

WinFrog Device Group:	PLOW
Device Name/Model:	Smart Cutter
Device Manufacturer:	
Device Data String(s) Output to WinFrog:	
WinFrog Data String(s) Output to Device:	
WinFrog Data Item(s) and their RAW record:	PLOWDATA 490 ROV REF VEH NONE

DEVICE DESCRIPTION:

The Smart Cutter device is an analog to digital converter that converts voltages from the device's sensors to angular measurements for rotation, inclination, pitch and roll. This device in WinFrog allows you to enter maximum and minimum reference angles, as well as maximum and minimum reference voltages so that the observed voltages can be converted.

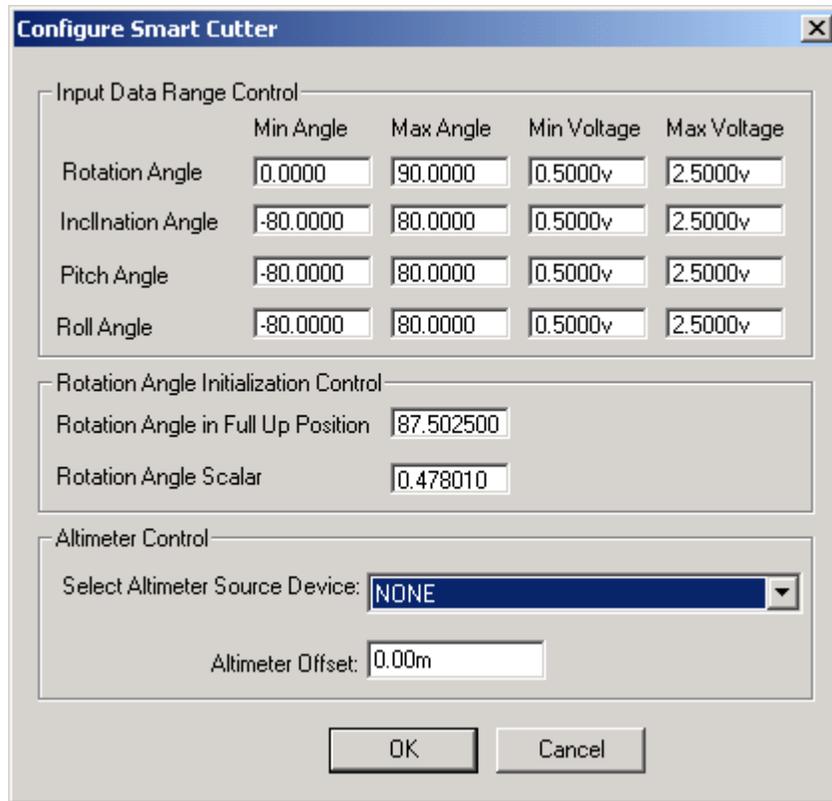
DEVICE CONFIGURATION INSTRUCTIONS

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 Configure Smart Cutter dialog box appears, as seen below.



As mentioned above, this device is an analog to digital converter. As such, it requires reference angles and voltages to define its minimum and maximum limits. In the Input Data Range Control section of the dialog, enter the limits of the various angles to be measured, as well as the limits of the associated voltages. While the default values should be sufficient for most operations, if there are any questions regarding the validity of these limits you should check with the personnel in charge of the Smart Cutter plow. Note that the rotation angle refers to the depressor angle and that the Inclination angle refers to the stinger angle.

In the Rotation Angle Initialization Control section, the default values should be sufficient for most operations. These default values should only be changed by experienced operators who have a full understanding of the effects of any changes.

In the Altimeter Control section, from the dropdown list box, select the Altimeter device to be used, as well as any offset that needs to be applied to it. The offsets are vertical offsets, applied from the CRP of the Smart Cutter plow to the sensor head, with positive being up.

