COASTAL ACOUSTICS from Sonardyne

# OM-8025-000-16

# User Guide for Type 8025-000-16 Scout USBL System

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# Document Information

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# Contents

# 1 SCOUT USBL OVERVIEW

## 1.1 Introduction

Scout User and Maintenance Guide is a guide and introduction to installing, setting up and maintaining a Scout USBL acoustic tracking system.

Scout USBL is a high-performance, cost-effective underwater acoustic positioning system that can be used to track up to four acoustic beacons underwater.

Scout USBL can be used to track subsea targets such as:

- Remotely Operated Vehicles (ROVs)
- Divers
- Towfish
- Autonomous Underwater Vehicles (AUVs)

Scout USBL can be used for operations such as:

- Underwater inspection
- Cable and pipe route surveys
- Harbour and dam inspection
- Inshore construction and salvage
- Marine biology surveys
- Marine archaeology

Scout USBL has been developed as a system that is simple to install, quick to set up as well as being easy and intuitive to operate. For dry operating environments Scout USBL can run on a laptop computer, for wet environments the waterproof Scout Command Unit can be used.

Scout is particularly useful for operators with little or no prior experience of USBL systems or those who want to arrive on location and begin tracking immediately. System operation is described in detail in this manual and further information can be found in the online Help.

As the Scout USBL transceiver includes its own internal motion reference unit Scout does not require extensive calibration before use. The system can track up to four targets in water depths from 5m to 500m. Positions for the targets can be relative to the vessel carrying the Scout system or if a GPS receiver is available and interfaced the positions can be given in real world latitude and longitude or grid co-ordinates.

## 1.2 Scout USBL Tracking System Components

This section describes each of the components that make up a Scout USBL Tracking System.

A Scout USBL tracking system has four main components (see figure 2-1):

- An acoustic transceiver
- A surface interface unit (SIU) or Surface Command Unit (SCU)
- Acoustic beacons
- A computer running the Scout USBL software

The tracking system can also take data from a Global Positioning System (GPS) receiver, a ROV or diver depth instrument and an ROV compass instrument

**Transceiver**

The transceiver is the part of the system fitted to the boat that is deployed in the water. The transceiver can be deployed on a pole over the side of a ship or through a gate valve in the ship's hull.

SCOUT USBL Transceiver

The transceiver sends an acoustic (sound) interrogation signal to a transponder beacon through the water and can receive an acoustic reply signal back from the beacon. The acoustic signals are pulses of high frequency sound, they are too high to hear but a 'click' can often be heard when the transceiver is tested on deck. The transceiver can determine the distance away and direction from which a reply signal was received.

The connector on the top of the transceiver takes the cable that connects the transceiver to the Surface Interface Unit (SIU). At the other end is the transducer endcap that carries the delicate transducer elements used to transmit and receive acoustic signals. The transceiver is fitted with a grey plastic transducer guard secured with a hose clip, ensure that this protective guard is raised above the transducer endcap before deployment.

The transceiver contains a motion reference unit that continuously compensates for the motion of the transceiver when tracking.

- Do not drop the transceiver otherwise damage may occur to the transducer elements and the motion reference unit
- Ensure that the protective transducer guard is raised before deploying the transceiver

**Surface Interface Unit (SIU)**

The Surface Interface Unit (SIU) provides power and a communications link between the transceiver and the computer running the Scout USBL software. The SIU connects to the transceiver over a 30 metres cable fitted with a waterproof connector and to the computer using a USB link. Four additional serial ports are included that can be used to connect to external instruments.


**Surface Command Unit (SCU)**

A Surface Command Unit (SCU) is a single splashproof (IP65) box containing a Surface Interface Unit, a computer and monitor. This is designed as a simple, portable USBL tracking system that can be easily deployed from a small boat. The module includes an integrated keyboard, touch pad and touch screen all of which can be used to operate the Scout USBL software.

The SCU can connect to an external GPS receiver and a navigation computer via the serial ports on the front panel. A USB connector on the front panel allows connection of any external USB device including hard drives, memory drives and CD drives.

The SCU can be powered from a normal ac mains power supply or from a 12-16V dc power supply such as a car battery. Onboard batteries will power the unit for at least 30 minutes from a full charge.

**Beacons**
A transponder beacon will send back an acoustic reply signal in response to an acoustic interrogation signal from the transceiver. The reply is sent after an accurately timed fixed delay so the transceiver can use the time delay between sending the interrogation and receiving the beacon's reply to work out how far away the beacon is.

Scout USBL is compatible with Sonardyne's family of High Frequency (HF) transponder beacons. These compact, rugged beacons can be deployed in a maximum depth of 500m.


***Figure 1-1 Scout Transponder Beacon***

The Scout transponder beacons have battery packs that can be replaced in the field and do not have to be sent back to Sonardyne. If the beacons are fitted with long-life lithium packs then they have a listening life of 4½ years, ideal for acting as long term markers.

Transponder beacons can be fitted with a release hook. These beacons can be deployed on the seabed with a sinker weight to hold them down and a buoy to keep them upright. By sending a special command from the transceiver to the beacons through the water the beacons can be told to let go of the sinker weight and float to the surface for recovery.

A responder beacon uses an electrical signal sent down a wire to trigger an acoustic reply signal. This type of beacon can be used where a cable connects the object being tracked to the surface, such as a Remotely Operated Vehicle (ROV). The advantage of using a responder is that only one acoustic signal is sent through the water, this improves positioning accuracy and helps where the object being tracked is noisy.

**Computer and Scout USBL Software**
The computer running the Scout USBL software connects to the Surface Interface Unit (SIU) using two serial communications cables. The software talks to the transceiver via the SIU sending it commands to make it position beacons or send commands to them. The software also takes the range and angle measurements made by the transceiver and calculates the positions of the beacons from them. The boat, the beacons and a chart of the working area can be displayed on the computer's monitor.

**Optional Instruments**
To improve tracking accuracy the Scout USBL system can connect to an external Global Positioning System (GPS) receiver, a better performing Vertical Reference Unit (VRU) and gyrocompass than those installed in the transceiver. For further information see Section 7 Improving Tracking.


***Figure 1-2 Typical Scout Tracking Systems***

# 2 USBL OPERATION

## 2.1 Introduction

The positioning of a beacon using the Ultra-Short BaseLine (USBL) method is achieved by measuring the distance between the transceiver and the beacon and determining the direction from which the signal from the beacon is received back at the transceiver.

The transceiver sends an acoustic interrogation signal to a beacon and the beacon sends back a reply signal. The transceiver measures the time between sending its signal and receiving the signal from the beacon (travel time) then converts this time into a distance using the known speed of sound in water.

The transceiver contains multiple receive transducers on its bottom face. When an acoustic signal from a beacon arrives at the transducer the signal arrives at each transducer at a different time. The small differences in the time of arrival of the reply signal at each transducer can be used to determine the direction of the signal.

The direction of the signal is calculated relative to the transceiver so if the transceiver is tilted or rotated the position of the beacon moves. To compensate for this problem the Scout transceiver contains a sensor that measures the angle of tilt and the heading of the unit.

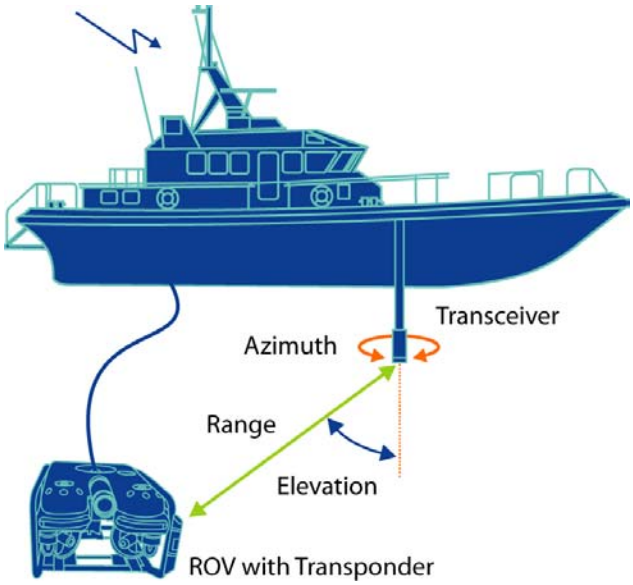



***Figure 2-3 USBL Positioning Method***

The Scout USBL will give a position for each beacon being tracked relative to the transceiver. By adding positions from a Differential Global Positioning System (DGPS) receiver the Scout USBL can give positions in real world latitude and longitude or grid co-ordinates.

## 2.2 Measuring Acoustic Ranges

Scout USBL positions an acoustic beacon by sending an interrogation signals to the beacon and measuring how long it takes to receive the reply signal. For this to work correctly there are a number of issues to consider:

**Signals**
There are lots of different interrogation signals that we could use so the signal sent to the beacon must be the correct one for that beacon. There are also lots of different reply signals that the beacons could use to we also have to look for the correct one. The correct interrogate and reply signals to use are written on the side of each beacon. Some acoustic beacons also have a variable delay between receiving an interrogation and sending back a reply; for Scout this Turnaround Time (TAT) is fixed for each type of beacon.

**Line of Sight**
Acoustic signals can only travel in straight lines and can only travel through water. Scout USBL can only track beacons if the transceiver can 'see' the beacon, there is a clear line-of sight between the transceiver and the beacon. If there is an obstruction such as a reef or a wreck between the beacon and the transceiver then Scout USBL cannot position the beacon correctly.

**Maximum Distance**
There is a maximum distance at which Scout USBL can position acoustic beacons and the distance is dependent on the depth of water. In 10m water depth Scout USBL can position beacons up to 400m away, as the water depth increases the distance increases to 500m.

The strength of the interrogate and reply signals decreases with distance so the further away the beacon is from the transceiver the quieter are the signals. By bringing the beacon and transceiver closer together the signals in the water get louder and so they can be received correctly. This is one of the factors that set the maximum operating distance for Scout USBL.

The interrogation signal can be made louder by controlling the transceiver's transmit power. The transmit power is fixed for all beacons that work with Scout USBL.

In cases where the reply signal from the beacon is too quiet it is possible to make it louder by increasing the transceiver's Receive Gain. The receive gain is fixed for all beacons that work with Scout USBL.

**Noise**
Scout USBL can only position a beacon if the beacon receives the interrogation signal correctly and the reply from the beacon is received by the transceiver. The signal can fail to be received for a number of reasons:

- Noise
- Bubbles
- Reverberation

If it is too noisy at the beacon or transceiver then the interrogation signal or reply signal will not be received correctly. Such things as boat's propellers, ROV thrusters and ROV hydraulics can generate noise.

In fact it is the strength of the signal in relation to the background noise that is the issue so making the signal stronger or the noise quieter can solve the problem. For further information see the Procedures section.

Bubbles in the water between beacon and transceiver can affect both transmit and receive signals. The bubbles destroy signals passing through them so it is important to keep beacons and transceivers away from bubbles made by thrusters, ship's propellers, divers and airlifts.

An acoustic signal transmitted into the water will bounce off any surface producing lots of echoes or reverberation. It can be difficult to receive the correct signal if the reverberation is too great so it is important that we reduce these echoes as far as possible by limiting how loud the signals are transmitted. For the beacons the transmit power is fixed but we can control the power level transmitted by the transceiver.

The best results will be obtained if both the transceiver's transmit power and receive gain are set to as low a level as possible under the current operating conditions.

**Speed of Sound in Water**

Scout USBL uses the speed of sound in water to convert travel times to distances. A typical value of 1485 metres per second (in mid-latitude regions) can be used but differences from the true value will affect positioning accuracy. The speed of sound in water is dependent on the salinity, temperature and depth of the water between the transceiver and beacon. The value can change slowly with the seasons and quite rapidly over the course of a day. For high accuracy work it is necessary to measure the speed of sound in water using a direct reading velocimeter and set the correct value in the Scout USBL software.

In situations where the speed of sound varies with depth, ray bending will affect the acoustic signals. Here the acoustic signal path is not a straight line between transceiver and beacon it is bent by diffraction.

**Calculating Depth**

Like all other USBL tracking systems, Scout USBL can only calculate the depth of a beacon reliably when the beacon is below the transceiver. When the beacon is alongside the transceiver there is not enough information in the received signal to be able to calculate depth so an alternative depth measurement is required.

The beacon can be given a fixed depth measurement or if available a measured depth can be used. Depth measurements from suitably equipped ROVs, towfish and divers can be fed in to Scout USBL and used as part of the position calculation. In general, if the depth of a beacon can be measured then it should be given to Scout USBL as it will always improve the position quality.

## 2.3 Tracking Targets

### 2.3.1 Tracking Relative to the Vessel

Scout USBL can be used to position a tracked target such as an ROV or diver relative to the vessel itself. The position of the target is shown relative to the boat and not in any real-world co-ordinates.

To track relative to the vessel, only the subsea target should be selected for tracking in the Tracking Wizard Select Vehicles page. See Section 5.4.1 Starting Tracking.

### 2.3.2 Tracking using Differential GPS

Where positions from a Differential GPS (DGPS) receiver are available, Scout USBL can be used to position a target in real-world co-ordinates.

The quality of the DGPS positions will directly affect the quality of the positions given by Scout USBL. Scout positions targets relative to a transceiver mounted on the vessel, so any errors in the position of the vessel will be applied to the position of the target being tracked. To achieve accurate real-world positions for the subsea targets is essential that high quality DGPS or RTK positions be used.

To track the subsea target using real-world co-ordinates, both the subsea target and the vessel should be selected for tracking in the Tracking Wizard Select Vehicles page. See Section 5.4.1 Starting Tracking.

*NOTE*:

Scout USBL should not be used with non-differential GPS as the error in the positions might be too large for useful tracking operations.

### 2.3.3 Tracking Towfish

Scout USBL can be used to position a towfish towed behind the vessel. Please ensure that the USBL transceiver is deployed so that there is a clear line of sight between it and the beacon on the towfish. If possible, avoid getting the ship's wake between the USBL transceiver and the towfish beacon.

The towfish can be positioned relative to the vessel or in real-world co-ordinates if DGPS positions are available. If using DGPS positions it will be necessary to increase the dynamics setting for the towfish to allow for high tow speed, see section 6.7.2.

### 2.3.4 Tracking Multiple Targets

Scout USBL can track up to four targets at the same time with the position of each target shown on the chart.

An output Report sentence can be created for each individual target and be fed to an external navigation system or GIS. Where multiple position Reports are used it is recommended that one of the proprietary sentences be used rather than a NMEA GGA sentence as the proprietary sentences include the name of the target being tracked. See section 6.10 Connecting Scout USBL to Another Computer.

Each target is positioned in turn so tracking more targets will reduce the position update rate for each separate target.

# 3 INSTALLING SCOUT USBL

## 3.1 Installing the Scout USBL Software

Note: Scout systems that use the Surface Command Unit (SCU) already have the software installed.

All Scout USBL systems are shipped from the factory with the Scout USBL software on CD together with the security key required to run the system. The following instructions should be followed to install the software on to the computer used to operate the Scout tracking system. These instructions should also be used if re-installation of the supplied version is required or when upgrading to a new version.

Before Scout USBL software can be installed, any previous versions of the same program must be uninstalled from the computer. The installer program provides an automatic mechanism for identifying and uninstalling previous versions of Scout USBL software.

1. Read the release notes included with the software
2. Close all other applications running on the computer
3. Insert the Scout USBL software CD into your CD-ROM drive
4. The CD installation routine should start automatically. If it does not, click 'Start' on the taskbar and then click 'Run'. Type D:\Setup.exe (Replace D with your CD-ROM or external USB hard disk drive's letter if it is different).
5. Follow the set-up instructions. You will be prompted to select the set-up type
   - Typical – This will install the most common options. Recommended for most users.
   - Compact – The program will be installed with the minimum required options. Use this option when available disk space is low.
   - Custom – You may choose the options to install. This option is only recommended for advanced users.
6. Restart the PC if prompted.

A Scout USBL software icon will now be visible on the desktop.

### Security Key

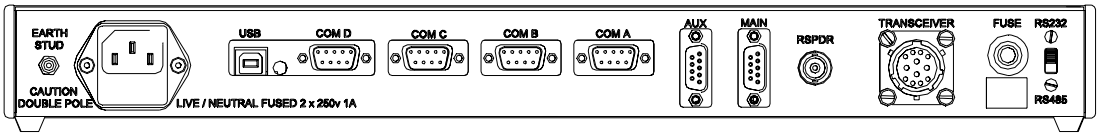
The security key provided with the Scout USBL system allows the software to run. The Scout USBL system will not work unless the security key is fitted to the computer. The security key is permanently fitted inside the Surface Control Unit (SCU).

*NOTE:*

The supplied security key should not be used in parallel or 'piggy backed' with other security keys from other applications or manufacturers at the same time. Always ensure that the Scout USBL security key is the only key attached to the parallel port on the computer.

## 3.2 Connecting the Scout USBL Hardware using a Surface Interface Unit

1. Locate the Surface Interface Unit (SIU) in a suitable rack close to the computer that will be used to run the Scout USBL software
2. Ensure the power switch on the front of the unit is set to off.
3. Connect the power cable to the power connector on the Surface Interface Unit backplate and the other end to a power socket.
4. Connect the USB port on the Surface Interface Unit to an unused USB port on the computer using a standard USB cable. The maximum usable cable length is about 3 metres.




5. Connect the transceiver cable to the Surface Interface Unit using the large green Amphenol connector on the backplate.
6. Check that the other end of the transceiver cable is connected to the transceiver.
7. Connect the transceiver data serial connectors (labelled **MAIN** and **AUX**) on the Surface Interface Unit backplate to a serial port on the computer such as COM1.

*NOTE*:

The transceiver serial connection called **Main** MUST be connected to a serial port on the computer and NOT via a USB serial port hub

8. If connecting the Scout USBL to an external computer, use a serial cable to connect a serial port on the back of the Surface Interface Unit to a serial port on the external computer. A crossover serial cable may be required.
9. Fit the yellow security key supplied with the Scout software to the parallel port or USB port on the computer that will be used to run the Scout USBL software. See note below.
10. Start the computer and run the Scout USBL software.
11. The power switch on the front of the Surface Interface Unit can now be switched on. Check that the transceiver's **Aux** port Rx (receive) LED is flashing, this shows that the cable connection to the transceiver is correct.
12. If communications are established with the transceiver still on deck they should be checked again once the transceiver is deployed to ensure no damage was done during deployment.

*NOTE:*

The supplied security key should not be used in parallel or 'piggy backed' with other security keys from other applications or manufacturers at the same time. Always ensure that the Scout USBL security key is the only key attached to the parallel port on the computer.

