WinFrog Device Group:	**ROV**
Device Name/Model:	**INNOVATUM (Ultra)**
Device Manufacturer:	**Innovatum International Ltd.** Units 11/12, Woodside Business Park Thetford Road, Ingham BURY ST EDMUNDS Suffolk IP31 1NR, UNITED KINGDOM Phone: +44 (0)1284 729123 Fax: +44 (0)1284 729133 email: info@innovatum.co.uk www.innovatum.co.uk **Innovatum Inc.** 2020 Southwest Freeway, Suite 203 Houston, Texas 77098 4807 Tel: +1 (713) 526-6333; Fax: +1(713) 526-2555 email: innovatum@argolink.net internet: http://www.innovatum.net
Device Data String(s) Output to WinFrog:	Day, Month, Year, Hour, Minutes, Seconds, Relative Heading, Mode, Solution, Signal Strength, Horiz. Video Overlay, Depth Video Overlay, **Source Type** (not shown in I/O Devices/Decoded Data), Horiz. Displacement, Horiz. Displacement Error, Vertical Displacement, Vertical Displacement Error, Burial Depth, Magnetic/Current. For 80 character string add: Altitude, Pitch, Roll, Absolute Heading, Time Split. See Configuration Details for more complete information.
WinFrog Data String(s) Output to Device:	Nill
WinFrog .raw Data Record Type(s):	Type 491

DEVICE DESCRIPTION:

Innovatum Ultra and Multi systems are magnetic cable and pipeline tracking systems capable of Passive Magnetic, Active AC (tone), Active DC and Pulse Induction tracking modes, with simultaneous calculation in the first mode and signal monitoring in the others.

There are numerous variations of the Ultra system. The systems can have AC sensors, DC sensors, gradiometers or pulse induction coils installed on the front, or on the front and rear of the vehicle. The simplest system is the Ultra/Multi #02, which has two forward sensors and can only be used for AC tone cable tracking. One of the more complex systems is the Ultra II, which has 4-axis pulse induction coils installed at both

the front and rear of a vehicle. This system can track pipelines or cables using all four tracking modes. Obviously more complex system installations will result in more accurate 3D-target positions.

The systems can be fitted to ROV's, manned submersibles, towed sleds, ploughs and even surface vessels (for shallow water work).

Innovatum manufactures the following Ultra systems:

- Model #00P
- Model #02
- Model #02P
- Model #04
- Model #04P
- Model #44
- Model #44P
- Model ULTRA II

The above systems which have outputs similar to those detailed in the Configuration Details section of this document will operate via the INNOVATUM driver. If the system being used has a different output, check the documentation on the INNOSPIDER driver for matching output. The INNOSPIDER driver was written for use on the Sea Spider, where the ROV has sensors on the front and rear of the vehicle.

Innovatum sensors include: Gradiometers, Triaxial Fluxgate Sensors, Hybrid Sensors, Pulse Induction Sensors, Echosounders, Altimeters, and Tone generators.

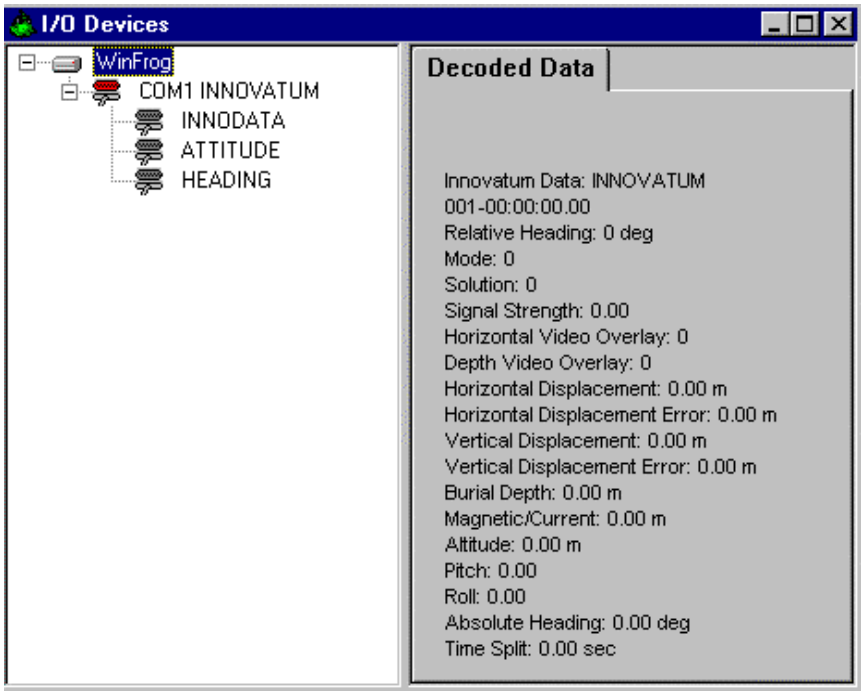
DEVICE CONFIGURATION INSTRUCTIONS (suggested):

