VEMCO VRAP SYSTEM

VRAP SOFTWARE MANUAL

Version 5.1.4 2011-12-9

VEMCO, *A Division of AMIRIX Systems Inc.*

AMIRIX Systems Inc.
Warranty and Disclaimer

WARRANTY

AMIRIX Systems Inc., doing business under its trade name VEMCO, provides a one (1) year warranty period for the Product from date of shipment.

VEMCO warrants that on the date of shipment all Products manufactured by VEMCO are free from defects in material and workmanship under normal use and service. This warranty applies to the components necessary for equipment upgrades, i.e. the VR1/VR2 to VR2W upgrade. With respect to transmitter products, while VEMCO is able to predict battery life with some certainty, VEMCO cannot guarantee that these Products will remain functional while submerged for extended periods of time. This warranty does not apply to any equipment, materials or design supplied by Buyer or a third party; re-battery services provided by VEMCO; Products for which VEMCO has not received payment; problems that results from: external causes such as accident, abuse, misuse; servicing not authorized by VEMCO; usage not in accordance with Product instructions; failure to follow the Product instructions or failure to perform preventative maintenance; usage of accessories, parts or components not supplied by VEMCO.

This warranty shall survive delivery only on the conditions and subject to the limitations set forth below.

NOTICE PERIODS

To receive a warranty remedy for a Product, Buyer must contact VEMCO's Customer Support Department during the warranty period to receive the Return Material Authorization ("RMA") instructions. Each defective Product returned for warranty remedy must be shipped at the Buyer's expense according to the RMA instructions and must include reasonable proof that the claimed defect is due to a matter embraced within the warranty set forth above and that such defect did not result from any act or omission of Buyer, including but not limited to any failure to operate and maintain the Product in accordance with VEMCO's applicable written instructions.

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VEMCO's liability, and the Buyer's exclusive remedy under this warranty, as to a defect in material or workmanship, is limited to the repair of such defect in the accessory, equipment or part in which the defect appears or, at VEMCO's option, to the replacement of such accessory, equipment or part with a similar item free from defect. As to any item repaired by VEMCO or furnished as a replacement by VEMCO, VEMCO's liability and the Buyer's exclusive remedy to the repair or replacement of such item for any further defect in material or workmanship, provided VEMCO receives written notice at Halifax, Nova Scotia, of such further defect from BUYER within ninety (90) days after the repaired or replaced item is shipped to BUYER and provided that BUYER returns same to VEMCO as provided under "Notice Periods".

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All repairs, replacements and corrections described above shall be performed by VEMCO at its plant at Halifax, Nova Scotia, or at such other place as may be mutually agreeable, and with reasonable care and dispatch in order that the Product, accessory, equipment or part will not be kept out of service longer than necessary. Return to BUYER of a repaired, replacement, or corrected accessory, equipment, part or Product shall be at VEMCO's expense. Title to and risk of loss of the Product, accessory, equipment, or part returned to VEMCO pursuant hereto shall at all times remain with the BUYER, except that title to a returned accessory, equipment, part, or Product shall pass to VEMCO concurrently with shipment to BUYER of any item furnished by VEMCO to BUYER as a replacement therefore. VEMCO shall have only such responsibility for any Product, accessory, equipment, or part owned by the BUYER and in the possession of VEMCO as is chargeable by law to a bailee for hire, but shall not be chargeable for loss of use thereof.

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Normal wear and tear and the need for regular maintenance shall not constitute a defect under this warranty.

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EXPORT

Products and associated materials supplied or licensed hereunder may be subject to various export laws and regulations. It is the responsibility or BUYER to comply with such laws and regulations.

NEGOTIATED AGREEMENT

It is fully understood by the parties that the price of the Product and other mutual agreements of the parties set forth in this agreement were arrived at in consideration of this warranty, SPECIFICALLY INCLUDING THE WAIVER, RELEASE AND RENUNCIATION BY BUYER SET FORTH ABOVE (DISCLAIMER AND RELEASE).

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INTRODUCTION

ABOUT VEMCO

VEMCO, a division of AMIRIX Systems Incorporated, is a leader in the design and manufacture of oceanographic research tools and systems since 1979. Located in Halifax, Nova Scotia, VEMCO's product line ranges from miniature acoustic transmitters and data loggers to large tracking, positioning, and monitoring systems. Data communication methods include acoustic telemetry, radio modem and cellular telephone modem.

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SYSTEM OVERVIEW

The VRAP software is designed to work with the VEMCO Radio-linked Acoustic Positioning (VRAP) and Cabled Acoustic Positioning (CAP) systems. The software is used on a computer connected to the positioning system's base station. The base station communicates with remote receivers through either radios (VRAP) or RS485 cables (CAP). These remote receivers are referred to as buoys, although only the VRAP system receivers are actually contained in a buoy. The CAP remote receivers (buoys) are actually housed in a waterproof case.

The buoys (remote receivers) receive acoustic pulses from free running pingers and/or telemetry transmitters in the area of the study. This received information is transmitted to the base station where the position of each tag is calculated by the VRAP software based on the arrival times of the acoustic pulses. The positions of the remote receivers and the tags are displayed on the computer screen and stored in a database.

SOFTWARE

SYSTEM REQUIREMENTS

VRAP is a Windows©98/Windows NT© based software application that can be executed on any IBM compatible personal or mobile computer with the following configuration:

Minimum Pentium 3 Processor, 500MHz
Minimum 4 MB Video RAM
256 MB RAM
Minimum SVGA Monitor 256 Colour
CD drive for program installation
Three button mouse
One serial port for base station interface (required)

The default setup is saved in a configuration file every time the program is exited.

It is recommended that a backup power supply (UPS) be used with the computer to prevent damage to the database due to power fluctuations or loss of power.

NOTE: The VRAP software was written for 1024x768 screen resolution and is best viewed at this resolution. Any other setting will alter the appearance but not affect the performance of the software.

SOFTWARE INSTALLATION

VRAP is a Windows©98/Windows NT© application. VEMCO assumes customer familiarity with Windows©98 terminology.

To install the VRAP software:

Step 1: Insert the Install compact disk (CD) into the CD drive.
Step 2: From the Start menu in Windows©98/Windows NT©, select Run.
Step 3: Type D:\setup.exe (or E:\setup.exe if using drive E)
Step 4: Follow the on-screen instructions.

Running VRAP on Laptop Computers

When running the VRAP software on a laptop computer, a problem has been encountered related to the Power Save function built into many modern laptops. When the Power Save function powers down the computer, the com ports are often closed but are not automatically re-enabled when the laptop is "awakened". The VRAP software will not be able to communicate with the base station and an error message will be displayed. The VRAP software must be restarted in order to re-enable the com port and restore proper operation. To avoid this problem, disable any Power Save features on the laptop prior to running the VRAP software.

Be careful to avoid power fluctuations or interruptions during a study.

The VRAP software contains the following sub-menus:

File	-	create a new project, open a previously created project, or print the results.
Edit	-	copy the results to the clipboard, setup a project.
Window	-	arrange opened windows during a study or playback.
View	-	zoom the *Chart* window in or out, and view the distances between buoys.
Tools	-	calibrate various values, test communication with each buoy, and put buoys in low-power mode.
Study	-	start and end a study, view a playback file, and create a new playback file.
Help	-	use the help file to view the Software section of this manual while running the VRAP software.

FILE MENU

New

The *New* option in the *File* menu is used to setup a new project. Before setting up a new project, create a new directory in the *Projects* directory (the *Projects* directory was created when the VRAP software was installed). When the *New* option is selected, the *Open* window will appear to allow the new project to be named. After the project is named and the Open button selected, the *Project settings* window (see *Edit* menu section) will appear so the project may be setup.

It is ***STRONGLY*** suggested that the directory containing the project be backed-up on a daily basis.

Open

The *Open* selection in the *File* menu allows a previously saved project to be opened. A new study (see *Study* menu section) can then be run with this project's setup.

Reopen

The *Reopen* feature of the *File* menu lists the last five projects that have been opened. One of these may be selected from the list to be opened.

Close

An opened project may be closed by selecting the *Close* feature in the *File* menu.

Save As

The *Save As* option allows a project to be saved under a different name. This allows more than one project to have the same settings without requiring the extra effort of setting up the new projects.

NOTE: The features discussed thus far apply to the project settings only and not to data received during a study. Data is automatically saved during the study.

Print

The *Print* option is only available when a study is being run or while a playback is being viewed. During either of these conditions, any of the following may be selected to be printed: *Chart* window, *Buoy Status* window, *Tag Status* window, *Track History* window, *Waypoints*.

The *Chart* window is a graphic, so printing it will open the *TeeChart Print Preview* window. The others are text files and printing one of them will open the *Print Setup* window.

TeeChart Print Preview

Selecting *Chart window* from the list in the *Print* command will open the *TeeChart Print Preview* window and allow a copy of the *Chart* window to be printed to a configured printer. If a printer has not been configured using the *Printer Setup* button then the default printer will be used.

The *Paper Orientation* box in the *TeeChart Print Preview* window allows the orientation of the graph on the paper to be selected. The choices are *Portrait* (8.5x11 inches) or *Landscape* (11x8.5 inches).

The margins in the *TeeChart Print Preview* window can be adjusted by selecting the desired percentage from the appropriate boxes in the *Margin* box. The margins can be reset by selecting *Reset Margins*. Selecting *View Margins* will show the location of the margins in the window with gray doted lines.

Print Setup

When a text window (*Buoy status*, *Tag status*, *Track history*, *Waypoints*, or *Study notes*) has been selected to be printed, the *Print Setup* window will appear. Within this window, the printer can be selected and the properties set for it, as well as selecting the paper size, source, and orientation.

Page setup

The *Page Setup* option in the *File* menu allows the paper to be setup for printing, and will open when printing either the *Buoy Status* window, the *Tag Status* window, the *Track History* window, or the *Waypoints* window. The *Page Setup* window will open to allow the paper size and source to be selected, the orientation of the paper (either portrait or landscape) to be chosen, and the size of the margins to be set.

Exit

Use *Exit* to leave the program, or click on the small “x” in the top right corner of the VRAP window.

EDIT MENU

Copy

The *Copy* command allows the information in a study or playback to be copied. The *Chart* window may be copied as either a bitmap or a metafile. The other windows (*Buoy status*, *Tag status*, *Track history*, and *Waypoints*) are copied to the Clipboard and may be pasted in a spread sheet, such as Excel or Quattro Pro.

Project settings

A project is the geographical setup of the buoys and the information pertaining to those buoys and to the tags used in the area. After a project is setup, any number of studies may be run using the project's settings.

A project is setup within the *Project settings* window. There are three areas of a project that must be attended to: the physical location, the buoys, and the tags (continuous and coded transmitters). Each of these is contained on a separate "page" in the *Project settings* window and are accessed by selecting the desired tab in the top left corner of the window. For example, click the second tab (marked “Buoys”) to move to the *Buoys* page.

When the project is setup, click the OK button to exit the window and save the project setup. The project is automatically saved every time the OK button is selected in the *Product settings* window.

Project

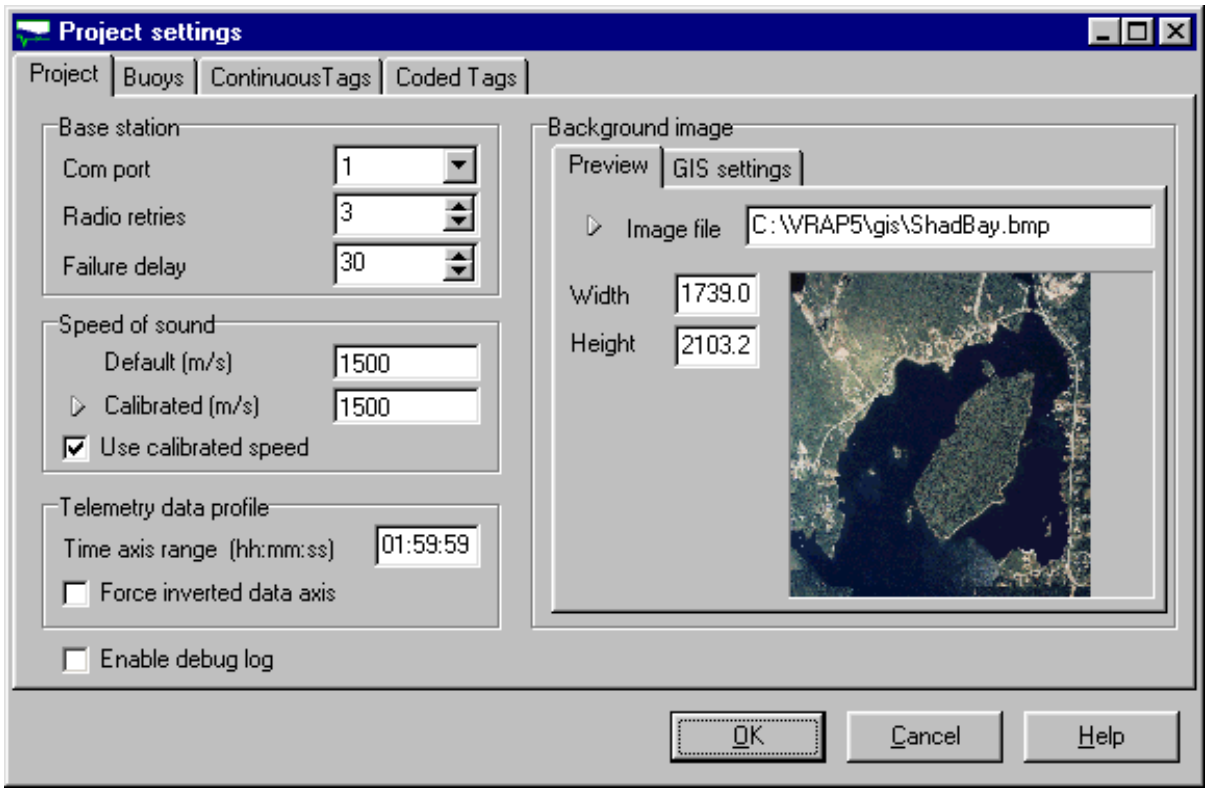
The *Project* page in the *Project settings* window is used to enter the base station information, the speed of sound, the telemetry data profile, and the background image.

Base station

The Base Station is the metal box to which the computer and the antenna are both attached. The com port on the computer to which the base station is connected must be identified in the *Com port* box. This is a pull-down list (click the down arrow next to the box) which identifies the com ports (also referred to as serial ports) on your computer.

