WinFrog Device Group:	**ROV**
Device Name/Model:	**Sonsub Innovator3**
Device Manufacturer:	
Device Data String(s) Output to WinFrog:	See Telegram Specification section below.
WinFrog Data String(s) Output to Device:	See Telegram Specification section below.
WinFrog Data Item(s) and their RAW record:	ROVDATA 496 POSITION 303 HEADING 409 BOTTOMDEPTH 911 ATTITUDE 413 OUTPUT NONE

DEVICE DESCRIPTION:

This is a driver that is designed to both read ROV type data from the Sonsub Innovator3 ROV as well as to send positional data to the Sonsub Innovator3 ROV.

This device requires that the starting position of the ROV is known, the distance travelled can be accurately measured (via properly scaled odometer readings) and that either a survey line be tracked or that the heading data is reliable. WinFrog calculates new positions for the ROV using the known starting position, distance travelled and either the KP of the tracked survey line or the heading data (dead reckoning).

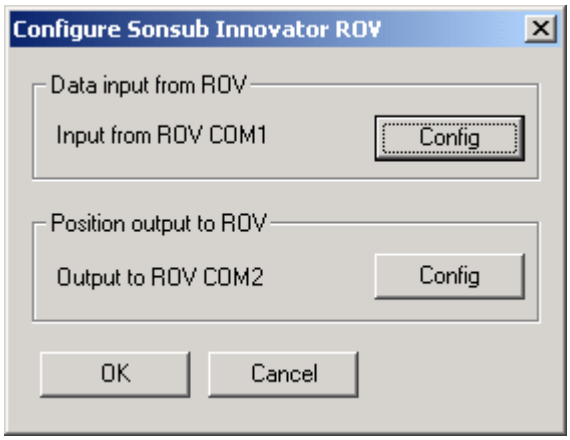
The initial odometer reading is entered in the Sonsub Innovator Configuration dialog box. The odometer readings do not update automatically, you must enter the new odometer readings manually in the Configure ROV window (from the ROVDATA data item) as discussed below.

DEVICE CONFIGURATION INSTRUCTIONS

WINFROG I/O DEVICES > EDIT I/O:

Serial
Configurable Parameters

This device requires that two data ports be configured, one for the Data Input to WinFrog from the ROV and the other to output positional data to the Sonsub Innovator3 system. When the device is added to WinFrog the Configure Sonsub Innovator ROV dialog box opens as seen below.

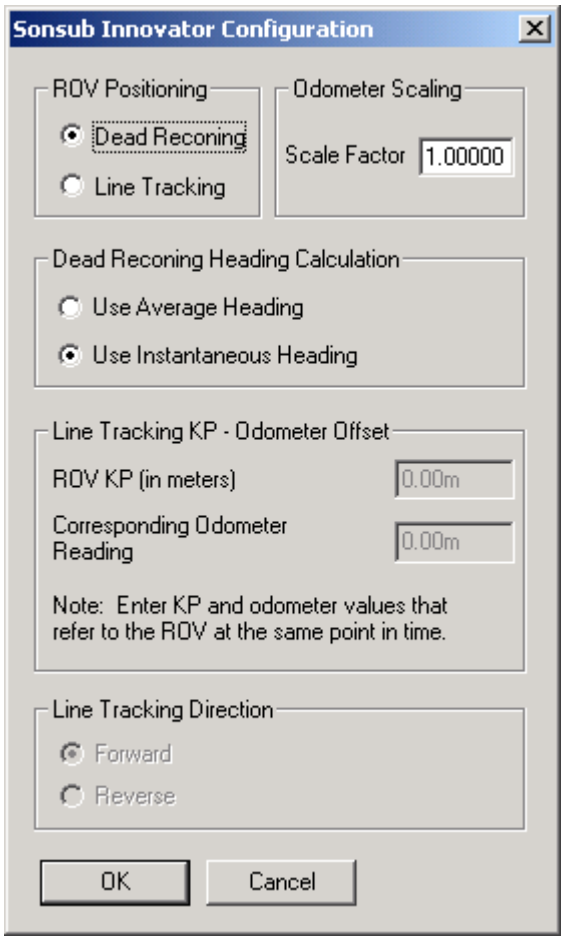


The configuration of these two ports is the same as for any device in WinFrog. Click the Config button for either port and the standard Device I/O Parameters window will open.

