APPLIED ACOUSTICS
Underwater Technology

V-Nav
Operation Manual

Software Rev 1.20

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Revision History

Issue	Change No.	Reason for change	Date
A	N/A	Draft Issue V1.20	16/10/14

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Thank you for choosing Applied Acoustic Engineering as one of your subsea equipment suppliers. We hope you experience many years of reliable operational use from our products.

If you do encounter any technical issues with any of our products then please don't hesitate to contact our Technical Team via the following methods.

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Email: techsupport@appliedacoustics.com

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 V-Nav System

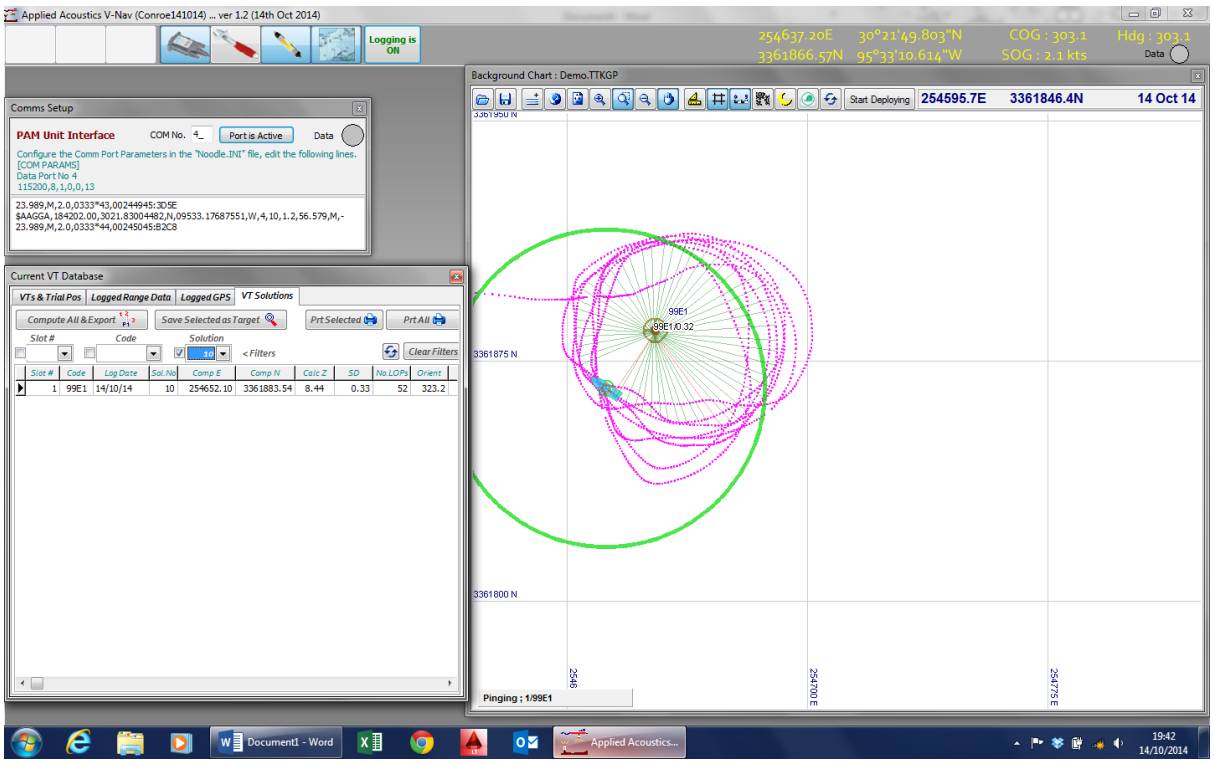
This manual provides the user with information on the operation of the V-Nav System. Ilex Computing were commissioned by Applied Acoustics to write the V-Nav data acquisition and processing package.

VNAV is a positioning system for statically deployed AAE Beacons. The system provides a navigation screen for deployment, acquisition and processing of range data to obtain seabed positions for the deployed units. Once processed, exports are provided to feed into seismic processing packages or CAD plotting.

The system can be used to accurately position OBC seismic arrays or multiple seabed objects, quickly and reliably.

Beacon Compatibility

- AAE 1400 VNAV Beacon
- AAE 1000 Series.
- AAE 300 Series.
- AAE 200 Series.
- AAE 1500 Release Beacon.
- AAE 529, 559 Release Beacon.



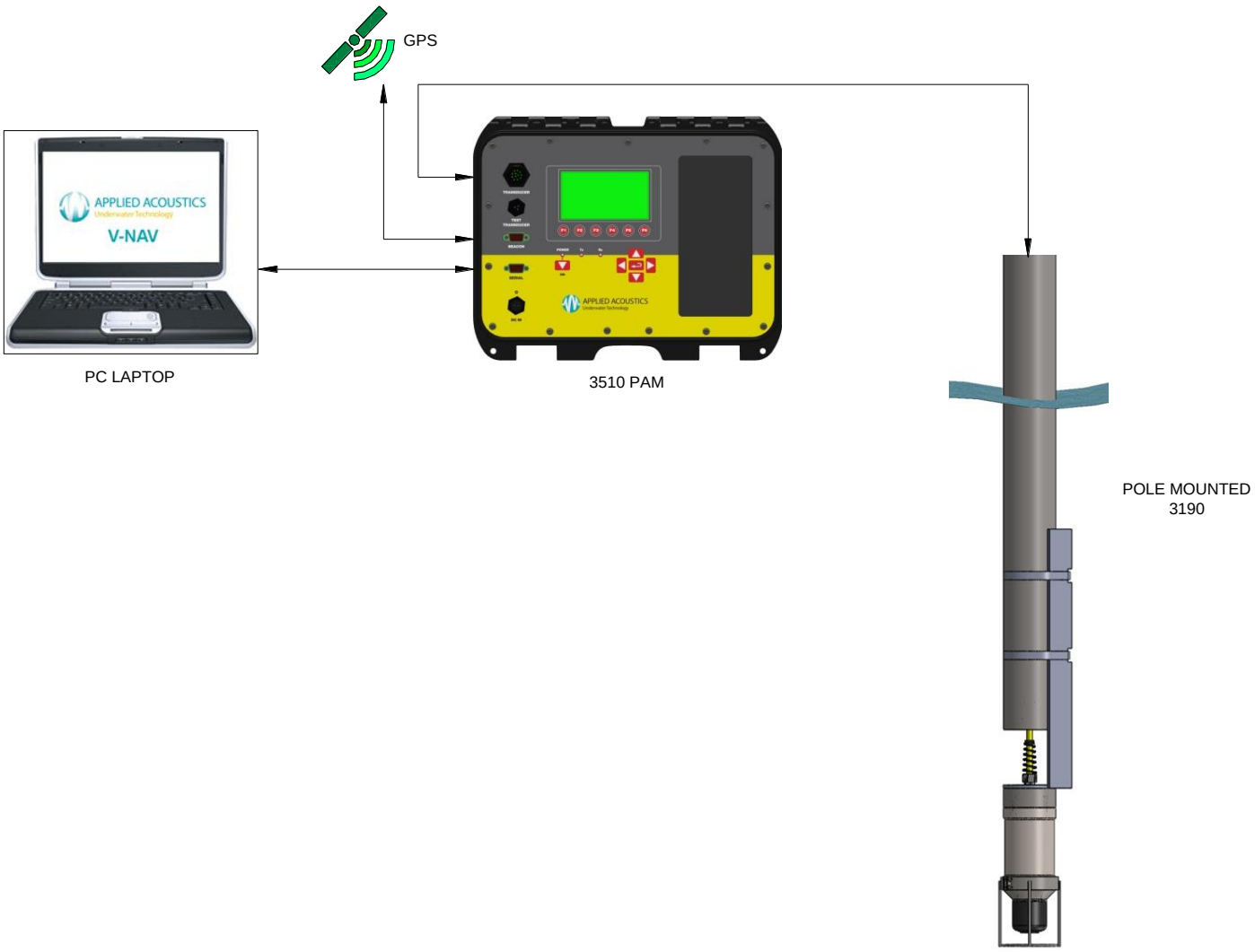
2. System Description

System Components

- VNAV Option Enabled PAM 3510.
- VNav Software Dongle C/W Software.
- Model 3190 MF Dunker C/W Deployment bracket.
- GPS receiver. *
- PC c/w serial port. *
- Pole mount for 3190 Dunker. *

* Operator supplied with system.

System Configuration



System Overview

The system is comprised of the PAM 3510, a pole mounted 3190 dunking transducer and any number of Beacons. The dunker & GPS input are connected to the PAM 3510. The V-Nav software controls the PAM 3510, processing the time stamped data into a position solution.

V-Nav positions static seabed beacon by taking ranges from known points around the beacon, these are known as Lines Of Position (LOPs). The LOPs are then used to compute a Least Squares solution for the beacon.

Once configured V-Nav initiates a cycle of interrogation to the deployed beacons, interrogation of beacons is controlled by a range ring. Using the current vessel position the software computes the beacons that are in range and only interrogates those. The cycle steps through each of the "enabled and deployed" beacons to amass a dataset. By using this technique the cycle is optimized and the maximum cycle rotation can be achieved.

As each range (one way m/s time) is logged the application will compute the Least Squares solution for the beacon, this can normally only be achieved once the number of ranges builds up. As each interrogation is made a line is flashed on-screen between the vessel transducer and the trial position (TP) for the beacon being interrogated, thus providing an indication of the position.

The data is logged in an ACCESS ".accdb" database file which is stand-alone and can be opened independently of V-Nav, a new ACCESS data file is created each time a project is started. Accurate positions for the seabed units is computed and the more balanced the data set i.e. data gathered from all sides of the deployed beacon - the stronger the solution.

Once there are enough ranges to complete the computation the vectors (LOPs) will be displayed on screen along with the error ellipse and computed position of the VT from each interrogation.

Basic Theory

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

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

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

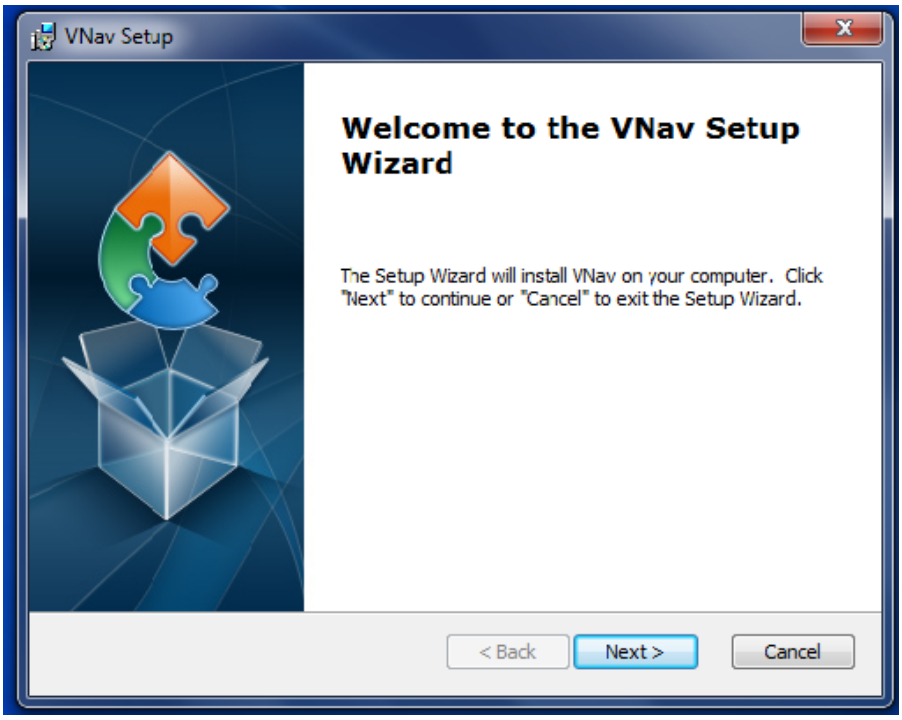
3. Software Installation

V-Nav Installation

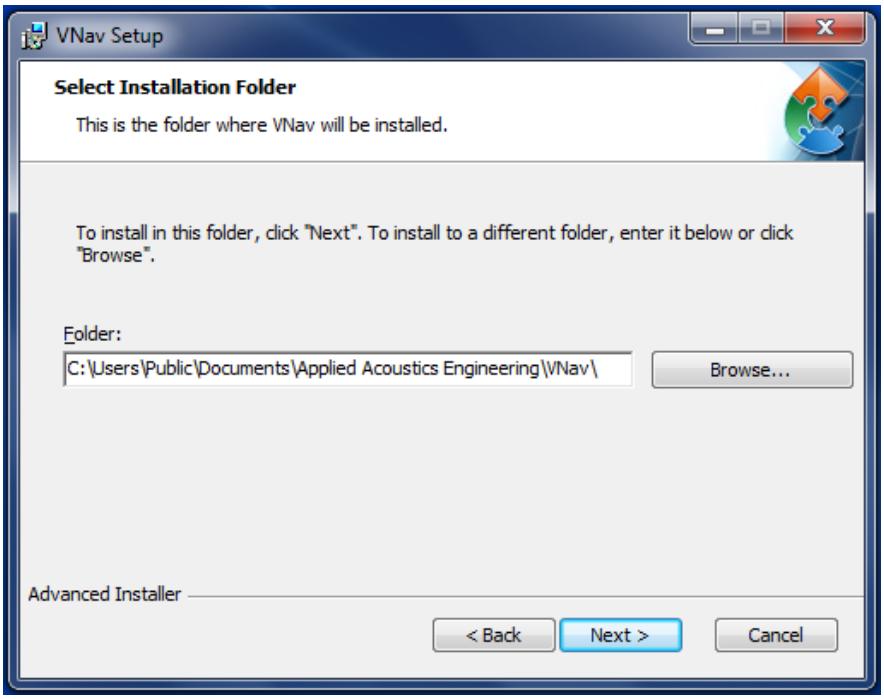
Do not fit USB Dongle to PC until Driver has been installed.

The V-Nav package is supplied with a dongle for security and installation of the drivers follows the main installation.

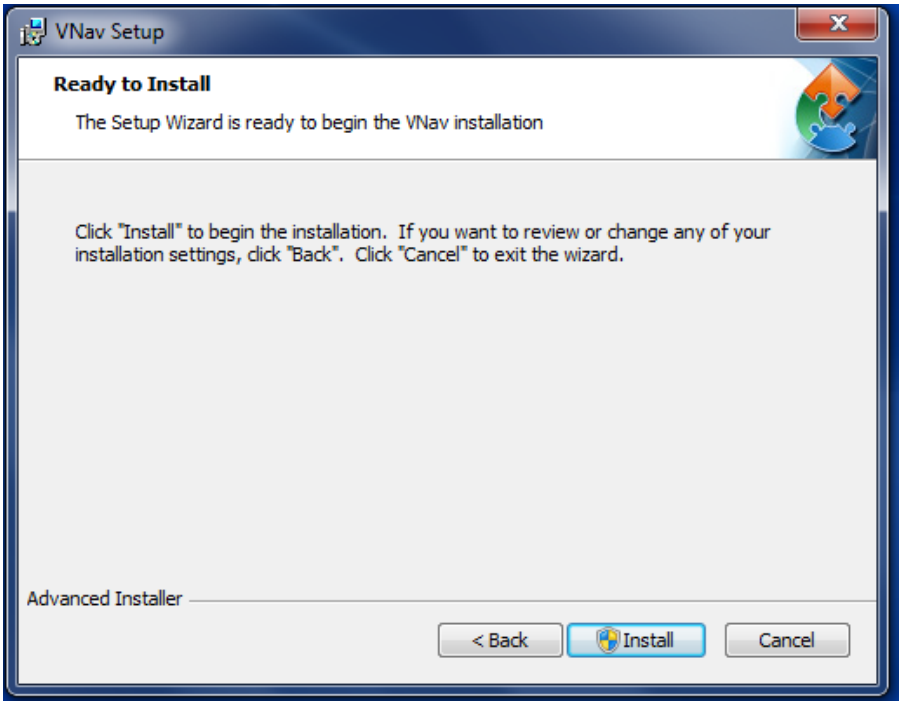
Run the installation file "Vector_Nav.msi" from the supplied CD.



Click Next

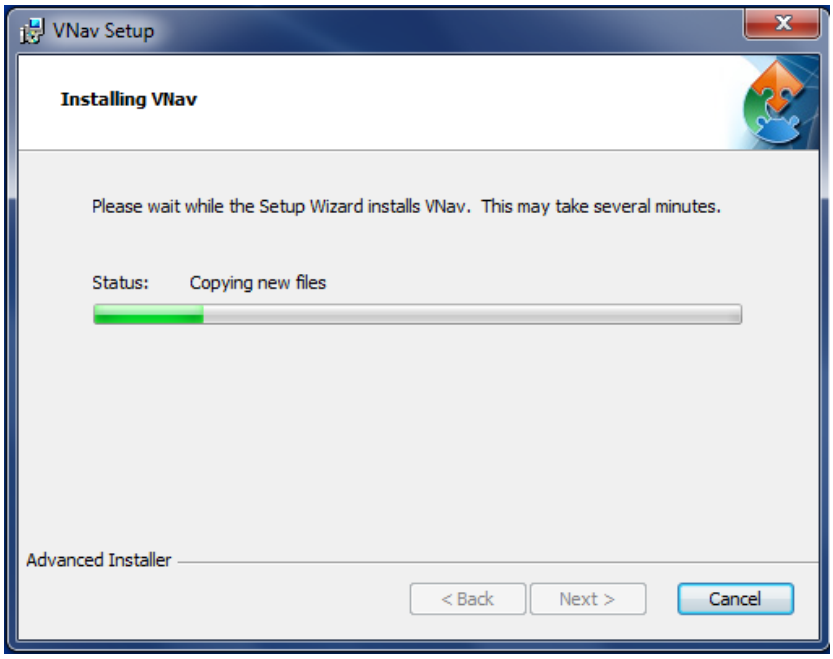


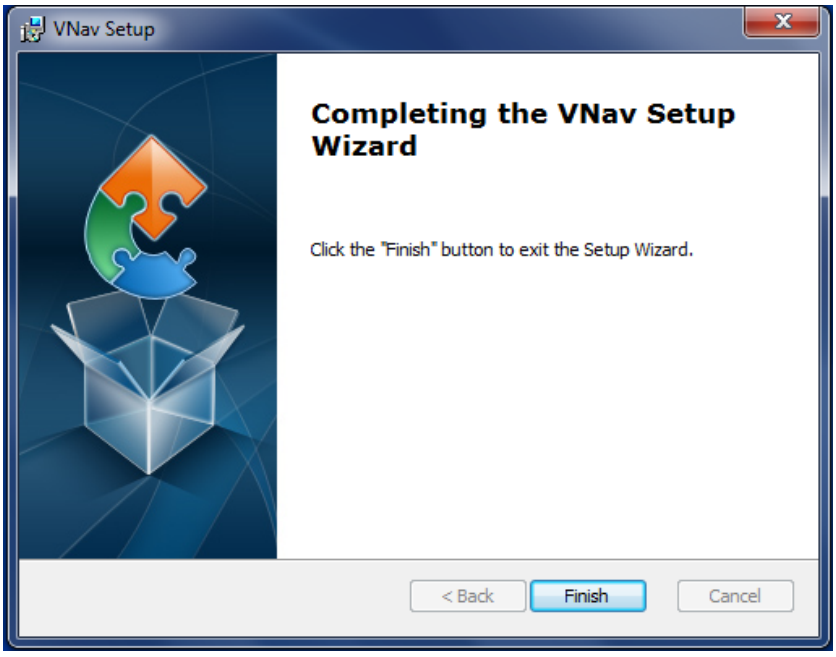
Use the default folder location and click Next



Click ‘Install’ to begin process.

Please contact your system administrator if you do not have installation rights.
Click Yes if prompted to continue installation.





V-Nav Installation complete, the Dongle driver can now be installed.

Dongle Installation

From the follow folder location on your PC:

Public Documents\Applied Acoustics Engineering \Dongle Driver

Locate file depending on your system:

Sentinel Protection Installer v7.6.6

Microsoft Windows XP (32-bit and 64-bit), Windows Server 2003 (32-bit and 64-bit), Windows Vista (32-bit and 64-bit), Windows Server 2008 (32-bit and 64-bit), Windows Server 2008 R2 (64-bit), Windows 7 (32-bit and 64-bit), Windows 8 (32-bit and 64-bit), Windows Server 2012 (64-bit), and Windows 8.1 (32-bit and 64-bit). - See more at: http://www.safenet-inc.com/support-downloads/sentinel-drivers/#sthash.EcriB8AW.dpuf

Or

Sentinel Driver 7.5.8

Windows 2000/XP/Server 2003/2008/2012/Vista & Windows 7&8 (32 bit and 64 bit) - See more at: http://www.safenet-inc.com/support-downloads/sentinel-drivers/#sthash.EcriB8AW.dpuf

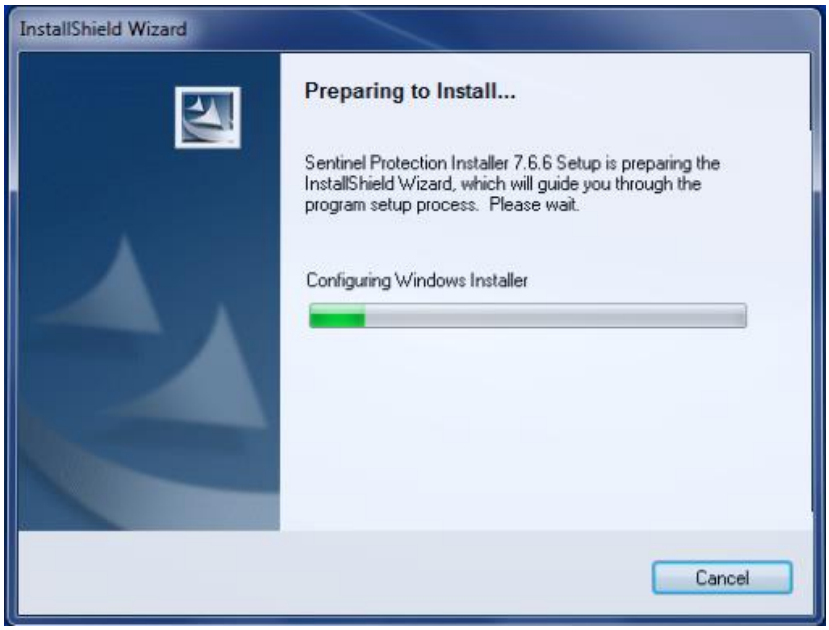
Current drivers and further information can be found at:-

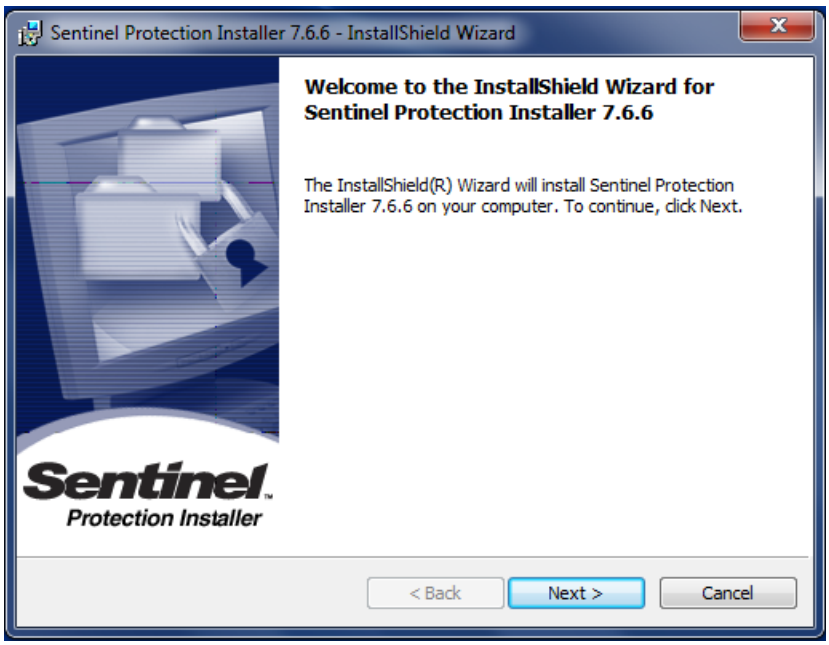
http://www.safenet-inc.com/support-downloads/sentinel-drivers/

Select driver applicable to your operating system and run the executable to install the driver.

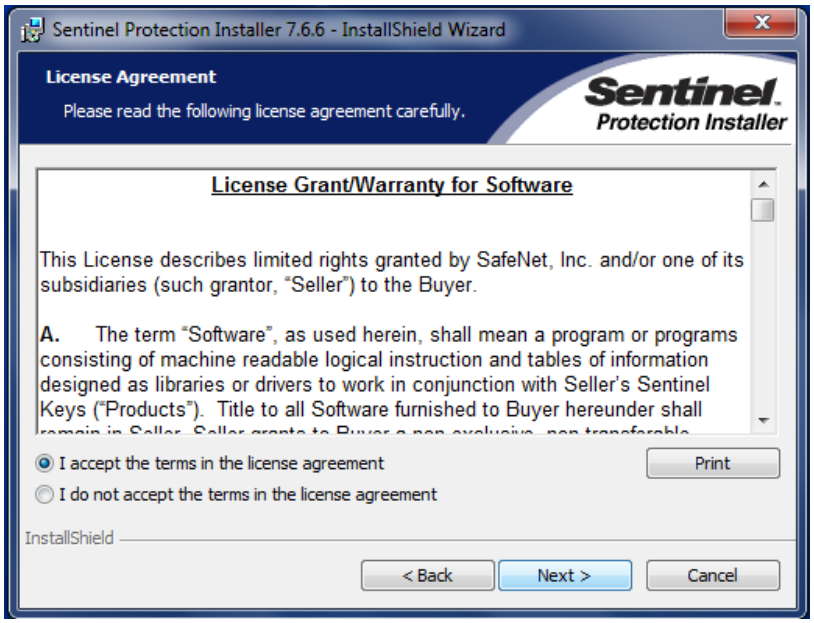
Installation of v7.6.6 Driver

Please contact your system administrator if you do not have installation rights.
Click Yes if prompted to continue installation.

