WinFrog Device Group:	**INS**
Device Name/Model:	**Seatex MRU 4 & 6**
Device Manufacturer:	**NAVIA Maritime AS, Seatex Division** Pirsenteret, N-7462, Trondheim, Norway Tel: +47 73 54 55 00, Fax: +47 73 51 50 20 http://www.seatex.no **Seatex Inc.** 911 Western Avenue, Suite 302, Seattle, WA 98104-1031, USA Tel: +1 206 903 8393; Fax: +1 206 903 8394 **Seatex Ltd.** Suite 1, Old Skene Road Westhill, Aberdeen AB32 6RL Tel: ++44 1224 744625; Fax: ++44 1224 744626 Duty phone: +44 (0) 831 349277 e-mail: sales@seatex.demon.co.uk
Device Data String(s) Output to WinFrog:	Variable but begins with $PSXN
WinFrog Data String(s) Output to Device:	Nil
Data Types	ATTITUDE, HEADING, HEAVE
WinFrog .raw Data Record Type(s):	Type 413 (Attitude): Time, Pitch, Roll, Status Type 888 (Heave): time, heave, roll, pitch, yaw, heave velocity, heave acceleration Type 410 (Heading): Time, heading, status, delta time, … repeat last four items 14 times. Type 910 (Heading for events): Time heading status

DEVICE DESCRIPTION:
The MRU 4 or 6 is one of seven different models of MRU's (Motion Reference Units) produced by Seatex Inc. The models include the MRU-1 through MRU-6 and the MRU-H. These units vary in capability (the higher the model number the more capable) and depending on model, can provide some or all of the following data:

- Pitch (radians)
- Roll (radians)
- Yaw (radians)
- Heave (M)
- Heave velocity (m/s)
- Heave Acceleration (m/s/s)
- Heading (Magnetic from Fluxgate Compass) (radians)

The MRU 4 or 6 can be used for motion compensation in swathe bathymetric echo sounders, DP systems, ROVs, high-speed (high dynamics) vessel motion damping systems and tow-fish systems.

Although the MRU 4 or 6 offers many data output variables, the WinFrog driver only decodes pitch, roll, yaw, heading, heave, heave velocity and heave acceleration. WinFrog allows for any order of input. WinFrog only decodes the ASCII $PSXN NMEA style format and the data must be in the floating point format.

WinFrog can be configured to apply the attitude data to remove device and tracking offsets caused by the vehicle's pitching and rolling motion. These calculations include reducing the GPS antenna position to the Z datum zero reference, removing apparent vehicle wandering due to the vehicle's pitch and roll.

DEVICE CONFIGURATION INSTRUCTIONS:

Baud Rate: Software configurable between 1200 and 56000 baud
Data Bits: 8
Stop Bits: 1
Parity : None
Handshake: None

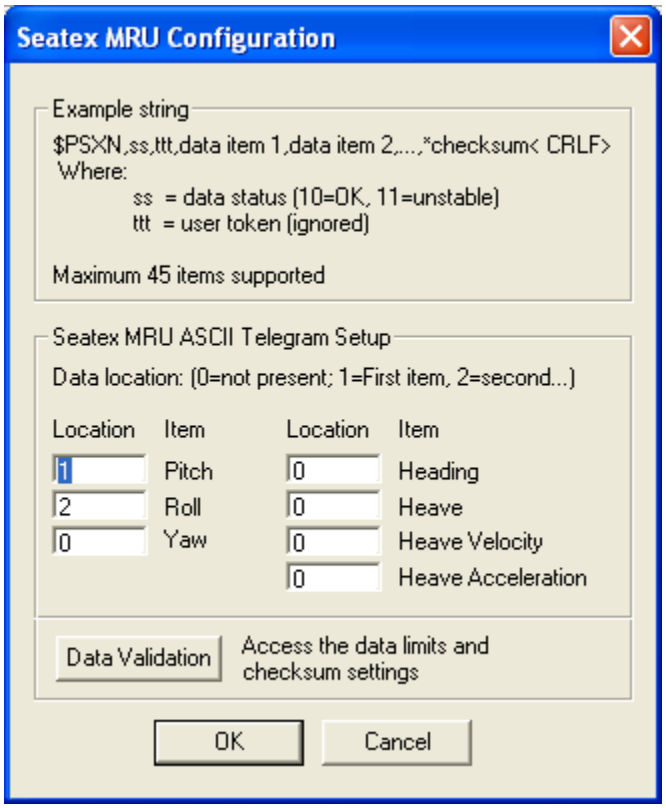
WINFROG I/O DEVICES > CONFIG OPTIONS:

The Seatex MRU 4 & 6 is added to WinFrog from the INS device category. Adding an MRU 4 & 6 creates the ATTITUDE, HEADING and HEAVE data items.

In the Decoded Data display, you can view the raw data from the unit. The time difference between readings is also displayed.

