WinFrog Device Group:	**INS**
Device Name/Model:	**Trimcube**
Device Manufacturer:	**Measurement Devices Ltd.** Silverburn Crescent, Bridge of Don Industrial Estate, Aberdeen AB23 8EW, Scotland, UK Tel:+44 (0)1224 246700 Fax:+44 (0)1224 824987 Internet: http://www.mdl.co.uk
Device Data String(s) **Output to WinFrog:**	Output String is 12 ASCII Characters terminated by a <CR> <LF>. I.E. P+2531R-1012(CR)(LF) (This corresponds to 'X-axis' angle of 25.31^{o}, and a 'Y-axis' angle of –10.12^{o})
WinFrog Data String(s) **Output to Device:**	Nil
WinFrog .raw Data Record Type(s):	Type 413 (Attitude): Time, Pitch, Roll, Status

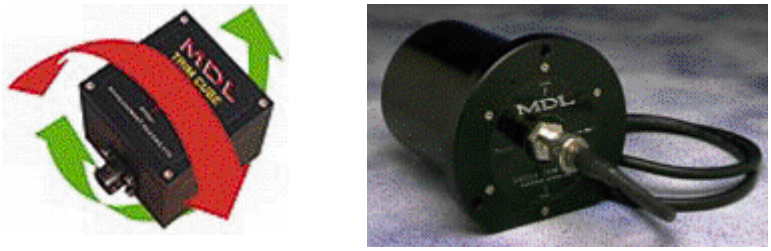
DEVICE DESCRIPTION:

The Trim Cube is a biaxial inclinometer with an integral single chip microcomputer, which utilizes electrolytic gravity sensors to determine inclination. The TRIM CUBE's electronics automatically compensate for temperature and voltage fluctuations, apply calibration data, and format and control data output.

The Trim Cube is designed to monitor pitch and roll on static or dynamic platforms. The output rate is approx. 5 readings per second in a 12 character ASCII format using the standard sign conversions: Pitch being rotation around the X axis and Roll being around the Y axis. The TrimCube has a measuring range of +- 40 degrees with an angular resolution of 0.1 degrees. The unit's accuracy is stated to be 0.08 degrees at the midpoint.

The unit is small and can be mounted using the tapped holes (M4 type). When mounting such small inclination units it is sometimes difficult to orient the device to the vehicle. It is therefore good practice to mount the device to a hard surface or plate, and then mount the plate to the vehicle. Calibration of the unit can also be performed within Winfrog.

The TRIM CUBE is also available in a waterproof embodiment with a depth rating of 3000m. This device is named the SubSea Trim.



Trim Cube and Subsea Trim

WinFrog can be configured to apply the attitude data to remove device and tracking offsets caused by the vehicle's pitching and rolling motion. These calculations include reducing the GPS antenna position to the Z datum zero reference, removing apparent vehicle wandering due to the vehicle's pitch and roll.

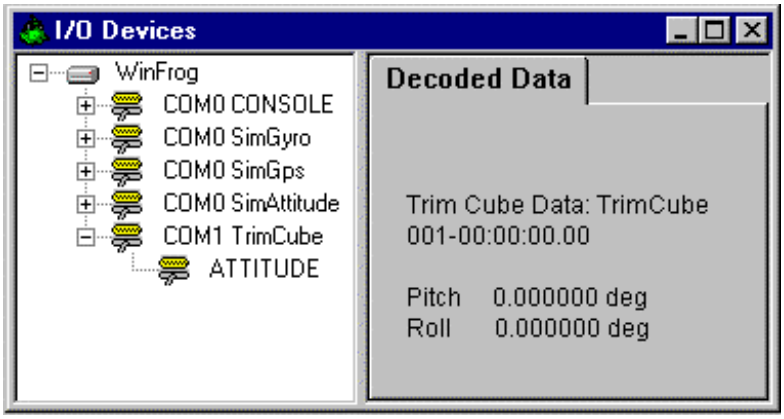
DEVICE CONFIGURATION INSTRUCTIONS:

Baud Rate: 1200 (1200 or 9600 selectable for the Subsea Trim)
Data Bits: 8
Stop Bits: 1
Parity : NONE

The TrimCube outputs data in the RS232 format, with handshaking. (See Configuration Details below for wiring details). The output string consists of a string of 12 characters terminated by carriage return and line feed. The ASCII numbers are hundredths of degrees of tilt in the range – 4000 to + 4000. A typical string would appear thus P+2531R-1012(CR)(LF). This would correspond to an X angle of +25.31 ° and a Y angle of –10.12°.

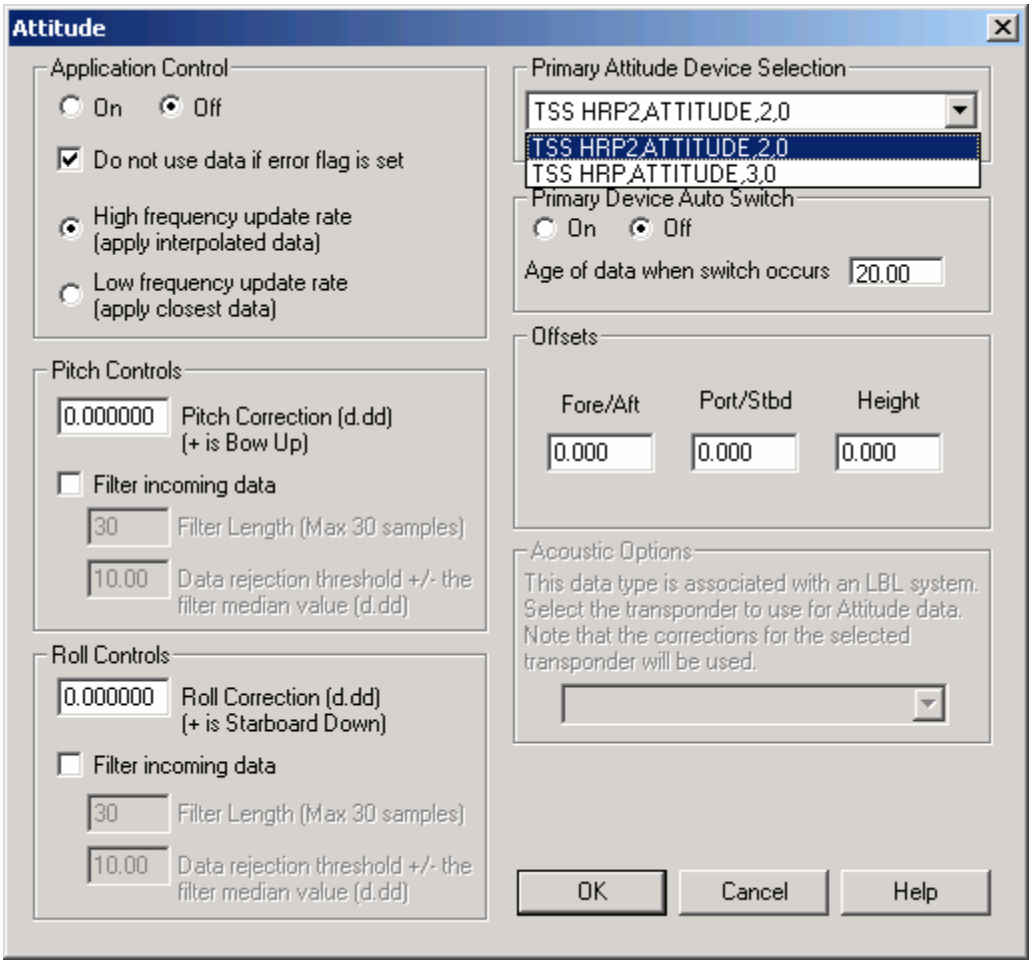
WINFROG I/O DEVICES > CONFIG OPTIONS:

The TRIM CUBE is added to WinFrog via the INS device category. Adding the TrimCube creates an Attitude data item in the I/O Devices window, as seen below. The TrimCube does not require any configuration at the "generic" I/O Device level.



