

WinFrog Device Group:	PLOW
Device Name/Model:	Pirelli Plow (DH4)
Device Manufacturer:	Pirelli-Jacobson Inc. 5350 30th Ave. NW Seattle, WA 98107 USA Tel: 1 206-782-1618 Fax: 1 206-789-2851 Email: pirelli.jacobson@us.pirelli.com
Device Data String(s) Output to WinFrog:	\$PJIDS,plowTowTen, shipTowTen,BurialDepth,pitch,roll,subDepth,heading ,altitude,subsurface velocity,surface Ice count,surface Ice velocity, surface Ice tension,ship tow wire out,stinger angle, depressor angle,tow cable angle Note: tension in kN, distances in m (except altitude in cm), velocity in m/s, angles in degrees
WinFrog Data String(s) Output to Device:	
WinFrog Data Item(s) and their RAW record:	HEADING 409 PLOWDATA 490 ROV REF VEH NONE COUNT 492

DEVICE DESCRIPTION:

The DH4 is a remotely-operated towed jetting sled that can be used for the simultaneous lay and bury of either fiber optic or power cables.

This driver is designed to read Heading, Cable and Plough related data from the Pirelli DH4 plow.

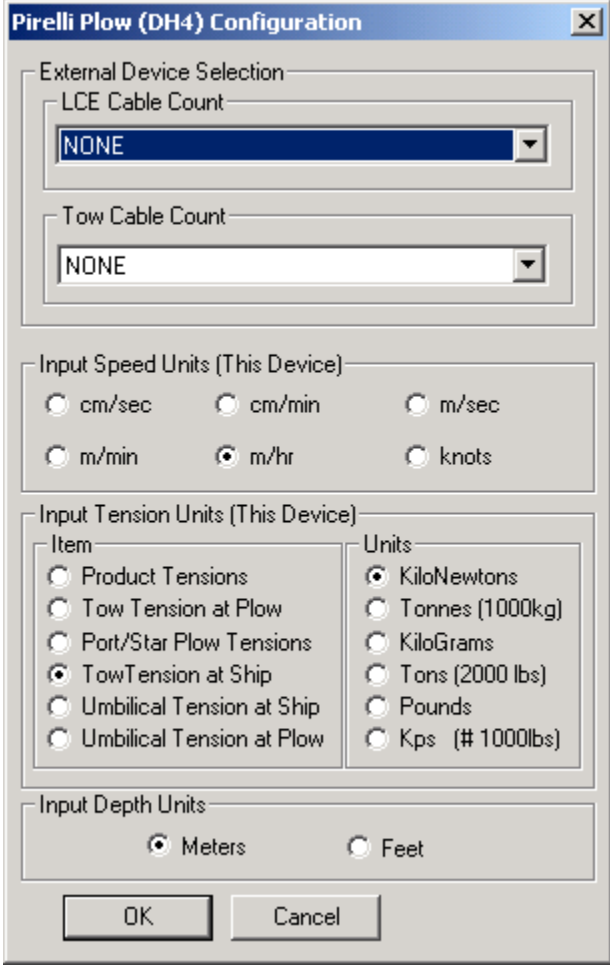
DEVICE CONFIGURATION INSTRUCTIONS

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 Pirelli Plow (DH4) Configuration dialog box appears, as seen below.



The image shows the 'Pirelli Plow (DH4) Configuration' dialog box. It has a title bar with a close button. The dialog is divided into several sections: 'External Device Selection' with two dropdown menus for 'LCE Cable Count' and 'Tow Cable Count', both currently set to 'NONE'; 'Input Speed Units (This Device)' with six radio buttons for 'cm/sec', 'cm/min', 'm/sec', 'm/min', 'm/hr' (selected), and 'knots'; 'Input Tension Units (This Device)' with two columns of radio buttons. The 'Item' column includes 'Product Tensions', 'Tow Tension at Plow', 'Port/Star Plow Tensions', 'TowTension at Ship' (selected), 'Umbilical Tension at Ship', and 'Umbilical Tension at Plow'. The 'Units' column includes 'KiloNewtons' (selected), 'Tonnes (1000kg)', 'KiloGrams', 'Tons (2000 lbs)', 'Pounds', and 'Kps (# 1000lbs)'. At the bottom is the 'Input Depth Units' section with 'Meters' (selected) and 'Feet' radio buttons. 'OK' and 'Cancel' buttons are at the very bottom.