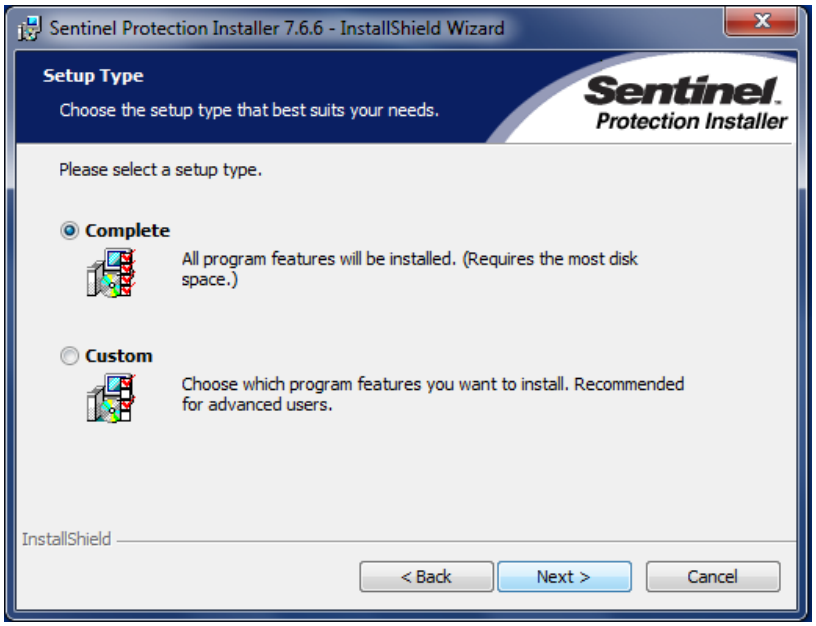




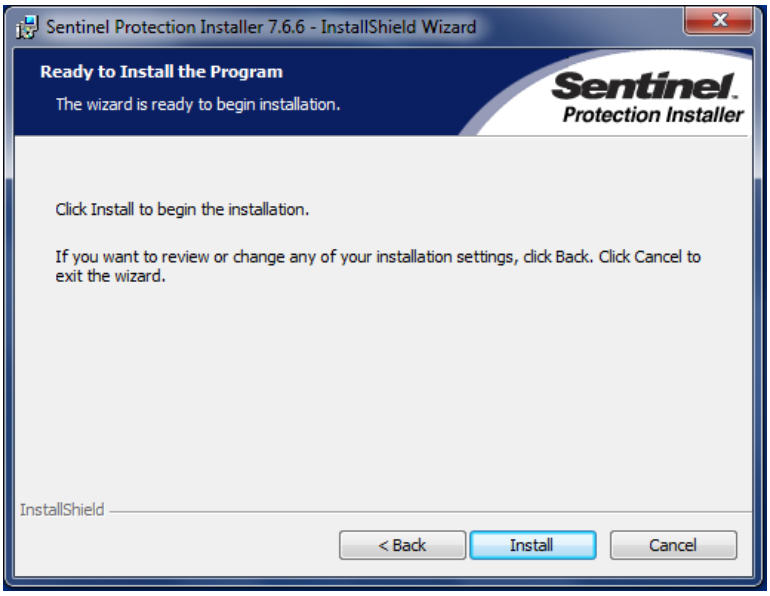
Click Next to continue



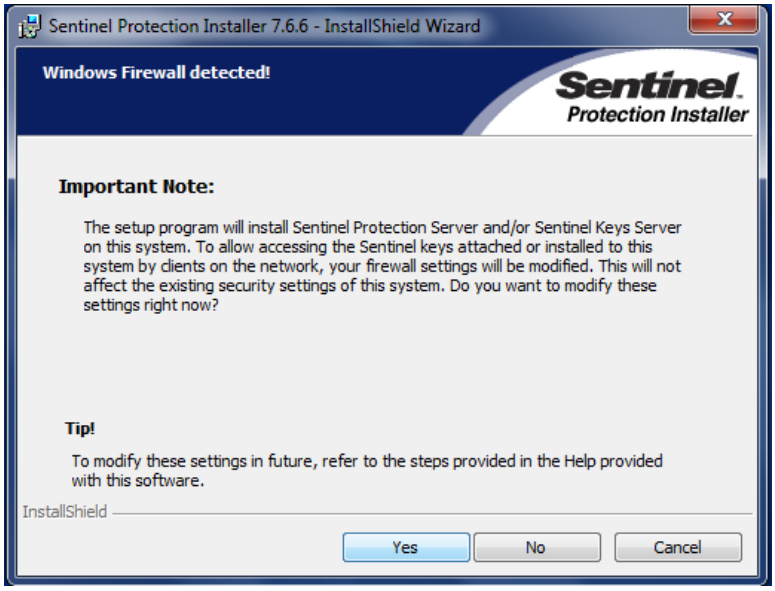
Select Accept terms in the license agreement and click Next.



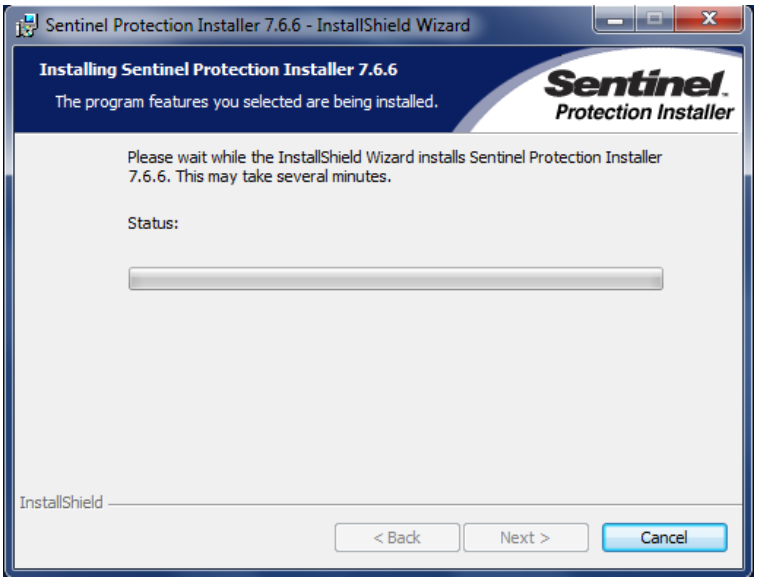
Select Complete and click Next

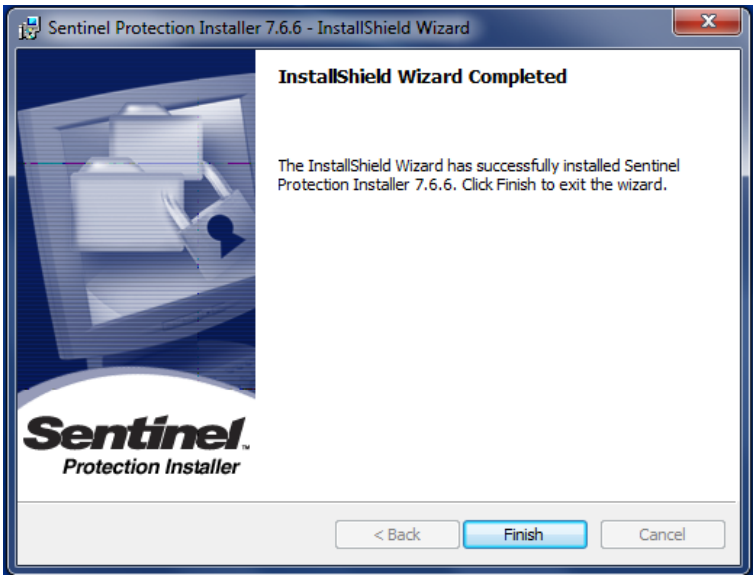


Click Install



Click Yes to continue



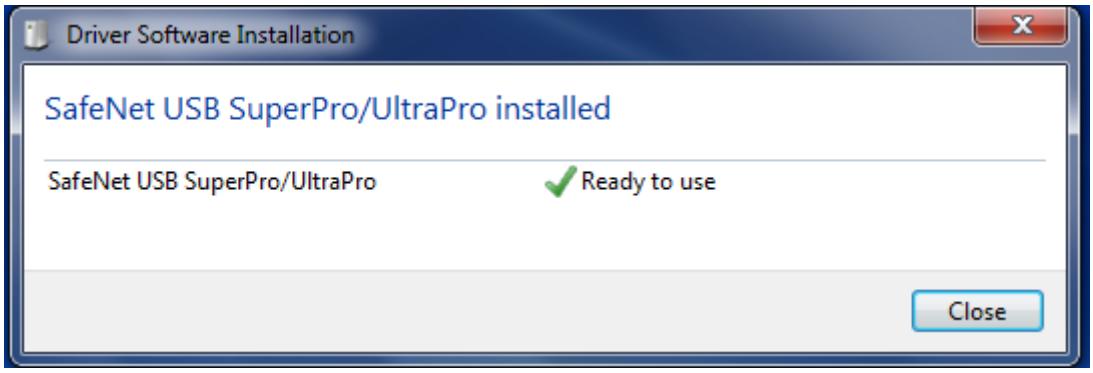


Click Finish to exit installer.

If prompted re-start the PC to complete installation.

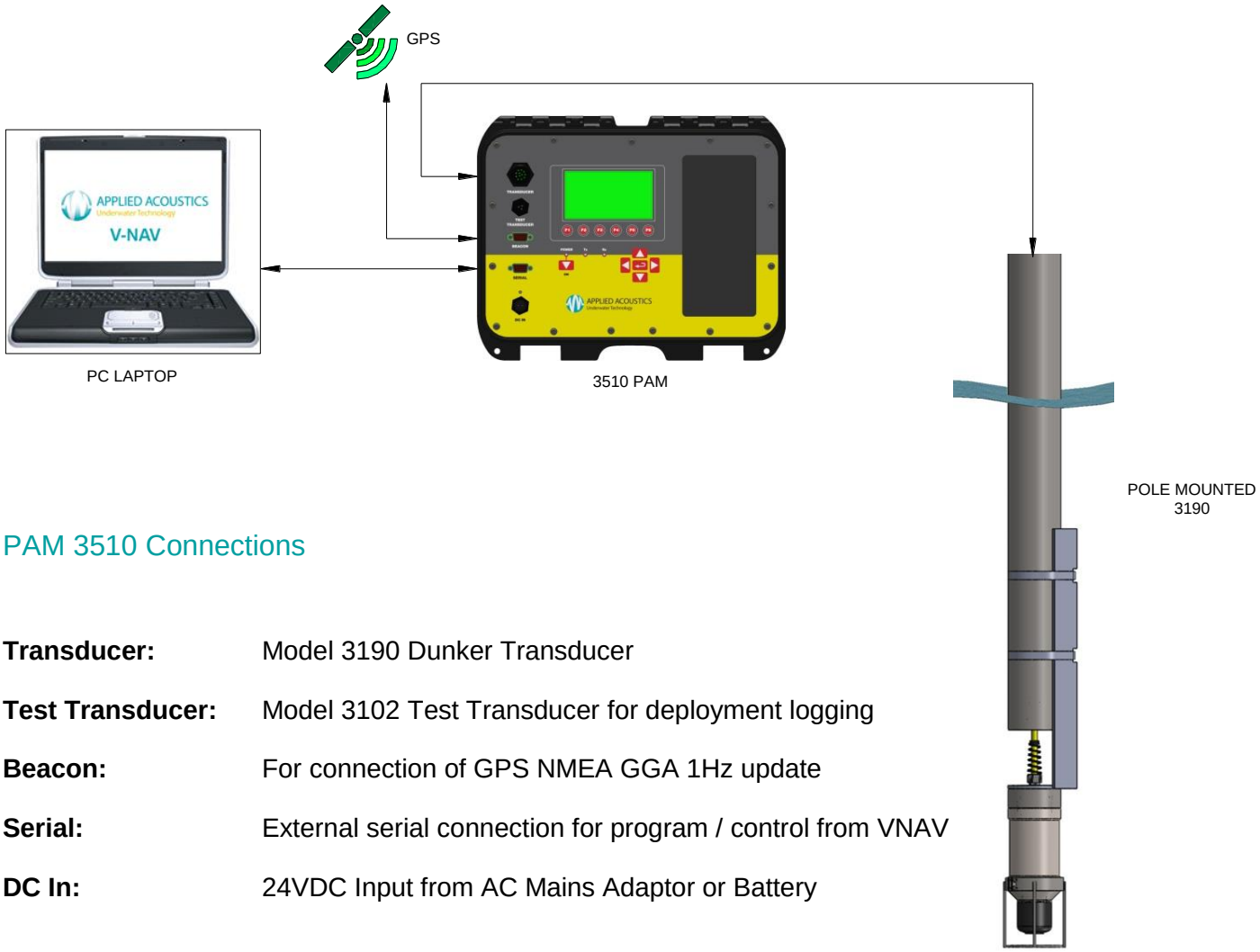
Insert Safe Net USB Dongle into PC

- PC will detect device and begin automatic installation.
- To speed up the process search of Windows Update can skipped
- When successfully installed the following message is displayed.



All Software and Drivers are now installed.

4. System Connections



PAM 3510 Connections

Transducer: Model 3190 Dunker Transducer

Test Transducer: Model 3102 Test Transducer for deployment logging

Beacon: For connection of GPS NMEA GGA 1Hz update

Serial: External serial connection for program / control from VNAV

DC In: 24VDC Input from AC Mains Adaptor or Battery

PAM 3510 Serial Port Settings

Beacon: Serial GPS Data (NMEA GGA format)

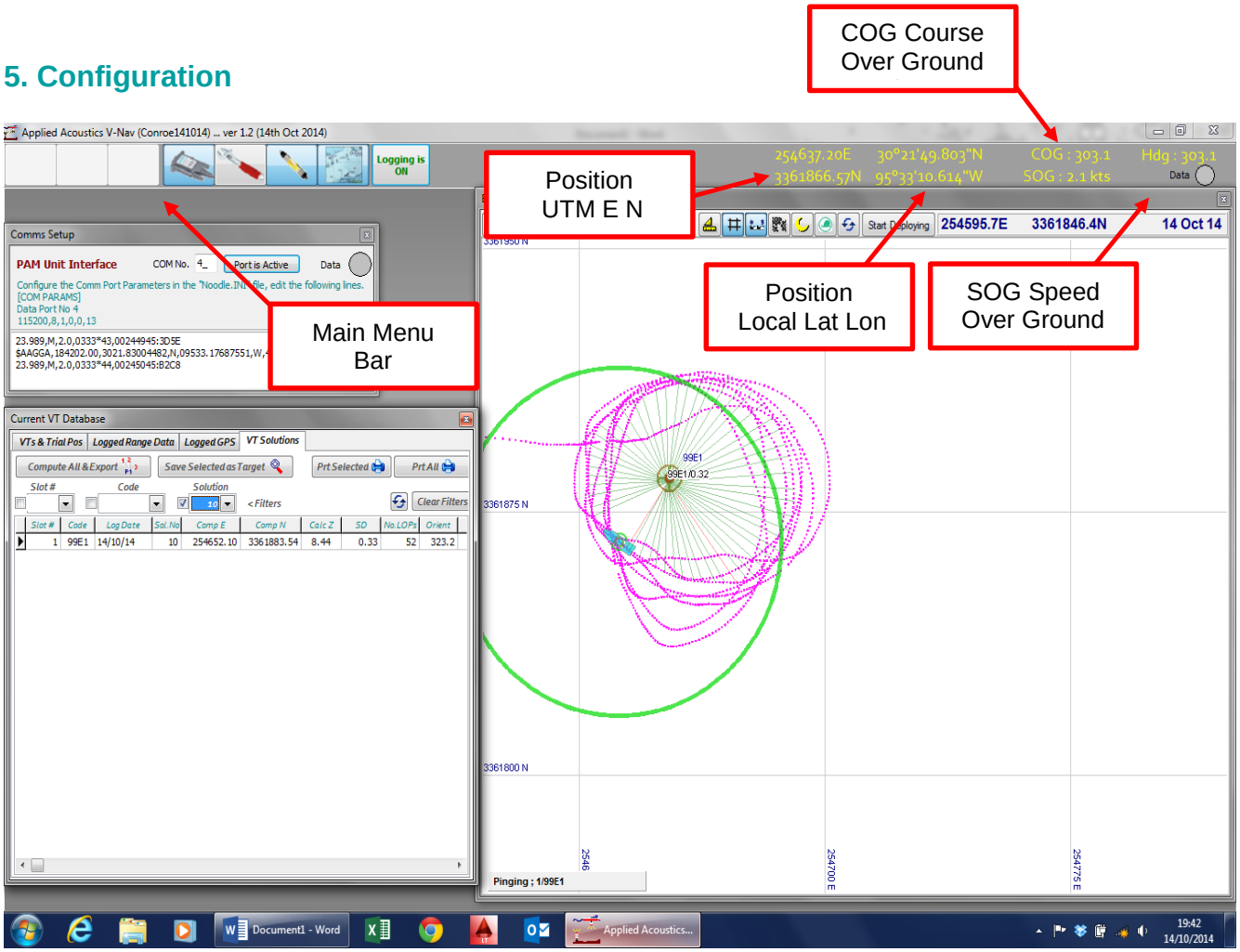
Default Baud rate = 9600, 8, N, 1

1 second update

Serial: Serial External PC Control

Default Baud rate = 115200, 8, N, 1

5. Configuration



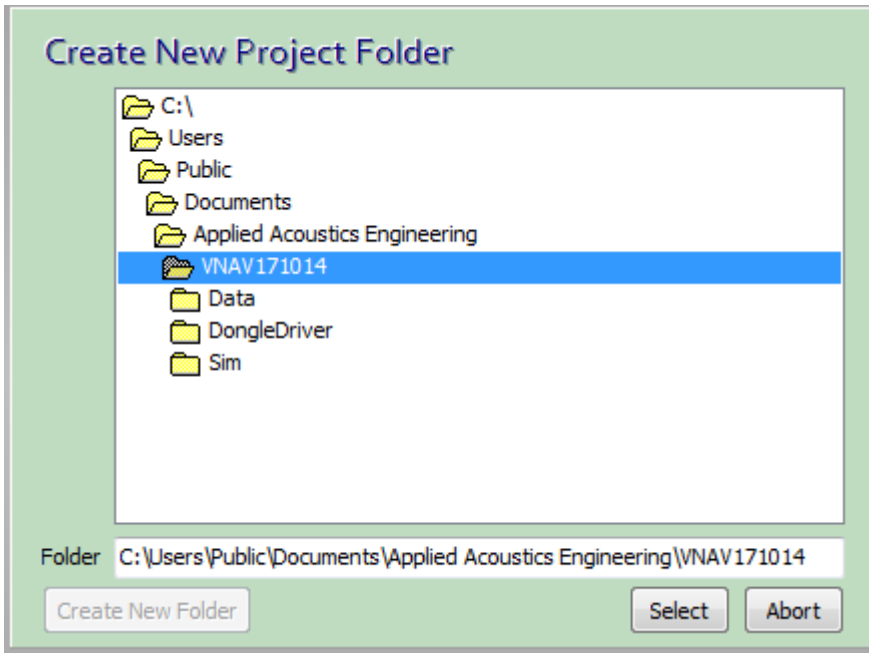
Main Button Bar

The button bar along the top of the main screen accesses the main functional areas of the software, some are one click, some of the buttons are toggles and stay down while the form is displayed, click again and the form is hidden.

The Easting/Northing are based on the spheroid and projection configured in Project Parameters, NOT the raw GPS (WGS84) position, the COG (Course Over Ground) and SOG (Speed Over Ground) are calculated based on the actual movement of the vessel through the water. Also in this area is 'Data Status', this flashes Green when data is received. If the COM port is enabled but no data is received within 10 secs. then this will turn red.

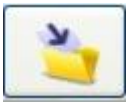
New Project
The software allows projects to be organised into folders, this enables individual configurations and database storage to remain manageable and can be easily archived.

When the button is clicked a dialog will be shown



you can click on the folder tree to navigate to a suitable folder, then click "Select" or you can edit the path shown in the edit box beneath the list to create a new folder, once you change the name click the Add Folder button and you will relocate to that folder, then "Select". When "Select" is clicked, all the data files from the root folder will be copied to the selected folder and a blank database file is created in the new project folder. This folder then becomes the default project folder.

Open Project
When the software starts the last opened project is loaded, this uses the Spheroid, Projection and Datum Shift database and loads the project specific Targets, Lines and configuration. It also loads the .accdb database file with the logged/computed data for that project. This button allows the user to change to a different project in order to review/re-compute.



Save Project
When working on a project data is saved automatically, this button allows you to save a project with a different name.

Coms Config
When pressed the Comms Configuration form is displayed, click again to close the form.

Survey Parameters
This button shows the Parameters when depressed, this provides access to all the background data, system configuration and project parameters.

VT Database
When depressed the VT database containing trial points, logged data and solutions is displayed.

Chart view
When depressed the Chart view is visible showing the vessel, background .SHP/.DXF/.TIF files, solutions are flashed up as they occur.

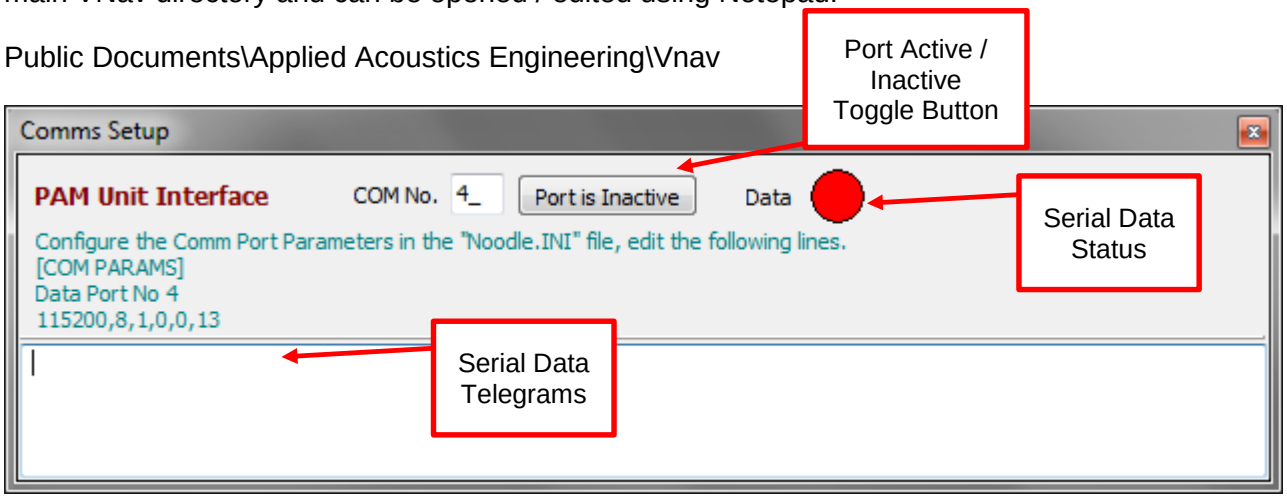
Logging
To turn the logging ON click this button, VT position computations are not performed unless logging is on. When the logging is turned on a dialog is presented to determine if the logging session is a new session or if the data is to be added to the existing solution.

View / Configure COM Port

The Comms Setup window allows the operator to monitor and control the serial communication between the PAM and the VNav Application.

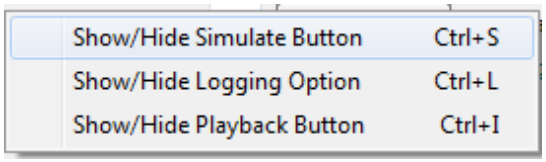
The Default Baud Rate and Com Parameters are set in the Noodles.ini file which is located in the main VNav directory and can be opened / edited using Notepad.

Public Documents\Applied Acoustics Engineering\Vnav



Special Commands:

By right click the mouse over the PAM Unit Interface text A context menu is displayed allowing the user to simulate, Log data or play back.

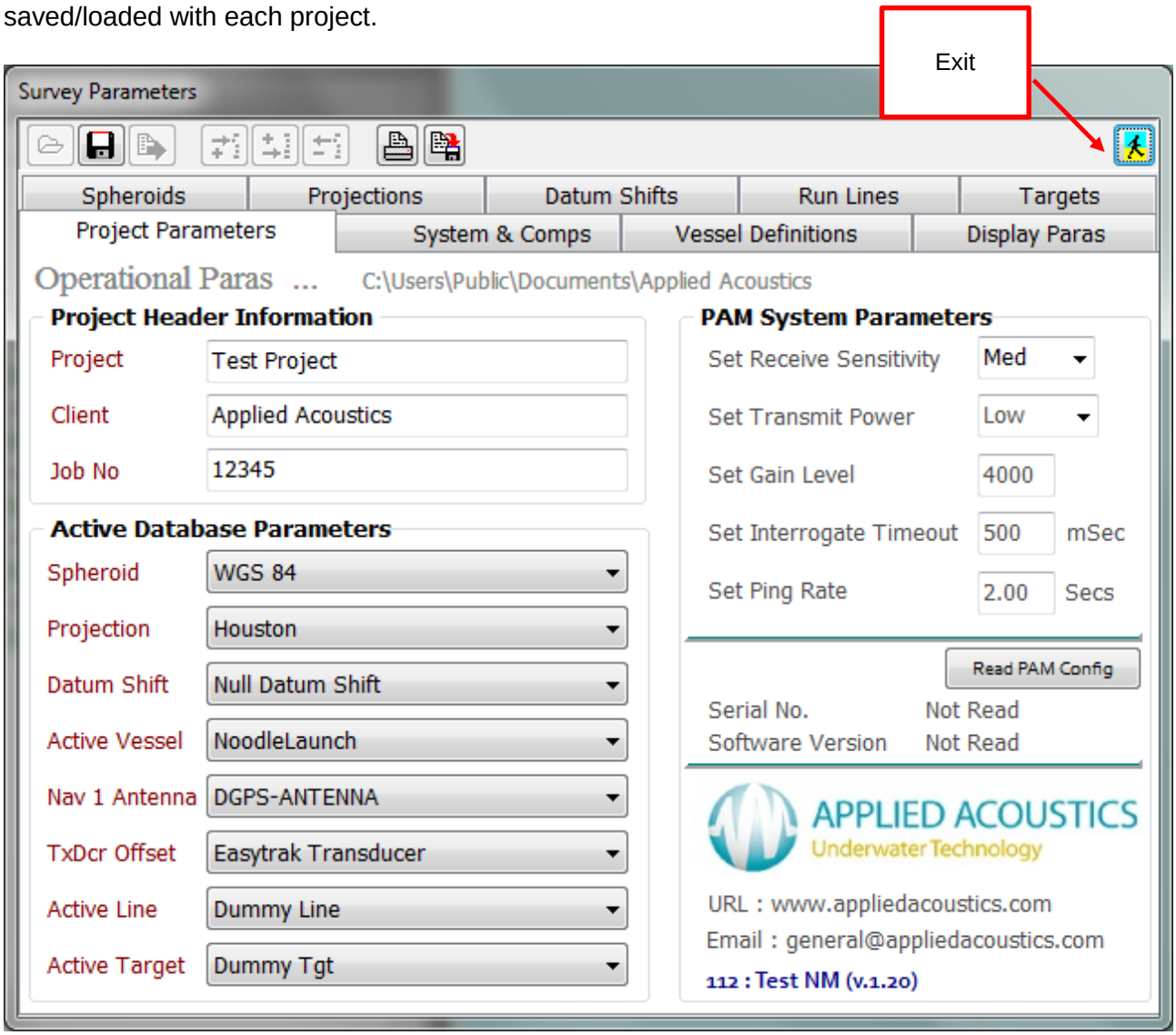


Survey Parameters

Survey Parameters consists of several tabs containing base data, two of the tabs are used to configure the parameters for your particular project – Project Parameters and System Configuration. The remaining are used to define parameters.

The "Spheroids", "Projections", "Datum Shift" and "Vessel" pages are universal and do not change with each project, this is because they are universal and once entered may be the same for many projects. The user can change the "Project Parameters" and "System Configuration" pages to select the parameters to use on your particular project.

"Run-lines" and "Targets" are pages that maybe specific to a particular project and are saved/loaded with each project.



Project Header Information

Project name, Client and Job Number can be entered, this information is used in the generation of positional reports.

PAM System Parameters

Receive Sensitivity: from the drop down menu select Hi, Med or Lo. The higher the sensitivity level the more sensitivity the receiver, thus in short range applications the sensitivity level can be set to Lo.

Transmit Level: from the drop down menu select Hi or Lo. Typically for ranging applications below 150m LO can be used, if there are high noise levels or intermittent ranging results the Transmit Power Level can then be switched up to check for improvements.

Gain Level: this is from 0 to 4000 and is the Analogue AGC level of the 3190 Dunker. This can be normally set to 4000 as this is within the operation limits of the ADC / DSP of the PAM.