Baud Rate: 9600
Data Bits: 8
Stop Bits: 1
Parity: None

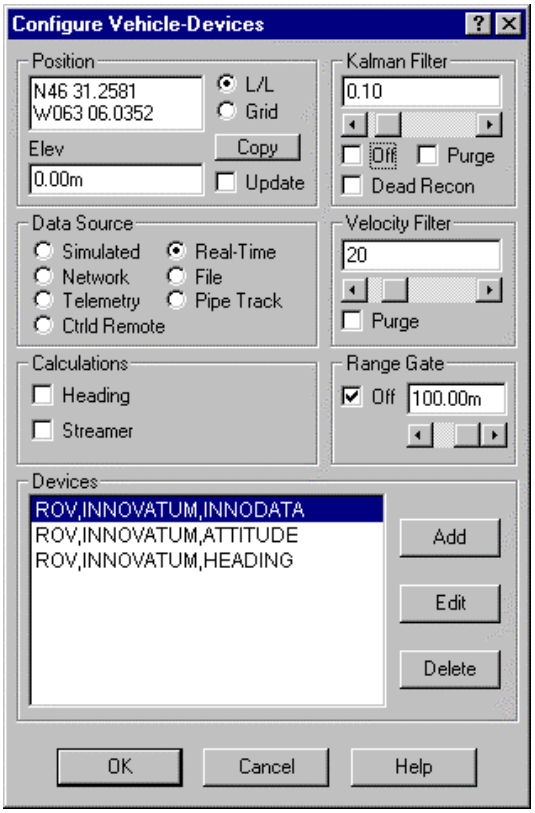
WINFROG I/O DEVICES > CONFIG OPTIONS:

The INNOVATUM device is added to WinFrog from the ROV device category. The INNODATA, ATTITUDE AND HEADING data items are added to the system when the INNOVATUM device is initiated. Attitude and heading data are available to WinFrog only when the 80-character string is output from the device. Refer to the CONFIGURATION DETAILS section for more information on the data string from this device.

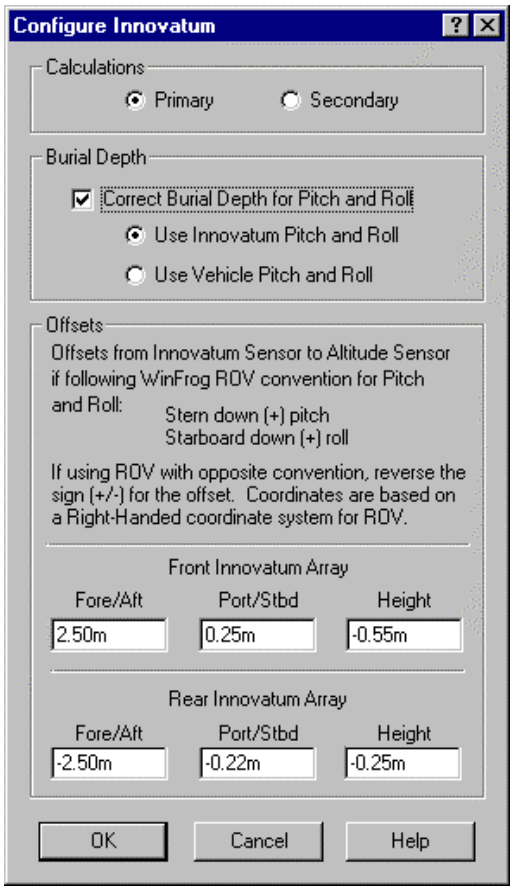
No configuration is available or required at the device level.



WINFROG VEHICLE > POSITION > DEVICE > EDIT OPTIONS:
The INNODATA data item must be added to the vehicle for cable and/or pipeline tracking. The ATTITUDE AND HEADING data types are optional and can be added to the vehicle if the Innovatum system data is to be utilized for pitch, roll and vehicle heading.



EDIT ROV, INNOVATUM, INNODATA:
In the appropriate vehicle's Configure Vehicle- Devices window, highlight the ROV, INNOVATUM, INNODATA data item, and click the Edit button. The Configure Innovatum dialog box appears.