WINFROG I/O DEVICES > CONFIGURE DEVICE:

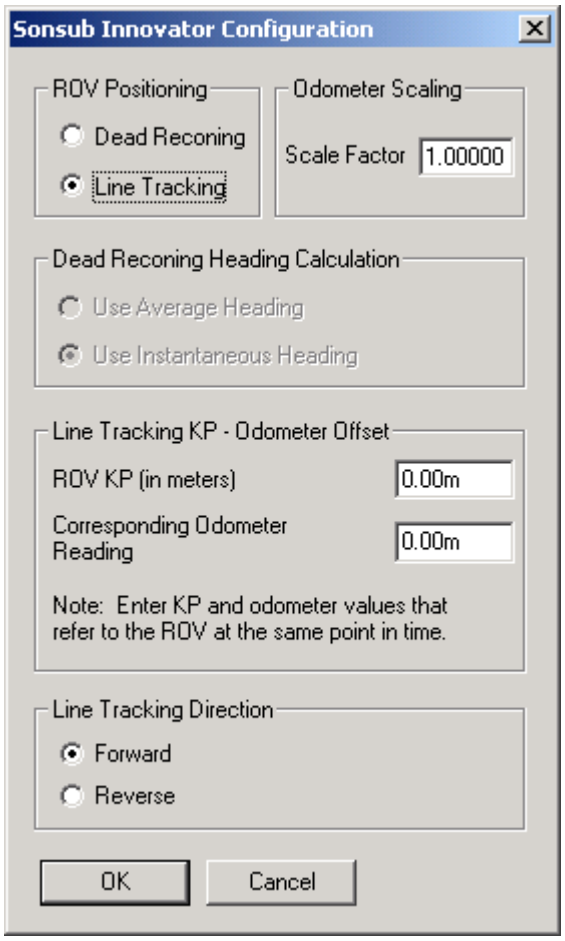
This device must be configured at the I/O Device window level. There are two options available, both of which require an accurately scaled odometer reading. As explained below, the ROV's position will be calculated from either the odometer reading and the heading or the odometer reading and the KP of the tracked survey line. These options are typically used for shallow water operations where USBL acoustic devices are not effective.

In the I/O Devices window, click the device name to select it, then right-click and select Configure Device. The Sonsub Innovator Configuration dialog box appears, as seen below.



There are two options for ROV positioning. The Dead Reckoning option (depicted above) requires that either the Average or Instantaneous Heading Calculation be selected. Some consideration must be given to the stability of the heading data before a choice is made. Also, enter a Scale Factor for the Odometer readings. With a stable heading source and an accurately scaled odometer reading, the ROV can be positioned by using the Dead Reckoning option.

The other option for ROV positioning is the Line Tracking option, depicted below.



This option also requires an accurately scaled odometer reading. This option also requires that a survey is tracked by the ROV in WinFrog. Select a point in time where the KP of the ROV, in relation to the line being tracked is known. At that point enter both the KP of the ROV and the odometer reading in the Line Tracking KP – Odometer Offset section. Specify whether the ROV is to travel the line being tracked in either the Forward or Reverse direction.

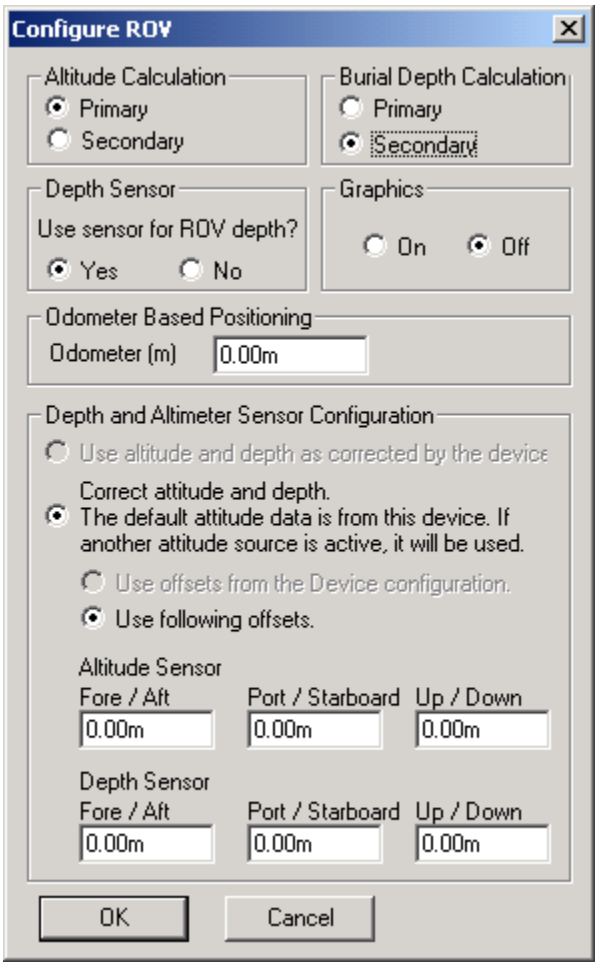
WINFROG VEHICLE > CONFIGURE VEHICLE DEVICES > DEVICE DATA ITEM > EDIT:

Adding the Sonsub Innovator3 device creates six data items: ROVDATA, POSITION, HEADING, BOTTOMDEPTH, ATTITUDE and OUTPUT. Once the data items have been added to the vehicle, they must be edited to suit the application.

Data item: ROV, Sonsub Innovator3, ROVDATA

This data item is used to read specific ROV type data from the Sonsub Innovator3, as well as to manually enter odometer readings to calculate new positions for the ROV.

Highlight this data item in the vehicle's device list and click the Edit button to open the Configure ROV dialog box as seen below.



Altitude Calculation:
Primary will result in this vehicle's altitude being determined from the observed altitude value found in the string from this device minus the altitude offset also found on this dialog. This value can be displayed in the Vehicle Text window as ROV Alt.

Secondary will result in no calculation or assignment of the vehicle's altitude from this device. The raw data is still always recorded.

Burial Depth Calculation:
This device does not use this option.

Graphics:
Select the On radio button to display the device name and a square at the location of the tracked offset, within the Graphics and Bird's Eye windows.

Use sensor for ROV depth:
Selecting the Yes radio button will cause the depth of this vehicle's CRP to be determined from the observed depth value found in the string from this device plus the depth offset below. This vehicle's elevation will be the negative of this value. This value will be used to calculate the bottom depth.

The bottom depth will be determined as:
Observed depth + Depth Offset + observed altimeter - altitude Offset
The offsets (see below) are not corrected for pitch and roll when determining the water depth.

Selecting the No radio button will result in this device obtaining the depth of the CRP from the vehicle itself, as opposed to assigning it to the vehicle as above. You must assign another device to determine the depth of the vehicle (e.g. USBL and assigning it as the source for depth).

Note: The observed altimeter value is always used for depth determination regardless of the prime/secondary altimeter setting.

Odometer Based Positioning:
In this window the operator enters the odometer readings. As discussed above these readings are used with either the Dead Reckoning or Line Tracking options to determine the new ROV positions. The operator enters the new odometer readings and WinFrog calculates a new position for the ROV.

Depth and Altimeter Sensor Configuration:
For all ROV devices except Deep Blue ROV, the radio button settings cannot be changed. See the Deep Blue ROV device documentation for information on setting these radio buttons.

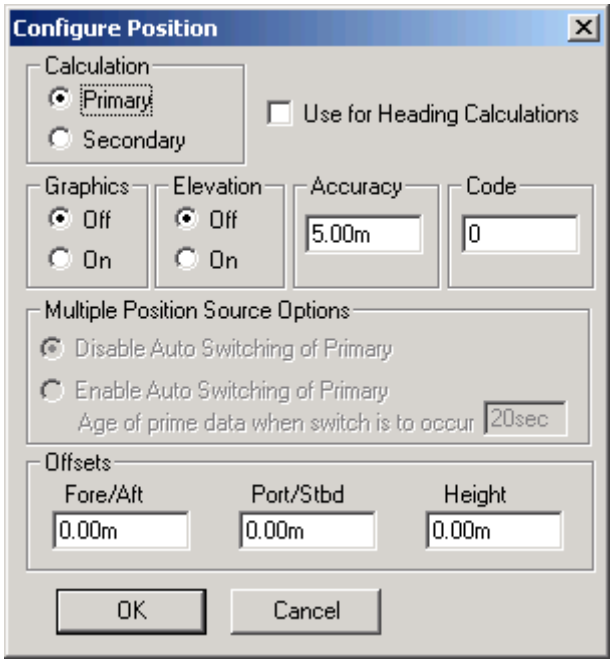
Vertical offsets of the altitude and depth sensors, relative to the CRP, can be entered here. The Altitude Offset is the vertical distance (positive up) from the ROV's CRP to the acoustic beacon tracking the seafloor. The Depth Offset is the vertical distance (positive up) from the ROV's CRP to the sensor that provides depth information of the ROV.