The *Radio retries* value is the number of times radio communication will be attempted before a communication failure will be identified. This does not apply for CAP systems and can be left at the default value (3).

The *Failure delay* is the length of time, in seconds, the computer will wait after a communication failure has been identified and before communication is attempted again. For example, if the *Radio retries* value is 3, and the *Failure delay* is 30 seconds, then the software will try to communicate with a buoy three times and then wait 30 seconds before tying to communicate again. This does not apply for CAP systems and can be left at the default value (30).



The *Enable debug log* feature should ***only*** be enabled (check in box) when radio communication needs to be recorded between the base station and the buoy. When enabled, the VRAPLOG.txt file will be created in the project directory to record all radio communications. This file can grow to 4M per day so only use the feature for debugging radio communication.

Speed of sound

The speed of sound in water is either entered as a default value or is calibrated. The default value is set at 1500 meters per second, but can be over-written by entering the new value in the *Default* box. After the buoys are setup in the water and the locations are entered in the software, the speed of sound can be calibrated by the buoys. If the calibrated value is to be used, the *Use calibrated speed* box ***must be*** checked (see picture above) otherwise the default value will be used. The process of calibrating the speed of sound is explained in the Appendix.

Telemetry data profile

The time axis in the telemetry graph (see *Displays* section of manual) is selected by entering a time in the *Time axis range* box in the format of hours:minutes:seconds. This will be the length of time shown on the horizontal axis in the telemetry data graph.

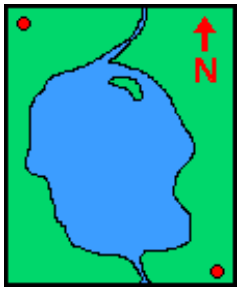
The *Force inverted data axis* option is used to invert the vertical axis, putting the smaller values at the top of the graph and the larger values at the bottom. This feature is automatically used if the data is given as depth, putting deep data near the bottom of the graph and shallow data near the top. This only needs to be forced (the box checked) if the data is not depth but you want the axis inverted.

Background image

The background image may be imported into the software. This background will be seen in the *Chart* window during a study, or a playback, and the buoy and tag locations will be plotted on it.

BITMAP CALIBRATION

There are a variety of methods available to calibrate a bitmap for use with the VRAP software program. The common methods will be touched on in this section.



The bitmap must have north at its top for the latitude and longitude scaling to be properly implemented.

An important step to calibrating the bitmap is in correctly positioning the calibration points. An example is shown in the sketch to the right. The two points (shown as red dots) were selected to allow maximum vertical and horizontal separation between the points. This will give the best scaling possible.

Electronic Charts with a Navigation Program

A navigation program, such as Nobeltec or the terrestrial equivalent ArcView, can be used with electronic charts of the project area. The charts must be purchased locally in addition to the navigation software and typically cost $200. To produce a calibrated bitmap using a navigation program, follow the steps outlined below.

1. Open the navigation software and load the chart containing the project area.
2. Find the project area on the chart and use the zoom feature to adjust the view of the project area to the desired scale.
3. Place a mark/waypoint close to one of the top corners and record the latitude and longitude of that point.
4. Place a mark/waypoint close to the opposite bottom corner from the previously selected top corner and record the latitude and longitude of that point. For example, if the top left corner was selected, then use the bottom right corner (see example above). ***It is very important to use opposing corners of the bitmap.***
5. Make a couple of extra marks/waypoints and record their latitude and longitude information. These additional points will be used to check the calibration in the VRAP software.
6. Copy the screen by simultaneously pressing the Alt and Print Screen keys.
7. Paste the bitmap into a graphics program that works with bitmaps, such as Paint or Photoshop.
8. Make desired changes to the bitmap, if applicable, such as removing any unneeded notations that clutter the project area.
9. Save the bitmap, making note of its name and location.
10. Enter the VRAP software and insert the background image for the project (see *Preview* in the *Background image* section).
11. Calibrate the background image (see *Background image* in the *Calibrations* section of the Appendix).

Electronic Charts without a Navigation Program

Electronic charts of the project area can be purchased locally for a typical cost of $200. A simple chart viewing program usually accompanies the chart files. To produce a calibrated bitmap using the chart viewing program, follow the steps outlined below.

1. Open the viewing software and load the appropriate chart.
2. Find the project area on the chart and use the zoom feature to adjust the view of the project area to the desired scale.
3. Select an identifiable point in one of the top corners and record the latitude and longitude of that point and the point location (eg. edge of island, road, top of lake, etc.). The latitude and longitude of the mouse position is generally shown at the bottom of the window.
4. Select an identifiable point in the opposite bottom corner from the previously selected top corner and record the latitude and longitude of that point and the point location. For example, if a point in the top left corner was selected, then use an identifiable point in the bottom right corner (see example on previous page). ***It is very important to use opposing corners of the bitmap.***
5. Select a couple of extra identifiable points and record their latitude and longitude information, along with the location of the points. These additional points will be used to check the calibration in the VRAP software.
6. Copy the screen by simultaneously pressing the Alt and Print Screen keys.
7. Paste the bitmap into a graphics program that works with bitmaps, such as Paint or Photoshop.
8. Make desired changes to the bitmap, if applicable, such as removing any unneeded notations that clutter the project area.
9. Save the bitmap, making note of its name and location.
10. Enter the VRAP software and insert the background image for the project (see *Preview* in the *Background image* section).
11. Calibrate the background image (see *Background image* in the *Calibrations* section of the Appendix).

Using a Differential GPS and an Electronic Aerial Photo

1. Select the desired area for the project on the electronic aerial photo. Be sure the area is in bitmap format (file extension is .bmp) and that the size of the file is no more than two megabytes (2 MB).
2. Print the bitmap of the project area and select two identifiable points on the photo (eg. edge of island, road, top of lake, etc.) in opposing corners. For example, if a point in the top left corner was selected, then use an identifiable point in the bottom right corner (see example on previous page). ***It is very important to use opposing corners of the bitmap.*** These points will be used for the calibration.

NOTE: The points selected on the aerial photo must be points that are easily identified on the ground. Be aware that aerial photos may be a few years old and therefore subtle changes may have occurred in the area.

3. Travel to the first of the calibration points to measure and record the latitude and longitude repeatedly for approximately 30 minutes. Discard any unrealistic data (latitude or longitude that is greatly different from the other measurements) and average the remaining data. This averaged point will be used in the VRAP software.
4. Repeat Step 3 for the other calibration point.
5. Identify a couple of additional points on the photo and record the latitude and longitude of these points. These additional points will be used to check the calibration in the VRAP software and do not need to be averaged as the calibration points were (see Step 3).
6. Enter the VRAP software and insert the background image for the project (see *Preview* in the *Background image* section).
7. Calibrate the background image (see *Background image* in the *Calibrations* section of the Appendix).

Using a Differential GPS without an Electronic Aerial Photo

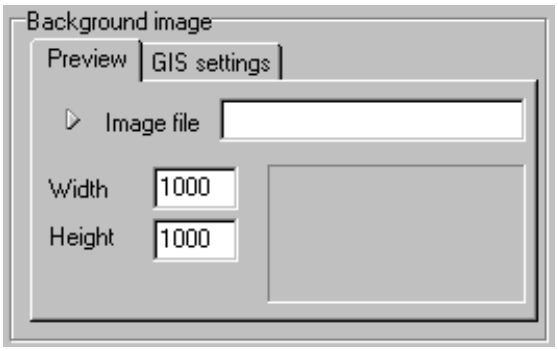
This method is best used with a differential GPS device that will record points, download them to a computer, and plot the points on the screen.

1. Use the differential GPS to record the general shape of the project area. For example, if the project is to be conducted in a lake, record the GPS data while walking or boating around the circumference of the lake.
2. Record two points in opposing corners of the project area. For example, if a point in the top left corner was selected, then use a point in the bottom right corner (see example on previous page). ***It is very important to use opposing corners of what will be the bitmap.*** At each calibration point, measure and record the latitude and longitude repeatedly for approximately 30 minutes. Discard any unrealistic data (latitude or longitude that is greatly different from the other measurements) and average the remaining data. The averaged points will be used in the VRAP software.
3. Select a couple of extra points and record their latitude and longitude information. These additional points will be used to check the calibration in the VRAP software and do not need to be averaged as the calibration points were.
4. Download the data and view it on the computer screen at the desired scale.
5. Copy the screen by simultaneously pressing the Alt and Print Screen keys.
6. Paste the screen into a graphics program that works with bitmaps, such as Paint or Photoshop.
7. Make desired changes to the bitmap, such as tracing the outline of the lake, adding reference points, etc.
8. Save the bitmap, making note of its name and location.
9. Enter the VRAP software and insert the background image for the project (see *Preview* in the *Background image* section).
10. Calibrate the background image (see *Background image* in the *Calibrations* section of the Appendix).

PREVIEW

The *Preview* page in the *Background* section of the *Project* page is used to select the background that will be seen on the computer screen during a study or playback. Initially, there is nothing in the *Preview* section, as shown below. If a bitmap is available of the study area, enter the file path in the *Image file* box, or click the arrow to the left of the *Image file* box to browse for the file. The file must be in **bitmap** (.bmp) form to be compatible with the VRAP program.

After a file has been entered, it is previewed in the window, as shown in the *Project settings* window on the previous page. The default width and height are set at 1000 meters. If latitude and longitude information is available for the background site, the information is entered using the *GIS settings* page. Otherwise, enter the width and height of the bitmap image **in meters**.



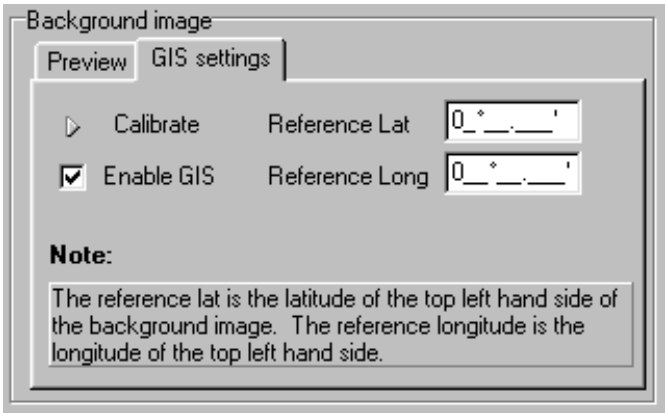
NOTE: Bitmap resolution should be approximately 200dpi. High resolution bitmaps will use additional computer resources and may significantly slow down the system.

GIS SETTINGS

The details pertaining to the background selected in the *Preview* page are specified in the *GIS settings* page (GIS is Geographical Information System). When initially selected, the page appears as the one shown below. Selecting the arrow symbol to the left of Calibrate will open the *Calibrate background* window to allow the exact points to be chosen on the bitmap and the corresponding latitude and longitude to be entered (see *Calibration* section of Appendix for details).

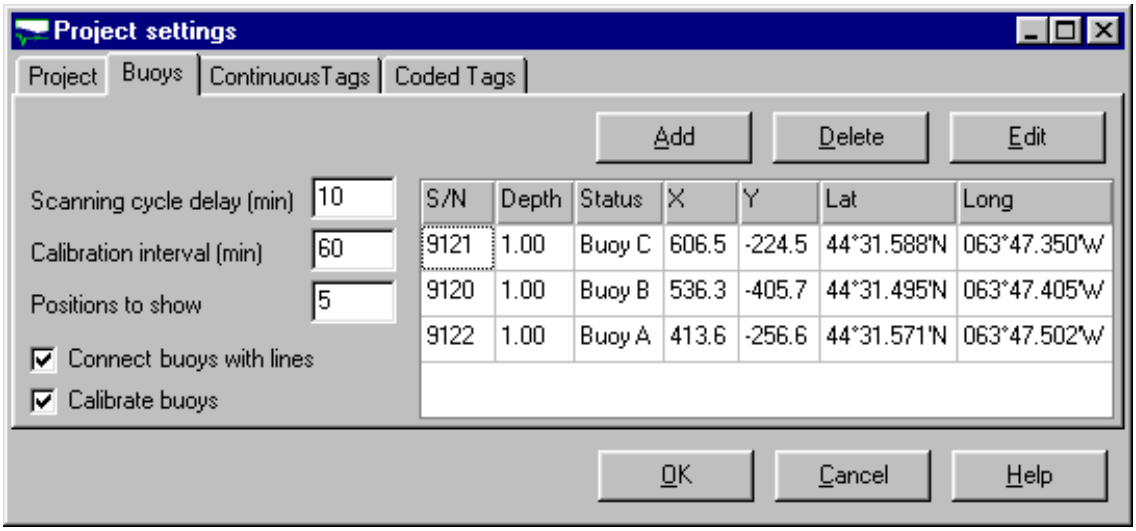
After the background has been calibrated, the *Reference Lat* and *Reference Long* values appear in the respective boxes. These values refer to the **top left corner** of the background.

The *Enable GIS* must be selected (checkmark in box) in order for the latitude and longitude information to be shown on the screen and stored in the study file along with the X and Y values.



Buoys

The *Buoys* page in the *Project settings* window (shown below) is used to enter information pertaining to the buoys. The left side of the page contains operating information necessary for the buoys while the right side contains the information relevant to each buoy.



The buoy information is added by selecting the Add button and filling in the necessary information in the *Buoy setup* window. A buoy is deleted from the list by selecting the desired buoy (Buoy 9121 is selected below) and clicking the Delete button. Selecting a buoy and clicking the Edit button will open the *Buoy setup* window to allow any changes to be made to that buoy's information.

Scanning cycle delay - the length of time, in minutes, the buoys will wait between scanning cycles. This feature is used to conserve buoy battery life.

Calibration interval - the time, in minutes, between automatic buoy position calibrations. The time value used depends on the conditions in which the buoys are operating. A calibration may be forced before the specified time has elapsed. This may be done by selecting *Buoys* in the *Calibrate* option of the *Tools* menu, or by clicking the Calibrate button in the *Chart* window.

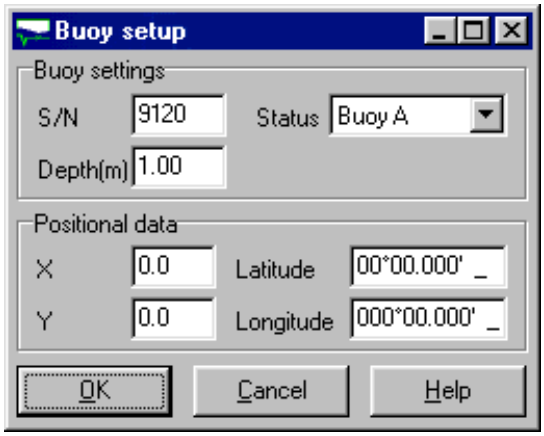
Positions to show - The number of previous buoys positions (previous calibrations) to be displayed on the *Chart* window is entered in the *Position to show* box.

