

MicronNav 200 System

Software Manual

0734-SOM-00003-01



© Trittech International Ltd

The copyright in this document is the property of Trittech International Ltd. The document is supplied by Trittech International Ltd on the understanding that it may not be copied, used, or disclosed to others except as authorised in writing by Trittech International Ltd.

Trittech International Ltd reserves the right to change, modify and update designs and specifications as part of their ongoing product development programme. All product names are trademarks of their respective companies.

Open Source License Statement: This product includes software code developed by third parties, including software code subject to the GNU General Public License Version 2 ("GPLv2"). We will provide upon request the applicable GPL source code files via CD-ROM or similar storage medium for a nominal cost to cover shipping and media charges as allowed under the GPL. This offer is valid for a 3 year period from first manufacture of this product.

General Public License ("GPLv2") Inquiries: Please direct all GPL inquiries to the following address:

Trittech International Ltd
Peregrine Road
Westhill Business Park
Westhill, Aberdeenshire
AB32 6JL, UK

Table of Contents

Help & Support.....	5
Warning Symbols	6
The Genesis USBL MicronNav Application	7
The MicronNav USBL Main Screen	7
Navigation Control Bar	8
Unit Table	9
Setting the Environmental Parameters	10
MicronNav USBL System Settings	11
General Settings Tab	11
Configuration Settings Tab.....	12
AHRS Settings Tab.....	13
Hub Settings Tab	14
IO Settings Tab.....	16
Display Settings Tab	16
Diagnostics Settings Tab	17
Chart Device System Settings	18
Map Settings Tab.....	18
Display Settings Tab	19
Importing an Existing Chart.....	20
Using the Google Maps™ Function.....	21
Chart Device Environment Settings.....	23
Using Chart Markers.....	24
MicronNav Base Location Setup and Configuration.....	26
Mobile (GPS) / Vessel Setup.....	26
Fixed Platform Setup	28
USBL System and Equipment Setup.....	30
Setup and Configuration of the MicronNav (Battery) USBL Modem.....	30
Establish Communication with the Micron USBL Modem	30
Configuration Settings Tab.....	31
Transponder Mode Configuration.....	33
Responder Mode Configuration	33
Connecting External Sensors	39
Adding a GPS Receiver	39
Adding a Compass.....	40
Adding an MRU Sensor	41
Adding an NMEA Echosounder / Altimeter.....	42
Connecting a Bathymetric Sensor.....	44

Data Telemetry with USBL Dunking Transducer.....	46
General Setup and Configuration.....	46
Transmitting data from surface to subsea	50
Testing the Data Telemetry System	52
Data Sharing and Output.....	54
Configuring the Data Output String	55
USBL System Care and maintenance.....	57
MicronNav USBL Dunking Transducer Calibration	57
2D Magnetic Calibration (Fixed Platform or Vessel Setup).....	58
3D Magnetic Calibration (Magnetic Field Mapping)	60
Zero Orientation	62
Gyro Bias Estimation	62
Post Calibration Checks.....	63
Updating the MicronNav USBL System Firmware	64
USBL Dunking Transducer Firmware Update	64
MicronNav Hub Firmware Update	65
Software Troubleshooting	66
Appendices	67
Appendix A - Heading/Pitch/Roll Strings.....	67
Appendix B - Marker File Formats	68
Appendix C - List of Current String Formats	70

Help & Support

First please read this manual thoroughly (particularly the Troubleshooting section, if present). If a warranty is applicable, further details can be found in the Warranty Statement, 0080- STF-00139, available upon request.

Tritech International Ltd can be contacted as follows:



Mail

Tritech International Ltd
Peregrine Road
Westhill Business Park
Westhill, Aberdeenshire
AB32 6JL, UK



Telephone

+44(0)1224 744 111



Email

support@tritech.co.uk



Website

www.tritech.co.uk

Prior to contacting Tritech International Ltd please ensure that the following is available:

1. The Serial Numbers of the product and any Tritech International Ltd equipment connected directly or indirectly to it.
2. Software or firmware revision numbers
3. A clear fault description
4. Details of any remedial action implemented



Contamination

If the product has been used in a contaminated or hazardous environment, the product must be decontaminated with any potential hazards reported prior to returning the unit for repair. Under no circumstances should a product be returned that is contaminated with radioactive material.

The name of the organisation which purchased the system is held on record at Tritech International Ltd and details of new software or hardware packages will be announced at regular intervals. This manual may not detail every aspect of operation and for the latest revision of the manual please refer to www.tritech.co.uk

Tritech International Ltd can only undertake to provide software support of systems loaded with the software in accordance with the instructions given in this manual. It is the customer's responsibility to ensure the compatibility of any other package they choose to use.

Warning Symbols

Throughout this manual the following symbols may be used where applicable to denote any particular hazards or areas which should be given special attention:



Note

This symbol highlights anything which would be of particular interest to the reader or provides extra information outside of the current topic.



Important

When this is shown there is potential to cause harm to the device due to static discharge. The components should not be handled without appropriate protection to prevent such a discharge occurring.



Caution

This highlights areas where extra care is needed to ensure that certain delicate components are not damaged.



Warning

DANGER OF INJURY TO SELF OR OTHERS

Where this symbol is present there is a serious risk of injury or loss of life. Care should be taken to follow the instructions correctly and conduct a separate Risk Assessment prior to commencing work.

The Genesis USBL MicronNav Application

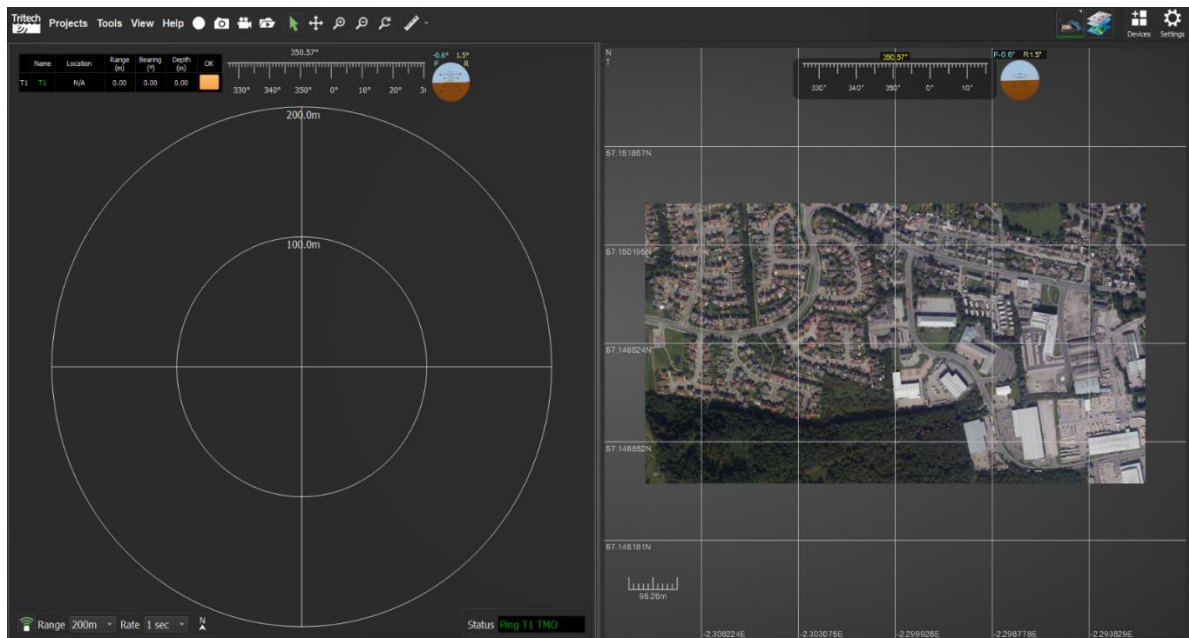


Please note that the screen illustrations may differ slightly from those displayed on your computer.

For details of the general installation and use of the Genesis software package please refer to the appropriate manual or quick start guide.

The MicronNav USBL Main Screen

When an operational NavHub and MicronNav system is connected to a computer running the Genesis software package it should automatically be detected and added to the devices. Genesis will add the device for the USBL system and Chart and display both as shown below.



MicronNav PPI Display Window

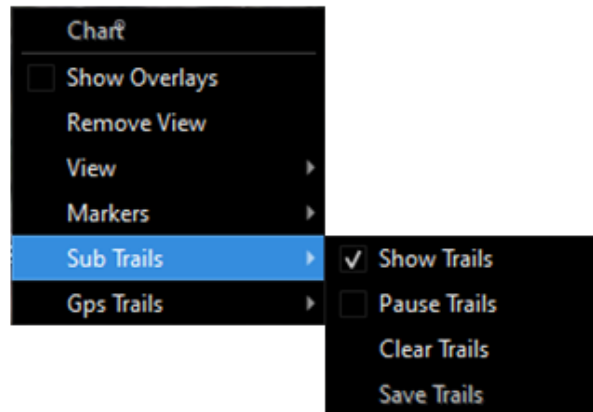
Genesis Chart Device Window

The Plan Position Indicator (PPI) display shows the Compass heading, and Pitch and Roll visual indicators from the MicronNav USBL system. There are Range rings to assist in estimating distance, according to the 'Range' set in the controls.

The Chart Display Window displays the loaded chart, or Google Maps display and will mirror the marker positions shown on the PPI display. More details on the setup and configuration of the Chart Display are contained in the MicronNav Chart Display Settings section of this manual.

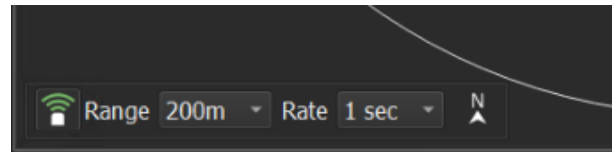
The MicronNav Navigation Control Bar and Unit Table may be displayed as an overlay on either the PPI or Chart Display.

By right clicking on the PPI or Chart Display the option to show the Markers, Sub (USBL Modem) position trails and GPS position trails can be controlled. More details on these options can be found in the relevant section of this manual.



Navigation Control Bar

The Navigation Control Bar typically located in the bottom left of the PPI display provides controls for the USBL Diving Transducer and display.



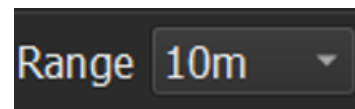
Online / Offline Button

With USBL connected to Nav Hub if transponder is selected then enables 'pinging' of each selected transponder in turn. GREEN – Online WHITE – Offline



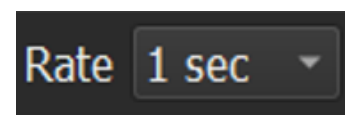
Range Scale Control

Selects the displayed operating slant range from a minimum of 10m to a maximum of 1000m. This should be selected appropriately dependent on the distance from the USBL Modem to the USBL Diving Transducer.



Interrogation Rate Control

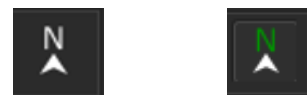
The interrogation rate of the system (i.e., time between each successive acoustic interrogation) this can be adjusted between a minimum of 1s and a maximum of 10s (1, 2, 5 or 10 sec).



This is particularly useful when operating in a harbour type environment where multipath reflections may cause multiple positions to be displayed, increasing the time between transmissions allows time for any multipath reflections to diminish.

North Up / Heading Up

PPI display can be oriented with either a North Up or Heading Up referenced. North up is indicated by the Icon turning green when toggled.



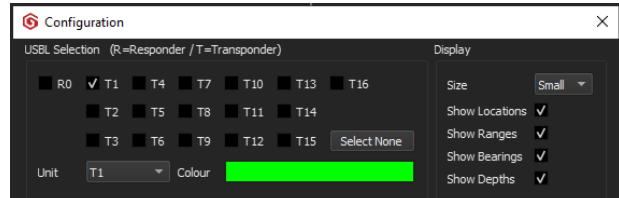
The above only applies to the PPI display and not the Chart display which is always North Up.

Unit Table

The Unit Table is overlaid and displayed in the PPI or Chart window and gives the response details (distance, bearing etc) for the active USBL Modem (Transponders or Responder)

	Name	Location	Range (m)	Bearing (°)	Depth (m)	OK
T1	T1	N/A	0.00	0.00	0.00	<input type="checkbox"/>

A 'Double Click' on the header row of the table will display the configuration menu which will allow the different Transponder or responder USBL Modem(s) to be enabled and disabled, and configuration of the displayed data.



Setting the Environmental Parameters

If suitable devices are connected to Genesis (Bathymetric Sensor, Sonar with SoS sensor etc.) then the values from these units can be selected as the reference values within the settings for the other devices. If not, the global (project) values will be used.

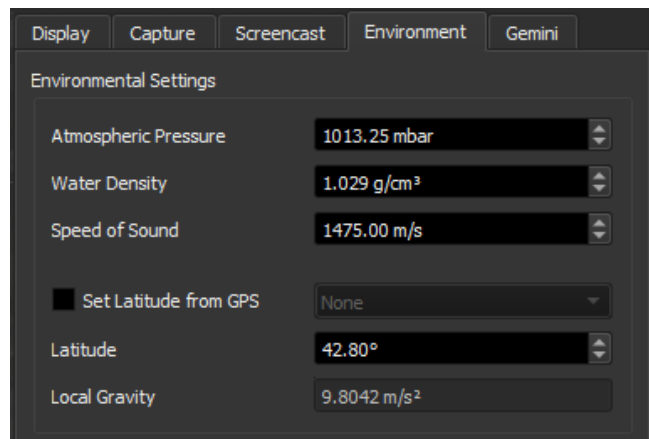


These values can be reviewed and changed within the main Gemini project settings.

The Environment settings tab allows the user to set manual values for:

- Local Atmospheric Pressure
- Water Density
- Speed of Sound
- Latitude

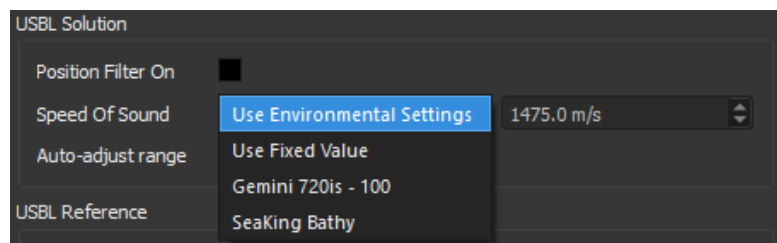
The local latitude can be either set manually or taken as an input from an attached GPS device. This is used to calculate the gravitational constant.



Setting the Speed of Sound (SoS)

There are 4 options for Speed of Sound available to setup and use within the Genesis software, these can be selected via the drop-down list in the USBL Solution tab.

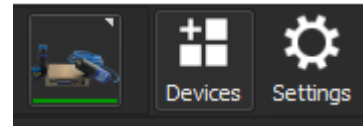
Within the MicronNav Configuration settings tab there are several options available for setting the Speed of Sound (SoS) used by the USBL system:



- Use Environmental Settings - This will use the value entered into the Genesis system settings.
- Use Fixed Value - This will allow a fixed value to be entered that will be used by the MicronNav system only.
- Gemini xxxx - Dependent on the model of sonar connected, this will allow the MicronNav system to use the SoS as measured by the Gemini sonar.
- SeaKing Bathy - If connected, this will allow the MicronNav system to use the SoS as measured by the SeaKing Bathymetric Sensor.

MicronNav USBL System Settings

As Trittech devices are connected, they will be automatically detected and added to the program. The Genesis main window will display the default configuration and the status icons for the devices will appear in the top right of the menu bar area.



Clicking on the icon will bring up the settings and properties for the device with any error messages shown in the diagnostic tab of the device properties.

General Settings Tab

This displays general information when the MicronNav Hub and USBL Dunking Transducer are connected.

MicronNav 200

This shows the MicronNav Hub Device Node, Online / Offline status and firmware Version.

Attitude Sensor

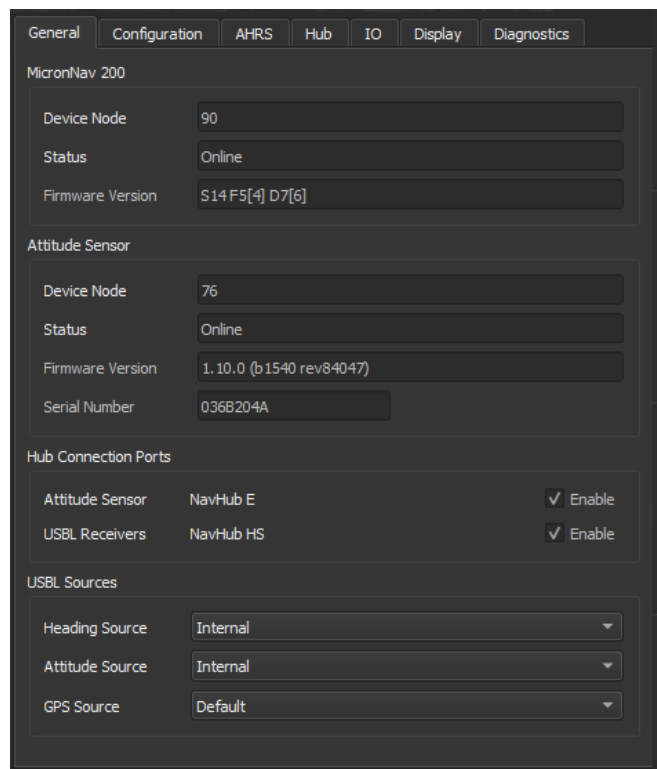
This shows the USBL Dunking Transducer Device Node, Online/Offline Status, Firmware Version and Device Serial Number.

Hub Connection Ports

This shows the Hub Port the internal attitude and USBL Receiver are connected to.

USBL Sources

These options select the positional sensors used by the USBL system:



Heading Source

This is an option to use the internal sensor or an external sensor such as a Ships Compass. Heading Source options can be selected from a drop-down list, these being None, Internal or a connected Compass/MRU.

Attitude Source

This is an option to use the internal sensor or external sensor such as an MRU. The Attitude Source options are selected from a drop-down list, these being Internal or a connected Compass/ MRU.

GPS Source

This is an option to select the GPS source to be used for the USBL system. The GPS Source options are selected from a drop-down list, these being None, Default or a connected GPS.

Configuration Settings Tab

This allows the software to be configured for use with the intended platform and application.

USBL Selection

Select the number of Transponders or a single Responder to interrogate.

Enable Ping Sounds

Enabling this option will play a sonar sound whenever a Transmit pulse is sent and a Receive pulse is acknowledged.

USBL Solution: Position Filter

This aids in more accurate tracking, by filtering lower quality signals.

Speed of Sound (SoS)

There are four options available:

- 'Use Fixed Value' to enter a set value for the USBL system (1475.0 m/s default).
- 'Use Environmental Settings' to use the value set in the Genesis main settings menu.
- If a Gemini Multibeam sonar is connected with a built in SoS sensor this will appear as an option.
- Connecting a Tritech survey instrument that has a built in SoS sensor (e.g., SeaKing Bathy).

Auto Adjust Range

This will automatically adjust the range of the tracking on the Plan Position Indicator (PPI) Display, when the USBL Modem(s) move closer or further away from the USBL Dunking Transducer.

USBL Reference: Platform Type

This allows selection of either a Mobile (GPS) configuration that will use the position input from an attached GPS receiver or set a Fixed set position for the USBL Dunking Transducer. If using a fixed position, the coordinates are entered manually or can be taken from a loaded Chart Marker position.



The fixed coordinate configuration (xx°xx'xx", xx.xxx° etc.) are global environment settings controlled through the Genesis settings menu.

Transducer Offsets

This allows for accurate positioning of the USBL Dunking Transducer on the intended platform. 'R' or (Rotation) can apply a rotational correction or if the Heading Source is None, this will be the Fixed Rotation used in the system. The axes for the offsets are:

X: Port-Starboard Y: Fwd.-Aft Z: Depth-Height R: Fixed Rotation

For more detail please refer to the manual section *MicronNav Base Location Setup and Configuration*.

Attitude Sensor: Filter Period

Select from OFF 1, 2 or 3 secs. This applies an averaging filter to smooth erratic attitude heading sensor readings.

AHRS Settings Tab

This contains the calibration and diagnostic functions for the AHRS sensors within the USBL Dunking Transducer.

Info

This contains the identification and firmware details of the AHRS sensor and the calibration functions. More detail on the calibration of the sensor is contained in the manual section *MicronNav USBL Dunking Transducer Calibration*.

Configuration Data

This displays the output format and any filter that is set within the firmware. The update rate is optimized and set at 10Hz but can be increased to 30Hz. It is recommended that the default update rate is used unless instructed to change this by Tritech support.



Self Test Results

The internal AHRS performs a set of checks and tests on the internal sensors during start-up and reports the results (green = good, red = fail). If any self-tests are reporting failures, these can often be cleared by restarting the AHRS sensor, by clicking on the [Reboot] button. Any persistent self-test failures may indicate local environmental interference (e.g., excessive magnetic fields or vibration). In this case try moving the USBL Dunking Transducer to an alternative location away from such interference.

Measurement Status

The status indicators for the Magnetometer, Gyroscope and Accelerometer sensors show green when the X, Y, Z axis measurements on each are within filter bounds. The indicators display red if clipping is observed on the AHRS sensors. For the magnetometers, clipping may occur if there are areas of strong magnetic interference nearby. For the Gyros and Accelerometers, clipping may occur if the unit is subjected to excessive vibration or shocks.

Filter Status

The Filter Status indicator will display red if there is clipping detected on the raw data input or the data provided is invalid. If the error continues the unit should be powered down and restarted to see if this clears the error.



A prolonged 'Out of Range' (red) status warns of excessive interference (magnetic, vibration, shock) upon the sensors and should be investigated.

Hub Settings Tab

This is where the MicronNav Hub settings are changed. When setting up a Trittech or external peripheral device connected to one of the additional ports on the MicronNav Hub, the port will need to be configured correctly.

Nav Hub Settings:

Port Mode

These drop-down selection boxes change the communication protocol that the Port is set to. To make things easier for integration, Ports A-D show the corresponding COM Port numbers assigned to them by Windows.

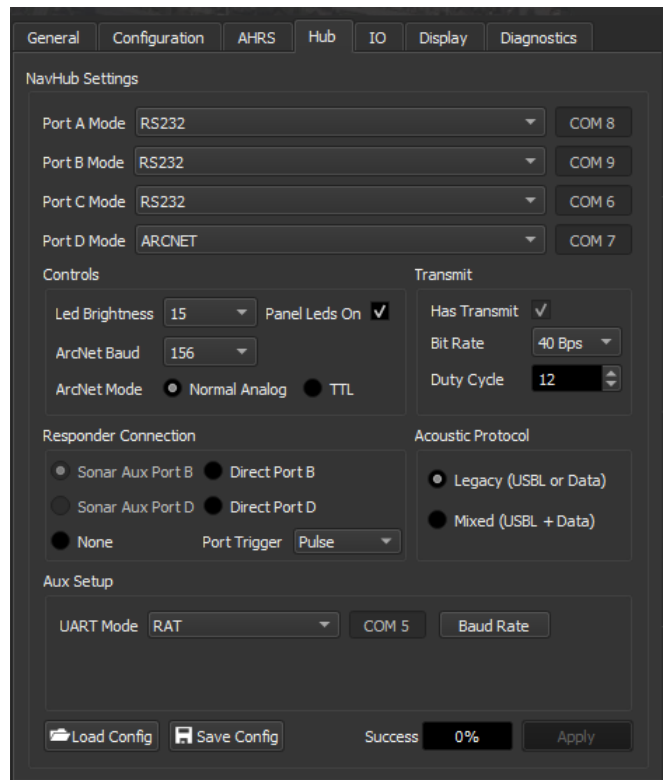
Controls:

Led Brightness

This sets the relative brightness of the front panel LEDs of the MicronNav Hub. A setting of 15 is full brightness, with 0 being the lowest possible.

