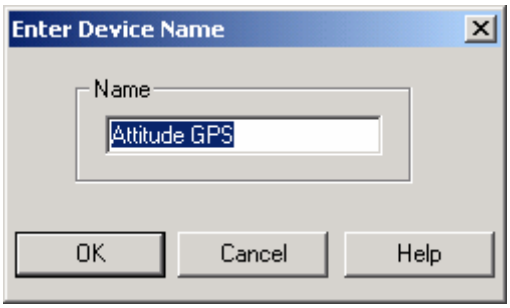
WinFrog Device Group:	**INS**
Device Name/Model:	**ATTITUDE GPS**
Device Manufacturer:	
Device Data String(s) Output to WinFrog:	
WinFrog Data String(s) Output to Device:	N/A
WinFrog Data Item(s) and their RAW record:	GPS ATTITUDE DATA 413 HEADING 910

DEVICE DESCRIPTION:
This device is not a physical piece of hardware, rather it is driver designed to incorporate the data from three individual GPS devices in order to derive the attitude and heading of the vessel. Pitch and roll corrections are determined by comparing the actual pitch and roll of the vessel with the pitch and roll output by this device.

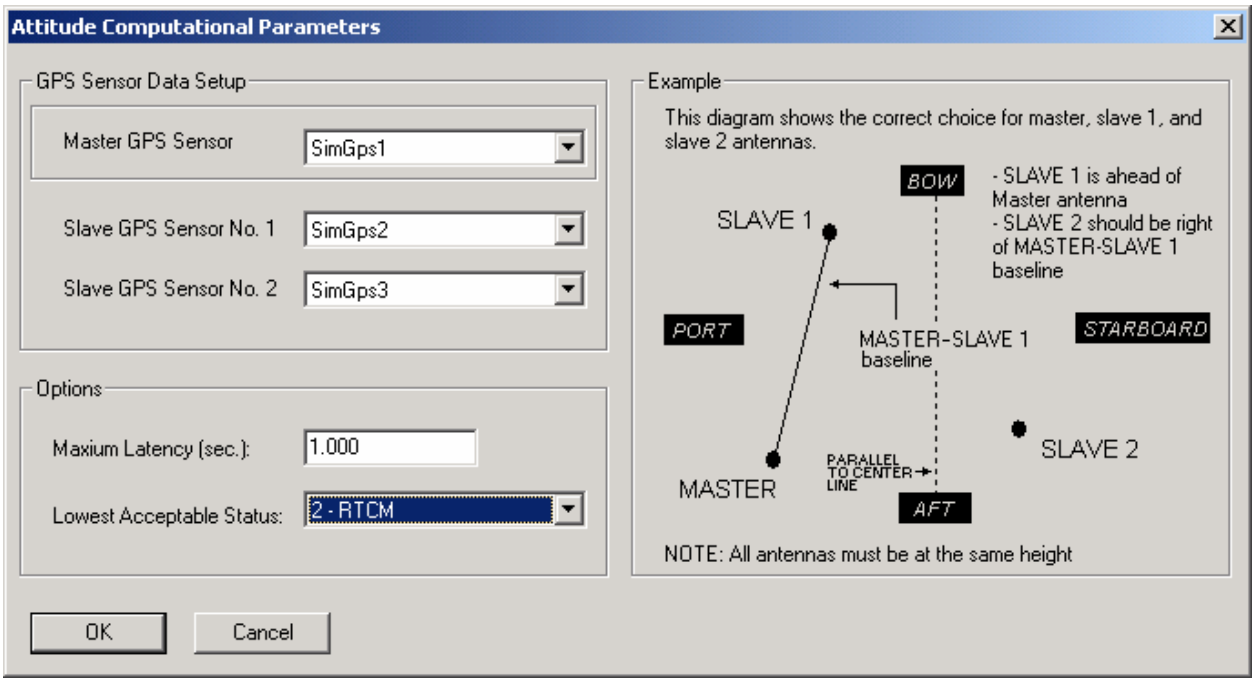
DEVICE CONFIGURATION INSTRUCTIONS

WINFROG I/O DEVICES > EDIT I/O:
As this device is not a physical piece of hardware, there are no I/O parameters to set. When added to WinFrog it is assigned to Com port 0.

In the I/O Devices window, click the device name to select it, then right-click and select Edit I/O. A dialog appears in which to change the name of the device if desired as seen 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 Attitude Computational Parameters dialog box appears, as seen below.

