WinFrog Device Group:	**PLOW**
Device Name/Model:	**Oceanteam Plough (MD3 ED009)**
Device Manufacturer:	Oceanteam Shipping ASA (Corporate Headquarters) Tveitaråsveien 12 5232 Paradis, Norway PO Box PB: 463 Nesttun 5853 Bergen, Norway Tel: +47 55 10 82 40 Fax: +47 55 10 82 49 Email: info@oceanteam.no
Device Data String(s) Output to WinFrog:	See Telegram Specification section below.
WinFrog Data String(s) Output to Device:	$NAV,kP,LCE tension, Ship Speed, Ship Heading
WinFrog Data Item(s) and their RAW record:	ATTITUDE 413-004-W HEADING 408 or 409 PLOWDATA 490ROV REF VEH NONE

DEVICE DESCRIPTION:

This driver is designed to read plow related data from the plow and to output navigation and cable data (as described above) to the plow control. This driver can also be used to position the plow relative to the ship.

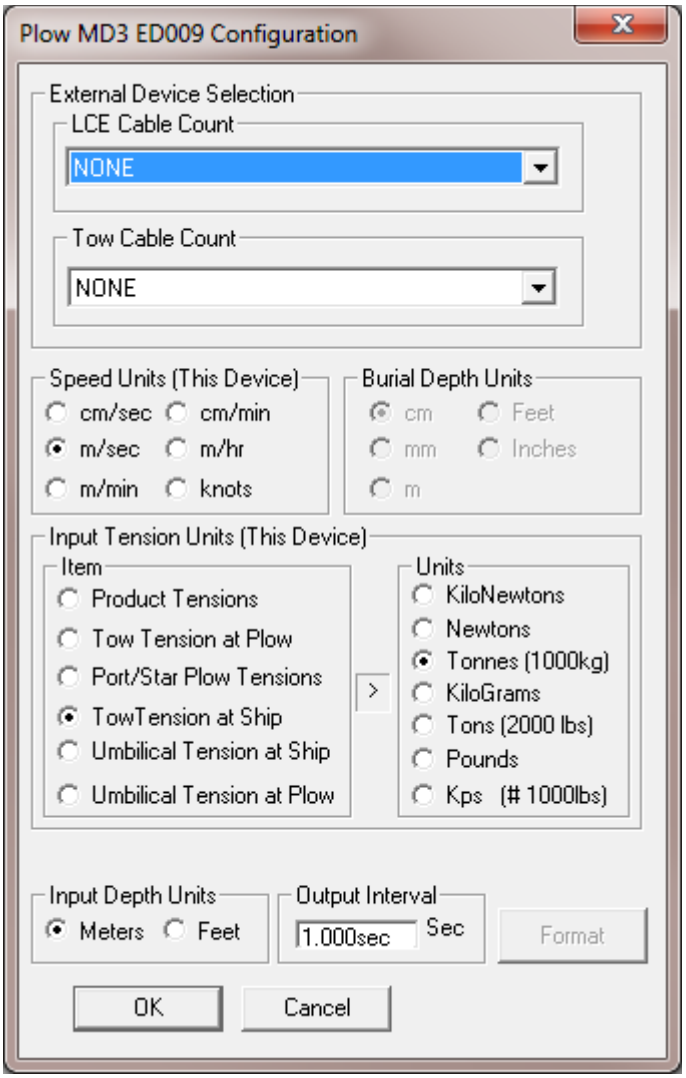
DEVICE CONFIGURATION INSTRUCTIONS

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 Plow Configuration dialog box appears, as seen below.