## 3.3 Connecting the Scout USBL Hardware using a Surface Command Unit

1. Place the Surface Command Unit (SCU) securely on a table or on the floor
2. Ensure the power switch on the front of the unit is set to OFF.
3. Connect the mains adapter power cable to the POWER connector on the Surface Command Unit and the adapter's other cable to a mains power socket.
4. OR connect the battery power cable to the POWER connector and put the clips on to a 12 volt battery. Ensure each clip is on the correct battery terminal.
5. Connect the orange transceiver cable to the large TRANSCEIVER connector.
6. Check that the other end of the transceiver cable is connected to the USBL transceiver.
7. If connecting the Scout USBL to an external computer, use a serial cable to connect serial port COM2 on the front panel to a serial port on the external computer. A crossover (null modem) serial cable may be required.
8. The power switch on the front of the Surface Command Unit can now be switched to ON. The Scout USBL program will start automatically as will the Motion Sensor Module program. Check that the transceiver's Sensors port Rx (receive) LED is flashing, this shows that the cable connection to the transceiver is correct.
9. If this is the first time that Scout USBL has been run since installing a new version of the program then the Motion Sensor Module will need to be configured. The Motion Sensor Module is described in Section 11 The Motion Sensor Module.
10. Instructions on using the SCU touch pad and touch screen can be found in section 4.9
11. If communications are established with the transceiver still on deck they should be checked again once the transceiver is deployed to ensure no damage was done during deployment.


*NOTE*:

Do NOT operate the SCU with an external USB mouse or any other USB device connected in an environment where the SCU can be splashed with water.

## 3.4 Surface Command Unit (SCU) Serial Port Allocations

Some of the serial ports on the SCU are dedicated to specific uses while others are available for connecting other instruments.

| Serial Port | Type | Use | Baud |
|---|---|---|---|
| COM 1 | Front panel | 'COM 1' GPS | Same as GPS |
| COM 2 | Front panel | 'COM 2' External computer | Same as Ext. comp. |
| COM 3 | Internal | Transceiver Sensors | 115200 |
| COM 4 | Internal | Transceiver Acoustics | 38400 |
| COM 5 | 'COM 5' | 'AUX 1' ROV/Diver depth | N/A |
| COM 6 | 'COM 6' | 'AUX 2' ROV heading | N/A |
| COM 21 | Internal | MSM Primary TSS2 telegram | 115200 |
| COM 22 | Internal | Scout MRU instrument | 115200 |

- Serial port COM1 is available on the front panel of the SCU. It is recommended that this port be used to connect a GPS receiver however ports 2, 5 and 6 could be used instead.
- Serial port COM2 is available on the front panel of the SCU. It is recommended that this port be used to connect to an external navigation computer however ports 1, 5 and 6 could be used instead.
- Serial port COM3 is permanently connected to the transceiver's Sensors port that is used to feed heading and attitude data to the Motion Sensor Module.
- Serial Port COM4 is permanently connected to the transceiver's Acoustics port that is used by Scout to communicate with the transceiver itself.
- Serial ports 5 and 6 are available on the front panel of the SCU and can be used to connect to other instruments such as ROV depth, Diver depth and ROV heading
- Serial ports 21 and 22 are internally connected and are used to pass heading data from the Motion Sensor Module (MSM) to the heading instrument in Scout USBL.

## 3.5 Deploying the Scout USBL Transceiver

The Scout USBL transceiver is small and lightweight so can be deployed in a number of ways depending on requirements.

**General Requirements**

- The transceiver must be mounted so that it is pointing vertically downwards with the connector at the top and the black acoustic transducer at the bottom.
- The transceiver must be installed with the white forward direction mark pointing forward, towards the bow of the vessel.
- For best results the transceiver must be deployed at least 1 metre below the lowest part of the vessel's hull.
- The transceiver should be deployed as far away as practicable from any source of noise or bubbles such as propellers, thrusters, aeration etc.
- The deployment should allow the transceiver the minimum amount of movement. Although the internal motion reference unit compensates for the roll, pitch and heading of the transceiver, better tracking results can be achieved by reducing the overall motion of the transceiver itself.
- Keep brackets, rope and structure away from the bottom face of the transceiver
- Take care when deploying and recovering the transceiver ensuring that the acoustic transducers are not damaged.

**Through-hull mounting**

The best way to mount a Scout transceiver is on a pole through the hull of a ship. The pole should be stiff, rigidly mounted and long enough to put the transceiver at least 1 metre below the ship's keel. The rigid mounting and stiff pole will minimise any movement of the transceiver, will keep the transceiver pointing downwards and will give optimum tracking accuracy.

**Over the Side Pole mounting**

The transceiver can also be mounted on a rigid pole over the side of the ship. The pole or frame should be aligned vertically with the vessel as far as is possible and ideally should be braced so the vertical alignment does not vary during operation

**Over the Side Cable Deployment**

In situations where a deployment pole cannot be used then it is possible to deploy the transceiver on a cable over the side of the ship or from a dock. This method is not recommended for use on a vessel underway or anchored in a tideway, as the transceiver will stream out with the current and no longer point vertically downwards. Any methods used to weight the transceiver to keep it pointing downwards are likely to reduce tracking ability.

Details about the mounting bracket required for a Scout USBL transceiver can be found in Section 0: Specifications.

*NOTE*:

When the transceiver is deployed for the first time on a new vessel or in a new location, please calibrate the motion sensors in the transceiver. See Section 7.1

- Do not drop the transceiver otherwise damage may occur to the transducer elements and the motion reference unit
- Ensure that the protective transducer guard is raised before deploying the transceiver

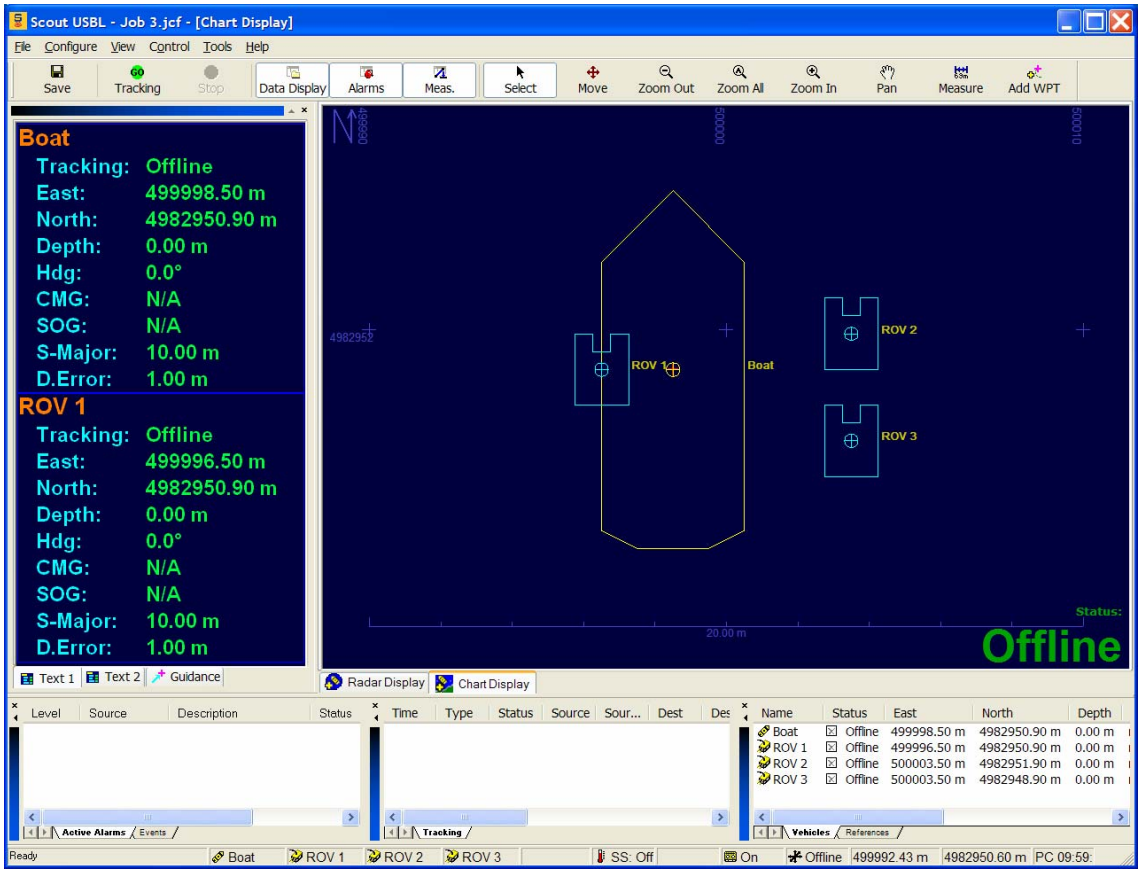
# 4 SCOUT USBL SOFTWARE

The key elements of the Scout USBL desktop are indicated below. The following section introduces the main features.

## 4.1 System Displays

The Scout USBL software desktop is made up of a number of displays which provide real-time information such as position, range lines, error ellipse and the status of measurements being used to track a vehicle.

The following section introduces the key features of the Scout USBL software.



## 4.2 Chart Displays

### 4.2.1 Radar Chart Display

The Radar display shows the position of all surface vessels, mobile vehicles and reference transponders in Polar or Cartesian format. The display can be configured by right clicking with the mouse cursor anywhere on the display and selecting *Properties* from the pop-up menu. The properties of any component displayed on the display (vehicles, reference transponders etc.) can be easily accessed by double clicking on the component.

For example, the Radar Chart can be configured to centre on any object (surface vessel, mobile vehicle, reference, waypoint) and orientated north up, bow-up, stern-up or user defined.

The Radar Display appears by default but can be displayed by selecting **Radar Display** from the **View** menu. The display can also be opened by clicking the **Radar Display** tab at the bottom of the display area.

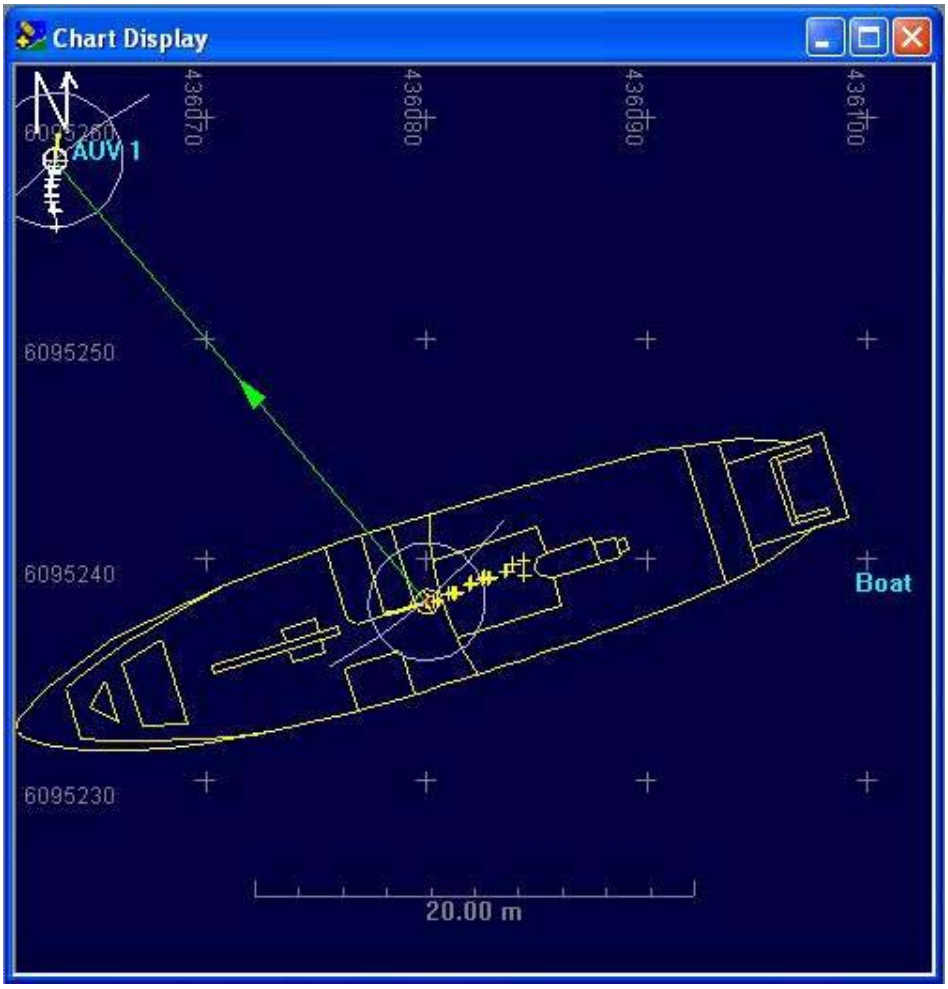
To zoom the **Radar Display** the zoom slider at the left of the display can be used or the scroll wheel on the mouse if fitted.

### 4.2.2 Chart Display

The Chart display shows the position of all surface vessels, mobile vehicles and reference transponders in a Cartesian format. The chart can be configured by right clicking with the mouse cursor anywhere on the chart and selecting *Configure Chart* from the pop-up menu. The properties of any component displayed on the Chart (vehicles, reference transponders etc.) can be easily accessed by double clicking on the component.

The **Chart Display** can be displayed by selecting **Chart Display** from the **View** menu. The display can also be opened by clicking the **Chart Display** tab at the bottom of the display area.

To zoom the **Chart Display** the zoom buttons on the toolbar can be used or select the Zoom options from the **View** menu.




## 4.3 Status bar

The Status bar at the bottom of the main window shows information about Scout USBL and gives quick access to some property pages.

The status of the boat and ROV or diver targets are shown in status boxes. When offline the status boxes are grey, when tracking they are green and when lost they go red. Double click a status box to show that target's properties.

Double click the logging icon to show the logging dialog.

The tracking status box shows if the system is offline or tracking.

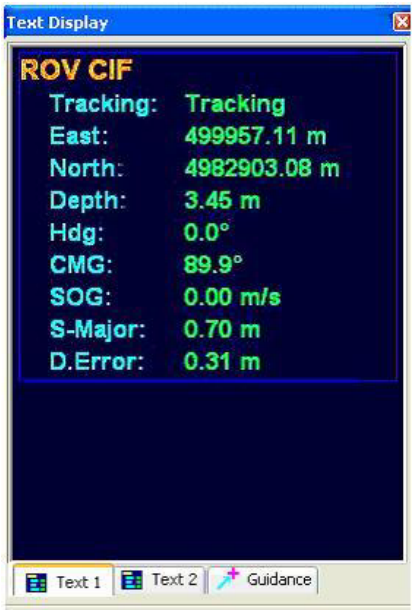
- The co-ordinates of the cursor on the chart are shown in two boxes alongside the current system time.

## 4.4 Text and Guidance Data Displays

The Data Display consists of three elements - two configurable Text Display tabs and a Guidance tab. The operator can switch between any of the display types using the tabs at the bottom of the display.

- To show or hide the data displays select **Data Display** from the **View** menu.

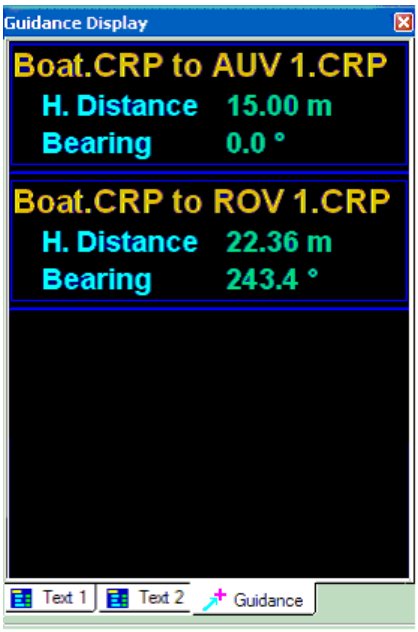
### 4.4.1 Text Display




The Text displays allow the display of operator selectable properties for the system and vehicles in the current job. They are designed to display information that can change during tracking rather than semi-permanent properties within instruments.

- To modify the text display, double click the mouse inside the display or select **Text** from the **View** menu.

### 4.4.2 Guidance Display




The Guidance display allows the display of operator selectable guidance information between any vehicle / offset to vehicle / offset or Waypoint combination. The guidance information is provided to assist the operator in navigating a vehicle to another vehicle or known Waypoint and is updated each navigation cycle.

- To modify the guidance display, double click the mouse inside the display or select **Guidance** from the **View** menu

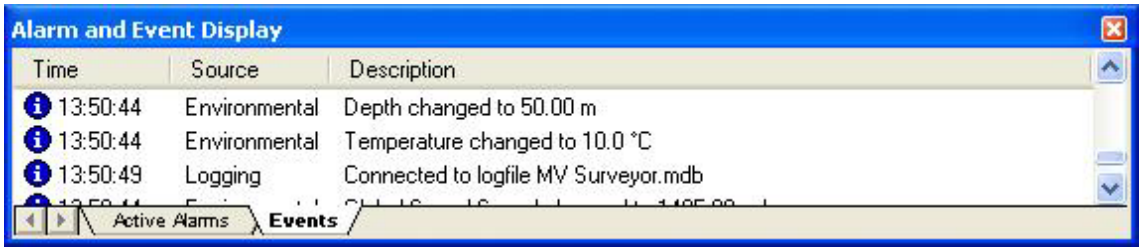
## 4.5 List Displays

### 4.5.1 Alarms / Events List

The Active Alarms list shows the alarms that have been generated by the program, which require the attention from the operator. The Events display lists those events that have occurred within the program, including operator initiated events. Events are used to show what the program is doing.

The operator can control the number of active alarms and events that are kept and also manually clear the list at any time.

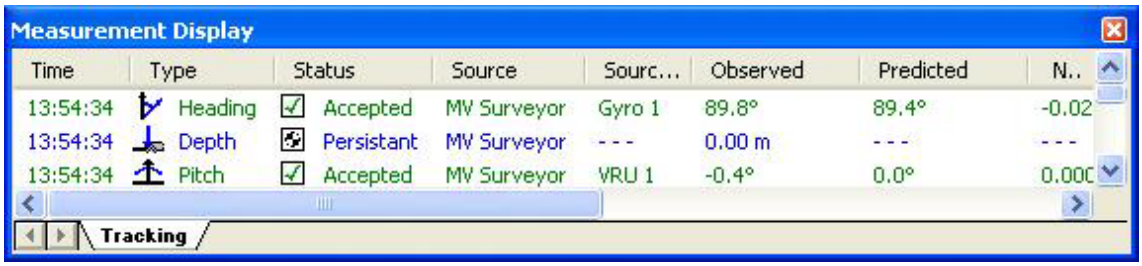
- To show or hide the Alarms/Events display select **Alarms/Events** from the **View** menu.




### 4.5.2 Measurements List

The Measurements list shows the raw and estimated values and the quality of each measurement being used for tracking vehicles as they are received. Co-ordinates are calculated using a mathematical optimal estimator which allows for the weight of predicted and measured positions to be set depending on vehicle dynamics. The appropriate quality information is also displayed.