The offset position will be corrected for pitch and roll then the vertical offsets will be applied to determine the depth of the ROV and height of the ROV above the bottom.

Data item: ROV, Sonsub Innovator3, POSITION

This data item is added to the ROV's device list. It is used in conjunction with the updated odometer readings to position the ROV in WinFrog.

Highlight the ROV, Sonsub Innovator3, POSITION data item in the ROV's device list and click the Edit button to open the Configure Position dialog box as seen below.



Calculation:
Set the Calculation selection to Primary or Secondary. Devices set to Primary calculation are used to provide a vessel position. Note that more than one Primary positioning device can be added to a vehicle's device list; data from these devices will be combined in a weighted mean solution. (See the paragraph on Accuracy below for more on the weighting of Primary calculation device data).

If the Calculation type is set to Secondary, WinFrog will simply monitor the device's data. WinFrog will not use the data from a secondary device in the final solution of the vehicle's position.

If auto switching is enabled (see below) a secondary may automatically become a primary should all the primaries fail.

Use For Heading Calculations:
Select this checkbox if the device is to be used in conjunction with another GPS device for determination of the heading of the vessel.

Graphics:
If On is selected, a labeled square will show the raw (offset but unfiltered) location of the GPS antenna in the Graphics and Bird's Eye windows. This provides a means of comparing raw device and filtered vehicle positions.

Elevation:
Setting the Elevation option to On will result in the elevation determined by GPS to be used as the elevation of the vessel referencing the GPS (WGS84) Ellipsoid. The sounder data recorded in WinFrog's .RAW data files will not be affected.
This option is meant only for those applications where there is no fixed vertical reference (i.e. mean sea level), such as on a river. For acceptable results, this option requires the use of high accuracy "RTK" GPS data.

Accuracy:
The Accuracy value entered provides WinFrog with the expected accuracy of the position from this device. This value is used in the weighting of this device compared to other positioning devices that may be added to the vehicle's device list. The smaller the value entered, the more accurate it is considered to be, and hence the more weight that will be applied to the device's data.

The Accuracy parameter can be changed from the suggested values. Changes should be made with caution, however, as they will affect the final filtered position of the vehicle.

Code:
This entry window is used when the GPS data is being received by a remote GPS receiver connected via telemetry link. If this is the case, set the Code to coincide with the code parameters associated with the GPS unit being used.
For all other applications, the Code entry must be set to 0.

Multiple Position Source Options:
This group box allows you to enable automatic switching of a secondary to primary should the data from all POSITION and PSEUDORANGE data items set to primary timeout. The **Age** entered is the length of time that the secondary will wait in the absence of data from all primaries, before taking over as primary. This age is only entered for the secondary.

For example, if the POSITION or PSEUDORANGE data items associated with two GPS receivers were set to primary and the POSITION or PSEUDORANGE data item of a third GPS receiver was set to secondary, both primary GPS receivers must time out before the secondary will become the primary. Upon the recovery of either of the original primary data items, the original primary will be reset to primary and the original secondary will be reset to secondary.

Note for the auto switching feature to work, there must be at least one primary and one secondary enabled. For example, given two data items, one set to primary with

the auto switching disabled and the other set to secondary with the auto switching enabled, if the primary fails the secondary is not set to primary and the vehicle positioning stops until the primary data item recovers.

Disable Auto Switching of Primary:
If this data item is not to be involved in the auto switching process, check this box. As stated above, this data item is then not involved in the auto switching process in any way.

Enable Auto Switching of Primary:
If this data item is to be involved in the auto switching process, either as a primary or a secondary, check this box. If set to secondary, enter the Age of data the primary data items must reach before this secondary is switched to act as the primary.

In order for this option to be effective you must have at least one primary and one secondary. If there are multiple secondary data items that are enabled for switching, the first one to receive data will become primary.