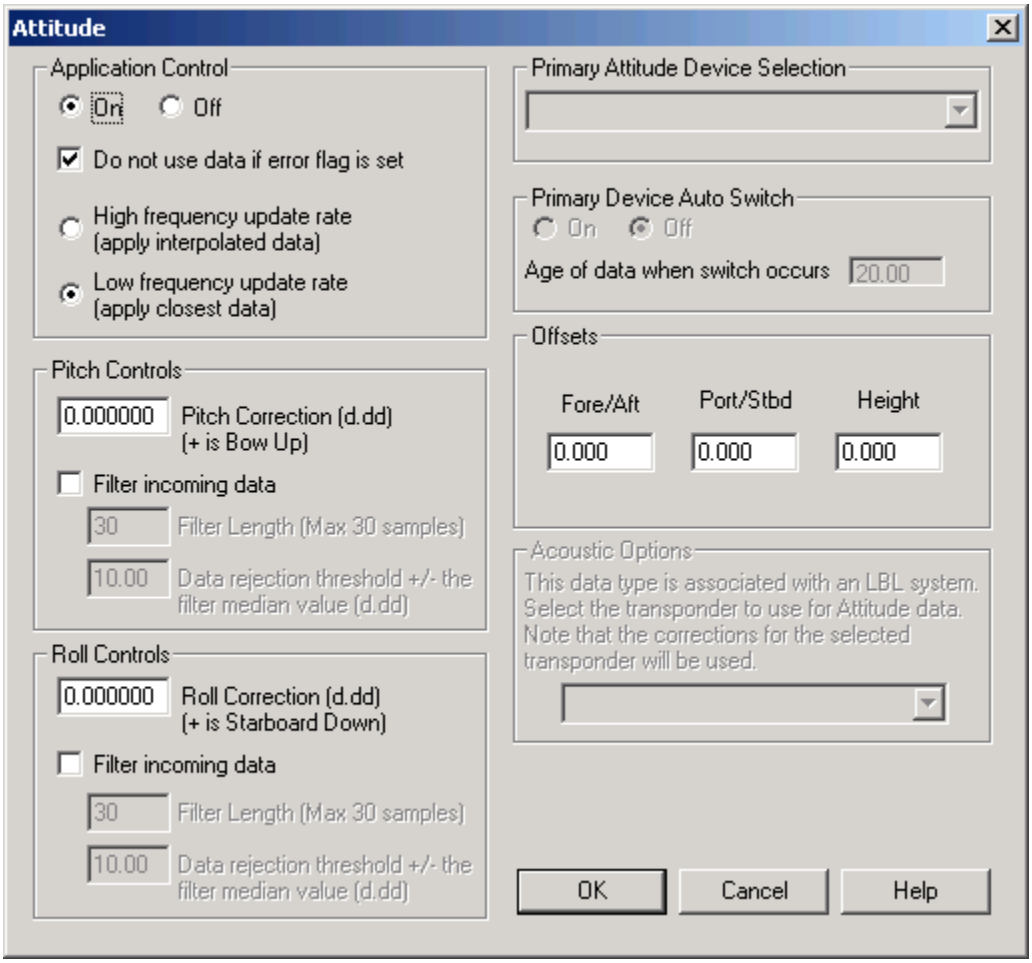
Select the data source (device) for the LCE tension data that is to be included in the output telegram. Select the data source (device) for the Tow cable count that can be used to position the plow (only the count is used). Select the appropriate Input Speed Units (this defaults to m/s which is the expected unit). Select the Input Tension units for each item (these default to tonnes which are the expected units). Specify whether the Input Depth Units are to be meters or feet (defaults to meters which is the expected unit).

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

Adding the plow device creates four data items ATTITUDE, 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, Plow MD3 ED009, 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 click the **Edit** button. The **Attitude** dialog box appears as seen below. This data item should only be added to the plow vehicle.



Attitude
By default, the sensor mode is off, meaning that data from the device will not be assigned to the vehicle nor 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 checkbox 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 – checkboxes 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 the LBL Acoustics chapter for more information.

Data item: ROV, Plow MD3 ED009, HEADING

Highlight this data item and click the Edit button to open the Configure Gyro dialog box as seen below. This data item should only be added to the plow vehicle.

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.

Status Control
If the respective device is providing data status (valid or not valid) for the HEADING data, selecting this option will result in WinFrog monitoring the data status and if it is set to not valid, the data will not be used.