Panel LEDs On

This control, when unchecked, switches off the front panel LEDs regardless of the Brightness control. By default, this control is checked.



Arcnet Baud

This drop-down selection box is displayed when ARCNET is selected on Ports C or D. This changes the baud rate for ARCNET communications.

Arcnet Mode

Allows switching between standard Analog or TTL Arcnet.

**Transmit:
Has Transmit**

Enables and disables the data transmission through the USBL Dunking Transducer

Bit Rate

The acoustic data transmission rate can be changed between 40 and 100 Bps. 100Bps data rate will have a reduced transmission range.

Duty Cycle

This alters the Duty Cycle of the USBL Dunking Transducer which has the effect of reducing the acoustic power in the water. The recommended setting is 12; a lower setting will result in up to 10dB lower transmit source level.



If using the USBL system in an enclosed environment prone to strong multi-path echoes (eg quarry with hard sides and floor), a reduction in the Duty Cycle (acoustic power) may increase the tracking and data transfer reliability.

Responder Connection

The preference for Responder USBL Modem connection can be set here. This is covered in detail in the *Responder Mode Configuration* section of the manual.

Acoustic Protocol

This allows switching of the MicronNav Hub between Legacy (single mode) and Mixed acoustic modes.



If using the USBL system in a single mode (Transponder tracking or data transmission) it is recommended to set the USBL system (Hub and USBL Modems) to Legacy mode. For mixed operation or using with the Diver Control Button the system must be set to Mixed mode.

**Aux Setup:
UART Mode**

Select the function of either a Remote Access Terminal (RAT) or an Aux USB (For use with Diver Distress Button or Data Transfer).

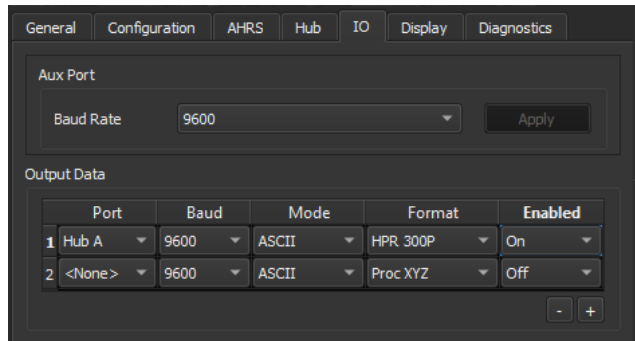
Load Config \ Save Config

Saves or loads all of the current user configuration settings from the Nav Hub properties page (i.e., non-volatile settings stored on the device after power down).

IO Settings Tab

The IO tab options are used to configure setup of remote communications which allows for the output of positional data to an external computer or program.

Further details and an example detailing the output of a Simrad HPR 300 string to a secondary computer is covered in the section *Data Sharing and Output*.



Aux Port

This setting determines the baud rate setup when configured for data transfer. When used as a RAT connection this should remain at 9600 for the RAT to function.

Display Settings Tab

Sub Options:

Number of Trail Points

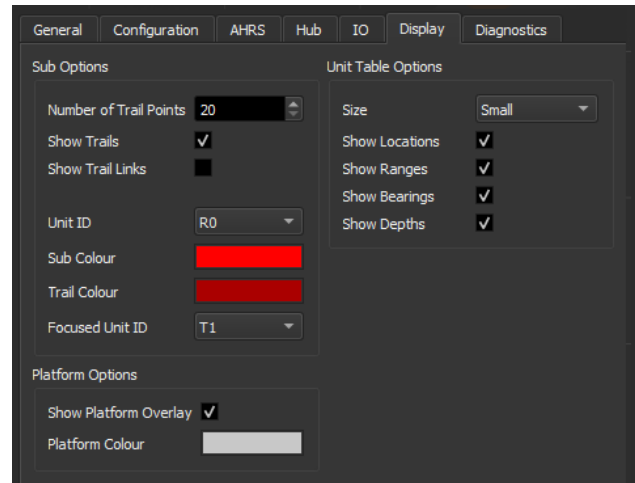
Set the maximum number of trail points shown on the Map or PPI display whilst tracking the USBL Modem (Transponder or Responder).

Show Trails

Turn on/off the Trail Points.

Show Trail Links

This option links the trail points together.



Unit ID / Sub Colour / Trail Colour

These options control the colours for the most recent marker point and trails for the corresponding Unit ID.

Focused Unit ID

This sets the Unit ID that the Chart will centre on and track if configured to focus on the MicronNav device.

Platform Options

If Fixed Platform is selected in the Configuration tab, these options control the display of the platform overlay (as a box) on the Chart or PPI display and its colour.

Unit Table Options

These selections control the size and data fields displayed on the Unit Table overlay shown on the Chart and PPI display

	Name	Location	Range (m)	Bearing (°)	Depth (m)	OK
T1	T1	N/A	0.00	0.00	0.00	<input type="checkbox"/>

Diagnostics Settings Tab

This tab displays the identification and run data for the NavHub as well as the diagnostic and input data being received from the USBL Dunking Transducer. This tab will also display any specific warnings or alerts from the MicronNav system and is typically used during troubleshooting.

Info:

Serial Number

This will populate with the MicronNav Hub Serial Number.

Run Time

This is the total operating run time logged by the MicronNav Hub device.

Input Data

These are time stamped messages received on the Main MicronNav Hub Port and are useful for diagnosing the connection status.

Disable Heading diagnostics

This option disables the display of magnetic heading values from the internal sensors on the Input Data display

Pause

This temporarily pauses the Input Data display.

Plot Mag Data

This replaces the Alerts display window with a graphical display of the the X Y Z magnetic data from the internal sensors to aid calibration and diagnostics. More detail on this feature is contained in the section *MicronNav USBL Dunking Transducer Calibration*.

Clear

This will clear the Input Data display window.

Alerts

These are time stamped Alert Messages generated by Genesis.

If the Micron Nav Hub is disconnected the Diagnostics tab will be updated with a warning symbol and the alert message detailed in the Alerts window.

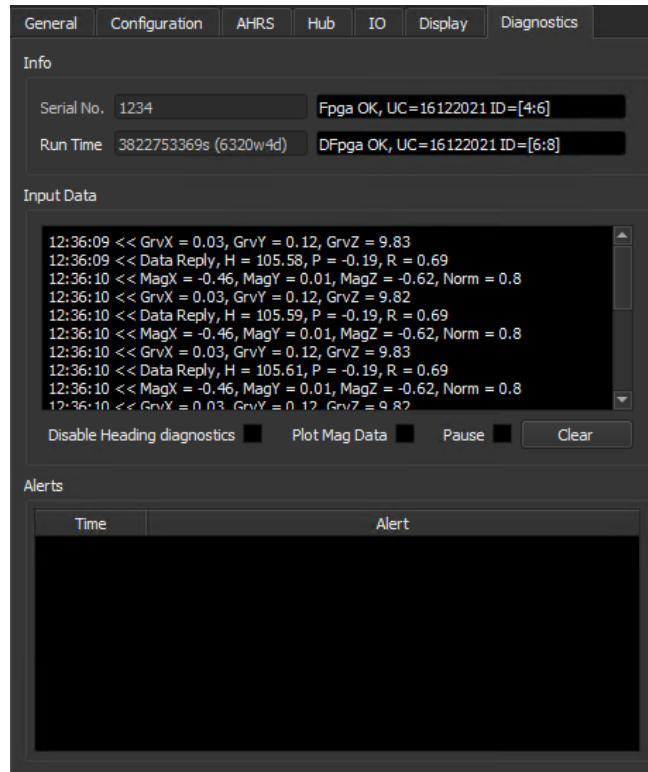
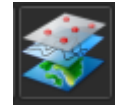


Chart Device System Settings



When connecting the MicronNav to the computer, the Device will be auto added into Genesis and a Chart Device Icon will be added alongside it. Further charts can then be added if necessary.

To adjust the settings and configuration for the Chart click in the Chart Device icon which will display the settings tabs.



Map Settings Tab

Origin

This displays the reference Latitude and Longitude/ Metric UTM coordinates for the origin of the chart. The origin can be set in the Chart Origin drop down menu.

Google Maps™

This enables the use of Google Maps to render the chart. Please refer to the relevant section of this manual for more detail.

Chart:

World File

This enables use of a World file for the required chart, which has been saved to the computer. The world file contains the reference positioning and scale for the associated chart image to be displayed correctly.

Bitmap File

This allows the import of a suitable raster graphics file (.bmp .png .jpg .tif) to be used as the chart. After import, Genesis saves a copy of the file in the '...save at' location which can be checked or changed by clicking the [...] button to the right.

Chart Origin

This sets the specified origin location to one of the corners or centre of the graphic file.

Ellipsoid

The ellipsoid code being used (if using UTM coordinates). This is changed within Genesis Settings menu in the Display tab within Geographic Co-ordinates.

Skew Angle

This is the Chart's Angle of orientation. Corrections can be applied to orient the chart so North heading is correct and the corners of the map are aligned.

Length

This is the metric coverage of the chart graphic file East to West.

Height

This is the metric coverage of the chart graphic file North to South.

Display Settings Tab**Display Options:****Show Raster**

Selecting this option will show the Raster image file associated with the chart.

Show Markers

This will show markers that have been imported into the chart or recent ones that have been created.

Focused Device

This enables the chart device to focus/centre on any of the available Chart Devices. In this case it has been focused on the GPS. See the Devices description below.

Grid Options:**Show Grid Lines**

This option controls the display of the geographical grid lines on the Chart Display.

Number of Grid Lines

Select how many grid lines are required for the chart.

Grid Line Colour

Set the colour for the grid lines.

Show Scale

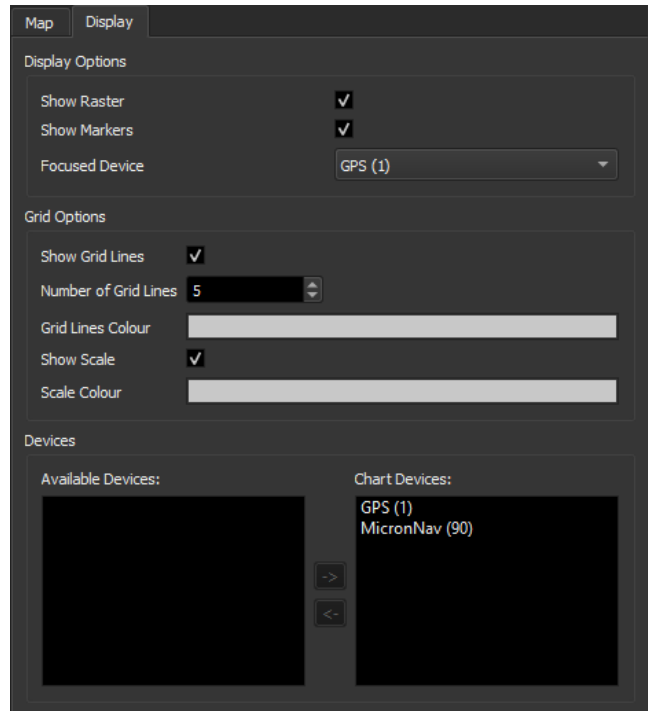
This switches the display Scale on/off.

Scale Colour

Set the colour for the Chart Display scale.

Devices

This shows the available devices loaded into Genesis and allows them to be added for display onto the Chart Display window. To display onto the Chart the device must be selected from the 'Available Devices' and added to the 'Chart Devices' box by pressing the directional button [->]. To remove a device from the chart, do the opposite. Once on the 'Chart Devices' list the device can be selected as a 'Focused Device'.



Importing an Existing Chart

The following instructions explain how to import an Image file and a World file from a previously saved chart. The image below shows the options available in the Chart Device Map Tab.

Importing a World File

Select [Import...] and locate the World file associated with the required chart. This will also load any associated image file with same filename found in the folder

Loading a Bitmap/Image File

Select [Import...] and locate the Bitmap file corresponding to the World file that has just loaded

Saving the Imported Chart

To save the chart, click on the Close button at the bottom right of the window. This will then save the chart information to the project file and the image file to the selected "Save At" folder. The project file and image will also be stored in any saved Genesis Log File (.GLF).



Creating a Bitmap Chart

Below are guidelines to aid in capturing a Bitmap chart and saving to an image format that can be imported into Genesis Software. To create and import a bitmap / raster graphic as a chart the following information is required:

- The Latitude and Longitude of the origin of the chart or the metric UTM coordinates of the corner of origin of the chart
- The metric coverage of the chart from East to West (Length)
- The metric coverage of the chart from North to South (Height)
- The ellipsoid code to be used (if using UTM coordinates)
- The UTM zone to be used (if using UTM coordinates)

Once the chart/map image is loaded, geographical information (location and size) for the loaded image must then be entered into the Map Device Settings.

Using the Google Maps™ Function

This function allows the use of Google Maps™ as an alternative to a loaded chart. This is an online service and requires an internet connection and the connection of a Trittech product or device to the computer running Genesis.



If the laptop running the Genesis software has an instance of Google Maps running in another software application, this will need to be closed before Genesis can use the Google Maps Function.

Origin

If using 'Chart' as the focused device enter the required centre origin point for the Chart. If a different Focused Device is selected the Chart will automatically centre itself on that location.

Google Maps

Select to enable Google Maps and enter a custom API Key if purchased this from Google. With a Custom API Key, Genesis does not require a Trittech product to be connected to display Google Maps.

Selecting Google Maps will display configuration settings specific to this option.

The screenshot shows the 'Map' settings panel with the 'Display' tab selected. The 'Origin' section contains input fields for 'Latitude' (57°9'3.420") and 'Longitude' (-2°18'28.800"). The 'Google Maps' section has a checked 'Enable Google Maps' checkbox and a 'Custom API Key' field. The 'Google Maps Settings' section includes a 'Terrain Type' dropdown set to 'Satellite' and a 'Daily Quota Remaining' field showing 4088. The 'Google Maps Cache Settings' section includes a checked 'Enable Disk Caching' checkbox, a 'Cache Folder' field with a file explorer icon, a 'Cache Limit' dropdown set to 536,870,912 bytes, a '...cache size' field showing 71,741,617 bytes, and a 'Clear Cache' button. A 'Force Cache Current View' button is located at the bottom of the cache settings section.

Google Maps Settings:**Terrain Type**

This will display the different Terrain Type, which are selected via the drop-down list. Available options in this are:

- Roadmap
- Satellite
- Terrain
- Hybrid

Daily Quota Remaining

Google Maps is a paid for service which Tritech support in Genesis by allowing a fixed quota of map tiles to be downloaded into Genesis in a 24hr period. This shows the remaining number of map tiles in the daily quota.

Google Maps Cache Setting:**Enable Disk Caching**

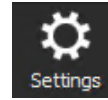
Disk Caching takes a copy of the map tiles at different levels, so that the mapping can be used later without an internet connection. Cached map tiles will be automatically deleted after a set period according to the Google Maps terms of use.

Force Cache Current View

This captures all the maps in the area at different levels, which is useful in times of a bad connection.

Chart Device Environment Settings

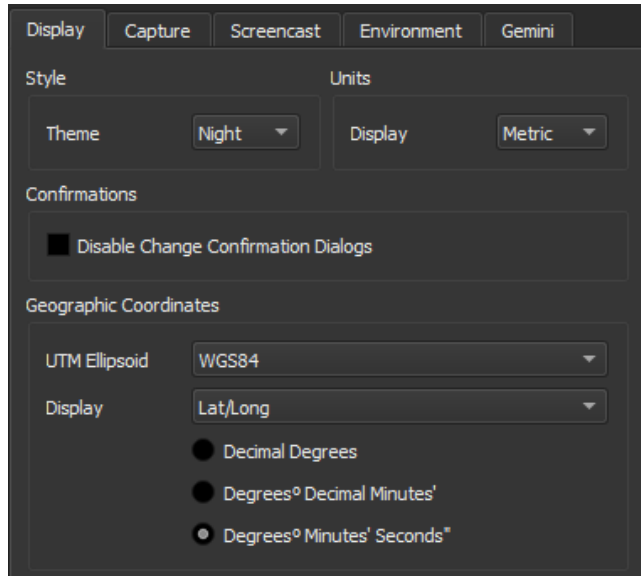
The Geographic and Chart Environment settings are selected from the main Genesis Settings tabs.



Adjusting Geographic Coordinates

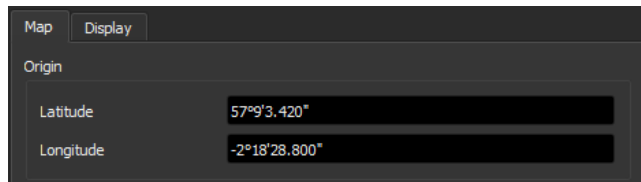
The controls for the Geographic Coordinates (Lat/Long or UTM E/N), format and UTM Ellipsoid are found in the 'Display' settings tab as shown opposite. Changes to these parameters will affect the Project and all other Genesis devices.

The coordinate system selected will also be displayed on the Unit Table.



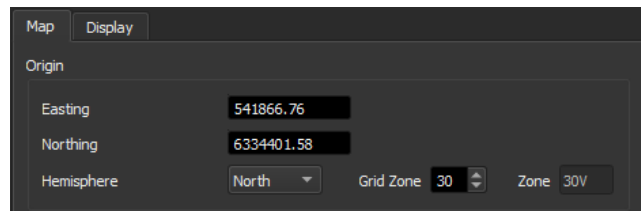
Lat/Long Example

This example shows the Lat/Long option selected, which will show in the Chart Application, Map Tab Menu.



UTM E/N Example

This example shows the UTM Option selected, which will show in the Chart Application, Map Tab Menu.



Using Chart Markers

The Chart application in Genesis, includes the facility to lay a series of markers to label and track objects, points of interest and waypoint positions. These markers can be saved to file for the purpose of re-loading at a later date or to form part of a report.

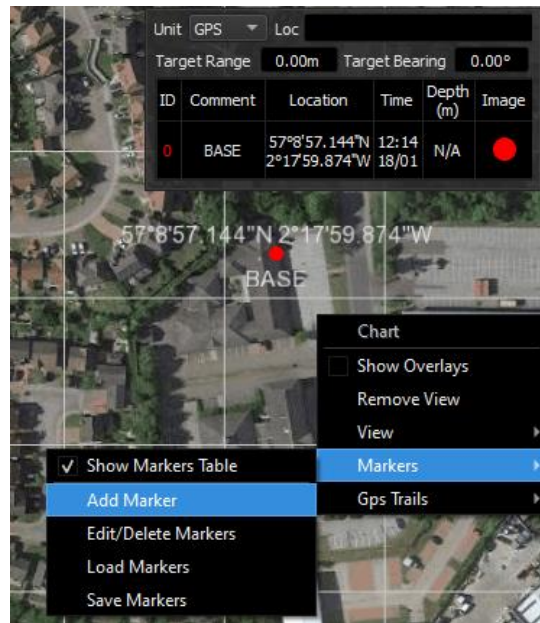
There are two formats of marker file:

- full comma separated file format with the filename extension **.mrk**
- shortened comma separated format with the filename extension **.csv**

Creating and Laying a Marker

Right-clicking anywhere on the chart will open the chart options where the Marker selections can be accessed.

Double-clicking anywhere on the chart will open the Add Marker box with the options for laying a marker at the point clicked.

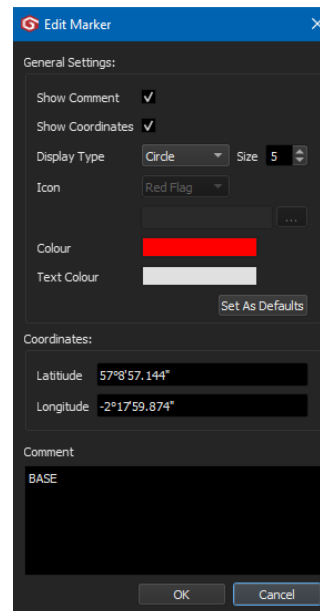


Editing Markers

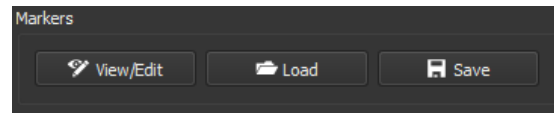
The Edit Marker dialog, here options for the marker can be configured such as shape, image (from a pre-set or loaded bitmap), size, colour, font colours, comment, and coordinates. Once configured, clicking on Ok will lay the marker on the chart.

Multiple markers can be created and laid onto the chart. The markers will be stored in the Genesis configuration, closing and re-opening Genesis will result in the markers being re-loaded as well.

The markers can be edited, cleared, Exported, Imported or loaded by right-clicking on the chart and selecting Markers from the pop-up menu.



The options to edit load and save Markers can also be accessed from the Display Settings Tab in the main Genesis Settings



If a full format .mrk file is to be opened, it is recommended that this be in the state as saved from Genesis (i.e., no subsequent modifications have been made to the text file). The .mrk file format is a native format and any slight modifications or errors to this format will not be handled.

Loading Markers from another System

It is recommended that the shortened .csv format be used. There are several variations to this format that can be handled, and these are described in the Appendices at the end of the manual.

Saving Markers

To save a Marker for use on another computer:

- right click on the chart
- select the Save Markers option from the Marker Dialog box, a Save File box will open up
- save the Marker in the desired file location

MicronNav Base Location Setup and Configuration

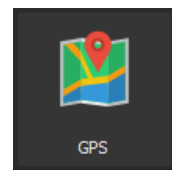
The base location for the MicronNav USBL Dunking Transducer, and therefore the base (origin) location for the USBL tracking can be configured in two different ways. It can be setup to display as a vessel (for mobile operations), or as a fixed platform. When configured as a vessel (Mobile GPS) it will take its origin position from the GPS device, as a Fixed Platform it requires the origin position coordinates to be entered manually.



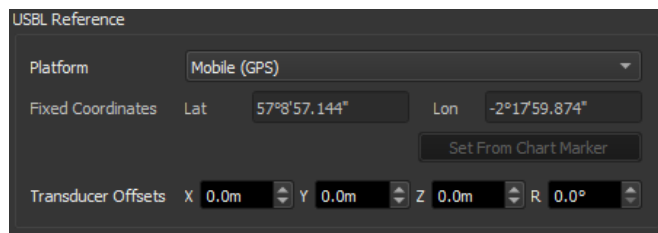
When using a GPS location for a Vessel, the reference Datum Point will be the GPS Receiver. All offset measurements for the MicronNav System, should be measured from this point.

Mobile (GPS) / Vessel Setup

The GPS is typically connected via USB or direct Serial Port connection. After connection the GPS Device can be added to Genesis via the Devices button in the top right.



To use the GPS as the origin point the 'Platform' selection should be set to 'Mobile (GPS)' on the MicronNav Configuration settings tab. If there is more than one GPS connected to Genesis ensure that the correct unit is selected.