The Telephone and Tow cable counts are included in the data string from this device. If the cable counts from this device are to be used by the Pirelli Plow (DH4) Plow vehicle then NONE must be selected from the dropdown lists above. If the Telephone and Tow cable counts are to be used for the other purposes (i.e. for inclusion in the COUNT 492 raw record – see COUNT data item section below) then another cable count source must be selected from the dropdown lists.

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.

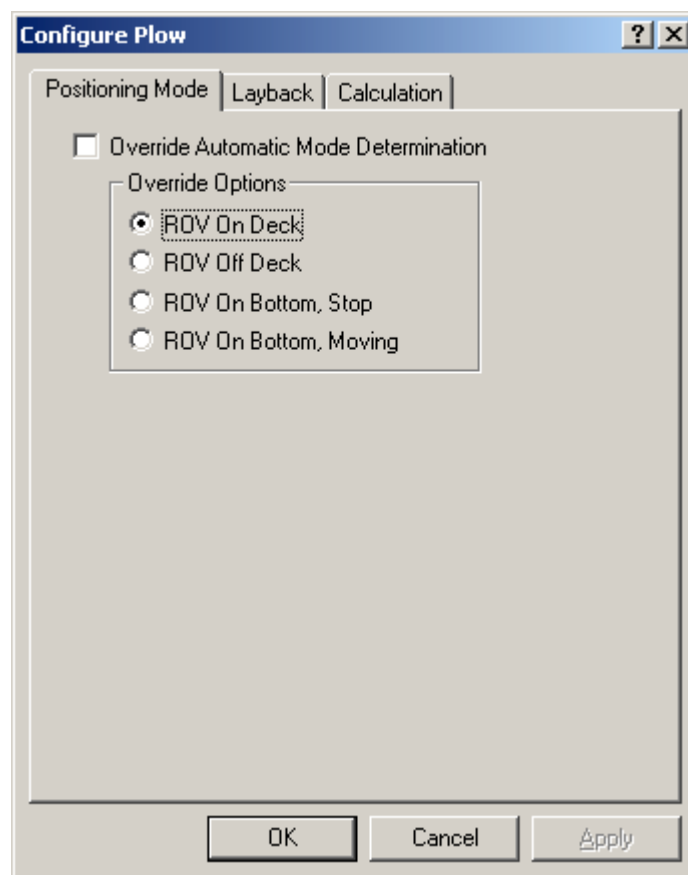
WINFROG VEHICLE > CONFIGURE VEHICLE DEVICES > DEVICE DATA ITEM > EDIT:

Adding the Pirelli Plow (DH4) device creates four data items: PLOWDATA, HEADING, ROV REF VEH and COUNT. Once the data items have been added to the vehicle, they must be edited to suit the application.

Data item: ROV, Pirelli Plow (DH4), PLOWDATA

This data item would typically be attached 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.

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.



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 'Calculation' tab selected. The dialog has three tabs: 'Positioning Mode', 'Layback', and 'Calculation'. The 'Calculation' tab contains the following settings:

- Layback Calculation Method:** Radio buttons for 'Pythagorean' (selected) and 'Catenary'. To the right is a text field for 'Tow Cable Constant' with the value '73.29051' and the unit 'N/m'.
- Use ROV Depth:** Radio buttons for 'Yes' and 'No' (selected).
- Use ROV Speed:** Radio buttons for 'Yes' and 'No' (selected).
- Use ROV Tow Angle:** Radio buttons for 'Yes' and 'No' (selected).
- Trench Depth:** A text field for 'Offset' with 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.

