applied acoustics

underwater technology

Easytrak Pyxis

3690 Series

Operation Manual

ISO9001:2015 Certificate No: QEC 80128837a/108/Q Rev: 001

Revision History

Issue	Change No.	Reason for change	Date
A	N/A	FIRST ISSUE	08/07/22

Contents

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modulus technology ltd carries out all technical support, servicing and repairs. If you have any technical issues with our products please contact the modulus technology team:

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Applied Acoustic Engineering Ltd has made every effort to ensure that the information contained in this manual is correct at time of print. However our policy of continual product improvement means that we cannot assume liability for any errors which may occur.

These written instructions must be followed fully for reliable and safe operation of the equipment that this manual refers to. Applied Acoustic Engineering Ltd cannot be held responsible for any issues arising from the improper use or maintenance of equipment referred to in this manual or failure of the operator to adhere to the instructions laid out in this manual. The user must be familiar with the contents of this manual before use or operation.

1. Introduction to the 3690 Easytrak Pyxis

This manual provides the user with information on the installation, operation and maintenance of the Easytrak Pyxis Inertial Ultra-Short Base Line (USBL) underwater acoustic positioning system..

The Easytrak Pyxis USBL takes the best of applied acoustic engineering's USBL technology and combines it with a highly advanced inertial navigation system (INS). To create a state of the art, inertially aided Ultra Short Baseline system capable of accurate subsea tracking with survey grade performance. The high precision combination of aae's Sigma 2 acoustic protocols and SBG Systems' OEM version of the Navsight Apogee INS brings together two leading names in the field of marine technology, resulting in aae's most accurate and long range positioning system, providing many time, cost and performance benefits to global survey operators.

As a tightly coupled, factory fitted package, Pyxis is a calibration free system able to immediately operate from any vessel as soon as the work site has been reached. The MEMS based INS does not fall under ITAR regulations, and the range restricted option means the whole system can be shipped unhindered and without export control to almost anywhere in the world. Available with omni-directional and directional transceiver options, and boasting an accuracy of up to 0.1% of slant range.

Easytrak Pyxis is ideal for surveys. Utilising the integrated INS and GNSS the absolute positioning of divers, sonar fish, ROVs, or seabed objects in UTM (Universal Transverse Mercator) co-ordinates can be achieved. With GNSS enabled, Easytrak Pyxis can also be used to navigate to and from the worksite indicated by an entered waypoint. Place marks can also be added to log items of interest.

The necessity of determining an accurate velocity of sound (VOS) through water is critical. VOS accuracy is important in two areas, (1) across the face of the transducer (used for measuring the bearing and depression angle to a target), and (2), the distance to and from the target (the range). To help overcome this source of error, a sound velocity profile may be loaded into Pyxis. Alternatively, if a sound velocity profile is not available, the operator can enter two values of VOS into Easytrak, one for the transceiver and a second for the beacon range calculation.

Depth beacons are recommended to provide greater positioning accuracy, particularly appropriate at low depression angles where the slightest change can result in a significant shift in the target's vertical position.

The integrated SBG Navsight and Apogee IMU provides a comprehensive inertial navigation solution. The factory calibrated OEM Apogee IMU integrated in the Pyxis Transceiver is the main motion sensing element and the most important performance driving factor coupled with the Navsight processing unit housed within the Pyxis console.

The integrated OEM Navsight embeds all the navigation algorithms processing, dual antenna, triple frequency GNSS receiver, capable of PPP and centimetre precision using RTK, plus all inputs and outputs interfaces.

An integrated lever arm alignment calibration tool is included to allow loosely coupled processing of lever arm data. Providing a solution for vessels of all sizes and manoeuvrability. The INS retains standalone functionality to provide vessel attitude, heave and position data to other sensors.

Note: Easytrak Pyxis takes about 90 seconds to initialise from power up.

2. USBL Basic Theory

Easytrak Pyxis is an Ultra Short Base Line (USBL) Acoustic Navigation System. The system uses a single compact transducer containing multiple receiving ceramics and an interrogate ceramic.

The receiving ceramics are so arranged that each can detect an acoustic signal from a target's transmission. The acoustic signals may arrive at slightly different times due to their different signal paths. From these time differences, the bearing and depression angle* to the target are computed.

For a TRANSPONDER, time taken from the vessel's interrogating transmission through the water to the reception of the target acoustic signal provides the range:

$$\text{Range} = \frac{\text{VOS x Travel-time}}{2} \text{ (m)}$$

The divide by 2 is because sound has to travel to and from the target i.e. twice the distance.

For a RESPONDER, time taken from the vessel electrical interrogate signal through a cable to the reception of the target acoustic signal provides the range:

$$\text{Range} = \text{VOS x Travel-time (m)}$$

Given range, bearing, and the depression angle, the relative position of the target beacon to the vessel transducer can be determined.

* The vertical angle between the horizon and the target

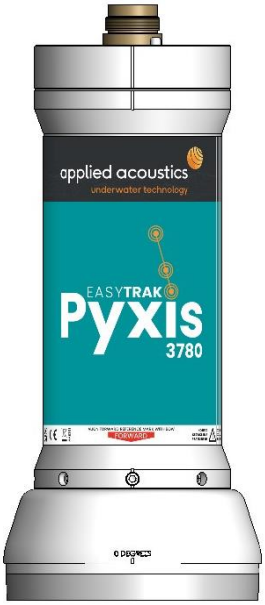
3. System Description

Easytrak Pyxis consists of an EZT-3690 console, EZT-3780 series transceiver, EZT-PC deck cable, 2 x GNSS antenna and up to 16 beacons.

Easytrak Pyxis 3690 Console Unit

Easytrak Pyxis is an advanced inertial Ultra Short Baseline (USBL) positioning and tracking system which incorporates Sigma Spread Spectrum Technology to provide a secure acoustic link The console integrates the main PC and INS processing unit and provides control and interfaces for the system. The console also provides power and communications to the Easytrak Pyxis Transceiver and GNSS antennas.

378X Series Easytrak Pyxis Transceiver



The Easytrak Pyxis transceiver transmits and receives acoustic signals using a multi element ceramic transducer. The transceiver is fitted with a factory calibrated and aligned survey grade IMU to provide attitude information for the acoustic solution. The transceiver calculates the position of dynamic subsea targets through the transmission and reception of acoustic signals between the submerged transceiver and the target beacon. The transceiver also has an integral depth and temperature sensors.

1100 and 1300 Series Beacon

The 1100 and 1300 Series Beacon incorporates Spread Spectrum Technology; the wide bandwidth transmissions reducing its susceptibility to interference thus enabling accurate positioning and secure data transmission. AAEs beacons retain flexibility by incorporating tone burst channels and analogue data telemetry options as standard. The 1100 series beacons may be connected to the Pyxis console to read and change the beacon configuration if required.

4. Installation

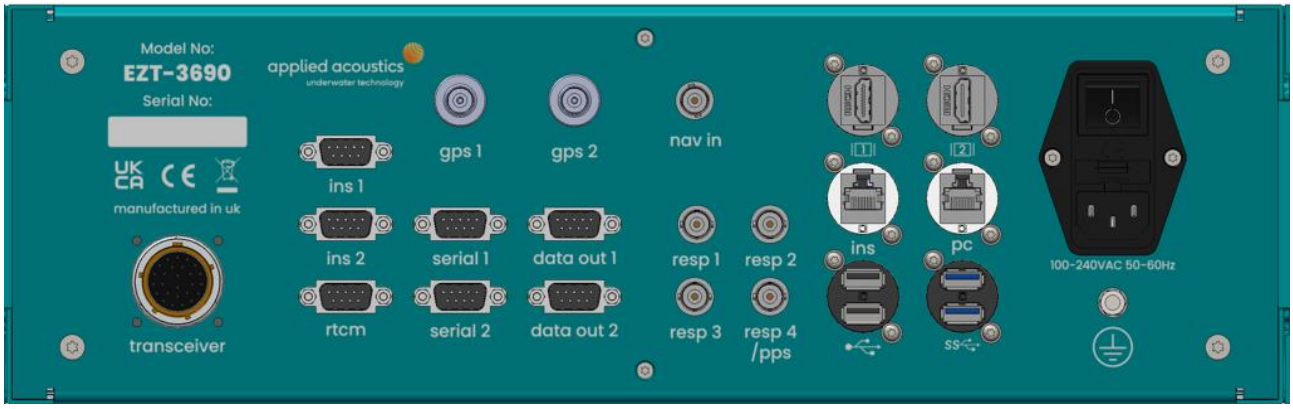
Easytrak Pyxis 3690 Console Unit

Front Panel

USB Port x 2	User USB connections
On // Off Switch	With VAC supply connected and switched on, press to start

Rear Panel

Ensure the console is secured to prevent falling or sliding due to vessel movement. The console can be mounted in a standard 19’ rack.



transceiver: connection to the Pyxis transceiver using the Pyxis deck cable.

ins 1(B) and ins 2(C): ins port B and C serial ports available for data output or external sensor interface.

serial 1 and 2: 2 serial ports available for external sensor interface, aux inputs and for a secondary data out configuration.

data out 1 and 2: 2 serial ports available for data out configuration.

gps 1: TNC connection for primary gps antenna (1).

gps 2: TNC connection for secondary gps antenna (2).

nav in: external trigger for beacon position cycle synchronistion.

resp 1 to 4: 4 BNC connection to beacon to be triggered in responder mode. Responder 4 is PPS output or responder.

HDMI 1 and 2: 2 HDMI monitor connections.

ins LAN: Ethernet connection to INS for UDP data out.

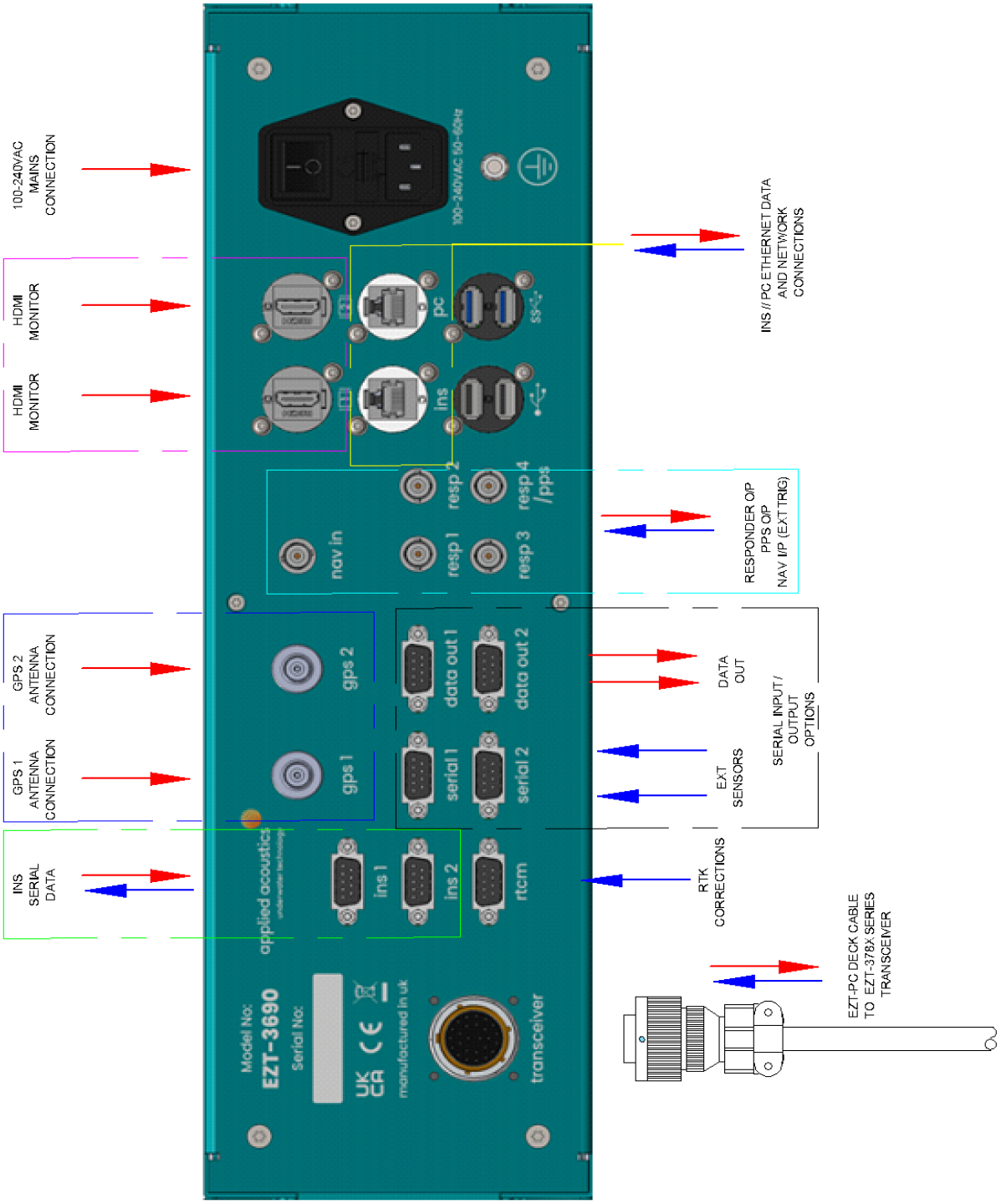
pc LAN: Ethernet connection to PC for remote VNC desktop, internet connection and UDP USBL data out

USB 3: 2 USB 3 ports.

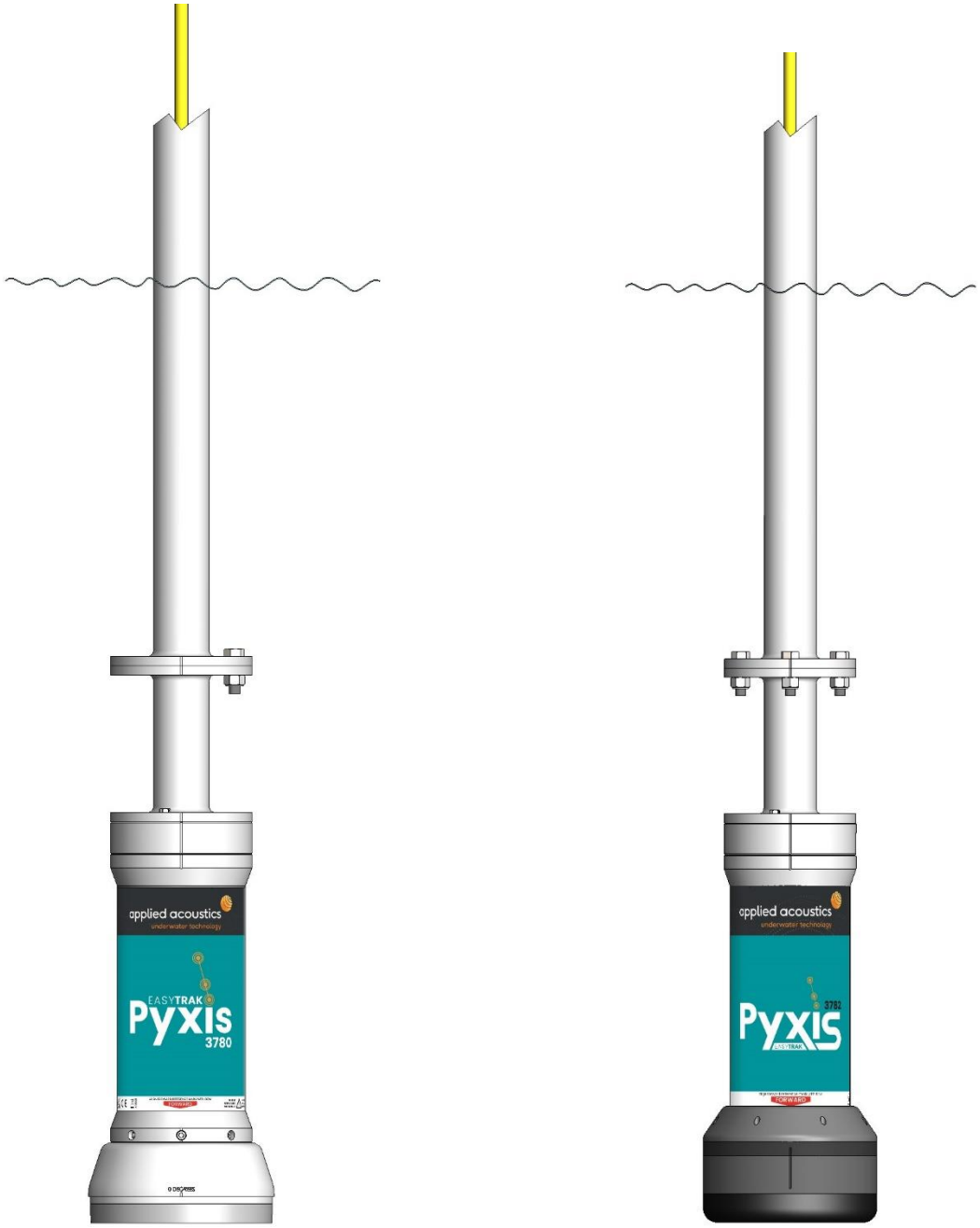
USB 2: 2 USB 2 ports.

mains inlet: The power supply is auto-ranging (115 – 230VAC 50/60Hz).

earth: chassis earth connection.

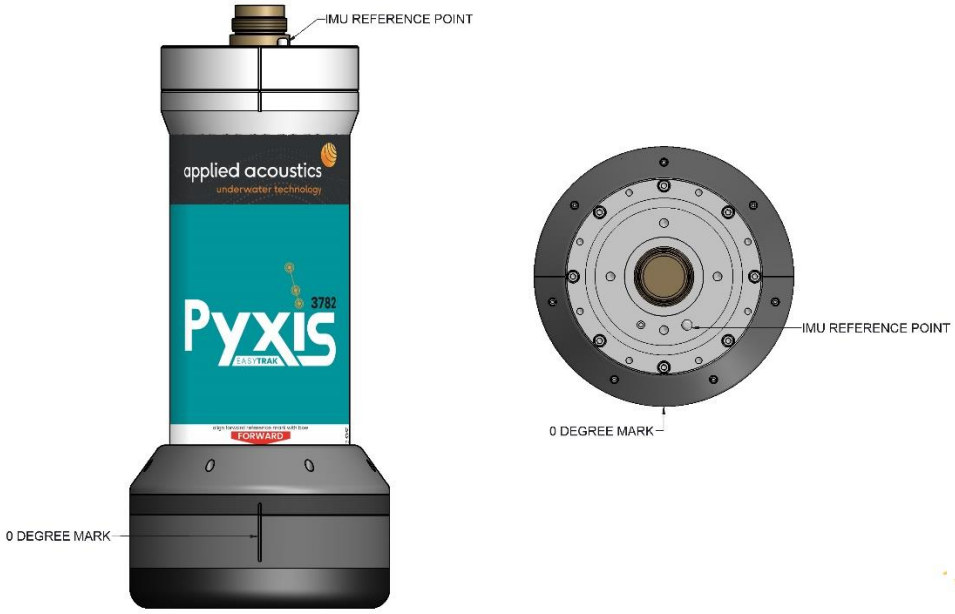

100-240VAC MAINS CONNECTION
HDMI MONITOR
HDMI MONITOR
INS // PC ETHERNET DATA AND NETWORK CONNECTIONS
RESPONDER O/P
PPS O/P
NAV I/P (EXT TRIG)
GPS 2 ANTENNA CONNECTION
GPS 1 ANTENNA CONNECTION
INS SERIAL DATA
DATA OUT
EXT SENSORS
SERIAL INPUT / OUTPUT OPTIONS
RTK CORRECTIONS
EZT-PC DECK CABLE TO EZT-378X SERIES TRANSCEIVER
100-240VAC 50-60Hz
pc
ins
nav in
resp 1
resp 2
resp 3
resp 4 /pps
gps 2
gps 1
data out 1
data out 2
serial 1
serial 2
ins 1
ins 2
rtcm
transceiver
applied acoustics
Model No:
EZT-3690
Serial No:
manufactured in uk

Easytrak Pyxis 378X Transceiver Deployment



System installation is the responsibility of the operator.
For advice and assistance please contact:

Email techsupport@modulustechnology.com
Tel: +44 (0)1493 416452
Fax: +44 (0)1493 440720


IMU REFERENCE POINT
applied acoustics
underwater technology
Pyxis
3782
EASYTRAK
FORWARD
0 DEGREE MARK
IMU REFERENCE POINT
0 DEGREE MARK


IMU REFERENCE POINT
applied acoustics
underwater technology
EASYTRAK
Pyxis
3780
FORWARD
0 DEGREE
0 DEGREE MARK
IMU REFERENCE POINT
0 DEGREE MARK

Pole Mounted – Over the Side

The Easytrak Pyxis transceiver can be fixed over the side of a ship with a suitable pole. The pole mount should be rigid to provide a stable platform for the transceiver whilst the vessel is underway at the desired operating speed. The diameter of the pole will depend on the length required and the anticipated maximum speed of the ship. It is recommended that the pole be secured by cables fore and aft to prevent bending and strumming when the ship is underway.

Ensure that when deployed the transducer is at least 1 metre below the draft of the vessel and that it has clear horizontal visibility through 360°. Ensure the alignment mark on the transducer is inline (forward) with the forward / aft line of the vessel. Extreme care has to be taken in shallow water that the transducer does not strike the seabed.

See appendix A for mounting bracket dimensions.

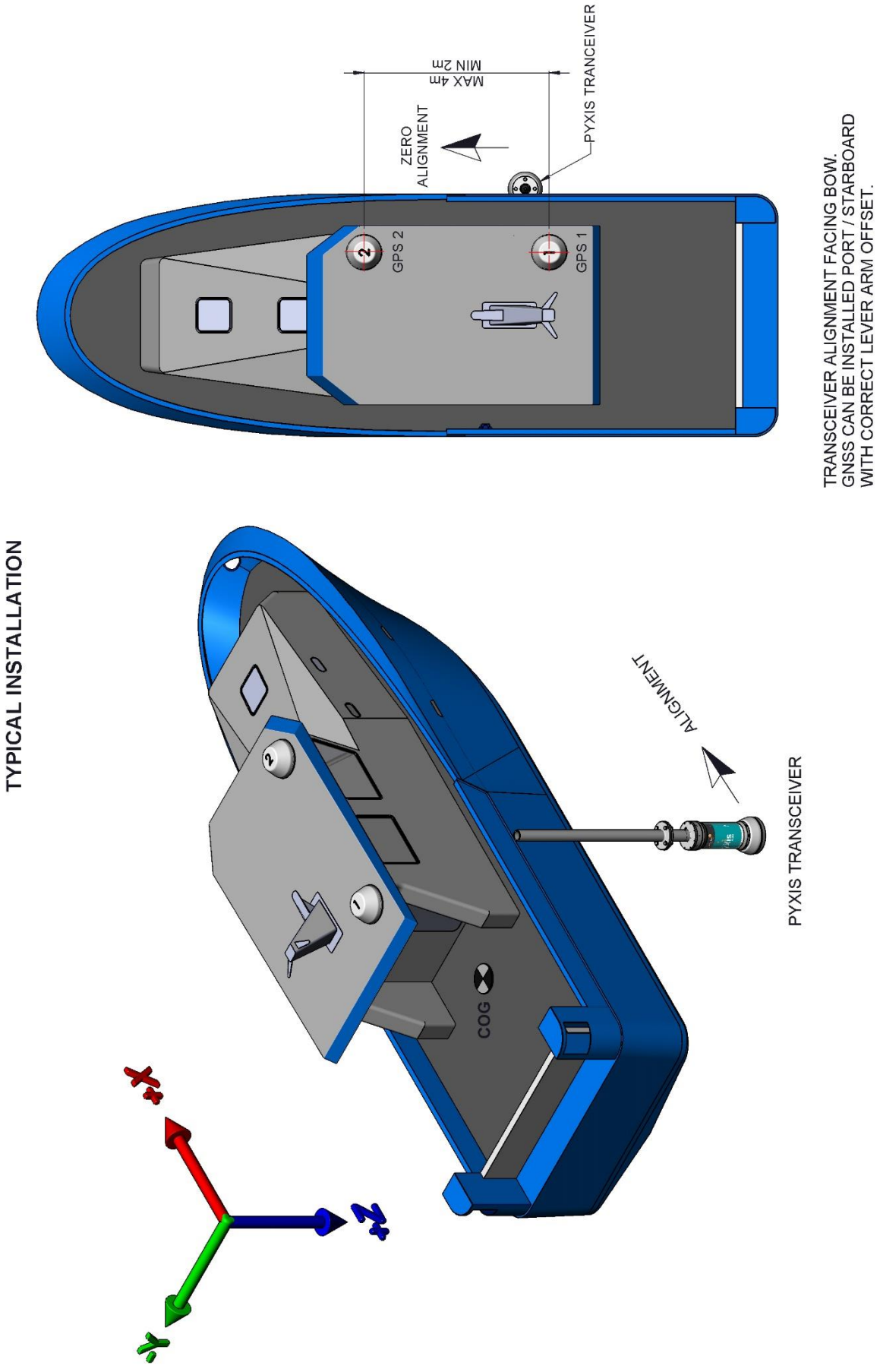
Pole Mounted – Through a Gate Valve

Ensure the gate valve is of a suitable diameter to take the transducer and any mounting hardware. The transducer should be mounted on a suitable shaft; see appendix C for transceiver mounting dimensions.

Ensure that when deployed, the transducer's black potted end is below the draft of the vessel by at least 1 meter and that it has clear horizontal visibility through 360°.

The gate valve's deployment system must be designed to ensure that the alignment mark on the transducer is inline (forward) with the forward / aft line when positioned through the gate valve.

Note: Please see Section 8 INS Alignment.


TYPICAL INSTALLATION
TRANSCEIVER ALIGNMENT FACING BOW.
GNSS CAN BE INSTALLED PORT / STARBOARD
WITH CORRECT LEVER ARM OFFSET.
PYXIS TRANCEIVER
MAX 4m
MIN 2m
ZERO
ALIGNMENT
GPS 2
GPS 1
ALIGNMENT
PYXIS TRANSCEIVER
COG
X
Z
Y

Deck Cable

Connects the Pyxis Transceiver to the Pyxis Console. To prevent damage to the cable and minimise potential problems, please ensure the following points are observed:

- Ensure personnel cannot step on, or trip over, the deck cable.
- Keep the cable away from sources of electrical noise such as electrical generators, sonar sources (bang boxes etc.).
- Avoid trapping the cable in doorways, hatches and alike.
- Ensure the cable is not bent less than the minimum bend radius of **150mm**.
- Ensure the cable is not laid over sharp edges.
- When deployed over the side of a vessel, ensure that the cable is secured to any mounting pole to prevent chaffing, strumming, and excessive movement.
- Ensure the polyurethane outer jacket of the cable is not breached allowing water ingress.

5. Operation

Power Up

- Ensuring connections are made as Section 4; the Easytrak Pyxis can be powered up.
- Switch the main power button on the rear panel.
- Press the On/Off button on the front panel. The switch will indicate green.
- The system will automatically launch and set the configuration to the selected setup.

Note: System boot is approx. 90 seconds, allow INS data to show active.
The INS warm up time is 5 mins post boot.

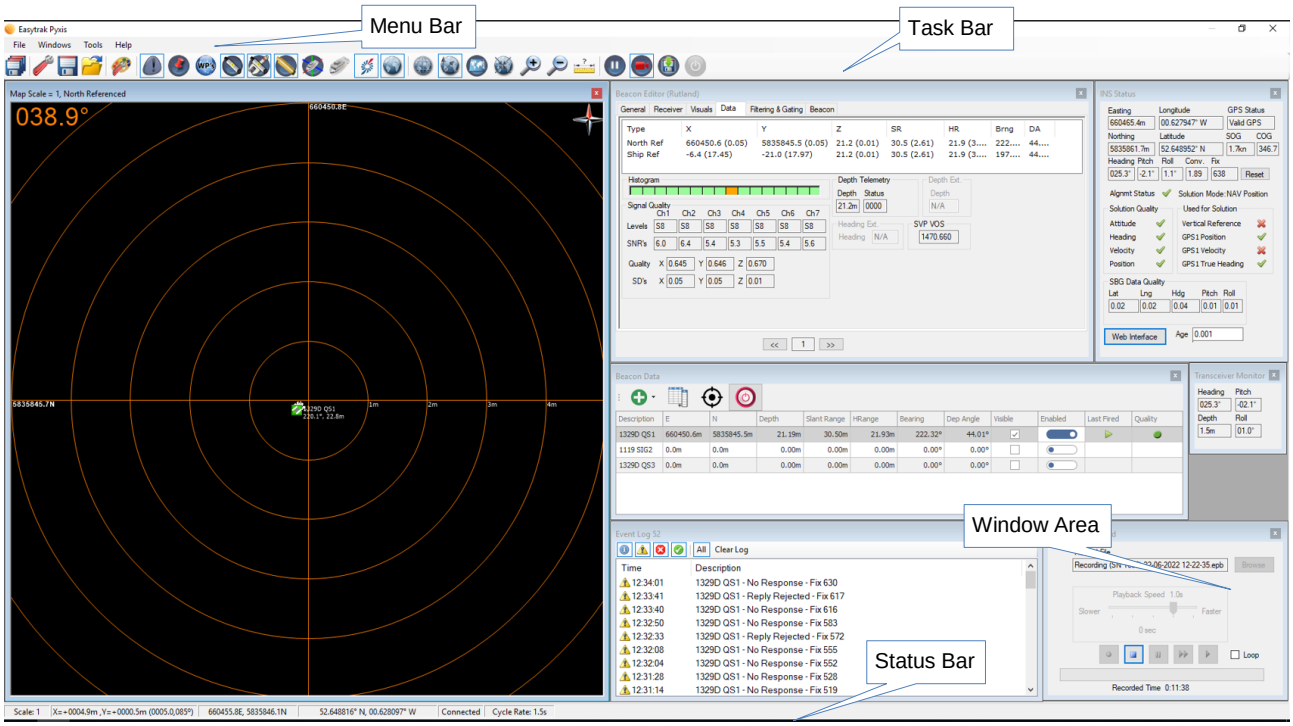
- To power down the system briefly press the power button the front panel. This will perform a controlled shut down of the system.
- The mains power can be isolated by the rear switch.

Front Panel Indicators

transceiver power	Green when power is applied to transceiver
system status	Green when system is operation
ins status	Green when ins is operation
tx / rx	Flashes green when transceiver has transmitted or received an acoustic signal
serial 1, 2	Green when external data is connected and decoded

6. Easytrak Pyxis Software

Overview



The software provides an intuitive user interface to configure, operate and monitor the Easytrak Pyxis system.

The system setup, beacon setup and visual preferences can all be saved into individual configuration files. A startup configuration may be selected from any combination of these files for quick startup of the system. Previously saved files can be reloaded for easy reconfiguration of the system. There is no limit to the number of setup files that may be saved on the system so multiple setups can be pre-configured.

Each of the display windows can be accessed from either the Menu bar, from the Tool Bar or via a keyboard shortcut. Each window can be resized and positioned as required or auto-positioned within the window area. There is a Status Bar, with system and positional information.

