

WinFrog Device Group:	PLOW
Device Name/Model:	Towed Vehicle
Device Data String(s) Output to WinFrog:	None
WinFrog Data String(s) Output to Device:	None
WinFrog .raw Data Record Type(s):	PLOWDATA 490 record HEADING 410 or 409 No data is recorded for the ROV REF VEH data type. The original positioning device will record this data.

DEVICE DESCRIPTION: This device is used calculate the position of a plow or other ROV vehicle using just cable count and depth or cable count, depth and tension. There are two methods to choose from 1) Pythagorean, which is strictly geometric and 2) Static catenary. In either case the tow wire must be under tension, this device will not work if the vehicle is self-propelled.

This driver is strictly for positioning; it does not obtain plow type data (e.g. burial depth) from a serial port. This device gets its cable count, tension and depth data from other devices.

Other plow devices can also calculate the vehicle position using these same dialogs but with some minor differences. Please refer to the specific driver when using it to position the vehicle.

Initial positioning of Vehicle

To reposition the towed vehicle manually, copy or enter the coordinates on the Configure Vehicle Devices dialog, confirm that the Update checkbox is checked and click OK.

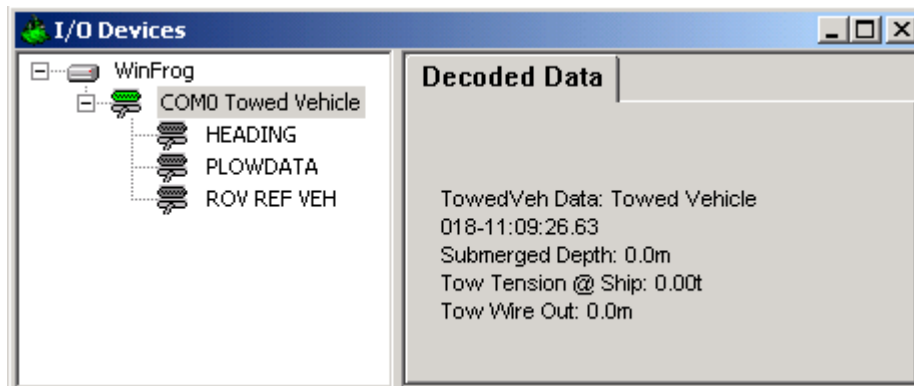
DEVICE CONFIGURATION INSTRUCTIONS

WINFROG I/O DEVICES > EDIT I/O

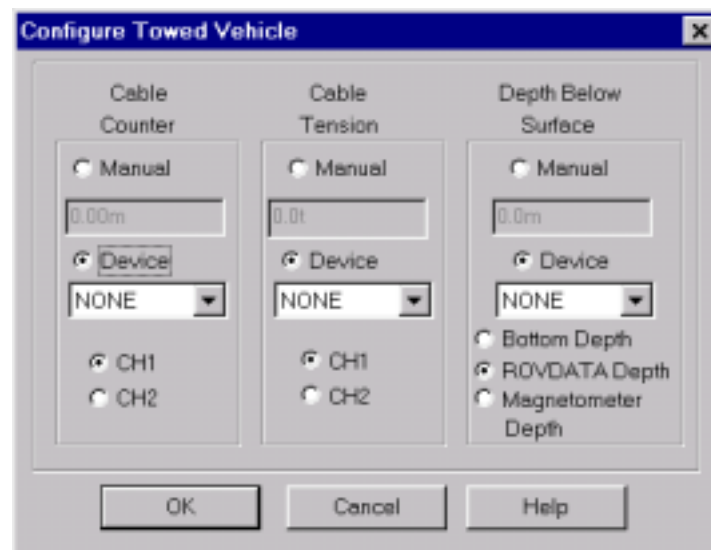
A dialog appears in which to change the name of the device if desired.