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

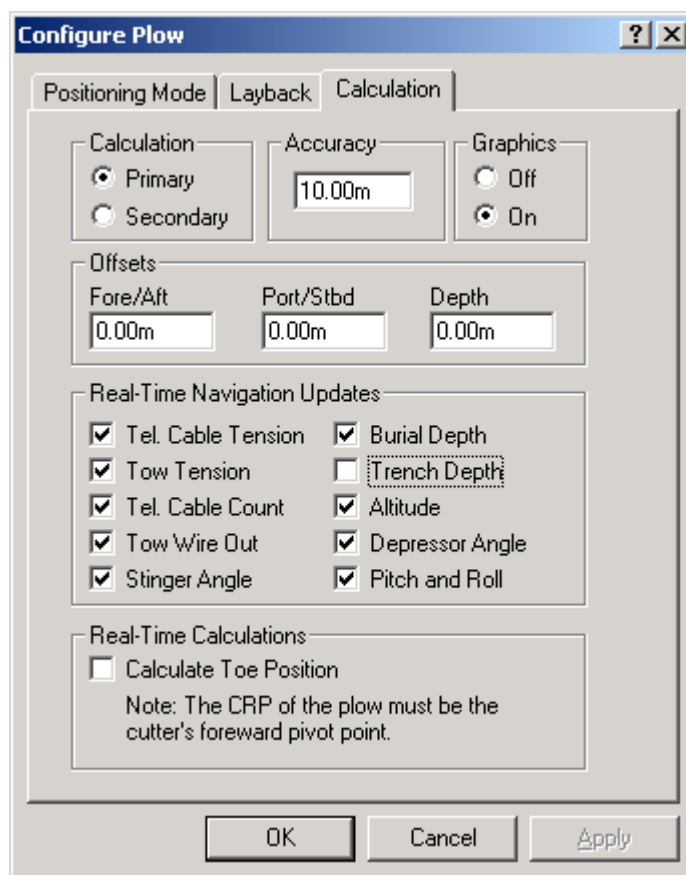
Yes causes the speed of the device to be obtained from this device. This requires that the towed vehicle in use must have the ability to output a speed in its data string. If it does not, then select No. **No** causes the speed to be calculated from the positional information and time. It will be assigned 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, Pirelli Plow (DH4), 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.

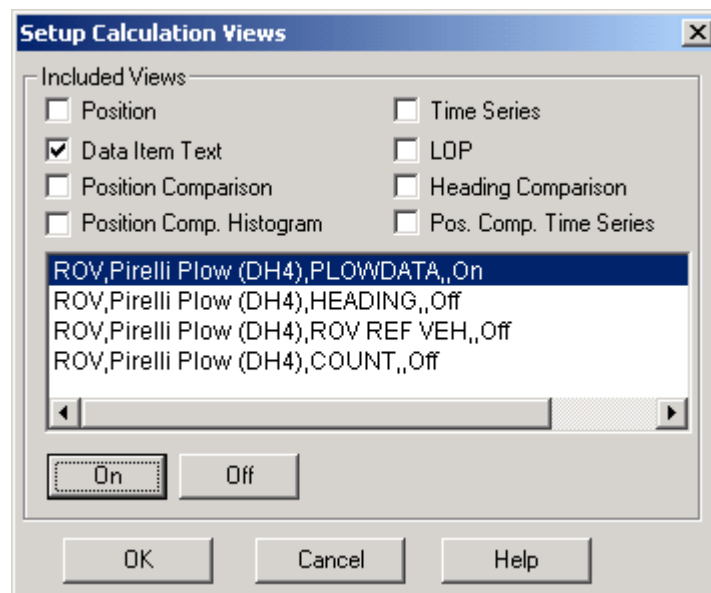
Real-Time Navigation Updates

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.