If this option is not selected, the data is used regardless of the data status.

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, Plow MD3 ED009, PLOWDATA

This data item is used to read plow related data and to provide a reference point on the plow for positioning the plow relative to the ship. This data item should only be added to the plow vehicle.

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

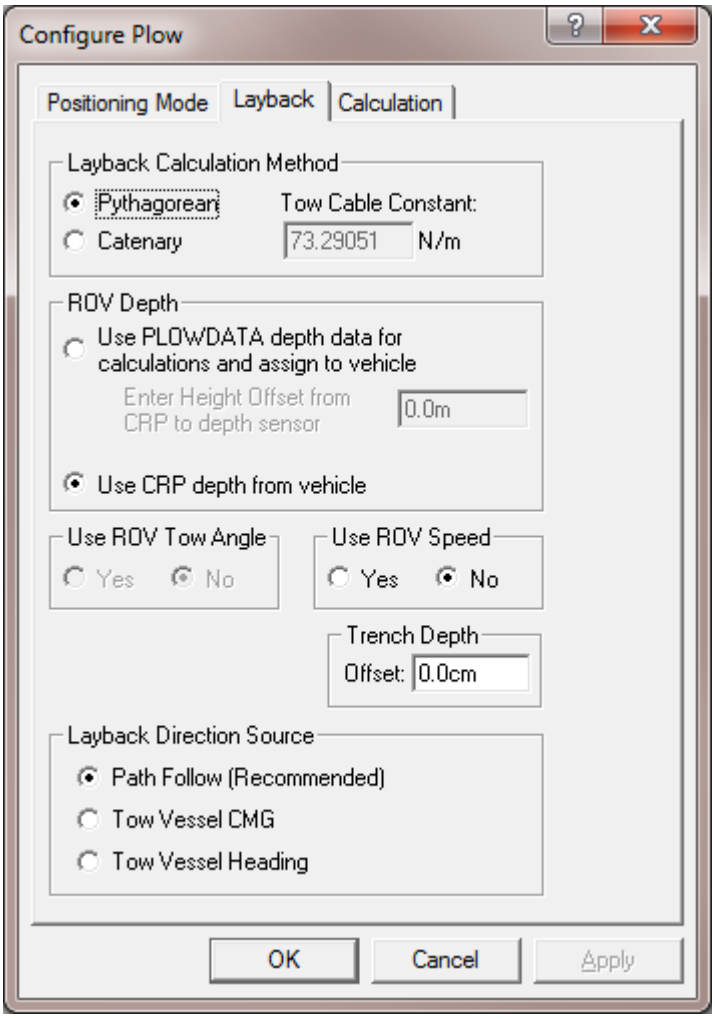
Override Automatic Mode Determination:
This checkbox determines whether WinFrog automatically determines the towed vehicle location and mode or whether the operator determines it.

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.

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.

Catenary
Not supported for this device.

Use ROV Depth
Use PLOWDATA depth for calculations and assign to vehicle 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.
2) The value used to calculate the layback is the above value plus the depth offset entered on the Calculations tab plus the value *Tow Point above the Water*, entered in the ROV REF VEH configuration dialog (attached to the tow vehicle).

Use CRP depth from Vehicle causes the depth for the layback calculation to be obtained from the vehicle. Essentially, this means the depth must be obtained by another device and assigned to the vehicle by that device.

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
Not applicable.

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.