Calculations:
Selecting the Primary radio button will permit the Burial Depth, heading, pitch and roll data to be displayed in the Vehicle window, and the data will be available in the 491 raw data record. If Secondary is selected, the Burial Depth data will only be available in the 491 raw data record.

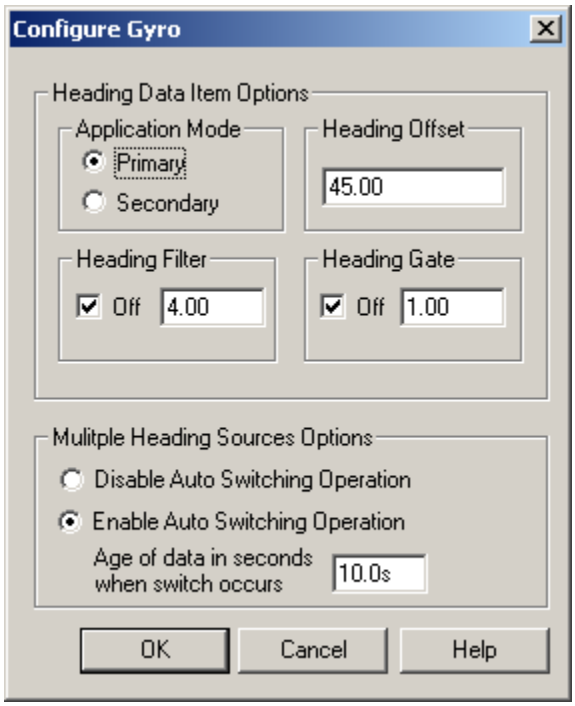
Burial Depth:
The Burial Depth can be corrected for pitch and roll using the Innovatum attitude data (if the 80-character record is used); or, via another ATTITUDE system added to the vehicle. Raw data will also be present in the associated records for post processing. Refer to the CONFIGURATION DETAILS section for information on data recorded.

Offsets:
The X,Y,Z offsets applied from the Innovatum Sensor to the Altitude Sensor are input for both the Front and Rear Innovatum Arrays. These offsets are applied as listed in the Configure Innovatum dialog seen above. Initially only front mounted

Innovatum systems were operational via this driver (i.e. Ultra/Multi#02, Ultra 02P, Multi 32). In WinFrog software versions compiled after September 1999 (incl. V.3.1), the driver was changed and now computes rear burial depth, for fore and aft mounted systems.

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

EDIT ROV, INNOVATUM, HEADING:
In the vehicle's Configure Vehicle-Devices window, highlight the ROV, INNOVATUM, HEADING data item and click the Edit button. The Configure Gyro dialog box appears.



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.

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.

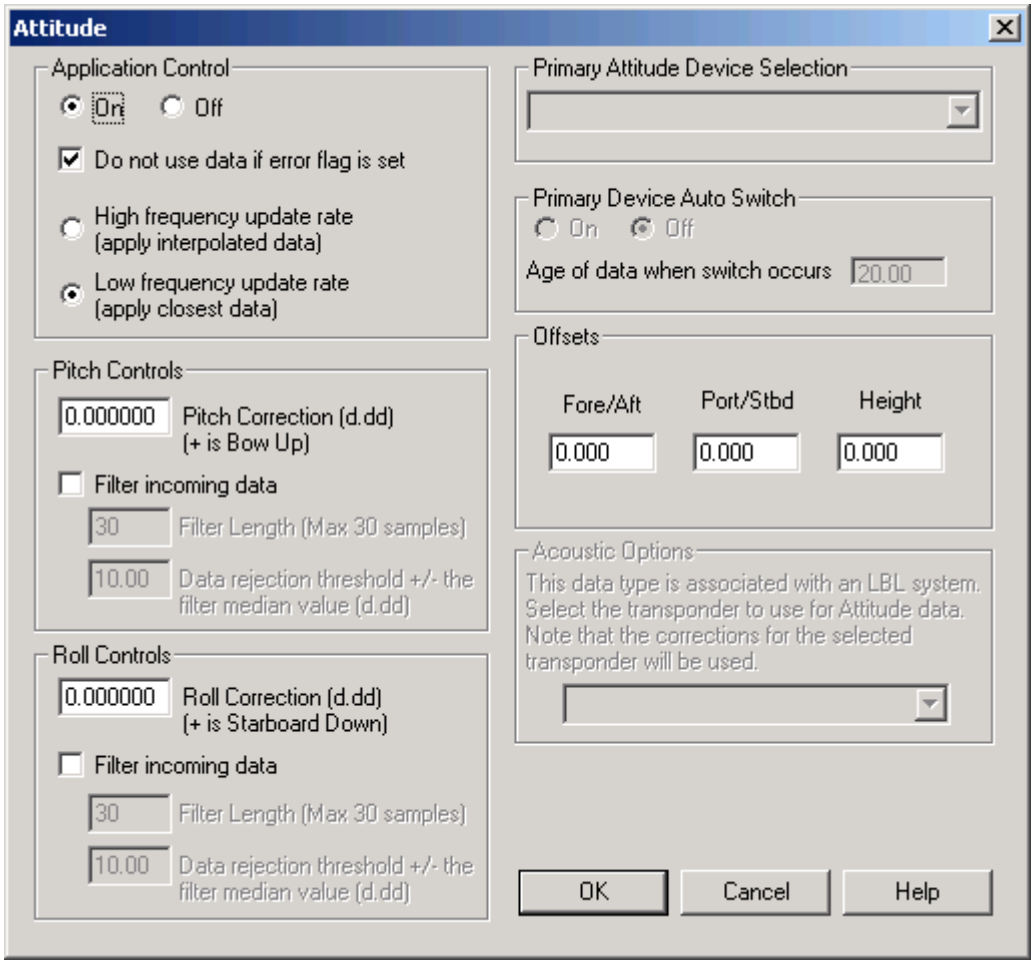
Note that this option is only available if more than one HEADING source is associated with the respective vehicle. Changes made to the Auto Switching options for any one of the HEADING data items are automatically assigned to the others upon exiting this dialog with OK. If the Auto Switching option is 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.

