WinFrog Device Group:	INS
Device Name/Model:	NMEA INS (this is a modified NMEA String)
Device Manufacturer:	
Device Data String(s) Output to WinFrog:	"Position,Heading,Speed Log,Bottomdepth" $P001,time,N/S,lat,lon,E/W,GPSstatus,COG, HDG,vel(fore/aft),depth. See CONFIGURATION DETAILS below for units.
WinFrog Data String(s) Output to Device:	Nil
WinFrog Data Item(s) and their RAW record:	303 GPS Data 910 – Heading Data 402 – Speed Log Data

DEVICE DESCRIPTION:

Despite the name, the NMEA INS device's data string **is not** of standard NMEA format. WinFrog's NMEA INS "device" accepts data unique to a device created by Fugro in Houston, Texas. This "device" combines data from other Position, Heading, Speed Log, and Bottom depth devices to create a single comprehensive "device" data string.

DEVICE CONFIGURATION INSTRUCTIONS:

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

Standard RS-232C serial communication.

WINFROG I/O DEVICES > CONFIGURE DEVICE:

The NMEA INS device is added to WinFrog from the INS device category. Adding the NMEA INS device to WinFrog creates Position, Heading, Speed Log, and Bottomdepth data items that can be added to a vehicle's device list, as seen below.
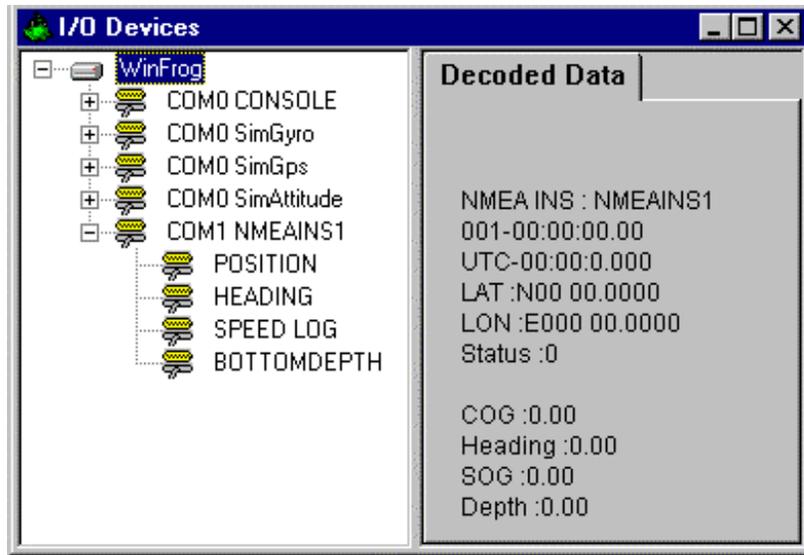
The NMEA INS device can be configured at the I/O Devices level. Highlight the NMEA INS in the I/O Devices window and then right-click and select Configure Device. The NMEA INS Configuration dialog box appears as seen below.
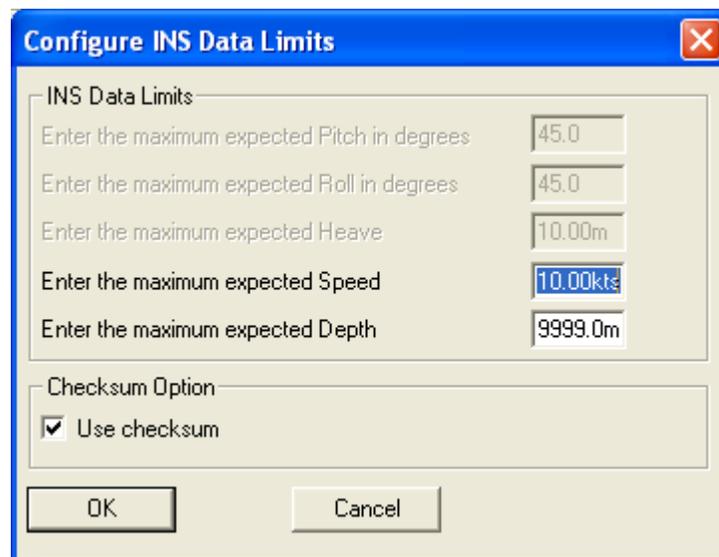
INS Data Limits:
You can enter the maximum expected value for speed and depth. If the absolute value of the decoded speed or depth, in a given message is greater than the respective entered maximum expected value, the data is flagged. The heading and CMG are also checked to be >= 0 and < 360, and the latitude and longitude are checked for >= 0 and <= 90, and >= 180 and <= 180 respectively. The status is shown in the I/O Device window with an asterisk next to the specific data that failed the test. If any data fails, then none of the data in that message is passed to the vehicle

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.