Connect buoys with lines - Selecting the *Connect buoys with lines* option (checkmark in box) will connect the buoys shown in the *Chart* window with three lines. This aids in identifying the study area within the buoys.

Calibrate buoys - When the *Calibrate buoys* box has a checkmark in it, the buoys will be automatically calibrated according to the time entered in the *Calibration interval* box. If the box is not checked then the buoys will not be automatically calibrated and the *Calibration interval* value shown is ignored. The buoys can still be calibrated manually (see *Tools* menu).

Buoy Setup window

The *Buoy Setup* window (shown below) opens when either the *Add* button or *Edit* button is selected in the *Buoys* page of the *Project settings* window. There are two sections within the setup window, *Buoy settings* and *Positional data*.

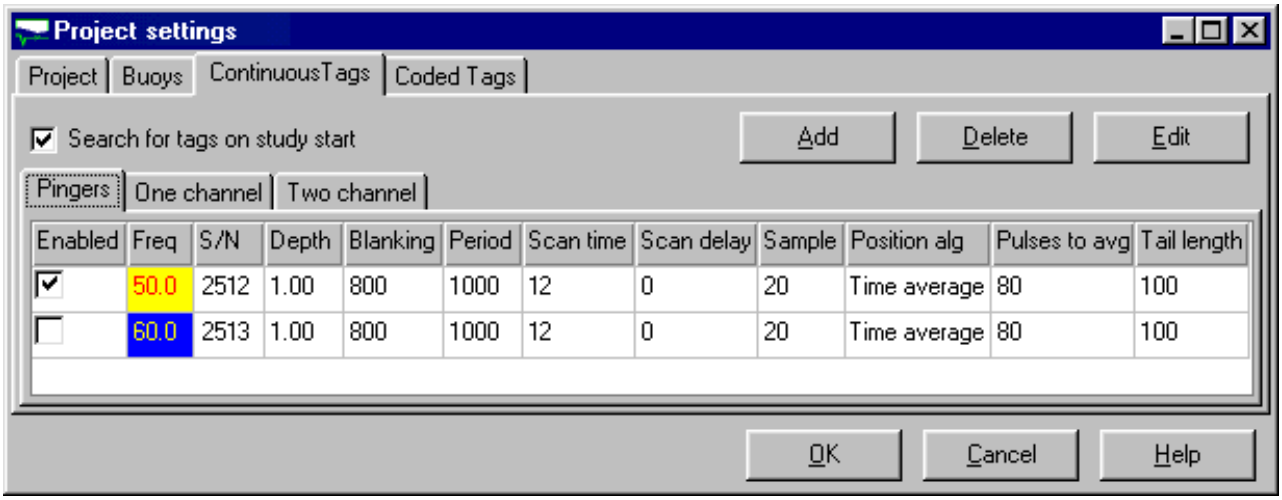


The *Buoy settings* section of the window includes the serial number (S/N) of the buoy, the depth of the hydrophone (in meters), and the status of the buoy. The status indicates the assignment of that buoy. For example, the buoy to be assigned as Buoy A will have Buoy A selected from the pull-down list (click on the down arrow next to the *Status* box). The other status options are Buoy B, Buoy C, and Idle. Idle is used if a buoy is setup in the software but not used in the study.

The positional data of the buoy may be entered in the applicable boxes if the information is known. If the information is not known, the *Calibrate* option under the *Tools* menu can be used to find the position data and that data will automatically be entered in the *Buoy setup* window.

Continuous Tags

The *Continuous Tags* page in the *Project settings* window is used to enter the information pertaining to the different continuous tags. The word "tag" is used to refer to all acoustic transmitter types and is derived from the term "fish tag". The *Search for tags on study start* option determines when the buoys will begin listening for the tags on the selected frequencies. If the option is selected (checkmark in box) then the buoys will begin the scanning cycle of listening for tags ***as soon as*** the study is begun. With the option disabled, the buoys will not begin a scanning cycle until the *Search for tags* button in the *Chart* window is selected.



A continuous tag is added by first selecting the tab with the desired tag type listed (either pinger, one

channel, or two channel), then clicking the Add button, and finally entering the necessary information in the tag setup window. A continuous tag is deleted from the list by selecting the desired tag (click on it with the mouse) and clicking the Delete button. Selecting a tag and clicking the Edit button will open the setup window for that tag to allow any changes to be made to the tag's information.

The information pertaining to each tag is listed in the table for that tag type. A tag will only be used in a study (searched for during a scanning cycle) if the *Enabled* box contains a check mark. Clicking the box with the mouse button will toggle the *Enabled* option on and off.

Continuous Tag Setup windows

When a tag's information is added or edited (see *Tags setup* window), a setup window will appear according to the tag type selected. This window will always contain the sections *Tag parameters*, *Scan options*, *Visual settings*, and *Calculation settings*. Telemetry tags will also have a *Telemetry data* section. A sample *One channel telemetry setup* window is shown below.

Tag parameters:

The *Tag parameters* include the operating frequency of the continuous tag (in kHz), the approximate depth at which the tag is operating (only necessary if the tag does not transmit depth telemetry data), the blanking interval (*Blanking*), and the serial number of the tag.

Two channel continuous telemetry tags also require the sync value (in milliseconds) used to correctly identify the temperature and depth data. If this value is incorrect, the software will be unable to identify the telemetry data from the received pulses. The sync value is usually 1150ms, but should be verified in the Transmitter Specifications manual shipped with the tags.

Scan options:

The ***Enabled*** check box is used to include this tag in the scanning cycle search. Tags can also be enabled from the *Continuous Tags* page in the *Project settings* window.

The ***Scan time*** is the length of time (in seconds) that the buoys will listen for this tag on this frequency. A *Scan time* of 12 seconds is suggested for continuous tags.

The ***Scan delay*** is the length time (in seconds) that the buoys will skip over this tag in the scanning cycle. For example, if the *Scan delay* is set for 300 seconds (5 minutes) then the buoys will not listen for this tag each time it appears in the scanning cycle for five minutes. This is advantageous when using fixed marker tags.

The ***Upload interval*** is the time (in seconds) between data uploads from the buoy to the base station during the *Scan time*. For example, if the *Upload interval* is set for 10 seconds and the *Scan time* is 60 seconds, the buoys will listen for 10 seconds, upload the data, listen for 10 seconds, upload the data, and repeat the cycle of listening and uploading until the 60 seconds have elapsed. The *Upload interval* should not exceed 5 minutes.

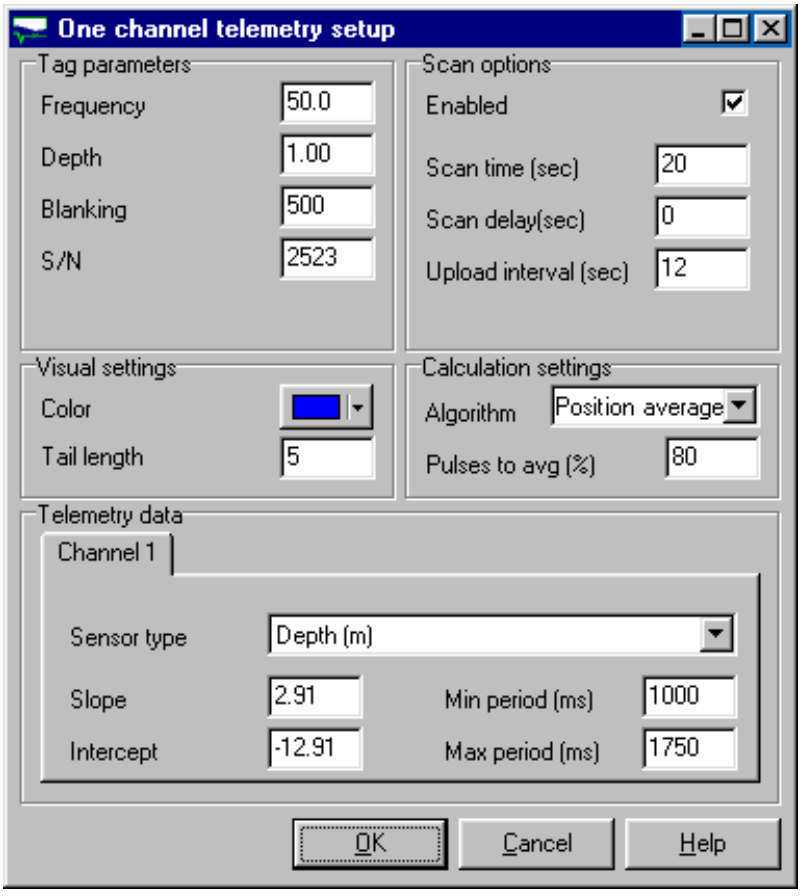
NOTE: When a buoy is uploading data to the base station it can not listen for acoustic tags.

During the *Upload interval*, the buoys with firmware versions 1.16 and higher are in Power Saving mode and the radios on the buoys are off. This means that the base station radio can not communicate with the buoys until the *Upload interval* is complete. This extends the time between buoys battery charges.

Visual settings:

The tag colour can be changed by clicking on the down arrow next to the current colour (blue in the example below) and either selecting a colour from those shown or selecting Other and adding a different colour.

The *Tail length* refers to the number of previous points that will remain in the *Chart* window. After the number of previous points has been met, the most recent points will remain and the oldest point will be removed from the screen. For example, if the *Tail length* was set to five points, when the sixth point is received it will be plotted on the screen and the first point will be removed.



Calculation settings:

The algorithm used to calculate the position of a tag may be selected from the three given in the pull-down list, namely *Fast track*, *Time average*, and *Position average*.

The VRAP software performs a statistical analysis to the received data and identifies the best data. The *Pulses to avg* value is the percentage of data to be considered as "best" data and be used in the algorithms. This value does not need to be set at the same value for all tags.

Telemetry data:

The *Telemetry data* section is only visible if the continuous tag type has telemetry capabilities. Two channel telemetry will have two "pages" in this section, one with a tab marked Channel 1 and a second tab marked Channel 2. A one channel continuous telemetry tag setup will only have the Channel 1 page. Both channels require the same information in order to correctly report the telemetry data.

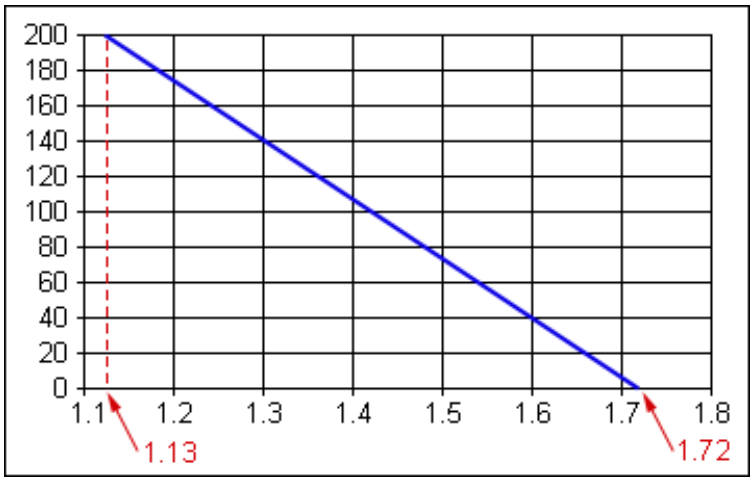
The sensor type can be either temperature (in Celsius) or depth (in meters). Select the desired sensor type from the pull-down list. The slope (m/s), intercept (m), minimum period (ms), and maximum period (ms) values are mandatory for the software to correctly interpret the telemetry data. The values are all listed in the Transmitter Specifications manual that was shipped with the tags. The slope and intercept are found in the table at the beginning of Transmitter Specifications manual. The minimum period and maximum period are taken from the graphs at the back of the Transmitter Specifications manual by following the steps listed below.

<u>Min/Max Period</u>:

1. Identify the correct graph for the transmitter. The transmitter serial number is listed below the graph.
2. Calculate the minimum period value:
   a. Read the minimum period from the graph. This will be the left end of the graph line. The graph below identifies this point and gives a minimum period of 1.13 seconds.
   b. Convert the period from seconds to milliseconds by multiplying it by 1000. In the example below, the minimum period of 1.13 seconds becomes 1130 milliseconds (ms).
   c. Subtract 100ms from the minimum period read from the graph and round the value to the nearest hundred milliseconds. The example's value of 1130 ms becomes 1000 ms. This is the minimum period value.
3. Enter the minimum period value in the "Min period (ms)" box in the tag setup window.
4. Calculate the maximum period value:
   a. Read the maximum period from the graph. This will be the right end of the graph line. The graph below identifies this point and gives a maximum period of 1.72 seconds.
   b. Convert the period from seconds to milliseconds by multiplying it by 1000. In the example below, the maximum period of 1.72 seconds becomes 1720 milliseconds (ms).
   c. Add 100ms from the maximum period read from the graph and round the value to the

nearest hundred milliseconds. The example's value of 1720 ms becomes 1800 ms. This is the maximum period value.

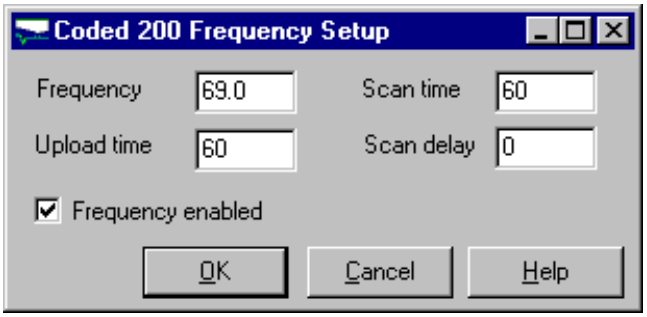
5. Enter the maximum period value in the "Max period (ms)" box in the tag setup window.



Coded Tags

The *Coded Tags* page in the *Project settings* window is used to enter the frequency and information pertaining to the different coded tags to be used with the buoys. The word "tag" is used to refer to all acoustic transmitter types and is derived from the term "fish tag". A coded tag uses a group of pulses to transmit an identification code (ID code) on a set frequency. This allows a large number of coded tags to be used on the same frequency. There are also different types of coded tags. The differences are explained in the *Coded Channels* section of the Appendix.

