WinFrog Device Group:	**ROV**
Device Name/Model:	**Edgetech**
Device Manufacturer:	Edgetech 455 Fortune Boulevard Milford, MA 015757 Ph 508 478 9500 fax 508 478 1456 Edgetech 1141 Holland Drive, Suite 1 Boca Raton, FL 33487 U.S.A. Tel: (561) 995-7767 Fax: (561) 995-7761 Email: info@edgetech.com
Device Data String(s) Output to WinFrog:	SONAR_MESSAGE_ALIVE SONAR_MESSAGE_SYSTEM_STATUS SONAR_MESSAGE_DATA_ACTIVE DEV_DVL_DATA DEV_PRESSURE_DATA DEV_PITCHROLL_DATA
WinFrog Data String(s) Output to Device:	SONAR_MESSAGE_ALIVE SONAR_MESSAGE_DATA_ACTIVE SONAR_MESSAGE_SYSTEM_STATUS
WinFrog Data Item(s) and their RAW record:	ROVDATA 496 HEADING 410, 409 BOTTOMDEPTH 411 ATTITUDE 413 SPEED LOG 402

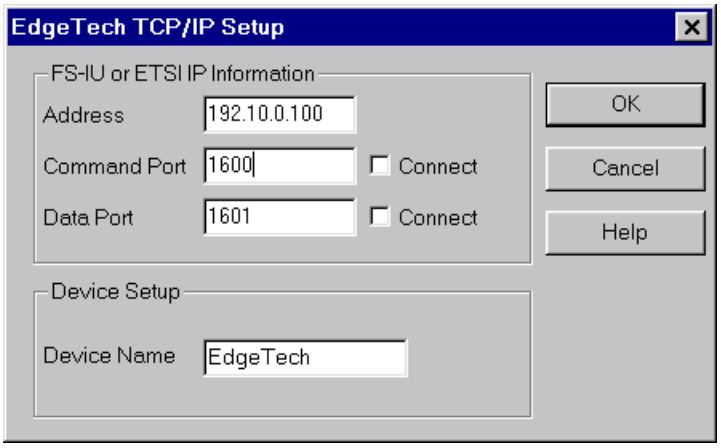
DEVICE DESCRIPTION:
The Edgetech system is a towed multi beam system. The data output to WinFrog consists of ROV type data, specifically:

1. Pitch and roll
2. Doppler speed
3. Depth and altitude
4. Heading
5. Temperature and salinity

See the Edgetech manual for details.

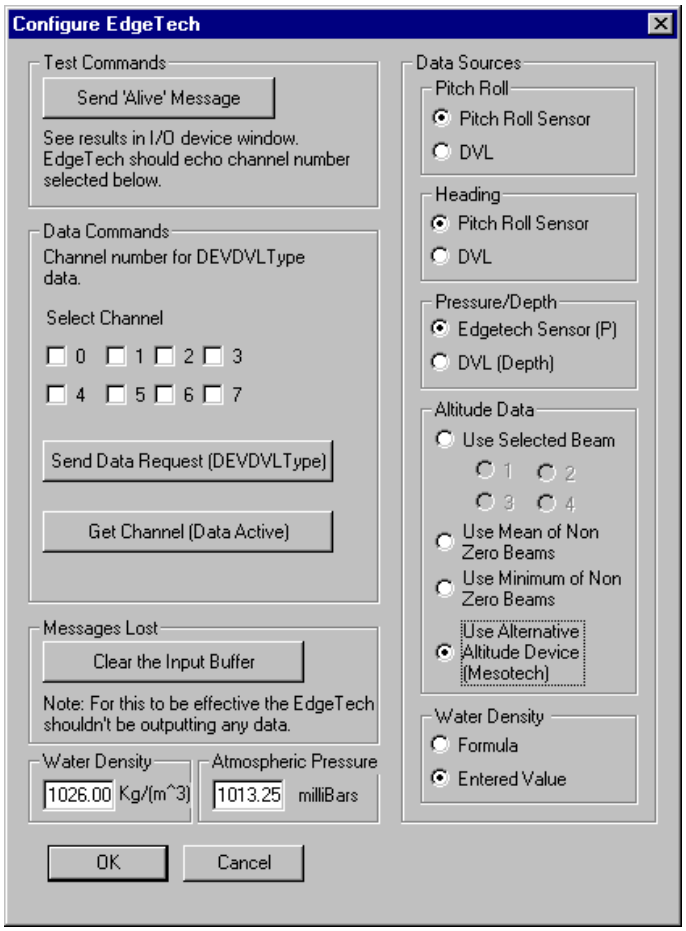
DEVICE CONFIGURATION INSTRUCTIONS:

WINFROG I/O DEVICES > EDIT I/O:
This device uses TCP/IP for communications. When first selected or when Edit I/O is selected, the following dialog will appear.



To establish communications enter the address of the Edgetech, the command and data ports. Check the Connect boxes and click OK. If the address and ports are unknown see the personnel running the Edgetech or consult the Edgetech manual. The name of the driver may also be changed. When the OK button is clicked WinFrog will attempt to establish a connection. Verify that the connection has been made by looking at the top two lines displayed in the Decoded Data tab of the I/O Devices window for the Edgetech device. Further testing may be done from the Configure device dialog, see below.

WINFROG I/O DEVICES > CONFIGURE DEVICE:
This device must be configured at the I/O Device window level. In the I/O Devices window, click the device name to select it, then right-click and select Configure Device. The Configure EdgeTech dialog box appears, as seen below.