Many windows also have 'Context Menus', with functions available that are appropriate to the window that the mouse is currently over. The context menus are available by pressing the right mouse button

Task & Menu Bar

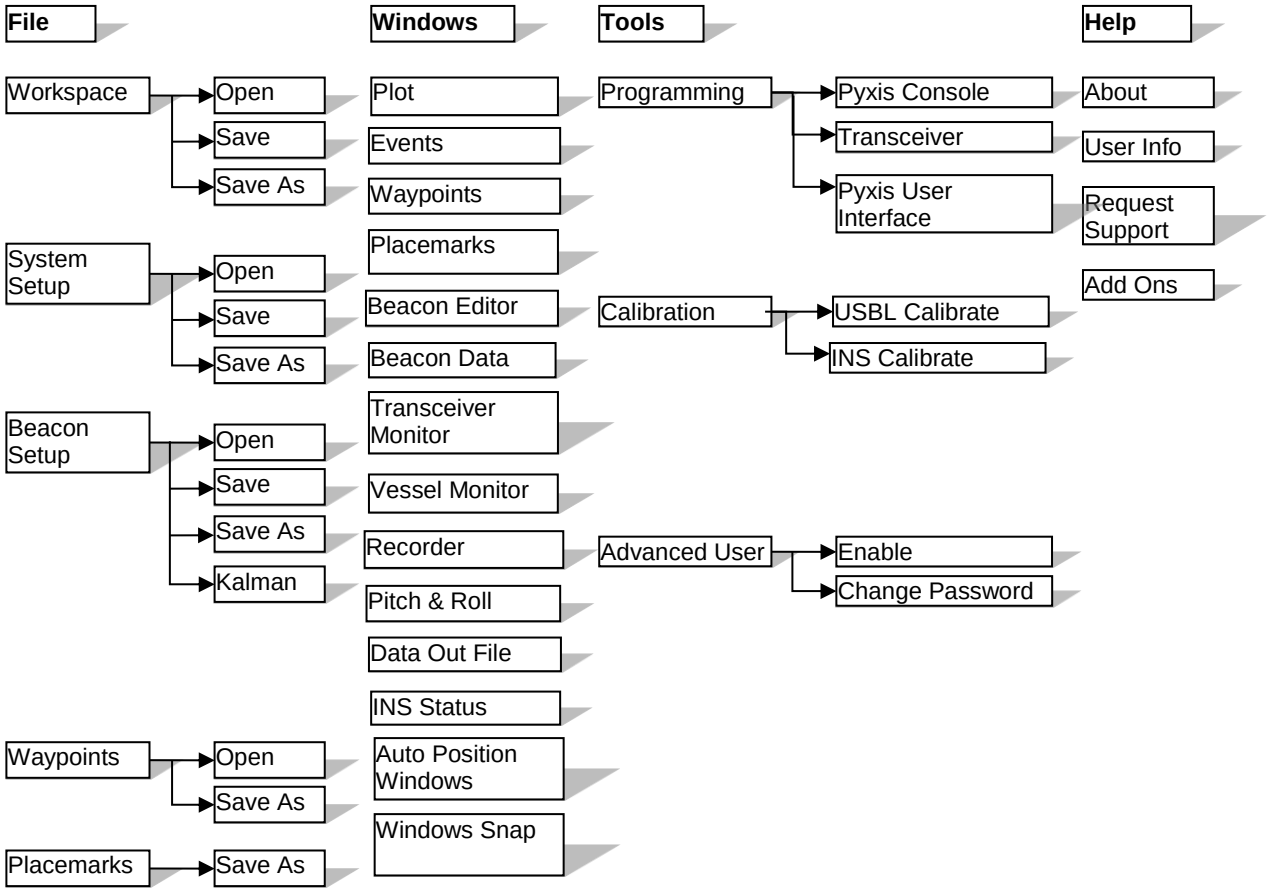
Most commonly used tools and windows are accessible through the following short cuts

	Save All Configuration Files
	Edit System Configuration
	Save System Configuration
	Open System Configuration
	Edit Workspace Configuration
	Display/Hide Event Log Window
	Display/Hide Placemarks Window
	Display/Hide Waypoints Window
	Display/Hide Beacon Data Window
	Display/Hide Beacon Editor Window
	Display/Hide Transceiver Monitor Window
	Display/Hide Vessel Pitch & Roll Window
	Display/Hide Vessel Monitor Window
	Display/Hide INS Monitor Window
	Display/Hide Plot Window
	Set Plot Window to Grid Display Mode
	Set Plot Window to Polar Display Mode
	Revert to previously selected centralize mode
	Enable Map Overlay on Plot Window
	Plot Window – Zoom In
	Plot Window – Zoom Out
	Enable Measurement Mode
	Pause ALL beacon tracking

	Display/Hide Recorder Window
	Display/Hide Data Out File Window
	Power Up Transceiver (only enabled if auto power down has occurred)

From the Menu Bar additional functions for system configuration and tools can be found

Menu bar File Structure



** Available in advanced user mode only

Pyxis Configuration

The Pyxis configuration is divided into four areas:

- Workspace
  This is where visual elements of the setup are defined. This includes the visibility and position of windows, visual preferences such as text colour and other visual options.
- System
  The setup of external inputs such as GPS, Gyro, VRU. Data output and operating modes may be setup within this area.
- Beacon
  The setup of beacons, such as frequencies, ranges, types etc. are configured within the beacon editor. 1000 or 1100 Series beacons may be connected to display and set beacon properties.
- INS

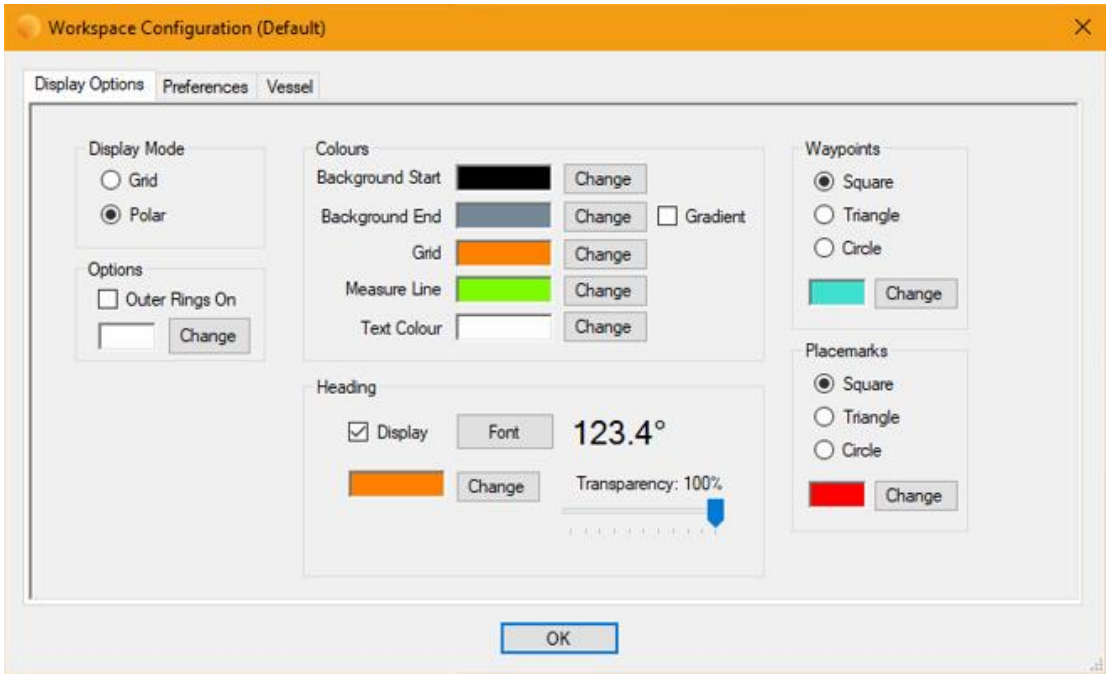
  The INS settings required for the Pyxis operation are configured and monitored during operation. Any user / vessel specific settings including lever arm offsets are stored in system setup. Other INS settings for data out puts are saved within the Navsight processing module.

Workspace Configuration

Toolbar Button: 

The three tabs contained within the workspace configuration are described below. Note that the title bar of this window shows the name of currently loaded workspace file in brackets.

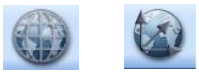
Display Options



The Display Options tab allows the operator to configure the display to their preference for the local environment. For example - by altering the colour scheme 'workspaces' can be created for day and night operations.

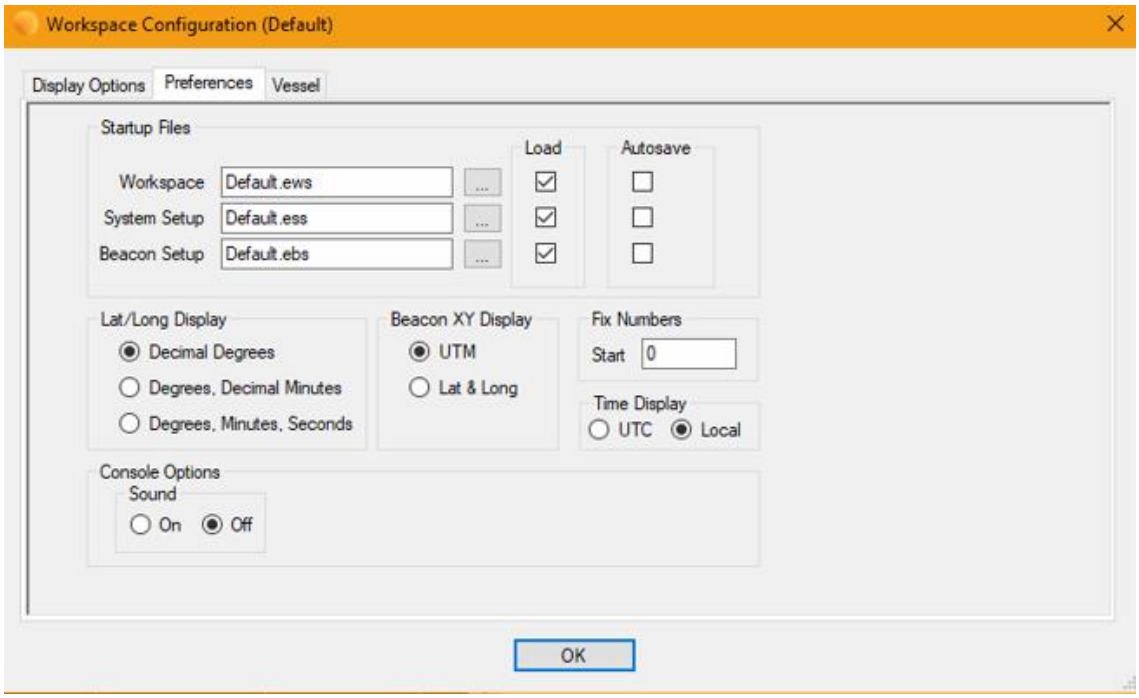
Display Mode

The Plot data can be controlled from this tab, the mode either Grid or Polar can be selected. This is also controlled from shortcuts on the tool bar.



Preferences

The Preferences tab allows the operator to set the Nexus configuration files that will be automatically loaded on startup of the system.



Startup Files

Any combination of startup files may be selected. The auto loading of individual files may be enabled/disabled using the 'Load' checkbox. If 'Autosave' is checked then the file will automatically be saved when closing down the unit.

Lat/Long Display

The positions of beacons and vessel may be displayed in either UTM's or Lat & Long mode. If Lat & Long mode is selected then the format can be either decimal degrees, degrees and decimal minutes or degrees, minutes and seconds

Fix Numbers

The start value of the vessel fix number may be set. A zero will result in the first beacon interrogation being fix number one.

Time Display

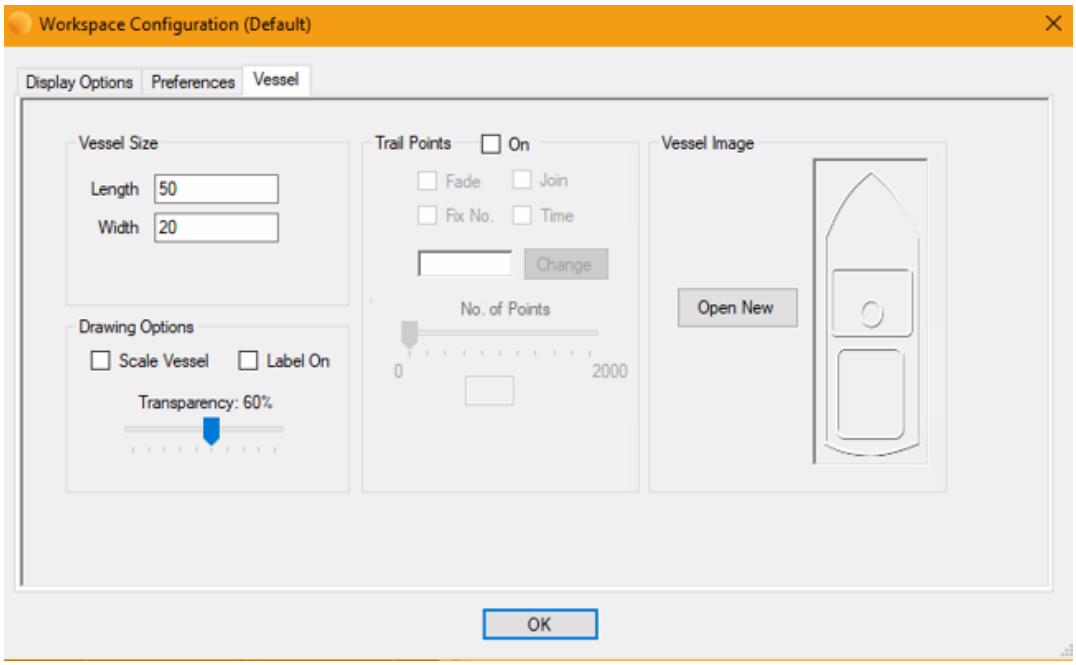
Time and date values within the system may be displayed as either UTC or local time.

Console Options

The console sounds may be turned on or off.

Vessel

The Vessel tab allows the operator configure the plot display for the vessel.



Vessel Size & Drawing Options

Drawing options allow the vessel to be scaled, to display a label showing the heading and position and to set the transparency of the vessel on the plot window.

Trail Points

Trail points for the vessel can be configured, including the number of points, the colour of the trail points and whether the end of the trail fades away. The points may be joined and also the fix number and time can be displayed at fixed intervals.

Vessel Image

The vessel image option allows the user to select the vessel image that will be used for the plot window. The user can select from a number of predefined vessel images to suit the display. If required the user can add their own vessel image (this must be in a .png format).

System Configuration

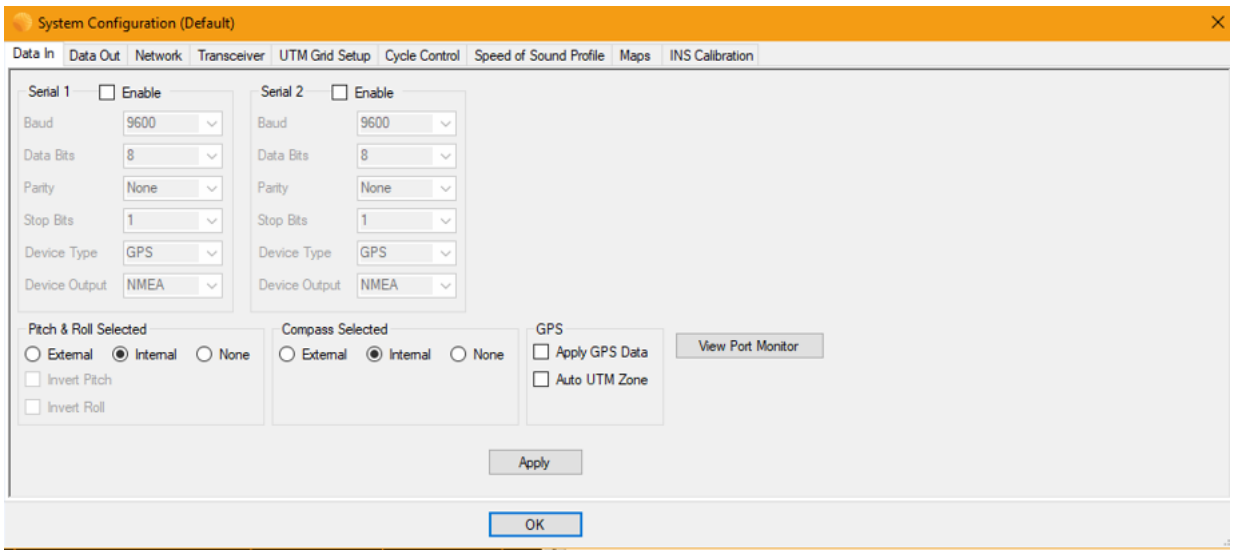
Toolbar Button: 

The eight tabs contained within the 'System Configuration' area are described below. Note that the title bar of this window shows the name of currently system configuration file in brackets.

All system configuration settings can be saved to file for quick setup. The system can load any saved configuration on startup (configured in Workspace -> Preferences).

Data In

The 'Data In' tab of the system configuration allows the Serial Ports to be configured for external inputs GPS, VRU ,Gyro, Target Depth, Target Heading & Beacon (AAE 1000 and 1100 series only). A device type of 'Multiple' may also be selected, in this mode heading (gyro) and GPS data may be input on a single port.



Serial set-up options:

Baud rate: 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, and 921600
Data bits: 8.
Stop bits: 1, or 2.
Parity: None, Even, or Odd.

Serial port settings changed on this tab will only be applied to the system upon clicking 'Apply' or 'OK'. A validity check will be performed before applying the settings and a warning will be displayed if the check shows a potentially invalid setup (i.e. more than one port configured for Gyro input).

Compass Selected/Pitch & Roll Selected

There are controls for the source of the Compass, Pitch and Roll sensors. These can be set to internal, external or none, depending on the desired configuration. If external pitch and roll is selected, then the pitch and roll values may be inverted if required.

GPS

If GPS is interfaced, the external positional data can be applied to the calculated position to give an absolute position of the target. Tick 'Apply GPS Data' to calculate absolute positions. Go to the UTM Grid Setup tab to configure the local grid origins.

For GPS time synch only, configure a serial port and do not apply GPS data.

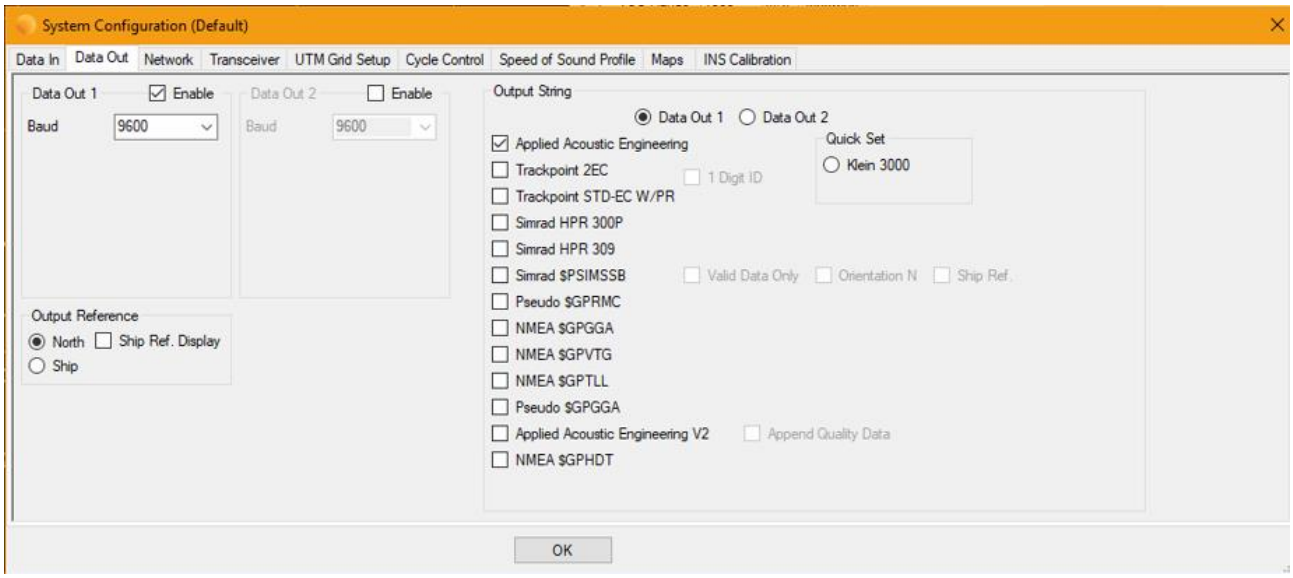
Auto UTM function, tick box to select. The UTM grid will be automatically calculated once upon valid GPS position. To re-calculate toggle function on / off.

View Port Monitor

The 'View Port Monitor' button may be used to view valid data being received on each serial port in real time.

Data Out

The Data Out tab is the RS232CC communications set-up for the output of serial data. The Pyxis has 2 serial RS232 data ports on the rear panel.
Data is output after each Fix is processed (not at a pre-defined rate).



Output Reference

The data type viewed on the Plot window is linked to the data out port, the data type can be controlled from this tab or via the Plot Window \ Context Menu. The link between viewed data and exported data is for QC purposes.

- North Ref
  Positions are referenced to the NORTH. Compass, pitch, roll, and offset values are applied to the computed position. A Compass must be used to be north referenced, otherwise the data will be ship (bow) referenced.
- Ship Referenced
  Positions are referenced to the bow of the vessel. Compass, pitch, roll, and offset values are applied to the computed position if available.

Output String

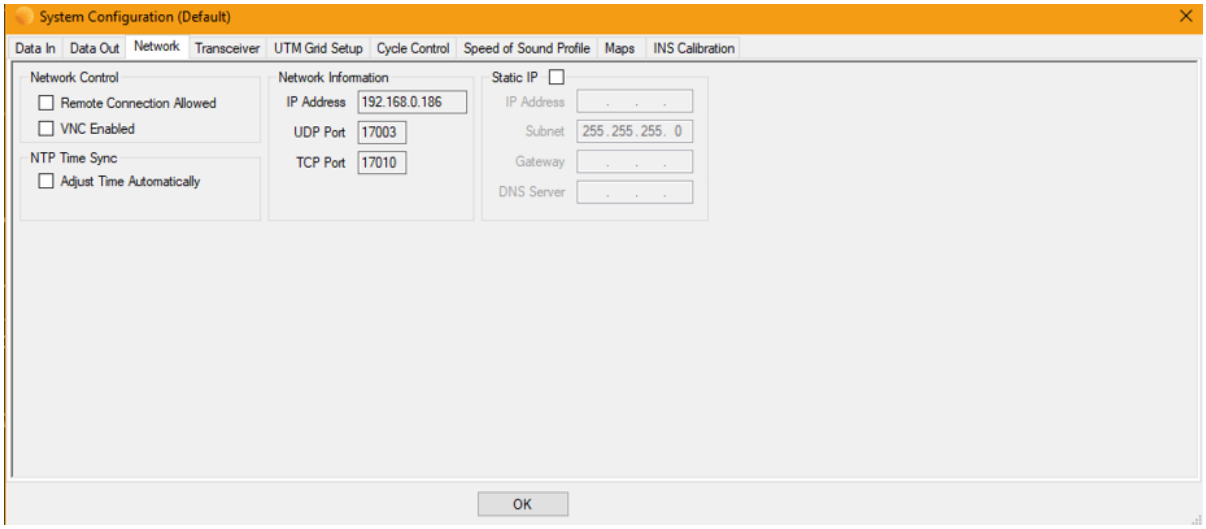
The output string mode can be selected from a number of pre-defined output formats. The primary and secondary output strings may be configured independently by selecting the required output string destination radio button. Any number of output formats may be selected. If more than one selection is made then each string will be appended, each individual string will be terminated with a carriage return and line feed. A quick set option for Klein 3000 enables all required output messages to be selected.

String	Description
AAE	Applied Acoustic Engineering's string
TPII-2EC	Simplified version of the ORE Trackpoint 2EC string
TP-EC W/PR	ORE Trackpoint string including pitch & roll
Simrad 300P	Simplified version of the Simrad string
Simrad 309	Simplified version of the Simrad string
Simrad $PSIMSSB	HiPAP NMEA format strings
Pseudo $GPRMC	Pseudo GPS format string
NMEA $GPGGA	NMEA GPGGA format string
NMEA $GPVTG	NMEA GPVTG format string
NMEA $GPTLL	NMEA GPTLL format string
Pseudo $GPGGA	A custom GPGGA string with target position instead of vessel position in standard GGA message
Applied Acoustic Engineering V2	Applied Acoustic Engineering's V2 $AADS1 string
Klein 3000 (Quick Set)	Requirements for the Klein 3000 SSS. The strings $GPGGA, $GPVTG, & $GPTLL are selected

If GPS data is available, the data output strings $PSIMSSB, $PSIMSNS, $GPRMC use GPS UTC time and date. If not available Easytrak's internal date and time is used

Network

The system may be connected to a network. Once connected, a number of system features are enabled.



UDP Broadcasts

If connected to a network, the output string from the Nexus system is also sent out as a UDP broadcast, to the network, on the UDP port number specified in Network Information

Network Control

A limited number of system parameters may be controlled via a TCP network interface (see Appendix F for details).

Remote Connection Allowed

Select this option to allow remote TCP connections to the Nexus console. The connection will only be accepted on the TCP port number specified in Network Information

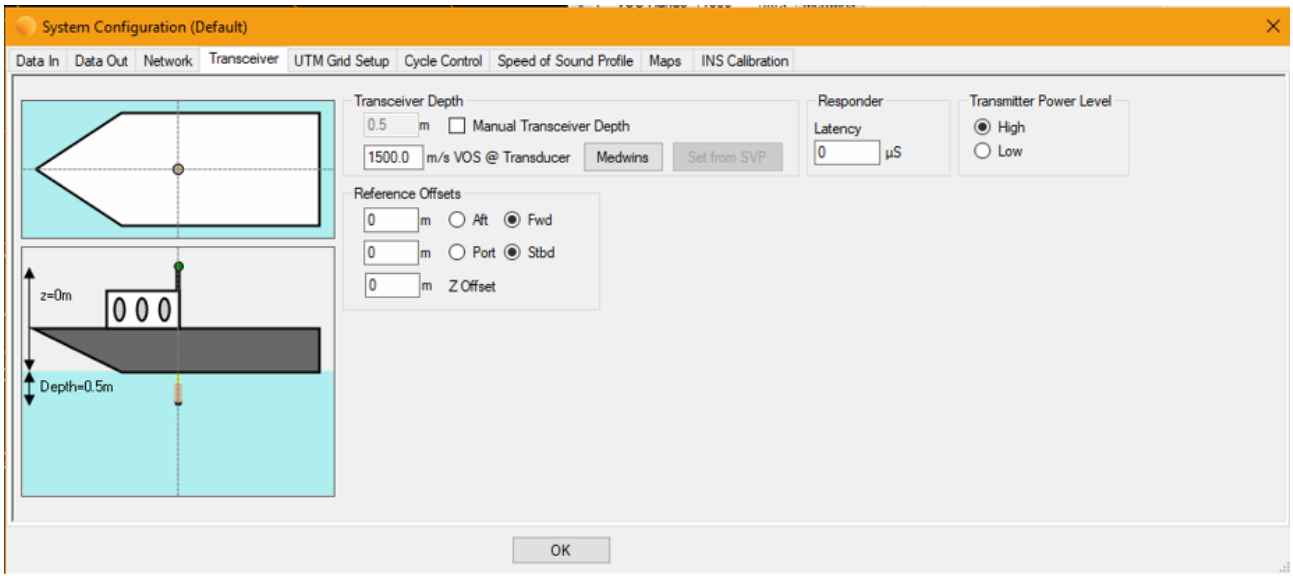
Network Information

The IP address of the Pyxis system is displayed, along with the UDP port number used for broadcast data. The TCP port number used for incoming remote connections is also shown here.

The UDP port number and the TCP port number may be changed when in Advanced User mode

Transceiver

The position calculated by Easytrak Nexus 2 Lite is referenced to the transducer, by entering the installation offsets the position can be referenced to another part of the vessel, for example, the navigation antenna or CRP.



The following offsets are available: Forward/Aft (m), Port/Starboard (m), Z (Height m). Transducer depth (m) below water line.

Reference Offsets

Offsets are the measured distances from the reference point to the transceiver. The vessel plan diagrams update with an indication of the transceiver position referenced to the desired point.

Transceiver Depth

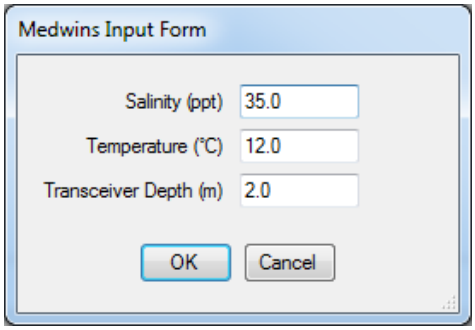
The depth of the transceiver must be entered manually.

Responder Latency

The responder latency parameter is applicable only when the responder output is used in conjunction with an external data multiplexer (E.G. Side scan tow fish or ROV system). Any transmission delay/latency added to the responder signal by the multiplexer system is entered here.

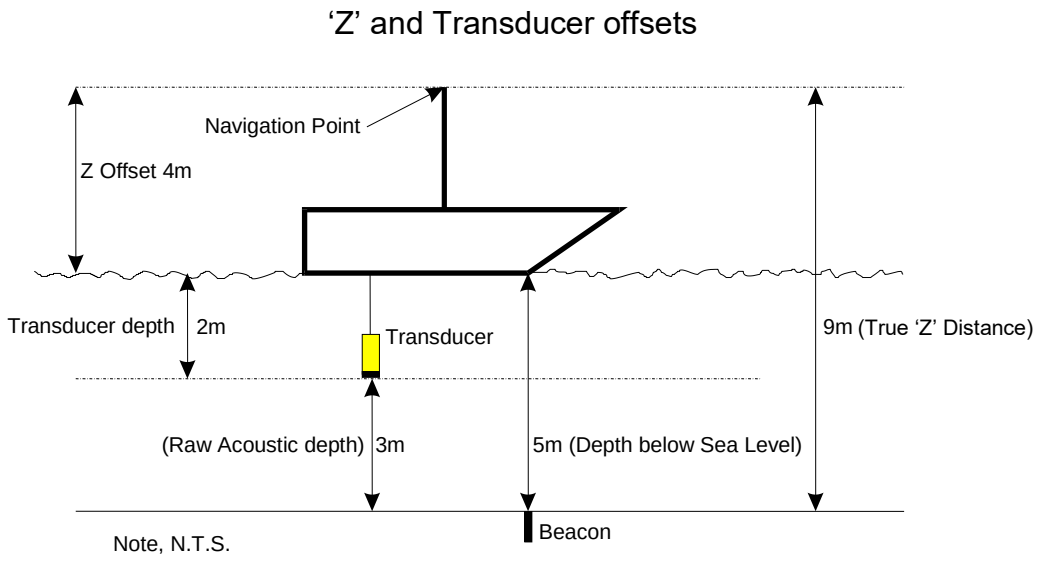
Velocity of Sound at Transducer Face (VOS)

Enter the Velocity of Sound (VOS) for transmission through water used in phase measurements at the transducer face.
VOS can be entered manually or can be calculated by using Medwin's method of calculation. (Click on 'Medwins' button to open the calculator.)



Enter the parameters. The result is automatically placed in the VOS text box.

Notes on Transducer Depth and Z Offsets

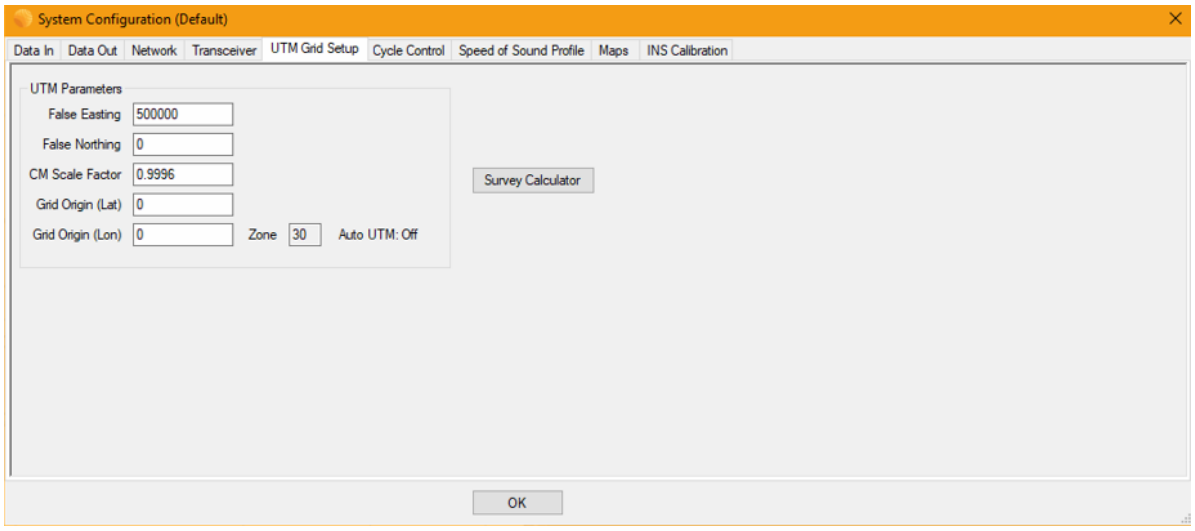


The Navigation Point is the point on the vessel where all navigation measurements are referenced to; in above example, the top of the mast.