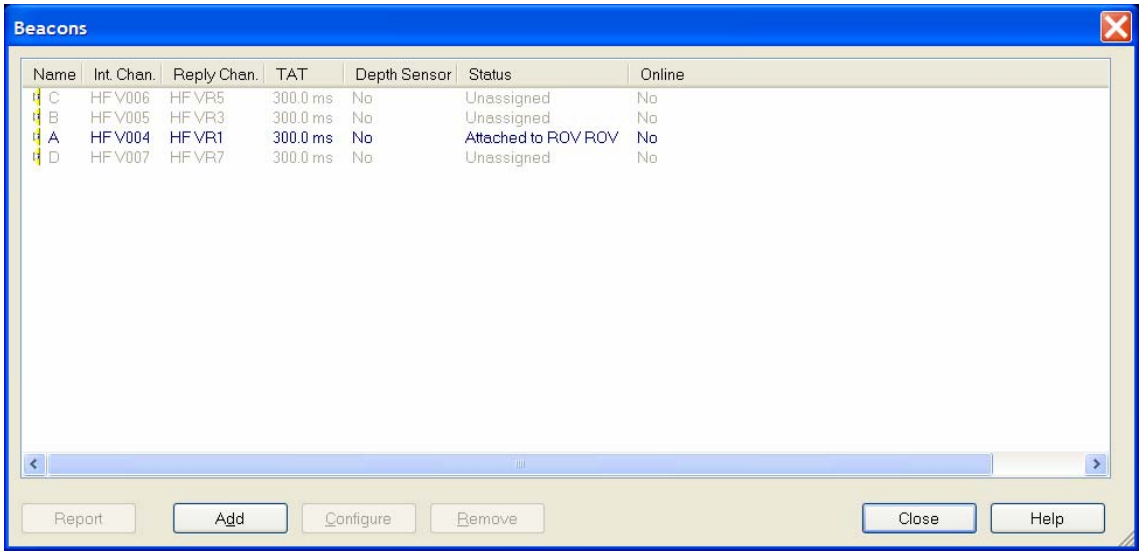
- To show or hide the Measurements display select **Measurements** from the **View** menu.



### 4.5.3 Beacons Display

The Beacons Display shows a list of the acoustic transponder beacons defined in the Job.

- To show the Beacons display select **Beacons** from the **Configure** menu.



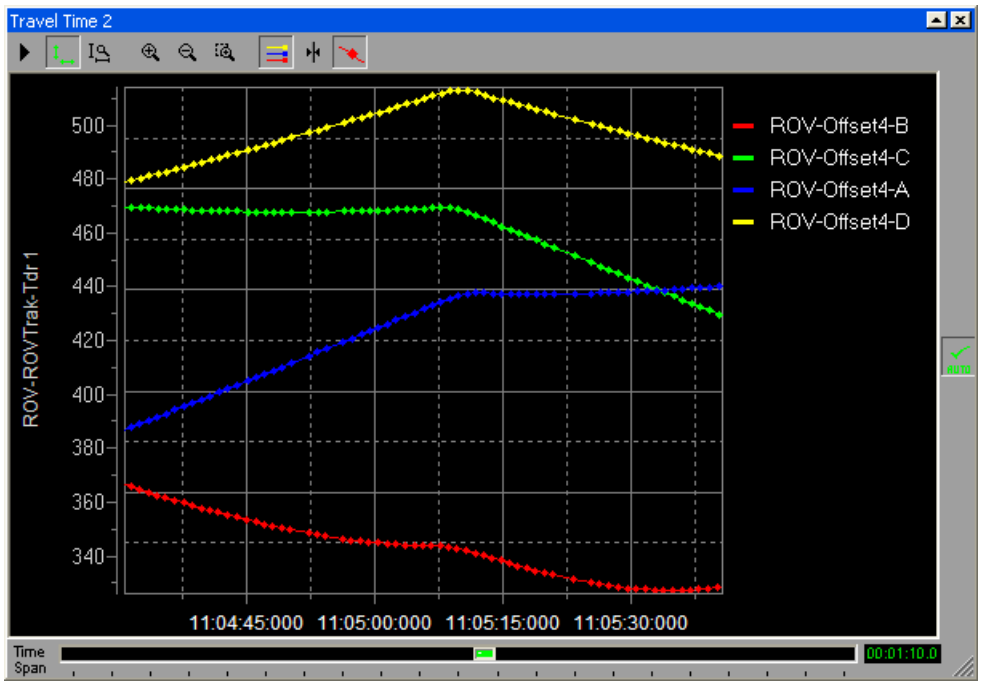

| | |
|---|---|
| Name | This is the name of the beacon, set when it was created. |
| Int. Chan. | The acoustic interrogation channel used to interrogate or measure a range to this beacon |
| Reply Chan. | The acoustic channel that the beacon replies with after being interrogated |
| TAT | The Turn Around Time, the time between the beacon receiving an interrogation signal and it sending back a reply signal. |
| Depth Sensor | Shows if the beacon is fitted with a depth sensor. |
| Status | Shows if the beacon is attached to a Target such as an ROV |
| Online | Shows if the beacon is currently being tracked |

## 4.6 Configurable Displays

There are various optional display types available to the operator that can be configured to display different information in either a graphical or textual form.

### 4.6.1 Travel Time Display

The Travel Time display is a real-time display that shows raw acoustic ranges from the beacons to the transceiver on the ROV or diver. The display provides a graphical view of the time between the transmission of the interrogation pulse and the reception of the reply pulse. This display can be used to show the quality of the acoustic ranges.




To show the travel time display:

1. From the **View** menu select **Travel Time**
2. In the **Travel Time Display Editor** click the **New** button, click **Tdr1** in the Editor's tree display then click **Add Item**. Click **Close** button in the Editor.
3. Use the Time Span slider bar at the bottom of the display to change how much data is shown

## 4.7 Toolbars

- To show or hide each of the toolbars select **Toolbars** from the **View** menu.

### 4.7.1 Main Toolbar


This toolbar provides access to a number of job related tasks.

| Button | Function |
|---|---|
|  | Save current job |
|  | Start tracking for each Target |
|  | Stop tracking or replay |
|  | Toggle Active Alarms Display |
|  | Shows or hides the Measurements Display |
|  | Selects chart items / components |
|  | Allows a selected vehicle to be dragged to a new position on the chart. |
|  | Zooms out the current chart |
|  | Zooms in the chart keeping all references and vehicles visible |
|  | Zooms in the current chart |
|  | Pans the chart. Click on chart and drag the point to a new position |
|  | Runs the Measurement Tool to measure the distance and bearing between two user-defined points |
|  | Adds a waypoint. Click on chart to add a waypoint |

### 4.7.2 Fix Toolbar


This toolbar is used to take position fixes of the selected vehicle or provide an average fix via the Average Fix Tool.

| Button | Function |
|---|---|
|  | Creates fix point at current location of selected vehicle. |
|  | Opens the Average Fix tool dialog. |

## 4.8 Menus

The top-level structure of the menu bar is as follows:

### 4.8.1 File Menu

This menu allows job files to be managed.

| Menu Item | Description |
|---|---|
| New | Opens the Job Set-up Wizard which will guide you through the process of creating a new job |
| Open | Opens the File Open dialog where an existing job can be selected and opened |
| Save | Saves the current job |
| Save As | Save the current job under a different file name |
| Close | Close the current job |
| Import | Imports a previously exported *.jfa file containing job, log, navigation file data, vehicle shape files |
| Export | Allows the current job, log, navigation file data, vehicle shape files, to be saved to a specified path for import at a later date |
| Guidance ▶ | Guidance menu options |
| Open Navigation File | Opens an existing navigation file |
| Save Navigation File | Save the current navigation file |
| Close Navigation File | Close the current navigation file |
| Import Fix Points | Imports fix points in comma-delimited (.CSV) format from file |
| Export Fix Points | Exports fix points in comma-delimited (.CSV) format to file |

| Menu Item | Description |
|---|---|
| Print | Prints the currently selected chart |
| Print Preview | Shows the print preview |
| Print Set-up | Opens the Print Set-up dialog |
| Exit | Quit Scout tracking system |

### 4.8.2 Configure Menu

This menu allows a number of job set-up functions to be carried out.

| Menu Item | Description |
|---|---|
| Job | Shows the Job dialog |
| Units | Shows the Display Units dialog |
| Global Settings | Shows the Display Units dialog |
| Geodesy | Shows the Geodesy dialog |
| Logging | Shows the Logging dialog |
| Instruments | Shows the Instruments dialog |
| Vehicles | Shows the Vehicles dialog |
| Beacons | Shows the Beacons display |
| Environmental | Shows the Environmental dialog |
| Guidance ▶ | Guidance menu options |
| Waypoints | Shows Waypoints dialog |
| Fixpoints | Shows Fixpoints dialog |
| Reports | Shows Reports dialog |

## 4.9 Mouse, Tablet and other Pointing Devices

The Scout USBL software is a Microsoft Windows program and is therefore designed to be used with a mouse or other pointing device. With Scout USBL running on a desktop or laptop computer, the computers own pointing device can be used.

Where Scout USBL is run on a Surface Command Unit (SCU), three options exist:

### 4.9.1 Touch Pad

The touch pad on the SCU front panel operates in a similar way to the touch pad found on some laptop computers.

- The mouse cursor on the chart can be moved by putting a finger onto the touch pad and moving it around
- A single light tap on the touch pad creates a mouse single left click
- A single light tap on the top-right corner of the touch pad creates a mouse single right click, this is used to show context menus in each of the Displays
- A mouse left double click can be done by lightly double tapping the touch pad. This can be used to show the properties of objects on the Chart or in lists
- A mouse left click and hold can be emulated by double tapping on the touch pad but hold down the second tap. This can be used to resize the display windows.

### 4.9.2 Touch Screen Display

The SCU display is a touch screen so toolbar and dialog buttons can be pressed by touching them on the screen. A mouse left double click can done by lightly tapping the screen.

### 4.9.3 External Mouse

An external USB mouse can be connected to the USB port on the SCU front panel, the mouse then operates in the normal way.

*NOTE*:

Do NOT operate the SCU with an external USB mouse or any other USB device connected in an environment where the SCU can be splashed with water.

# 5 USING SCOUT USBL

## 5.1 Introduction

These notes summarise the required procedures for both the initial configuration and setting up of Scout USBL software and the execution of typical USBL tracking tasks. They should be read in conjunction with the online Help for more detailed explanation of configuration options and settings.

All procedures assume that the system hardware has been installed correctly and that the transceiver, transponder beacons and other positioning instruments required for the job have been deployed, calibrated and correctly configured.

## 5.2 Starting and Stopping Scout USBL

By default, Scout USBL software will start automatically when the computer is started, this option is selected when the software is installed. If the Scout USBL software does not start automatically, proceed as follows.

*NOTE*:

The Scout USBL software will only start if the yellow security key is fitted to the computer running the Scout USBL software. The security key is permanently fitted inside the Surface Command Unit (SCU).

To start Scout USBL:

- Double click the Scout software icon on the desktop to start Scout USBL software.


Or

- Select **Programs** from the **Start** menu on the taskbar
- Select the **Sonardyne** folder, then the **Pharos** folder then click **Scout**

To stop Scout USBL:

1. Save the current job in Scout USBL software by clicking **Save Job** on the **File** menu.
2. Click **Exit** on the **File** menu to quit Scout USBL software.

## 5.3 Creating a new Job

On starting up, Scout USBL will open the last Job file that was used so the configuration of the system is then the same as it was when the Job was last saved.

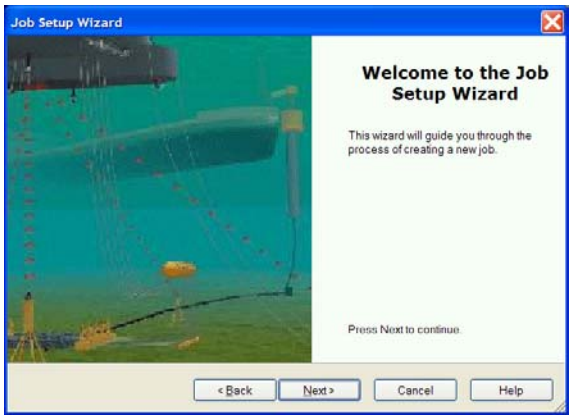
A new Job can be created at any time however if the new Job is similar to an existing one then modifying an existing Job is often easier.

**To modify an existing job:**

1. From the **File** menu select **Save As**
2. Type in the new name for the Job file and click **Save**

A new Job file will be saved using the name given. This new Job file can now be modified and saved in the usual way.

**To create a new default Job:**

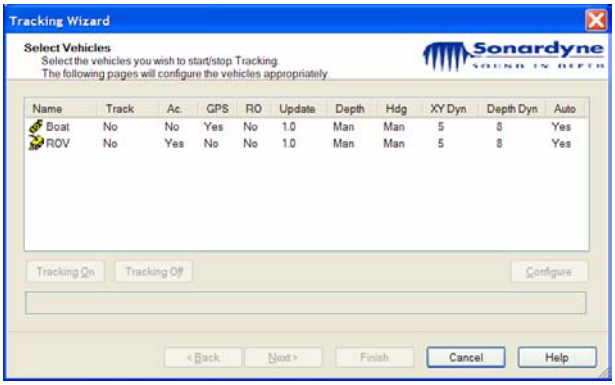



1. From the **File** menu select **New**
2. If a Job is currently loaded you will be asked if you want to close it, click **Yes**
3. The **Job Setup Wizard** is then shown, click **Next**
4. On the **Job Details** page, select an existing **Project Name** or type in a new name, select a **Project Folder** and type in a new **Job Name**.
5. Set **Client Name** and **Job Description** if required
6. Click the **Next** button. If the selected folder does not exist then you will be prompted before it is created, click **Yes**.
7. Select a new log file to use or simply use the default offered.
8. On the last page click the **Finish** button and the new Job will be created.

The new Job will contain default instruments, vehicles and settings that are appropriate for Scout.

## 5.4 Starting and stopping tracking

### 5.4.1 Starting Tracking




Start tracking by selecting the Tracking Wizard  icon on the main toolbar.

1. Check that the USBL transceiver and the motion reference unit are connected and working. Check that the DGPS receiver is connected and working if used.
2. Select the targets to track using the **Tracking On** button and click **Next**. See Note below.
3. On the **Initialise Transceivers** page check that the status of the transceiver is **Set**. If the status is **Not Set** then click the **Quick Set** button. Click the **Next** button.
4. The **Logging** page is used to set the log file for tracking data. Click the **Configure** button to show the **Logging** dialog then click the button next to the **Log file Name** to select the file. Type in the name of the new log file and click **Save**. Close the **Logging** dialog.
5. Click the **Next** button to start tracking. When tracking starts the targets selected will begin to move around on the chart display.

**Selecting Targets for Tracking**

- When tracking targets relative to the vessel, only set tracking on for the target or targets to be positioned. Do not set tracking on for the vessel itself.
- When tracking targets in real-world co-ordinates, set tracking on for the targets to be positioned and the vessel itself.

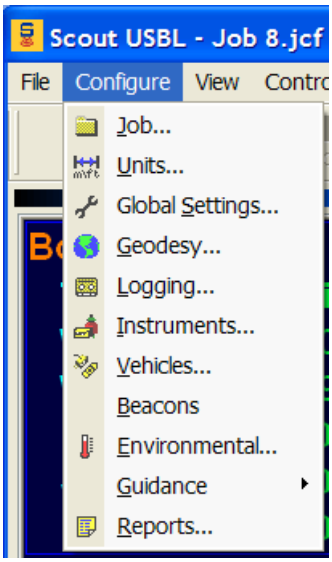
### 5.4.2 Stopping Tracking

- Click the Stop Tracking  icon on the toolbar to stop all targets being tracked.

*NOTE*:

When the transceiver is deployed for the first time on a new vessel or in a new location, please calibrate the motion sensors in the transceiver. See Section 7.1

# 6 CONFIGURING SCOUT USBL




## 6.1 Configuring a new Job

The default settings for a new Job may not be correct for your current tracking operation, so is important to check each of the options in turn before starting tracking. The configuration pages can be found in the **Configure** menu options.

### Job

The Job configuration pages show where the Job file is kept and some basic client information.

### Units

Setting the current display units is described in Section 6.11 Configuring the Display Units

### Global settings

#### Co-ordinates Page

- Setting the display co-ordinates is described in Section 6.12 Selecting a co-ordinate display format
- Display co-ordinates are covered in Section 10.1.3 Co-ordinate systems

#### Heading Page

- Setting the options on the heading page is described in Section 8.2 Advanced heading options.

### Geodesy

The Geodesy options are described in Section 10 Geodesy.

### Logging

The Logging options are described in Section 6.2 Logging - Selecting Logging Options

### Instruments

When a new Job is created, a USBL transceiver, GPS receiver, compass and vertical reference unit instruments are created automatically. The four Coastal beacons are also included.

### Vehicles

When a new Job is created a vessel and a ROV target are created automatically. The vessel has the USBL transceiver, GPS receiver, compass and vertical reference unit already attached and only the offsets need to be set.

### Beacons

This shows a list of all of the acoustic transponder beacons defined in the system.

### Environmental

The basic options for setting the speed of sound are described in Section 6.8

### Guidance

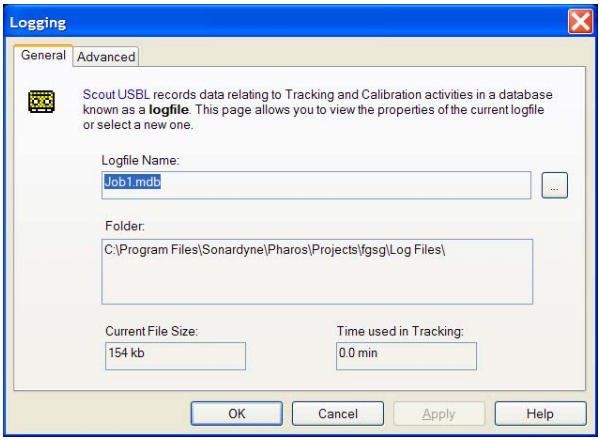
Waypoints are described in Section 6.9.1 and fix points are described in Section 6.9.2

**Reports**

The use of reports is covered in Section 6.10 Reports - Connecting Scout USBL to another computer

## 6.2 Logging - Selecting Logging Options

Scout USBL records tracking information in a Log file. The Log file contains information about positions, times and measurements recorded during tracking. As the log file contains all that information it can be used to show where the targets have been and what the measurements were like during tracking.




A new Log file should be created each time tracking is started so information about each tracking task is kept separate. Fortunately there is an easy way to do this as the log file can be set in the last page of the Tracking Wizard.

