WinFrog Device Group:	**PLOW**
Device Name/Model:	**CTC Data**
Device Manufacturer:	CTC Marine Projects Coniscliffe House Coniscliffe Road, Darlington County Durham, DL3 7EE England Tel: +44 (0) 1325 390500 Fax: +44 (0) 1325 390555 E-Mail: marketing@ctcmarine.com
Device Data String(s) Output to WinFrog:	See the end of the document
WinFrog Data String(s) Output to Device:	$SMD,toolFix, ddmmyy, hhmmss.ss, Plow Lat, Plow lon,plow Speed, plow Advance,shipLat, shipLon, rovRefVehSpeed, rovRefVehAdvance, rovRefVehHeading, Plow Kp, Plow Offline\r\n
WinFrog Data Item(s) and their RAW record:	ROV REF VEH NONE PLOWDATA 490 HEADING 409 TSS340DATA 493

DEVICE DESCRIPTION:

This is a driver designed to read data from the plough or ROV used by CTC Marine. There is also an output to the ROV computer as described in the WinFrog Data String(s) Output to Device section above.

DEVICE CONFIGURATION INSTRUCTIONS

WINFROG I/O DEVICES > EDIT I/O:

Serial
Configurable Parameters

WINFROG I/O DEVICES > CONFIGURE DEVICE:

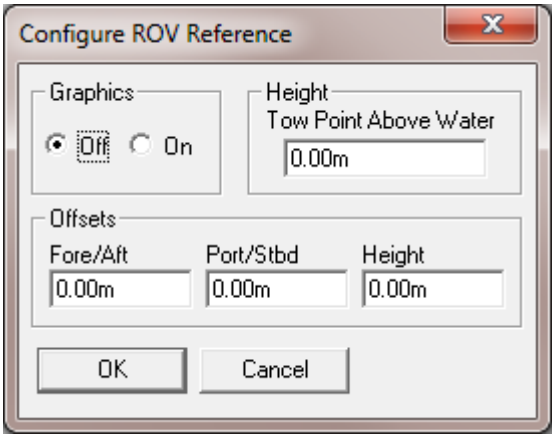
No configuration is required at the I/O Device window level.

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

Adding the CtcData device creates four data items: ROV REF VEH, PLOWDATA, HEADING and TSS340DATA. Once the data items have been added to the vehicle, they must be edited to suit the application.

Data item: ROV, CtcData, 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, CtcData, PLOWDATA

This data item is typically attached to the Plow vehicle in WinFrog. Highlight this data item and click the Edit button to open the Configure Plow dialog box as seen below.

Positioning Mode tab

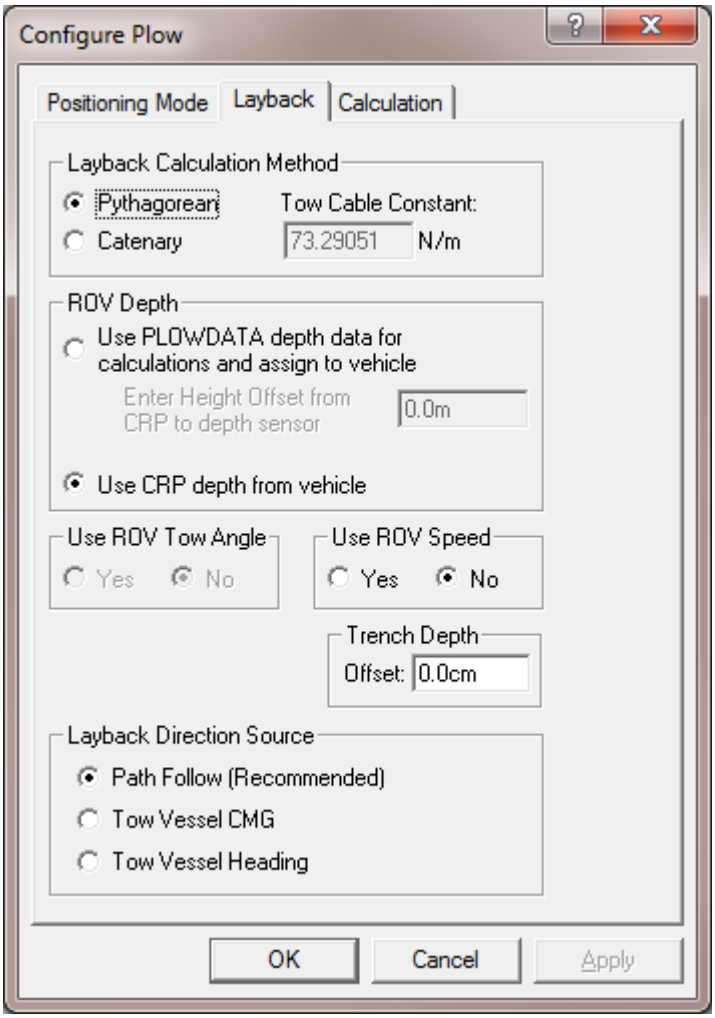
Override Automatic Mode Determination:
This checkbox determines whether WinFrog automatically determines the towed vehicle location and mode or whether the operator determines it.