- Acoustic depth
  True 'Z' distance = Raw Acoustic Depth (3) + 'Z' Offset (4) + Transducer Depth (2)
  3 + 4 + 2 = 9m
- Manual Depth (Where the depth is entered manually.)
  True 'Z' distance = Manual depth to target (5) + 'Z' Offset (4)
  5 + 4 = 9m
- Depth Beacon (Telemetry etc.)
  True 'Z' distance = Telemetry depth (5) + 'Z' Offset (4)
  5 + 4 = 9m

UTM Grid Setup

UTM Grid Setup allows the operator to enter UTM set-up parameters:



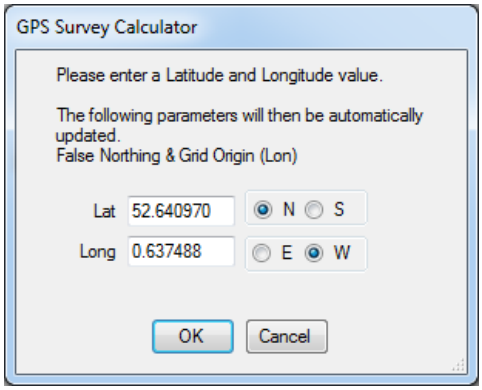
UTM Parameters

The following values may be manually entered

- False Easting
- False Northing
- Central Meridian Scale Factor
- Grid Origin – Latitude
- Grid Origin – Longitude

Survey Calculator

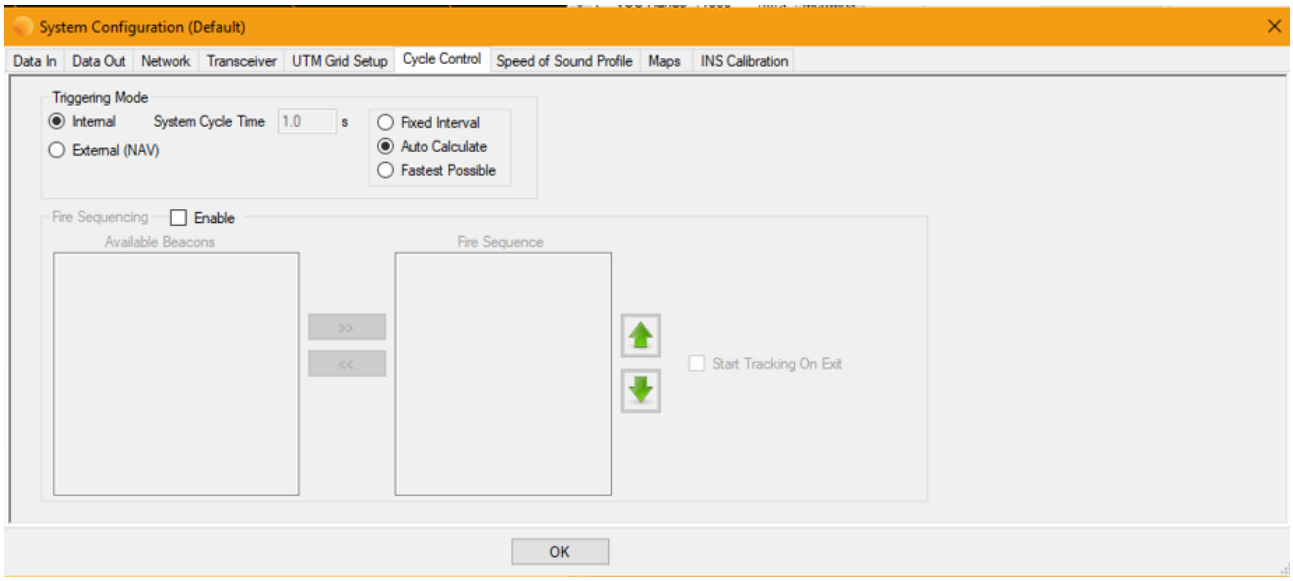
Longitude Grid Origin and False Northing can be calculated by pressing the 'Survey Calculator' button. The UTM Zone determined alongside the Longitude Grid Origin is for reference only.



To calculate the UTM zone start the Survey Calculator. Enter the degrees and decimal degrees of your local latitude and longitude. If GPS is available the position is automatically set to the current GPS position. Click OK to apply and exit. The calculator, upon exit, sets the parameters in the UTM Grid Setup.

Cycle Control

The Cycle Control tab allows the operator to set the system cycle time between beacon interrogations or select an external trigger source.



Triggering Mode

- Internal
  The cycle time is controlled internally and is set by the operator. Internal triggering modes are described below
- External
  System is triggered via the NAV IN connection on the rear panel.
  TTL type 5 volt pulse triggers on rising edge.

Before the triggering modes are described it is important to understand the factors within the system that can effect the system cycle times possible.

The expected maximum range of each enabled beacon has the largest effect, as the maximum range parameter of a beacon increases, then the fastest possible cycle time of the system will increase. Also the beacon channel and type will effect the cycle time,

different beacons have different internal turnaround times (the time taken from the beacon receiving an acoustic interrogation to sending an acoustic response) and therefore effect the total time taken to receive a response from a beacon at range.

Internal Triggering Modes

Other factors such as interrogation pulse length and internal system delays all effect the system cycle times possible. These are all taken into account in determining if the cycle time required can be achieved.

Fixed Interval

When in fixed interval mode the unit will attempt to complete the fire sequence in the time set within the 'System Cycle Time' parameter. If this is not possible a message will be displayed.

Auto Calculate

In this mode the system will automatically determine the fastest possible cycle time based on all the relevant parameters described at the beginning of this section.

Fastest Possible

In this mode the system will automatically interrogate the next beacon in the fire sequence as soon as the previous acoustic response is received. This mode will result in a much faster cycle time if beacons are at close range and will automatically adjust the cycle time as the range of the beacons increases or decreases.

Fire Sequencing

Fire sequencing can be used to define custom fire sequences rather than a sequential order of beacon interrogation. With fire sequencing the system may be configured, for example, to fire one particular beacon more frequently than others.

A sequence of up to 30 entries may be defined.

Available Beacons may be added to the fire sequence by 'Double Clicking' on the available beacon or by selecting the available beacon and pressing the '>>' button.

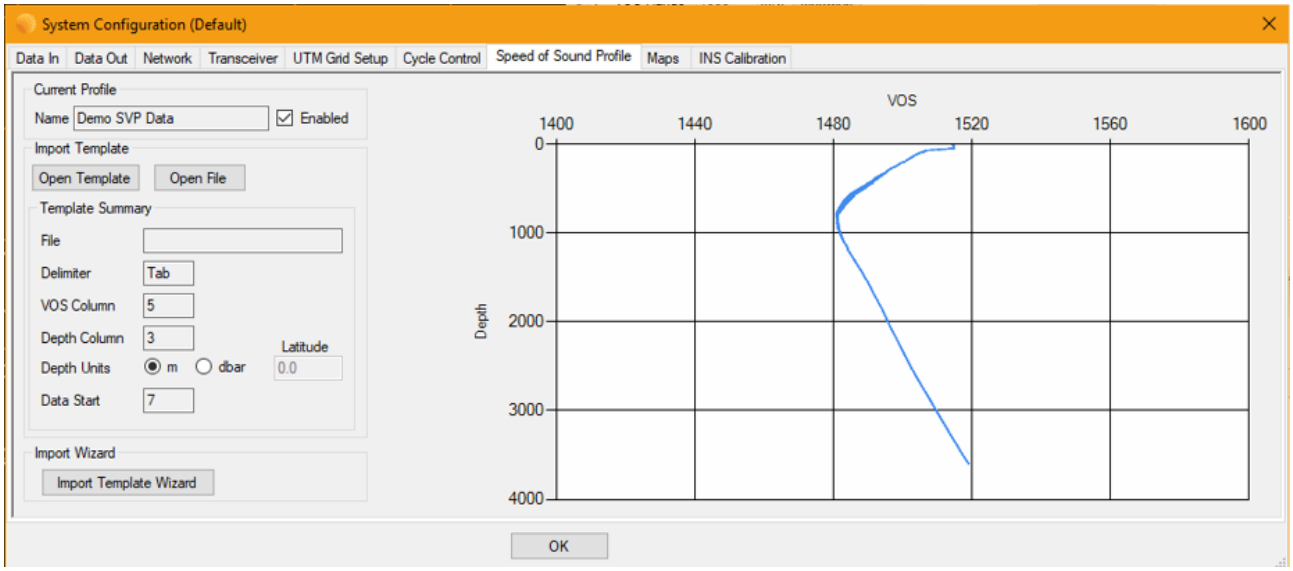
Beacons may be removed from the fire sequence by 'Double Clicking' on them or by selecting them and then pressing the '<<' button or by clicking the right mouse button and selecting 'Remove'.

Beacons in the fire sequence may be moved up and down the sequence with the up and down arrows to the right of the fire sequence section.

If the 'Start Tracking On Exit' checkbox is selected, all of the beacons in the fire sequence will be automatically enabled and interrogation started upon exit from the system configuration window.

Speed of Sound Profile

The Speed of Sound Profile tab enables data gathered from any profiling hardware to be imported into Nexus.



Once a Sound Velocity Profile has been loaded and enabled, the system will automatically calculate the optimum velocity of sound value for each beacon, based on the current depth of the beacon. This value will be continually updated as the beacon depth changes.

Ensure that the 'Enabled' check box is selected in the 'Current Profile' to use the loaded speed of sound profile within the system.

Loading a new Speed of Sound Profile

There are two possible ways of loading a new speed of sound profile from a data file into the system.

If a previously created import template has been loaded, then once the data file has been selected, the import can continue without any user intervention.

If a template for the data file to import has not been loaded, then the 'Import Wizard' may be used. The wizard enabled the user to select the position of the first line of data, the columns containing the depth and velocity of sound data and also if the depth units are meters or decibars.

Load Profile using Import Template

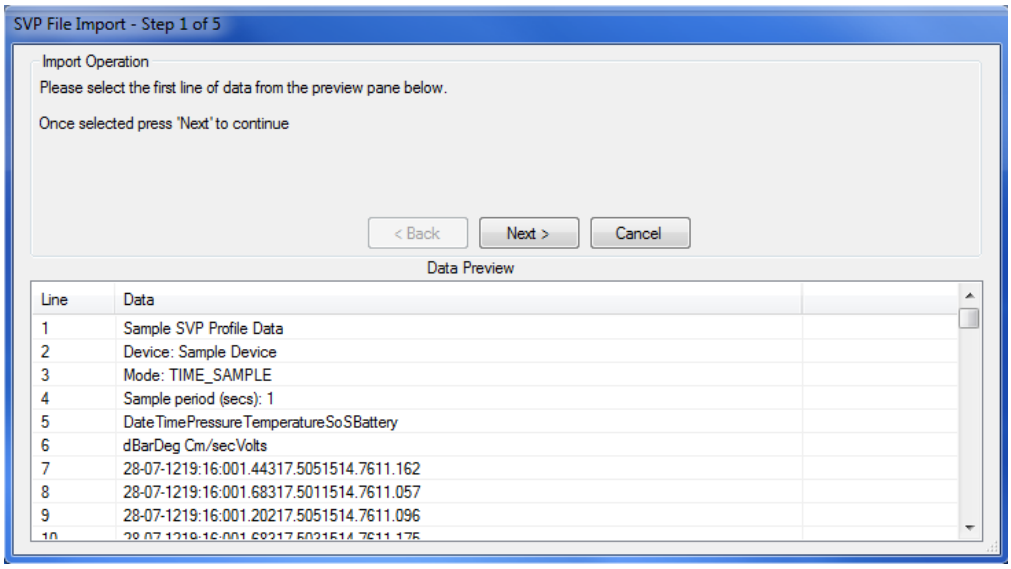
If no template is loaded press the 'Open Template' button to select a previously saved import template (note that the system will automatically remember the last template used and load this on startup). When a template is loaded it will be summarised in the 'Template Summary' section.

Once a template is loaded, the 'Open File' button will be enabled. Press this button to select the SVP data file to load into the system. After a file has been loaded, the 'Enabled' check box will be automatically set. Also, the VOS @ Transducer will be adjusted, based on the data in the SVP file and the current transducer depth value.

Load Profile using Import Wizard

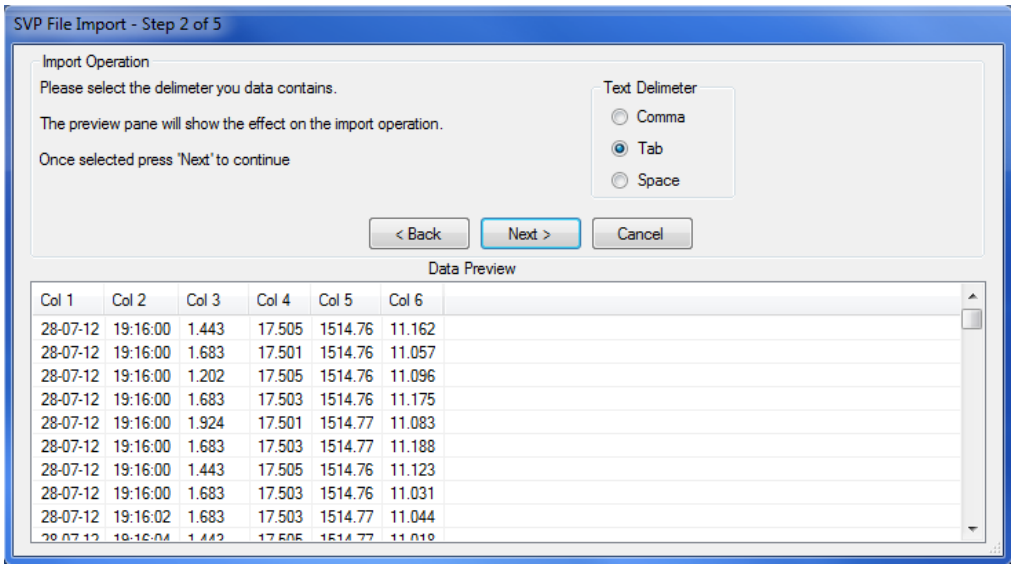
To start the wizard press the 'Import Template Wizard' button. After selecting the data file to import the following screen will be displayed

Step 1 of 5



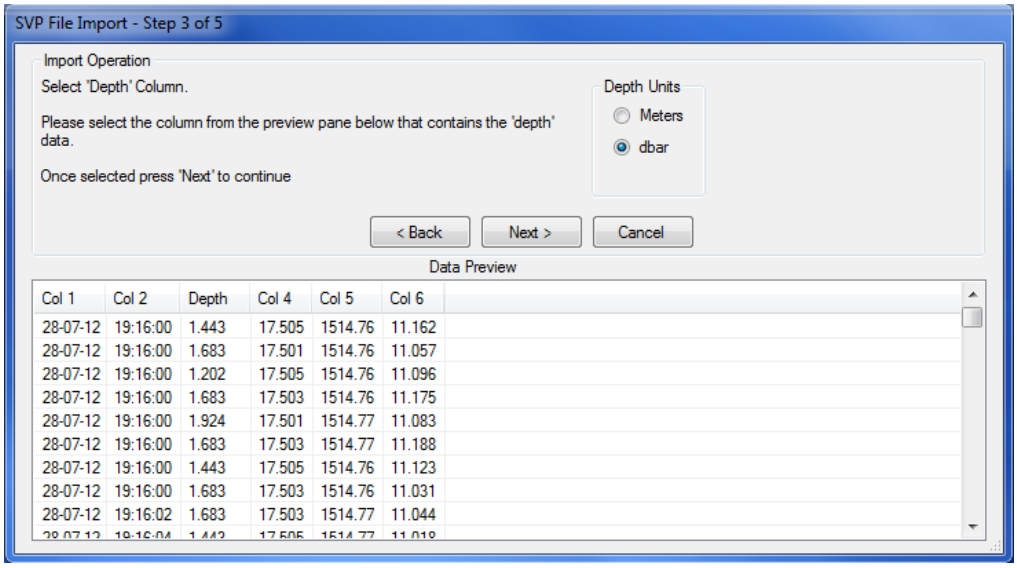
In the data preview window, select the line that contains the first line of sound velocity data. Once selected, press 'Next' to continue.

Step 2 of 5



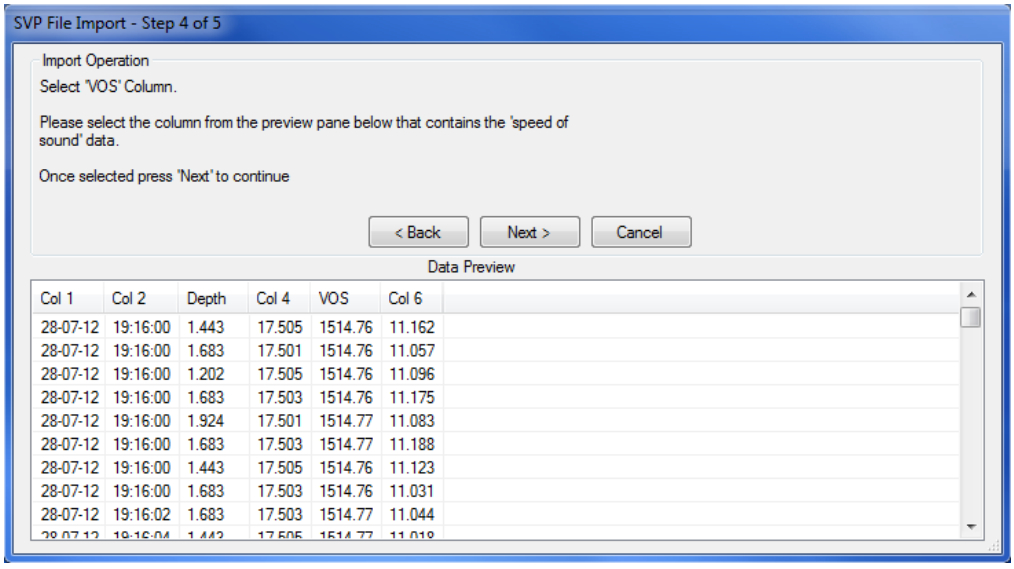
Select the column delimiter. The wizard will have automatically chosen the text delimiter that it thinks is used in the file. The delimiter may be changed if required, the results of the change will be displayed in the 'Data Preview' window. Once selected, press 'Next' to continue.

Step 3 of 5



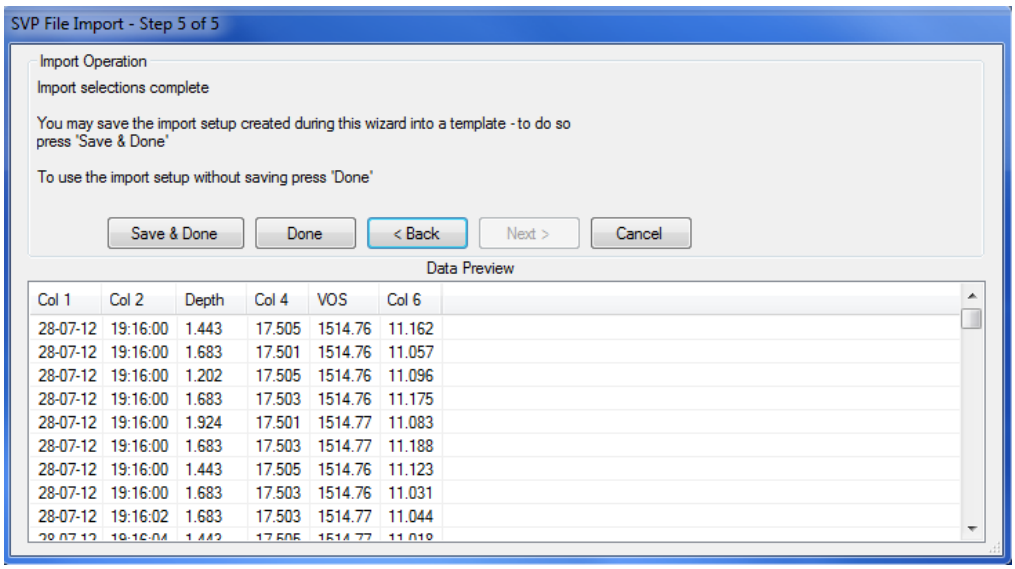
In the data preview window, select the column that contains the depth value by clicking on the relevant column header. The depth units will default to meters, if the data is in decibars then ensure the Depth Units is set accordingly. Once selected, press 'Next' to continue.

Step 4 of 5



In the data preview window, select the column that contains the velocity of sound value by clicking on the relevant column header. Once selected, press 'Next' to continue.

Step 5 of 5



Please confirm that the correct columns have been selected.

If required, the results of the import wizard may be saved into an SVP template to enable any future imports of data files in the same format to be quickly processed. To save as a template and complete the import press 'Save & Done'

If a template is not required for future data file imports, press the 'Done' button to complete the import.

About SVP Templates

A template file contains the following information:-

Position of first line of sampled data
The data column delimiter
The data column containing the depth value
The data column containing the velocity of sound value
A value indicating if the depth value is represented in meters or decibars

About Decibar Depth Values

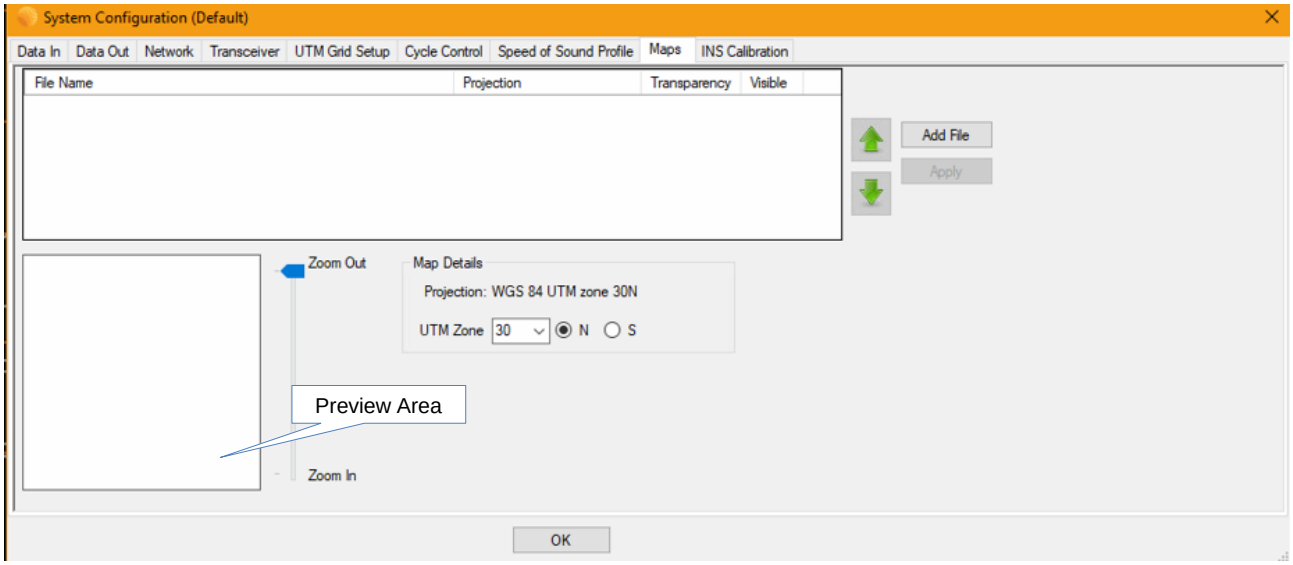
When a depth value is in decibars, Nexus will convert the dbar value into a depth value using the standard Unesco pressure to depth formula*. To accurately convert decibars

* Refer to N. P. Fofonoff and R. C. Millard (1983) Algorithms for Computations of Fundamental Properties of Seawater, Unesco Technical Papers in Marine Science No. 44

to depth a latitude value is required. The latitude used when importing may be entered into the 'Latitude' text box. If a valid GPS position is being received by the Nexus system then the latitude value will be automatically set to the current latitude from the GPS data.

Maps

Easytrak Pyxis can overlay user supplied georeferenced images on the plot window



Multiple overlay files may be added. Each file can be moved up or down the overlay order and can be set to the required transparency to enable optimal viewing.

The preview area shows the images selected and may be zoomed in or out using the slider. Changes are not applied to the system until the 'Apply' or 'OK' button is pressed.

The map overlay will only be displayed in the plot window when the 'Map Overlay' button is selected on the toolbar

Add File

Click the 'Add File' button to select a georeferenced image. Pyxis supports the following file formats, .tif, .jpg, .dxf, .shp

All overlay files must be in the projection that is selected in 'Map Details'

Transparency

The transparency of any image may be set from 0 to 100

Visible

Tick the checkbox to enable or disable the visibility of the selected layer

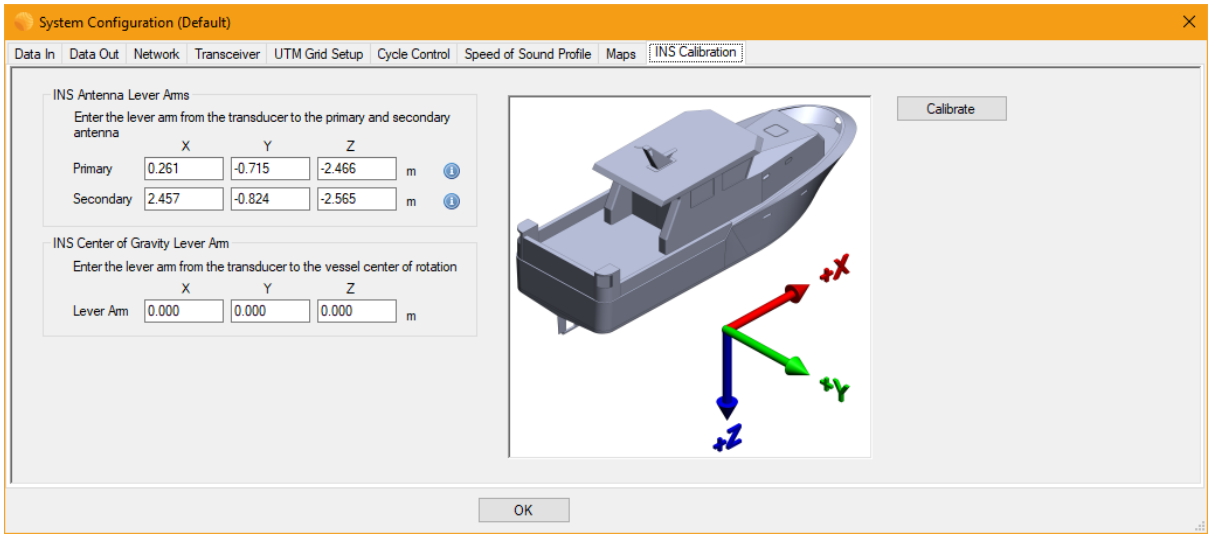
Delete

Click on the dustbin image to remove an image from the overlay. Note the file will not be deleted from the system

Up/Down

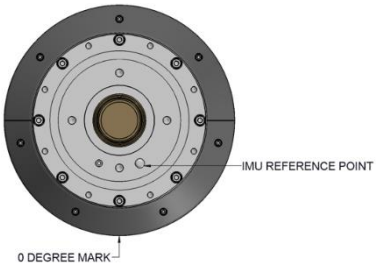
Any image may be moved up or down the display overlay by selecting the layer and pressing the green up/down arrows

INS Configuration



On this tab the lever arm offsets are entered for the INS, these are used by the inertial engine to calibrate and align the system.

A positive X is forward of the transceiver IMU reference point.
A positive Y is to starboard (right) of transceiver IMU reference point.
A negative Z is above the transceiver IMU reference point.



Note X axis forward / aft and Y axis port / starboard.

INS Antenna Lever Arm Offsets

Primary Antenna (GPS1): Enter the lever arm X,Y and Z from the IMU reference to the primary GNSS antenna.
Secondary Antenna (GPS2): Enter the lever arm X,Y and Z from the IMU reference to the secondary GNSS antenna.

INS Centre of Gravity Lever Arm Offsets

Enter the lever arm X,Y and Z from the IMU reference to the vessels centre of rotation / gravity. This is to reference the IMU to the vessel's orientation frame.

Ensure lever arms are entered within 5cm precision.

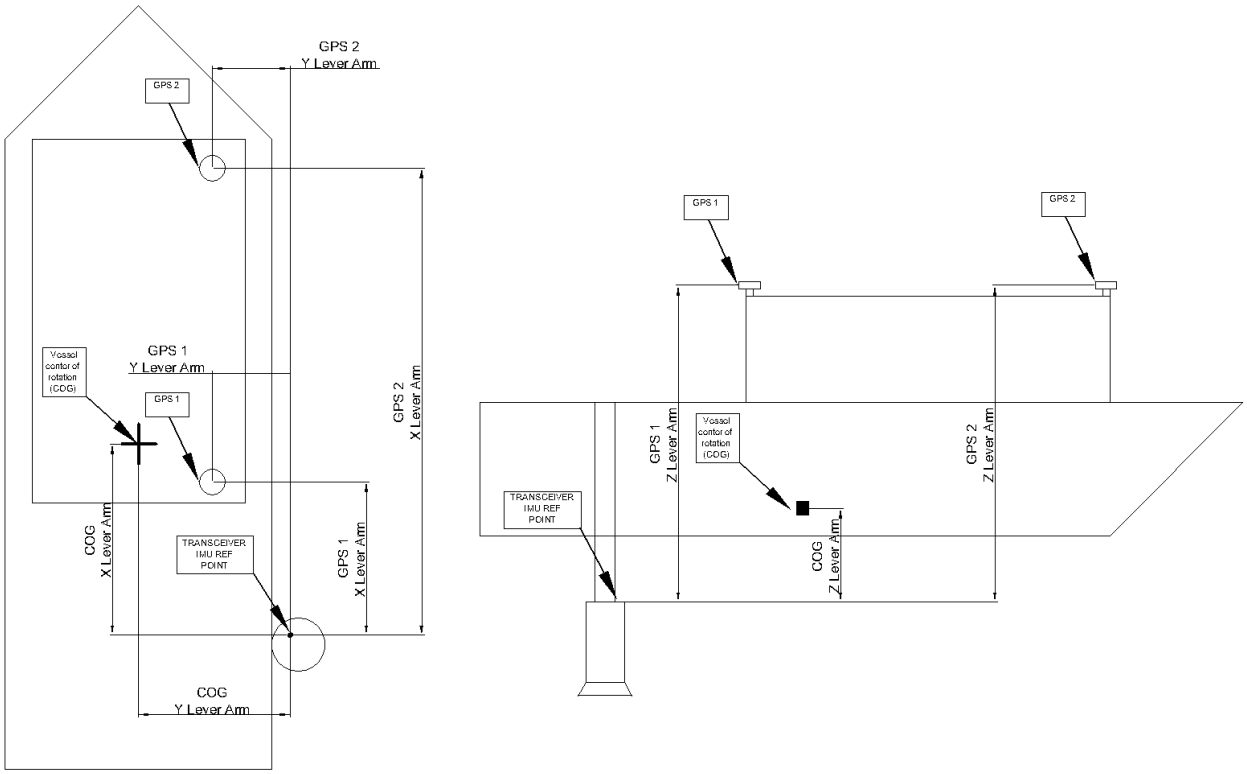
GNSS Antenna placement

First, the GNSS antennas must be installed on the ship, according to the following requirements:

- The antennas must be fixed with respect to the transceiver IMU.
- Both antennas must be mounted in the same orientation with respect to the vessel.
- Both antennas must have the same optimal view of sky (avoiding signal masks due to the vessel structure)
- The cables must be the same length and type for both antennas.
- Baseline of typically greater than 2m, 3 m is recommended.