EDIT ROV, INNOVATUM, ATTITUDE:
When attitude devices are added to a vehicle, they are initially turned OFF. To begin using the inclination corrections in the position output the operator must turn the sensor ON, and edit the device inside the 'Configure Vehicle Calculations' dialog box.



Attitude
By default, the sensor mode is off, meaning that data from the device will not be used in the vehicle's calculations. To turn the sensor on, and begin using the inclination corrections in the position output, click the 'On' radio button.

Error flag testing
The error flag check box is applicable to those devices that output a code indicating the data is either good or bad. If checked and the device supports such a code in its telegram, WinFrog will look at the code and if the data is indicated as bad, WinFrog will not use the data.

Sensor Update Frequency Rate
If the associated attitude sensor has a high frequency update rate (e.g. 10Hz and higher) it is appropriate to extract attitude data for application by either interpolating or extrapolating for a given epoch. In this case, the *High frequency update* option should be selected. Some attitude sensors have slow update rates, in particular

those installed in acoustic transponders that require interrogation. For these sensors interpolation/extrapolation can produce a bad value as there is insufficient information to determine the correct shape of the curve (aliasing). Thus the most current attitude needs to be used. In this case, select the *Low Frequency update* option. This option applies to the use of the attitude data by the following data items:

- POSITION
- ELEVATION
- ALTITUDE
- XPONDER
- LBL TRANSCEIVER
- PROFILE

Pitch and Roll
There are two control groups, one for each of pitch and roll. Correction values can be added in this section of the window. The correction values (entered in units of degrees-decimal degrees) are added to the raw pitch and roll values received from the device before the data is applied to the vehicle's calculations. Ensure that entered values adhere to the sign convention used by WinFrog. You can verify that the corrections are entered properly by viewing the pitch and roll values in the I/O Device window and the Vehicle Text window.

Filtering
Additionally you may filter the incoming values to remove extraneous noise or spikes – check boxes are provided to switch this feature on or off. A filter length (up to 30 samples) and a threshold value (applied to the median of the samples in the filter to obtain lower and upper bounds) can be entered. Any pitch or roll values outside of the bounds are rejected and not used in the vehicle calculations, but will be recorded in the RAW files. If either one of pitch or roll is rejected, both values are ignored, although you may set up the filtering parameters for them separately. The status of the filters, including the current valid range for each of pitch and roll, and the percentage of values rejected, can be viewed in the calculations window, selecting the appropriate ATTITUDE data item.

> ***Important:***
> Do not enable filtering unless there is a high enough data rate (say 10hz) to correctly determine the shape of the curve. Essentially, if the low frequency update rate is selected above, do not enable filtering.

Primary Attitude Device Selection
If more than one attitude device is present, you may select one of them to be primary and the others to be secondary and allow WinFrog to automatically switch between them should the primary system stop sending data or has bad data. There must be at least two attitude data items added to the vehicle to use this feature. (Note: The attitude and offset data displayed in this dialog is for the attitude device corresponding to the data item that is being edited. Selecting a Primary Attitude

Device from the drop down list does not affect these values for any attitude device in the list. Every attitude device needs to be set up for its own corrections and offsets.)