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 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.

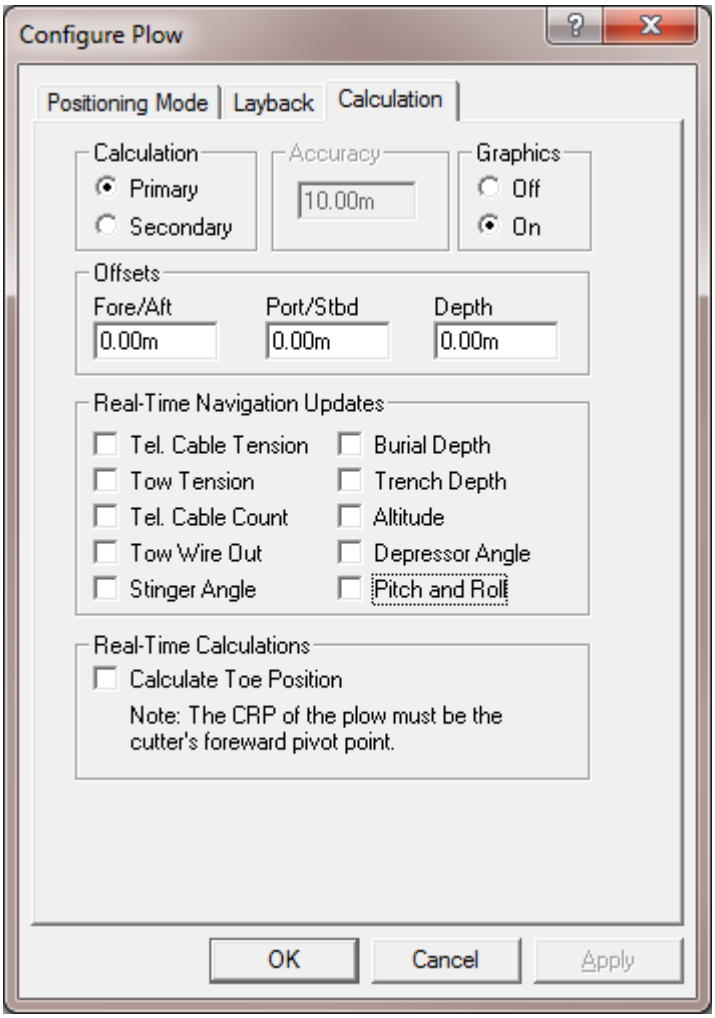
Trench Depth
Offset – If the Trench depth checkbox is selected on the Calculation tab (see below) then this value, 0.0 or otherwise, will be assigned as this vehicle's trench depth.

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, CtcData, 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.

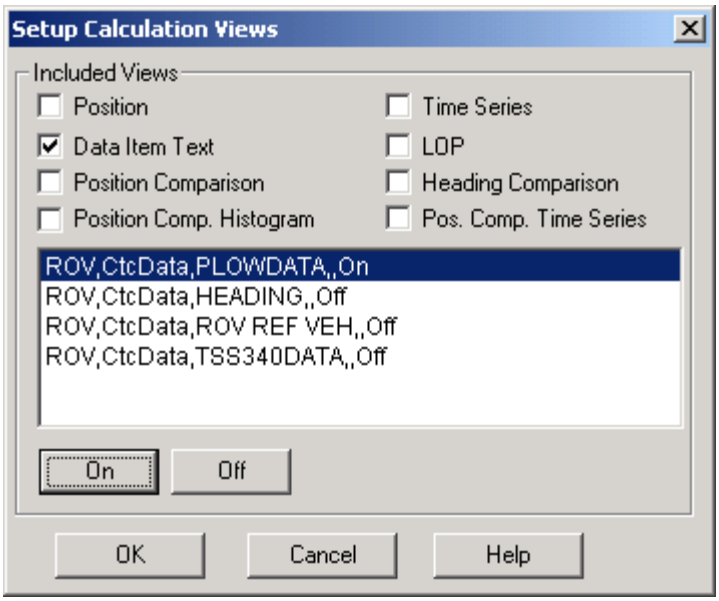
Depth is an offset from the CRP. It is applied in several different ways:

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.

