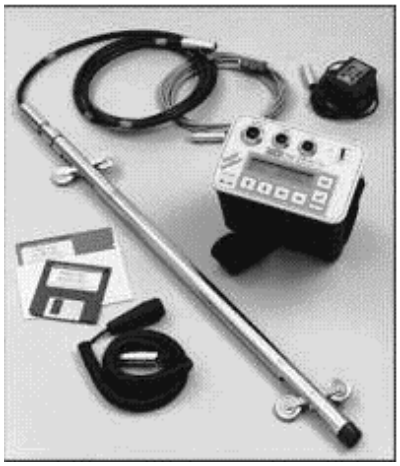
WinFrog Device Group:	**INS**
Device Name/Model:	**Digitilt**
Device Manufacturer:	Slope Indicator Co. USA 3450 Monte Villa Parkway, PO Box 3015 Bothell, WA 98041-3015, USA Phone: 425-806-2200 Fax: 425-806-2250 http://www.slope.com Slope Indicator Co. (Canada) 190-6260 Graybar Rd. Richmond, BC, V6W 1H6 Phone: 604-276-2545, Fax: 604-276-0190
Device Data String(s) Output to WinFrog:	Pitch, Roll (on channels A and B respectively)
WinFrog Data String(s) Output to Device:	Nil
WinFrog .raw Data Record Type(s):	Type 413 (Attitude): Time, Pitch, Roll, Status

DEVICE DESCRIPTION:

The Digitilt inclinometer calculates two axis tilt by utilizing two force balanced servo-accelerometers placed a fixed (known) distance apart. This device can be used to provide precise monitoring of vertical data in applications such as construction control and safety monitoring. The DigiTilt has been used for jacket placements, vessel pitch and roll monitoring and drilling rig inclination monitoring. Because of the units' size and shape, it can be mounted on a vessel and physically oriented to the vessels' attitude. Because of the instrument's high precision and dependability, they can be used for monitoring precise attitude for both underwater and surface positioning applications.



Digitilt Probe and DataMate

For use in WinFrog, another Slope Indicator product, the DataMate, is required to interface the Digitilt probe to the WinFrog computer.

The items required for use within Winfrog (as shown in the figure above) are:

- Digitilt Probe
- DataMate (Control Unit)
- Control Cable
- Power Supply
- Serial Cable

The DigiMate can also be ordered with proprietary software and a trigger switch. These are not required for use within Winfrog.

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 pitch and roll.

DEVICE CONFIGURATION INSTRUCTIONS:

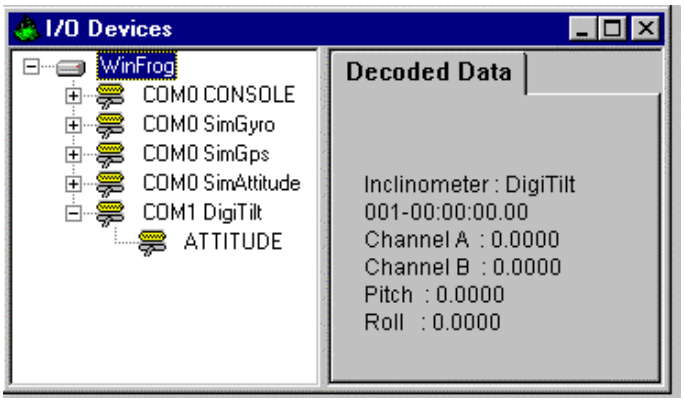
Baud Rate: 4800
Data Bits: 8 (or 7)
Stop Bits: 1 (or 2)
Parity : NONE

The DigiMate utilizes Standard RS-232 one way serial communication to output data to a Winfrog Serial Port. See the Device Configuration section below for details on interface wiring.

Note: The DataMate may be configured for communication parameters other than listed above. The units available from Clear Focus Group in Halifax Canada (++1 902 465 2955) are configured (and marked) as listed above.

WINFROG I/O DEVICES > CONFIG OPTIONS:

The DigiTilt is added to WinFrog from the INS device category. Adding a DigiTilt to WinFrog creates an Attitude data item, as seen below.



The Decoded Data section of the I/O Devices window displays the raw data being received from the DataMate. These are listed under Channel A: (2*sinθ value-pitch); and under Channel B: (2*sinθ value-roll).