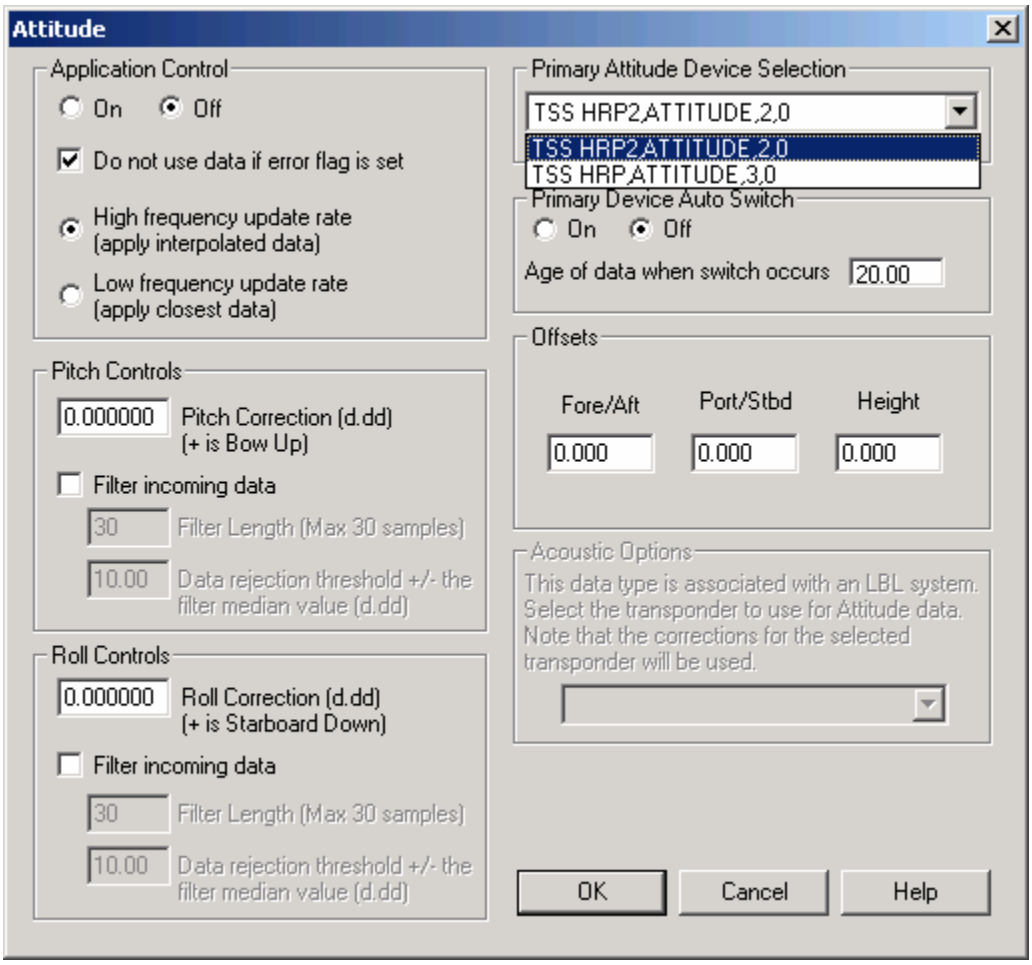


As mentioned above, this device utilizes three separate GPS units. The GPS antennas must be installed according to the diagram shown above and assigned correctly from the dropdown lists in the GPS Sensor Data Setup dialog boxes. The Maximum Latency should be left at the default of 1.000 seconds unless you are confident that this value needs to be changed. The Lowest Acceptable Status (selected from the dropdown list) sets the status value that must be met before it is used in the calculation. For example, if the GPS receiver being used outputs a status of 6 for differentially corrected positions, then the Lowest Acceptable Status would be set to 6. Refer to documentation for the GPS receivers being used to determine what status value is output to indicate DGPS positioning.

WINFROG VEHICLE > CONFIGURE VEHICLE DEVICES > DEVICE DATA ITEM > EDIT:
Adding the Attitude GPS device creates two data items: ATTITUDE and HEADING. Once the data items have been added to the vehicle, they must be edited to suit the application. Note that the three GPS devices must also be added to the vehicle in order for this driver to function properly.

Data item: INS, attitude GPS, ATTITUDE

The Attitude data item must be edited once it is added to a vehicle's device list. Highlight the **Attitude** data item in the vehicle's device list, then select the **Edit** button. The **Attitude** dialog box appears as seen below.



Attitude
By default, the sensor mode is off, meaning that data from the attitude 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.

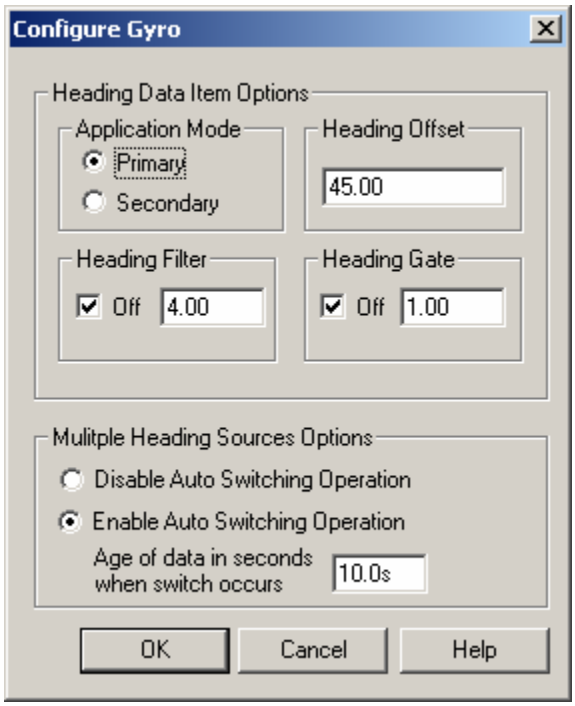
Offsets
These offsets are used to calculate remote heave (leaver arm). It is expected that these values are the offset from the center of gravity of the sensor. Then using the observed pitch, roll, and heave, the heave at the center of gravity will be calculated and assigned to the vehicle, which may then be output using the INSIX output device. However, it is recommended that the sensor be placed at the center of gravity. If this is not possible, it is better to enter the lever arm offsets into the sensor and have the sensor make the correction, then have the sensor output the corrected values with respect to the center of gravity. The INSIX output device expects that the heave assigned to the vehicle is with respect to the center of gravity.

WinFrog records the attitude data to a type 413 raw data record. This record contains observed Heave, Pitch, Roll, status, accuracy, and a time stamp to indicate precisely when the data was observed. See Appendix B: WinFrog File Formats in the WinFrog User's Guide for details on the Type 413 raw data record.

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

Data item: INS, attitude GPS, 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 select 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 case 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 1 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.