, set the time by clicking Apply.

While GPS Plus X contacts the collar, the time will continue internally until the moment in which the command is sent.

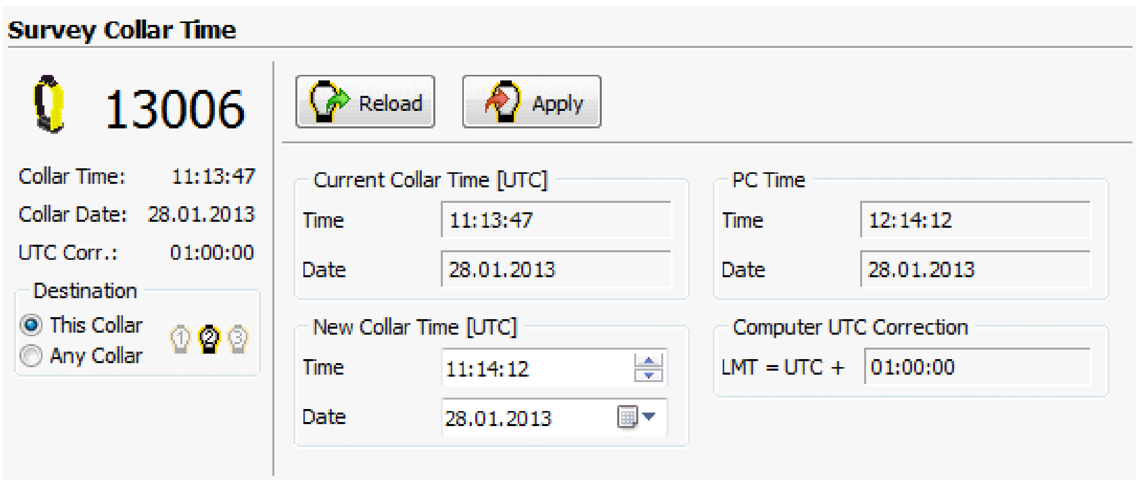


Figure 103: Survey Collar Time frame

Note: With each GPS fix, the collar time is reset to the correct UTC time. It is thus not possible to synchronise the collar with another time, e.g. a clock running in your office, than the GPS satellite system's time. Also, UTC correction in the collar cannot be enabled by sending the local mean time to the collar, but by sending the UTC correction command only.

4.2.3.2.3 Firmware Upload

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Configuration ⇨ Firmware Upload
Devices ⇨ Remote Stick ⇨ VERTEX Lite Collar ⇨ Configuration ⇨ Firmware Upload
Devices ⇨ VERTEX Plus Collar ⇨ Configuration ⇨ Start Bootloader

Survey collar:
Select the update (.bin) file with .... Afterwards, you can see that some information appears in the window. You can check information on Device Model, File Type, Version (the firmware version you are going to upload to the collar) and the Version Attributes. You can choose if you like to upload the firmware only to the selected all collars found in the Device Search by setting up the Destination on the left side of the frame. Send the upgrade to the collar with Start. The upload will be verified automatically while it is progressing.

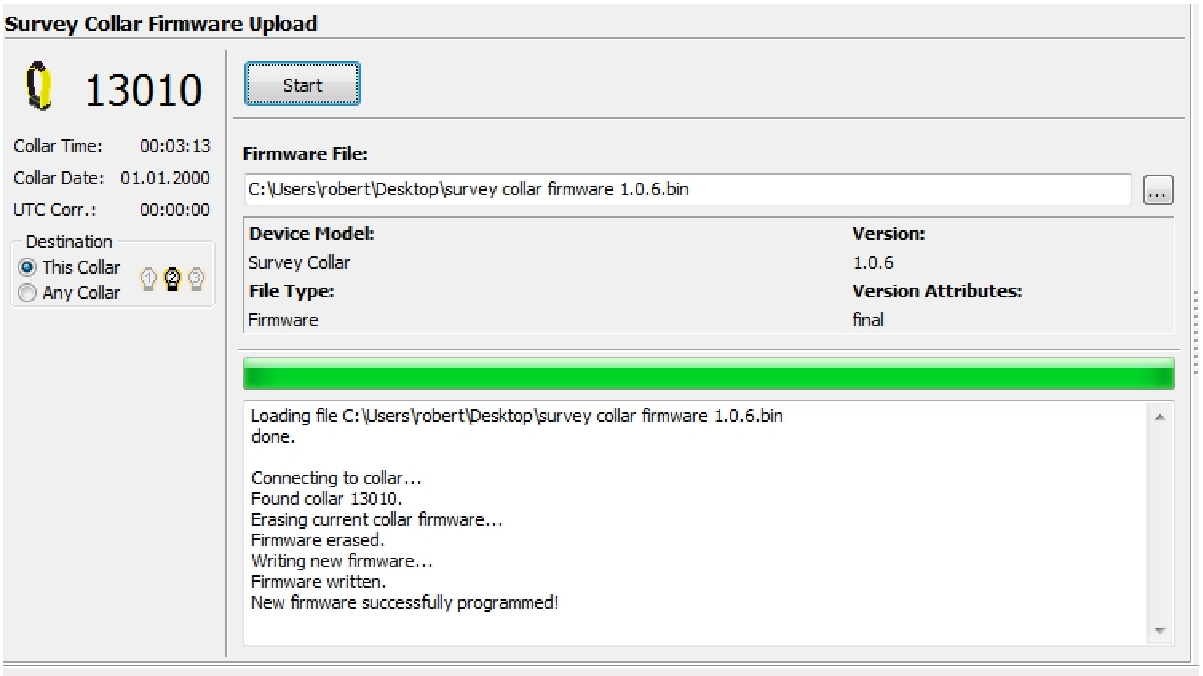


Figure 104: Frame to upload the Survey collar firmware file

VERTEX Plus collar:
You should not do a firmware update unless you experience problems with the current collar firmware or need a feature only available in a newer version than the present one. In this case, get the appropriate file from VECTRONIC Aerospace and start the Bootloader.

To upload new firmware the collar has to be deactivated - so please attach the magnet to the electronic housing.

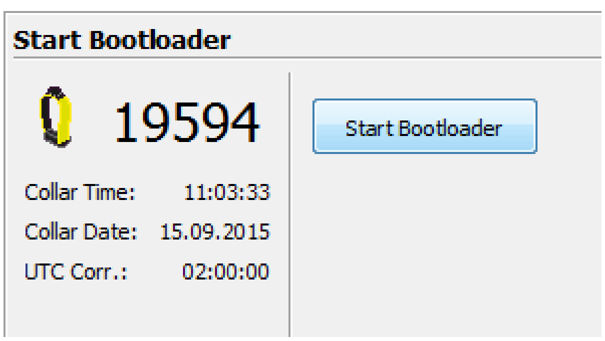


Figure 105: Start Bootloader

A notification window will appear to inform you that your collar switches the mode to be able to change firmware settings (e.g. firmware updates).

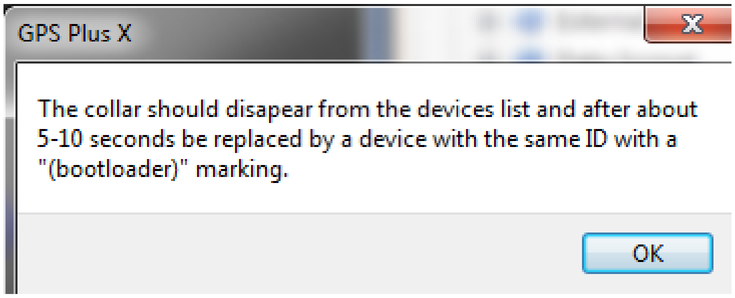


Figure 106: Switch to Bootloader Mode

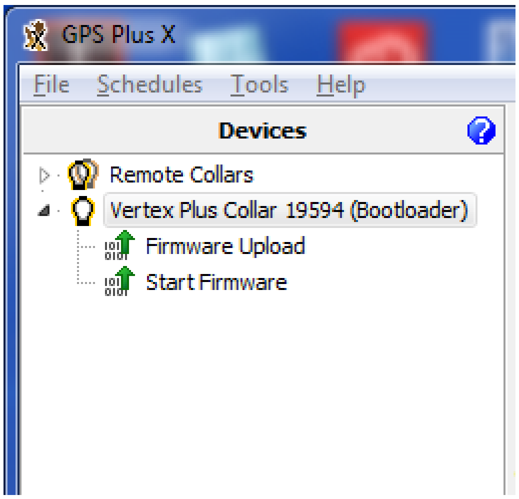


Figure 107: Bootloader Mode

First, you need to upload the new firmware. Click on "Firmware Upload" and browse (...) your computer for the firmware file you got from VECTRONIC and click the 'Start' button.

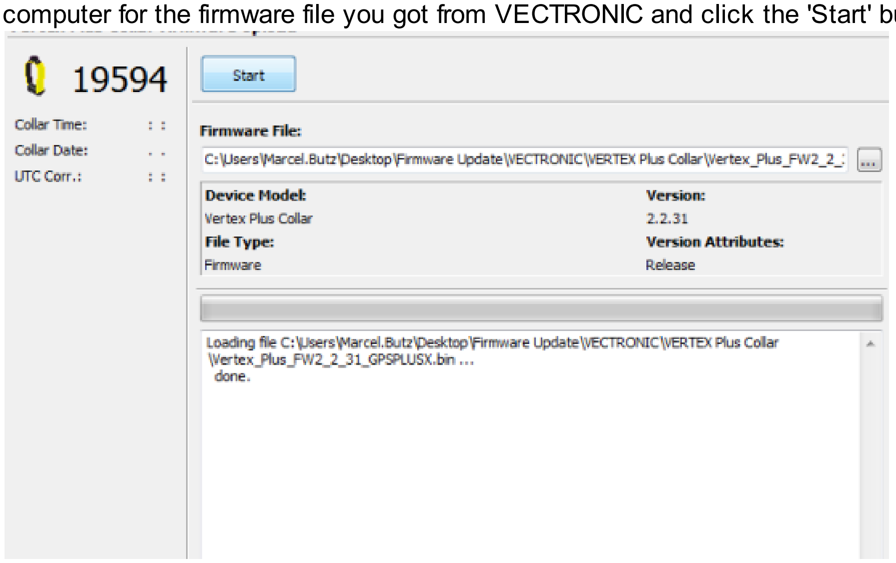


Figure 108: Upload Firmware

If the upload process is finished click on "Start Firmware" and the collar will switch back to 'Normal mode'.

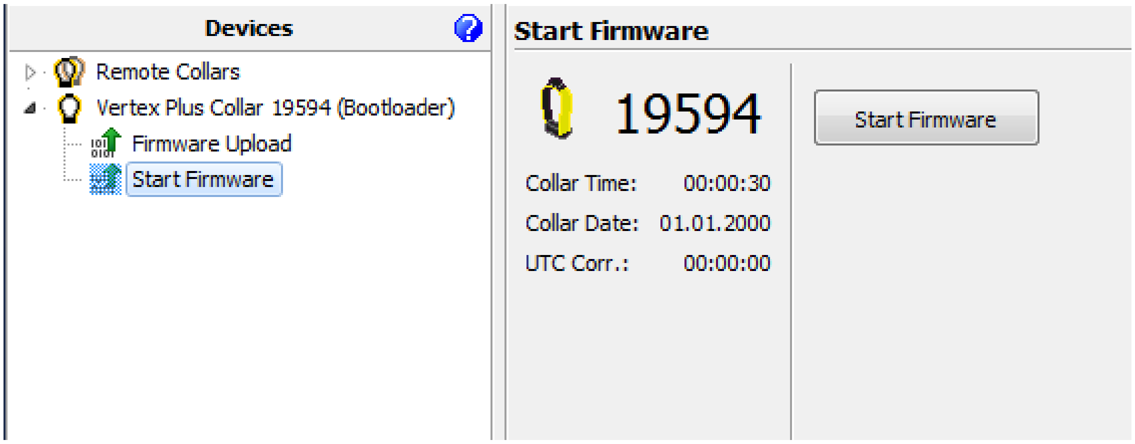


Figure 109: Start Firmware

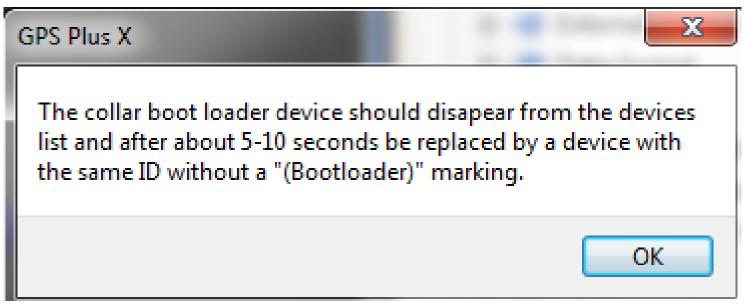


Figure 110: Switch back to Normal Mode

4.2.3.3 Handheld Terminal

While the Handheld Terminal is connected to the PC, you can read out the Handheld Terminal information, configure the Handheld Terminal, or manage commands and data related to VHF/UHF collars.

The Handheld Terminal can be connected directly via USB cable and it can also be accessed at the node, or it can be connected with the Link Manager and can be accessed at the node. The subnodes for the Handheld Terminal are found at the node.

To communicate with the Handheld Terminal, please make sure that it is switched on; otherwise you will receive an error message.

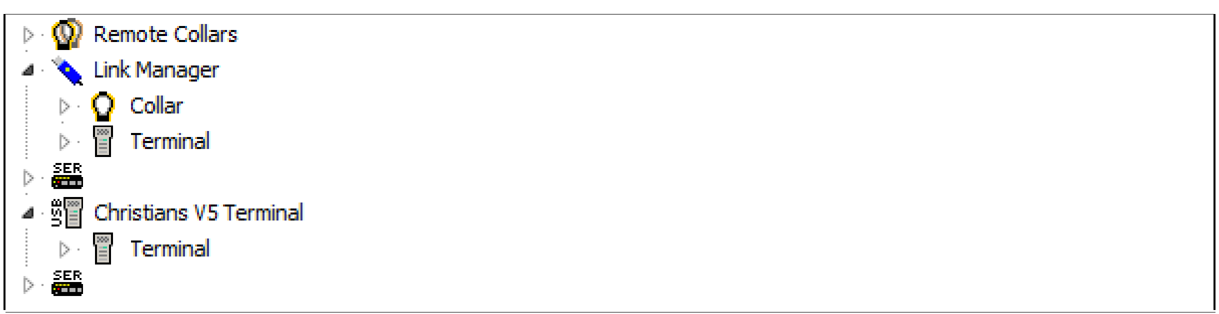


Figure 111: Devices tree with two connected Handheld Terminals, one via Link Manager and one via USB cable.

Refer to:

Handheld Terminal Information

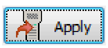
Handheld Terminal Configuration

Handheld Terminal Remote Collars

4.2.3.3.1 Terminal Configuration

There are two general icons for the configuration of the Handheld Terminal:

reads out the current configuration of the terminal; changes made in the configuration frame will be lost.



writes the new configuration to the terminal; the former configuration cannot be restored.

Refer to:

Configure Positions

Configure Collar registered on Handheld Terminal

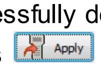
Configure Handheld Terminal Time

Handheld Terminal Firmware Upload

4.2.3.3.1.1 Configure positions

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Configuration ⇨ Configure

The node Configure allows you to mark positions downloaded from the collar as “transmitted”.

With the default settings, all positions on the collar will be sent according to the GSM or IRIDIUM Mode (exceptions can be configured with the Position Transmission command, see Position Transmission (GSM and IRIDIUM collars only)). If you check Mark positions as “transmitted” in collar after receiving, positions successfully downloaded from the collar with the Handheld Terminal will not be sent via GSM or IRIDIUM. Press  to send the command to the Handheld Terminal.

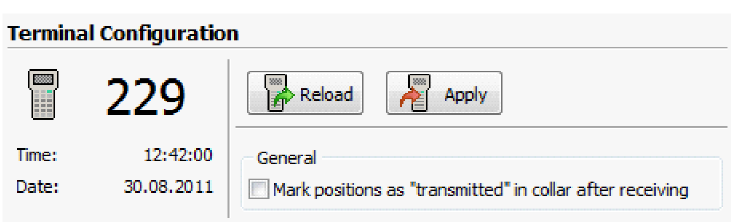


Figure 112: Handheld Terminal configuration frame

4.2.3.3.1.2 Configure collars registered on Handheld Terminal

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Configuration ⇨ Collars

The Handheld Terminal can only communicate with collars that are registered on the Handheld Terminal.

The frame will show two lists:

The left list (**Collars on PC**) shows all collars registered on your PC, but not on the Handheld Terminal; note that it can include collars which are not equipped with VHF or UHF communication. You can only register collars on the Handheld Terminal that are already registered in your installed version of GPS Plus X.

The right list (**Terminal Collars**) shows all collars listed on the connected Handheld Terminal. The black collars are also registered on your PC. They do not appear in the left list because they have already been registered on the Handheld Terminal. The red collars are registered on the Handheld Terminal, but not on the PC. You can download data for these collars and send new commands for them to the Handheld Terminal, but if you remove these collars from the Terminal Collar list, you cannot register them on the Handheld Terminal again until you have registered them on your PC.

To register a collar on the Handheld Terminal, select it from the left list and press Add. The collar ID will now be moved to the right list. To select more than one collar, use the Shift or Ctrl key.

Remove will delete a collar from the Handheld Terminal.

Its ID number will be moved to the left list if the collar is registered on the PC. If it is not registered, the ID number will disappear from the lists. It cannot be registered again on the Handheld Terminal as long as it is not registered on the PC. After you have edited the Terminal Collars list, press Apply to write the new list to the Handheld Terminal.

Note: If you remove a collar ID from the Handheld Terminal, all data of this collar stored on the Handheld Terminal will be erased. There is no way to restore these data!

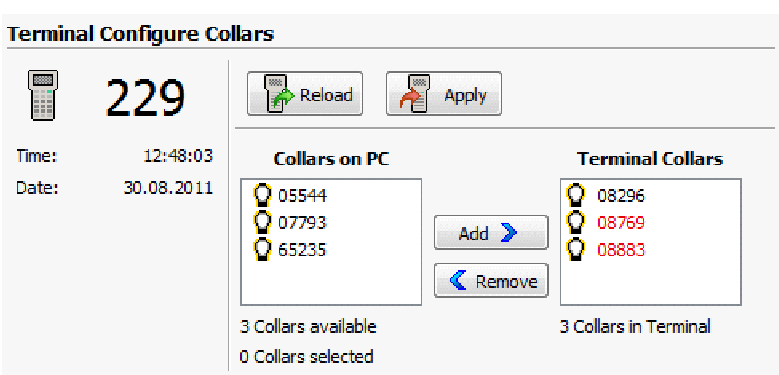


Figure 113: Collar list for Handheld Terminal configuration

4.2.3.3.1.3 Configure Terminal Time

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Configuration ⇨ Set Time

Fill in the correct time settings (Time, Date) and apply the settings to the Handheld Terminal.

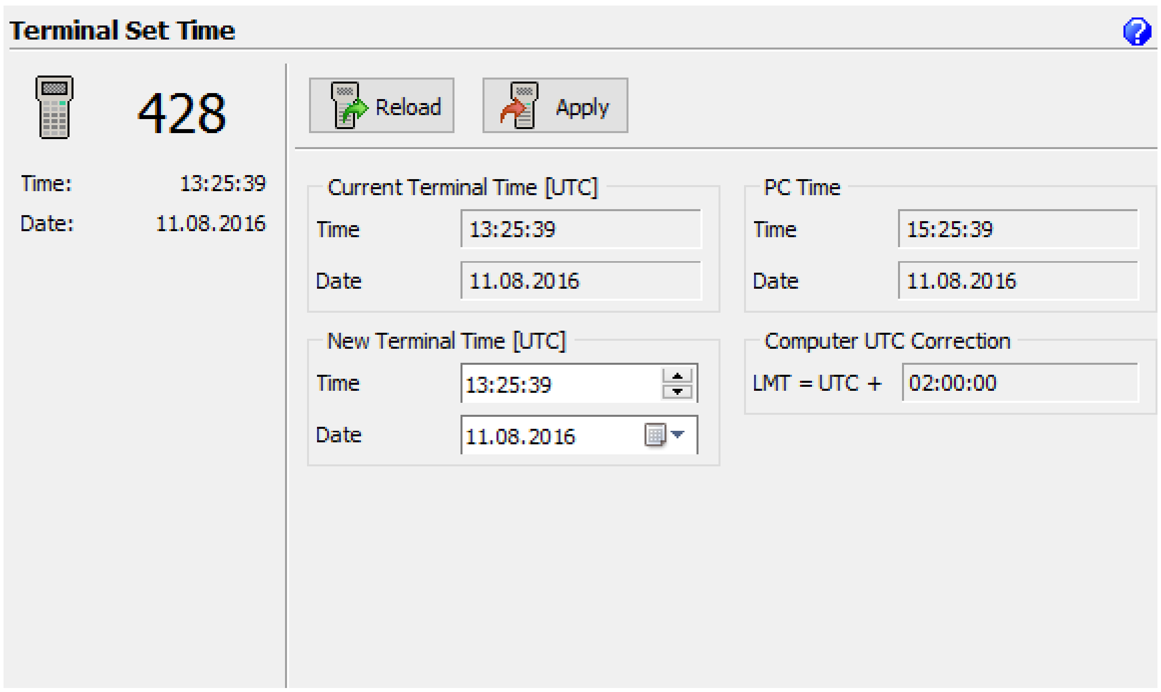


Figure 114: Terminal Set Time

4.2.3.3.1.4 Handheld Terminal Firmware Update

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Configuration ⇨ Firmware Upload

It might be useful to update the firmware of a Handheld Terminal, for example after new feature have been added to the VHF/UHF collar firmware (i.e. Virtual Fence). Please request the firmware file from VECTRONIC Aerospace. It will be a .TRM file. Store it in a convenient folder. Go to the node Firmware Upload, and open the firmware file with . You can monitor how the file is loaded into the program on the progress bar and in the log window (Figure Log file showing the upload process).

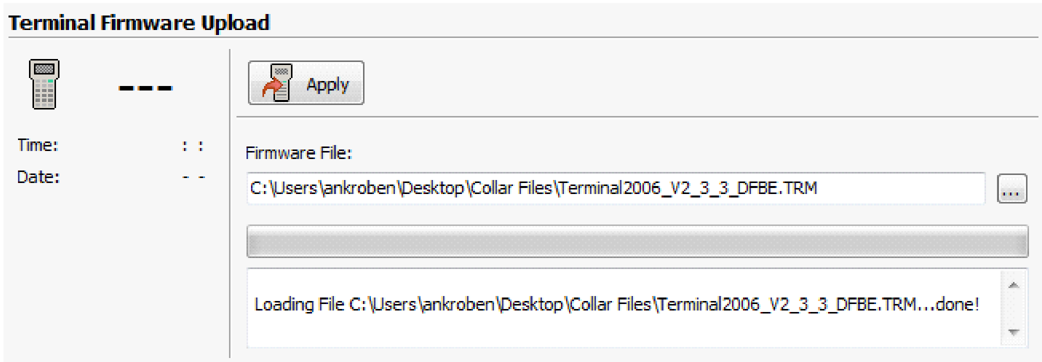


Figure 115: Handheld Terminal Firmware Upload frame after the firmware file has been loaded to the software.

Press Apply to send the software to the Handheld Terminal. A pop-up window will prompt you to press START on the Handheld Terminal.

If you do not do this within 10 seconds, the process will be aborted and the error message "Boot loader ID has not been received." will be shown.

After pressing START, the firmware will be written to the Handheld Terminal. Again, you can monitor this on the progress bar and in the log window (Figure below), but this upload will take longer than the first one.

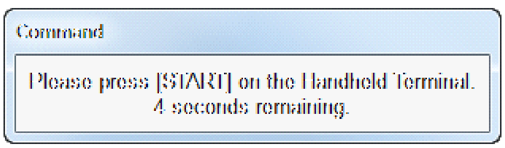


Figure 116: Prompt to activate reception of firmware by Handheld Terminal

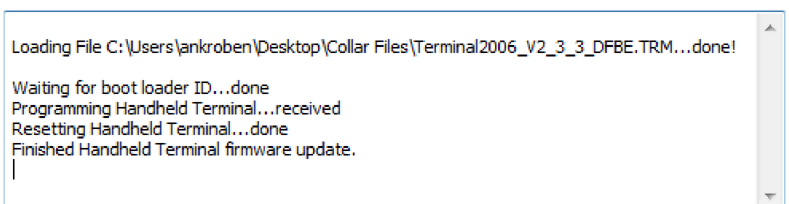


Figure 117: Log file showing the upload process

4.2.3.4 Trap Transmitter

Devices ⇨ Remote Stick ⇨ Trap Transmitter ⇨ Configuration

Please refer to chapter Device Search for information on how to connect your TT3 to the PC.

Refer to:

User configuration for Trap Transmitter

Time

Firmware Update for Trap Transmitter

4.2.3.4.1 User configuration for Trap Transmitter

Devices ⇨ Remote Stick ⇨ Trap Transmitter ⇨ Configuration ⇨ User Configuration

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In this frame you can change the user-definable configurations of your Survey collar.

The actual configurations can be seen in the Telemetry of the Trap Transmitter and in the Info File (Info File Trap Transmitter).

Settings changed by the user will be displayed in black, while the factory setting is displayed in grey.

You can define the following parameters:

Beacon	
Beacon Frequency	Choose the frequency of your VHF beacon by simply typing it into the field. You can only select frequency values between the minimum and maximum value.
Beacon Power	Choose the beacon output power in dBm by using the up-and down arrows.
Beacon Patterns **(Standard & Mortality Pattern)**	In this frame you can configure the VHF beacon patterns. You can set the pulse type, the pulse length in ms and the Loop Length in ms. These settings can be configured for the Standard Pattern of the VHF beacon as well as for the Mortality Pattern.
Start Date and Time	

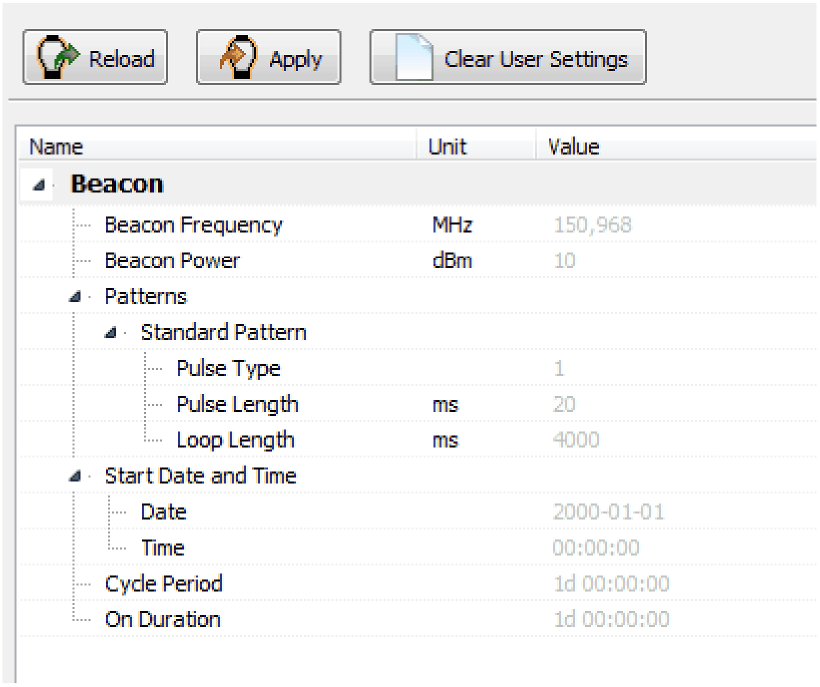


Figure 118: Trap transmitter User configuration

4.2.3.4.2 Time

Devices ⇨ Remote Stick ⇨ Trap Transmitter ⇨ Configuration ⇨ Time

---

The program suggests the time and date of the PC adjusted by the UTC correction configured at **Configuration** ⇨ System ⇨ UTC Correction (see System UTC Correction).

You will notice that the displayed time continues to run. To change the time, click on the hours, minutes, or seconds and then click on the up or down arrows. To change the date click on the drop-down arrow and a calendar will open; select a date in the calendar.

Finally, set the time by clicking Apply.

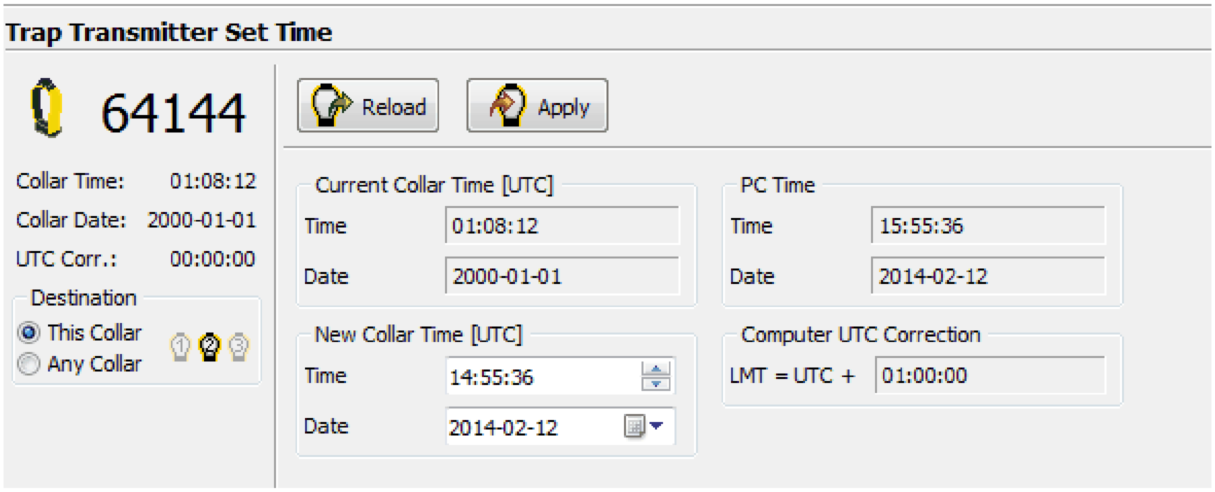


Figure 119: Trap Transmitter Time frame

4.2.3.4.3 Firmware Update for Trap Transmitter

Devices ⇨ ⇨ Trap Transmitter ⇨ Configuration ⇨ Firmware Upload

Select the update (.bin) file with . Afterwards, you can see that some information appears in the window. You can check information on Device Model, File Type, Version (the firmware version you are going to upload to the collar) and the Version Attributes. You can choose if you like to upload the firmware only to the selected collar or to all collars found in the Device Search by setting up the Destination on the left side of the frame. Send the upgrade to the collar with Start. The upload will be verified automatically while it is progressing.

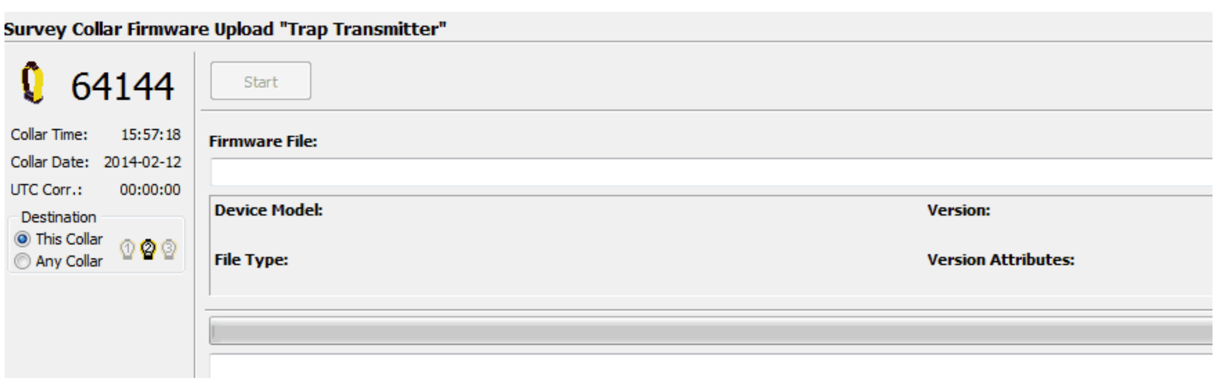


Figure 120: Frame to upload the Trap Transmitter firmware file

4.2.4 Remote collars (Handheld Terminal only)

For information how to use the Handheld Terminal to communicate with the collar (upload / download data) please refer to the Handheld Terminal Manual (Chapter 7). You can find the download link on our homepage under downloads.

4.2.5 Schedules

Schedules can be programmed for

- GPS fixes (mandatory),
- VHF beacon (optional to save battery),
- GSM/IRIDIUM transmission (optional for GSM/IRIDIUM collars),
- activity data
- external camera
- proximity application
- virtual fence
- external sensors

All schedules can be transmitted via VHF/UHF Handheld Terminal, GSM, IRIDIUM and via USB Remote Stick (GPS Plus Survey collars only).

The schedule editors can be found in the Schedule menu and at certain nodes in the Devices tree.

Refer to:

GPS Schedules

Uploading an Activity schedule

Beacon Schedule Editor

GSM/IRIDIUM Schedule Editor (optional)

Camera Schedule Editor

Schedules for VERTEX Collars

4.2.5.1 GPS PLUS and GPS PRO collars

Devices ⇨ Remote Collars ⇨ GPS Plus Collars ⇨ Schedules

Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules

Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules

All schedules for the GPS Plus / GPS PRO collars are set by Vectronic Aerospace according to your specifications. If you need changes in these schedules, you have the possibility to configure user-defined schedules and send them to the collar. When you have Iridium communication or GSM communication in combination with your own ground station you may send the commands on your own.

Refer to:

GPS Schedule

Beacon Schedule

GSM/IRIDIUM Schedule

Virtual Fence

Camera Schedule

4.2.5.1.1 GPS Schedule

The GPS schedules define at which times or in which intervals GPS fixes are performed. Generally, there are four kinds of GPS schedules, a standard schedule which is needed for each collar, a Virtual Fence schedule (optional) which is used inside a predefined area, a proximity schedule (optional) which is used in case of a proximity event and an Activity schedule if the activity level exceeds the user-defined threshold. All GPS schedules have the same basic characteristics; exceptions will be discussed in the respective chapters.
The schedules have different priorities. The schedule with the highest priority is used. For example if you have a Virtual Fence event and at the same time a proximity event, the Proximity schedule is used. The following table shows a priority list of the schedules:

Priority	Schedule
highest	Mortality Schedule
	Proximity Schedule
	Virtual Fence Schedule
	Activity Schedule
lowest	GPS Schedule

Please note that the Mortality schedule was set by VECTRONIC Aerospace. It is fixed and cannot be changed. This schedule depends on the type of the collar.

GLOBALSTAR collars take 5 position fixes in intervals of 30 minutes. GSM and IRIDIUM collars take 10-20 position fixes in very short intervals (depending on IRIDIUM / GSM mode) and then every 30 minutes for six hours. Store on Board collars take position fixes every 30 minutes for six hours.

Refer to:

GPS schedule editor

Uploading a GPS schedule

Uploading a Proximity schedule

Uploading a Virtual Fence schedule

4.2.5.1.1.1 GPS schedule editor

Menu Bar ⇨ Schedules menu ⇨ GPS Schedule Editor
Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ GPS
Devices ⇨ Remote Collars ⇨ Schedules ⇨ GPS
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ GPS Schedule

---

Figure below shows the editor frame that is used for all GPS schedule commands. A GPS schedule contains one or more rules. On the bottom of the left side of the frame, the number of rules (No. of Rules) and the Binary Size of the resulting schedule is shown. The possible number of rules depends on the way the schedule is transferred to the collar (via Link Manager, Handheld Terminal, GSM ground station, or IRIDIUM). The right section of the editor gives you a graphical display of your schedule.

The time used in this editor is not defined to be UTC (Universal Time Coordinated) or any other LMT (Local Mean Time). The selection of UTC or LMT is done with the UTC correction inside the collar (refer to UTC Correction, but **not** to System UTC Correction). Please check that the programmed times and the UTC correction correspond to obtain the correct times for GPS measurements.

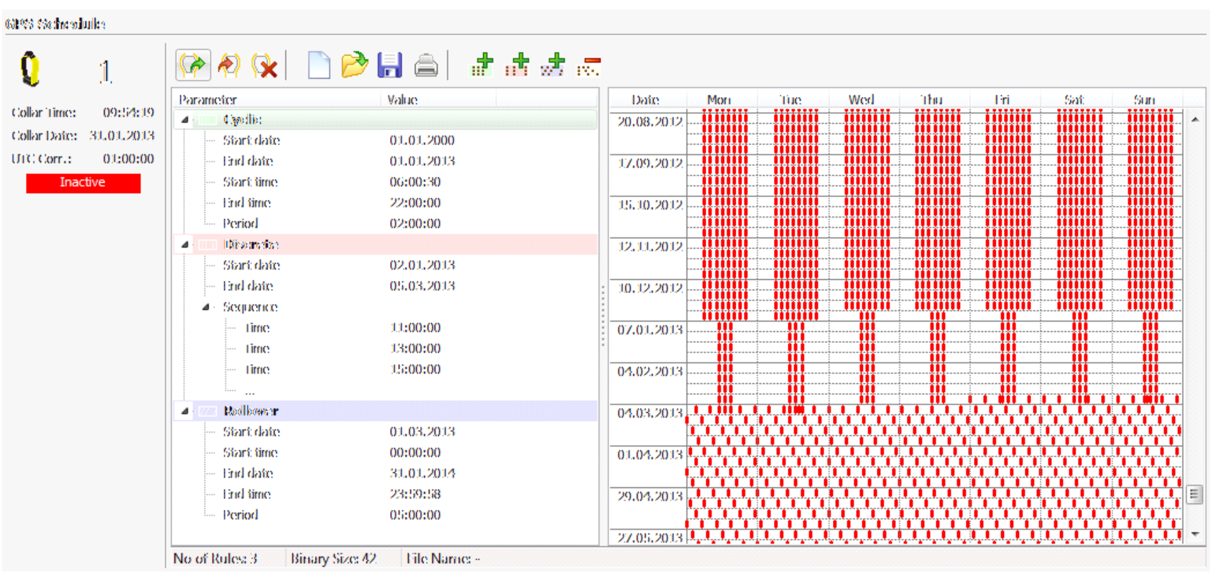


Figure 121: GPS Schedule Editor. This example shows all three rule types. The red lines in the right section of the editor indicate the times of a GPS fix. Each line represents one week, and each column one day, beginning with Monday. The red lines indicate the time of a GPS fix. Since in our example rules overlap for a certain time period, fixes are taken according to both rules.

Create a schedule by using one of the three rule types

1. Cyclic Rule
2. Discrete Rule

3. Rollover Rule

and a default schedule will appear.

Change date or time by clicking on it and type in a new value, you also can use the calendar function or the up-down arrows. You can combine different rules to create a complex schedule.

If two rules apply at the same time, GPS fixes will take place according to both rules.

Remove a rule from the schedule with . The times of GPS fixes will be displayed on the calendar in the right frame. The default file name of a GPS schedule is `GpsSchedule.gsf`, but you can change the name during the storage process with to your requirements.

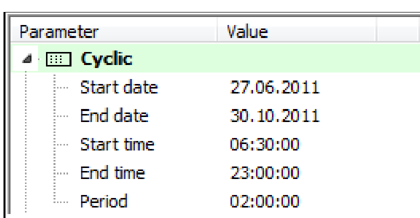
Please consider the following Notes:

Note: If the start date of all rules is more than one week in the future, the collar will automatically attempt a fix once a week until the first Start Date. This is a safety measure in case the collar clock was not set properly, and to allow the collar to recalibrate its internal clock at least once a week.

Note: When the last scheduled fix has been performed, the collar will automatically perform a fix every 6 hours to enable you to locate and recover the collar. To avoid this, define a schedule that extends the calculated operational lifetime.

Note: **For safety reasons you should define at least one schedule starting on 01.01.2000.** If the collar's time is reset for any reason, the timer will start at this date and without an appropriate schedule, you will not obtain GPS fixes for at least one week. This is especially important if you do not use the VHF/UHF data communication, since GSM or satellite transmissions are linked to GPS fixes and will not be used without GPS schedule.

Note: Rollover rules are only supported by collars with a firmware version of 1.7.1 or higher. The firmware version can only be validated if the collar is connected to the PC directly via the Link Manager, but not via UHF (Handheld Terminal) or SMS (GSM ground station). If you program a schedule containing a rollover rule to a collar not supporting it, the rollover rule will be ignored and your schedule might be useless to your needs.



The Cyclic Rule defines a period of time with a Start date and an End date in which fixes will be performed each day in a selected frequency. Enter the start and end day of the chosen period and the time of start and end on each day within this period. Then select the frequency of GPS measurements (Period). The first measurement will be taken at the exact start date and time (in our example 06:30 on the 27.06.2011). The second measurement will take place at the start time plus the period (here 08:30 on the 27.06.2011). The end time is not necessarily the time of the last measurement of the day. In our example the last measurement would be at 22:30.

The Discrete Rule defines a period of time with a Start date and an End date in which several discrete times per day can be defined for GPS fixes. Enter the start and end day of the period, then enter the discrete times of measurement in the Sequence list. Select a time from the list and press the delete button to remove it from the list. The measurements will take place at exactly these times every day of your selected rule period, in our example at 11:00, 13:00, and 15:00.

The Rollover Rule does not work on a day-by-day basis like the other two rules. It defines a Start date and Start time, an End date and End time, and a Period. In our example, the rule will start on the 10.03.2012 at 00:00:00, and a GPS fix will be attempted every 5 hours until the 27.06.2012 at 23:59:58. This way, the measurements do not necessarily take place every day at the same time and are independent from single days. You can enter any frequency from one minute to 36 hours 24 minutes and 30 seconds.

4.2.5.1.1.2 Uploading a GPS schedule

Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ GPS

If the collar is connected to the PC via Link Manager, you can download the current GPS schedule from the collar with and edit it. You can also create an entirely new schedule. To upload the schedule to the collar, press . This schedule will be used as the basic schedule, not as Virtual Fence or proximity schedule.

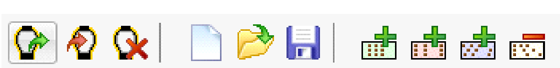


Figure 122: Button menu for upload with the Link Manager

Devices ⇨ Remote Collars ⇨ Schedules ⇨ GPS

If you want to upload a GPS schedule via GSM or IRIDIUM, you can open already stored schedules with or create a new one. Select the collars you want to send the schedule to in the Devices tree from the node Remote Collar list and press .

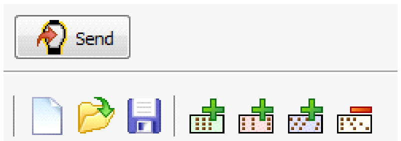


Figure 123: Button menu for upload to remote collars with GSM or IRIDIUM communication

Note: If you use GSM communication with the VECTRONIC ground station, you cannot use this option. Please contact us for schedule changes.

Devices ⇨ ⇨ Terminal ⇨ Remote Collars ⇨ GPS Schedule
Devices ⇨ ⇨ Terminal ⇨ Remote Collars ⇨ GPS Schedule

If you want upload a GPS schedule via Handheld Terminal, you can download existing schedules from the terminal with , edit them, open already stored schedules from your PC or create a new one. Press and select the desired collars, and press . You can send the new schedule to the collar after you have established radio communication in the field.

Figure 124: Button menu for upload to remote collars with GSM or IRIDIUM communication

4.2.5.1.1.3 Uploading a Proximity schedule

Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ Proximity
Devices ⇨ Remote Collars ⇨ Schedules ⇨ Proximity
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Proximity Schedule

---

You can define a GPS schedule as proximity schedule. It is created and uploaded the same way as the standard GPS schedule, but you need to select the proximity schedule nodes.

4.2.5.1.1.4 Uploading a Virtual Fence schedule

Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ ⇨ Virtual Fence
Devices ⇨ Remote Collars ⇨ Schedules ⇨ Virtual Fence
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Virtual Fence Schedule

---

You can define a GPS schedule as Virtual Fence schedule. It is created and uploaded the same way as the standard GPS schedule, but there are differences in the upload.

Via Link Manager and Handheld Terminal, the upload is similar to the upload of a standard GPS schedule.

If you want to send a Virtual fence schedule to a collar via GSM or IRIDIUM, it has to be sent with a Virtual Fence collection. Please refer to chapter Uploading a Virtual Fence Collection to the collar.

4.2.5.1.1.5 Uploading an Activity schedule

Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ Activity
Devices ⇨ Remote Collars ⇨ Schedules ⇨ Activity
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Activity Schedule

---

You can define a GPS schedule as Activity schedule. It is created and uploaded the same way as the standard GPS schedule, but you need to select the activity schedule nodes.

Refer to:

Activity Schedule Switching

4.2.5.1.1.6 Activity Schedule Switching

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Activity Schedule Switching
Devices ⇨ Remote Collars ⇨ Configuration ⇨ Activity Schedule Switching
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Collar Configuration

---

With the Activity Schedule Switching you can define an activity threshold value for switching GPS schedules. Therefore, mark Enable activity schedule switching and choose one value from 1 to 254 by using the arrow menu. If the activity measured is greater or equal, the collar will switch to the Activity Schedule.

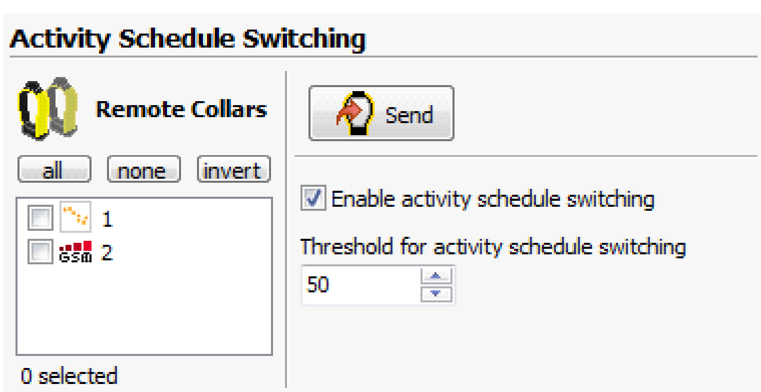


Figure 125: Activity Schedule Switching

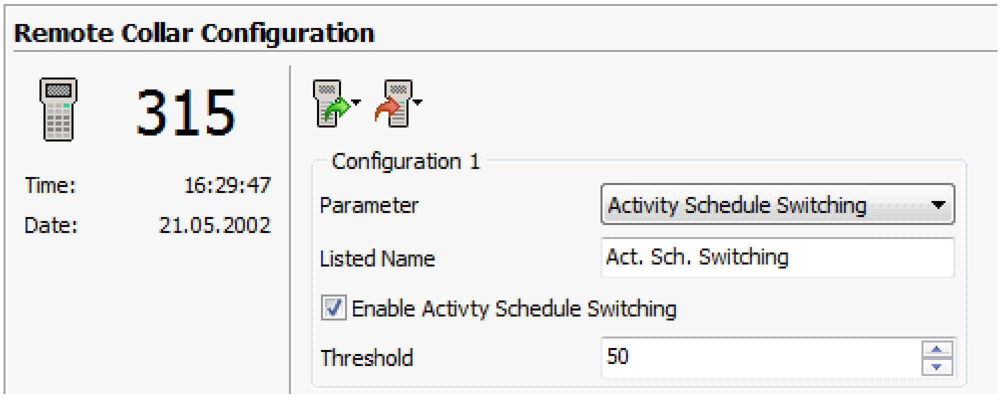


Figure 126: Activity Schedule Switching via Terminal

4.2.5.1.2 Beacon Schedule

Menu Bar ⇨ Schedules menu ⇨ Beacon Schedule Editor
Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ Beacon
Devices ⇨ Remote Collars ⇨ Schedules ⇨ Beacon
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Beacon Schedule

---

The beacon schedule defines the times of day in which the VHF beacon transmitter will be switched on. You can save energy by switching it off during times you will not radio-track the animal. Without a beacon schedule, the beacon will be switched on at all times. If the main battery has run out, the beacon will be switched on at all times to make the recovery of the collar easier.