Test Commands

Send 'Alive' Message sends this command to the Edgetech. Included in the command is the value in the Channel number for DEVDVL Type data. Although the value itself has no meaning to the Edgetech, the Edgetech will echo this command and the value. This can be used as a test. When WinFrog receives the Edgetech message, the time and value will be displayed on the third line of the Edgetech Decoded Data tab.

Data Commands

Send Data request (DEVDVL Type) sends the following message:
Sonar message = SONAR_MESSAGE_DATA_ACTIVE
Subsystem = DEVICE_SUBSYSTEM_SERIAL_PARSED
Sonar command = SONAR_COMMANS_SET
Data value = 1 (Activate)
The channel number is set to the value entered by the operator.

It is necessary to send this command to cause the Edgetech to output the data assigned to the particular channel specified in the edit box (Channel number for DEVDVL data type). The data output depends upon the setup within the Edgetech. If it is unknown which data is assigned to which channels, enabling the output of extra

channels should not adversely affect WinFrog. WinFrog will ignore messages not intended for it. The only adverse effect that should occur is if there is high traffic.

Get Channel (Data Active) sends the following message:
Sonar message = SONAR_MESSAGE_DATA_ACTIVE
Subsystem = DEVICE_SUBSYSTEM_SERIAL_PARSED
Sonar command = SONAR_COMMANS_GET
Data value = 1 (Activate)
The channel number is set to the value entered by the operator.

This message requests the current setting for the channel entered. The response to this command is displayed in the Decoded Data tab of the I/O Device window below the header
"Data Channel Status Returned Sonar Command". If the status is 0, the data for this channel is inactive, 1 means it is active. The Returned Sonar Command is the Sonar Command returned by the Edgetech, normally this is Reply but may be
0 = Set
1 = Get
2 = Reply
3 = Error
4 = Play back
All other values = Unknown

Messages Lost

Clear the Input Buffer

The data received from the Edgetech is placed into a circular buffer. If the Edgetech is sending too much data too fast and there are several applications other than WinFrog running on the machine, WinFrog may not be able to extract all the data from the buffer before new data arrives. This causes a buffer overrun and WinFrog will loose track of the messages. If it does not seem able to decode the messages properly, try clearing the buffer – first stop the Edgetech from transmitting data then click this button to clear the buffer.

Water Density

The Edgetech sensor returns observed pressure, which must be converted into depth. To convert the pressure to depth, the density of the water is required. This may be calculated (see below) or may be entered by the operator. If a manual value is desired, enter it here.

Atmospheric Pressure

To correct the observed pressure, which contains the atmospheric pressure, enter the atmospheric pressure correction value here. This is subtracted before the value is converted to depth.

Data Sources

Pitch roll, Heading, Pressure/Depth and Water Density

There are three data messages
DEV_DVL_DATA,
DEV_PRESSURE_DATA and
DEV_PITCHROLL_DATA.
The first contains the DVL (doppler velocity log) and pitch, roll, heading, depth, temperature and salinity. Thus the operator has a choice as to which message to use to obtain the pitch, roll, heading and depth from. Use the radio buttons to select which message is to be used. If the DEV_PRESSURE_DATA message (Edgetech sensor) is selected a choice must be made as to how the water density is to be obtained. A standard formula using the observed temperature and salinity from this same message or a manually entered value, see above.

Altitude Data

There are four options for the selection of Altitude data: 'Use Selected Beam', 'Use mean of non zero beams', 'Use minimum of non zero beams', and 'Use alternative altitude device (Mesotech)'.

The DEV_DVL_DATA contains the altitude from four different beams. Select 'Use Selected Beam' and select which one is to be used to obtain the altitude.

The option 'Use mean of non zero beams' allows the selection of the mean of non-zero beams from the four different altitude beams in the DEV_DVL_DATA message.

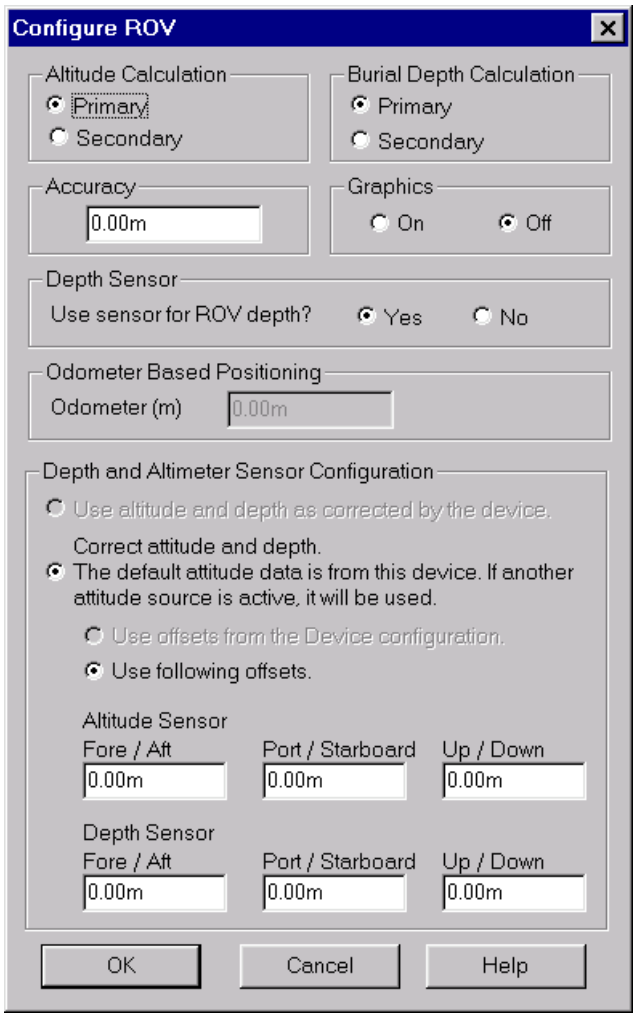
The option 'Use minimum of non zero beams' allows the selection of the minimum value of the non-zero beams from the four different altitude beams in the DEV_DVL_DATA message.