Once installed, the two GNSS antennas lever arms must be measured. These are the signed distances, expressed in the vessel coordinate frame, FROM the IMU, TO the GNSS antenna. It must be measured within 5 cm of accuracy. A calibration is then performed to estimate these lever arms within 1 cm of accuracy. The following diagram shows a typical installation, with antenna 1 (position and velocity) at the back and antenna 2 (heading) on the front:

INS Offset



INS Calibration

Easytrak Pyxis combines high precision acoustic USBL, INS and GNSS technologies to provide survey grade repeatable subsea positioning. The Pyxis system has an integrated INS, this allows operations without performing a USBL calibration. All acoustic and chassis alignments are calibrated in the factory with only installation specifc INS alignment required in the field. The factory calibrated Pyxis system significantly reduces vessel mobilisation delays be removing the requirement for USBL calibrations.

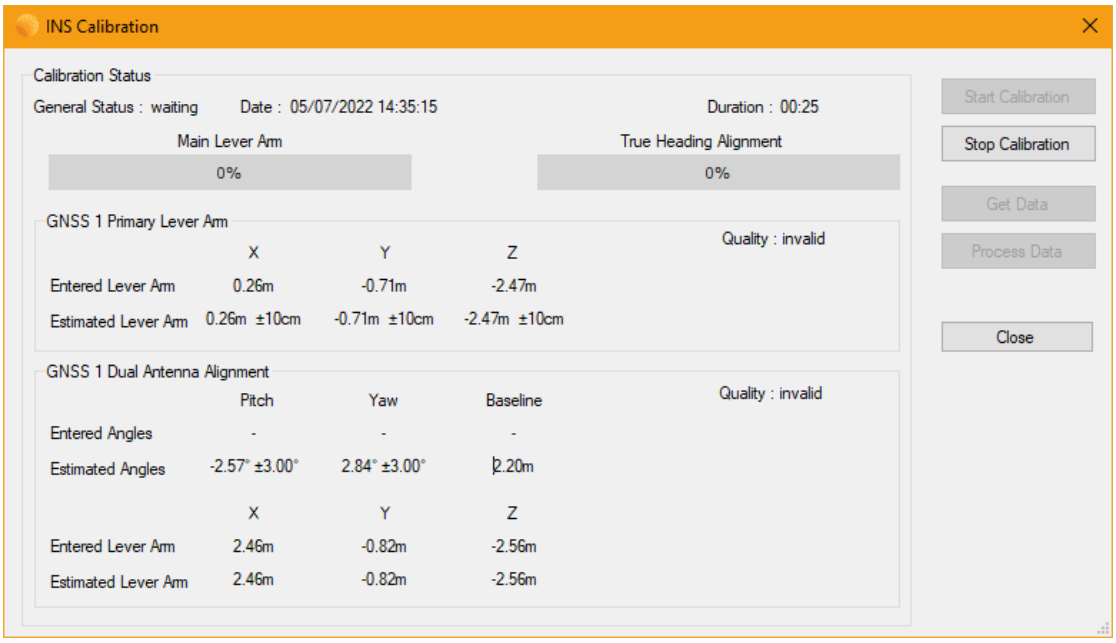
An INS lever arm calibration routine is needed to align the vessel installation and provide full system accuracy. Easytrak Pyxis's embedded lever arm calibration tool provides calibration covering all survey vessels. System calibration is normally complete within 20 to 30 minutes.

The Pyxis INS calibration tool requires RTK GNSS differential corrections to be interfaced.

The tool runs an online calibration with status and data feedback and logs the calibration data for offline Qinertia loosely coupled processing before applying.

The calibration tool is launched by clicking the 'Calibration' button.

Ensure lever arms are correctly estimated before starting the calibration.
Check configuration using the web interface.
Ensure RTK corrections are interfaced.



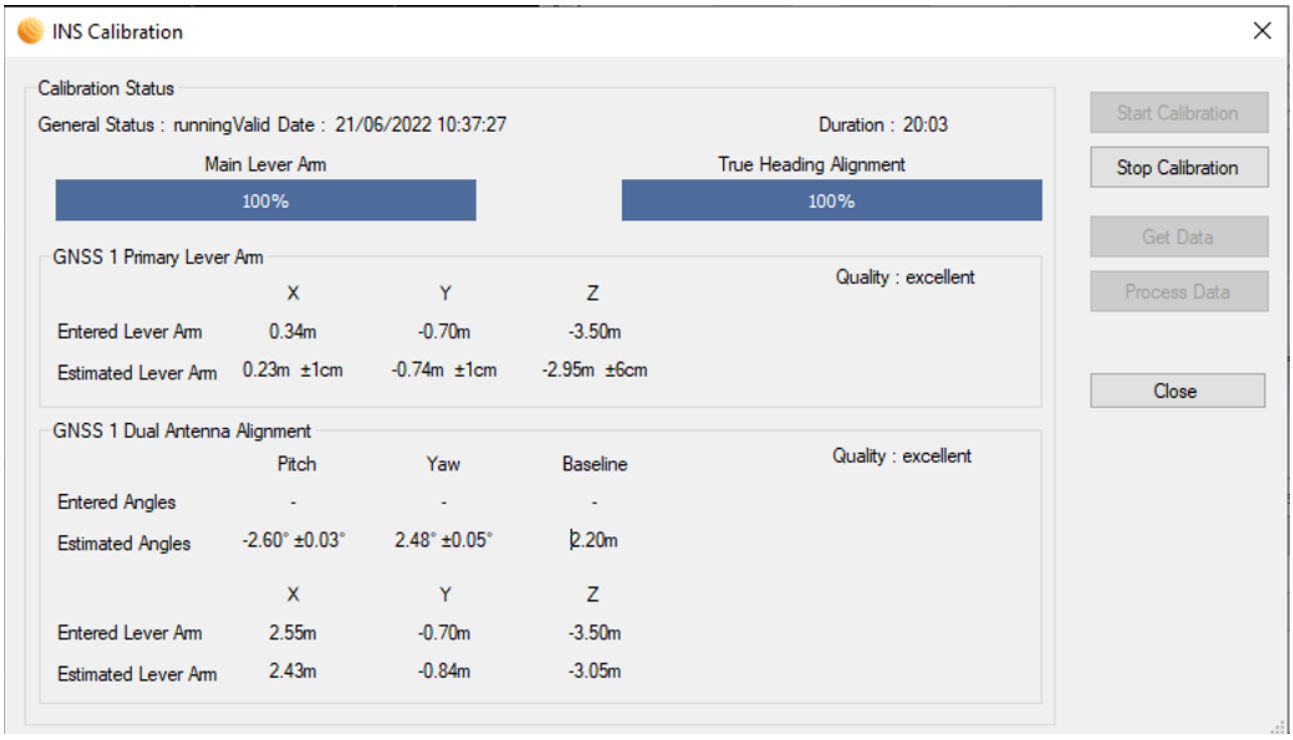
The calibration tool provides the status of the calibration together with the estimated lever arms, quality, accuracy and duration.

General Status:

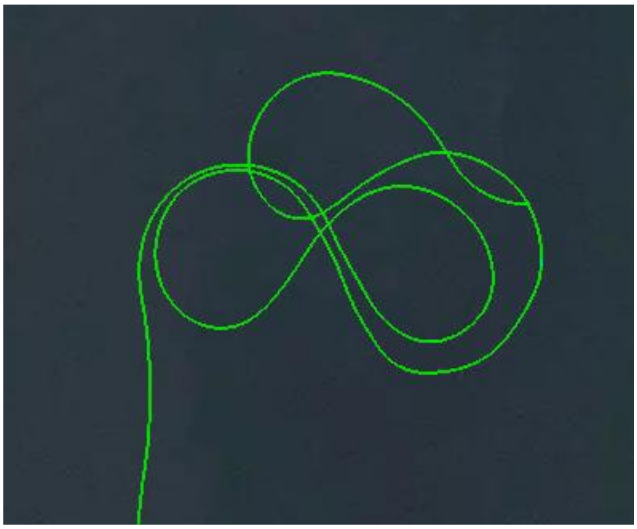
Waiting	System is waiting for forward motion or full navigation mode to commence estimation.
Running	System is acquiring data.
Running Valid	Calibration is valid and runnning.

To start the calibration click 'Start Calibration' button.

Once started, the calibration status will typically go into "Waiting" state. In order to actually run the calibration, the INS switches into full navigation mode, which means the heading and position are resolved. Once the calibration is started and the vessel is operated with sufficient speed (higher than 2.5m/s), the calibration status will transition to "running" mode. Two progress bars now display the calibration progress: one for the Main GNSS lever arm estimation, and one for True Heading alignment (linked to the secondary lever arm). The more dynamics and quality of the GNSS the INS receives, the faster the calibration will be.



The typical recommendation is to perform high speed manoeuvres, eight shape patterns, accelerations and deceleration phases.



For advanced feedback on the performance of estimated parameters, the calibration page also displays the estimated lever arms and angles, in comparison to what you entered initially, with associated standard deviations.

Typically with RTK GNSS corrections the error in the primary lever arm is 1cm indicating high confidence in the calculation.

Completing the Online Calibration / Data acquisition

When active, the calibration continuously improves the lever arm and alignments. Even after reaching 100% completion, it is still possible to enhance the estimated values by continuing with vessel manoeuvres. On the opposite side, in case of poor GNSS environment and/or low dynamics, it might be challenging/impossible to reach a 100% complete calibration.

It is recommended that for small survey vessels with RTK GNSS a minimum calibration of 20mins is performed. It is recommended that for large survey vessels with RTK GNSS and lower dynamics, a minimum calibration of 35mins is performed.

Before ending the online calibration the user should also verify the consistency of the estimated parameters with respect to the entered values and actual setup.

Note: For a 20 minute calibration, RTK and dynamics are required. Low dynamic or non RTK applications can take longer to perform a calibration (1 hour).

To end the calibration click 'Stop Calibration'.

The form will return to the previous online calibration data used and not the last performed. The Pyxis system includes an offline processing tool to improve data therefore the online estimation data is not used.

The calibration status at the end of the calibration will be not applied.

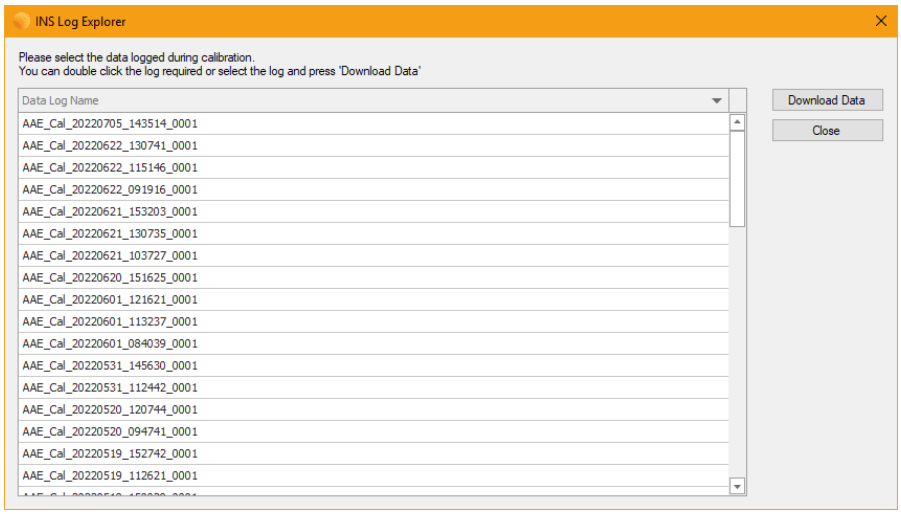
Calibration Processing

There are 3 simple steps to automatically process the calibration data:

(1) Get Data, download the logged data from the INS.

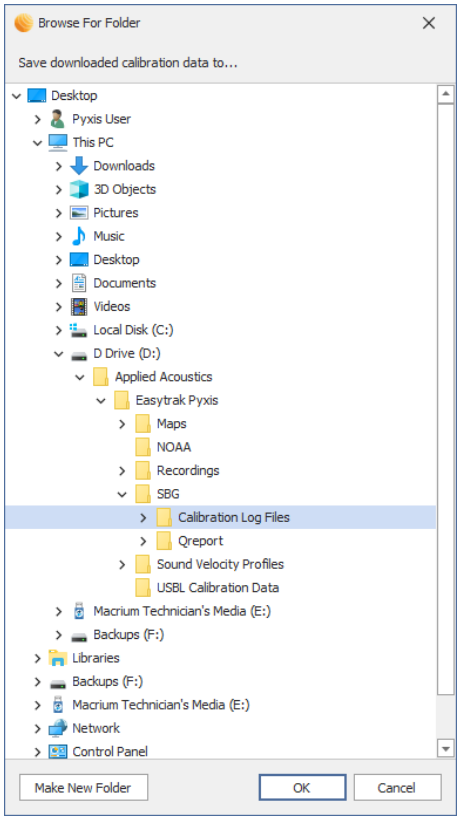
Click 'Get Data' to display available data files. These are arranged in date order, newest first.

To select highlight log name and click 'Download Data'



Select the default destination folder and click OK

Once complete click 'Close'

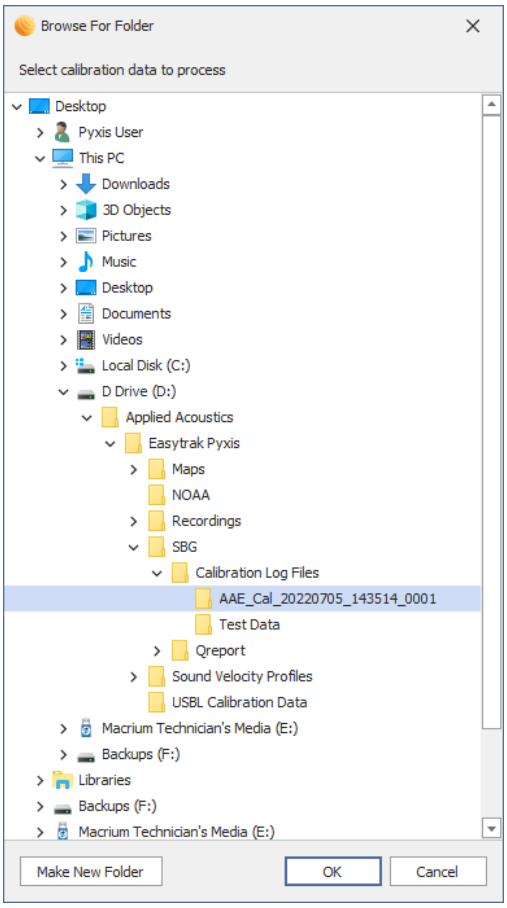


(2) Process Data, select data file to process.

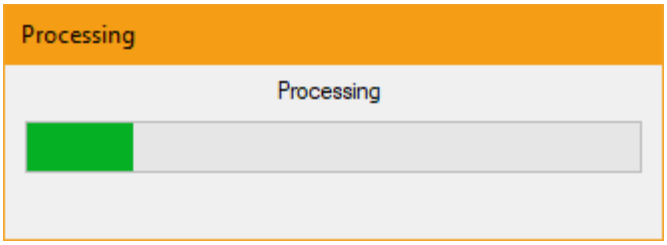
Click ‘Process Data’

Select the desired log file

Click ‘OK’



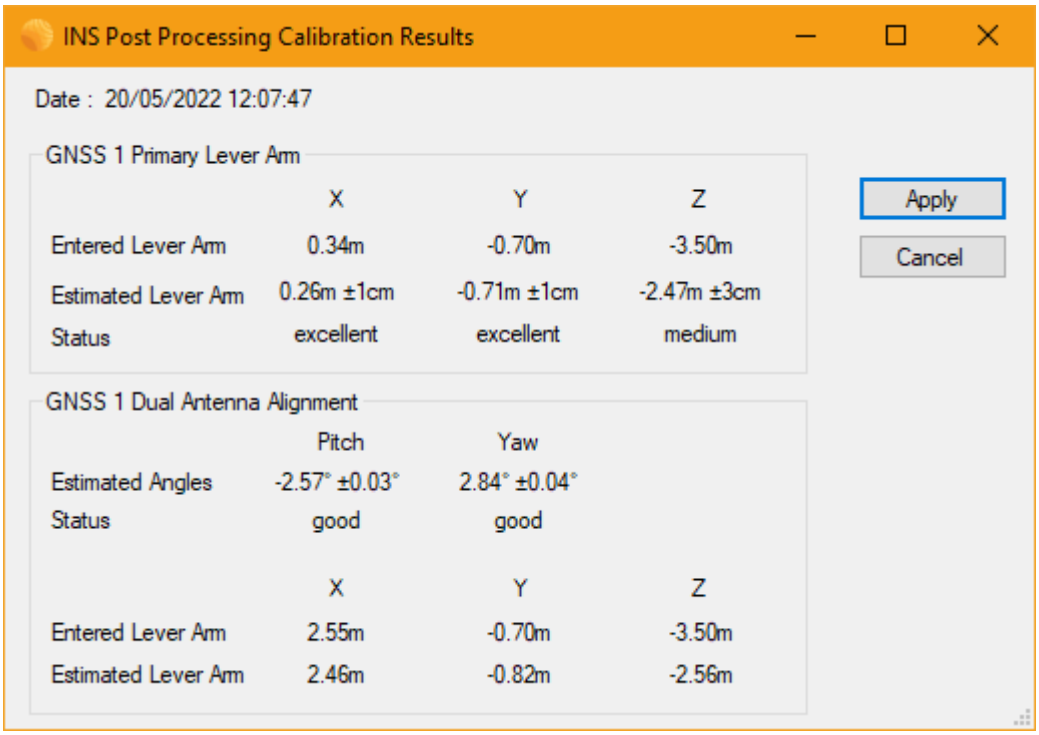
The data file is then analysed and processed.



(3) Review results and apply.

Once processed the results are presented for review.

Click apply to use the calculated lever arm offsets.



Following applying the new lever arms the Pyxis system will require re-boot and INS alignment.

Following re-boot, full performance is reached after an initial warm-up time of 5 minutes. The system is operational before that time, but performance parameters cannot be guaranteed.

To align the INS from a static position accelerate the vessel to perform 2-3 minutes of motion patterns with GNSS availability that will be used to let the Kalman filter converge, then decelerate to a stationary position, this will allow the alignment phase to complete.

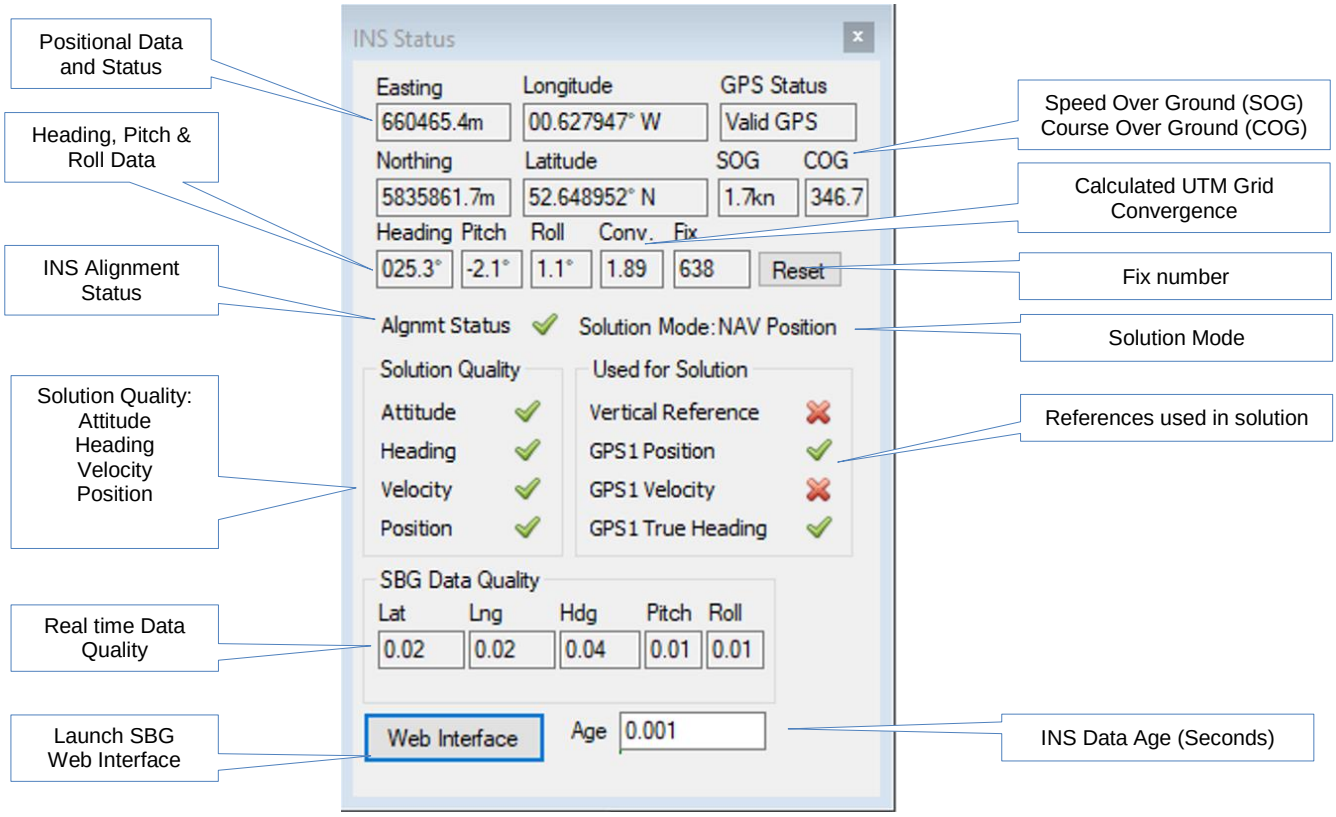
There is no standard pattern to perform, the INS will only need as much dynamics as possible (orientations and accelerations).

Upon applying new lever arms, save settings and re-boot system.
Upon re-boot, perform alignment prior to operations

INS Window

Toolbar Button: 

The INS Status window provides the full status of the INS system together positional and attitude data.



When aligned and operational the Pyxis INS system status will be as above.

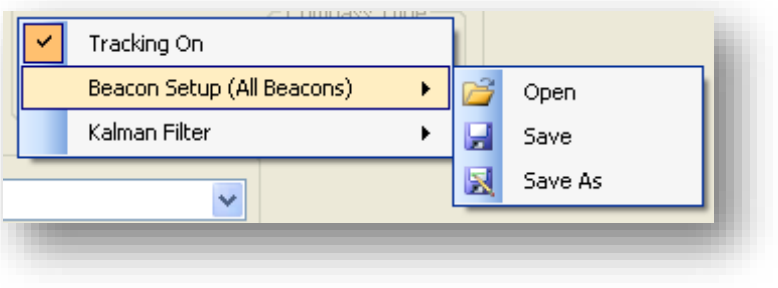
Beacon Editor

Toolbar Button: Shortcut Key: Ctlr+B

The tabs contained within the 'Beacon Editor' window are described below. Note that the title bar of this window shows the name of currently loaded beacon setup file in brackets.

Beacon Editor Context Menu

Pressing the right mouse button when over the beacon editor window will show the 'Context Menu' as below



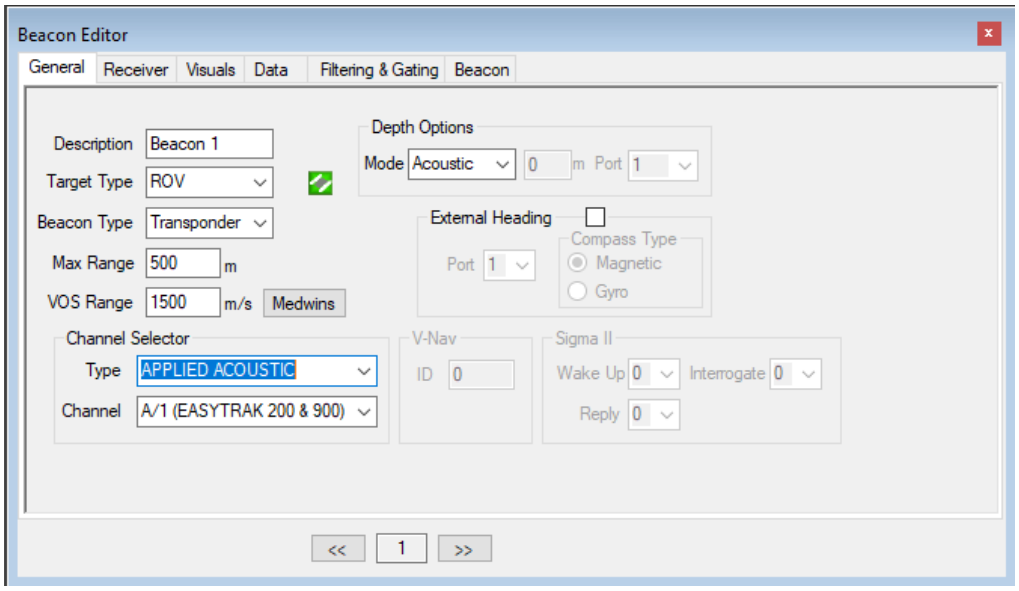
From this menu the following functions can be performed

- Turn Tracking On
- Load or Save a Beacon Setup File – This will load or save the values for ALL beacon setups (including the Kalman Filter configuration for each beacon)

Load or Save a Kalman Filter Configuration File
This save the Kalman Configuration for ONLY the individual beacon selected
A Kalman Configuration may be loaded for the currently selected beacon or for ALL beacons

General

The General tab allows the operator to set the individual beacon parameters for up to 16 different beacons. To select the required beacon, use either the mouse wheel or the '<<' and '>>' buttons



Description

A Description can be added, for example Beacon S/N or Diver 1. This is an aid for display, event log messages and place mark reference and will have no effect on the data or output.

Target Type

The type of target may be selected. This will display an appropriate graphic in the plot window. If a 'Release' target type is selected this will also enable the 'Release' tab in the beacon editor to control release beacon functionality* If V-Nav is selected then this will also enable the V-Nav section of the configuration (and disable the channel selector section).

Depth Options

- Acoustic — Depth is calculated from measured acoustic depression angle.
- Manual — Depth is entered manually in the text box provided.
- Telemetry Easytrak — Depth is measured and transmitted from a telemetry beacon to
- External — Depth is received from an external source

* Will only be dislayed if release beacons add on feature enabled

External Depth Mode (NMEA Input Format)
If external depth mode is selected, a depth value for any beacon may be input on a nexus serial port. Depth strings accepted are NMEA $..DBT, $..DBS, $..DBK, $..DPT. If this mode is selected a port must be selected that will receive the depth string for this particular beacon. If the selected port is not configured for external depth input a warning message will be displayed.

External Depth Mode (Custom AAE Format)
Nexus can also accept beacons depths in a custom AAE format. The data can contain depth information for any number of beacons in a single string and hence requires only one serial port to be used for multiple beacon depth values.

$AADBM,B,V.V[,B, V.V]*HHCL

Data between [ ] may be repeated as required

Where

Header	$AADBM
Beacon number (1 - 10)	B
Depth Value (m)	V
Check Sum	H
Carriage return (CR)	C
Line feed	L

External Heading

If the target being tracked has a known heading (such as an ROV) then this heading may be input (via a serial port). This value can then be used within the Kalman filter to aid in the prediction algorithm of the filter. The serial port receiving the heading data should be selected (and also configured within the System Configuration) and the type of compass should be defined to ensure the Kalman filter uses an appropriate Standard Error figure for the heading.

Beacon Type

Transponder - Beacons that receive an acoustic interrogate signal and then reply after a set time (turn around delay) on a different frequency.

Responder - Beacons that reply (transmit) after a set time (turn around delay) upon receiving an electrical key (trigger) rather than acoustic signal.

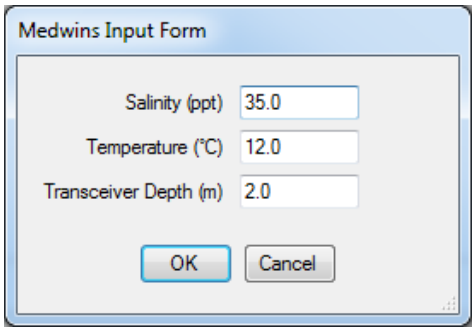
Max Range

Enter the max range (slant range, not horizontal range) for the target, this allows the system to adjust the cycle rate for fastest possible update rate option or to determine the minimum time required before the next beacon can be fired.

Ensure Max Range value is set correctly, if true acoustic range > max range value then tracking will be lost if system cycling is in fast as possible mode. A warning message will be displayed in the event log if acoustic range is approaching the maximum entered range

Velocity of Sound (VOS) Range

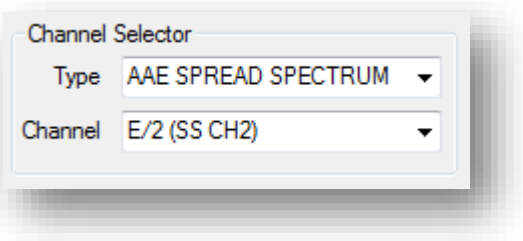
Enter the Velocity Of Sound (VOS) for transmission through water to be used in the range calculation. This is the mean velocity. VOS can be entered manually or can be calculated by using Medwin's method of calculation. Click on 'Medwins' to open the calculator.



Enter the parameters for the calculation and click 'OK' to perform. The result is automatically placed in the VOS variable.
If a VOS profile is known for the working area, the average VOS can be entered.

Channel Selector

To select the desired channel



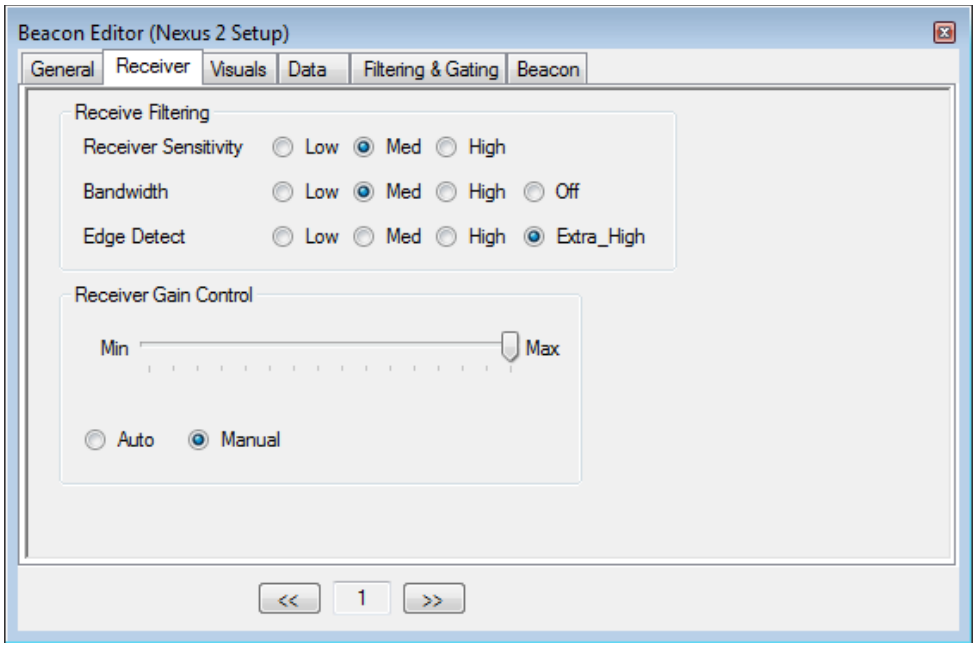
1. Select the Beacon Manufacturer from the 'Type' drop down menu
2. Select the channel, from the 'Channel' drop down menu

V-Nav ID

Enter the ID of the V-Nav beacon here. Valid values are 0 – 7199

Receiver

Each of the beacons receiver settings can be configured for optimal tracking.



