

WinFrog Device Group:	PLOW
Device Name/Model:	SeaPlow IX
Device Manufacturer:	Perry Slingsby Systems 821 Jupiter Park Drive Jupiter, Florida 33458-8946 Tel: 1 561 743 7000 Fax: 1 561 743 1313 Email: pssi@us.perrymail.com
Device Data String(s) Output to WinFrog:	See Telegram Specification section below.
WinFrog Data String(s) Output to Device:	NONE
WinFrog Data Item(s) and their RAW record:	HEADING 410 PLOWDATA 490 ROV REF VEH NONE

DEVICE DESCRIPTION:

This driver is used for positioning and reading plow related data from the SeaPlow IX plow.

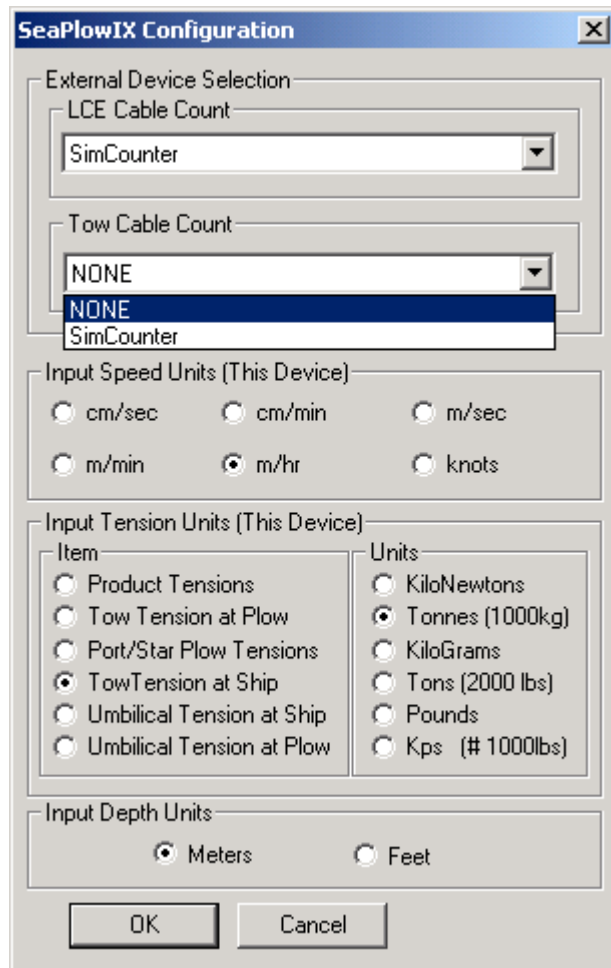
DEVICE CONFIGURATION INSTRUCTIONS

WINFROG I/O DEVICES > EDIT I/O:

Serial
Configurable Parameters

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 SeaPlowIX Configuration dialog box appears, as seen below.



The image shows the 'SeaPlowIX Configuration' dialog box. It has a title bar with a close button. The dialog is divided into several sections:

- External Device Selection:**
 - LCE Cable Count:** A dropdown menu with 'SimCounter' selected.
 - Tow Cable Count:** A dropdown menu with 'NONE' selected. A list is open showing 'NONE' (highlighted) and 'SimCounter'.
- Input Speed Units (This Device):** A group box containing six radio buttons:
 - cm/sec
 - cm/min
 - m/sec
 - m/min
 - m/hr** (selected)
 - knots
- Input Tension Units (This Device):** A group box containing two columns of radio buttons:

Item	Units
☐ Product Tensions	☐ KiloNewtons
☐ Tow Tension at Plow	☒ Tonnes (1000kg)
☐ Port/Star Plow Tensions	☐ KiloGrams
☒ TowTension at Ship	☐ Tons (2000 lbs)
☐ Umbilical Tension at Ship	☐ Pounds
☐ Umbilical Tension at Plow	☐ Kps (# 1000lbs)
- Input Depth Units:** A group box containing two radio buttons:
 - Meters** (selected)
 - Feet

At the bottom are 'OK' and 'Cancel' buttons.

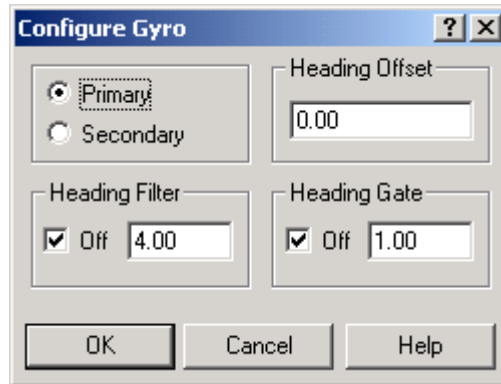
From the dropdown list boxes select the data source for the LCE telephone cable count data and the Tow cable count data. Also select the appropriate Input Speed Units as well as the Input Tension Items and their associated Units. Specify whether the Input Depth Units are to be meters or feet.