The option 'Use alternative altitude device (Mesotech)' allows the selection of the altitude data from the Mesotech device.

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

Data item: **ROV, EdgeTech, ROVDATA**

Attach this data item to the ROV. The dialog below appears when this data item is edited.



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 will 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.

Depth Burial Calculation: Not available from this device.

Accuracy: Not used by this device.

Graphics: Not used by this device.

Odometer Based Positioning: Not used by this device.

Use sensor for ROV depth:

Yes 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 the value above. 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

No will result with this device obtaining the depth of the CRP from the vehicle itself, as opposed to assigning it to the vehicle as above. The operator 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 primary/secondary altimeter setting.

Depth and Altimeter Configuration:

Altitude Offset is the distance between the altitude sensor and the CRP. Positive if the sensor is above the CRP.

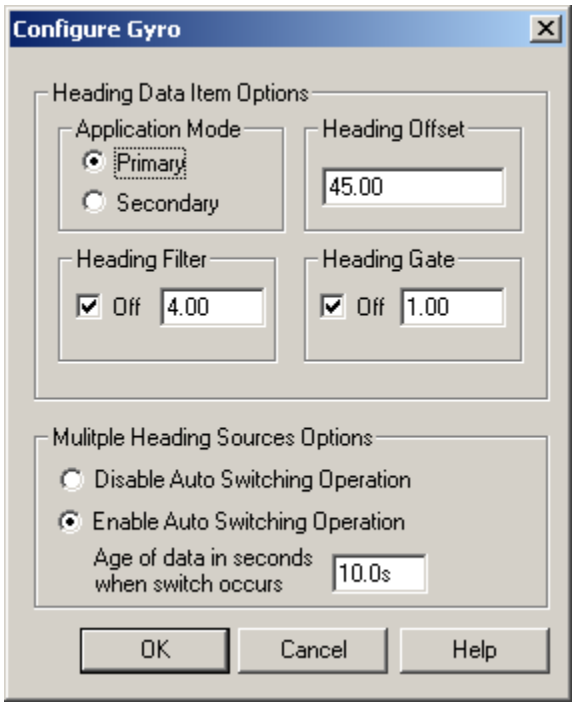
Depth Offset is the distance between the depth sensor and the CRP. Positive if the sensor is above the CRP.

The offset position will be corrected for pitch and roll then the vertical offsets will be applied to determine the depth and altimeter. If no pitch and roll corrections are required, enter 0 for the Fore/Aft Port/Starboard offsets but the Up/Down corrections will still be applied, unless they are 0.

The depth and altitude sensor offsets are used to determine the bottom depth, however the pitch and roll correction is not applied to these offsets when determining the bottom depth.

Data item: **ROV, EdgeTech, HEADING**

The Heading data item must also be edited once it is added to a vehicle's device list. Highlight the HEADING data item in the vehicle's device list, then click the Edit button. The Configure Gyro dialog box appears 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:

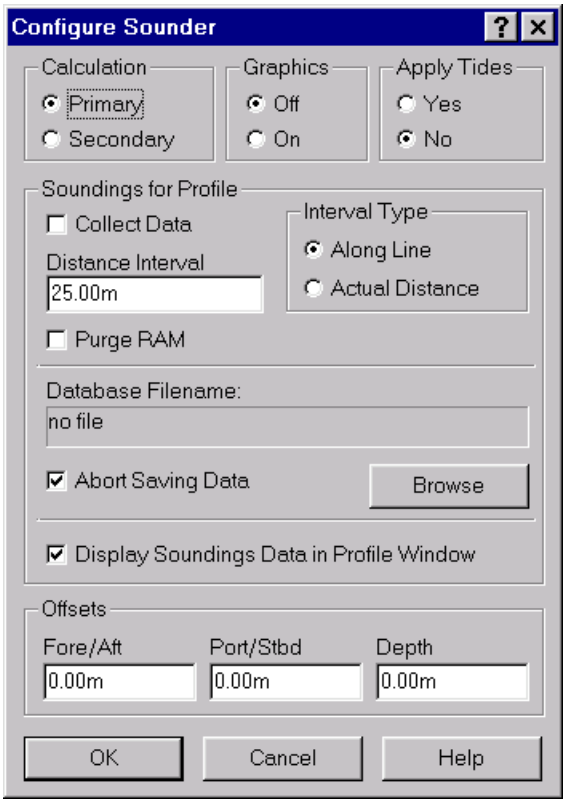
Select the mode you wish to operate WinFrog.

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, EdgeTech, BOTTOMDEPTH**

Attach this data item to the ROV in order to log bottom depth. Bottom depth is calculated from the ROV depth and the altimeter value, plus any offsets entered. See ROVDATA above. The Configure Sounder dialog appears when this data item is edited. It does not use the magnetometer depth and altitude.



Calculation:

Primary will result in this vehicle's depth being assigned the value determined above plus the depth offset found in this dialog box. *Do not enter this offset twice; it should be entered in the ROVDATA dialog box.* Tide will be applied if enabled.