- To set the logging options select **Logging** from the **Configure** menu.

The **General** page shows the currently selected log file, the folder where it is kept, the size of the file and the length of tracking time recorded in the file.

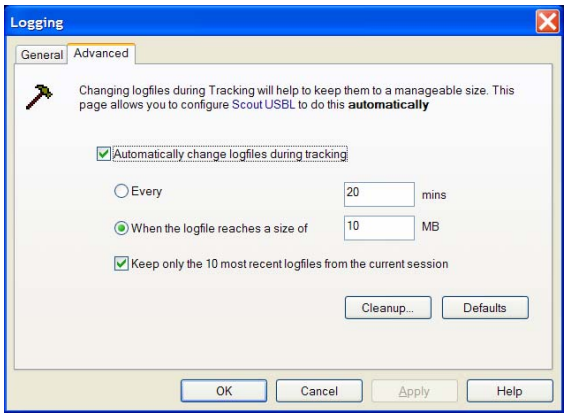
To change the log file:

1. Click the button to the right of the **Logfile Name**
2. The **Save As** dialog is shown, type in the name of the new file and click **Save**

The **Advanced** page allows you to change logging options.

Here you can select how the system manages log files. As the log files can be quite large the system can be set to automatically change the log file after a given time interval or when the log file reaches a given size.

By default the log file is changed when the file reaches 10 MB in size.



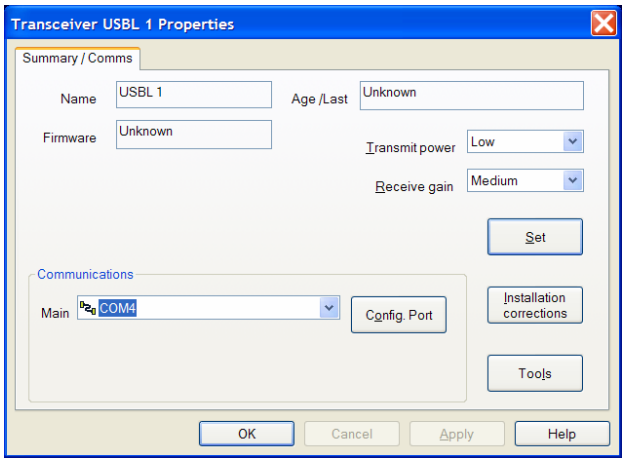

The system can also be set to only keep the ten most recent log files so any older than that are deleted automatically. This feature is used to stop the computer's hard disk filling up with old unused log files. If all log files are to be kept then ensure this option is not selected.

The Log File Cleanup Wizard can be started by clicking the **Cleanup** button. This Wizard can be used to remove any unwanted log files from the computer.

## 6.3 Instruments - Setting up the Transceiver

The USBL transceiver has to be set up for its connection to the computer and set up correctly for the current operating conditions.

- To show the transceiver's property pages, from the **Configure** menu select **Instruments** then select the USBL transceiver.




### 6.3.1 The Summary/Comms Page

This page is used to select the serial port being used to connect to the transceiver and to set how the transceiver transmits and receives the acoustic signals from the beacons.

| | |
|---|---|
| Name | This is the name of the transceiver, set when it was created. |
| Firmware | The version of the firmware inside the transceiver. Set by the transceiver itself. |
| Age/Last | The time and date that the transceiver was last set up for tracking. Set by Scout USBL. |
| Transmit power | Sets how loud an interrogation signal will be transmitted, the default value is Low. Press the Set button after changing this value. |
| Receive gain | Sets how much gain is used when receiving reply signals from beacons. The default value is Low. Press the Set button after changing this value. |
| Set button | Sets up the transceiver ready for tracking by sending commands to it |
| Installation corrections button | Shows the Installation corrections dialog, see section 6.3.2 |
| Communications \| Main | The computer's serial port that the transceiver is connected to. For a Scout SCU system this is COM4 |
| Main Config. Port button | Shows the serial port configuration dialog |
| Tools button | Show the Signal Response, Noise Plot and Comms Displays, these are only used for fault-finding and diagnostics |

**Ranging controls**

The Transmit power control sets how loudly the transceiver transmits the interrogation signals and the Receive gain sets how quiet a reply signal can be received.

- For normal operation the default values of High transmit power and High gain can be used
- When working with a noisy ROV the transmit power may need to be increased
- When working at the maximum operating range then both the transmit power and receive gain may need to be increased
- When tracking targets close to the transceiver then both the transmit power and receive gain can be reduced.

The Set button actually sends the commands to the transceiver to set the selected values and must be pressed for new settings to be applied.

**Note**: The maximum operating range of Scout USBL is fixed to 500m.

**Communications controls**

The communications controls set the serial port that the transceiver is connected to and allow you to test the connection.

The Port control is used to select the serial port from the list of ports available on your computer. The Test button can be used to check the connection to the transceiver. If the transceiver has just been connected and powered up it may be necessary to click the **Set** button on this page before the **Test** will work.

The **Config Port** button gives access to the Serial Port Configuration dialog. See below.

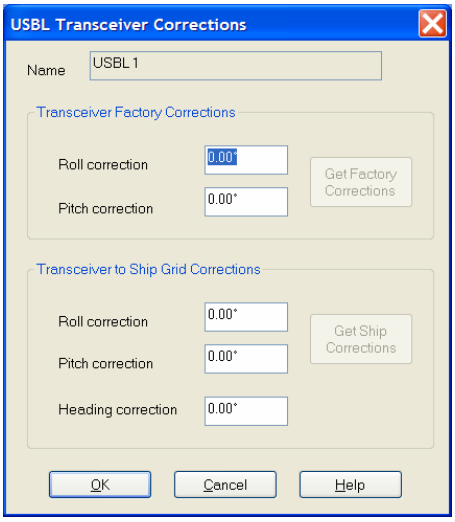
**Tracking controls**

The Use in tracking check box sets whether the transceiver is used when tracking is started on the vessel. This control can be used to disable acoustic positioning on a vessel fitted with GPS if just GPS tracking is required. For normal operation this check box is on (checked).

### 6.3.2 The Installation Corrections Dialog

This dialog is used to set the alignment corrections for the USBL transceiver. For Scout USBL all roll and pitch corrections should be zero as the Motion Sensor Module corrects for any attitude misalignment.

The Transceiver to Ship Grid Heading correction can be used to correct for misalignment between the transceiver and the fore/aft line on the vessel.




### 6.3.3 The Serial Port Configuration Dialog

This dialog is used to set the serial port configuration for the instrument.

| | |
|---|---|
| Port name (in Title bar) | The name of the port |
| Baud rate | The rate at which the data is sent to the transceiver. |
| Data bits, stop bits, parity | Communications options. The defaults are 8, 1 and none. |
| Timeout | The length of time to wait before notifying that data has stopped being received on this port. The default is |
| Latency | The age of the data being received on this port. The default is 0 seconds. |
| Set Defaults button | Sets the default values appropriate for this instrument |

For the transceiver the only control that can be changed is the baud rate and this is unlikely that you will need to change this under normal operating conditions.

### 6.3.4 Testing the Connection to the Transceiver

To check that the transceiver can communicate with the computer first ensure that the correct Options have been selected. Once done, show the **Summary/Comms** page in the Transceiver properties.

- Check that the Surface Interface Unit (SIU) is switched on
- Check that the cable from the transceiver is connected to the SIU
- Check that the correct serial port selected in the **Summary/Comms** page
- Check that the correct baud rate (38400) is selected in the **Serial Port Configure Dialog**
- Click the Test button on the transceiver's **Summary/Comms** page

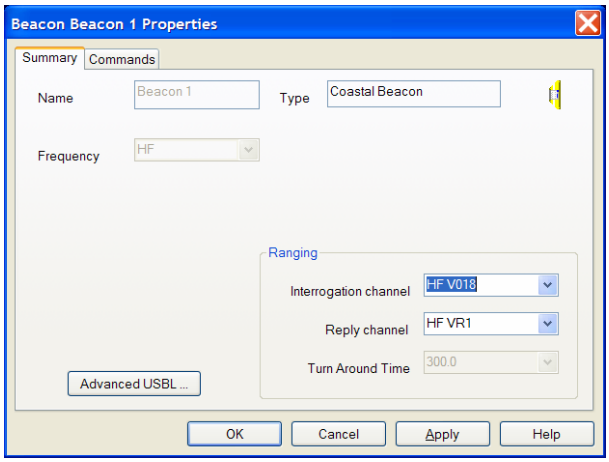
If the transceiver is powered up and correctly connected, Scout USBL will report that the transceiver is working OK.

Clicking the **Show Comms** button can show the communications between transceiver and computer

## 6.4 Instruments - Setting up a Beacon

Each beacon has to be set up so that the transceiver can interrogate it and receive its reply signals.

To show the beacon's property pages, from the **Configure** menu select **Instruments** then select the beacon required.




### 6.4.1 The Summary Page

This page is used to set the interrogation and reply channels for the beacon

| | |
|---|---|
| Name | The name of the beacon |
| Type | The type of beacon |
| Frequency | Always HF for Scout USBL |
| Interrogation Channel | See Below |
| Reply Channel | See Below. This control is not available for beacons A, B, C and D |
| Turn Around Time | Set by the Interrogation Channel |
| Address | The address of the beacon, see below |
| Advanced USBL button | Shows the USBL Advanced Ranging Options dialog |

**Interrogation Channel**

It is essential that the Interrogation channel and reply channel controls be set to the same value written on the side of the beacon. If the incorrect channels are used then Scout USBL will not be able to measure a range to or position the beacon.

Scout USBL is provided with up to four dedicated beacons called 'A', 'B', 'C' and 'D'. These beacons have the corresponding channels A, B, C and D. For these beacons the interrogation channel of the beacon sets the reply channel it uses:

| Beacon | Interrogate channel | Reply channel |
|---|---|---|
| A | HF V004 | HF VR1 |
| B | HF V005 | HF VR3 |
| C | HF V006 | HF VR5 |
| D | HF V007 | HF VR7 |

Other coastal beacons can have different interrogate and reply channels.

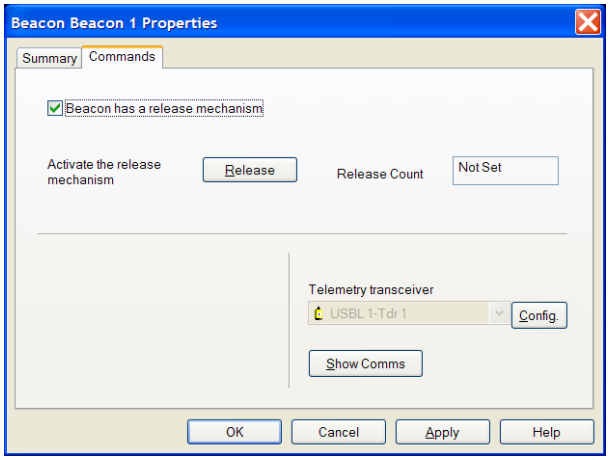
**The USBL Advanced Ranging Options Dialog**

The controls on this dialog are described in Section 8.1 Advanced ranging options.

### 6.4.2 The Commands Page

The commands page is used to send release commands to the beacon.

Lightweight Release Transponder (LRT) beacons have a release mechanism on the bottom endcap. When deployed the release mechanism is tied to a sinker weight and the beacon itself is attached to a float. Three release commands are sent to the beacon to tell it to activate its release mechanism. The beacon is released from the sinker weight allowing the beacon to float to the surface to be recovered.

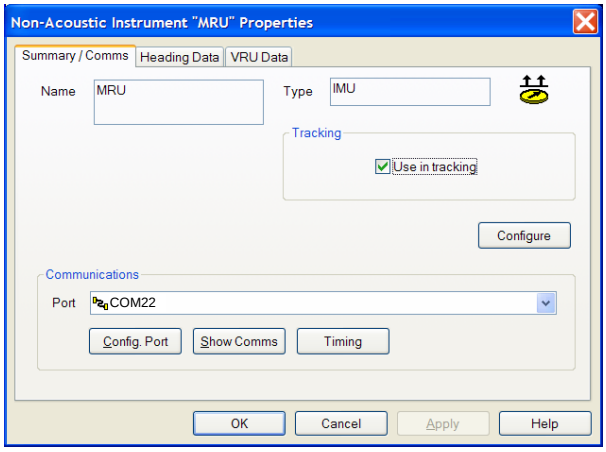



| | |
|---|---|
| Beacon has a release mechanism | Set this if the beacon is a Lightweight Release Transponder (LRT) |
| Release button | Used to send the three release commands to the beacon |
| Release count | Shows how many commands have been sent |

## 6.5 Instruments – Setting up the Motion Reference Unit (MRU)

### 6.5.1 Summary/Comms Page

Scout USBL used the heading, roll and pitch measurements from a Motion Reference Unit (MRU) to calculate the attitude of the transceiver during tracking. The measurements are provided by the MRU built in to the transceiver and are connected to Scout USBL via the Motion Sensor Module (MSM), see Section 11.



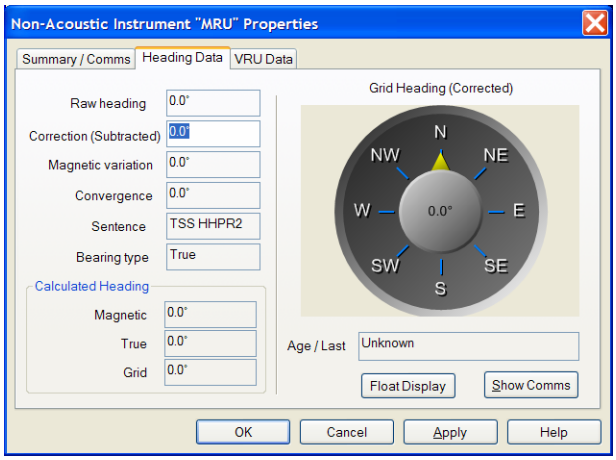

| | |
|---|---|
| Name | The name of the instrument |
| Type | The type of instrument - IMU |
| Use in tracking | Selects whether to use the motion reference unit when tracking the vessel it is attached to. For normal operation this should be set to on (checked). |
| Configure button | Shows the Motion Sensor Module (MSM) dialog |
| Port | The computer's serial port that the MRU is connected to |
| Config. Port button | Shows the serial port configuration dialog |
| Show Comms button | Shows the serial communications display for the selected port |
| Timing button | Shows the timing dialog |

### 6.5.2 Serial Port Configure Dialog

See section 6.3.2

### 6.5.3 Heading Data Page

This page shows the heading measurements from the instrument. The heading is shown along with the offsets and corrections used to calculate the grid heading used in tracking.

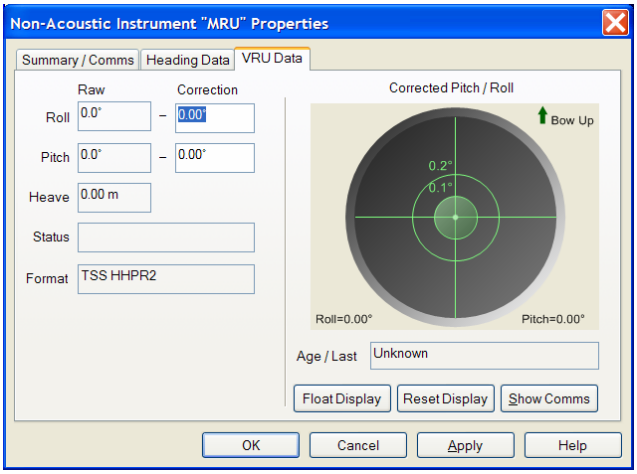



| | |
|---|---|
| Raw heading | The raw magnetic heading measurement from the transceiver's motion sensor |
| Correction | A correction value that can be subtracted from the raw measurement, by default this should be zero |
| Magnetic variation | The local magnetic variation used to convert a magnetic heading to a true heading. This value is set in the Global Settings pages |

| | |
|---|---|
| Convergence | The convergence value used to convert a true heading into a grid heading. This value is set in the Global Settings pages. |
| Sentence | Always set to 'TSS HHPR2' |
| Bearing type | Always set to 'True' |
| Calculated Magnetic | The calculated magnetic heading |
| Calculated True | The calculated true heading |
| Calculated Grid | The calculated grid heading |
| Age/Last | The age and time of last position update |
| Show comms button | Shows the serial communications display for the selected port |
| Float display | Creates a floating graphical display showing data from this instrument |

### 6.5.4 VRU Data Page

This page shows the attitude measurements from the instrument. The raw roll and pitch measurements are shown along with the offsets and corrections used to calculate the corrected roll and pitch used in tracking.




| | |
|---|---|
| Raw roll and pitch | The roll and pitch measurements from the transceiver's motion sensor |
| Roll and pitch correction | A correction value that can be applied to the raw roll and pitch. By default these values should be zero. |
| Heave | Not used |
| Status | Not used |
| Format | Always set to 'TSS HHPR2' |
| Age/Last | The age and time of last position update |
| Show comms button | Shows the serial communications display for the selected port |
| Float display | Creates a floating graphical display showing data from this instrument |

### 6.5.5 Testing the connection to the Motion Reference Unit (MRU)

To check that data is being received correctly from the MRU, first ensure that the correct options have been selected. Once done, show the **Heading Data** page in the MRU properties and check that the **Raw Heading** value is changing. Next, show the **VRU Data** page in the MRU properties and check that the **Roll** and **Pitch** values are changing.

- Check that the cable from the transceiver is connected to the Surface Interface Unit or Surface Control Unit.
- Check that the correct serial port selected in the Summary/Comms page, this should be COM22.
- Check that the correct baud rate is selected in the Serial Port Configure Dialog, this should be 115K Baud
- Check the Motion Sensor Module is operating correctly, see Section 11

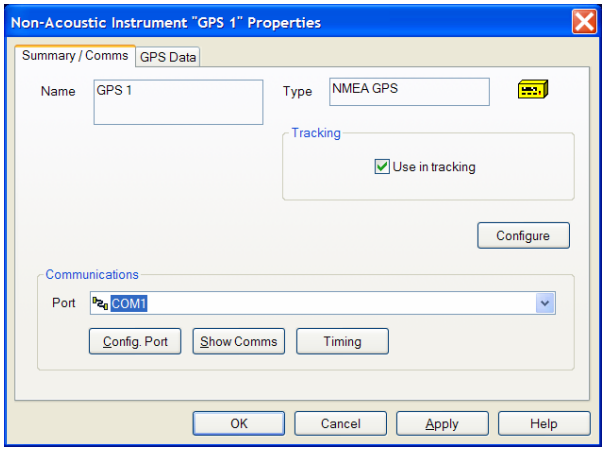
## 6.6 Instruments - Setting up the GPS Receiver

### 6.6.1 Summary/Comms Page

Scout USBL needs a GPS receiver for calibrating the array of beacons.

