

<b>WinFrog Device Group:</b>	<b>PLOW</b>
<b>Device Name/Model:</b>	<b>SMDPLOW 1</b>
<b>Device Manufacturer:</b>	Soil Machine Dynamics Wincomblee Road Newcastle upon Tyne, UK NE63QS  Tel: + 44 191 234 2222 Fax: + 44 191 234 0444 Email: smd@smd-uk.com
<b>Device Data String(s) Output to WinFrog:</b>	See Telegram Specification below.
<b>WinFrog Data String(s) Output to Device:</b>	See Telegram Specification below.
<b>WinFrog Data Item(s) and their RAW record:</b>	PLOWDATA            490 ROV REF VEH        NONE HEADING            409

**DEVICE DESCRIPTION:**

This driver is designed to read plow related data from the SMDPLOW1 plough.

***DEVICE CONFIGURATION INSTRUCTIONS***

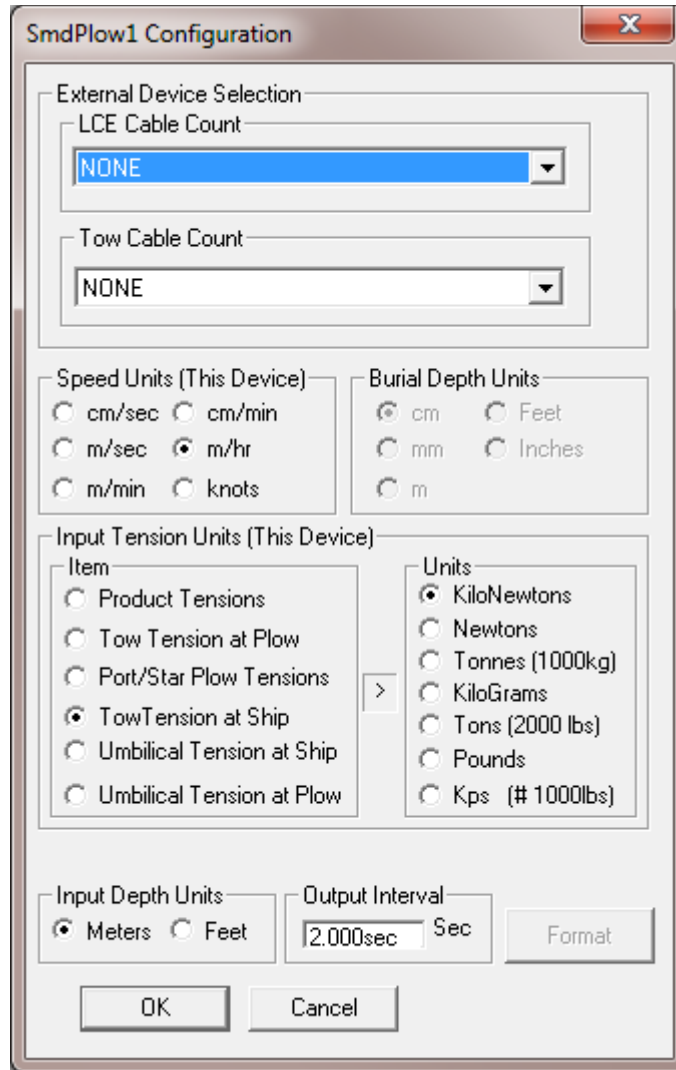
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**WINFROG I/O DEVICES > EDIT I/O:**

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 SmdPlow 1 Configuration dialog box appears, as seen below.



From the dropdown list boxes select the data source (device) 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.

Note: This device can provide the tow tension and tow cable count at the ship and at the plow. If you select a device from the Tow Cable Count dropdown list the data from that device will override the tow tension and count from this device. Similarly this device can provide LCE tension and if you select a device from the LCE Cable Count dropdown list the data from that device will override the LCE tension from this device