Secondary no assignment of depth will be made using data from this device. The raw data is still always recorded.

Graphics:

On displays the offset position of the sounder in the Graphics window.
Off does not display this point.

Soundings for profile:

Collect Data: If selected, soundings may be displayed in the profile window and may also be stored in a Microsoft Access database (if the cable module is available). Note: whether or not this is checked does not affect storage in the raw file.

Distance Interval is the distance the vessel must move before another sounding will be saved in memory or stored to the database.

Interval Type:
Along Line: A sounding will be saved when the vessel has moved the specified distance parallel to the track or survey line.

Actual Distance: A sounding will be collected when the vessel has moved the specified distance in any direction.

Purge Ram: When selected, the soundings in memory will be deleted. This does not affect any soundings that are being stored in the database or raw files.

Database File Name: Select the database file in which to store the soundings using the Browse button. Once selected the “Abort Saving Data” checkbox will clear.

Abort Saving Data: If selected, storage to the database will cease.

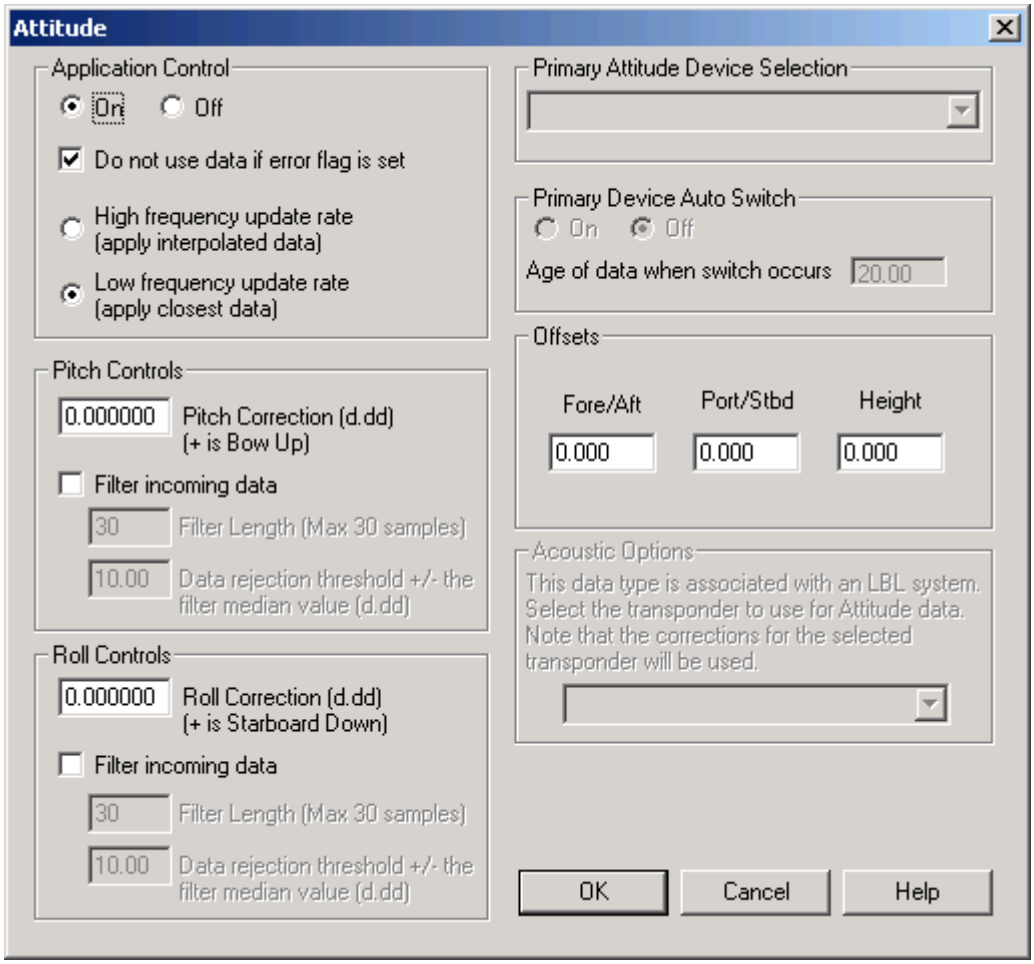
Display Soundings in Profile Window: Select this checkbox to display the soundings in the Profile window. In order to see the soundings in the Profile window, a survey line must be assigned to this vehicle and the Profile window must be configured as “Continuous Profile Along Selected Survey Line” found with the display tab.

Offsets:

Enter the altimeter offsets. Note: if a vertical offset is entered here, it will be applied to the depth calculated from the ROVDATA data item before assignment to the vehicle.

Data item: **ROV, EdgeTech, ATTITUDE**

When the ATTITUDE data item is edited, the Attitude dialog box appears 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

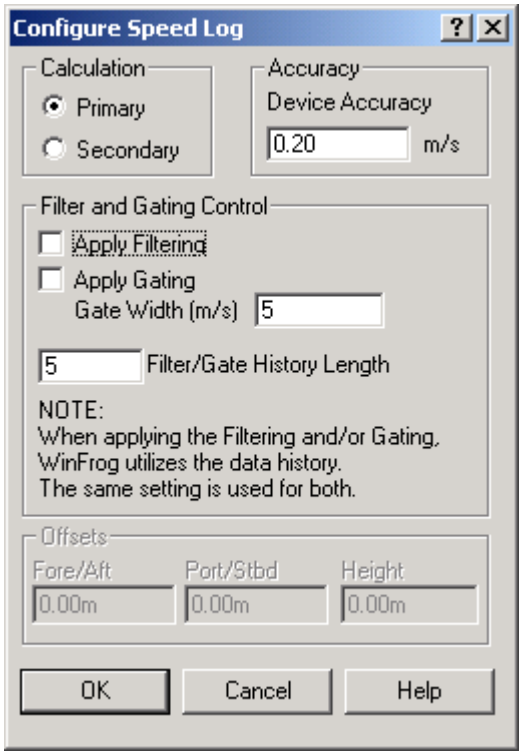
These are not applicable in this case.