WINFROG VEHICLE - DEVICES > EDIT OPTIONS:

Once the Trim Cube has been added to a vehicle's device list, it must be edited to suit the application. In the vehicle's Configure Vehicle Devices dialog box device list, highlight the Trim Cube device and click the Edit button. The Attitude dialog box appears as seen below.



Attitude

By default, the sensor mode is off, meaning that data from the attitude 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 offsets are used to calculate remote heave (leaver arm). It is expected that these values are the offset from the center of gravity of the sensor. Then using the observed pitch, roll, and heave, the heave at the center of gravity will be calculated and assigned to the vehicle, which may then be output using the INSIX output device. However, it is recommended that the sensor be placed at the center of gravity. If this is not possible, it is better to enter the lever arm offsets into the sensor and have the sensor make the correction, then have the sensor output the corrected values with respect to the center of gravity. The INSIX output device expects that the heave assigned to the vehicle is with respect to the center of gravity.

WinFrog records the attitude data to a type 413 raw data record. This record contains observed Heave, Pitch, Roll, status, accuracy, and a time stamp to indicate precisely when the data was observed. See Appendix B: WinFrog File Formats in the WinFrog User's Guide for details on the Type 413 raw data record.

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

CONFIGURATION DETAILS:

The TrimCube must be mounted to a hard surface and carefully oriented so that the device's axis' are in alignment with the vessel's axis'. If the unit is not "zeroed" to the vehicle's axis, corrections can be entered as detailed above. Calibrations to determine corrections are best performed after the unit mounting is finalized.

Technical Specifications:

	Cube	Subsea
Mechanical		
Housing:	Anodised Aluminium	Anodised Aluminium
Dimensions:	66 x 66 x 66mm	165 x 170mm (dia x h)
Fixings:	4 Blind Tapped Holes (M4)	3 Clearance Holes (M8)
Weight:	410g	3.5kg
Electrical Connector:	Cannon (PT07 10 07 P)	Burton 8 Pin
Cable Connector:	Cannon(PT06A 10 07 S)	Burton 9 Pin With 1m Flying Cable
Technical		
Resolution:	0.01°	0.01°
Measuring Range:	± 40°	± 40°
Accuracy:	0.08°(Mid-point)	0.08°(Mid-point)
Cross Axis Coupling at 25°	Less than 0.5%/TD>	Less than 0.5%
Time constant:	0.3secs	0.3secs
Pin Functions		
	A 0V	**1** 0V
	B 12V Input	**2** 12V Input
	C 5V Output	**3** 5V Output
	D Serial Output Current Loop or RS232	**4x** Serial Output Current Loop or RS232
	E Serial Enable TTL Output:	**5** Serial Enable TTL Output:
	F Display Data TTL Output	**6** Display Data TTL Output
	G Display Clock TTL Output	**7** Display Clock TTL Output
		8 No Connection
Supply voltage:	12V DC +/- 30%	12V DC +/- 30%
Outputs:	RS232 +Handshake	RS232 +Handshake
Temperature range:	0°C to +40°C	0°C to +40°C
Serial Data Format:	1200 Baud 8 Bits No Parity 1 Stop Bit	9600 / 1200 Baud (Selectable) 8 Bits No Parity 1 Stop Bit
Display Output	8 Digits Sent Out, Serially As 64 Bits	8 Digits Sent Out, Serially As 64 Bits
Surface Display Unit		
Housing:	Machined Aluminium	
Dimensions:(WxLxH)	172x112x125mm	128x172x111mm
Operating Temperature:	0°C to +45°C	0°C to +45°C
Weight:	1.5kg	1.5kg
Display:	LCD	LCD
Supply voltage:	Universal Mains or 12V DC	Universal Mains or 12V DC