Checksum Option:
If the NMEA INS device is configured to include a checksum, WinFrog can be set to check this value. If the device is not including the check sum, this box must not be checked otherwise WinFrog will ignore the telegram.

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

As mentioned above, the NMEA INS device consists of several different data items including Position, Heading, Speed log, and Bottomdepth. These data items can be treated as individual devices and added to the same or different vehicle's device lists, as required.

As per any device, once a data item 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, highlight the desired data item and click the Edit button. The following paragraphs detail configuration of these data items.

1. Configuration of the NMEA INS1 POSITION data item.

    The NMEA INS' s Position data item is configured similarly to a standard positioning sensor using the Configure Position dialog box, as seen below.
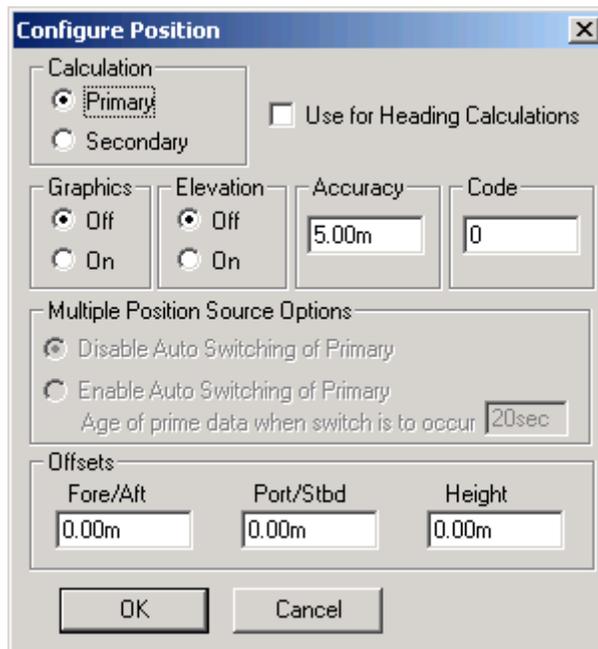
Calculation:
Set the Calculation selection to Primary or Secondary. Devices set to Primary calculation are used to provide a vessel position. Note that more than one Primary positioning device can be added to a vehicle's device list; data from these devices will be combined in a weighted mean solution. (See the paragraph on Accuracy below for more on the weighting of Primary calculation device data).

If the Calculation type is set to Secondary, WinFrog will simply monitor the device's data. WinFrog will not use the data from a secondary device in the final solution of the vehicle's position.

If auto switching is enabled (see below) a secondary may automatically become a primary should all the primaries fail.

Use For Heading Calculations:
Select this checkbox if the device is to be used in conjunction with another GPS device for determination of the heading of the vessel.

Graphics:
If On is selected, a labeled square will show the raw (offset but unfiltered) location of the GPS antenna in the Graphics and Bird's Eye windows. This provides a means of comparing raw device and filtered vehicle positions.

Elevation:
Setting the Elevation option to On will result in the elevation determined by GPS to be used as the elevation of the vessel referencing the GPS (WGS84) Ellipsoid. The sounder data recorded in WinFrog's .RAW data files will not be affected.
This option is meant only for those applications where there is no fixed vertical reference (i.e. mean sea level), such as on a river. For acceptable results, this option requires the use of high accuracy "RTK" GPS data.

Accuracy:
The Accuracy value entered provides WinFrog with the expected accuracy of the position from this device. This value is used in the weighting of this device compared to other positioning devices that may be added to the vehicle's device list. The smaller the value entered, the more accurate it is considered to be, and hence the more weight that will be applied to the device's data.

The Accuracy parameter can be changed from the suggested values. Changes should be made with caution, however, as they will affect the final filtered position of the vehicle.

