WinFrog Device Group:	**INS**
Device Name/Model:	**TSS Heave 325**
Device Manufacturer:	**TSS (UK) LTD HQ** New Mill New Mill Lane, Witney Oxfordshire, UK OX8 5TF Tel: +44 (0)1993 777700; Fax: +44 (0)1993 777701 Email: tssmail@tssuk.co.uk http:// www.tss-realworld.com **US Office** 10801 Hammerly Blvd. Suite 206 Houston Texas 77043 Tel: +1 713-461-3030**;** Fax: +1 713-461-3099 Email: tssusa@tssusa.com
Device Data String(s) Output to WinFrog:	Heave, Roll, Pitch, and Yaw
WinFrog Data String(s) Output to Device:	Nil
WinFrog .raw Data Record Type(s):	Type 888 HEAVE Type 413 ATTITUDE

DEVICE DESCRIPTION:

TSS Ltd. produces various heave and pitch and roll sensors. The TSS- 320B/325 is a combination of two separate TSS products: the 320B Heave Compensator and the 325 Motion Sensor. The 320B is the actual heave compensator – it takes the mark pulse from the sounder and aligns it with the instantaneous heave measurement from the sensor. The 320B enables marking of the original paper trace with both heave and compensated depth and, via digital or analogue means output data to a logging point.

The 325, in addition to accurate heave measurement, compensates for the effects of vessel roll and pitch and the effects of horizontal and lateral accelerations. This sensor provides accurate heave measurements on any size of vessel, in moderate to high dynamic conditions. In addition, output of roll/pitch information can be supplied to the latest generation of hydrographic software packages for later post-processing.

A further advantage of the 320B/325 is the inclusion of a built in digitizer. This allows clients to heave compensate earlier generations of analogue echo-sounders and also allows output – from the 320B – of the raw depth/compensated depth and measured heave to an external digital datalogger, thereby upgrading their system to full digital capability.

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.

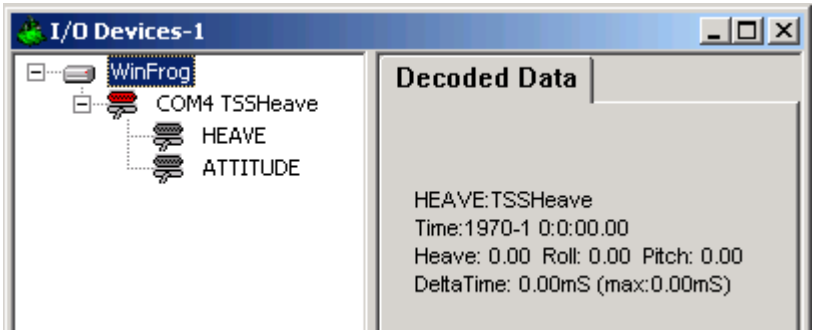
Note that WinFrog does not apply heave data to depth readings in real-time. The heave data is only recorded for use in post processing, i.e. depths are not corrected for heave using this device. In order to display heave corrected depths, you must interface the heave compensator directly to a compatible depth sensor device.

Note that this driver is the same as the TSS1 Heave device driver except that this driver does not decode and log data if the status information in the telegram indicates there is a problem (if status character is anything but a blank).

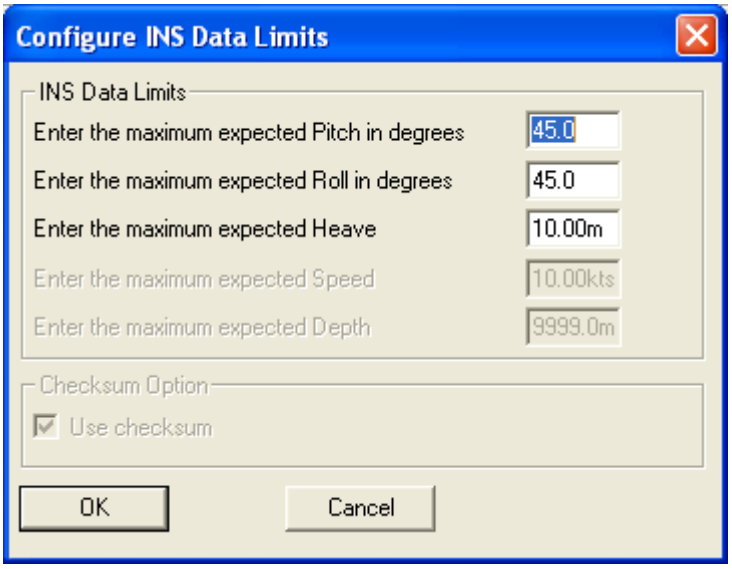
DEVICE CONFIGURATION INSTRUCTIONS:

WINFROG I/O DEVICES > EDIT I/O:
Serial
Configurable Parameters

WINFROG I/O DEVICES > CONFIGURE DEVICE:
The TSS 325 is added to WinFrog from the INS device category. Adding the TSS 325 to WinFrog creates a Heave and Attitude data item that can be added to a vehicle's device list. No configuration is required at the I/O Device level.



The configuration associated with this device applies to data checking and validation. Accessing the device configuration results in the following dialog.