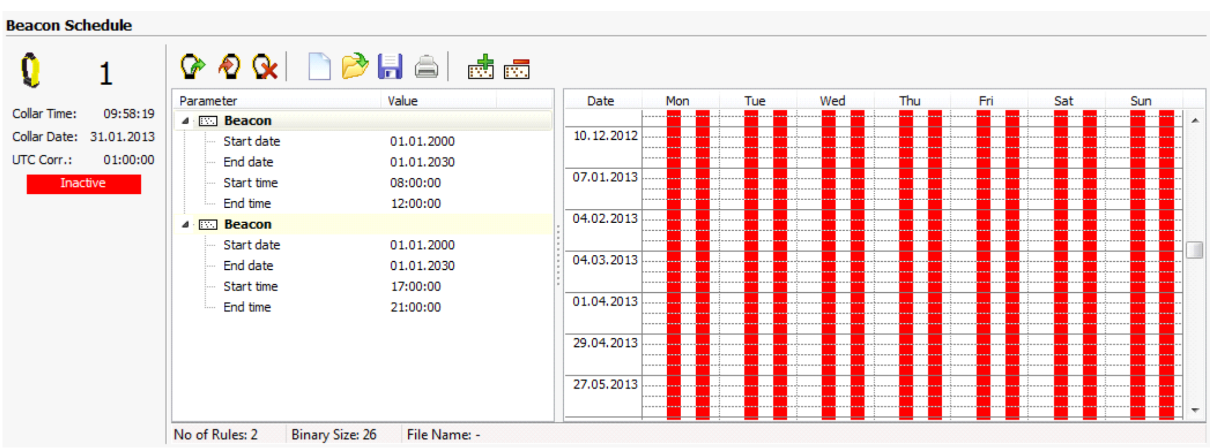


Figure 127: VHF Beacon Schedule Editor

The creation, editing and upload of a VHF schedule are similar to those of a GPS schedule (see chapter GPS schedules), but here only cyclic rules are possible. You can combine several rules to achieve a more complex schedule. Click to define a new rule and edit the start and end date for the schedule. Then define the time of day at which the beacon will be switched on (Start time) or off (End time) each day. The beacon-on times are marked red in the schedule calendar on the right side. Default file name of a beacon schedule is `BeaconSchedule.gsf`, but you can change the name during the storage process with to your requirements.

Note: When all End Dates of the VHF schedule are outdated, the VHF beacon is switched **off** and you **cannot radiotrack** your animal any more until the main battery has run out.

4.2.5.1.3 GSM and Iridium Schedule

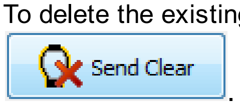
Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ GSM/Iridium
Devices ⇨ Remote Collars ⇨ Schedules ⇨ GSM/Iridium
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ GSM/Iridium Schedule
Menu Bar ⇨ Schedules menu ⇨ GSM/Iridium Schedule Editor

By default, the collar will collect a defined number of positions before it sends a message (e.g. 7 positions for one SMS). With the GSM/IRIDIUM schedule, you can define a certain time of day or a certain time period (e.g. every 60 hours) to send the GPS positions. At this time, the collar will switch on its GSM or IRIDIUM communication and send all positions stored since the last communication. This feature can reduce your collar's energy requirements, because communication attempts of the collar can be reduced.

One example would be a collar which takes hourly positions and sends seven positions per SMS. If you set the period to 14 hours, you would get two SMS with 7 positions each at the communication time, saving the energy for one communication attempt. With the GSM schedule, up to 70 positions or 10 SMS can be sent in one attempt.

The creation of a GSM/IRIDIUM schedule is similar to the creation of a Rollover Rule for a GPS schedule (see GPS Schedule Editor). Define a Start date and Start time, and an End date and End time for each rule. Then define a Period within this time span. A communication attempt will take place at the beginning of this period. If no communication can be established, the collar will wait for the next scheduled communication time (begin of next period). The upload of a GSM/IRIDIUM schedule is similar to that of a GPS schedule.

To delete the existing GSM / IRIDIUM schedule via Remote Collars please select the collar ID and click



.

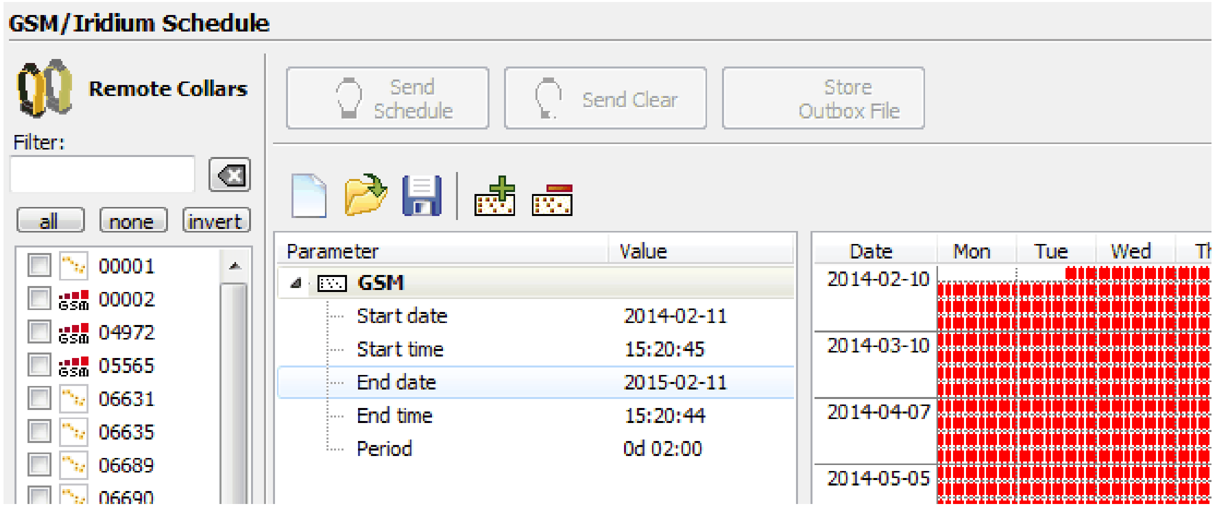


Figure 128: GSM/IRIDIUM Schedule Editor

Note: If a communication attempt has failed, the collar will try to send the positions from this attempt with the next attempt. This is independent from using the GSM/IRIDIUM schedule. With one communication attempt, a maximum of 70 positions or 10 SMS can be sent; these include the most recent positions. All older positions will be sent with the next attempt. If you program the GSM/IRIDIUM schedule to send 70 positions by default, messages that have not been sent will not be sent in a later attempt since there is no capacity for them.

Note: When all rules have passed, data is transmitted once a week (a maximum of 70 positions or 10 SMS can be sent). If all communication periods are in the future, an SMS is sent every two weeks. If the interval between two events is shorter than 50 minutes, the time is set to 50 minutes.

4.2.5.1.4 Virtual Fence

The Virtual Fence option for your GPS Plus collar allows you to define areas of special interest like a national park, a township, certain vegetation areas, or the home range of other animals in which you want to use an alternative GPS schedule. This opens possibilities for highly flexible schedules tailor-made for you and your study. A Virtual Fence Schedule is just another GPS Schedule.

Refer to:

The Virtual Fence editor

Uploading a Virtual Fence Collection to the collar

Virtual Fence Events (applies to GSM and IRIDIUM collars only)

4.2.5.1.4.1 The Virtual Fence editor

Menu Bar ⇨ **Tools** ⇨ Virtual Fence Editor
Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Virtual Fence Polygons
Devices ⇨ VERTEX Plus Collar ⇨ Configuration ⇨ Virtual Fence Polygons

Virtual Fence editors can be found in the Tools menu and in the nodes for Link Manager, Remote Collars, and Terminal.

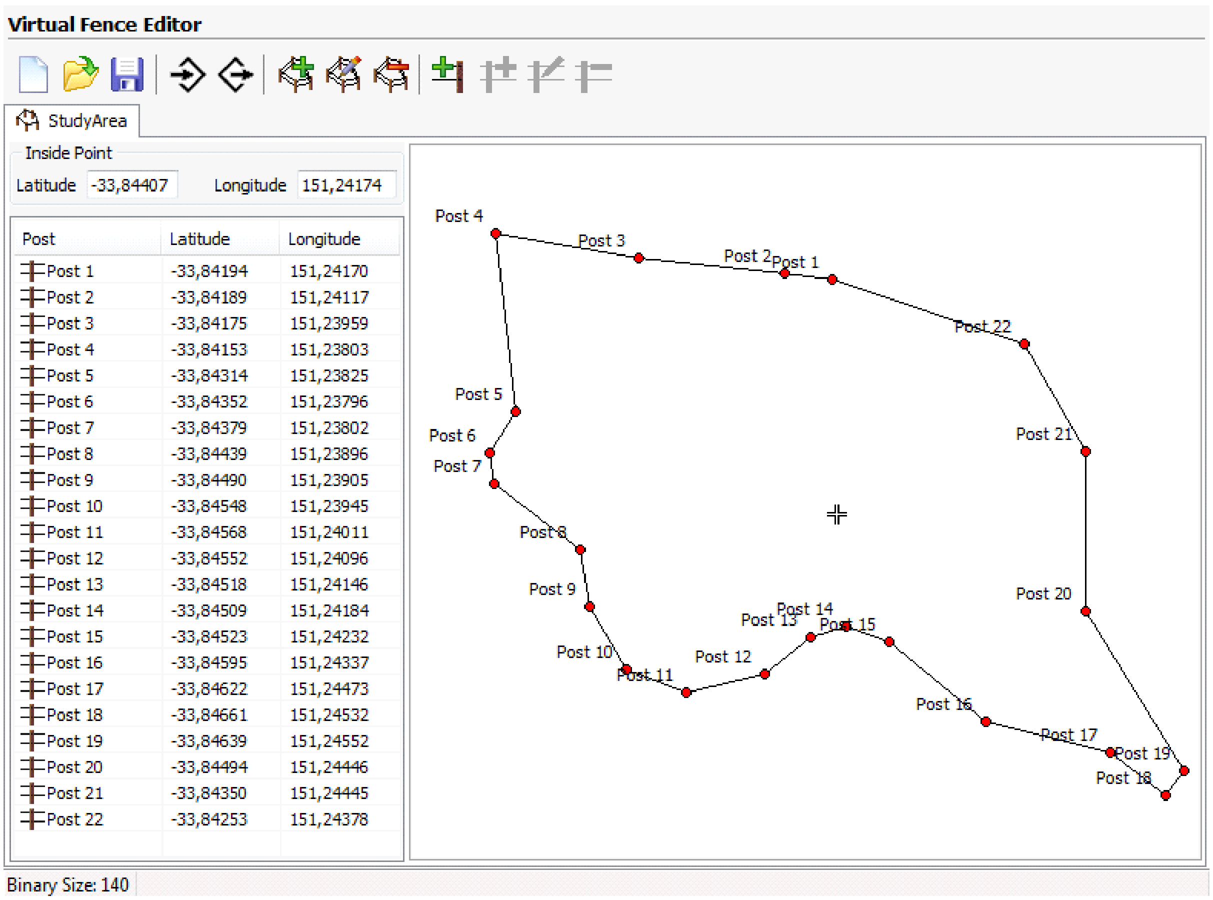


Figure 129: Virtual Fence editor

There are two ways to create a Virtual Fence:

1. in GPS Plus X by defining the Fence Post of a polygon with their single coordinates (Virtual Fence collections created in older versions of GPS Plus can be opened in GPS Plus X)
2. in Google Earth by creating a polygon and saving it as .KML file.

A Virtual Fence Collection can contain several single fences or polygons.

Each fence will be created and edited on its own tab, but all opened fences are shown in every tab (Figure below). The fence that belongs to the opened tab is marked with bright red posts. All fences that are opened at one time can be saved as one Virtual Fence Collection (.VFC) and can be uploaded to the collar via Link Manager, VHF/UHF Handheld Terminal, GSM, and IRIDIUM. For detailed information on shapes, combinations of several polygons of a Virtual Fence refer to the GPS Plus Collar Manual.

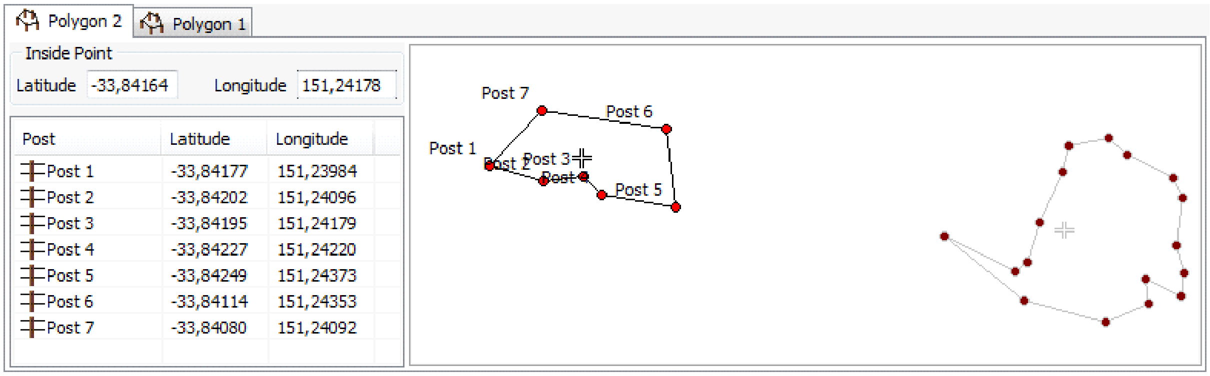


Figure 130: Combination of two fences. The positions in the left tab define the left fence (bright red posts).

Creates a polygon with four Posts and an Inside Point. The Posts are the corners of the Virtual Fence. The Inside Point is a reference of what side of the Fence is "inside". If you apply an alternative GPS schedule, this defines if the Virtual Fence schedule is applied while the collar is inside the enclosed area or outside.

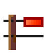
Edits the name of the fence.

Deletes the opened fence.

Appends a post to the end of the fence (e.g. Post 8 in Figure above).

Inserts a post before the selected post.

Edits the selected fence post. A new window will open (Figure below), in which you can edit the post's coordinates and name. The post you are currently editing is highlighted in green in the fence schematic.



Removes the selected post from the fence.

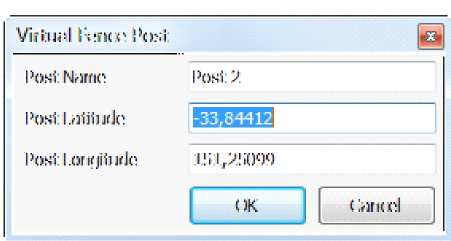


Figure 131: Post editing window

- Create a polygon using  in Google Earth covering your target area.
- Click the left mouse button to set a post.

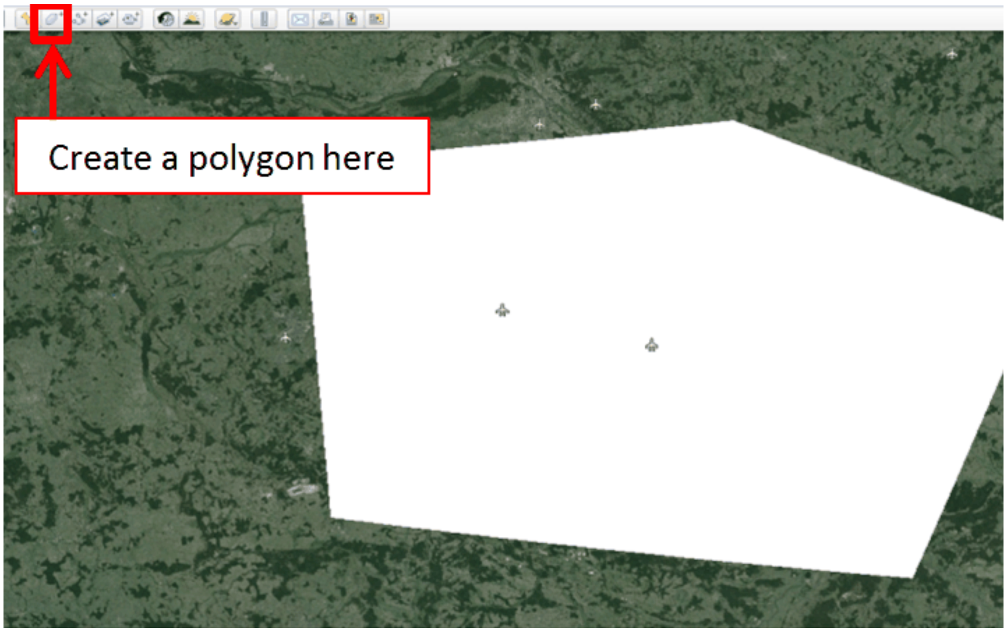
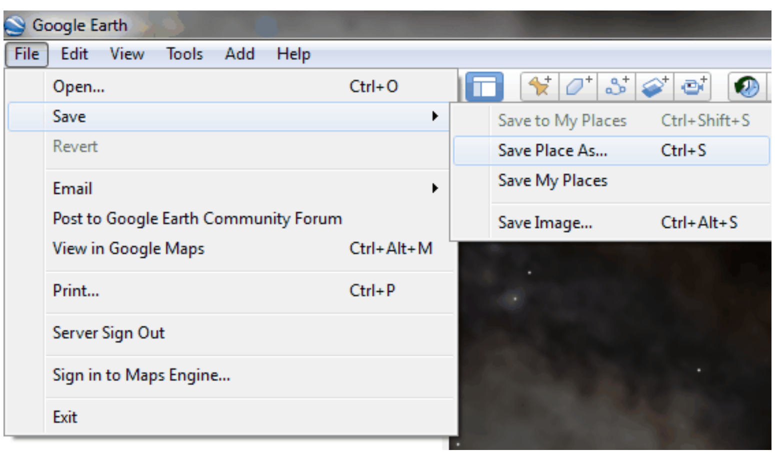


Figure 132: Google Earth - Creating a Virtual Fence

- Convert it into a KML file: File - Save - Saving As



- Import it in GPS Plus X under: collar – configuration - Virtual Fence Polygons

Please note: All Virtual Fences together cannot have more than 70 Posts!

You can create a polygon in Google Earth, save it as .KML file, and import it into GPS Plus X.

Please make sure that you use the Add Polygon command in Google Earth, and that the polygon does not have more than 63 corners or posts. Other series of coordinates will not be interpreted correctly.

Imports a .KML file from Google Earth into the Virtual Fence Editor. The corners of the polygon will be imported as posts.

Exports a fence (active fence only, not the complete Virtual Fence Collection) as .KML file to view in Google Earth.

4.2.5.1.4.2 Uploading a Virtual Fence Collection to the collar

There are limits for the size of the Virtual Fence Collection (.VFC) and the corresponding GPS schedule.

Using the Link Manager to send the .VFC to the collar, the maximum size of the .VFC is 385 bytes, the maximum size of the associated GPS schedule is 490 bytes. The actual size of the .VFC is given in the bottom left corner of the GPS schedule editor.

If you transfer the .VFC via IRIDIUM or GSM, Virtual Fence Collection and GPS schedule are transferred in one message, so both files must be smaller. For IRIDIUM or GSM 7-bit coding, the maximum size of the two files is combined 129 bytes, for GSM 6-bit coding, the maximum size of the two files is 109 bytes.

Refer to:

Upload via the Link Manager

Upload via GSM or IRIDIUM

Upload via VHF/UHF Handheld Terminal

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Virtual Fence Polygons
Devices ⇨ Link Manager ⇨ Collar ⇨ Schedule ⇨ Virtual Fence

You can directly create and upload a Virtual Fence Collection at the node Virtual Fence Polygons. This frame allows you to download the Virtual Fence Collection currently stored on the collar, edit, and save it.

You can also create a new Virtual Fence or open an already stored one. The Virtual Fence Collections can be directly written to the collar.

Note: The Virtual Fence Collections stored on the collar will be overwritten without warning and cannot be restored!

If you want your collar to automatically change the GPS schedule when the animal is positioned inside the Virtual Fence, you need to upload a Virtual Fence schedule.

This is done with the node Schedule ⇨ Virtual Fence. You can create a new schedule at this node, but you can also open any kind of GPS schedule stored earlier. The GPS schedule uploaded with this node is automatically labeled as Virtual Fence schedule.

Devices ⇨ Remote Collars ⇨ Configuration ⇨ Virtual Fences

If you upload a Virtual Fence Collection via GSM or IRIDIUM, you also have to send a Virtual Fence GPS schedule in the same SMS or IRIDIUM message.

The frame gives you two Open File dialogues. With the first one, select a stored Virtual Fence Collection. With the second one, select the GPS schedule.

Then choose the receiving collars and press Send. When sending this command, you do not have to distinguish between GSM and IRIDIUM collars, but you can send it to both collar types at the same time.

If you want to delete the Virtual Fence stored on a collar, use the node Clear Virtual Fence. It will delete the Virtual Fence and its schedule, and you have to send a new Virtual Fence Collection and GPS schedule to enable the Virtual Fence again.

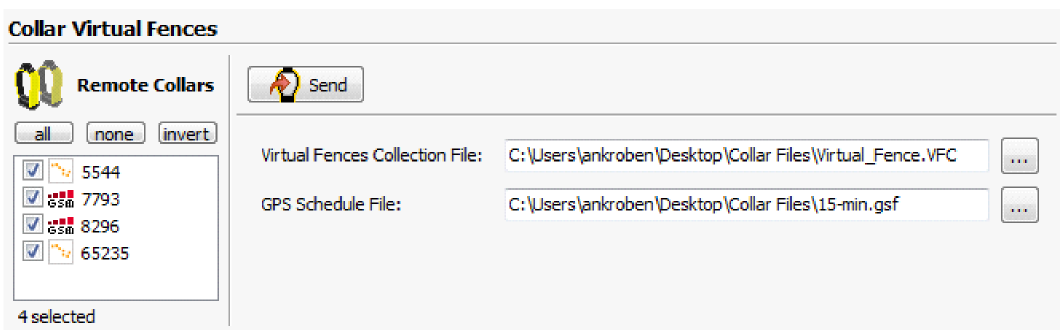


Figure 133: Frame to upload a Virtual Fence Collection and schedule via GSM and/or IRIDIUM

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Virtual Fence Polygons
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Virtual Fence Schedule

Open the node Virtual Fence Polygons.

This will open a Virtual Fence editor. Download a Virtual Fence Collection from the Handheld Terminal with , create a new Virtual Fence, or open an already stored one. When your Virtual Fence Collection is finished, select the collars from the pop-up list and write the files to the Handheld Terminal. This will only change the Virtual Fence polygons/collection, it will not affect the Virtual Fence schedule.

To change the Virtual Fence schedule, open the node Virtual Fence Schedule. Download a Virtual Fence schedule from the Handheld Terminal with , create a new schedule, or open an already stored one (see GPS Schedules for details). Upload it to the Handheld Terminal with .

4.2.5.1.4.3 Virtual Fence Events (applies to GSM and Iridium collars only)

Devices ⇨ Link Manager ⇨ Collar ⇨ Configuration ⇨ Virtual Fence Events
Devices ⇨ Remote Collars ⇨ Configuration ⇨ Virtual Fences Events
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Collar Configuration

If you are using a Virtual Fence, you can configure the collar to send a message via GSM or IRIDIUM after the collar has been located for the first time inside the Virtual Fence and/or after it has been located for the first time again outside the Virtual Fence. To ensure that you will receive the message, you can set a Retransmit Interval, which defines the time in minutes after which the message will be sent a second time. Different to position messages, the collar will not try to retransmit the message if the GSM network/IRIDIUM satellite has not confirmed the reception of the message.

The frames for Link Manager and Remote Collars (GSM/IRIDIUM) are the same (Figure below). Use the checkboxes for the messages that will be sent and enter the Retransmit Interval (0:00 means no retransmission). If you want to transmit the command via VHF/UHF Handheld Terminal, go to Collar Configuration and select the parameter Virtual Fence Events. Store the configuration file as described in Remote communication via UHF/VHF Handheld Terminal.

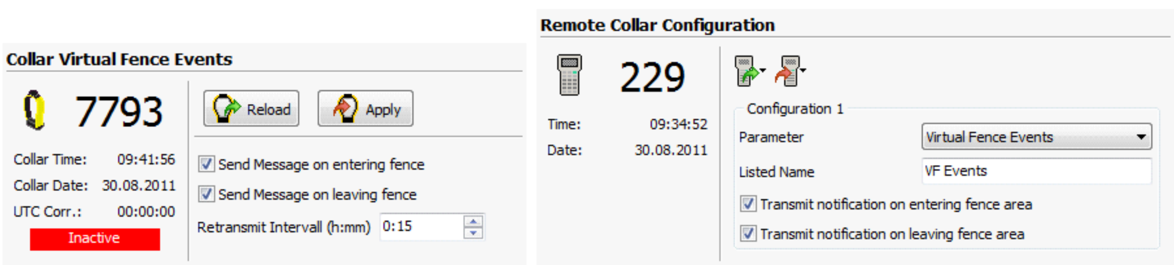


Figure 134: Frames to configure the Virtual Fence Event transmission with the Link Manager (left) and with the VHF/UHF Handheld Terminal (right).

4.2.5.1.5 Camera Schedule Editor

Menu Bar ⇨ Schedules menu ⇨ Camera Schedule Editor
Devices ⇨ Link Manager ⇨ Collar ⇨ Schedules ⇨ Camera
Devices ⇨ Remote Collars ⇨ Schedules ⇨ Camera
Devices ⇨ Link Manager or ⇨ Terminal ⇨ Remote Collars ⇨ Camera Schedule

The external camera is a device for taking photos / videos. This option is available for collars with UHF communication. The photos / videos are stored in the camera and can be read out by VECTRONIC.
In the Camera Schedule Editor you can define the times in which the camera will be activated. Add a

new rule by clicking or delete a rule by clicking. You can define and combine several rules.

The rule consists of three parts in which you can define the following options:

The activation time frame

The Mode frame

The Trigger frame

4.2.5.1.5.1 The activation time frame

In this frame you can configure the settings of the rule activation times:

Start Date / Time	the date / time when the camera rule is active
End Date / Time	the date / time when the camera rule is inactive
Cycle Duration	defines the cyclic times of the camera rule. Please type in the duration in the format (d hh:mm:ss). If you type in for example 2d:00:00, the rule will be activated every two days at the defined time span between start date / time and end date / time.
Active Duration	defines the time when the camera is active and could take photos / videos. Please type in the duration in the format (d hh:mm:ss). The camera will only be active if the time is within the defined cycle period.

Below is an example for an activation time frame. The start time is 11:00:00, the Cycle Duration is 2 days and the Active Duration is 2 hours. Using this schedule, the camera rule is active every second day between 11:00:00 and 13:00:00.

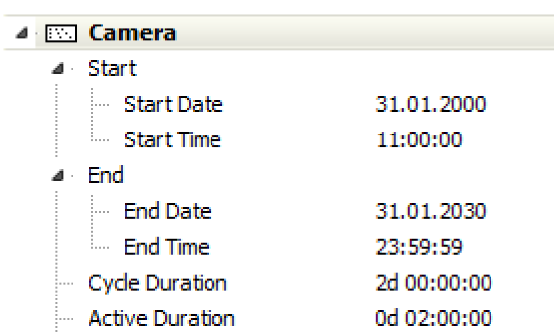


Figure 135: Camera Schedule Editor – Activation time frame

4.2.5.1.5.2 The Mode frame

In this frame you can configure what will happen when the trigger event occurs.

Mode	Define whether you want to take photos or record videos. Therefore, double-click on the opened mode node and use the arrow to open the menu.

If you choose to take photos, you can set the following:

Photo Count	defines the amount of photos you can take. The maximum value is 255.
Intervals (mm:ss)	defines the time span between sequenced photos. An interval of at least 30 s between two photos is recommended. The camera needs this time to recover. Choosing a lower interval may lead to a loss of photos.

If you choose to record a video, you can set the following:

Video Length	defines the length of the video. The maximal value is 18 hours.

4.2.5.1.5.3 The Trigger frame

Here you can configure the trigger. The trigger defines at which events the photo / video (which you chose from the Mode frame) is recorded. You can choose from the following events:

GPS	Fix Skip Count defines the amount of skipped events between the fixes on which the photos / videos are recorded. Extended Trigger defines that photos / videos are only recorded if one of the following options is enabled: On Prox. Detected (when a proximity event is detected), On Prox. Not Detected (when no proximity event is detected), On Inside Fence (when the animal is inside the Virtual Fence), On Outside Fence (when the animal is outside the Virtual Fence). You can enable more than one option. So it is possible, for example, to take photos only in times when your animal is inside the Virtual Fence and a proximity event is detected.
Timer	Here you can define an Interval (d hh:mm) in which photos / videos are recorded. Again, you can choose the Extended Trigger options. Extended Trigger defines

	that photos / videos are only recorded if one of the following options is enabled: On Prox. Detected (when a proximity event is detected), On Prox. Not Detected (when no proximity event is detected), On Inside Fence (when the animal is inside the Virtual Fence), On Outside Fence (when the animal is outside the Virtual Fence). You can enable more than one option.
Vaginal Implant	Here you can choose if you take photos / videos when no activity is detected (the Vaginal Implant is outside the animal) or if no contact is detected (the Vaginal Implant is outside the animal and the animal has left the calving site).
Proximity	Here photos / videos are recorded when a new ID is detected. The Lock Time (d hh:mm) defines the time span until the same ID can trigger the camera again.

Please note: As you can set several rules, it is possible that two or more rules overlap. In this case, the longer and more extensive rule will be triggered. For example, you have two rules with overlapping time. One rule is set for taking a photo and one rule for recording a video. When both times overlap, only the video is recorded. Another example is a case in which you have two video rules overlapping, however, one video recording time is longer than the other one. If the rules overlap, the videos will be joined together.

To delete the existing camera schedule via Remote Collars please select the collar ID and click

.

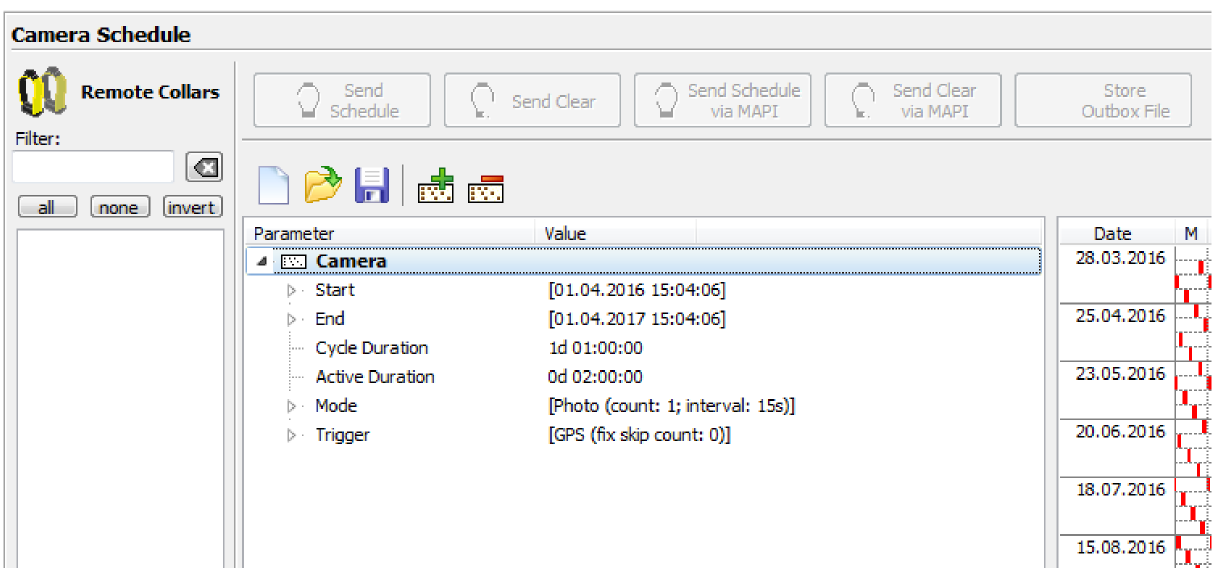


Figure 136: Camera Schedule Editor

For MAPI explanations please follow the link.

4.2.5.2 VERTEX collars (VERTEX Plus, Survey, VERTEX Lite)

The GPS schedule as well as the VHF Beacon schedule of VERTEX collars is set by Vectronic Aerospace according to your specifications. If you need changes in these schedules, you have the possibility to configure user-defined schedules and send them to the VERTEX collar.

If you need help connecting your collar to the computer refer to Direct communication with VERTEX Plus Collar and Remote communication via USB Remote Stick

For information to respective schedules refer to:

GPS Schedule for VERTEX collar

VHF Beacon Schedule for VERTEX collar

VERTEX Collar GPS & Beacon Schedule Files Upload

Schedules definable for VERTEX Plus collars:

Communication Schedule

External Sensor Receiver Schedule

Proximity GPS Schedule

Virtual Fence Schedule

Camera Schedule

4.2.5.2.1 GPS Schedule for VERTEX collar

Menu Bar ⇨ Schedules menu ⇨ VERTEX GPS Schedule Editor
Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Schedules ⇨ GPS
Devices ⇨ Remote Collars ⇨ VERTEX Collars ⇨ GPS Schedule

If you need another schedule than the factory set GPS schedule, you can change it in this frame. If you want to create a new schedule the first time (only the default schedule exists in the collar), a notification window will appear.

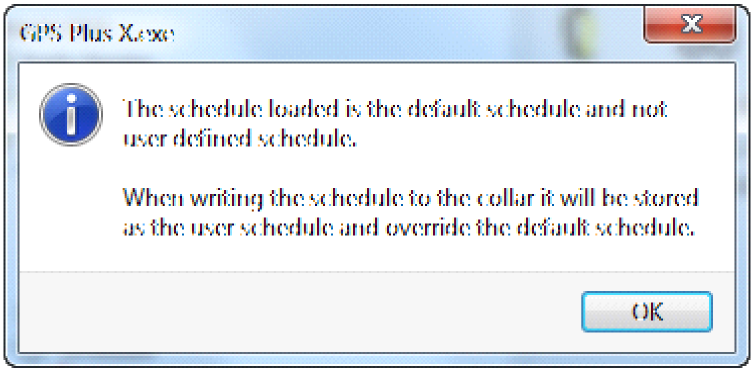


Figure 137: Notification window when selecting the GPS schedule frame for the first time

In the GPS schedule frame (Figure Survey Collar GPS Schedule frame) you can edit the rules for the collar in the left part of the frame. A graphic of the defined rules is displayed in the right part of the frame. The schedule which appears when opening the GPS schedule frame is the default schedule for the selected collar. You will be able to overwrite the default schedule with your own schedule. Therefore, you can set the following parameters:

Start Date	the date when the rule should start
End Date	the date when the rule should end
Period Length	the length of the period in which the Sequence for GPS recording is repeated
Sequence	The sequence is a time span within the period length between you like to take GPS positions. Here you can define: Offset – it defines the time span between the start of the period and the recording of the first GPS position; Duration – period in which the GPS positions will be recorded with the Fix Rate repetition; Fix Rate – GPS position recording repetition rate. Please note that you can only take GPS fixes within the time span of the period. This way, the sum of offset and duration must be smaller than the value of the defined period length. If you like to take only 1 GPS fix per sequence, the fix rate can equal the duration value. If you have already two position recordings in one sequence, you can delete the other sequence in the rule editor.

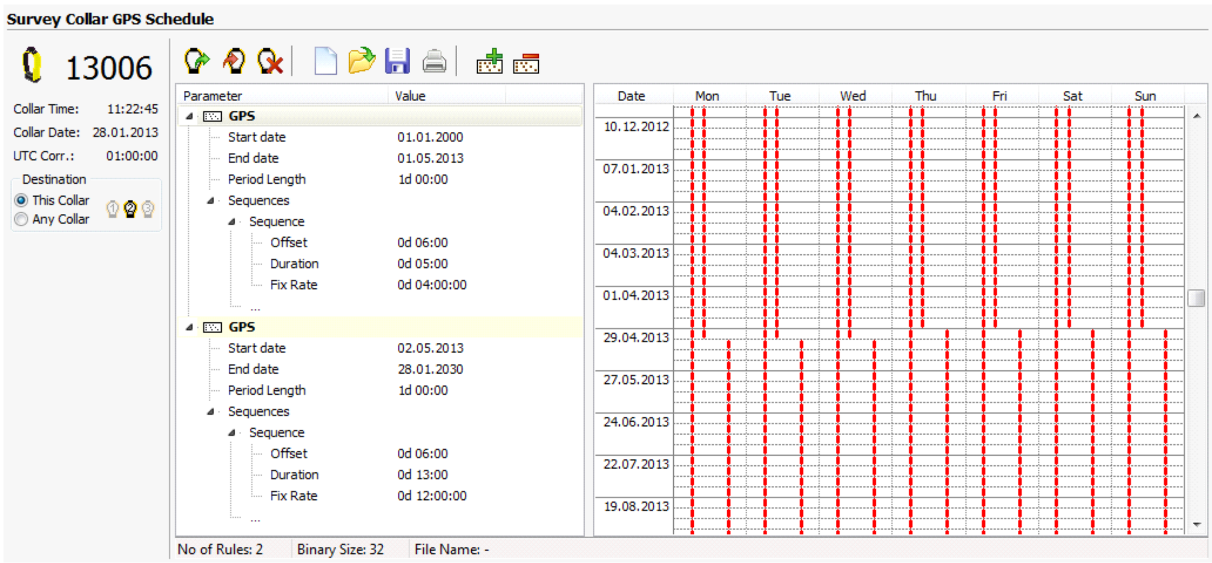


Figure 138: Survey Collar GPS Schedule frame

After changing the default rules to the user defined rules, you can choose if you like to send the new schedule only to the selected collar or to all collars found in the Device Search by setting up the Destination on the left side of the frame.

Press to apply the current settings to the collar.

Please note: As a Survey GLOBALSTAR collar you **can only take up to two positions per day,** GPS Plus X will check if there are not more than two fixes per day configured. If the rules are set up in a way that more than two positions are recorded every day, you will receive an error message.

The amount of positions per day is unlimited for Survey and VERTEX Plus IRIDIUM collars.

Note: For safety reasons you should define at least one schedule starting on 01.01.2000. If the collar's time is reset for any reason, the timer will start at this date and will attempt to take one fix per week until another schedule starts or until the clock is set to the correct UTC time by a successful GPS fix.

Note: The collar will take on GPS fix per week when all schedules rules are in the future or already outdated.

4.2.5.2.2 VHF Beacon Schedule for VERTEX collar

Menu Bar ⇨ Schedules menu ⇨ Beacon Schedule Editor

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Schedules ⇨ VERTEX Beacon

Devices ⇨ Remote Collars ⇨ Schedules ⇨ VERTEX Beacon (VERTEX IRIDIUM collars only)

The configuration of the VHF Beacon schedule is the similar to the configuration of the GPS schedule ([see chapter GPS Schedule for GPS Plus Survey Collar)](#) but without setting the Fix Rate. You can only set the Start Date and End Date, Period Length, Offset and Duration. The VHF beacon is active in the time span between Offset and Duration. For example, if you choose 6 hours for the Offset and a Duration of 4 hours with a Period Length of 1 day, the VHF beacon will be active every day from 6.00 am to 10.00 am. In difference to the GPS schedule, you can define max. 372 VHF beacon schedule rules.

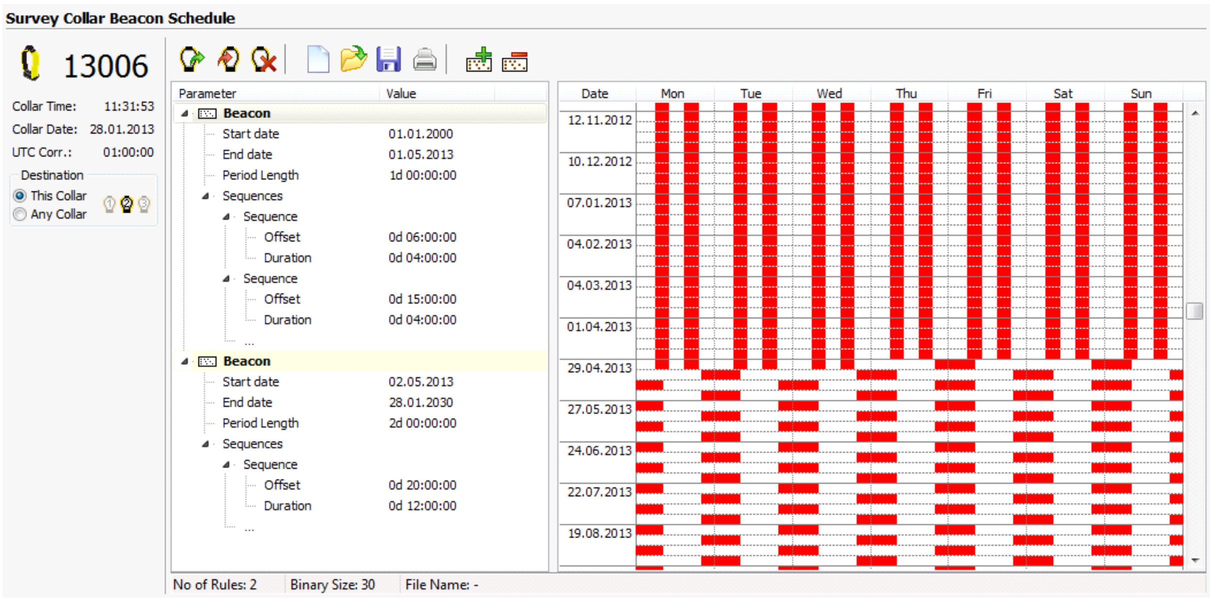


Figure 139: Survey Collar Beacon Schedule frame

To save battery life, it might be useful to switch off the beacon during times when you will not track your animal (e.g. during the night).

After setting up the VHF Beacon schedule, you can choose if you like to send the new schedule only to the selected collar or to all collars found in the Device Search by setting up the Destination on the left side of the frame. To send the VHF beacon schedule to the collar / to the collars, press .

Note: When all End Dates of the VHF schedule are outdated, the VHF beacon is switched on 24 hours per day.

4.2.5.2.3 Communication Schedule for VERTEX collar

With this feature you can control when the collar tries to contact the satellite to transfer fixes. It is only necessary to create this schedule if you do not agree with the default settings which collects 4 fixes and send them instantly in one message. The schedule creation rules are similar to the Beacon schedule.

4.2.5.2.4 External Sensor Receiver Schedule for VERTEX Plus collar

The External Sensor Receiver schedule defines when the collar listens for signals sent by external sensors. The schedule rules are similar to the Beacon schedule: You can only set the Start Date and

End Date, Period Length, Offset and Duration. The External Sensor Receiver is active in the time span between Offset and Duration.

4.2.5.2.5 VERTEX collar GPS & Beacon Schedule Files Upload

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Schedules ⇨ GPS & Beacon Files Upload

You can choose and upload GPS and Beacon Schedule files to your Survey collar. You can decide whether you want to send the schedules to This Collar (the collar which is actually connected) or to Any Collar by selecting the corresponding option on the left side of the frame (see below).

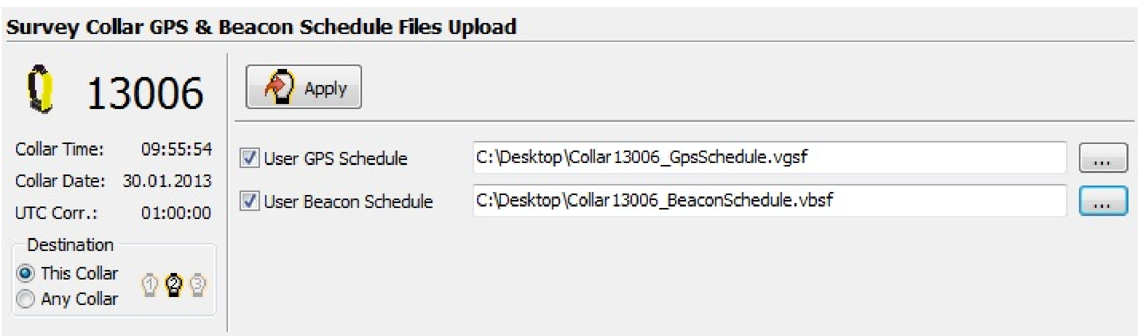


Figure 140: Survey Collar GPS & Beacon Schedule Files Upload frame

Note: The upload of GPS user schedules that do not apply to the rules of two fixes per day and two fixes being at least 30 minutes apart, is prohibited. If you try to upload such a schedule, an error message will appear.

4.2.6 Collected Data

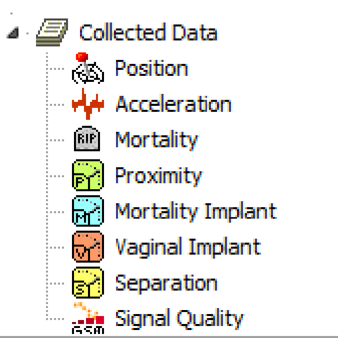


Figure 141: Collected Data

This frame shows the data retrieval options of your device. Labeling might differ with different collar generations and types.

On the Collected Data base node you can read and safe data all at once. By ticking the checkboxes you also can choose several data sets to safe them as single parts.

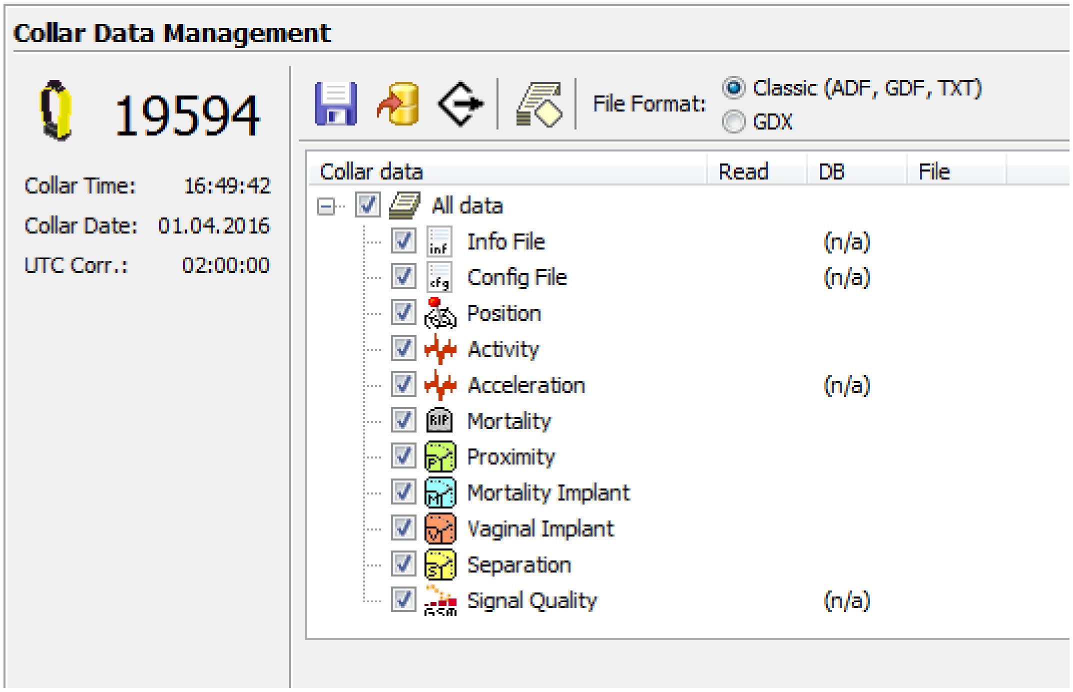


Figure 142: Collar Data Management: Read all data

Following buttons will appear on the symbol bar in this chapter:

Reads data from the collar and displays it in frame; this is not automatically as the download of data can take several seconds to minutes.