The serial port on the computer used to connect to the GPS receiver must be selected first. Once configured the GPS Data page can be used to check the positions are being received correctly.

It is recommended that Differential GPS (DGPS) be used with Scout USBL. Positions from non-Differential GPS receivers are subject to errors of up to 10m and these position errors will directly affect the positions of targets positioned using Scout USBL.




| | |
|---|---|
| Name | The name of the beacon |
| Type | The type of beacon |
| Use in tracking | Selects whether to use the GPS receiver when tracking the vessel it is attached to. For normal operation this should be set to on (checked). |
| Configure button | Shows the GPS configure dialog |
| Port | The computer's serial port that the GPS is connected to |
| Config. Port button | Shows the serial port configuration dialog |
| Show Comms button | Shows the serial communications display for the selected port |
| Timing button | Shows the timing dialog |

### 6.6.2 Serial Port Configure Dialog

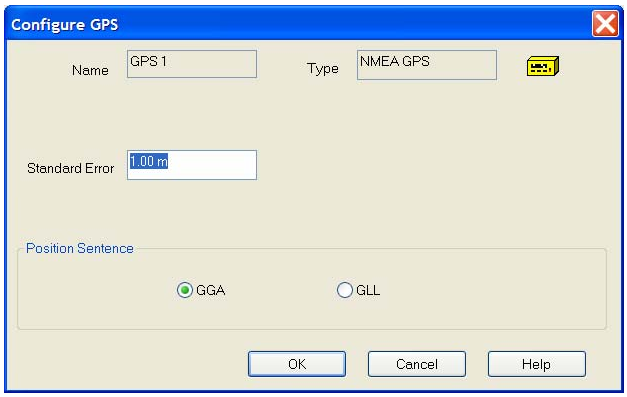
See section 6.3.2

### 6.6.3 Configure GPS Dialog

This dialog is used to select the specific options available for a GPS receiver.

The Standard Error is used in the position calculations and needs to be set correctly for the type of GPS used.

The Position Sentence must also be set correctly for the type of sentence sent by the GPS receiver. Where the receiver always transmits both sentences select the GGA option.

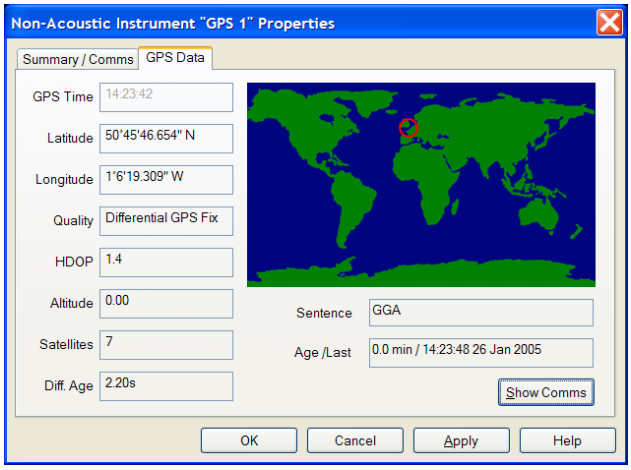



| | |
|---|---|
| Standard error | The position error for the GPS receiver<br>Native GPS – 5 to 10m<br>Differential and RTK GPS – 1m |
| Position sentence | Select the correct NMEA sentence type sent by the GPS receiver to the computer; GGA, GLL or Garmin TEXT |

### 6.6.4 GPS Data Page

This page is used to show the position information from the GPS receiver as it arrives. The page shows if data is being received and if so, whether it is being decoded correctly.

If the data from the GPS is being received and decoded correctly then the map of the world shows a flashing red circle at the reported latitude and longitude.




| | |
|---|---|
| GPS Time | The valid time of the position |
| Latitude, Longitude | The Latitude and Longitude of the position |
| Quality | The type of GPS position fix |
| HDOP | The horizontal dilution of precision quality value |
| Altitude | The antenna altitude |
| Satellites | The number of satellites used to compute a position |
| Diff. Age | The age of the differential data used to compute a position |
| Sentence | The NMEA sentence type selected |
| Age/Last | The age and time of last position update |
| Show comms button | Shows the serial communications display for the selected port |

### 6.6.5 Testing the connection to the GPS receiver

To check that data is being received correctly from the GPS receiver first ensure that the correct Options have been selected. Once done, show the **GPS Data** page in the GPS receiver properties and check that the **Latitude** and **Longitude** values are changing. If the world map on the **GPS Data** page shows 'No Data' then the positions are not being received or decoded correctly.

- Check that the GPS receiver is switched on and is configured sending out the correct strings
- Check that the cable from the GPS receiver is connected to the correct serial port on the computer
- Check that the correct serial port selected in the Summary/Comms page
- Check that the correct baud rate is selected in the Serial Port Configure Dialog
- Check that the correct sentence type is selected in the Configure GPS Dialog

## 6.7 Vehicles - Setting Up a Target for Tracking

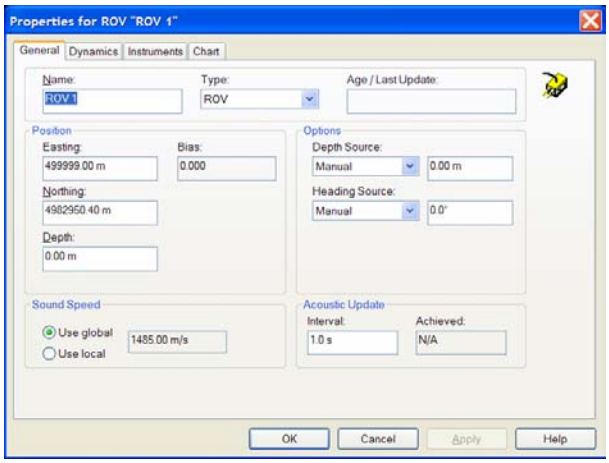
Each target or vehicle to be tracked has to be set up correctly for that type of target. The boat fitted with its GPS receiver can be tracked using GPS positions and the ROV fitted with the transceiver can be positioned using acoustic range measurements to the beacon array.

The target or vehicle property pages show the current position and quality information for each target. The pages allow instruments to be attached to each target such as transceivers and GPS receivers. The other pages allow you to select how the target will be tracked and how the target appears on the chart display.

To show the Target's property pages select **Vehicles** from the **Configure** menu and double click on the appropriate target.

### 6.7.1 Setting up the General Page

The General page is used to show the name type and position of the target. This page is also used to select the source of depth and heading measurements along with the required position update interval.



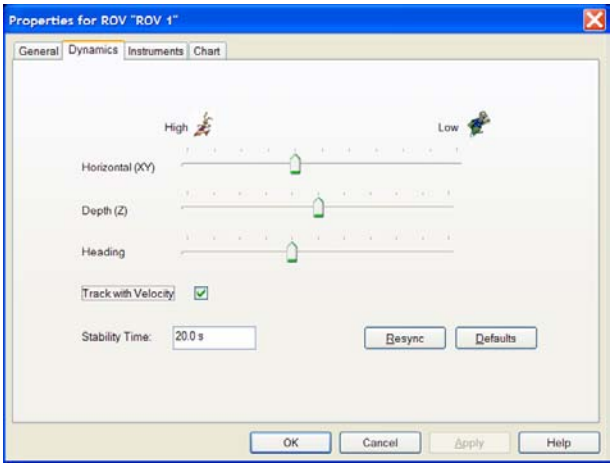

| | |
|---|---|
| Name | The name of the target |
| Type | The type of target – ROV, vessel, diver and so on |
| Age/Last | The time the values were last updated |
| Description | A short description of the target |
| Easting, Northing, Depth | The position of the target in current co-ordinates |
| Bias | A measure of the accuracy of the last position fix |
| Sound speed – Use global | Use the global sound speed value for tracking, this is selected by default |
| Sound speed – Use local | Use a separate sound speed value for tracking this target |
| Depth source and value | The source of depth measurements: Manual, computed or measured |
| Heading source and value | The source of heading measurements: Manual or measured |
| Acoustic Update Interval | The requested acoustic update interval. The default is 1 second but when working in shallow water or near obstructions use 2 seconds for each target to be tracked |
| Acoustic Update Achieved | The update interval actually achieved |

Measured depth and heading options are only available if external depth or heading instruments are being used, see section 8.3.

### 6.7.2 Setting up the Dynamics Page

The **Positioning** page is used to set positioning properties such as position update rate or depth and heading measurement settings.

Use the **Defaults** button if you are unsure of the appropriate settings.




| | |
|---|---|
| Horizontal (XY) | This controls how the target horizontal positions are filtered |
| Depth (Z) | This controls how the target depth is filtered |
| Heading | This controls how the target heading is filtered |
| Track with velocity | Set this for the vessel and ensure it is not set for ROV and Diver type targets |
| Stability time | Sets the time delay the positioning filter takes between losing the target's position and resetting. The default is 15 seconds. |
| Resync | Forces the filter to reset the target position |
| Defaults | Set the default control values for the target |

**Track with Velocity**

This option should only be set for the vessel and for towfish being tracked in real-world co-ordinates, see below. Do not set this option for ROV or diver target vehicles.

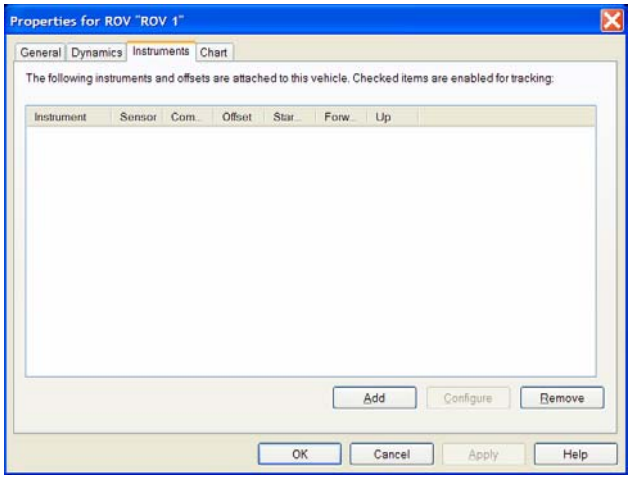
**Towfish Tracking**

When tracking a towfish and using positions from a DGPS receiver the **Horizontal(XY)** dynamics setting should be increased to allow for high tow speeds and the **Track with Velocity** option should be used. If tracking relative to the vessel only, the motion of the towfish is quite slow, as the fish will largely remain in the same place. However, if tracking using real-world co-ordinates the towfish speed over the ground will be the same as the vessel speed of the ground so the dynamics will need to be increased to allow for this.

### 6.7.3 Setting up the Instruments Page

This page is used to attach instruments such as transceiver, compass and GPS receiver to a target.

Where we need to merge measurements from a number of instruments their position on the target becomes important. To be able to merge the measurements correctly we need to account for differences in position on the boat or ROV.




| | |
|---|---|
| Instrument list | The list of instruments attached to the target, click an instrument to select it |
| Instrument – Add | Click to add a new instrument to the target |
| Instrument - Configure | Click to show the properties of the selected instrument |
| Instrument - Remove | Click to remove the selected instrument from the target |
| Offset - Add | Click to add a new offset to the target |
| Offset - Configure | Click to show the properties of the selected offset |
| Offset - Remove | Click to remove the selected offset |

**Offsets and Instruments**

An offset describes the relative position of an instrument on a boat or ROV. The offsets are defined relative to a common reference point and are measured in three dimensions: forward, starboard and up. Along with offset measurements we may need to know the heading of the boat so the heading must be measured as well.

If we are combining measurements from a GPS receiver and the acoustic transceiver, for example when calibrating the array of beacons, offsets in position between acoustic transducer and GPS antenna must be allowed for.

*NOTE*:

If the antenna has been mounted directly over the transducer then the offsets are zero and we do not have to measure the heading of the boat. If the antenna is NOT above the transducer then the heading of the boat must be measured and a digital compass is required.

It does not matter which point is chosen as the offset reference point on the boat. Convenient points would be the transducer, the GPS antenna or the centre of the transom. All offset measurements must be made from this reference point to each instrument.

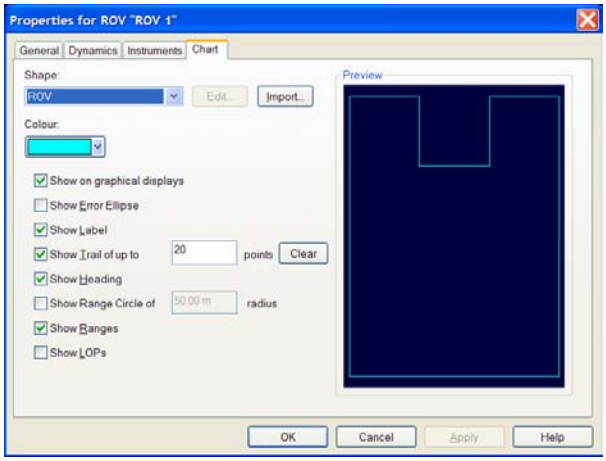
**To set measured offset values for each instrument:**

3. Attach each instrument to the boat or ROV
4. Select the instrument and offsets to change then click **Configure**
5. Type in the measured values for **Forward**, **Starboard** and **Up** then click **OK**
6. Check that the new offsets are displayed correctly in the instrument list

### 6.7.4 Setting up the Chart Page

The Chart page is used to set how the target is displayed on the chart.

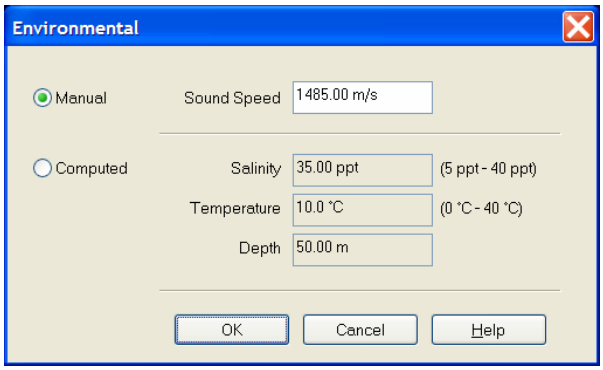
A number of options are available for each target however the default options will be correct in most cases.




| | |
|---|---|
| Shape | Selects the shape to show for this target |
| Edit | Allows creation of a new shape |
| Import | Import a shape in Drawing eXchange format (DXF), SVS or SDM format |
| Colour | The colour used for the default shape |
| Show on graphical displays | Shows or hides the target on the chart. Ensure this is set |
| Show error ellipse | Shows or hides the position error ellipse on the chart |
| Show label | Shows or hides the target's text label |
| Show Trail | Shows or hides the position snail trail and sets trail length |
| Show heading | Shows or hides the heading line |
| Show range circle | Shows or hides a range circle around the target |
| Show ranges | Shows or hides the acoustic ranges measured to the target |
| Show LOPs | Shows or hides the lines of position (LOPs) for the acoustic ranges |

## 6.8 Environmental - Setting the Speed of Sound

Scout USBL uses the speed of sound in water to convert the time taken to send and receive the acoustic signals into a distance. The speed of sound is set in the environmental dialog, to show this dialog select **Environmental** from the **Configure** menu.




The speed of sound can be defined in one of four ways:

- If the actual speed of sound is known then this can be entered as a Manual value
- If the water salinity, water temperature and depth are known then they can be entered and a speed calculated from them.
- If instruments are attached to the system that can measure the speed then they can be used to periodically update the value.

For some Scout USBL operations the speed of sound in water will not be known so the default value of 1485 m/s should be used. For accurate positioning it is important that the speed of sound is known.

To set the default speed of sound:

- Select the **Manual** option and set the **Sound Speed** value to 1485.0 m/s

If the water temperature is known then a computed value may be more realistic. In the open sea the salinity is usually 35 ppt but in fresh water it is 0 ppt. In areas at sea near rivers the salinity can change considerably with the tide so for accurate survey work the speed of sound should be measured regularly.

To set the speed of sound from temperature, salinity and depth measurements:

1. Select the **Computed** option
2. Enter the estimate of **Salinity**, **Temperature** and operating **Depth.** The new Sound Speed will be calculated once the values have been set.
3. Click **OK** to close the dialog.

Note: The sound speed formula used in Scout USBL is Chen and Millero (1977)

## 6.9 Guidance - Using Waypoints and Taking Fixes

### 6.9.1 Waypoints

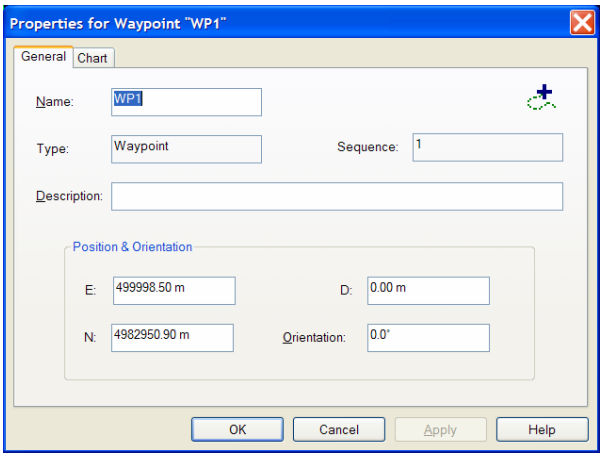
Waypoints are markers that can be added to the chart to show the position of a point of interest. Waypoints can be used to mark the position of a single small point or a set of them can be used to outline an area of interest. Waypoints can have drawing shapes associated with them so they can be used to show the positions of objects on the seabed. A range circle can be shown around each Waypoint and used to identify an exclusion zone.

Targets including the vessel can display their position relative to one or more Waypoints; this can be useful for guiding ROVs and divers on to points of interest.

Waypoints are stored in a navigation file separate from the job file, this allows the Waypoints to be shared between Jobs and set up in advance.

- To show the Waypoints page select **Guidance** then **Waypoints** from the **Configure** menu

**To add a new Waypoint:**




1. Click Add on the **Waypoints** dialog. If a navigation file has not been created a warning will show, click **Yes** and type in the name of the file to be created in the **Save As** dialog.
2. In the Waypoint properties **General** page, type in a new **Name** for the Waypoint or use the default offered.
3. Type in a **Description** if required
4. Type in the position co-ordinates of the Waypoint, its depth and an orientation if known.

**To apply a new drawing shape to a Waypoint:**

1. Click on the Chart tab to show the Chart page
2. Click Edit Shape
3. Select the shape to use, its Length, Width and Colour
4. Or click Import to import a shape in Drawing eXchange format (DXF), SVS or SDM format

**To set a range circle around a Waypoint**

1. Click on the Chart tab to show the Chart page
2. Click Show Range Circle and type in the radius to use
3. Click Apply

**To remove a Waypoint**

- Click Remove in the Waypoints dialog

### 6.9.2 Fix Points

Fix points are positions of targets recorded during tracking and can be used to record the positions of objects of interest. Each fix point has a position, a position error, a time the fix was taken and an associated description. A fix is shown on the chart as a green cross (+). Fix points cannot be modified once created and they cannot be deleted.