Interrogate Time Out: this is the waiting time (2 way travel time) the PAM will wait following an acoustic interrogation to a beacon for a replay before issuing a time out reply to VNav. This is set in milli seconds. A time out of 500ms allows for a max range of 375m.

Ensure Interrogate time out is greater than range x 2 / 1500 and less than ping rate.

Set Ping Rate: This is the update rate in seconds of the ranging to the beacon. This is defendant on the beacon used and the range plus operating environments – a nominal starting rate is 2 seconds.

Ensure Ping Rate time out is greater than max range expected x 2 / 1500.

Active Database Parameters

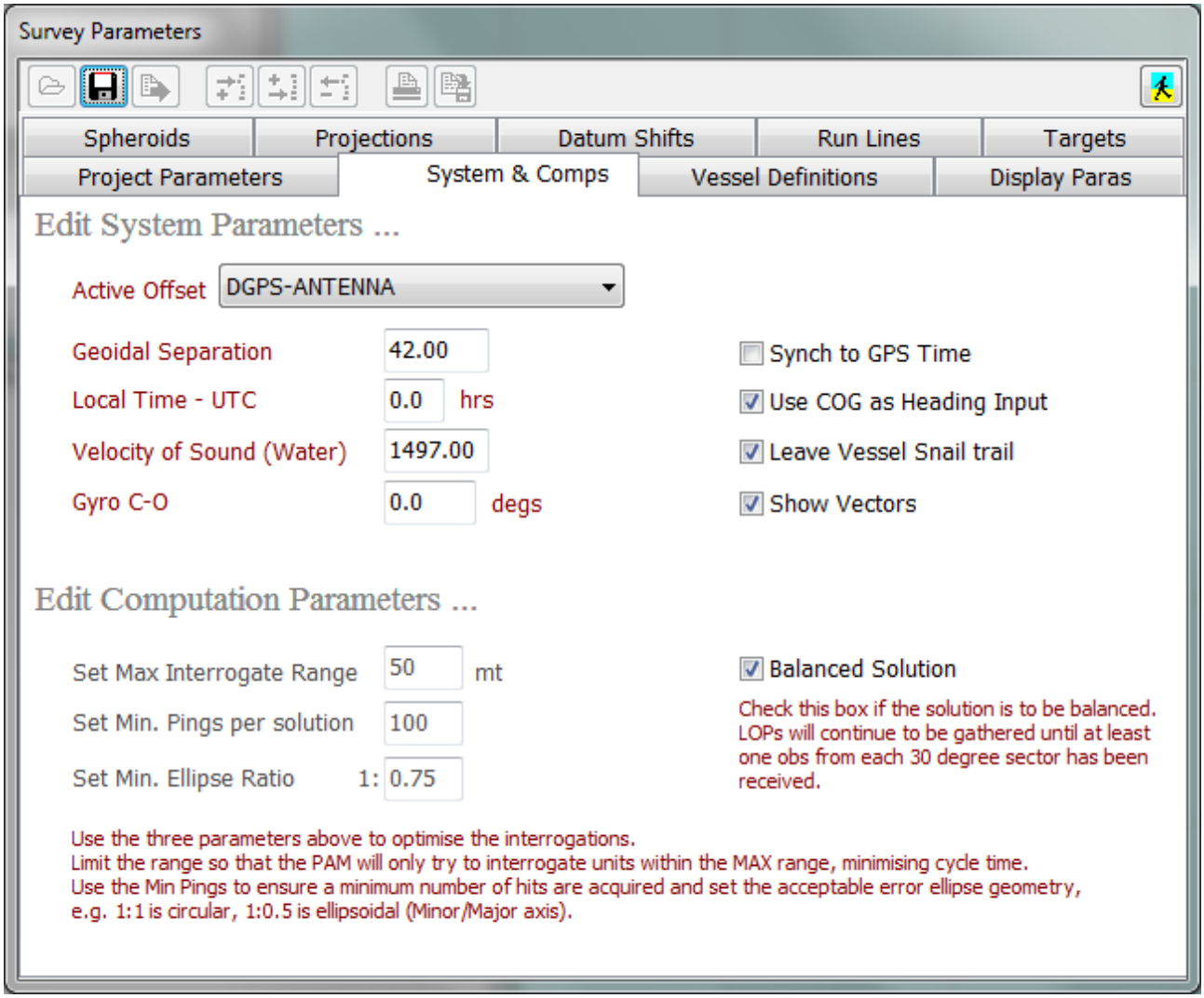
This is where the operator selects which database parameters are to be used in the current project.

The predefined and user options for each parameter are listed in drop down menus, select which option is required.

The user can use this function to offline process, for example if the solution had been calculated and accepted in the field with an incorrect vessel offset. This can be amended and the solution recalculated.

Each parameter must have an option selected. If no Run Line or Target required use the Dummy Options.

System Configuration



Edit System Parameters

Active Offset, select the Active Offset for the transducer from the list of predefined offsets.

Geoidal Separation: Enter separation (difference) between your current location and the ellipsoid.

Local Time – UTC: If you synch to GPS time enter the time offset to convert to the local zone.

Velocity of Sound: Velocity of sound is used to convert the 1-way mS times to meters, if you change the velocity of sound then the effective range will increase/decrease accordingly. The software logs the mS times rather that range so that if the velocity is found to be in error, a solution can be re-computed using a revised velocity of sound.

Gyro C-O: This can be used to enter a fixed offset for any Gyro Interfaced. COG (Course over ground) is the default source of heading reference.

Show vectors: This draws the LOPs (Vectors) on the chart plotter as the solution becomes valid.

Edit Computation Parameters

This area is provided to configure computation parameters, these define when the solution will be deemed complete or can be used as filters when re-computing a solution offline.

Set Max Interrogation Range: This sets an active range ring of x meters around the vessel an active beacon is only interrogated within this range.

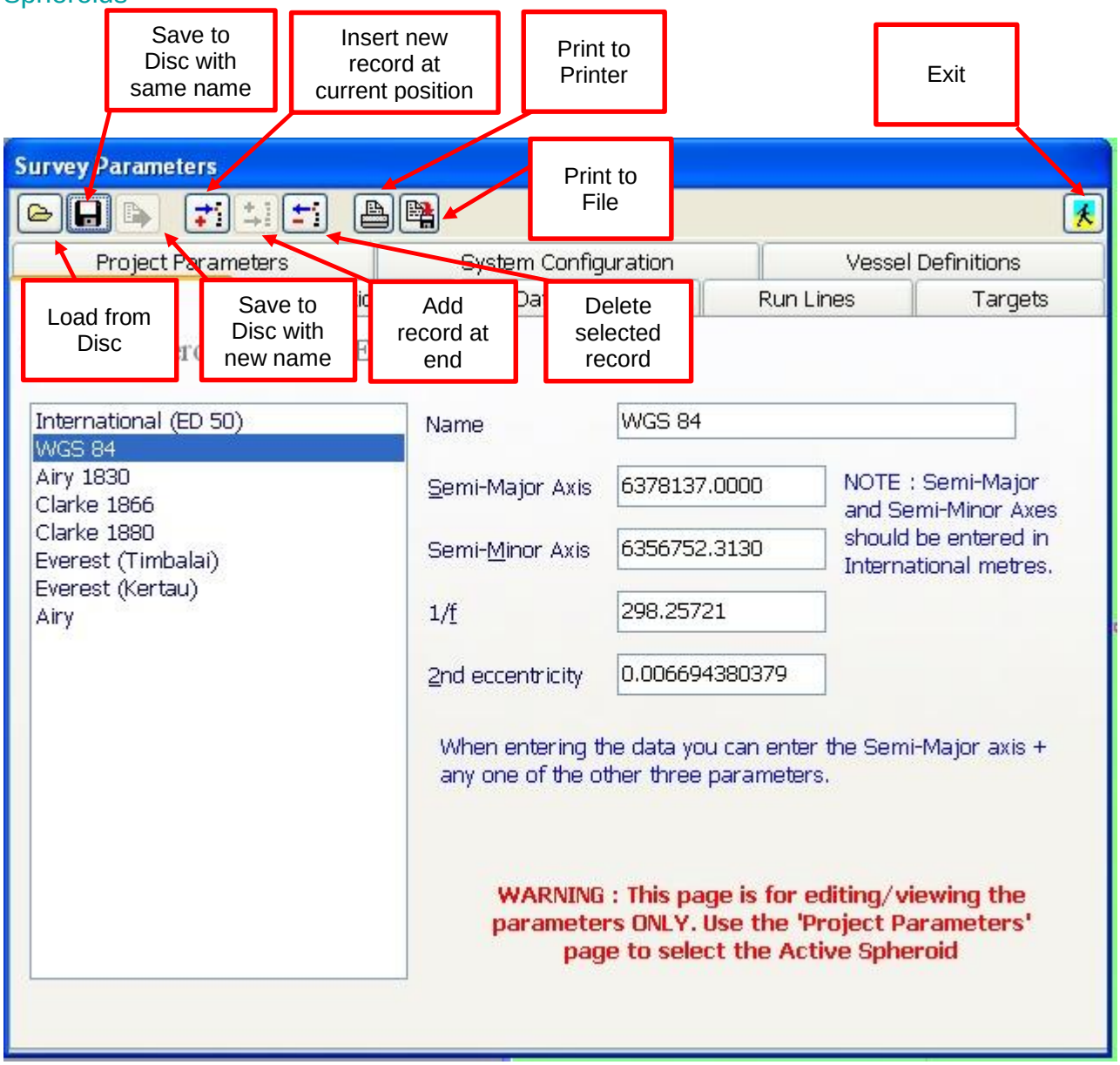
Set Min Number of Pings per Solution: The solution will continue to be acquired until the minimum has been achieved, upon completion of minimum pings the solution will complete if the ellipse ratio set and or balanced solution is within limits.

Set Min Ellipse Ratio: 1:1 is circular and 1:0.5 is ellipsoidal, this allows the operator set the acceptable error limits. The circular the solution indicates that the solution is balanced and accurate, missing data or angular ranges results in an elliptical plot.

Balanced Solution: Tick this box to ensure that the solution includes data from every 30º segment around the target, this ensures that the resulting solution plot is circular.

When making changes to settings, press SAVE before changing Tabs or exiting.

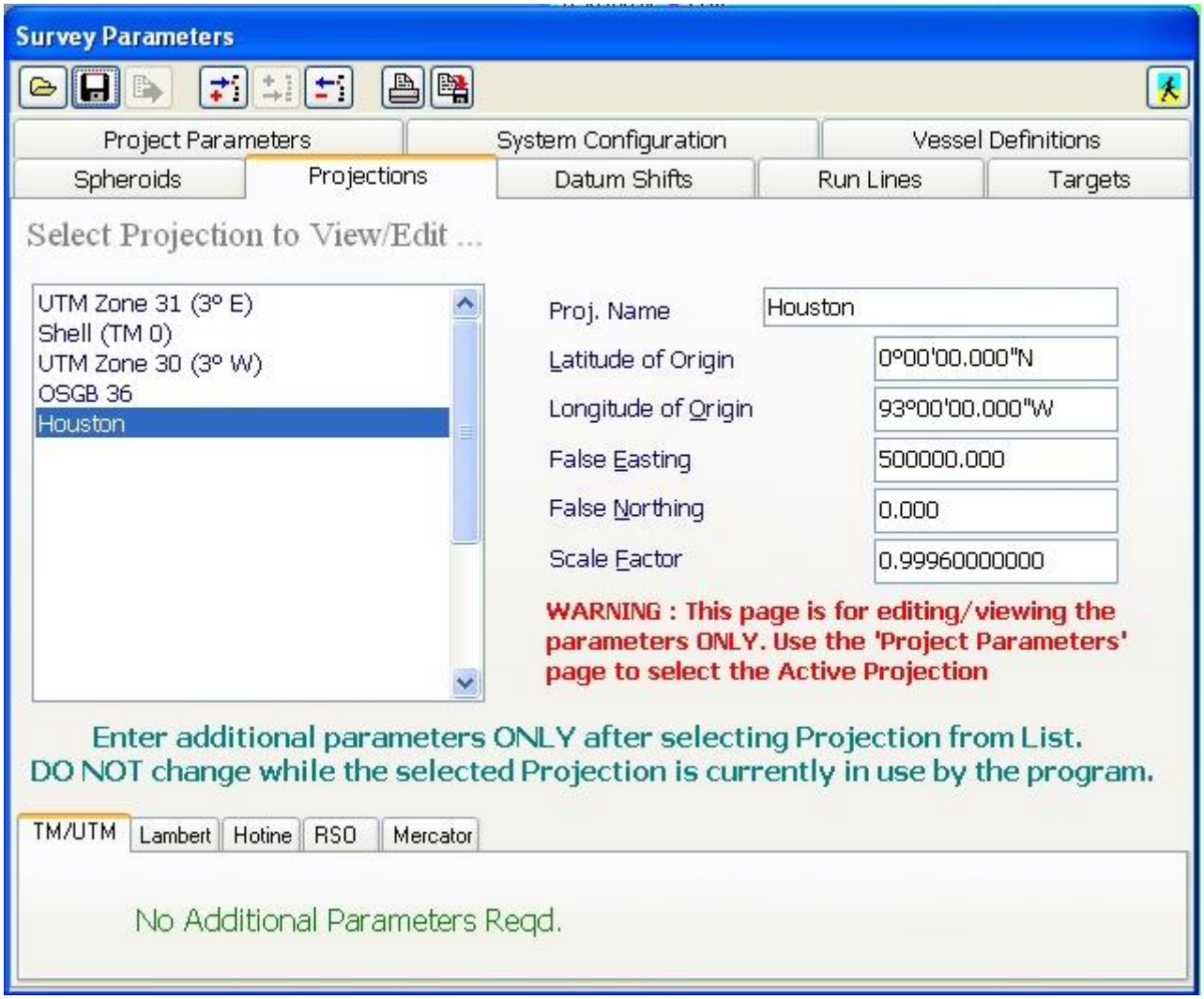
Spheroids



The user should use this tab to define Spheroid parameters, only 2 parameters need entering, e.g. Enter the Semi-Major axis and the 1/f value and the other two will be computed automatically.

When making changes to settings, press SAVE before changing Tabs or exiting.

Projections



The projections entry screen is similar to the Spheroids screen and allows the user to enter all the parameters which are used in computing the Easting and Northing from Latitude and Longitude.

Projections are the way the spheroid is displayed as a map. Several parameters are required depending on the type of Projection selected.

Five types of projections are supported by the software, all these have a few common parameters which are set in the top part of the form, the projection specific elements are entered using the section at the bottom which contains notebook tabs.

Click on the pull-down list of Projections and the data boxes will show the parameters for the selected item. Enter the parameters as shown, in the case of the RSO the Latitude and Longitude of Origin are for the Origin of the Initial line, for example :

Usage	Lat Origin	Lon Origin	Skew	F.Easting	F.Northing
Malaysia	0 0 0.6191 S	105 14 11.19435 E	323°07'48.3686"	804671.30	0.00
Borneo	0 0 0.6191 S	109 41 07.87270 E	53°07'48.3686"	0.00	0.00

These values should not be confused with the Lat/Lon for the projection e.g. 4 N and 115 E.

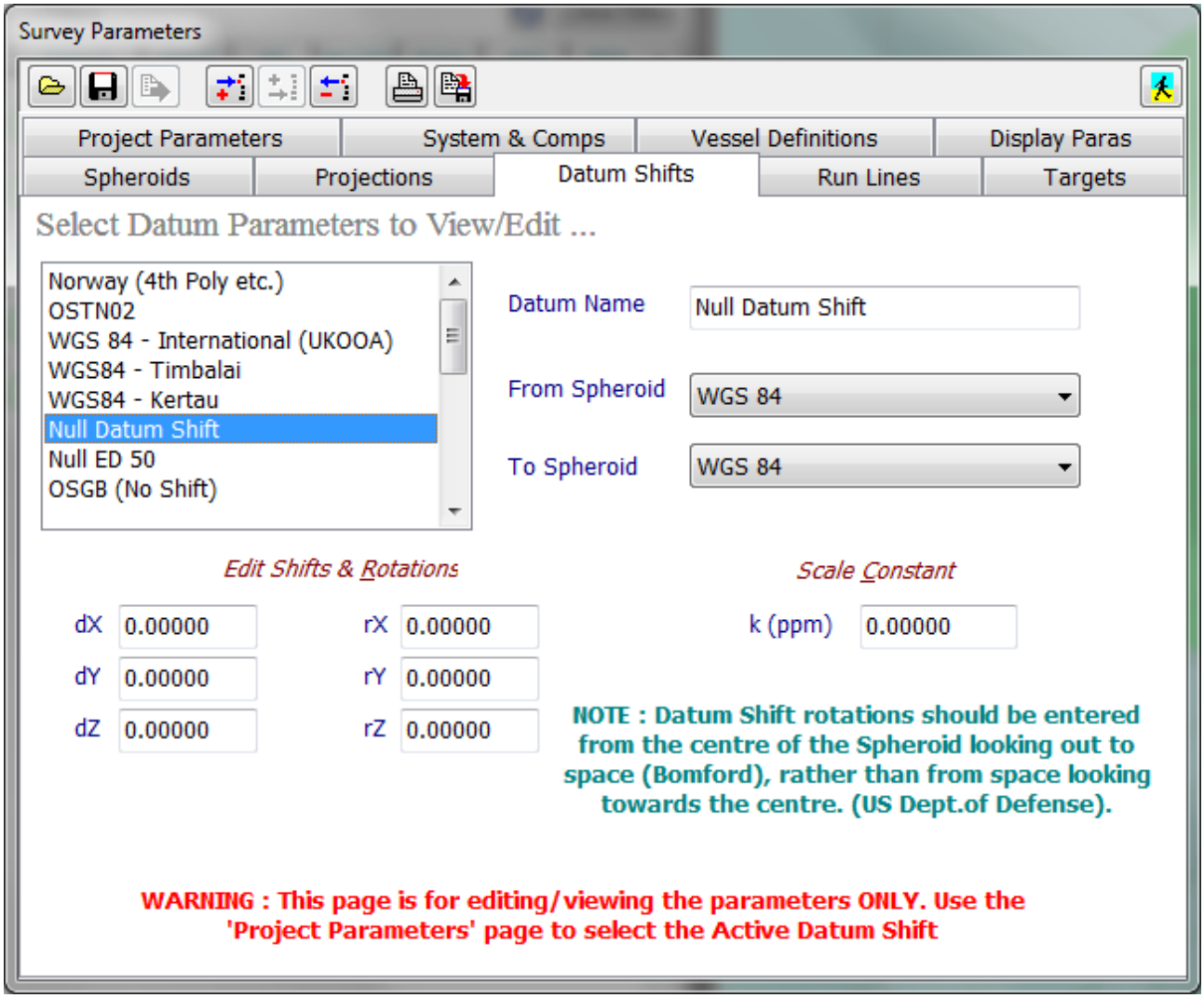
The additional parameters required for each projection type are :

TM/UTM	None
Lambert	1st and 2nd standard parallels of latitude.
Hotine	Start and end co-ordinates far the line which defines the projection skew.
RSO	Skew of the Initial line at its origin
Mercator	None

When entering parameters ensure that you carry out a test conversion on a point to verify the parameters.

When making changes to settings, press SAVE before changing Tabs or exiting.

Datum Shifts



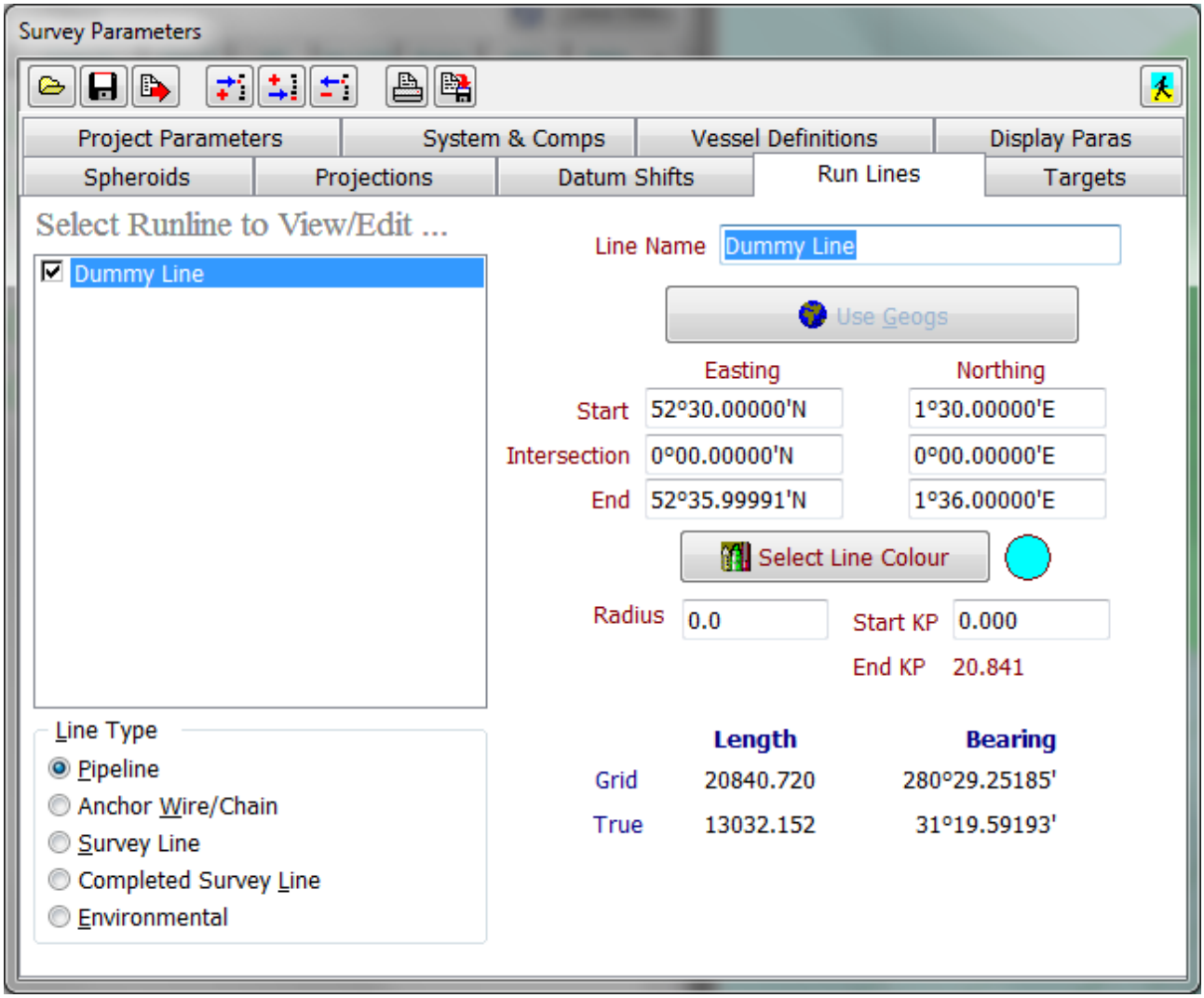
Datum shifts convert from one Spheroid to another Spheroid e.g. you may be acquiring position data from a GPS receiver but plotting in Airy (OSGB).

There are some conversions already set up, a standard conversion between WGS84 and International (ED 50) for UK sector North Sea working.

There are three Combo boxes on this page, the top for entering the conversion name, the other two contain a list of all the available Spheroids. Select either an existing datum definition or select a blank one using the "Select Datum" pull down list then enter any descriptive name in the "Datum Name" box. Select from the two Spheroid lists the Spheroid which the raw data is in (From), and the one which you are using for the operation (To) then enter the shift parameters. The shift parameters are obtained from an authoritative source or locally derived and should be checked using a known coordinate to ensure the correct transformation.

When making changes to settings, press SAVE before changing Tabs or exiting.

Run Lines



This screen allows you to enter lines and curves and assign KP values. This allows input of pipeline routes and sail routes as a series of straight and curved lines. These are plotted over any imported DXF data.

Start by finding a blank line and clicking "Enter Line at selected point' button, enter a name for the line in the "Line Name" edit box then enter the start of line coordinates. Press save to write to database.

As each start and end co-ordinate is entered the length and bearing is computed. Two types of lines can be entered, straight and curved as follows...

- To enter a straight section simply enter the end co-ordinates.
- To enter a curved section enter the end co-ordinates plus a radius. The radius should be entered as a positive number for clockwise curves and as a negative number for anti-clockwise curves.

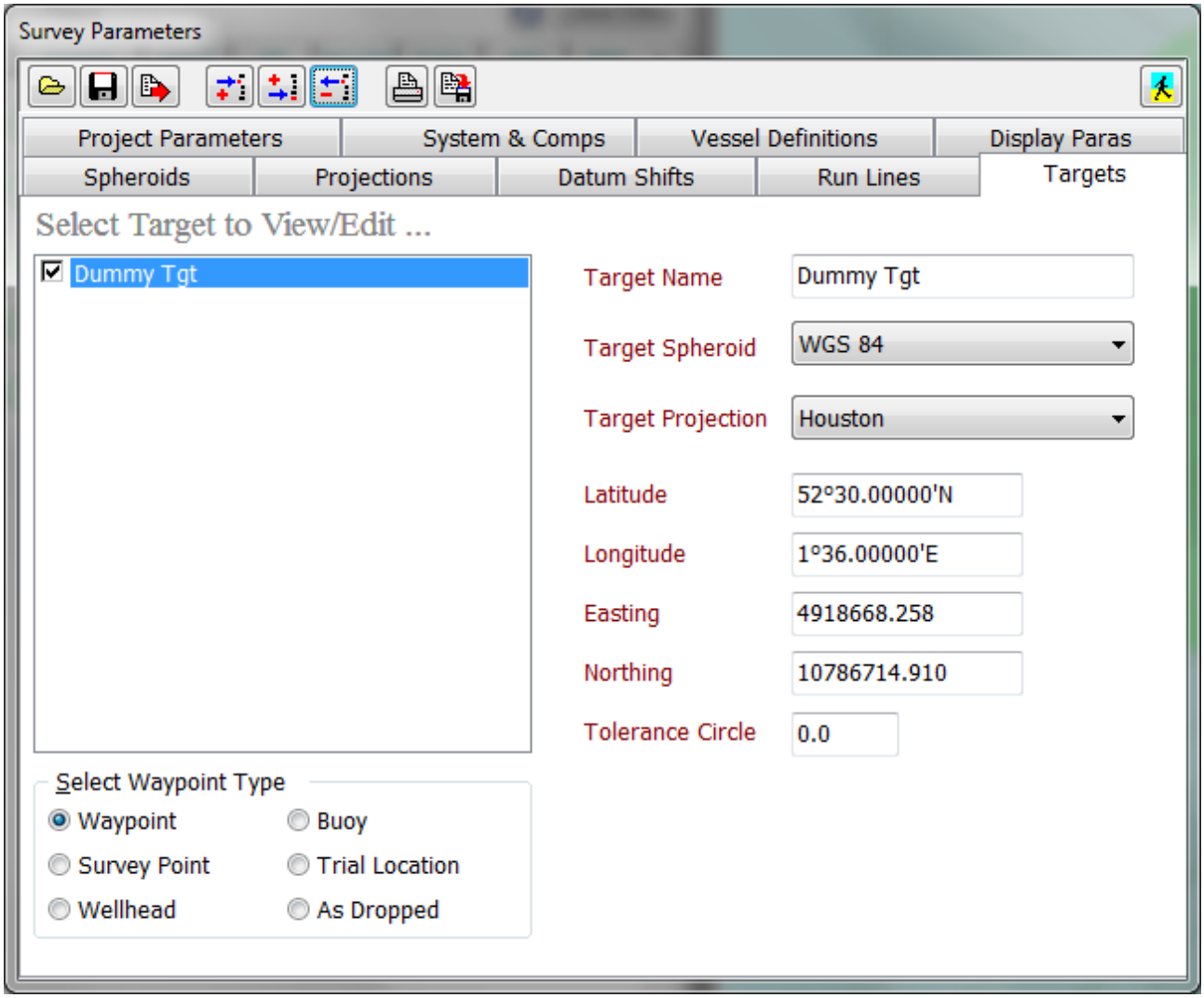
After entering the radius you will be prompted for the centre coordinate to eliminate any ambiguity in the data entry, simply click the check box next to the relevant coordinate.