Saves the data to the storage module; we advise to save all data from the collar, even if you export them as data files.

Saves data to storage module.

Exports data to your computer / disk

These commands erase the data stored on the collar. From left to right: GPS position, acceleration, mortality, proximity. Please make sure that you have stored the data before you use this command. Data cannot be restored once deleted!

Please refer to Data frames

4.3 The Data Tree

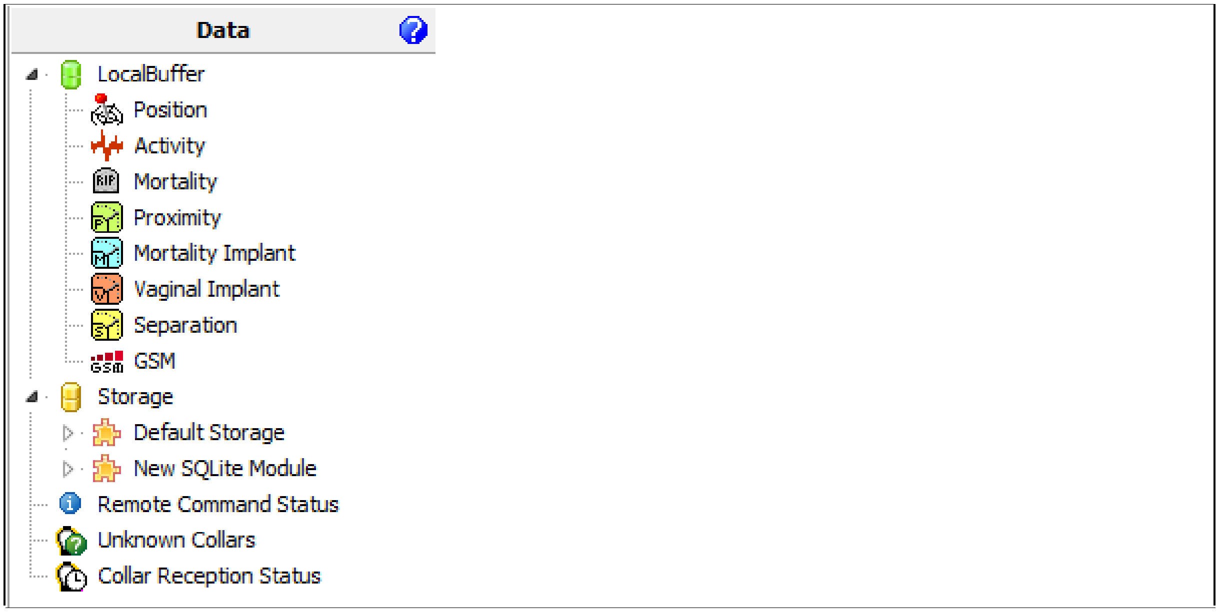


Figure 143: Data tree

In this section you find all the collar-collected data which are stored in either the Data Storage Service or in the GPS Plus X Local Buffer. By navigating through the tree you are able to access the data stored in the different storage modules and in your Local Buffer. When your data services are running and you save data, it will be stored directly in the Storage, which refers to the storage modules. If this connection is currently unavailable, data are stored in the Local Buffer and transferred to the Storage after the connection has been restored. This frame also includes a list of Unassigned Communication IDs.

In GPS Plus X, data are handled or stored in different steps:
First, you can download data directly from the collar, from the Handheld Terminal or remotely using the wireless USB Remote Stick.
Then, data are displayed in the nodes Collected Data of the Link Manager, Terminal or USB Remote Stick in the Devices tree. Then you can decide whether you want to export the data or store them in the database of the software.

For safety reasons, we advise to store all data in the database, even if you have exported them. This way, you have data of all collars in one database.

If your PC is not connected to your data services (see chapter Data Storage Service (DSS) configuration), the data will be stored in the Local Buffer until the PC reconnects to the data services. All data will then be transferred from the Local Buffer to Storage. A copy of the transferred data can remain in the Local Buffer or all data in the Local Buffer will be deleted (see Local Buffer).

Refer to:

Data frames

Downloading Data via Link Manager

Terminal Collected Data

Downloading Data via USB Remote Stick

Local Buffer

Data Storage

Communication IDs

4.3.1 Data frames

There are several ways to access, view, and export data in GPS Plus X.

You can read stored data from

- a GPS Plus / GPS PRO collar via Link Manager (Data via Link Manager),
- a VERTEX Plus collar via cable "USB to VERTEX Collar Interface" (Data from VERTEX Plus collar)
- a Survey collar via USB Remote Stick (Data via USB Remote Stick).
- a Handheld Terminal (Data from Terminal),
- data stored in the local buffer (Local Buffer) and data located in the storage modules (Main Data Storage).

In all cases, data are displayed in specific lists, they can be filtered according to time and quality, and they can be exported. The data frames are the same for each access option and will be explained in the following sections.

You have the possibility to use the copy to clipboard functionality. This might be useful if you don't need the full data sheet but only several data. You may export them for example to Excel and send it to colleagues.

You can select multiple data records by holding the ctrl button or Shift button and clicking on the desired data records. By pressing ctrl + c or ctrl + insert, data rows are exported as ASCII table and copied to the clipboard. Clicking the right mouse button on selected rows, a context menu opens which allows you to additionally copy CSV Spreadsheet to clipboard. Summarizing, you have the possibility to use this function in case of the Export function when you only need several data rows. The copy to clipboard functionality is faster when choosing special data records.

You can change the sequence of columns by Dragging and Dropping the column header. Furthermore, you can hide columns which you don't need by right clicking on the header of the desired columns.

All data frames are similar to each other and contain three panels: Filter, Export, and Details. They can be maximised or minimised with the and buttons. At the very bottom of each frame, four numbers are shown:

Record Count	number of fixes recorded in and downloaded from the collar
Visible	number of fixes displayed
Hidden	number of fixes that do not fulfil the filter criteria and are therefore hidden; these fixes will not be exported or displayed in the chart, but will be stored to the database.
Selected	number of clicked lines

Figure 144: bottom of frame

Refer to:

GPS Data

Activity data

External Sensors

Trap Transmitter data

GSM Quality

4.3.1.1 GPS Data

For each fix, the quality is given. The categories for fix quality are as such:

GPS-Val.-3D	This is a special feature of the used GPS receiver: A fix is considered validated, if the receiver uses five or more satellites to calculate the position and the DOP is less than 10.0. Since the navigation solution needs only four satellites, the equations are over-determined by one or more values. This can be used to

	calculate some validation on the range measurements. If this has succeeded, the fix is considered validated; this is the best fix quality you can get.
GPS-3D	At least four satellites were used. This is an accurate fix.
GPS-2D	Three satellites were used. This fix used the height information of the last fix as fixed.

Refer to:

Filter

4.3.1.1.1 Filter

You can use the Filter functions to exclude invalid data or choose special study periods for storage/export.

All filter criteria are optional. You can switch the filter on with the corresponding button.

If the filter is active, it will stay active when you choose another collar. This way, you can choose other collars and the filter settings remain.

You will see only the data you chose with the filter settings.

Start and End	Enable the time filter for the displayed data with the checkboxes and define date and time of one or both.
Hide fixes less than	With this checkbox, define a minimal quality for the displayed fixes. All fixes with lower quality will not be displayed, exported, or saved.
Hide invalid altitude fixes	Fixes in which the altitude is not valid will not be displayed, exported, or saved.

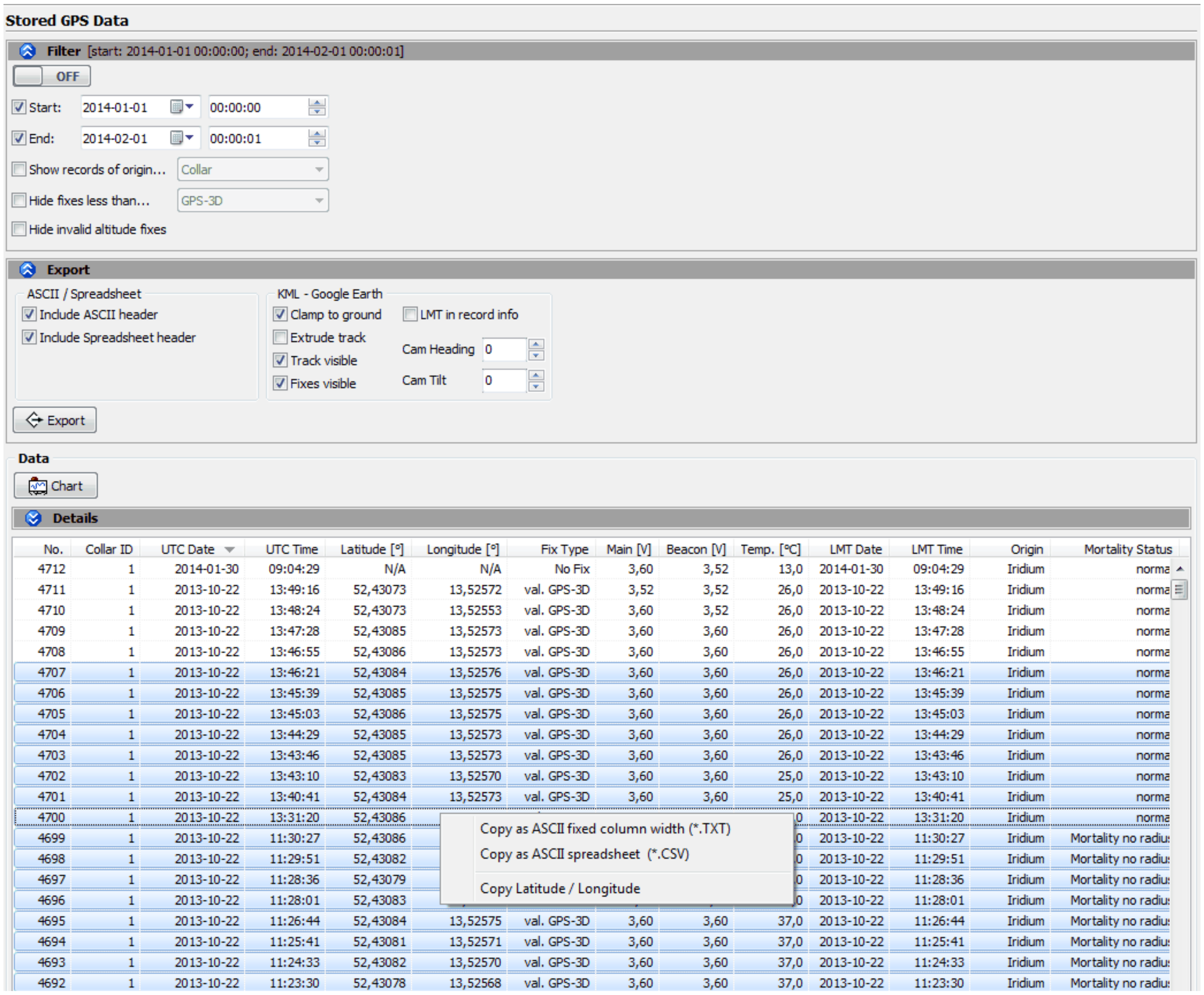


Figure 145: Frame to download and view the GPS data.

To copy a latitude / longitude pair into the temporary buffer store of your computer use the right mouse button and choose Copy Latitude / Longitude .

You can also copy a variety of GPS positions into ASCII fixed column or into ASCII spreadsheet (see picture above).

Refer to:

Export
Data

4.3.1.1.2 Export

These are the settings to export the data as data file in different formats.

The following formats are available:

GPS Data File (.GDF)	the VECTRONIC Aerospace format for GPS data. This format can be read by GPS Plus versions older than 10.0, and contains information which can help the VECTRONIC Aerospace team with trouble shooting. The .GDF format can also be used as import format.
ASCII fixed column width (.TXT)	has equal sized (number of characters) fields for every row and thus can be easily read by humans (as a table)
ASCII spreadsheet (.CSV)	is machine readable, which means table entries are separated by a freely definable character (e.g. comma) that can be defined in the options form
DBase table (.DBF)	is only readable after being imported into a database system
GPS Exchange Format (.GPX)	is a XML format containing waypoints and can be imported into several GPS software applications
Keyhole Markup Language (.KML)	is a XML format used in Google Earth to display tracks, points of interest, etc.
Keyhole Markup Language Zipped (.KMZ)	is a zipped XML format for Google Earth to display tracks, points of interest, etc.
BioTelemetry eXchange (.BTX)	is an XML format defined by VECTRONIC Aerospace, which will make it easier to exchange acquired data over system boundaries
GPS Data eXchange (.GDX)	is an XML format defined by VECTRONIC Aerospace, which will make it easier to exchange acquired data over system boundaries. It is an internal format of GPS Plus X and can also be used as import format.
SMS Zip file (.zip)	is a format to export SMS files (packed in a ZIP file) for export to the old GPS Plus software

There are some options for the data export that can be defined first.

ASCII/Spreadsheet	By default, only the GPS fix data will be exported. For easier access to these informations, it might be useful to export the header for the data columns too
KML – Google Earth:	
Clamp to ground	if checked, the path displayed in Google Earth is always shown as anchored to the ground, regardless of its altitude or if terrain is enabled or not
Extrude Path	if checked, the path will be shown as an semi-transparent wall with height of the fixes altitude
Track visible	if checked, the track will be visible in Google Earth as coloured line
Fixes visible	if checked, all fixes will be visible in Google Earth as coloured icons
LMT in record info	if checked, the local mean time according to the UTC correction of GPS Plus X will be shown in Google Earth
Cam Heading	viewing direction of 0 – North 90 – West 180 – South 270 - East
Cam Tilt	inclination of the camera 0 – straight downwards 90 – horizontal into viewing direction 180 – straight upwards 270 - horizontal into opposite viewing direction

Refer to:

[Data](#)

Press 

to open a Save File dialog, and choose a folder and a format to which you want to export the data as selected by the filter.

The default file name, which can be changed to your requirements, will be `GPS_Collar8769_ YYYYMMDDhhmmss.GDF`, including the collar ID and time stamp of the export.

Data will be exported in the same sequence as shown in the display, so please check if a desired data is visible.

4.3.1.1.3 Data

The button Chart opens a separate window with a grid chart with all filtered fixes to give you fast access to your data. This window can remain open while you proceed working with GPS Plus X, and you can open more windows with other data sets to compare positions.

With the File menu, you can Save the chart as one of these files:

Windows Meta File (.WMF)	vector format, which is easily scalable; text and data will also be scaled
Enhanced Windows Meta File (.EMF	newer version of .WMF
Bitmap (.BMP)	pixel-oriented graphic, chart will be stored as it is shown in the window

You can also Print the chart directly. With the View menu, you can change the charts appearance. With Units, you can switch between a grid in degrees or kilometres (Figure below).

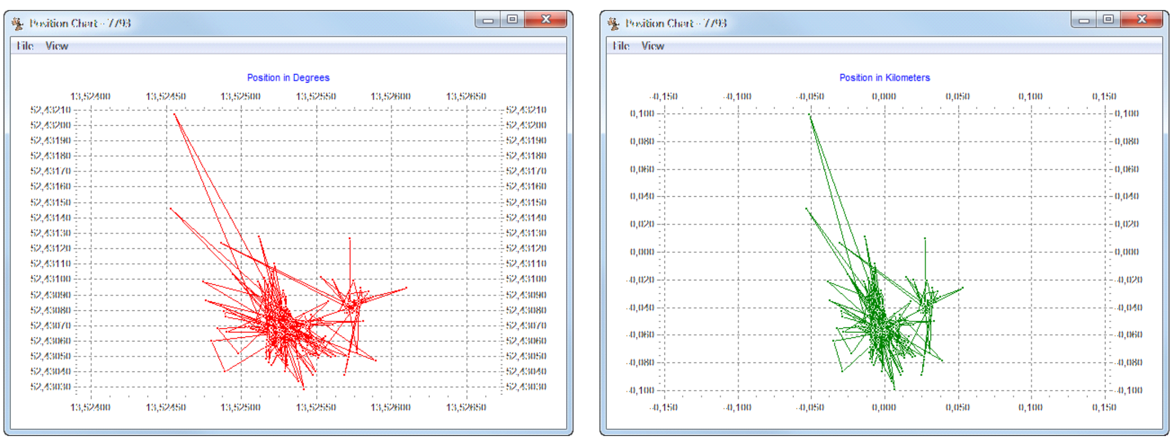


Figure 146: Position charts in degrees (left, red lines) and kilometres (right, green lines)

Hide Lines can be checked to show the fixes only (Figure below). If the cursor is positioned within the grid, its position is always labelled with degrees or kilometres, depending on the selected unit. You can Zoom In and Zoom Out. Zoom All returns you to the original view showing all positions.

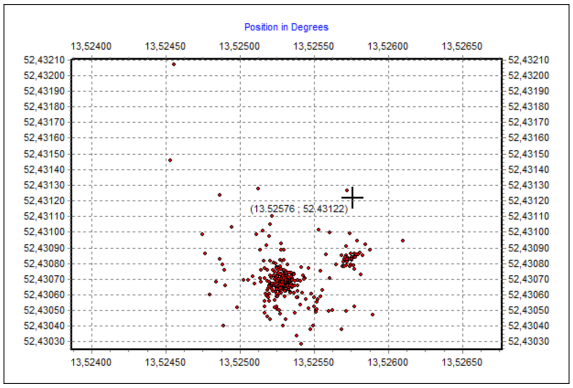


Figure 147: Chart with fixes only ("Hide Lines" is enabled). The position of the cursor is given in degrees.

All selected positions are displayed in the bottom part of the frame. These are the same positions that will be exported or displayed. There are two sections to display the data. The first one is minimised by default. It shows the details for one fix only. This fix can be selected from the list below. This list contains all filtered positions. The displayed columns can be selected by right-clicking on the column and checking the desired columns. Column order can be changed by dragging and dropping the column header. Fixes can be sorted by different parameters. To select a parameter and the sorting order, left-click on the respective header. The following information can be displayed:

No	line index, dependent on time stamp; this index number is created when data are read out of the collar and will not be changed when data are filtered (this way, "data gaps" caused by filtering are easily detectable)
Collar ID	ID of the collar from which the positions have been downloaded
UTC date and time	time in Universal Time Coordinated (UTC, equivalent to GMT, without daylight saving time/summer time)
LMT date and time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the the message originates from
SCTS Date/Time	the date/time when the provider receives the message
ECEF X, Y, and Z	coordinates in the Earth Centred Earth Fixed coordinate system
Latitude, Longitude, Height	geographical position based on WGS84

DOP (Dilution of Precision)	value for the geometric constellation of the received GPS satellites
Fix Type	quality of fix obtained
3D Error	shows the difference [m] between the real position and the transmitted position
Sats used	number of satellites used for the fix. When you have satellites communication or GSM in your collar, those data are missing and N/A is displayed. You will be able to see those data when your collar is connected to the PC
Sat No/ C/No [dBHz]	channels of the GPS receiver with two columns each containing the received satellite number and the carrier to noise ratio in dBHz
Main [V]	voltage of the main battery in Volts
Mortality Status	shows the mortality status at the time of the GPS fix: Normal, Low actitvity within radius, Low activity outside radius, Mortality within radius, Mortality without radius, N/A (displayed if the mortality option is inactive)
Beacon [V]	voltage of the beacon battery in Volts
Temp [°C]	temperature inside the upper housing of the collar; this is not necessarily the ambient temperature, since the animal and/or the sun will warm up the collar
Transformed Coordinates	One or two columns: the headings may vary depending on the coordinate system selected
Activity (Survey collars)	shows the activity of the last 5-minute-interval before the last GPS position was recorded. The values can only be obtained via GLOBALSTAR. They are not stored in the collar and cannot be downloaded after the collar has been retrieved from te animal

4.3.1.2 Activity data

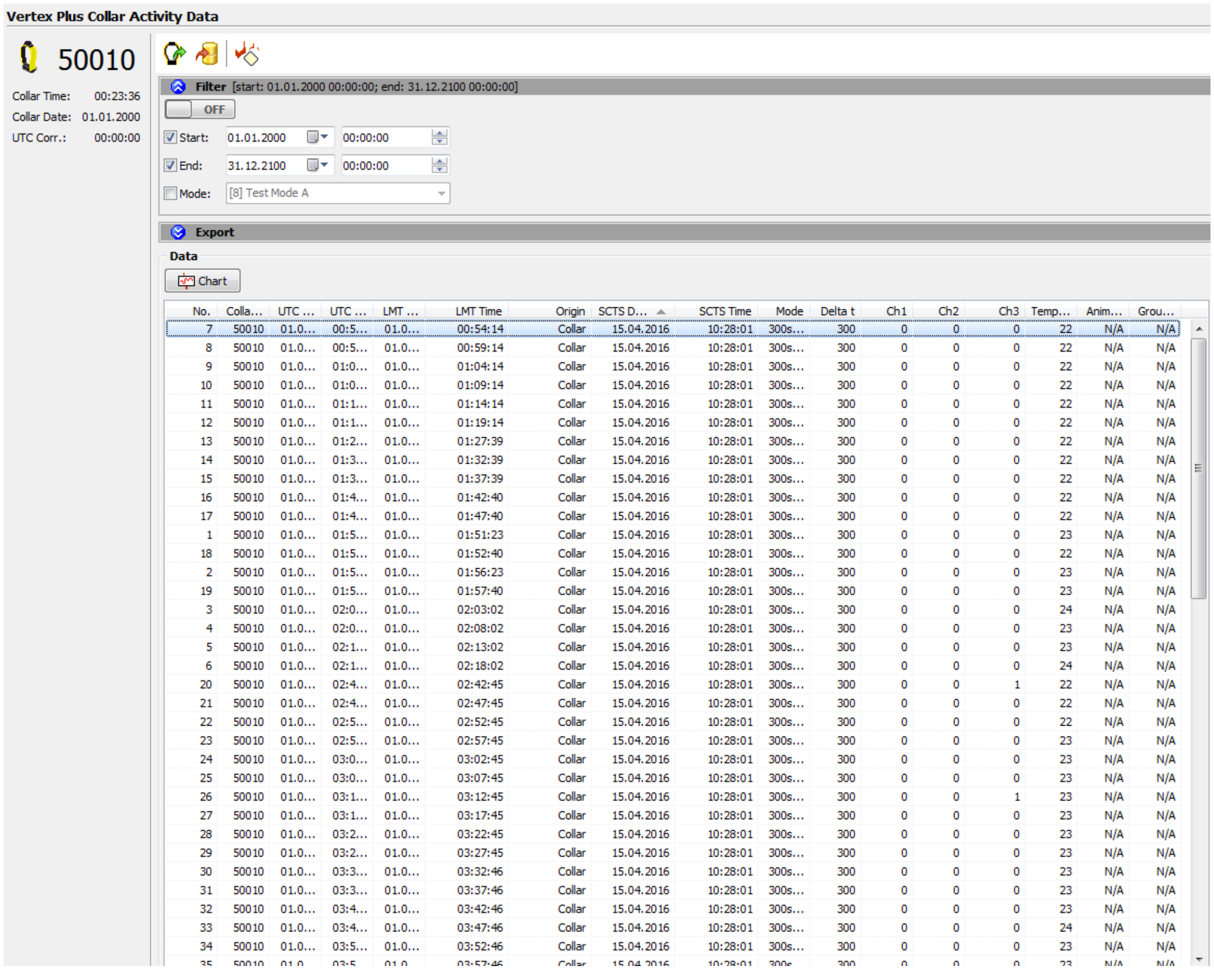


Figure 148: Frame to download and view the activity data

Refer to:

[Filter](#)

4.3.1.2.1 Filter

You can use the Filter functions to exclude invalid data or choose special study periods for storage/ export.

[Data frames](#)

All filter criteria are optional. You can switch the filter on with the corresponding button. Start and End enable the time filter for the displayed data with the check-boxes and define date and time of one or both.

You can also filter according to the activity mode by checking the box Mode and selecting a mode from the drop-down list.

If the filter is active, it will stay active when you choose another collar. This way, you can choose other collars and the filter settings remain. You will see only the data you chose with the filter settings.

Refer to:

Export

4.3.1.2.2 Export

These are the settings to export the data as data file in different formats. The following formats are available:

Activity Data File (.ADF)	the VECTRONIC Aerospace format for activity data. This format can be read by GPS Plus versions older then 10.0 and the Activity Pattern software, and also contains information which can help the VECTRONIC Aerospace team with trouble shooting. The .ADF format can also be used as import format.
ASCII fixed column width (.TXT)	has equal sized (number of characters) fields for every row and thus can easily be read by humans (as a table).
ASCII spreadsheet (.CSV)	is machine readable, which means table entries are separated by a freely definable character that can be defined in the options form.
DBase table (.DBF)	is only readable after being imported into a database system.
BioTelemetry eXchange (.BTX)	is an XML format defined by VECTRONIC Aerospace, which will make it easier to exchange acquired data over system boundaries.
GPS Data eXchange (.GDX)	is an XML format defined by VECTRONIC Aerospace, which will make it easier to exchange acquired data over system boundaries. It is an internal format of GPS Plus X and can also be used as import format.

There are some options for the data export that can be defined first.

ASCII/Spreadsheet	by default, only the activity data will be exported. For easier access to these informations, it might be useful to export the header for the data columns too.

Press [Export] to open a **Save File** dialog, and choose a folder and a format to which you want to export the data as selected by the filter. The default file name, which can be changed to your requirements, will be `ACT_Collar8769_ YYYYMMDDhhmmss.ADF`, including the collar ID and time stamp of the export. Data will be exported in the same sequence as shown in the display, so please check if a desired data is visible.

Refer to:

Data

4.3.1.2.3 Data

The button [Chart] opens a separate window with a grid chart with all filtered activity data sets. You can open more windows with other data sets to compare activity values.

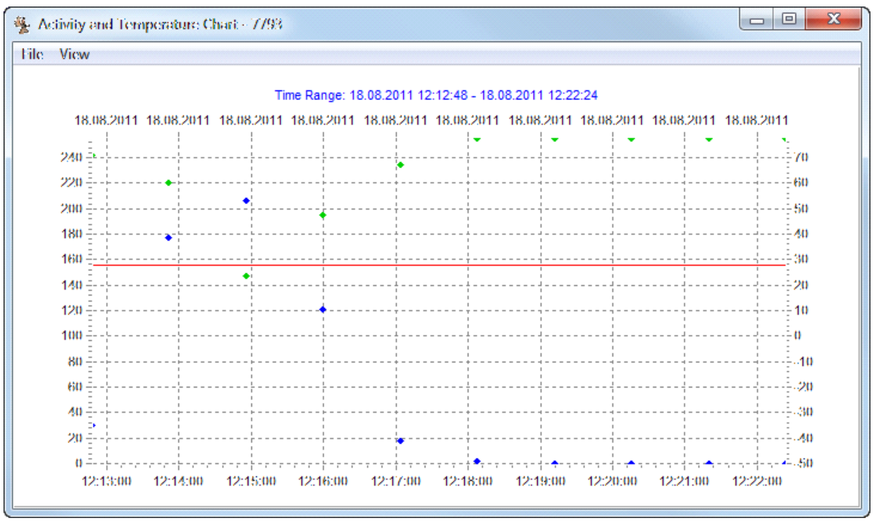


Figure 149: Activity and Temperature Chart

With the **File** menu, you can **Save** the chart as one of these files:

Windows Meta File (.WMF)	vector format, which is easily scalable; text and data will also be scaled.
Enhanced Windows Meta File (.EMF)	newer version of .WMF
Bitmap (.BMP)	pixel-oriented graphic, chart will be stored as it is shown in the window.

You can also **Print** the chart directly.

With the View menu, you can change the charts appearance.

The chart shows the activity values of channel 1 (green diamonds) and channel 2 (blue diamonds), as well as the temperature data (red line, if sensor is enabled). You can show or hide each parameter by checking and unchecking them.

With Zoom In and Zoom Out you can change the time period of your chart to your needs. Alternatively, with Zoom you can display on the levels Day, Week, Month, Year, All. The displayed time period is given as Time Range on top of the chart.

All selected activity data sets are displayed in the bottom part of the frame . These are the same positions that will be exported or displayed. The displayed columns can be selected by right-clicking on the column and checking the desired columns. Data sets can be sorted by different parameters. To select a parameter and the sorting order, left-click on the respective header.

The following information can be displayed:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded
UTC date and time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date and time	local mean time, depending on the value set in UTC Correction (see chapter System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
Mode	activity mode; for details on the modes please refer to chapter Activity Mode
Delta t	time interval over which acceleration values have been measured for one stored activity value
Ch1	activity value for channel 1 (depending on activity mode)
Ch2	activity value for channel 2 (depending on activity mode)
Temp	temperature of the collar; this is not necessarily the ambient temperature, since the animal and/or the sun will warm up the collar

4.3.1.3 External Sensors

If you download data from the external sensors (i.e. Proximity, Separation, Mortality Implant, Vaginal Implant) directly from the collar, via Link Manager or from a UHF Handheld Terminal, there will be one node for all external sensors.

Each sensor's data can be downloaded on a single tab.

If you want to access these data in the storage, there will be nodes for each sensor. The data format will be described in the following sections.

Information on the function and of the external sensors currently available is given in Appendix A: External Sensors.

Refer to:

Mortality

Proximity

Mortality Implant

Vaginal Implant

Separation Sensor

4.3.1.3.1 Separation Sensor

The frame is the same as for the activity data (Activity data) for more information on the product please refer to Appendix A.4: Separation sensor.

Data can be exported as ASCII (.TXT), ASCII Spreadsheet (.CSV) and GPS Plus Data Exchange (.GDX), with or without header. The default file name, which can be changed to your requirements, will be `SEP_Collar8769_ YYYYMMDDhhmmss.TXT`, including the collar ID and time stamp of the export.

The list in the lower part of the frame displays the filtered separation sensor data sets with the following information:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded
UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)

LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
Transmitter ID	ID number of the received UHF ID tag
Temperature [°C]	temperature in °C measured by the vaginal implant
Received	indicates whether a UHF ID signal has been detected (= True) or not (= False)
Alive	shows if the animal which ID was received by the collar, is still alive (= True) or if it is dead (= False).
Description	Two cases can appear in this column: (1) Status Message, (2) Alarm Message – appears when no signal was detected for one hour. The animals are separated from each other.

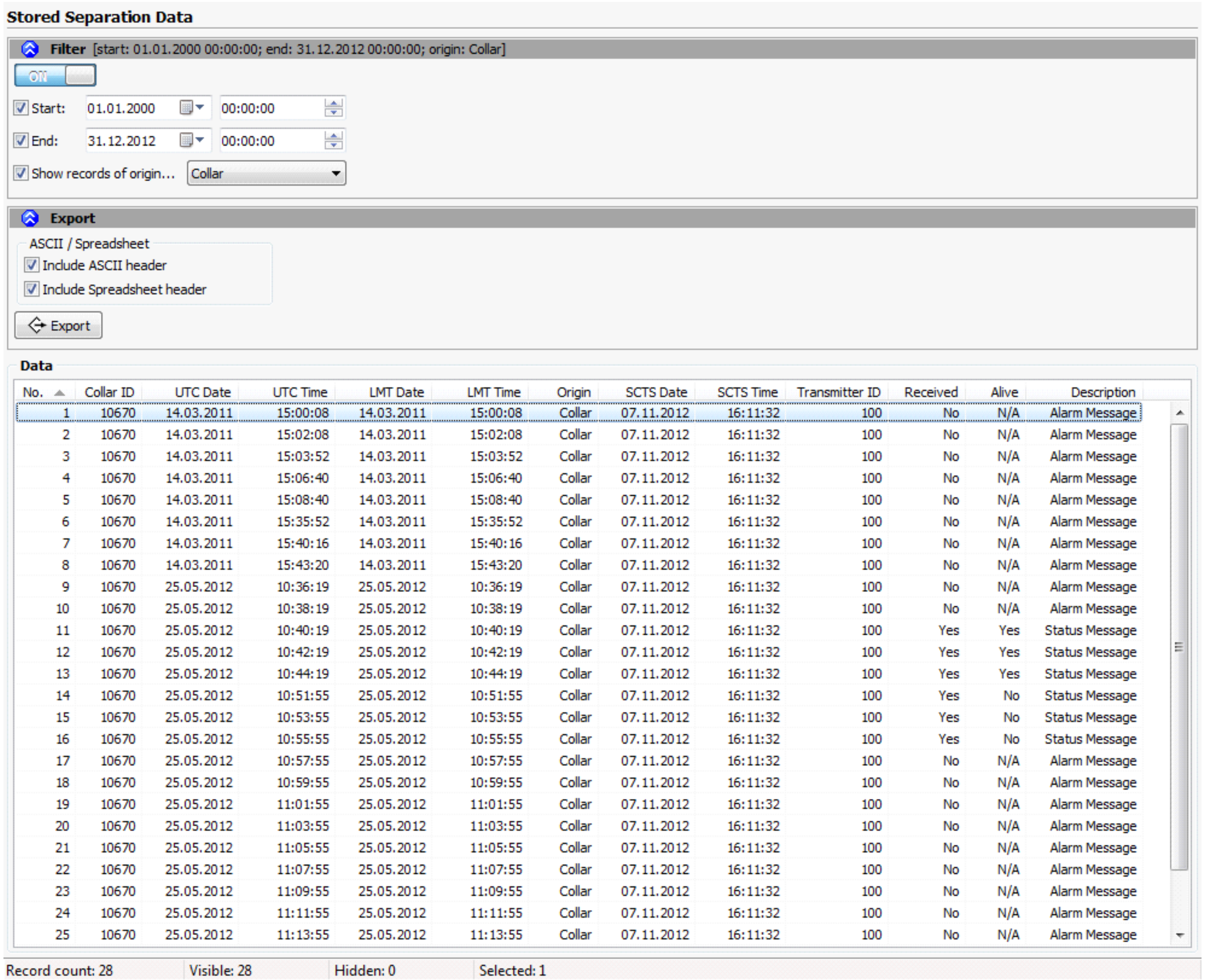


Figure 150: List of separation sensor data

4.3.1.3.2 Vaginal Implant

The frame is the same as for the activity data (Activity data) for more information on the product please refer to Appendix A.3: Vaginal Implant (VIT).

Data can be exported as ASCII (.TXT), ASCII Spreadsheet (.CSV) and GPS Plus Data Exchange (.GDX), with or without header. The default file name, which can be changed to your requirements, will be `VIT_Collar8769_ YYYYMMDDhhmmss.TXT`, including the collar ID and time stamp of the export.

The list in the lower part of the frame displays the filtered vaginal implant data sets with the following information:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded

UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
Transmitter ID	ID number of the received UHF ID tag
Temperature [°C]	temperature in °C measured by the vaginal implant
Status	indicates whether any kind of movement has been detected; 255 = activity detected (the Vaginal Implant is inside the animal), 0 = no movement at all has been detected (the Vaginal Implant is outside the animal). 1. expelled 2. not expelled 3. N/A
Description	Three cases can appear in this column: (1) Status Message, (2) No Activity Event: This description appears when the temperature was below the barrier for a defined time. The ActivityLevel is 0 and the temperature is displayed as N/A in this case. (3) No Contact Event: N/A is displayed for the Temperature as well as for the ActivityLevel. The Vaginal Implant is out of the animal and does not send data since about one hour.

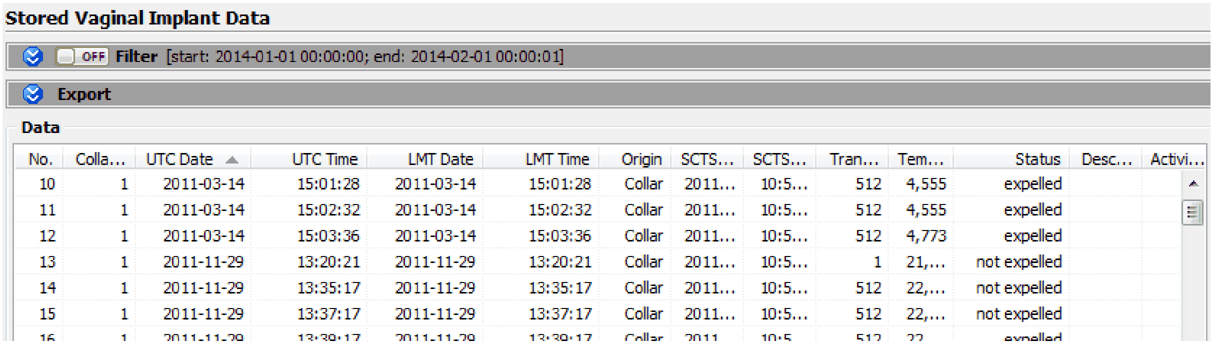


Figure 151: List of vaginal implant data

4.3.1.3.3 Mortality Implant

The frame is the same as for the activity data (Activity data) for more information on the product please refer to Appendix A.2: Mortality Implant (MIT).

Data can be exported as ASCII (.TXT), ASCII Spreadsheet (.CSV) and GPS Plus Data Exchange (.GDX), with or without header.

The default file name, which can be changed to your requirements, will be `MIT_Collar8769_YYYYMMDDhhmmss.TXT`, including the collar ID and time stamp of the export.

The list in the lower part of the frame displays the filtered mortality implant data sets with the following information:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded
UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
Transmitter ID	ID number of the received UHF ID tag

Temperature [°C]	temperature in °C measured by the mortality implant
HeartRate	indicates whether heart beat or any other kind of movement has been detected; 255 = heart beat detected, 0 = no movement at all has been detected. The HeartRate does not show the real heart rate but if the animal is dead (0) or alive (255).
Description	Three cases can appear in this column: (1) no description appears when the data was directly read out from the collar, (2) Status Message with a HeartRate of 255 appears when the animal is alive, Status Message with a HeartRate of 0 appears when a mortality event has already happened, (3) Mortality Event appears when the HeartRate changes from 255 to 0, the Temperature will be displayed as N/A because this information is not transmitted in case of mortality.

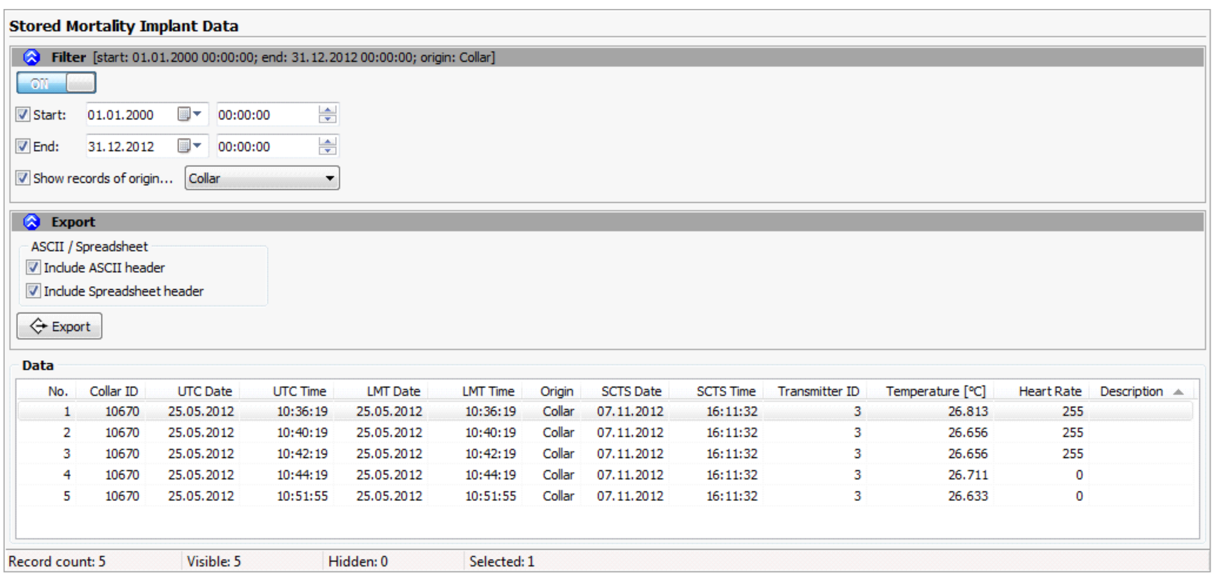


Figure 152: List of mortality implant data

4.3.1.3.4 Mortality

This command downloads the mortality events from the collar. The frame is the same as for the activity data (Activity data).

Data can be exported as ASCII (.TXT), ASCII Spreadsheet (.CSV) and GPS Plus Data Exchange (.GDX), with or without header.

The default file name, which can be changed to your requirements, will be `MOR_Collar8769_YYYYMMDDhhmmss.TXT`, including the collar ID and time stamp of the export.

The list in the lower part of the frame displays the filtered mortality data sets with the following information:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded
UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
Kind	shows the kind of the message. Possible kinds are “Mortality” and “Low Activity”.

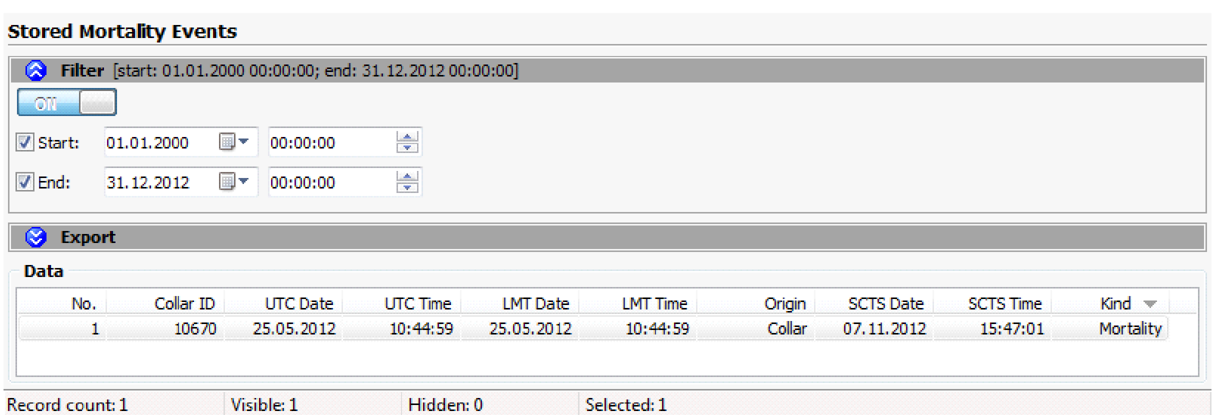


Figure 153: List of mortality events

4.3.1.3.5 Proximity

The frame is the same as for the activity data (Activity data) for more information on the product please refer to Appendix A.1: Proximity Sensor.

Data can be exported as ASCII (.TXT), ASCII Spreadsheet (.CSV) and GPS Plus Data Exchange (.GDX), with or without header. The default file name, which can be changed to your requirements, will be `PRX_Collar8769_ YYYYMMDDhhmmss.TXT`, including the collar ID and time stamp of the export.

The list in the lower part of the frame displays the filtered proximity data sets with the following information:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded
UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
Transmitter ID	ID number of the received UHF ID tag
RSSI [dBm]	Received Signal Strength Indicator: signal strengh of the UHF ID tag that was measured at the time of the data set. N/A is displayed, if the signal was sent via IRIDIUM or GSM.
Alive	shows if the animal which ID was received by the collar, is still alive (= True) or if it is dead (= False).

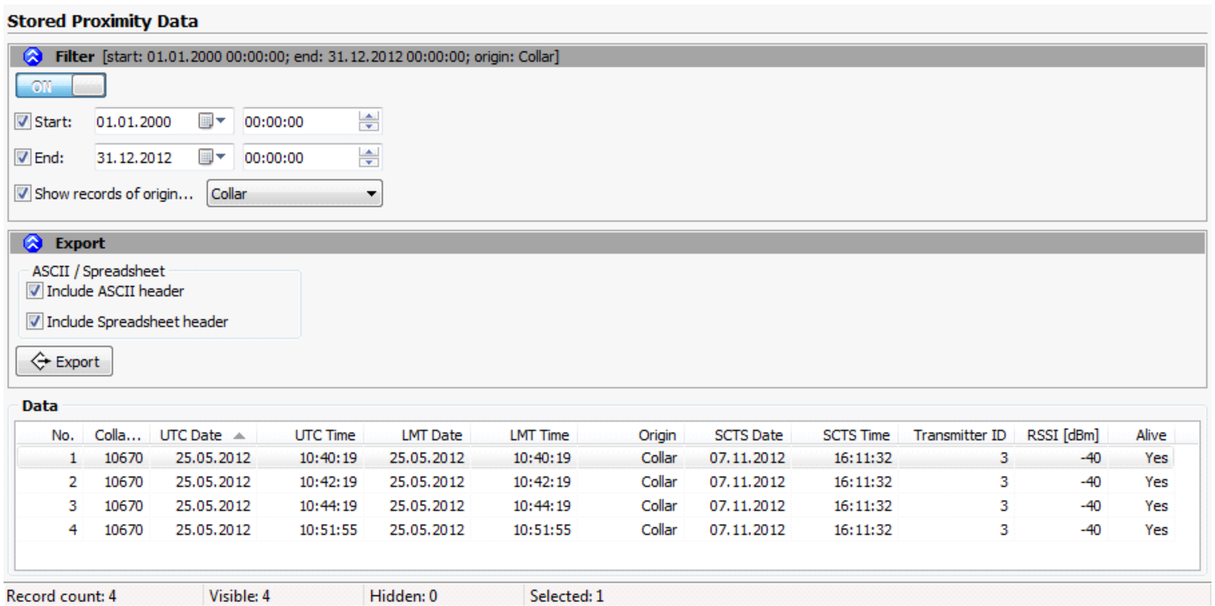


Figure 154: List of proximity events

4.3.1.4 Trap Transmitter data

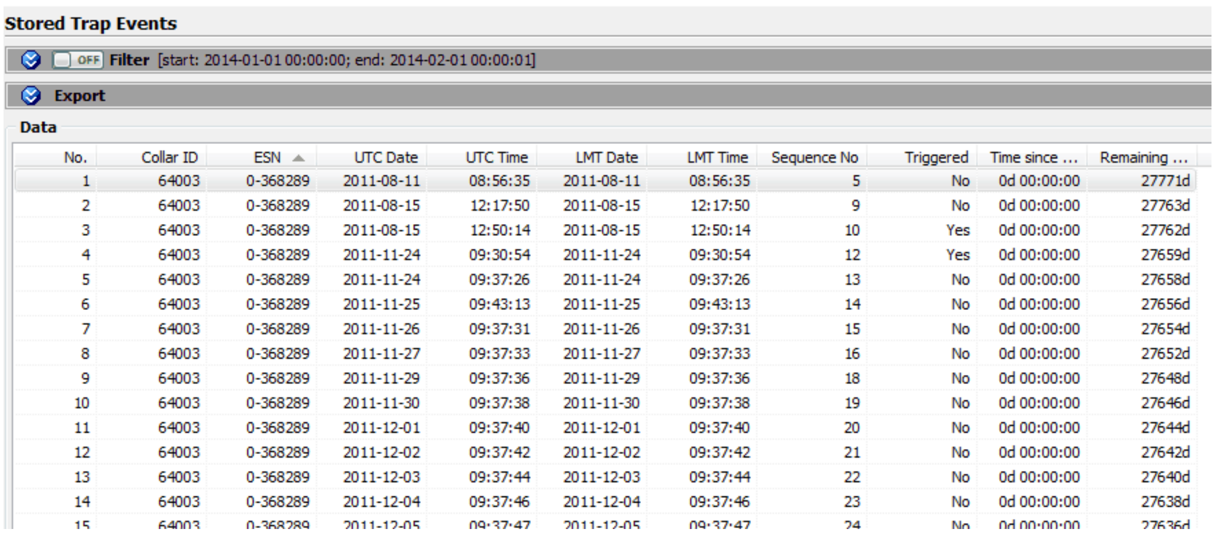
Trap events from the trap transmitters are also stored in the database.