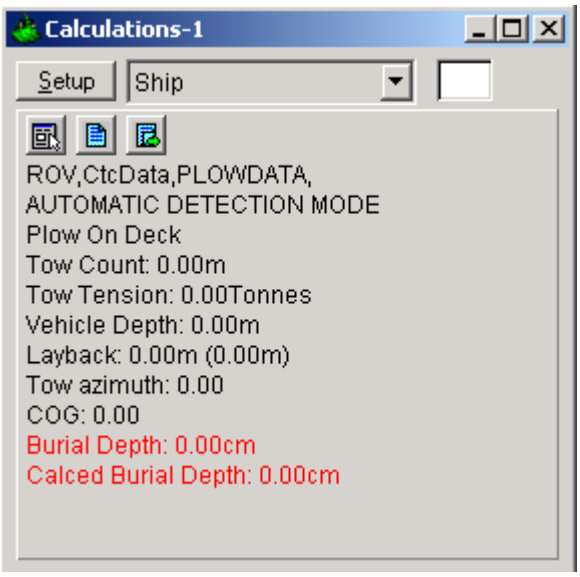
Real-Time Navigation Updates
Most Plow devices have the ability to provide real-time data updates via an umbilical. The Decoded data tab in the I/O Devices window will indicate what data is updated in real-time for each device. You should only select the checkboxes for data output by the device, as leaving 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, CtcData, 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, CtcData, HEADING

Highlight this data item and click the Edit button to open the Configure Gyro dialog box 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 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.

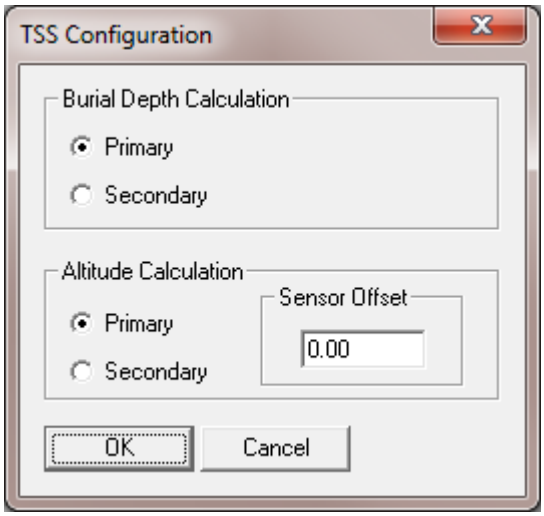
This option is not available in the WinFrog Remote package.

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, CtcData, TSS340DATA

Highlight this data item and click the Edit button to open the TSS Configuration window as seen below.



Burial Depth Calculation:
Set the Calculation selection to Primary or Secondary. Devices set to Primary calculation are used to provide a burial depth. Note that more than one burial depth device can be added to a vehicle's device list; in this situation only one burial depth device may be set to Primary. If the Calculation type is set to Secondary, WinFrog will simply monitor the device's data. WinFrog will not associate the burial depth data from the device with the vehicle; the data will only be logged to the raw data files.

Note: In the case of Primary device failure, WinFrog will not automatically use the Secondary devices for the vehicles burial depth computation. You must manually change a Secondary device to Primary in order for the data to be utilized.

Altitude Calculation:
Set the Calculation selection to Primary or Secondary. Devices set to Primary calculation are used to provide an altitude. Note that more than one altitude device can be added to a vehicle's device list; in this situation only one altitude device may be set to Primary. If the Calculation type is set to Secondary, WinFrog will simply monitor the device's data. WinFrog will not associate the altitude data from the device with the vehicle; the data will only be logged to the raw data files.

Note: In the case of Primary device failure, WinFrog will not automatically use the Secondary devices for the vehicles altitude computation. You must manually change a Secondary device to Primary in order for the data to be utilized.

The Sensor Offset is the vertical distance from the CRP to the TSS sensor (up is +ve, down is –ve).

TELEGRAM to WinFrog

$WFCTC,a.a,d.d,lllll.l,vvvvv.v,ccccc.c,bbbbb.b,t.t,h.h,u.u<LF>

Where:

$WFCTC = header

a.a = altitude metres (of the plough) free format

d.d = depth metres (of the plow) free format

lllll.l = CF lateral offset from TSS 340, 7 characters, centimetres

vvvvv.v = CF vertical offset from TSS 340, 7 characters, centimetres

ccccc.c = CF altitude offset from TSS 340, 7 characters, centimetres

bbbbb.b = CF burial depth from TSS 340, 7 characters, centimetres

t.t = trench depth centimetres free format

h.h = heading degrees free format

u.u = umbilical cable out metres

<LF> line feed required but a carriage return can precede it i.e. <CR><LF>

Ten fields are required.

The four TSS 340 fields must be seven characters.

Also WinFrog will decode the above telegram with the alternate header $ROV

e.g.

$WFCTC,12.4,134.5,00005.7,00006.8,00007.9,00008.0,123,245,1400

Or

$ROV,12.4,134.5,00005.7,00006.8,00007.9,00008.0,123,245,1400