Two types of position fix can be taken, a single fix or an average fix. A single fix will simply take the next position of the target and add a Fix Point at that position. An average fix will use the Average Fix Tool to compute an average of a set of positions for the target along with statistics to indicate the quality of the position fix.

Fixes are taken using the Fix Toolbar but fixes can be seen using the Fix Points dialog.

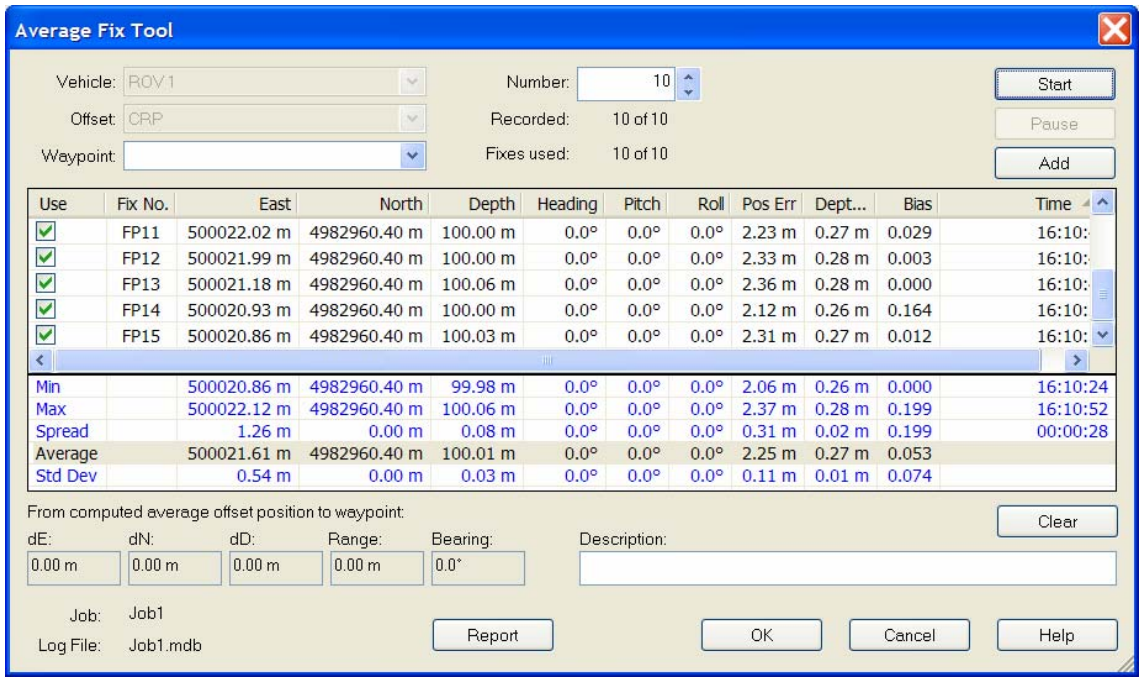
- To show the Fix Toolbar, from the **View** menu select **Toolbar** then **Fix**
- To show the Fix Points page select **Guidance** then **Fix Points** from the **Configure** menu

**To add a single Fix point:**

- On the **Fix Toolbar**, select the target to take a fix on then click the **Manual Fix** button.

**To take an Average Fix**

1. On the Fix Toolbar click Avg. Fix. To show the Average Fix Tool
2. Select the Vehicle (target) and the Number of fixes to take then click Start




The Average Fix Tool calculates the minimum and maximum Eastings and Northings value along with the spread (Maximum – Minimum) and the standard deviation.

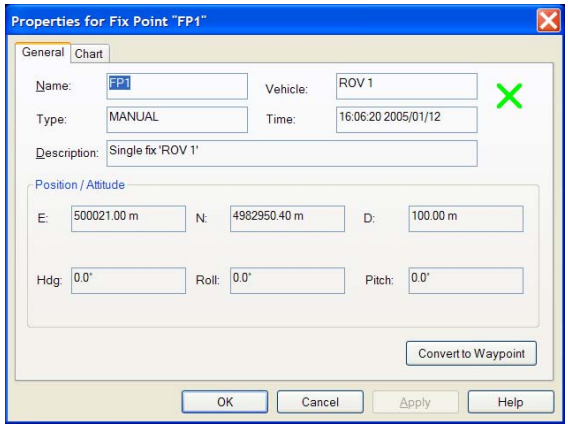
- To create a report on the position fix click the Report button
- To clear the fixes recorded so far click the Clear button.

**To convert a Fix Point into a Waypoint:**

- On the **Fix Points** dialog, right click on the Fix Point to change and select **Convert to Waypoint**

**To enable or disable automatic prompt for description:**

- On the **Fix Points** dialog set or unset the **Prompt for a description when a new fix is made** check box



## 6.10 Reports - Connecting Scout USBL to another computer

Scout USBL can send position information to other computers over a serial link using a Report. The two computers need to be joined together using a serial cable, Scout USBL is then configured to send the Report and the other computer must be configured to receive it.

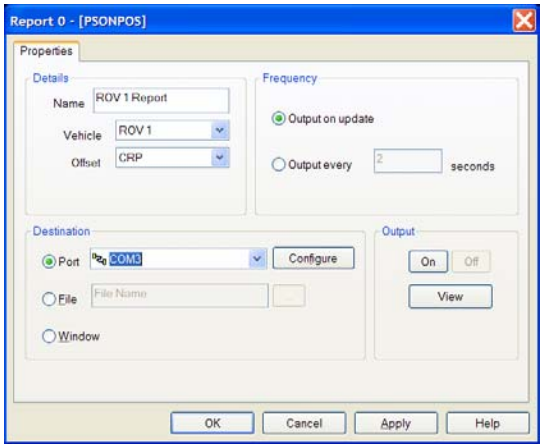
A Report contains information about a single target, so if you want to send information about lots of targets at the same time you can send multiple reports to the other computer over the same serial link.

- To show the Report Manager display properties select **Reports** from the **Configure** menu.

This display shows all the Reports currently defined in the system.

**To add a new Report:**

1. To add a new Report click **Add**, select the type of Report required from the list and click **OK**.
2. In the Report properties set the **Name** for the Report, which target (**Vehicle**) it relates to and the **Offset** on the vehicle (CRP by default)
3. Choose to output the report every time the target is positioned by selecting **Output on update** (default) or output at a given interval using **Output every N seconds**
4. Select the **Destination** serial port to use and click the Configure button to set the baud rate.
5. To see the Report click the View button
6. Switch the Report on by clicking the **On** button, to disable the Report click the **Off** button

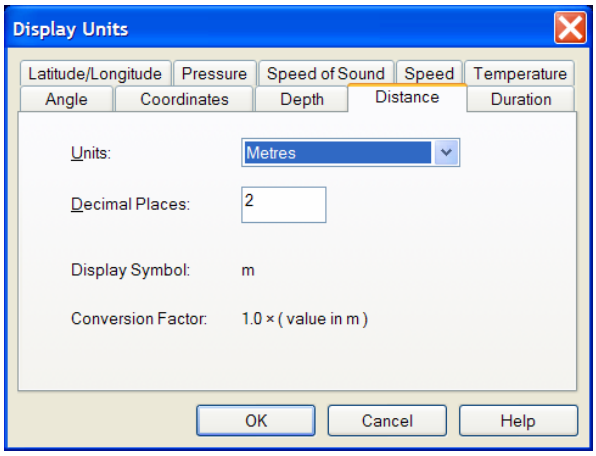



The format of each report is described in section 12.2 Report Formats.

**Tracking Multiple Targets**

An output Report sentence can be created for each individual target and be fed to an external navigation system or GIS. Where multiple position Reports are used it is recommended that one of the proprietary sentences be used rather than a NMEA GGA sentence as the proprietary sentences include the name of the target being tracked.

## 6.11 Configuring the display units




The units used for displaying values for distance, depth, speed and so on can be set using the Display Units properties. Each tab allows a different unit to be selected and the number of decimal places to show but also shows the display symbol used and the conversion factor applied.

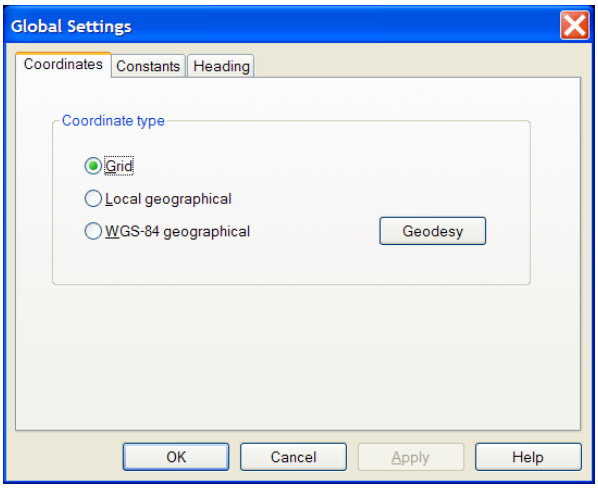
- To show the Units pages select **Units** from the **Configure** menu.

## 6.12 Global Settings - Selecting a co-ordinate display format

By default the system will display positions for targets in grid co-ordinates as Eastings and Northings. If the targets are being positioned in real-world co-ordinates then it is possible to display the position in geographical co-ordinates as a latitude and longitude. Targets can be positioned in real-world co-ordinates if a GPS receiver is connected to the system or the vessel is using a reference beacon itself positioned in real-world co-ordinates.

The co-ordinate display format is set using the Global Settings properties Co-ordinates page.

- To show the Co-ordinates page select **Global Settings** from the **Configure** menu.




- To show the co-ordinates in the default grid format select **Grid**
- Select **Local geographical** to show the co-ordinates in the local datum
- Select **WGS84 geographical** to show the co-ordinates in the WGS84 datum used by GPS receivers

Note: If the targets are being positioned relative to the ship only then they will be shown with small co-ordinate numbers generally less than 1000m, such as 234E 475N. If the targets are being positioned in real-world co-ordinates then they will be shown with much bigger numbers, such as 418578E 5579436N.

Co-ordinate formats are described in Section 10: Geodesy

# 7 TOOLS AND WIZARDS

## 7.1 Motion Sensor Calibration Tool – *MagField Mapper*

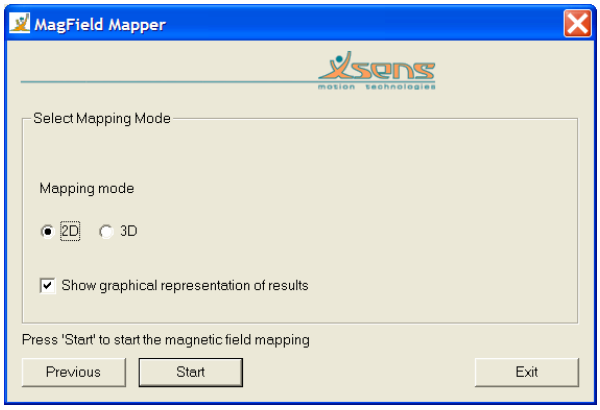
The motion sensor in the USBL transceiver can be used to accurately record its orientation in three dimensions. However, when the sensor is mounted close to an object that contains ferromagnetic materials this causes errors in the measured orientation. These errors can be removed by calibrating the sensor using the Motion Sensor Calibration Tool. The calibration only has to be performed once during the period in which the transceiver is deployed.

To calibrate the sensor measurements have to be recorded from the sensor while the transceiver is deployed in its working position. Measurements have to be made at all orientations so the simplest procedure is to sail the boat in a circle while collecting measurements.

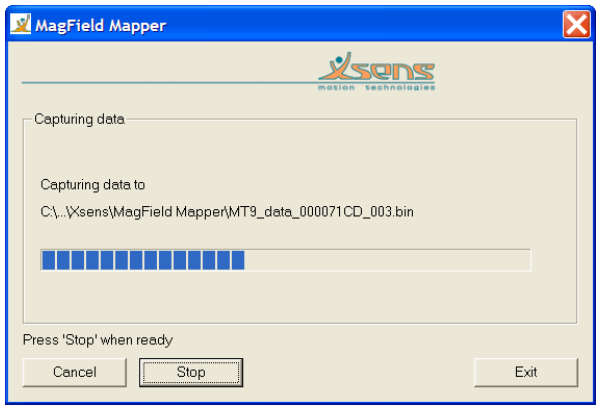
**To calibrate the motion sensor:**

1. Ensure the USBL transceiver is connected and working correctly.
2. Close the Scout program
3. From the **Desktop**, double-click the **MagField Mapper** icon**.** The Magfield Mapper program will appear.

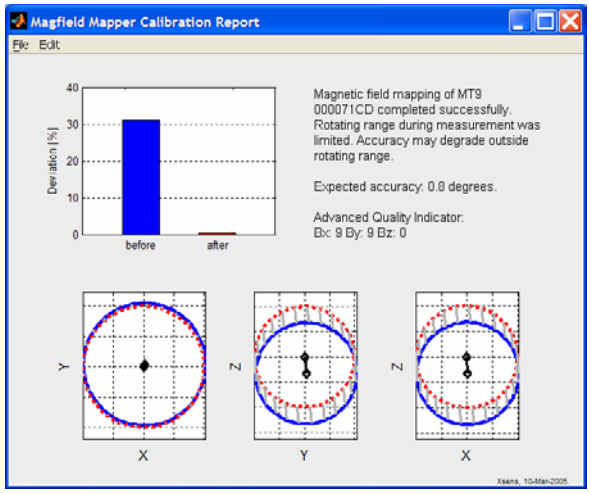
4. Set the baud rate to be 115200 baud
5. Click the **Scan** button. If the motion sensor is found click **Next**
6. If the motion sensor has not been found then the button will still say **Scan**. Check all cabling and connectors to the transceiver then click the **Scan** button again.
7. On the **Change Input Type** page select the **Use XXXX on COM3** option, where XXXX is the serial number of the sensor in the transceiver. Click **Next**.
8. In the **Select Output Directory** page use the default directory offered.
9. In the **Select Mapping Mode** Page select **2D** mapping mode and select **Show graphical representation of results.**



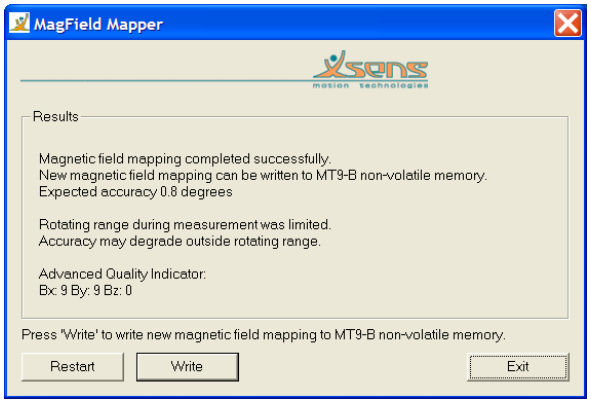

10. Press **Start** to start recording measurements
11. Sail the boat in a complete circle at slow speed. The circle should be a small diameter.



12. When the circle is complete press the **Stop** button. The measurements will then be processed and a Calibration Report
13. Close the Calibration Report Dialog

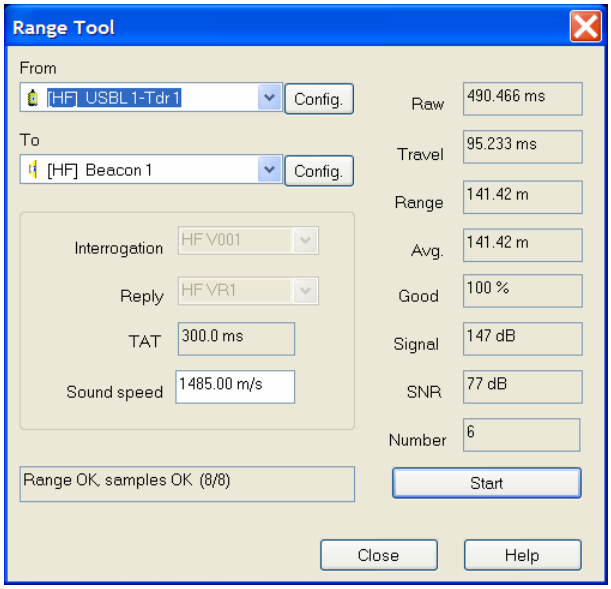



14. If the results are acceptable press **Write** to save the results in the transceiver.
15. Click **Exit** to close the MagField Mapper program.
16. To re-start **Scout**, double-click the Scout icon on the **Desktop**



## 7.2 Range Test Tool

The Range Test Tool can be used to check that the transceiver and beacons are working correctly. The Tool will continuously measure the distance between the transceiver and a beacon by measuring the acoustic range between them. The beacon being used for the test must be defined in the system already.




The range measurements are made between a transceiver and a beacon selected in the **From** and **To** lists.

When the distance is being measured correctly the tool shows the raw travel time in milliseconds measured by the transceiver and that time converted to a distance in the current distance units.

| | |
|---|---|
| From | The transceiver to measure the distance from |
| To | The beacon to measure the distance to |
| Interrogation | The name of the signal being used to interrogate the beacon, set in the beacon's property pages |
| Reply | The name of the reply signal |
| Config. | Shows the property pages for the transceiver or beacon |
| TAT | Turn Around Time. This is the delay between the beacon receiving the interrogation signal and sending back the reply signal. |
| Sound speed | The speed of sound in water being used to convert the travel time to a distance |
| Raw | The raw travel time in milliseconds measured by the transceiver |
| Range | The distance in the current distance units calculated from the raw travel time |
| Avg. | The average distance measured |
| Good | A quality measure showing the percentage of measurements that succeeded |
| Signal | A quality measure in decibels showing the strength of the beacon's reply signal received by the transceiver |
| SNR | A quality measure in decibels showing the ratio between the beacon's reply signal level and the background noise level received by the transceiver |
| Number | The number of measurements made |
| Comment | Shows if the measurement succeeded and the number of samples measured |
| Start/Stop button | Starts and stops the test |

**To test the range measurement to a beacon:**

1. Select the transceiver as the **From** instrument if it is not already
2. Select the beacon to test as the **To** instrument
3. Check that the **Interrogate** and **Reply** signals are correct for the beacon being tested. If not set correctly then change the values in the beacon's property pages accessible using the **Config** button.
4. Click **Start** to start the test and **Stop** to stop the test

- If the distance is measured correctly the **Raw** and **Range** values show non-zero numbers and the **comment** shows 'Range OK'.
- If the distance is not being measured the **Raw** and **Range** values are zero and the **comment** shows 'Range failed'.