Acoustic Options

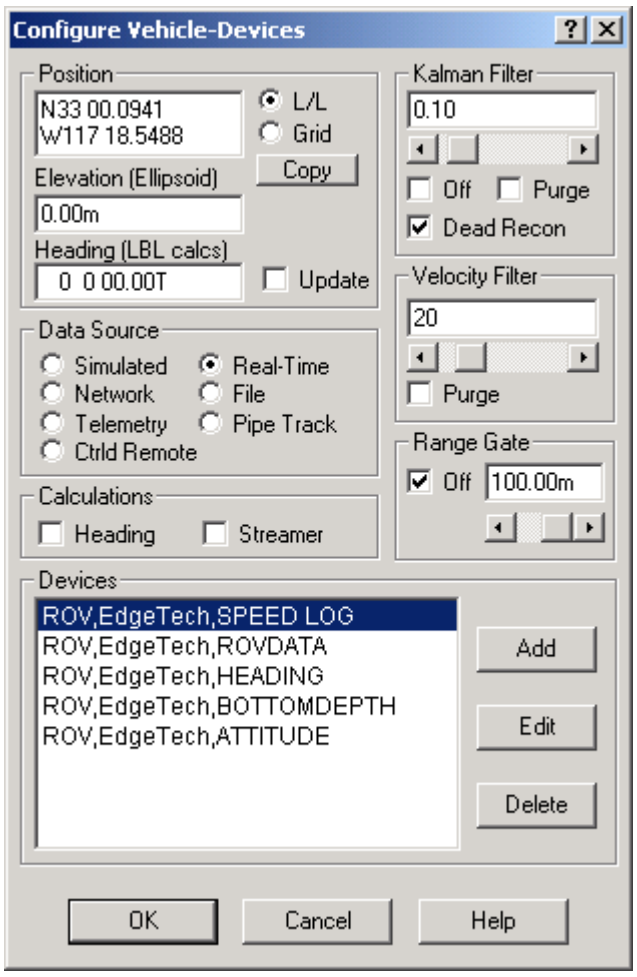
This applies to long base line acoustic transponders that have inclinometers. See chapter 17 for more information.

Data item: **ROV, Edgetech, SPEED LOG**

When the EDGETECH's Speed Log data item is added to a vehicle's device list, it must be edited to suit the application. To edit the device, in the vehicle's devices list highlight the SPEED LOG,EDGETECH,SPEED LOG data item and click the Edit button. The Configure Speed Log dialog box appears as seen below.



WinFrog is able to utilize the data from Doppler speed log in the position Kalman Filter to enhance results, specifically for positioning an ROV with USBL. It is critical that the device is set up correctly, and monitored, in order to ensure correct application of the data. It is also important to note that only the *Speed over Ground* data is used in the Kalman Filter. The Kalman Filter is under the Vehicle Text Window/Configure Vehicle Devices for each vehicle. See the Configure Vehicle-Devices dialog box below.



The application and monitoring of the Doppler speed log is detailed in the following sections. It is important to note that the values and limits stated here for any of the configurations discussed are guidelines. You must evaluate the actual performance and make adjustments accordingly.

1. Background on Filtering and Gyro Input

General Kalman Filtering:
The Kalman Filtering performed by WinFrog allows the direct input (to the filter) of position and velocity data. The application of this data within the filter is a balance between:

- The accuracy attributed to each individual data type, and,
- The Kalman Filter setting itself.

The former is the accuracy entered by the operator for each data item when configuring its use as attached to a vehicle. The latter is the Kalman Filter setting controlled with the slider bar in the Configure Vehicle-Devices dialog box.

It is important to realize that the correct application of the Kalman Filter requires careful consideration of the actual accuracy of each data item, and, the relative accuracy between data items utilized. If the accuracy relationship is unbalanced, the Kalman Filter will be biased towards the data item with the overly optimistic accuracy setting.

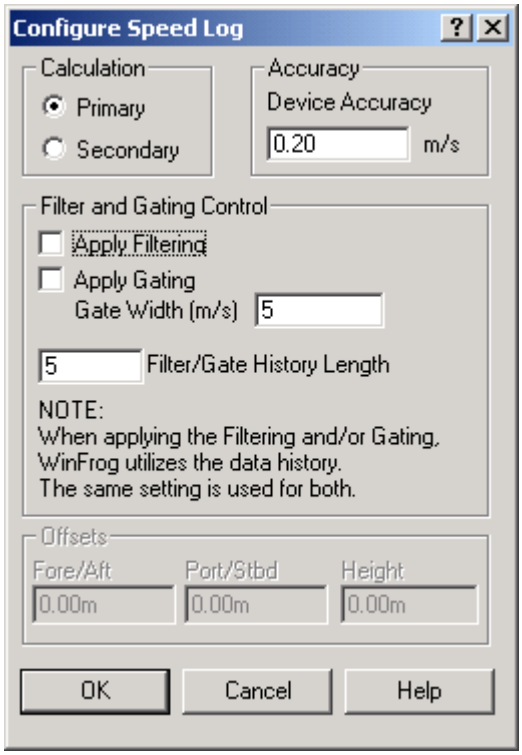
The Kalman Filter setting itself controls how reactive to new data the filter will be. The default setting of 0.1 is applicable for many situations. The impact that the new data has in the filter is also affected by the accuracy setting for that data item. Note that the lower the value, the more smoothing that is applied.