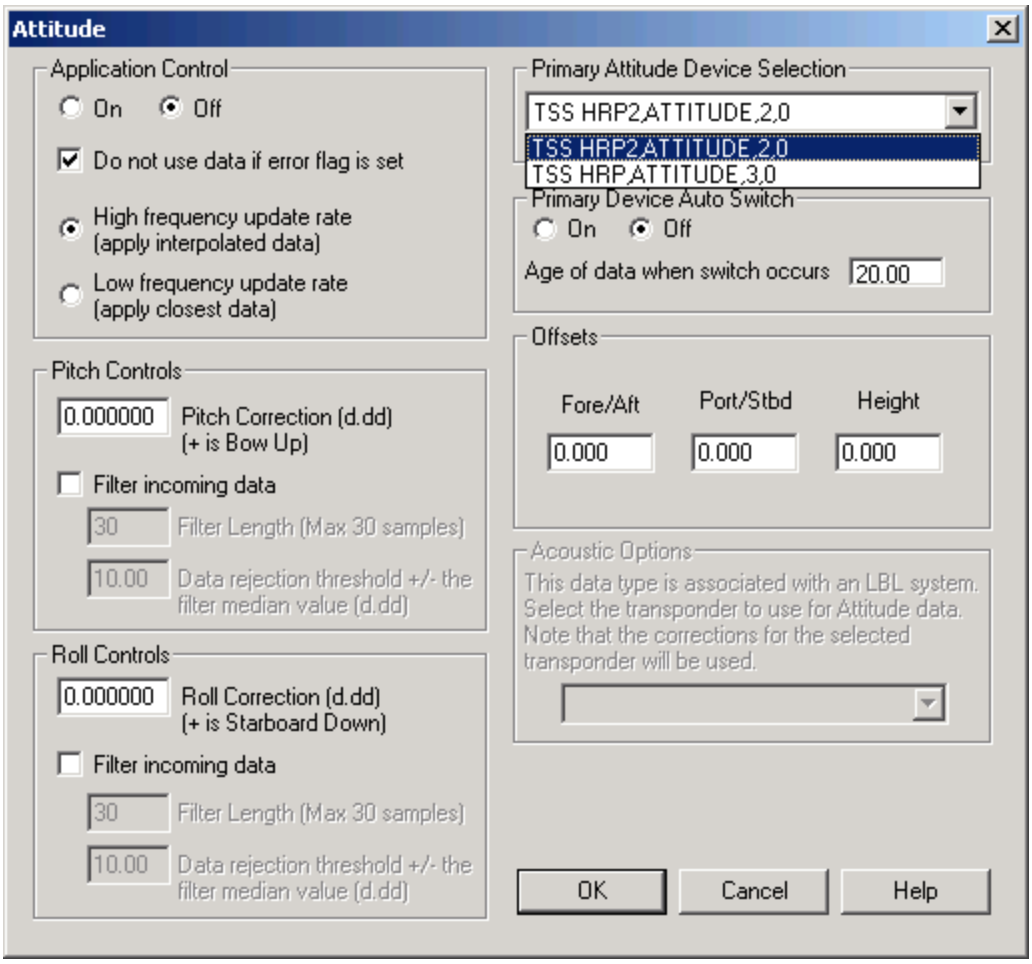
You can enter the maximum expected value for pitch, roll and heave. If the absolute value of the decoded pitch, roll or heave, in a given message is greater than the respective entered maximum expected value, the data is flagged and none of the data in that message is passed to the vehicle. The status is shown in the I/O Device window with an asterisk next to the specific data that failed the test.

The data is also checked for correct message type, valid characters and input buffer overruns and the status displayed in the I/O Device window.

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

Data item: INU, TSSHeave, HEAVE
No configuration is required at the HEAVE data item.

Data item: INU, TSSHeave, ATTITUDE
When the Attitude data item is edited, 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 TSS 325 should be mounted as close to the vessels' center of gravity (COG) as possible.

TECHNICAL SPECIFICATIONS:

	320B Heave Compensator	325 Motion Sensor
Range	±10m over 2-20 second period	
Accuracy	±5cm or 5% of measured range	
Size	445 x 143 x 296mm	160 x 370mm
Weight	5.0 Kg	8.0 Kg
Packaging	Rugged transit case	
Fixing	Free-standing and brackets supplied for standard 19" rack and adjustable-tilt bulkhead mounting	Secured to vibration frame
Power	90-260V a.c. 40-400Hz 24W (18-36V d.c. option)	
Operating temperature	0° to +50°C	-5° to +40°C
Depth rating		1000m
Display	40 character vacuum fluorescent	
Front panel	Splash proof	
Connections	BCD input -6 digits. TTL positive logic BCD output -6 digits. TTL positive logic (drive 10 TTL loads) RS232 I/O 'A' - Standard 25-way D-type; for data-logger and/or remote control RS232 I/O 'C' - Standard 25-way D-type; for dual-channel echosounders IEEE 488 - Standard IEEE connector (option) Sensor - Power plus digital accelerometer data Trigger Input - BNC positive/negative TTL compatible Trigger output - BNC positive/negative + 11V for profiling Trigger output (mark output) - returned to echosounder to indicate heave and corrected seabed. Variable width and offset Analogue output - BNC analogue heave	
Options	Power supply, 18-36V d.c. IEEE-488 (GP-IB) input/output interface VDU graphic display software (needs MS-DOS) Field support kit Interface kits for specified echosounders	