WINFROG I/O DEVICES > CONFIGURE DEVICE:

The Towed Vehicle device is added to WinFrog from the PLOW device group. Adding this device creates three data items: HEADING, PLOWDATA and ROV REF VEH.



The Towed Vehicle device must be configured at the I/O Devices level. In the I/O Devices window, highlight the Towed Vehicle device, then right-click and select Configure Device. The Configure Towed Vehicle window will appear, as seen below.



This dialog allows you to specify where this data is to come from in order to calculate the position of the towed vehicle. Each value may be entered manually or may be obtained from a device you select from the dropdown list box. If manual entry is selected, the buttons specifying channel (e.g. CH1) or the others (e.g. Bottom depth)

have no effect. Enter the manual values in the units shown. (Units are set in the Configure Units dialog accessed from the main menu.)

If only the Pythagorean solution is to be used to fix the towed vehicle position, then only a cable count and depth are required. Otherwise all three values or a source for all three values are required.

Data from a device

Cable Counter

Listed in the dropdown box are all the devices that have a COUNTER data type. Select the desired counter device from the dropdown list. Select the channel where the desired count is located. Many counters output several counts. WinFrog stores a tow winch count in channel 2 (CH2) and a telephone count in channel 1 (CH1). **Be sure to check that the correct value is displayed in the I/O device window/Decoded Data tab. The value can also be found in the Calculations window.** See below for more details about configuring a Calculations window.

Cable Tension

Listed in the dropdown box are all the devices that have a COUNTER data type. If the catenary solution is to be used, then the tension is required. The cable weight is also required, see the Configuring the PLOWDATA data item, Layback tab section below.

Select the desired tension device from the dropdown list. Select the channel where the desired tension is located. Many counters output several tensions. WinFrog stores a tow winch tension in channel 2 (CH2) and a telephone cable tension in channel 1 (CH1). **Be sure to check that the correct value is displayed in the I/O device window. The value can also be found in the Calculations window.** See below for more details about configuring a Calculations window.

Depth Below Surface

The depth is required for the position calculation of the towed device. Its source may be selected here and assigned to the towed vehicle. Selection of a depth source here may be overridden by the setting in the **Use ROV Depth** group box described in the Layback tab, see below. Listed in the drop down box are all the devices that have the ROVDATA, MAGNETOMETER or BOTTOMDEPTH data types.

If the depth required for the position calculation is already assigned to the vehicle:

If the vehicle depth is already being assigned to the towed vehicle and this is the depth desired for use in the position calculation, then select **Device** and **None** for

the name of the device. On the Layback tab (see below) one must also set **No** in the **Use ROV Depth** group box. The other three radio buttons have no effect.

If the depth required for position calculation is to be taken from a specific device:

Select the desired device from the dropdown list. If the device is a sounder then select the **Bottom Depth** radio button. If the device is a magnetometer then select the **Magnetometer** button. If the device is an ROV type select the **ROVDATA Depth**, **Bottom Depth** or **Magnetometer** depending upon which depth is desired. On the Layback tab (see below) one must also set **Yes** in the **Use ROV Depth** group box. This depth will then be assigned to the vehicle with offsets.

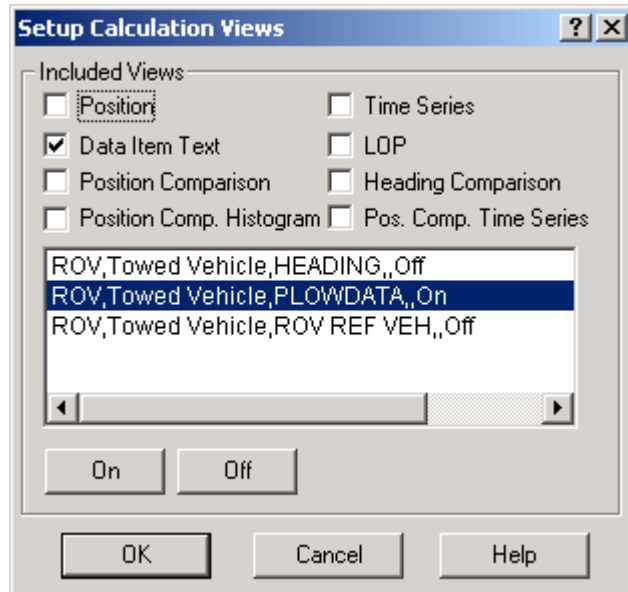
Note:

- 1) The ROVDATA DEPTH is the depth of the ROV.
- 2) The BOTTOM DEPTH is the sum of the ROVDATA DEPTH plus the altitude of the ROV plus the offsets.
- 3) Not all ROV devices have ROVDATA, BOTTOM DEPTH or MAGNETOMETER data types.
- 4) Not all magnetometers can provide the depth.

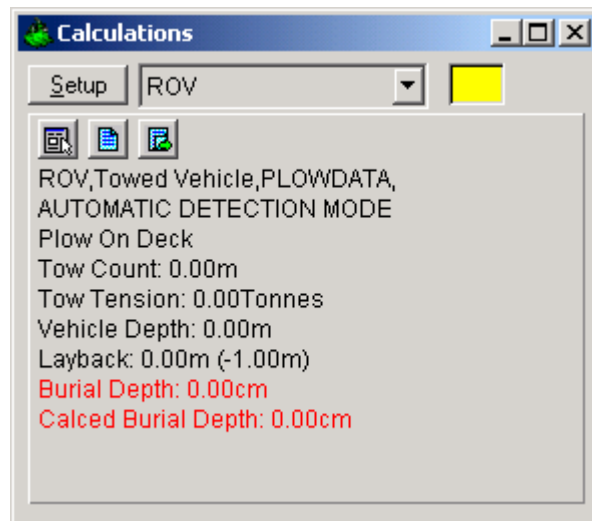
Be sure to check that the correct value is displayed in the I/O device window except if the depth is to come from the vehicle itself. In which case check that the depth is correct in the Calculations window.

Configure Calculations Window:

To display the Calculations window, select View > Calculations from the main menu. Select the appropriate vehicle from the dropdown list box and click the Setup button. The Setup Calculation Views dialog box opens. Select **Data Item Text** and turn the data item **ROV, Towed Vehicle, PLOWDATA** on by highlighting it and clicking the **ON** button as seen below.



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

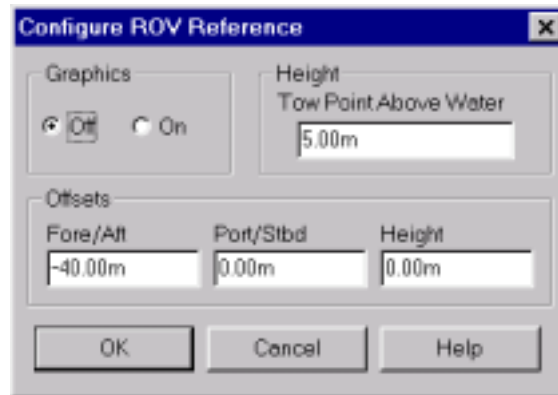


From this window you can monitor the input data as well as the layback calculation. This calculation window also provides a shortcut to the Configure Plow dialog box by clicking the  button. The use of the Configure Plow dialog is discussed in more detail below.

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

Configuring the ROV REF VEH data item:

The **Towed Vehicle ROV REF VEH data item** is added to the tow vehicle (ship) and must be edited once it is added to the vehicle's device list. Highlight the **ROV, Towed Vehicle, ROV REF VEH** data item in the vehicle's device list, then click the **Edit** button. The **Configure ROV Reference** dialog box appears as seen below.



Graphics:

On displays a small square at the offset point in the Graphics window.

Height:

Tow Point Above Water is the distance between the water and the last point the cable touches the vessel. This is also assumed to be where the cable count is measured.