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

Adding the SeaPlow IX device creates three data items: HEADING, PLOWDATA and ROV REF VEH. Once the data items have been added to the vehicle, they must be edited to suit the application.

Data item: ROV, SeaPlowIX, HEADING

If the Heading data from the sensor on the Plow is deemed reliable enough to orient the vehicle, then this data item is added to the Plow vehicle in WinFrog. 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.



Calculation (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 with heading information. However, unlike the Position data items, WinFrog does not calculate a weighted mean solution for multiple Heading data items. If more than one Heading data item is set to primary, the vessels heading, in WinFrog, will jump back and forth between the two. Devices set to Secondary are simply monitored, and are not used in the vehicle's calculations.

In the case of Primary device failure, WinFrog will not automatically use the Secondary device(s). You must manually change a Secondary device to Primary status in order for it to be used in the vehicle's calculations.

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:

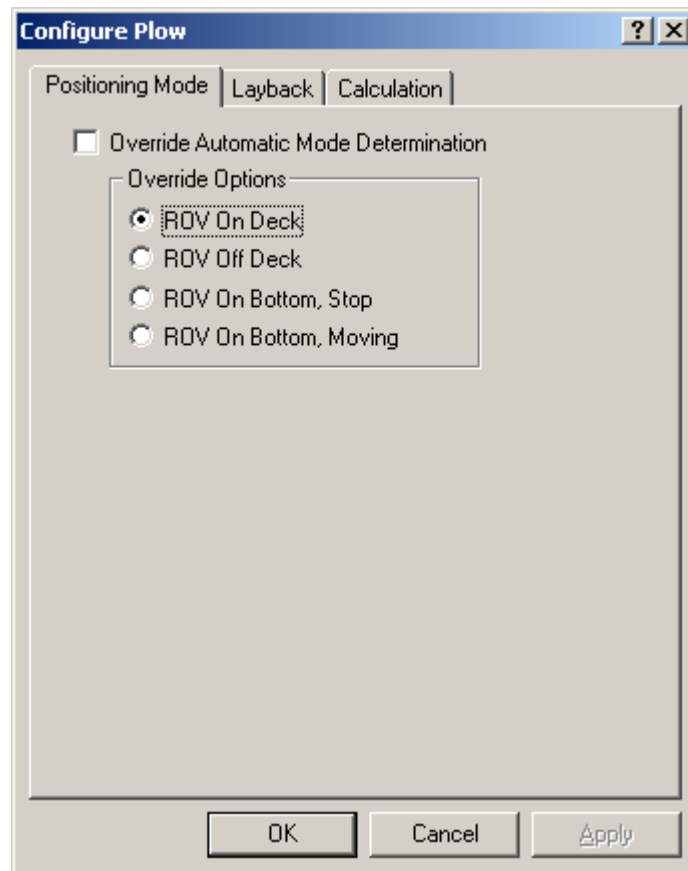
The Heading Filter is used to "smooth" heading values used by the vehicle. The value entered in the Heading Filter indicates the number of headings that will be used to predict the next heading value. The larger the value entered, the "heavier" the filter will be – i.e. the slower the vehicle's heading 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.

Data item: ROV, SeaPlowIX, PLOWDATA

This data item is used to read plow related data as well as to provide a reference point on the plow for positioning the plow relative to the ship. It is typically added to the plow vehicle in WinFrog.

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



Positioning Mode tab

Override Automatic Mode Determination:

This checkbox determines whether WinFrog automatically determines the towed vehicle location and mode or whether the operator determines it.

When in automatic mode, WinFrog uses the following criteria to determine the mode of the towed vehicle:

ROV On Bottom, Moving is assumed if the speed is greater than .2 knots or the Use ROV Speed setting is off and the layback is calculated at more than 1 meter.

ROV Off deck is assumed if the speed is greater than .2 and the layback is calculated at less than 1 meter and the altitude is greater than 4 meters.

ROV On deck is assumed if the speed is 0 and the layback calculated is less than the sum of the depth offset entered on the Calculations tab and the Tow point above water entered on the ROV REF VEH dialog.

ROV On Bottom, Stopped is assumed if none of the others are true.

Override Options:

ROV On deck places the towed vehicle on the tow vessel 5 meters forward of the offset point entered in the ROV REF VEH dialog.

ROV Off deck places the towed vehicle on the tow vessel at the tow point, which is the offset point entered in the ROV REF VEH dialog.

ROV On Bottom, Stop leaves the vehicle where it was when this option was selected and makes no further calculations as to its position.

ROV On Bottom, Moving calculates the towed vehicle's position using the data available and updates all displays with this data.