Note: This option is not enabled unless WinFrog determines that there is more than one POSITION and/or PSEUDORANGE data item associated with the respective vehicle. The exception to this is the case of a WinFrog with the Remote module operating as a Controlled Remote being configured remotely from the Controller. In this case, the option is always enabled even though it may not be applicable. The operator must be aware of what is available on the Remote and configure the data item accordingly.

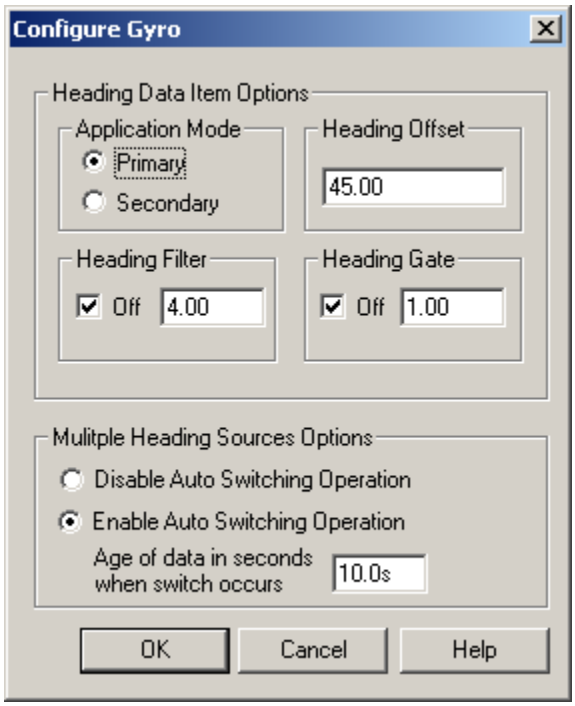
Note: This option is not available in the WinFrog Remote package.

Note: This option is not available for USBL based POSITION data items.

Offsets:
Offsets are required to associate the GPS antenna position with the vessel's Common Reference Point (CRP). The offsets are applied *from* CRP (of the vehicle) *to* the GPS antenna location.
Forward Offsets are entered as positive values.
Aft Offsets are entered as negative values.
Starboard Offsets are entered as positive values.
Port Offsets are entered as negative values.
Height Offsets are positive upwards. (It is suggested that the vessel's Height origin should be at the water line.

Data item: ROV, Sonsub Innovator3, HEADING

This data item is used to provide the ROV vehicle, in WinFrog, with heading data. Highlight this data item in the vehicle's device list and click the Edit button to open the Configure Gyro dialog box as seen below.



Heading Data Item Options:

Application Mode(Primary/Secondary):

Set the type of calculation to Primary or Secondary by selecting the appropriate radio button. Devices set to Primary are used to provide the vehicle heading information. Devices set to Secondary are simply monitored, and are not used in the vehicle's calculations.

Note that WinFrog supports automatic switching from a designated Primary to a Secondary in the event that data from the Primary fails (see Multiple Heading Sources Options).

Heading Offset:

A correction value (as determined from a gyro calibration) can be input in the Heading Offset box. This value is added to the heading value from the device to provide a corrected heading for the vehicle. Note that positive or negative values can be entered.

Heading Filter/Heading Gate:

The Heading Filter is used to "smooth" heading values used by the vehicle. The value entered in the Heading Filter indicates the number of headings that will be used to predict the next heading value. The larger the value entered, the

"heavier" the filter will be – i.e. the slower the vehicle's heading will respond to changes.

The Heading Gate defines a tolerance value to limit the use of anomalies in gyro readings. If the next observed gyro value received falls outside the specified range of predicted values (i.e. plus or minus the entered value), the value will not be used.

Multiple Heading Sources Options:
WinFrog supports automatic switching from a designated Primary source to an alternate Secondary source in the event that the Primary fails. The first Secondary source to receive data after the Primary has failed becomes the alternate Primary providing the heading for the vehicle. When the designated Primary is detected as active again, the alternate Primary source reverts to Secondary and the designated Primary provides the heading data to the vehicle.

If an alternate Secondary fails and there are additional Secondary sources, it in turn is detected by the first of the remaining operational Secondary sources to receive data after the failure, at which time this Secondary becomes the alternate Primary.