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

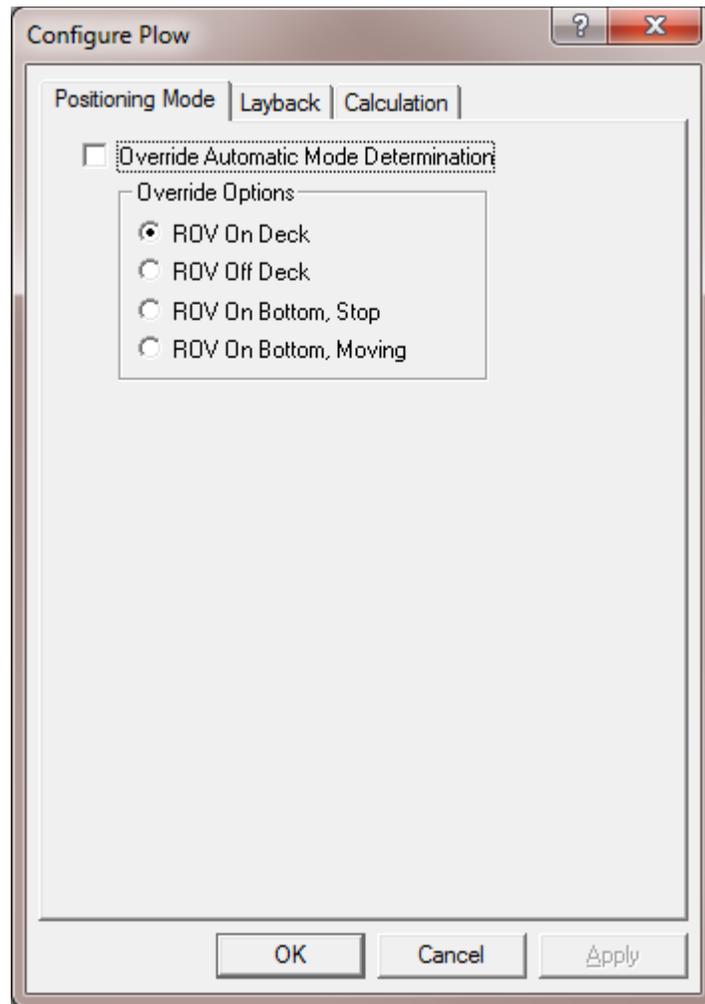
Adding the Smart Cutter device creates two data items: PLOWDATA and ROV REF VEH. Once the data items have been added to the vehicle, they must be edited to suit the application.

Data item: ROV, Smart Cutter, 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. The 'Enter Height Offset from CRP to depth sensor' is 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.

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.

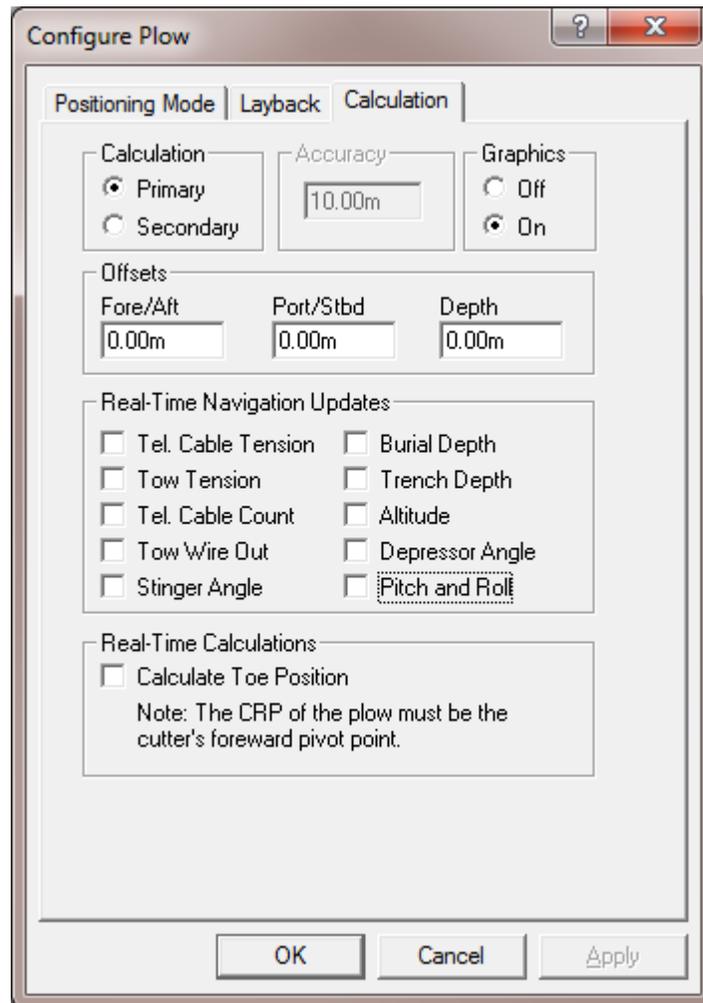
Layback Direction Source

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, Smart Cutter, 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.