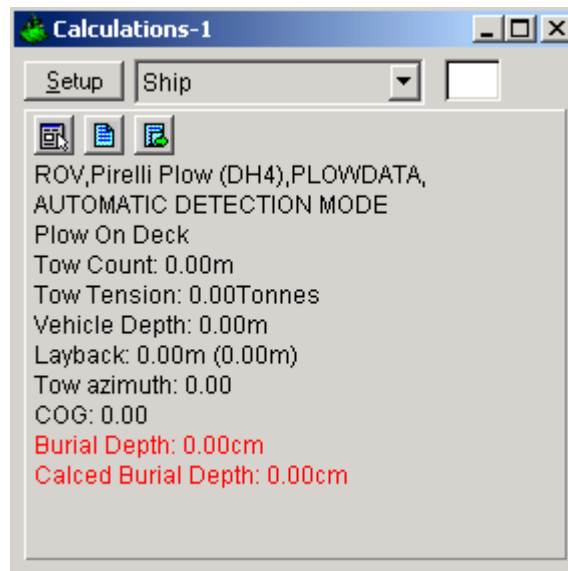
Real-Time Calculations

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, Pirelli Plow (DH4), PLOWDATA** on by highlighting it and clicking the **ON** button as seen below.



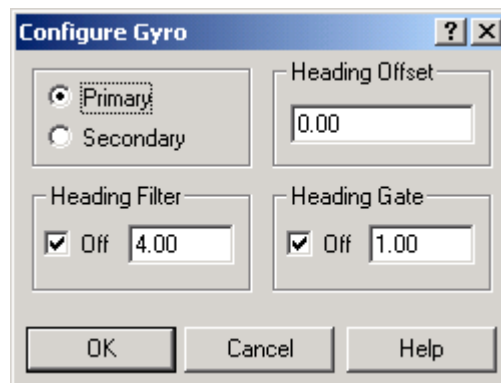
Exiting with OK will display the Calculations window as seen below.



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, Pirelli Plow (DH4), 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.

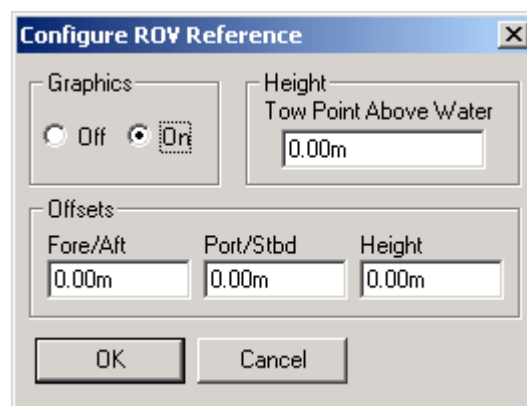
Heading Filter/Heading Gate:

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, Pirelli Plow (DH4), 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.

Data item: ROV, Pirelli Plow (DH4), COUNT

As mentioned above, the telephone and tow cable count data is included in the telegram from the plow. However, in order to utilize the cable count data for this data item for use in other functions (cable modeling, etc.), this device must be configured at the I/O Device level. Refer to the WINFROG I/O DEVICES > CONFIGURE DEVICE section above for details.

After this device is configured to read cable count data to the COUNT data item, the COUNT data item can be added to the ship's device list. This results in the cable count data being made available for other functions, as well as for logging to the COUNT 492 record in the raw files. It should be noted that this option is not commonly used.

Configuring this device in this manner will give the same results as if the counter device itself was configured to provide the cable count data and the counter device's COUNT data item is added to the ship's device list.

Highlight the **ROV, Pirelli Plow (DH4), COUNT** data item in the vehicle's device list and click the Edit button to open the Configure Counter dialog box.

This data item configuration dialog has two tabs, Reference Counters and Real-Time Navigation Updates.