Code:
This entry window is used when the GPS data is being received by a remote GPS receiver connected via telemetry link. If this is the case, set the Code to coincide with the code parameters associated with the GPS unit being used.
For all other applications, the Code entry must be set to 0.

Multiple Position Source Options:
This group box allows you to enable automatic switching of a secondary to primary should the data from all POSITION and PSEUDORANGE data items set to primary timeout. The **Age** entered is the length of time that the secondary will wait in the absence of data from all primaries, before taking over as primary. This age is only entered for the secondary.

For example, if the POSITION or PSEUDORANGE data items associated with two GPS receivers were set to primary and the POSITION or PSEUDORANGE data item of a third GPS receiver was set to secondary, both primary GPS receivers must time out before the secondary will become the primary. Upon the recovery of either of the original primary data items, the original primary will be reset to primary and the original secondary will be reset to secondary.

Note for the auto switching feature to work, there must be at least one primary and one secondary enabled. For example, given two data items, one set to primary with the auto switching disabled and the other set to secondary with the auto switching enabled, if the primary fails the secondary is not set to primary and the vehicle positioning stops until the primary data item recovers.

Disable Auto Switching of Primary:
If this data item is not to be involved in the auto switching process, check this box. As stated above, this data item is then not involved in the auto switching process in any way.

Enable Auto Switching of Primary:
If this data item is to be involved in the auto switching process, either as a primary or a secondary, check this box. If set to secondary, enter the Age of data the primary data items must reach before this secondary is switched to act as the primary.

In order for this option to be effective you must have at least one primary and one secondary. If there are multiple secondary data items that are enabled for switching, the first one to receive data will become primary.

Note: This option is not enabled unless WinFrog determines that there is more than one POSITION and/or PSEUDORANGE data item associated with the respective vehicle. The exception to this is the case of a WinFrog with the Remote module operating as a Controlled Remote being configured remotely from the Controller. In this case, the option is always enabled even though it may not be applicable. The operator must be aware of what is available on the Remote and configure the data item accordingly.

Note: This option is not available in the WinFrog Remote package.

Note: This option is not available for USBL based POSITION data items.

Offsets:
Offsets are required to associate the GPS antenna position with the vessel's Common Reference Point (CRP). The offsets are applied *from* CRP (of the vehicle) *to* the GPS antenna location.
Forward Offsets are entered as positive values.
Aft Offsets are entered as negative values.
Starboard Offsets are entered as positive values.
Port Offsets are entered as negative values.
Height Offsets are positive upwards. (It is suggested that the vessel's Height origin should be at the water line.

2. Configuration of NMEAINS1 HEADING data item.

   The NMEA INS' s Heading data item is configured similarly to a standard heading sensor using the Configure Gyro dialog box, as seen below.
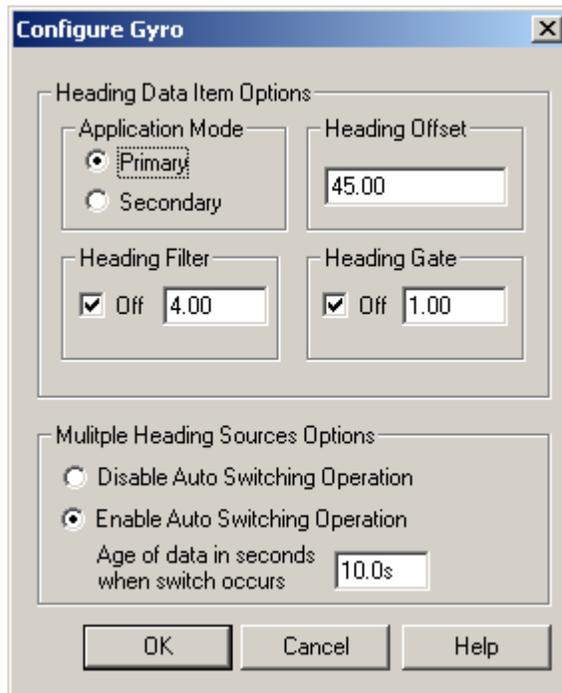
Heading Data Item Options:
Application Mode (Primary/Secondary):
Set the type of calculation to Primary or Secondary by selecting the appropriate radio button. Devices set to Primary are used to provide the vehicle heading information. Devices set to Secondary are simply monitored, and are not used in the vehicle's calculations.