When the *Coded Tags* page is initially opened, there are no frequencies setup. To add a frequency, select the Add button in the top right corner of the *Coded Tags* page. This will open the *Coded 200 Frequency Setup* window, shown here. Enter the frequency, *Upload time*, *Scan time*, and *Scan delay* (these are explained below). Be sure the *Frequency enabled* box is checked, otherwise this frequency will be skipped over during a study.



The ***Scan time*** is the length of time (in seconds) that the buoys will listen for tags on this frequency. A *Scan time* of 60 seconds is suggested for coded tags if a number of frequencies are in the scanning cycle list. If only coded tags are being used and the tags are all on one frequency, then a larger *Scan time* is suggested, such as an hour.

The ***Scan delay*** is the length time (in seconds) that the buoys will skip over this tag in the scanning cycle. For example, if the *Scan delay* is set for 300 seconds (5 minutes) then the buoys will not listen for this tag each time it appears in the scanning cycle for five minutes. This is advantageous when using fixed marker tags.

The ***Upload interval*** is the time (in seconds) between data uploads from the buoy to the base station during the *Scan time*. For example, if the *Upload interval* is set for 20 seconds and the *Scan time* is 80 seconds, the buoys will listen for 20 seconds, upload the data, listen for 20 seconds, upload the data, and repeat the cycle of listening and uploading until the 80 seconds have elapsed. The *Upload interval* for coded tags should be at least the same length of time as the maximum off time for the tag (listed in the *Transmitter Specifications* manual).

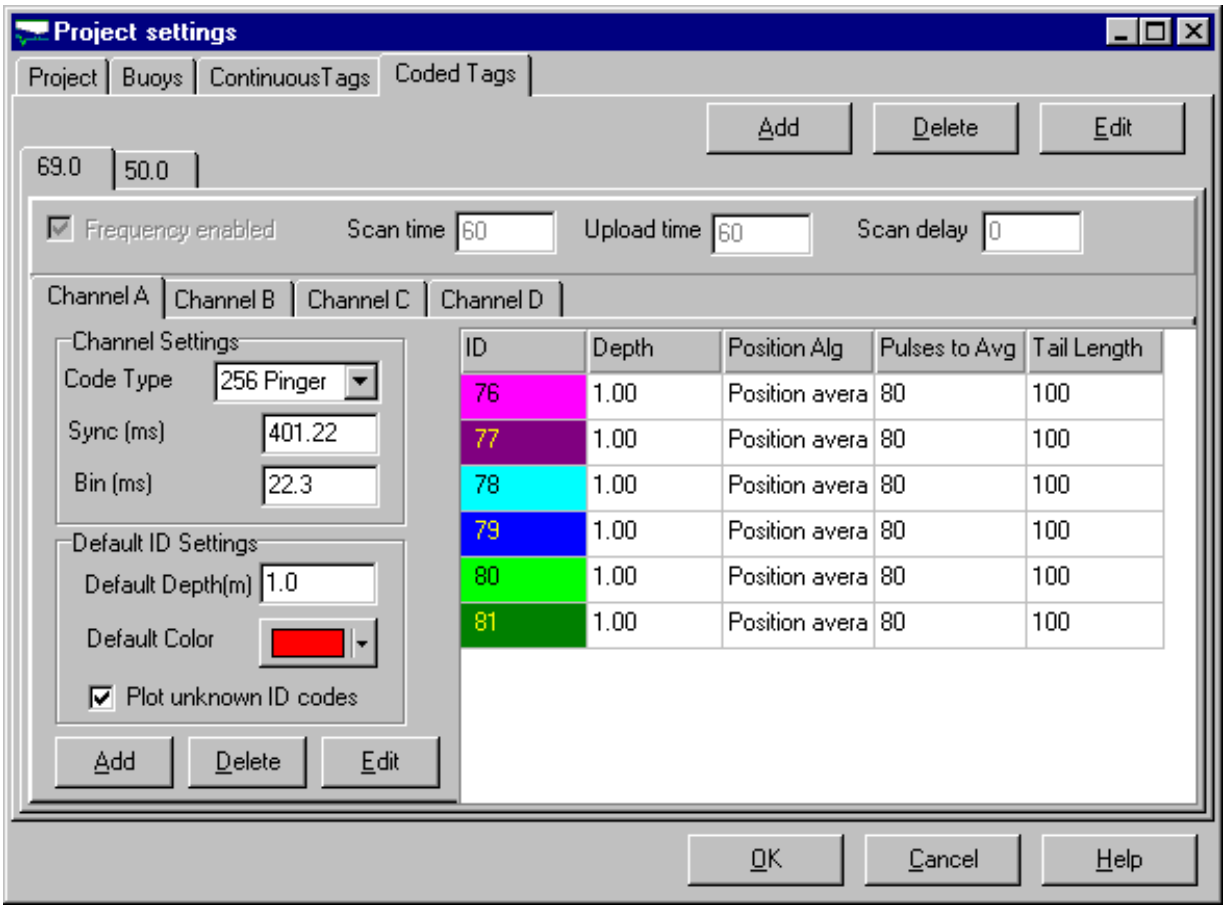
NOTE: When a buoy is uploading data to the base station it can not listen for acoustic tags.

During the *Upload interval*, the buoys with firmware versions 1.16 and higher are in Power Saving mode and the radios on the buoys are off. This means that the base station radio can not communicate with the buoys until the *Upload interval* is complete. This feature extends the time available between buoys battery charges.

After the frequency has been setup, select the OK button on the *Coded 200 Frequency Setup* window and the new frequency will be added to the *Project settings* window with the Default "D" coded map settings (see the Appendix for details) for the coded channels. The values entered in the *Coded 200 Frequency Setup* window will be displayed at the top of the frequency page but will not be directly accessible for editing.

A frequency can be edited by selecting the frequency tab (69.0kHz is selected in the window below) and then clicking the Edit button in the top right corner. The *Coded 200 Frequency Setup* window will re-open and allow changes to be made to everything in the window except the frequency.

A frequency can also be deleted by selecting the frequency tab (69.0kHz is selected in the window below) and then clicking the Delete button in the top right corner. A warning will appear indicating that all transmitters setup on that frequency will be deleted if the frequency is deleted. The frequency will not be deleted unless the Yes button is selected.



After a frequency has been entered, any tags received on that frequency will be detected and identified by their ID code if they conform to the default coded channel setup. For custom tags with sync and bin values that are not the default values, the coded channels (A, B, C, and D) must be setup to match the tags. This is done in the *Channel Settings* section of the frequency page.

Channel Settings:

The *Channel Settings* section includes the *Code Type*, the *Sync* value (in milliseconds), and the *Bin* value (in milliseconds). These three settings must match the settings of the tag for the tag to be correctly identified by the receivers on the buoys. The tag settings are found in the *Transmitter Specifications* manual included with the tags when they are shipped from the factory.

The *Code Type* can be changed by selecting another option from the pull-down list. The differences between the code types is explained in the *Coded Transmitter Types* section of the Appendix. The sync and bin values may be entered in the boxes marked *Sync* and *Bin*.

If another type of coded receiver is being used with the study, such as a VR60, it is suggested that the different receivers be setup with the same channel setup. For example, the setup for Channel A on the buoys should match the setup of Channel A on the VR60, the setup for Channel B on the buoys should match the setup of Channel B on the VR60, and so forth.

Default ID Settings:

The *Default ID Settings* section of the frequency page is used to set the approximate depth value needed for position calculations (unless the tag measures depth) and the default colour which will represent tags received on this frequency in the Chart window.

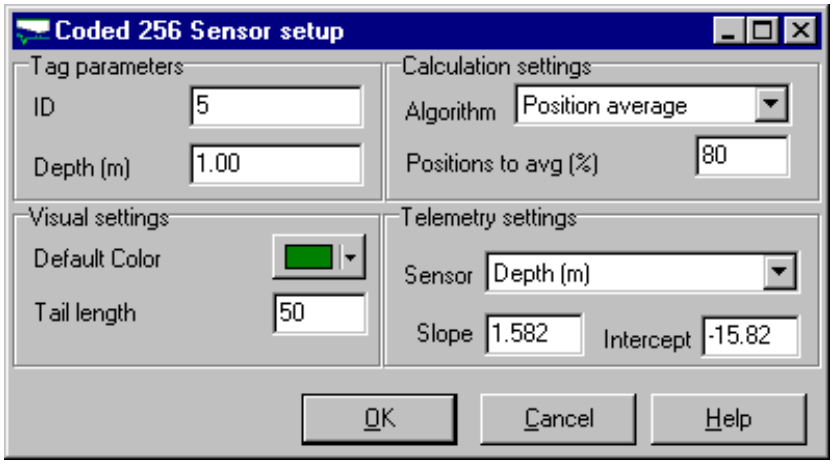
The *Plot unknown ID codes* option will allow all received ID codes to be displayed in the Chart window. Disabling this feature (removing the check mark) will allow only tags that have been setup, and therefore are "known" to the program, to be shown in the Chart window. All received ID codes will be stored in memory, but only tags that were setup will be displayed.

A tag can be added to, deleted from, or edited in a frequency by selecting the appropriate button at the bottom left corner of that frequency page. When the Add or Edit buttons are selected, a window will open to allow the addition or changes to be made. This window is discussed in the *Coded Tag Setup Windows* section. When the Delete button is selected, the highlighted tag in the list on the right side of the window will be deleted. There is no warning window or undelete feature so be sure the desired tag is the one highlighted.

For studies with large numbers of coded tags, it is suggested that the individual tags not be added to the software. The buoys will identify any tags with the same *Channel Settings* information and be able to do so faster than if each individual tag had been setup. For smaller studies where each tag is to be identified with a unique colour, the tags will have to be setup. Also, telemetry tags must be setup for correct interpretation of the data. In the example window on the previous page, the tags with ID codes 76, 77, 78, 79, 80, and 81 have been setup with unique colours. Any additional tags received on this frequency and code type will be shown in the default colour, red.

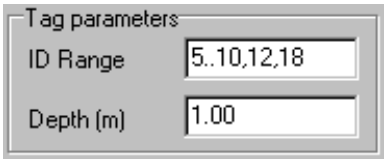
Coded Tag Setup Windows

When a coded tag's information is added or edited, a setup window will appear according to the tag type selected. This window will always contain the sections *Tag parameters*, *Visual settings*, and *Calculation settings*. Telemetry tags will also have a *Telemetry settings* section. A sample *Coded 256 Sensor setup* window is shown below.



Tag parameters:

The *Tag parameters* include the ID code and the approximate depth at which the tag is operating (only necessary if the tag does not transmit depth telemetry data). If the tag is being edited, the ID code number is disabled and therefore not available for changes. When a group of pingers (without telemetry) are being added with the same code type, sync, and bin, the ID numbers may be entered as a range or group. In the example shown below, the pingers with ID codes 5, 6, 7, 8, 9, 10, 12, and 18 are entered at one time. Two dots between two numbers will add all numbers between the two (eg. 5..10). A comma between two numbers will add both numbers but no numbers between them (eg. 12,18).



Visual settings:

The tag colour can be changed by clicking on the down arrow next to the current colour (green in the example above) and either selecting a colour from those shown or selecting Other and adding a different colour.

The *Tail length* refers to the number of previous points that will remain in the *Chart* window. After the number of previous points has been met, the most recent points will remain and the oldest point will be removed from the screen. For example, if the *Tail length* was set to five points then when the sixth point is received it will be plotted on the screen and the first point will be removed.

Calculation settings:

The algorithm used to calculate the position of a tag may be selected from the three given in the pull-down list, namely *Fast track*, *Time average*, and *Position average*.

The VRAP software performs a statistical analysis to the received data and identifies the best data. The *Pulses to avg* value is the percentage of data to be considered as "best" data and be used in the algorithms. This value does not need to be set at the same value for all tags.

Telemetry settings:

The *Telemetry settings* section is only visible if the 256 Sensor tag type is selected, which has telemetry capabilities.

The sensor type can be either temperature (in Celsius) or depth (in meters). Select the desired sensor type from the pull-down list. The slope (m/s or °C/s) and intercept (m or °C) values are all listed in the Transmitter Specifications manual that was shipped with the tags. These values are mandatory for the software to correctly interpret the telemetry data.

WINDOW MENU

When a study or playback is in operation, a list of the opened windows is shown at the bottom of the *Window* menu (below the double line). Selecting one of these windows from the list will make that window the active window and bring it to the front if it is covered or restore it if it has been minimized.

Tile

The *Tile* command in the *Window* menu will arrange the windows open during a study or a playback so they are all visible. The active window at the time the *Tile* command was given will be positioned in the top left corner of the *VRAP* window. This method of viewing the windows works best with a large computer screen.

Cascade

The *Cascade* command in the *Window* menu will arrange the windows open during a study or a playback so they are all stacked on top of each other with only the title bar visible on the lower windows. The active window at the time the *Cascade* command was given will be positioned on the top of the stack.

Arrange Icons

The *Arrange Icons* feature will arrange the icons of any minimized windows in the bottom left corner of the *VRAP* window. A window must be minimized before the *Arrange Icon* command will have any effect on it. The icon closest to the bottom left corner at the time the command was given will be the first in the corner, and so on. If the *VRAP* window is not wide enough to accommodate all the icons then they will be stacked.

VIEW MENU

Zoom In

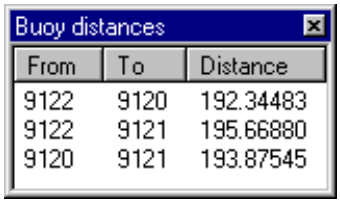
The *Zoom In* feature allows the image in the *Chart* window to be zoomed in. Position the image (pan) so the area of interest is in the center of the *Chart* window before clicking the *Zoom In* feature. The *Zoom In* feature can be accessed either in the *View* menu or by clicking the button with the magnifying glass and the plus symbol on it in the *Chart* window.

Zoom Out

The *Zoom Out* feature allows the image in the *Chart* window to be zoomed out. The *Zoom Out* feature can be accessed either in the *View* menu or by clicking the button with the magnifying glass and the negative symbol on it (shown below) in the *Chart* window.

Buoy Distances

The *Buoy Distances* option in the *View* menu will open the *Buoys distances* window (shown below) to display the last known distances between each pair of buoys. The buoys are identified by their serial number and the distances are given in meters.