There is no special entry type for trap transmitters. Instead, trap transmitters are registered and labelled as collars. Incoming trap events will be stored as such in the database under the transmitter's "Collar ID".

Data can be exported as ASCII (.TXT), ASCII Spreadsheet (.CSV) and GPS Plus Data Exchange (.GDX), with or without header. The list in the lower part of the frame displays the filtered trap events with the following information:

No	line index, dependent on time stamp
Collar ID	ID of the collar from which the positions have been downloaded
ESN	Electronic Serial Number
UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)

Sequence No.	Sequence number of message as counted by the trap transmitter
Triggered	shows No if trap has not been triggered and Yes if trap has been triggered and an alert message was sent
Time since event	gives the time that has been past since the trap has been triggered
Remaining Lifetime	gives an estimate of the expected lifetime of the transmitter in days while in stand-by; each message sent shortens the lifetime for one additional day. For details on the lifetime expectation, refer to the trap transmitter manual



No.	Collar ID	ESN	UTC Date	UTC Time	LMT Date	LMT Time	Sequence No	Triggered	Time since ...	Remaining ...
1	64003	0-368289	2011-08-11	08:56:35	2011-08-11	08:56:35	5	No	0d 00:00:00	27771d
2	64003	0-368289	2011-08-15	12:17:50	2011-08-15	12:17:50	9	No	0d 00:00:00	27763d
3	64003	0-368289	2011-08-15	12:50:14	2011-08-15	12:50:14	10	Yes	0d 00:00:00	27762d
4	64003	0-368289	2011-11-24	09:30:54	2011-11-24	09:30:54	12	Yes	0d 00:00:00	27659d
5	64003	0-368289	2011-11-24	09:37:26	2011-11-24	09:37:26	13	No	0d 00:00:00	27658d
6	64003	0-368289	2011-11-25	09:43:13	2011-11-25	09:43:13	14	No	0d 00:00:00	27656d
7	64003	0-368289	2011-11-26	09:37:31	2011-11-26	09:37:31	15	No	0d 00:00:00	27654d
8	64003	0-368289	2011-11-27	09:37:33	2011-11-27	09:37:33	16	No	0d 00:00:00	27652d
9	64003	0-368289	2011-11-29	09:37:36	2011-11-29	09:37:36	18	No	0d 00:00:00	27648d
10	64003	0-368289	2011-11-30	09:37:38	2011-11-30	09:37:38	19	No	0d 00:00:00	27646d
11	64003	0-368289	2011-12-01	09:37:40	2011-12-01	09:37:40	20	No	0d 00:00:00	27644d
12	64003	0-368289	2011-12-02	09:37:42	2011-12-02	09:37:42	21	No	0d 00:00:00	27642d
13	64003	0-368289	2011-12-03	09:37:44	2011-12-03	09:37:44	22	No	0d 00:00:00	27640d
14	64003	0-368289	2011-12-04	09:37:46	2011-12-04	09:37:46	23	No	0d 00:00:00	27638d
15	64003	0-368289	2011-12-05	09:37:47	2011-12-05	09:37:47	24	No	0d 00:00:00	27636d

Figure 155: List of trap events

4.3.1.5 GSM Quality

If you download data directly from the collar via Link Manager, this frame is the same as for the activity data (Activity data).

In the storage, there is a special node for GSM Quality. Data can only be exported as ASCII (.TXT), with or without header.

The default file name, which can be changed to your requirements, will be `GSM_Collar8769_YYYYMMDDhhmmss.TXT`, including the collar ID and time stamp of the export.

The list in the lower part of the frame displays the filtered GSM quality data sets with the following information (Figure below):

No	line index, dependent on time stamp

Collar ID	ID of the collar from which the positions have been downloaded
UTC date / UTC time	time in Universal Time Coordinated (UTC, equivalent to GMT, but without daylight saving time/summer time)
LMT date / LMT time	local mean time, depending on the value set in UTC Correction (see System UTC Correction)
Origin	shows where the message originates from
SCTS Date/Time	the date/time when the message receives the provider
RSSI [dBm]	Received Signal Strength Indicator: signal strengh of the GSM network that was measured while transmitting an SMS
BER [%]	Bit Error Rate, which is calculated from the last communications (establishing the link to the service centre, etc)

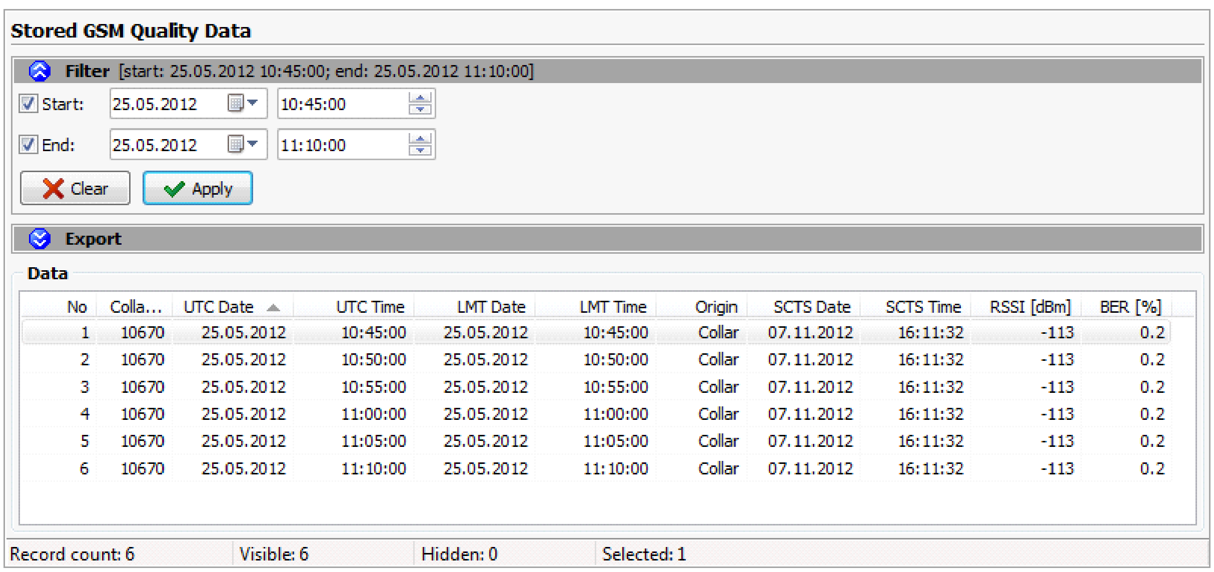


Figure 156: List of GSM quality data

4.3.2 Data via Link Manager

Devices ⇨ Link Manager ⇨ Collar ⇨ Collected Data

This node will display the data currently stored on the connected collar.

If you want to process data quickly, you can use the main node Collected Data (Figure below). It will give you a list of all data types.

Check the data types you want to process. Press to send the data to the Data Storage Service, which will distribute the data to the storage modules assigned to this collar. If your data services are not active (e.g. because you are not connected to your network), the data will be stored in the Local Buffer and transferred automatically when the data services are active again.

For a fast export of the data, check the boxes of the data types you need and press . You will now be able to browse for the folder to store these data files. At the right side of all selected data types, the icon will appear. It will change into while data are exported, then into until the export is finished, and then finally change into . Position data are exported as .GDF, activity data as .ADF, and all other data as .TXT.

Press to erase the checked data from the collar. You will be prompted to confirm this command. Please make sure that you have stored the data safely before erasing them.

There is no way to restore the erased data!

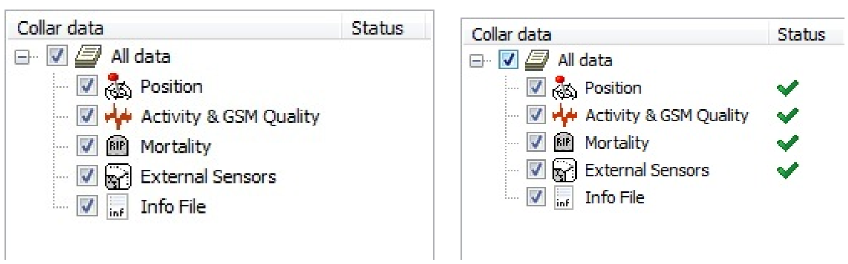


Figure 157: Frame to manage data stored on a collar connected via Link Manager. When exporting data, the status icons show you the process of the export.

If you want to export data in another format or if you do not want to process all data stored on the collar, you can also view all data at the subnodes. There you can filter certain data and export them in different formats (e.g. into a .TXT or Google Earth file).

Three icons will accompany you through the subnodes:

Reads data from the collar and displays it in the frame; this is not done automatically, because the download of data can take several seconds to minutes. Activity and GSM Quality is always downloaded together and displayed on two tabs at the node Activity & GSM Quality.

Saves the data to the storage module; we advise to save all data from the collar, even if you export them as data file.

This icon depends on the type of data that are read out. From left to right: GPS, activity & GSM quality, mortality, external sensors data (mortality implant, vaginal implant, separation sensor and proximity data). These commands erase the selected data stored on the collar. Please make use that you have stored the data before you use this command.

4.3.3 Data from VERTEX Plus collar

Devices ⇨ VERTEX Plus Collar ⇨ Collected Data ⇨ Acceleration

Here you can view and store Acceleration Activity Data from VERTEX Plus Collar directly via cable.

By clicking you can upload data from the collar

By clicking you can save data as compressed binary data, which can only be used with GPS Plus X.

By clicking you can save as uncompressed CSV data, which can used with other programms.

By clicking you will erase all acceleration data from the collar.

4.3.4 Data from Terminal

Devices ⇨ Link Manager or ⇨ Terminal ⇨ Collected Data

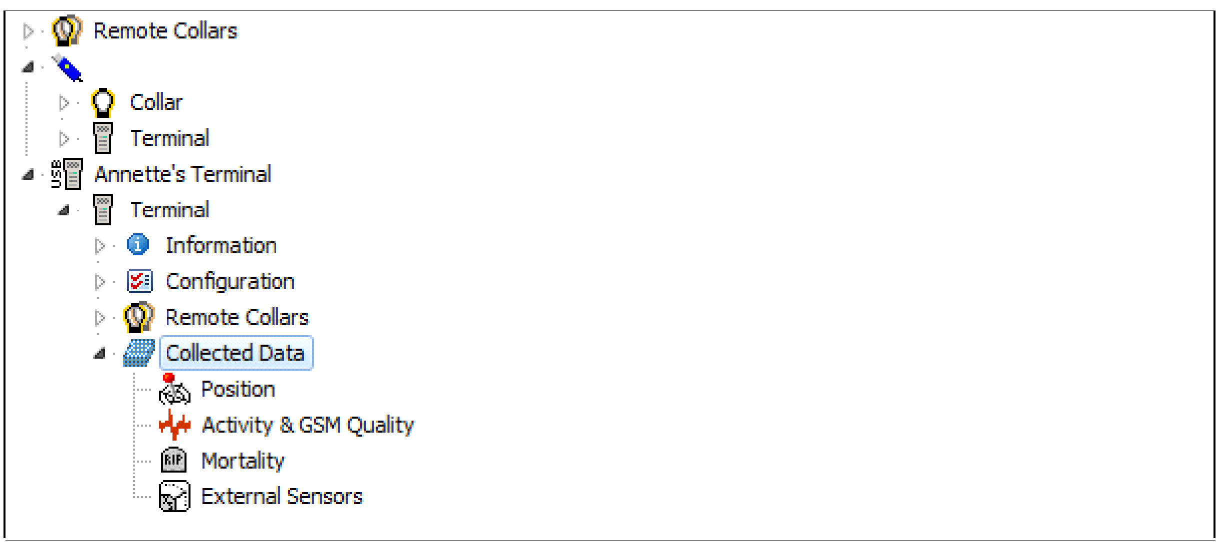


Figure 158: Devices tree with nodes for collected data.

The Collected Data node for the Handheld Terminal gives a table of the collars registered on the Handheld Terminal. If it has had contact with the collar before, it will show the collar's firmware version (N/A means this information is not available, i.e. no information for this category is stored).

The table also shows the number of data sets available for GPS, activity, mortality, and external sensors data (mortality implant, vaginal implant, separation sensor and proximity data). Select a collar by left-clicking on it, use Shift or Ctrl to select two or more collars.

These icons will send all data / GPS data / activity data / mortality data / external sensor data of the selected collars to the database.

These icons will erase all data / GPS data / activity data / mortality data / external sensor data of the selected collars in the Handheld Terminal. Please make sure that you have stored the data safely before erasing them. **There is no way to restore the erased data!**

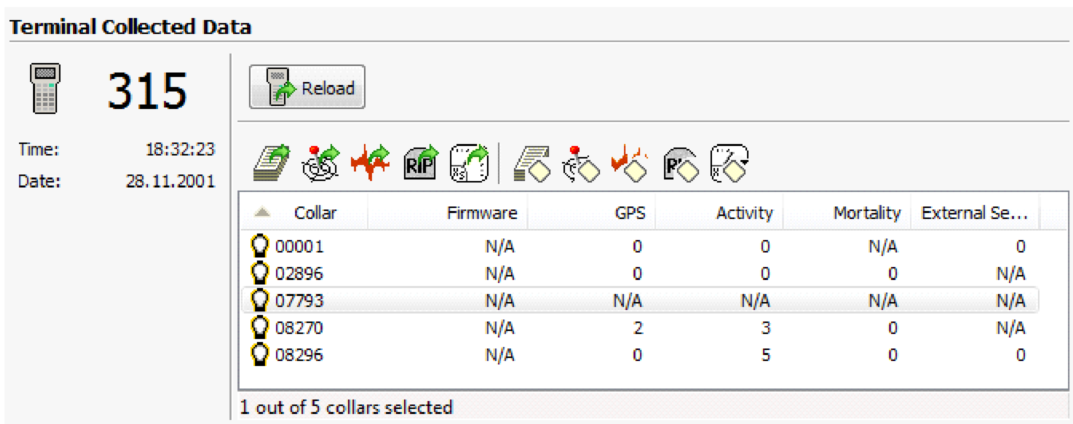
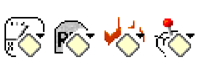


Figure 159: List of all data sets stored on the Handheld Terminal

It is also possible to view a certain data type, i.e. GPS data, for each collar separately and filter and export them. To do this, select the node for the required data type. The frames are almost entirely the same as for the respective Link Manager nodes (Downloading Data via Link Manager). The only differences are the buttons on top of the frame:

This icon opens a drop-down list of all collars registered on the Handheld Terminal. Select one collar to read out the data of this collar.

This command sends all filtered and therefore displayed data to the Data Storage Service.



This icon depends on the frame you have activated. It opens a drop-down list with all collars registered on the Handheld Terminal. Select all collars you want to process with the checkboxes. Press this icon to delete all GPS / activity / mortality / external sensors data (mortality implant, vaginal implant, separation sensor and proximity data) from the selected collar. **Again, there is no way to restore these data!**

4.3.5 Data via USB Remote Stick (Survey)

Devices ⇨ Remote Stick ⇨ Survey Collar ⇨ Collected Data ⇨ Position

The Collected Data Tab of the Survey collar includes the Position data frame.

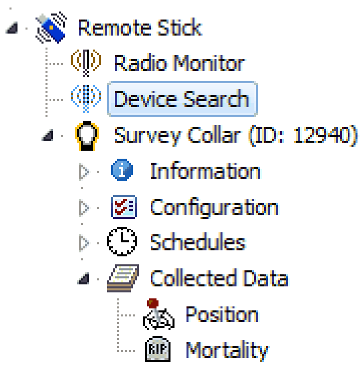


Figure 160: Devices tree with nodes for collected data for Survey Collar.

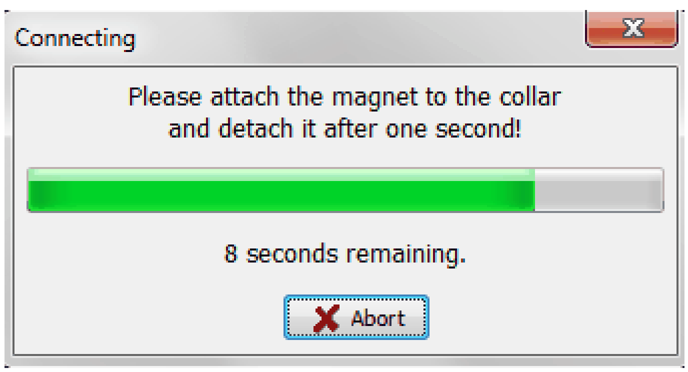


Figure 161: Pop up window to start the download

When clicking the Position node, you need to detach the magnet from the collar and reattach it after one second.

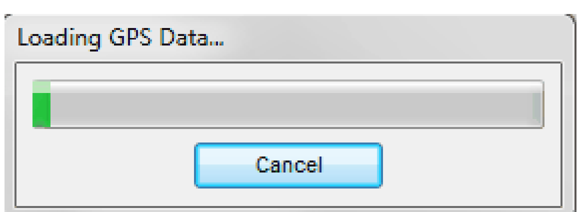


Figure 162: Pop up window wile the data is downloaded

The download starts when the collar has been found by the USB Remote Stick and a window will appear (figure above) which shows the download progress. Depending on the amount of data, the download will take a few seconds.

4.3.6 Local Buffer

Data ⇨ Local Buffer

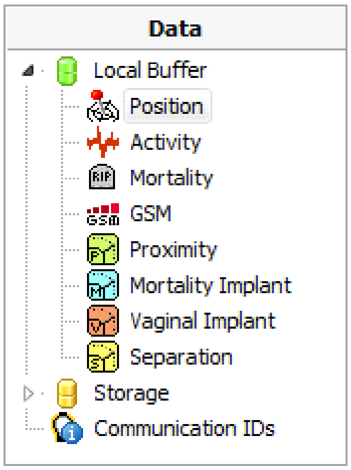


Figure 163: Data tree with Local buffer node

The Local Buffer will be used if the data services are not active, i.e. while your PC is not connected to the server.

After reactivating the data services, you can send the data to the main Storage with . By default, the data will stay in the Local Buffer even after they have been sent to the database. To erase the data, please check “Remove from Local Buffer after transfer”. The data will then be available even if the data services are not active. You can clear the entire Local Buffer with .

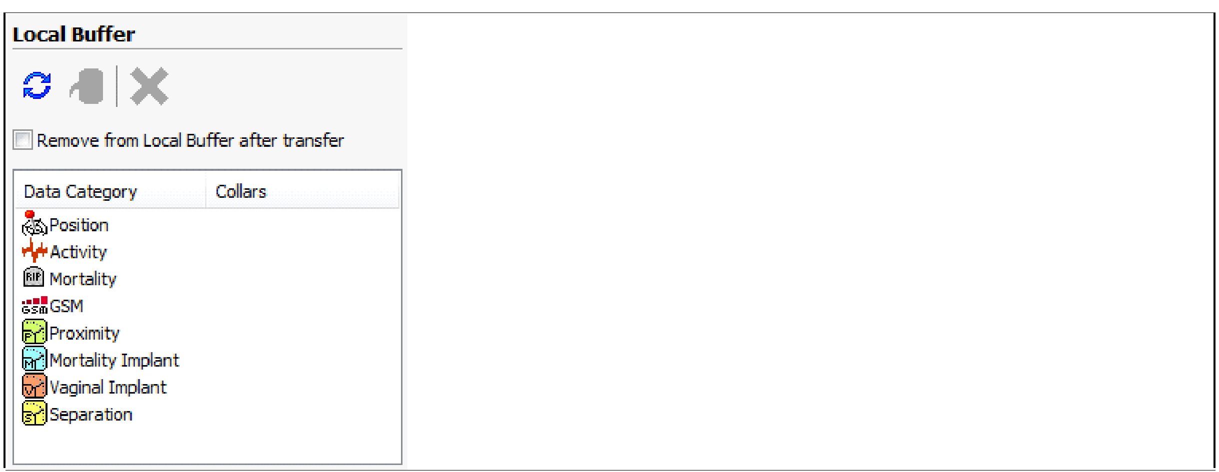


Figure 164: Local Buffer in offline mode

4.3.7 Data Storage

Data ⇨ Storage

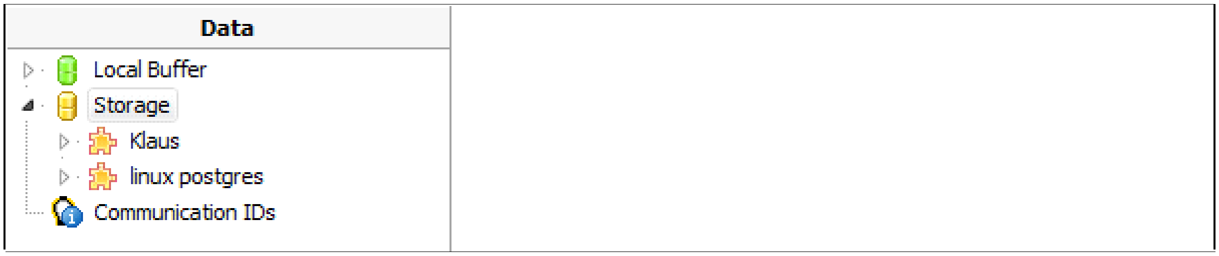


Figure 165: Data tree with list of Storages

All data are finally stored in so-called storage modules. See chapter Software structure for details on this.

One user can have access to different storage modules, and data from one collar can be sent to different storage modules too. All data storages are shown as nodes in the Data tree. The node Storage in this tree opens a control frame for the Data Storage Service (DSS), while the nodes for the single storage modules allow access to the data from the collars.

Refer to:

Data Storage Service Status

Main Data Storage

4.3.7.1 Data Storage Service Status

Data ⇨ Storage

The node Storage will open the Data Storage Service Status frame (Figure below).

It will give you an overview of the communication with collars within a defined time period prior to opening the frame. To refresh the lists, press Reload. The button Clear history will clear all lists shown in the frame.

The single lists have smaller Clear buttons to clear the related list only.

For frequent automatic updates, set an interval in seconds and check Auto Update.

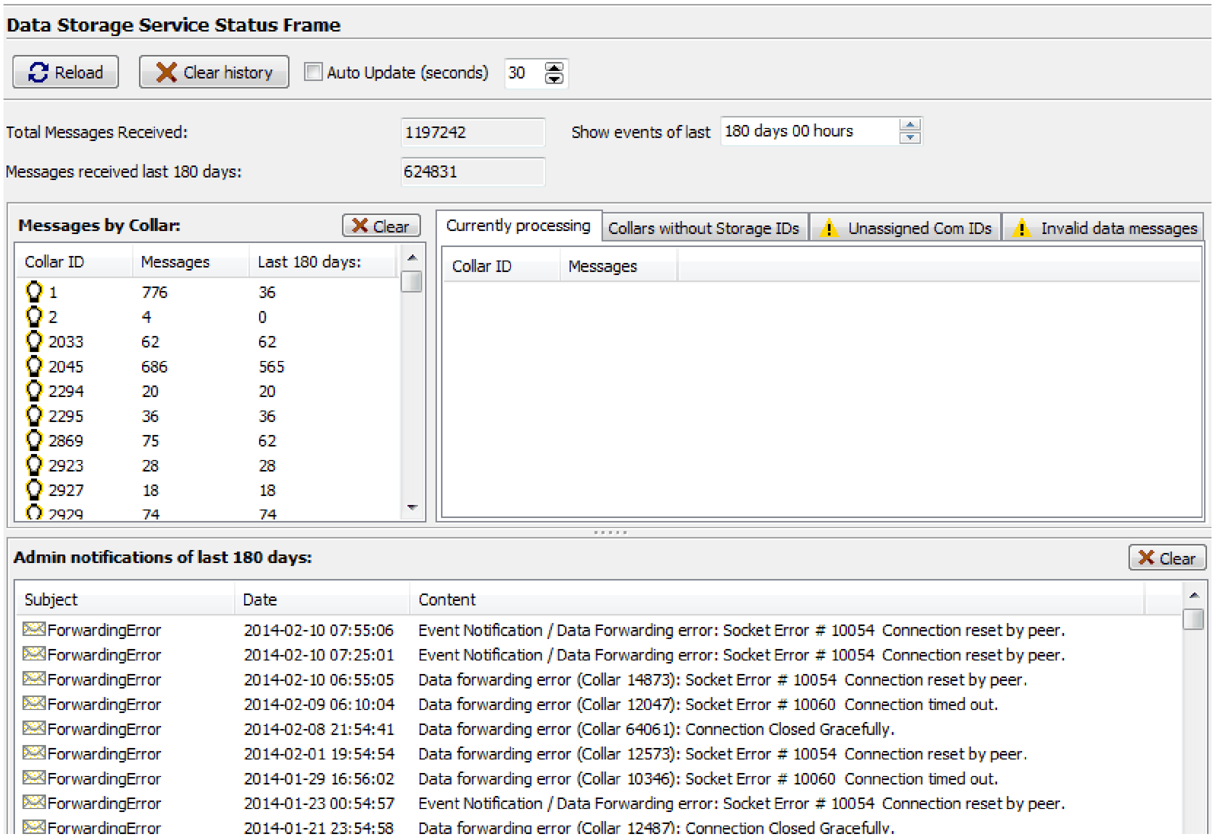


Figure 166: Data Storage Service Status frame

Total Messages Received gives you the absolute number of messages received by the Data Storage Service, but you can define the time span for the messages that will be displayed with Show events of last. Select the desired time span and press Reload or ENTER to apply this selection.

These messages include all kinds of messages that might come in via GSM, email, or HTTP download: positions, mortality/proximity/Virtual Fence events, confirmation messages from the collar, and service messages from the provider. It also includes messages that are not related to GPS Plus X at all, but have been received by the Data Collector Service nonetheless. The number of received messages and their status are shown in the two lists **Messages by Collar box**.

The left box gives the number of messages received for each collar received within the defined time sorted by collar ID. Only collars from which messages have been received in this time are listed, independent whether they are GSM, IRIDIUM, or GLOBALSTAR collars. Messages that are not assigned to a collar yet are not listed here.

The tabs of the right box display more information on all received messages. Tabs that contain information are marked with ⚠:

Currently processing	number of messages processed by GPS Plus X at the moment; these messages cannot be sent to the storage because information is missing. Details on these messages are given on the following tabs.

Unassigned Com IDs	list of messages from collars with unassigned communication IDs; the list shows the Com ID (telephone number, IRIDIUM ID, or GLOBALSTAR ESN), the Com Type (GSM, IRIDIUM, or GLOBALSTAR), and the Msg Count (number of messages to be processed from this ID).
Collars without Storage IDs	list of all collars which do not have a storage module assigned to, with Collar ID and number of messages from this collar (Msg Count)
Invalid data message	list of messages with invalid data (e.g. confirmation messages, service messages from the provider) with Collar ID, Com Type (GSM, IRIDIUM, or GLOBALSTAR), and content of message (Data Message)

In case the system does not have a connection to the Data Storage Service, while auto update is active, you will get a orange warning panel (picture below). GPS Plus X will retry to update the data and the warning panel will disappear on success.

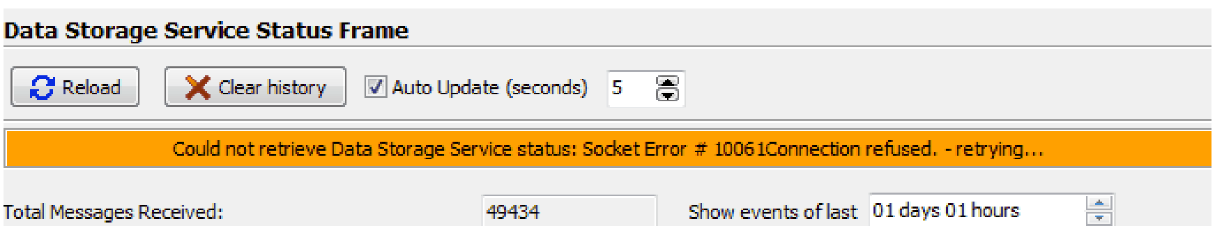


Figure 167: Data Storage Service Status frame with warning panel

4.3.7.1.1 Main Data Storage

Data ⇨ Storage ⇨ [NAME OF STORAGE MODULE]

All data sent to the database can be accessed at the Storage node in the **Data** tree (Figure below). There will be a node with the name of the storage module(s).

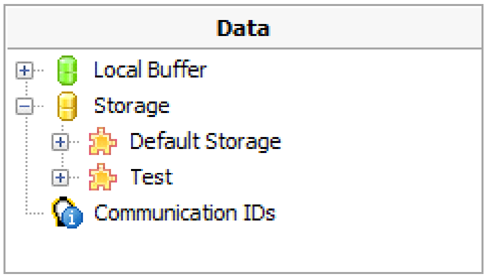


Figure 168: Data tree

Each storage module has several subnodes, either one subnode per data type or one per collar ID, Animals or groups.

To select this, right-click on the storage module's name. A menu will open were you can select Data by Type and Data by Group/Animal/Collar. If changes occur in the collar list (e.g. registration of new collar), you can refresh the collar nodes with Reload collar list.

For more information about creating Groups or Animals please refer to **Configuration** ⇨ Data Storage ⇨ Storage Modules.

This list will show all collars registered in this storage module, including those registered on other GUIs.

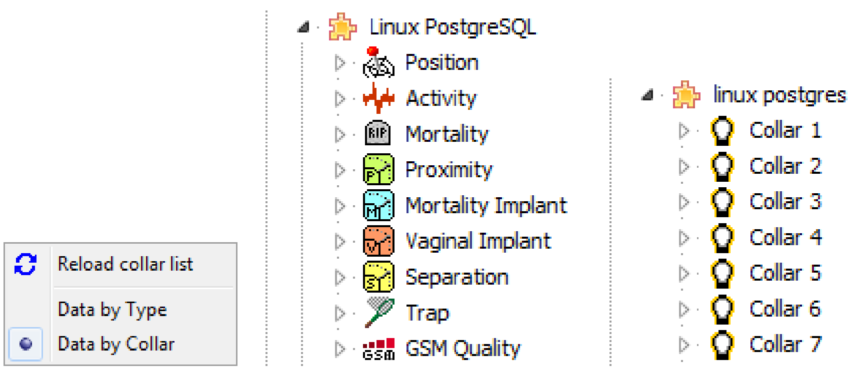
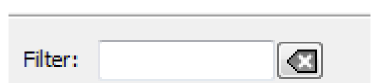


Figure 169: Menu to organise subnodes in a storage module node (left), subnodes organised by type (centre), and organised by collar (right)

If you activate the node of a storage module (e.g. VAS Postgres), you will get a list of all assigned collars (and trap transmitters) and the available data sets (Figure List with all collars and number of data sets in a storage module).

You can filter after several collar numbers, in the field 

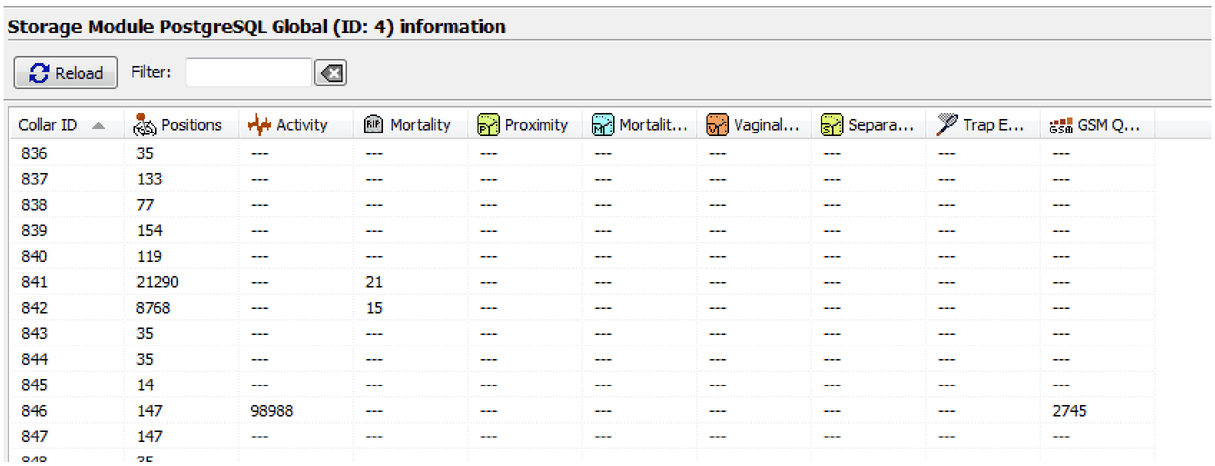
or using crtl+f. Do delete the current search use or ESC.

For each kind of data (GPS, activity, etc.), the number of data sets in the storage module is given. By clicking on the data type in the first row, you can sort the collars according to the number of data sets available for the selected data type.

You can access these data sets by double-clicking on them. The data frames will then be opened and you can export or view the data sets (see Data frames).

If the nodes are organised by collar ID, you can open the collar list frame by clicking directly on one collar node. The list will appear with the selected collar being highlighted, and the data sets can be accessed by double-clicking.

You can also access the data sets directly from the **Data** tree, if the nodes are organised by data type. Open the node for the desired data type and click on the desired collar. The respective data frame will open directly.


Storage Module PostgreSQL Global (ID: 4) information

Reload Filter:

Collar ID	Positions	Activity	Mortality	Proximity	Mortalit...	Vaginal...	Separa...	Trap E...	GSM Q...
836	35	---	---	---	---	---	---	---	---
837	133	---	---	---	---	---	---	---	---
838	77	---	---	---	---	---	---	---	---
839	154	---	---	---	---	---	---	---	---
840	119	---	---	---	---	---	---	---	---
841	21290	---	21	---	---	---	---	---	---
842	8768	---	15	---	---	---	---	---	---
843	35	---	---	---	---	---	---	---	---
844	35	---	---	---	---	---	---	---	---
845	14	---	---	---	---	---	---	---	---
846	147	98988	---	---	---	---	---	---	2745
847	147	---	---	---	---	---	---	---	---

Figure 170: List with all collars and number of data sets in a storage module

If you use more than one storage module, you can copy data between modules by right-clicking on the Collar ID.

Copy all collar data to allows you to select another storage module and copy the collar's entire data set.
Copy RAW data to copies the data originally received by the Data Collector Service (DCS), which means SMS files or email attachments. Depending on the other columns (Positions, Activity, etc) you can copy one data type for a specific collar.

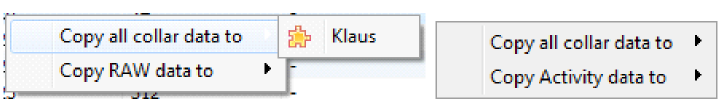


Figure 171: Menus to copy data sets between storage modules

Copying data might take a long time, especially with high amounts of data sets. Therefore, this task will be performed in the background, while you can proceed to work with GPS Plus X. However, the Data Storage might not be accessable during this time.

4.3.7.1.2 Data Export for multiple collars

Data ⇨ **Storage** ⇨ [NAME OF STORAGE MODULE]

To export collar data of multiple collars at once, please highlight the affected collars and Use the right mouse button.

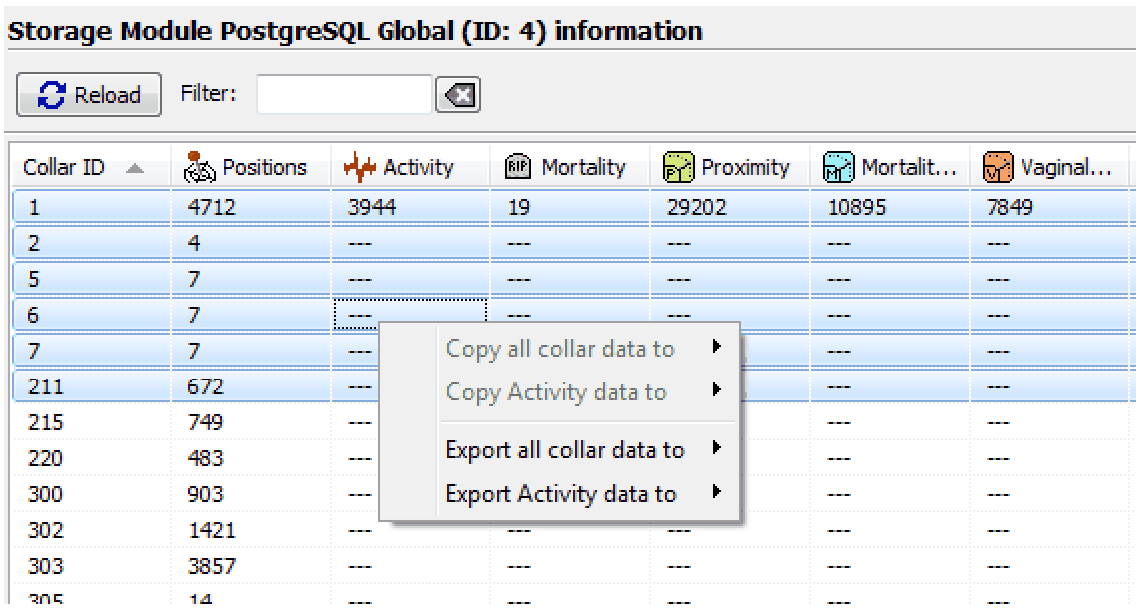


Figure 172: collar list

4.3.8 Remote Command Status

[Data](#) ⇨ Remote Command Status

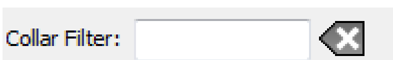
The node list gives you **Admin notifications of the last X days and X hours** with the Subject, the Date of the message, and the Content of the message.

The bottom list **Collar commands of last X days and X hour** displays all commands that have been sent to collars with

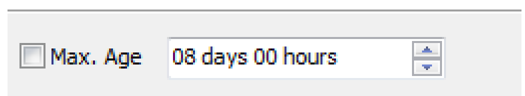
For frequent automatic updates, set an interval in seconds and check Auto Update.

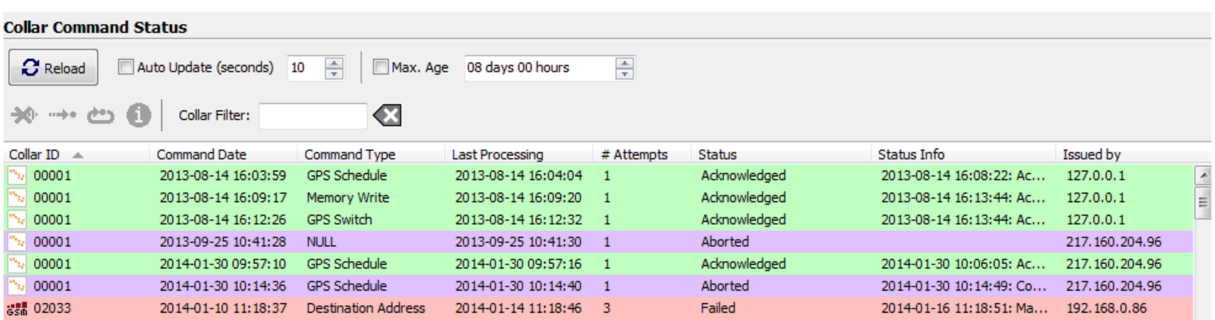
Collar ID	ID number of the collar
Command date	date on which the command has been created

Command type	command which has been send to the collar
Last Processing	date of the last attempt to reach the collar
# Attempts	total number of attempts to send this command
Status Info	reports the current status of the command message. The color of the row changes depending on the status. The following statuses are possible: • Command aborted (violet) • Command sent (blue) • Command failed (red) • Command successful (green) • Transmission pending (yellow)
Issued by	IP number of which the command was send

You can filter after several collar numbers by separating them with a , in the field 

or using crtl+f. Do delete the current search use  or ESC.

If necessary you can also filter the message by age: 



Collar ID	Command Date	Command Type	Last Processing	# Attempts	Status	Status Info	Issued by
00001	2013-08-14 16:03:59	GPS Schedule	2013-08-14 16:04:04	1	Acknowledged	2013-08-14 16:08:22: Ac...	127.0.0.1
00001	2013-08-14 16:09:17	Memory Write	2013-08-14 16:09:20	1	Acknowledged	2013-08-14 16:13:44: Ac...	127.0.0.1
00001	2013-08-14 16:12:26	GPS Switch	2013-08-14 16:12:32	1	Acknowledged	2013-08-14 16:13:44: Ac...	127.0.0.1
00001	2013-09-25 10:41:28	NULL	2013-09-25 10:41:30	1	Aborted		217.160.204.96
00001	2014-01-30 09:57:10	GPS Schedule	2014-01-30 09:57:16	1	Acknowledged	2014-01-30 10:06:05: Ac...	217.160.204.96
00001	2014-01-30 10:14:36	GPS Schedule	2014-01-30 10:14:40	1	Aborted	2014-01-30 10:14:49: Co...	217.160.204.96
02033	2014-01-10 11:18:37	Destination Address	2014-01-14 11:18:46	3	Failed	2014-01-16 11:18:51: Ma...	192.168.0.86

Figure 173: Collar command status

4.3.9 Unknown collars

Data ⇨ Unknown collars

This frame gives a list of all collars with their communication type and communication ID if these information are stored in the collar list.

All registered collars and their communication information – if known – are displayed in the right Collar List.

The left list, Unassigned Commmunication IDs is a list of telephone numbers, IRIDIUM IDs, and GLOBALSTAR ESNs which have sent a message to this GPS Plus X system, but cannot be connected to a collar, either because the number has not been assigned to a collar yet, or because the number is not a collar's number at all.

To assign these Com IDs to a collar which is already listed on the right side, just drag&drop it onto its Collar ID. Press Apply to save the assignment or Revert to undo all assignments since you last saved this list. If the collar is not listed yet, create a new collar by double-clicking on the Comnnunication ID. A new window will open with the form to register a collar.

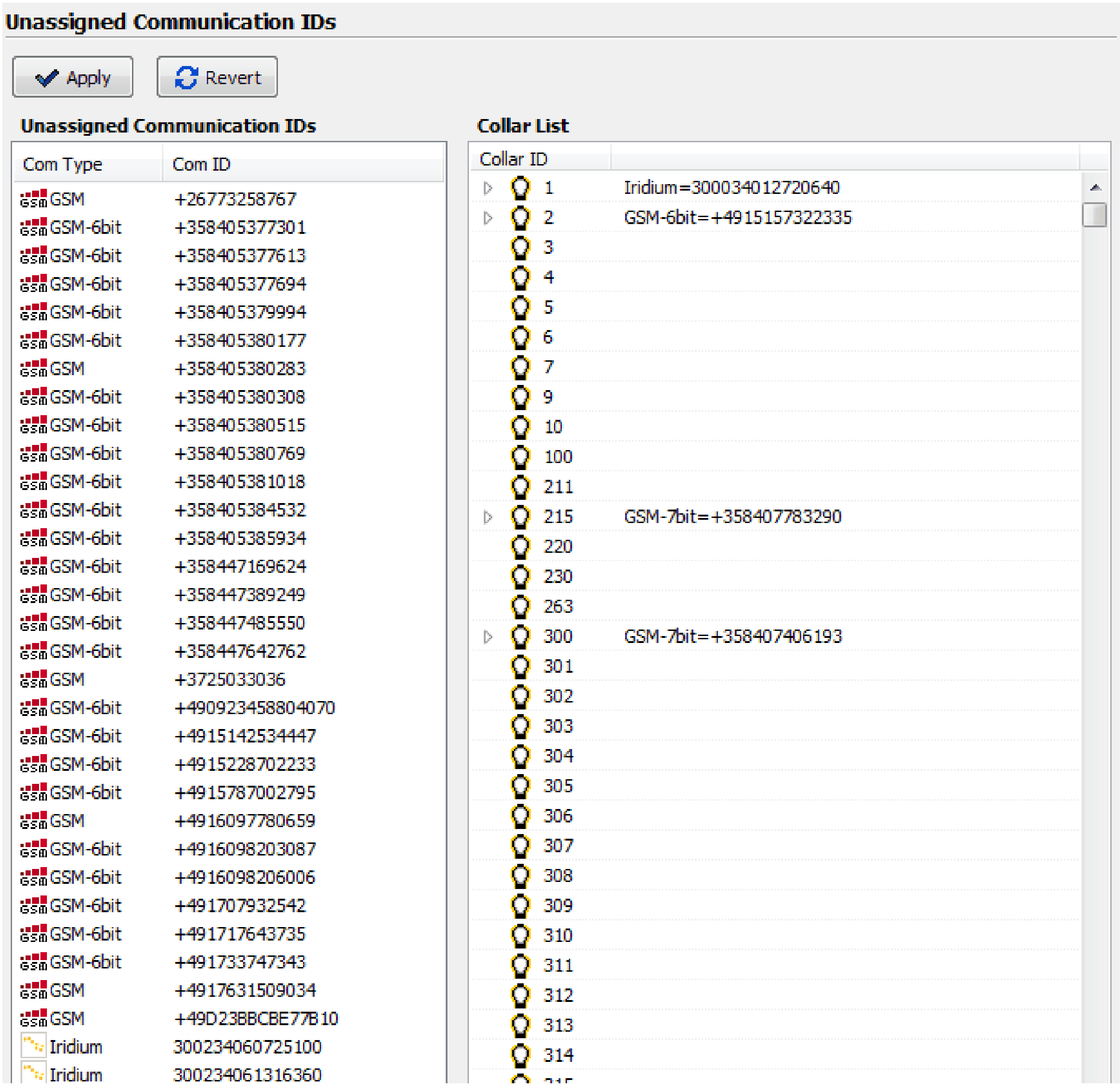


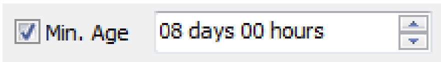
Figure 174: List of unassigned communication IDs

4.3.10 Collar Reception Status

[Data](#) ⇨ Collar Reception Status

The Collar Reception Status displays when the last reception of a collar took place. This display is useful to keep an overview of collars which stopped sending messages for any reason.

Press Reload to reload last receptions of your collars. Press Ignore to hide specific collars from the list. You also can set the minimum age of last reception to be displayed.