Receive Filtering

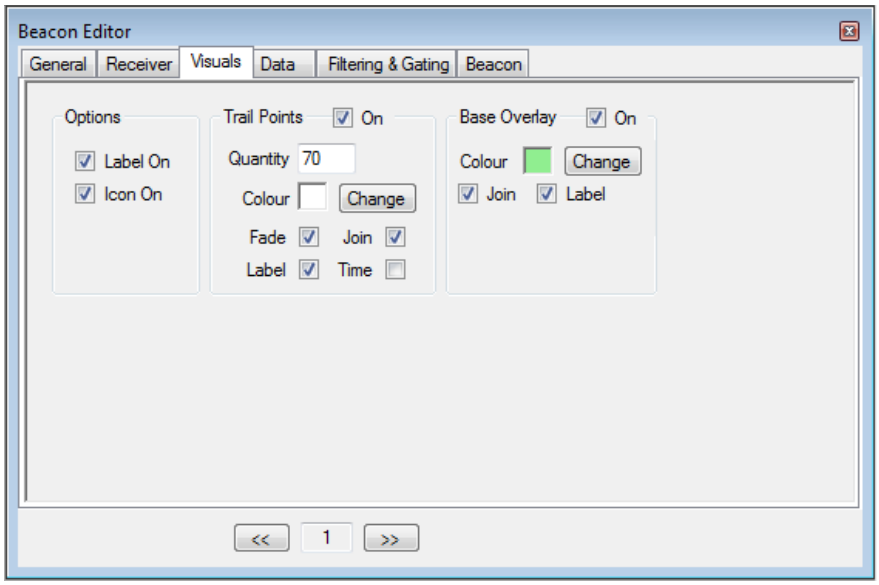
Receiver sensitivity and bandwidth can be adjusted to obtain optimal signal to noise levels. See Data Tab for received signal information.

Receiver Gain Control

The gain of the beacon can be set to Auto or Manual. In Manual mode the gain can be adjusted using the slider bar.

Visuals

The display properties for each beacon can be set be the user.



Options

Within the plot window, each beacon can have a label displayed (showing description, horizontal range and bearing). This may be switched on/off using the 'Label On' check box.

The Icon graphic representing the target type can be switched on or off using the 'Icon On' check box

Trail Points

Trail points may be displayed showing the beacons position history.

The following options may selected

- Trail points On/Off
- The number of points
- Fading out of the end of the trail point
- A line drawn between trailpoints
- A label showing the fix number of the point (will be displayed every 5th point)
- Show the time of the data after the fix number
- The colour of the trail points, lines and labels

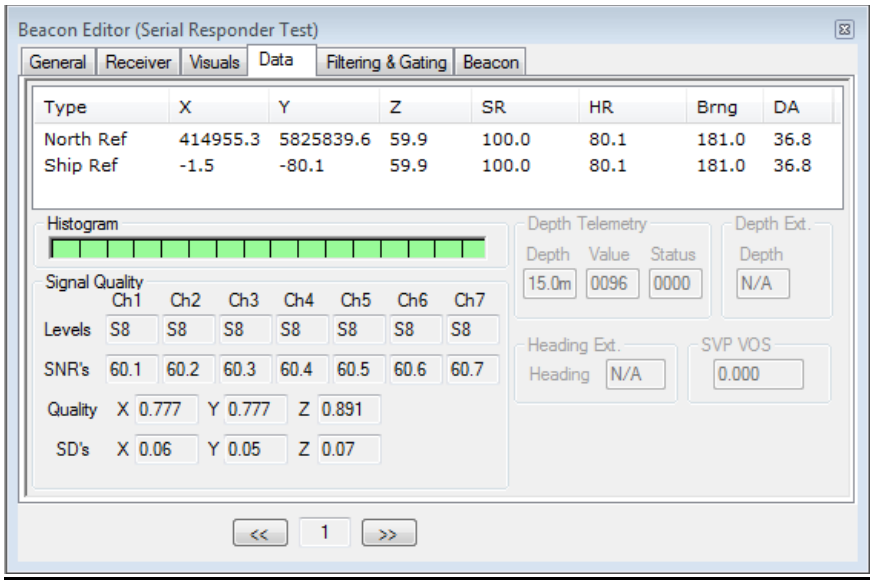
Base Overlay

The base data (before Kalman Filtering) may be overlaid onto the plot window to allow comparison with the output data. The following options may be selected

- A line drawn between trailpoints
- A label showing the fix number of the point (will be displayed every 5th point)
- The colour of the trail points, lines and labels

Data

The 'Data' tab displays position and signal quality data.



Signal Quality

- Levels
  S0 (Minimum) to S9 (Maximum), is an indication of the signal received at each of the receiver elements (channels).
- Signal to Noise Ratio (SNR's)
  This is the signal to noise ratio measured at each of the receiver channels.
- Quality factor

  This is the quality of the confidence level in the solution, 1 or <1 indicates a high level of confidence.
- SD's (Standard Deviations)

  This is the standard deviation of the X,Y and Z positions over the last 16 positions. This indicates the stability or relative movement of the target depending on application.

Depth Telemetry

This is the depth telemetry data received from a depth telemetry enabled beacon.

Depth Ext.

This displays the depth data received from an assigned external serial port (see System Configuration -> Data In).

Heading Ext.

This displays the heading data received from an assigned external serial port (see System Configuration -> Data In).

SVP VOS

This displays the velocity of sound value used from the loaded sound velocity profile (see System Configuration -> Speed of Sound Profile)

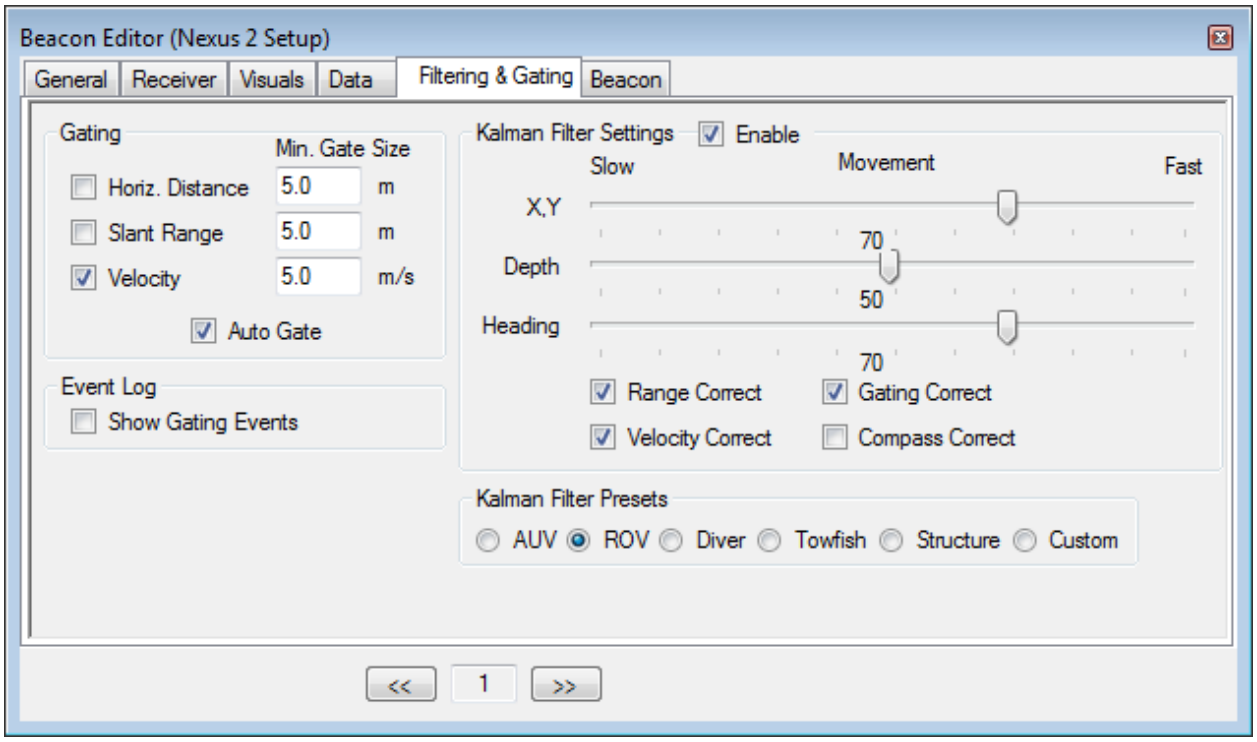
Histogram

This shows the status of last 16 interrogations of the displayed beacon.

- Green - Good
- Amber- Gated Position (only shows if gated or smoothed data is selected)
- Red - No response from beacon

Filtering & Gating

All gating and filtering parameters may be setup in this tab. Each beacon can be controlled individually to allow the optimum setup that is appropriate for the type of target being tracked.



Gating Description

Gating can be used to remove spurious positions made with Easytrak Nexus due to signal reflections, excessive environmental noise etc. Any position that is deemed to be 'out of gate' will be replaced with a predicted position.
Parameters that can be gated include Distance (horizontal), Range and Velocity.
Gating limits the deviation a particular parameter may change between interrogations.
A value can be entered in a text box to define the gate size, or, in the case of automatic gating mode, the minimum size of the gate.

- Auto Gating
  In automatic gating mode, a gate starts at the minimum value. Should there be five "out of gate" readings, the gate doubles in size until stable "in gate" readings are obtained. The gate then halves in size as a set of ten good readings is obtained. The gate shrinks until the user defined minimum gate size is reached.
- Show Gating Events
  Any out of gate events will be displayed in the 'Event Log' window when this option is selected.

Gating Search Mode

When any gating mode is enabled, if any beacon is out of gate for a number of positions, a search mode is activated. In this mode the last known good position of the beacon will be outputted and the gate values will be set to maximum. This ensures that when a valid response is received from the beacon, it will automatically be accepted as a valid position. The gate values will then return to their previous values and the search mode will be de-activated.

Kalman Filter Introduction

The Kalman filter was developed by Rudolf E. Kalman and presented in a paper in 1960. Although not initially attracting much interest, the Kalman filter was soon adopted by NASA for use in its Apollo project, and today can be found in many navigation systems.

The Kalman filter helps to remove random noise contained within data. In this case the data is the raw position received (the observation) from the Nexus transceiver. The Kalman filter models the system and based on previous observations the Kalman filter

predicts the next expected position. When the new Nexus observation arrives, the positions are merged together based on the weighting (confidence) of the filter prediction and the weighting of the new observation.

Kalman Filter Settings

The XY, Depth and Heading Movement Sliders

The XY, Depth and Heading sliders affect the dynamics of the Kalman filter. With the sliders set to slow the filter will smooth the track more (more confidence in the prediction than the observation), but will be slower to respond to any real change in direction or velocity of the target. Conversely, with the sliders set to fast, the filter output will follow the observed data track more (has more confidence in the observation), but will be more responsive to noise and rapid changes of direction of the target.

Range Correct

The greater the slant range of any USBL system the greater the standard error of an observation will become – mainly functions of the bearing and depression angle. To help compensate for this, turn range correct on. This adjusts the standard error as a function of range. In this instance the standard error is based on 1% of slant range rather than a fixed standard error of 1m. It is recommended that this button is selected.

Velocity Correct

The velocity check box should be selected ON where the target is moving along a track relative to the vessel rather than static; for example tracking an Autonomous Underwater Vehicle (AUV) running survey lines.

An example where the velocity option is not recommended is if a towfish is being positioned relative to the vessel; in this case the towfish will appear virtually stationary to the vessel other than slight lateral and vertical movements.

Gating Correct (Spurious Observation)

This option allows the observations to be analysed prior to going into the Kalman filter by using the special gating facilities within Nexus. If the observed position is deemed to be especially poor (spurious – outside any selected gate), the weights of the Kalman filter are adjusted to rely more heavily on the filter's predicted rather than observed position.
It is recommended that this button is selected.

Compass Correct

Compass compensation is where the target has an internal compass that can be interfaced to Nexus. This will aid the Kalman filter in changes of target orientation. A typical target would be a Remotely Operated Vehicle (ROV) which commonly has an internal compass to help the pilot with orientation and navigation.

Kalman Filter Presets

A number of Kalman Filter setups are defined within the system that are suitable for typical types of targets being tracked. These setups may be selected by clicking any one of the radio buttons

Saving Kalman Filter Setups

Any Kalman filter setup may be saved to file from the context menu (right mouse). A Kalman setup may be loaded into just the currently selected beacon or into all beacons

Advanced User Mode

Pyxis has an 'Advanced User Mode' which can be enabled from the Tools menu.

When in advanced user mode the system will recalculate the currently received acoustic data points. This advanced mode enables the trail point history to show how adjusting gating and Kalman filter parameters *would* have affected the output data.

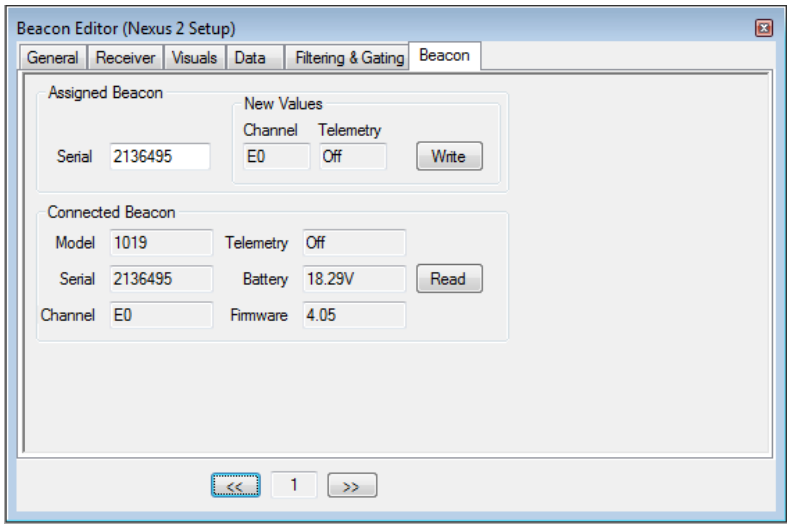
This feature may be of use, for example, if the output data appears to be *lagging* behind the actual target position. This may happen if the Kalman Filter is tuned incorrectly for the target type (such as Velocity Correct turned off).

Advanced user mode also adds extra functionality to the 'Beacon Editor -> Filtering & Gating' tab. A 'Kalman Display Options' section enables the current Kalman Data Set to be saved as a *reference* so that when tuning the filter this reference may be compared to the current Kalman Filter setup.

Beacon

The beacon tab is used to display the details of a 1000 & 1100 series beacon that may be connected to a Nexus serial port. The connected beacon can also be configured to match the current channel number and depth telemetry mode of the current beacon setup.

To communicate with a beacon, a serial port must be configured as 'Beacon' in the System Configuration setup.
A standard 1082 Smart Switch lead plus cross over (null modem) lead must be used to allow communication between the 101X Beacon and Nexus.



Assigned Beacon

By assigning a beacon setup to a particular beacon serial number, the system will ensure that the current configuration may only be written to the desired beacon. This ensures that the user cannot accidentally configure the wrong beacon with the wrong setup.

Enter the serial number of a beacon you wish to assign to this beacon setup.

The 'Write' button will set the channel number and telemetry mode (if selected and available) to the values that have been previously selected. The values that will be written to the beacon are displayed in the 'New Values' area for confirmation.

Connected Beacon

The 'Read' button will interrogate the connected beacon to read configuration data.

The configuration of the currently connected beacon will be displayed in this area. The following information is displayed:

- Model Number
- Serial Number
- Channel Number
- Telemetry On/Off
- Battery Voltage
- Firmware Revision Number

Beacon communication is only supported from Console Nexus Firmware V1.2.7 and newer

Release

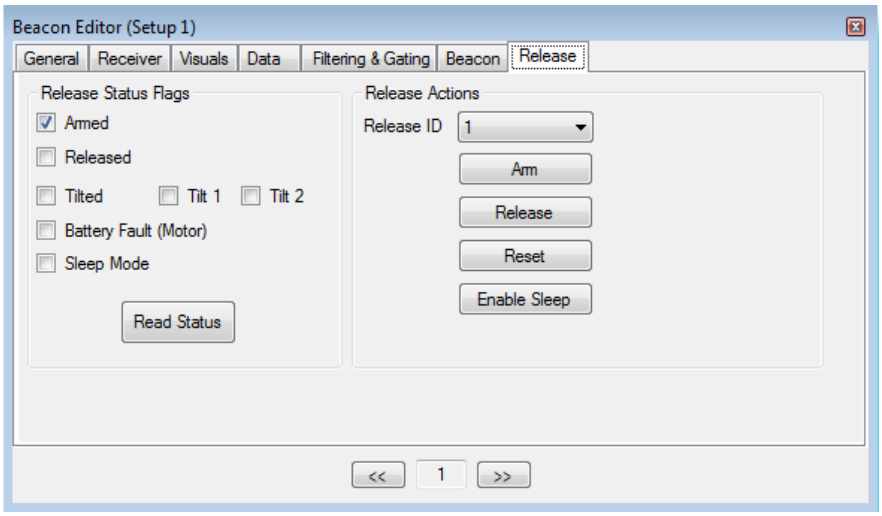
The release tab enables control of Applied Acoustics 5xx

Release functionality is an add on feature that must be enabled.

General Operation

The release tab, will not be visible until the 'Target Type' is selected as a release type in the 'General' tab.

5xx Release Operation



Release ID

The 5xx release beacon will have an ID (0 – 15), determined by the release beacon switch settings. To communicate with the beacon, the ID must be set from the 'Release ID' drop down selection box.

Release Status Flags

This area displays the operational status of the release beacon. The 'Read Status' button may be pressed to interrogate the release beacon and obtain the current operational status.

Please refer to the release beacon manual for a detailed description of each of the status flags.

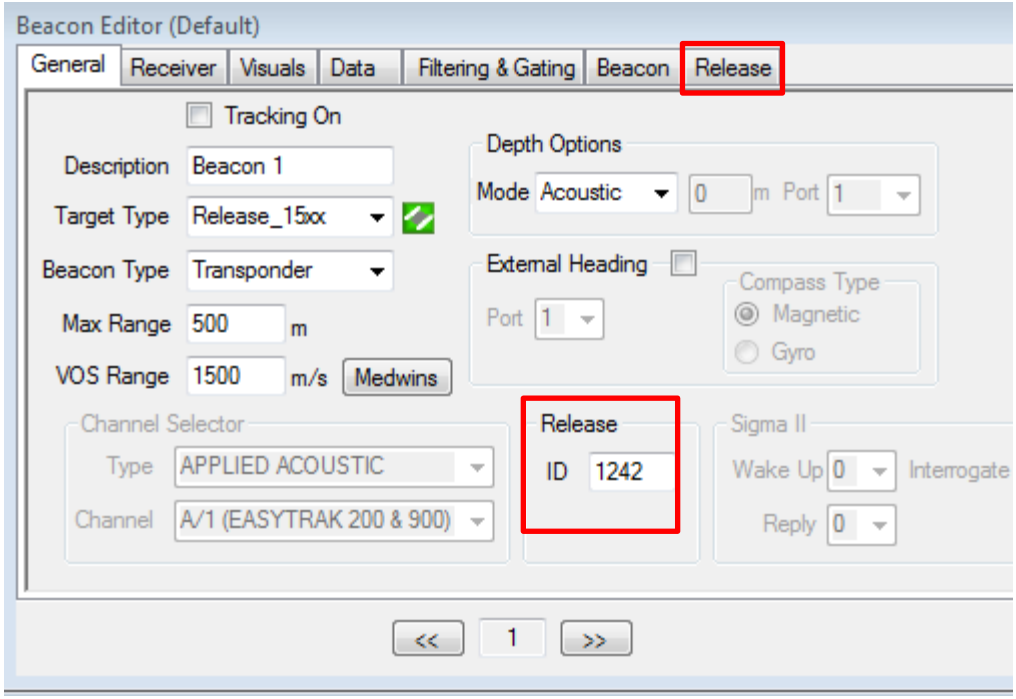
Release Actions

A number of actions may be performed with a release beacon.

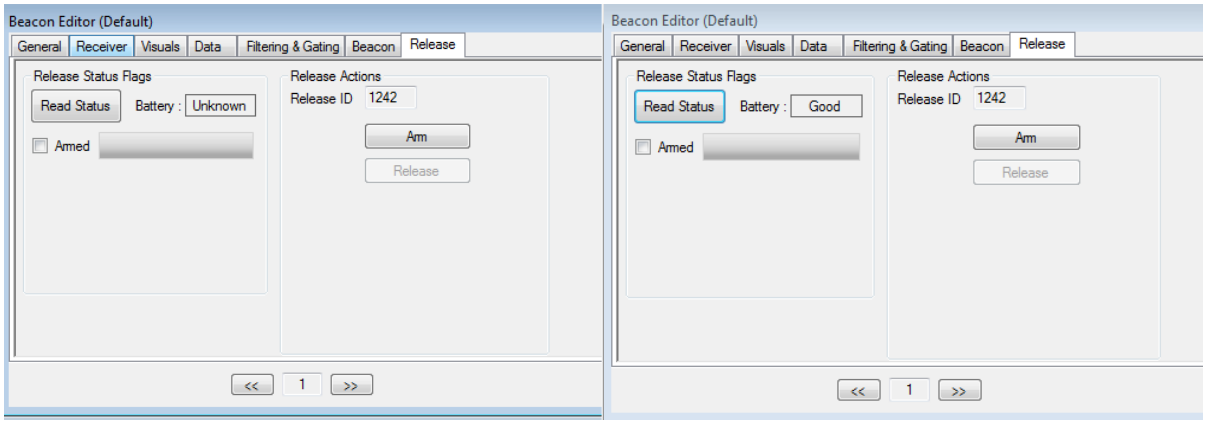
- Arm – A release beacon must be armed prior to release. Once the beacon is armed (as indicated by the status flags) the 'Release' button will become active
- Release – Once armed, a release operation may be performed. The user will be prompted to confirm that a release operation is required prior to actioning the release
- Reset – This will reset the release status flags to their default conditions. Note however that if any fault condition remains this will be indicated in the status flags.
- Enable/Disable Sleep – A release beacon may be put into a sleep mode. In this mode the beacon will only respond to release commands and not to normal acoustic interrogations

15xx Release Operation

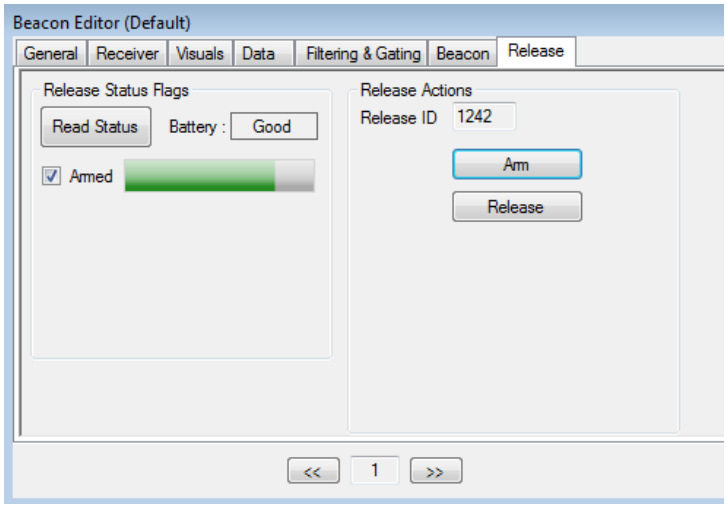
To enable 15xx release operation the target type must be set to Release_15xx this will then enable the release tab. It will also enable you to set the release ID as shown.



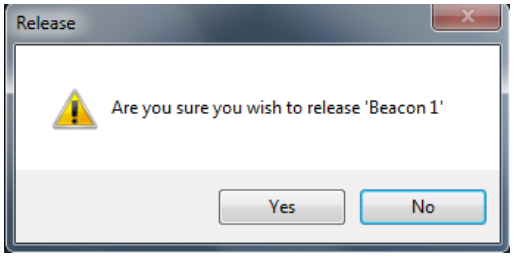
The release tab allows you to check the status of a beacons battery, arm and release the 1519. Pressing the read status command will fetch the battery status of the 15xx release.



When the Arm command is pressed providing the ID is correct and a valid reply is received the release button will become active, the ARMED flag will be set and a countdown bar will start travelling across.



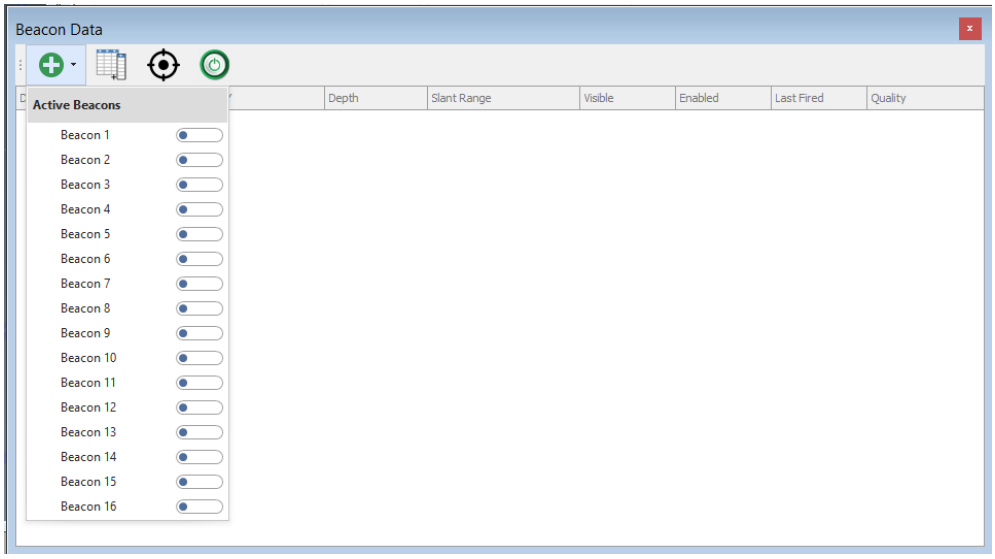
This will set a 60s window where the beacon must then be released. When the release command is sent a prompt will ask to confirm the release.



If released successfully the tab will reset and the arm flag will uncheck.

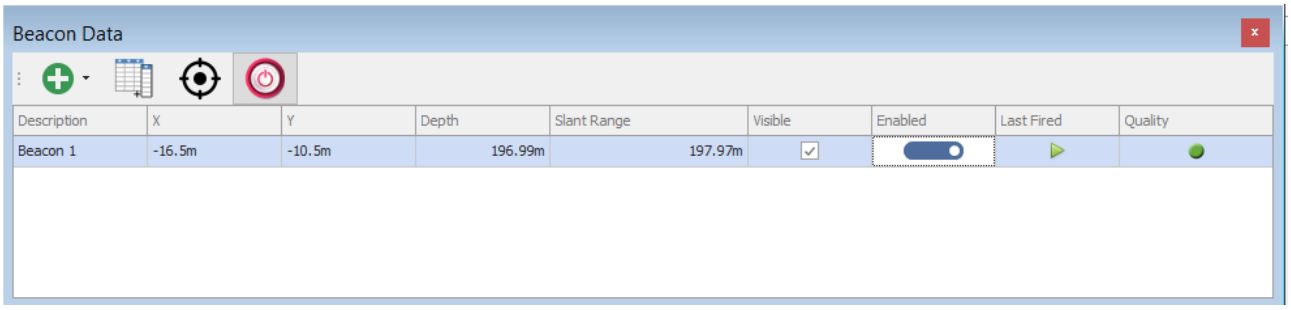
Beacon Data

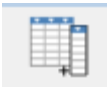
Toolbar Button  Shortcut Key: Ctrl+D



This is the primary control and monitoring window for the system, the beacon configuration is set within Beacon Editor.

Press the  to select Active Beacons. The window provides controls for the active beacons along with positional and status information all of the beacons that are active.



 Column picker, allows the user to configure the table.

 Centre of selected beacon.

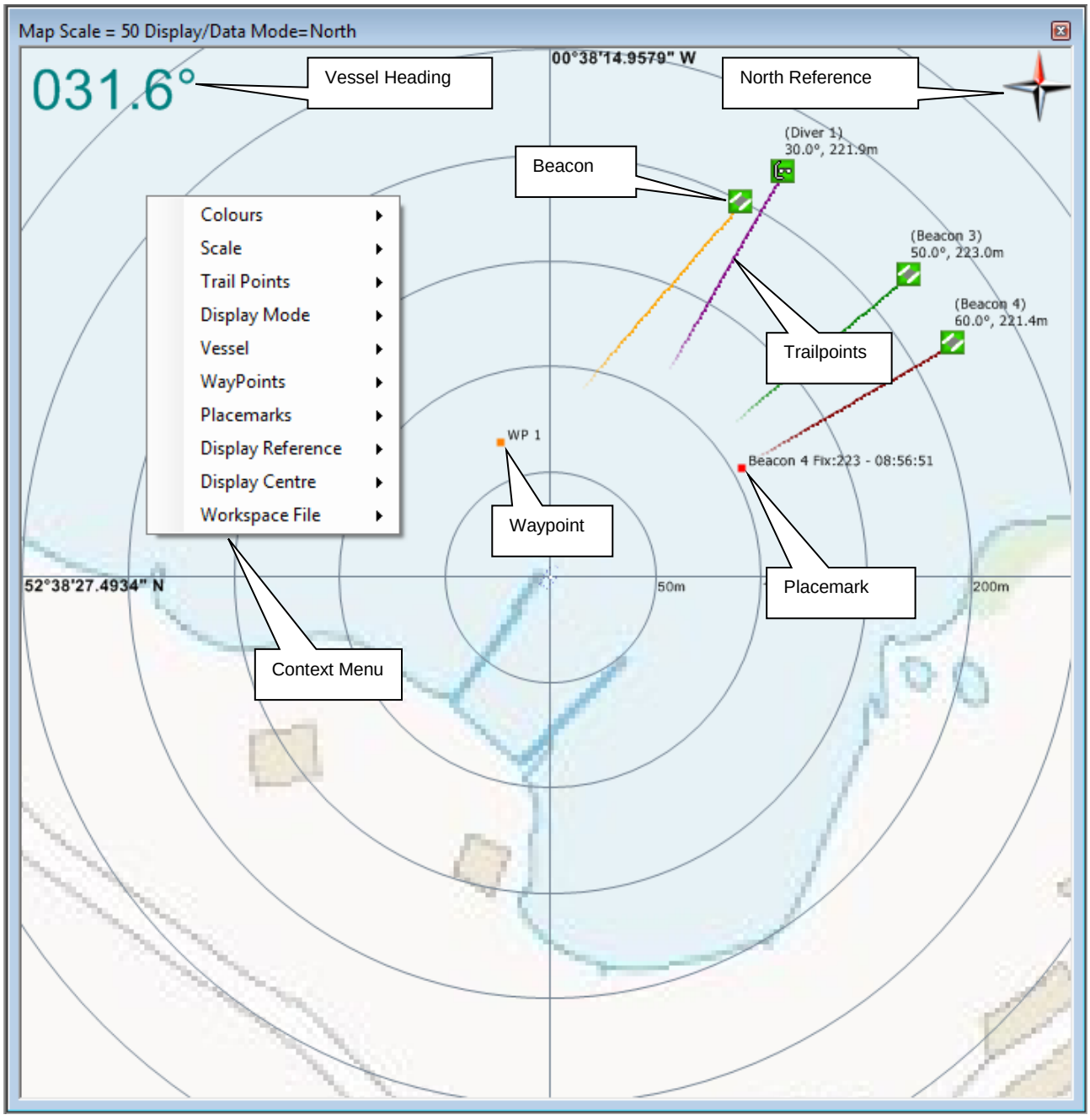
 Toggle all beacons on / off.

- The  shows the last beacon that was interrogated.
- The ‘Visible’ check box determines if the beacon is displayed in the plot window.
- The beacons description is displayed here. The description may also be edited from here.
- X and Y (or Eastings and Northings) indicate the relative or absolute co-ordinates on the horizontal plane in meters.
- Z is the distance of the target below the transducer or reference point in meters.
- SRng is the slant range to the target in meters.
- HDist is the horizontal distance to the target in meters.
- Brng is the bearing to the target in degrees.