Transducer Offsets

If the USBL Dunking Transducer is not located at the same point as the GPS receiver, the X and Y offset distance should be entered here. For more accurate depth readings the depth below the water line should be entered as the Z offset. If the forward marking on the USBL Dunking Transducer is not in the fwd. direction of the vessel then the R offset can be entered to compensate. Sign conventions are:

- X axis +ve. Port (L) -ve Stb. (R)
- Y axis +ve Fwd. -ve Aft
- Z axis +ve Up -ve Down
- R axis +ve C'wise 0 to 360 °

The position of the GPS and Vessel display options are found in the 'Chart' area on the GPS Device Display settings tab. From there the vessel measurements and GPS location on the vessel can be set. These options control how the Vessel is displayed on the Chart Device.

Show Coordinates

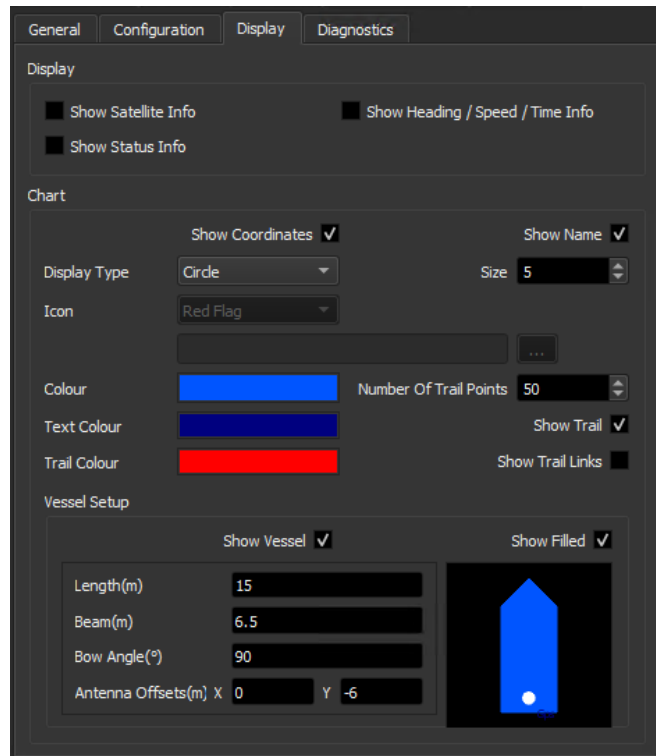
This displays the GPS origin coordinates next to the vessel on the Chart display.

Show Name

This displays the GPS Device name next to the vessel on the Chart display

Display Type / Size / Icon

With the 'Show Vessel' option deselected a configurable icon or marker will be displayed on the Chart in the position of the GPS.



Colour / Text Colour / Trail Colour

These control the colour of the vessel or GPS marker point, the colour of the coordinate and name text and the colour of the GPS trail points shown on the Chart display.

Number of Trail Points / Show Trail

This displays or hides the GPS location trail and specifies how many trail points are displayed on the Chart display.

Show Trail Links

This will show the path of the GPS location by linking the trail points

Show Vessel / Show Filled

This will display the vessel on the Chart display and show it as an outline or filled shape.

Length / Beam / Bow Angle

This will allow the vessel to be displayed to the same scale as the Chart display and with the correct shape.

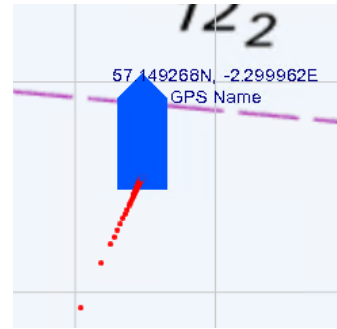
Antenna Offsets

Antenna Offsets should be entered to compensate for a differing location of the GPS receiver in relation to the centre point of the vessel. This will more accurately show the position of the vessel on the Chart display.

X axis +ve. Port (L) -ve. Stb (R)
 Y axis +ve. Fwd. -ve. Aft

The GPS receiver position is indicated by the white dot on the display.

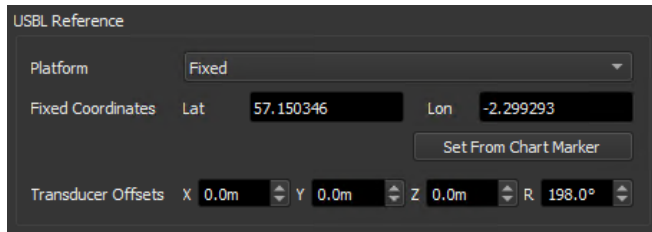
The picture on the right shows the Vessel shown on the Chart Display when configured as above.



Fixed Platform Setup

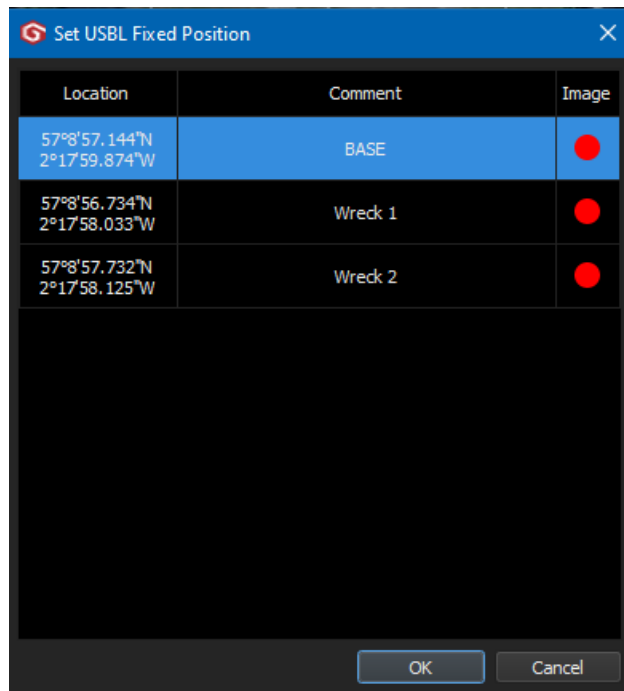
If working from a fixed position or operating without a GPS but from a known location, the MicronNav system can be setup with a Fixed Platform origin.

In the MicronNav Configuration settings tab 'Fixed' should be selected as the 'Platform' type and the location coordinates entered.

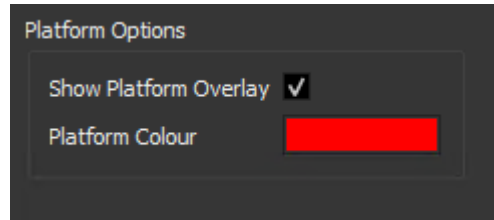


The Transducer Offsets should be entered in the same way as for the Mobile (GPS) Platform.

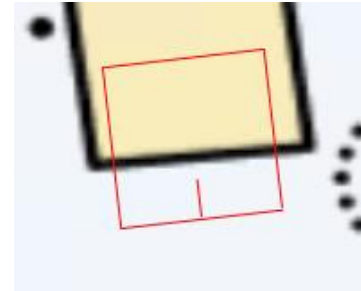
If unsure of the base location, but have it marked as a Chart Marker position, select 'Set from Chart Marker' and enter the location coordinates by selecting the appropriate marker.



The options to display the Platform and choose the colour are found on the MicronNav Display settings tab.



The picture on the right shows the Platform shown on the Chart Display when configured as above.



USBL System and Equipment Setup

Setup and Configuration of the MicronNav (Battery) USBL Modem

The Micron USBL Modem (Modem) can be setup and configured for communication to the USBL Diving Transducer in different ways:

- Remote Transponder (acoustically receive and reply)
- Remote Responder (acoustically reply from a pulse trigger)
- Remote Responder (acoustically reply from a serial trigger)
- Data Modem (acoustically receive and/or reply)

With the Modem loaded with version 13 firmware and above the configuration can be verified and changed easily by connecting to Genesis through the NavHub. Modems loaded with firmware before version 13 will need to be reset using the magnet prior to connecting to Genesis through the NavHub. Once connected the firmware can be updated to the current revision.



The following procedures require a Micron whip terminated with a 6 pin DIN connector and wired for power and communications. For electrical wiring details, refer to the section in the MicronNav 200 Hardware Manual.



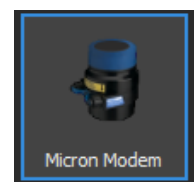
Tritech Micron Connectors

The Micron connectors can be easily damaged if fitted incorrectly or excessive force used which may lead to damage not covered under warranty. Refer to the MicronNav 200 System Hardware manual, for information on fitting, removal, and maintenance of the Micron Connector.

Establish Communication with the Micron USBL Modem

To configure the Modem, it first needs to be added as a device in Genesis and placed into programming mode. To add the device:

- Add a Micron Modem from the Devices menu
- Attach the Micron connector (power & comms) cable to the main port of the Modem
- Plug the Modem into Port D of the MicronNav Hub

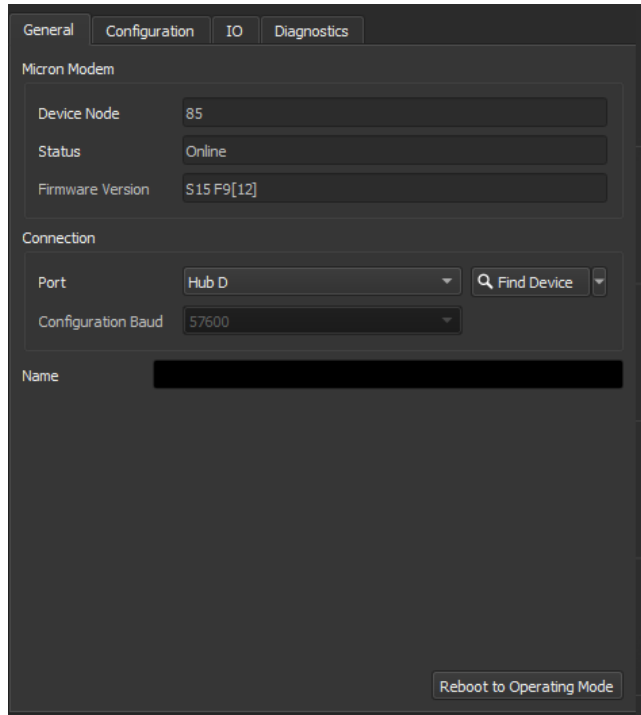


Port D of the MicronNav Hub should be configured to RS232 comms unless the Modem is configured to operate over RS485.

With the Modem connected communication will need to be established:

- In the Micron Modem General settings tab Select 'Hub D' from the Connection Sub menu (the Baud Rate is automatically set at 57600).
- Click on [Find Device]
- The red indicator bar on the Micron Modem Icon will turn green when communications are established
- The Firmware version can be viewed and updated if necessary

Once any changes to the settings have been made and applied to the Modem select [Reboot to Operating Mode] to return to normal operation.



To avoid addressing issues and reduce the risk of programming errors it is recommended that only one Modem should be connected to the NavHub during programming, firmware update or configuration.

Configuration Settings Tab

The following explains the settings available to configure within the Configuration Sub Tab for a Micron Modem Device (Modem) in Transponder or Responder Mode.

Duty Cycle

This gives the option to alter the Duty Cycle of the Modem, which has the effect of reducing the acoustic power in the water. The recommended setting is 12; a lower setting will result in up to 10dB lower transmit source level.

Unit OpMode

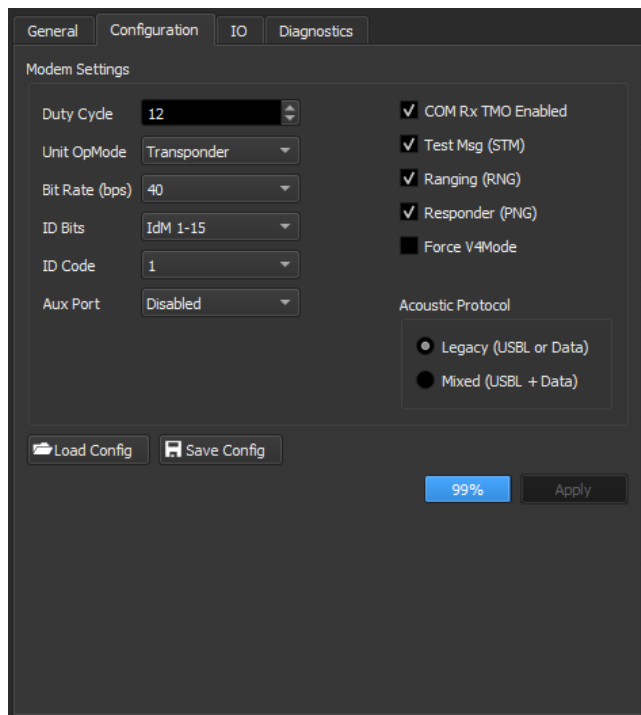
This contains the options for the Operational Mode of the Modem.

Bit Rate

This has two options, 40(bps) and 100(bps). The 100bps setting will have a lower range capability than 40bps.

ID Bits

This is recommended to be set at IdM 1-15 for Transponder and Responder mode.





If using the USBL system in an enclosed environment prone to strong multi-path echoes (eg quarry with hard sides and floor), a reduction in the Duty Cycle (acoustic power) may increase the tracking and data transfer reliability.

ID Code

This is the Unit ID set for identifying each individual Transponder, e.g., 1 is equal to T1.

Aux Port

Special features on the aux port of the Modem, can be configured here. When using a Responder with a downstream Micron Echosounder, this will need to be set to Disabled. For all other options, contact Trittech to discuss specific requirements.

Acoustic Protocol:

Legacy

This allows for USBL or Data usage. This mode is recommended for simple systems and/or compatibility with earlier MicronNav 100 components that have not been updated.

Mixed

This allows for simultaneous USBL and Data usage. The system will automatically interleave data transfer with USBL positioning.



The following settings can & should be left ticked (ON) unless there is a specific need to disable these features:

- COM Rx TMO Enabled
- Test Message (STM)
- Ranging (RNG)
- Responder (PNG)

Force V4 Mode

This should be left un-ticked (OFF), unless specifically advised by Trittech to enable this feature for debugging.

A summary of the relevant settings for configuring the Modem or Battery Modem in Transponder and Responder modes are shown in the table below:

Modem Mode	Unit OpMode	ID Bits	ID Code
Transponder	Transponder	IdM 1-15	1 to 16
Responder	Responder (Serial)		R0
	Responder (Pulse)		

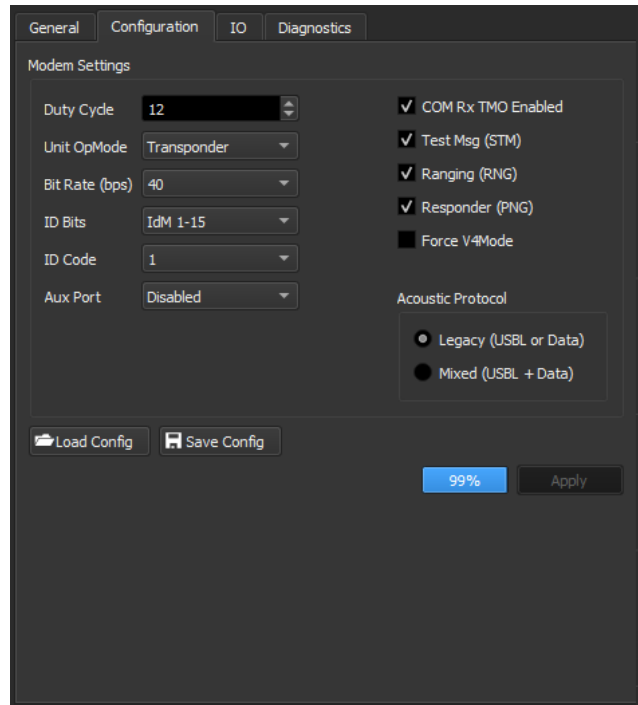
Details of the options for Data Modem configuration are shown in the relevant section of this manual.

Transponder Mode Configuration

The settings on the right show the standard (and recommended) configuration for the Modem set to Transponder Mode with a Unit ID of T1

After changing any of the configuration press [Apply] to write the changes to the Modem.

To return to standard operating mode the [Reboot to Operating Mode] button at the bottom right of the General tab should be pressed. The indicator bar at the bottom of the Micron Modem image will then turn RED and it can be removed from the device list.



Responder Mode Configuration

Responder mode has two settings available and is configured via the 'Unit OpMode' setting in the configuration tab:

- Serial mode (Standard) which uses an ASCII 'p' character to trigger the Responder.
- Pulse mode uses a slower pulse, which is intended for ROV Multiplexers that do not have a spare serial channel but may have a slower 'General Purpose Input/ Output' (GPIO) channel to use for triggering a responder.

The Responder Modem can be connected in two ways:

- Through the AUX Port of a Micron Sonar connected on Port B or D of the MicronNav Hub, (Factory Default option)
- Directly connected to Port B or D of the MicronNav Hub (Direct Responder)

Serial connection to the Responder should be configured:

9600 baud, 8 data bits, 1 stop bit, no parity



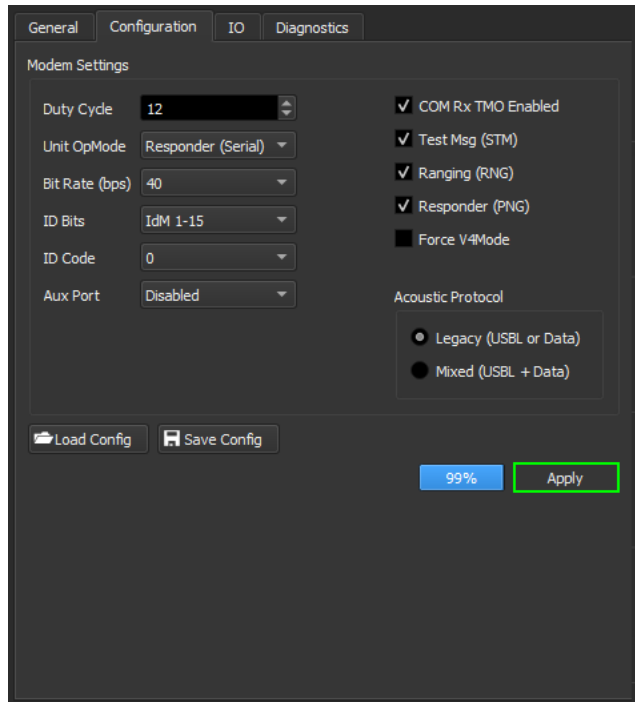
As standard serial comms to the Micron Modem are configured for RS232. RS485 comms is only available when specified at original order or if returned to Trittech for modification.

Modem Responder Configuration

The settings on the right show the standard (and recommended) configuration for the Modem set to Responder mode. These settings are the same for Serial or Pulse operation.

After changing any of the configuration press [Apply] to write the changes to the Modem.

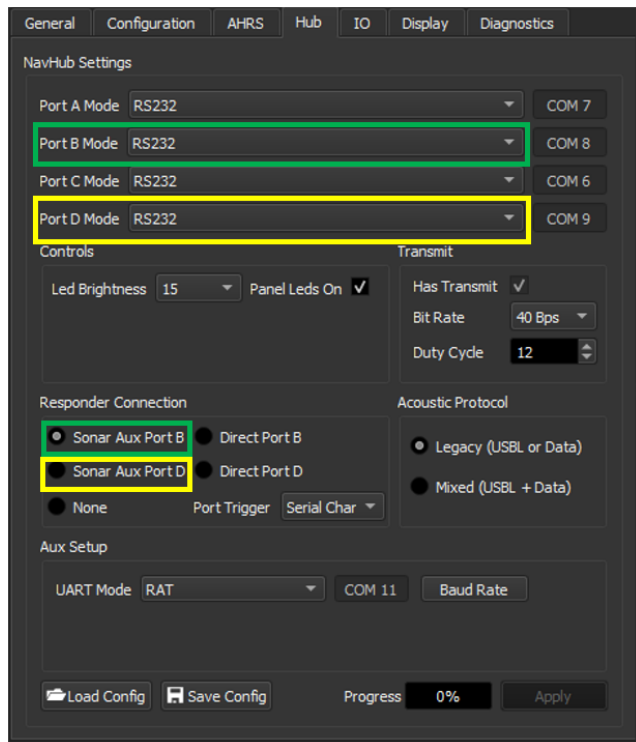
To return to standard operating mode the [Reboot to Operating Mode] button at the bottom right of the General tab should be pressed. The indicator bar at the bottom of the Micron Modem image will then turn RED and it can be removed from the device list.



System Settings for Indirect (Standard) Responder

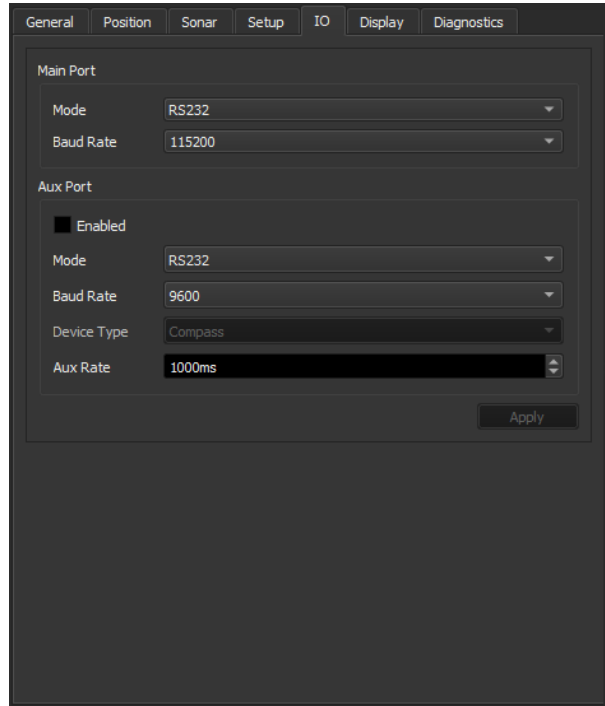
The settings on the right show the recommended configuration of the NavHub to operate the Modem Responder in an indirect responder setup.

The Micron Sonar should be connected to Port B or D of the NavHub, and the corresponding 'Responder Connection' option selected. Although shown as RS232 connections the selection should suit the configuration of the Micron Sonar.



The settings on the right show the recommended configuration shown in the Micron Sonar IO settings tab. The Main Port Mode will be set to match the comms between the Micron Sonar and MicronNav Hub.

The Aux Port Mode should be set to match the comms setting of the Modem (standard is RS232) and baud rate set to 9600

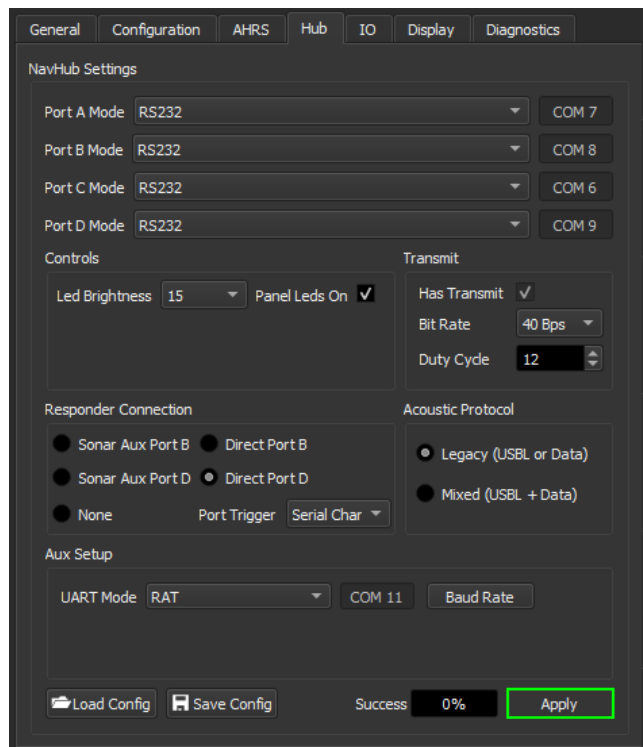


System Settings for Direct Responder

This can be utilised for checking the functionality of a Modem set to Responder mode. Or when operating the Modem Responder through a vehicle’s Multiplexer (MUX).