The screenshot shows a Windows-style dialog box titled "Configure Counter". It has two tabs: "Reference Counters" (selected) and "Real-Time Navigation Updates". The "Reference Counters" tab contains several sections for configuring a counter:

- Choose Reference Counter to Modify:** A dropdown menu showing "Counter# 1".
- Direction:** A button labeled "Up / Down".
- Set Specific Cable Count:** A text input field containing "1000.0" and a "SET" button.
- Set Counter Scale:** A text input field containing "1.0000000".
- New Counter Scale from Cable Count:** A text input field containing "1000.0" and a "SET" button.
- Set Counter Offset:** A text input field containing "1000.0" and a "SET" button.
- Counter Name:** A text input field containing "Counter# 1" and a "SET" button.

At the bottom of the dialog are "OK" and "Cancel" buttons.

Reference Counters tab

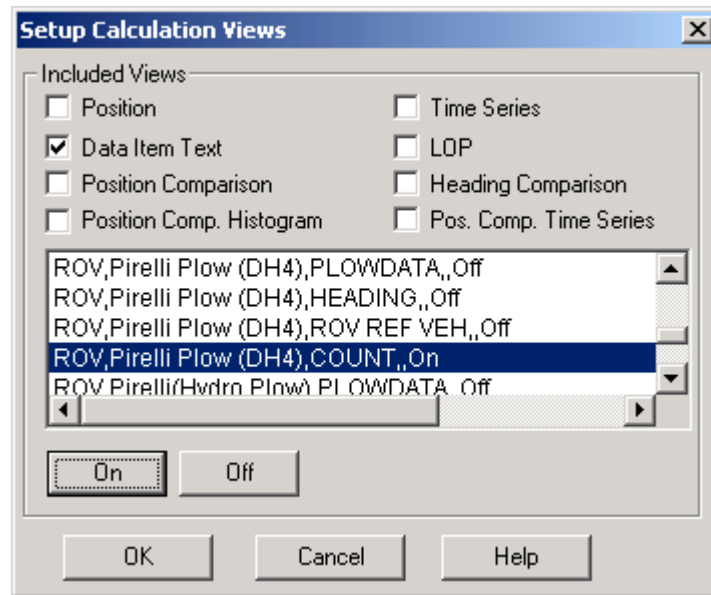
This tab is used in conjunction with the Calculations window to maintain up to five reference counts based on the Channel One (cable) count. These reference counts are not used for any real-time calculations and are not logged to any file; they are intended for reference purposes only.

One common use for the Reference Counters page is to have a 'count down' between cable body deployment. This is accomplished by entering the cable spans between cable bodies in the 'Set Specific Cable Count' field(s), selecting the 'Direction' as 'Down' and exiting with OK when the first cable body is launched.

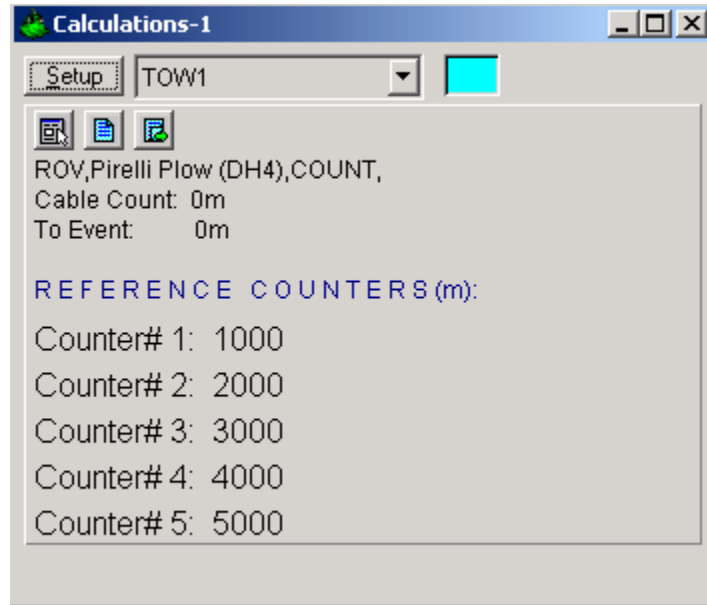
View and configure the Calculations window (shown below) by completing the following steps.