The screenshot shows the 'Configure Plow' dialog box with the 'Layback' tab selected. The 'Positioning Mode' tab is also visible. The 'Layback Calculation Method' section has two radio buttons: 'Pythagorean' (selected) and 'Catenary'. To the right of the 'Pythagorean' radio button is a text box labeled 'Tow Cable Constant' containing the value '73.29051' and the unit 'N/m'. Below this, there are three groups of radio buttons: 'Use ROV Depth' with 'Yes' and 'No' (selected), 'Use ROV Speed' with 'Yes' and 'No' (selected), and 'Use ROV Tow Angle' with 'Yes' and 'No' (selected). To the right of these is a text box labeled 'Trench Depth Offset' containing the value '0.0cm'. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Apply'.

Layback tab

Layback Calculation Method

Pythagorean uses the depth and cable count to form a right triangle. The layback is then calculated and applied to the tow vehicle's offset position along with an azimuth based upon the previous towed vehicle's raw position. WinFrog will use this position to calculate an azimuth but use the calculated layback for the distance between the towed vehicle and the tow vehicle.

The right triangle is formed thus: the hypotenuse is the cable count and the vertical value is the sum of the depth, Tow Point Above Water and the z offset found on the Calculations tab below.

Catenary requires the weight of the cable in newtons/meter, (1lbs/ft = 14.63nt/m). This calculation uses the cable count, depth of the towed vehicle and the tow tension to calculate the layback using a static catenary model. The azimuth used is the same as described above.

Use ROV Depth

Yes causes two actions:

- 1) The depth obtained from this device will be added to the depth offset and assigned to this vehicle. The depth offset is entered in the Calculation tab. The depth obtained from this device is either the manually entered value (if applicable) or the depth from one of the data items from the selected device.
- 2) The depth obtained from this device is used to determine the layback. No offset is applied except which may be applied at the source device.

No causes the depth for the layback calculation to be obtained from the vehicle. Essentially, this means the depth must be assigned by another device. This overrides the selection of a device or manual entry of depth.

Use ROV Speed

Yes causes the speed of the device to be obtained from this device. This requires that the towed vehicle in use must have the ability to output a speed in its data string. If it does not, then select No. **No** causes the speed to be calculated from the positional information and time. It will be assigned to the vehicle.

Use ROV Tow Angle

This option only applies to the SeaPlowVIII Device.

Trench Depth

Offset – If the Trench depth checkbox is selected on the Calculation tab (see below) then this value, 0.0 or otherwise, will be assigned as this vehicle's trench depth.

Calculation tab

Calculation

Primary – when selected, the layback described above will be used to calculate this vehicle's position, which will be assigned to it.

Secondary – when selected, this device will not determine this vehicle's position.

Accuracy

The Kalman filter uses this value as a weight factor. It should be set to a reasonable value.

Graphics

Select the On radio button to display a square in the Graphics and Bird's Eye windows at the offset position below.

Offsets

The **Fore/Aft** and **Port/Stbd** offset point is the reference point for the layback distance. Essentially the lay back distance is the distance between this point and the offset point of the tow vehicle described in the **ROV, SeaPlowIX, ROV REF VEH** section. This can also be viewed as the beginning or 0 point of the tow cable. This offset point is from the towed vehicle's CRP to the tow point.

Depth is an offset from the CRP. It is applied in several different ways:

- 1) If **Use ROV Depth** is set to **Yes** (on the Layback tab) this value is added to the depth from this towed vehicle device and assigned to the vehicle's depth. See Use ROV Depth on the Layback tab above.
- 2) If the Pythagorean solution is selected, this value is added to the vehicle depth and the Tow Point Above Water value to get the vertical portion of the right triangle when computing the layback.
- 3) If the catenary solution is selected, this value is not used in the model.