TOOLS MENU

Calibrate

There are a number of aspects of the VRAP system that can be calibrated and can be accessed from the *Tools* menu. These include: *Buoys*, *Speed of sound*, and *Background image*. Each of these can also be accessed from different locations within the software.

Buoys

The *Buoys* command in the *Calibrate* section of the *Tools* menu will open the *Chart* window without beginning a study (the *Search for tags* and *Stop searching for tags* buttons are not present). Clicking the *Calibrate buoys* button in the top left corner will begin the process of

calibrating the positions of the buoys. The *Buoy status* window will also open. A more in depth explanation is given in the *Calibrations* section of the Appendix.

Speed of sound

The exact speed of sound in water is actually a function of the salinity of the water, and may be calibrated for the project area by using the buoys. This calibration may also be accessed from the *Project* page of the *Project settings* window (see *Edit* menu). The necessary steps are listed in the Calibration section of the Appendix.

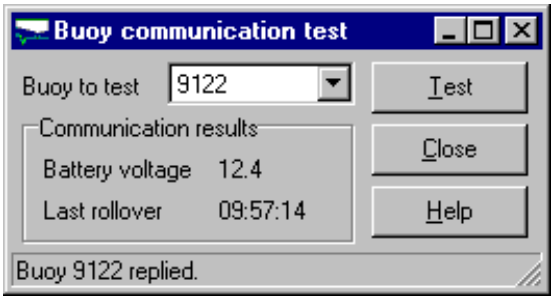
Background image

The background image shown in the *Chart* window (during a study) or *Playback* window (during a playback) can be tied to the actual latitude and longitude values. How the background image is calibrated is detailed in the Calibrations section of the Appendix.

Test communications

The *Test communications* option in the *Tools* menu will open the *Buoy communication test* window. Communication between the base station and each buoy can be tested individually. Select the desired buoy from the pull-down list in the *Buoy to test* box. Click the *Test* button on the right side of the window. The bottom of the window is the status line and the events during the communication test will be shown there.

After the communication test is completed, the battery voltage (in Volts) and the time of the last roll over (in hours) will be shown in the *Communication results* section of the window. A counter within the program will rollover every time the buoy is reset (powered up) and every 15.5 hours after power up. The *Last rollover* is the time the counter last rolled over. This information has trouble shooting benefits.



Sleep

The *Sleep* command in the *Tools* menu will put the buoys in a low power mode (or "sleep" mode) to conserve the battery life of the buoys while they are not in use.

To power up a buoy after it has been put in sleep mode, send any command to that buoy. The simplest method is probably to test the communication of the buoy.

NOTE: Due to improvements to the buoy firmware, the buoy radios drain less power from the batteries while they are running than while they are in sleep mode. Plans are in place for future improvements to sleep mode so it will drain less power than it presently does.

STUDY MENU

Start

The *Start* command in the *Study* menu will begin a study. Six windows will open to display the information collected during the study. These windows are titled: *Chart window*, *Buoy status*, *Tag status*, *Track history*, *Waypoints*, and *Study notes*. The windows will appear in the same manner they appeared when the last study was ended. For example, if a window was minimized when the previous study was ended, then that window will be minimized when the new study is begun. The window locations may be arranged using the options available in the *Window* menu.

The data received during a study is **automatically** saved in a data base as the study progresses. The data base is in the same directory as the project file. ***This directory should be backed up regularly.*** For large studies over a number of days, the directory should be backed up daily.

A study is ended by selecting the *Stop study* command, or by clicking the "X" in the top right corner of the *Chart* window.

Stop study

The *Stop study* command (in the *Study* menu) is given to end the current study, which was begun using the *Start* command. Clicking the "X" in the top right corner of the *Chart* window will also end a study.

Playback

The *Playback* command, within the *Study* menu, allows a previous study to be viewed again by replaying the plot file. Six windows will open to display the information collected during the study. These windows are titled: *Study playback*, *Buoy status*, *Tag status*, *Track history*, *Waypoints*, and *Playback*. The windows will appear in the same manner they appeared when the last playback or study was ended. For example, if a window was minimized when the last playback or study was ended, then that window will be minimized when a new playback is begun. The window locations may be arranged using the options available in the *Window* menu.

When *Playback* is selected, the *Open* window will appear to allow the desired plot file to be chosen. The plot files are named according to the date and order in which they were created (see *Plot file naming convention* section).

HINT: Use the *Pause* feature (see *Playback window* section) to pause the playback while analysing data that is time sensitive.

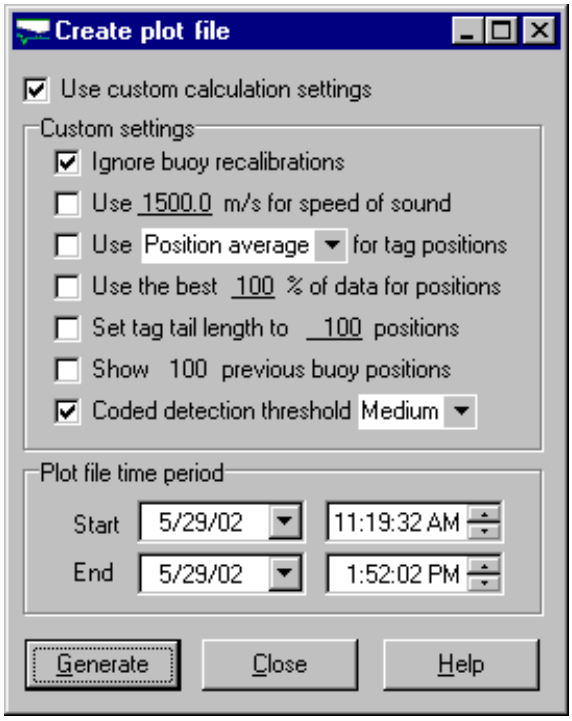
A playback is ended by selecting the *Stop playback* command, or by clicking the "X" in the top right corner of the *Study playback* window.

Stop playback

The *Stop playback* command, within the *Study* menu, is given to end the current playback of a study, which was begun using the *Playback* command. Clicking the "X" in the top right corner of the *Study playback* window will also end the playback of a study.

Build plot file

The information received during a study is stored in a data base and a plot file is created based on the settings used during the study. The *Build plot file* command, within the *Study* menu, allows a new plot file to be created from previous study data. A plot file was created during the study based on the settings at the time of the study. Other plot files can be created using different settings than those in the original study, and/or for a specific time period within the study.



Plot file naming convention

Plot files are named using the convention VRAP YYYY-MM-DD.ZZZ, where:

YYYY-MM-DD = date the plot file was created (year month day)
ZZZ = number of plot files created on this date (beginning with 000)

An example of a plot file name is VRAP 2002-05-14.001, which is the second time a plot file was created on May 14, 2002. The third plot file created on the same day would be VRAP 2002-05-14.002. The file extension on the plot file increments by one each time a new plot is created as long as all plot files are created in the same directory location.

NOTE: By default, the *Plot file time period* covers all completed studies in a project.

To create a new plot file:

1. Select *Build plot file* in the *Study* menu.
2. Select the project file (with a ".vrp" extension) in the *Open* window and click the Open button. The *Create plot file* window will open.
3. To make a subset plot file with the original settings, enter the start and end times (with the correct dates) in the *Plot file time period* section of the window. The *Use custom calculations settings* box should be empty (no checkmark). Click the Generate button.
4. To make a plot file using different settings, click the *Use custom calculations settings* box. Make the desired changes within the *Custom settings* section (these are explained below). The box to the left of the desired change **must contain a check mark** for the change to occur. If a subset plot file is also desired, enter the start and end times (with the correct dates) in the *Playback file time period* section of the window. Click the Generate button.
5. View the new plot file by selecting *Playback* in the *Study* menu and selecting the new plot file within the Open window.

Custom settings options:

NOTE: A change will only occur if the box associated with that change contains a check mark.

Ignore buoy recalibrations: New playback file will use the data based on only the initial positions of the buoys, before buoy calibrations we made in the study.

Use ___m/s for speed of sound: Enter a new speed of sound to be used to calculate the position of a tag (must click on the value currently shown before new value can be entered).

Use (pull-down list) *for tag positions*: Select the algorithm that is to be used to plot the tag positions from the pull down list. The options are: *Fast track*, *Time average*, and *Position average*.

Use the best ___% of data for positions: The VRAP software performs a statistical analysis to the received data and identifies the best data. Enter the new percentage of this best data to be used in the positioning algorithm (*Fast track*, *Time average*, and *Position average*). This feature is referred to as *Pulses to Avg* in the transmitter setup sections.

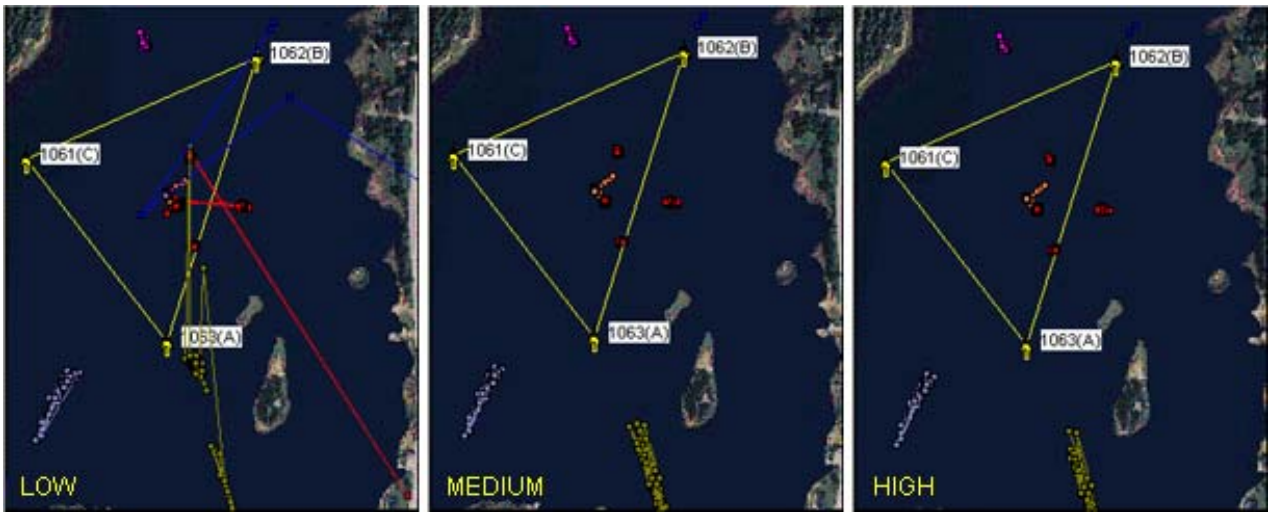
Set tag tail length to ___positions: The tail length refers to the number of previous points that will remain in the *Playback* window. After the number of previous points has been met the most recent points will remain and the oldest point will be removed from the screen. For example, if the *Tail length* was set to five points, when the sixth point is received it will be plotted on the screen and the first point will be removed. All of the points are in the plot file, but only the tail length points will be seen on the screen.

Show ____ previous buoy positions: The number of pervious buoys positions (previous calibrations) to be displayed in the *Playback* window. A 24 hour period is suggested.

Coded detection threshold (pull-down list): The minimum number of pulses required from a coded tag in order to consider a position valid enough to be plotted. One buoy must receive a complete coded pulse train to identify the tag (ID code) but the number of pulses received by the other two buoys to plot a position may be varied. There are three levels available for the detection threshold, which are listed in the table below. As the number of tags in a study increases, the threshold level should increase to reduce false positions. A study plotted in real time is shown with the Medium threshold level.

Coded Detection Threshold Levels	
THRESHOLD NAME	REQUIREMENTS
Low	Sync + 1 pulse
Medium	Sync + 2 pulses
High	Sync + 3 pulses

The example shown below was taken from a study with 21 tags that had little movement. As expected, the best position results occur within the triangle made by the buoys. The sample on the far left, which is a plot file with a low threshold setting, shows that the displayed results could be very uncertain. With fewer tags in the water, the results from a low threshold setting may be less dramatic. The results using medium and high settings are much cleaner of "flyers" (a single position that implies a tag moved a great distance and then immediately back again).



NOTE: This is a post-processing function and has ***no effect*** on the stored data.

HELP MENU

Help Topics

Selecting *Help Topics* under the *Help* menu will open the help window. The window offers the options:

Contents

To select a general topic for overall help, use the *Contents* feature. Open a topic by double clicking on the book symbol next to the name, or on the name itself. A list of sub-topics will appear to choose from. Double clicking on one of these sub-topics will open the help topics related to that general topic.

Index

To select a specific topic, use the *Index* feature, which will display the complete list of topics in the help file. To select a topic, either move through the list (using the arrow keys or the scroll bar) until the desired topic is highlighted, or type the name in the box at the top of the window. As the name is entered, the list will reflect the letter being entered. For example, if the letter "t" is entered, the list will alter so the "t" section is shown. Once the topic is highlighted, either select *Display* at the bottom of the window, or double click on the topic name.

Find

To search for a specific word within a topic use the *Find* feature. A word list must be created if *Find* has not been previously used. Simply follow the on-screen instructions to setup *Find*. If *Find* is not desired, select *Cancel*. A list of topics containing the desired word is listed in the third box from the top. Select a topic and click the *Display* button at the bottom of the window.

How to Use Help

The *How to use help* feature provides access to the Windows Help file, which provides step-by-step directions on using a help file.

About

About provides information about the VRAP software, such as the version number. It also contains information on how to contact VEMCO Ltd.