Note that WinFrog supports automatic switching from a designated Primary to a Secondary in the case 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 NMEA Gyro 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 1 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.

3. Configuration of NMEAINS1 SPEED LOG data item:

The configuration of the NMEA INS' s Speed Log data item is similar to the configuration of a standard speed log sensor. The configuration is undertaken using the Configure Speed Log dialog box, as seen below.
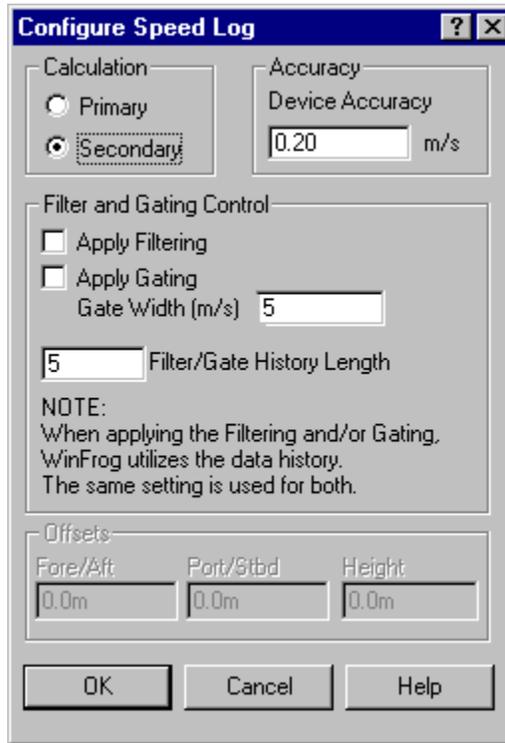

Note that by default the Speed Log Calculation mode is set to Secondary status. This ensures that data from the speed log is not unwittingly applied to vehicle calculations before the device is first configured correctly.

See documentation on the NMEA Speed Log device for further details on the Configure Speed Log dialog box.

Note: The input string for this device is very different from the NMEA Speed Log Device

4. Configuration of NMEAINS1 BOTTOMDEPTH data item:

The NMEA INS' s Bottom Depth data item is configured similarly to a standard depth sensor using the Configure Sounder dialog box, as seen below.
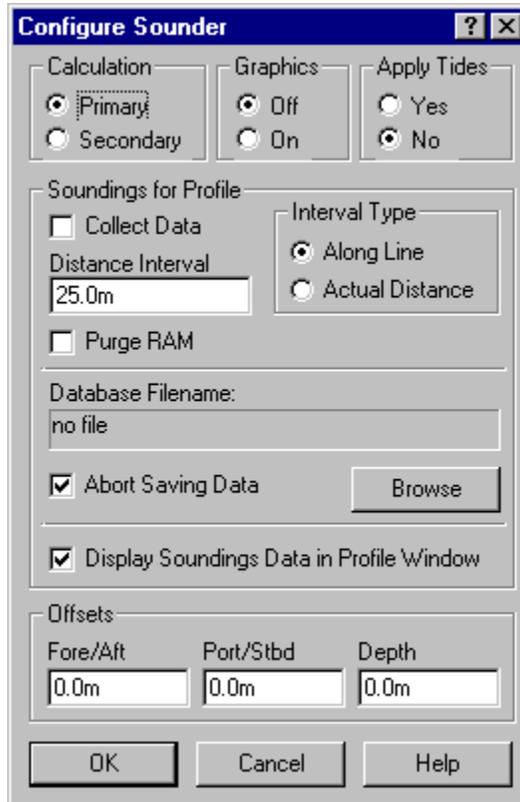
See documentation on the NMEA Sounder device for further details on the Configure Sounder dialog box.

Note: The input string for this device is very different from that of a standard NMEA Sounder device.

CONFIGURATION DETAILS:

Output String:
  The NMEA INS data string is unique to this device. The format contents of this data
  string is shown below:

$P001,time,N/S,lat,lon,E/W,GPSstatus,COG,HDG,vel(fore/aft),depth.
$P001,hhmmss.s,ddmm.mm,N/S,ddmm.mm,E/W,n,d.dd,d.dd,x.x,x.x

```
                                              Depth
                                              Velocity (fore/aft)
                                              HDG
                                              COG
                                              GPS Status
                                              Longitude
                                              Latitude
                                              Time
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