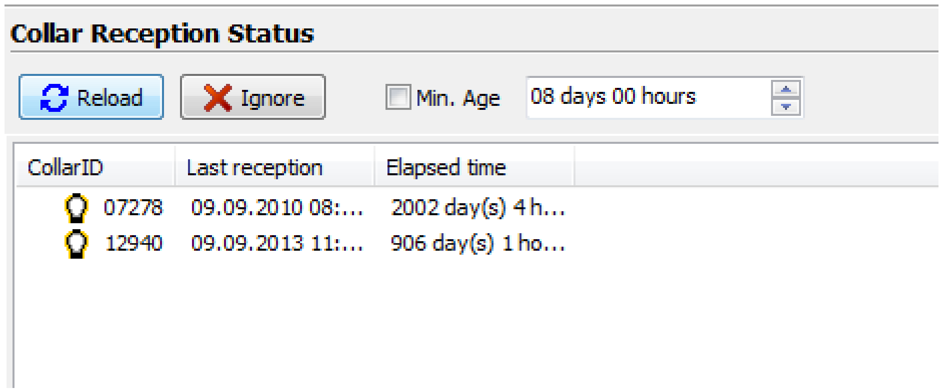


Figure 175: Collar Reception Status

You can configure alert messages if there is no collar reception detected. Please refer to Email

4.4 The Configuration Tree

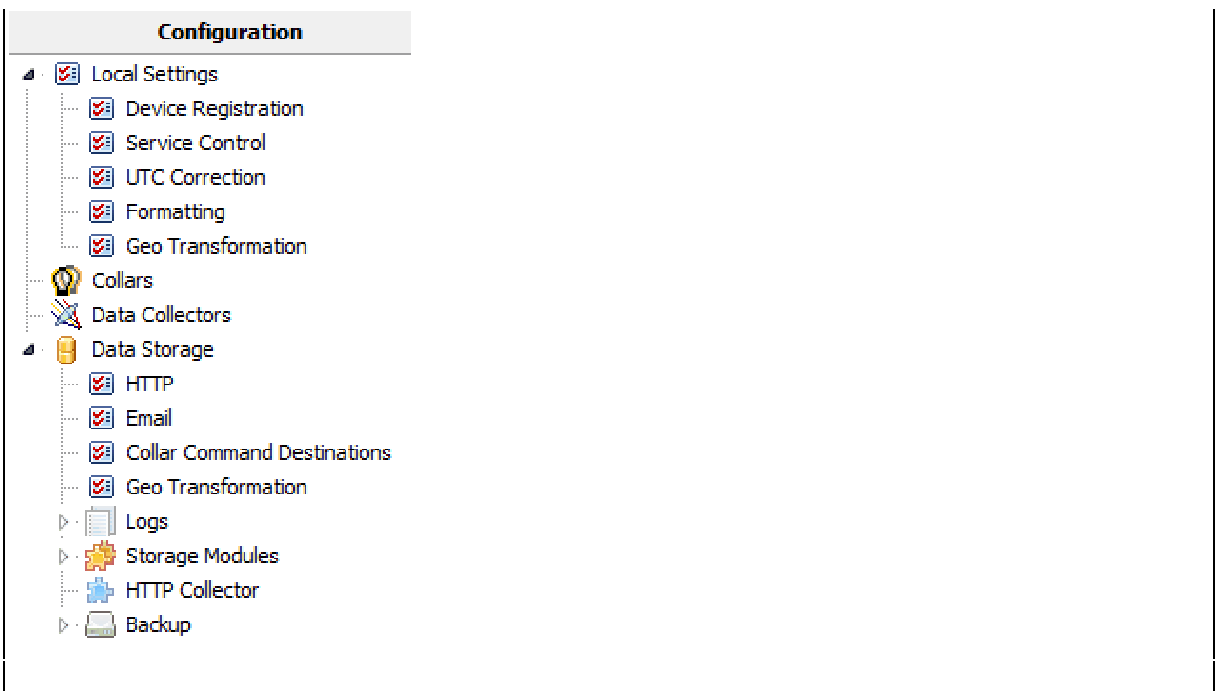


Figure 176: Configuration tree

The **Configuration** tree allows you to configure GPS Plus X regarding the communication devices (Link Manager, UHF/VHF Handheld Terminal and USB Remote Stick), formats for numbers, time and date, and the data storage services. You can also set up the Geo Transformation for the GPS coordinates. The node Collars includes a list of all collars registered for this copy of GPS Plus X and allows you to add or erase collars from this list. Also settings for collection and storage of your GPS Data can be made here.

For a detailed description of the structure of GPS Plus X, please refer to chapter Software structure.

Refer to:

Local Settings

Collar Configuration

Data Collector Service (DCS)

Data Storage Service (DSS)

4.4.1 Local Settings

Refer to:

Device Registration (Link Managers, Handheld Terminals, USB Remote Sticks)

Service Control

UTC Correction

Formatting

Geo Transformation Configuration

4.4.1.1 General

This frame contains the destination email address for collar commands via **MAPI.**

You only have to pay attention to this configuration if there is no classic smtp-server. If you are not administrator of your local email system, command mails (schedules, parameter settings...) of GPS Plus X may get blocked and you have not the permission to change that. MAPI uses standard Email software with which GPS Plus X can cooperate with.

Figure 177: General Configuration

4.4.1.2 Device Registration

Configuration ⇨ Local Settings ⇨ Device Registration

If you plug in a USB device (i.e. Link Manager, Handheld Terminal, USB Remote Stick) for the first time while the program is running, a window will appear to inform you that this device has not been registered yet (Figure below).

It will give you a Device Description consisting of the type of device (e.g. “GPS Plus Handheld Terminal”) and offers the possibility to enter a Display Name with which you can recognise it. After typing this name, press Register; the device will then appear in the **Devices** trees and can be used. If you do not want to register the device, press Cancel. You will not be able to access the device yet, but you can register it later (see System Device Registration list).

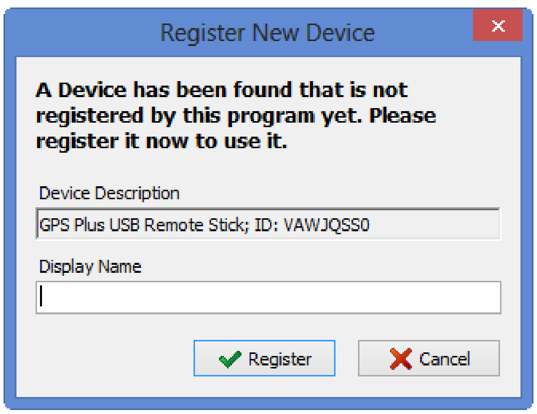


Figure 178: Notification that an unregistered device (e.g. Link Manager, Handheld Terminal) has been detected

A list of all registered USB devices can be found at **Configuration** ⇨ Local Settings ⇨ Device Registration.

Press Rescan to refresh the list. However, changes in connected devices will usually be shown automatically.

Unregistered Devices will be shown in a drop-down list in the left part of the frame. These devices will not appear in the **Devices** tree and cannot be accessed until they are registered.
You can label each device with a Device Name. Then, press Register and the device will appear in the Registered Devices list.
To remove a name from this list, highlight it and press Remove or DEL .

The list indicates the icon and Display Name, its Type (Link Manager 1, Link Manager 2, Handheld Terminal USB, USB Remote Stick) by name and icon, indicates whether it is connected to the computer, and its ID (USB devices) or the Com Port number for serial devices is connected to.

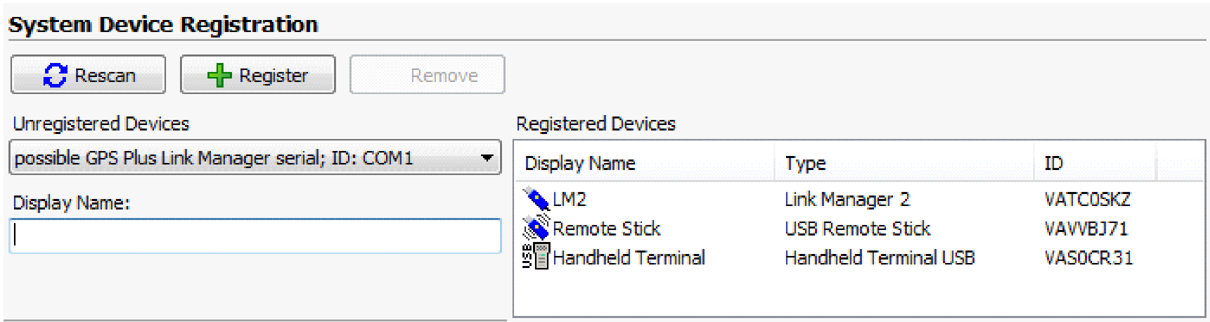


Figure 179: System Device Registration list

4.4.1.3 Service Control

Configuration ⇨ Local Settings ⇨ Service Control

As described in Software structure, GPS Plus X contains of one or several Data Collector Services (DCS) and one Data Storage Service (DSS).
These can be located on the computer you are working on or on another computer within the network.
The status of the services can be monitored at the node Service Control.

By default, the services are installed and running. To refresh the status of the services, press Get Status.

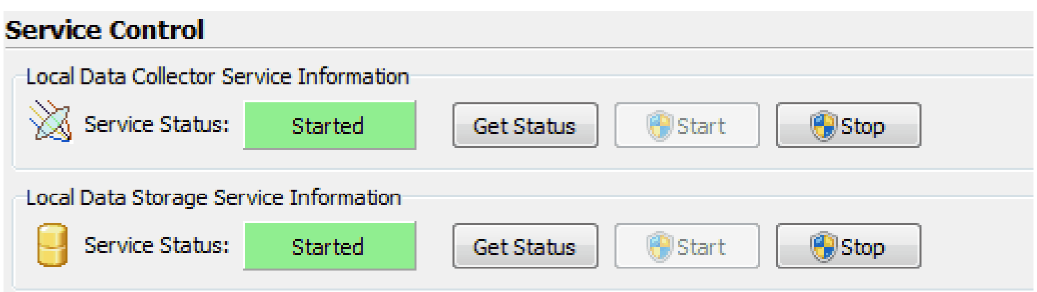


Figure 180: Service Control with services running

In some cases it might be useful to disconnected your GUI (graphical user interface) from the DSS and/or DCS (Data collector / storage service), e.g for training or maintenance purposes. In this case you can stop the services by pressing Stop. An elevation dialog opens. It only opens once, so you can't change the settings (Cancel, Allow). The Service Control frame will change to the Figure below. To restart the services, press Start.

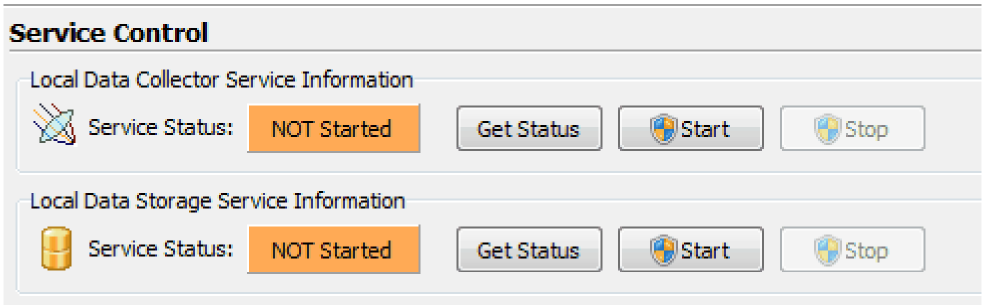


Figure 181: Service Control with installed services

4.4.1.4 System UTC Correction

Configuration ⇨ Local Settings ⇨ UTC Correction

In addition to the optional UTC correction in the collar, there is an optional UTC correction in GPS Plus X.

The UTC correction in GPS PLUS X affects only the time stamp when displaying the GPS and activity data and has nothing to do with the UTC correction inside the collar. UTC correction in the collar affects the GPS schedule and VHF beacon schedule.
Both corrections work independently from each other, so the System UTC Correction does not apply to any commands sent to the collar. The system UTC correction applies to the export and display of the data only. All data sets are stored and exported with two time stamps, coordinated universal time (UTC) and local mean time (LMT). LMT is based on the UTC correction you define for the system. If you do not define a system UTC Correction, the UTC correction of your computer will be used as default.

Based on the system UTC correction, your data will be displayed and exported with two time stamps, one in UTC and one in LMT according to your settings.

There are two main settings possible for the UTC correction:

"Use windows time zone settings", GPS Plus X will use your computer's time as LMT. The time zone and UTC correction of your computer will be shown by GPS Plus X (Figure below).
With Daylight Saving, you can choose whether your data's time stamp will be automatically adjusted according to daylight saving in summer, or if the time stamp will remain on standard time during the entire year.

"Use custom time zone settings" you can also select another time zone than the one on your computer. Choose a time zone from the drop-down list. The selected time zone will be shown underneath the list. Again, you can select whether you want to use Daylight Saving or not. Press Apply to save the settings to your PC. Press Revert to display the original settings before you press Apply.

Note: If you choose to use daylight saving time, this will not be indicated in the displayed and exported data.

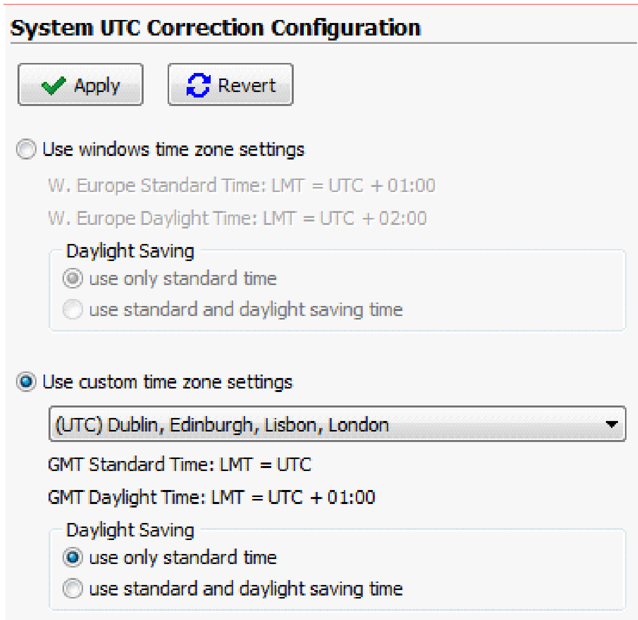


Figure 182: System UTC Correction frame

4.4.1.5 Formatting

Configuration ⇨ Local Settings ⇨ Formatting

This frame allows you to customise a format for numbers, times and dates. The default setting is the format selected in your Windows System. Alternatively, you can define other formats. Either choose a format from the drop-down lists or define your own. The selected format will apply to the display of the data in GPS Plus X, but also to the export format, so the Formats Configuration allows you to choose a format suitable for the software you will use for further analysis.

Numbers

Decimal Separator	defines the symbol that separates the integral part of a number from its fractional part
List Separator	defines the symbol that separates columns when data are exported

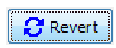
Time

Time separator	defines the symbol that separates hours, minutes, and seconds
Time format	defines the format and sequence in which hours, minutes, and seconds are displayed. The abbreviations used for this definition are explained in the right box (Time format notation).
AM/PM symbol	defines the format of the am or pm symbol if this is included in the time format

Date

Date separator	defines the symbol that separates days, months, and years
Date format	defines the format and sequence in which days, months, and years are displayed. The abbreviations used for this definition are explained in the right box (Date format notation).

Press 

to save the settings to your PC. Press 

to display the original settings before you press 

.

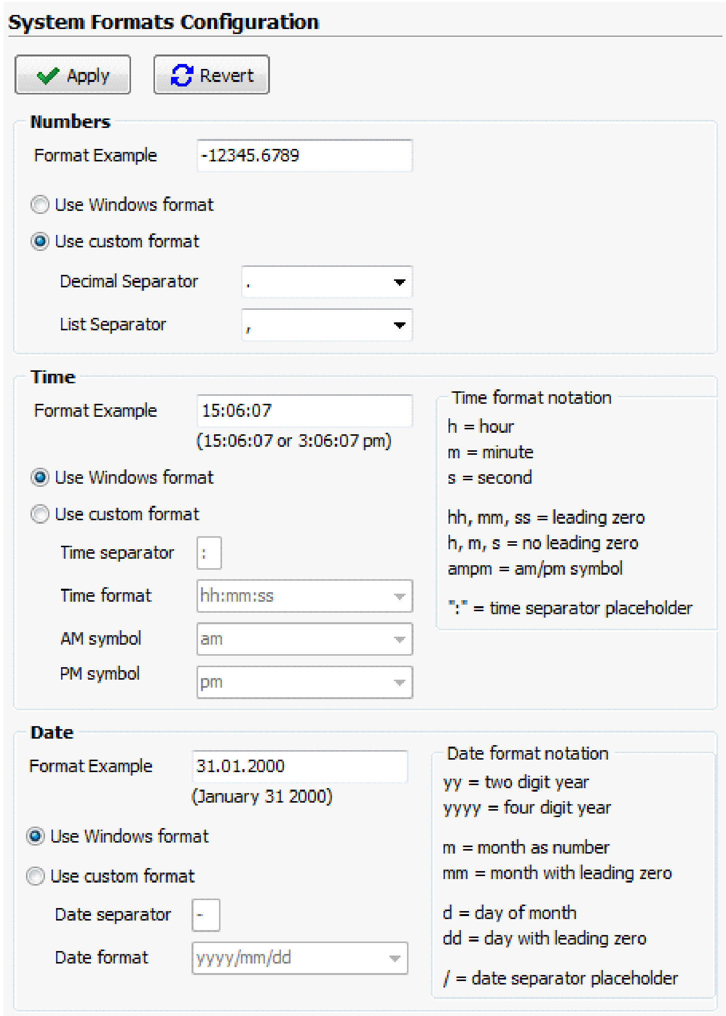


Figure 183: Frame to define formats for numbers, time, and date

4.4.2 Collar Configuration

Configuration ⇨ Collars

If you want to register new collars, refer to Registering and managing collars

You can see the Collar List in this frame. Here you can select several collars in the collars list frame with holding ctrl or Shift button and left clicking on the desired collars. When clicking on the right mouse button within the blue marked lines, a new window (Group edit node) appears. You can choose from different Group edit commands or copy the collar ID's into the temporary buffer store of your computer:

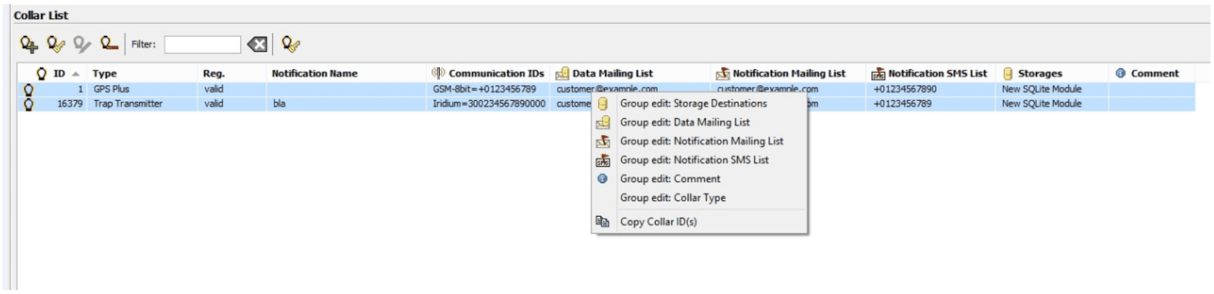


Figure 184: Collar List / Group edit node

Storage Destinations	From the Storage Destination Editor you can select storage modules and add them to all marked collars. By clicking the button „Add selected to all“ the selected storage modules will be added to all marked collars. By clicking the button “Add new to all” you can define a new storage module for all marked collars. The Default Storage modul is PostgreSQL. But you can create your own Storage Modul. For this please refer to **Configuration** ⇨ Data Storage ⇨ Storage Modules
Data Mailing List	By choosing this command you can enter and edit e-mail destination addresses for the collars. When you click the button “Add selected to all”, the selected address will be added to all marked collars. If you type in a new address, you can click to “Add new to all” and the address will be added to all marked collars and to the destination list. By clicking OK, the new configuration will be send to all selected collars.

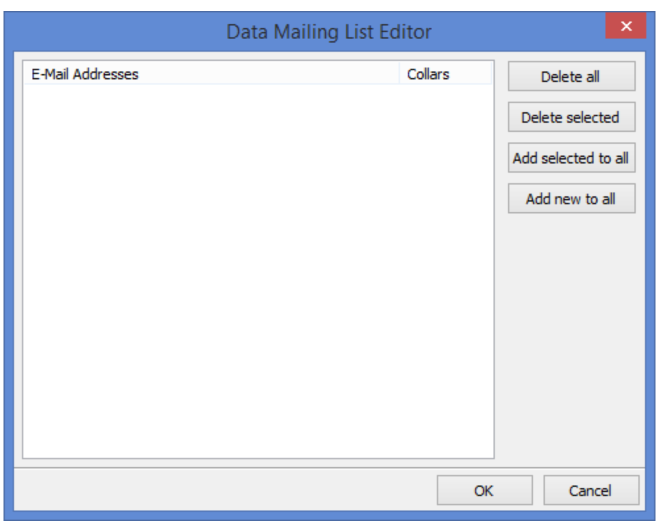


Figure 185: Data Mailing List Editor

Notification Mailing List	In this frame you can type in e-mail addresses to which the collar sends notification messages. These notifications apply when an event is detected (mortality,

	separation, Vaginal Implant, Virtual Fence). The selected e-mail addresses will be added to all marked collars by clicking OK. Please be sure the recipients receives messages from all marked collars. When you click the button "Add selected to all", the selected address will be added to all marked collars. If you type in a new address, you can click "Add new to all" and the address will be added to the list and to all marked collars. By clicking OK, the new configuration will be send to all selected collars.
Notification SMS List	In this frame you can type in telephone numbers to which the collar sends notification messages. These notifications apply when an event is detected (mortality, separation, Vaginal Implant, Virtual Fence). The selected telephone numbers will be added to all marked collars by clicking OK. Please be sure, that the recipients should receive messages from all marked collars. When you click the button "Add selected to all", the selected telephone numbers will be added to all marked collars. If you type in a new number, you can click "Add new to all" and the number will be added to the list and to all marked collars. By clicking OK, the new configuration will be send to all selected collars.

4.4.2.1 Geo Transformation

Configuration ⇨ Local Settings ⇨ Geo Transformation

By default, GPS Plus X will display the coordinates in WGS84 format.

The Geo Transformation allows you to transform coordinates in more than 150 local grid systems.

The settings defined in this node only apply to data sets manually exported from your computer.
If you want to transform coordinates as part as the automatical data SMS processing, you need to change the settings at the node Configuration ⇨ Data Storage ⇨ Geo Transformation

The commands, however, are the same in both frames and will be explained here.

You can select a coordinate system and a reference ellipsoid independently. Furthermore, you can define your own coordinate system and/or reference ellipsoid (including geodetic shift). The following settings can be made for the Target System of the transformation:

Country or Region	the country or region in which your coordinates are situated; this selection limits the number of coordinate systems to those common and valid in the selected region

Coordinate System	for details, please refer to Appendix H: Available Coordinate Systems
Reference System	or reference ellipsoid, and geodetic shift, default setting is WGS84
Meridian Strip	only for appropriate coordinate systems as Gauss Krueger, UTM etc.
Decimal Places	number of decimal places of the transformed coordinates
Check Coordinate System Range	if checked, the software will control if the coordinates are within the limits of the selected coordinate system

The Geo Transformation frame consists of four tabs.

Tab 1 "User Coord. System 1", is shown in Figure Frame to configure the Geo transformation with first tab User Coord. System 1.
This tab allows you to define your own coordinate system. This is only recommended for specialist in this field. Otherwise, the results may be quite unpredictable.
The same is also for Tab 2 "User Geodetic Shift" and Tab 3 "User Ellipsoid". They are used to define the ellipsoid upon which the coordinate system is projected.

The originating system for all transformations is Geographic Coordinates in Degree (as decimal, not degrees and minutes or degrees, minutes and seconds) and WGS 84 as reference ellipsoid.

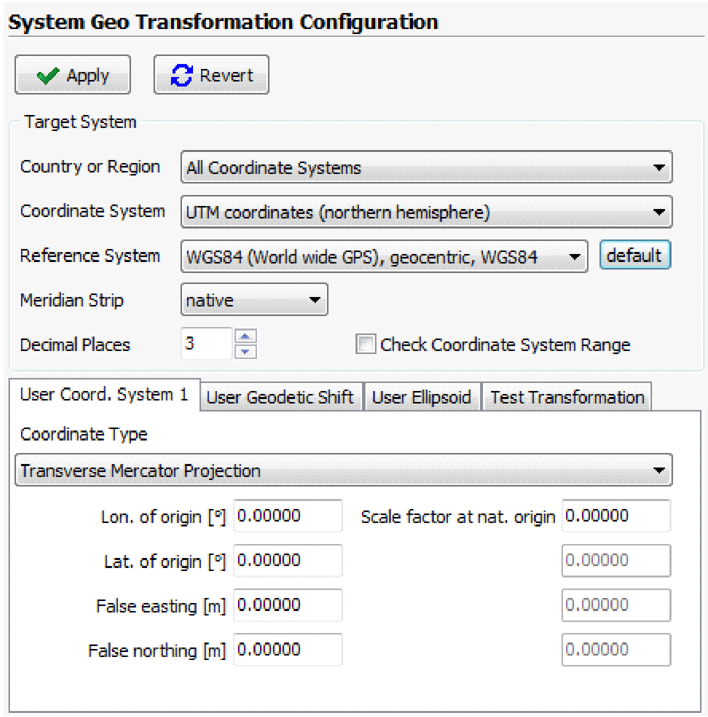


Figure 186: Frame to configure the Geo transformation with first tab User Coord. System 1

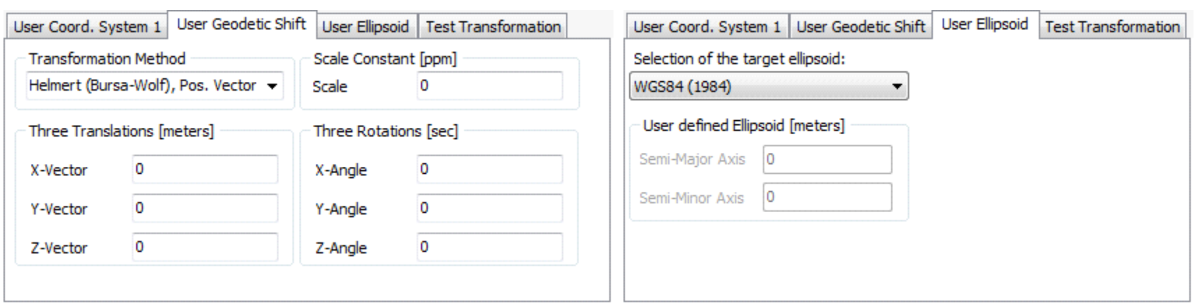


Figure 187: Tabs User Geodetic Shift and User Ellipsoid

To test the transformation you have chosen, use Tab 4 "Test Transformation". Enter a coordinate pair (longitude and latitude) and transform it to your system. Input has to be in degrees (format: ddd.ddddd). If you move to the target coordinates (on the right) and point for a few seconds on one of the coordinate results, the program will display the format of the output (as described in Appendix H: Available Coordinate Systems).

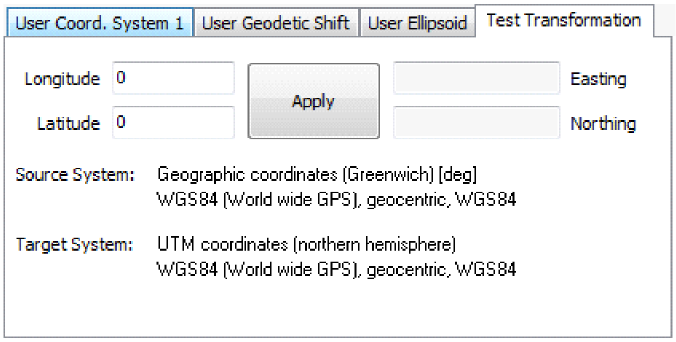


Figure 188: Tabs to test the user-defined coordinate system

4.4.3 Data Collector Service (DCS)

Configuration ⇨ Data Collectors

The Data Collector Services (see software structure) are configured at the Data Collector node. The main frame gives a list of all data collectors and their major properties. One data collector is sufficient to organise communication with different GSM ground stations and email clients, but you can also use different data collectors, e.g. if you work in a network with different institutions or research facilities.

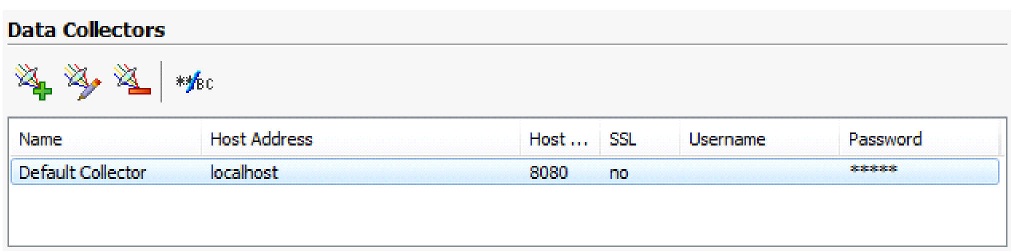


Figure 189: List of data collectors

 opens a new frame and allows you to set up a new data collector (see Figure in next chapter: Frame to enter settings for data collector)

 allows you to edit the selected data collector by opening the data collector frame (see Figure in next chapter: Frame to enter settings for data collector)

 removes the selected data collector from the list

 passwords are shown while this icon is kept pressed

Refer to:

[Default Collector](#)

4.4.3.1 Default Collector

Configuration ⇨ Data Collectors ⇨ Default Collector

The following information is displayed in the list when you add a new collector or if you edit an existing collector.
The information need to be entered to set up a data collector as in Figure "Frame to enter settings for data collector" and allows you to set up a new data collector.

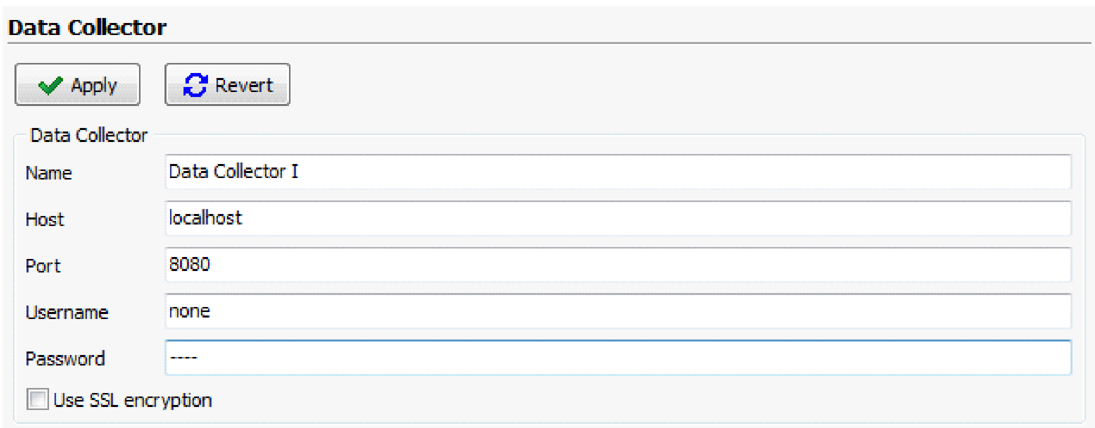


Figure 190: Frame to enter settings for data collector

Data collector	name of the data collector used on this copy of GPS Plus X, one collector can be different names on different user's copies
Address	IP address of the data collector; localhost indicates that the data collector is on your PC
Port	port which is used to communicate with data collector (default 8080)
SSL	indicates whether this connection is SSL secured or not
Username	username for this data collector
Password	password for this data collector; to show the password, keep the icon pressed

Refer to:

[HTTP](#)

[Email](#)

[Data Storage](#)

[Logs](#)

[Collector Modules](#)

[Backup](#)

4.4.3.1.1 HTTP

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ HTTP

This frame configures the connection between your computer and the Data Collector Service (DCS). It is similar to the HTTP configuration frame for the data collectors **Configuration** ⇨ Data Storage ⇨ HTTP

Host Port	TCP port for the connection; the default port is 8080, but if this port is blocked by a firewall or used by another application, it must be changed in accord with your IT manager or administrator
Session Timeout	timespan in seconds without communication after which the session is terminated automatically
Maximum Connections	number of connection the http server is allowed to maintain at one time
Require login	this setting must be checked if the DCS is password protected; GPS Plus X will then automatically send your Username and Password at the beginning of each session
Username	your username for logging into the DCS (if password protected)
Password	your password for logging into the DCS (if password protected)
Use SSL encryption	check this to use SSL encryption for this communication

4.4.3.1.2 Email

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Email

The admins of GPS Plus X can be notified via email if there are problems with the data collectors, the data services, etc. The Admin Notifier frame consists of three parts: The SMTP configuration, the Email notification, and the Message Types. The frame is similar to that for the Data Storage Service (**Configuration** ⇨ Data Storage), but the list of message types is different:

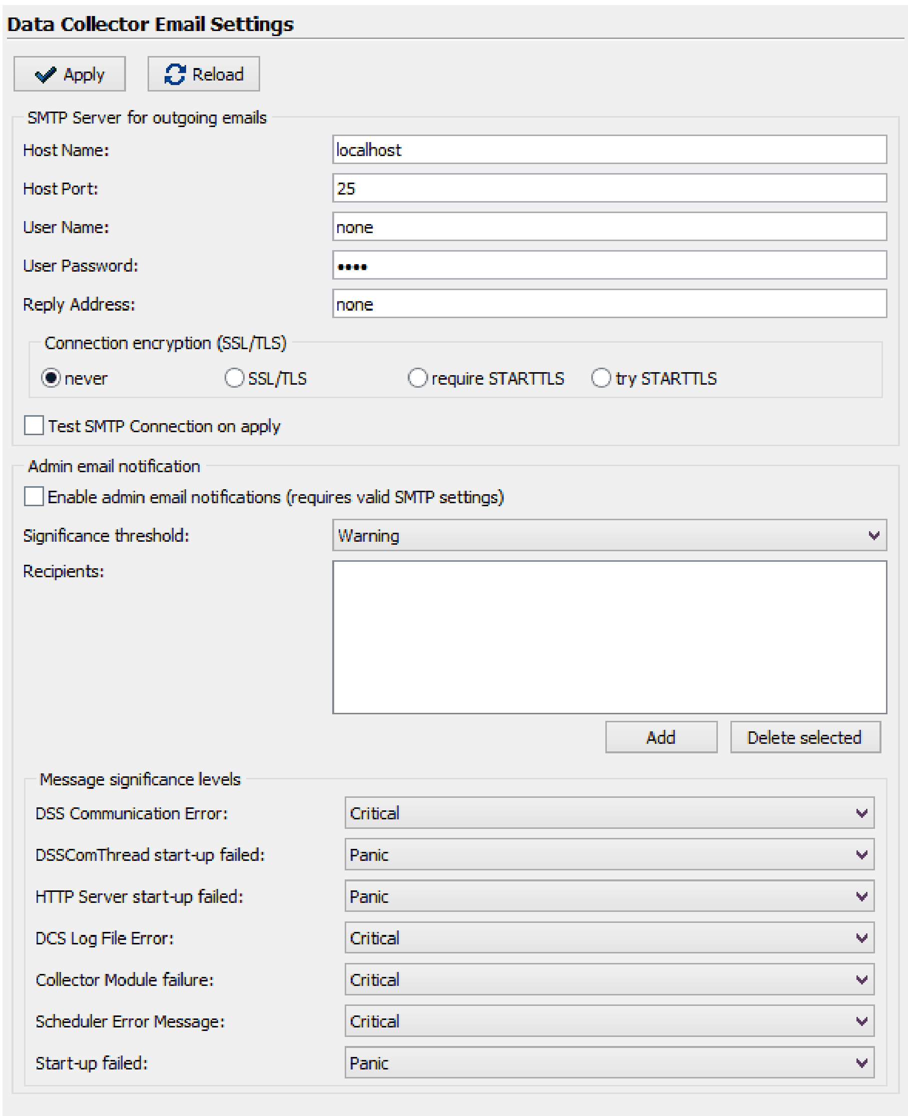


Figure 191: Frame with email messages types for the Data Collector

4.4.3.1.3 Data Storage

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Data Storage

This frame configures the Data Storage Service (DSS) the Data Collector will send the incoming data to. As the DCS, the DSS can be on the same computer as the GUI, or on another computer within the network. To configure the connection, you need to complete the following fields:

Host address	IP address of the data collector; localhost indicates that the data collector is on your PC
Host port	port which is used to communicate with data collector (default 8080)
Username	username for this data collector
Password	password for this data collector; to show the password, keep the icon pressed
Use SSL encryption	check this to use SSL encryption for this communication

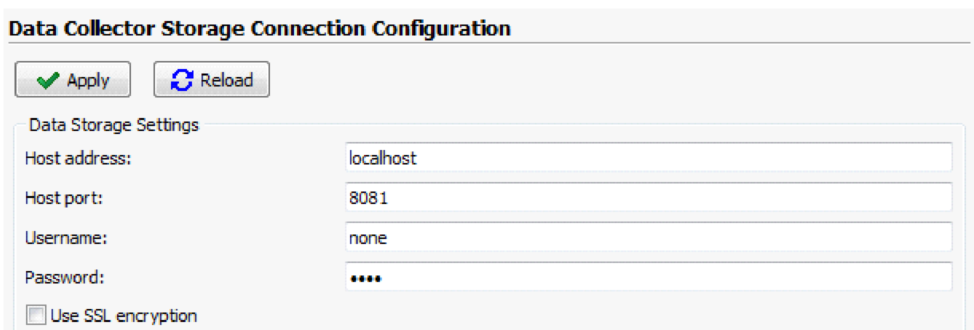


Figure 192: Frame for the Data Collector Storage Connection configuration

4.4.3.1.4 Logs

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Logs

There are three logs providing information on events on the computer on which the DCS is running:

System	is logging all events related to the DCS and its connections
Data Storage	is logging all events related to the DSS assigned to this DCS
Collector Modules	is logging all events related to the modules used for data reception; these modules can be either GSM clients or SMS email clients

(see next chapter **Configuration** ⇨ Data Collectors ⇨ Default Collector ⇨ Collector Modules)

The logs will always show the events up to the moment when you have opened the frame. To get the latest notifications, press Reload. To get frequent updates, enable the Auto Update and choose the length of the update interval in seconds, the frame will then reload the notifications automatically.

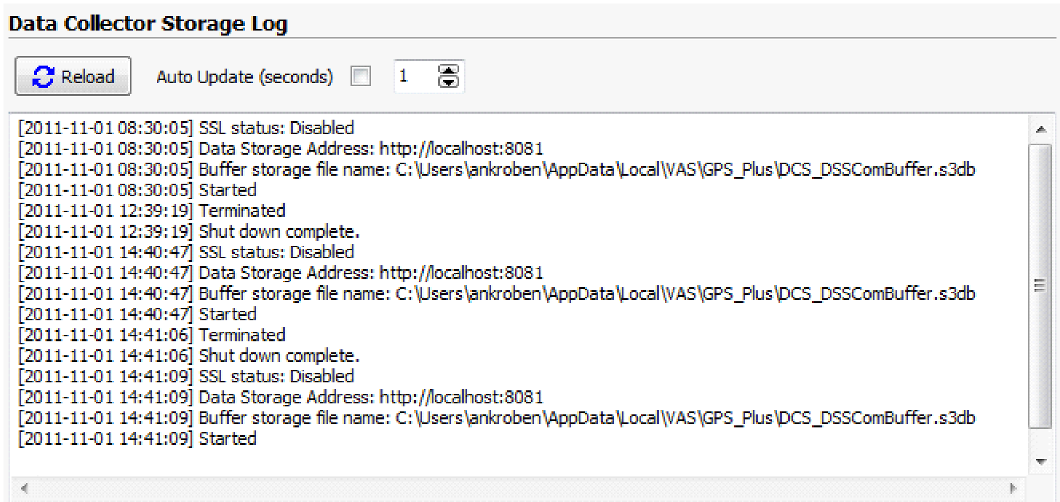


Figure 193: Log frame as used for the Data Collectors

4.4.3.1.5 Collector Modules

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Collector Modules

The remote communication with GSM, IRIDIUM and GLOBALSTAR collars is done via data collector modules, which are part of the Data Collector Service. They need to be configured at the Collector Module node. This node opens a frame with a list of all data collector plugins. The table shows the following information:

Module name	name given by the user, e.g. the position of the GSM ground station, or the project that uses a certain email account
Module type	indicates whether it is a GSM ground station (GSM client) or an email account (SmsEmailClient), an HTTP server connection (HttpDataClient)
Read mode	indicates whether data from this module are read only on demand (Reading Once), continuously (Reading Continuous), or no reading is scheduled (inactive)

The plugin can be edited and configured by using the buttons in the top left bar:

adds a new module to the list; you need to select a module type from the menu shown in Figure below "Menu with the possible plugins". After selecting a module type, the frame GSM client or Email data client (see next chapter) is shown.

edits the highlighted module from the list by opening the frame in GSM client or Email data client (see next chapter)

deletes the highlighted module from the list **This configuration cannot be restored and the module must be configured again!**

The buttons in the top right bar define the reading of the modules. “Reading” means that data are received from the provider (GSM ground station or email account):

finish reading and stop	this command finishes the ongoing reading and terminates the reading process until it is manually triggered again
read once	the system will check for new messages once and then wait for the next manual trigger
read continuos	the system will continuously check for new messages
abort reading	this command immediately aborts the reading process; you can also trigger this command with Ctrl + C

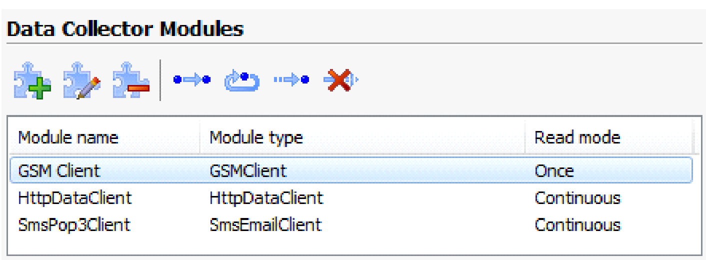


Figure 194: List of configured data collector modules

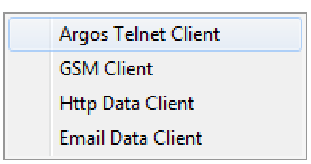


Figure 195: Menu with the possible plugins

4.4.3.1.5.1 GSM client

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Collector Modules ⇨ GSM client

The GSM client frame configures the connection with a GSM ground station. This is an external modem to receive SMS from collars. You have to configure the following parameters:

Name	the name for the plugin to identify it
Pause Time [seconds]	the time interval between single readings
Start in Continuous Read mode	check this box if you want to start reading immediately after configuration and if you want this plugin to read contiuously
Com Port	port through which the GSM ground station is connected to the computer. Select the com port from the drop-down list
Baud Rate	select the Baud Rate from the drop-down list (9600 to 115200 bit/s); select the one that is appropriate to the GSM module you are using. Most of them work with 9600 or 19200 Baud as default and many even use autobauding, which leaves the choice to you
SIM PIN	enter the PIN of the SIM card used in the GSM ground station
Country calling code	the international country calling code of your collars. In some rare cases SMS messages use national phone number coding rather than international. In these cases the phone number has to be transformed to be identified by removing the national calling code prefix and adding the international calling code for the country the collars GSM SIM card is coming from. Note: This only needs to be configured if there are any problems with receiving SMS. We suggest to contact the VECTRONIC Aerospace support before entering any information here.
National calling code prefix length	the number of national calling code prefix digits of your collars. It is necessary in the same cases as explained for the Country calling code.

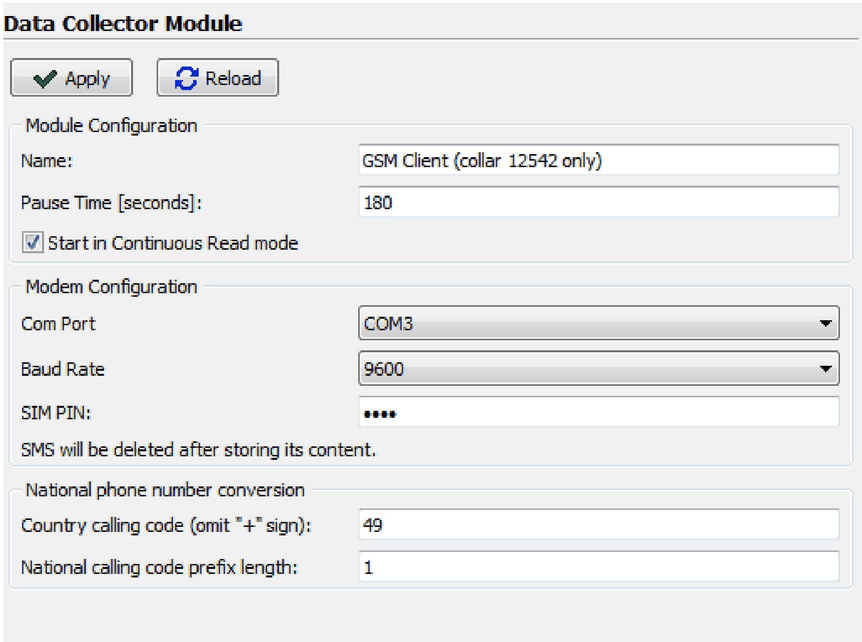


Figure 196: Frame to configure a GSM client

4.4.3.1.5.2 Email Data client

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Collector Modules ⇨ Email Data client

The SMS email client plugin frame configures the reception of data emails sent by VECTRONIC Aerospace.

This refers to data sent by SMS to the VECTRONIC Aerospace GSM ground station and to data sent from IRIDIUM or GLOBALSTAR satellite collars. The set-up is very similar to setting up a POP3 email account in your email program (e.g. Thunderbird).

You have to configure the following parameters:

Name	the name for the plugin to identify it
Pause Time [seconds]	the time interval between the end of one reading process and the beginning of the next
Start in Continuous Read mode	check this box if you want to start reading immediately after configuration and if you want this plugin to read contiuously

POP3 Host	name of the host of the POP3 account from which you download your data emails
POP3 Port	com port used for incoming emails; most POP3 hosts use the default port 110
POP3 User ID	the user-name for this account
POP3 Password	your password for this account
Connection encryption	select with the radio buttons whether this account uses a secure connection or not; this is usually defined by your provider
Delete messages after reading	check this box if you want to delete all messages from the POP3 account after they have been read by the plugin; if messages are read several times, GPS Plus X will still only save them once, but if the POP3 account's memory is full, no new messages will be stored.

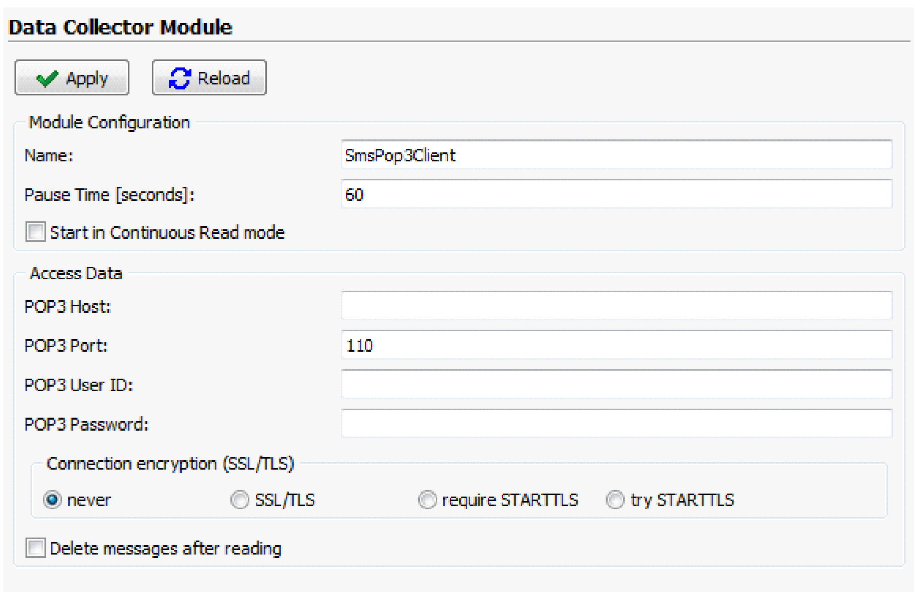


Figure 197: Frame to configure a SMS Pop3 client

4.4.3.1.5.3 IMAP Email Data Client

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Collector Modules ⇨ IMAP Email Data client

The IMAP Email Data client plugin frame configures the reception of data emails sent by VECTRONIC Aerospace.