Plot Window

Toolbar Button  Shortcut Key: Ctrl+D

This is the main plotting window where the vessel and the target positions are plotted. Waypoints and place-marks can also be viewed on the window.

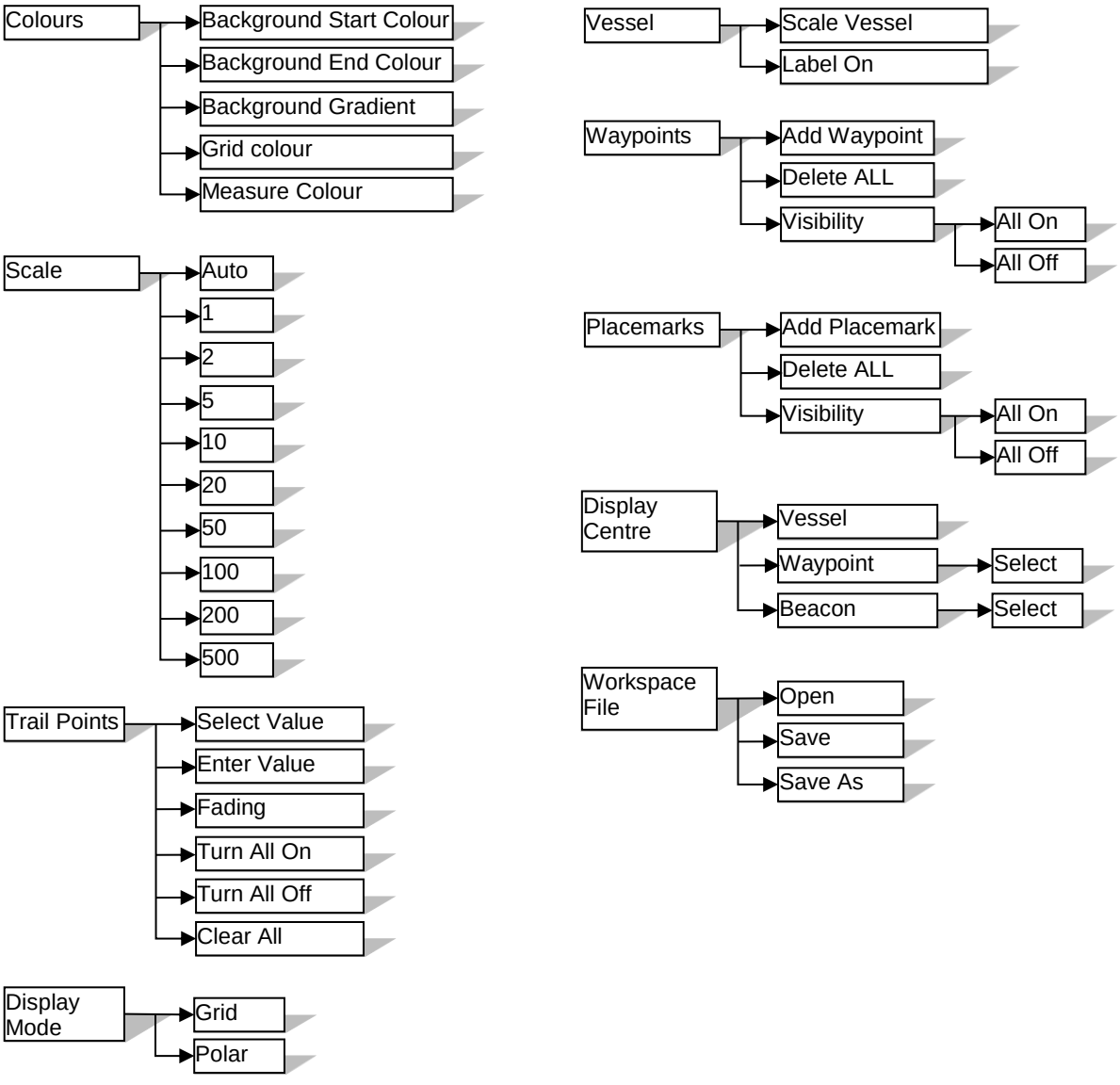


The current data source and scale is displayed in the Title Bar. If (A) is present the scale is in automatic mode.

The Display Mode can either be Grid or Polar (as above). This can be controlled from the context menu, system preferences or shortcuts on the tool bar.

If maps have been loaded then the overlay may be switched on or off via the 'Map Overlay'  toolbar button

The Context Menu is accessed by a Right Mouse Click when the Plot Window is active.



- Colours

  The colours of the plot window may user defined for operating conditions. These may also be adjusted from Edit Workspace - Display Options.

- Scale

  The scaling of the plot window may be adjusted or set to automatic if required.

In automatic mode the plot window will be adjusted to display all active (visible) targets.

- Trail Points
  Values for ALL beacons trail points can be adjusted.
- Display Mode
  The display mode can be set to grid or polar.
- Vessel
  The label and vessel scaling can be toggled on // off. This along with other vessel settings may also be adjusted from Edit Workspace – Vessel.
- Waypoints
  A waypoint can be added (its position will be the point at which the right mouse was clicked from the plot window).
  All waypoints can be deleted (a confirmation prompt will be displayed).
  All waypoints visibility may be turned on or off.
- Placemarks
  A placemark can be added (its position will be the point at which the right mouse was clicked from the plot window).
  All placemarks can be deleted (a confirmation prompt will be displayed).
  All placemarks visibility may be turned on or off.
- Display Centre
  The current centre of the plot window can be selected. Options are Vessel, any waypoint or any active beacon.
- Workspace File
  A workspace file may be loaded or saved from this menu.

The plot window scale may be changed by zooming in and out. This may be achieved using the wheel mouse when the plot window is active. Alternatively the 'Zoom In' and 'Zoom Out' buttons on the toolbar can be used.

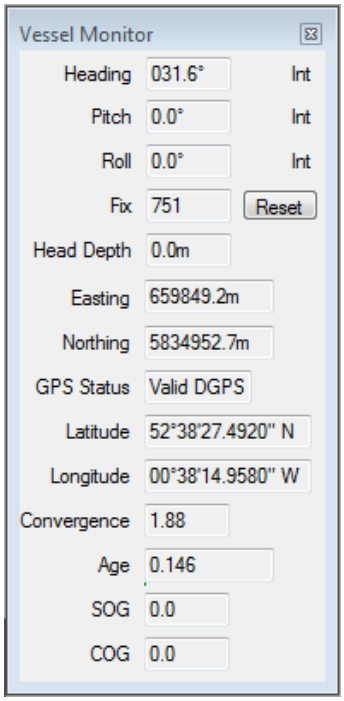

The plot window may also be '*panned*' by pressing and holding the left mouse button whilst dragging the display (please note the display will not change until the left mouse button is released). This effectively *fixes* the plot window centre point to a specific x/y (or Easting/Northing) value.

If panning has been applied, the centre point may be set back to vessel, waypoint of active beacon as previously described. Alternatively the 'Centralize' button on the toolbar will revert the centre point of the window to the previously selected centre mode before any panning was carried out.

Vessel Monitor

Toolbar Button  Shortcut Key: Ctrl+V

The Vessel Monitor will display the all vessel's parameters including Heading, Pitch, Roll, GPS Position, Speed Over Ground (SOG) and Course Over Ground (COG) and the age of the GPS position relative to the last received beacon response.



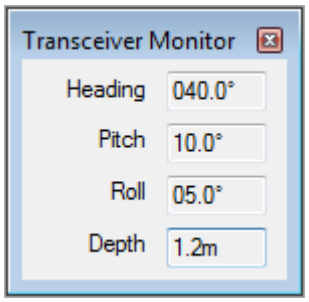
The Vessel Monitor also indicates if internal (Int.) or external (Ext.) heading, pitch and roll are selected.

The fix number may be reset by pressing the 'Reset' button.

Transceiver Monitor

Toolbar Button  Shortcut Key: Ctrl+T

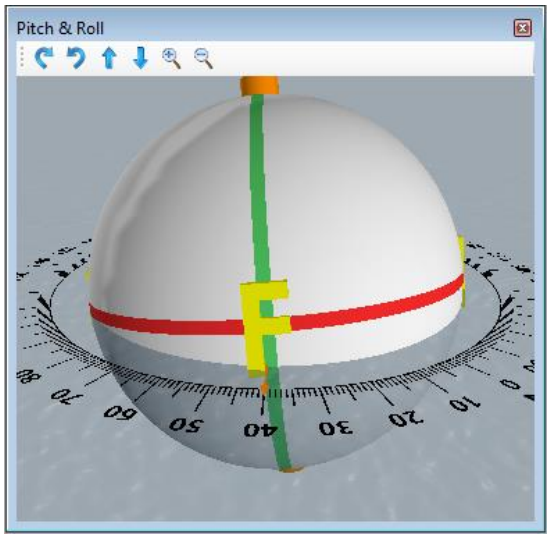
The Transceiver Monitor window displays the heading, pitch, roll and depth of the transceiver.



Pitch & Roll Monitor

Toolbar Button  Shortcut Key: Ctrl+A

The Pitch & Roll Monitor window show a graphical representation of the current vessel heading, pitch & roll.



The forward, aft, port and starboard of the vessel are indicated on the model with F,A,P & S respectively. The arrow shows the current vessel heading overlaid on the compass.

The current view of the model can be changed via the buttons on the toolbar or via the mouse wheel, the mouse wheel mode of adjustment can be altered using a combination of the Ctrl, Alt and Shift buttons as below.

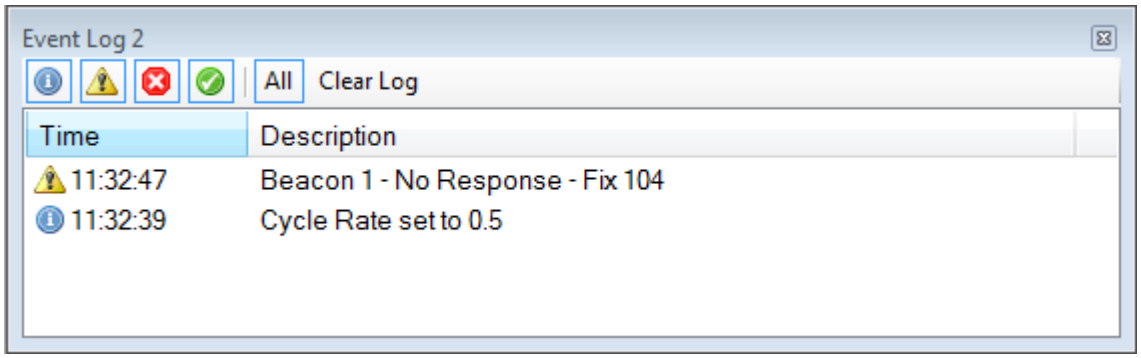
Wheel - Zoom In/Out
Wheel + Ctrl - Change viewing angle
Wheel + Alt - Change view elevation

Shift Key - With any above combinations, holding will increase the speed of adjustment

Event Log

Toolbar Button  Shortcut Key: Ctrl+V

The event log displays any required system messages.



The Event Log records and reports all system events in four levels:

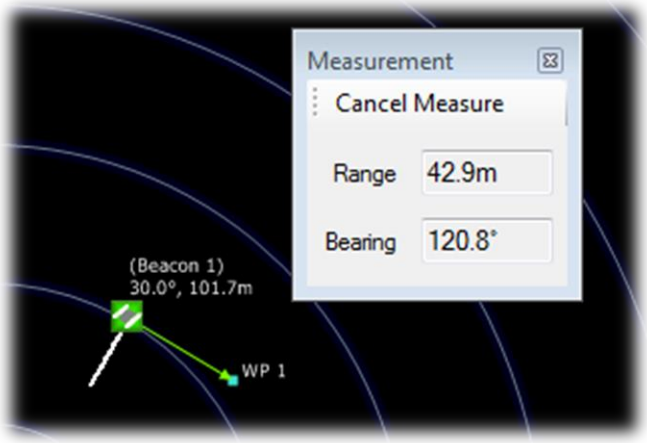
	Information:	Information Only Messages
	Warning:	System Warning Messages
	Critical:	Critical System Messages
	Confirmation	Confirmation Only Messages

The Event Log can be filtered to display only the desired level messages. By selecting one or more of the message type icons in the tool bar to view messages. Filters can be removed to display all messages.

The 'Clear Log' button clears the event log window of all messages.

Measurement

Toolbar Button 



The Measurement Tool can be used to measure between any two points on the plot screen, a range and bearing will be displayed in the measurement window.

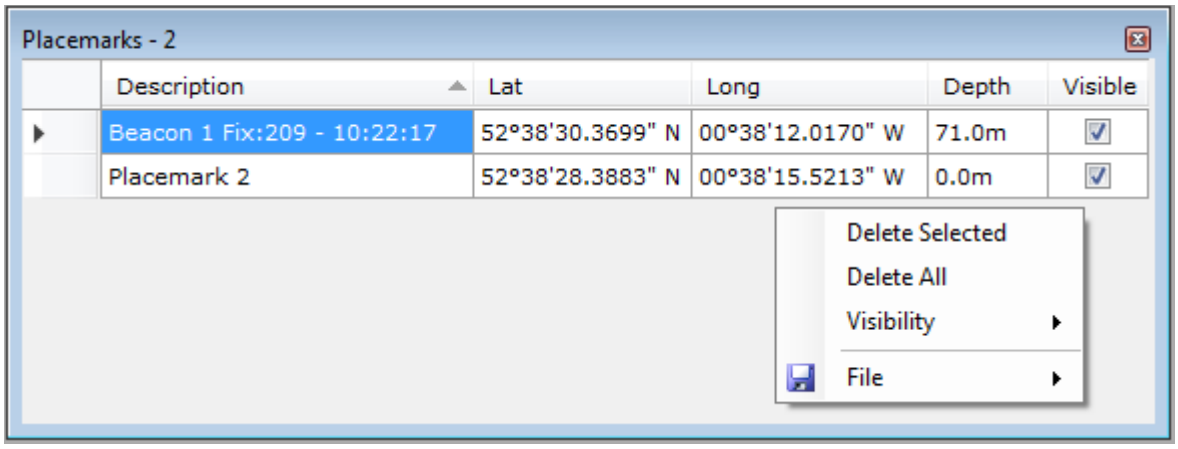
A measurement may be 'attached' at one or both ends to an object such as the vessel, a beacon, a waypoint or a placemark.

Select the measurement tool from the task bar and move the cursor to the plot window. The cursor will change to a crosshair on a valid attachment point, select this point by left clicking. The second point for the measurement can then be selected in the same manner. If no end measurement point is selected the measurement will be to the current cursor position.

To cancel the measurement click 'cancel measurement' to close

Placemarks

Toolbar Button  Shortcut Key: Ctrl+M



Place marks are designed to offer the operator the ability to mark and record places of interest or events typically in Eastings and Northings (for reference) with the depth of the reading appended. The above example is shown with the context menu displayed (right mouse click).

F5 adds a Place mark at the last received beacon position

Place marks can be added by positioning the cursor over the place to be marked on the plot window and double clicking the left button.

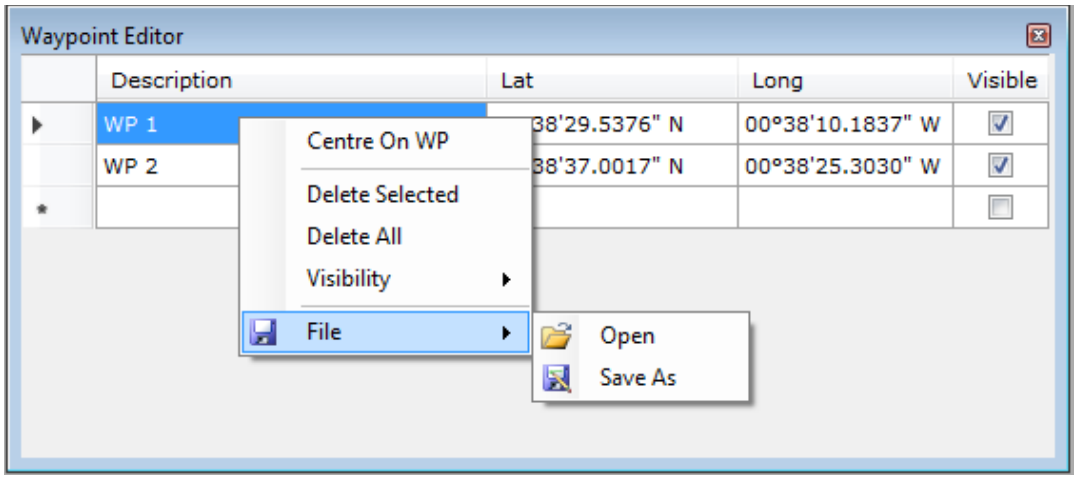
Place mark descriptions can be user defined to refer to a particular event or area.

Place marks can be visible / invisible on the plot window by ticking the visible check box.

A place mark file can be saved to disc and exported. Please note that placemarks saved to a file will be saved as a Lat/Long position, therefore please ensure that GPS data is being received and applied.

Waypoints

Toolbar Button  Shortcut Key: Ctrl+W



Waypoints are designed to be used as references or markers for navigation purposes. The above example is shown with the context menu displayed (right mouse click).

Waypoints can be added by positioning the cursor over the place to be marked on the plot window and right clicking selecting add waypoint. Waypoints can also be manually configured by entering the co-ordinates of the waypoint. This may be specified in either Eastings and Northings or as Lat and Long values.

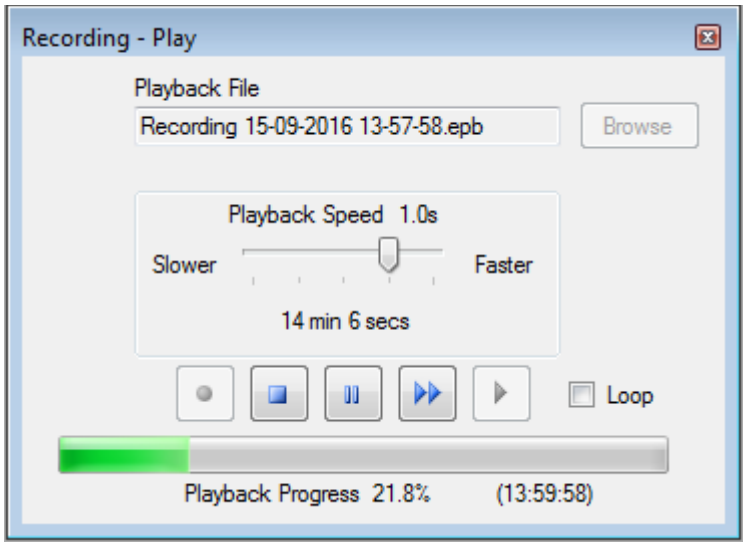
Waypoint descriptions may be any text required by the user to easily identify the waypoint.

Waypoints can be visible / invisible on the plot window.

A waypoint file can be saved to file, and re-loaded.

Recorder/Playback

Toolbar Button  Shortcut Key: Ctrl+R



The record and playback function allows the operator to record the tracking and all peripheral interfaces in real time. To have the facility to play back the logged data for review. As the data is recorded in raw format the data sets can be re-created with new offsets, smoothing levels, etc. to produce a different final data set.

To record a file click on the record button, the system will automatically assign a file name with reference to the date and time. The filename will be displayed in the text box and a message will be displayed in the event log.

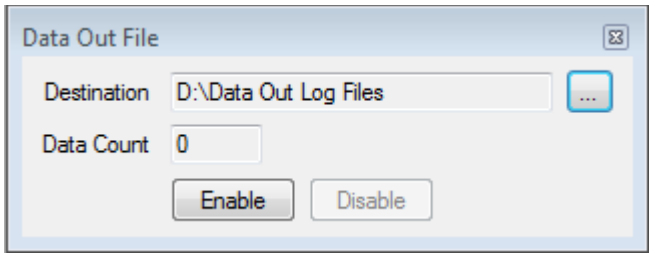
To stop recording click Stop.

To playback a file, browse to the file location (default location) and select.

Select desired playback speed and click Play. The playback speed can also be adjusted during playback, pausing and fast forward is also supported.

Data Out File

Toolbar Button  Shortcut Key: Ctrl+F



The output message generated by nexus, and sent out via the data out port, may be logged to a text file.

Pressing the '...' button selects the destination folder in which the files will be written.

Pressing 'Enable' creates a new file and starts logging. The file name will be automatically generated, using the current system date and time. A confirmation will be displayed in the event log.

An example file name is shown below.

'DataOut 2018-07-18 16-05-54.txt'

The 'Data Out' count shows the total number of fixes that have been written to file.

Pressing 'Disable' will end the logging to file, a confirmation will be displayed in the event log.

Tools Menu

A number of tools/utilities are available via the tools menu such as system programming, calibration etc.

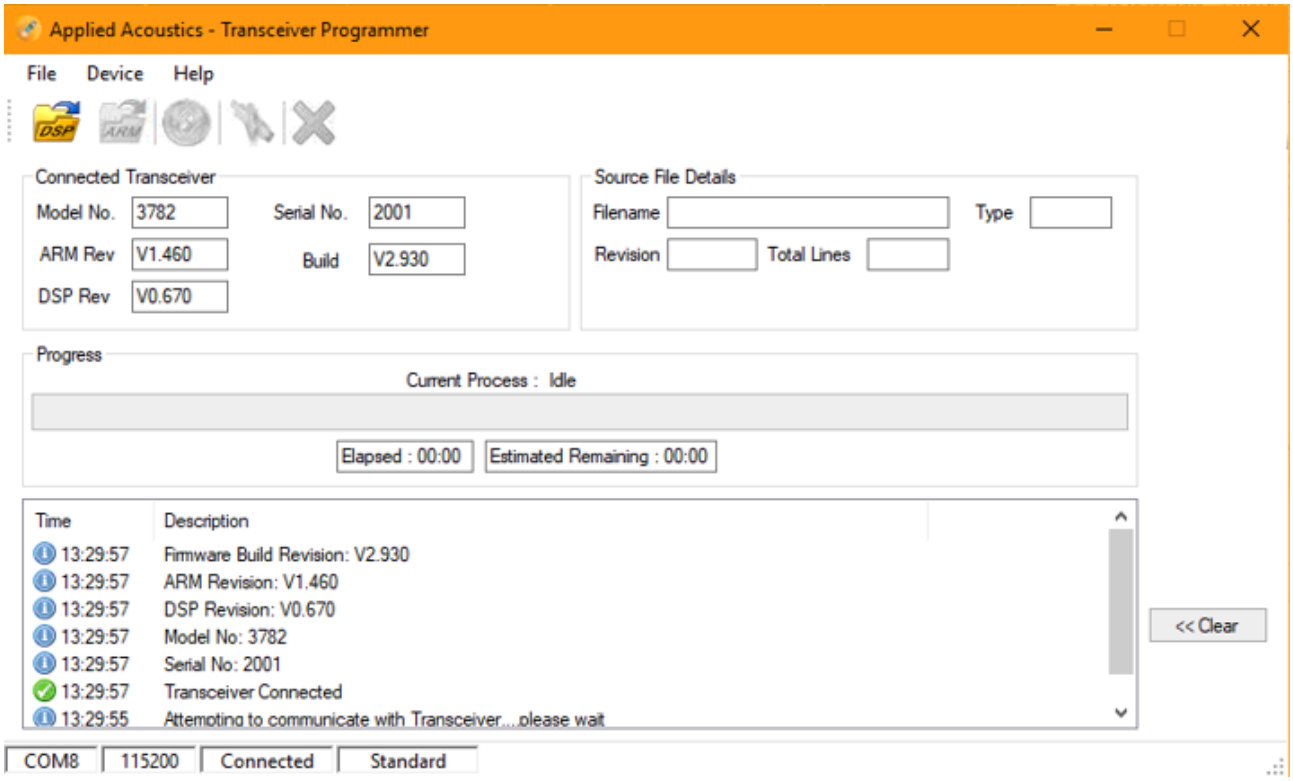
Programming

From the programming menu the software in both the console and the transceiver may be updated with data files supplied from Applied Acoustics.

The Pyxis transceiver is a single file update for both ARM and DSP firmware, this may both be reprogrammed from the utilities accessible from this menu.

The Pyxis console firmware may also be updated.

Below is an example of the Pyxis Transceiver programming utility



The programming procedure is the same for all updates and is as follows

- Insert a USB memory stick containing the update file.
- Launch the required programming tool.

- Open a source file – the browser automatically selects the external drive and sets the file filters to the correct type depending on the application. Select the desired file.
- Click Program, the progress bar then indicates the state of the update.
- If required, the system will prompt to shut down the unit.
- If required, power up the system to complete update and operate as normal.

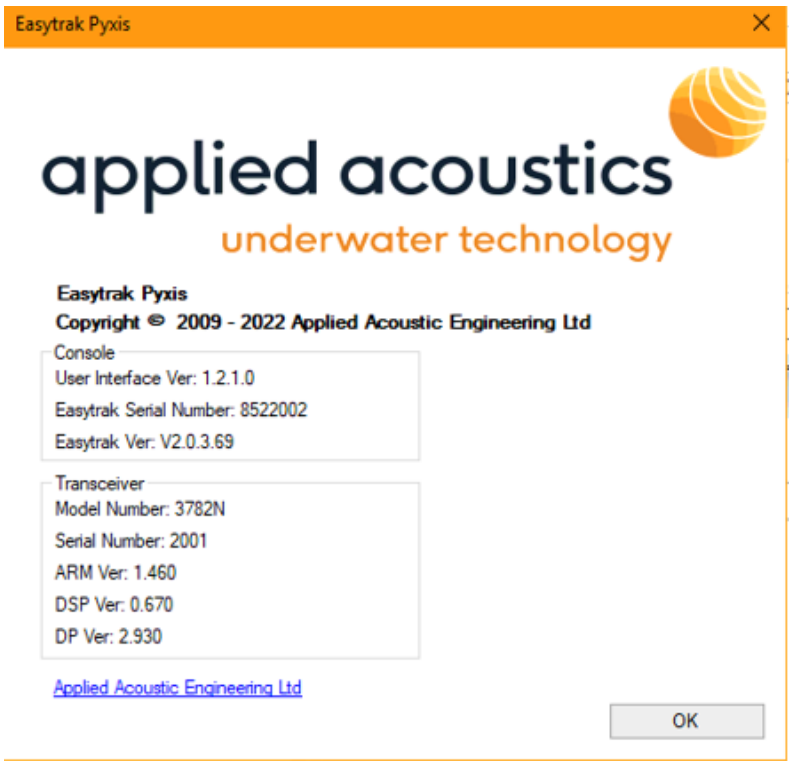
Advanced User Mode

Advanced user mode may be enabled from the Tools menu. A password may also be entered to restrict access to this mode if required.

Help Menu

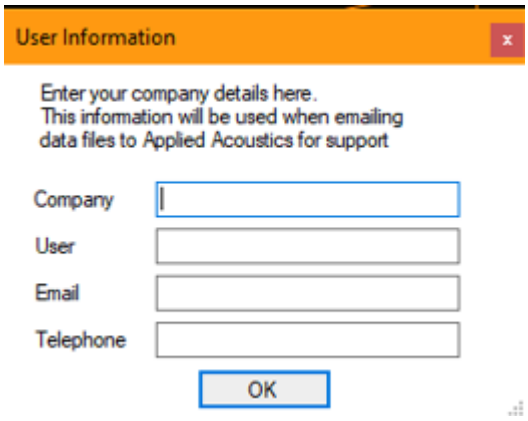
About

The about box displays system information about the console and the transceiver including software/firmware revisions and serial numbers.



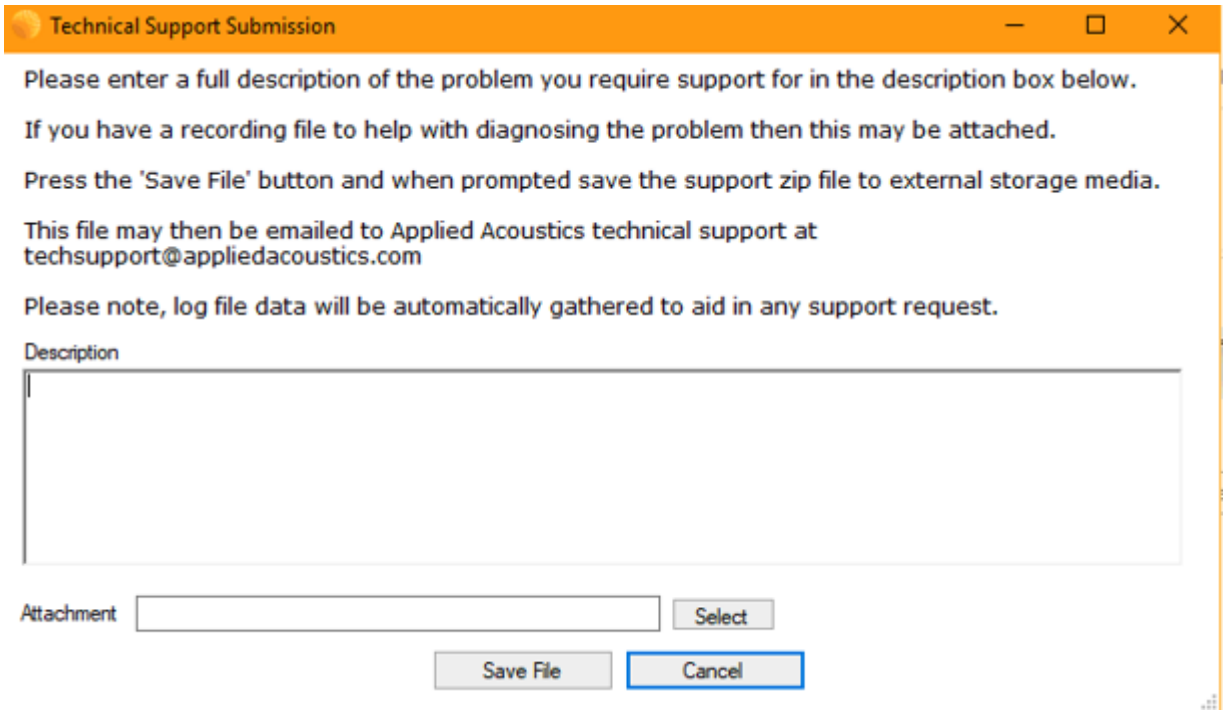
User Information

The user information window allows the user to input contact details which will be sent to Applied Acoustics when sending a technical support request.



Request Support

If you require any technical support you may request this via the help menu.



Please enter a brief description of the problem or request in the area provided. It is also possible to attach a previously recorded file that may help customer support.

The support request data may be saved to a zip file and saved to an external USB device and then emailed to Applied Acoustics at a later date.

8. Troubleshooting

Fault / Symptom	**No Signal return at any range**
Possible Causes	**Incorrect Channel.** Check Beacon editor **Beacon power.** This may be due to a discharged battery, fouled transducer, or beacon fault. Try with a known working beacon. **Obstruction.** The beacon's signal may be blocked by submerged parts of the vessel, seabed objects – manmade or natural. **Deck Cable.** Check that the deck cable or connectors have not been damaged. Look for cuts, splits or abrasions. Check there is no corrosion on the connector pins. **Damaged responder cable**. Check the pulse from Nexus is present at the Responder end of the cable (approx. 12VDC pulse on load). **Confirmation**. Temporarily locate the transducer and a suitable beacon on-deck. Try interrogating the beacon. Is the transducer transmitting (clicking)? Is the beacon transmitting (clicking)? No, try another transducer / beacon. Is Easytrak Pyxis receiving the beacon's transmission? If there is still no response the transducer is suspect.

Fault / Symptom	**Incorrect Range**
Possible Causes	**Incorrect Velocity of Sound.** Enter correct value. **Turn around delay.** Is the turn around delay set correctly in the beacon? Correct turn around delay. Another beacon in the water set to the same channel. Another sonar system transmitting at the beacon's reply frequency.