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

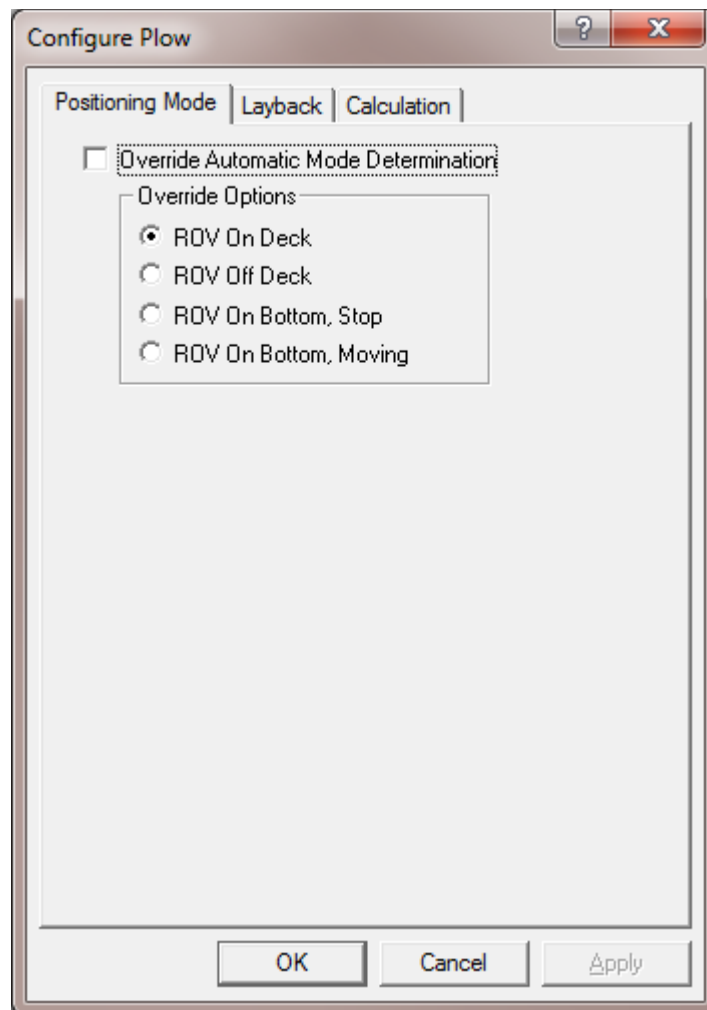
Adding the SMDPLOW 1 device creates two data items: PLOWDATA and ROV REF VEH. Once the data items have been added to the vehicle, they must be edited to suit the application.

**Data item: ROV, SMDPLOW 1, 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.

## Layback tab

The screenshot shows the 'Configure Plow' dialog box with the 'Layback' tab selected. The dialog has three tabs: 'Positioning Mode', 'Layback', and 'Calculation'. The 'Layback' tab contains the following settings:

- Layback Calculation Method:**  Pythagorean,  Catenary. The 'Tow Cable Constant' is set to 73.29051 N/m.
- ROV Depth:**  Use PLOW/DATA depth data for calculations and assign to vehicle. Enter Height Offset from CRP to depth sensor: 0.0m.  Use CRP depth from vehicle.
- Use ROV Tow Angle:**  Yes,  No.
- Use ROV Speed:**  Yes,  No.
- Trench Depth Offset:** 0.0cm.
- Layback Direction Source:**  Path Follow (Recommended),  Tow Vessel CMG,  Tow Vessel Heading.

Buttons at the bottom: OK, Cancel, Apply.

### 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**

**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**

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.