WinFrog converts the raw Channel A and Channel B data to degree-decimal degree values (of the zenith angles) and are displayed as Pitch (in degrees); and, Roll (degrees).

Note: The Pitch angle being output by the DataMate is positive for Bow down. WinFrog changes the sign of this value so that the Digitilt sign convention coincides with other INS devices in Winfrog (i.e. Bow down is negative pitch). Therefore, in the I/O Devices window, the Channel A value and the Pitch value will display opposite signs. Similarly, Channel B and Roll will be of opposite sign.

The Digitilt device must be edited at the "generic" I/O Device level. In the I/O Devices window, highlight the DigiTilt device, then click the right mouse button and select Config Device. The DigiTilt config dialog box appears as seen below.

Offsets:
The DigiTilt config dialog box allows you to enter *'correction'* values that will be added to the pitch and roll values received from the DigiTilt. These values might be entered to zero the pitch and roll of the inclinometers to correct for installation differences. Simply type in desired Pitch and Roll values, remembering the sign convention output by the DataMate is opposite to that of WinFrog. Therefore entries in this dialog box must conform to the DataMate's sign convention, i.e. + for bow down and starboard up. Entries made in this dialog box will be added to the pitch and roll values from the Datamate and these 'corrected' values will be stored in the raw files.

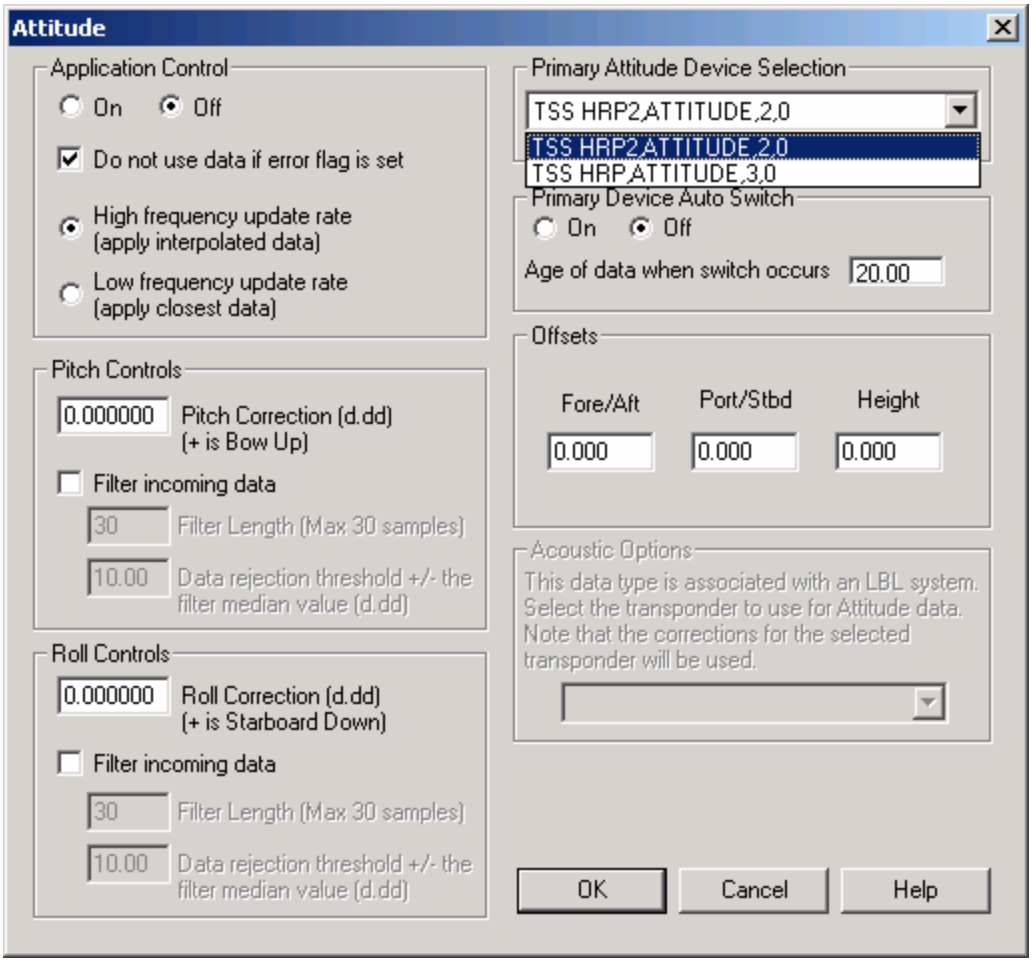
Probe:
There are actually two different models of DigiTilt Inclinometer probes that can be purchased from Slope Indicator Inc. - a Metric model and an English model.
The difference lies in the distance between the accelerometers (the probe's wheel base), and the matching distances marked on the control cable. The Metric version has a 0.500 meter wheel base, whereas the English version has a wheelbase of 24 inches (0.610 meters).