Note: In WinFrog, as in the MRU 4 or 6, the Pitch angle is positive for Bow up. The Roll angle is positive for Starboard Down.

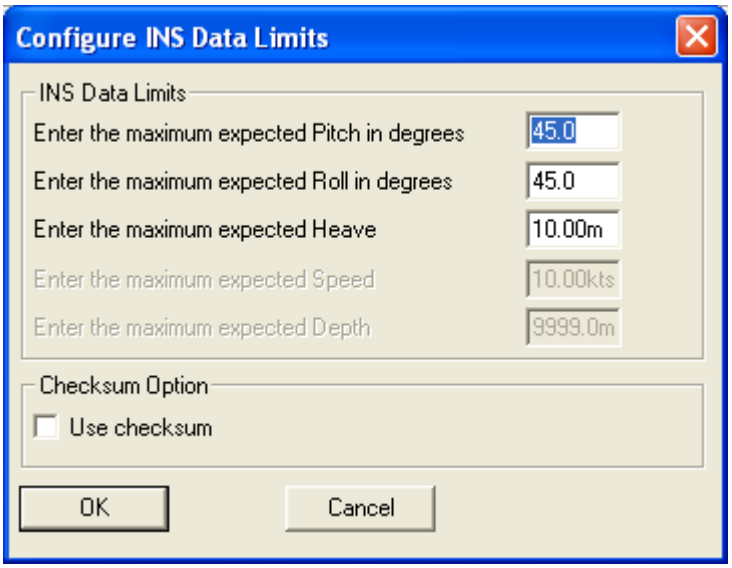
The MRU 4 & 6 must be configured at the "generic" I/O Devices level. Highlight the MRU 4 & 6 in the I/O Devices window and then right-click and select Configure Device. The Seatex MRU 4 & 6 INS Configuration dialog box appears as seen below.



Enter the location of each data item in the telegram numbered from the first data item. Thus the first data item is actually the forth element in the telegram. If the data item is not present enter 0. A maximum of 45 data items are allowed in the telegram of which WinFrog only supports 7.

Data Validation

Click this button to access the data validation options, including configuring the use of the checksum, via the following dialog.



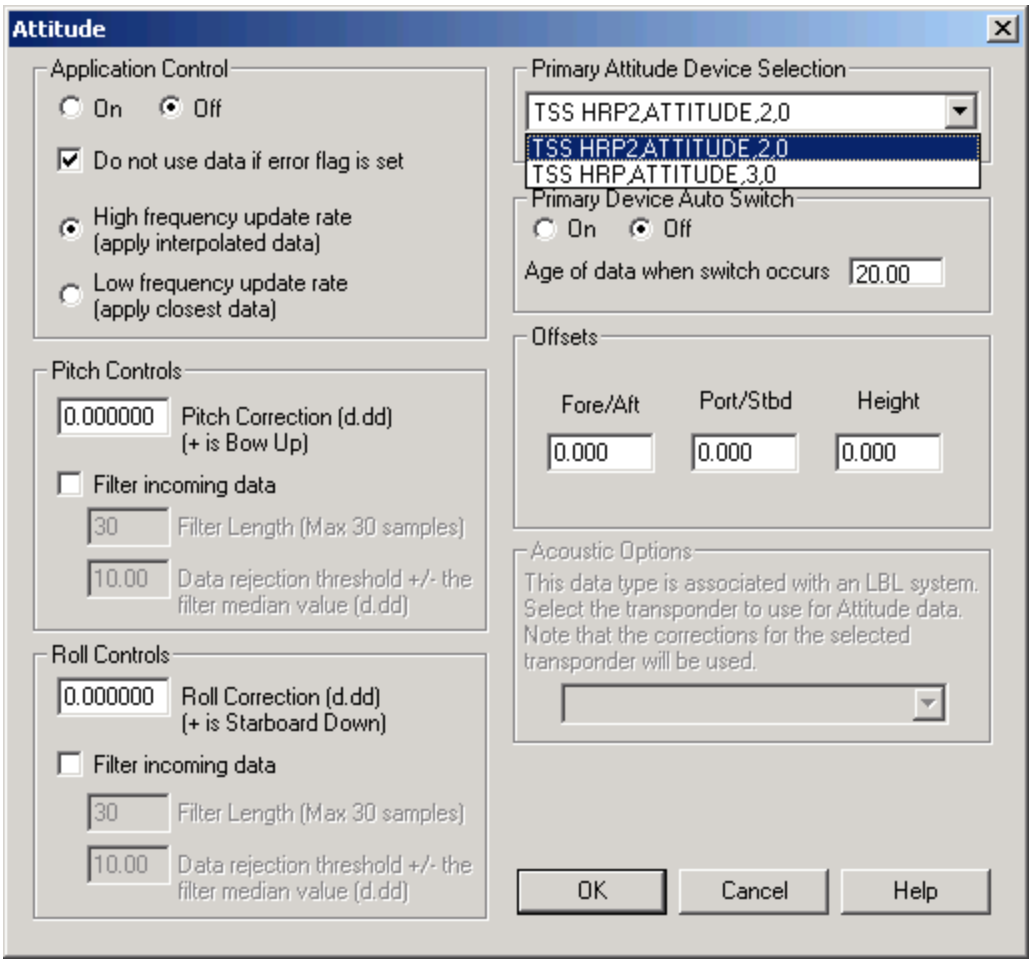
INS Data Limits:
You can enter the maximum expected value for pitch, roll and heave. If the absolute value of the decoded pitch, roll or heave, in a given message is greater than the respective entered maximum expected value, the data is flagged and none of the data in that message is passed to the vehicle. The heading is also checked to be >= 0 and < 360. The status is shown in the I/O Device window with an asterisk next to the specific data that failed the test.