Fault / Symptom	**Short range**
Possible Cause	**Excessive range for conditions.** Range is dependent on local conditions such as in-band noise from man-made or marine sources. If possible reduce noise or work at a shorter range. **Beacon reply insensitivity.** This may be due to a fouled transducer, or beacon fault. Clean beacon transducer with fresh water. Try using another beacon. **Transducer reply insensitivity.** Check that the transducer is not damaged or fouled. Clean transducer with fresh water. **Obstruction.** The beacon's signal may be blocked by submerged parts of the vessel, seabed objects – man-made and natural. Bubbles of air and gas produced by the vessel's propeller. **Thermoclines.** This is due to abrupt changes of velocity of sound in water due to variances of water temperature and / or salinity. The effect of this can be to 'tunnel' or bend the acoustic signal away from either the target or the transducer. If possible try adjusting the height of the transducer in the water.

Fault / Symptom	**Short range**
Possible Cause	Excessive range for conditions. Range is dependent on local conditions such as in-band noise from man-made or marine sources. If possible reduce noise or work at a shorter range. Beacon reply insensitivity. This may be due to a fouled transducer, or beacon fault. Clean beacon transducer with fresh water. Try using another beacon. Transducer reply insensitivity. Check that the transducer is not damaged or fouled. Clean transducer with fresh water. Obstruction. The beacon's signal may be blocked by submerged parts of the vessel, seabed objects – man-made and natural. Bubbles of air and gas produced by the vessel's propeller. Thermoclines. This is due to abrupt changes of velocity of sound in water due to variances of water temperature and / or salinity. The effect of this can be to 'tunnel' or bend the acoustic signal away from either the target or the transducer. If possible try adjusting the

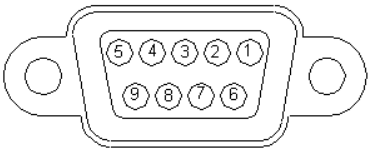
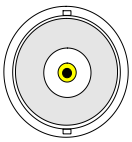
	height of the transducer in the water.

Fault / Symptom	**Unstable positions - bearing instability but range fairly stable**
Possible Causes	**Transducer depth.** Transducer may not be deep enough in the water. It is recommended the transducer be below the draft of the vessel by at least 1 metre. **Multipath interference.** This may be due to multipath interference close to the transducer or close to the target. It may be due to vessel movement especially if no form of compass compensation is being used. Adjust the height of the transducer in the water. **Movement.** If the transducer is free hanging over the side of the vessel, is the transducer being adversely affected by bow thrusters or alike? Relocate transducer. Tether transducer with rope forward and aft to reduce movement and rotation. **Contaminated Transducer.** Ensure the transducer is clean and uncontaminated prior to installation. Grease can have an adverse effect on the transducer. A lightly damped cloth should be used. Solvents are not recommended. **Damaged receive element.** Select Beacon editor data tab, check the relative signal levels and see if one (or more) element is very low relative to the other elements. Typically the faulty element would be <0-5% compared to a 'good' element of '70% at a range of a few tens of metres.

Fault / Symptom	**Unstable positions - bearing instability and range unstable**
Possible Causes	**Transducer depth.** Transducer may not be deep enough in the water. It is recommended the transducer be below the draft of the vessel by at least 1 metre. **Interrogation rate too fast.** If the interrogation rate is too quick, it is possible that reflections from previous signals may not have reduced sufficiently, and are picked up first rather than the new signal. **Multipath interference.** This may be due to multipath interference

	away from the transducer e.g. pipelines, underwater structures, and thermoclines. If the sea is flat calm, it is common for the water / air interface to give strong reflections. If possible try adjusting the height of the transducer in the water. **Acoustic noise.** The noise can be vessel borne such as from the propeller (try running at different revs), sonar systems (try synchronising so that the sonar's transmission does not overlap Easytrak's receive time. It is known in certain parts of the world for marine animals to generate quite loud acoustic noise. Select the dropdown menu Help/diagnostics (option 2) and check the in-water noise level. **Electrical noise.** This can be conducted or radiated from generators, welding kits, radio communications, sonar systems etc. If possible, switch off equipment one system at a time until the offending piece of equipment can be identified. Select the dropdown menu Help/diagnostics (option 2) and check the in-water noise level.

9. External I/O Connector Pin Outs

• Serial Connectors 2 Receive Data (Rx) 3 Transmit Data (Tx) 5 Gnd	
• BNC Connector Inner Signal + Outer Signal – Note the BNC connector is isolated.	

10. Channels

Easytrak Pyxis – (Sigma II)

Sigma2 Channel configuration consists of a Wake-Up Tone (WUT), Interrogate Code (IC), Reply Code (RC) and Turn-Around-Time Extension (TATX) in sequence before selecting the confirmed configuration

WUT + IC + RC + TATX

Wake up (WUT) ID 0-7, total of 8

Interrogate Code (IC) 00 to14, total of 15 codes

Reply Code (RC) 00 to 14, total of 15 codes

Turn-Around-Time Extension (TATX): Default extension = 0ms.

Easytrak Pyxis – Quick Set Sigma II

ID Channel	Nexus 2 Channel	Transponder TAT (ms)	Responder TAT (ms)
AA	AAE SIGMA 2 QUICKSET 1	75	75
AB	AAE SIGMA 2 QUICKSET 2	75	75
AC	AAE SIGMA 2 QUICKSET 3	75	75
AD	AAE SIGMA 2 QUICKSET 4	75	75
AE	AAE SIGMA 2 QUICKSET 5	75	75
AF	AAE SIGMA 2 QUICKSET 6	75	75
BC	AAE SIGMA 2 QUICKSET 7	75	75
BD	AAE SIGMA 2 QUICKSET 8	75	75

AAE Spread Spectrum Channels

ID	Channel	Transponder TAT (ms)	Responder TAT (ms)	Description
E0	SS CH 0	100	100	AAE Spread Spectrum
E1	SS CH 1	100	100	AAE Spread Spectrum
E2	SS CH 2	100	100	AAE Spread Spectrum
E3	SS CH 3	100	100	AAE Spread Spectrum
E4	SS CH 4	100	100	AAE Spread Spectrum
E5	SS CH 5	100	100	AAE Spread Spectrum
E6	SS CH 6	100	100	AAE Spread Spectrum
E7	SS CH 7	100	100	AAE Spread Spectrum
E8	SS CH 8	100	100	AAE Spread Spectrum
E9	SS CH 9	100	100	AAE Spread Spectrum
EA	SS CH 10	100	100	AAE Spread Spectrum
EB	SS CH 11	100	100	AAE Spread Spectrum
EC	SS CH 12	100	100	AAE Spread Spectrum
ED	SS CH 13	100	100	AAE Spread Spectrum
EE	SS CH 14	100	100	AAE Spread Spectrum
EF	SS CH 15	100	100	AAE Spread Spectrum
F0	SS CH 16	100	100	AAE Spread Spectrum
F1	SS CH 17	100	100	AAE Spread Spectrum
F2	SS CH 18	100	100	AAE Spread Spectrum
F3	SS CH 19	100	100	AAE Spread Spectrum
F4	SS CH 20	100	100	AAE Spread Spectrum
F5	SS CH 21	100	100	AAE Spread Spectrum
F6	SS CH 22	100	100	AAE Spread Spectrum
F7	SS CH 23	100	100	AAE Spread Spectrum
F8	SS CH 24	100	100	AAE Spread Spectrum
F9	SS CH 25	100	100	AAE Spread Spectrum
FA	SS CH 26	100	100	AAE Spread Spectrum
FB	SS CH 27	100	100	AAE Spread Spectrum
FC	SS CH 28	100	100	AAE Spread Spectrum
FD	SS CH 29	100	100	AAE Spread Spectrum
FE	SS CH 30	100	100	AAE Spread Spectrum
FF	SS CH 31	100	100	AAE Spread Spectrum

Digital Depth telemetry available if depth sensor fitted to beacon

AAE Easytrak Channels

Channel	RXF1 (Hz)	RXF2 (Hz)	TXF1 (Hz)	TXF2 (Hz)*	Transponder TAT (ms)	Responder TAT (ms)	Pulse Width (ms)
A0	17500	-	30000	29000	30	30	2
A1	18500	-	28000	27000	30	30	2
A2	19500	-	26000	25000	30	30	2
A3	20500	-	29000	28000	30	30	2
A4	21500	-	27000	26000	30	30	2
A5	22500	-	30000	29000	30	30	2
A6	18000	20000	27000	26000	60	30	2
A7	18000	21000	28000	27000	60	30	2
A8	18000	22000	30000	29000	60	30	2
A9	18000	23000	29000	28000	60	30	2
B0	20000	18000	30000	29000	60	30	2
B1	20000	21000	29000	28000	60	30	2
B2	20000	22000	28000	27000	60	30	2
B3	21000	18000	27000	26000	60	30	2
B4	21000	20000	26000	25000	60	30	2
B5	21000	22000	28000	27000	60	30	2
B6	21000	23000	30000	29000	60	30	2
B7	22000	18000	26000	25000	60	30	2

*Depth telemetry transponders only.

Simrad HPR Channels

Channel	Simrad Channel	RXF1 (Hz)	TXF1 (Hz)	TXF2 (Hz)*	Transponder TAT (ms)	Responder TAT (ms)	Pulse Width (ms)
01	1	20492	29762	32468	30	30	10
02	2	21552	30488	29762	30	30	10
03	3	22124	31250	30488	30	30	10
04	4	22727	31847	31250	30	30	10
05	5	23364	32468	31847	30	30	10
06	6	24038	27173	29070	30	30	10
07	7	24510	27777	27173	30	30	10
08	8	25000	28409	27777	30	30	10
09	9	26042	29070	28409	30	30	10
11	11 Square	21552	27173	32468	30	30	10
22	22 Circle	22727	28409	27173	30	30	10
33	33 Delta	23923	29762	28409	30	30	10
44	44 X	25126	31250	29762	30	30	10
55	55 Y	26455	32468	31250	30	30	10

*Depth telemetry transponders only.

Simrad HiPAP Channels

Channel	RXF1 (Hz)	RXF2 (Hz)	TXF1 (Hz)	TXF2 (Hz)*	Transponder TAT (ms)	Responder TAT (ms)	Pulse Width (ms)
12	21000	21500	29250	29750	60	30	10
13	21000	22000	29750	30250	60	30	10
14	21000	22500	30250	28750	60	30	10
15	21000	23000	30750	27250	60	30	10
16	21000	23500	27250	27750	60	30	10
17	21000	24000	27750	28250	60	30	10
18	21000	24500	28250	30750	60	30	10
21	21500	21000	28500	29000	60	30	10
23	21500	22000	29500	30000	60	30	10
24	21500	22500	30000	28500	60	30	10
25	21500	23000	30500	27000	60	30	10
26	21500	23500	27000	27500	60	30	10
27	21500	24000	27500	28000	60	30	10
28	21500	24500	28000	30500	60	30	10
31	22000	21000	28750	29250	60	30	10
32	22000	21500	29250	29750	60	30	10
34	22000	22500	30250	28750	60	30	10
35	22000	23000	30750	27250	60	30	10
36	22000	23500	27250	27750	60	30	10
37	22000	24000	27750	28250	60	30	10
38	22000	24500	28250	30750	60	30	10
41	22500	21000	28500	29000	60	30	10
42	22500	21500	29000	29500	60	30	10
43	22500	22000	29500	30000	60	30	10
45	22500	23000	30500	27000	60	30	10
46	22500	23500	27000	27500	60	30	10
47	22500	24000	27500	28000	60	30	10
48	22500	24500	28000	30500	60	30	10
51	23000	21000	28750	29250	60	30	10
52	23000	21500	29250	29750	60	30	10
53	23000	22000	29750	30250	60	30	10
54	23000	22500	30250	28750	60	30	10
56	23000	23500	27250	27750	60	30	10
57	23000	24000	27750	28250	60	30	10
58	23000	24500	28250	30750	60	30	10
61	23500	21000	28500	29000	60	30	10

62	23500	21500	29000	29500	60	30	10
63	23500	22000	29500	30000	60	30	10
64	23500	22500	30000	28500	60	30	10
65	23500	23000	30500	27000	60	30	10
67	23500	24000	27500	28000	60	30	10
68	23500	24500	28000	30500	60	30	10

Simrad HiPAP Channels Continued

Channel	RXF1 (Hz)	RXF2 (Hz)	TXF1 (Hz)	TXF2 (Hz)*	Transponder TAT (ms)	Responder TAT (ms)	Pulse Width (ms)
71	24000	21000	28750	29250	60	30	10
72	24000	21500	29250	29750	60	30	10
73	24000	22000	29750	30250	60	30	10
74	24000	22500	30250	28750	60	30	10
75	24000	23000	30750	27250	60	30	10
76	24000	23500	27250	27750	60	30	10
78	24000	24500	28250	30750	60	30	10
81	24500	21000	28500	29000	60	30	10
82	24500	21500	29000	29500	60	30	10
83	24500	22000	29500	30000	60	30	10
84	24500	22500	30000	28500	60	30	10
85	24500	23000	30500	27000	60	30	10
86	24500	23500	27000	27500	60	30	10
87	24500	24000	27500	28000	60	30	10

ORE Trackpoint Channels

Channel	LXT Channel	RXF1 (Hz)	TXF1 (Hz)	TXF2 (Hz)*	Transponder TAT (ms)	Responder TAT (ms)	Pulse Width (ms)
0A		18000	24000	23000	15	15	1.5
0B		17000	24000	23000	15	15	1.5
10	LXT Code 1	17000	23000	22000	15	15	1.5
09		18000	25000	24000	15	15	1.5
0A		16000	25000	24000	15	15	1.5
1B		21500	26000	25000	15	15	1.5
20	LXT Code 2	19000	25000	24000	15	15	1.5
29		18000	26000	25000	15	15	1.5
2A		17500	28500	27500	15	15	1.5
2B		18500	26500	25500	15	15	1.5
30	LXT Code 3	17000	27000	26000	15	15	1.5
40	LXT Code 4	19000	29000	28000	15	15	1.5
50	LXT Code 5	17000	30000	29000	15	15	1.5
60		18000	28000	27000	15	15	1.5
69		16000	23000	22000	15	15	1.5
6A		18000	23000	22000	15	15	1.5
6B		20500	23000	22000	15	15	1.5
70		18000	30000	29000	15	15	1.5
79		17000	24000	23000	15	15	1.5
7A		19000	24000	23000	15	15	1.5
7B		17000	25000	24000	15	15	1.5
80		21000	29000	28000	15	15	1.5
89		17000	26000	25000	15	15	1.5
8A		21000	33000	32000	15	15	1.5
8B		18000	31000	30000	15	15	1.5

11. Easytrak Pyxis Data Output formats

Applied Acoustic Engineering (AAE) Data string

The AAE string has 76 characters including carriage return and line feed when not in GPS mode.

i,t,hhmmss,xxxxx.x,yyyyy.y,zzzzz.z,rrrr.r,bbb.b,dd.d,ccc.c,RRR.R,ppp.p,SSSCL

Description	String code
Beacon identification (1 to 4)	i
Data type: Ship ref (0), North ref (1), Smoothed (3)	t
Hour	h
Minute	m
Second	s
X (or Eastings)	x
Y (or Northings)	y
Z (Depth)	z
Slant range	r
Bearing to target	b
Depression angle	d
Compass	c
Roll	R
Pitch	p
Status (see overleaf)	S
Carriage return (CR)	C
Line Feed (LF)	L

All ranges and positions are in metres and angles are in degrees.

Note fields are comma separated. Leading 0's (except time) and empty fields are space filled. When in GPS mode, the X, Y and Z fields automatically expand to take the full GPS data value.

Example strings

"Normal" string

1,0,115906,111.1,*-222.2,**333.3,*415.7,153.4,53.3,123.5,**0.4,*-0.6,000CL**

"GPS" string

1,0,115906,111.1,500000.0,6500000.0,*415.7,153.4,53.3,123.5,**0.4,*-0.6,000CL**

Note * = space.

Error codes

Any error code is constructed by adding the following.

Interrogation has timed out	001
Outside velocity gate	032
GPS error	064
Reply signal overload	256

An error code of '000' means no error.

Applied Acoustic Engineering V2(AAE) Data string

Field	Pos	Name	Comment
$AADS1	1	String Identifier	
,xx	2	Beacon Identifier	01 to 10
,x	3	Data Type	Always 5 for Nexus 2
,x	4	Orientation	H (Ship Ref), N (North Ref)
,x	5	GPS Position	Y or N
,hhmmss.s	6	Time	
,xxxxx.x	7	Beacon X Value (or Eastings)	Metres
,xxxxx.x	8	Beacon Y Value (or Northings)	Metres
,xxxxx.x	9	Beacon Z Value	Metres
,xxxx.x	10	Beacon Slant Range	Metres. Zero if GPS Position
,xxx.x	11	Beacon Bearing	Degrees. Zero if GPS Position
,xx.x	12	Beacon Depression Angle	Degrees. Zero if GPS Position
,xxx,x	13	Compass	Degrees
,xxx.x	14	Pitch	Degrees
,xxx.x	15	Roll	Degrees
,xxx	16	Status	See Error Codes
,xx.xx	17	X Value Standard Deviation	Optional
,xx.xx	18	Y Value Standard Deviation	Optional
,xx.xx	19	Z Value Standard Deviation	Optional
,xx.xxx	20	X Quality	Optional

,xx.xxx	21	Y Quality	Optional
,xx.xxx	22	Z Quality	Optional
*HH		Checksum	Checksum
CL		Terminators	Carriage return / line feed

Example string

$AADS1,01,5,N,N,111430.2, -200.4, 0.1, 99.8, 223.9,270.0,26.5, 0.0, 0.0,
0.0,000[,00.12,00.21,00.14,00.863,00.863,00.472]*02

Note: Data in [ ] is optional

All ranges and positions are in metres and angles are in degrees.

Note fields are comma separated. Leading 0's (except time) and empty fields are space filled. When in GPS mode, the X, Y and Z fields automatically expand to take the full GPS data value.

Error codes

Any error code is constructed by adding the following.

Interrogation has timed out	001
Outside velocity gate	032
GPS error	064
Reply signal overload	256

An error code of '000' means no error.

ORE Trackpoint 2EC Data string

The **simplified TP-2EC** string has 68 characters including carriage return and line feed.

i*hh:mm:ss*ccc*bbb.b*rrrrr.r*xxxxxx.x*yyyyyy.y*zzzzz.z*-ttttt.t*EECL

Description	String code
Beacon identification	i
Hour	h
Minute	m
Second	s
Compass	c
Bearing	b
Slant range	r
X (or Eastings)	x
Y (or Northings)	y
Z	z
Telemetry	t (always 0.0)
Error	E
Carriage return (CR)	C
Line Feed (LF)	L

Note * = space.

Note fields are space separated. Leading 0's (except time) are space filled. When in GPS mode, the X, Y and Z fields automatically expand to take the full GPS data value.

Example:-

2*23:59:59*359*359.91234.5*-10000.0*-10000.0*10000.0******0.0*00CL**

Note * = space.

Error codes

No error	00
Lost signal	06

Simrad HPR 300P Data String

The **simplified HPR 300P** string has 48 characters including carriage return and line feed.

ii*HB**SSS**ccc.c*xxxx.x*yyyy.y*zzzz.z**QQ.QCL**

Description	String code (above)
Beacon identification	i (Beacon number rather than channel number)
Transducer number	H (Always 1)
Beam	B (Always 'W')
Status	S
Compass	c (Note compass heading rather than course)
X (or Eastings)	x
Y (or Northings)	y
Z	z
Quality	Q (Always 0.0)
Carriage return (CR)	C
Line Feed (LF)	L

Note * = space.

Note fields are space separated. Leading 0's are space filled. When in GPS mode, the X, Y and Z fields automatically expand to take the full GPS data value. For figures larger than 999.9 the decimal point is removed i.e. 1001 meters.

Example:-

21**W***OK**359.9*-999.9**999.9**-1000***0.0CL**

Note * = space.

Error codes

No error	' OK'
No reply	'NRY'

ORE Trackpoint STD-EC W/PR Data string

The **simplified STD-EC W/PR** string has **80** characters including carriage return and line feed.

i*hh:mm:ss*ccc*bbb.b*rrrrr.r*xxxxxx.x*yyyyyy.y*zzzzz.z*-ttttt.t*EE*RRR.R*PPP.PCL

Description	String code
Beacon identification	i
Hour	h
Minute	m
Second	s
Compass	c
Bearing	b
Slant range	r
X (or Eastings)	x
Y (or Northings)	y
Z	z
Telemetry	t (always 0.0)
Error	E
Roll	R
Pitch	P
Carriage return (CR)	C
Line Feed (LF)	L

Note * = space.

Note fields are space separated. Leading 0's (except time) are space filled. When in GPS mode, the X, Y and Z fields automatically expand to take the full GPS data value.

Example:-

2*23:59:59*359*359.91234.5*-10000.0*-10000.0*10000.0******0.0*00**1.2* 2.1CL**

If the signal is lost, the following string is outputted.

2*23:59:59*359*-.-*****-.-******-.-******-.-*****-.-******-.-06***-.-***-.-CL**

Note * = space.

Error codes

No error	00
Lost signal	06

Simrad HPR 309 Data Telegram

The **simplified HPR 309** telegram has 32 bytes including the '@' terminator.

Field Name	Size (bytes)	Byte Offset	Comment
Header	1	0	Currently set to 1
Roll	2	1	Used
Pitch	2	3	Used
Heading	2	5	Used
Transponder index	1	7	Beacon No. (1-4)
X Position	3	8	Used
Y Position	3	11	Used
Depth	3	14	Used
Position Status	1	17	Good = 0, bad = 1
Time out	1	18	Not used (0)
Transponder sequence	3	19	Not used (0)
Tracking TD angle	2	22	Not used (0)
Test	1	24	Not used (0)
Transponder type	1	25	Not used (0)
Transponder specification	1	26	Set to 1 (mobile transponder)
Transducers	1	27	Not used (0)
Transducer status	1	28	Not used (0)
Kalman filter window	1	29	Not used (0)
Checksum	1	30	Used
End of telegram	1	31	Hex 0x40 ('@')

Note the X, Y and depth values in the Simrad 309 telegram will be dependent on the data mode selected.

Comments on the Simrad HPR309 Telegram

Header	Currently set to 1
Roll	Roll is a 12 bit, 2's complement scaled integer. Positive direction is when port side is up. Resolution is 360.0/4096 degrees. Minimum value = 800H (-2048) = -180.0°. 0 = 0°, and 7ffH = 2047 = (180° - resolution) °. The first byte in this field contains the 6 most significant bits and the next byte the six least significant bits.
Pitch	Pitch is a 12 bit, 2's complement scaled integer. Positive direction is when bow is up. Resolution is 360.0/4096 degrees. Minimum value = 800H (-2048) = -180.0°. 0 = 0°, and 7ffH = 2047 = (180° - resolution) °. The first byte in this field contains the 6 most significant bits and the next byte the six least significant bits.
Heading	Roll is a 12 bit, 2's complement scaled integer. Positive direction is clockwise. Resolution is 360.0/4096 degrees. Minimum value = 800H (-2048) = -180.0°. 0 = 0°, and 7ffH = 2047 = (180° - resolution) °. The first byte in this field contains the 6 most significant bits and the next byte the six least significant bits.
Transponder index	1 for beacon 1, 2 for beacon 2, 3 for beacon 3, and 4 for beacon 4.
X, Y and Depth position	The X, Y and Depth positions are with respect to the ship's datum point. X is positive when Starboard of the datum, Y is positive when Forward of the datum, Depth is positive when down from the datum. X, Y and Depth are 16 bit, 2's complement scaled integers. (Note the integer is sign extended to 18 bits) Resolution is 8192.0/65536 meters. Minimum value = 8000H (-4096) = -4096.0. 0 = 0 meters, and 7fffH = (4096.0 - resolution) meters. The first byte in this field contains the 6 most significant bits, the next byte the six 'middle' significant bits, and the last byte the six least significant bits.
Position status	Good fix bit 0 = 0 and bad fix bit 0 = 1
Time out	Not used, bit 0 = 0.

Transponder sequence	Not used, bit 0 = 0.
Tracking TD angle	Not used, bit 0 = 0.

Comments on the Simrad HPR309 Telegram cont'd

Test	Not used, bit 0 = 0.
Transponder type	Not used, bit 0 = 0.
Transponder specification	Mobile transponder, bit 0 = 1.
Transducers	Not used, bit 0 = 0.
Transducer status	Not used, bit 0 = 0.
Kalman Filter window	Not used, bit 0 = 0.
Checksum	The checksum results in the exclusive Oring of all bytes of the telegram up to but not including the checksum byte.
End of telegram	The end byte of the telegram is always HEX 0x40, the character '@'.

Simrad $PSIMSSB Data String

The **simplified Simrad $PSIMSSB** string is of variable length and is terminated by a carriage return and line feed.

Field	Name	Comment
$PSIMSSB	Start character and address	
,hhmmss.ss	Time	Real time of measurement
,cc	Beacon code	E.g. D50, D66
,A	Status	A = OK, V not OK
,cc	Error code	Left empty
,a	Coordinate system	Set to 'C' for Cartesian or 'U' for UTM coordinates.
,a	Orientation	Set to 'H' for heading up, or 'N' for North referenced.
,a	SW Filter	Set to M for measured
,x.x	X coordinate	X depends on data format set.
,x.x	Y coordinate	Y depends on data format set.
,x.x	Depth	Depth depends on data format set.
,x.x	Expected accuracy	Always 0.0
,a	Additional information	Set to 'N'
,x.x	1st Additional value	Left empty
,x.x	2nd Additional value	Left empty
*HH	Checksum	Checksum
CL	Terminators	Carriage return / line feed

Example string

$PSIMSSB,161618.00,B50,A,,C,H,M,10.0,20.0,30.3,0.0,N,,*5FCL

Note, providing GPS $GPRMC is available, the data output string $PSIMSSB uses GPS UTC time and date. If GPS is not available, or $GPRMC is not selected, Easytrak's internal date and time is used.

Simrad $PSIMSNS Data string

The **simplified Simrad $PSIMSNS** string is of variable length and is terminated by a carriage return and line feed.

Field	Name	Comment
$PSIMSNS	Start character and address	
,hhmmss.ss	Time	Real time of measurement
,cc	Beacon code	E.g. D50, D66
,xx	Transceiver number	Always 1
,xx	Transducer number	Always 1
,x.x	Roll	Roll in degrees
,x.x	Pitch	Pitch in degrees
,x.x	Heave	Always 0.0
,x.x	Heading	Between 0° and 360°
,x	Tag	Left empty
,x	Parameters	Bits (0,1) = 1 (SSBL) Bit (4) = 1 (Mobile) Bit (5) =1 (UTM Time) Other bits = 0
,x.x	Time age	Always 0.0
,x	Spare	Empty field
,axx	Master Slave	Always M121
*HH	Checksum	Checksum
CL	Terminators	Carriage return / line feed

Example string

$PSIMSNS,161618.00,B50,1,1,0.0,0.0,0.0,86.2,,1,0.00,,M121*69CL

Note, providing GPS $GPRMC is available, the data output string $PSIMSSB uses GPS UTC time and date. If GPS is not available, or $GPRMC is not selected, Easytrak's internal date and time is used.

Pseudo $GPRMC Data string

RMC - Recommended Minimum Navigation Information.

The **pseudo $GPRMC** string is terminated by a carriage return and line feed.

$GPRMC,hhmmss.sss,A,llll.llll,N,yyyyy.yy,E,k.k,c.c,DDMMYY,v.v,V*HHCL

Description	String code
Header	$GPRMC
Hour	h
Minute	m
Second	s
Status	A = OK, V = Warning
Latitude ddmm.mmmm	l
North or South (N/S)	N
Longitude dddmm.mmmm	y
East or West (E/W)	E
Speed over ground, knots	k
Course over ground, degrees true	c
Day	D
Month	M
Year	Y
Magnetic Variation, degrees	v
Magnetic Variation, east / west (E/W)	V
Check Sum	H
Carriage return (CR)	C
Line feed	L

Example String

$GPRMC,092204.999,A,5250.5589,S,00142.5084,E,0.00,89.68,210206,0.0,E*44

Note, providing GPS $GPRMC is available, the data output string $PSIMSSB uses GPS UTC time and date. If GPS is not available, or $GPRMC is not selected, Easytrak's internal date and time is used.

KLEIN 3000 SSS Data strings

An output is provided for various Side Scan Sonars. This selection outputs three strings one immediately after the other - $GPGGA, $GPVTG, and $GPTLL.

The strings $GPGGA and $GPVTG provide the position and course over ground of the vessel, and string $GPTLL provides the position of the towfish.

Vessel Position

$GPGGA,hhmmss.ss,ddmm.mmm,N,dddmm.mmm,E,q,xx,p.p,a.b,M,c.d,M,x.x,nnnn*HHCL

Description	String code
Header	$GPGGA
UTC of position	hhmmss.ss
Latitude	ddmm.mmm
North or South (N/S)	N
Longitude	dddmm.mmm
East or West (E/W)	E
GPS Quality indicator (Varies with which D/GPS receiver is used)	q
Number of satellites in use	xx
Horizontal dilution of precision	p.p
Antenna altitude above mean-sea-level	a.b
Units of antenna altitude, metres	M
Geoidal height	c.d
Units of geoidal height, metres	M
Age of Differential GPS data (seconds since last valid RTCM transmission)	x.x
Differential reference station ID, 0000 to 1023	nnnn
Check Sum	H
Carriage return (CR)	C
Line feed	L

Note some of the fields may be left blank; this will vary depending upon the D/GPS receiver used.

Note, providing GPS $GPRMC is available, the data output string $PSIMSSB uses GPS UTC time and date. If GPS is not available, or $GPRMC is not selected, Easytrak's internal date and time is used.

Klein 3000 Data strings / Continued

Vessel track made good and ground speed

$GPVTG,ttt.t,T,mmm.m,M,nnn.n,N,kkk.k,K*HHCL

Description	String code
Header	$GPVTG
True track made good (Degrees)	t
True	T
Magnetic track made good (Degrees)	m
Magnetic	M
Ground speed (Knots)	n
Knots	N
Ground speed (Km/h)	k
Km/h	K
Check Sum	H
Carriage return (CR)	C
Line feed	L

Note some of the fields may be left blank; this will vary depending on the GPS receiver used.

Target position

$GPTLL,nn,llll.llll,N,yyyyy.yy,E,EasytrakAlpha,hhmmss.ss,T,*HHCL

Description	String code
Header	$GPTLL
target number (1 - 4)	nn
Latitude ddmm.mmmm	l
North or South (N/S)	N
Longitude dddmm.mmmm	y
East or West (E/W)	E
System ID string	EasytrakAlpha
Hour	h
Minute	m

Second	s
Status (T=tracking, L= Lost)	T
Check Sum	H
Carriage return (CR)	C
Line feed	L

Pseudo $GPGGA Data string

The output string contains original data as received from GPS input message apart from the fields highlighted in blue below.

1. Latitide and Longitude contain target position (not vessel position)
2. GPS Quality Indicator field contains acoustic quality where 1 = good response, 0 = no response
3. Antenna alititude contains Target Depth (Z), with offsets applied. If Z offset is 0 depth below sea level.
4. Differential Station ID contains Target (beacon) number of data transmitted

$GPGGA,hhmmss.ss,ddmm.mmm,N,dddmm.mmm,E,q,xx,p.p,a.b,M,c.d,M,x.x,nnnn*HHCL

Description	String code
Header	$GPGGA
UTC of position	hhmmss.ss
Latitude	ddmm.mmm
North or South (N/S)	N / S
Longitude	dddmm.mmm
East or West (E/W)	E / W
GPS Quality indicator	1 / 0
Number of satellites in use	xx
Horizontal dilution of precision	p.p
Antenna altitude above mean-sea-level	a.b
Units of antenna altitude, metres	M
Geoidal height	c.d
Units of geoidal height, metres	M
Age of Differential GPS data (seconds since last valid RTCM transmission)	x.x
Differential reference station ID	1 to 16*
Check Sum	H
Carriage return (CR)	C

Line feed	L

Note some of the fields may be left blank; this will vary depending upon the D/GPS receiver used.