Note that this option is only available if more than one HEADING source is associated with the respective vehicle. Changes made to the Auto Switching options for any one of the HEADING data items are automatically assigned to the others upon exiting this dialog with OK. If the Auto Switching option is enabled and the respective HEADING source has been set to Primary, all others are automatically set to Secondary. The exception to this is when configuring a WinFrog Controlled Remote (WinFrog with a Remote module) from a Controller. In this case, changes made to one HEADING source are not automatically made to other HEADING sources. The operator must explicitly make them for each HEADING source.

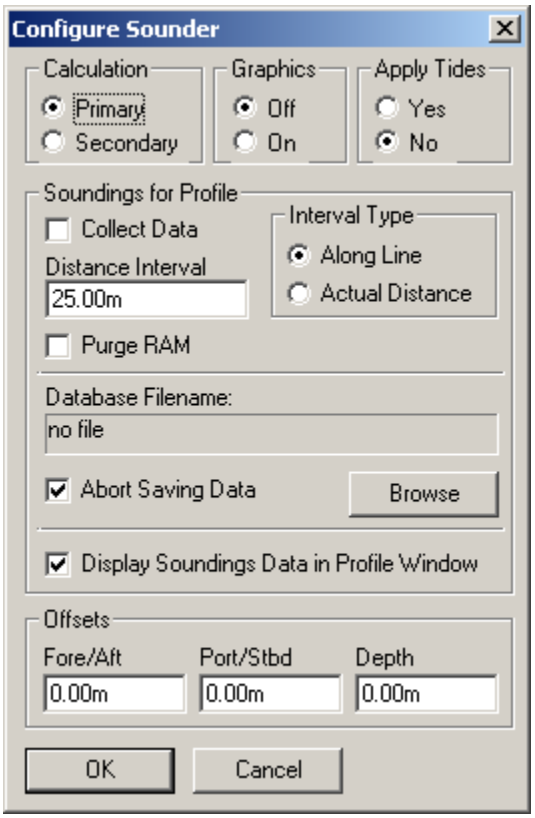
This option is not available in the WinFrog Remote package.

Disable/Enable Auto Switching Operation:
Select the mode you wish to operate WinFrog.

Age of data in seconds when switch occurs:
Enter the age of data that is permitted before the source is considered to have failed.

Data item: ROV, Sonsub Innovator3, BOTTOMDEPTH

Highlight this data item in the vehicle's device list and click the Edit button to open the Configure Sounder dialog box as seen below.



Calculation:
Set the type of calculation to Primary or Secondary using the appropriate radio button. WinFrog will only utilize (i.e. display and record) data from a Primary depth sensor device. If there is more than one Primary depth sensor attached to a vehicle's device list, WinFrog will not mean the data (as is done with positional devices), but rather alternate between the devices. Data from a Secondary status depth sensor will simply be monitored.

Graphics:
Select the On radio button to display a labeled square representing the location of the depth sensor in the Graphics and/or Bird's Eye windows.

Apply Tides:
If the Yes radio button is selected, WinFrog will apply tidal corrections to the observed water depths. Depths displayed in the Vehicle Text window and recorded in automatic event (i.e. .DAT, .SRC, and .RCV) and type 351 raw files will refer to the datum corrected depths. Note that type 911 raw data records will remain truly raw and will not reflect the tide correction.

The tide information can be supplied by a real time telemetry system or by predicted tide files. Either way, the tide "device" must also be attached to the same vehicle's device list. For more information, refer to documentation on Tide devices.

Soundings for Profile:
This section of the Configure Sounder dialog permits the collection of sounding data to an .mdb database file for display in WinFrog's Profile window. This collection is completely separate from automatic event or raw data collection.

Collect Data
Select this checkbox to enable the collection of data to an .mdb database file.

Interval Type
Select to utilize either Along Line or Actual Distance (i.e. between successive position updates) calculations for data collection intervals. Selecting Along Line requires that you also enable survey line tracking.

Distance Interval
Specify the distance interval at which the data will be collected.

Purge RAM
Sounding data is stored in the RAM memory of the computer. Any data collected which will not be required at later time can be deleted by selecting the Purge RAM checkbox, then clicking the OK button to exit the dialog box.

Database filename
Click the Browse button to define where and to what filename the .mdb file will be written. The file name and location is displayed in this window.

Abort Saving Data
Select this checkbox to abort saving data to the .mdb file. In other words, to save data to the .mdb file ensure that this box is NOT checked.

Display Soundings Data in Profile Window
Select this checkbox to enable the display of this data in WinFrog's Profile window.