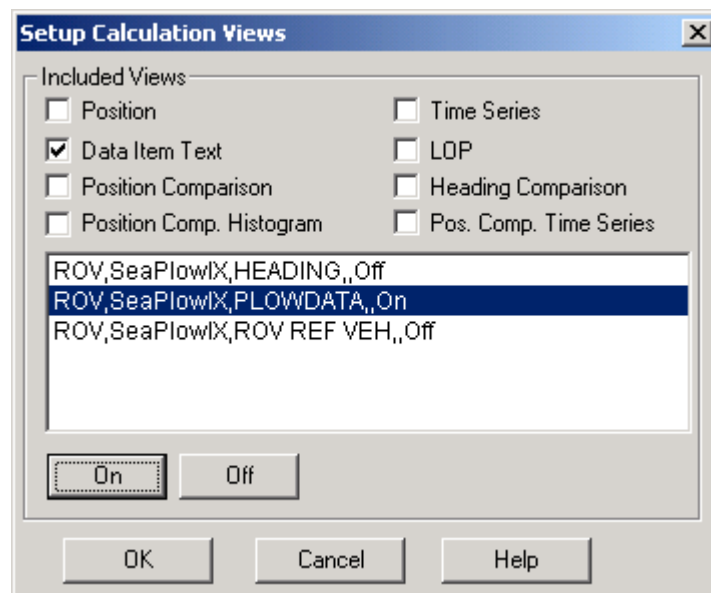
Real-Time Navigation Updates

Most Plow devices have the ability to provide real-time data updates via an umbilical. The Decoded data tab in the I/O Devices window will indicate what data is updated in real-time for each device. You should only select the checkboxes for data output by the device, as leaving these checkboxes selected causes data to be assigned to the vehicle. If the device does not output a particular type of data, 0 will be assigned for each item left selected and this will cause values from other devices to be overwritten.

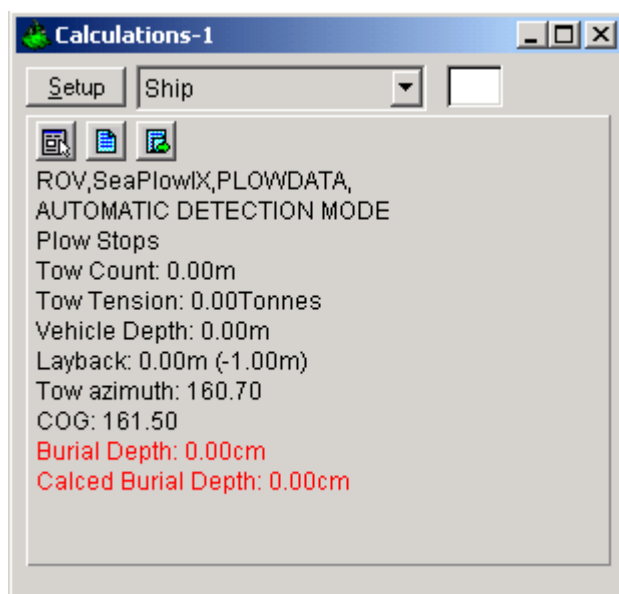
Real-Time Calculations

Calculate Toe Position – this option only applies to the Smart Cutter plow device.

The results of the above configurations are typically viewed in a Calculations window. To display the Calculations window, select View > Calculations from the main menu. Select the appropriate vehicle from the dropdown list and click the Setup button. Select **Data Item Text** and turn the data item **ROV, SeaPlowIX, PLOWDATA** on by highlighting it and clicking the **ON** button as seen below.



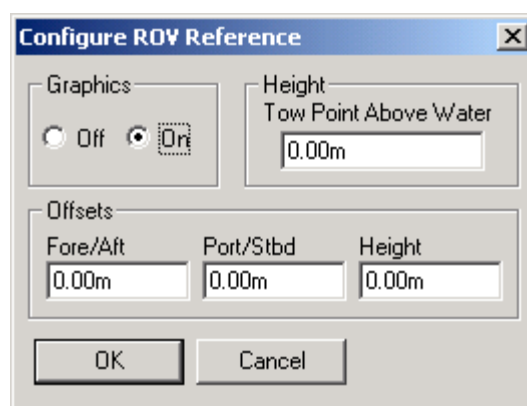
Exiting with OK will display the Calculations window as seen below.



From this window, you can monitor some of the input data as well as the layback calculation. This Calculation window also provides a shortcut to the Configure Plow dialog box by clicking the  button.

Data item: ROV, SeaPlowIX, ROV REF VEH

This data item is attached to the vehicle in WinFrog that has a real-time positioning source (DGPS etc.), typically the ship. This vehicle with its known position serves as the reference point for determining the Plow's position. Highlight this data item and click the Edit button to open the Configure ROV Reference dialog box seen below.



Graphics:

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

Tow Point Height:

The height of the tow point above water is added for layback calculations only if a towed vehicle model is used.

Offsets:

The X,Y,Z Offsets are applied from the CRP to the tow point (usually the winch) on the ship. These values are set similar to values that would be applied to any device offset within WinFrog. Note that the Height Offset is not used for operations involving plow vehicles.

Note: It is advised to use the waterline as the vertical CRP reference when sub-sea positioning devices are employed.

TELGRAM SPECIFICATION:

Field	Data
1	"\$SPVIII"
2	portPull
3	stbdPull
4	asLaidTension
5	depHeight
6	trenchDepth
7	pitch
8	roll
9	subDepth
10	fwdPortSkidHeight
11	fwdStbdSkidHeight
12	aftPortSkidHeight
13	aftStbdSkidHeight
14	heading
15	altitude
16	speed
17	travel
18	shipTowTen
19	shipTowOut
20	burialDepth
21	plowTelemetry
22	rudderAngle
23	plowComment