The settings on the right show the recommended configuration of the NavHub to operate the Modem Responder in direct responder setup.

The Modem should be connected to Port B or D of the NavHub directly, or through a MUX.



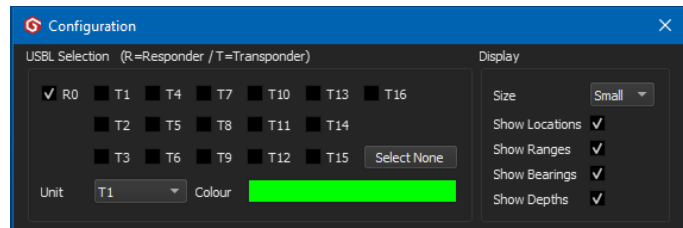
Selecting Responder from the Unit Table

Double click on the Unit table located on the top left-hand side of the PPI /Chart Display

	Name	Location	Range (m)	Bearing (°)	Depth (m)	OK
T1	T1	N/A	0.00	0.00	0.00	<input type="checkbox"/>

Select the R0 device number as shown in the Configuration menu opposite.

Close the tab.

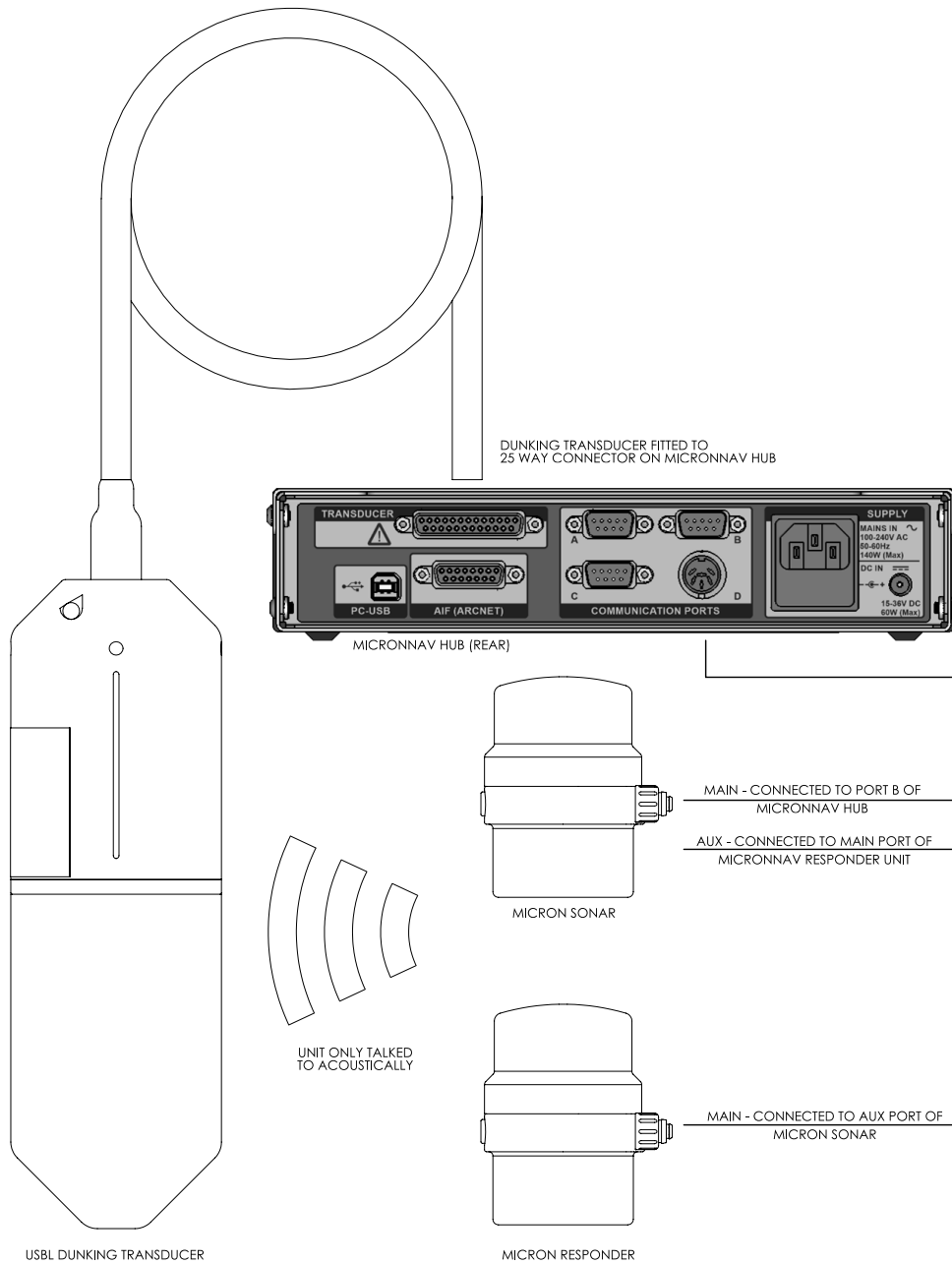


The Unit Table will now show R0 and display Range, Depth and Bearing and the responder will now appear and track in the PPI Display/Chart.

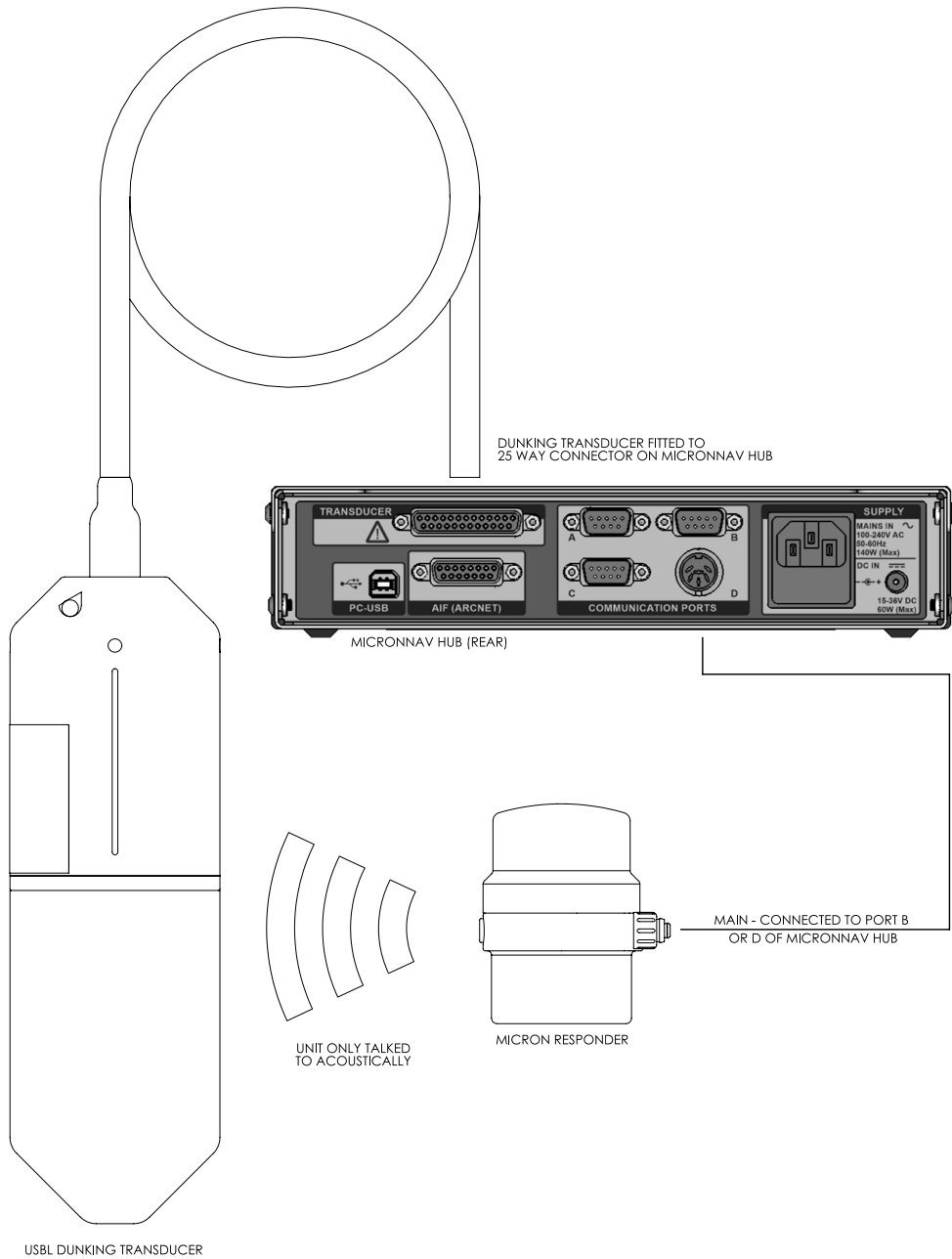
	Name	Location	Range (m)	Bearing (°)	Depth (m)	OK
R0	R0	N/A	0.00	0.00	0.00	<input type="checkbox"/>

Example showing the standard installation of a Modem Responder

This is the standard Modem Responder configuration with the Micron Modem connected via the Aux port of a Micron Sonar.



Example showing the Modem installed in the Direct Responder configuration



Connecting External Sensors

Various external sensors and sensor inputs can be incorporated into the Genesis system to aid positional accuracy or display (and log) additional information. This includes data inputs from external third-party sensors (Windows video capture device, ROV AHRS etc.) in addition to Trittech products. This data can be recorded within a single log file for later playback.

For electrical connections to the MicronNav Hub please refer to the MicronNav 200 Hardware Manual and to the relevant Trittech and third-party manuals.



The main interface with Genesis is via serial ports (virtual or physical). For external connections it is important that the Windows COM port number allocated to the specific equipment or interface is known. These can normally be identified through the Device Manager utility within Windows.

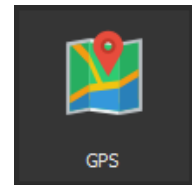
Please refer to the relevant third party or Windows documentation for additional connection and configuration details.

A list of the input strings recognised and decoded by Genesis can be found in the *Appendices* at the rear of this manual.

Adding a GPS Receiver

If a greater degree of bearing accuracy is required of the system, then a GPS Receiver, External Compass & MRU can be connected. This gives the option to select a combination of internal and external sensors within a project. The MicronNav system can be configured to accept a NMEA GPS input string from an external third-party GPS receiver. This enables the synchronisation of the Genesis display and ROV tracked position to true world position.

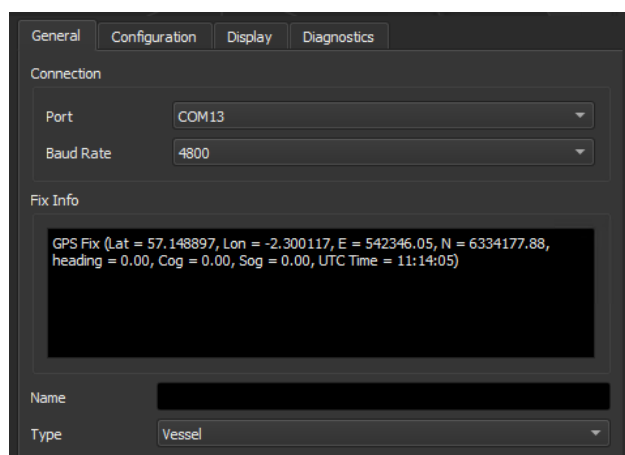
The GPS is typically connected via USB or direct Serial Port connection. After connection the GPS Device can be added to Genesis via the Devices button in the top right.



The General Settings tab for the GPS Device allows selection of the serial port and baud rate.

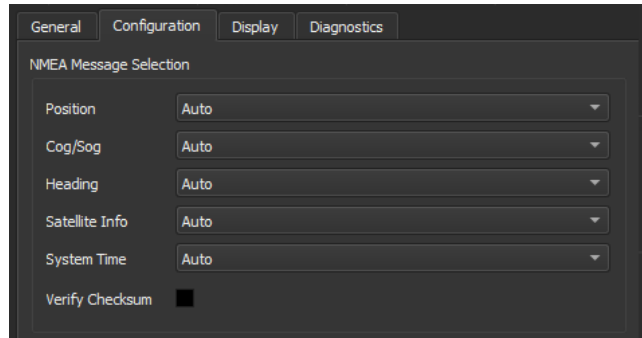
Once the GPS has a stable position fix the details are displayed in the 'Fix Info' window. There will be no position shown in Genesis until the GPS has a fix.

There is the option to name the device to aid identification if more than one is connected.

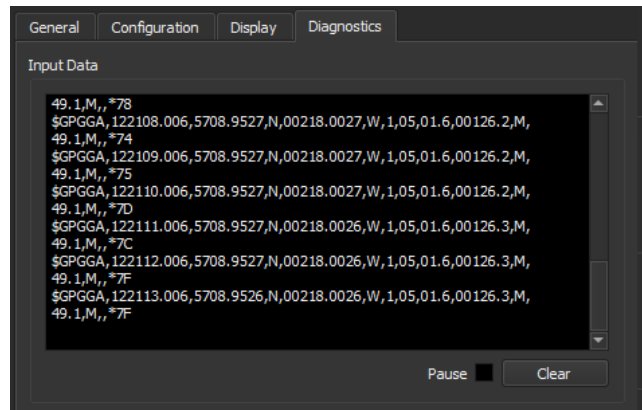


The Configuration tab allows the selection of specific NMEA input strings and the checksum verification control.

If these are left at Auto, the system will detect the decode string from the GPS and update the system time from the GPS time.



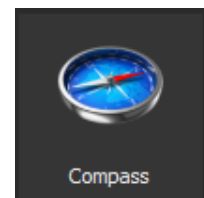
The Diagnostics tab shows the raw data being received from the device and can be used for troubleshooting any issues with the output.



Adding a Compass

The data from a vessel compass (heading, pitch, and roll) can be used in place of the internal AHRS on the USBL Dunking Transducer, or can be displayed separately. AHRS data from a ROV or other remote vehicle can be displayed and used to orientate the remote display of a sonar on the Chart view.

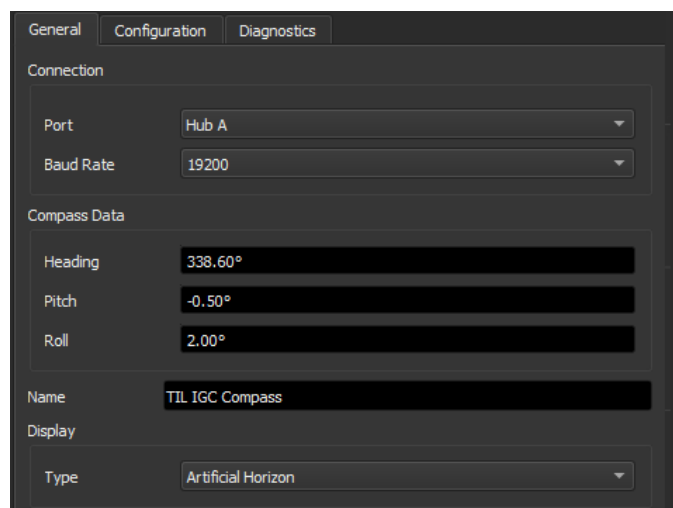
After connection the Compass Device can be added to Genesis via the Devices button in the top right.



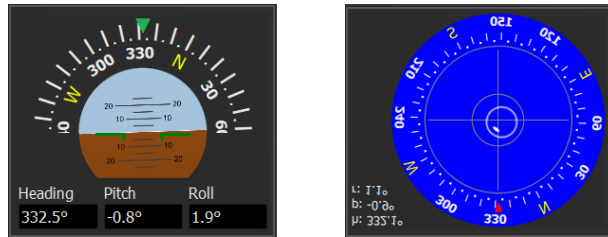
The General settings tab allows the selection of the serial port and baud rate.

The values from a recognised input string are displayed in the 'Compass Data'

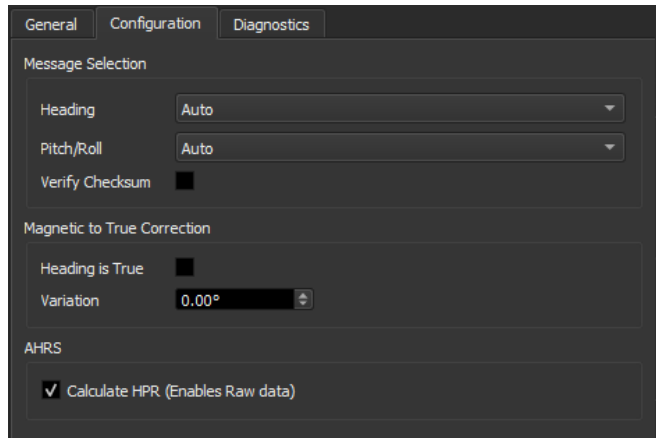
There is the option to name the device to aid identification if more than one is connected.



The compass display type can be selected from the more typical 'Artificial Horizon' or 'Spirit Level'.

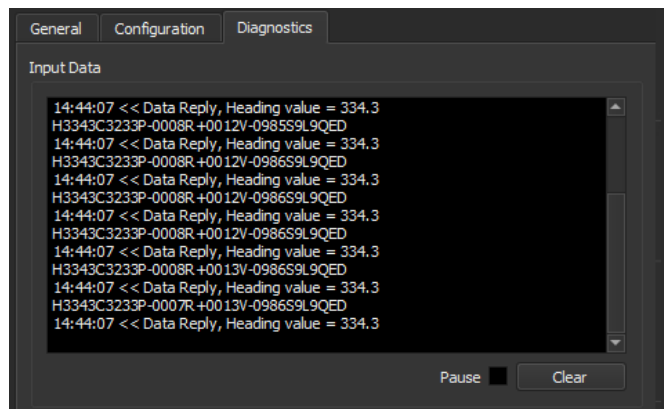


The Configuration tab allows selection of the specific input strings, or to allow Genesis to automatically recognise a compatible input. There is the option to enable or disable checksum verification.



A correction of the input between true and magnetic heading can be enabled and specified if required.

The Diagnostics tab shows the raw data being received from the device and can be used for troubleshooting any issues with the output.



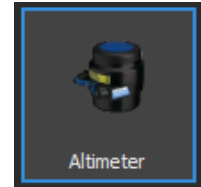
Adding an MRU Sensor

To interface an MRU sensor via Genesis, follow the steps for adding a Compass Device as described above. Genesis will auto detect the incoming data string from the external device when set to Auto (A full list of the compatible strings can be found in Heading/Pitch/Roll string compatibility Appendix) and display in the Compass device.

Adding an NMEA Echosounder / Altimeter

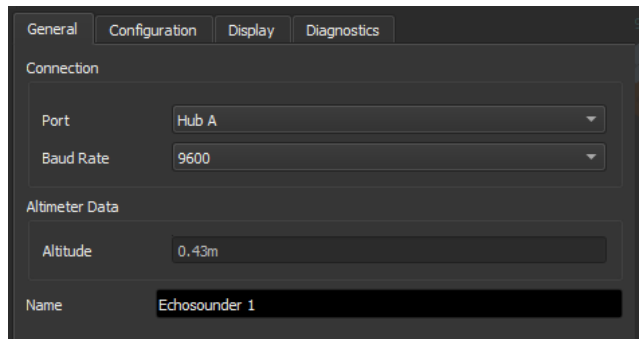
This device can be used to interface and display data from a Tritech Micron Echosounder, Tritech PA Altimeter or third party NMEA standard altimeter that outputs Depth Below Transducer (DBT).

After connection the device can be added to Genesis via the Devices button in the top right.



Click on the Altimeter Device Icon, in the General Menu, select the required USB or Serial Port, set the Baud Rate of the Altimeter.

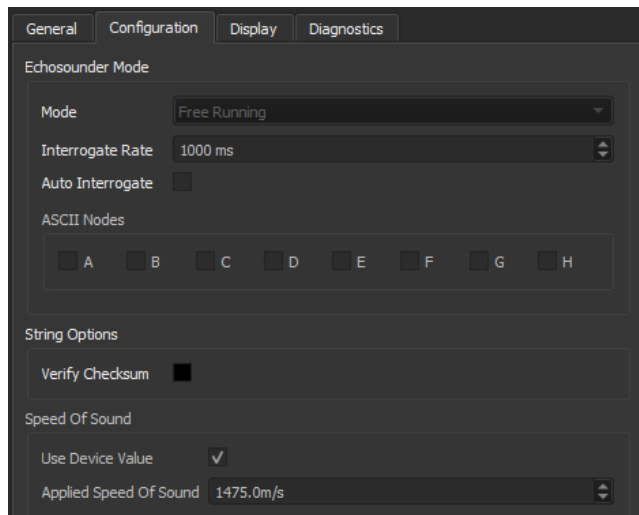
The General settings tab allows the selection of the correctly configured serial port and baud rate.



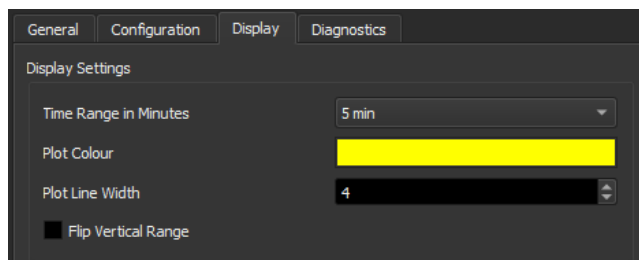
The values from a recognised input string are displayed in the 'Altimeter Data'

There is the option to name the device to aid identification if more than one is connected.

The Configuration tab displays details of the Altimeter configuration and interrogation options. These options are only applicable to the relevant Tritech products.

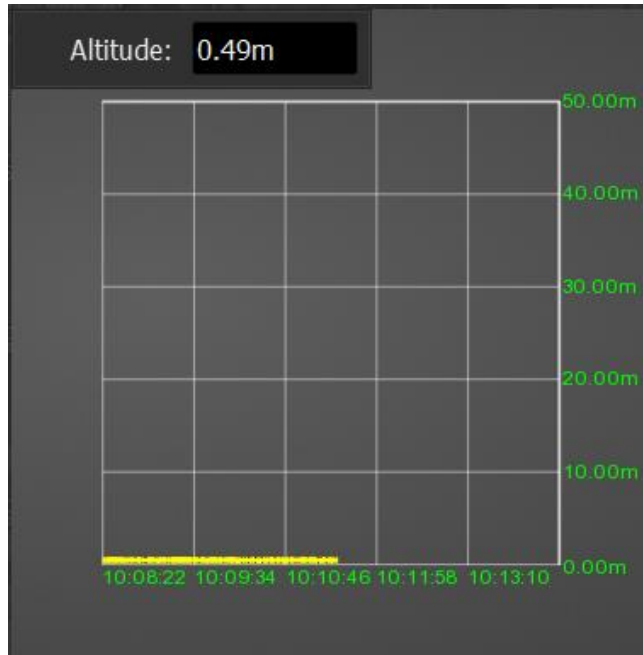


The Display settings tab is used to configure the on-screen chart display including scaling, plot colour and width. Checking the 'Flip Vertical Range' box will set the value to a negative and so display underneath the axis as a depth.