## 7.3 Geodesy Test Tool

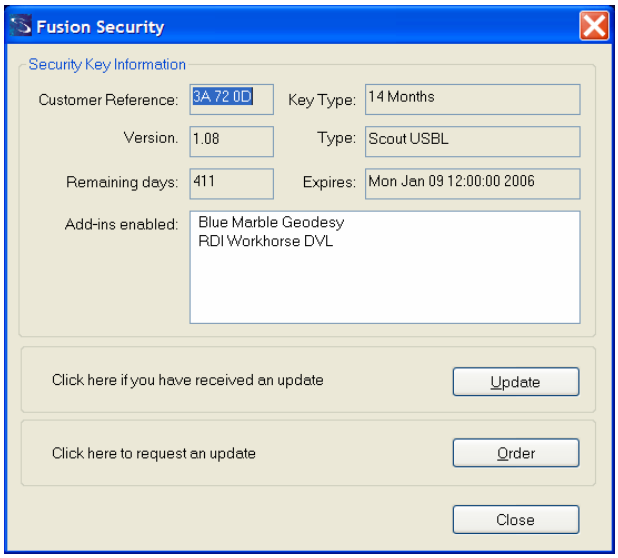
The Geodesy Test Tool is described in Section 10 Geodesy

## 7.4 Security Tool

The Security Tool is used to show the current configuration of the security key, to update the key with a new configuration or to request an update to the key.

The keys will stop working or expire after a fixed number of days and an update is required to allow them to work again.

Scout USBL has a number of optional features that can be included and these are called 'Add-ins', these options include the use of extended geodesy capability. The security key allows the use of the add-ins.




| | |
|---|---|
| Customer reference | The customer's reference number |
| Version | The version of Scout that this software key is configured for |
| Remaining days | The number of days remaining before the key expires |
| Key type | The type of key fitted |
| Type | The application type the key is configured for |
| Expires | The date that the key expires |
| Add-ins enabled | The Add-ins configured in the key |
| Update button | See Updating the security key below |
| Order button | See Requesting an update below |

**Updating the security key**

To update the key using a file or string, press the Update button. The Update Security Key dialog is then shown.

- If you are updating the key using a file then select the file to update and click Open

Or

- If you are updating the key using a string then select the Enter String Update option and paste the string into the text box. Click Update to update the key.

**Requesting an update**

To request an update to the security key press the Order button. The Request Update dialog is shown.

1. Type in your name, telephone number, email address, fax number and company name and address
2. Type in the Security Key Serial Number, this can be found on the key itself next to the letters 'CE'
3. Select the system and the add-ins required
4. Click the **Print** button to make a paper copy of the request that can be faxed to Sonardyne
5. Click the E-Mail button to send the request to Sonardyne by email.

## 7.5 Replay Tool

A demonstration project containing tracking data is included as part of the Scout USBL installation. Using the Replay Tool, target positions logged in the data file can be replayed, displayed and output as reports. During Replay, the same controls and displays that are active during Tracking are available, this allows an operator to familiarise themselves with the various displays and configuration options.

**To open the Scout USBL Demo Project:**

1. From the **File** menu select **Open**. If a job is currently open, you will be asked to close this job first.
2. From the **Open** dialog, select the Demo Data folder. For a default installation of Scout USBL, the demo data is stored in:

   `\Program Files\Sonardyne\Pharos\Projects\Demo Data\Configuration`
3. Select the file `USBLDemo.jcf`

**To Replay Tracking Data:**

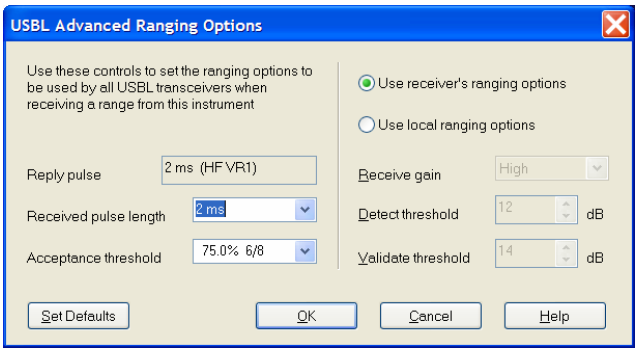
1. Ensure that the Scout USBLDemo log file is selected. From the **Configure** menu, select **Logging…** and check that the `USBLDemo.mdb` log file is selected. For a default installation of Scout USBL, the demo data is stored in:

   `\Program Files\Sonardyne\Pharos\Projects\Demo Data\Log Files`
2. From the Tools menu, select **Replay**. The Replay Control dialog will appear. Press the **Play** button  to start replaying the data. The Replay Control dialog allows you to control the playback speed and to select the start and stop times in the log file from which to replay data.
3. During replay, the following functionality or information is available:
   - Chart displays
   - Text displays
   - Guidance display
   - Travel Time display
   - List displays

# 8 ADVANCED TRACKING

## 8.1 Beacons - Advanced ranging options

This dialog allows you to change some of the advanced options available when measuring acoustic ranges, these options should only be changed in extreme circumstances. The options apply only to the selected beacon so if more than one beacon is being tracked then the options will need to be changed separately for each beacon.




- To show this dialog, show the property page for a beacon and click the **Advanced USBL** button.

| | |
|---|---|
| Reply pulse | This shows the length of the reply signal pulse sent back by the beacon and the signal's channel |
| Received pulse length | Sets the amount of the reply pulse to use |
| Acceptance threshold | Sets the threshold over which a reply pulse can be accepted |
| Use receivers/local ranging options | Choose to use local or receiver's ranging options |
| Receive gain | The receive gain to use when receiving signals from this beacon |
| Detect threshold | The detect threshold to use when receiving signals from this beacon |
| Validate threshold | The validate threshold to use when receiving signals from this beacon |
| Set Defaults button | Sets the controls to their default values |

**Setting the Received pulse length and Acceptance threshold**

In some unusual tracking situations the reply signal from a beacon can bounce off the surface, seabed or a structure underwater (multipath) and arrive at the transceiver just after the signal that came directly from the beacon. If the multipath signal arrives while the direct signal is still being received it may destroy the back of the wanted, direct signal and stop the direct signal being received correctly.

One way around this problem is to tell the transceiver to look only for the front part of the reply signal and ignore the other half. Reply signals from Scout USBL beacons are 2 milliseconds long so to overcome some multipath problems we can set the **Received pulse length** to 1 ms.

The Acceptance threshold sets how much of the signal has to be received before it is considered valid. In situations where the signal is being destroyed by multipath this value can be reduced however this increases the chances of a false position being generated.

Use the **Set Defaults** button to set the controls to their default values.

**Using local ranging options**

Where more than one target is being tracked and some are close to the transceiver while others are far away tracking can be improved by using separate receive options for each target's beacon. By default the receive options are set the same for all beacons, the values set in the transceiver's properties.

**To select a different set of values for a beacon:**

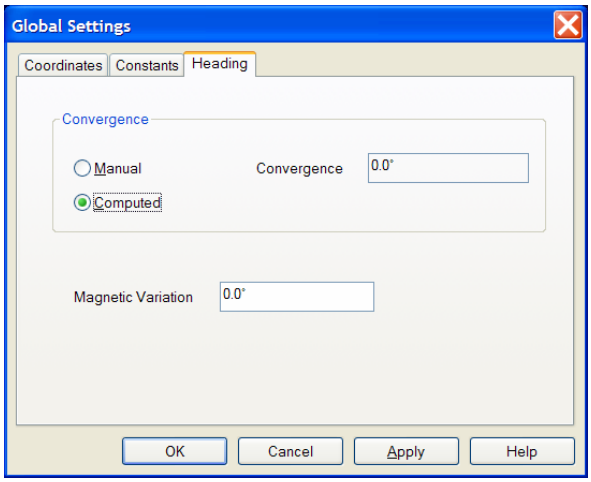
1. Select Use local ranging options
2. Select the required Receive gain, Detect threshold and Validate threshold
3. Click OK

Use the **Set Defaults** button to set the controls to their default values.

## 8.2 Advanced Heading Options

Advanced heading options can be set using the Global Settings Heading page.

- To show this page, select **Global Settings** from the **Configure** menu and click the **Heading** tab.




The convergence value is used to convert grid heading to true and is dependent on where in the world you are working. This value is small and need only be set if an accurate gyrocompass is fitted to the system.

- Select **Manual** and enter a value if the value is known for the operating area.
- Select **Computed** if a GPS receiver is connected to the system as the value can be calculated if the position of the vessel is known.

The Magnetic Variation value is used to convert magnetic heading to grid heading and should be set if an accurate gyrocompass is **NOT** fitted to the system and heading from the transceiver is being used for positioning. The value to be used is dependent on where in the world you are working and it is often printed on the nautical chart for the working area.

## 8.3 Using Depth Measurements from an External Instrument

Scout USBL can be connected to external depth instruments that provide the depth of a target in real time. This feature is particularly useful when tracking targets alongside the vessel rather than under the vessel as it is difficult to calculate a target's depth in this position.
Supported depth strings include:

- $PSSIROV
- Depth instrument
- Seaeye depth
- $SONDEP

External depth instruments connect to Scout USBL over a serial link. The formats of the strings from these instruments are described in Section 12.3: Depth instrument formats.

**Offsets on the Target**

The depth instrument reports depth measurements at the depth of the sensor on the instrument. Scout USBL positions the transducer at the top of the beacon so any depth difference between the transducer and the depth instrument must be accounted for in the depth instrument offset. The offset defines the position of each instrument on the target. In most cases the transducer on the top of the beacon is defined as the origin (0,0,0) and other instruments are positioned relative to it. As this is a depth instrument the forward and starboard position does not matter and can be left at zero. The height difference between transducer and depth instrument does matter and is defined as a value measured in the Up direction.

Measure the difference in height between the acoustic transducer and the depth instrument, if the depth sensor is below the acoustic transducer then set the Z offset value (Up) to minus the measured value.

**Measurement errors**

Each type of instrument will give depth measurements to a different accuracy. By default the depth measurements are given an accuracy of 1 metre, if your instrument gives measurements considerably more accurate or worse than this then the measurement error should be set correctly in the depth instrument properties.

**To create an external depth instrument:**

1. From the **Configure** menu select **Instruments**
2. Click Add and select Depth Instrument
3. Select the correct depth instrument type, type in a name for the instrument and click **OK**
4. On the depth instrument property page select the serial port to use
5. Click the **Config. Port** button and set the serial connection options. Click **OK**.
6. On the depth instrument property page click the Configure button
7. On the Configure Depth Instrument page, set the depth measurement error and click **OK**
8. Close the depth instrument property page

**To attach the depth instrument to the target**

1. From the **Configure** menu select **Vehicles**
2. Select the target to add the depth instrument to and click the **Instruments and Offsets** tab.
3. On the **Instruments and Offsets** page click Instrument **Add**, select the new depth sensor from the list and click **Add**. The instrument will be added to the target at offset 0,0,0.
4. Set the offset values as required.

# 9 ADVANCED CHART OPTIONS

## 9.1 To change the Chart centre

The chart can be altered so that it centres on a target or it follows the targets.

**To centre the chart on a target:**

1. Click on the target to centre on in the chart to select it
2. From the **View** menu select **Centre** then **Centre on Vehicle**

The chart will now centre on the selected target so the target stays in the middle and the chart moves under it.

**To make the chart follow a target:**

1. Click on the target to centre on in the chart to select it
2. From the **View** menu select **Centre** then **Follow Vehicles**

**To set the chart back to the normal manual operation:**

- From the **View** menu select **Centre** then **Manual**

## 9.2 To change the Chart Colours

The colours used for the chart objects can be altered

- From the View menu select Display Properties then show the Colours page.

## 9.3 To set a Chart Backdrop

The chart can display a vector drawing as a backdrop loaded from a Drawing eXchange Format (DXF) file.

1. From the **View** menu select **Display Properties**
2. Click the **Backdrop** page
3. Click the file button to the left of **Current Backdrop** to show the **Open** dialog. Select the file to open and click **OK**.
4. When the file has been loaded a preview is shown along with a default centre co-ordinate.
5. Change the centre co-ordinate if the backdrop is not in real-world co-ordinates or the same co-ordinate frame as Scout USBL is using.
6. Click **OK** to close the Chart property pages

# 10 GEODESY

## 10.1 Introduction

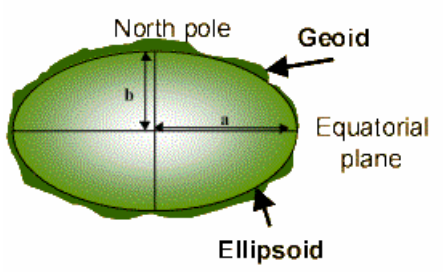
This section of the manual covers the complicated subjects of geodesy, the shape of the Earth, models of the Earth and position co-ordinates.

For tracking operations where the targets are positioned relative to the boat this section is not required reading. For any tracking operation where the vessel itself is positioned using a GPS receiver or in real-world co-ordinates then this section is important.

For any place in the world there are many different Latitudes and Longitudes and many different grid co-ordinates in Eastings and Northings. The Latitude and Longitude changes for each point depending on the model of the Earth being used. The grid co-ordinates change with the way Latitude and Longitude are converted to Eastings and Northings. As there are so many possibilities, positions for tracked targets must always specify which Earth model is being used and how the co-ordinates are being converted.

### 10.1.1 Datums and Ellipsoids

The earth's physical surface includes mountains, valleys, rivers and surface of the sea. It is highly irregular and not suitable for calculating positions, so a more smoothed representation of the earth is used called the Geoid. The Ellipsoid is a smooth mathematical surface that best fits the shape of the Geoid but even so it's not always a good fit everywhere on the planet.




An ellipsoid is defined by:

a semi-major axis
b semi-minor axis
f flattening

Some Ellipsoids are designed to fit the whole Earth equally well (or badly) while others are designed to fit better in smaller areas. This is why there are different Ellipsoids. When an Ellipsoid is tied to the Earth and co-ordinates for specific points are described, a Datum is created.

It is often necessary to define the co-ordinates of a point in more than one datum. In order to do this a Datum Transformation is performed. This is a mathematical technique that enables the co-ordinates to be converted from one datum to another using a defined mathematical model. A series of datum transformation parameters and point position co-ordinates are input to the model to yield a new set of co-ordinates referenced to the second datum.

WGS84 is the reference ellipsoid used by NASA. It is the Defense Mapping Agency (DMA) World Geodetic System 1984 (WGS84) ellipsoid model used for the Global Positioning System (GPS). This is the default ellipsoid used for positions given by GPS receivers and the default used by Scout USBL.

### 10.1.2 Datum Transformations

The datum transformation is the mechanism for converting co-ordinates from one Datum to another.

The Cartesian co-ordinate frame must be defined by specifying the origin and the orientation of the three axes of the Ellipsoid. A spheroid is then associated with the Cartesian co-ordinate frame at a single point or multiple points to produce the datum. A point on, above or below the earth's surface is uniquely defined by three co-ordinates (X,Y and Z).

**None**

Where the datum used for tracking is the same as that used for the position measurements then no transformation is required.

**3 and 7 Parameter**

When point co-ordinates require converting to another datum a 'datum transformation' is applied. This entails shifting the origin of Datum A to match the origin of Datum B (translation), re-aligning the axes of Datum A so they become parallel with Datum B (rotation) and re-scaling Datum A to match Datum B (scaling).

This process can involve seven parameters:

- X, Y and Z translation parameters
- X, Y and Z rotation parameters
- s - scaling parameter in ppm

It is possible to use any combination of these parameters in order to perform the transformation. However, in many cases the rotation and scaling parameters are accounted for in the translation parameters and this leads to the simpler three-parameter transformation.

**Molodensky (Blue Marble Add-in)**

The Molodensky transformation method shifts co-ordinate values between local and geocentric datums. It provides a general solution with limited accuracy and provides a transformation that is accurate to within 5-10 meters. The Molodensky method can be defined for local geodetic datums worldwide.

This option is only available if the Blue Marble Geodesy Add-in is enabled, see Section 10.1.4

**NADCON (Blue Marble Add-in)**

The NGS NADCON method transforms co-ordinate values between the North American Datum of 1927 (NAD 27) and the North American Datum of 1983 (NAD 83). The NGS NADCON method provides a transformation that is accurate to within 0.15-0.5 meters.

The NGS NADCON method applies a simple interpolation algorithm using a gridded set of standard datum shifts as parameters. The shift values for a geographic area are stored in a pair of grid files, the first representing latitude shifts (named with the extension .las) and the other representing longitude shifts (named with the extension .los).

This option is only available if the Blue Marble Geodesy Add-in is enabled, see Section 10.1.4

### 10.1.3 Co-ordinate systems and Projections

A co-ordinate can be thought of as a magnitude that defines a position. The co-ordinates of a point can be described in one, two or three dimensions. A one-dimensional system simply consists of distance along a straight line (e.g. how far along the line is the point from some arbitrary origin).

A two dimensional system describes the position of a point on some surface. This can be either a flat surface or a curved (sphere, spheroid) surface. In both cases only two co-ordinates are required to define the unique position of a point (e.g. x and y, Easting and Northing or latitude and longitude).

A three dimensional system implies that three co-ordinates are required to uniquely define the position of a point. This again can be either a flat earth or spherical application. The grid will consist of the two horizontal co-ordinates plus a height (Orthometric height) and the spherical co-ordinates consist of the position of the point normal (or vertical) to a surface (e.g. ellipsoid) plus some height.

A co-ordinate system can also be known as a Terrestrial Reference Frame (TRF)

**Geodetic co-ordinates**

A Geodetic co-ordinate system is a three-dimensional co-ordinate system defined by an ellipsoid (usually of revolution), the equatorial plane of the ellipsoidal and a plane defined along the polar axis (a meridional plane).

Co-ordinates in a geodetic co-ordinate system are shown as a geodetic latitude and longitude. The geodetic latitude is the angle between the normal to the ellipsoid at a location and the equatorial plane. The geodetic longitude is the angle between the meridional reference plane and a meridional plane containing the normal to the ellipsoid at a location. Height is given as a geodetic height, the perpendicular distance of a location from the ellipsoid.

**Plane co-ordinates**

Plane co-ordinates are the simplest types of co-ordinates to use for everyday practical applications. To achieve this simplicity, the ellipsoidal latitude and longitude co-ordinates, or 3-D geocentric co-ordinates, must therefore be projected onto a plane surface. It is not possible to do this without some distortion. This problem can be demonstrated by attempting to wrap a piece of paper around an orange.