Note: To view the reference counts, the COUNT data item must be attached to the vehicle.

1. Select View > Calculations from the main menu to open the Calculations window.
2. In the Calculations window, click the Setup button to open the Setup Calculation Views dialog shown below.



3. In the Setup Calculation Views dialog, select the Data Item Text checkbox. Then to turn On the COUNT data item, select the COUNT data item from the list and click the On button.
4. Click OK and a Calculations window, with the reference counter information displays as seen below.



Once the Calculations window has been opened and configured, the five reference counters can be modified using the Reference Counters page of the Configure Counter dialog. (Note: the Configure Counter dialog can be directly accessed from the Calculations window by clicking the  icon in the Calculations window.)

The Reference Counter tab allows the reference counters to be modified in a number of ways, as described below. Start by selecting the reference counter you want to modify from the dropdown list box at the top of the page.

Direction

When the *Up/Down* button is not depressed, the reference count will increase if the input cable count increases and decrease if the input cable count decreases. When the *Up/Down* button is depressed, the reference count will decrease if the input cable count increases and increase if the input cable count decreases.

Set Specific Cable Count

To set the reference counter to a specific cable count, enter the desired value in the edit field and click the *Set* button. When the Configure Counter dialog OK button is clicked, the desired reference counter value will be set to the entered value. This value will then continue to increment or decrement based on the input cable count and the current settings for the reference count.

Set Counter Scale

To change the scale at which the reference count will increment or decrement relative to the input cable count, enter the desired scale factor into the scale field. Leave the *New Counter Scale from Cable Count* value at its present value to apply the scale from the current point onward. Enter a count value into the *New Counter Scale from Cable Count* field to apply the scale from a previous count value onward.

Once the desired scale factor and count value is entered, click the *Set* button and then click the *OK* button.

Set Counter Offset

To set an offset from the input cable count to the reference count, enter the desired value into the Set Counter Offset field, click the *Set* button and then click the *OK* button. This value will be added to the input cable count.

Counter Name

To change the reference counter name, enter the desired name into the *Counter Name* field. Click the *Set* button and then the *OK* button to enter the change.

Real-Time Navigation Updates tab

The screenshot shows the 'Configure Counter' dialog box with the 'Real-Time Navigation Updates' tab selected. The dialog has a title bar with a question mark and a close button. Below the title bar are two tabs: 'Reference Counters' and 'Real-Time Navigation Updates'. The 'Real-Time Navigation Updates' tab contains several sections:

- Interval:** A text box containing '1.0 s' and a label 'Enter Raw Data File Logging Interval in Seconds, 0=All Data'.
- Channel 1 (Telephone / Power Cable):** A section with three checked checkboxes: 'Cable Count', 'Payout Speed', and 'Tension'.
- Channel 2 (Tow Cable):** A section with three checked checkboxes: 'Cable Count', 'Payout Speed', and 'Tension'.
- Channels 3,4,5 Tension:** A section with three unchecked checkboxes: 'LCE Tension (Channel 3)', 'CDE 1 Tension (Channel 4)', and 'CDE 2 Tension (Channel 5)'.
- General:** A section with two unchecked checkboxes: 'Distance to Event' and 'Cable Angle'.

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

This tab enables/disables certain data from this device to be passed to the vehicle. Unlike the Reference Counters tab, data from the Real-Time Navigation Updates tab can be logged to the raw files if this data item is associated with a vehicle. This allows the vehicle to have more than one COUNT without one conflicting with the other. One COUNTER device may provide the telephone cable count while the other provides the tow count. If a checkbox is selected, the data value will be passed to the vehicle. For example, if the *Cable Count* checkbox is selected in the *Channel 1* section, then the cable count from the input device will be passed to the vehicles channel 1 count.

The *Interval* section sets the data logging interval used when the “With Events” Logging Control option is selected (refer to chapter 10 of the WinFrog User’s Guide for more information).

TELGRAM SPECIFICATION:

See Device Data String(s) Output to WinFrog section above.