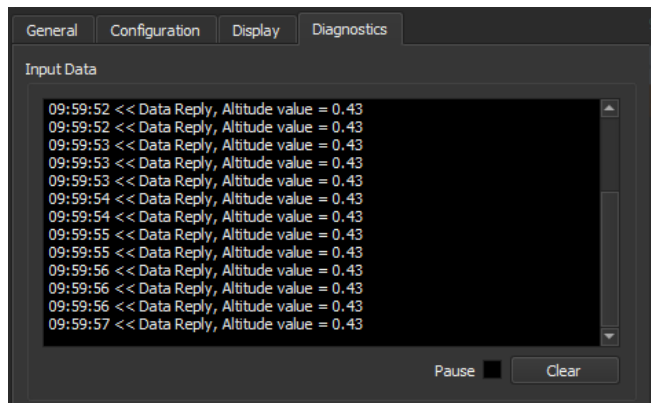


The picture on the right shows the Altimeter Display Window that shows onto the main Genesis screen.

When operating in air or above its maximum detection depth the Altimeter will register as either 0 or Max depth depending on the configuration of the sensor.



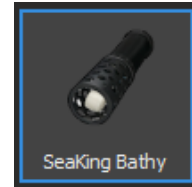
The Diagnostics tab shows the raw data being received from the device and can be used for troubleshooting any issues with the output.



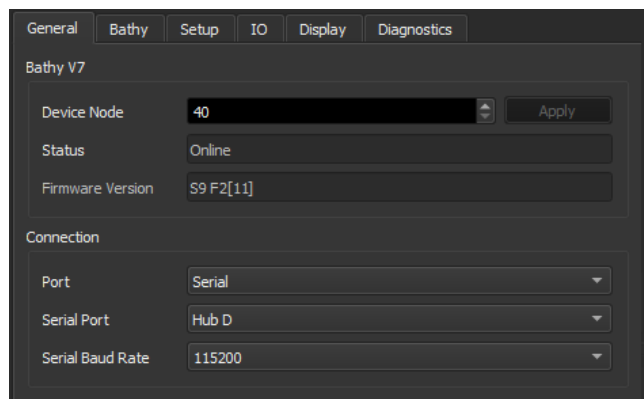
Connecting a Bathymetric Sensor

The Bathymetric Sensor (Bathy) device can be used to give a highly accurate depth reading in addition to a reference Speed of Sound (SoS) value to Genesis and the MicronNav system. For detail of the connection requirements please refer to the specific product manual.

After connection the device can be added to Genesis via the Devices button in the top right. If the Bathy is configured to communicate over ARCNET or Ethernet it will automatically add itself into Genesis on connection and power up.

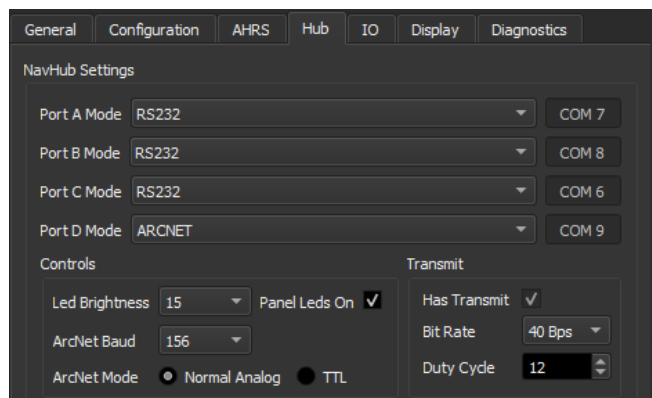


The Bathy General settings tab will allow the communications configuration to be set and the firmware updated if a newer version is available.

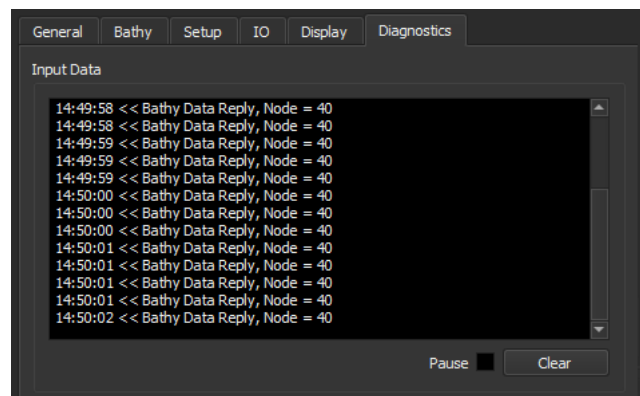


If set for ARCNET communications, the Bathy should be connected to the dedicated (15 way) ARCNET Port, Port C or Port D of the MicronNav Hub.

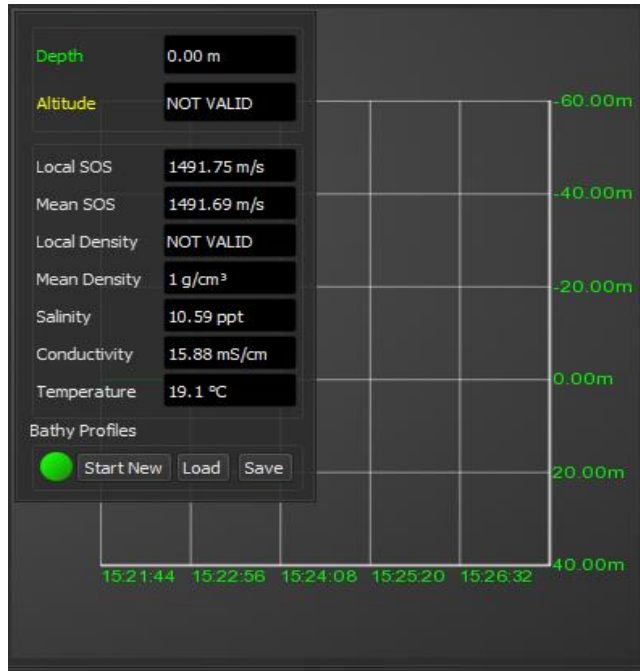
The settings in the MicronNav Hub setting tab will require to be configured for an ARCNET connection (if on Port C or D) and the baud rate verified. The typical configuration for a connection on Port D is shown opposite.



The Diagnostics tab shows the raw data being received from the device and can be used for troubleshooting any issues with the output.



The Bathymetric data will be displayed in its own window within Genesis and the Speed of Sound and Depth data used as inputs to other Genesis devices.



Data Telemetry with USBL Dunking Transducer

A Modem or a group of Modems may be used to give a two-way communications link between a topside computer and a subsea sensor. The data telemetry can be mixed with the USBL tracking information or transmitted with no tracking data. This feature can be used with the standard externally powered Micron USBL Modem or the self-powered Battery Modem.

Data telemetry with USBL tracking is achieved by switching the acoustic comms into 'Mixed' mode and using the MicronNav Hub Aux COM port (Virtual Com Port) to transfer data (interleaved with USBL positioning). The Modem (in Transponder mode) holds data in an internal buffer until it is interrogated acoustically by a USBL Dunking Transducer. The advantage of this method is that multiple Modems in Transponder mode, can be interrogated and USBL tracking is available.

Data telemetry without USBL tracking is achieved by switching the MicronNav Hub into 'Surface Modem' or 'Subsea Modem' mode, and then the hardware will operate functionally as a Data Modem (without USBL Tracking). The Modem (in Subsea Modem mode) transmits data acoustically as soon as it is received on the Main port; the advantage of this method is that data throughput in a simple point-to-point data-transfer-only system is higher.

General Setup and Configuration

Bit Rate

All nodes in the system must be configured to use the same acoustic bit rate, either 40 bps (default) or 100 bps. By its very nature, the higher bit rate is less tolerant of detrimental factors in the acoustic environment (background noise, multipath, range). However, if these factors are not significant in a particular application, then the higher data throughput at 100 bps may be of use. Typically, the maximum range achievable at 100 bps will be about half that achieved at 40 bps in the same conditions.

Acoustic Protocol (Legacy / Mixed)

The USBL Dunking Transducer and all Modems in the system must be configured to use the same acoustic protocol (Legacy or Mixed). The Legacy acoustic protocol is used in the MicronNav100 system, and only allows the system to be operated in a single mode, either tracking or data transfer. The Mixed acoustic protocol allows the system to provide tracking functionality while at the same time transferring data.

Data Telemetry with USBL Tracking

The following shows the recommended settings for the MicronNav 200 System when configured for data transfer combined with Transponder USBL tracking data:

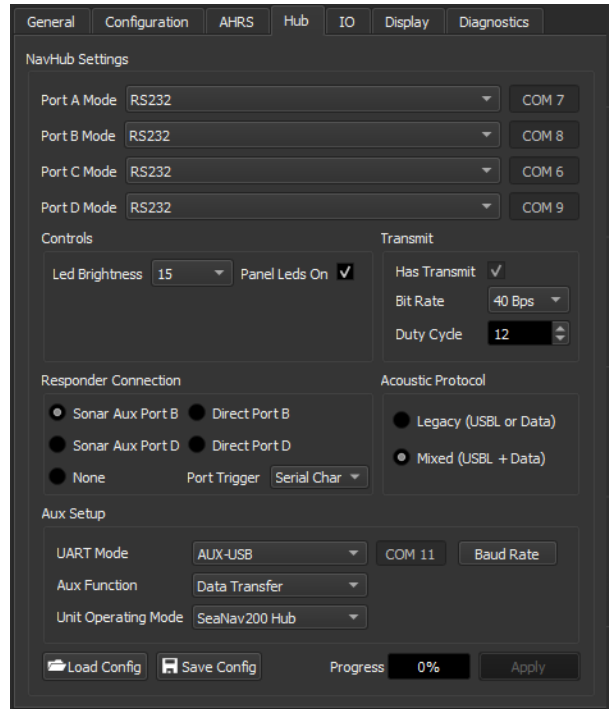
The settings on the right show the typical configuration MicronNav Hub settings tab. Of particular importance are the Acoustic Protocol and Aux Setup settings.

If required to setup or verify the Modem configuration, ensure the appropriate port on the NavHub (Port D) is configured appropriately.

The Acoustic Protocol should be set to Mixed.

The Aux Setup should be configured as shown with:

- UART Mode = AUX-USB
 - Aux Function = Data Transfer
 - Unit Op. Mode = SeaNav200 Hub
- The COM port number displayed is the number allocated by Windows to the serial port for data transfer.



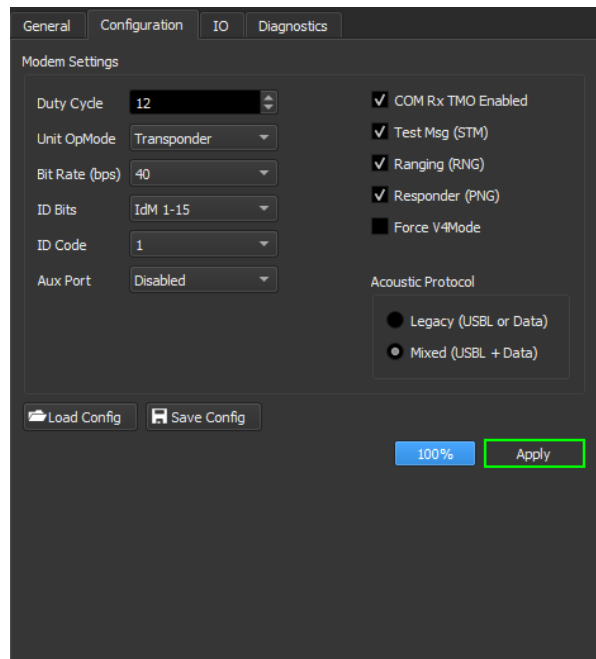
This will disable the RAT (Remote Access Terminal) port on the front of the MicronNav 100/200 Hub as the internal communications channel is now reassigned to support Data Transfer.

To configure and / or verify the Modem settings first add the Micron Modem into Genesis and switch it from operating mode. This is detailed in the section *Setup and Configuration of the MicronNav (Battery) USBL Modem*.

The settings on the right show the typical configuration Micron Modem Configuration settings tab.

The 'Unit OpMode' should be set to Transponder and 'Acoustic Protocol' set to 'Mixed'

If any changes are made to the configuration, the [Apply] button must be selected to write them to the Modem. On completion return the Modem to operating mode via the control on the General settings tab.



Data Telemetry without USBL Tracking

When setup for data transfer the MicronNav USBL Dunking Transducer (Surface Modem) and Micron USBL Modem (Subsea Modem) operate as a complementary pair. Each uses different acoustic Chirp patterns to avoid the possibility of a unit falsely detecting reflections of its own transmitted signal. In this configuration the USBL Dunking Transducer only operates as a Modem and no longer processes or outputs any USBL tracking data.

The following shows the recommended settings for the MicronNav 200 System when configured for data transfer without USBL tracking:

The settings on the right show the typical configuration MicronNav Hub settings tab. Of particular importance are the Acoustic Protocol and Aux Setup settings.

If required to setup or verify the Modem configuration, ensure the appropriate port on the NavHub (Port D) is configured appropriately.

The Acoustic Protocol should be set to Legacy.

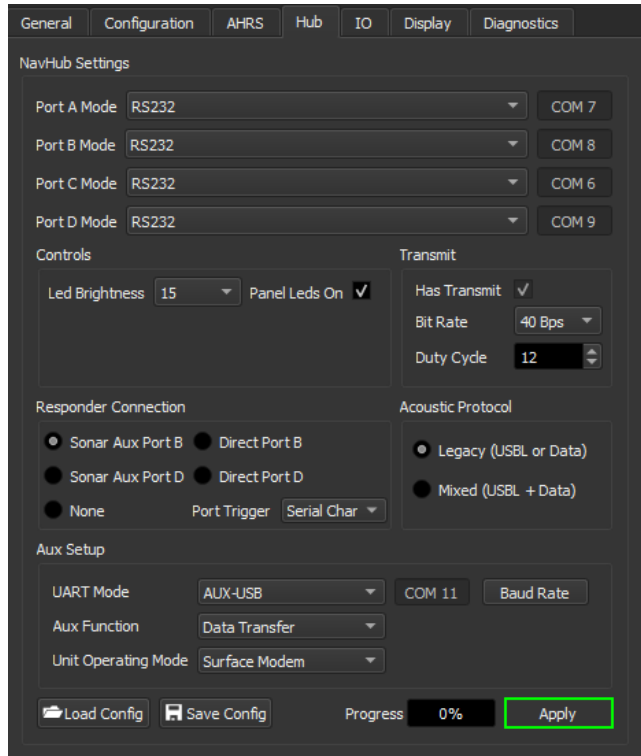
The Aux Setup should be configured as shown with:

UART Mode = AUX-USB

Aux Function = Data Transfer

Unit Op. Mode = Surface Modem

The COM port number displayed is the number allocated by Windows to the serial port for data transfer.



If the distance between the Surface and Subsea Modem is short and conditions good the Bit Rate can be increased for faster data transmission.



This will disable the RAT (Remote Access Terminal) port on the front of the MicronNav 100/200 Hub as the internal communications channel is now reassigned to support Data Transfer.

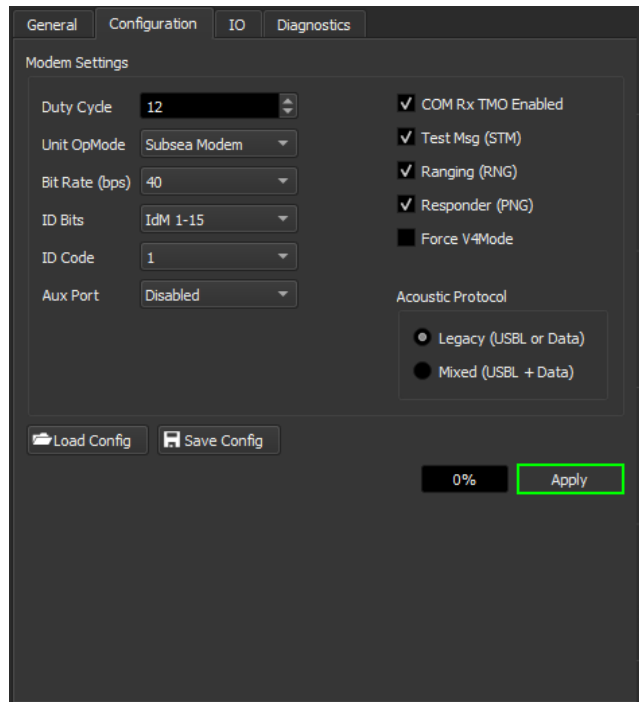
To configure and / or verify the Modem settings first add the Micron Modem into Genesis and switch it from operating mode. This is detailed in the section *Setup and Configuration of the MicronNav (Battery) USBL Modem*.

The settings on the right show the typical configuration Micron Modem Configuration settings tab.

The 'Unit OpMode' should be set to 'Subsea Modem' and 'Acoustic Protocol' set to 'Legacy'.

The 'Bit Rate' should match the setting on the MicronNav Hub.

If any changes are made to the configuration, the [Apply] button must be selected to write them to the Modem. On completion return the Modem to operating mode via the control on the General settings tab.



Transmitting data from surface to subsea

When the system has data to transmit via the acoustic modem function, it is held in the MicronNav 200 Hub Aux Port buffer prior to transmission. Blocks of data are then sent in turn to each of the live Modem Transponders in turn. For a system with two live Transponders:

- The system pings T1 and sends the first 4 bytes of data in the buffer
- The system pings T2 and sends the next 4 bytes of data in the buffer
- The system then pings T1 again and sends the next 4 bytes of data in the buffer

In this way the data in the buffer is split between T1 and T2.

If the data in the buffer is required to be received by only one of the two transponders for example only T1, then the solution to this would require the customer to format the data string in the buffer to account for this. For example, to transmit the message “send status” to both transponders the data would be formatted as below:

Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Chr	s	e	n	d	s	e	n	d		s	t	a		s	t	a	t	u	s		t	u	s	

To send the message to only T1 the data string would be formatted as below:

Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Chr	s	e	n	d						s	t	a					t	u	s					

MicronNav Hub Special Commands

A number of special commands are implemented for the MicronNav 100/200 Hub Aux Port. These will only be accepted when the unit is idle, i.e., not waiting for 4 characters to be accumulated in the input buffer. By waiting >4s, the input buffer will automatically be flushed, guaranteeing that the special commands will be accepted. Alternatively, this can be managed by keeping tight control over how many characters are sent to the unit and making sure it’s a multiple of 4 before issuing a special command.

The special command set for the MicronNav 100/200 Hub / MicronNav 100/200 USBL Dunking Transducer are:

Command	Function
%NH<LF>	Sets the unit type as MicronNav (100 /200) Hub
%MS<LF>	Sets the unit type as Modem (Surface)
%SL<LF>	Sets the unit type as Modem (Subsea)
%VQ<LF>	Queries the version and unit type. The response is the version number and unit type e.g. %VR12NH<LF>



The Micron USBL Modem special commands PNG and RNG are not supported by the MicronNav 100 and 200 Hub or USBL Dunking Transducer.

Micron USBL Modem and USBL Battery Modem Special Commands

A number of special commands are implemented for the Micron Modem Main Port. These will only be accepted when the unit is idle, i.e., not waiting for 4 characters to be accumulated in the input buffer.

By waiting >4s, the input buffer will automatically be flushed, guaranteeing that the special commands will be accepted. Alternatively, this can be managed by keeping tight control over how many characters are sent to the unit and making sure it's a multiple of 4 before issuing a special command.

The special command set for the Modem are:

Command	Function
%MS<LF>	Sets the unit type as Modem (Surface)
%SL<LF>	Sets the unit type as Modem (Subsea)
%RE<LF>	Sets the unit type as Responder (Serial triggered)
%RP<LF>	Sets the unit type as Responder (Pulse triggered)
%TR<LF>	Sets the unit type as Transponder
%In<LF>	Sets the unit ID <i>n</i> when in Transponder mode. The value <i>n</i> is in Hex, e.g. : unit ID = 1 to 9, <i>n</i> = 1 to 9 unit ID = 10 to 16, <i>n</i> = A to F
%IQ<LF>	Queries the unit ID when in Transponder mode. The response is the unit ID in Hex notation (as above), eg %I4<LF> or %IB<LF> for T4 or T11.
%VQ<LF>	Queries the version and unit type. The response is the version number and unit type e.g., %VR12TR<LF>
%V4<LF>	Switches the unit to V4 to allow it to communicate with software applications using the V4 comms protocol (e.g., SeaNet Pro, Genesis). A V4 mtReboot command or power cycle will be required to restore to normal operation.

When changing the unit type, there is a delay of approximately 0.3s while the unit re-initialises and can operate in the new mode.

Testing the Data Telemetry System

For the following testing, the USBL Dunking Transducer and the Modem should be placed close together in a container of water. The Terminal programs (PuTTY, Docklight), used for this testing are example third-party terminal programs only, and not supported or necessarily endorsed by Tritech; others are available.

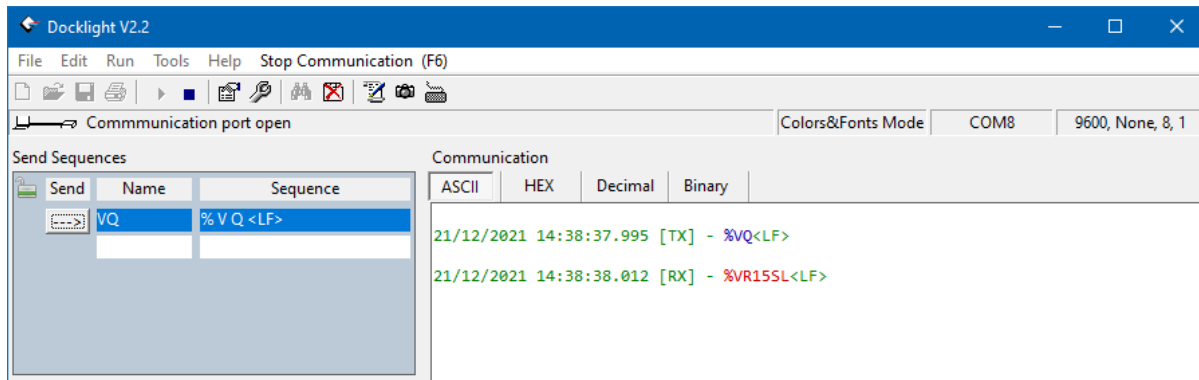
For the purposes of testing, the serial connection from the Modem Main Port is connected to Port B of the MicronNav Hub. The table below shows the connected ports, baud rates and associated com port for both testing examples.