DISPLAY WINDOWS

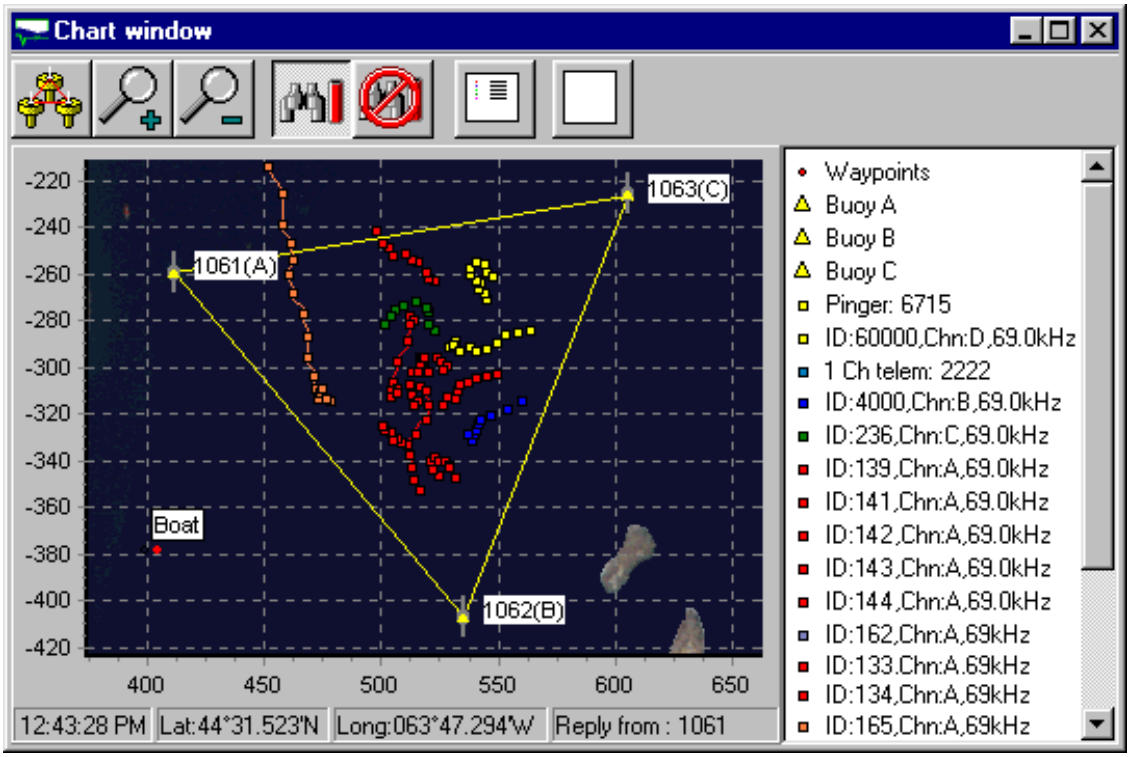
Chart window

The *Chart* window displays the locations of the buoys, any received tags, and any waypoints on the selected background when a study is being run. The background, with the buoys and tags, can be panned to reposition what is seen in the window. If a gray background is shown, and a bitmap image was imported, zoom out until the image can be seen and pan until the image is in the center of the chart and zoom in.

The buoy locations, and if there are lines connecting the buoys, is selected in the *Buoys* section of the *Project settings* window.

The buttons in the top left corner of the window are (from left): *Calibrate buoys*, *Zoom in*, *Zoom out*, *Search for tags*, and *Stop searching for tags*. The *Search for tags* button (with the binoculars and tag) will begin a scanning cycle to search for tags enabled in the study. The *Stop searching for tags* button (the *Search for tags* button symbol with a "no" symbol over top) will stop a previously started scanning cycle.

A legend is shown to the right of the chart, listing the symbols used in the study and the received tags. The legend button at the top of the window will toggle the legend between scroll and non-scroll modes, which is especially advantageous when there are more tags than will fit in the legend. The legend in the window shown below is in scroll mode. The scroll legend will not print directly from VRAP software (see *Print* in the *File* menu).



The current computer time is displayed in the bottom left corner of the window. Next to the time is the latitude and longitude matching the current location of the mouse arrow. The right corner has the status line, displaying the current operation of the software. In the sample window above, the software is receiving a reply from the buoy SN 1061.

The horizontal axis at the bottom of the background is the X axis, with the zero X value at the horizontal center of the background. The Y value may be read from the vertical axis, and the zero Y value is at the vertical center of the background. The grid corresponding with these axises may be toggled on and off with the Grid button at the top of the *Chart* window. If the grid lines are visible then the button looks like a blank piece of white paper. When the grid is off, the button looks like a grid.

More than one tag may be represented by the same symbol, especially if coded tags are involved in the study. A tag can be identified in the plot by clicking on the tag symbol with the left mouse button. This will open the list shown here. Selecting "Tab to Front" in the list will move the selected tag to the front in the *Track history* window (see *Track history* in the *Display Windows* section of this manual).

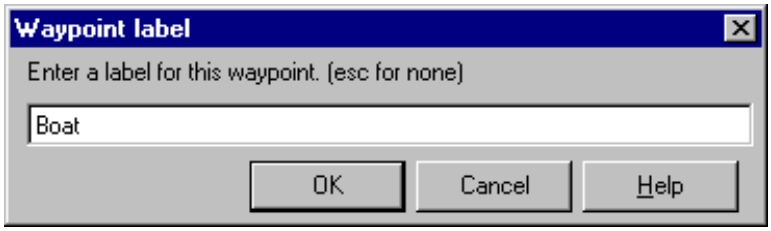
Shadows zones are three areas around the buoy configuration where the position calculation of a transmitter will have two solutions (see Introduction for more details). The VRAP software will assume that the pseudo position closest to the last valid position is the correct one and will plot this position in the *Chart* window. The shadow positions may be viewed by left clicking on the desired tag position and selecting from the list (shown here). The options are: Show Primary, Show Shadow, Show Both, Hide Both, Show All, and Hide All. This may also be accomplished in the *Visibility* column of the *Track history* window.

Create waypoint

A waypoint can only be created while a study is being run, and from within the *Chart* window. Click the middle mouse button while the mouse is over the *Chart* window. The options *Add waypoint* and *Show all waypoints* will appear.

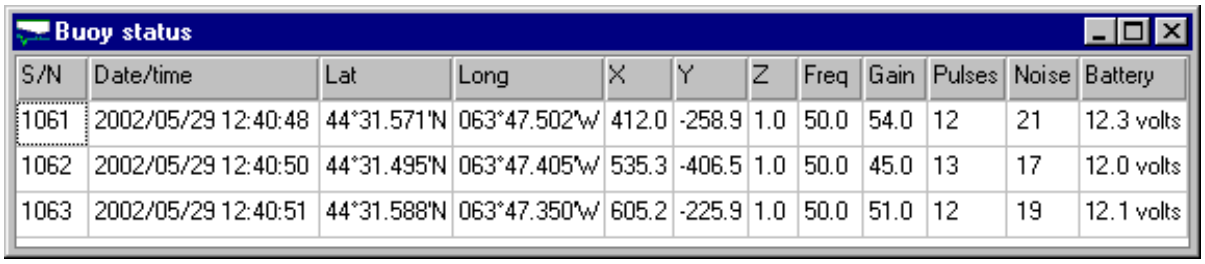
Selecting *Add waypoint* will turn the mouse arrow to a pointing hand. Click the tip of the index finger of the hand on the location in the background for the new waypoint. The *Waypoint label* window (shown below) will appear for the waypoint's label to be entered. This label will be shown in the *Chart* window and in the *Waypoints* window. If a label is not desired, then press the Escape (Esc) key on the computer keyboard.

The *Show all waypoints* option will display all the waypoints in the study, including the ones whose visibility was removed in the *Waypoints* window.



Buoy status

The *Buoy Status* window, which opens during either a study or a playback, contains the list of buoys (by serial number) with the date and time of the last communication with the buoy, the current location (latitude, longitude, X, and Y values), the depth of the buoy's hydrophone (as assigned during buoy setup), the receiver gain, the number of pulses received by the buoy in the last upload interval (the time between data uploads from the buoy to the base station, assigned during tag setup), the noise level, and the voltage level of the buoy's battery (in Volts).

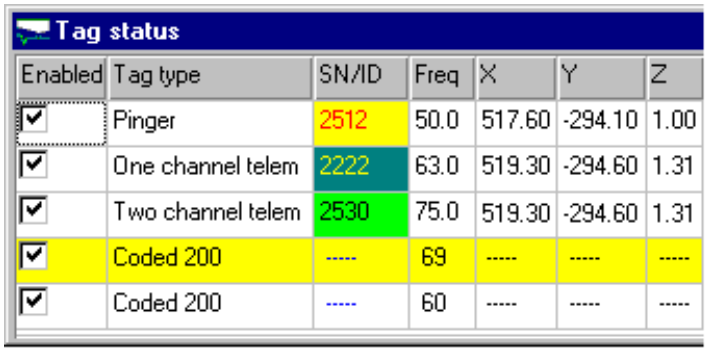


S/N	Date/time	Lat	Long	X	Y	Z	Freq	Gain	Pulses	Noise	Battery
1061	2002/05/29 12:40:48	44°31.571'N	063°47.502'W	412.0	-258.9	1.0	50.0	54.0	12	21	12.3 volts
1062	2002/05/29 12:40:50	44°31.495'N	063°47.405'W	535.3	-406.5	1.0	50.0	45.0	13	17	12.0 volts
1063	2002/05/29 12:40:51	44°31.588'N	063°47.350'W	605.2	-225.9	1.0	50.0	51.0	12	19	12.1 volts

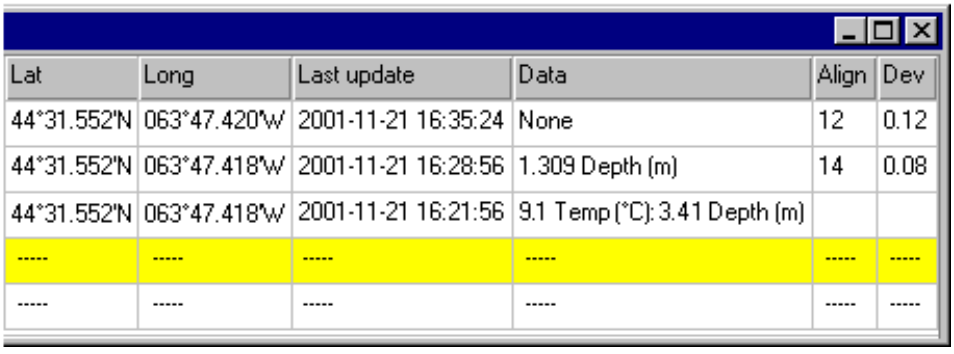
Tag status

The *Tag status* window opens during either a study or a playback. The window contains the current information for each continuous tag that has been setup, including: enabled, tag type, serial number, frequency, X and Y co-ordinates on bitmap, Z (depth as assigned in tag setup), latitude, longitude, last update, received data, alignment, and deviation. Each of these are explained below. The window also displays the frequencies setup for coded tags, but does not have any additional information because a large variety of tags may be present on that frequency.

The *Tag status* window shown below has been split in two to allow it to fit on this page.



Enabled	Tag type	SN/ID	Freq	X	Y	Z
☑	Pinger	2512	50.0	517.60	-294.10	1.00
☑	One channel telem	2222	63.0	519.30	-294.60	1.31
☑	Two channel telem	2530	75.0	519.30	-294.60	1.31
☑	Coded 200	-----	69	-----	-----	-----
☑	Coded 200	-----	60	-----	-----	-----



Lat	Long	Last update	Data	Align	Dev
44°31.552'N	063°47.420'W	2001-11-21 16:35:24	None	12	0.12
44°31.552'N	063°47.418'W	2001-11-21 16:28:56	1.309 Depth (m)	14	0.08
44°31.552'N	063°47.418'W	2001-11-21 16:21:56	9.1 Temp (°C): 3.41 Depth (m)		
-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----

Enabled: If a check mark is in the Enabled column, the buoys will monitor this frequency. The Enabled column does not appear in the Playback version of the *Tag status* window.

Last update: the last time a search was made for this tag. If the continuous tag was not received at the time of the last search, the location (X, Y, lat and long) and telemetry data (if applicable) will be removed from the status window.

Align: the number of pulses received by the buoys that can be assumed to originate from the same tag (the data is in alignment).

Dev: the deviation within the received aligned data.

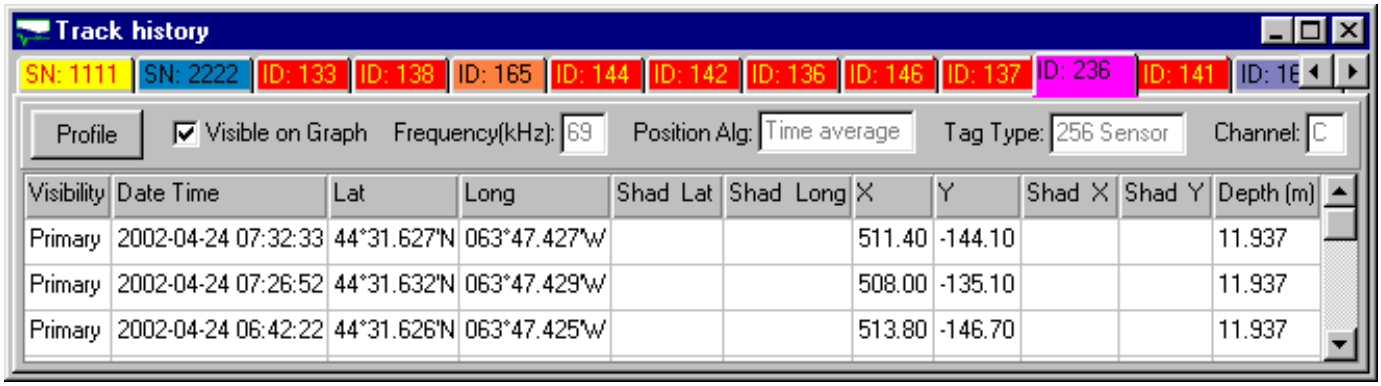
The frequency that is currently being monitored will be shown highlighted in yellow. In the window above, the frequency 69kHz is being monitored.

Track history

The *Track history* window lists the location history of each enabled tag in the study. Each tag is on a different "page" in the window and is accessed by clicking the tab for the desired tag. The tabs are colour coded to match the colour representing the tag in the *Chart* window, and contain either the tag's serial number (continuous tags) or ID number (coded tags).

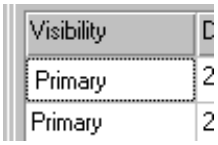
The top of each tag page displays the frequency of the tag, which position algorithm is being used, the tag type, and the coded channel (for coded tags only). For telemetry tags, the Profile button on the left will be enabled to allow the telemetry graph to be viewed (see the *Telemetry graph* section). When the *Visible on Graph* is disabled (the check mark is removed), all reference to this tag is removed from the *Chart* window. The data is still being received and recorded but the tag is not visible in the *Chart* window.

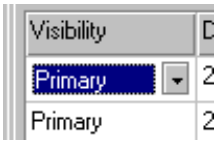
The information shown for a tag includes the visibility, the data and time, the latitude, the longitude, the shadow latitude, the shadow longitude, the X co-ordinate, the Y co-ordinate, the shadow X, and the shadow Y, and telemetry data (if applicable). The information at the top of the list is the most recent position, and the number of positions shown is the same as the tail length.