Offsets:

Fore/Aft from the common reference point (CRP) to the point where the cable count is measured. This is also assumed to be the point where the cable leaves the vessel.

Port/Stbd from the common reference point (CRP) to the point where the cable count is measured. This is also assumed to be the point where the cable leaves the vessel.

Height is not used.

Configuring the PLOWDATA data item:

The **Towed Vehicle PLOWDATA data item** is added to the towed vehicle (plow) and must be edited once it is added to the vehicle's device list. Highlight the **ROV, Towed Vehicle, PLOWDATA** data item in the vehicle's device list, then select the **Edit** button. The **Configure Plow** dialog box appears 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 (see above).

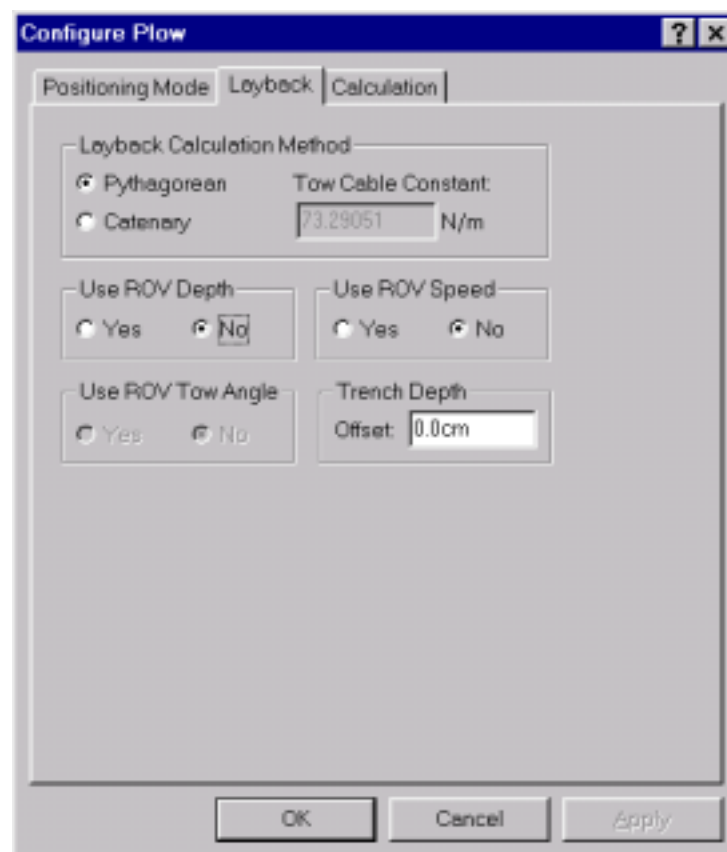
ROV Off deck places the towed vehicle on the tow vessel at the tow point, which is the offset point entered in the ROV REF VEH dialog (see above).

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

Clicking the Layback tab produces the following dialog:



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:** Two radio buttons, 'Pythagorean' (selected) and 'Catenary'.
- Tow Cable Constant:** A text box containing '73.29051' followed by 'N/m'.
- Use ROV Depth:** Two radio buttons, 'Yes' and 'No' (selected).
- Use ROV Speed:** Two radio buttons, 'Yes' and 'No' (selected).
- Use ROV Tow Angle:** Two radio buttons, 'Yes' and 'No' (selected).
- Trench Depth Offset:** A text box containing '0.0cm'.

At the bottom of the dialog are three buttons: 'OK', 'Cancel', and '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 angle used is the same as described above.

Use ROV Depth

Yes causes two actions:

- 1) The depth obtained from this device (Towed Vehicle) 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 or the depth from one of the data types from the selected device. See **WINFROG I/O DEVICES > CONFIG OPTIONS Depth Below Surface** above.
- 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 essentially overrides the selection of a device or manual entry of depth (See CONFIG OPTIONS above).