This refers to data sent by SMS to the VECTRONIC Aerospace GSM ground station and to data sent from IRIDIUM or GLOBALSTAR satellite collars. The set-up is very similar to setting up a POP3/IMAP email account in your email program (e.g. Thunderbird).

You have to configure the following parameters:

Name	the name for the plugin to identify it
Pause Time [seconds]	the time interval between the end of one reading process and the beginning of the next
Start in Continuous Read mode	check this box if you want to start reading immediately after configuration and if you want this plugin to read contiuously
IMAP Host	name of the host of the IMAP account from which you download your data emails
IMAP Port	com port used for incoming emails; most IMAP hosts use the default port 143
IMAP User ID	the username for this account
IMAP Password	your password for this account
IMAP Folder	defines the folder/directory in your IMAP account that will be checked for new data
Connection encryption	select with the radio buttons whether this account uses a secure connection or not; this is usually defined by your provider
Delete messages after reading	check this box if you want to delete all messages from the IMAP account after they have been read by the plugin; if messages are read several times, GPS Plus X will still only save them once, but if the IMAP account’s memory is full, no new messages will be stored.

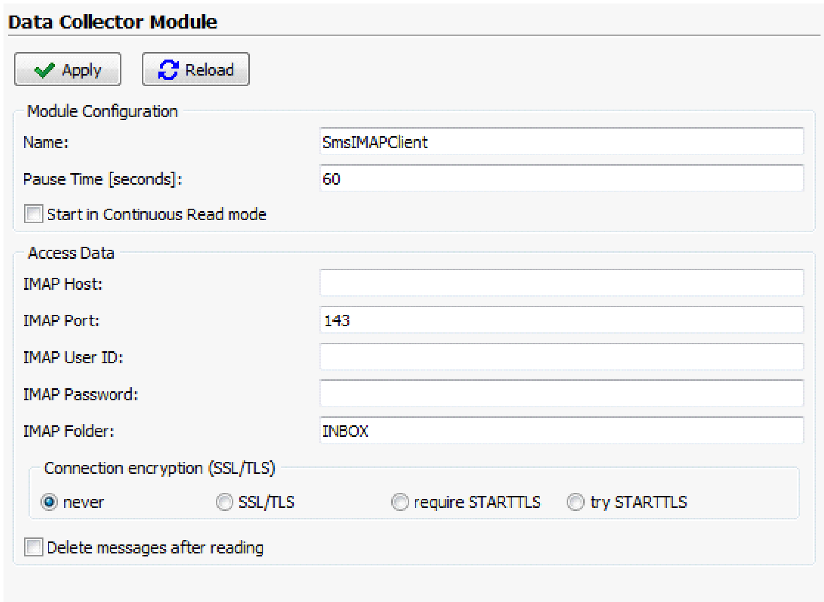


Figure 198: Frame to configure a SMS IMAP client

4.4.3.1.5.4 HTTP Data Client

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Collector Modules ⇨ HTTP Data Client

---

This client is used to download data from a VECTRONIC Aerospace server.

By default, it is configured correctly; therefore you do not need to change any settings here. Changes might only be necessary in after consulting VECTRONIC Aerospace.

Plugin Name	the name for the plugin to identify it
Pause Time [seconds]	the time interval between the end of one reading process and the beginning of the next
Load data of the last x days	the time period of days starting today for which data are downloaded from the HTTP server, the maximum value which you can choose as is x = 3650 days
Start in Continuous Read mode	check this box if you want to start reading immediately after configuration and if you want this plugin to read contiuously

Host address	name of the host of the server from which you download your data
Use SSL encryption	check this box if you want to use SSL encryption to communicate with the server
Download data of collars	list of collar IDs for which data will be downloaded from this server (see below for details).
Add Collars	list of collar key files that need to be added to the field Download data of collars (see below for details).

Data are downloaded for all collars which are listed in the field Download data of collars.

To add a collar, click on Add item. Select the KEY file for the collar you want to add. Press Reload. The ID number of the collar will now be shown in field Download data of collars and data will be downloaded as soon as the module is activated.

To delete a collar from the list, highlight the collar and press Delete selected. The collar ID will disappear.

Note: If you delete a collar from the download list, you will need the key to add it again. Make sure the key will be available then.

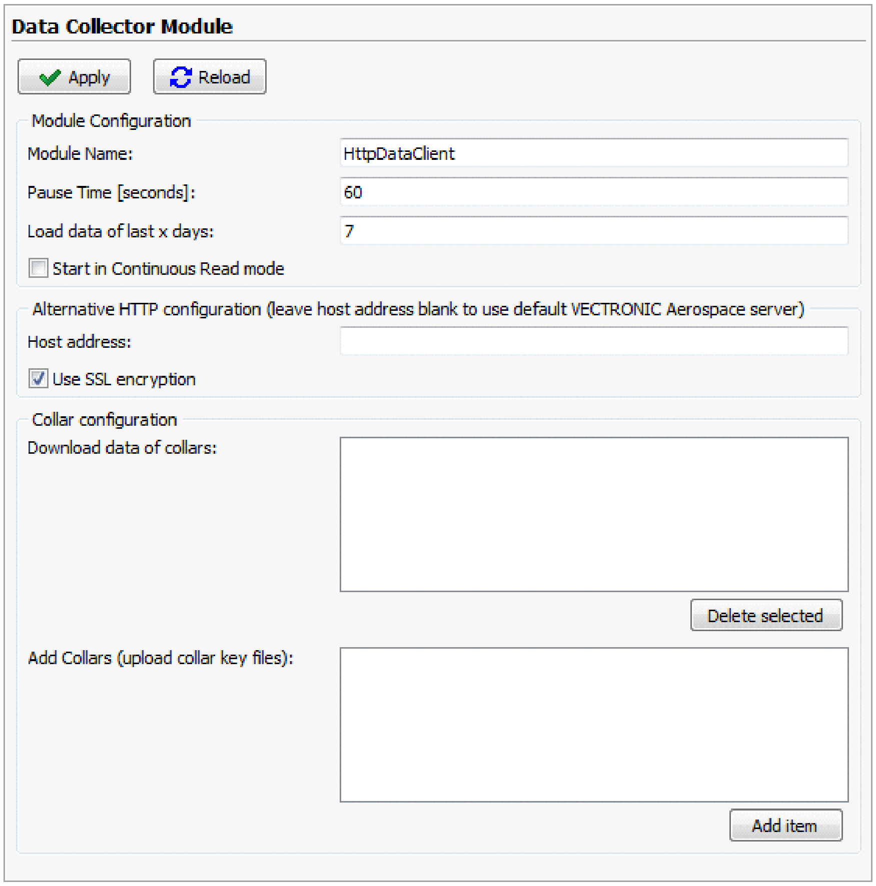


Figure 199: Frame to configure a HTTP data client

4.4.3.1.6 Backup

Configuration ⇨ Data Collectors ⇨ Default Collector ⇨ Backup

It is easy to backup the data collector service automatically by schedule.
Backups of the collector modules involve the complete data collector service configuration. The Backup node displays a list of all the backups that are scheduled.

creates a new schedule rule by opening the Backup schedule rule editor in Figure 160

opens the window in Figure 160 to add the highlighted schedule

deletes the highlighted schedule from the list

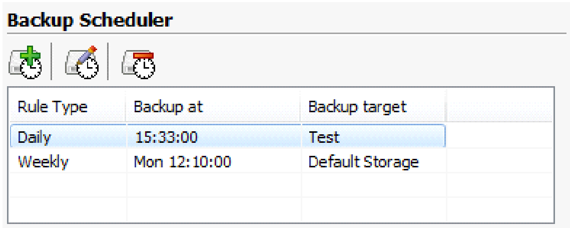


Figure 200: List of scheduled backups

There are two types of backups:

- The Daily backup is done each day at the defined Execution time for the selected Data Collector Service
- The Weekly backup is done on the selected Day of the week at the defined Execution time for the selected Data Collector Service

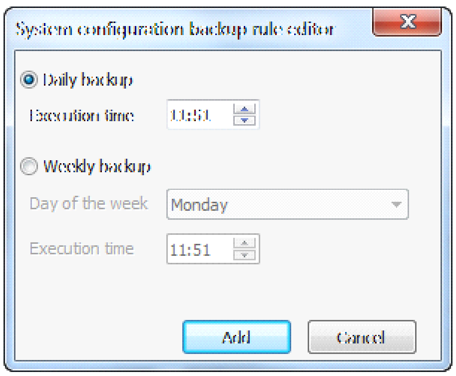


Figure 201: System configuration backup rule editor

4.4.4 Data Storage Service (DSS)

Configuration ⇨ Data Storage

The Data Storage Service (DSS) (see chapter Software structure) is configured at the Data Storage node. There is only one DSS for the entire GPS Plus X network. To configure it, you need to add the following information from your internet provider or administrator:

Host Address	IP address or host name (e.g. vectronic-wildlife.net) of the DSS; localhost indicates that the DSS is on your PC
Host Port	TCP port for the connection; the default port is 8081, but if this port is blocked

	by a firewall or used by another application, it must be changed in accord with your IT manager
Username	username for the DSS
Password	password for the DSS
Use SSL encryption	check this to use SSL encryption for this communication

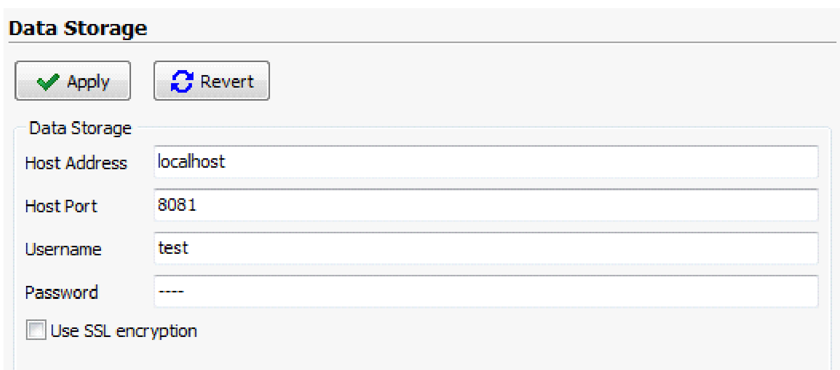


Figure 202: Configuration of the Data Storage Service (DSS)

Refer to:

HTTP

Email

Collar Command Destinations

Geo Transformation

Logs

Storage Modules

HTTP Collector

Backup

4.4.4.1 HTTP

Configuration ⇨ Data Storage ⇨ HTTP

This frame configures the connection between your computer and the Data Storage Service (DSS).

Host Port	TCP port for the connection; the default port is 8081
Session Timeout	timespan in seconds without communication after which the session is terminated automatically
Maximum Connections	number of connection the http server is allowed to maintain at one time
Require login	this setting must be checked if the DSS is password protected; GPS Plus X will then automatically send your Username and Password at the beginning of each session
Username	your username for loggin into the DSS (if password protected)
Password	your password for loggin into the DSS (if password protected)
Use SSL encryption	check this to use SSL encryption for this communication

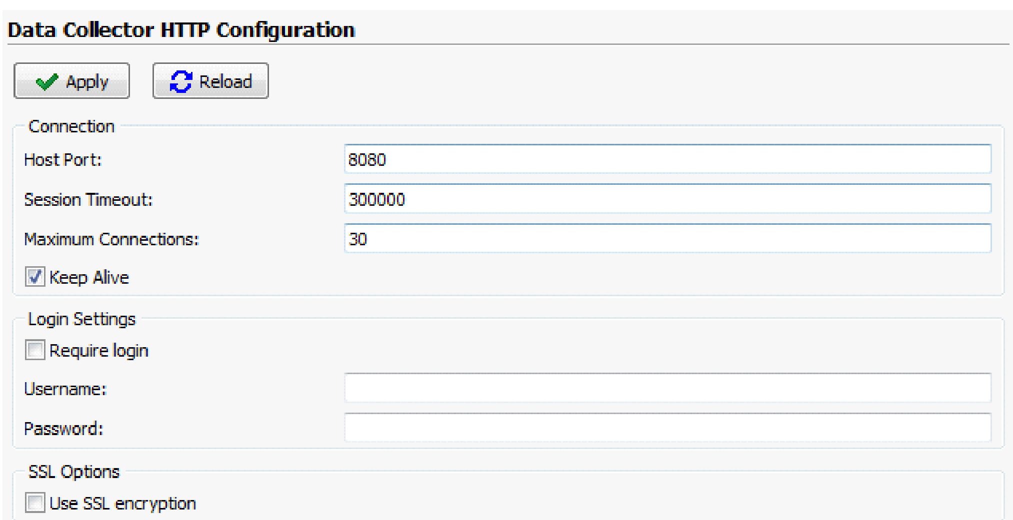


Figure 203: Frame for the HTTP configuration

4.4.4.2 Email

Configuration ⇨ Data Storage ⇨ Email

The admins of GPS Plus X can be notified via email if there are problems with the storage modules, the data services, etc.

The Admin Notifier frame consists of three parts: The SMTP configuration, the Email notification, and the Message Types.

First, you need to configure the SMTP for the outgoing notification emails. This is similar to configuring an SMTP for your normal email address.

The following information is needed:

Host name	domain of the email account used for sending the emails
Host port	port used to send the emails (default 25)
User name	your user name on this account
User password	your user password on this account
Reply address	the email address which is shown as return address
Connection encryption (SSL/TLS)	use the radio buttons to indicate whether encryption should be used, and check if the system should Use secure authentification (SASL). The settings depend on your email provider. Please check your email provider’s FAQ or ask your system administrator for information.

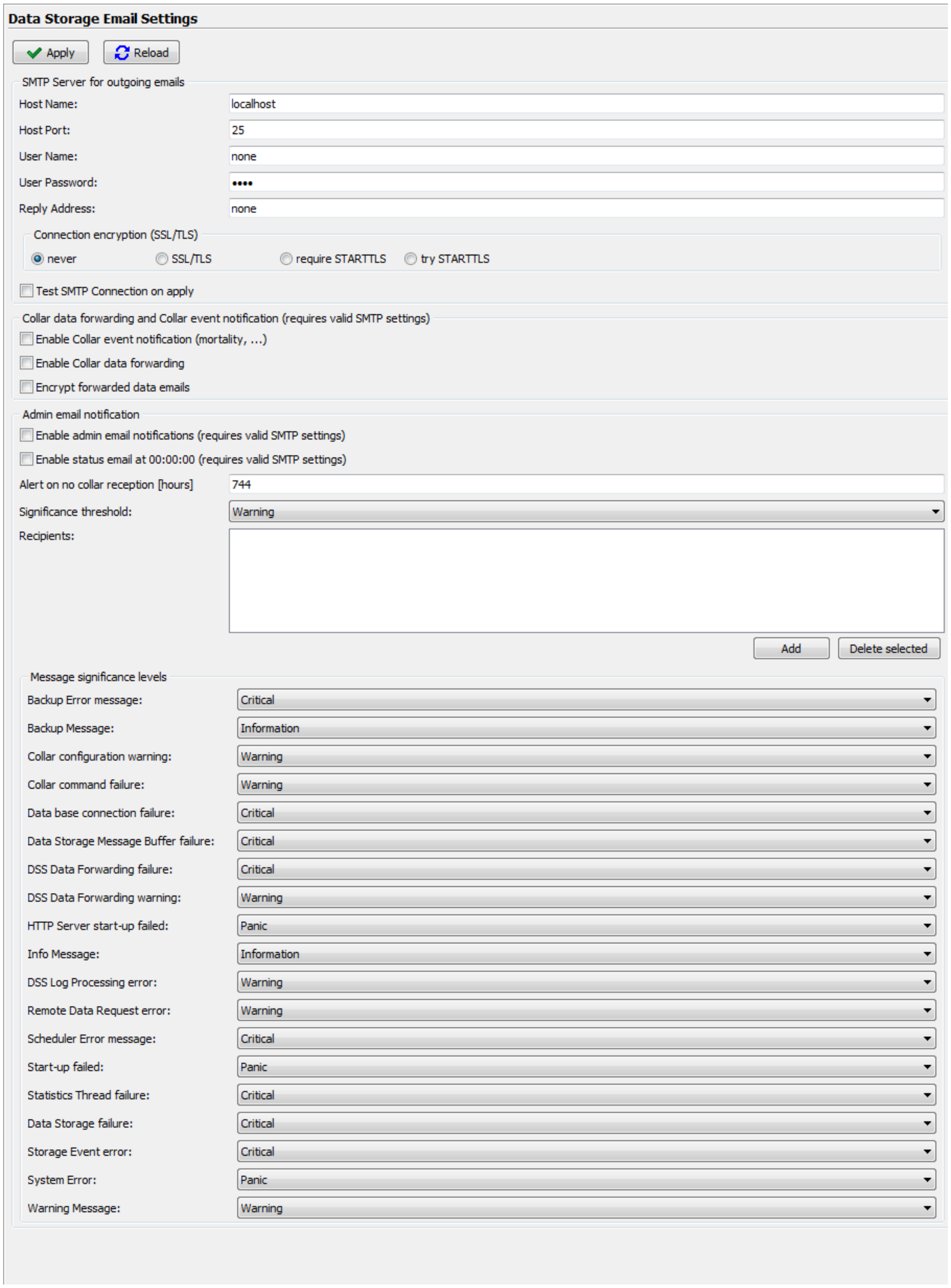
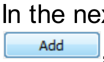


Figure 204: Frame to set up email notifications for the system admins

In the next step, you can set up a list of people (Recipients) who will receive notifications. If you press 

, a window will appear. Enter the required email address and press OK. You can also select email addresses from the list by clicking on them and remove them from the list by clicking on 

.

With Significance threshold, you can define the minimum significance a notification needs to have to be sent by email. All messages with lower significance will only be displayed in the Data Storage Service Status frame (see Data Storage Service Status).

Message significance levels: Here you can define the significance for different message types. Those message types that have been assigned the threshold significance will be sent out as emails. The remaining messages can be viewed on demand at the Data Storage Service Status frame (Data tree, Storage).

4.4.4.3 Collar Command Destinations

Configuration ⇨ Data Storage ⇨ Collar Command Destinations

This node allows you to configure the outgoing communications of the DSS. These are:

- new commands, schedules, and configurations sent via SMS or email to GSM or IRIDIUM collars,
- GPS data and mortality events received by GSM or email and have to be forwarded to external email addresses,
- notifications on system performance or alerts for the admins.

The first part of the frame allows you to configure the GSM communication if there is a GSM ground station connected to your GPS Plus X network. Even if the GPS Plus X network uses several GSM ground stations, you need to define one for outgoing communication. For this, you need to fill in:

DCS Host address	IP adress of the DCS in which the GSM ground station is running
DCS Host port	TCP port of the DCS in which the GSM ground station is running
Username	your username for loggin into the DCS (if password protected)
Password	your password for loggin into the DCS (if password protected)
Use SSL encryption	check this to use SSL encryption for this communication

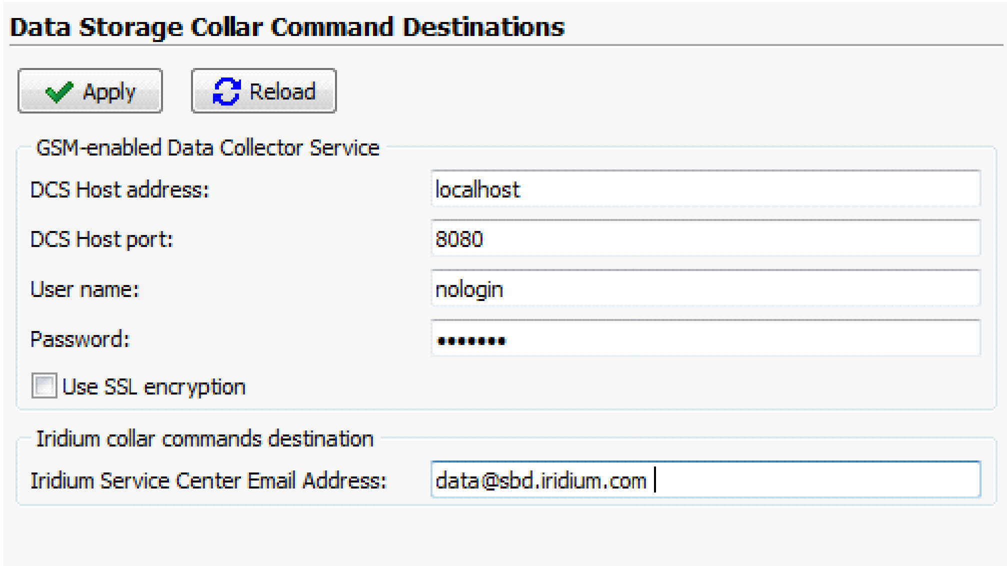


Figure 205: Frame to configure the outgoing communication of the Data Storage Service

In the last part of the frame, you can configure the IRIDIUM Service Center Email Address. Emails sent to this address will be forwarded to a collar via the IRIDIUM satellite system.

4.4.4.4 Geo Transformation

Configuration ⇨ Data Storage ⇨ Geo Transformation Configuration for positions received via GSM or Email (GeoDLL Config)

By default, GPS Plus X will display the coordinates in WGS84 format.

The Geo Transformation allows you to transform coordinates in more than 150 local grid systems. At this node, you can configure how the coordinates are transformed during the automatic process of SMS data files received by GSM ground station or email. For details, please refer to chapter **Configuration** ⇨ Local Settings ⇨ Geo Transformation

4.4.4.5 Logs

Configuration ⇨ Data Storage ⇨ Logs

There are two logs providing information on events on the computer on which the DCS is running:

System	is logging all events related to the DSS and its connections

Storage Modules	is logging all events related to the storage modules

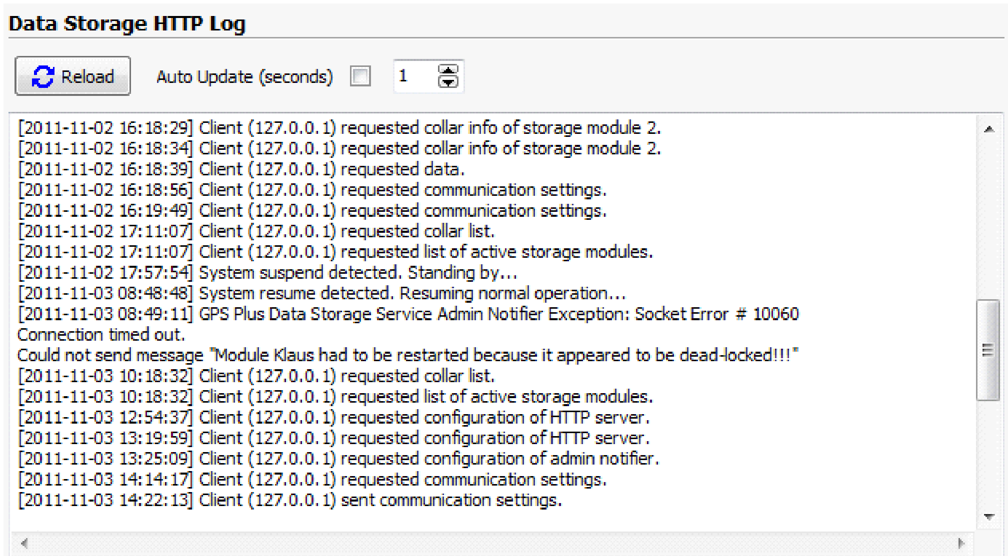


Figure 206: Log frame as used for the Data Storage Service

The logs will always show the events up to the moment when you have opened the frame. To get the latest notifications, press Reload. To get frequent updates, enable the Auto Update and choose the length of the update interval in seconds, the frame will then reload the notifications automatically. For each day, a log file is saved in your working directory (e.g c:\Users\[USERNAME]\AppData\Local\VAS \GPS Plus X\Logs\), so you can also access the older logs. Logs which are older than 30 days will be deleted by the system.

4.4.4.6 Storage Modules

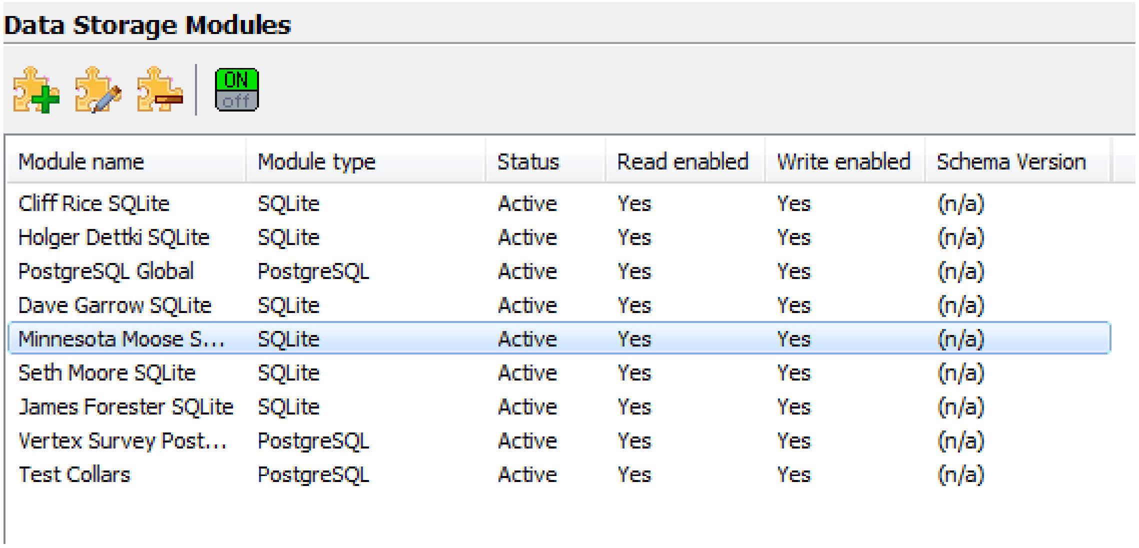
Configuration ⇨ Data Storage ⇨ Storage Modules

The storage modules are the actual location where the data collected by the collars are stored (for details please refer to Software structure).

opens a menu to create a new SQLite (default) or PostgreSQL (recommended for 50 or more collars) module (Figure: Frame to configure an SQLite data). The Module Name is automatically filled in the field by the program. You can change this name to a personalized name which enables you to recognize your data.

allows you to edit the selected storage module by opening the storage module frame

removes the selected storage module from the list


Data Storage Modules

Module name	Module type	Status	Read enabled	Write enabled	Schema Version
Cliff Rice SQLite	SQLite	Active	Yes	Yes	(n/a)
Holger Dettki SQLite	SQLite	Active	Yes	Yes	(n/a)
PostgreSQL Global	PostgreSQL	Active	Yes	Yes	(n/a)
Dave Garrow SQLite	SQLite	Active	Yes	Yes	(n/a)
Minnesota Moose S...	SQLite	Active	Yes	Yes	(n/a)
Seth Moore SQLite	SQLite	Active	Yes	Yes	(n/a)
James Forester SQLite	SQLite	Active	Yes	Yes	(n/a)
Vertex Survey Post...	PostgreSQL	Active	Yes	Yes	(n/a)
Test Collars	PostgreSQL	Active	Yes	Yes	(n/a)

Figure 207: List of all storage modules

For both SQLite and PostgreSQL modules, you can define:

Module name	for identification of the storage module (e.g. “Wild Boar Group”)
Read enabled	all users with access to this storage module can view and export all data (default setting)
Write enabled	all users with access to this storage module can add new data, copy them between other storage modules they have write access too, or delete data (default setting)

GPS data sent to a storage module can be automatically exported into different formats; these can be chosen in the configuration frame during the creation of the module or later when editing it. For details of the different formats, please refer to GPS Data Export.

Different configurations are needed for the access to the storage modules. For the SQLite modules (Figure below, left), only one is needed:

Database filename	filename of the database

For PostgreSQL modules (Figure below, right), you need to define:

Host name	IP address of the storage module
Host port	TCP port for the connection

Data base name	name of the database
User name	your username for loggin into the module
User password	your password for loggin into the module

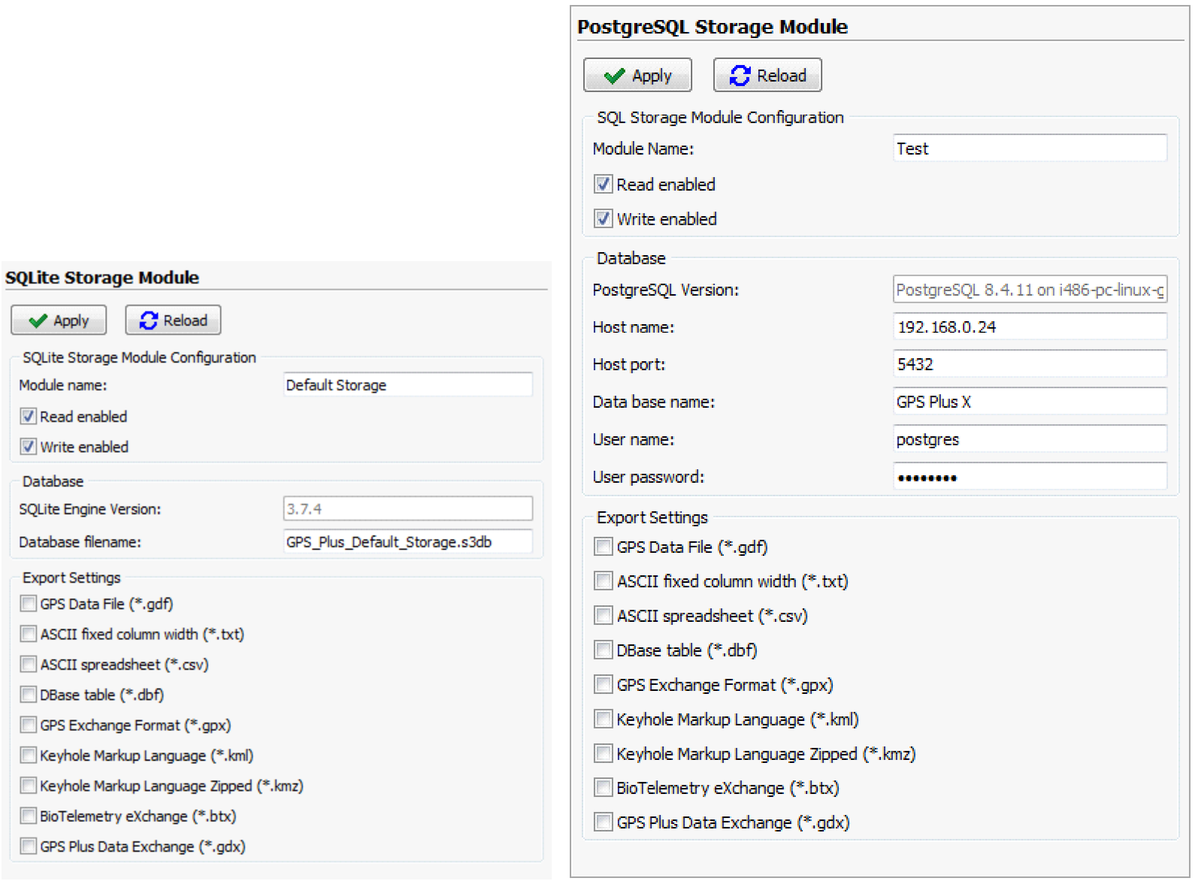


Figure 208: Frame to configure an SQLite data (left) and a PostgreSQL (right) storage module

In the storage module of the configuration frame you have the possibility to define animals, to assign a collar ID to a specific animal and to create species or groups.
Refer also to:

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Animal

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Collar-Animal Assignments

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Species

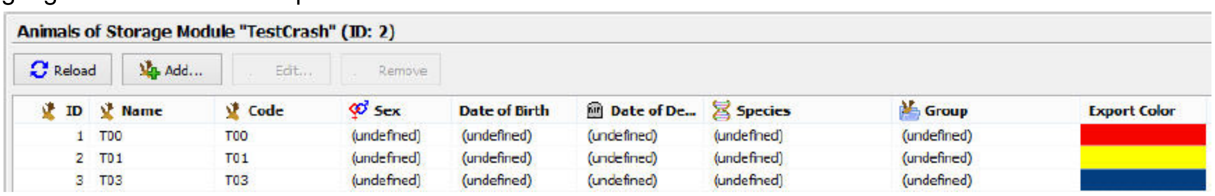
Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Groups

4.4.4.6.1 Animal

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Animal

---

In this frame you can create an animal with a name, a code, sex and the date of birth or death of the animal. This animal, you can assign a specific collar ID, to a species or to a group. It is not possible to assign one animal to more than one group or species. For information about creating a species or a group please refer to the chapter Species and Groups.
It is possible to view collar data of an animal in the data storage.
There is also the possibility to define a color for each animal for better identification for viewing the data in google earth after data export in kml.file.



Animals of Storage Module "TestCrash" (ID: 2)

Reload | Add... | Edit... | Remove

ID	Name	Code	Sex	Date of Birth	Date of De...	Species	Group	Export Color
1	T00	T00	(undefined)	(undefined)	(undefined)	(undefined)	(undefined)	
2	T01	T01	(undefined)	(undefined)	(undefined)	(undefined)	(undefined)	
3	T03	T03	(undefined)	(undefined)	(undefined)	(undefined)	(undefined)	

Figure 209: Animals of Storage Module

To specify a collar ID with a new animal identification press Add... or mouse rightclick, type in all information in the field "Create Animal" (see picture below) and press OK.

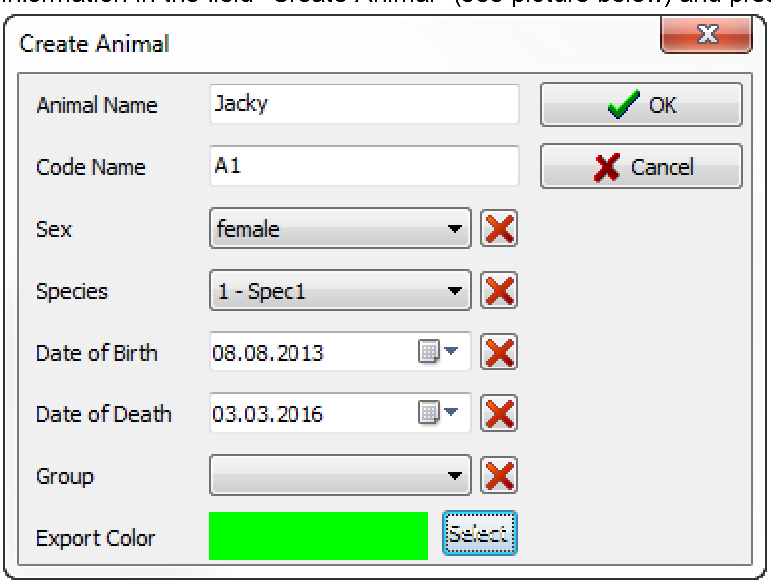


Figure 210: Create Animal

To edit the animal specification for an existing collar ID, select the collar ID and press Edit... . Type in your new specifications in the field "Edit Animal" and press OK (see picture below).

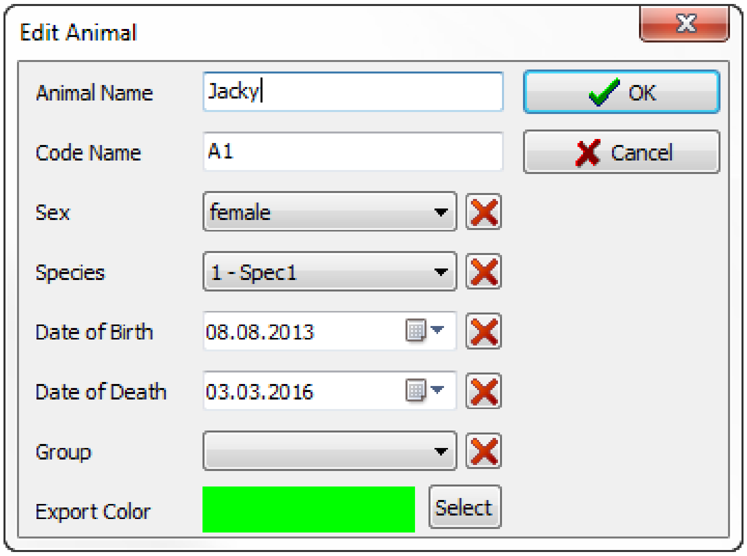
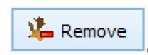
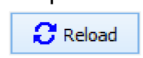


Figure 211: Edit Animal

To delete the animal specification for an existing collar ID, select the collar ID and press  .

When you added, edited or deleted the animal specifications for a collar press  so the changes are displayed.

4.4.4.6.2 Collar-Animal Assignments

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Collar-Animal Assignments

In this frame you can assign a collar ID to a specific animal. It is possible to assign one or more collar IDs to the same animal. But it is not possible to assign more than one animals to the same collar.
It is required to define a start date for the collar-animal assignment. A end date for the collar-animal assignment can be defined but it is not required.

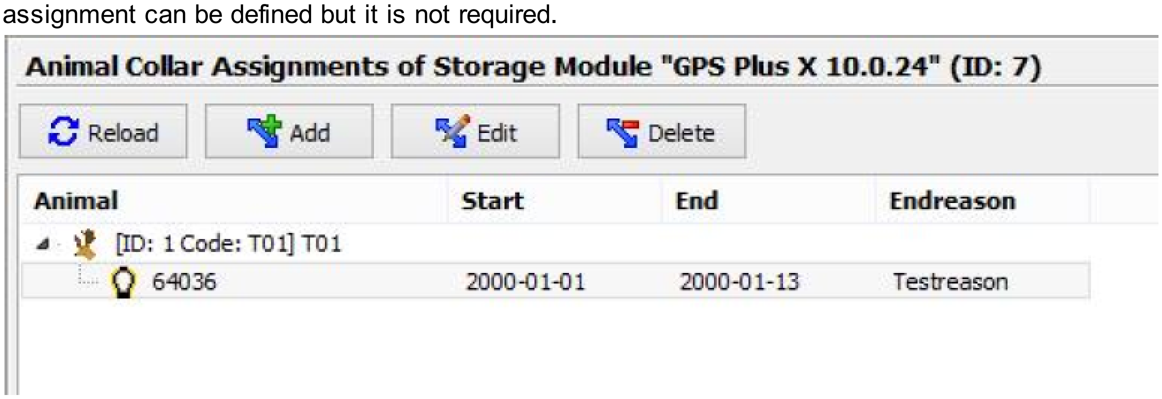
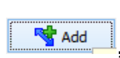


Figure 212: Animal-Collar Assignments

To assign a collar ID to a specific animal press  , type in all information in the field "Create Assignment" (see picture below) and press OK.

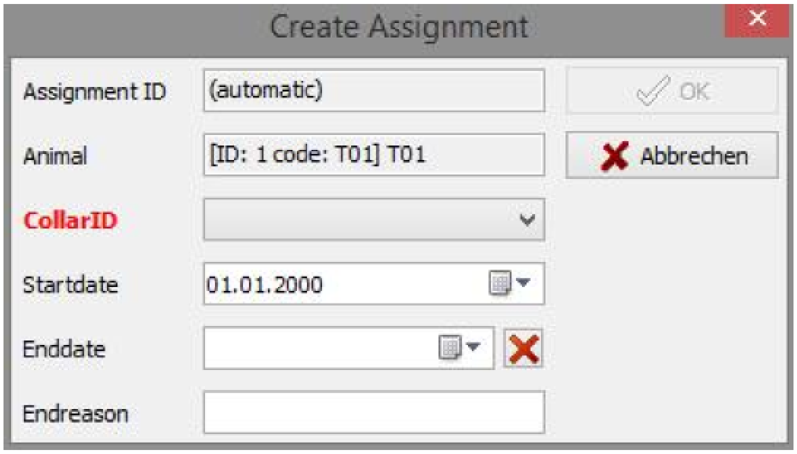
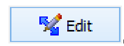


Figure 213: Create Assignment

To edit the Collar-Animal Assignment, select the collar ID and press 

. Type in your new specifications in the field "Edit Assignment" and press OK.

To delete the Collar-Animal Assignment, select the collar ID and press 

.

When you added, edited or removed the Collar-Animal Assignment for a collar press 

so the changes are displayed.

4.4.4.6.3 Species

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Species

In this frame you can create a species with a Name and a Description. The quantity of animals assigned to this species is also displayed. It is possible to assign more than one animal to a species. But it is not possible to assign one animal to more than one species.

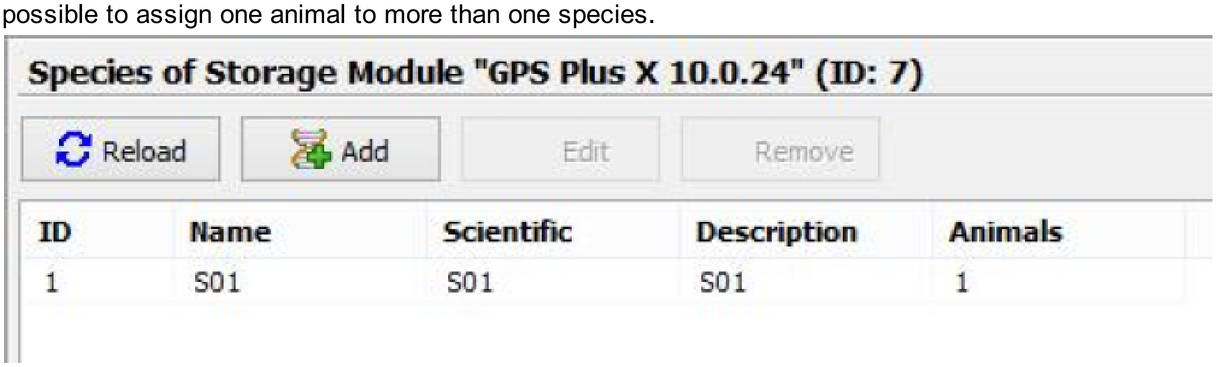
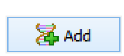
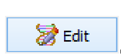


Figure 214: Species of Storage Module

For creating a new species press 

or mouse rightclick, type in all information in the field "Create species" and press OK.

For editing, select the species and press 

. Type in your new specifications in the field "Edit Species" and press OK.

For deleting, select the species and press Remove.

When you added, edited or deleted a species press Reload so the changes are displayed.

4.4.4.6.4 Groups

Configuration ⇨ Data Storage ⇨ Storage Modules ⇨ module ⇨ Groups

In this frame you can create a group with a name and a description. The quantity of animals assigned to this group is also displayed. It is possible to assign more than one animal to a group. But it is not possible to assign one animal to more than one group.

It is possible to view collar data of a group in the data storage and to export them.

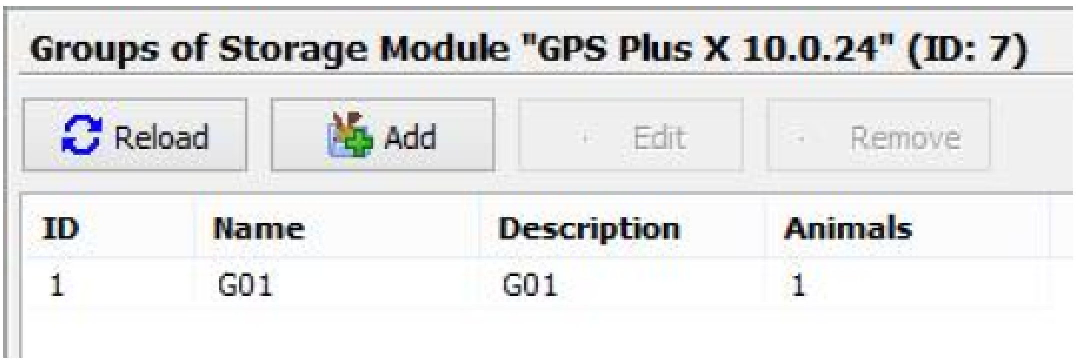


Figure 215: Groups of Storage Module

For creating a new group press Add or mouse rightclick, type in all information in the field "Create Group" and press OK.

For editing, select the group and press Edit. Type in your new specifications in the field "Edit Group" and press OK.

For deleting, select the group and press Remove.

When you added, edited or deleted a group press Reload so the changes are displayed.

4.4.4.7 HTTP Collector

Configuration ⇨ Data Storage ⇨ HTTP Collector

The HTTP Data Collector provides simple means to download data of all registered collars from an HTTP service provided by VECTRONIC Aerospace. Using the Hypertext Transfer Protocol (HTTP) allows users to download their collar's data through most firewalls. The service accepts connections on TCP ports 80 (standard HTTP port) and 443 (standard HTTPS, SSL/TLS encrypted HTTP).

The first time the collector attempts to download data it will fetch all data available on the HTTP service for the registered collars. Any subsequent attempt will only read the data that was received by the service after the most recent data record of the previous connection.

Please note: Depending on the amount of available data the initial download may take up to several minutes or even hours to complete.

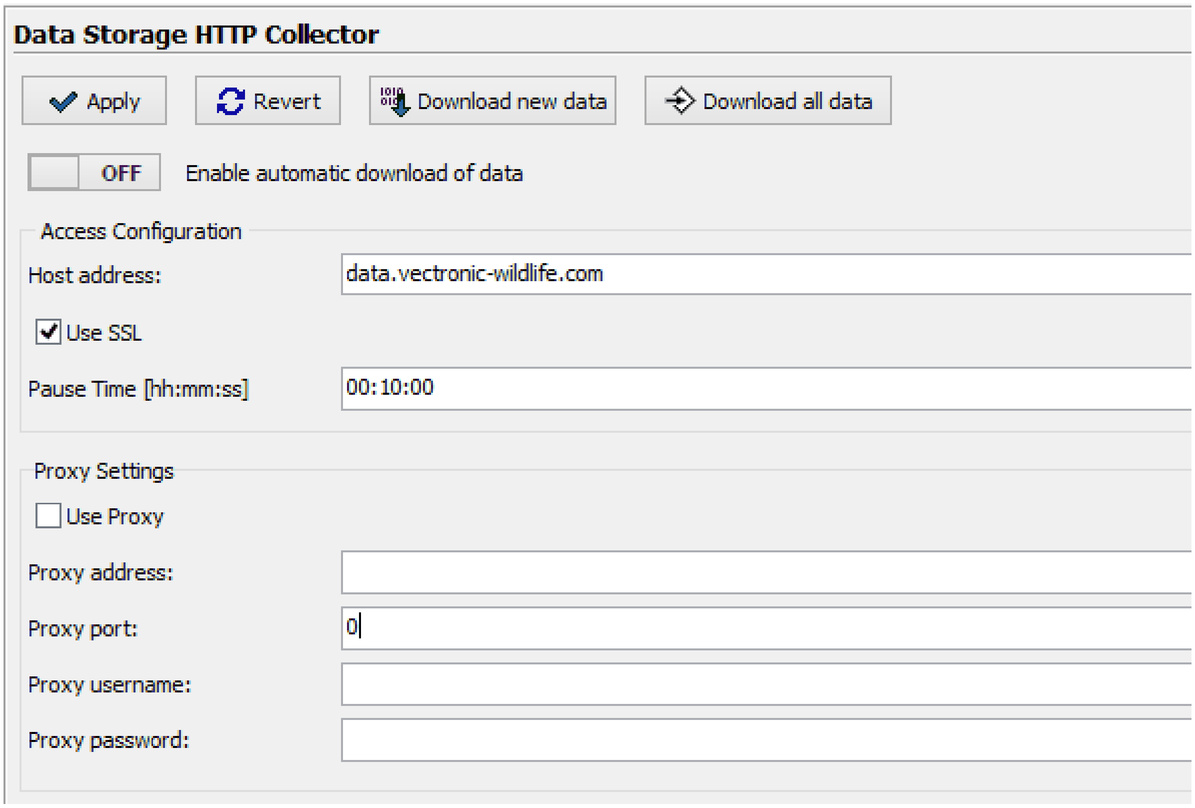


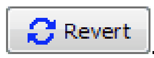
Figure 216: Data Storage HTTP Collector

The following list describes the available parameters:

Enable automatic download of data	**Click this slider to enable or disable the automatic data download**
Host address	Address of the HTTP Data Service (Default: data.vectronic-wildlife.com)
Use SSL	Defines whether SSL (TLS) encrypted communication channels shall be used to download the data (Default: ON, recommended)
Pause Time	This parameter defines the time interval between two consecutive attempts to download data from the HTTP

Enable automatic download of data	**Click this slider to enable or disable the automatic data download**
	Data Service (Format: hh:mm:ss, Default: 00:10:00)
Proxy Settings	Please check with your administrator if a Proxy is installed. If there is, you have to type in the address, port, username and password to receive data.