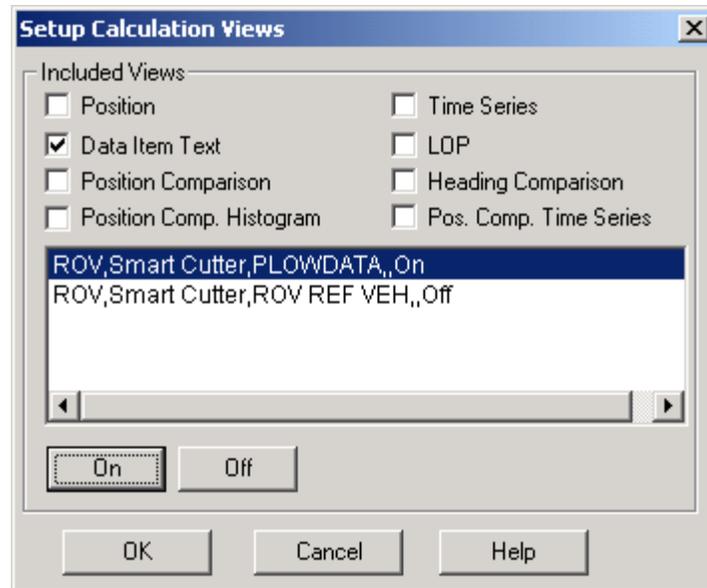
Real-Time Navigation Updates

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.

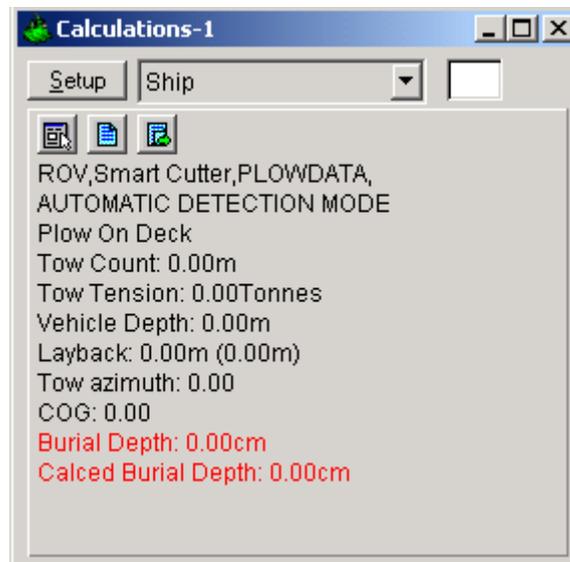
Real-Time Calculations

Calculate Toe Position – If this option is selected then WinFrog uses the derived rotation, inclination and pitch angles, as well as the dimensions of the Smart Cutter plow, to calculate the Toe position. The Toe position is defined as the last point on the Smart Cutter plow that the cable touches.

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, Smart Cutter, PLOWDATA** on by highlighting it and clicking the **ON** button as seen below.



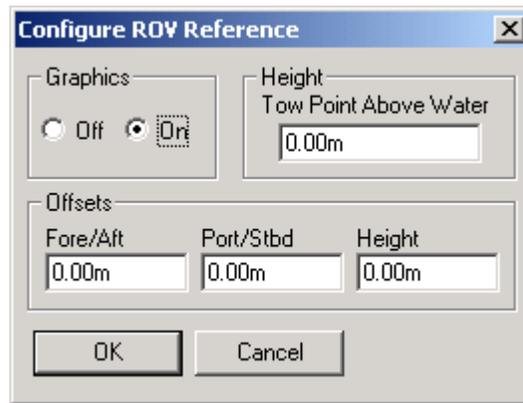
Exiting with OK will display the Calculations window as seen below.



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, Smart Cutter, 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 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.