Connected Port	Baud Rate	Allocated COM Port
MicronNav Hub Aux (RAT)	9600	COM 11
Micron Modem Main		COM 8 (Hub Port B)

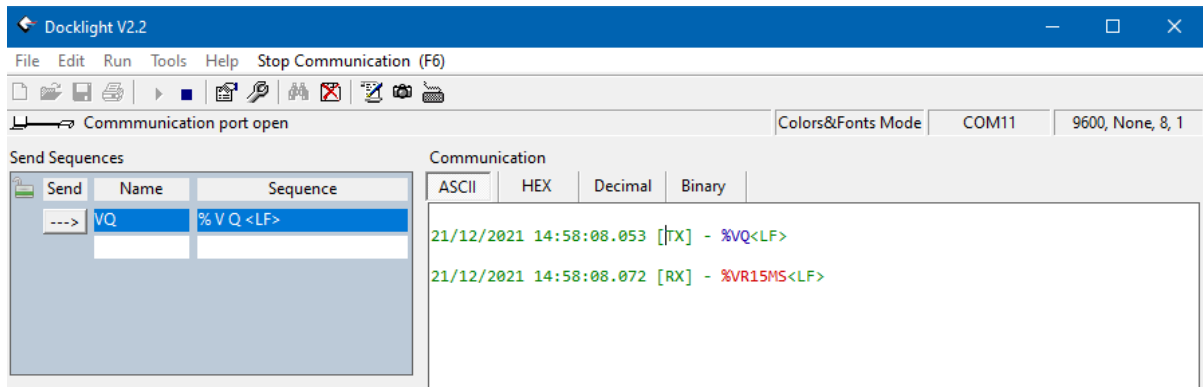
Data Telemetry Without USBL Tracking

- Open two instances of a terminal program
- Set one terminal session to the connected Subsea Modem port (COM port 8 @ 9600 Baud)
- Set the other terminal session to the Surface Modem (Nav Hubs virtual aux port COM11 @ 9600 Baud)

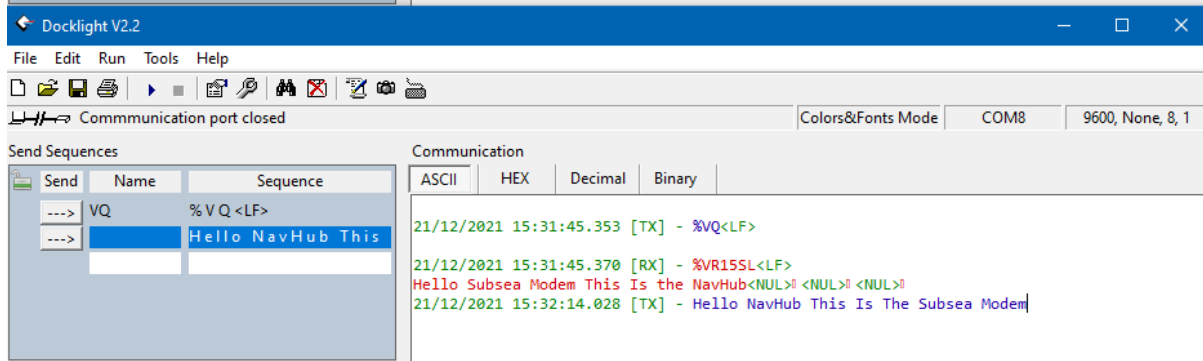
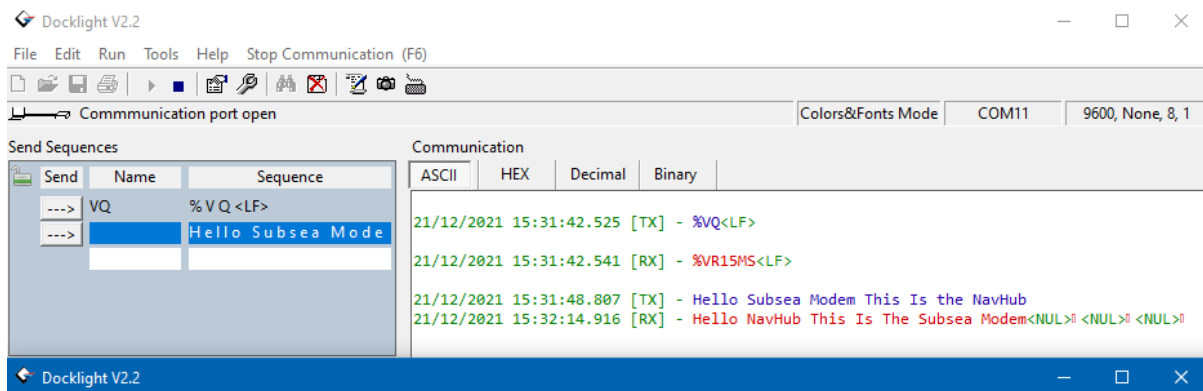
Test the terminal connections to each by requesting the version and unit type from each Modem using the `%VQ<LF>` command function:



The Subsea Modem interrogated with `%VQ<LF>` replies with `%VR15SL<LF>` confirming version number as 15 and type is a Modem (Subsea).



The Surface Modem (USBL Dunking Transducer) interrogated with `%VQ<LF>` replies with `%VR15MS<LF>` confirming version number as 15 and type is a Modem (Surface). This confirms a terminal connection with each Modem and the terminals can now be used to send messages between surface (USBL Dunking Transducer) and Subsea Modems acoustically.



In the above example the Surface Modem (USBL Dunking Transducer) is transmitting `Hello Subsea Modem This Is The NavHub`

This is received in the second instance of the terminal program, and is replied to with `Hello NavHub This Is The Subsea Modem`

Data Telemetry with USBL Tracking

Follow the instructions for testing as described above except keep Genesis open to enable the USBL tracking function and ensure that a Transponder(s) are enabled in the unit table. Ensure that both MicronNav Hub and Modem are correctly configured for **Mixed** 'Acoustic Protocol'.

Data Sharing and Output

The MicronNav location data can be made available for use by third party software packages running on an external PC, or other software running on the same computer. This section details how to set this up including a worked example.

The following list of output strings are currently available, and these are covered in detail in the *Appendices* at the rear of the manual. Additional third party and industry standard output strings may be added on customer request, please contact Tritech for more information.

Tritech proprietary strings:

- 'Raw XYZ'
- 'Proc XYZ'

Third party strings:

- 'TP-2EC' (Trackpoint)
- 'HPR 300P' (Simrad HPR)
- 'HPR 410' (Simrad HPR)
- NMEA '\$GPGGA' (Lat/Lon Fix Data)
- NMEA '\$GPGLL' (Lat/Lon Position)
- NMEA '\$GPRMC' (Lat/Lon Fix Data)
- NMEA '\$RATTM' (Tracked Target Message for charting packages)
- '\$PSIMSSB' (Simrad)
- '\$GPDBT' (Depth Below Transducer = USBL 'Z' co-ordinate)

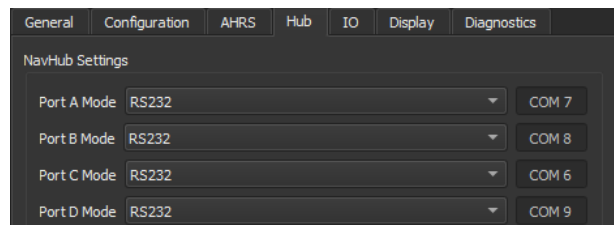
Configuring the Data Output String

The following is a worked example using the Simrad HPR 300P output string to a secondary computer through a physical serial cable connection. To output to a program running on the same computer a physical or virtual serial loop-back connection would be required. For output of the serial data over a TCP/IP network connection please consult the relevant third-party documentation for the hardware or software being used.

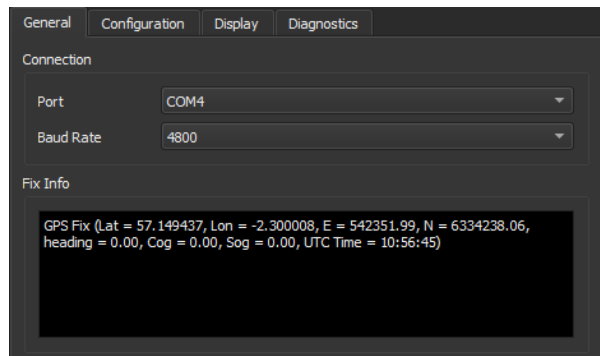
The following example assumes that a MicronNav System and GPS are both attached, added as devices, and powered on. To receive a valid USBL position output in the terminal program, the Transponder will need to be successfully interrogated by and reply to the USBL Dunking Transducer. The computers are connected through a wired RS232 interface between the NavHub Port A and the comm port on the secondary computer.

Primary (Genesis) Computer

In the MicronNav Hub settings tab ensure that Port A is set for RS232 communications.



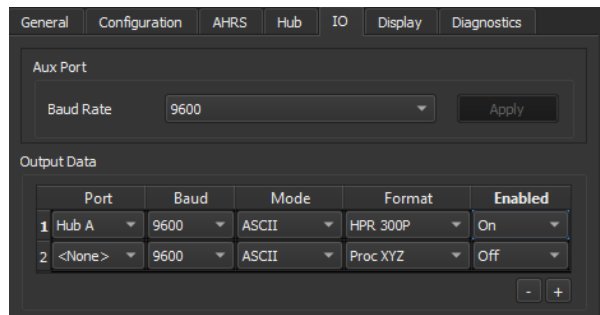
In the GPS General settings tab ensure that the GPS is operational and has a location fix.



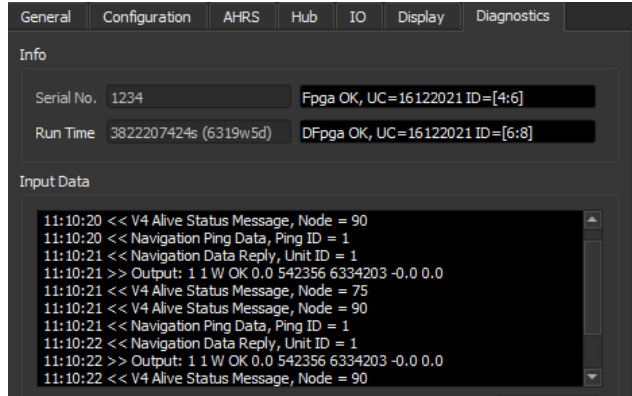
In the MicronNav IO settings tab set one of the Output Data channels to the required configuration and enable:

- Port Hub A
- 9600 Baud
- ASCII data type
- HPR 300P data string format

The number of Output Data Channels can be adjusted using the [-] and [+] buttons.



The output data is displayed in the MicronNav Diagnostics tab.



Secondary (Receiving) Computer

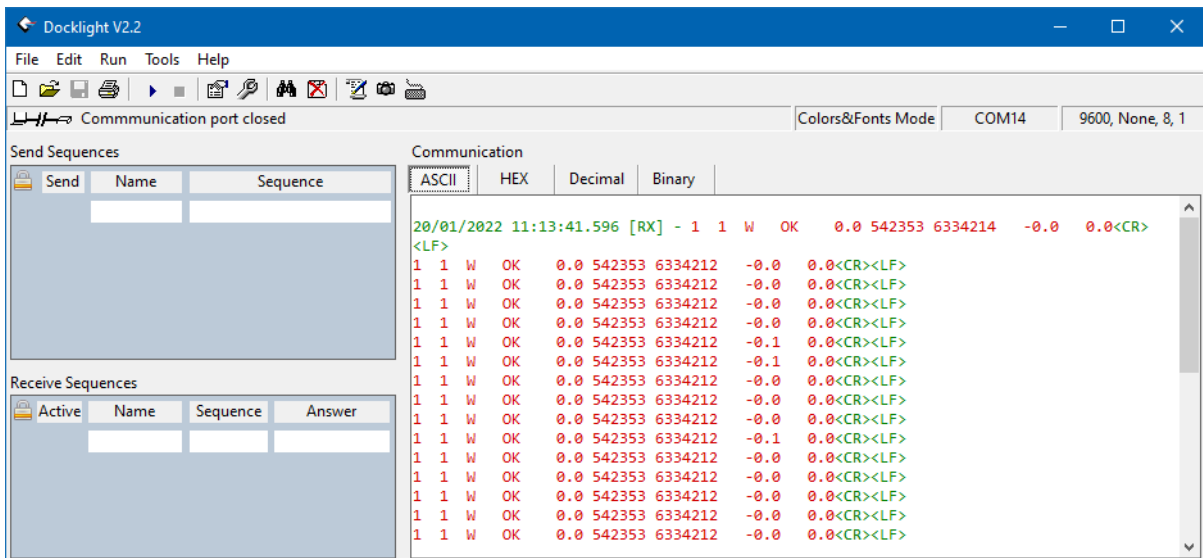
There are various third-party terminal programs available for viewing output string data. (PuTTY & Docklight) are example third-party terminal programs only, and not supported or endorsed by Tritech.

Attach a serial cable from the MicronNav hub to the com port being used on the secondary computer.

Start-up PuTTY or Docklight and set the input port to the number of the port connected to on the secondary computer.

Set the baud rate to match the primary computer output baud rate (9600).

Start communications with the computer, the HPR 300P string will be seen displayed in the terminal window as illustrated below:



USBL System Care and maintenance

MicronNav USBL Dunking Transducer Calibration

The AHRS calibrations refer to the new MicronNav 200 USBL Dunking Transducer and not the older MicronNav 100 unit.



MicronNav 100 USBL Dunking Transducer



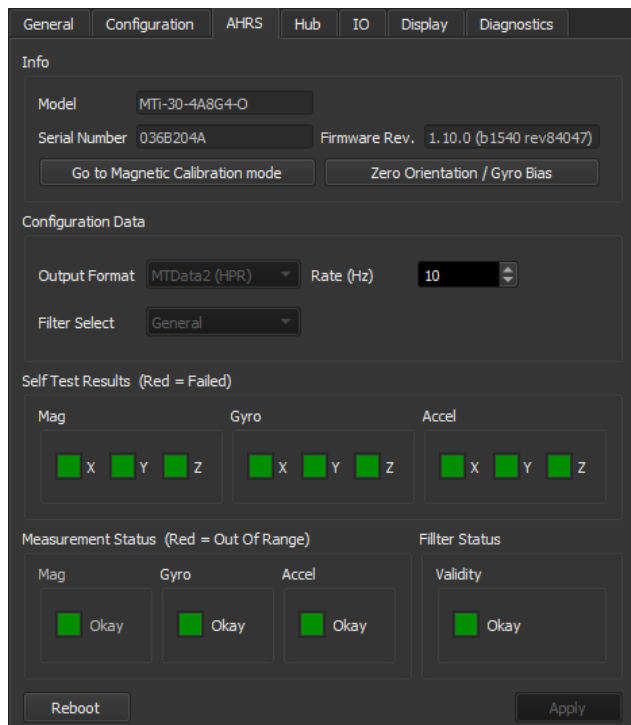
MicronNav 200 USBL Dunking Transducer

The Magnetic Calibration and Zero Orientation / Gyro Bias modes are accessed from the MicronNav 200 AHRS settings tab that is shown in Genesis when the MicronNav200 system is connected and powered. With the USBL Dunking Transducer connected either mode can be selected.

There are two modes of Magnetic calibration:

- 2D to compensate for any local magnetic environmental effects in normal use.
- 3D to compensate for magnetic effects should the system be used at high horizontal angles.

The Zero Orientation for the AHRS output eliminates any fixed angular offsets after mounting.



A summary of the Magnetic Calibration and Gyro Bias options are shown in the table below along with the recommended installation stage and frequency.

Calibration / Bias	Function	Frequency
2D Magnetic	Horizontal compensation for local magnetic influences.	After installation onto vessel or installation at a fixed platform location.
3D Magnetic	Horizontal and vertical compensation for local magnetic influences.	Only required should 2D magnetic calibration fail due to excessive angular (pitch and roll) movement.
Zero Orientation	Zero the angular (pitch and roll) after installation to compensate for any fixed offset.	After installation onto fixed mounting. During operations after system or software restart.
Gyro Bias	Zero bias the AHRS internal Gyro sensor and compensate for any internal offsets	Not normally required.

2D Magnetic Calibration (Fixed Platform or Vessel Setup)

The aim of this procedure is to map and compensate for any local magnetic interference or effects by rotating the USBL Dunking Transducer through 720° whilst keeping it as close to level as possible. If the angle of the USBL Dunking Transducer exceeds 10° the calibration may fail to complete and require to be repeated.



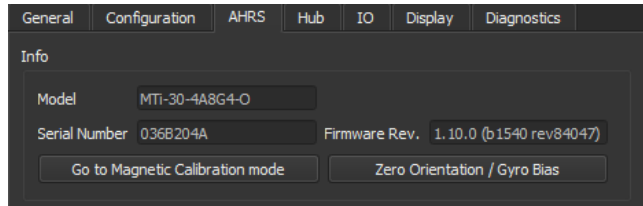
Once started the new 2D calibration will remove the previous data from the USBL system. The calibration should only be started with the expectation it will be completed.

If the USBL Dunking Transducer is moved to a different fixed position, a different vessel mounting position or the vessel moved to a different location it is recommended that the process be repeated to compensate for any differing environmental disturbances and effects.

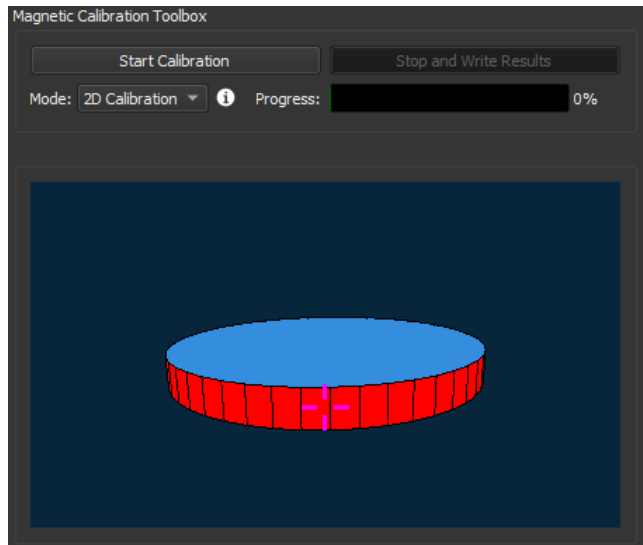
The application of this procedure will differ according to the use of the USBL system at a fixed platform location, or mounted to a vessel or other water craft. For calibration on a vessel the USBL Dunking Transducer should be deployed in its final position with any other equipment in their typical locations. If being mounted on a fixed platform the calibration should take place with as much of the mounting equipment and in as close to the final position as is practical.

This procedure should be performed while the Vessel/Ship is in motion, with the USBL Dunking Transducer deployed. The boat is required to slowly move through 360 degrees in a circle at a recommended speed of 2 knots. In 2D mode the Pitch and Roll sensor will calibrate between +/- 10 degrees. If calibrating in the field, the important thing is to keep 2-3m away from any temporal soft/hard iron disturbances.

Click on the [Go to Magnetic Calibration] button on the MicronNav AHRS settings tab to open the Magnetic Calibration Toolbox.



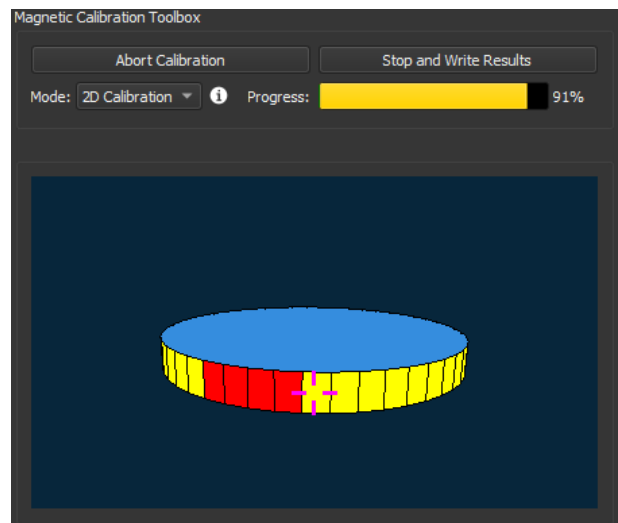
In the Toolbox select 2D Calibration and press the [Start Calibration] button to begin the process.



If mounted to a vessel, slowly (approx.. 2 knots recommended speed) steer the vessel in a full circle through 360 degrees.

If at a fixed location, slowly rotate the USBL Dunking Transducer through 360 degrees whilst straight and level.

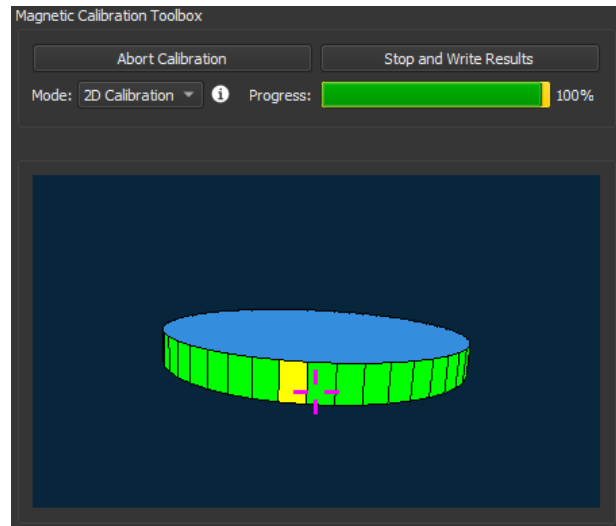
The Progress bar needs to turn Yellow and reach 80%, before the stop and write results option can be selected.



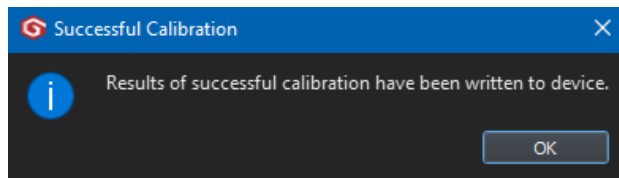
If possible, a second rotation or pass is recommended in the opposite rotational direction. This will increase the accuracy of the calibration.

Green filled bearing sections indicate that the sensor has passed over that bearing point twice.

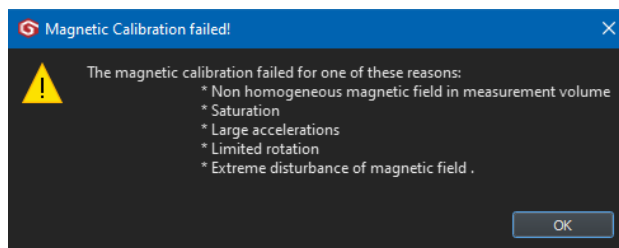
Once complete the [Stop and Write Results] button can be selected to program the USBL Dunking Transducer with the calibration values.



A dialog will appear informing of results (successful or not) and the sensor will return to Measurement mode automatically.



If the calibration fails, then it will need to be repeated.



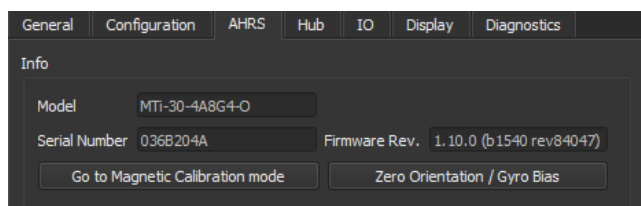
3D Magnetic Calibration (Magnetic Field Mapping)

A full calibration of the USBL Dunking Transducer is completed at manufacture. In normal use it should not be required to repeat the 3D calibration unless the 2D calibration repeatedly fails to complete ,due to excessive angular displacement during the calibration process.