Primary Device Auto Switch
Select the On radio button to turn on this feature. Then enter the time out time in the edit box. If WinFrog does not receive data from the primary attitude device, or if it receives bad data for this length of time, it will switch to the next secondary that is enabled and has good data.

Auto Switch Feature Usage
To use this feature first turn the sensor on as described in the Attitude section above. Next, select the attitude device that you wish to be primary from the drop down list box. Then turn the primary device auto switch on and enter the time out time. Then edit all the other attitude data items and enable them in the Attitude group box. Note that the same selected primary will be displayed for all attitude data items; similarly, the automatic feature will be turned on and the time out time will be the same. However, you must individually enable each attitude device in the Attitude group box.

Offsets
These are not applicable in this case.

Acoustic Options
This applies to long base line acoustic transponders that have inclinometers. See chapter 17 for more information.

The operator should keep in mind that when the Attitude is turned on for a vehicle, the position displayed is affected a distance equal to the sin of the (pitch and roll) angle, multiplied by the positioning sensors' height. See CONFIGURATION DETAILS on the Digitilt INS device for the applicable formula.

CONFIGURATION DETAILS:
Refer to system documentation or vessel documentation for information on the installation and hook up of this unit. Interfacing to this unit should only be performed by experienced personnel. Listed below is the character string output from this device.

System performance can be found on the Innovatum web site listed at the beginning of this document.

Character String – 64 characters:

Character	Description
1	Space
2	Space
3	} Day of month (1 to 31)
4	}
5	} Space
6	}} Month of year (first three letters)
7	}}
8	}}
9	}}
10	} Year (all four digits)
11	}
12	}
13	}
14	}}Hour of day
15	}}
16	:
17	}Minutes of hour (0 to 59)
18	}
19	:
20	}} Seconds of minute (0 to 59)
21	}}
22	}Relative heading (+ or -) in degrees
23	}<equals Vehicle heading minus Target heading>
24	}
25	}} Mode 1=Passive, 2=Active DC, 3=Active AC, 4=Active AC (grads)
26	} Solution 0=No Signal, 1=Direction only, 2=Horizontal Displacement only, 3=Horizontal and vertical displacements
27	}} Signal Strength (logarithmic) & polarity
28	}}
29	}}
30	}}
31	} Video overlay (per cent horizontal displacement)
32	} (-99 to +99 equals full left to full right)
33	}
34	}} Video overlay (per cent maximum depth)
35	}} (0 to 99 equals minimum to maximum)
36	} Source type 0-Single 1=Complex
37	}} Target horizontal displacement (in metres)

38	}} (+ = target to right, - = target to left)
39	}}
40	}}
41	}}
42	} Probable error in horizontal displacement (in metres)
43	}
44	}
45	}
46	}} Target vertical displacement (in metres) from Innovatum reference to target
47	}} center
48	}}
49	}}
50	} Probable error in vertical displacement (in metres)
51	}
52	}
53	}
54	}} Vertical displacement from skids to top of target (in metres)
55	}} (this value is only equivalent to "depth of bury" provided that skids are
56	}} level with seabed)
57	}}
58	}}
59	} In passive mode - total normalized radial magnetization of target.
60	} In active mode - estimated magnitude of current flowing in target
61	} In active DC mode, + indicates DC current flowing in same direction as
62	} vehicle heading
63	}
64	}

A Typical Data String would be as follows:

```
"25 MAY 200015:33:27-4 33 3.6 19320.0.320.061.610.22 0.95 0.48"
```

Where:

Date =	25 May 2000
Time =	15:33:27
Relative Heading =	-4
Mode =	Active AC
Solution =	Horizontal & depth calculation
Signal Strength =	3.6
Overlay Horizontal =	19
Overlay depth =	32
Source =	Single
Horizontal Displacement =	0.32 metres
Horizontal Error =	+/- 0.06 metres
Vertical Displacement =	1.61 metres
Vertical Error =	+/- 0.22 metres
Skids to top =	0.95 metres
AC Current =	0.048 amps

Additional Characters when 80-character string is output:

Character	Description
65	} Altitude in metres referenced to skids
66	}
67 (.)	}
68	}
69	}
70 (+/-)	} Degrees Pitch
71	}
72	}
73 (+/-)	Degrees Roll
74	}
75	}
76	} Absolute heading
77	}
78	}
79	} Time Split (not used)
80	