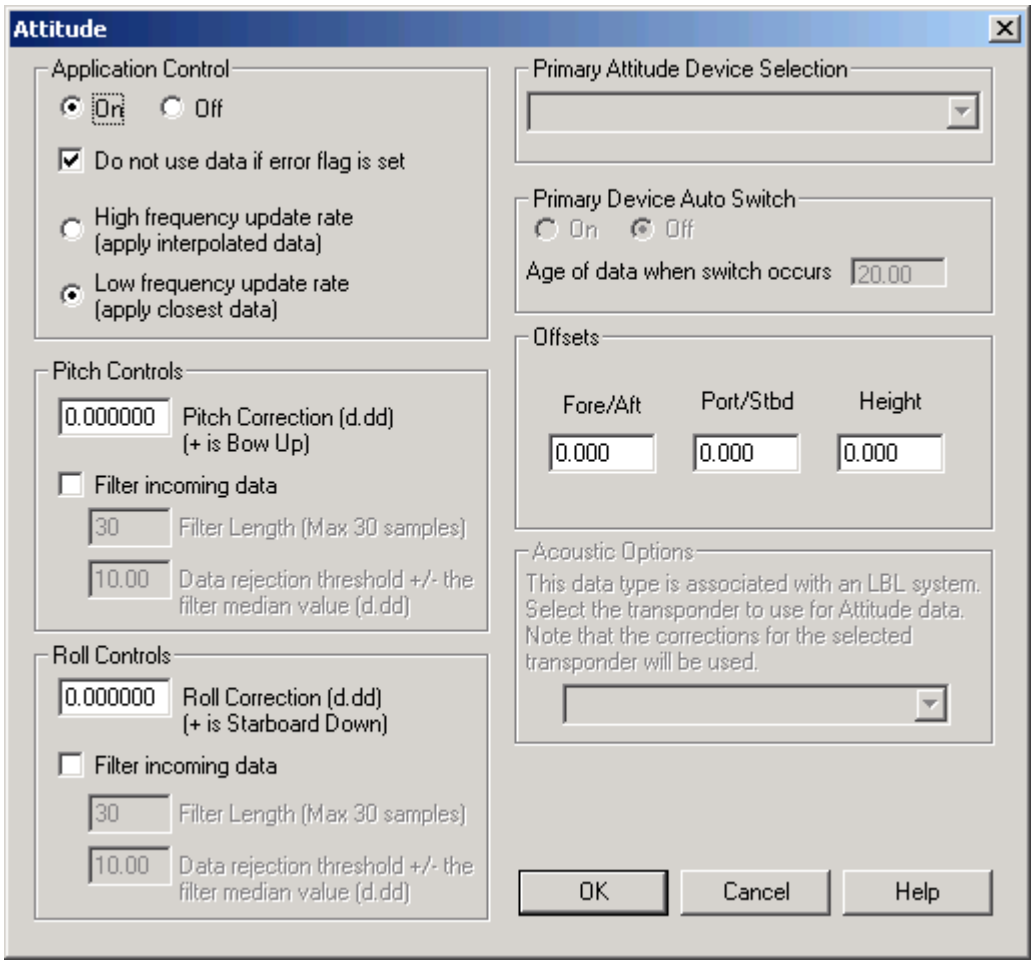
Offsets
This section of the dialog allows for entry of offset values as measured from the vessel's Common Reference Point (CRP). Note that the Fore/Aft and Port/Stbd offsets are used for "cosmetic" visual purposes only: A depth sensor is not a positioning device, and hence its horizontal offsets have no application. If the depth sensor's position is to be recorded correctly, you must create and enable a vehicle Tracking Offset for that specific location. The offsets entered here can simply be used as a means of graphically confirming that the Tracking Offset values have been entered correctly.

The Depth Offset is applied; the entered value will be added to the received depth sensor data.

Depths displayed in the Vehicle Text window and recorded in automatic event (i.e. .DAT, .SRC, and .RCV) and type 351 raw files will refer to the corrected depths. Note that type 911 raw data records will remain truly raw and will not reflect the depth offset correction.

Data item: ROV, Sonsub Innovator3, ATTITUDE

Highlight this data item in the vehicle's device list and click the Edit button to open the Attitude dialog box as seen below.