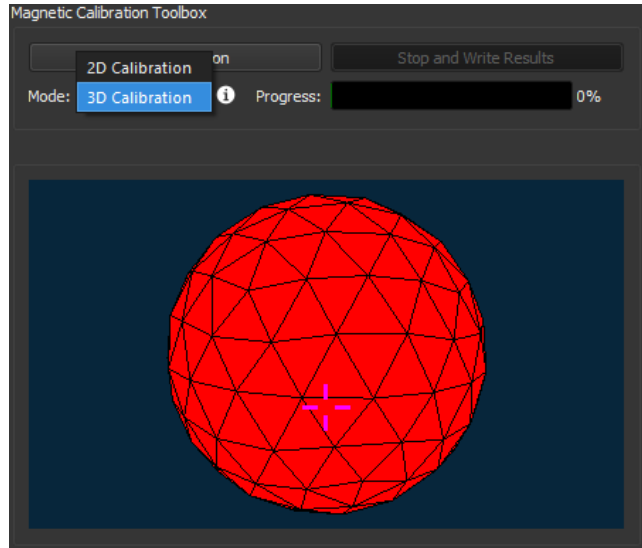


Once started the new 3D calibration will remove the previous data from the USBL system. The calibration should only be started with the expectation it will be completed.

Click on the [Go to Magnetic Calibration] button on the MicronNav AHRS settings tab to open the Magnetic Calibration Toolbox.



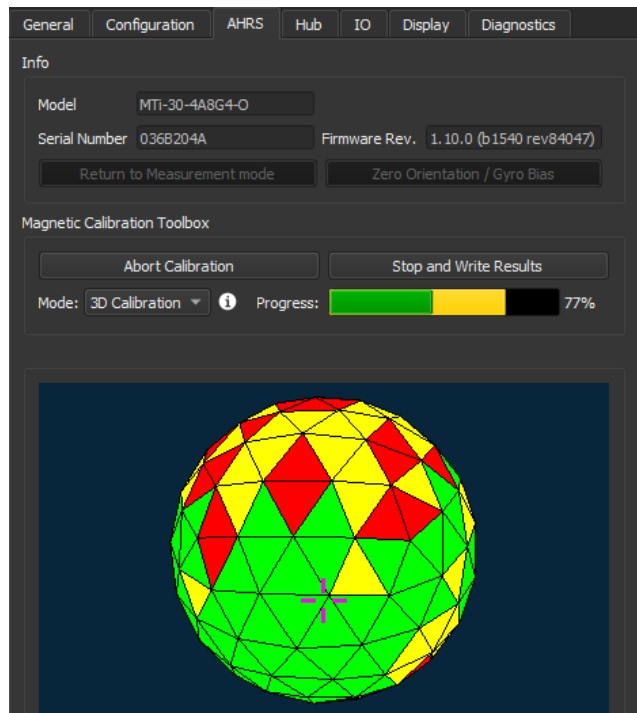
In the Toolbox select 3D Calibration and press the [Start Calibration] button.



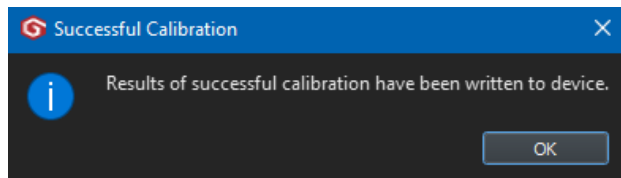
Holding the USBL Dunking Transducer by hand, rotate the unit through all angles/planes, until the sphere has an adequate coverage of yellow/green filled faces.

The progress bar should be > 30% as a minimum before the Stop and Write Results button can be activated. The more complete the calibration sphere (green tiles) the more accurate the calibration.

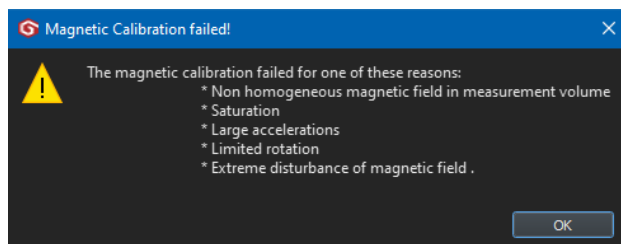
When satisfied with the level of calibration (beyond the minimum 30%), press [Stop and Write Results].



A dialog will appear informing of results (successful or not) and the sensor will return to Measurement mode automatically.



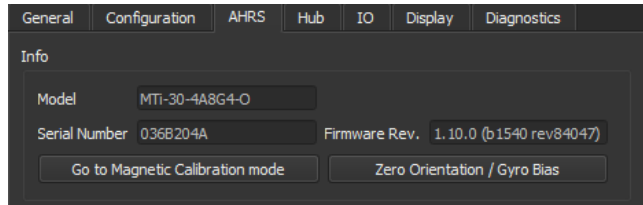
If the calibration fails, then it will need to be repeated.



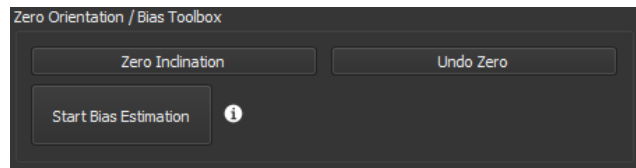
Zero Orientation

After installation the AHRS pitch and roll output values can be zeroed to remove any fixed angular offsets.

Click on the [Zero Orientation / Gyro Bias] button on the MicronNav AHRS settings tab to open the Zero Orientation / Bias Toolbox.



Click on the [Zero Inclination] button to “zero” the pitch and roll values and level the unit.



To remove the offsets and return to the original calibrated bias press the [Undo Zero] button.



Excessive movement during the short period that the system is measuring and calculating the Zero offsets will cause the operation to fail.

The Zero Orientation settings are not saved within the USBL Dinking Transducer and so require to be reset after power on or a restart of the Genesis software.

Gyro Bias Estimation

The output for the internal Gyro sensor is not typically used by the MicronNav 200 System and as such there is no requirement to adjust the calibration of this sensor.

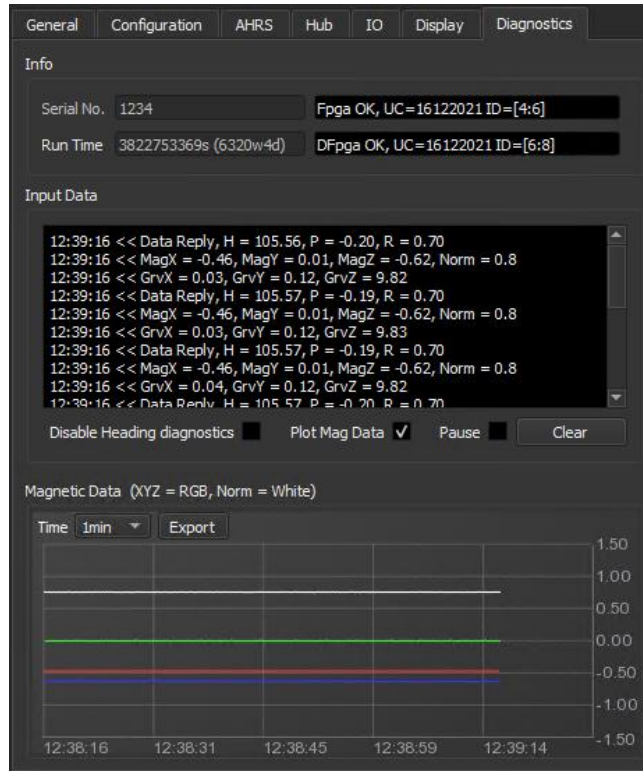
Post Calibration Checks

Following a magnetic calibration, or during operation, should the reliability of the magnetic heading become an issue the quality of the calibration can be verified. The 'Plot Mag Data' display shows the magnetic input on the three axes (X Y Z) and a calculated "quality" value of the input data against the programmed calibration. From this a visual indication of measured values against the calibrated values can be displayed and the quality of the calibration verified.

The 'Plot Mag Data' option should be selected in the MicronNav 200 Diagnostics settings tab which will display the output from the magnetic sensors (X/Y/Z - Red/Green/Blue) and the calculated variance against the calibrated values (White)

The USBL Dunking Transducer or Vessel should be slowly turned through 360 degrees as detailed in the calibration procedure.

A Norm (White) value of 1 indicates a good correlation between the calibrated and measured value and good quality calibration. A Norm value below 0.5 or above 1.5 at any point through the rotation indicates a low quality of calibration that should be repeated.



Updating the MicronNav USBL System Firmware

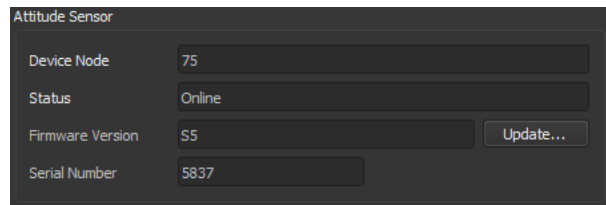
USBL Dunking Transducer Firmware Update

The following Firmware update procedure only applies to the MicronNav 100 USBL Dunking Transducer. The MicronNav 200 UDBL Dunking Transducer uses an AHRS sensor which does not currently require firmware updates.



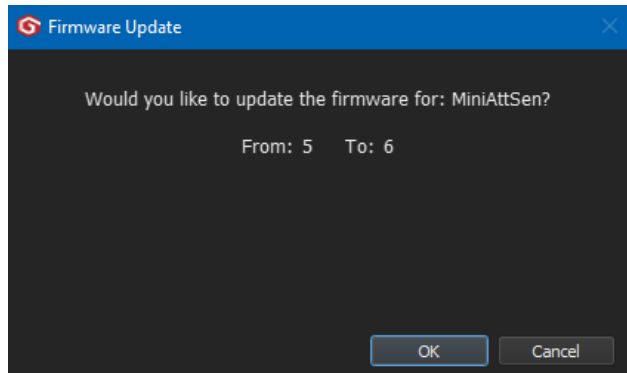
When a new Firmware version becomes available for the USBL Dunking Transducer it will be contained within a new Genesis release.

This update is applied from the Attitude Sensor group on the MicronNav General settings tab. The [Update] button next to the 'Firmware Version' indicates a new firmware revision is available and may be updated.



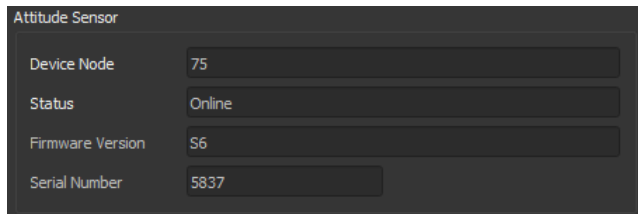
Before the Firmware Update process begins, ensure that the system has a reliable power supply for both the MicronNav Hub and computer. The USBL Dunking Transducer requires to be securely connected into the back of the MicronNav Hub.

Clicking on the Update button will open the Firmware Update status window. Click on the Okay option and the process will start.



During the update process the Firmware Update Window will cycle through 3 steps of erasing and reprogramming the firmware on the USBL Dunking Transducer. There is no further action required until the Firmware Update Window confirms that it has successfully installed the update.

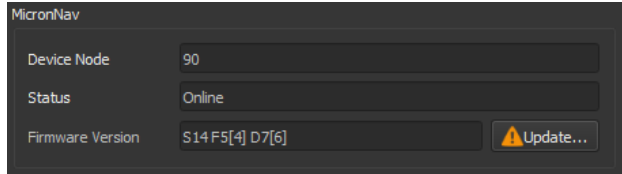
Once the firmware has been updated, the MicronNav General settings tab will display the new firmware version.



MicronNav Hub Firmware Update

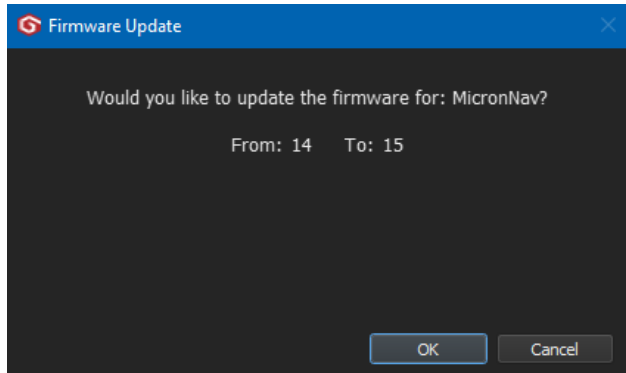
When a new Firmware version becomes available for the MicronNav Hub it will be contained within a new Genesis release.

This update is applied from the MicronNav group on the MicronNav General settings tab. The [Update] button next to the 'Firmware Version' indicates a new firmware revision is available and may be updated.



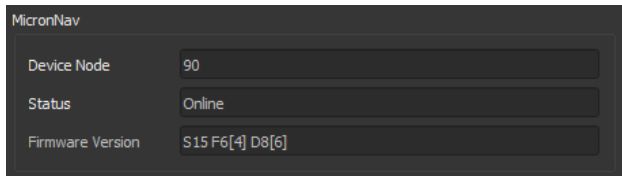
Before the Firmware Update process begins, ensure that the system has a reliable power supply for both the MicronNav Hub and computer.

Clicking on the Update button will open the Firmware Update status window. Click on the [Okay] option and the process will start.



During the update process the Firmware Update Window will cycle through 3 steps of erasing and reprogramming the firmware on the MicronNav Hub. There is no further action required until the Firmware Update Window confirms that it has successfully installed the update.

Once the firmware has been updated, the MicronNav General settings tab will display the new firmware version.



Software Troubleshooting

The GPS Is plugged in but not functioning.

- Is the GPS connected to the MicronNav Hub or PC?
- Has the GPS got adequate power?
- Has the GPS receiver got a position fix?
- Refer to Software setup for guidance on integrating a Serial or USB GPS

USBL Dunking Transducer Pitch/Roll not working

- Is the USBL Dunking Transducer correctly plugged into the MicronNav Hub?
- Has the Pitch/Roll Device been switched off?
- Refer to General Menu (USBL Sources)

USBL Dunking Transducer Heading Not Working

- Is the USBL Dunking Transducer near any ferrous metals or magnets?
- Has the AHRS sensor been calibrated recently to adjust for this? See the AHRS Calibration Section.
- The USBL Dunking Transducer needs to be a least 2-3 metres away from the harbour wall or boats hull and at least 1 metre below the water
- Has the Heading Source been set to None in USBL Sources, or has the Platform been set to Fixed in USBL Reference?

Appendices

Appendix A - Heading/Pitch/Roll Strings

The following strings are detected and interpreted by Genesis as standard.

Compatible Strings with Attitude:

String	Description
TCM2	\$C123.4P12.3R12.3T12.3X123.4Y123.4Z123.4E000*FF<CR><LF>
NMEA 'TRO'	\$--TRO,x.xx,a,y.yy,b*kk<CR><LF>
NMEA 'TRH'	\$--TRH,x.xx,a,y.yy,b,z.zz,c*kk<CR><LF>
CDL1	H123.4P+123.45R+123.45T00.0D00000.0B00.0FR<CR><LF>
MDL	H0750P-0019R-0022<CR><LF>
Digilog/Oceantools	H0750P-0019R-0022E<CR><LF>
CDL Microtilt	P+12.34R+12.34<CR><LF>
TSS1	:XXAAAASMHQHQRSMPPPP<CR><LF>
SMC 'SMCS'	\$PSMCS,±yy.yyy,±xx.xxx,±hh.hh<CR><LF>
SMC 'SMCD'	\$PSMCD,±yy.yy,±xx.xx,±zzz,z,±yv.yv,±xv.xv,±zv.zv*hh<CR><LF>

Compatible Strings with Heading:

String	Description
HDG	\$--HDG,x.x,x.x,a,x.x,a*hh<CR><LF>
HDT	\$--HDT,x.x,T*hh<CR><LF>
HDM	\$--HDM,x.x,M*hh<CR><LF>

Appendix B - Marker File Formats

Full Marker File Format (.mrk extension)

This is the format that is native to Genesis and Seanet Pro and includes full details of the marker configuration. The file is in an ASCII Comma Separated format and contains the following fields:

Index	Value	Description
1	ID	This is a unique string ID. It comprises a 2-letter header ("mk") followed by a Date Time code. Any unique string value is acceptable.
2	Group	This is unused and should be set to 0.
3	X Coordinate	For the .mrk file this will always be output in UTM Easting.
4	Y Coordinate	For the .mrk file this will always be output in UTM Northing.
5	Altitude	This is UTM Altitude and is currently unused.
6	UTM Zone Parallel	Zone latitudinal letter (e.g., 'C' through 'X').
7	UTM Zone Meridian	Zone longitudinal number (e.g., 1 through 60).
8	UTM Ellipsoid	Ellipsoid code (0 = Airy, 1 = Australian National, 2 = Bessel1841, 3 = Clarke 1866, 4 = Clarke 1880, 5 = Everest, 6 = GRS80, 7 = International 1924, 8 = Modified Airy, 9 = WGS84).
9	Point Size	Applies to Circle, Square & Triangle shape types only, otherwise set to 0.
10	Date & Time	Date & Time in English (GB) Locale. Format is "dd/mm/yyyy hh:mm:ss"
11	Shape Type	0 = Circle, 1 = Square, 2 = Triangle, 3 = Sonar Range, 4 = Pre-set Image (see Image Info below).
12	Shape Colour	Applies to Circle, Square and Triangle shape types only, otherwise set to 00000000 (32-bit RGBA).
13	Font Inner Colour	Applies to Comment Text (32-bit RGBA).
14	Font Outer Colour	Applies to Comment Text (32-bit RGBA).
15	Marker Bitwise	Bit 1 = Show Marker, Bit 2 = Show Coordinates, Bit 3 = Show Comment Text (i.e., 00000111 = Show All).
16	Image Info	Pre-sets = Red Flag, Blue Flag, Green Flag, Buoy, Anchor, Rock, Danger, POI, Viewport, Sonar, Diver, Wheel, Comment or MLO Alternatively can be full path and name of an image file (e.g., 'C: \Image1.bmp').
17	Comment	Comment text.

Shortened Marker File Format (.csv extension)

This file format is a more concise and usable format, particularly for loading a pre-defined marker list into Genesis. The file is in an ASCII Comma Separated format and contains the following fields:

Index	Value	Description
1	ID	This is a unique string ID. It comprises a 2-letter header ("mk") followed by a Date Time code. Any unique string value is acceptable.
3	X Coordinate	For the .csv file, will be in coordinate system used in Genesis (either Longitude or UTM Easting).
4	Y Coordinate	For the .csv file, will be in coordinate system used in Genesis (either Latitude or UTM Northing).
10	Date & Time	Date & Time in English (GB) Locale. Format is "dd/mm/yyyy hh:mm:ss"
11	Shape Type	0 = Circle, 1 = Square, 2 = Triangle, 3 = Sonar Range, 4 = Pre-set Image (see Image Info below).
16	Image Info	Pre-sets = Red Flag, Blue Flag, Green Flag, Buoy, Anchor, Rock, Danger, POI, Viewport, Sonar, Diver, Wheel, Comment or MLO Alternatively can be full path and name of an image file (e.g., 'C:\Image1.bmp').
17	Comment	Comment text.

Shortened .csv file variations

All field data

All 7 fields contain data as normally created when Genesis saves the .csv file.

First 4 fields only

There is no entry for Shape, Image Info or Date & Time. Since no shape data is available all the markers will use a red flag.

First 5 or 6 fields only

No Date & Time entry, also, if the Shape Type is 0, 1, 2 or 3 then the Image Info entry can be omitted (since there will be no need for it).

Appendix C - List of Current String Formats

Proc XYZ

The 'Proc XYZ' data message contains the World X, Y & Z co-ordinate position of the Responder/Transponder. The output message will include a message header and be in the following format, in accordance with the proprietary Input/ Output protocol.

```
"%D" + SlotReplyHdr + 'Proc XYZ' Nav Data Structure + <CR> <LF>
```

SlotReplyHdr Data Structure (sent in hexadecimal format)		
Data Description	Data Range	Data Types
Total Number of Bytes in Message in Hex (including Command and Reply codes)	NB	CARDINAL
Slot Number (range "01" to "0C")	SlotN	SLOTN
Generic Device Type	SourceTypes	SOURCEN
Data Reply Mode (0=ASCIIText, 1=Hex, 2=Binary, 3=CSV)	0,1,2 or 3	DIGIT
Send SeaKing Long = 3*, Send SeaKing Short = 2*, Send Raw data = 1, Send Processed Data = 0 (*Not applicable)	0,1,2 or 3	DIGIT
Example: Byte Count = Hex 0049 (73) Slot = 08 = MicronNav Source type = 32(Hex 20) = Null (not defined for MicronNav) Data reply mode is ASCIIText Send data = 0 = Proc XYZ ALWAYS Hex e.g., "0049082000"		

'Proc XYZ' Nav Data Structure		
Data Description	Data Range	Data Types
Unit ID (0 = Responder, 1..16 = Transponder)	0 to 19	SHORTCARD
World X co-ordinate (Easting), including datum position offset.	-9.99999E-37 to +9.99999E+37	REAL
World Y co-ordinate (Northing), including datum position offset.	-9.99999E-37 to +9.99999E+37	REAL
Vertical position relative to vessel transducer and including datum position offset (in millimetres, +ve is downwards)	000000000 to 100000000	LONGINT
Quality Flag / RMS Error. Larger values indicate better quality.	0.0 to 3.0	REAL
Valid Reply Set Bit 0 = 1 = Tx Transducer Ok Bit 1 = 1 = Rx 1 Transducer Reply Ok Bit 2 = 1 = Rx 2 Transducer Reply Ok Bit 3 = 1 = Rx 3 Transducer Reply Ok Bit 4 = 1 = Rx 4 Transducer Reply Ok e.g., Valid reply = Bits 1 to 4 set to 1 = "30" (or "31")	000 to 031	SHORTCARD
Time of data, local time = hhmmssdd	00000000 to 23595999	tohhmmssdd
<p>Example:</p> <p>Unit ID = 0 (Responder), World X co-ordinate (Easting) of 503868.427, World Y co-ordinate (Northing) of 6025011.669, Vertical Z co-ordinate of 4.102m, Quality Flag = 0.8, Valid reply Set = 30 (all valid), Fix taken at 15:31:56.</p> <p>ASCII Text = "%D004B082000000+5.03868427E+05+6.02501167E+06+0000004102+0.80000E +0003015315632<CR><LF>"</p> <p>CSV = "%D003E082030,0,503868.427,6025011.669,+4102,0.8,30,15315632<CR><LF>"</p>		

Raw XYZ

The 'Raw XYZ' data message contains the Relative X, Y & Z co-ordinate position of the Responder/Transponder. The output message will include a message header and be in the following format, in accordance with the proprietary RemV4 Output protocol...