Clicking the Geog button in the centre of the page will toggle the displayed co-ordinates between Geographical (Latitude/Longitude) and Grid (Easting/Northing). Lines can be entered using either Latitude & Longitude or Easting & Northing.

The Line type can also be selected by clicking one of the defined types in the panel at the bottom. The different line types plot the data in different colours to distinguish their different types.

When making changes to settings, press SAVE before changing Tabs or exiting.

Targets



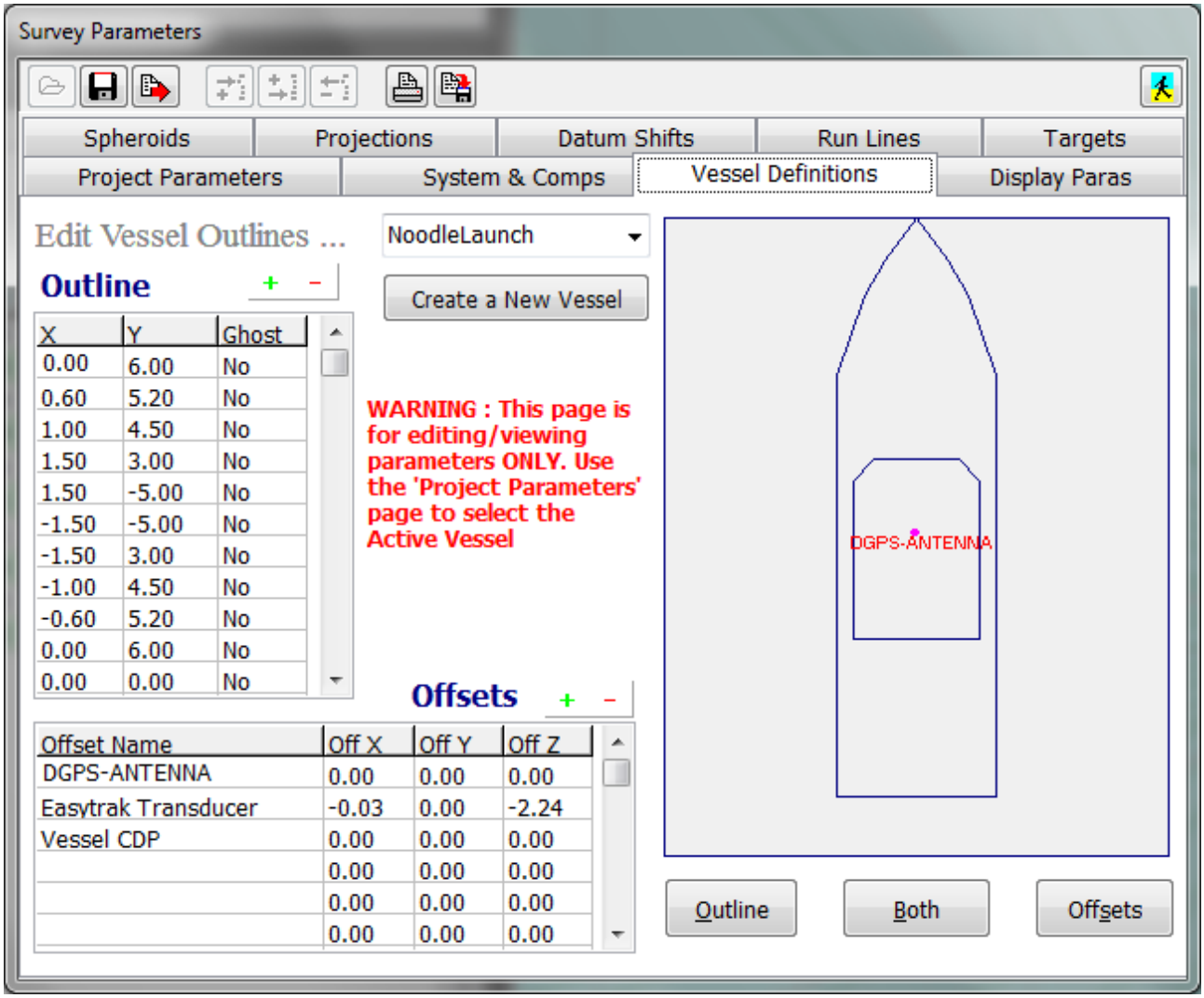
Data entry on this tab is similar to those already described, the user should select a blank line or use add a record button, enter a name for the Target then enter either the Latitude and Longitude or the Easting and Northing for the point. As you use the TAB key to move to the next item the coordinate will be converted. All points are stored in the database as Latitude & Longitude such that you can then display it in different UTM zones without changing the coordinate.

The user can also specify a Waypoint type and colour, when the point is plotted a symbol is plotted dependant on the point type.

A large number of Waypoints can be entered and saved in a specific file name using the buttons at the right of the form.

When making changes to settings, press SAVE before changing Tabs or exiting.

Vessel Definitions



The entry screen for vessels (shown here) is similar to a spreadsheet entry system, click on a cell an enter the value, press F2 when in a cell to edit the value and move around using the cursor keys.

Before entering any data establish a reference point on the ship, this is the point that all your outline definitions and offsets will be relative to.

Enter the vessel outline points in sequence, each point will be joined to the previous point. If you wish to draw a secondary outline enter a line containing an X and Y value of 0, then on the following line start your new shape. 50 points can be used to define the outline and 20 offsets can be established.

To create a new Vessel click on the ‘create a vessel button’, enter a new name and click ‘Save to Disc with a different name’ to bring up the save as Windows pop up. Save the file.

Enter the outline definition, entering anchor co-ordinates where applicable, items can be deleted or inserted using the red and green +/- buttons above the grid.

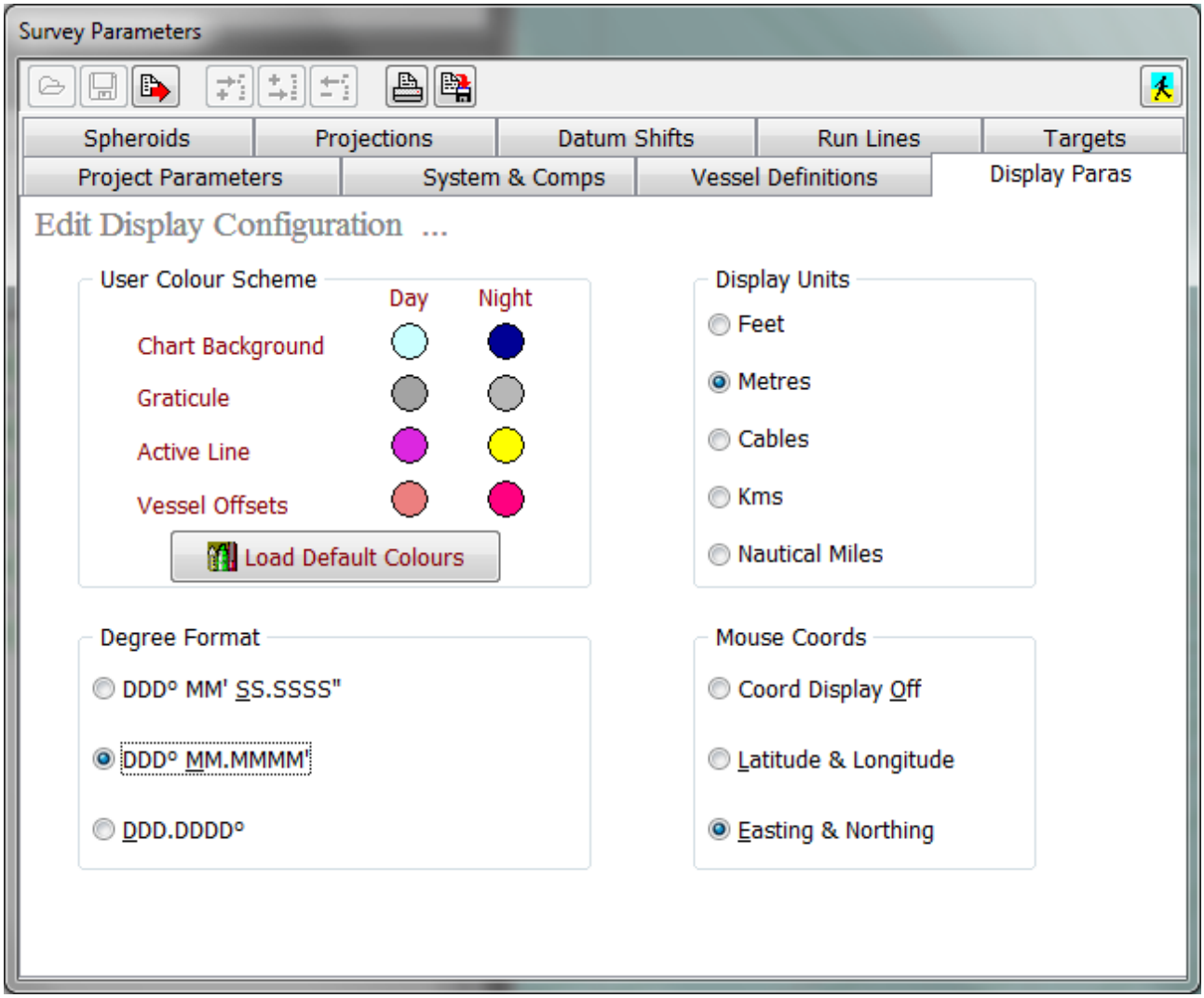
Enter the offset definitions, for a point to show on plots and in lists it must have a non zero value, (if a point at 0,0 is to be shown then enter a value of 0.001 for either X or Y.

Data can be viewed on the plot at the right to help verify the shape or the location of the offsets, the buttons beneath the graphic allow just outline, just offsets or both to be displayed. This is sometimes useful where layback points are included as the screen automatically scales to include all the data.

Once all data has been entered select the Save As button and save the data to a file either as a new vessel or overwriting an existing one.

When making changes to settings, press SAVE before changing Tabs or exiting.

Vessel Definitions



The user can configure the Chart Display colour scheme or reset to default colours.

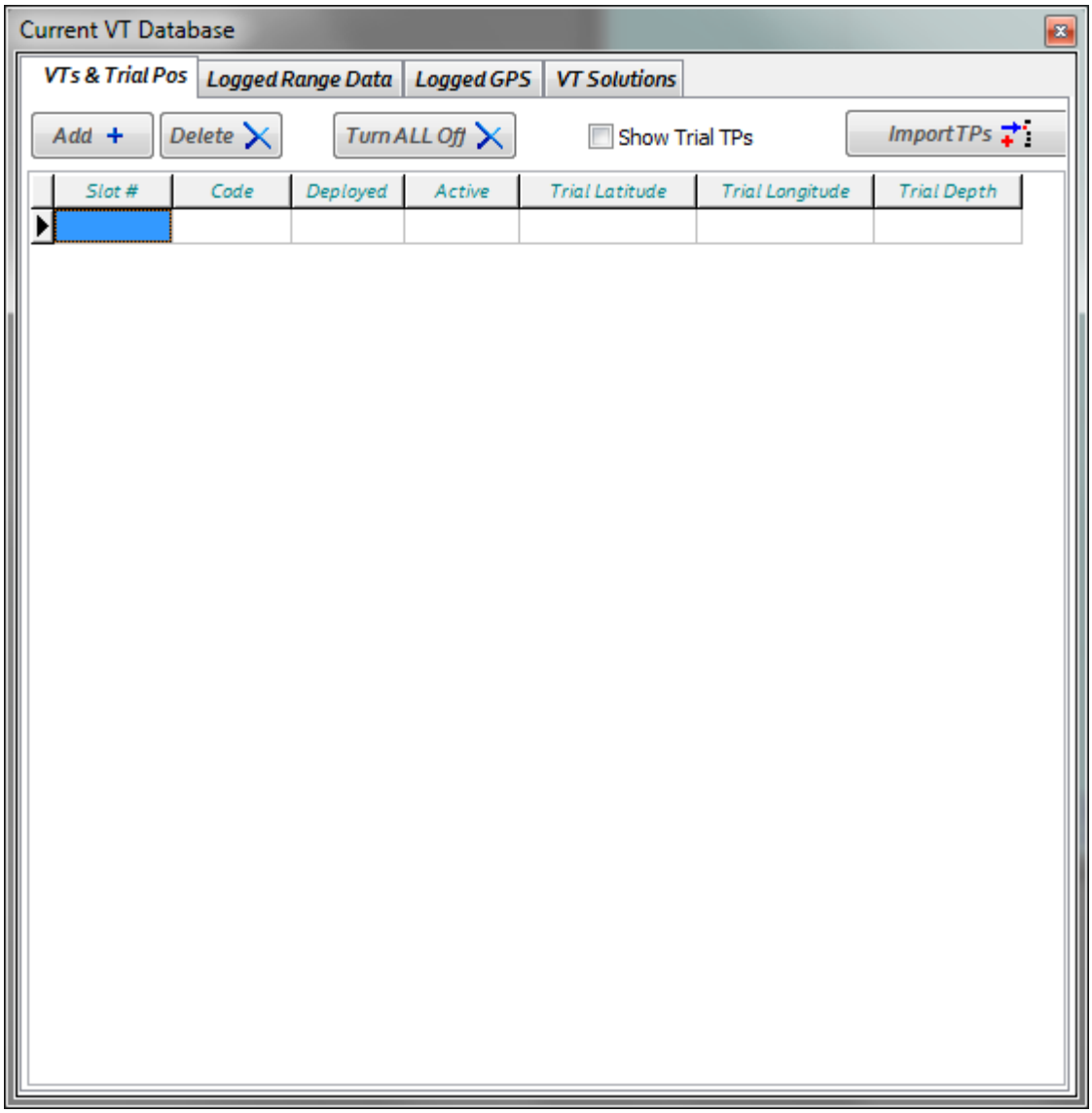
The Display units can be selected: Feet, Meters, Cables, KMs, and Nautical Miles.

Degree Format: User selectable format for display and in positional reports.

Mouse CoOrds: Allows the user to select cursor position type or switch off.

The last selections are saved upon exit.

Current VT Database



The current VT (Vector Transponder) Database is the 'engine room' of the application, the Database imports and processes the initial VT (Beacon) deployment location (TP), the Logged GPS Data and logged beacon ranges to produce the VT position solutions.

One of the principles of the logging database is that VT units are organized by code and solution number. When logging is turned on a prompt appears to determine if data is to be added to the current solution number or a new solution number. The reason for this is that it allows - for instance - an array of VT units to be deployed, the data acquisition to commence and perhaps acquire 50% of the data, then further data to be acquired later as part of the same dataset.

VT & Trial Positions

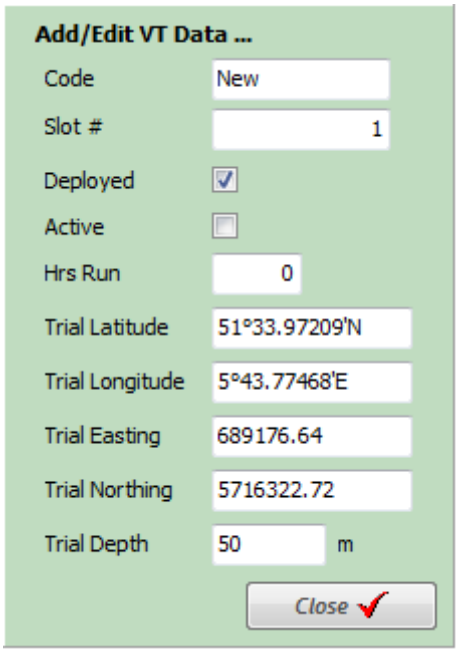
The VTs are organized by slots, the slot number is used by VNav as the unique identifier allowing multiple instances of the same acoustic ID to be used in a large scale deployment.

Adding a VT (Vector Transponder / Beacon)

There are two methods to add a VT to the project database:

(1) Click 

to create a beacon manually, this grabs the latest GPS position of the vessel to use as the Trial Position (TP).
The Code (Acoustic ID) of the VT or Beacon should be entered manually together with the trial depth (A default depth of 50m is used otherwise).



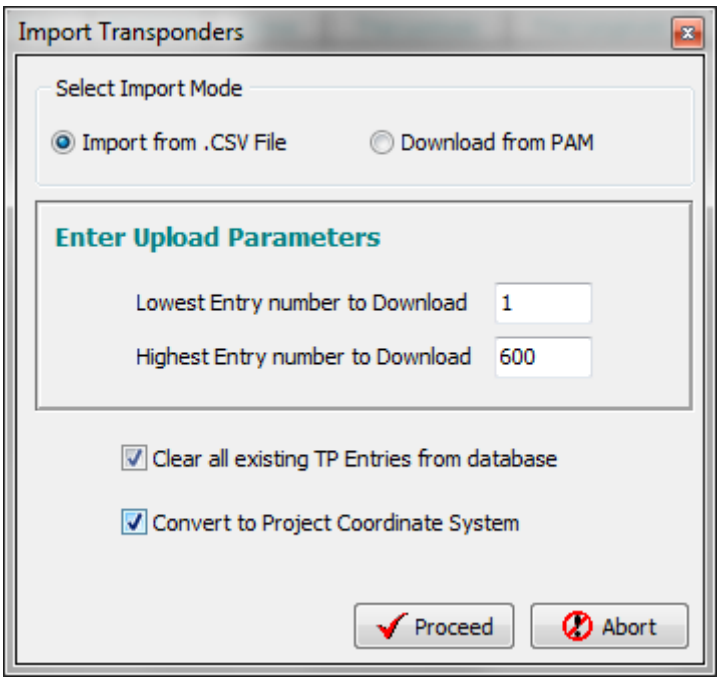
With VT configured the beacon can be active from the pop up window or closed.

To plot the TP position of the Chart Plotter tick ‘Show Trial TPs’ check box.

To enable tracking of a standard AAE Navigation Beacon rather than a VT (1400 Vector Transponder) use the prefix 99 followed by the 2 digit channel number. For example 99E0 = Beacon set to AAE SS Channel E0 or 9923 = Beacon set to AAE channel 23 (HiPAP).

(2) Click 

to use an automatic option to import Trial Positions.



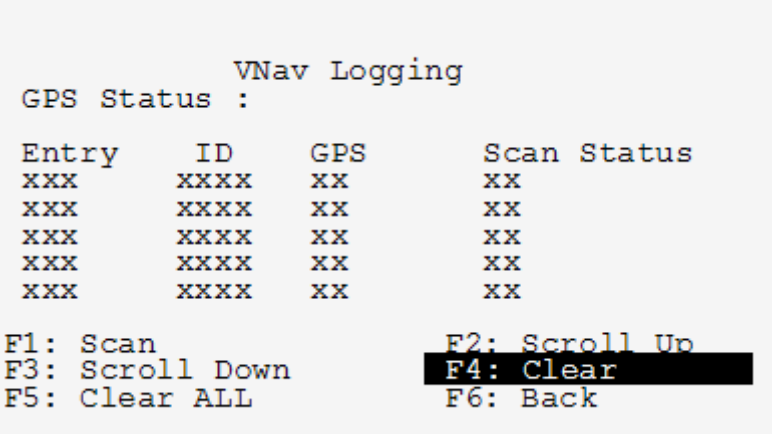
.**CSV File**

Selecting the import from a CSV File and clicking proceed opens a window to select the preconfigured deployment locations. An example of the format can be found at:

Public Documents\Applied Acoustics Engineering\Vnav \ Data \ VTImportTest.csv

Download from a PAM 3510 Unit

PAM 3510 Deployment Logging Operation



PAM3510 Deployment Logging Screen

The PAM 3510 allows the deployed position or trial position to be logged to an entry (slot), this allows the same IDs to be used on large deployments. The entry and Vector ID are logged to the GPS position ready to be uploaded to the VNAV Software for acquisition set-up.

With GPS interfaced the status is reported, the GPS antenna should be referenced or as close as possible to the deployment location. There are 600 entries (slots) available for storage.

Place the test transducer close to the Vector Beacon's transducer face and press F1 to scan as the beacon is being deployed from the vessel. If successful the table will update with the ID, GPS Status OK and Scan Status OK, else any errors are reported.

Once logging is complete, the whole table or part can be uploaded to the VNAV application. This is controlled by the Import TPs button on the VT Data Base Menu.

V-NAV Download

Upon completion of the above procedure with the PAM3510. Select the ‘Download from PAM’ option and enter the range to be imported from PAM, then click Proceed to download the deployed positions.

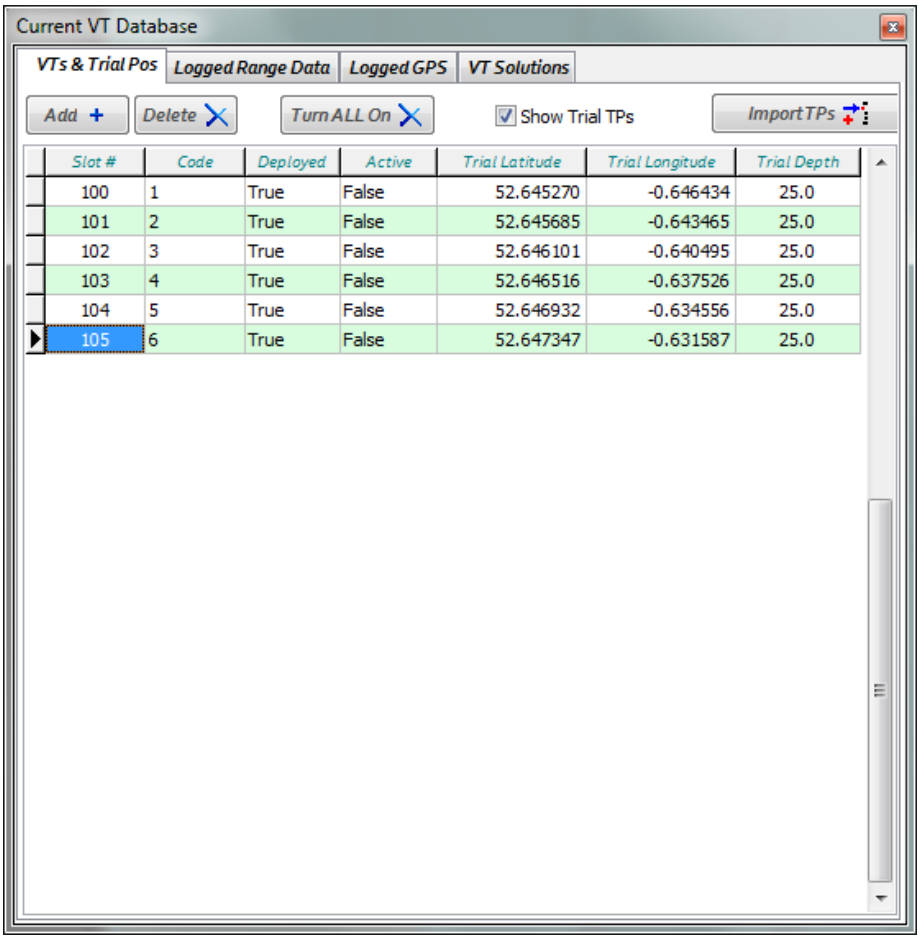
Ensure serial coms are active and the deployment data for the array is acquired.

A default depth of 25m is applied to all beacons as an initial point for the solution.

The PAM3510 logs the GPS positions in WGS84 Spheroid to convert these positions into the project specific settings select ‘Convert to Project Coordinate System’.

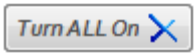
To clear the current data base and over write with new positions select ‘Clear all existing TP Entries from Database’. Else leave up ticked to add new positions to current database.

Screen shot of an uploaded array from a PAM 3510



Slot #	Code	Deployed	Active	Trial Latitude	Trial Longitude	Trial Depth
100	1	True	False	52.645270	-0.646434	25.0
101	2	True	False	52.645685	-0.643465	25.0
102	3	True	False	52.646101	-0.640495	25.0
103	4	True	False	52.646516	-0.637526	25.0
104	5	True	False	52.646932	-0.634556	25.0
105	6	True	False	52.647347	-0.631587	25.0

Enable / Disable VTs (Beacons)

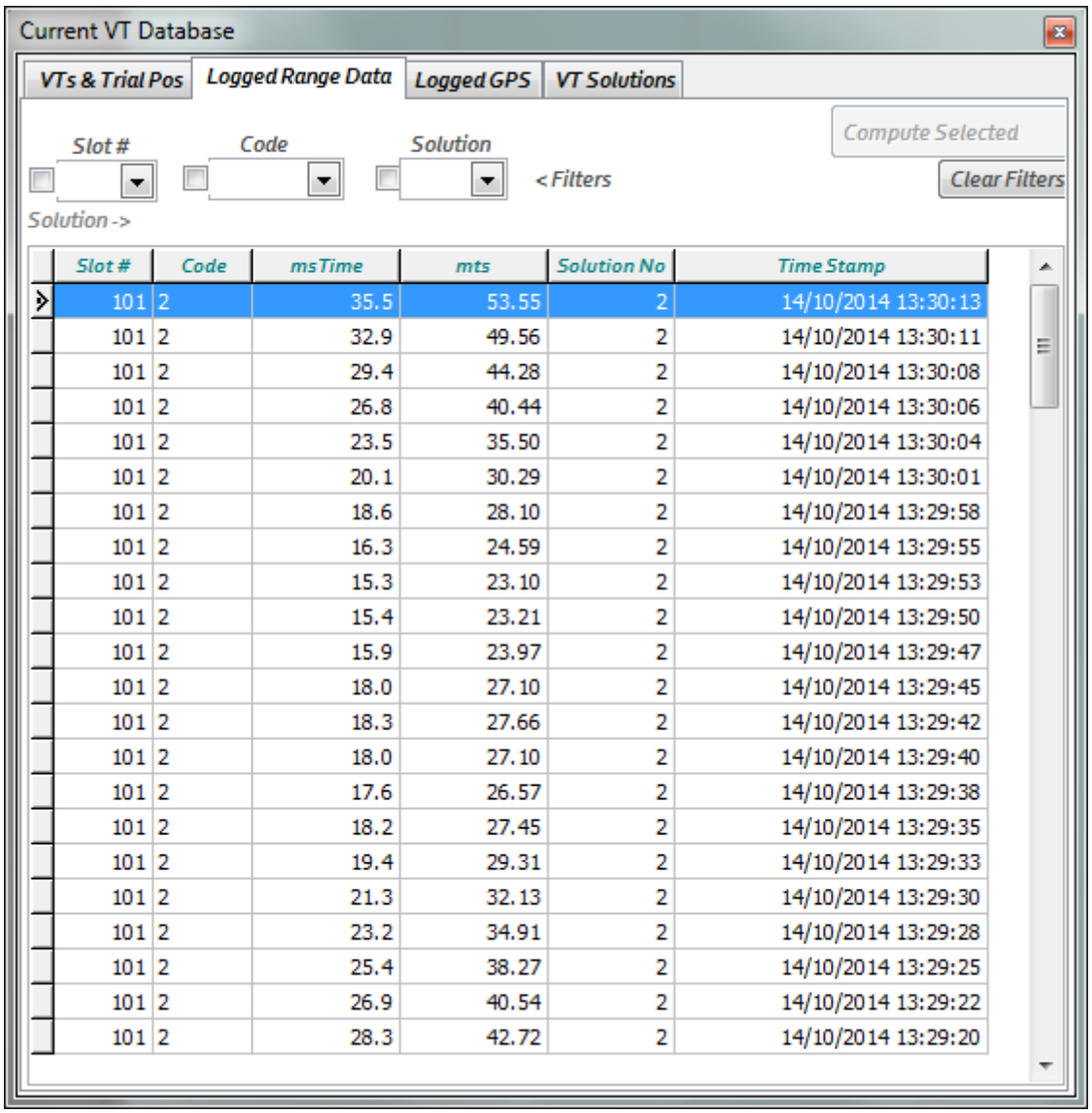
To enable all the beacons click 

This is a Toggle Button, when all Enabled click the same button to Disable All.