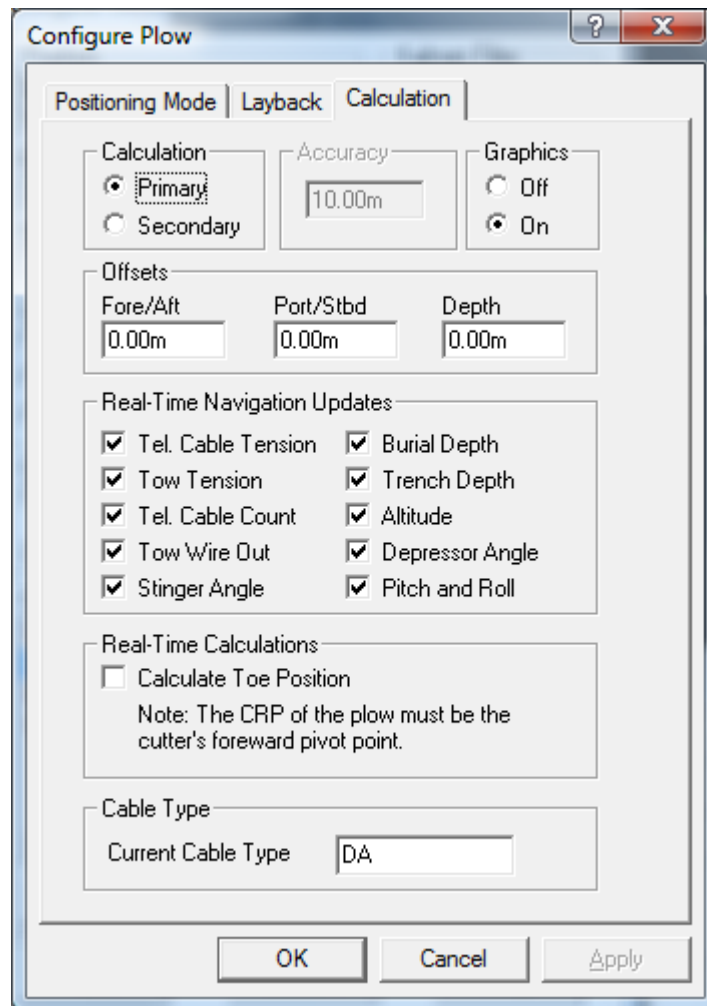
### **Layback Direction Source**

**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, SMD SMDPLOW 1, 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.

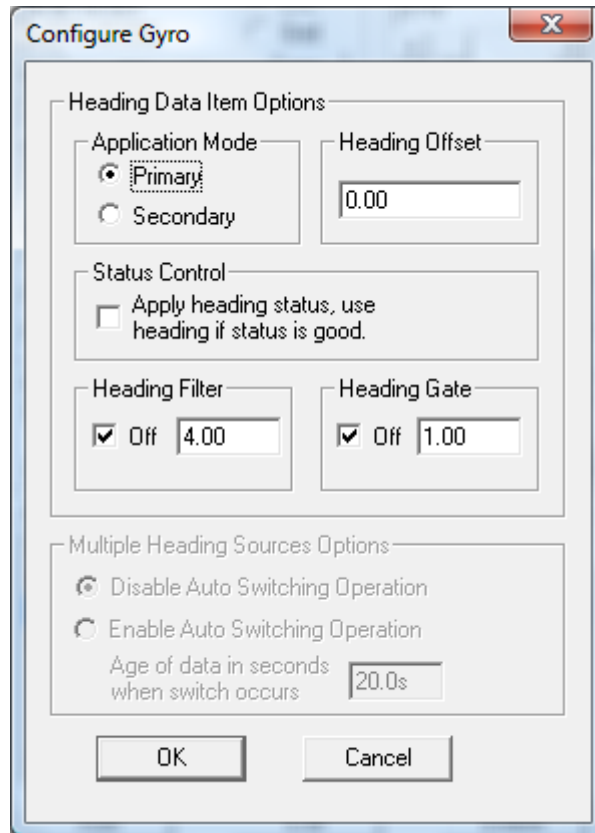
### **Cable Type**

Enter the cable type being plowed. This is included in the 490 records.

### **Data item: ROV, SMDPLOW 1, HEADING**

Once the data item has been added to the vehicle, it must be edited to suit the application. In the vehicle's device list, highlight the HEADING data item and 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 NMEA Gyro 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:**

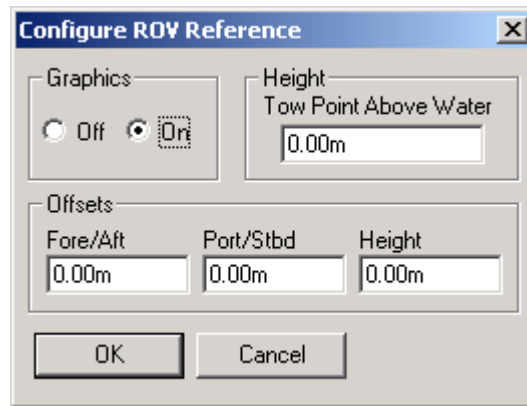
Select the mode you wish to operate WinFrog.

**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, SMDPLOW 1, 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.