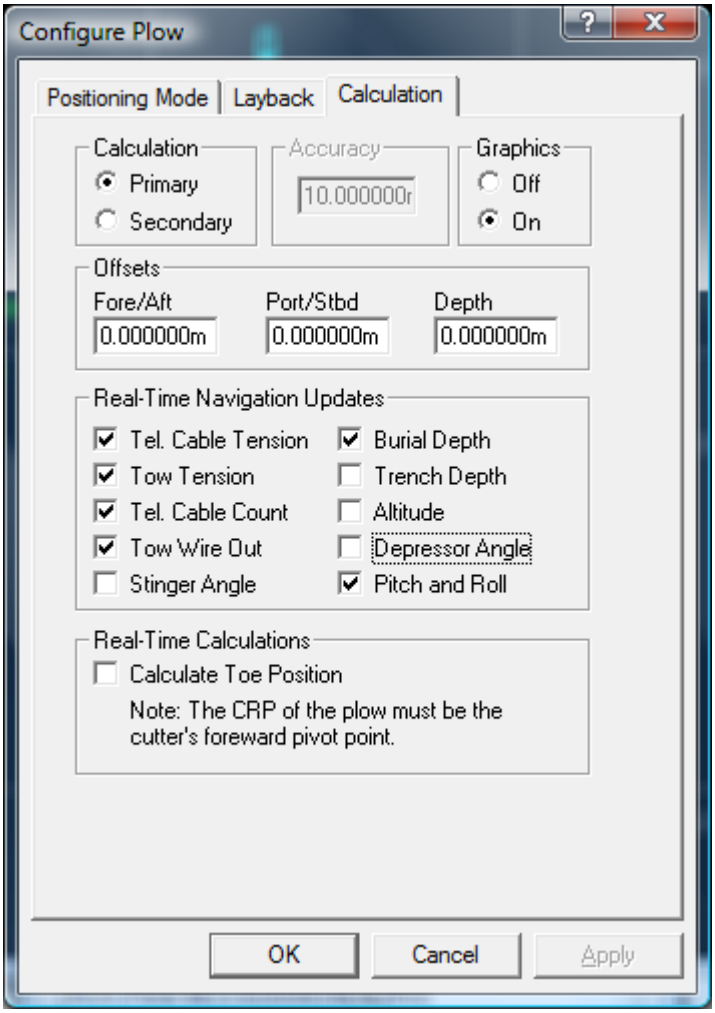
Layback Direction Source

Path Follow (Recommended) This is the recommended selection. It uses its own previous position and the tow vehicle location to determine the direction to the new position.

Tow Vessel CMG This selection uses the tow vehicle's course made good (plus 180 degrees) to determine the direction to the new position. As the course made good changes the towed vehicle will swing back and forth.

Tow Vessel Heading This selection uses the tow vehicle's heading (plus 180 degrees) to determine the direction to the new position. As the vessel's heading changes the towed vehicle will swing back and forth. This is usually more pronounced than the Tow Vessel CMG selection.

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, Plow MD3 ED009, 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.

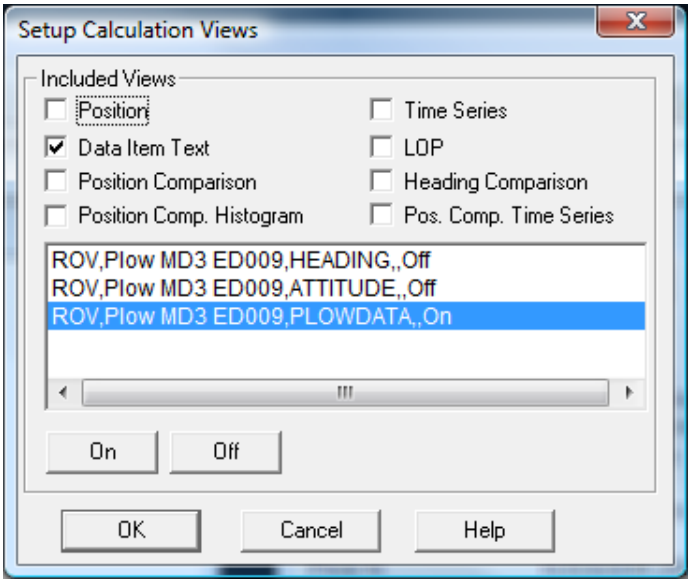
Depth is an offset from the CRP. It is applied in several different ways:

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.