Each Beacon can be individually enable / disabled by either double clicking the slot to launch the properties to amend or by selecting the cell in the Active column and changing the status from False to True by pressing T True or F False on the keyboard, to confirm setting press enter or click on another cell in the table.

Logged VT Data

The page shown here displays all the logged VT data in this project database, if Logging is ON then each new data item is added at the top of the list. In the instance here all codes and all solution numbers are displayed.



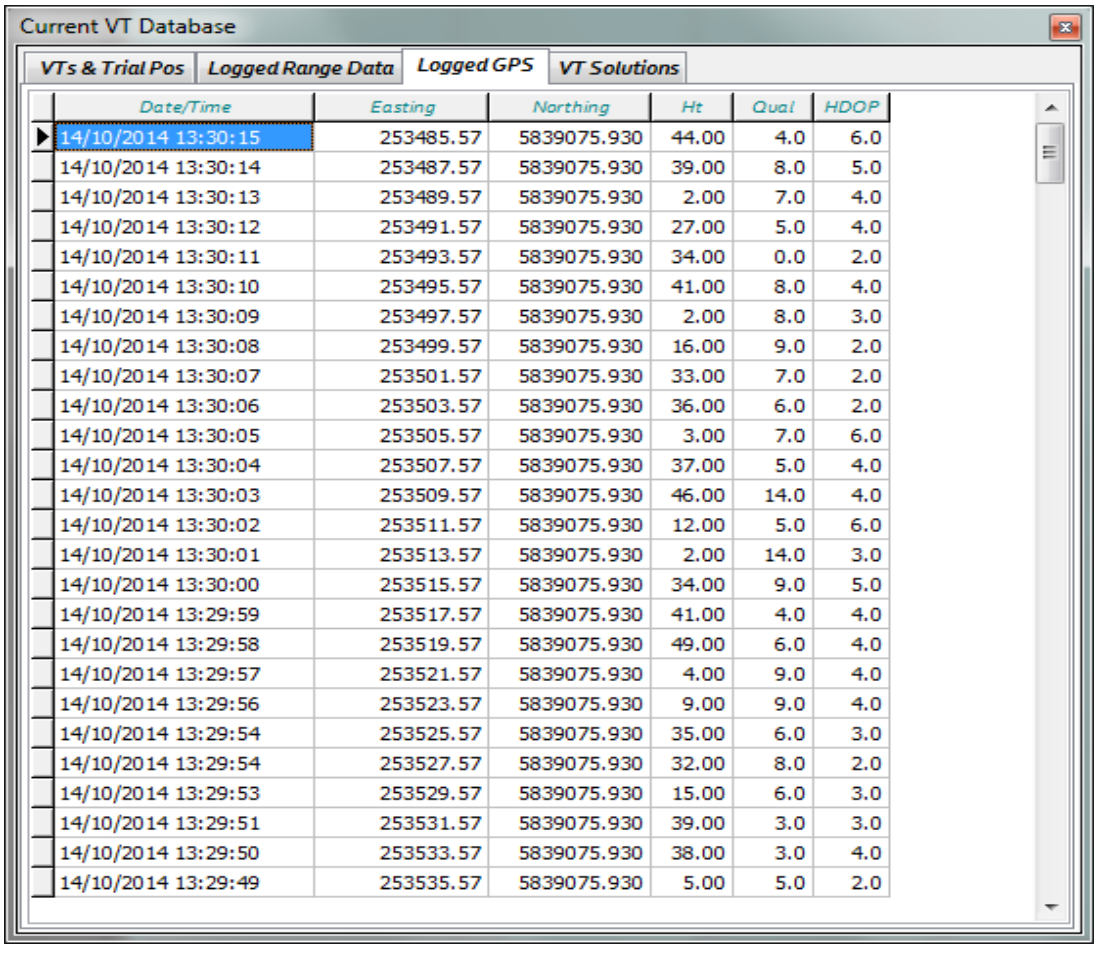
Slot #	ID used within V-Nav
Code	Acoustic ID of Beacon / VT
ms Time	ms Time: One way acoustic range time in milli seconds
mts	mts: Acoustic Range in Meters. Acoustic range converted from ms time.
Sol Number	Solution Number: A solution is created for a single or group of computed positions upon enabling logging within a project. Thus allowing multiple 'passes' to be taken to compare results over time.
Time Stamp	Time stamp: Time of observation to be used in calculating solution.

The "Compute Solution" button is used to compute the solution for the filtered code/solution combination. The Compute Solution button is only active when all fields in the filters are filled, Slot, code and solution selected.

When logging is enabled a solution is computed, the solution is placed in the "VT Solutions" page.

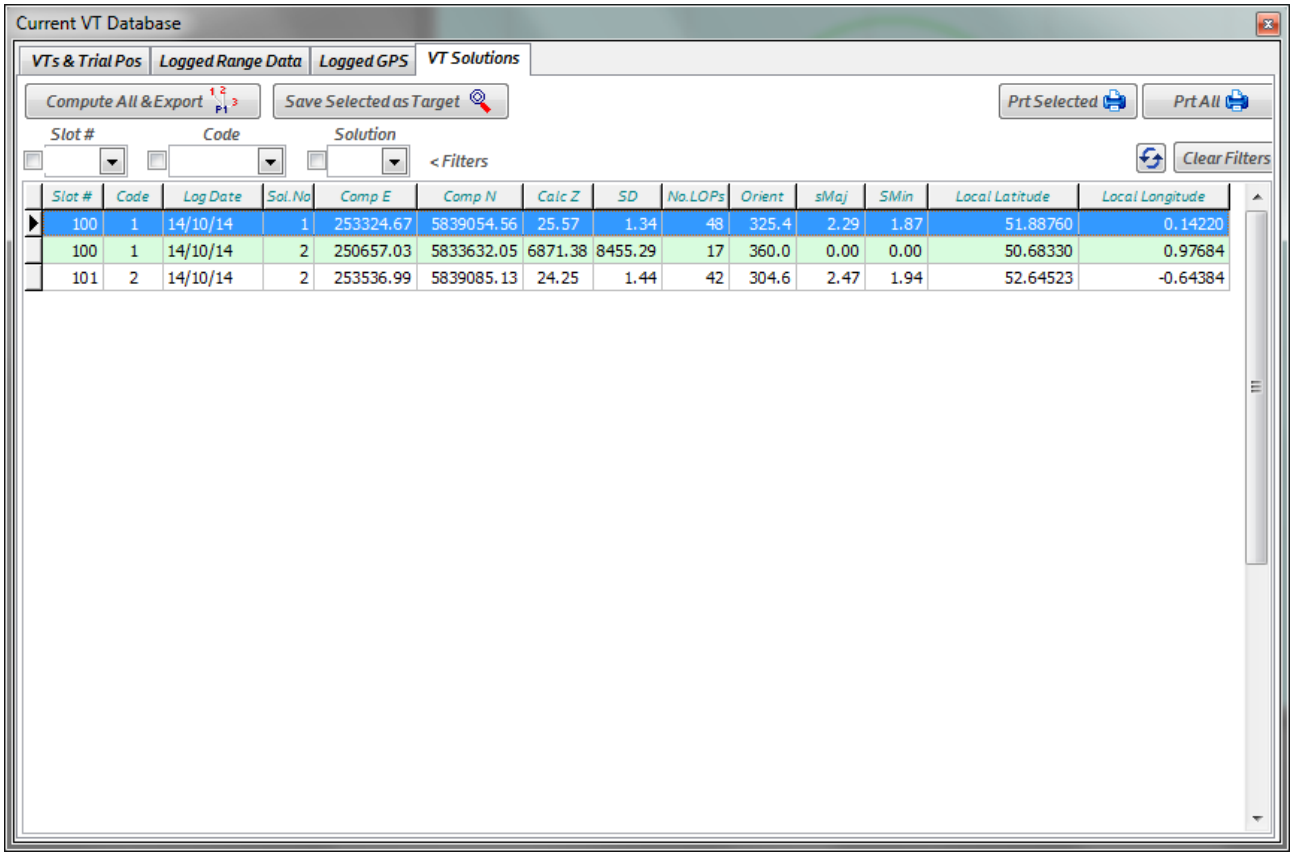
Logged GPS Data

This page provides a listing of all the GPS data logged in this project database, as new data is logged it appears at the top of the list.



Date/Time	Easting	Northing	Ht	Qual	HDOP
14/10/2014 13:30:15	253485.57	5839075.930	44.00	4.0	6.0
14/10/2014 13:30:14	253487.57	5839075.930	39.00	8.0	5.0
14/10/2014 13:30:13	253489.57	5839075.930	2.00	7.0	4.0
14/10/2014 13:30:12	253491.57	5839075.930	27.00	5.0	4.0
14/10/2014 13:30:11	253493.57	5839075.930	34.00	0.0	2.0
14/10/2014 13:30:10	253495.57	5839075.930	41.00	8.0	4.0
14/10/2014 13:30:09	253497.57	5839075.930	2.00	8.0	3.0
14/10/2014 13:30:08	253499.57	5839075.930	16.00	9.0	2.0
14/10/2014 13:30:07	253501.57	5839075.930	33.00	7.0	2.0
14/10/2014 13:30:06	253503.57	5839075.930	36.00	6.0	2.0
14/10/2014 13:30:05	253505.57	5839075.930	3.00	7.0	6.0
14/10/2014 13:30:04	253507.57	5839075.930	37.00	5.0	4.0
14/10/2014 13:30:03	253509.57	5839075.930	46.00	14.0	4.0
14/10/2014 13:30:02	253511.57	5839075.930	12.00	5.0	6.0
14/10/2014 13:30:01	253513.57	5839075.930	2.00	14.0	3.0
14/10/2014 13:30:00	253515.57	5839075.930	34.00	9.0	5.0
14/10/2014 13:29:59	253517.57	5839075.930	41.00	4.0	4.0
14/10/2014 13:29:58	253519.57	5839075.930	49.00	6.0	4.0
14/10/2014 13:29:57	253521.57	5839075.930	4.00	9.0	4.0
14/10/2014 13:29:56	253523.57	5839075.930	9.00	9.0	4.0
14/10/2014 13:29:54	253525.57	5839075.930	35.00	6.0	3.0
14/10/2014 13:29:54	253527.57	5839075.930	32.00	8.0	2.0
14/10/2014 13:29:53	253529.57	5839075.930	15.00	6.0	3.0
14/10/2014 13:29:51	253531.57	5839075.930	39.00	3.0	3.0
14/10/2014 13:29:50	253533.57	5839075.930	38.00	3.0	4.0
14/10/2014 13:29:49	253535.57	5839075.930	5.00	5.0	2.0

VT Solutions



The page here shows the computed solutions for the VT units, these are either computed manually from the "Logged Range Data" page or during acquisition whilst the logging is on. When logging is on, as each new VT range is received, the relevant Code/Solution computation is carried out and the updated result appears in this page.

Slot #	ID used within V-Nav
Code	Acoustic ID of Beacon / VT
Sol Number	Solution Number: A solution is created for a single or group of computed positions upon enabling logging within a project. Thus allowing multiple ‘passes’ to be taken to compare results over time.
Comp E	Computed Easting
Comp N	Computed Northing
Calc Z	Calculated Z, Z = Depth
SD	SD is the standard deviation of the computed position
No LOPs	No. of LOPs: A LOP is a Line Of Position which is a term used in positioning triangulation in this case it is the number of acoustic ranges taken.
Orient	Orient: Orientation of the error ellipse
sMaj	sMaj: The length of the major axis of the error ellipse
Smin	sMin: The length of the minor axis of the error ellipse
Local Latitude	Computed Latitude
Local Longitude	Computed Longitude

You can see from the data above that in some cases the computation has failed, this may be due to poor geometry or bad range data. This is generally apparent in the "Calc Z" becoming very large and unrealistic.

When computing the solutions the software uses the current Velocity of Sound entered on the System Configuration page, if this is changed the solution will be affected, you should always check this if you are post-processing data to ensure the correct velocity is used.

Three buttons are provided to output the results, "Compute All & Export" will provide a .CSV file.

The other two buttons provide a printout of either all the solution data without the raw data, or, the selected code/solution with the raw data for further analysis.

A further button is provided to allow the selected line as a Target in the Survey Database, this can then be saved as a target for future use in navigating to the point.

Double clicking on a line will cause the particular solution to be re-computed and the screen will jump to the solution - check that auto-update is not turned on.

Lines of data can be removed by pressing CTRL DEL keys, this provides the option to delete the line where the cursor is positioned.

Example of the Report Output format

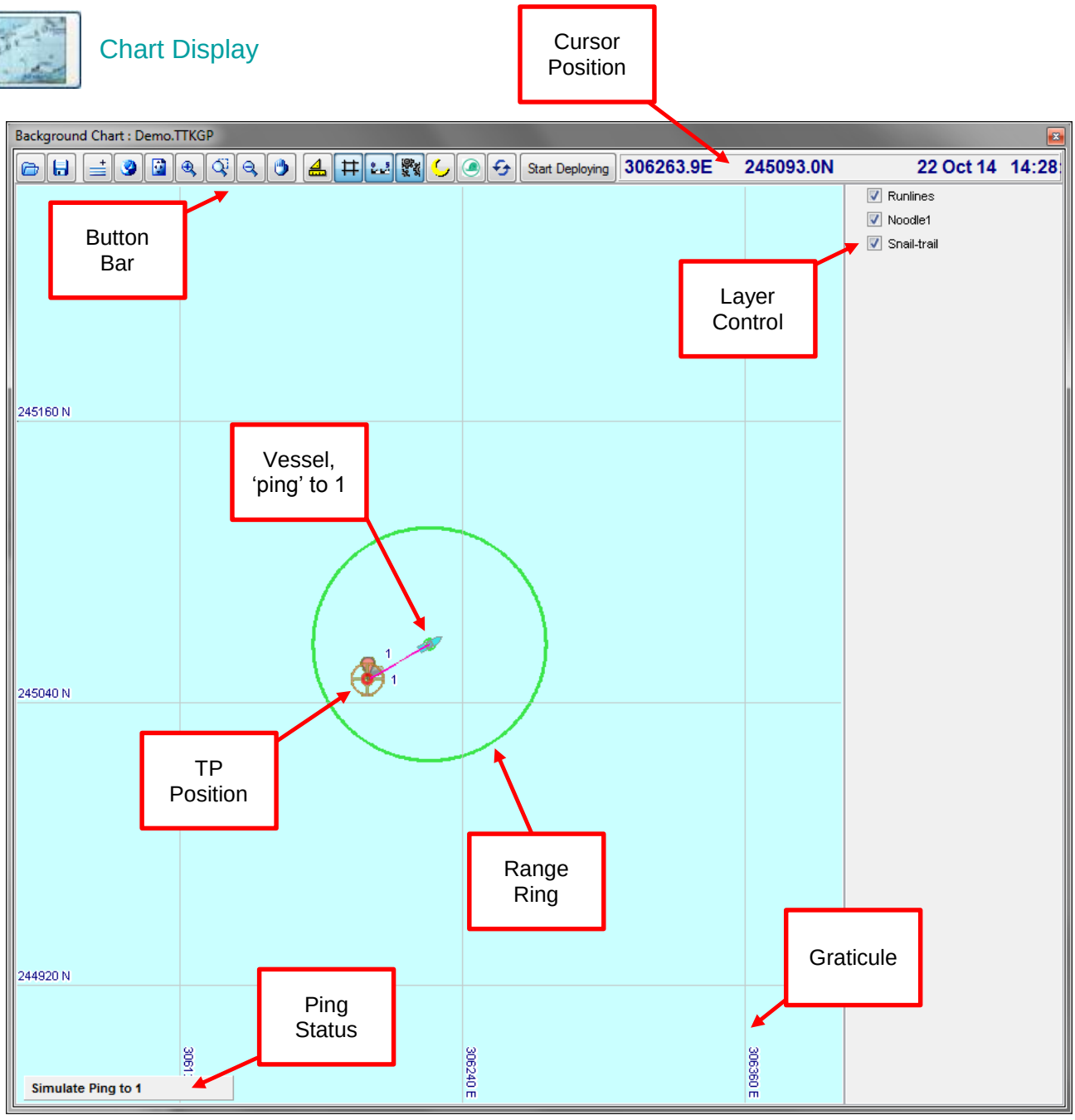
Vector Nav 1.2 (14th Oct 2014)

Computed Solutions for Project : Test Project
Client : Applied Acoustics Job No : 12345

Velocity of 1496.46
X Offset -0.03
Y Offset 0

Slot	Code	Solution Nc	Logged Date	Comp Lat	Comp Lon	Comp E	Comp N	Comp Dept SD		Num LOPs	Orientation	Semi-Maj	Semi-Min
1	9.90E+02	10	15/10/2014	30°21.95700'N	95°33.12180'W	254734.6	3362095	11.792	0.339	101	316.3	0.37	0.32
1	9.90E+02	9	15/10/2014	29°51.40140'N	95°44.33700'W	254734.6	3362096	11.652	0.335	101	320.8	0.36	0.32
1	9.90E+02	8	15/10/2014	30°21.94260'N	95°33.11220'W	254734.5	3362095	11.573	0.351	101	313.8	0.37	0.36
1	9.90E+02	7	15/10/2014	30°21.95460'N	95°33.11940'W	254734.7	3362095	11.672	0.397	101	314.5	0.45	0.37
1	9.90E+02	6	15/10/2014	30°41.31600'N	95°33.55440'W	254734.8	3362096	11.604	0.342	110	319.1	0.38	0.32
1	9.90E+02	5	15/10/2014	30°21.95520'N	95°33.12300'W	254734.7	3362095	11.802	0.306	101	320.8	0.34	0.29
1	9.90E+02	4	15/10/2014	30°21.96900'N	95°33.11880'W	254734.9	3362096	11.062	0.333	101	308.9	0.36	0.32
1	9.90E+02	3	15/10/2014	30°21.95520'N	95°33.12120'W	254734.9	3362095	11.147	0.453	101	326.4	0.53	0.4
1	9.90E+02	2	15/10/2014	30°51.14460'N	95°19.85100'W	254734.8	3362096	11.264	0.393	101	326.4	0.45	0.35
1	9.90E+02	1	15/10/2014	30°21.97020'N	95°33.11820'W	254735	3362095	11.289	0.37	101	325.8	0.42	0.33

Chart Display



The chart view provides a live update showing the vessel position, background .SHP/.DXF/.TIF image, live solutions, targets and run lines. At the top is a button bar providing functionality for the chart for example zoom-in, zoom-out, zoom-window, measuring tools, scale bar and chart scroll method.

When zoomed out the vessel is shown as a green arrow, as the user zooms in to a scale where the vessel shape can be determined the arrow changes to the vessel shape. Offsets and vessel orientation can be monitored in real time.

The chart can be configured independently to the main project and can be considered a separate display project to the main positioning project. Chart settings and configuration are made from the button bar.

 Loading Project/File: The first button provides a dialog to allow the user to load an existing project or background file. A project file consists of a file with the ".TTGKP" file extension and this file contains a list of all the layers and properties that make up a project e.g. A.DXF, B.SHP, C.TIF. When starting a new project a single file can be loaded initially, this may be a .TIF, .DXF or other accepted file type, additional layers can be added to this and as each layer is added the Layer Panel on the right side will update to show the list of layers currently loaded.

Each layer has properties such as transparency, line colours etc. which can be individually configured.

 Saving Project: When a project is saved the software saves the list of layers/files that are currently set in the "Layer Panel" and saves the current screen position, when the project is re-loaded the chart view should be as when saved.

 Add a Layer - This allows you to add a layer to the viewer, maybe a .SHP, .DXF, .TIF or other file

 Zoom All - Clicking this button causes the chart area to zoom out to the full extent of ALL layers.

 Zoom Selected Layer - Click once on a layer in the list, then click this button to zoom so that the extents match the select layer extent.

 Zoom IN - This halves the current chart scale, enlarging the chart image.

 Zoom Window - This allows zooming to a specific area of data, press and hold the left mouse button and drag across an area - moving from left to right - when the mouse button is released the area shown in the window should be displayed. To zoom out, click and hold the left mouse button and drag from right to left, the smaller the area you drag, the greater the zoom, for lesser values, drag a larger area.

 Zoom OUT - This doubles the current chart scale, shrinking the chart image.

 Pan Screen - When clicked, the button will stay down and you can move the chart center by placing the mouse over the chart area, pressing and holding the left mouse button, then moving the mouse across the screen, releasing when at the desired location. Click the button again to turn off this feature.

 Measure Tool - When depressed distance and bearing can be acquired from the chart view, move the mouse to the start of your measure line, press and hold the left mouse button and drag, the measure line is drawn and a circle described at the same radius. The distance and bearing is displayed in the status bar at the base of the Tabbed pages.

 Show Graticule - When depressed a UTM graticule is displayed on screen, clicking again removes the graticule.

Show Scale Bar - When depressed a scale bar is shown at the top left of the screen to provide an indication of distances on the chart view.

Auto-Update - When depressed the chart will always re-center on the vessel position, if not depressed the chart will stay still and the vessel will move across the chart and eventually leave the screen display.

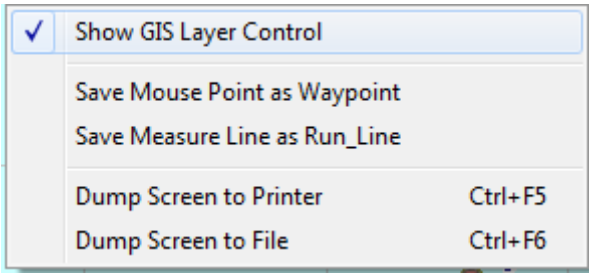
Day/Night Colour - This provides either a dark or light background for the display, sometimes DXF files have the detail is white so a dark background will display the to better effect.

Clear Snail Trail - This button is provided to reset the snail trail, the snail trail itself can be enabled/disabled from the System Configuration page in Survey Parameters. The Snail-trail is maintained - but not updated - whilst the snail-trail is turned off but not reset. By clicking this button all snail-trail events will be removed.

Re-draw - Clicking this button will cause all routes and features to update and be re-drawn.

Popup Context Menu

When the mouse is positioned over the chart area and the user right-clicks the mouse the pop-up menu above will be displayed.



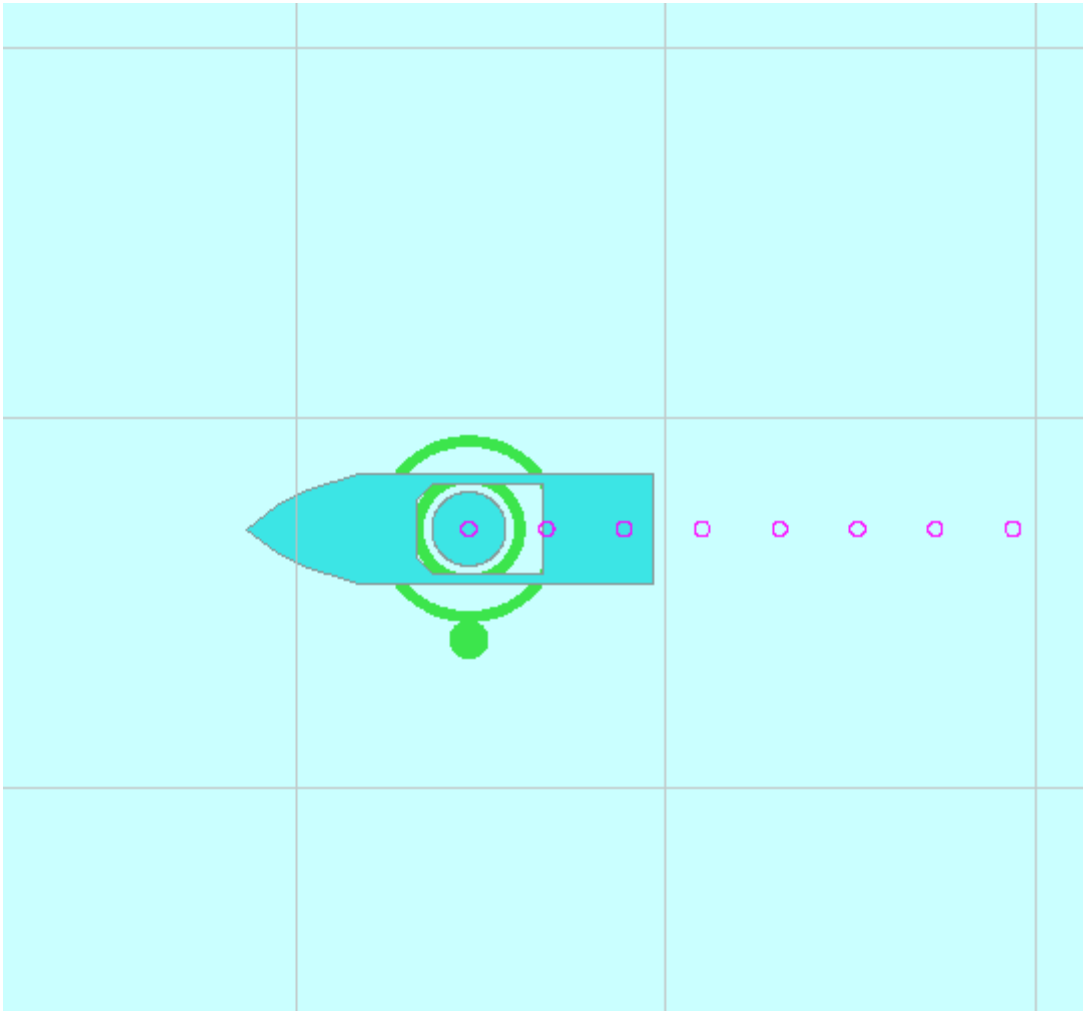
Show/Hide the Layer Panel, this allows the chart view to display full-screen.

By clicking on the screen with the mouse, then pulling up this pop-up menu, you can automatically save the mouse click as a target, this will be added to the targets in the Survey Parameters.

After a measure line has been made - as shown on the screen above, the line between mouse-down and mouse-up can be saved as a run-line.

The last two items allow the current chart view (not the entire screen), to be saved to file or printed to a selected printer - which may be a PDF printer.