Use ROV Speed

Yes causes the speed of the device to be obtained from this device. Since the Towed Vehicle device has no source for the ROV speed this value will always be zero. Consequently, always use 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 does not apply to the Towed Vehicle device, only to the SeaplowVIII.

Trench Depth

Offset: If the Trench depth checkbox is checked on the Calculation tab below, then this value, 0.0 or otherwise, will be assigned as this vehicle's trench depth. Generally the Towed Vehicle device cannot determine trench depth, therefore this edit box is ignored and the Trench Depth checkbox on the next tab is set unchecked.

Calculation Tab

Clicking the Calculation tab produces the following dialog:

The screenshot shows the 'Configure Plow' dialog box with the 'Calculation' tab selected. The dialog has a title bar with a question mark and a close button. Below the title bar are three tabs: 'Positioning Mode', 'Layback', and 'Calculation'. The 'Calculation' tab is active. It contains several sections: 'Calculation' with radio buttons for 'Primary' (selected) and 'Secondary'; 'Accuracy' with a text box showing '10.00m'; 'Graphics' with radio buttons for 'Off' and 'On' (selected); 'Offsets' with three text boxes for 'Fore/Aft', 'Port/Stbd', and 'Depth', all showing '0.00m'; 'Real-Time Navigation Updates' with a grid of checkboxes for 'Tel. Cable Tension', 'Tow Tension', 'Tel. Cable Count', 'Tow Wire Out', 'Stinger Angle', 'Burial Depth', 'Trench Depth', 'Altitude', 'Depressor Angle', and 'Pitch and Roll' (which is highlighted with a dashed border); and 'Real-Time Calculations' with a checkbox for 'Calculate Toe Position'. A note below this checkbox states: 'Note: The CRP of the plow must be the cutter's forward pivot point.' At the bottom are three buttons: 'OK', 'Cancel', and 'Apply'.

Calculation

Primary: the layback described above will be used to calculate this vehicle's position, advance and speed which will be assigned to it.

Secondary: this device will not determine this vehicle's position.

Accuracy

This data type cannot be utilized with the Kalman Filter and thus in this case, this value is not used.

Graphics

On causes a box to be drawn in the Graphics and Bird's Eye windows, at the offset position below.

Off means that no box will be drawn.

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 **ROV, Towed Vehicle, ROV REF VEH** section above. 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.

Depth is an offset from the CRP, it is applied in several different ways:

- 1) If **Use ROV Depth** is set to **Yes** 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

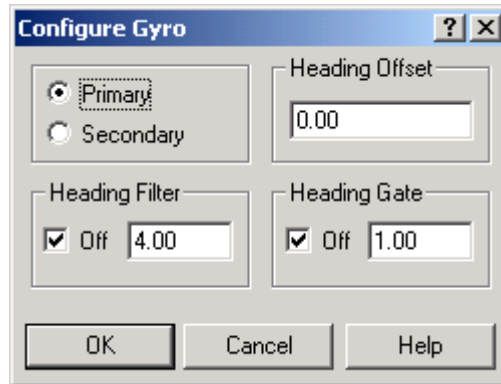
Since the Towed Vehicle device does not read any of these values, all of these checkboxes should be unselected. If the trench depth was unavailable from another source and you wanted this value recorded, you could manually enter it as the offset on the previous tab (Layback) then leave the Trench Depth checkbox selected. With the possible exception of the trench depth, leaving these checkboxes selected causes data to be assigned to the vehicle. Since this device does not obtain this data from anywhere, 0 is assigned for each item left selected. This will cause values from other devices to be overwritten.

Real-Time Calculations

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

Configuring the HEADING data item:

The **Towed Vehicle Heading data item** must also be edited once it is added to a vehicle's device list. Highlight the **ROV, Towed Vehicle, HEADING** data item in the vehicle's device list, then click the **Edit** button. The **Configure Gyro** dialog box appears as seen below. As mentioned above, this driver is strictly for positioning, i.e. it does not obtain heading data from a serial port. Instead this data would have to come from another device.



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.