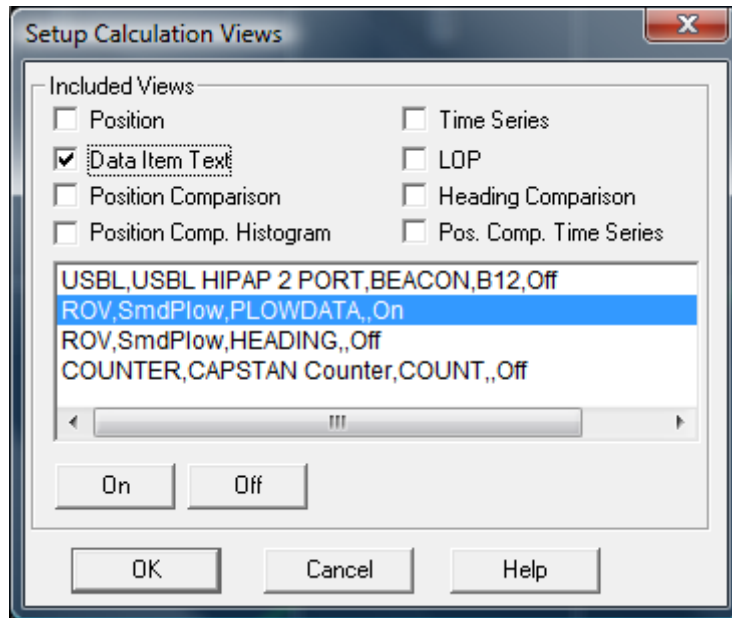
### Offsets:

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 plough vehicles.

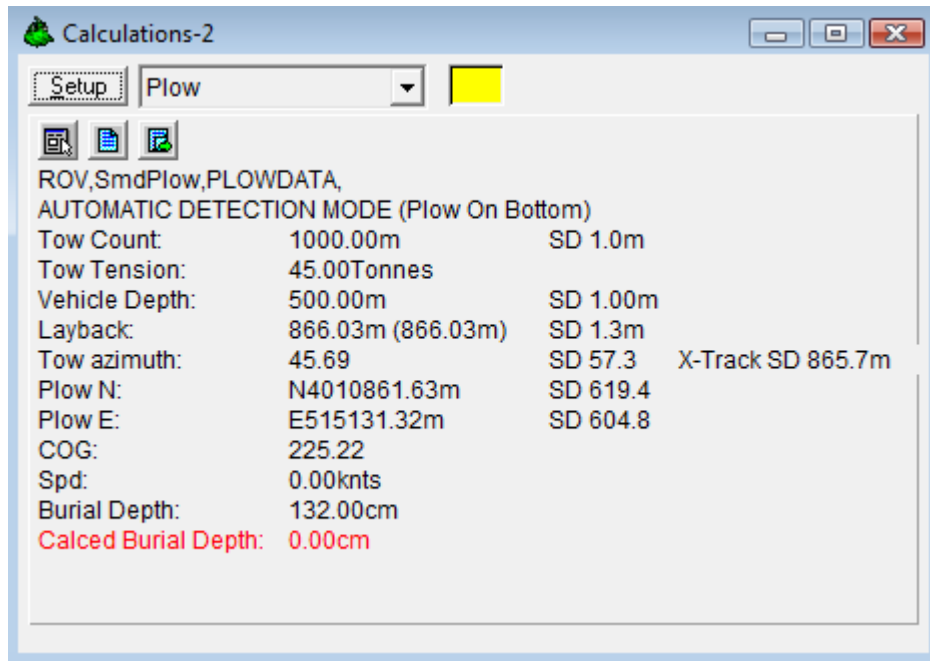
*Note: It is advised to use the waterline as the vertical CRP reference when sub-sea positioning devices are employed.*


### Calculations Window:

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, SMDPLOW 1, 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, if it's used. This Calculation window also provides a shortcut to the Configure Plow dialog box by clicking the  button.

## TELGRAM SPECIFICATIONS:

### Output string

\$SPKST,shipSpeed, shipHeading, shipKp, plowKp, IceTension, Tow Winch Count, Tow Winch Tension

Where:

- Ship speed is in knots
- Heading is in degrees
- Tensions in tonnes
- KPs in kilometers
- Tow Winch Count in metres

If you have selected an external device from the drop down list to provide the tow cable count then the Tow Winch Count and Tension are from the selected device. Otherwise these two quantities are from this device (SMD Plow1) taken from the telegram below.

### Input String

Field Data

- 1 \$NAV
- 2 Cable tension - plow(tons)
- 3 burial depth (cm)
- 4 trench depth (cm)
- 5 tow force - plow (tons)
- 6 tow force - ship (kN)
- 7 tow wire length (m)
- 8 water depth (m)
- 9 plow heading (degrees)
- 10 plow pitch (degrees)
- 11 plow roll (degrees)
- 12 depressor height (cm)
- 13 port skid height (cm)
- 14 stbd skid height (cm)