When the Track history window is copied (see Copy in the Edit menu), only the selected tab will be copied.

The visibility is what is being shown in the *Chart* window. The primary position is shown by default (Primary), but the shadow point, if one exists, may be shown (Shadow). Other options are to show neither point (Hide both), or both points (Show both). The visibility of the tag's location at a point in time can be changed by highlighting the visibility for that point in time (click the square in the chart - see STEP 1 below) and clicking the square again (see STEP 2). Click the now-visible down-arrow to reveal the options in a pull-down list (see STEP 3). Select the desired visibility setting and either press Enter or click elsewhere in the window.

STEP 1: 

STEP 2: 

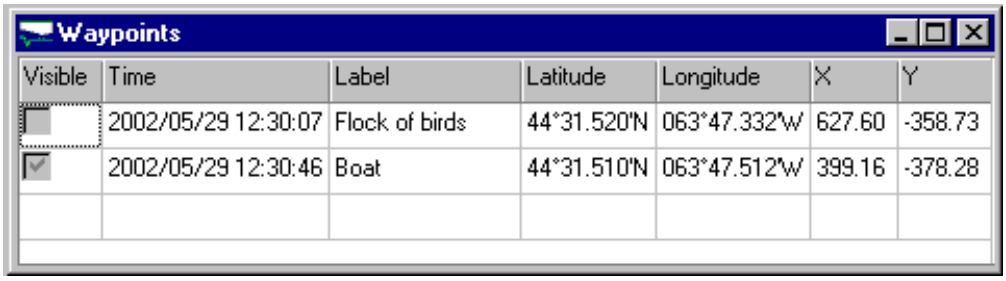
STEP 3: 

The shadow values are shown only if the tag was in a shadow zone. The value closest to the previous plotted position will be considered the valid point and will be plotted in the *Chart* window, but the shadow values will be given in the *Track history* window. If a previous point is not available, the point closest to a buoy will be used.

Waypoints

The *Waypoints* window, shown below, lists the time the waypoint was created, its label, the latitude and longitude of the waypoint, and the X and Y values. The label may be edited by clicking on a selected waypoint (or a slow double click) and typing the changes. When the change has been entered, click elsewhere in the window or press the Enter key to make the change effective in the Chart window.

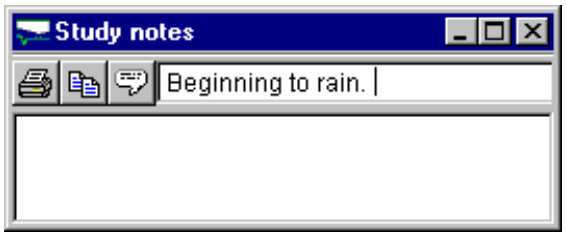
The *Visible* check box (on the left) allows the waypoint to become "invisible" on the *Chart* window. The waypoint still exists and can be returned to view by either clicking the *Visible* box again, or by clicking the middle button on the mouse (while the mouse is over the *Chart* window) and selecting the *Show all waypoints* option. The sample *Waypoints* window below indicates that the "Boat" waypoint is visible in the *Chart* window, but the "Flock of birds" waypoint is not visible.

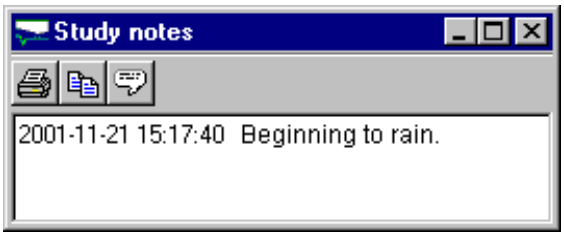


Study notes

The *Study notes* window allows notes to be entered as the study progresses. These notes can be read during a playback, and can be printed or copied during either a study or a playback.

To enter notes, click the third button at the top of the window (with a "bubble" symbol). A line will appear next to the button (see picture below and on left) with a cursor. Type the note in the line and press Enter. The note will appear with the date and time the note was entered, as shown in the picture below and on the right. Notes may be written only during a study, but may be viewed during either a study or a playback.





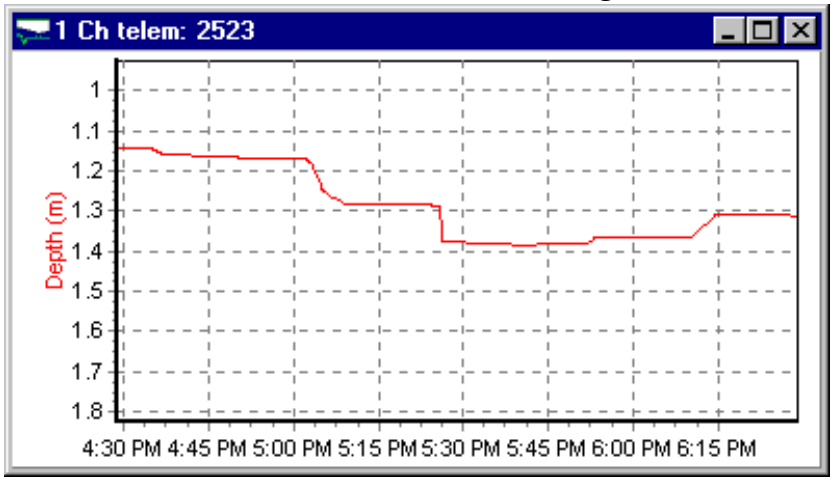
Telemetry graph

The data from a telemetry tag can be viewed in graphical form, as shown below. This is accomplished by clicking the *Profile* button in the *Track history* window.

The graph can be repositioned with the pan feature. This is performed by clicking the right mouse button on the graph and dragging the mouse without releasing the mouse button. When the graph is in the desired location, release the mouse button.

A section of the graph may be zoomed in on by clicking the graph with the left mouse button and dragging the mouse down and to the right (encircle the desired area with the box formed) before releasing the mouse button. Zoom out by clicking the left mouse button on any part of the graph and move the mouse up and to the left before releasing the mouse button.

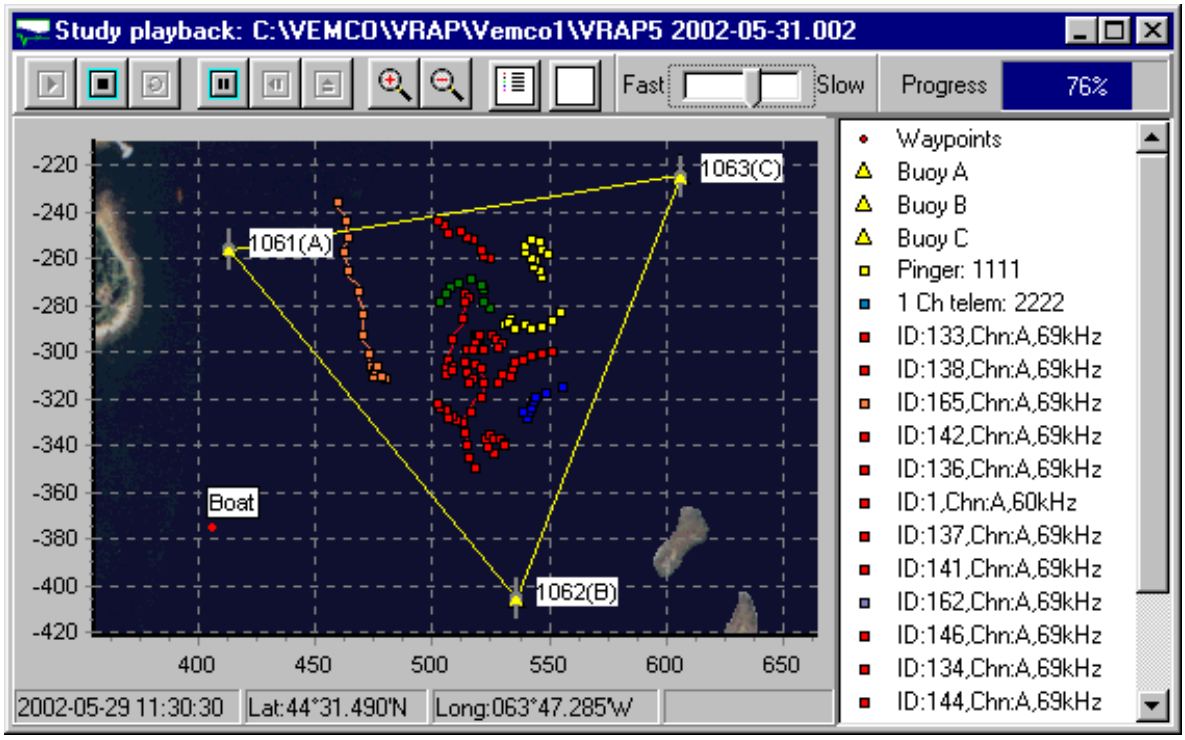
For two channel telemetry tags, the data from channel one is shown in red with the left vertical axis and the data from channel two is shown in blue with the right vertical axis.



Playback window

The *Playback* window is essentially the *Chart* window while a playback file is being viewed. In appearance, the *Playback* window is very similar to the *Chart* window, with only the buttons along the top of the window being changed. These buttons are (from left to right): Play, Stop, Continuous play, Pause, Rewind, Eject - load new file, Zoom In, Zoom Out, Legend, and Grid. The speed of playback can be controlled by sliding the Speed bar closer to either Fast or Slow. The amount of the playback viewed is indicated as a percentage in the Progress bar in the top right section of the window.

The latitude and longitude values at the bottom of the window indicate the location of the mouse arrow when it is pointing within the window. The date and time of this moment in the original study are shown in the bottom left corner of the window.



If any changes have been made to a plot file during a playback, a prompt will appear when the plot file is closed pertaining to saving the changes.

APPENDIX

CALIBRATIONS (using software)

Buoys

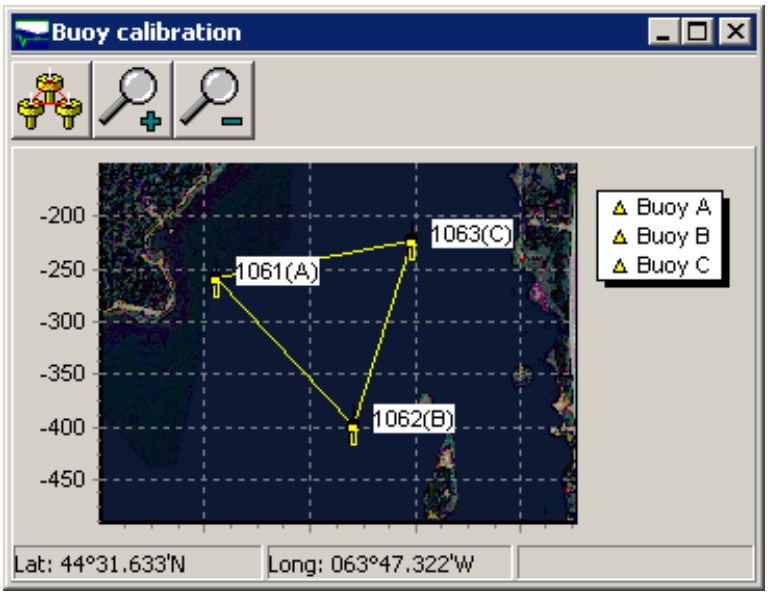
The buoys may need to be calibrated if their position is believed to have changed, or if a new project is being setup. A change in position may be caused by tidal or wave action.

The position of the buoys may be automatically calibrated during a study according to the *Calibration interval* value assigned in the *Project settings* window.

A manual calibration can be requested while a study is being run from within the *Chart* window, or when a study is not being run by selecting *Buoys* in the *Calibrate* option within the *Tools* menu.

When the buoys are calibrated from the *Tools* menu, the *Buoy calibration* window opens (shown below) and the buoys appear on the chart. If the buoys are shown in their approximate locations, then click the *Calibrate Buoys* button within this window (top left corner, with an icon of three buoys) and the calibration cycle will begin. If the buoys are not shown in their correct positions (approximately), then move the buoys manually until they are close to their actual positions and click the *Calibrate Buoys* button. This usually occurs when GPS data is not available or is not correct.

To manually move the buoys in the chart, left-click the desired buoy once and release the mouse button. That buoy is now connected to the mouse arrow and will move with the mouse. Position the buoy over the desired area and left-click the mouse again. The buoy is now "dropped" in its new location. Repeat this with the other buoys until all are approximately in place.



The cycle of calibration events are:

1. Buoy A is instructed by the base station to activate its local pinger, which operates at 34kHz.
2. The base station instructs Buoy B and Buoy C to receive at 34kHz and record incoming data.
3. After an elapsed period of time, Buoy A is instructed to deactivate its local pinger and transmit its data to the base station. Buoy B and Buoy C are instructed to transmit the data pertaining to the signals received from Buoy A.
4. Steps 1-3 are repeated with Buoy B transmitting an acoustic signal from its local pinger and Buoy A and Buoy C listening.
5. Steps 1-3 are repeated with Buoy C transmitting an acoustic signal from its local pinger and Buoy A and Buoy B listening.
6. The position of each buoy is calculated.

The status bar at the bottom of the window will display the action and result at each step of the calibration procedure.

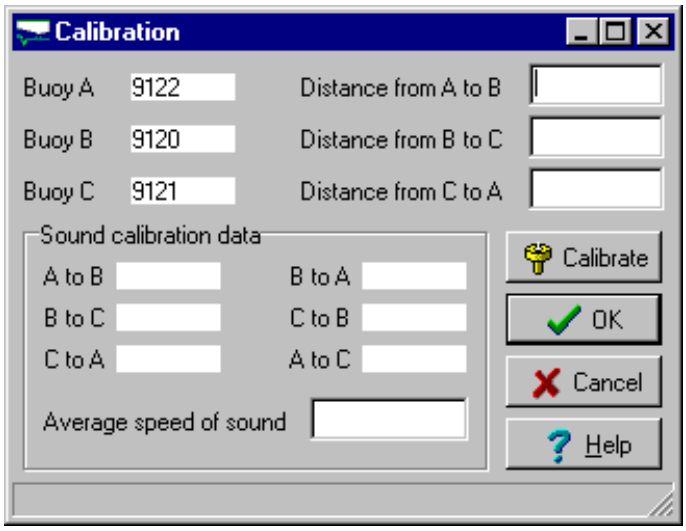
Speed of Sound

The exact speed of sound in water is actually a function of the environmental conditions in the water (such as salinity and temperature), and may be calibrated for the project area by using the buoys. How often the speed of sound should be calibrated depends on how rapidly the environmental conditions are changing. The speed of sound can not be calibrated while a study is being run.