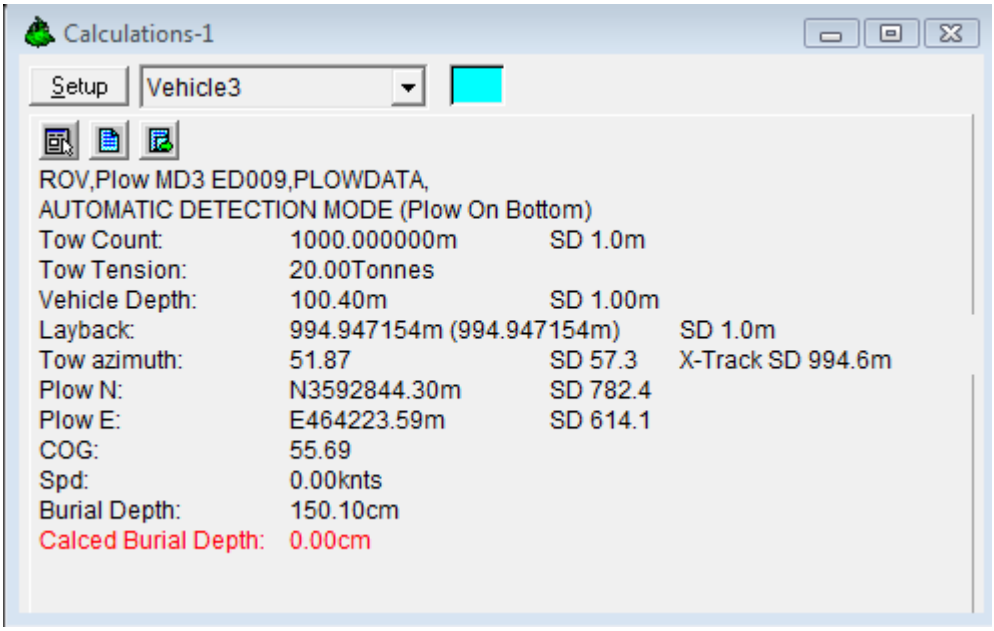
Real-Time Navigation Updates
Most Plow devices have the ability to provide real-time data updates via an umbilical. The Decoded data tab in the I/O Devices window will indicate what data is updated in real-time for each device. You should only select the checkboxes for data output by the device, as leaving 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 – Not applicable.

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, Plow MD3 ED009, PLOWDATA** on by highlighting it and clicking the **ON** button as seen below.



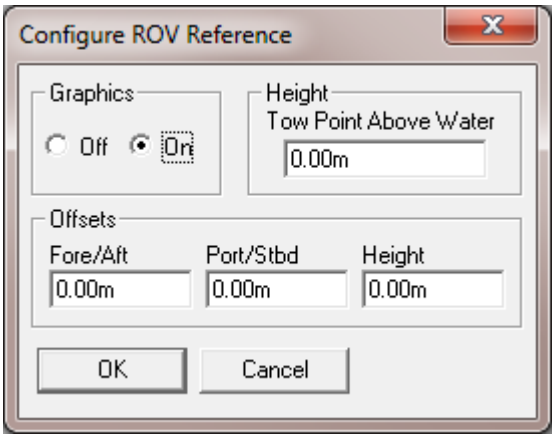
Exit with OK to display the Calculations window as seen below.



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, Plow MD3 ED009, ROV REF VEH

This data item should only be attached to the vehicle in WinFrog that has a real-time positioning source, i.e. the tow vehicle. 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 as 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:

Header: $SMD
field-1: Burial Depth (cm)
field-2: As Laid Tension (T)
field-3: Plough Speed (m/s)
field-4: Water Depth (m)
field-5: Port Skid Height (cm)
field-6: Stbd Skid Height (cm)
field-7: Vehicle Pitch (deg)
field-8: Vehicle Roll (deg)
field-9: Plough Heading (deg)
field-10: Plough Tow Force (T)
field-11: Cable Distance (m) (actually distance ploughed so far called travel in WinFrog)
field-12: Hinge Angle (deg)
Terminator: <CR><LF>