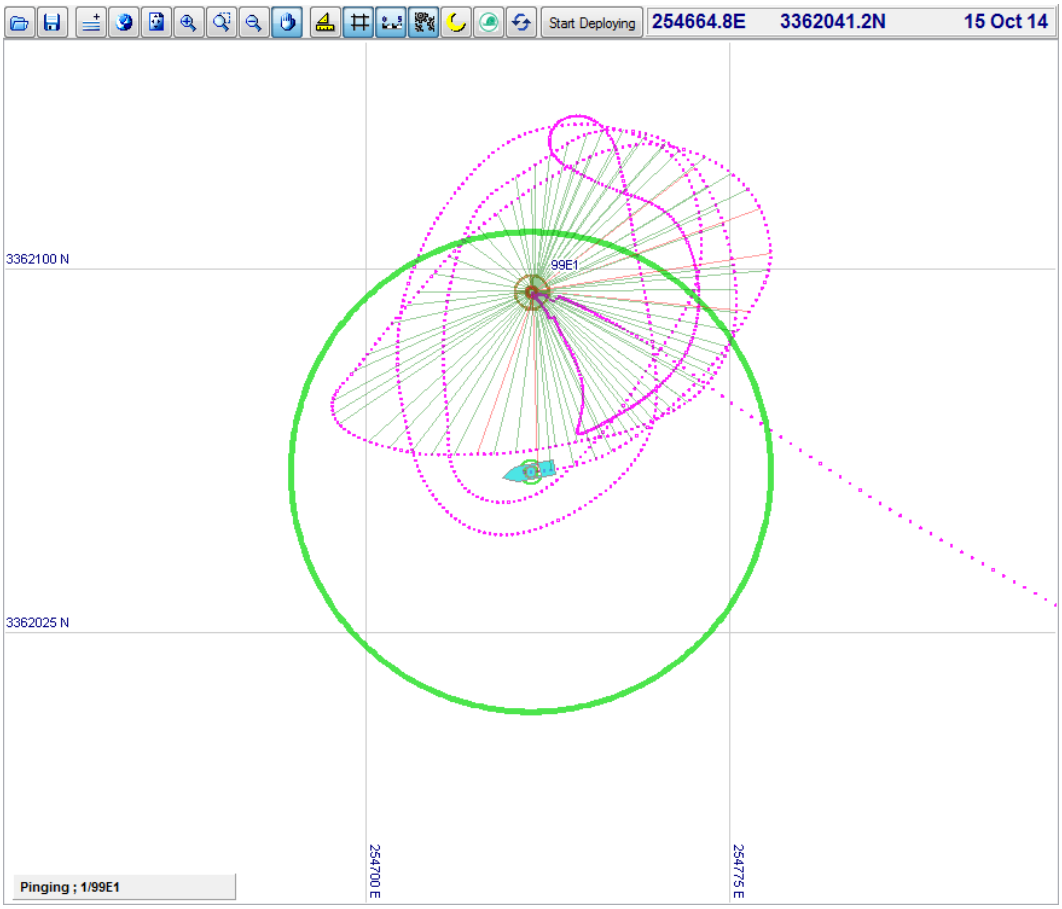
Display



As the user zooms in to the chart view to get more detail the vessel outline will become apparent and the active offset will be displayed with a triple ring, this is the coordinate that is displayed at the top right, if a different point is selected the coordinate changes accordingly. Changing the active offset does not change the Transducer offset, this is set in Project Parameters and will only change when changed there and this ensures that the Transducer calculated coordinate is always for the correct offset.

Logging On / Solutions Chart Display

With Logging Enabled, upon resolving a solution for the active target the chart will display the vectors (LOPs) together with the error ellipse at x10 magnification to visualise. The accepted vectors are green and rejected are red.

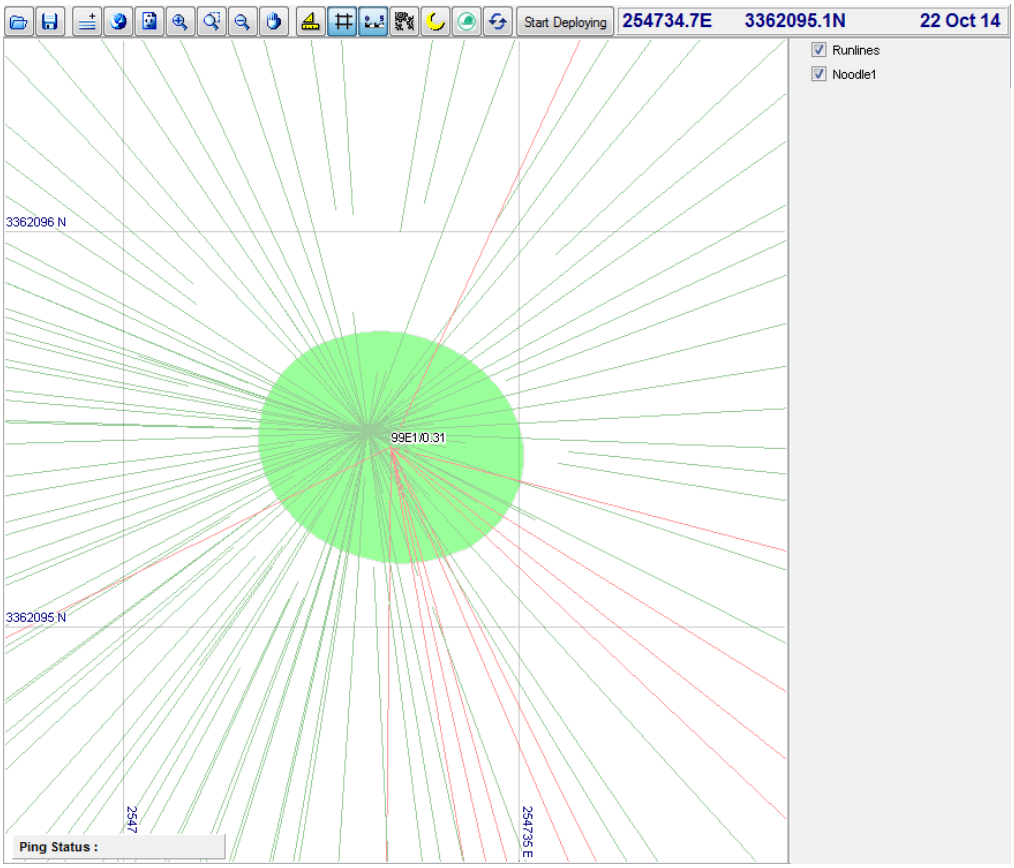


A screenshot similar to that above is displayed when the solution is computed online from a 1019 Beacon set to channel E1. The lines are the LOPs (Lines Of Position) between the observed transducer position on the vessel and the computed VT position. At the computed VT position the error ellipse is drawn, this is colour coded to indicate quality red, amber and green.

Red = SD > 10m

Amber = SD > 2m

Green = SD < 1m

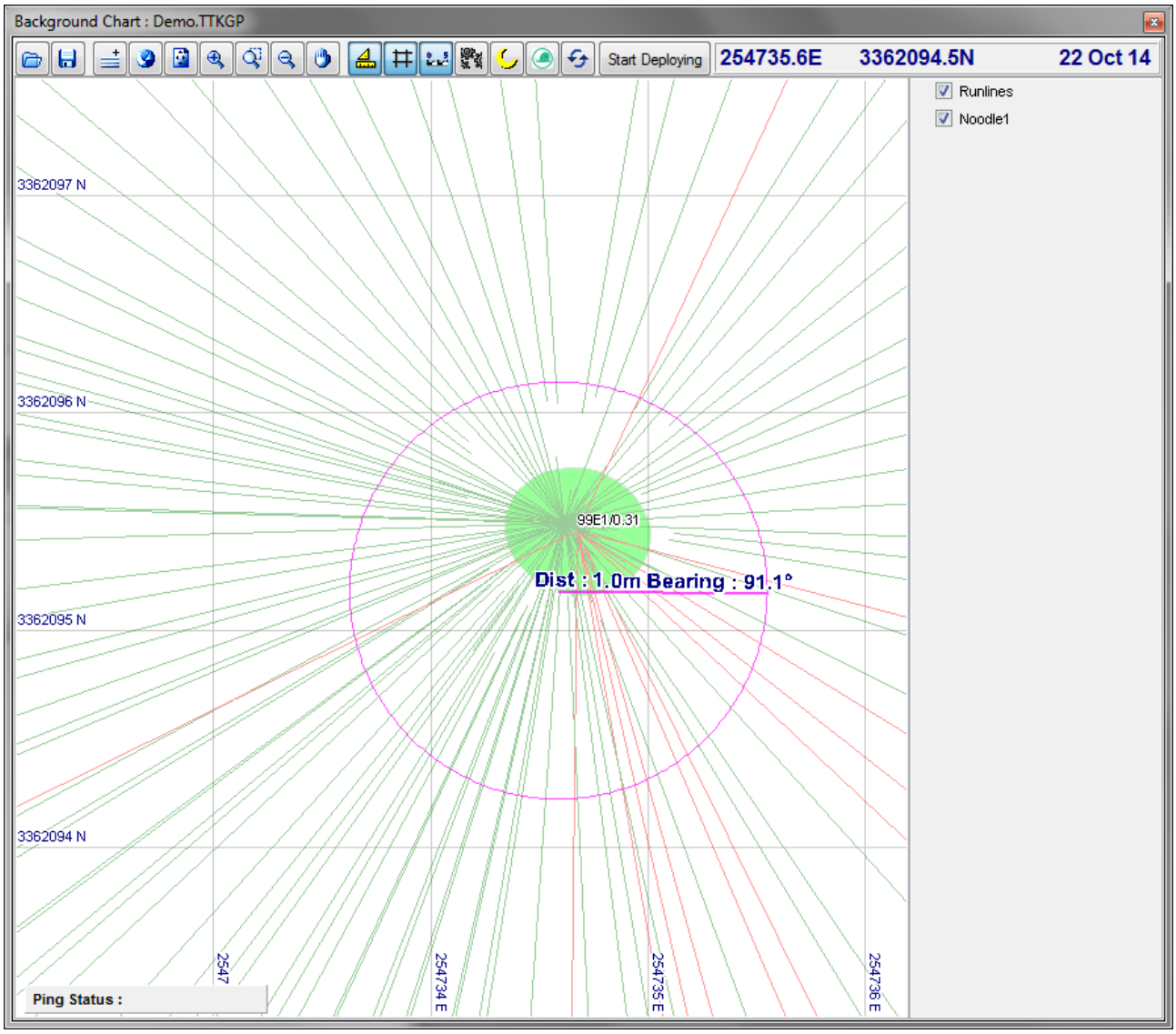


Zooming into a solution position the error ellipse can be seen, this provides an indication of quality for the solution, both its geometry and range errors. The user can define the quality acceptance of a solution by setting the geometry of the ellipse, minimum number of pings and balance or not balanced solution. The above example has an SD of 0.31m using a balanced solution from 100 LOPs. The number of LOPs per station is user defined and can be reduced depending on operational requirements, a typical level 20 to 25.

If a long narrow ellipse is displayed then the geometry is not balanced and you should try and acquire more data from the direction of the tips of the ellipse.

If you see all the computed points away from the center, with the lines stopping short of the center then the velocity of sound value may be too low. If the lines all pass through the center and the points are scattered around the center then the velocity may be too fast.

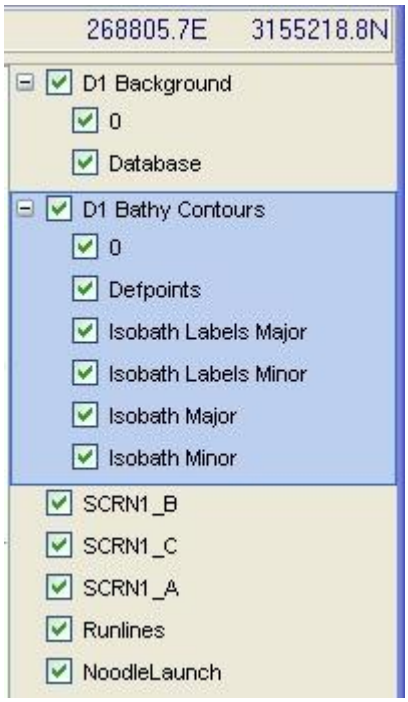
Measuring on Screen



The display here shows a solution having been computed, the purple ring has been described by the mouse and the center is where the mouse was clicked and the end of the straight line is where the mouse button was released. The bearing and the radius of the circle are shown at the top right of the screen, as the mouse moves the range and bearing update dynamically

By right clicking on this screen you can save the measured line as a new run-line.

Layer Control



This panel shows the list of layers which are incorporated into the current project. Where an item is ticked it is displayed on screen.

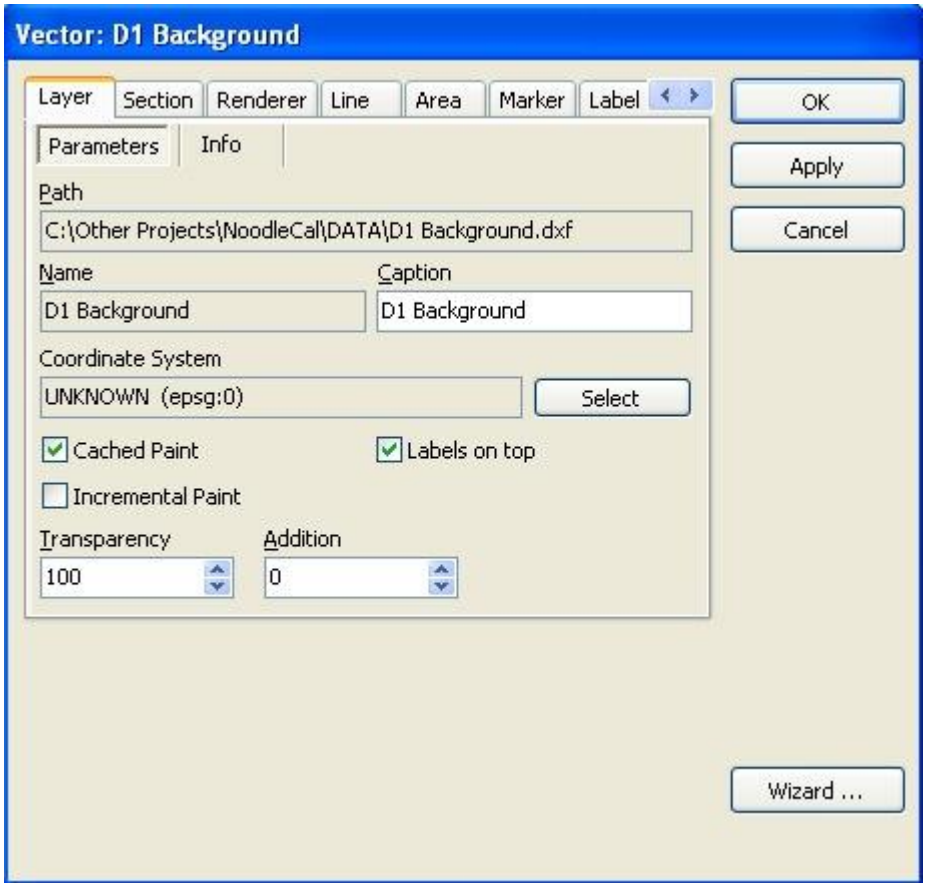
Some layers such as DXF files have sub-layers, these can be enabled/disabled in the same way as the parent layers.

Each of these layers has properties associated with it such as transparency, marker colour, marker size, all of which are accessed through the Layer Properties form.

Layers can be added or removed from the project using the pop-up menu, right click when over the Layer panel to access, layer properties can also be accessed by double-clicking on the relevant layer.

1. "Show layer Properties" pulls up the form with all the Layer properties on the various pages, you can adjust the properties and when the project is saved the changed properties will be saved also.
2. Import Layer from File
4. Remove Selected Layer

Layer Properties



The form shown here is provided for all the Layers, it can be accessed either through double clicking a layer, or by right-clicking on the Layer Panel and selecting from the pop-up menu.

Key items that can be changed in these pages is transparency level, colours and markers types for objects and lines.

6. Operation

(a) Connections

GPS Receiver to PAM 3510

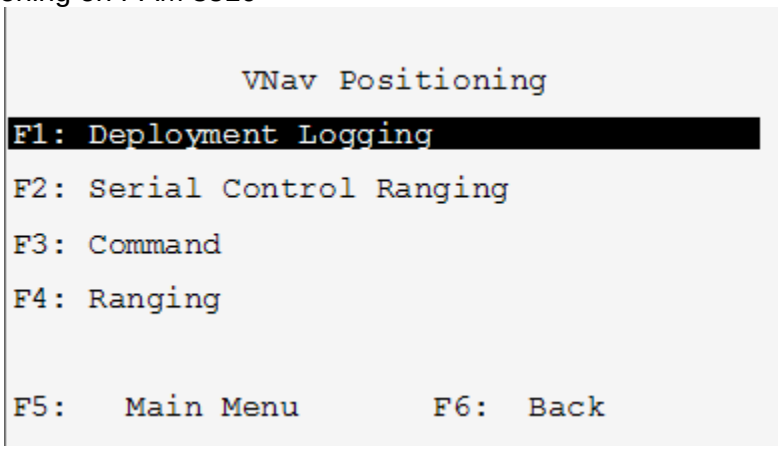
Com Port: Beacon: Serial GPS Data (NMEA GGA format)
Default Baud rate = 9600, 8, N, 1
1 second update

VNav to PAM 3510

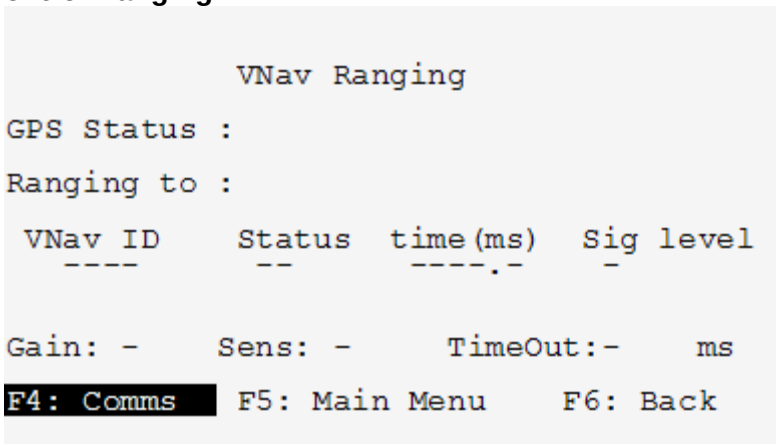
Com Serial: Serial External PC Control
Default Baud rate = 115200, 8, N, 1

(b) PAM 3510

Select V-Nav Positioning on PAM 3510



Select F2: Serial Control Ranging



This is a status / info page for ranging to the beacons.

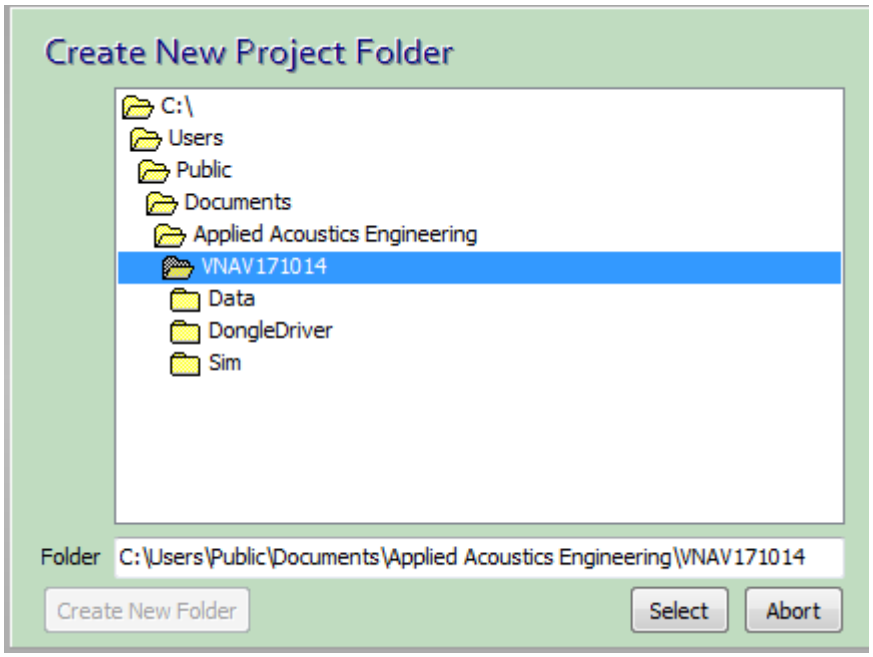
GPS status is indicated, ensure status is reported OK before starting V-Nav.

(c) V-Nav Operation

Insert V-Nav Dongle, ensure Serial Com Port is available and launch V-Nav.

Create a New Project or Open an existing project as necessary.

New Project
When the button is clicked a dialog will be shown



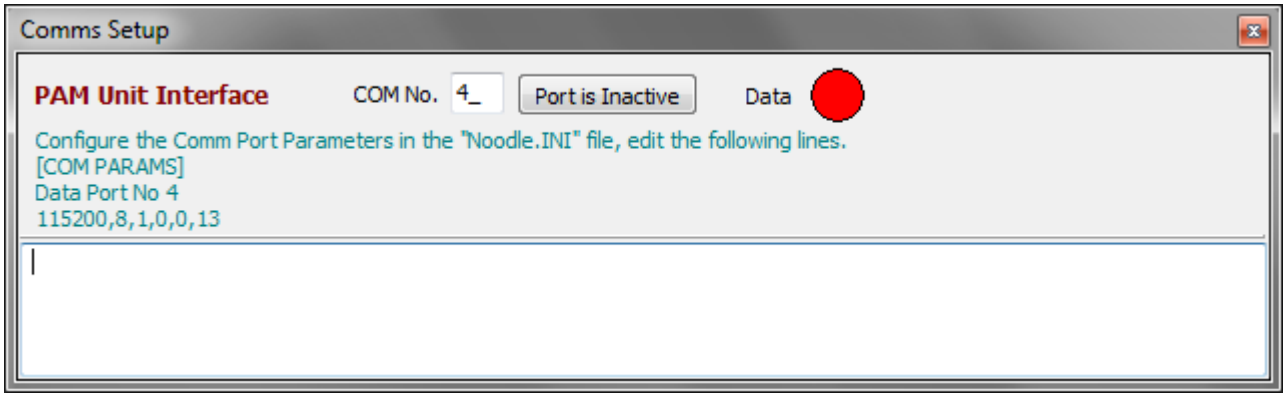
Click on the folder tree to navigate to a suitable folder, then click "Select" or you can edit the path shown in the edit box beneath the list to create a new folder, once you change the name click the Add Folder button and you will relocate to that folder, then "Select". When "Select" is clicked, all the data files from the root folder will be copied to the selected folder and a blank database file is created in the new project folder. This folder then becomes the default project folder.
To create a folder use backslash followed by the name, the create folder button will activate. EG Type … \NewProject then click ‘Create New Folder’

Open Project
When the software starts the last opened project is loaded, this uses the Spheroid, Projection and Datum Shift database and loads the project specific Targets, Lines and configuration. It also loads the .accdb database file with

the logged/computed data for that project. This button allows the user to change to a different project in order to review/re-compute.

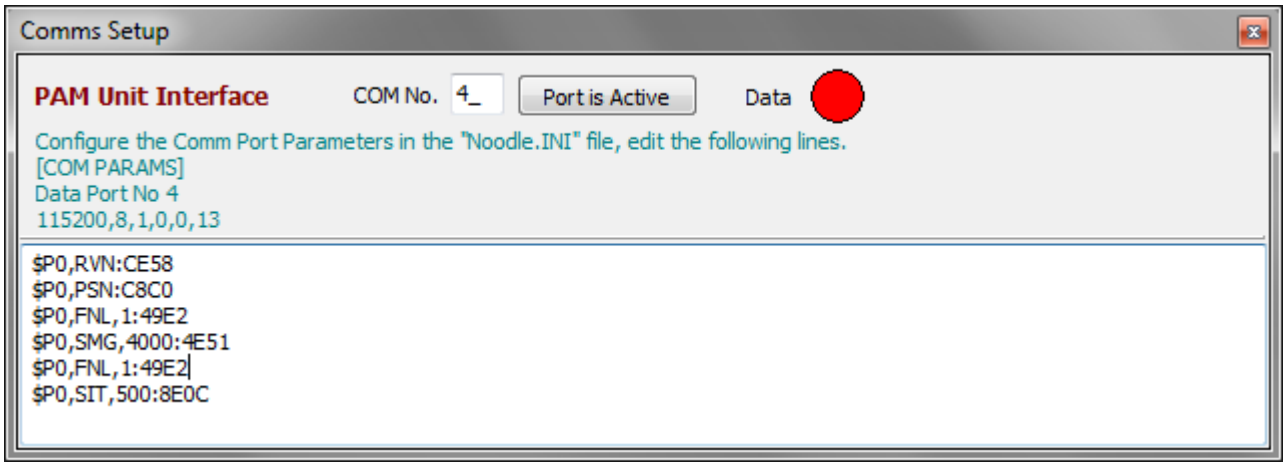
If changing Project or creating a New a Project, upon making changes re-start V-Nav to apply changes.

(d) Launch Com Port Control



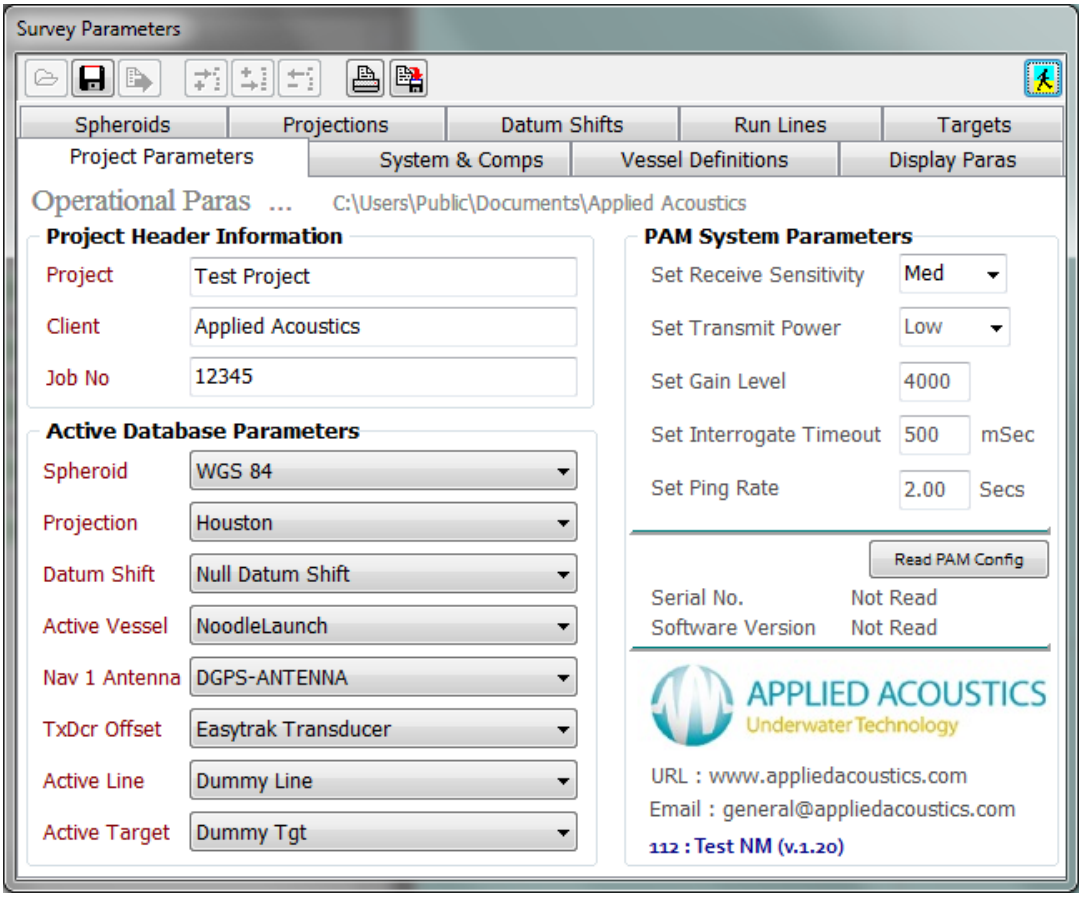
Change the COM Port if required, NB Permanent changes can be made in the system ini file.