The data is also checked for correct message type, valid characters and input buffer overruns and the status displayed in the I/O Device window.

Checksum Option:
If the MRU has been configured (via Seatex's MRC software) to include a check sum in its output data string, this box may be checked. If the telegram does not include the check sum and this box is checked no data will be decoded.

WINFROG VEHICLE TEXT WINDOW > CONFIGURE VEHICLE DEVICES > DEVICES > EDIT OPTIONS:

ATTITUDE
When the MRU 4 & 6's Attitude 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 INU,Seatex MRU 4 & 6, Attitude data item and click 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.

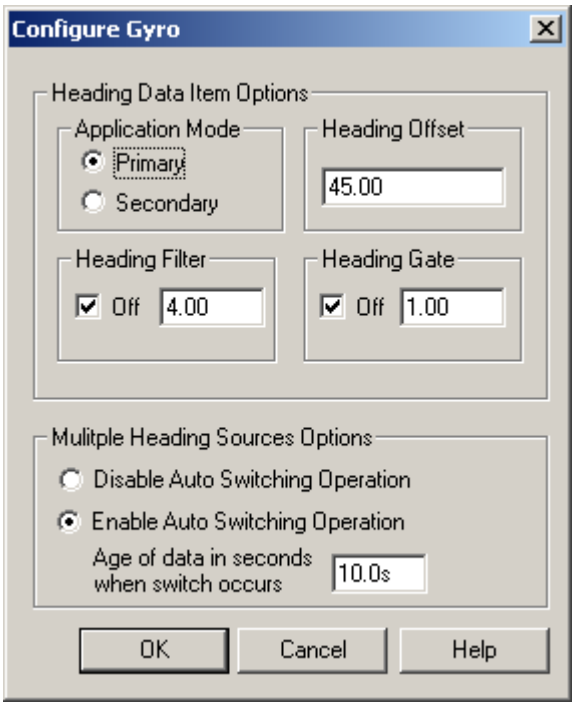
Offsets
These offsets are used to calculate remote heave (leaver arm). It is expected that these values are the offset from the center of gravity of the sensor. Then using the observed pitch, roll, and heave, the heave at the center of gravity will be calculated and assigned to the vehicle, which may 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.

HEADING

Once the heading data item has been added to the vehicle's device list, it must be edited to suit the application. In the appropriate vehicle's device list, highlight the heading data item and click the Edit button. The standard 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 MRU 4 or 6 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 compass readings. If the next observed value 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.

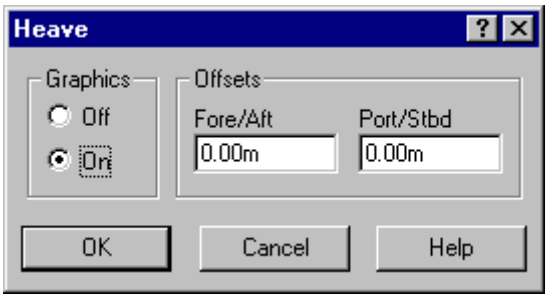
Note that this option is only available if more than 1 HEADING source is associated with the respective vehicle. Changes made to the Auto Switching options for any one of the HEADING data items are automatically assigned to the others upon exiting this dialog with OK. If the Auto Switching option is 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.

HEAVE
When the Heave data item is edited, the Heave dialog box appears as seen below.



Graphics:
The Graphics Off/On radio buttons have no application at this time. This is to say that when the graphics is turned on, no display of the unit's position will appear.

Offsets:
The Fore/Aft and Port/Stbd entry boxes allow you to enter Offsets of the MRU sensor from the vessel's Common Reference Point (CRP).

The heave data is only recorded for use in post processing, i.e. if an echo sounder is added to WinFrog, recorded depths are not corrected for heave. If real time heave corrected depth data is required, you must use an echo sounder that is capable of interfacing to the MRU and applying the heave data internally. WinFrog does not make the correction as the time delays can cause erroneous results.