If the Kalman Filter is set to OFF, the Velocity Filter is used. The Velocity Filter is a 'central tendency' filter, which seeks the median of the input values. The Velocity Filter does not affect position (i.e. the position of the vehicle will be the resultant of the raw data from the positioning sensors). The velocity filter will 'smooth' the velocity only. This is good for use when minor changes in velocity need to be monitored (e.g. Cable Lay Vessels and Vessel Tows where estimated time of arrival is important).

Gyro Requirements:
A Doppler speed log unit provides WinFrog with fore/aft and port/starboard (and in some cases, up/down) velocities. For use in the Kalman Filter, these are converted to Northing and Easting velocity vectors. Therefore, it is necessary to have a reasonably accurate and calibrated vehicle heading source to enable the transformation of the velocities from a vehicle based X/Y reference frame to an absolute North/East reference. The heading data used is that which is configured for the vehicle, including any offsets applied in the associated HEADING data item configuration.

At present, the vertical velocities are not utilized within WinFrog.

2. Speed Log Window Configuration



Calculation:

Set to Primary if you wish the Doppler data to be used to assist the position of the vehicle.

Accuracy:

Accuracy of the Doppler speed logs in m/s. The default is 0.2. Change this only with caution and knowledge of the results.

Apply Filtering:

Controls the filtering of the raw Doppler data prior to its use in the Kalman Filter. If selected, a central tendency filter is applied to the data using the number of samples defined in the *Filter/Gate History Length*, the result of which is used for input to the Kalman Filter.

Apply Gating:

Controls the gating of the raw data prior to its use in the Kalman Filter. If selected, the new data is tested against the data history based upon the number of samples defined in the *Filter/Gate History Length*. If it exceeds the gate limits, the data is rejected.

Gate Width:

Defines the gating limits in m/s, the value must be determined by monitoring the data.

Filter/Gate History Length:

Defines the number of samples (minimum 3, maximum 30) to be used for both the central tendency filtering and the gating. This setting must reflect the application, environment and the Doppler performance. It depends upon balancing the need to smooth the data and the required responsiveness to real changes in the data. The longer the filter, the smoother the result; however, the result will be less responsive to the actual dynamics of the vehicle. The shorter the filter, the less smooth the results, and the more responsive to the actual dynamics of the vehicle.

Offsets:

Not applicable for this operation.

It should be noted that if the *Apply Filtering* option is selected, but not the *Apply Gating* option, a default gating value of 10m/s is used for the purpose of utilizing the filtering function.

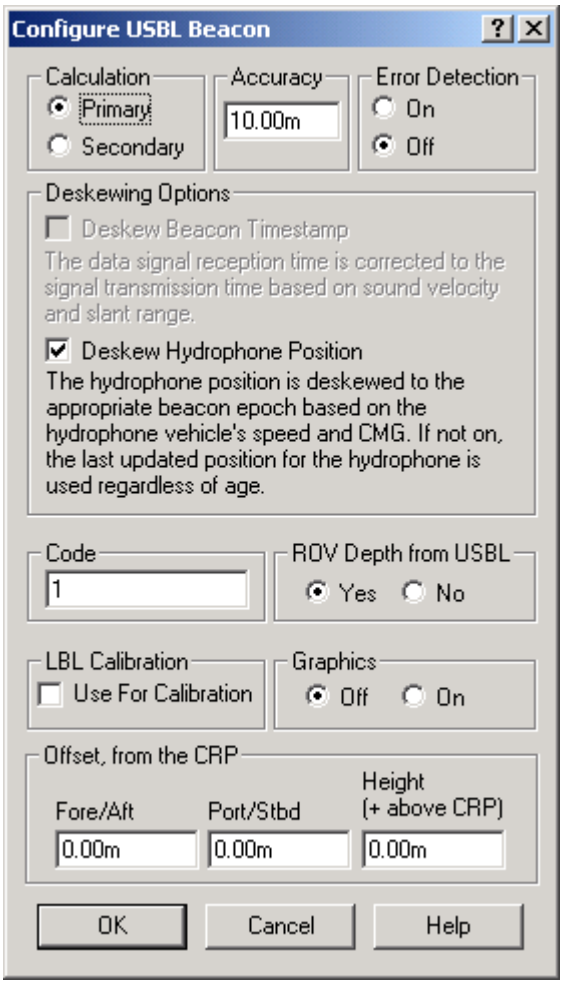
CONFIGURATION DETAILS:

Under this section we will attempt to provide further information of the devices that may benefit from the Speed Log input.

The correct use of the SPEED LOG data item is dependent upon the correct use of associated data items and the configuration of the associated vehicle Position Calculations. In a typical situation, the Doppler speed log is mounted on an ROV being positioned with USBL, so this is the setup that will be examined here.