In the Config DigiTilt dialog box, you must define which unit is being used. This information is used in WinFrog's angle calculations. See the Configuration Details section below for further information.

Note: DigiTilt probes available from Clear Focus Group in Halifax Canada (++1 902 465 2955) are English Probes.

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

When the DIGITILT is added to a vehicle's device list, it must be edited to suit the application. In the vehicle device list highlight the DigiTilt Attitude data item then 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.

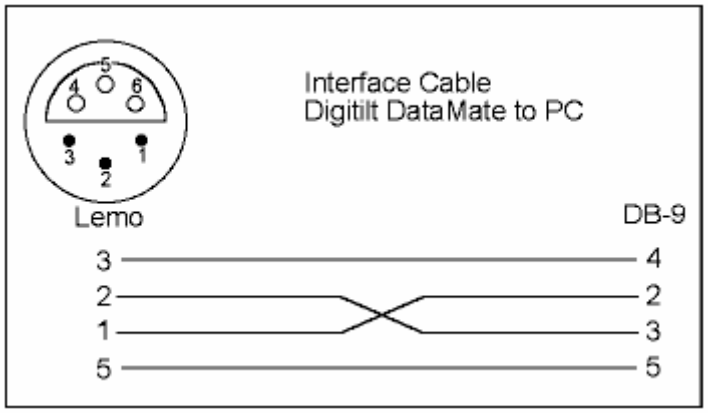
Acoustic Options
This applies to long base line acoustic transponders that have inclinometers. See chapter 17 for more information.

CONFIGURATION DETAILS:
The Digitilt Probe can be secured to the vessel, or mounted in a 2” Square ‘tube’ secured to the Vessel or Structure for which inclination data is required.

A control cable is strung from the unit to the DataMate. Digitilt probes and control cables are suited for underwater applications.

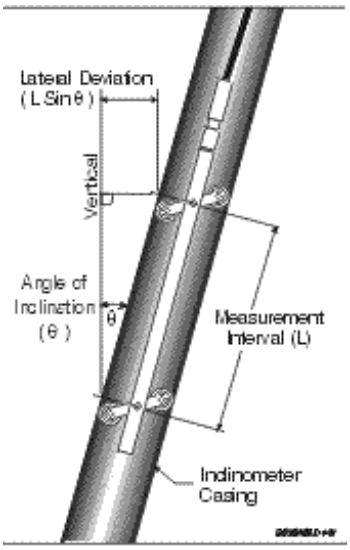
The serial cable is run from the DataMate to a Winfrog I/O port. The charger can be plugged into the DataMate or alternatively, a 10VAC-power supply can be hooked up to the power port on the DataMate.

The battery power on the DataMate is viewable when the ON/OFF switch is in the middle position (the battery power position). The operational range of the battery power is approx. 0.5700 to 0.6300.



The DigiTilt manual describes setting data output from the DigiMate as follows:
You can "print" to a terminal program. Any terminal program (such as “Hyperterminal” in WINNT) can receive ASCII data from the DataMate. Set the serial parameters on your terminal program to the same baud rate, no parity, 8 data bits, 1 stop bit. On the DataMate, go to "Datasets" and choose "Print". You will be prompted for a baud rate, and defaults to 9600. On the DataMate, select the dataset and press enter. The data will be output through the serial port in ASCII format.

If you can't establish communication between the PC and the DataMate, you should check which version of software is used by the Digimate. If you recently upgraded your computer to 500Mhz or faster, the DOS DMM program can't communicate. Switch to Windows DMM and the problem will probably be resolved.



Angle of Inclination