To apply your changes press the Apply button 

. To revert the changes made in this form to the currently active configuration press the Revert button 

.

Please do NOT change the 'Host address' and 'Use SSL' parameters unless told to do so by VECTRONIC Aerospace.

If the HTTP Data Collector is configured to automatically download collar data, no further action is required by the user. As soon as the GPS Plus X Data Storage Service is running data will be downloaded in intervals defined in the collector's configuration.

It is also possible to manually download data which might be needed in cases where automatic download is not desirable. To only download new data that arrived after the previous connection, press the Download new data button. To download ALL available data of all registered collars (again), press the Download all data button.

4.4.4.7.1 Validation of HTTP data download

To check whether all collars and the HTTP Data Collector are configured correctly users may take a look at the HTTP collector log which can be found in the Logs section of the Data Storage service configuration node in the configuration tree. See (Figure below) for details.

The log contains information about number of messages downloaded per collar and error messages in case of connection problems.

Configuration ⇨ Data Storage ⇨ Logs

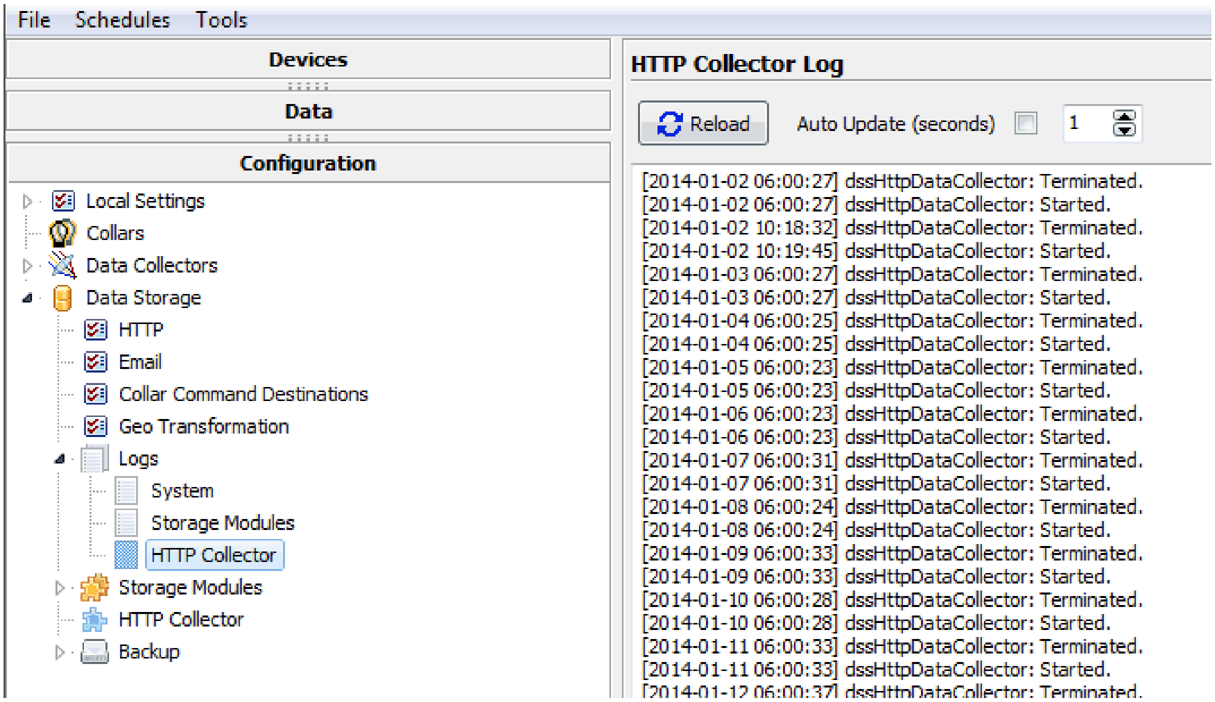


Figure 217: HTTP Collector Log

Another possibility to verify whether the system is working correctly is to open the Data Storage Service Status Frame by clicking on the Storage node of the tree structure in the Data section of the main window (Figure below).

If data is currently being processed, the Currently processing tab page shows the number of remaining messages to be processed per collar.

Data ⇨ Storage

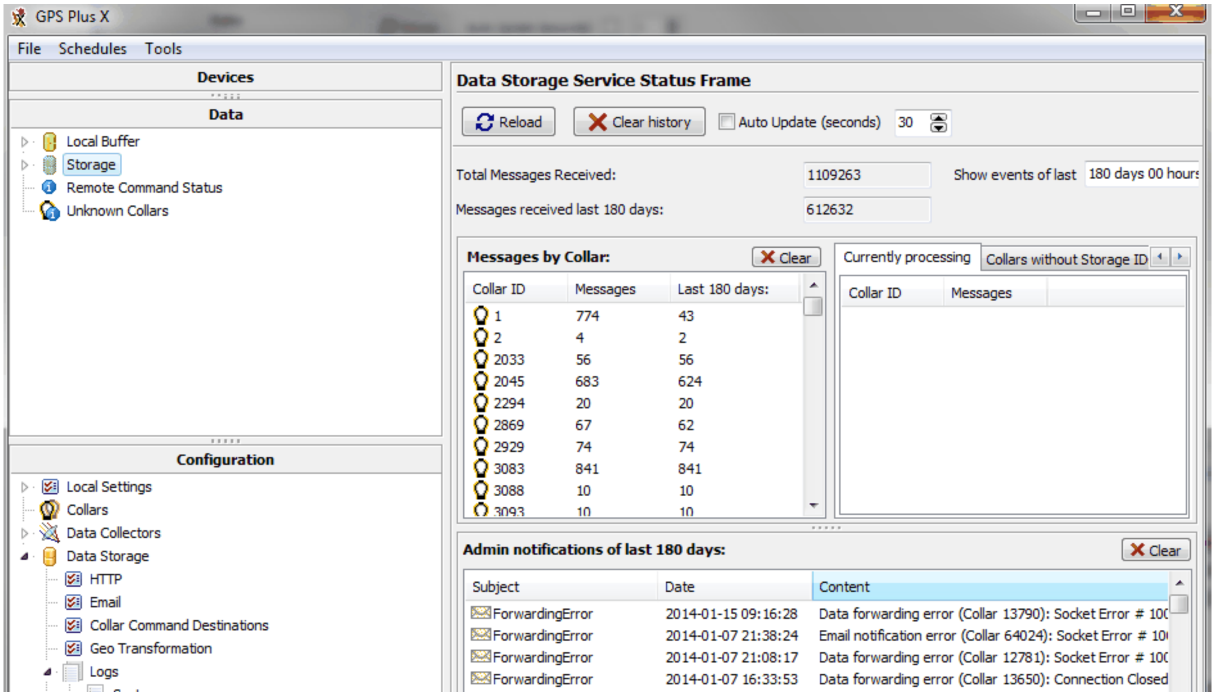


Figure 218: Data Storage Service Status Frame

4.4.4.8 Backup

Configuration ⇨ Data Storage ⇨ Backup

It is easy to backup the storage modules, either manually on demand or automatically by schedule. Backups involve only one module at a time. The Backup node displays a list of all the backups that are scheduled.

opens a pop-up window for choosing the backup rule and creating a new Backup schedule (Figure: Pop-up window for the configuration of backup rules (left) and the Module backup rule editor (right)).

edits the highlighted schedule

deletes the highlighted schedule from the list

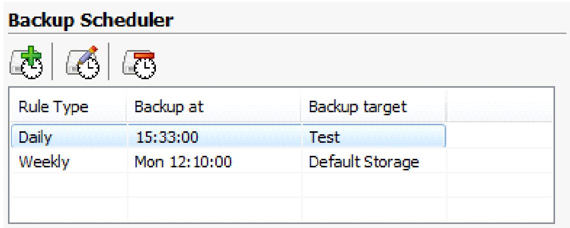


Figure 219: List of scheduled backups

There are two types of backups:

- The Daily backup is done each day at the defined Execution time for the selected Storage module
- The Weekly backup is done on the selected Day of the week at the defined Execution time for the selected Storage module

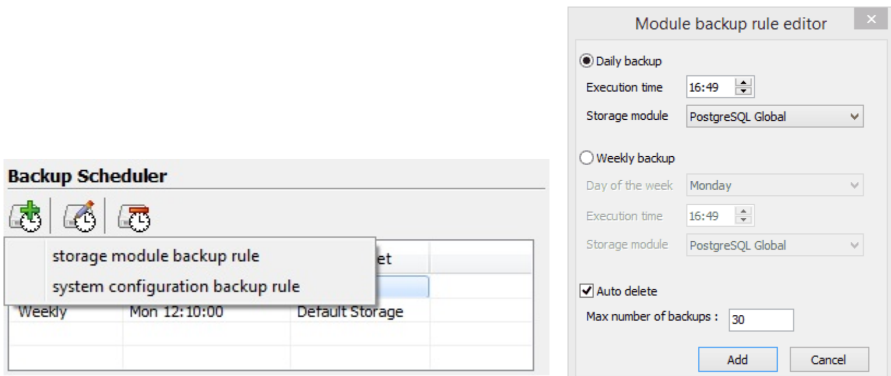


Figure 220: Pop-up window for the configuration of backup rules (left) and the Module backup rule editor (right).

Each storage module has its own subnode to manage the backups that have already been created. This frame shows two lists. The first list includes all backups that have been created for the storage module.

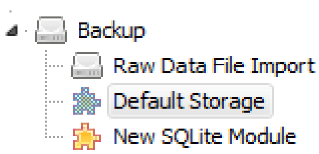
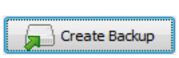
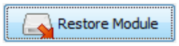


Figure 221: Backup Node

The second list shows all backups that have not been finished (**Unfinished Backups**).
The options in this frame are:



This button creates a backup of the storage module immediately.



This button overwrites the storage module with the selected backup file. This is only possible, if there are no data in the storage module, which means you need to create a new storage module first (see Storage Modules).

GPS Plus X will automatically search for backup files that match the format of the new storage module and display them in the list of backup files. Select one backup file and press Restore Module. You will see a window warning you that in 20 seconds the storage module will be replaced with the backup file. During these 20 seconds you have time to abort the process. If you try to replace a storage module that already contains data, you will receive the notification:

FAILED to restore storage module [MODULE NAME]: Cannot restore backup! Target module not empty: data found in table "gps_plus_positions". Database needs to be empty.

Note: Only backups of the same storarge module type can be restored into each other. This means a backup file created from an SQLite module can only be restored into another SQLite module, not into a PostgreSQL module. The same applies for PostgreSQL modules.

This button deletes the selected backup files. They cannot be restored!

This button opens an Open File dialog from which you can select a backup file. This command allows you to use backup files from other computers (e.g. files stored externally for safety reasons).

This button opens a Save As dialog to save a backup file at an external location. This allows the exchange of backup file with other computers.

This button deletes a selected backup from the **Unfinished Backups** list. It is only enabled if there are any unfinished backups.

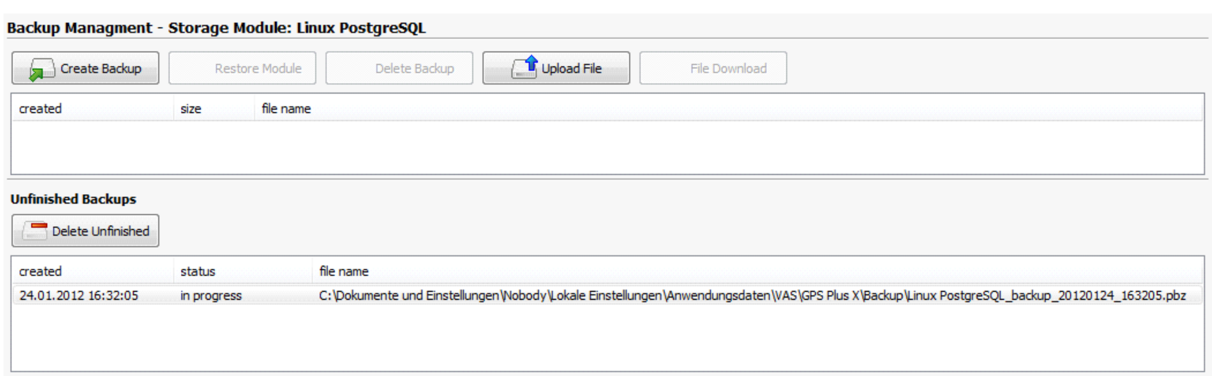


Figure 222: Backup Management frame for a storage module

4.4.4.8.1 Raw Data File Import

Configuration ⇨ Data Storage ⇨ Backup ⇨ Raw Data File Import

Here you can retrieve data for a collar from the back up files. Choose a time range and the collar ID's and click Start.

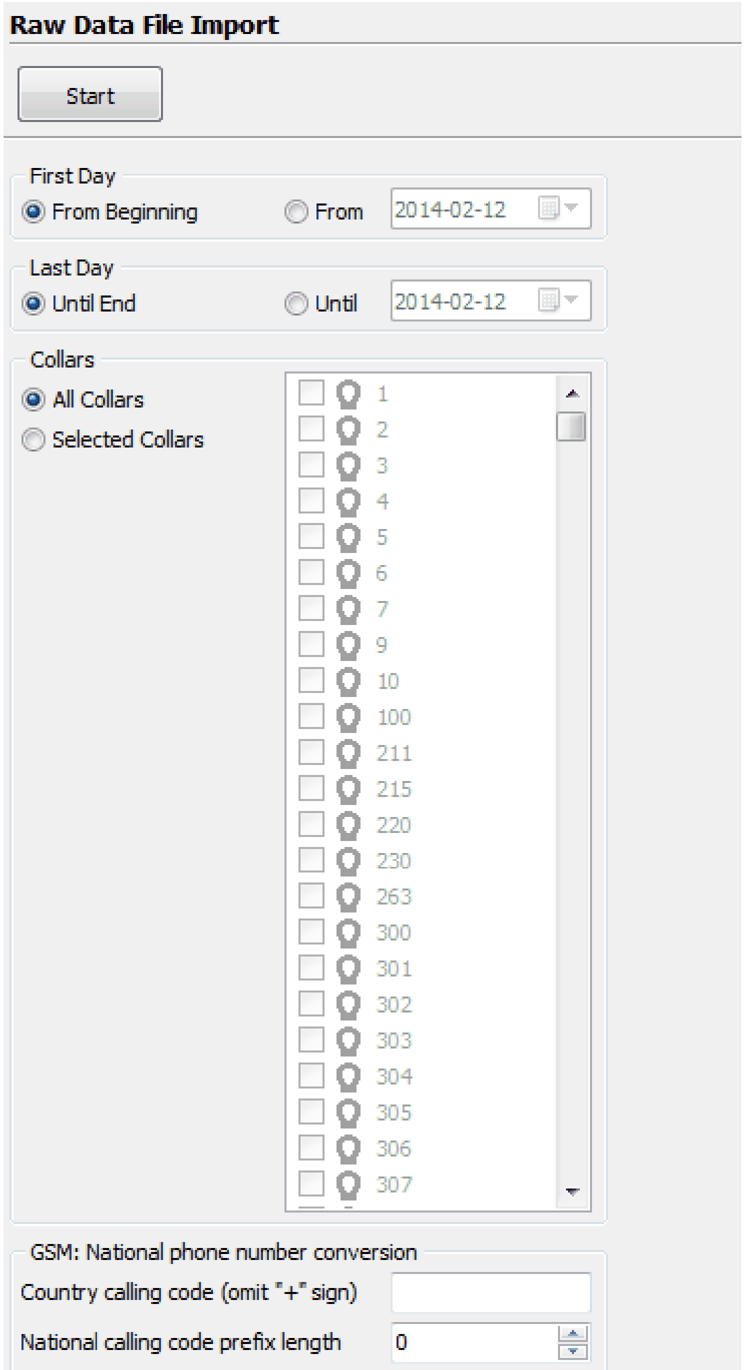


Figure 223: Raw Data File Import

Note: The collar notifications of the last 7 days will be resend, using this function.

4.5 Status Bar

Please check the Status bar, when the program is working slowly. Here you can see if the Data Storage is currently processing data.

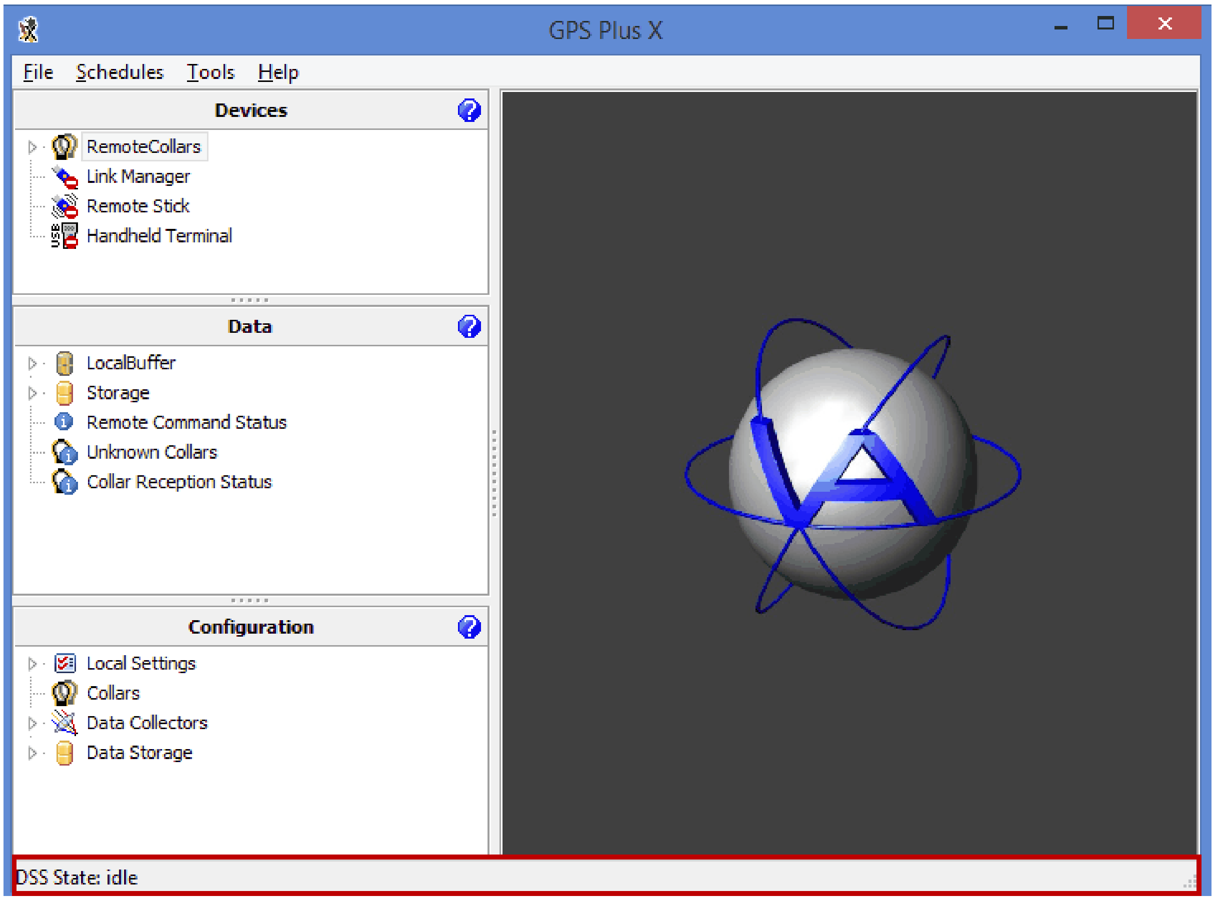


Figure 224: Status Bar

5 Appendix

Refer to:

Appendix A: External Sensors

Appendix B: Collar Telemetry Description

Appendix C: Information File Description

Appendix D: File extensions and names

Appendix E: Features and related chapters

5.1 Appendix A: External Sensors

VECTRONIC GPS Plus and VERTEX Plus collars with UHF communication can receive data from external transmitters, which are UHF ID tags (used for proximity and separation sensor), mortality implants, vaginal implants, etc. Data from these transmitters are stored inside the collars internal memory and can be downloaded via cable, UHF data communication, and (partly) GSM or IRIDIUM. Most of the sensors offer the option to send notification messages via GSM and IRIDIUM.

All external sensors share the same UHF receiver in the GPS Plus / VERTEX Plus collar, and all sensors can be used simultaneously. It is possible to define “active times” for each sensor, so one or all sensors would be switched on for some hours. The active times are valid for each sensor independently. During a sensor’s active time, the collar will listen for the external transmitters assigned to this sensor (or all sensors which are currently active) in defined intervals and for a defined duration. For listen intervals and durations when using more than one sensor, please refer to the configuration of the external sensors.

Refer to:

5.1.1 Appendix A.1: Proximity Sensor

The proximity sensor is part of a system that enables you to monitor interactions between different animals such as predator and prey or encounters between individuals of different social groups. The proximity sensor in the VERTEX Plus collar with UHF communication is able to receive ID codes within a range between 50 and 130 meters.
If an ID code is received, it will be stored in the memory with the signal strength and the time stamp. If GSM or Iridium transmission is enabled, a list of ID codes encountered between two transmissions is sent with each SMS or Iridium message. Signal strength and time stamp are not transmitted via GSM or Iridium. These are only available via cable or UHF link. The file extension is .PRX.
NOTE: Signal strength does not provide reliable information about the distance between two collared animals.
If an ID code has been received by the proximity sensor, an alternative GPS schedule can be activated. This way the frequency of GPS fixes can be intensified. The proximity GPS schedule can stay active for a configurable period of time after the last ID code has been received. Then the GPS receiver will return

to the standard schedule. The proximity sensor will be switched off during GPS fixes, so data gaps might occur.
You can decide if ID's will be ignored or if they create an immediate reaction (ID Black list, ID White list). If you do not enter any ID's to the lists the sensor will behave normally and react to all incoming signals.

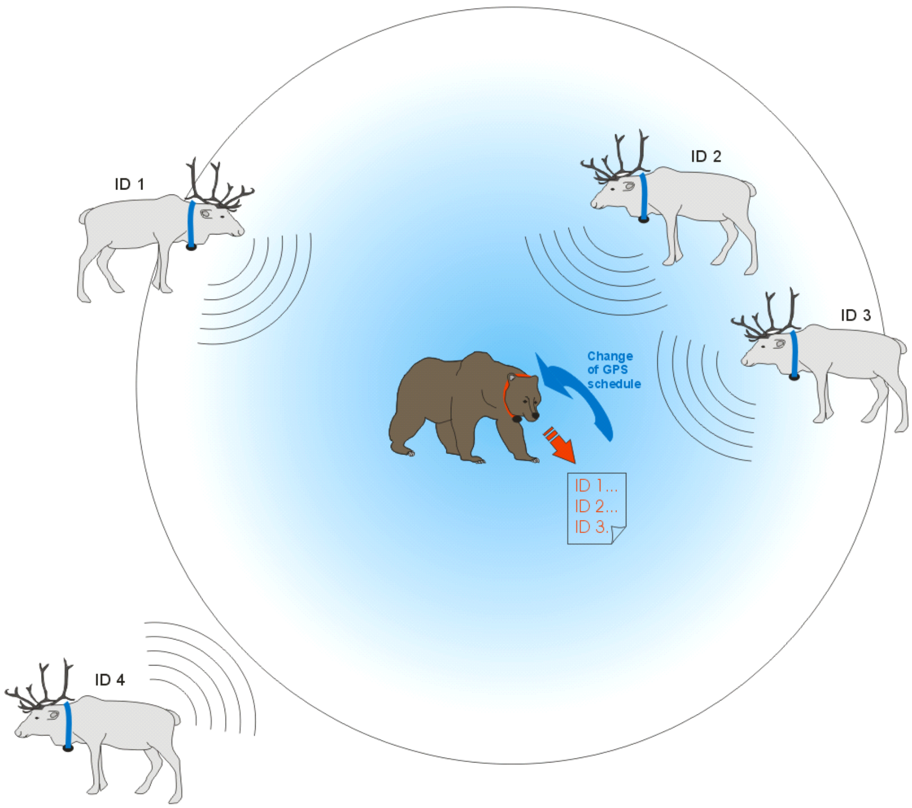


Figure 225: Proximity sensor.
UHF tags (blue collars) send an ID code which is received by the proximity sensor on a VECTRONIC GPS Plus collar (red) if the UHF tag is within the radius of the sensor (app. 100 m). The IDs of the tags in range (ID 1, ID 2, ID 3) are stored in the collars memory. ID4 is out of range. As soon as at least one ID is received, the GPS schedule is changed to the proximity GPS schedule (optional).

5.1.2 Appendix A.2: Mortality Implant (MIT)

The MIT is designed to inform you immediately if your study animal has died. The Mortality Implant Transmitter is a stainless steel tube which can be placed either into the rumen or into the abdominal cavity of the animal. For the latter a surgery is needed and it is only recommended for non ruminants or ruminants with a small esophagus/rumen.

The MIT contains a highly sensitive acceleration sensor and a temperature sensor. Unlike the mortality sensor inside VERTEX Plus collar, the MIT is able to detect the heartbeat of the animal. The MIT frequently sends status messages of the animal to the GPS collar using UHF communication. With each position message, the most recent body temperature and the status (alive/dead) can be sent remotely as well. Optionally the GPS collar can send a separate mortality message.

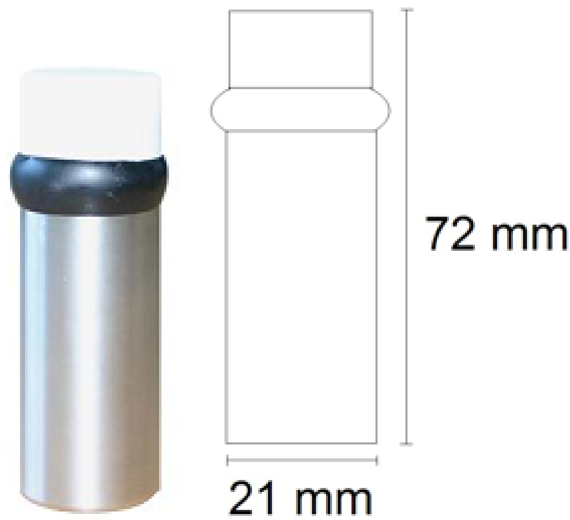


Figure 226: Mortality Implant Transmitter

•

Heartbeat and motion: A highly sensitive acceleration sensor detects the slightest movements like heartbeat or breathing. If no motion has been detected for a user definable period of time, the animal is presumed dead and a mortality alert with the current GPS position data is sent. The VERTEX Plus collar's VHF beacon will also switch to mortality mode.

Temperature: Body temperature is measured with an accuracy of 0.1°C. Following pre-defined intervals, the temperature is sent to the VERTEX Plus collar and stored in the collar memory.

5.1.3 Appendix A.3: Vaginal Implant (VIT)

The Vaginal Implant Transmitter (VIT) is used to observe the pregnancy and the birth events of a collared animal. The VIT informs the researcher about the date and location of the calving site and provides physiological data during the whole pregnancy. It measures and optionally stores the temperature and motion and defines its status. The VIT transmits this data with its unique ID to the collar which will initiate the alert notifications in case of birth event or separation. We offer 2 different sizes suitable for medium (e.g. deer) and large (e.g. moose) species.

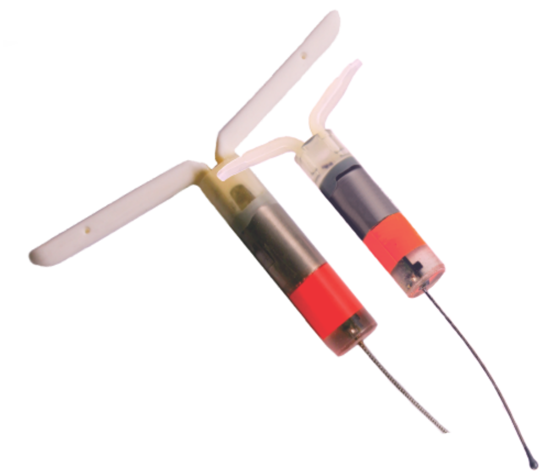


Figure 227: Moose sized VIT (left) and deer sized VIT (right)

Birth detection: When the VIT is pushed out of the mother's body, two things are expected to happen: The temperature around the VIT will most likely drop and the motions will stop. When this happens, the VERTEX Plus collar will recognize a birth event which will conduct an unscheduled GPS fix and send an alert notification to the researcher.
Separation: The VIT continuously transmits an ID signal via UHF frequency to the VERTEX Plus collar. When the mother moves away from the calving site, the ID signal is not received any longer. The VERTEX Plus collar will send a separation message after one hour has passed without detecting the ID signal (default settings).
Localisation: To locate the calving site, the VIT is equipped with a VHF beacon transmitter. The VHF can be programmed as flexible as the one in the GPS collar.

5.1.4 Appendix A.4: Separation sensor

The separation sensor works with the same hardware and the same method as the proximity sensor, but the application and the recorded/sent data differ.

The separation sensor listens for up to ten pre-defined UHF ID tags. With each listening attempt, the collar stores whether the ID signal has been received (true) or not (false, Figure below). A complete list of all listen attempts with time stamp, ID number, and ID tag status can be downloaded via cable or UHF Handheld Terminal. Recorded data will not be transmitted via GSM or IRIDIUM.

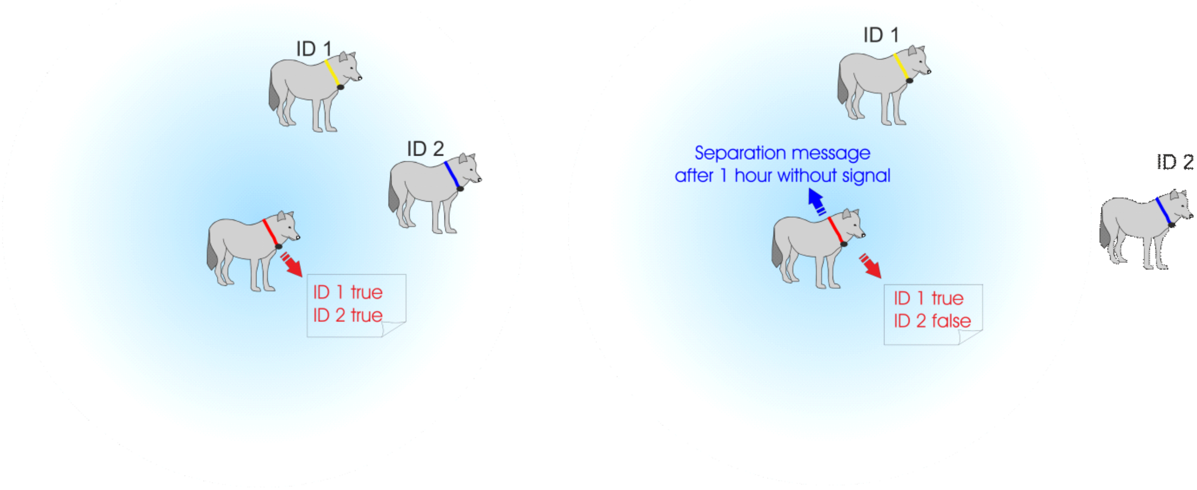


Figure 228: Separation sensor.
UHF tags (yellow and blue collar) send an ID code which is received by the separation sensor on a VECTRONIC GPS Plus collar (red), if the UHF ID tag is within the radius of the sensor (app. 100 m). With each listening attempt, all received ID numbers are stored in the separation data as “true” (see left picture). If an ID tag is not received by the sensor, its ID will be stored as “false” (see right picture, ID 2). If one ID tag has not been received for one hour, the collar will send a separation message via GSM or IRIDIUM (optional).

If the signal has not been received for one hour, the collar can send a separation message via GSM or IRIDIUM (optional). If the separation sensor is only active during some hours of the day, and an ID tag’s signal is not received when the sensor is switched on, the collar will wait for one hour without receiving the signal before it sends the separation message. If the separation sensors active time is shorter than one hour, and the ID tag’s signal has not been received during this time, it will send a separation message at the end of the active time.

Proximity and separation sensors receive signals from the same UHF ID tags. Up to ten ID tags can be assigned to the separation sensor, but only one ID tag can be excluded from the proximity sensor. Using proximity and separation sensors at the same time with more than one UHF ID tag as “separation” tag, has two consequences:

- the non excluded ID tags will appear as proximity event
- the proximity GPS schedule will apply whenever the not excluded ID tags are in the vicinity of the collar.

5.2 Appendix B: Collar Telemetry Description

The following table gives an overview of the meaning of the data visible in the telemetry window:

System Tab:

Device

Device is	if the magnet is attached correctly, the device is inactive; if the magnet is detached, the device is active
Temperature [°C]	temperature of the collar in degree Celsius

Counter

Resets	number of resets of the collar (for diagnostics only)
Restarts	if this value is greater than 324.000, collar will made a re-initialisation

Batteries

Main [V]	voltage of the main battery
Beacon [V]	voltage of the beacon battery
Balancing	internal voltage balancing process

Software

Serial Number	serial number of the collar
Version	software version
Date	software built date

Hardware

Production Number	production number of the collar
Version	hardware Version
Date	production date

Beacon Controller

Software Version	version of the collar's beacon controller software
Controller Status	update status of the collar's beacon controller software

Collected Data Tab:

GPS

On Time	max. GPS On Time for a fix
Trial	number of successive unsuccessful GPS fixes; if this value is greater than 19, a new initialisation of the GPS receiver will be performed during the next

	fix
Valid Count	number of validated fixes from last fix (only for diagnostics)
Avg. Fix [s]	average time that was needed to obain a fix; computed from accumulated fix times and number of stored fixes (see Memory – GPS).
Tracking Time	time during which the GPS device tracks the acquired satellites; it can be extended for better precision of position.

Next Measurement

Time	time of next GPS fix
Date	date of next GPS fix

Last Valid Fix

Time	time of last valid fix
Date	date of last valid fix
Lat [°]	latitude in degree of last valid fix
Long [°]	longitude in degree of last valid fix
Altitude [m]	altitude in meters of last valid fix

Activity

Activity 1	last determined value of activity 1
Activity 2	last determined value of activity 2
Counter	counter to save activity value, eight second steps

Mortality

Period	user-programmable Mortality Period in hours
Counter	mortality counter; counts the time since last activity has been detected and will be deleted after a Mortality Event. The timer counts in intervals of eight seconds.

Hibernation

Hibernation active	if checked, the hibernation sensor is enabled
Wakeup Level	if the activity counter reaches this level, hibernation mode will be stopped and normal operation of the collar resumed
Delay Time [h]	if no activity above the wakeup level has been detected within this time, the

	collar will go into hibernation mode

Memory

Activity	number of activity datasets in memory
GPS	number of GPS datasets in memory

Temperature

T [°C]	temperature of the collar in degrees Celsius

RF Tab:

VHF Beacon Schedule

Start Date	day on which the VHF beacon will be activated
End Date	day on which the VHF beacon will be deactivated
Start Time	time at which the VHF beacon will be activated every day
End Time	time at which the VHF beacon will be deactivated every day

RF Comm. Time

Enable	daily start time (UTC or LMT, depending on UTC correction) of the UHF or VHF Data Communication
Disable	daily end time (UTC or LMT, depending on UTC correction) of the UHF or VHF Data Communication

Frequencies [MHz]

Uplink	frequency in MHz from Handheld Terminal to collar
Downlink	frequency in MHz from collar to Handheld Terminal
VHF Beacon	frequency in MHz of the VHF beacon

RF Modem

High Power	gain voltage of the power amplifier, if main battery is used

GSM / SatComm Tab:

GSM

Mode	GSM transmission mode, please refer to Appendix F: F.1
Destination Address	phone Number to which the SMS will be transmitted

Pin	pin Number of GSM SIM card
SMS Delay	time span after sending an SMS in which the collar waits for reading incoming SMS (e.g. new schedules, commands)
SMS Count	number of locations waiting for SMS delivery; if value is equal or greater than the number of positions per SMS, a SMS will be generated and transmitted

IRIDIUM

Mode	IRIDIUM transmission mode, please refer to Appendix F: F.2
IMEI	IRIDIUM device identifier, serial number of the IRIDIUM transmitter

GLOBALSTAR

Attempts	number of consecutive transmission attempts for a data block
Fixes per Message	number of positions per message: 1 or 2
Tx	transmission Mode, please refer to Appendix F: A.1
ESN	GLOBALSTAR ESN, serial number of the transmitter

Virtual Fence Events

Message on Enter	if yes, then a message will be sent after the collar has entered the virtual fence
Message on Leave	if yes, then a message will be sent after the collar has left the virtual fence
Retransmit Interval	time span after which the Virtual Fence Event message is sent a second time

Comm Interval Data

Next Comm. Time	next scheduled time for GSM/IRIDIUM communication defined by the GSM/ IRIDIUM schedule
Position Transmission	running number of position that is transmitted, the remaining positions will be stored on the collar only.

5.3 Appendix C: Information File Description

Refer to:

Collar

Handheld Terminal

5.3.1 Appendix C.1: Collar

`Collar Date (UTC)`	current date of the collar in UTC
`Collar Time (UTC)`	current time of the collar in UTC
`Software Version`	version of the software on the collar
`Serial Number`	serial number of the collar
`Software Date`	release date of the collar software
`Hardware Version`	hardware version of the collar
`Production Number`	usually identical with serial number
`Production Date`	production date of the printed circuit board
`Beacon Software Vers.`	version of the beacon software
`Beacon Update Status`	value used for debugging by VECTRONIC Aerospace
`Temperature logging`	indicates if the temperature sensor is enabled (1 – ON) or disabled (0 – OFF)
`Activity Mode`	indicates the activity mode (12.6 Activity Mode or the Activity Pattern software manual)
`Activity Interval`	indicates the interval in which activity values are stored (12.6 Activity Mode or the Activity Pattern software manual)
`Angle Threshold`	head angle for the activity sensor; this setting is only used for activity mode 4 (12.7 Activity Threshold Mode or the Activity Pattern software manual)
`Accel. Threshold`	acceleration value which has to be exceeded for activity modes 4 and 5 (12.7 Activity Threshold Mode or the Activity Pattern software manual)
`Mortality logging`	indicates if the mortality sensor is enabled (1 – ON) or disabled (0-OFF) (12.8 Mortality and Hibernation Mode)
`Mortality Period`	time period in hours for which the collar needs to be without activity to trigger a mortality event (12.8 Mortality and Hibernation Mode)
`Hibernation is`	indicates if the hibernation sensor is enabled (12.8 Mortality and Hibernation Mode)
`Hib. Wakeup Level`	the activity level which has to be exceeded to reactivate a collar from hibernation mode (12.8 Mortality and Hibernation Mode)
`Hib. Delay Time`	time period without activity after which the collar enters hibernation mode (12.8 Mortality and Hibernation Mode)
`Uplink Frequency`	frequency on which a VHF or UHF collar receives commands from a Handheld Terminal
`Downlink Frequency`	frequency on which a VHF or UHF collar sends data or information to a Handheld Terminal
`UHF Beacon Frequency`	frequency of the UHF beacon (only available in few older collars)
`UHF Beacon On Time`	feature is not available anymore
`UHF Period`	feature is not available anymore

`Com Enable Time`	time of the day in UTC or LMT (depending on the UTC correction) at which the VHF or UHF data communication is switched on; this setting does not apply to the VHF or UHF beacon (12.10 RF Communication Time)
`Com Disable Time`	time of day in UTC or LMT (depending on the UTC correction) at which the VHF or UHF data communication is switched off; this setting does not apply to the VHF or UHF beacon (12.10 RF Communication Time)
`VHF Beacon Frequency`	frequency of the VHF beacon transmitter to locate the collar with a VHF tracking receiver
`VHF Beacon Pattern`	beeping pattern of the VHF beacon (7.2 Play Beacon Patterns and 12.9 Beacon Pattern)
`Iridium Mode`	number of positions per IRIDIUM message (IRIDIUM Mode)
`Iridium IMEI`	IRIDIUM identification number of the IRIDIUM transmitter
`Globalstar Attempts`	number of times the same Globalstar message is sent (Globalstar Mode)
`Fixes per Message`	number of positions per Globalstar message, possible numbers are one and two (Globalstar Mode)
`Transmission Mode`	sequel number of GPS position which is not only stored in the collar but also sent by Globalstar (Globalstar Mode)
`Globalstar ID`	Globalstar identification number of the collar
`GSM Mode`	number of positions sent with each SMS (GSM Mode)
`Destination Address`	telephone number of a GSM ground station to which the collar sends SMS (GSM Destination Address)
`GSM PIN Number`	PIN number of the collar’s SIM card
`SMS Reception Delay`	extension of the time the GSM modem is switched on after sending an SMS (SMS Reception Delay)
`Collar UTC correction`	indicates if the UTC correction in the collar is active (UTC Correction)
`Correction term`	amount of time for the UTC correction (UTC Correction)
`Proximity Sensor`	indicates whether the proximity sensor is enabled or disabled (External Sensors)
`Prox. Interval`	time span between two listening attempts by the sensor
`Prox. Duration`	time span during which the sensor is listening in one attempt
`Prox. Enable Time`	time of day when the sensor is switched on
`Prox. Disable Time`	time of day when the sensor is switched off
`Prox. Mode`	indicates the mode of the proximity sensor
`Prox. Frequency`	radio frequency of the communciation between sensor and UHF ID tags
`Prox. Transmission`	indicates whether proximity data will be transmitted via GSM or IRIDIUM
`Next Comm. Time`	time of the next scheduled communication via GSM or IRIDIUM
`Pos. Transmission`	sequel number of position that is not only stored in the collar but transmitted via GSM or IRIDIUM (12.17 Position Transmission)
`Message on VF enter`	indicates if a GSM or IRIDIUM message is sent when the collar has

	entered the Virtual fence (14.3 Virtual fence Events)
`Message on VF leave`	indicates if a GSM or IRIDIUM message is sent when the collar has entered the Virtual fence (14.3 Virtual Fence Events)
`Retransmit Interval`	the time span after which a VF message is sent a second time (14.3 Virtual Fence Events)
`GPS Mode`:	indicates whether the GPS mode is Solved or Differential, in newer collars only Solved is available
`GPS Schedule is`:	indicates if the GPS schedule on the collar can be changed or not ("locked")
`GPS Schedule`	times at which GPS fixes will be attempted (in XML standard, see 11.1 GPS Schedule Editor)
`UHF Schedule`	UHF beacon on and off times (in XML standard) for information only, not supported any more
`VHF Schedule`	VHF beacon on and off times (in XML standard, see 11.2 VHF Beacon Schedule Editor)
`Proximity Schedule`	proximity sensor on and off times (in XML standard, see 12.20 External Sensor)
`GSM/Iridium Schedule`	times or intervals at which the collar will try to send position messages via SMS or IRIDIUM (in XML standard, see 11.3 GSM Schedule Editor)
`Virtual Fence Collection`	gives the numbers of the fences and the coordinates of the fence posts and the inside point (14.1 Virtual Fence Editor)
`Virtual Fence Schedule`	times at which GPS fixes will be attempted while the collar is inside the Virtual Fence (11.1.4 Uploading a Virtual Fence schedule or 14.2 Uploading a Virtual Fence Collection)

5.3.2 Appendix C.2: Handheld Terminal

`Terminal Date (UTC)`	current date of the Handheld Terminal in UTC
`Terminal Time (UTC)`	current time of the Handheld Terminal in UTC
`Serial Number`	serial number of the Handheld Terminal
`Software Version`	version of the software on the Handheld Terminal
`Software Date`	release date of the Handheld Terminal software
`Hardware Version`	hardware version of this Handheld Terminal
`Production Date`	production date of this Handheld Terminal
`Uplink Frequency`	frequency on which the Handheld Terminal sends data to a collar
`Downlink Frequency`	frequency on which the Handheld Terminal receives data from a collar
`Mark Positions`	indicates if positions downloaded from the collar via Handheld Terminal can also be sent in addition via GSM or IRIDIUM (true) or not (false)

5.4 Appendix D: File extensions and names

List of file extensions used

.ADF	Activity Data File:	Activity Data File: Coded activity data from collar or Handheld Terminal including activity and temperature. The file name consists of the collar number and the time stamp of the download
.BSF	Beacon Schedule File:	Contains a complete VHF beacon schedule (GPS Plus versions older then 10.0 format was .BRF)
.CCF	Collar Configuration File:	Contains the configuration (schedules, communication configuration, activity mode) for the collar, can be used to automatically restore the configuration.
.COL	Collar Firmware File:	Contains firmware for collars.
.GDF	GPS Data File:	Binary coded GPS fix data from collar, Handheld Terminal or GSM ground station including main battery voltage, VHF beacon battery voltage, and temperature.The file name consists of the collar number and the time stamp of the SMS.
.GSF	GPS Schedule File:	Contains a complete GPS schedule (GPS Plus versions older then 10.0 format was .GRF)
.KEY	Collar or Program Access Key File:	Contains a key for one collar, or a programm plug-in (e.g. autoread email client) needed to register and use these in GPS Plus X. (Can also be a Drop Off key, which cannot be used in GPS Plus X)
.SMS	GSM Message File:	Contains one GSM or part of a Globalstar / IRIDIUM message with GPS data. The file name consists of the collar number and the time stamp of the message.
.TCF	Handheld Terminal Configuration File:	Contains the configuration of the Handheld Terminal.
.TRM	Handheld Terminal Firmware File:	Contains firmware for Handheld Terminal.
.VFC	Virtual Fence Collection:	Contains the coordinates for the Virtual Fence

List of file names

Depending on the type of information stored in a file, the file name can change. Most file nemaes have a time stamp which is coded as YYYYMMDDhhmmss, which means Y=year, M=month, D=day, h=hour, m=minute, s=second.