Attitude
By default, the sensor mode is off, meaning that data from the device will not be used in the vehicle's calculations. To turn the sensor on, and begin using the inclination corrections in the position output, click the 'On' radio button.

Error flag testing
The error flag check box is applicable to those devices that output a code indicating the data is either good or bad. If checked and the device supports such a code in its telegram, WinFrog will look at the code and if the data is indicated as bad, WinFrog will not use the data.

Sensor Update Frequency Rate
If the associated attitude sensor has a high frequency update rate (e.g. 10Hz and higher) it is appropriate to extract attitude data for application by either interpolating or extrapolating for a given epoch. In this case, the *High frequency update* option should be selected. Some attitude sensors have slow update rates, in particular those installed in acoustic transponders that require interrogation. For these sensors interpolation/extrapolation can produce a bad value as there is insufficient information to determine the correct shape of the curve (aliasing). Thus the most current attitude needs to be used. In this case, select the *Low Frequency update* option. This option applies to the use of the attitude data by the following data items:

- POSITION
- ELEVATION
- ALTITUDE
- XPONDER
- LBL TRANSCEIVER
- PROFILE

Pitch and Roll
There are two control groups, one for each of pitch and roll. Correction values can be added in this section of the window. The correction values (entered in units of degrees-decimal degrees) are added to the raw pitch and roll values received from the device before the data is applied to the vehicle's calculations. Ensure that entered values adhere to the sign convention used by WinFrog. You can verify that the corrections are entered properly by viewing the pitch and roll values in the I/O Device window and the Vehicle Text window.

Filtering
Additionally you may filter the incoming values to remove extraneous noise or spikes – check boxes are provided to switch this feature on or off. A filter length (up to 30 samples) and a threshold value (applied to the median of the samples in the filter to obtain lower and upper bounds) can be entered. Any pitch or roll values outside of the bounds are rejected and not used in the vehicle calculations, but will be recorded in the RAW files. If either one of pitch or roll is rejected, both values are ignored, although you may set up the filtering parameters for them separately. The status of the filters, including the current valid range for each of pitch and roll, and the percentage of values rejected, can be viewed in the calculations window, selecting the appropriate ATTITUDE data item.

Important:
Do not enable filtering unless there is a high enough data rate (say 10hz) to correctly determine the shape of the curve. Essentially, if the low frequency update rate is selected above, do not enable filtering.

Primary Attitude Device Selection
If more than one attitude device is present, you may select one of them to be primary and the others to be secondary and allow WinFrog to automatically switch between them should the primary system stop sending data or has bad data. There must be at least two attitude data items added to the vehicle to use this feature. (Note: The attitude and offset data displayed in this dialog is for the attitude device corresponding to the data item that is being edited. Selecting a Primary Attitude Device from the drop down list does not affect these values for any attitude device in the list. Every attitude device needs to be set up for its own corrections and offsets.)

Primary Device Auto Switch
Select the On radio button to turn on this feature. Then enter the time out time in the edit box. If WinFrog does not receive data from the primary attitude device, or if it receives bad data for this length of time, it will switch to the next secondary that is enabled and has good data.

Auto Switch Feature Usage
To use this feature first turn the sensor on as described in the Attitude section above. Next, select the attitude device that you wish to be primary from the drop down list box. Then turn the primary device auto switch on and enter the time out time. Then edit all the other attitude data items and enable them in the Attitude group box. Note that the same selected primary will be displayed for all attitude data items; similarly, the automatic feature will be turned on and the time out time will be the same. However, you must individually enable each attitude device in the Attitude group box.

Offsets
These are not applicable in this case.

Acoustic Options
This applies to long base line acoustic transponders that have inclinometers. See chapter 17 for more information.

Data item: ROV, Sonsub Innovator3, OUTPUT

This data item outputs the ROV position, in grid coordinates (E,N), as well as the ROV KP to the Sonsub Innovator3 system.

There are no Edit or configuration options available for this data item, however, it must be added to the appropriate vehicle's device list in order for the position and KP output to take place.

TELGRAM SPECIFICATION:

The Input data telegram from the Sonsub Innovator3 system contains the following data;

Field	Data
1	$PSSI
2	Hheading
3	Ppitch
4	Rroll
5	Ddepth
6	Aaltimeter

The Output data telegram to the Sonsub Innovator3 system contains the following data;

Field	Data
1	$NAV
2	easting
3	E
4	northing
5	N
6	kp