Click the 'Port is Inactive' button to toggle ON



Serial commands and telegrams are displayed in the window.

(e)Launch Survey Parameters



Check Project Header Information // Spheriod, Projection, Datum Shift // Vessel and offsets // Reference offset // PAM Serial Number and revision reported.

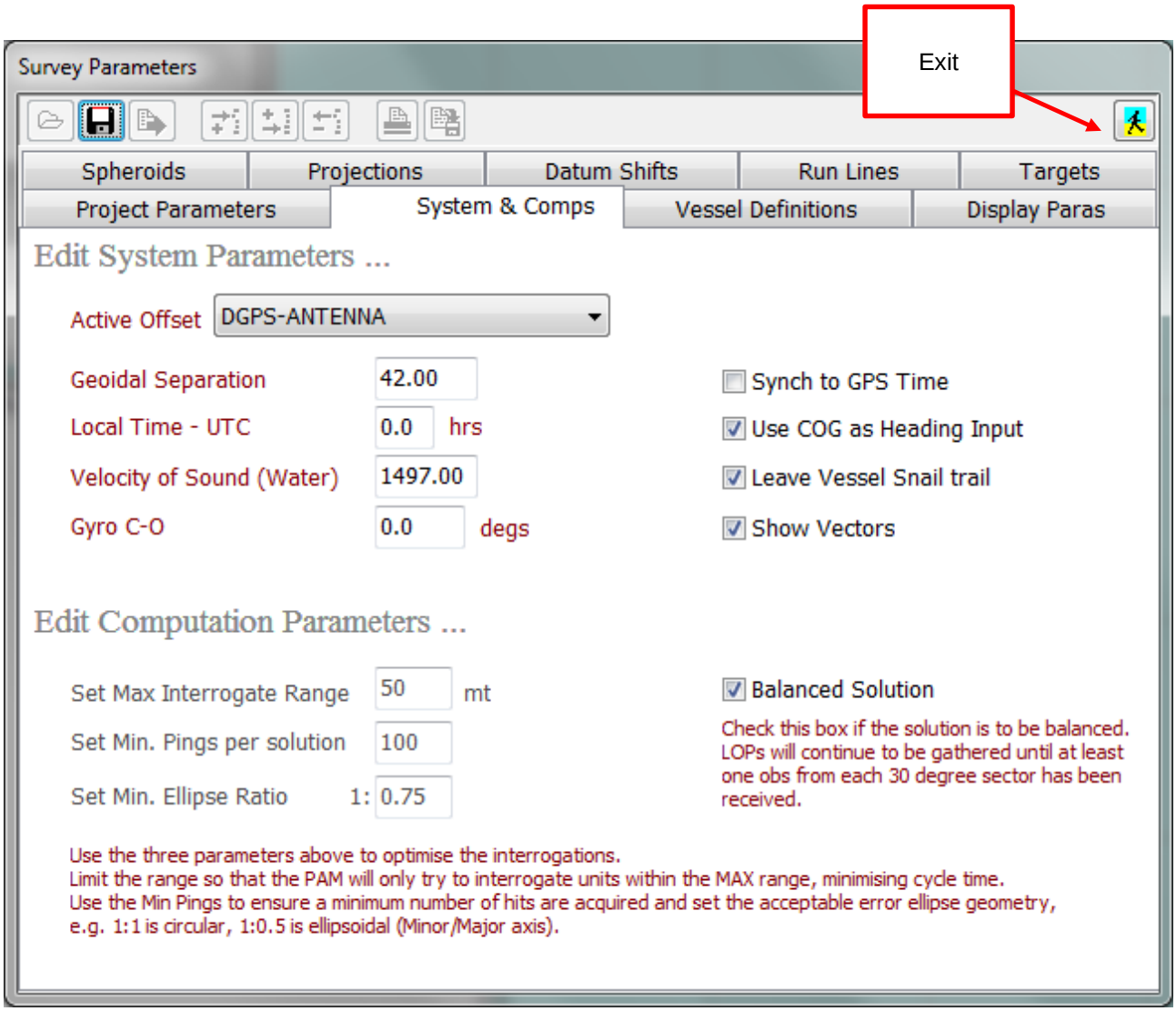
Receive Sensitivity: from the drop down menu select Hi, Med or Lo. The higher the sensitivity level the more sensitivity the receiver, thus in short range applications the sensitivity level can be set to Lo.

Transmit Level: from the drop down menu select Hi or Lo. Typically for ranging applications below 150m LO can be used, if there are high noise levels or intermittent ranging results the Transmit Power Level can then be switched up to check for improvements.

Gain Level: this is from 0 to 4000 and is the Analogue AGC level of the 3190 Dunker. This can be normally set to 4000 as this is within the operation limits of the ADC / DSP of the PAM.

Interrogate Time Out: this is the waiting time (2 way travel time) the PAM will wait following an acoustic interrogation to a beacon for a replay before issuing a time out reply to VNav. This is set in milli seconds. A time out of 500ms allows for a max range of 375m.

System and Comps Tab



Check Active Offset, select the Active Offset for the transducer from the list of predefined offsets.

Check Geoidal Separation: Enter separation (difference) between your current location and the ellipsoid.

Enter Velocity of Sound:

Set Max Interrogation Range: This sets an active range ring of x meters around the vessel an active beacon is only interrogated within this range.

Set Min Number of Pings per Solution: The solution will continue to be acquired until the minimum has been achieved, upon completion of minimum pings the solution will complete if the ellipse ratio set and or balanced solution is within limits.

Set Min Ellipse Ratio: 1:1 is circular and 1:0.5 is ellipsoidal, this allows the operator set the acceptable error limits. The circular the solution indicates that the solution is balanced and accurate, missing data or angular ranges results in an elliptical plot.

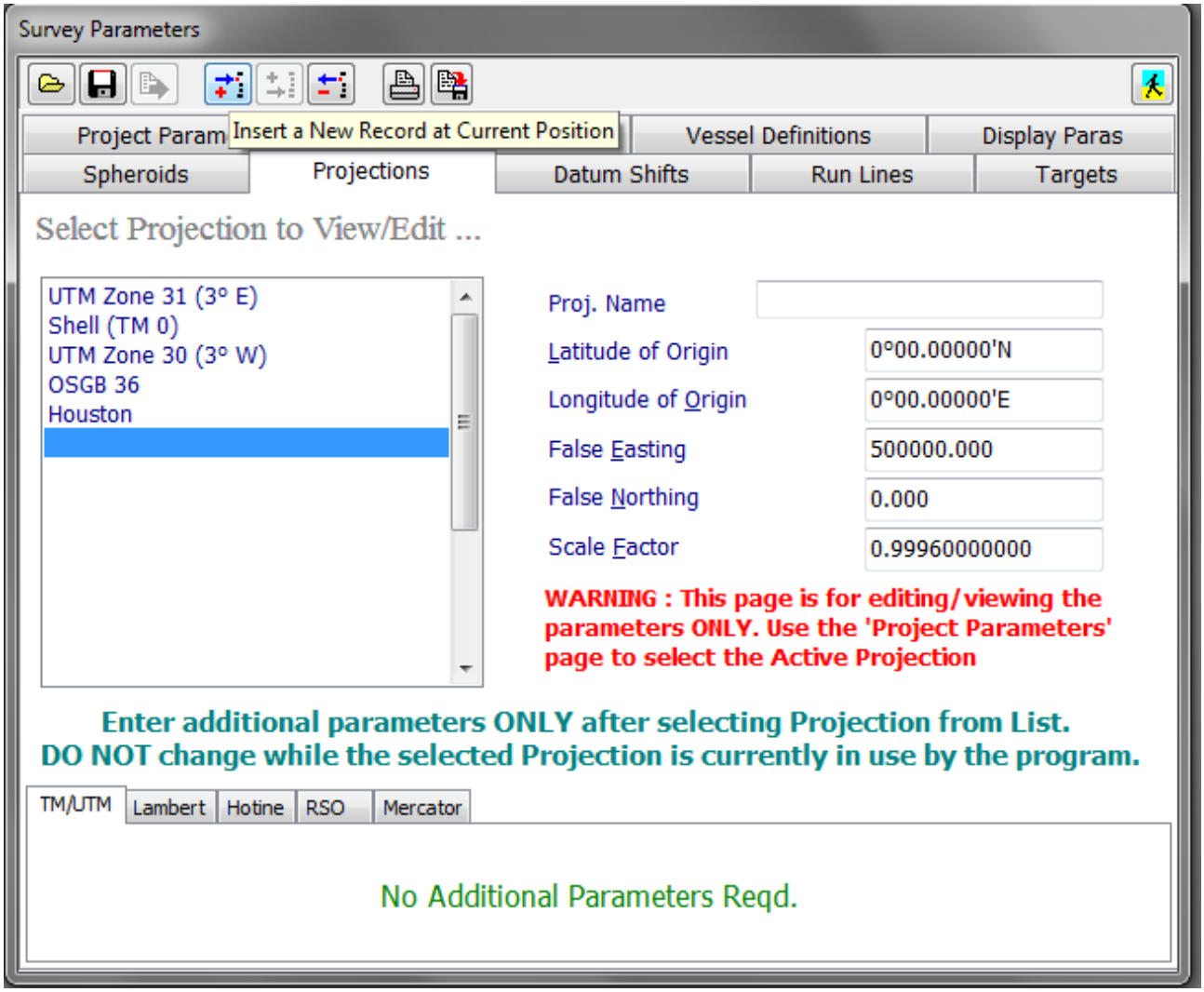
Balanced Solution: Tick this box to ensure that the solution includes data from every 30º segment around the target, this ensures that the resulting solution plot is circular.

Exit Survey Parameters when complete.

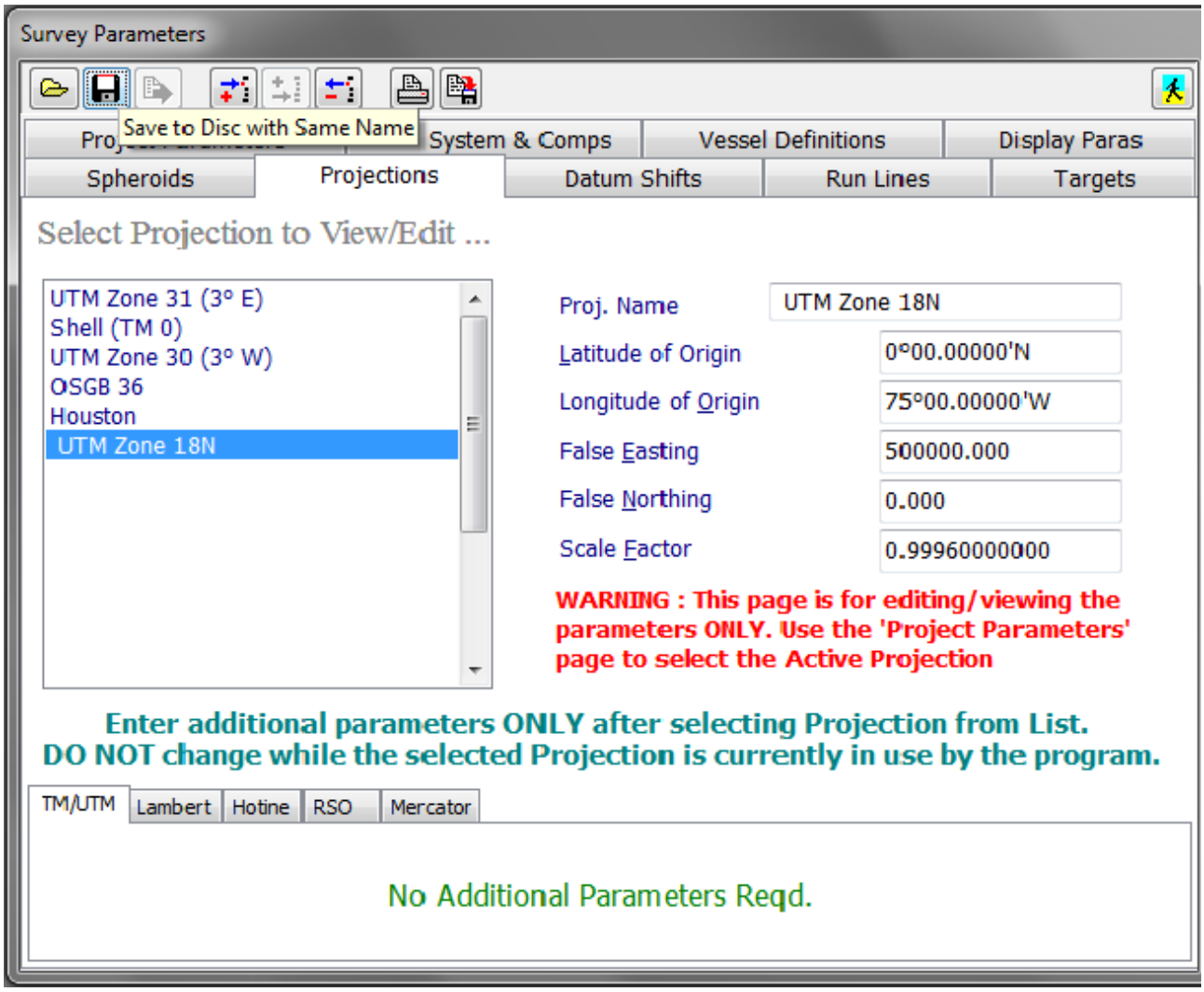
Project Parameters and System & Comps Tabs are automatically saved upon exit.
Click Exit to apply and close.
For configuration instructions please see Section 5

With parameters applied check the positions displayed are as expected.

For example to add a new projection to the Survey Parameters, select a free line and click ‘Insert a New Record at Current Position’.

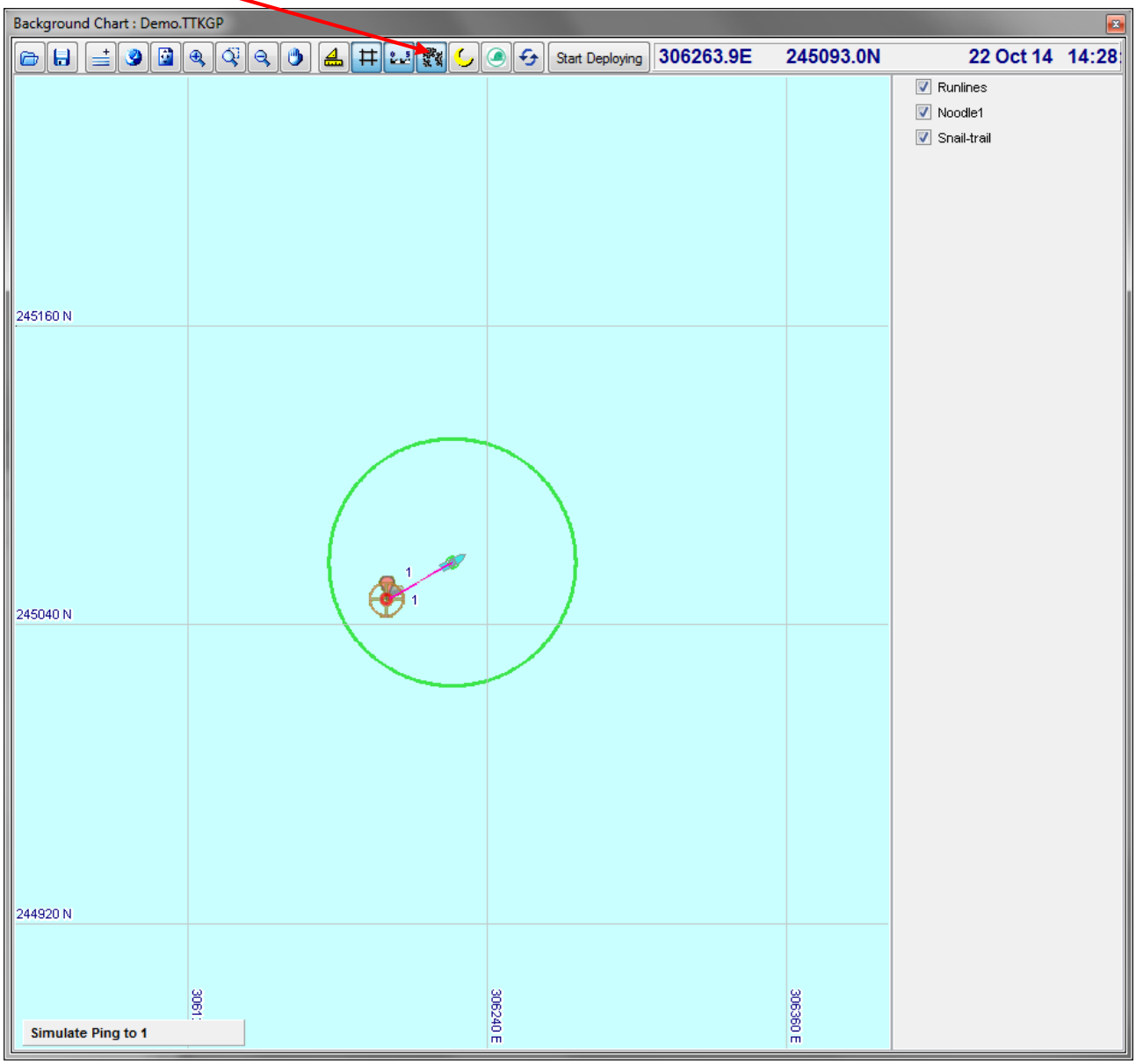


In the below example the projection for UTM Zone 18N has been added with a Longitude of origin of 74ºW, add the name for the projection and click save to add to the Survey Parameters database.

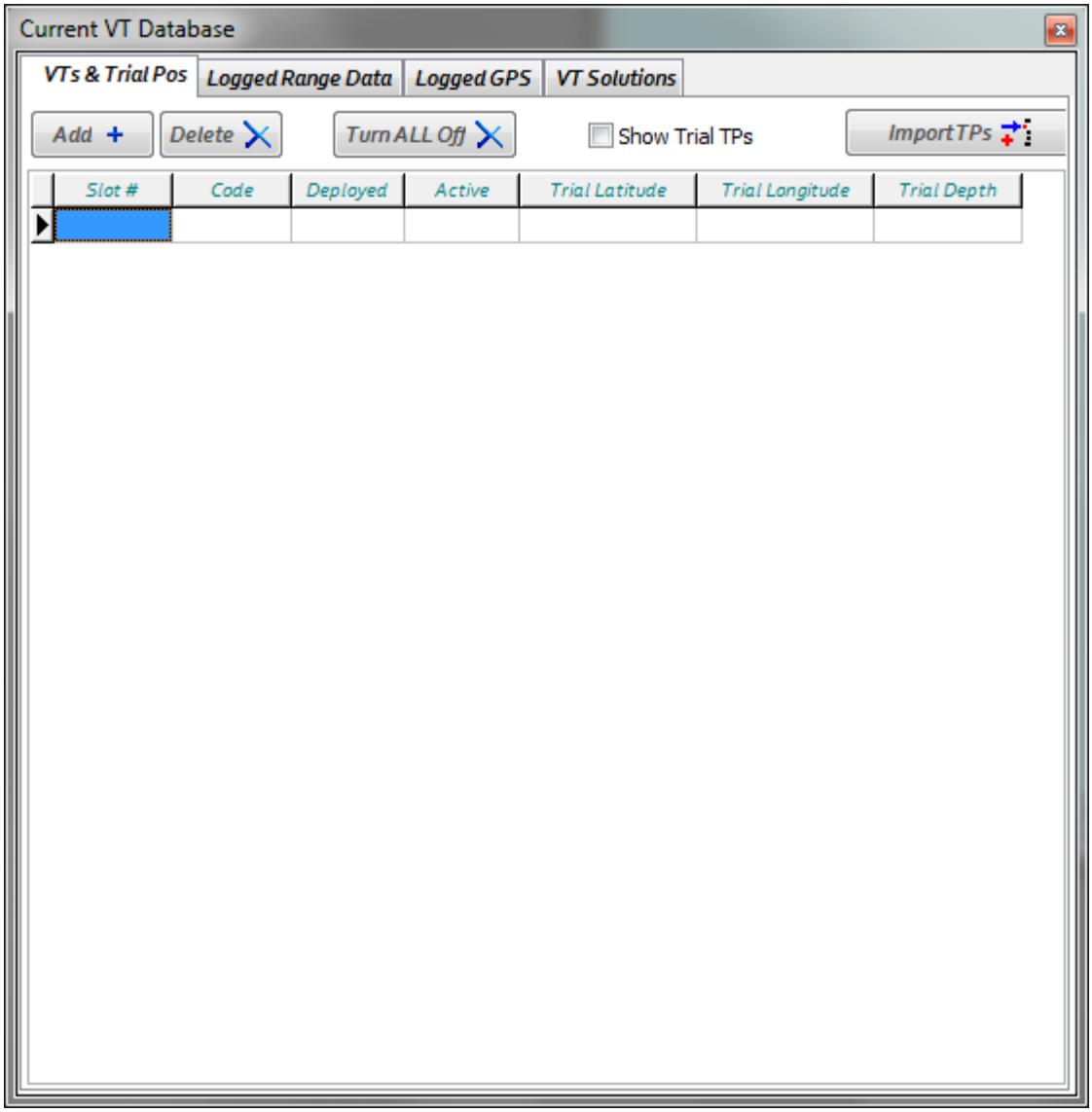


(f) Launch Chart Display

Click Auto Center to locate vessel and adjust zoom level.



(g) Current VT Database

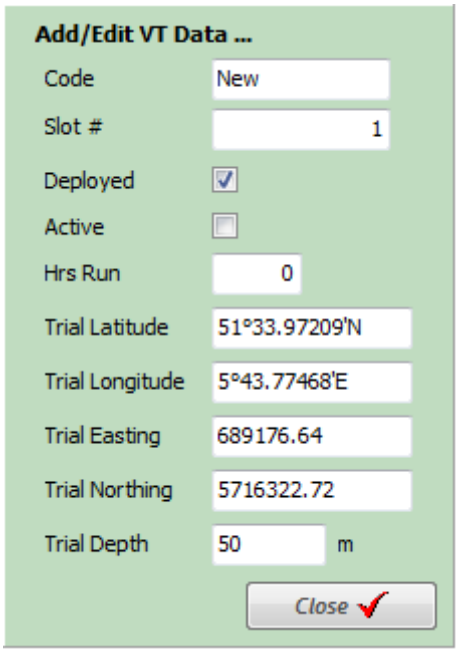


Adding a VT (Vector Transponder / Beacon)

There are two methods to add a VT to the project database:

(1) Click 

to create a beacon manually, this grabs the latest GPS position of the vessel to use as the Trial Position (TP).
The Code (Acoustic ID) of the VT or Beacon should be entered manually together with the trial depth (A default depth of 50m is used otherwise).



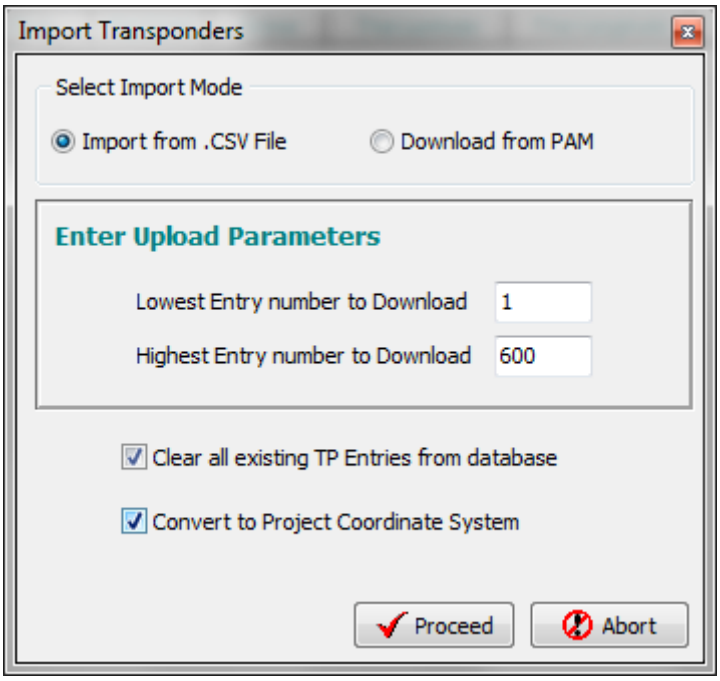
With VT configured the beacon can be active from the pop up window or closed.

To plot the TP position of the Chart Plotter tick ‘Show Trial TPs’ check box.

To enable tracking of a standard AAE Navigation Beacon rather than a VT (1400 Vector Transponder) use the prefix 99 followed by the 2 digit channel number. For example 99E0 = Beacon set to AAE SS Channel E0 or 9923 = Beacon set to AAE channel 23 (HiPAP).

(2) Click 

to use an automatic option to import Trial Positions.



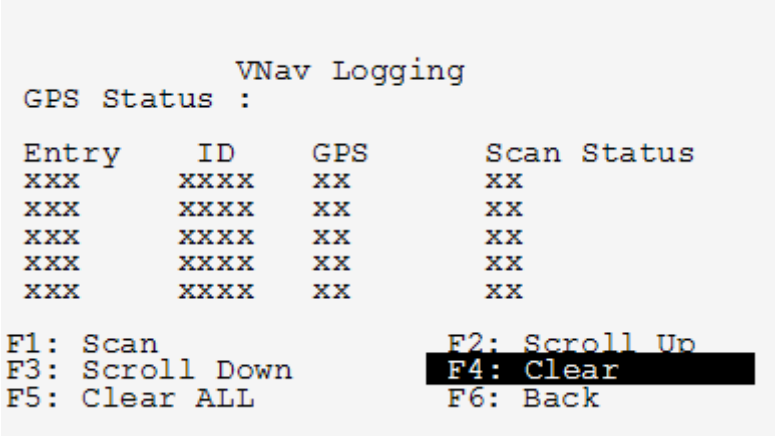
.CSV File

Selecting the import from a CSV File and clicking proceed opens a window to select the preconfigured deployment locations. An example of the format can be found at:

Public Documents\Applied Acoustics Engineering\Vnav \ Data \ VTImportTest.csv

Download from a PAM 3510 Unit

From the V-Nav Menu on the PAM 3510 select Deployment Logging:

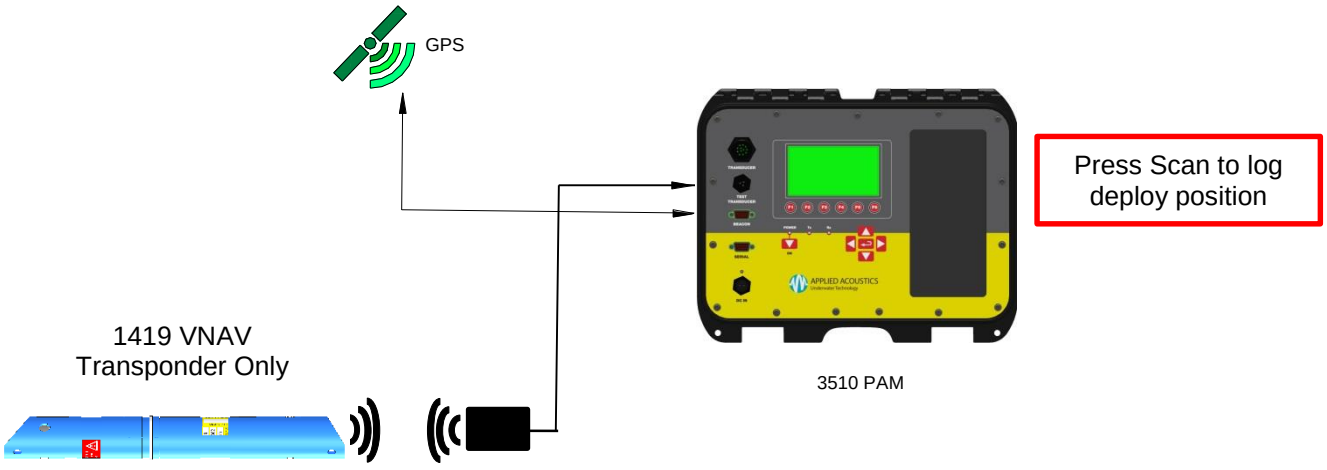


PAM3510 Deployment Logging Screen

The PAM 3510 allows the deployed position or trial position to be logged to an entry (slot), this allows the same IDs to be used on large deployments. The entry and Vector ID are logged to the GPS position ready to be uploaded to the VNAV Software for acquisition set-up.