* Number of supported targets dependent on transceiver model number

12. System Specification

Easytrak Pyxis Console Model 3690

Dimensions	19" Rack mount. 3U 483.0mm x 133.0mm x 348.0mm
Weight	7.5kg
Power requirements	90 – 250 Vac
Connection to transceiver	Rear panel connector for 3700 series Transceiver
Built-in PC	Industrial i7 board running embedded Win 10, 64GB HD
Temperature	Operating: -10° to +40°C Storage: -20° to +50°C
Front panel indicators	LED indicators for power and serial status
Serial communications	2 x RS-232 / RS485 External Input Port 3 x Individual INS Data Out RS232 Ports 2 x Positional Data Out RS232 Ports UDP Data Out
GNSS Antenna Connection	2 x TNC connection 2 x TNC GNSS Antenna 2 x 30m GNSS Antenna Cable
Data Output	aae format V1 and V2, TP-II2EC, TP-EC W/PR, Simrad 300P,Simrad 309, Simrad $PSIMSSB, Pseudo $GPRMC, NMEA $GPGGA, NMEA $GPVTG, NMEA $GPTLL, Pseudo $GPGGA, KLEIN 3000 (Quick set) Multiple outputs available
INS Data Output	3 Independent reference points NMEA, ASCII, BINARY, TSS, SIMRAD

Ext Compass Input	SGB-HTDS, SGB-HTDT, NMEA HDT,HDM, HDG
Ext VRU Input	$HCXDR , TSS1
Ext GNSS Input	NMEA; GLL, GGA, RMC
Geo Ref Graphical Overlay	GeoTiff, DXF
Target Heading Input	NMEA HDM, HDT, HDG, PNI TCM2
Target Depth Input	NMEA DBT, DBK, DBS, DPT
GNSS Time synch	NTP
Responder Output	4 x Positive 12V pulse 5ms, BNC
Nav In (Key In)	1 x Positive 12V pulse 5ms,
PPS	1 x 12V Pulse, BNC
USB	6 ports available, 2 on front panel
Ethernet	1 x INS Connection 1Gbps standard RJ45 jack. 1 x PC Connection 1Gbps standard RJ45 jack. Ethernet UDP Data Port

Easytrak Pyxis Transceiver Model 3782

Factory calibrated multi-element transceiver head complete with integral AHRS, depth sensor and temperature sensor.

Material	Stainless steel standard
Weight in air/water	15.5kg/11kg
Dimensions	200mm reducing to 152mm Ø x 432mm
Temperature	Operating: -10° to +40°C Storage: -20° to +50°C
Depth rating	30m
Electrical supply	48Vdc (from Pyxis console)
Depth sensor (Pressure Sensor)	5 bar, accuracy 0.25% between -10° to +40° C
Temperature sensor	1° resolution between -10° and +40° C

Accuracy / Performance

Accuracy is based on the correct speed of sound being entered, no ray bending and an acceptable S/N ratio

Position accuracy	0.25° of slant range, acoustic repeatability 0.12° DRMS at > 10° depression angle
Range resolution	Calculated to 0.01m resolution
Max range	Up to 2000m, range limited version available (995m)
Frequency band (MF)	18 - 32 kHz
Tracking beam pattern	180°

Transmitter	Variable, typical max 192dB re 1µPa at 1m
Beacon types	AAE Sigma 1, Sigma 2 Digital Spread Spectrum and AAE Tone channels. AAE V-NAV channels. HPR 400 channels 1100, 1000, 1200A, 1300A Series Beacons, Digital Depth Transponders, AAE Release and Telemetry Beacons.
Interrogation rate	>2Hz refresh rate. Internally set or external key

Integrated Navsight Apogee INS:

	RTK (Real Time Kinetic)
Roll / Pitch over 360°	0.008°rms
Heading 2m / 4m baseline	0.04° / 0.025°
Position x, y / attitude (z)	0.01m / 0.02m

Easytrak Pyxis Transceiver Model 3780

Factory calibrated multi-element transceiver head complete with integral AHRS, depth sensor and temperature sensor.

Material	Stainless steel standard
Weight in air/water	20kg/15kg
Dimensions	200mm reducing to 152mm Ø x 432mm
Temperature	Operating: -10° to +40°C Storage: -20° to +50°C
Depth rating	30m
Electrical supply	48Vdc (from Pyxis console)
Depth sensor (Pressure Sensor)	5 bar, accuracy 0.25% between -10° to +40° C
Temperature sensor	1° resolution between -10° and +40° C

Accuracy / Performance

Accuracy is based on the correct speed of sound being entered, no ray bending and an acceptable S/N ratio

Position accuracy	0.12° of slant range, acoustic repeatability 0.07° DRMS at > 20° depression angle
Range resolution	Calculated to 0.01m resolution
Max range	Up to 2000m, range limited version available (995m)
Frequency band (MF)	18 - 32 kHz
Tracking beam pattern	170°

Transmitter	Variable, typical max 192dB re 1µPa at 1m
Beacon types	AAE Sigma 1, Sigma 2 Digital Spread Spectrum and AAE Tone channels. AAE V-NAV channels. HPR 400 channels 1100, 1000, 1200A, 1300A Series Beacons, Digital Depth Transponders, AAE Release and Telemetry Beacons.
Interrogation rate	>2Hz refresh rate. Internally set or external key

Integrated Navsight Apogee INS:

	RTK (Real Time Kinetic)
Roll / Pitch over 360°	0.008°rms
Heading 2m / 4m baseline	0.04° / 0.025°
Position x, y / attitude (z)	0.01m / 0.02m

Transceiver Deck Cable

Diameter	12.8 mm nominal
Length	20 – 60 meter standard lengths 100 meter maximum length
Colour	Yellow - Connectors Supplied
SWL	20 kg (Allows Transceiver to be deployed from cable)

System Externally assessed for immunity and emissions; conforms to 89/336/EEC. RoHS compliant

Environment

Operating Temperature	-5 to 30°C
Storage Temperature	-5 to 45°C

Note: Specification is subject to change without notice

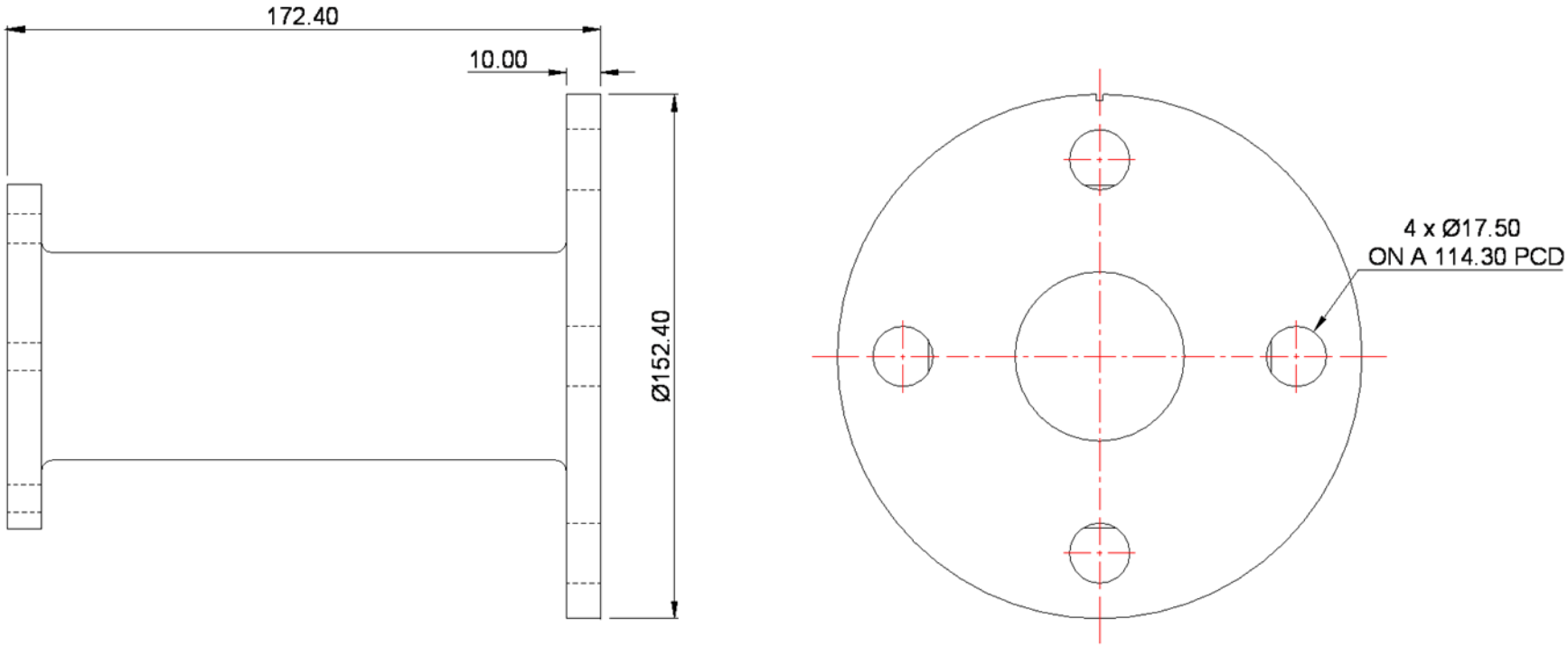
Handling

There are no special handling conditions with this product. For beacons, please see their specific manuals.

End of Life Recycling / Disposal

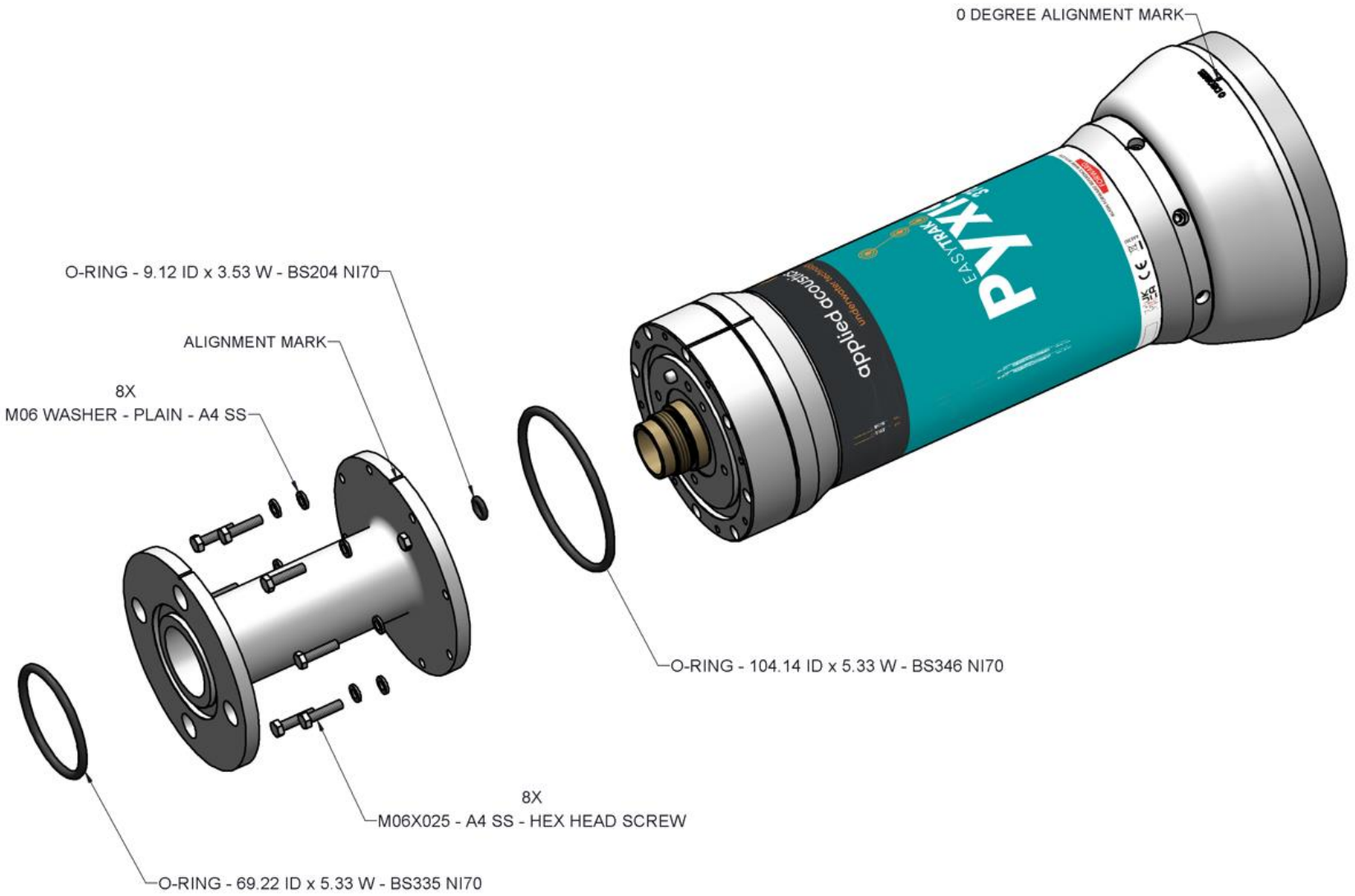
Within the UK, all electronic components and batteries must be taken for separate collection at the end of their working life under the Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 and Waste Batteries and Accumulators Regulations 2009 respectively. The AAE Technologies Ltd group (AAE Tg) of companies as UK manufacturers will responsibly dispose of any returned end of life AAE Tg components/batteries through registered/approved recycling schemes. In order to prevent uncontrolled waste disposal and promote recycling, please contact Technical Support for a RMA number and return any end of life items (if safe to do so) carriage paid by the sender to our UK head office

Appendix A – Transducer Mounting Bracket

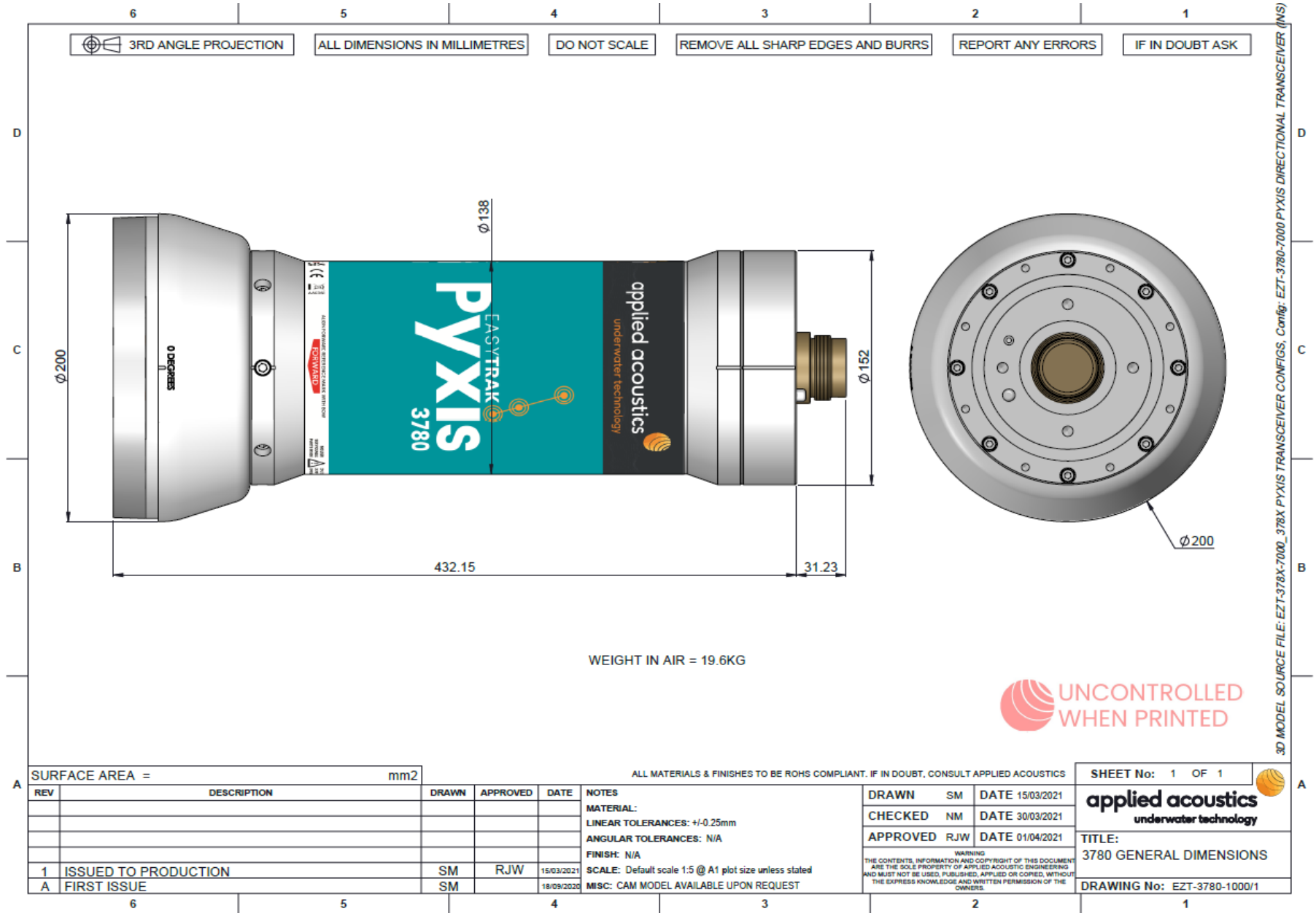


Transceiver installation is the responsibility of the operator.

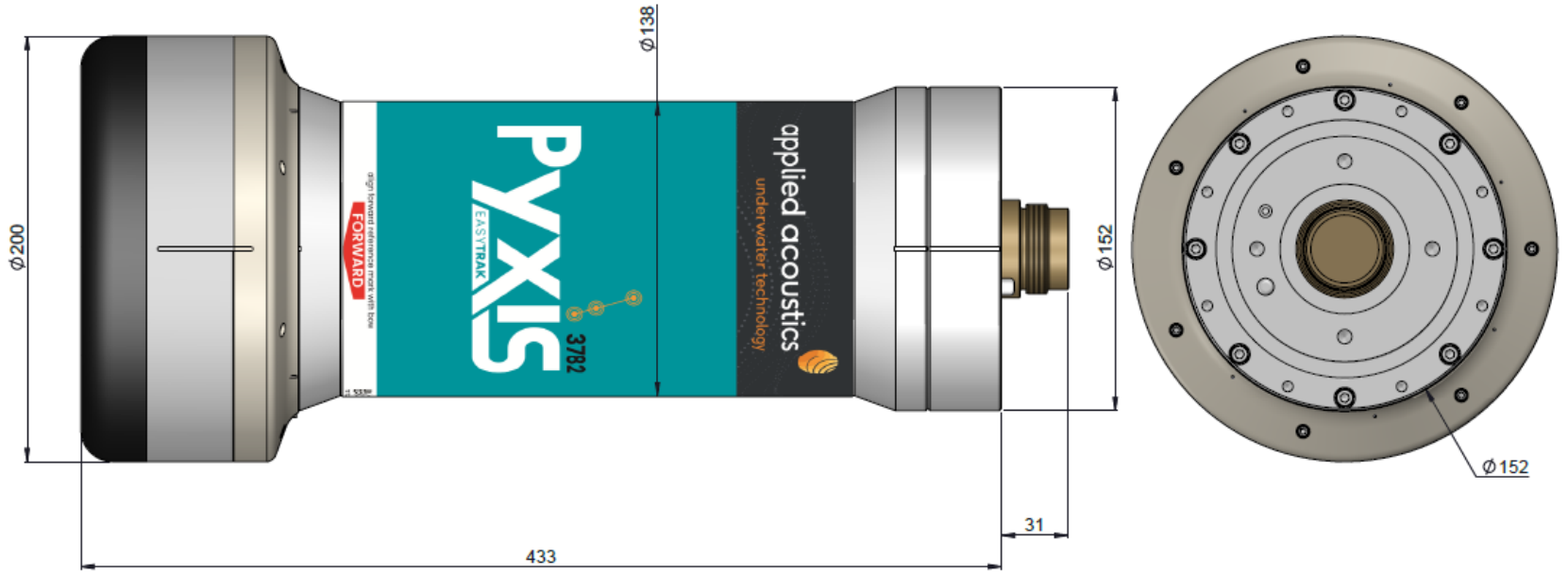
Appendix B – EZT-378X Transducer Mounting



Appendix C – Transceiver Dimensions



3RD ANGLE PROJECTION | ALL DIMENSIONS IN MILLIMETRES | DO NOT SCALE | REMOVE ALL SHARP EDGES AND BURRS | REPORT ANY ERRORS | IF IN DOUBT ASK



WEIGHT IN AIR = 15.33KG

UNCONTROLLED WHEN PRINTED

3D MODEL SOURCE FILE: EZT-378X-7000_378X PYXIS TRANSCEIVER CONFIGS, Config: EZT-3782-7000_INS VERSION 7 ELEMENT OMNI

SURFACE AREA = mm2

ALL MATERIALS & FINISHES TO BE ROHS COMPLIANT. IF IN DOUBT, CONSULT APPLIED ACOUSTICS

REV	DESCRIPTION	DRAWN	APPROVED	DATE
1	PRODUCTION	SM	JRH	10/02/2022

NOTES
MATERIAL:
LINEAR TOLERANCES: +/-0.25mm
ANGULAR TOLERANCES: +/-1.0 Degrees
FINISH: SEE DRAWING NOTES
SCALE: Default scale 1:5 @ A1 plot size unless stated
MISC: CAM MODEL AVAILABLE UPON REQUEST

DRAWN	SM	DATE 10/02/2022
CHECKED	NM	DATE 01/03/2022
APPROVED	JRH	DATE 01/03/2022

SHEET No: 1 OF 1

applied acoustics
underwater technology

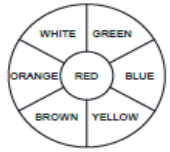
TITLE:
3782 GENERAL DIMENSIONS

DRAWING No: EZT-3782-1000/1

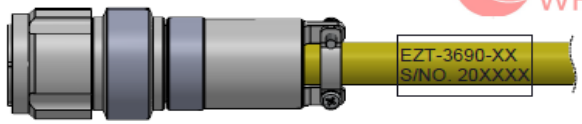
Appendix D – Deck Cable Wiring

3RD ANGLE PROJECTION | ALL DIMENSIONS IN MILLIMETRES | DO NOT SCALE | REMOVE ALL SHARP EDGES AND BURRS | REPORT ANY ERRORS | IF IN DOUBT ASK

LABELLING NOTES - MODEL NUMBER OF CABLE IS EZT-3690-XX
WHERE XX IS THE LENGTH OF THE CABLE IN METERS.
SERIAL NUMBER IS THE NEXT CONSECUTIVE NUMBER TAKEN
FROM THE SERIAL NUMBER LOG.
COVER LABEL WITH 1 x 50MM CLEAR HEATSHRINK



NOTE - DIAGRAM SHOWS END OF CABLE WIRE ORIENTATION
TO LOCATE TO JUPITER CONNECTOR. EACH COLOUR
REPRESENTS ONE TWISTED SCREENED PAIR.



ENGRAVE MODEL AND SERIAL NUMBER

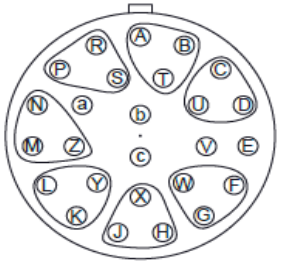
CONNECTOR TYPE :-

D38999/26FE-26PN (AAE NO. ECN050168)
EMC BACKSHELL (EZT-3690-2017)

CABLE TYPE - 7 x0.5MM² STP CABLE (AAE NO. ELD050029)
CABLE LENGTH TO BE SPECIFIED ON ORDER
(NOTE - MUST BE NO LONGER THAN 100M)

CONNECTOR TYPE - SOURIAU
JUPITER 'M' SERIES
PART NUMBER: FED F 20M T 27.16 SA

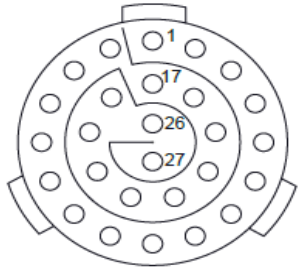
CABLE OUTER SCREEN TO BE
FITTED TO PIN a



FACE VIEW

D38999/26FE-26PN CONNECTOR PINS	FUNCTION	WIRE	JUPITER CONNECTOR PINS
A	48V	RED (1)	1
B	48V RETURN	BLACK (1)	2
T	SCREEN	SCREEN (1)	17
P	48V	ORANGE (2)	15
R	48V RETURN	BLACK (2)	16
S	SCREEN	SCREEN (2)	25
C	USBL SYNC	BROWN (3)	3
D	0V SIGNAL RETURN	BLACK (3)	4
U	SCREEN	SCREEN (3)	18
F	APOG RS485 A	YELLOW (4)	6
G	APOGRS485 B	BLACK (4)	7
W	SCREEN	SCREEN (4)	20
H	APOG SYNC A	BLUE (5)	8
J	APOG SYNC B	BLACK (5)	9
X	SCREEN	SCREEN (5)	21
K	USBL RS422 RX A	GREEN (6)	10
L	USBLRS422 RX B	BLACK (6)	11
Y	SCREEN	SCREEN (6)	22
M	USBL RS422 TX A	WHITE (7)	12
N	USBL RS422 TX B	BLACK (7)	13
Z	SCREEN	SCREEN (7)	24
a	OUTER SCREEN	OUTER SCREEN	N/C

NOTE
CABLE OUTER SCREEN TO BE CUT OFF
AND ISOLATED FROM WIRING
AND CONNECTOR



REAR VIEW

NOTE - THE NUMBERS SHOWN IN BRACKETS IN THE WIRE COLUMN RELATE TO ONE TWISTED SCREENED PAIR

3D MODEL SOURCE FILE: EZT-3690-4000_DECK CABLE, Config: Default

SURFACE AREA = mm2

ALL MATERIALS & FINISHES TO BE ROHS COMPLIANT. IF IN DOUBT, CONSULT APPLIED ACOUSTICS

REV	DESCRIPTION	DRAWN	APPROVED	DATE
2	DCR2498	SM	RJW	01/04/2021
1	PRODUCTION RELEASE	SM	RJW	12/03/2020

NOTES
MATERIAL:
LINEAR TOLERANCES: +/-0.25mm
ANGULAR TOLERANCES: +/-1.0 Degrees
FINISH: SEE DRAWING NOTES
SCALE: Default scale 1:2 @ A1 plot size unless stated
MISC: CAM MODEL AVAILABLE UPON REQUEST

DRAWN	SM	DATE 26/03/2021
CHECKED	NM	DATE 30/03/2021
APPROVED	RJW	DATE 01/04/2021

SHEET No: 1 OF 3

applied acoustics
underwater technology

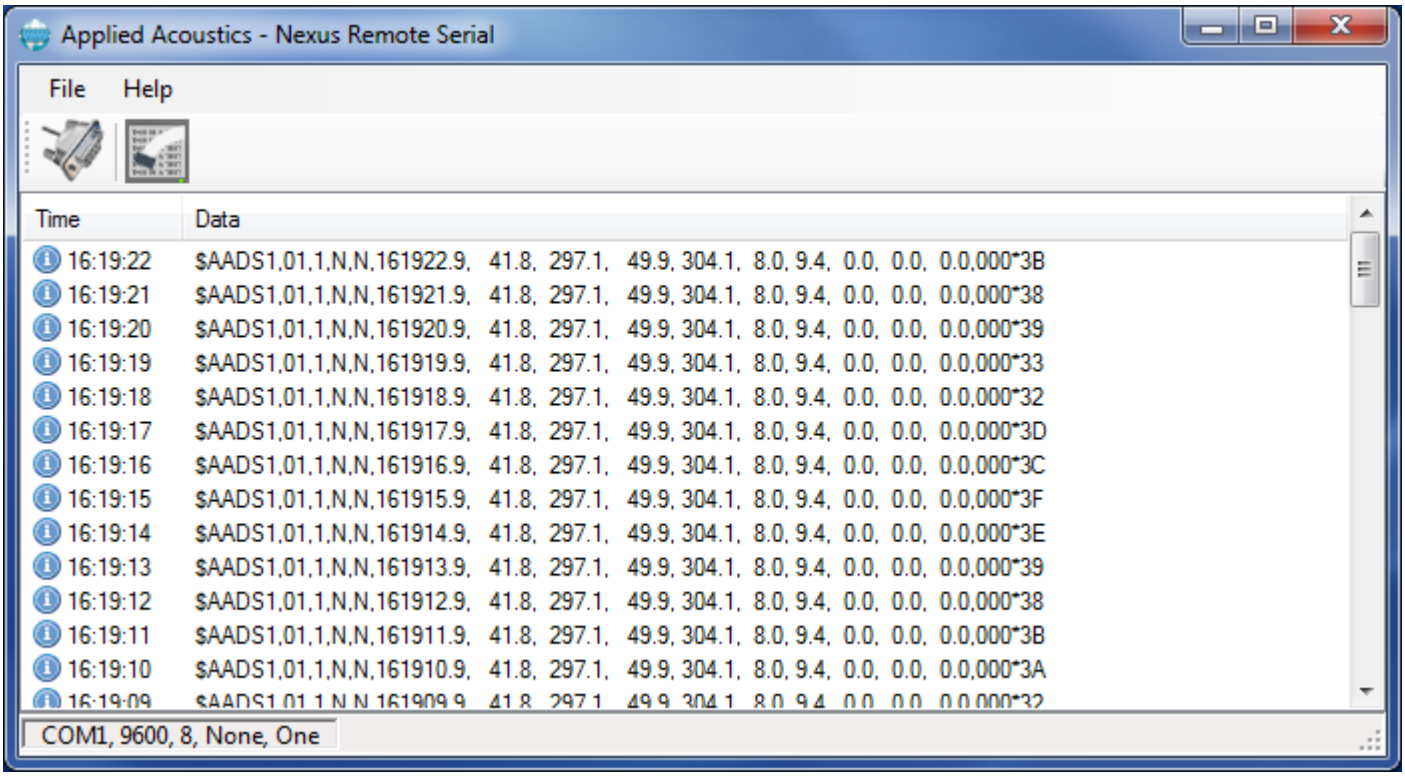
TITLE:
PYXIS CABLE WIRING ASSEMBLY

DRAWING No: EZT-3690-4000/2

Appendix E – Remote Serial Application

The system broadcasts a UDP message on port 17003 containing the currently selected output message, as selected in the system configuration.

An application is available that may be installed on a Windows PC. The application listens for the UDP broadcast from a Nexus unit and then outputs the received data from a local serial port.



The application may be configured to output on any available serial port and at any required baud rate and data format.

Please contact Applied Acoustics for more details.

Appendix F – Network Remote Control

The Pyxis system may be connected to a network via the LAN port on the rear panel. When connected, a limited number of parameters may be controlled via a network TCP port connection, the default port number used is 17010.

Commands are comma delimited, text based commands, in the following format.

$E0,Command[,Value1][,Value2][,ValueN]

Note: [ ] Indicates optional values

All commands will receive a response in the following format

$E0,Command[,Value1][,Value2][,ValueN],Status

Where status will indicate if the command was successful and will contain either 'OK' or 'FAIL'

Example

Sent: $E0,TEN,1,1
Received: $E0,TEN,1,1,OK

Network Commands

The following commands are supported.

Target Enable/Disable

Command: TEN
Value1: Target Number (1 – 16)
Value2: Target On or Off (1=On, 0=Off)

Example:
$E0,TEN,1,1

Velocity of Sound Range

Command: VSR
Value1: Target Number (1 – 16)
Value2: VOS (320-1999.9)

Example:
$E0,VSR,1,1493.6

Velocity of Sound Phase

Command: VSP

Value1: VOS (320-1999.9)

Example:

$E0,VSP,1493.6

INDEX

T

U

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Applied Acoustic Engineering Limited is a leading company in the design and manufacture of a wide range of subsea navigation and positioning products, and marine seismic survey equipment.

The extensive product range includes the innovative USBL tracking system, Easytrak, a variety of positioning and release beacons and seismic sub-bottom profiling equipment for offshore geotechnical and seabed analysis.

All products use acoustics, underwater sound waves, in location, positioning, navigation and data acquisition applications.

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