**** The distances between the buoys MUST be accurately measured in meters. ****

To calibrate the speed of sound by using the buoys, follow the steps listed below:

1. Secure the buoys in the locations being used in the study (see *Buoy Mooring* in the appropriate Hardware manual).
2. Enter the buoy information (serial number, etc.) in the *Buoy* section of the *Project settings* window (see *Edit menu* in Software section).
3. In the *Project* section of the *Project settings* window, click the arrow to the left of the *Calibrated* box ***or*** select *Speed of sound* under the *Calibrate* section of the *Tools* menu. The *Calibration* window will open (shown on next page) with the buoys A, B, and C identified on the left side of the window.
4. Enter the distances between the buoys (in meters) in the boxes on the right side of the window. It is important that the correct distances are entered in the correct boxes (the distance between Buoy A and Buoy B is entered in the box "Distance from A to B").
5. Click the *Calibrate* button (with the picture of a buoy on it). The buoys will communicate with each other and calculate the average speed of sound. This value will show in the *Average speed of sound* box at the bottom of the window and will be transferred to the *Project settings* window when the OK button in the *Calibration* window is selected.



This option is accessible from either the *Calibrate* option in the *Tools* menu, or from the *Project* page of the *Project settings* window (in the *Edit* menu).

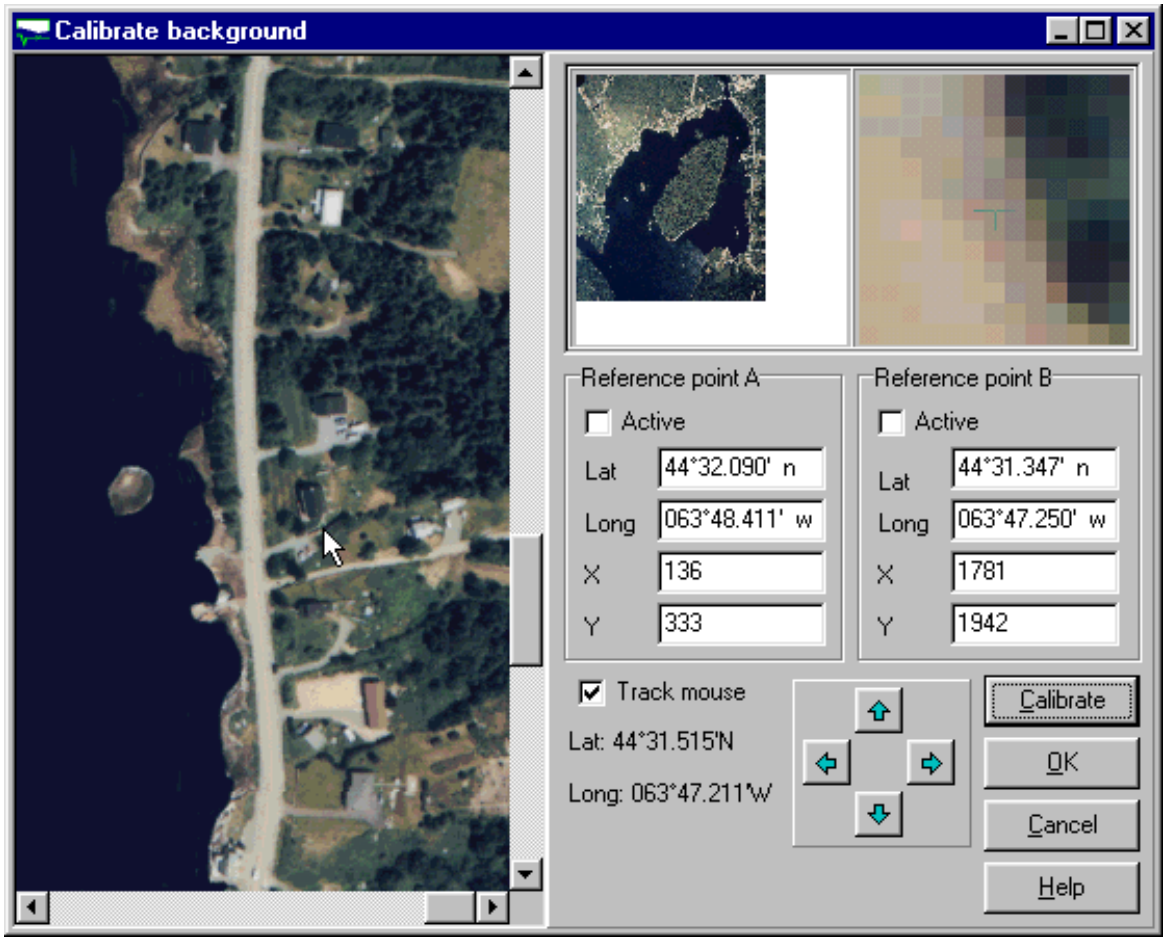
Background Image

The *Calibrate background* window (shown below) allows the background bitmap to be tied to the actual location by entering measured latitude and longitude values, and is opened by either selecting Calibrate in the *GIS settings* window (see *Project* section of *Project settings* in the *Edit menu*) or by selecting *Background image* in the *Calibrate* section of the *Tools* menu. It is best to measure the latitude and longitude of **at least** three reference points that are easy to identify on the bitmap. Two of these points should be in opposing corners (either top left and bottom right, or bottom left and top right), and as close to the corner as possible.

The positioning data is entered into the VRAP software by following the steps outlined below (after the *Calibrate background* window is open):

1. Click the Active box in the *Reference point A* section to activate the first reference point.
2. Verify that the Track mouse option has been selected (should be automatically selected).
3. Use the scroll bars to show the general area of the reference point in the left side of the window.
4. Move the mouse over the bitmap in the left half of the window until the tip of the mouse arrow is as close to the reference point as possible. Note that the bitmap on the right changes as the mouse arrow moves. This is an exploded view of the area the mouse is currently pointing to. The X and Y values also change to reflect the location of the mouse arrow.
5. Click the left mouse button. The X and Y values will be set as those to which the mouse arrow was pointing. If this is satisfactory, then proceed to Step 7.
6. Click the same Active box again (it was disabled when the reference point was selected) and use the blue positioning arrows to move the reference point pixel by pixel. The X and Y values will change as the cross hairs in the right bitmap moves.
7. Enter the measured latitude value in the Lat box, including the N or S for North or South.

8. Enter the measured longitude value in the Long box, including the E or W for East or West.
9. Repeat steps 1 - 8 for the second reference point, found in the *Reference point B* section.
10. Select the Calibrate button.
11. Point mouse arrow on a location in the bitmap for which the latitude and longitude are known and verify that the values shown to the left of the blue arrows are correct. The picture below illustrates this step.
12. Select OK to accept the calibration and close the window. This will return you to the *Project settings* window.



CODED CHANNELS

The VR60 receiver can identify up to four transmitter types on one frequency. This is done by using different sync and bin values for each of the four channels. The assigning of these sync and bin values is referred to as a coded map. The default coded map (referred to as Default Coded Map "D") is shown in the table below. The channel values differ depending on the frequency range so as to best fit the transmitter capabilities based on transmitter size and power.

VEMCO Default Coded Map "D"						
Transmitter Model	**Frequency Band (kHz)**	**Channel**			**Code Type**	
		#	**Sync (ms)**	**Bin (ms)**	**Description**	**Transmitter Abbr.**
V8, V8B, V8SC, V16, V16T, V16P	**51 - 78 kHz** (Blank = 300)	A	401.2	22.3	256 Pinger	R256
		B	380	20	4K Pinger	R04K
		C	360	20	256 Sensor	S256
		D	340	20	64K Pinger	R64K
V22, V22T, V22P	**34.1 - 50.5 kHz** (Blank = 650)	A	800	30	256 Pinger	R256
		B	770	30	4K Pinger	R04K
		C	740	30	256 Sensor	S256
		D	710	30	64K Pinger	R64K
V32, V32T, V32P, Chat	**27 - 34 kHz** (Blank = 750)	A	1000	40	256 Pinger	R256
		B	960	40	4K Pinger	R04K
		C	920	40	256 Sensor	S256
		D	880	40	64K Pinger	R64K

If a VRAP system that has been setup with a default coded map receives a pulse of 401.2 milliseconds then it knows that the bin should be 22.3 milliseconds (ms) and that the ping originated from a 256 pinger type transmitter. A 256 pinger type transmitter with a sync of 380 ms and a bin of 20 ms will not be identified unless the coded map is customized in the *Channel settings* section of the frequency page in the *Coded tags* section of the *Project settings* window.

CODED TRANSMITTER TYPES

The VRAP receiver is capable of receiving transmissions from the coded tags types explained below. Once a transmitter is powered, it will continue to broadcast according to factory setup until powered down.

256 Pinger

The coded 256 Pinger emits a pulse train consisting of six pulses, usually followed with either a fixed or random delay period. Each pinger will have one of 256 unique codes. The unique code, coupled with a random delay, allows a study to have up to 256 pingers operating on the same frequency at one time.

4K Pinger

For applications where more than 256 pingers are deployed at a single time, coded pingers with 4096 unique codes are available. The 4K Pinger emits a pulse train consisting of seven pulses and either a fixed or random delay period. A study can have up to 4096 pingers on the same frequency at the same time.

64K Pinger

For applications where more than 4096 pingers are deployed at a single time, coded pingers with 65536 unique codes are available. The 64K Pinger emits a pulse train consisting of eight pulses and either a fixed or random delay period. A study can have up to 65536 pingers on the same frequency at the same time.

256 Sensor

Coded telemetry transmitters are capable of transmitting either temperature or depth data within the pulse train. The 256 Sensor transmitters emits a pulse train consisting of eight pulses. A study may contain up to 256 coded telemetry transmitters on the same frequency and at the same time.

The ID number, slope, intercept, and data units of each transmitter being used must be entered using the *Telemetry transmitters* feature in the *Setup* menu for correct interpretation of the telemetry data.

GLOSSARY

Background Image - the bitmap used for the background in the *Chart* window during a study. This bitmap is imported into the VRAP software in the *Preview* page (tab) of the *Background image* section in the *Project* setup. The bitmap may be calibrated using latitude and longitude information (see *Calibrations* section of Appendix).

Blanking interval - the length of time after a valid pulse has been detected during which no further pulses can be detected. This is to prevent the receiver from double triggering on echoes. The blanking interval is normally set to less than 50% of the minimum transmitter period. Care must be taken when changing this value. If the interval is too short, false triggering will become a problem. If the interval is too long, data pulses may be missed.

Calibrate buoys - When the *Calibrate buoys* box has a checkmark in it, the buoys will be automatically calibrated according to the time entered in the *Calibration interval* box. If the box is not checked then the buoys will not be automatically calibrated and the *Calibration interval* value shown is ignored.

Calibration interval - the time, in minutes, between automatic buoy position calibrations. The time value used depends on the conditions in which the buoys are operating. A calibration may be forced before the specified time has elapsed. This may be done by selecting *Buoys* in the *Calibrate* option of the *Tools* menu, or by clicking the Calibrate button in the *Chart* window.

Connect buoys with lines - Selecting the *Connect buoys with lines* option (checkmark in box) will connect the buoys shown in the *Chart* window with three lines. This aids in identifying the study area within the buoys.

Deviation - refers to the standard deviation between pulses in a set of aligned data.

Fast Track - An average time is compiled and used with *Pulses to avg* to determine the best data times. The position is calculated for each of these best data times and all positions are plotted on the chart.

Panning the graph - The graph can be repositioned with the pan feature. This is performed by clicking the right mouse button on the graph and dragging the mouse without releasing the mouse button. When the graph is in the desired location, release the mouse button.

Pinger - tags that emit an acoustic signal at a fixed period and frequency. They are used for locating and tracking purposes and transmit no depth or temperature information. Once a pinger is powered, it will broadcast its signal according to the factory setup until powered down. It is possible to have pingers with a delay start and/or cycle on/off times.

Position Average - All positions are calculated. An average position is complied from the positions and used with *Pulses to avg* to determine the best data positions. A new average is taken of these best data positions and the single position is plotted on the chart.

Positions to show - the number of pervious buoys positions (previous calibrations) to be displayed on the *Chart* window. This value is entered in the *Positions to show* box in the *Buoy* page of the *Project settings* window (see *Edit* menu).

Project - the geographical setup of the buoys and the information pertaining to those buoys and to the tags used in the area. After a project is setup (in the *Project setting* section of the *Edit* menu), any number of studies may be run using the project's settings.

Scanning cycle - The buoy receivers listen to only one frequency at a time. To use tags on more than one frequency during a study, the buoys cycle through frequencies and listen for each *Enabled* tag (see the *Tags* page of the *Project settings* window in the *Edit* menu) listed.

Scanning cycle delay - the length of time, in minutes, the buoys will wait between scanning cycles. This feature is used to conserve buoy battery life. The value is set in the *Buoy* page of the *Project settings* window (see *Edit* menu).

Shadows zones - three areas around the buoy configuration where the position calculation of a transmitter will have two solutions. The locations of these areas depends on if the buoy hydrophones and the received signal are on the same plane or not. For more detail, see the *Theory of Operation* portion of the Introduction section in this manual.

Study - the collection and storage of data, such as tag positions and times. Data received during a study is *automatically* stored to a database.

Sync (2 channel tags) - a value (in milliseconds) that allows a receiver to correctly receive the data for a two-channel transmitter. The value is currently factory set at 1150ms and must be entered as such in the VRAP software (see the *Tag* page of the *Project settings* window in the *Edit* menu).

Tag - term used to refer to all acoustic transmitter types. It is derived from the term “fish tag”.

Tag types - three types of tags are available: pinger (transmits a ping at a constant interval, or period), one channel telemetry (transmits either temperature or depth telemetry data), and two channel telemetry (transmits both temperature and depth telemetry data).

Telemetry transmitters - either one or two channel devices transmitting information at a fixed frequency. The types of information transmitted are temperature and/or pressure. These transmitters are capable of transmission only. Once a transmitter is powered, it will continue to broadcast according to factory setup until powered down.

Time Average - An average time is compiled and used with *Pulses to avg* to determine the best data times. A new average is taken from these best data times and a position is calculated. This single position from the new average is plotted on the chart.

Waypoint - a location of significance or interest that can be recorded within a study. The location is marked with a red circle and may have an optional label. The waypoint may be viewed during playback of the study.

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