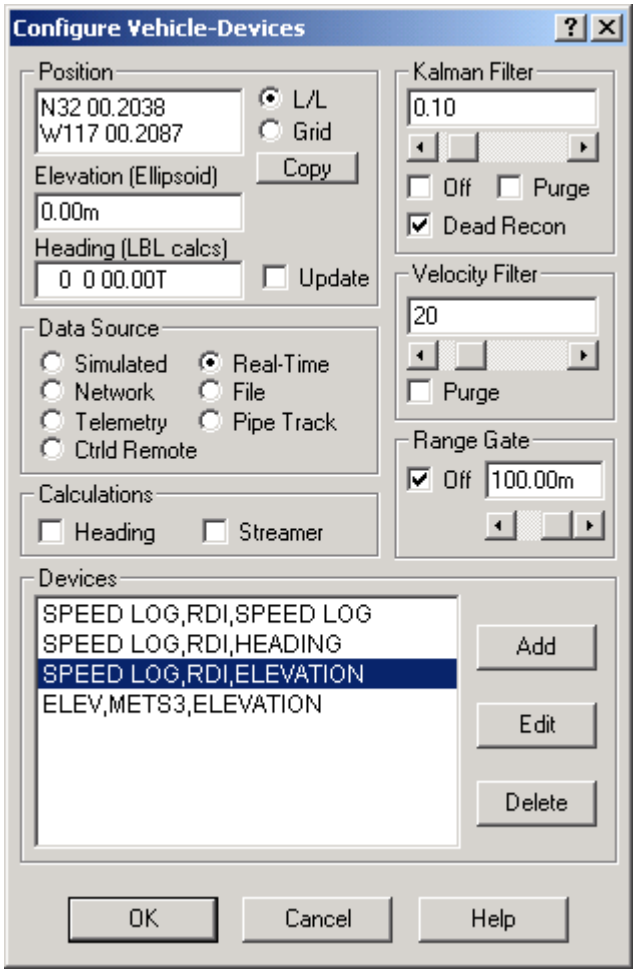
USBL BEACON Data Type Configuration:

The ROV will be positioned using a USBL BEACON data item.



The *Accuracy* is the critical setting. This is generally between 7-15m, depending upon the performance of the USBL system. The lower the value, the greater the influence of the USBL data in the Kalman Filter. The higher the value, the less the influence of the USBL data in the Kalman Filter.

Vehicle Calculations Configuration – Kalman Filter:
The Configure Vehicle-Devices dialog box allows you to configure the Kalman Filter and the Position Gating.



In order to utilize the SPEED LOG data in the determination of the vehicle position, the Kalman Filter must be on, i.e. not checked *Off*.

The responsiveness of the filter to new data is controlled with the untitled numerical entry in the *Kalman Filter* panel. This value can be entered directly in this box, or controlled with the slider. The smaller the number, the less responsive to new data the filter is. Again, the default is 0.10 and this is appropriate for the majority of applications. In noisy environments on a vehicle with a low dynamics, this can be reduced. Similarily, with good data on a vehicle with high dynamics, this can be increased. However, changes to this value should be made and monitored carefully to ensure that an inappropriate filter is not used. In general, this value will not be less than 0.05, or greater than 0.4. For ROV operations, a range of 0.10 to 0.30 is reasonable.

Vehicle Calculations Configuration – Range Gate:
The *Range Gate* setting is used not just for gating ranges, but position data also. It is an invaluable tool when positioning with USBL. This should be set to a value in keeping with the performance of the USBL system. The default of 100m is much too large to be of any use with the USBL. A value of 20m is a reasonable initial setting to use.

Resetting of the Vehicle's Position:
Based upon the monitoring of *ghost vehicles* (see below), you will be able to determine if the actual ROV position has been overly and incorrectly biased by either the doppler or the USBL to the point where it requires correction. This can be accomplished in several ways.

Purging the Kalman Filter:
From the Configure Vehicle-Devices dialog box, select the Purge checkbox in the Kalman Filter panel and exit this dialog with OK. This will reset the Kalman Filter and purge the *history*. The positioning will start afresh with the input of new data of any type currently configured to *Primary* for that vehicle.

Update the Vehicle Position:
Enter or copy a new initial position in the Configure Vehicle-Devices dialog box and select the Update checkbox. This will force the vehicle to this position and the Kalman Filter will take over.

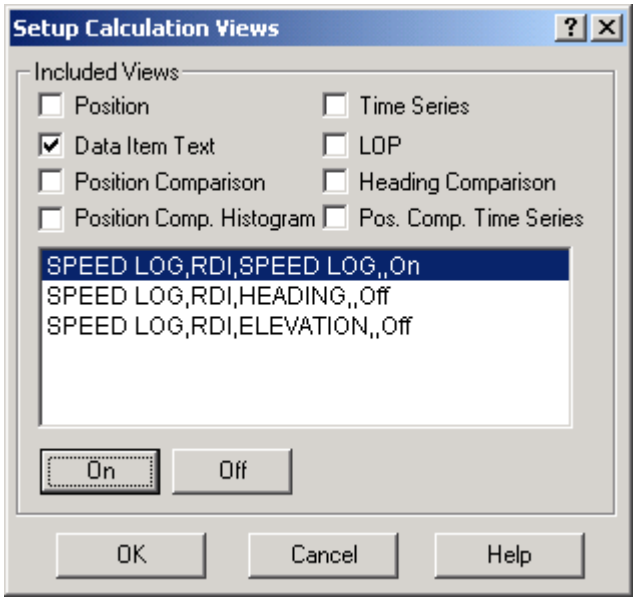
Disabling a Data Source:
Either the SPEED LOG or USBL BEACON data item can be removed from the solution by setting them to *Secondary*. The affect of the data will remain for a short period due to the fact that the Kalman Filter uses history to predict the future.