"%D" + SlotReplyHdr + 'Raw XYZ' Nav Data Structure + <CR> <LF>

SlotReplyHdr Data Structure (this Data Structure is sent in Hex Format)		
Data Description	Data Range	Data Types
Total Number of Bytes in Message in Hex (including Command and Reply codes)	NB	CARDINAL
Slot Number (range "01" to "0C")	SlotN	SLOTN
Generic Device Type	SourceTypes	SOURCEN
Data Reply Mode (0=ASCIIText, 1=Hex, 2=Binary, 3=CSV) *CSV = Comma Separated ASCII	0 or 1 or 2 or 3	DIGIT
Send SeaKing Long = 3*, Send SeaKing Short = 2*, Send Raw data = 1, Send Processed Data = 0 *Not applicable	0 or 1 or 2 or 3	DIGIT
<p>Example: Byte Count = Hex 0049 (73) Slot = 08 = MicronNav Sourcetype = 32(Hex 20) = Null (not defined for MicronNav) Data reply mode is ASCIIText Send data = 1 = Raw XYZ ALWAYS Hex e.g., "0049082001"</p>		

'Raw XYZ' Nav Data Structure (this Data Structure is sent in Hex Format)		
Data Description	Data Range	Data Types
Unit ID (0 = Responder, 1..16 = Transponder)	0 to 19	SHORTCARD
Relative X co-ordinate. Horizontal distance athwart from reference position (in millimetres, +ve = towards starboard)	000000000 to 100000000	LONGINT
Relative Y co-ordinate. Horizontal distance fore/aft from reference position (in millimetres, +ve = forwards)	000000000 to 100000000	LONGINT
Relative Z co-ordinate. Vertical distance from reference position (in millimetres, +ve is downwards)	000000000 to 100000000	LONGINT
Quality Flag / RMS Error. Larger values indicate better quality.	0.0 to 3.0	REAL
Valid Reply Set Bit 0 = 1 = Tx Transducer Ok Bit 1 = 1 = Rx 1 Transducer Reply Ok Bit 2 = 1 = Rx 2 Transducer Reply Ok Bit 3 = 1 = Rx 3 Transducer Reply Ok Bit 4 = 1 = Rx 4 Transducer Reply Ok E.G. Valid reply = Bits 1 to 4 set to 1 = "30" (or "31")	000 to 031	SHORTCARD
Time of data, local time = hhmmssdd	00000000 to 23595999	hhmmssdd
<p>Example: Unit ID = 0 (Responder), Relative X co-ord of -18.686m, Relative Y co-ord of 4.764m, Relative Z co-ord of 4.1m, Quality Flag = 0.8, Valid reply Set = 30 (all valid), Fix taken at 15:31:56.</p> <p>ASCII Text = "%D0049082001000-0000018686+0000004764+0000004100+0.80000E+0003015315632<CR><LF>"</p> <p>CSV = "%D0033082031,0,-18686,+4764,+4100,0.8,30,15315632<CR><LF>"</p>		

TP-2EC

This 3rd party output string is taken from the TrackPoint positioning system. The string has 68 characters, and the format is ASCII fixed field with space separators. Leading 0's (except time) are space filled. X, Y, Z co-ordinate positions are relative values unless GPS is active in which case the co-ordinate outputs become Easting, Northing and Depth respectively.

The full string format is as follows:

'TP-2EC' Reply Data Structure		
Data Description	Data Range	Data Types
Unit ID, in Hex (0 = Responder, 1..F = Transponder)	0 to Fh (0 to 19)	i
Fix Time (Local Time)	00:00:00 to 23:59:59	hh:mm:ss
Compass Heading (degrees)	0 to 359	ccc
Position Bearing (degrees)	0 to 359.9	bbb.b
Position Slant Range (metres)	0 to 99999.9	rrrrr.r
X (or Easting)	0 to 999999.9	xxxxxx.x
Y (or Northing)	0 to 999999.9	yyyyyy.y
Z (or Depth)	0 to 99999.9	zzzzz.z
Telemetry	Always 0.0	t.t
Error	' (No Error) or ' 6' (Lost Signal)	ee
(Carriage Return + Line Feed)	N/A	<CR LF>
<p>Example: GPS is active so co-ordinates are World. Unit ID = 0 (Responder), Fix taken at 15:33:02, Compass Heading = 337°, Position Bearing = 277.6°, Position Slant Range = 20.8m, X Co-ord (East) of 503871.9, Y Co-ord (North) of 602501.0, Z Co-ord (Depth) of 13.0m, No Error.</p> <p>ASCII Output Always (on a single line) = "0*15:33:02*337*277.6****20.8*503871.9* 602501.0****13.0*****0.0***<CR><LF>"</p> <p>Where; "*" is a space (ASCII code 32), "" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).</p>		

Simrad HPR 300P

This 3rd party output string is taken from the Simrad HPR positioning system. The string has 48 characters, and the format is ASCII fixed field with space separators. Leading 0's (except time) are space filled. X, Y, Z co-ordinate positions are relative values unless GPS is active in which case the co-ordinate outputs become Easting, Northing and Depth respectively. For values greater than 999.9, the decimal point is removed (e.g., 1001.1 is output as "1001").

The full string format is as follows:

'\$HPR 300P' Reply Data Structure		
Data Description	Data Range	Field Range
Beacon / Unit ID (0 = Responder, 1..16 = Transponder)	0 to 19	ii
Transducer Number	Always 1	H
Beam	Always 'W'	B
Status	'OK' (No error) or 'NRY' (No reply)	SSS
Compass heading (degrees)	0 to 359.9	ccc.c
X (or Easting)	0 to 999999	xxxx.x (or xxxxxx)
Y (or Northing)	0 to 999999	yyyy.y (or yyyyyy)
Z (or Depth)	0 to 999999	zzzz.z (or zzzzzz)
Quality Flag, unused	Always 0.0	QQ.Q
(Carriage Return + Line Feed)	N/A	<CR><LF>
<p>Example:</p> <p>GPS is active so co-ordinates are World. Unit ID = 0 (Responder), Compass Heading = 119.5°, X Co-ord (East) of 339080, Y Co-ord (North) of 497512, Z Co-ord (Depth) of 13.7m, No Error.</p> <p>ASCII Output Always = "0**1**W***OK**119.5*339080*497512***13.7***0.0<CR><LF>"</p> <p>Where; "*" is a space (ASCII code 32), "<CR>" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).</p>		

Simrad HPR 410

This 3rd party output string is taken from the Simrad HPR positioning system. The binary output telegram is 70 bytes long. The binary telegram includes a Telegram Header and Tail in line with the Simrad HPR protocol. The contained Message Type is 'Message 1, Transponder Position Data' (Data Block of 62 bytes).

The full binary telegram format is as follows:

'\$\$HPR 410' Reply Data Structure		
Data Description	Data Range	Field Range
Header		
Start Character	Always 55h	ShortCard
Block Length	1 to 65536	Cardinal
Message Type	Always 1	ShortCard
Destination	Always 0	ShortCard
Message Block (62 bytes)		
Tp Index / ID (0 = Responder, 1..16 = Transponder)	0 to 19	Cardinal
Operation Mode	Always 0	ShortCard
Sync Mode	Always 0	ShortCard
Tp Mode/Type	0 = Transponder, 10 = Responder	ShortCard
Tp Operation	Always 1 (Mobile Tp)	ShortCard
Pos Data Form	Bit 0 (0 = vessel, 1 = north)	ShortCard
Reply Status	Fixed at 0 (= Okay)	ShortCard
Filt x pos - Filtered Horiz Distance athwart from reference pos (in metres)	-9.99999E-37 to +9.99999E+37	Real
Filt y pos - Filtered Horiz Distance fore/aft from reference pos (in metres)	-9.99999E-37 to +9.99999E+37	Real
Filt z pos - Filtered Vert Distance from reference pos (in metres)	-9.99999E-37 to +9.99999E+37	Real
X pos - Raw Horiz Distance athwart from reference pos (in metres)	-9.99999E-37 to +9.99999E+37	Real
Y pos - Raw Horiz Distance fore/aft from reference pos (in metres)	-9.99999E-37 to +9.99999E+37	Real

'\$\$HPR 410' Reply Data Structure		
Data Description	Data Range	Field Range
Z pos - Raw Vert Distance from reference pos (in metres)	-9.99999E-37 to +9.99999E+37	Real
Slant Range - Raw Slant Range from transducer to Transponder (in metres)	-9.99999E-37 to +9.99999E+37	Real
P course - Vessel heading Course (in degrees)	-9.99999E-37 to +9.99999E+37	Real
P roll - Vessel Roll (+/-180 degrees)	-9.99999E-37 to +9.99999E+37	Real
P pitch - Vessel Pitch (+/-180 degs)	-9.99999E-37 to +9.99999E+37	Real
Td beam	0 = wide, 1 = narrow	ShortCard
Td type	Not used, Always 0	ShortCard
Td num	Always 1	Cardinal
Diagnostic	Not used, Always 0	Cardinal
Standard deviation, unused	Always 0.0	Real
Inst Data	Not used, Always 0	Real
Footer Tail		
Checksum(Sum of all bytes excluding Checksum and Stop Character)	1 to 65536	Cardinal
Stop Character	Always AAh	ShortCard
Example: The output telegram is binary so a viewable example is not given.		

NMEA \$RATTM

This NMEA 'Tracked Target Message' is a commonly used string in charting/navigation packages. The comma-separated ASCII string contains the target Range & Bearing and UTC Time-stamp. Target speed and course are not calculated and so are not contained in the string. Any fields with no calculated data will be padded with zero value data.

The full string format is as follows:

'\$\$RATTM' Reply Data Structure		
Data Description	Data Range	Field Range
NMEA string header	Always '\$RATTM'	hhhhhh
Comma separator	Always ','	,
Target number	00 to 99	ii
Comma separator	Always ','	,
Horizontal Target Distance from vessel (in nautical miles)	0 to 9.9999	d.dddd
Comma separator	Always ','	,
Target Bearing (degrees)	0 to 359.9	bbb.b
Comma separator	Always ','	,
Bearing Degrees identifier	'R' or 'T'	'R' (Relative) or 'T' (True)
Comma separator	Always ','	,
Target Speed, not calculated so padded with zero	Always '0.0'	s.s
Comma separator	Always ','	,
Degrees identifier, unused so defaulted to 'T'	'R' or 'T'	'R' (Relative) or 'T' (True)
Comma separator	Always ','	,
Distance of closest point of approach, not calculated so padded with zero	Always '0.0'	p.p
Comma separator	Always ','	,
Time to CPA, min, ("- " increasing), not calculated so padded with zero	Always '0.0'	t.t
Comma separator	Always ','	,
Speed/Distance units	Always 'N' (nautical miles)	K/N/S (km/ nautical miles/statue miles)

'\$\$RATTM' Reply Data Structure		
Data Description	Data Range	Field Range
Comma separator	Always ','	,
Target name (0 = Responder, 1..16 = Transponder)	e.g., "TARGET0" to "TARGET1"	ASCII variable field
Comma separator	Always ','	,
Target Status	'L' or 'T'	L = Lost, Q = Query in process, T = Tracking
Comma separator	Always ','	,
Target ?	Always null	R = Reference Target, otherwise null
Comma separator	Always ','	,
Time of data, UTC = hhmmss.ss	000000.00 to 235959.99	hhmmss.ss
Comma separator	Always ','	,
Type of acquisition	Always 'A'	A = Auto, M = Manual, R = Reported
Delimiter (asterisk)	Always '*'	*
Checksum (in Hexadecimal) (XOR of bytes between, but not inclusive of, '\$' and '*')	00 to FF	cc
(Carriage Return + Line Feed)	N/A	<CR><LF>
<p>Example: Target Number / Unit ID = 0 (Responder), Horizontal Target Range = 2 metres = 0.0011 nautical miles, Relative Target Bearing = 326.0°, UTC Time of reading = 005940.13.</p> <p>ASCII Output Always (on a single line) = "\$RATTM,00,0.0011,326.0,R,0.0,0.0,R,0.0,0.0,N, TARGET1,T,,005940.13,A*5B<CR><LF>"</p> <p>Where; "<CR>" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).</p>		

NMEA \$GPGGA

This NMEA string format is used for Global Positioning and mainly sent by GPS devices. It is a common format for providing co-ordinate positions in Latitude / Longitude format. There are a number of fields in this string that are not applicable and these fields have been set to sensible values as default.

The full string format is as follows:

'\$GPGGA' Reply Data Structure		
Data Description	Data Range	Field Range
NMEA string header	Always '\$GPGGA'	hhhhhh
Comma separator	Always ','	,
Time of data, UTC = hhmmss.ss	000000.00 to 235959.99	hhmmss.ss
Comma separator	Always ','	,
Latitude of Target in Degrees Min (Only valid when Compass and GPS input data are valid)	0 to 90 Degrees	DDMM.SSSS
Comma separator	Always ','	,
Latitude N or S	'N' or 'S'	a
Comma separator	Always ','	,
Longitude of Target in Degrees Min (Only valid when Compass and GPS input data are valid)	0 to 180 Degrees	DDDMM.SSSS
Comma separator	Always ','	,
Longitude E or W	'E' or 'W'	a
Comma separator	Always ','	,
GPS Quality Indicator	Always 2 (DGPS)	x
Comma separator	Always ','	,
Number of Satellites in Use	Always 7 (N/A)	xx
Comma separator	Always ','	,
HDOP	Always 2.2	x.x
Comma separator	Always ','	,
Antenna Altitude	Always 0.0	x.x
Comma separator	Always ','	,
Altitude Units Identifier	'M' for metres	a
Comma separator	Always ','	,
Geoidal Separation	Always 0.0	x.x

'\$GPGGA' Reply Data Structure		
Data Description	Data Range	Field Range
Comma separator	Always ','	,
Units Identifier	'M' for metres	a
Comma separator	Always ','	,
Age of Differential GPS data	Always 1.2	x.x
Comma separator	Always ','	,
Differential Reference Station ID	Always 1234	xxxx
Comma separator	Always ','	,
Delimiter (asterisk)	Always '*'	*
Checksum (in Hexadecimal) (XOR of bytes between, but not inclusive of, '\$' and '*')	00 to FF	cc
(Carriage Return + Line Feed)	N/A	<CR><LF>
<p>Example: UTC Time of reading = 144014.71, Target Latitude = 54° 22' 21.74" (N), Target Longitude = 2° 56' 25.07" (W).</p> <p>ASCII Output Always (on a single line) =</p> <p>"\$GPGGA,144014.71,5422.3624,N,00256.4178,W,2,07,2.2,0.0,M,0.0,M,1.2,1234*5C<CR><LF>"</p> <p>Where; "<CR>" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).</p>		

NMEA \$GPGLL

This NMEA string format is used for Global Positioning and mainly sent by GPS devices. It is a common format for providing co-ordinate positions in Latitude / Longitude format.

The full string format is as follows:

'\$GPGLL' Reply Data Structure		
Data Description	Data Range	Field Range
NMEA string header	Always '\$GPGLL'	hhhhhh
Comma separator	Always ','	,
Latitude of Target in Degrees Min (Only valid when Compass and GPS input data are valid)	0 to 90 Degrees	DDMM.SSSS
Comma separator	Always ','	,
Latitude N or S	'N' or 'S'	a
Comma separator	Always ','	,
Longitude of Target in Degrees Min (Only valid when Compass and GPS input data are valid)	0 to 180 Degrees	DDDMM.SSSS
Comma separator	Always ','	,
Longitude E or W	'E' or 'W'	a
Comma separator	Always ','	,
Time of data, UTC = hhmmss.ss	000000.00 to 235959.99	hhmmss.ss
Comma separator	Always ','	,
Fix Status (invalid if Ping not okay or no valid attitude or compass data)	'A' = Valid, 'V' = Invalid	x
Delimiter (asterisk)	Always '*'	*
Checksum (in Hexadecimal) (XOR of bytes between, but not inclusive of, '\$' and '*')	00 to FF	cc
(Carriage Return + Line Feed)	N/A	<CR LF>
Example:		
Target Latitude = 54° 22' 22.21" (N), Target Longitude = 2° 56' 23.91" (W), UTC Time of reading = 143231.51.		
ASCII Output Always = "\$GPGLL,5422.3701,N,00256.3986,W,143231.51,A*54<CR><LF>"		
Where; "<CR>" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).		

NMEA \$GPRMC

This NMEA string format is used for Global Positioning and mainly sent by GPS devices. It is a common format for providing co-ordinate positions in Latitude / Longitude format.

The full string format is as follows:

'\$GPRMC' Reply Data Structure		
Data Description	Data Range	Field Range
NMEA string header	Always '\$GPRMC'	hhhhhh
Comma separator	Always ','	,
Time of data, UTC = hhmmss.ss	000000.00 to 235959.99	hhmmss.ss
Comma separator	Always ','	,
Fix Status (N.B. Invalid if Ping not okay or no valid attitude or compass data)	'A' = Valid, 'V' = Invalid	x
Comma separator	Always ','	,
Latitude of Target in Degrees Min (Only valid when Compass and GPS input data are valid)	0 to 90 Degrees	DDMM.SSSS
Comma separator	Always ','	,
Latitude N or S	'N' or 'S'	a
Comma separator	Always ','	,
Longitude of Target in Degrees Min (Only valid when Compass and GPS input data are valid)	0 to 180 Degrees	DDDMM.SSSS
Comma separator	Always ','	,
Longitude E or W	'E' or 'W'	a
Comma separator	Always ','	,
Speed Over Ground (in knots)	Not calculated, always 0.00	x.xx
Comma separator	Always ','	,
Course Over Ground (in degrees)	Not calculated, always 000.00	xxx.xx
Date of data	Gregorian calendar 010100 to 311299	ddmmyy
Comma separator	Always ','	,

Magnetic Variation	N/A, always “	x
Comma separator	Always ‘,’	,
Delimiter (asterisk)	Always ‘*’	*
Checksum (in Hexadecimal) (XOR of bytes between, but not inclusive of, '\$' and '*')	00 to FF	cc
(Carriage Return + Line Feed)	N/A	<CR LF>

Example:

Target Latitude = 54° 22' 22.30" (N), Target Longitude = 2° 56' 25.51" (W), UTC Time of reading = 143221.57, Date of reading = 9th May 2008.

ASCII Output Always (on a single line) =

“\$GPRMC,143221.57,A,5422.3717,N,00256.4252,W, 0.00,000.00,090508,,*0F<CR><LF>”

Where; “<CR>” is Carriage Return (ASCII code 13), “<LF>” is Line Feed (ASCII code 10).

\$PSIMSSB

This 3rd party output string is taken from the Simrad HiPAP positioning system. The string is variable length ASCII with comma field separators. The X, Y, Z co-ordinate positions are relative values, unless the GPS is active, in which case the co-ordinate outputs become Easting, Northing and Depth respectively.

The full string format is as follows:

'\$PSIMSSB' Reply Data Structure		
Data Description	Data Range	Field Range
NMEA string header	Always '\$PSIMSSB'	hhhhhhhh
Comma separator	Always ','	,
Time of data (UTC time)	000000.00 to 235959.99	hhmmss.ss
Comma separator	Always ','	,
Beacon/Target ID (0 = Responder, 1..16 = Transponder)	B00 to B99	ccc
Comma separator	Always ','	,
Target Status	'A' = Okay, 'V' = Not Okay	A
Comma separator	Always ','	,
Error Code, left empty	Always blank	
Comma separator	Always ','	,
Coordinate system	'C' = Relative Cartesian, 'U' = Absolute UTM	A
Comma separator	Always ','	,
Orientation	'H' for Heading up & 'N' for North up (both when output is Relative XY), 'E' for Easting, Northing (when in Absolute UTM format)	A
Comma separator	Always ','	,
SW Filter	'M' for Measured, 'F' for Filtered	A
Comma separator	Always ','	,
X (or Easting)	0 to 999999	x.x
Comma separator	Always ','	,

Y (or Northing)	0 to 999999	y.y
Comma separator	Always ','	,
Z (or Depth)	0 to 999999	z.z
Comma separator	Always ','	,
Expected Accuracy, unused	Always 0.0	q.q
Comma separator	Always ','	,
Additional information	Always 'N'	A
Comma separator	Always ','	,
1st Additional value	Always blank	
Comma separator	Always ','	,
2nd Additional value	Always blank	
Delimiter (asterisk)	Always '*'	*
Checksum (in Hexadecimal) (XOR of bytes between, but not inclusive of, '\$' and '*')	00 to FF	cc
(Carriage Return + Line Feed)	N/A	<CR LF>

Example:

GPS is active so co-ordinates are World. Time of reading = 204854.17, Beacon ID = 00 (Responder), X Co-ord (East) of 538087.76, Y Co-ord (North) of 7039253.894, Z Co-ord (Depth) of 56.486m, Status = Okay.

ASCII Output Always (on a single line) =

"\$PSIMSSB,204854.17,00,A,,C,H,M,538087.760, 7039253.894,56.486,0.0,N,,*26<CR><LF>"

Where; "<CR>" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).

NMEA \$GPDBT

This NMEA string format is used for Water Depth data output and is the Depth Below Transducer value that is mainly sent by positioning devices. It provides the Z (Depth) coordinate output position in the USBL system.

The full string format is as follows:

'\$GPDBT' Reply Data Structure		
Data Description	Data Range	Field Range
NMEA string header	Always '\$GPDBT'	hhhhhh
Comma separator	Always ','	,
Depth in units of Feet	0 to 999999	f.ff
Comma separator	Always ','	,
Units Identifier	Always 'f'	U
Comma separator	Always ','	,
Depth in units of Metres	0 to 999999	M.MM
Comma separator	Always ','	,
Units Identifier	Always 'M'	U
Comma separator	Always ','	,
Depth in units of Fathoms	0 to 999999	F.FF
Comma separator	Always ','	,
Units Identifier	Always 'F'	U
Delimiter (asterisk)	Always '*'	*
Checksum (in Hexadecimal) (XOR of bytes between, but not inclusive of, '\$' and '*')	00 to FF	cc
(Carriage Return + Line Feed)	N/A	<CR LF>
<p>Example: Z (Depth) value = 54.12 metres. ASCII Output Always = "\$GPDBT,177.55,f,54.12,M,29.59,F*32<CR><LF>" Where; "<CR>" is Carriage Return (ASCII code 13), "<LF>" is Line Feed (ASCII code 10).</p>		

Current String Format Notes:

I/O Data Types			
Data Type	Binary Mode	Hex Mode	ASCII Text Mode
REMCH			“.”
REPCH			“%”
BOOLEAN	Nibble	“b”	“0” or “1”
DIGIT	Nibble	“n”	Any Digit “0” to “9”
CHAR	<byte>	<byte>	Any printable ASCII
SHORTCARD	<byte>	“Nn”	“000” to “255”
SHORTINT	<byte>	“Nn”	“-128” to “+128”
CARDINAL	<LSB><MSB>	“MmLI”	“00000” to “65535”
INTEGER	<LSB><MSB>	“MmLI”	“-32768” to “+32767”
LONGCARD	<LSB><.><.><MSB>	“Mm....LI”	“0000000000” to “4294967296”
LONGINT	<LSB><.><.><MSB>	“Mm....LI”	“-2147483648” to “+2147483647”
REAL	<LSB><.><.><MSB>	“Mm....LI”	“-9.99999E-37” to “+9.99999E+37”
LONGREAL	<LSB>,6*<><MSB>	“Mm.....LI”	“-9.99999999E-307” to “+9.99999999E+307”
TIME	<C><S><M><H>	“HhMmScCc”	“HHMMSSCC”
DATE	<D><M><Y>	“DdMmYyyy”	“DDMMYYYY”
SLOTN	<1..12>	“Nn” (“01” to “0C”)	“01” to “12”
SOURCEN	<0..99>	“Nn” (“00” to “63”)	“00” to “99”
DEVICEN	<0..99>	“Nn” (“00” to “63”)	“00” to “99”
NODEN	<1..16>	“Nn” (“01” to “63”)	“01” to “99”