With GPS interfaced the status is reported, the GPS antenna should be referenced or as close as possible to the deployment location. There are 600 entries (slots) available for storage.

Place the test transducer close to the Vector Beacon's transducer face and press F1 to scan as the beacon is being deployed from the vessel. If successful the table will update with the ID, GPS Status OK and Scan Status OK, else any errors are reported.



V-NAV Download

Upon completion of the procedure with the PAM3510. Select the ‘Download from PAM’ option and enter the range to be imported from PAM, then click Proceed to download the deployed positions.

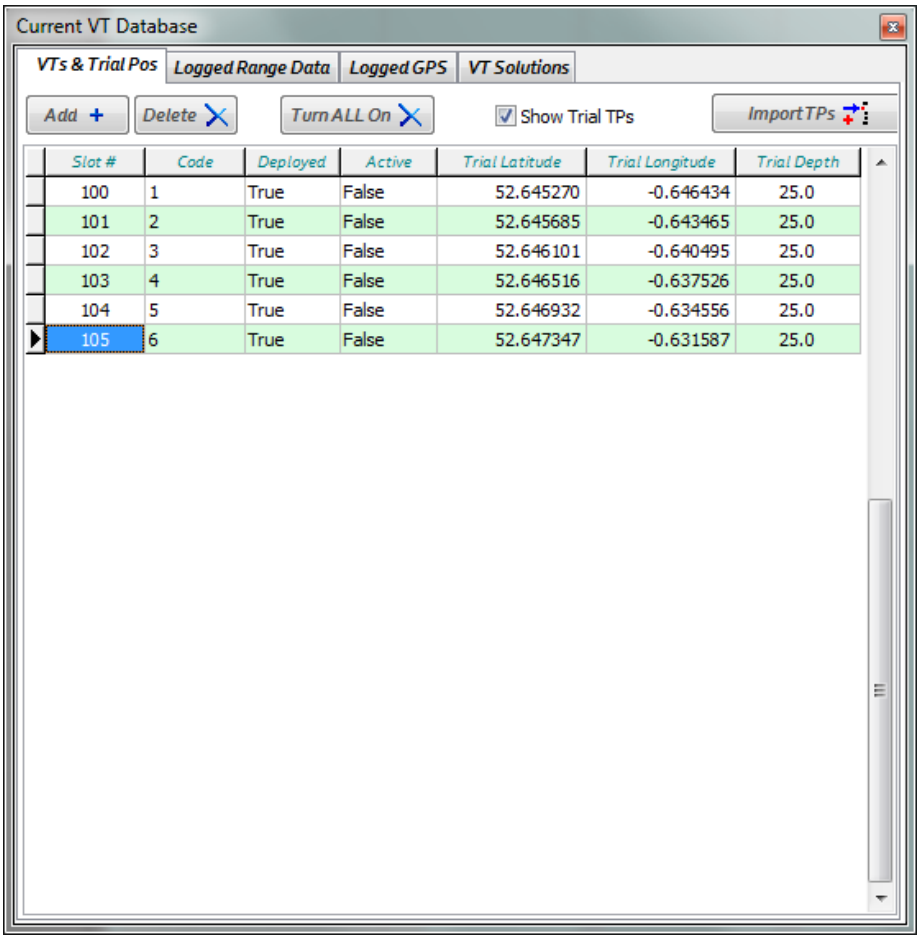
Ensure serial coms are active and the deployment data for the array is acquired.

A default depth of 25m is applied to all beacons as an initial point for the solution.

The PAM3510 logs the GPS positions in WGS84 Spheroid to convert these positions into the project specific settings select ‘Convert to Project Coordinate System’.

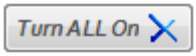
To clear the current data base and over write with new positions select ‘Clear all existing TP Entries from Database’. Else leave up ticked to add new positions to current database.

Screen shot of an uploaded array from a PAM 3510



Slot #	Code	Deployed	Active	Trial Latitude	Trial Longitude	Trial Depth
100	1	True	False	52.645270	-0.646434	25.0
101	2	True	False	52.645685	-0.643465	25.0
102	3	True	False	52.646101	-0.640495	25.0
103	4	True	False	52.646516	-0.637526	25.0
104	5	True	False	52.646932	-0.634556	25.0
105	6	True	False	52.647347	-0.631587	25.0

Enable / Disable VTs (Beacons)

To enable all the beacons click 

This is a Toggle Button, when all Enabled click the same button to Disable All.

Each Beacon can be individually enable / disabled by either double clicking the slot to launch the properties to amend or by selecting the cell in the Active column and changing the status from False to True by pressing T True or F False on the keyboard, to confirm setting press enter or click on another cell in the table.

The system will then range to active beacons within the range limit (circle) defined in Survey Parameters.

Solutions are not generated until Logging is enabled.

(h) Logging

To enable logging click the Logging toggle button, upon clicking the button the following option is displayed:

You have the option of continuing to log data with the current solution number or incrementing the solution to commence a new computation set.

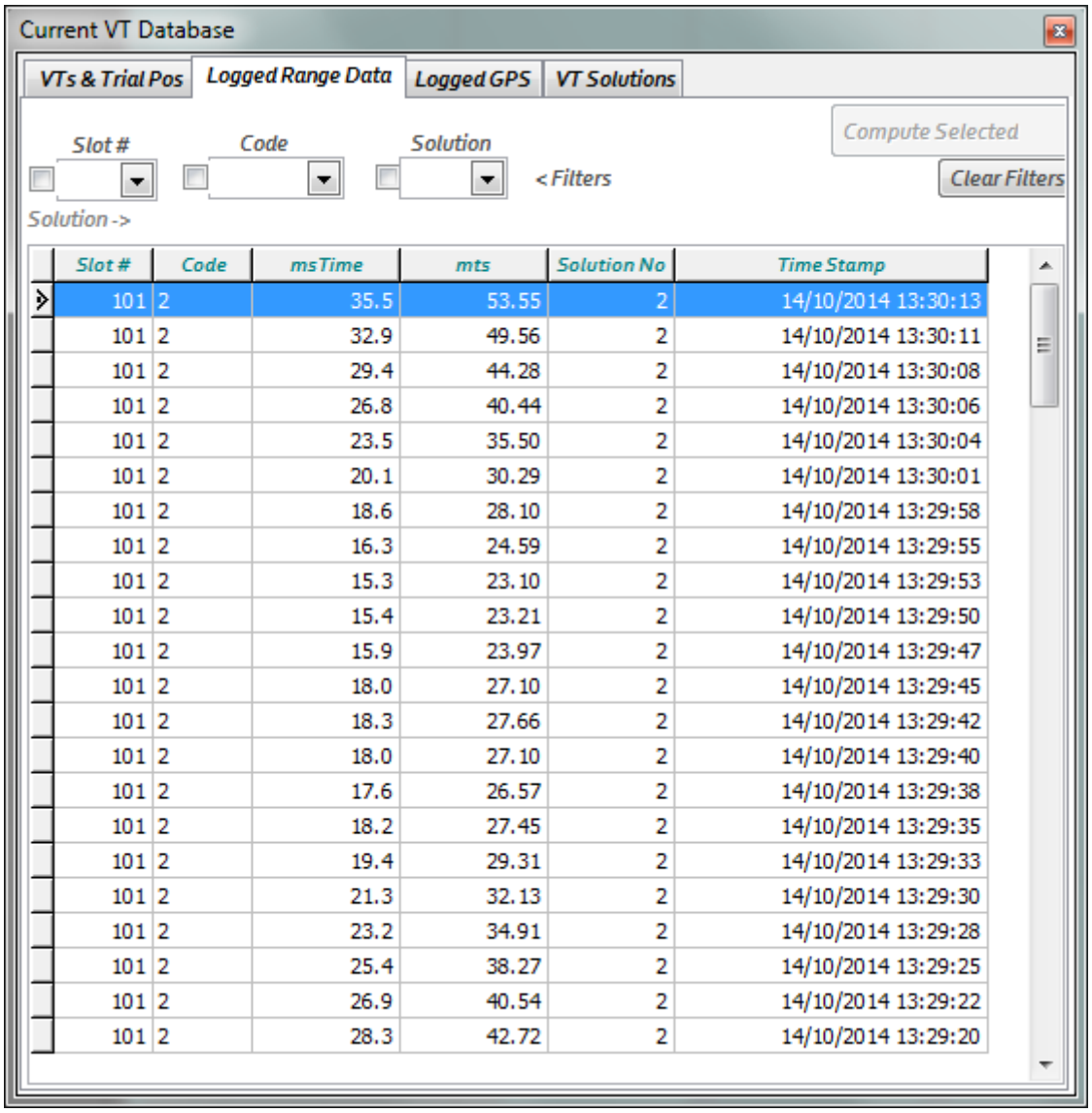
When computations are made, the data is selected based on the VT Code and the solution number, so a single code can have several solutions which may be for different days or different survey runs where the VT has not be physically moved. If the VT is recovered and re-deployed then a new solution number should be used to differentiate the dataset from previous data.

When Logging is active, the logging button is displayed as: 

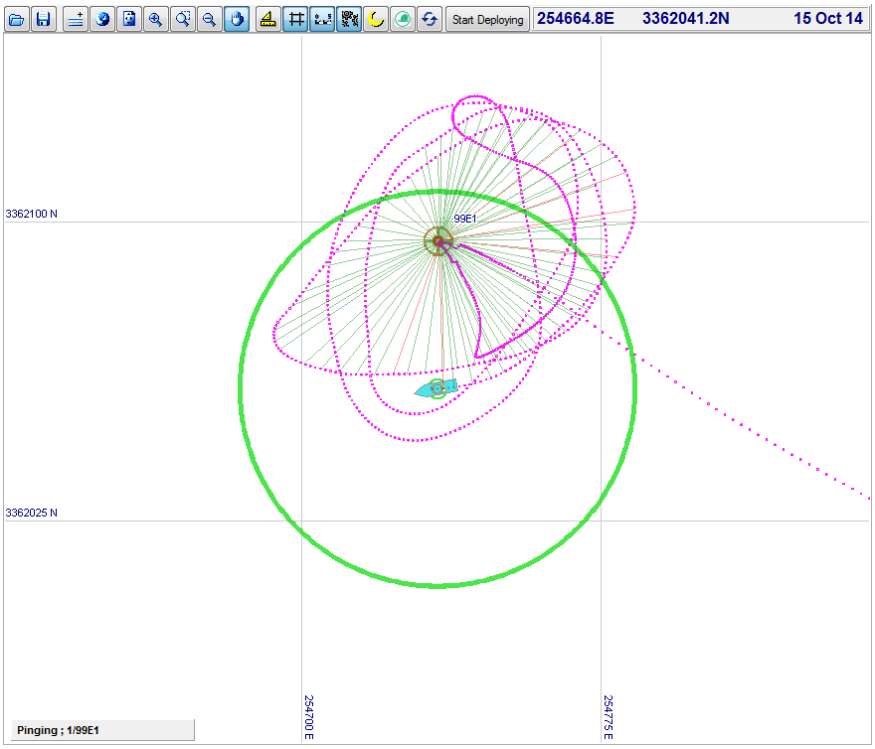
(i) Online Solutions QC

As a computation is made while Logging is ON, the chart view displays the error ellipse and individual computed positions at the current chart scale.

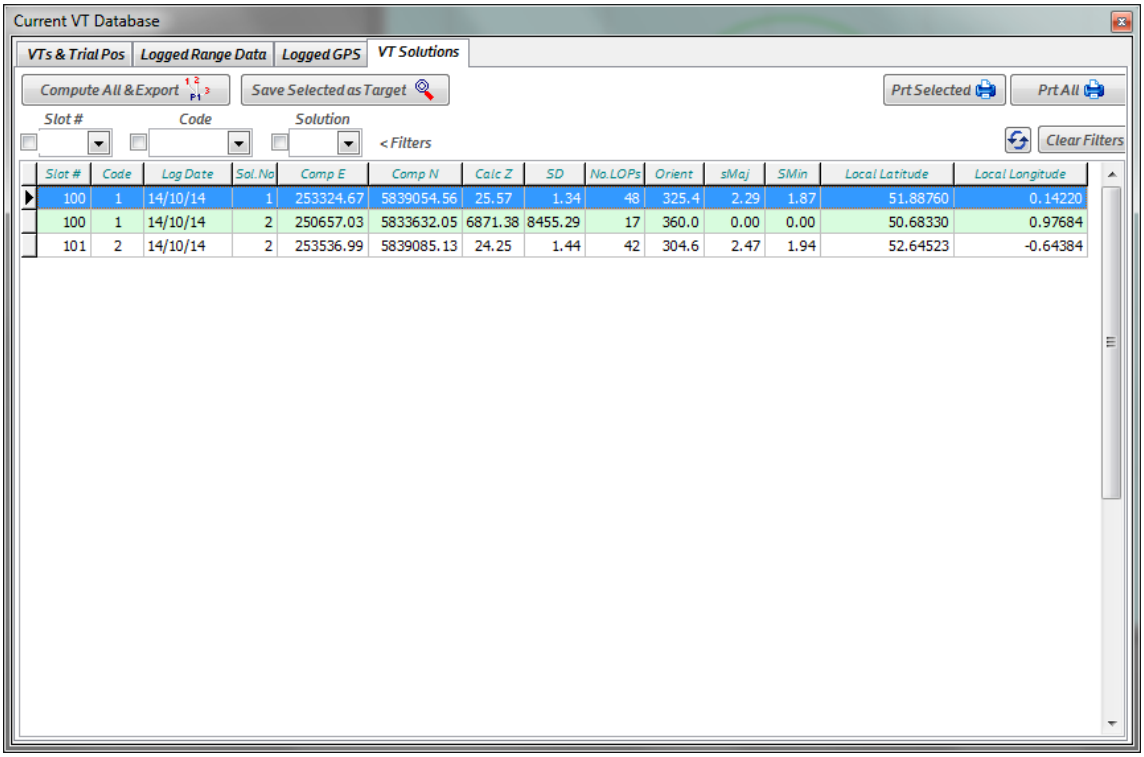
While Online the Logged range data is populated on the below tab, when a solution for a target can be computed it is displayed on the chart and on the tab.



The vectors (LOPs) are plotted on the chart display.



The status of the active solutions can also be monitored on the VT Solutions Tab.



Slot #	Code	Log Date	Sol.No	Comp E	Comp N	Calc Z	SD	No.LOPs	Orient	sMaj	SMin	Local Latitude	Local Longitude
100	1	14/10/14	1	253324.67	5839054.56	25.57	1.34	48	325.4	2.29	1.87	51.88760	0.14220
100	1	14/10/14	2	250657.03	5833632.05	6871.38	8455.29	17	360.0	0.00	0.00	50.68330	0.97684
101	2	14/10/14	2	253536.99	5839085.13	24.25	1.44	42	304.6	2.47	1.94	52.64523	-0.64384

The solution will continue to be acquired until all 3 of the below criteria have been met:

Min Number of Pings per Solution: The solution will continue to be acquired until the minimum has been achieved, upon completion of minimum pings the solution will complete if the ellipse ratio set and or balanced solution is within limits.

Min Ellipse Ratio: 1:1 is circular and 1:0.5 is ellipsoidal, this allows the operator set the acceptable error limits. The circular the solution indicates that the solution is balanced and accurate, missing data or angular ranges results in an elliptical plot.

Balanced Solution: Tick this box to ensure that the solution includes data from every 30º segment around the target, this ensures that the resulting solution plot is circular.

7. Troubleshooting

FAULT / SYMPTOM	**No Signal return at any range**
POSSIBLE CAUSES	**Incorrect Channel.** Check Beacon editor **Beacon TX 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 Nexus receiving the beacon's transmission? If there is still no response the transducer is suspect.

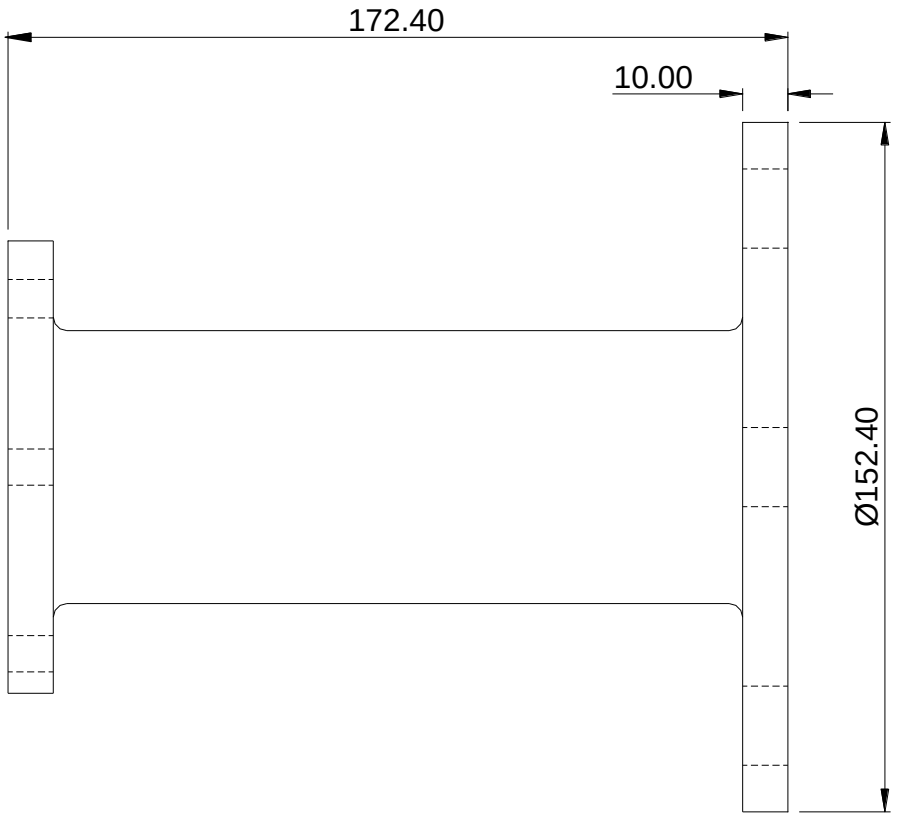
FAULT / SYMPTOM	**Incorrect Range**
POSSIBLE CAUSES	**Incorrect Velocity of Sound.** Enter correct value. **Turn around delay.** Is the turnaround delay set correctly in the beacon? Correct turn around delay. Another beacon in the water set to the same channel. Another sonar system transmitting at the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

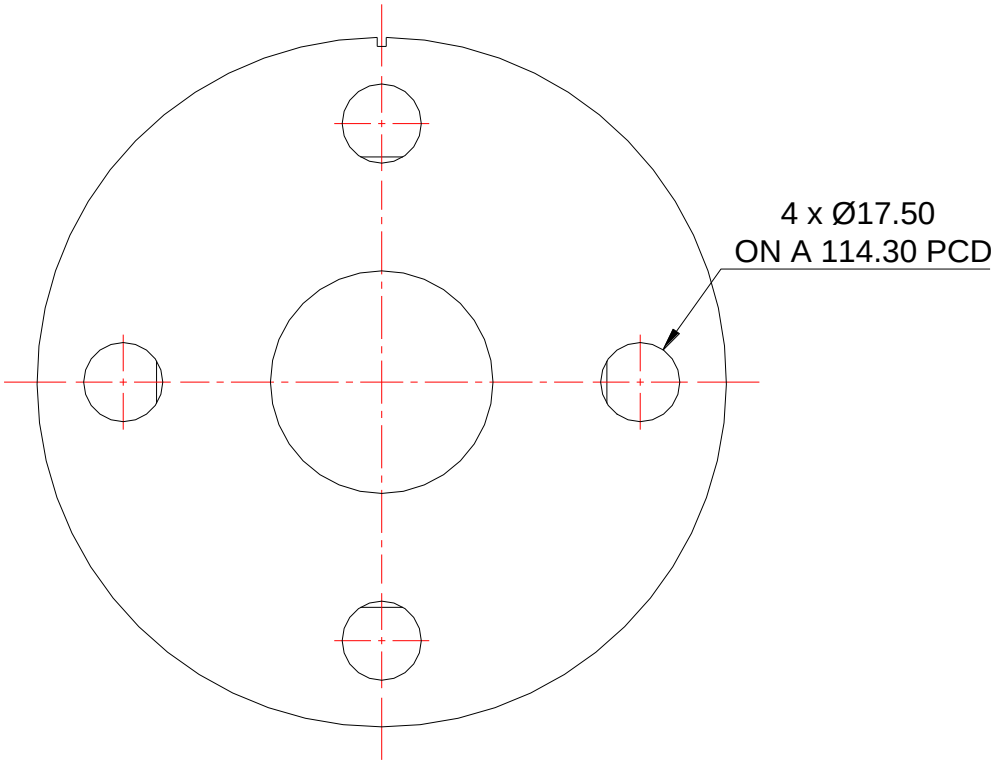
FAULT / SYMPTOM	**Short range**
POSSIBLE CAUSE	**Excessive range for conditions.** Range is dependent on local conditions such as in-band noise from man-made or marine sources. If possible reduce noise or work at a shorter range. **Beacon reply insensitivity.** This may be due to a fouled transducer, 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	**Unstable communications**
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. **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.

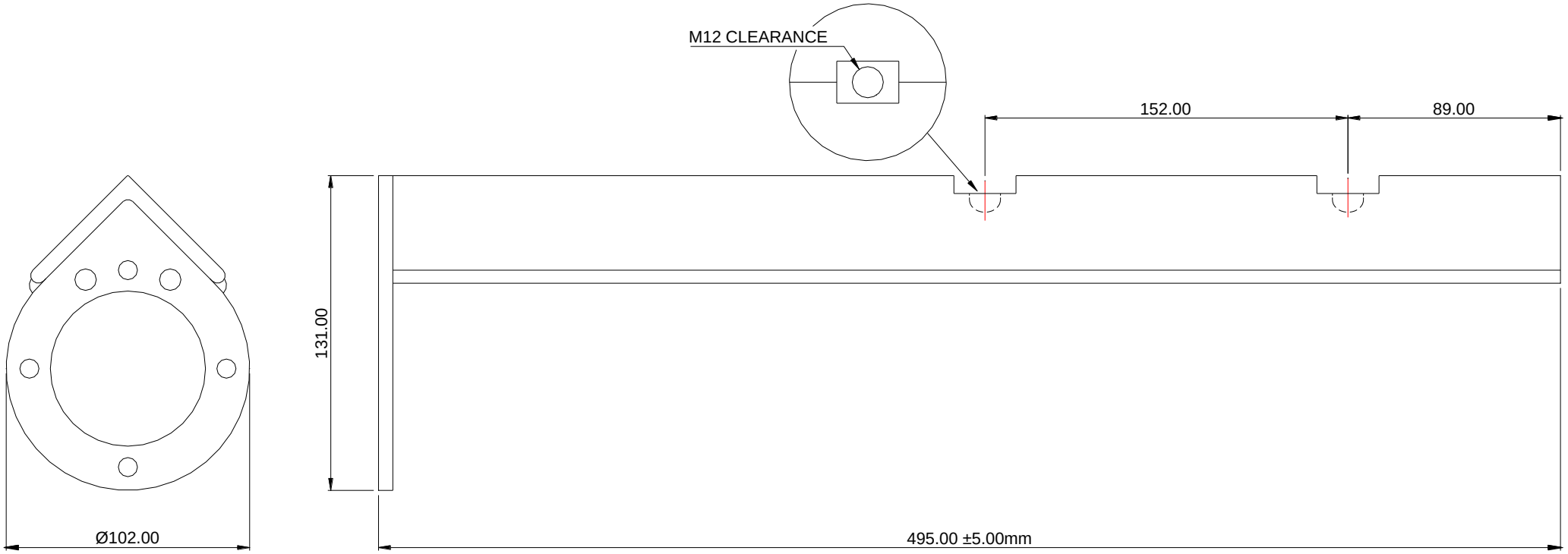
8. Data Output format

Appendix A – Transducer Mounting Bracket A

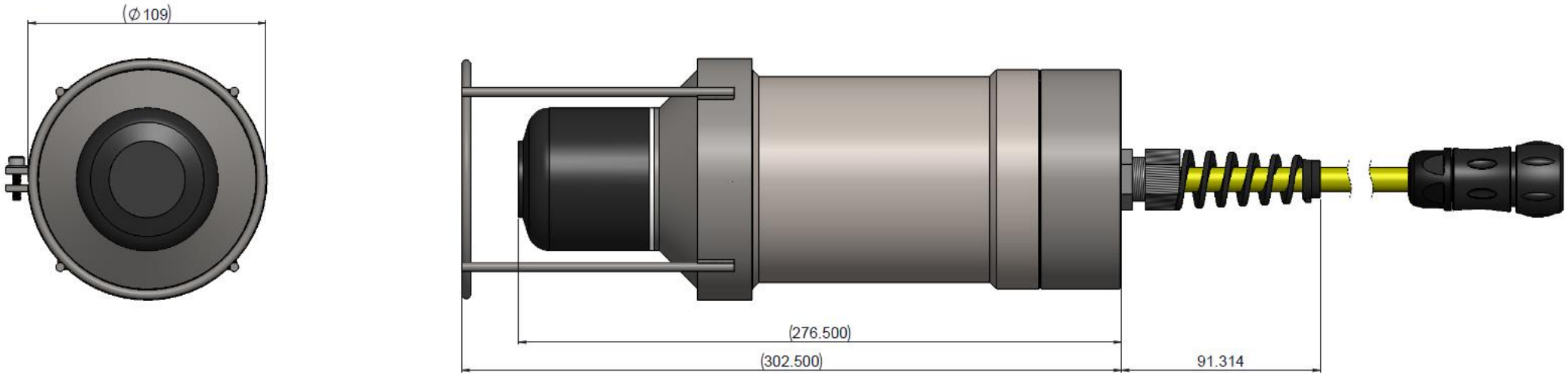




Appendix B – Transducer Mounting Bracket B



Appendix C – Model 3190 Transducer Mounting Dimensions



Applied Acoustic Engineering 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 devices for offshore geotechnical and seabed analysis known as sub-bottom profiling.

All products use acoustics, underwater sound waves, in location, positioning, navigation and data acquisition applications.system, Easytrak, a variety of positioning and release beacons and seismic devices for offshore geotechnical and seabed analysis known as sub-bottom profiling.

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