Monitoring the Application of the Speed Log:
The monitoring of the speed log device falls into three categories:

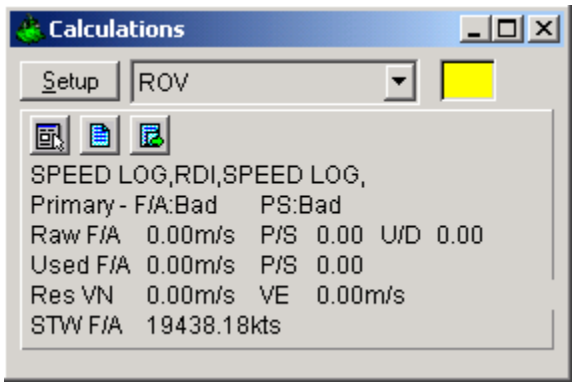
1. Input of data.
2. Filtering and gating of the speed log data, prior to use in the Kalman Filter.
3. Affect of the speed log data on the position.

Monitoring Device Input:
WinFrog does not provide alarms when a device stops updating. Therefore, the device input should be checked at the Device Window regularly. The time of data displayed for every device will indicate if data is being received.

Monitoring the Filtering and Gating of the SPEED LOG Data Item
To monitor the actual use of the speed log data as attached to the vehicle, a Calculation Window should be opened. In this window, select the appropriate vehicle from the dropdown list. Then using the Config button to the left of the vehicle dropdown list, access the configuration dialog box shown below.



Select the *Data Item Text* checkbox, highlight the SPEED LOG item and then click the *On* button. Exit with *OK*. The speed log data can then be monitored in this Calculation Window, as shown below.



The information provided in this window is as follows:

- Data type and device name
- Calculation setting (Primary/Secondary) and the status of the F/A and P/S velocity data. The status can be *OK*, *Gate* or *Bad*. OK indicates that the data is valid and used. Gate indicates that the data has been gated and is not used. Bad indicates that the data as received from the speed log was either invalid, or not an *Over Ground Speed*.
- The raw F/A, P/S and Up/Down Over Ground velocities in m/s.
- The F/A and P/S velocities used in the Kalman Filter. If the speed log data filtering is turned on, these will be the results of the filter. If not, these will be the raw data repeated.
- The Northing and Easting velocity vector residuals in m/s. The residuals are the Kalman Filter results minus the used data.

- The *Speed Through Water*, if the device also provides (or only provides) this value

This window provides you with the means to observe the results of the gating and filtering. Changes to the SPEED LOG data item configuration are required if excessive gating occurs or the filtered data does not reasonably represent the raw data.

It should also be noted that a time series plot of the *used* fore/aft velocity (and *Speed Through Water* if available) can be displayed by selecting the *Time Series* checkbox in the Calculation Window configuration dialog box.

Monitoring the Impact of the SPEED LOG Data Type:
The monitoring of the impact of the SPEED LOG data item on the positioning of the vehicle requires the setting up of *ghost* vehicles.

To monitor the performance of the SPEED LOG data only, add a vehicle to WinFrog, add the appropriate HEADING and SPEED LOG data items. Make sure to configure the vehicle's positioning parameters (i.e. Kalman Filter and Range Gating) and the data items, exactly as configured on the actual ROV Vehicle. When running with only a SPEED LOG data item as a source of positioning data, the vehicle must be given a starting positioning. Do this by copying the current ROV vehicle's position into the appropriate edit box in the *Configure Vehicle-Devices* dialog box and select the *Update* checkbox. Though the vehicle's position will always appear as yellow in the Vehicle Window, it will position based upon the Doppler speed log data.

To monitor the performance of the USBL BEACON data only, add a vehicle to WinFrog, add the appropriate HEADING and USBL BEACON data items. Make sure to configure the vehicle's positioning parameters (i.e. Kalman Filter and Range Gating) and the data items exactly as configured on the actual ROV Vehicle.

To minimize the distraction of the *ghost vehicles* on actual navigation and tracking, the operator may wish to do the following. From the *Vehicle Presentation* configuration option for the ghost vehicles, turn *Vehicle Window Data to* ***off*** to prevent the display of the vehicle data in the Vehicle window(s). The operator may also wish to limit the vehicle shape to a simple cross in a different colour to make graphical comparison easier.

The difference in positioning between these vehicles and the actual vehicle will illustrate the affect the use of the SPEED LOG data is having in the Kalman Filter.

Resetting of the Vehicle's Position:
Based upon the monitoring of the aforementioned *ghost vehicles*, the operator will be able to determine if the actual ROV position has been overly and incorrectly biased by either the doppler or the USBL (to the point where it requires corrective actions). This can be accomplished in the following ways:

Purging the Kalman Filter
From the Configure Vehicle-Devices dialog box, select the Purge checkbox in the Kalman Filter panel and exit this dialog with OK. This will reset the Kalman Filter and purge the history. The positioning will start afresh with the input of new data of any type currently configured to Primary for that vehicle.

Update the Vehicle Position
Enter or copy a new initial position in the Configure Vehicle-Devices dialog box and select the Update checkbox. This will force the vehicle to this position and the Kalman Filter will take over.

Disabling a Data Source
Either the SPEED LOG or USBL BEACON data item can be removed from the solution by setting them to Secondary. The affect of the data will remain for a short period due to the fact that the Kalman Filter uses history to predict the future.