Data files in manual export

`GPS_Collar8769_ YYYYMMDDhhmmss.GDF`	GPS position data, binary file
`ACT_Collar8769_ YYYYMMDDhhmmss.ADF`	Activity sensor data, binary file
`MOR_Collar8769_ YYYYMMDDhhmmss.TXT`	Mortality events, text file
`PRX_Collar8769_ YYYYMMDDhhmmss.TXT`	Proximity events, text file
`MIT_Collar8769_ YYYYMMDDhhmmss.TXT`	Mortality implant data, text file
`VIT_Collar8769_ YYYYMMDDhhmmss.TXT`	Vaginal implant data, text file
`SEP_Collar8769_ YYYYMMDDhhmmss.TXT`	Separation sensor data, text file
`GSM_Collar8769_ YYYYMMDDhhmmss.TXT`	GSM quality data, text file

Names of data files that are exported automatically do not have a time stamp, since they are overwritten automatically and frequently.

Configuration and information files

`Collar8769_ YYYYMMDDhhmmss.CCF`	binary collar config file, see above
`Info_Collar8769_ YYYYMMDDhhmmss.TXT`	collar info file (see Appendix C.1)
`Info_Terminal8769_ YYYYMMDDhhmmss.TXT`	Handheld Terminal info file (see Appendix Handheld TerminalC.2)

5.5 Appendix E: Features and related chapters

This table gives you information on which features can be used with which collar communication and where you will find the instructions for it.

	Link Manager	UHF/VHF	GSM	IRIDIUM
Send Schedule	✓	✓	✓	✓
Virtual Fence	✓	✓	✓	✓
Set Collar Time	✓	✗	✗	✗
UTC Correction	✓	✓	✓	✓
Activity Mode / Threshold	✓	VAS Config File	VAS Config File	VAS Config File

Mortality and Hibernation Mode	✓	VAS Config File	VAS Config File	VAS Config File
Activity Schedule Settings	✓	✓	✓	✓
Low Activity Configuration	✓	✓	✓	✓
Beacon Pattern	✓	✗	✓	✓
RF Communication Time	✓	✓	✓	✓
GPS Tracking Time	✓	✗	✓	✓
Position Transmission	✓	✗	✓	✓
GSM Mode	✓	✗	✓	✗
GSM Destination Address	✓	✗	✓	✗
SMS Reception Delay	✓	✗	✓	✗
IRIDIUM Mode	✓	✗	✗	✓
External Sensors	✓	✓	✓	✓
External Camera	✓	✓	✓	✓
Virtual Fence	✓	✓	✓	✓
Virtual Fence Events	✓	Events yes, but not Retransmit Interval	✓	✓
Collar Upgrade	✓	✗	✗	✗
Firmware Upgrade	✓	✗	✗	✗

✓ = via Vectronic

5.6 Appendix F: Transmission modes

Refer to:

GSM

IRIDIUM

Globalstar

5.6.1 Appendix F.1: GSM

Nr.		
0	No External Communication Module	No External Communication Mode
1	7 Fixes per SMS (6-bit, retry)	7 Fixes per SMS (7-bit), no repetition
2	7 Fixes per SMS (6-bit, retry)	7 Fixes per SMS (7-bit), repetition (10x max)
3	1 Fix per SMS (6-bit, retry)	1 Fix per SMS (7-bit)
4	8 Fixes per SMS (8-bit, retry)	6 Fixes per SMS (6-bit), no repetition
5	6 Fixes per SMS (6-bit, retry)	6 Fixes per SMS (6-bit), repetition (10x max)
6	1 Fix per SMS (6-bit, retry)	1 Fix per SMS (6-bit)
7	5 Fixes + header (6-bit, retry)	5 Fixes + header (6-bit), repetition (10x max)
8	4 Fixes + header (6-bit, retry)	4 Fixes + header (6-bit), repetition (10x max)
9	3 Fixes + header (6-bit, retry)	3 Fixes + header (6-bit), repetition (10x max)
10	2 Fixes + header (6-bit, retry)	2 Fixes + header (6-bit), repetition (10x max)
11	1 Fix + header (6-bit, retry)	1 Fix + header (6-bit), repetition (10x max)

5.6.2 Appendix F.2: Iridium

0 - No IRIDIUM Module

1 - IRIDIUM: 1 Fix per Message

2 - IRIDIUM: 2 Fixes per Message

3 - IRIDIUM: 3 Fixes per Message

…

17 - IRIDIUM: 17 Fixes per Message

5.6.3 Appendix F.3: Globalstar

0 - send every fix

1 - send every 2nd fix

2 - send every 3rd fix

3 - send every 4th fix

…

10 - send every 11th fix

11 - send every 12th fix

12 - send every 16th fix

13 - send every 24th fix

14 - send every 48th fix

15 - send every 96th fix

5.7 Appendix G: XML Standard

All schedules are stored in XML standard.

This chapter is designed to help you understand this standard.

Date, time, and time periods are coded in the following structure:

Date only: "2010-10-07"

"**yyyy-mm-dd**" with **y**=year, **m**=month, **d**=day

Time only: "00:00:00Z"

0"**hh**:**mm**:**ss**Z" with **h**=hour, **m**=minute, **s**=second, Z=label for Zulu time (equals UTC)

Date and Time: "2011-04-15T00:00:00Z"

"**yyyy-mm-dd**Thh:mm:ssZ" with **y**=year, **m**=month, **d**=day, T= label for time, **h**=hour, **m**=minute, **s**=second, Z=label for Zulu time (equals UTC)

Repetition Period, Duration: "P0DT5H0M0S"

"PdDThHmMsS"with P= period, **d**=day, D= label for day, T= separator for time, **h**=hour, H= label for hour, **m**=minute, M= label for minute, **s**=seconds, S= label for seconds

5.8 Appendix H: Available Coordinate Systems

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
ASIAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
Bangladesh (BD)		
BTM Bangladesh Transversal Mercator coordinates	kkkkmmm	kkkkmmm
India zone IIb (Bangladesh) Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Japan (JP)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Japan Plane Rectangular CS I Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS II Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS III Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS IV Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS V Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS VI Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS VII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS VIII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS IX Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS X Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XI Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XIII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XIV Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XV Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XVI Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XVII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XVIII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XIX Mercator coordinates	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
AUSTRALIAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
AUSTRALIAN Multinational		
Australian Lambert Conformal Conic coordinates	±kkkkmmm	±kkkkmmm
Australian VICGRID94 Lambert Conformal Conic	kkkkmmm	kkkkmmm
Australian VICGRID66 Lambert Conformal Conic	kkkkmmm	kkkkmmm
Australian Capital Territory (AU-ACT)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Australian Northern Territory (AU-NT)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Australian New South Wales (AU-NSW)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Australian Tasmania (AU-TAS)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
EUROPEAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
EUROPEAN Multinational		
Pan-European Lambert Conformal Conic ETRS-LCC	kkkkmmm	kkkkmmm
Pan-European Lambert Azim. Equal Area ETRS-LAEA	kkkkmmm	kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
Austria (AT)		
Austrian west zone (BMN) M28	kkkmmm	kkkmmm
Austrian central zone (BMN) M31	kkkmmm	kkkmmm
Austrian east zone (BMN) M34	kkkmmm	kkkmmm
Austrian Gauss-Krueger zone M28	±kkkmmm	kkkkmmm
Austrian Gauss-Krueger zone M31	±kkkmmm	kkkkmmm
Austrian Gauss-Krueger zone M34	±kkkmmm	kkkkmmm
Austrian Lambert coordinates (old system)	kkkmmm	kkkmmm
Austrian Lambert coordinates (new system)	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Belgium (BE)		
Belgian Lambert50 coordinates	kkkmmm	kkkmmm
Belgian Lambert72 coordinates	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Cyprus (CY)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Czechia (CZ)		
Czech Krovak S-JTSK coordinates	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Austrian central zone (BMN) M31	kkkmmm	kkkmmm
Austrian east zone (BMN) M34	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Denmark (DK)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Estonia (EE)		
Estonian Lambert Coordinates L-EST97	±kkkmmm	kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Finland (FI)		
Finish Transversal Mercator Coord. KKJ zone 2	kkkkmmm	kkkkmmm
Finish Transversal Mercator Coord. KKJ zone 3	kkkkmmm	kkkkmmm
Finish Transversal Mercator Coord. KKJ zone 4	kkkkmmm	kkkkmmm
Finish Transv. Mercator Coord. VVJ Uniform zone 35	±kkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
France (FR)		
French Lambert93 coordinates	kkkkmmm	kkkkmmm
French Lambert zone II etendu	kkkkmmm	kkkkmmm
French Lambert zone I (north)	kkkkmmm	kkkkmmm
French Lambert zone II (centre)	kkkkmmm	kkkkmmm
French Lambert zone III (south)	kkkkmmm	kkkkmmm
French Lambert zone IV (Corse)	kkkkmmm	kkkkmmm
French Lambert coordinates Nord de Guerre	kkkkmmm	kkkkmmm
Geographic coordinates (Paris) [gon]	±ggg	±ggg
Geographic coordinates (Paris) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Paris) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Germany (DE)		
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
German Lambert mean coordinates	±kkkmmm	±kkkmmm
German Lambert zone west coordinates	±kkkmmm	±kkkmmm
German Lambert zone east coordinates	±kkkmmm	±kkkmmm
German Lambert Esri-ArcData coordinates	±kkkmmm	kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
German Lambert LCC12 coordinates	±kkkmmm	kkkkmmm
Prussian Land Register Mueggelberg Berlin (18,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Mueggelberg Berlin (18+,DE)	±kkkmmm	±kkkmmm
German Soldner Munic	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Prussian Land Register (PK)		
Prussian Land Register Kucklinsberg (1,RU)	±kkkmmm	±kkkmmm
Prussian Land Register Paulinen (2,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Markushof (3,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Turmberg (4,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Kauernik (5,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Thorn (6,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Heinrichsthal (7,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Gollenberg (8,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Gnesen (9,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Josephsberg (10,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Schroda (11,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Pschow (12,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Rummelsberg (13,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Groeditzberg (14,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Kaltenborn (15,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Bahn (16,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Greifswald (17,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Greifswald (17+,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Mueggelberg Berlin (18,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Mueggelberg Berlin (18+,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Goetzerberg (19,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Torgau (20,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Burkersroda (21,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Magdeburg (23,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Ostenfeld (24,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Rathkruegen (25,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Bungsberg (26,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Celle (27,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Kaltenborn (28,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Silberberg (29,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Windberg (30,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Hermannsdenkmal (31,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Muenster (32,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Bochum (33,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Homert (34,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Kassel (35,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Schaumburg (36,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Fleckert (37,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Koeln (38,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Langschoss (39,DE)	±kkkmmm	±kkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Prussian Land Register Rissenthal (40,DE)	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Great Britain (GB)		
British Transverse Mercator coordinates	kkkkmmm	kkkkmmm
British National Grid (BNG)	aaeeeeennnnn	
Irish National Grid (ING)	aaeeeeennnnn	
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Greece (GR)		
Greek Transversal Mercator Coordinates GGRS87	kkkkmmm	kkkkmmm
Greek UTM Coordinates zones 4-5	skkkmmm	kkkkmmm
Greek Transversal Mercator Coord. TM3 west zone	kkkmmm	kkkmmm
Greek Transversal Mercator Coord. TM3 middle zone	kkkmmm	kkkmmm
Greek Transversal Mercator Coord. TM3 east zone	kkkmmm	kkkmmm
Geographic coordinates (Athens) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Athens) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Hungary (HU)		
Hungarian EOV coordinates	kkkkmmm	kkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Ireland (IE)		
Irish Transverse Mercator coordinates	kkkkmmm	kkkkmmm
Irish National Grid (ING)	aaeeeeennnnn	
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Italy (IT)		
Italian Gauss-Boaga west zone	kkkkmmm	kkkkmmm
Italian Gauss-Boaga east zone	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Roma) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Roma) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Latvia (LV)		
Latvian Transversal Mercator Coord. LKS92	kkkmmm	kkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Liechtenstein (LI)		
Swiss grid coordinates (LV95)	kkkkmmm	kkkkmmm
Swiss grid coordinates (LV03)	kkkmmm	kkkmmm
Swiss grid coordinates (Old Grid)	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Lithuania (LT)		
Lithuanian Transversal Mercator Coord. LKS94	kkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Luxembourg (LU)		
Luxemburgian Transverse Mercator	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
Malte (MT)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Netherlands (NL)		
Netherlands Stereographic coordinates	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Norway (NO)		
Norwegian Transv. Mercator NGO1948 zone 1	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 2	±kkkkmmm	±kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Norwegian Transv. Mercator NGO1948 zone 3	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 4	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 5	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 6	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 7	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 8	±kkkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Poland (PL)		
Polish Gauss-Krueger 2000/15-24 (3 degree strips)	skkkmmm	kkkkmmm
Polish Gauss-Krueger coordinates 1992/19	±kkkmmm	±kkkmmm
Polish Stereographic 1965 zone 1	kkkkmmm	kkkkmmm
Polish Stereographic 1965 zone 2	kkkkmmm	kkkkmmm
Polish Stereographic 1965 zone 3	kkkkmmm	kkkkmmm
Polish Stereographic 1965 zone 4	kkkkmmm	kkkkmmm
Polish Transverse Mercator 1965 zone 5	±kkkmmm	±kkkmmm
Polish Stereographic GUGiK coordinates	kkkkmmm	kkkkmmm
Polish Gauss-Krueger 1942/15-24 (3 degree strips)	skkkmmm	kkkkmmm
Polish Gauss-Krueger 1942/15-21 (6 degree strips)	skkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Portugal (PT)		
Portugese Transversal Mercator DLX coordinates	kkkkmmm	kkkkmmm
Portugese Transversal Mercator D73 coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Slovakia (SK)		
Slovakian Krovak S-JTSK coordinates	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Austrian central zone (BMN) M31	kkkmmm	kkkmmm
Austrian east zone (BMN) M34	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Slovenia (SI)		
Slovenian Transversal Mercator Coord. D48	kkkmmm	kkkkmmm
Slovenian Transversal Mercator Coord. D48+	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Spain (ES)		
Spanish Lambert MADRID coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Madrid) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Madrid) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Sweden (SE)		
Swedish Transv. Mercator RT90 7.5gonV 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 5gonV 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 2.5gonV 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 0gon 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 2.5gonO 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 5gonO 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R01 Skåne	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R02 Halland	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R03 Karlshamn	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R04 Göteborg	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R05 Vänern	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R06 Småland	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R07 Örebro	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R08 Gotland	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R09 Stockholm	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R10 Gävle-Dala	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R11 Umeå	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R12 Luleå	kkkkmmm	kkkkmmm
Swedish Transversal Mercator Coord. (13° 35')	kkkkmmm	kkkkmmm
Swedish UTM Coordinates zone 33	kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Switzerland (CH)		
Swiss grid coordinates (LV95)	kkkkmmm	kkkkmmm
Swiss grid coordinates (LV03)	kkkmmm	kkkmmm
Swiss grid coordinates (Old Grid)	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
NORTH AMERICAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
NORTH AMERICAN Multinational		
US National Atlas Lambert Azimuthal Equal Area	±kkkkmmm	±kkkkmmm
Canada - Mean Territory (CA)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - British Columbia & Alberta (CA-BC+AB)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Maritime Provinces (CA-MPR)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
CA-MTM zone 1 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM Newfoundland zone 2 Transv. Mercator	kkkkmmm	kkkkmmm
CA-MTM zone 3 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM Nova Scotia zone 4 Transv. Mercator	kkkkmmm	kkkkmmm
CA-MTM Nova Scotia zone 5 Transv. Mercator	kkkkmmm	kkkkmmm
CA New Brunswick NAD83 Stereographic coordinates	kkkkmmm	kkkkmmm
CA New Brunswick ATS77 Stereographic coordinates	kkkkmmm	kkkkmmm
CA Prince Edward Isl. NAD83 Stereographic Koord	kkkkmmm	kkkkmmm
CA Prince Edward Isl. ATS77 Stereographic Koord.	kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - North West Territories (CA-NWT)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Ontario & Manitoba (CA-ON+MN)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
CA-MTM zone 11 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 12 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 13 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 14 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 15 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 16 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 17 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Quebec (CA-QUE)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
CA-MTM Quebec zone 2 Transversal Mercator coord.	kkkkmmm	kkkkmmm
CA-MTM zone 4 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 5 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 6 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 7 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 8 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 9 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 10 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA Quebec Lambert coordinates	±kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Yukon (CA-YUK)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Alabama (US-AL)		
US-SPCS 1983 (101) Alabama east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (101) Alabama east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (102) Alabama west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (102) Alabama west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Alaska (US-AK)		
US-SPCS 1983 (5001) Alaska 1 Hotine Oblique Merc.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5001) Alaska 1 Hotine Oblique Merc.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5002) Alaska 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5002) Alaska 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5003) Alaska 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
US-SPCS 1927 (5003) Alaska 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5004) Alaska 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5004) Alaska 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5005) Alaska 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5005) Alaska 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5006) Alaska 6 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5006) Alaska 6 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5007) Alaska 7 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5007) Alaska 7 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5008) Alaska 8 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5008) Alaska 8 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5009) Alaska 9 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5009) Alaska 9 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5010) Alaska 10 Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (5010) Alaska 10 Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - American Samoa (US-AS)		
US-SPCS 1927 (5300) American Samoa Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Arizona (US-AZ)		
US-SPCS 1983 (202) Arizona central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (202) Arizona central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (201) Arizona east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (201) Arizona east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (203) Arizona west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (203) Arizona west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Arkansas (US-AR)		
US-SPCS 1983 (301) Arkansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (301) Arkansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (302) Arkansas south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (302) Arkansas south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - California (US-CA)		
US-SPCS 1983 (401) California I Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (401) California I Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (402) California II Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (402) California II Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (403) California III Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (403) California III Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (404) California IV Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (404) California IV Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (405) California V Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (405) California V Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (406) California VI Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (406) California VI Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (407) California VII Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Colorado (US-CO)		
US-SPCS 1983 (502) Colorado central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (502) Colorado central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (501) Colorado north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (501) Colorado north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (503) Colorado south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (503) Colorado south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Conneticut (US-CT)		
US-SPCS 1983 (600) Connecticut Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (600) Connecticut Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Delaware (US-DE)		
US-SPCS 1983 (700) Delaware Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (700) Delaware Transv. Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
USA - Florida (US-FL)		
US-SPCS 1983 (901) Florida east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (901) Florida east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (903) Florida north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (903) Florida north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (902) Florida west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (902) Florida west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Georgia (US-GA)		
US-SPCS 1983 (1001) Georgia east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1001) Georgia east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1002) Georgia west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1002) Georgia west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Hawaii (US-HI)		
US-SPCS 1983 (5101) Hawaii 1 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5101) Hawaii 1 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5102) Hawaii 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5102) Hawaii 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5103) Hawaii 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5103) Hawaii 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5104) Hawaii 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5104) Hawaii 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5105) Hawaii 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5105) Hawaii 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Idaho (US-ID)		
US-SPCS 1983 (1102) Idaho central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1102) Idaho central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1101) Idaho east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1101) Idaho east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (1103) Idaho west Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1103) Idaho west Transv. Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Illinois (US-IL)		
US-SPCS 1983 (1201) Illinois east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1201) Illinois east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1202) Illinois west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1202) Illinois west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Indiana (US-IN)		
US-SPCS 1983 (1301) Indiana east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1301) Indiana east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1302) Indiana west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1302) Indiana west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Iowa (US-IA)		
US-SPCS 1983 (1401) Iowa north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (1401) Iowa north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (1402) Iowa south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (1402) Iowa south Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Kansas (US-KS)		
US-SPCS 1983 (1501) Kansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1501) Kansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1502) Kansas south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1502) Kansas south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Kentucky (US-KY)		
US-SPCS 1983 (1601) Kentucky north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1601) Kentucky north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1602) Kentucky south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1602) Kentucky south Lambert coord.	kkkkmmm	kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Louisiana (US-LA)		
US-SPCS 1983 (1701) Louisiana north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1701) Louisiana north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1703) Louisiana offshore Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1703) Louisiana offshore Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1702) Louisiana south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1702) Louisiana south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Maine (US-ME)		
US-SPCS 1983 (1801) Maine east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1801) Maine east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (1802) Maine west Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1802) Maine west Transv. Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Maryland (US-MD)		
US-SPCS 1983 (1900) Maryland Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (1900) Maryland Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Massachusetts (US-MA)		
US-SPCS 1983 (2002) Massachusetts island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (2002) Massachusetts island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (2001) Massachusetts mainland Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (2001) Massachusetts mainland Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Michigan (US-MI)		
US-SPCS 1983 (2112) Michigan central Lambert coord.	kkkkmmm	kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
US-SPCS 1927 (2112) Michigan central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2102) Michigan central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2101) Michigan east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2111) Michigan north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2111) Michigan north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2113) Michigan south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2113) Michigan south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2103) Michigan west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Minnesota (US-MN)		
US-SPCS 1983 (2202) Minnesota central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2202) Minnesota central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2201) Minnesota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2201) Minnesota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2203) Minnesota south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2203) Minnesota south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Mississippi (US-MS)		
US-SPCS 1983 (2301) Mississippi east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2301) Mississippi east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2302) Mississippi west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2302) Mississippi west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Missouri (US-MO)		
US-SPCS 1983 (2402) Missouri central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2402) Missouri central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2401) Missouri east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2401) Missouri east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2403) Missouri west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2403) Missouri west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Montana (US-MT)		

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
US-SPCS 1983 (2500) Montana Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (2502) Montana central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2501) Montana north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2503) Montana south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Nebraska (US-NE)		
US-SPCS 1983 (2600) Nebraska Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (2601) Nebraska north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2602) Nebraska south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Nevada (US-NV)		
US-SPCS 1983 (2702) Nevada central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2702) Nevada central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2701) Nevada east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2701) Nevada east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2703) Nevada west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2703) Nevada west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New Hampshire (US-NH)		
US-SPCS 1983 (2800) New Hampshire Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2800) New Hampshire Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New Jersey (US-NJ)		
US-SPCS 1983 (2900) New Jersey Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (2900) New Jersey Transv. Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New Mexico (US-NM)		

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
US-SPCS 1983 (3002) New Mexico central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (3002) New Mexico central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (3001) New Mexico east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3001) New Mexico east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3003) New Mexico west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3003) New Mexico west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New York (US-NY)		
US-SPCS 1983 (3102) New York central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3102) New York central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3101) New York east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3101) New York east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3104) New York Long Island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (3104) New York Long Island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (3103) New York west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3103) New York west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - North Carolina (US-NC)		
US-SPCS 1983 (3200) North Carolina Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3200) North Carolina Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - North Dakota (US-ND)		
US-SPCS 1983 (3301) North Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3301) North Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3302) North Dakota south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3302) North Dakota south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Ohio (US-OH)		
US-SPCS 1983 (3401) Ohio north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (3401) Ohio north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (3402) Ohio south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (3402) Ohio south Lambert coordinates	kkkkmmm	kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Oklahoma (US-OK)		
US-SPCS 1983 (3501) Oklahoma north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3501) Oklahoma north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3502) Oklahoma south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3502) Oklahoma south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Oregon (US-OR)		
US-SPCS 1983 (3601) Oregon north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3601) Oregon north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3602) Oregon south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3602) Oregon south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Pennsylvania (US-PA)		
US-SPCS 1983 (3701) Pennsylvania north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3701) Pennsylvania north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3702) Pennsylvania south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3702) Pennsylvania south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Puerto Rico (US-PR)		
US-SPCS 1983 (5200) Puerto Rico Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (5201) Puerto Rico Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Rhode Island (US-RI)		
US-SPCS 1983 (3800) Rhode Island Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3800) Rhode Island Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - South Carolina (US-SC)		
US-SPCS 1983 (3900) South Carolina Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3901) South Carolina north Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (3902) South Carolina south Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - South Dakota (US-SD)		
US-SPCS 1983 (4001) South Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4001) South Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4002) South Dakota south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4002) South Dakota south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Tennessee (US-TN)		
US-SPCS 1983 (4100) Tennessee Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4100) Tennessee Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Texas (US-TX)		
US-SPCS 1983 (4203) Texas central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4203) Texas central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4201) Texas north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4201) Texas north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (4202) Texas north central Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4202) Texas north central Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (4205) Texas south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4205) Texas south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (4204) Texas south central Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4204) Texas south central Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
USA - Utah (US-UT)		
US-SPCS 1983 (4302) Utah central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4302) Utah central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4301) Utah north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4301) Utah north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (4303) Utah south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4303) Utah south Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Vermont (US-VT)		
US-SPCS 1983 (4400) Vermont Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4400) Vermont Transv. Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Virgin Islands (US-VI)		
US-SPCS 1927 (5202) Virgin Islands / St. Croix Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Virginia (US-VA)		
US-SPCS 1983 (4501) Virginia north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4501) Virginia north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4502) Virginia south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4502) Virginia south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Washington (US-WA)		
US-SPCS 1983 (4601) Washington north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4601) Washington north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4602) Washington south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4602) Washington south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
USA - West Virginia (US-WV)		
US-SPCS 1983 (4701) West Virginia north Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4701) West Virginia north Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (4702) West Virginia south Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4702) West Virginia south Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Wisconsin (US-WI)		
US-SPCS 1983 (4802) Wisconsin central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4802) Wisconsin central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4801) Wisconsin north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4801) Wisconsin north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4803) Wisconsin south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4803) Wisconsin south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Wyoming (US-WY)		
US-SPCS 1983 (4901) Wyoming east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4901) Wyoming east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4902) Wyoming east central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (4902) Wyoming east central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (4904) Wyoming west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4904) Wyoming west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4903) Wyoming west central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (4903) Wyoming west central Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
User Defined		
1st user defined coordinate system	(undefined)	(undefined)

5.9 Appendix I: Available Reference Ellipsoids

- DHDN/PD (DE 1995 <±5m), Rauenberg, Bessel
- ED50 (Europe), Potsdam, Hayford/Int.
- S42/83 (East Europe), Pulkowo, Krassowskij
- ETRS89 (Europe), geocentric, GRS80
- MGI (AT/CZ), Hermannskogel, Bessel
- NTF (FR), Paris Pantheon, Clarke IGN

- RD/NAP (NL), Amersfoort, Bessel
- CH1903+ (CH/LI 1993), Zimmerwald, Bessel
- RD/83 (DE new states <±1m), Rauenberg, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- BD72 (BE), Ukkel, Hayford/Int.
- OSGB36 (GB/IE), Herstmonceux, Airy
- LUREF (LU), Habay, Hayford/Int.
- ROMA40 (IT), Monte Mario, Hayford/Int.
- GRANIT87 (CH), Zimmerwald, Bessel
- DHDN/PD (DE 2001 <±3m), Rauenberg, Bessel
- DHDN/PD (DE old states south <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states middle <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states north <±1m), Rauenberg, Bessel
- PD/83 (DE state TH <±1m), Rauenberg, Bessel
- S42/83 (DE states MV/LSA <±1m), Pulkowo, Krassowskij
- ED50 (FR), Potsdam, Hayford/Int.
- RGF93 (FR), geocentric, GRS80
- S-JTSK (CZ), Hermannskogel, Bessel
- CH1903 (CH/LI), Bern, Bessel
- CHTRS95 (CH/LI), geocentric, GRS80
- ROMA40 (IT-peninsular <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sardinia <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sicily <±4m), Monte Mario, Hayford/Int.
- ED50 (DK), Potsdam, Hayford/Int.
- S42/58 (PL Uklad 1965), Pulkowo, Krassowskij
- SOLDNER (DE state BY <±1m), Munic, Laplace
- BD50 (BE), Royal de Belgique, Hayford/Int.
- IRELAND65 (IE), Slieve Donard, Airy modified
- MADRID1870 (ES <±7m), Madrid, Struve
- ED50 (ES EST99 peninsular), Potsdam, Hayford/Int.
- ED50 (ES ZNW99 northwest), Potsdam, Hayford/Int.
- ED50 (ES BAL99 Balearic isl.), Potsdam, Hayford/Int.
- DLX (PT), Lisbon, Hayford/Int.
- D73 (PT), Melrica, Hayford/Int.
- ED50 (PT), Potsdam, Hayford/Int.
- HD72 (HU), Szölöhegy, GRS67
- RT90 (SE), Stockholm, Bessel
- SWEREF99 (SE), geocentric, GRS80
- NGO1948 (NO), Oslo, Bessel modified
- ED50 (NO FI), Potsdam, Hayford/Int.
- KKJ (FI), Helsinki, Hayford/Int.
- ED50 (FI), Potsdam, Hayford/Int.
- ED50 (IT Sardinia), Potsdam, Hayford/Int.
- ED50 (IT Sicily), Potsdam, Hayford/Int.
- S-JTSK (SK), Hermannskogel, Bessel
- S42/83 (PL), Pulkowo, Krassowskij
- GGRS87 (GR), Dionysos, GRS80
- ED50 (GR), Potsdam, Hayford/Int.
- D48 (SI), Hermannskogel, Bessel
- EST97 (EE), geocentric, GRS80
- S42 (EE), Pulkowo, Krassowskij
- LKS94 (LT), geocentric, GRS80

- S42 (LT), Pulkowo, Krassowskij
- LKS92 (LV), geocentric, GRS80
- S42 (LV), Pulkowo, Krassowskij
- ED50 (CY), Potsdam, Hayford/Int.
- ED50 (MT), Potsdam, Hayford/Int.
- HELLENIC (GR <±3m), Athens, Bessel
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- NAD27 (US-AK), Meade's Ranch Kansas, Clarke
- NAD27 (US-AK Aleutian east), Kansas, Clarke
- NAD27 (US-AK Aleutian west), Kansas, Clarke
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA <±15m), Kansas, Clarke
- NAD27 (CA east <±6m), Kansas, Clarke
- NAD27 (CA-NWT <±5m), Kansas, Clarke
- NAD27 (CA-BC+AB <±8m), Kansas, Clarke
- NAD27 (CA-ON+MN <±9m), Kansas, Clarke
- NAD27 (CA-YUK <±8m), Kansas, Clarke
- ATS77 (CA-MPR), geocentric, WGS72
- American Samoa 1962 (US-AS), Samoa, Clarke
- GRS80a Authalic Sphere (US+CA), Sphere, Sphere
- Old Hawaiian mean (US-HI), Oahu, Clarke
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-ACT), Johnston, ANS
- AGD66 (AU-TAS), Johnston, ANS
- AGD66 (AU-NSW), Johnston, ANS
- AGD66 (AU-NT), Johnston, ANS
- Everest (BD), Kalianpur, Everest
- JGD2000 (JP 1994 ±1m), geocentric, GRS80
- JGD2000 (JP 2000 ±1m), geocentric, GRS80
- Tokyo (JP 1993 ±5m), Nikon, Bessel
- Tokyo (JP 1996 ±3m), Nikon, Bessel
- Tokyo (JP 1997 ±3m), Nikon, Bessel
- Tokyo (JP Okinawa), Nikon, Bessel
- Tokyo (JP Okinawa KR), Nikon, Bessel
- User defined geodetic datum shift
- No geodetic datum shift
- No datum shift and no ellipsoid transition

5.9.1 Appendix I1: Reference Systems – sorted by country/region

Reference Systems – sorted by country/region

ASIAN International

- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Bangladesh (BD)
- Everest (BD), Kalianpur, Everest
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Japan (JP)
- JGD2000 (JP 1994 ±1m), geozentrisch, GRS80
- JGD2000 (JP 2000 ±1m), geozentrisch, GRS80
- Tokyo (JP 1993 ±5m), Nikon, Bessel
- Tokyo (JP 1996 ±3m), Nikon, Bessel
- Tokyo (JP 1997 ±3m), Nikon, Bessel
- Tokyo (JP Okinawa), Nikon, Bessel
- Tokyo (JP Okinawa KR), Nikon, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

AUSTRALIAN International
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

AUSTRALIAN Multinational
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian Capital Territory (AU-ACT)
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-ACT), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian Northern Territory (AU-NT)
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-NT), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian New South Wales (AU-NSW)
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-NSW), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian Tasmania (AU-TAS)
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS

- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-TAS), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

EUROPEAN International

- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.
- S42/83 (East Europe), Pulkowo, Krassowskij

EUROPEAN Multinational

- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- ED50 (Europe), Potsdam, Hayford/Int.
- S42/83 (East Europe), Pulkowo, Krassowskij

Austria (AT)

- ETRS89 (Europe), geocentric, GRS80
- MGI (AT/CZ), Hermannskogel, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Belgium (BE)

- ETRS89 (Europe), geocentric, GRS80
- BD50 (BE), Royal de Belgique, Hayford/Int.
- BD72 (BE), Ukkel, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.
- NTF (FR), Paris Pantheon, Clarke IGN

Cyprus (CY)

- ED50 (CY), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84

Czechia (CZ)

- ETRS89 (Europe), geocentric, GRS80
- S-JTSK (CZ), Hermannskogel, Bessel
- S42/83 (East Europe), Pulkowo, Krassowskij
- MGI (AT/CZ), Hermannskogel, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Denmark (DK)

- ED50 (DK), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Estonia (EE)

- EST97 (EE), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- S42 (EE), Pulkowo, Krassowskij

- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84

Finland (FI)

- KKJ (FI), Helsinki, Hayford/Int.
- ED50 (FI), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84

France (FR)

- RGF93 (FR), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- NTF (FR), Paris Pantheon, Clarke IGN
- ED50 (FR), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Germany (DE)

- ETRS89 (Europe), geocentric, GRS80
- DHDN/PD (DE 1995 <±5m), Rauenberg, Bessel
- DHDN/PD (DE 2001 <±3m), Rauenberg, Bessel
- DHDN/PD (DE old states south <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states middle <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states north <±1m), Rauenberg, Bessel
- S42/83 (DE states MV/LSA <±1m), Pulkowo, Krassowskij
- RD/83 (DE new states <±1m), Rauenberg, Bessel
- PD/83 (DE state TH <±1m), Rauenberg, Bessel
- SOLDNER (DE state BY <±1m), Munich, Laplace
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Prussian Land Register (PK)

- DHDN/PD (DE 1995 <±5m), Rauenberg, Bessel
- DHDN/PD (DE 2001 <±3m), Rauenberg, Bessel

Great Britain (GB)

- ETRS89 (Europe), geocentric, GRS80
- OSGB36 (GB/IE), Herstmonceux, Airy
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Greece (GR)

- GGRS87 (GR), Dionysos, GRS80
- ED50 (GR), Potsdam, Hayford/Int.
- HELLENIC (GR <±3m), Athens, Bessel
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Hungary (HU)

- HD72 (HU), Szölöhegy, GRS67
- S42/83 (East Europe), Pulkowo, Krassowskij
- ETRS89 (Europe), geocentric, GRS80

- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Ireland (IE)

- ETRS89 (Europe), geocentric, GRS80
- IRELAND65 (IE), Slieve Donard, Airy modified
- OSGB36 (GB/IE), Herstmonceux, Airy
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Italy (IT)

- ETRS89 (Europe), geocentric, GRS80
- ROMA40 (IT), Monte Mario, Hayford/Int.
- ROMA40 (IT-peninsular <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sardinia <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sicily <±4m), Monte Mario, Hayford/Int.
- ED50 (Europe), Potsdam, Hayford/Int.
- ED50 (IT Sardinia), Potsdam, Hayford/Int.
- ED50 (IT Sicily), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Latvia (LV)

- LKS92 (LV), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- S42 (LV), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84

Liechtenstein (LI)

- ETRS89 (Europe), geocentric, GRS80
- CH1903+ (CH/LI 1993), Zimmerwald, Bessel
- CH1903 (CH/LI), Bern, Bessel
- CHTRS95 (CH/LI), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84

Lithuania (LT)

- LKS94 (LT), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- S42 (LT), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84

Luxembourg (LU)

- ETRS89 (Europe), geocentric, GRS80
- LUREF (LU), Habay, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.
- NTF (FR), Paris Pantheon, Clarke IGN

Malta (MT)

- ED50 (MT), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84

Netherlands (NL)

- ETRS89 (Europe), geocentric, GRS80

- RD/NAP (NL), Amersfoort, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Norway (NO)
- NGO1948 (NO), Oslo, Bessel modified
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- ED50 (NO FI), Potsdam, Hayford/Int.
- ED50 (Europe), Potsdam, Hayford/Int.

Poland (PL)
- ETRS89 (Europe), geocentric, GRS80
- S42/58 (PL Uklad 1965), Pulkowo, Krassowskij
- S42/83 (PL), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Portugal (PT)
- DLX (PT), Lisbon, Hayford/Int.
- D73 (PT), Melrica, Hayford/Int.
- ED50 (PT), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Slovakia (SK)
- ETRS89 (Europe), geocentric, GRS80
- S-JTSK (SK), Hermannskogel, Bessel
- S42/83 (East Europe), Pulkowo, Krassowskij
- MGI (AT/CZ), Hermannskogel, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Slovenia (SI)
- D48 (SI), Hermannskogel, Bessel
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Spain (ES)
- MADRID1870 (ES <±7m), Madrid, Struve
- ED50 (ES EST99 peninsular), Potsdam, Hayford/Int.
- ED50 (ES ZNW99 northwest), Potsdam, Hayford/Int.
- ED50 (ES BAL99 Balearic isl.), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Sweden (SE)
- RT90 (SE), Stockholm, Bessel
- SWEREF99 (SE), geocentric, GRS80

- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- ED50 (Europe), Potsdam, Hayford/Int.

Switzerland (CH)

- ETRS89 (Europe), geocentric, GRS80
- CH1903+ (CH/LI 1993), Zimmerwald, Bessel
- CH1903 (CH/LI), Bern, Bessel
- CHTRS95 (CH/LI), geocentric, GRS80
- GRANIT87 (CH), Zimmerwald, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

NORTH AMERICAN International

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

NORTH AMERICAN Multinational

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- GRS80a Authalic Sphere (US+CA), Sphere, Sphere

Canada - Mean Territory (CA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA <±15m), Kansas, Clarke
- NAD27 (CA east <±6m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - British Columbia & Alberta (CA-BC+AB)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-BC+AB <±8m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Maritime Provinces (CA-MPR)

- NAD83 (US+CA), geocentric, WGS84
- ATS77 (CA-MPR), geocentric, WGS72
- NAD27 (CA east <±6m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- Canada - North West Territories (CA-NWT)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-NWT <±5m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Ontario & Manitoba (CA-ON+MN)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-ON+MN <±9m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Quebec (CA-QUE)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA east <±6m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Yukon (CA-YUK)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-YUK <±8m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Alabama (US-AL)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Alaska (US-AK)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US-AK), Meade's Ranch Kansas, Clarke
- NAD27 (US-AK Aleutian east), Kansas, Clarke
- NAD27 (US-AK Aleutian west), Kansas, Clarke
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - American Samoa (US-AS)

- American Samoa 1962 (US-AS), Samoa, Clarke
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Arizona (US-AZ)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Arkansas (US-AR)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84

- WGS72 (World wide), geocentric, WGS72

USA - California (US-CA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Colorado (US-CO)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Conneticut (US-CT)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- GS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Delaware (US-DE)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Florida (US-FL)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Georgia (US-GA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Hawaii (US-HI)

- NAD83 (US+CA), geocentric, WGS84
- Old Hawaiian mean (US-HI), Oahu, Clarke
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Idaho (US-ID)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Illinois (US-IL)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Indiana (US-IN)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Iowa (US-IA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Kansas (US-KS)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Kentucky (US-KY)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Louisiana (US-LA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Maine (US-ME)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Maryland (US-MD)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Massachusetts (US-MA)

- NAD83 (US+CA), geocentric, WGS84

- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Michigan (US-MI)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Minnesota (US-MN)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Mississippi (US-MS)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Missouri (US-MO)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Montana (US-MT)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Nebraska (US-NE)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Nevada (US-NV)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New Hampshire (US-NH)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke

- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New Jersey (US-NJ)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New Mexico (US-NM)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New York (US-NY)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - North Carolina (US-NC)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - North Dakota (US-ND)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Ohio (US-OH)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Oklahoma (US-OK)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Oregon (US-OR)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke

- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Pennsylvania (US-PA)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Puerto Rico (US-PR)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Rhode Island (US-RI)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - South Carolina (US-SC)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - South Dakota (US-SD)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Tennessee (US-TN)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Texas (US-TX)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Utah (US-UT)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84

- WGS72 (World wide), geocentric, WGS72

USA - Vermont (US-VT)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Virgin Islands (US-VI)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Virginia (US-VA)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Washington (US-WA)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - West Virginia (US-WV)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Wisconsin (US-WI)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Wyoming (US-WY)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

User Defined
- User defined geodetic datum shift
- No geodetic datum shift
- No datum shift and no ellipsoid transition

5.10 Appendix J: Software Structure

Users interact with the system by using the graphical user interface (GUI) component. On one hand it allows to communicate with collars and Handheld Terminals directly connected to the local computer. On the other hand it provides means to communicate with the two background services, which serve as automatic data collector and data storage mechanism.
Due to the fact that these three software components communicate via HTTP(S) (the same protocol that is used in the World Wide Web), they do not have to be located on the same computer, but can be distributed over several machines either connected by a local area network (LAN) or the internet. This allows several researchers to access and work with the same data or to have multiple Data Collector Services (DCS) running on different machines. Each one receiving data from different GSM ground stations and / or email forwarding services while the data are still stored in one centralised Data Storage Service (DSS).
The graphical user interface (GUI) is located on the user’s computer. Each system can contain several GUI’s, usually one GUI per user or per computer. It can be used “offline”, that means without being connected to DCS and DSS, but here the software’s features will be restricted. The GUI offers a direct connection to a collar via Link Manager and to a Handheld Terminal via USB or Link Manager. The GUI allows you to configure and manage collars. Data can be downloaded from a collar or a Handheld Terminal and sent to the Data Storage Service (DSS) or exported directly (e.g. as ASCII file). Data in the DSS can also be accessed and exported. If the GUI is used offline, all data downloaded from a collar or Handheld Terminal are stored in the Local Buffer. As soon as the GUI is online again, these data can be moved to the Data Storage Service (DSS).

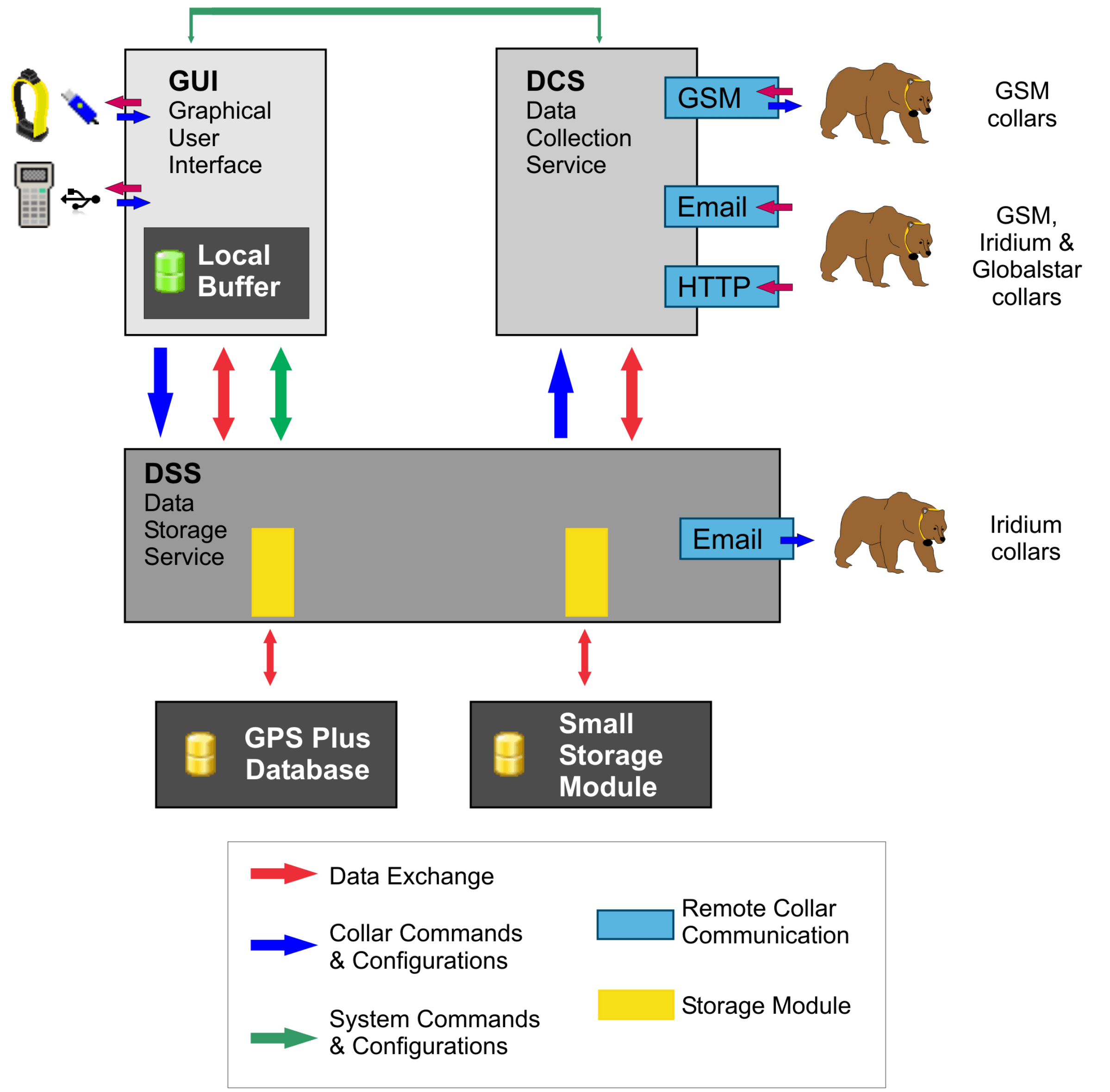


Figure 229: Schematic structure of the components of GPS Plus X

The Data Storage Service (DSS) is the heart of the software. For each System can only be used one DSS. If a single researcher (stand-alone applications) is using the software without connection to others, the DSS would normally be installed on the same PC as the user interface. The DSS stores the information about the collars (i.e. collar list), the configuration of the software, and the configuration for the remote collar communication. Most interactions between the system components are managed by the DSS. All collected data are sent to the DSS and then assigned to their final storage destinations, the Storage Modules.
There are two types of storage modules. One utilises a fully-fledged relational database management system (RDBMS) which requires the installation of a separate software package (PostgreSQL). The other one is a file-based database system that is embedded in GPS Plus X software (based on SQLite).
Several storage modules can be configured on a single DSS which allows a number of research projects to store data in the same DSS but in different storage modules to keep different data sets separated. Additionally data sets can be stored in more than one storage module, e.g. if they are to be used in more

than one project.
Data downloaded from collars and Handheld Terminals can be viewed in the GUI and are sent on command to the DSS. To view them again, they are requested from the DSS. Data transmitted from remote collars via GSM or email is received by the Data Collector Services (DCS), which can be configured with the GUI. If fully configured, data are automatically received and sent to the Data Storage Service (DSS) and from there stored in the storage modules assigned to the collar. These data can be viewed from the GUI, but depending on the storage module, they can also be accessed with third-party software.
To handle GSM, IRIDIUM, and GLOBALSTAR communication one DCS is enough, but a system can also contain several DCSs. This is especially useful in bigger networks, where several GSM ground stations and email accounts are used in different locations, but data are managed in only one Data Storage System.
Commands and configurations can be sent directly to collars or to Handheld Terminals connected via Link Manager. This is also possible while the GUI is offline. Commands, sent via SMS or email are routed through the DSS. Emails to IRIDIUM collars are sent directly from the DSS to the IRIDIUM network. Commands sent via SMS are sent from the DSS to the DCS and from there to the GSM ground station. The GSM ground station sends the actual SMS to the collar. All commands sent and the confirmations received from the collars are stored in the DSS and can be viewed later.