Basic projection properties include:

- Central Latitude
- Central Longitude or Central Meridian (CM)
- False Easting
- False Northing
- Scale Factor

**Technical Note: The Datum Transformation Rotation Convention**

The datum transformation rotation convention used in Scout USBL is the same as the Co-ordinate Frame Rotation Convention. This convention, also known as the Helmert Transformation or US Department of Defence (or DMA) Convention, is a right-handed co-ordinate frame where the rotation is considered to be of the co-ordinate axes.

$$\begin{bmatrix} X_2 \\ Y_2 \\ Z_2 \end{bmatrix} = \begin{bmatrix} \Delta X \\ \Delta Y \\ \Delta Z \end{bmatrix} + \left(1 + S * 10^{-6}\right) * \begin{bmatrix} 1 & R_Z & -R_Y \\ -R_Z & 1 & R_X \\ R_Y & -R_X & 1 \end{bmatrix} * \begin{bmatrix} X_1 \\ Y_1 \\ Z_1 \end{bmatrix}$$

The alternative convention is the position vector rotation convention, this is also known as the Bursa-Wolf Model, European or Bomford Convention where the rotation is considered to be of the point position around the co-ordinate axes. The difference between the two conventions is the sign of the rotation values.

Always check a datum transformation with a known point using the Geodesy Test Point Tool.

**Universal Transverse Mercator (UTM)**

The Universal Transverse Mercator (UTM) co-ordinate system is an international plane co-ordinate system developed by the US Army. The system extends around the globe from 84 degrees north to 80 degrees south. The world is divided into 60 zones in the Northern Hemisphere and 60 zones in the Southern Hemisphere, where each zone covers 6 degrees of longitude. Each zone extends 3 degrees eastward and 3 degrees westward from its Central Meridian and zones are numbered west to east from the 180-degree meridian.

This projection is the default used by Scout USBL, as it is a simple, commonly used projection that can be used in all parts of the world except the Poles.

The central Latitude, False Easting, False Northing and Scale Factor are all fixed values. The UTM Zone selected defines the Central Meridian:

| Zone | Central Meridian | Extent |
|---|---|---|
| 1 | 177W | 180W-174W |
| 2 | 171W | 174W-168W |
| 3 | 165W | 168W-162W |
| 4 | 159W | 162W-156W |
| 5 | 153W | 156W-150W |
| 6 | 147W | 150W-144W |
| 7 | 141W | 144W-138W |
| 8 | 135W | 138W-132W |
| 9 | 129W | 132W-126W |
| 10 | 123W | 126W-120W |
| 11 | 117W | 120W-114W |
| 12 | 111W | 114W-108W |
| 13 | 105W | 108W-102W |
| 14 | 99W | 102W-96W |
| 15 | 93W | 96W-90W |
| 16 | 87W | 90W-84W |
| 17 | 81W | 84W-78W |
| 18 | 75W | 78W-72W |
| 19 | 69W | 72W-66W |
| 20 | 63W | 66W-60W |
| 21 | 57W | 60W-54W |
| 22 | 51W | 54W-48W |
| 23 | 45W | 48W-42W |
| 24 | 39W | 42W-36W |
| 25 | 33W | 36W-30W |
| 26 | 27W | 30W-24W |
| 27 | 21W | 24W-18W |
| 28 | 15W | 18W-12W |
| 29 | 9W | 12W-06W |
| 30 | 3W | 6W-0W |

| Zone | Central Meridian | Extent |
|---|---|---|
| 31 | 3E | 0E-6E |
| 32 | 9E | 6E-12E |
| 33 | 15E | 12E-18E |
| 34 | 21E | 18E-24E |
| 35 | 27E | 24E-30E |
| 36 | 33E | 30E-36E |
| 37 | 39E | 36E-42E |
| 38 | 45E | 42E-48E |
| 39 | 51E | 48E-54E |
| 40 | 57E | 54E-60E |
| 41 | 63E | 60E-66E |
| 42 | 69E | 66E-72E |
| 43 | 75E | 72E-78E |
| 44 | 81E | 78E-84E |
| 45 | 87E | 84E-90E |
| 46 | 93E | 90E-96E |
| 47 | 99E | 96E-102E |
| 48 | 105E | 102E-108E |
| 49 | 111E | 108E-114E |
| 50 | 117E | 114E-120E |
| 51 | 123E | 120E-126E |
| 52 | 129E | 126E-132E |
| 53 | 135E | 132E-138E |
| 54 | 141E | 138E-144E |
| 55 | 147E | 144E-150E |
| 56 | 153E | 150E-156E |
| 57 | 159E | 156E-162E |
| 58 | 165E | 162E-168E |
| 59 | 171E | 168E-174E |
| 60 | 177E | 174E-180E |

### 10.1.4 The Blue Marble Geodesy Add-in

One of the add-in options available with Scout USBL is the Blue Marble Geodesy. This add-in provides support for more ellipsoids, datum transformations and projections:

**Basic options**

Datum transformations:
- None
- 3 Parameter
- 7 Parameter

Projections:
- Transverse Mercator
- Universal Transverse Mercator (UTM)

**Blue Marble options**

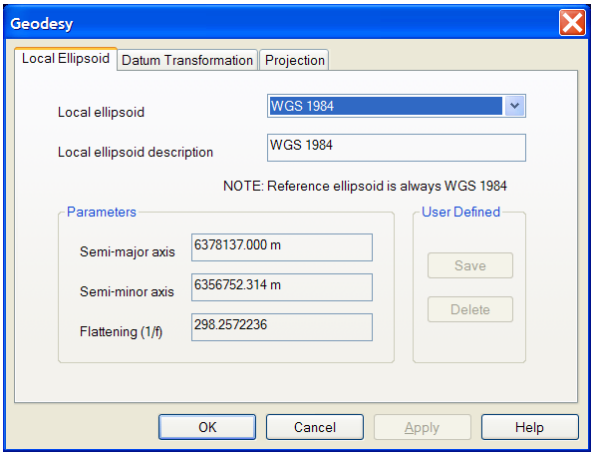
Datum transformations:
- None
- 3 Parameter
- 7 Parameter
- Molodensky
- NADCON

Projections:
- Transverse Mercator
- Universal Transverse Mercator (UTM)
- Lambert 1 parallel
- Lambert 2 parallel
- RSO
- Polar stereographic
- Cassini

To add the Blue Marble Geodesy option to your Scout USBL system, please contact Sonardyne International.

## 10.2 Setting the Geodesy Options

The Geodesy pages allow you to enter geodetic parameters within Scout USBL so positions in geographical co-ordinates can be correctly converted to grid co-ordinates and vice versa.



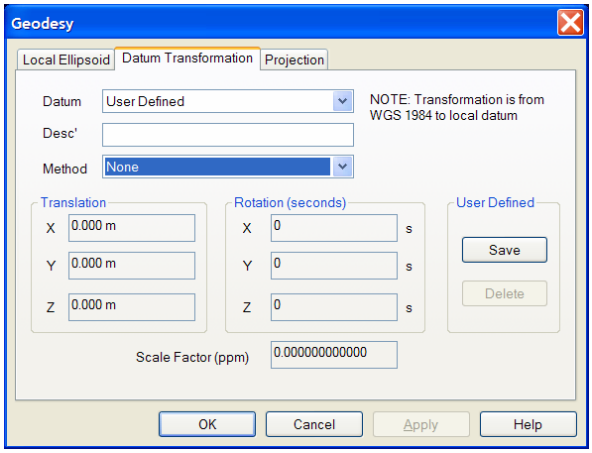

The **Local Ellipsoid** page allows you to select a pre-defined ellipsoid or to create a user defined ellipsoid.

By default use the WGS84 **Local ellipsoid**, as this is the one used by the Global Positioning System.

| | |
|---|---|
| Local Ellipsoid | Allows a pre-defined ellipsoid to be selected from the available list. Selecting **User Defined** allows you to define your own ellipsoid parameters. The default is WGS 1984.<br>**Note:** The drop-down list for selecting **Local Ellipsoid** is greyed out when the **Datum Transformation Method** at the Datum Transformation tab is set to **None**. Change this to **3** or **7 Parameter** or **Nadcon** to enable the list. |
| Local Ellipsoid Description | The user defined name for the ellipsoid. This can only be edited if a user defined local ellipsoid is selected. |
| Semi-Major Axis | The value of the semi-major axis. This can only be edited if a user defined local ellipsoid is selected. |
| Semi-Minor Axis | The value of the semi-minor axis. This can only be edited if a user defined local ellipsoid is selected. |
| Flattening | The flattening value. This can only be edited if a user defined local ellipsoid is selected. |
| Save button | Saves the selected user defined ellipsoid and the parameters defined. |
| Delete button | Deletes the selected user defined ellipsoid and the parameters defined. |

The **Datum Transformation** page allows you to select the datum transformation method and associated transformation parameters

By default use the datum transformation **Method** 'None'.




| | |
|---|---|
| Datum | Allows the datum to be selected from the drop-down list. |
| Description | The user defined description for the selected datum. This can only be edited if a user defined datum is selected. |
| Method | Allows the selection of datum transformation method. The default is **None**. **Note:** When set to **None** the drop-down list for selecting |

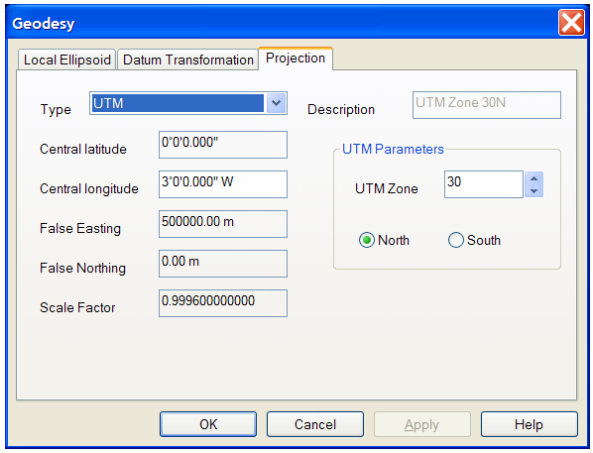
| | |
|---|---|
| | **Local Ellipsoid** is greyed out at the Local Ellipsoid tab. Change from **None** to **3** or **7 Parameter** or **Nadcon** to enable the list. |
| Translation XYZ | Value of translation |
| Rotation XYZ | Value of rotation. Not available when **3 Parameter** is selected. |
| Scale Factor | The scale factor entered in parts per million. |

If **Nadcon** is selected as the **Method**:

| | |
|---|---|
| Nadcon Latitude File | The selected Nadcon Latitude file to use. The file can be selected by clicking the button. |
| Button | Opens the **Open** dialog where the Nadcon Latitude file to use can be selected. |
| Nadcon Longitude File | The Nadcon Longitude file to be used. The file opened will depend on the Nadcon Latitude file selected. |
| Path | The location of the selected Nadcon Latitude File. |

The **Projection** page allows you to select the projection to use to convert positions in latitude and longitude to Eastings and Northings.

By default use the UTM projection **Type** and select the correct **UTM Parameters** for your working area.




| | |
|---|---|
| Type | Allows projection type to be selected. The default is UTM Zone 30 North. |
| Description | Description of the selected projection type |
| Central Latitude | The latitude value representing the origin of the projection |
| Central Longitude | The longitude value representing the origin of the projection |
| False Easting | False Easting co-ordinate value |
| False Northing | False Northing co-ordinate value |
| Scale Factor | Scale factor value. |
| UTM Zone | The UTM zone when UTM is selected as the Projection Type. The value can be between 1 and 60. |
| UTM North/South radio buttons | When selected indicates that the UTM zone selected is in the Northern or Southern hemisphere. |

If Lambert 2 parallel is the selected projection:

| | |
|---|---|
| North Parallel | Northern limit of Lambert 2 projection to use |
| South Parallel | Southern limit of Lambert 2 projection to use |

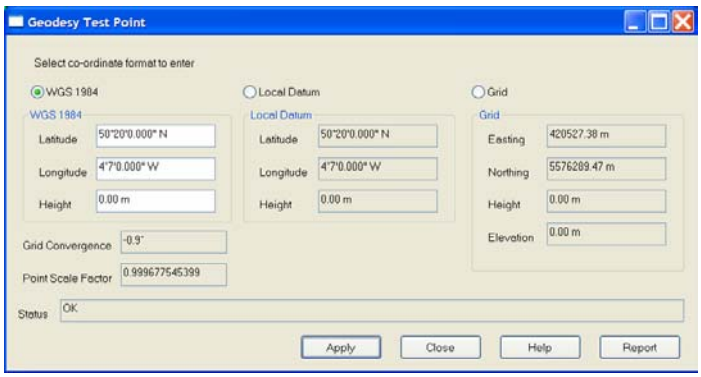
If RSO is the selected projection:

| | |
|---|---|
| Azimuth | Angle of projection centreline relative to true north. Only available when RSO is selected. |
| Skew Azimuth | Convergence at centre point of projection. Only available when RSO is selected. |

## 10.3 The Geodesy Test Point Tool

The geodesy Test Point Tool can be used to check the datum shift and projection for a test point.

The co-ordinates of the point are entered in WGS84 geographical, local datum geographical or grid co-ordinates and the tool can be used to convert between co-ordinate frames and datums.




- To show the Geodesy Test Point tool select **Geodesy Test** from the **Tools** menu.

**To convert a point from WGS84 geographical to local datum geographical and grid:**

1. Click the **WGS 1984** button
2. Type in a **Latitude**, **Longitude** and **Height** remembering to include N or S for the Latitude hemisphere and E or W for the Longitude hemisphere.
3. Click **Apply** and the co-ordinates will be converted

**To convert a point from Grid to local datum geographical and WGS84 geographical:**

1. Click the **Grid** button
2. Type in an **Eastings**, **Northings** and **Height**.
3. Click **Apply** and the co-ordinates will be converted

# 11 THE MOTION SENSOR MODULE

## 11.1 Introduction

The Motion Sensor Module (MSM) provides an interface between the motion sensor fitted inside the transceiver and the Scout USBL software.

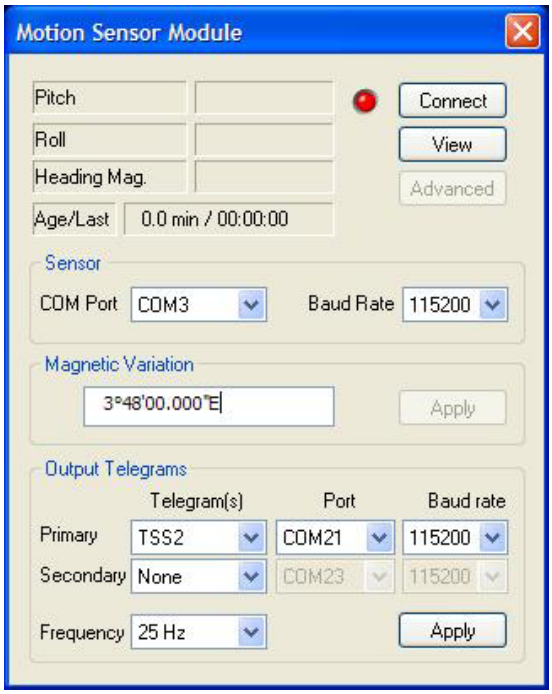
The motion sensor provides heading, roll and pitch in a proprietary format so the MSM translates this information into a form that Scout USBL can use. The MSM creates two data strings, one that emulate a standard NMEA compass and a second that emulates a standard vertical reference unit (VRU). In the Scout program two instruments are created by default and it is these that take in data from the MSM and use it to provide heading roll and pitch information for the vessel.


The Motion Sensor Module starts automatically when Scout USBL is started. If the transceiver is connected correctly and the MSM is receiving data from the transceiver's motion sensor then the MSM program minimises itself into the system tray in the lower left corner of the Windows desktop. The program will run in the background continuously providing data to Scout USBL.

To show the MSM display, double click the MSM icon in the system tray

## 11.2 Configuring the Motion Sensor Module

The Motion Sensor Module may need to be configured before it will start. If the MSM is not receiving data from the transceiver then it will remain on the desktop and the Connect LED will remain red.




| | |
|---|---|
| Connect button | Connects the MSM to the motion sensor in the transceiver |
| Connect LED | Shows the connection status |
| View button | Shows the attitude measurements in a display |
| Advanced button | Sets the advanced options. |
| Pitch, Roll, Heading | The current attitude measurements |
| Age/Last | The time and age of the last measurement |
| Apply smoothing | Ensure that this is always off |
| Sensor COM Port | The serial port being used for the sensor data, see Note below |

| | |
|---|---|
| Sensor Baud Rate | This must be set to 115200 |
| Primary telegram | This must be set to HDM |
| Primary Port | This must be set to COM20 |
| Primary baud rate | This must be set to 115200 |
| Secondary telegram | This must be set to TSS1 |
| Secondary Port | This must be set to COM 23 |
| Secondary baud rate | This must be set to 115200 |
| Frequency | This must be set to 25Hz |
| Apply | Applies the selected port configuration, click this after changing port settings |

**Sensor COM Port**
The sensor COM port is the serial port on the computer that connects to the transceiver **Aux** port and is used to get data from the motion sensor in the transceiver.

- For Surface Interface Unit (SIU systems this must be set to the port that the SIU **Aux** port is connected to.
- For Surface Command Unit (SCU) systems this must be connected to COM3

# 12 SPECIFICATIONS

## 12.1 Instruments Supported by Scout USBL

The Scout USBL System currently supports the following instruments:

| Instrument | Type |
|---|---|
| Digital USBL HF Transceiver (Type 8024) | Transceiver |
| AODC Emergency Locator beacon | Transponder |
| Prospector & LRT release beacons (A, B, C, D) | Transponder |
| OBC (Type 7815) & LRT (Type 7986) release beacons | Transponder |
| GPS (NMEA GGA, GLL, Garmin TEXT format) | GPS |
| Heading (NMEA HDT, HDM) | Heading Instrument |
| SG Brown (ASCII) gyro | Heading Instrument |
| Robertson SKR80/82 gyro | Heading Instrument |
| Seaeye ROV Compass | Heading Instrument |
| TSS 1 & TSS 3 | VRU Instrument |
| NMEA $PRDID | VRU Instrument |
| EM1000 / EM3000 | VRU Instrument |
| Generic Depth instrument | Depth Instrument |
| NMEA Depth ($SONDEP) | Depth Instrument |
| NMEA Depth ($PSSIROV) | Depth Instrument |
| Seaeye ROV Depth | Depth Instrument |

The formats of the depth instrument sentences are described in Section 12.3 Depth Instrument Formats

## 12.2 Report Formats

### 12.2.1 Summary

| | |
|---|---|
| NMEA GGA | Standard NMEA position sentence |
| PSONOG | Sonardyne standard grid position sentence |
| PSONALL | Sonardyne extended version of the PSONOG sentence |
| PSONPOS | Sonardyne grid position sentence, superseded by PSONOG |

### 12.2.2 NMEA GGA

**Description**

This report is a simulation of a standard NMEA GGA string used to show fix related data for a GPS receiver. All positions are relative to WGS-84.

**Format**

$GPGGA,HHMMSS.ss,DDMM.mmmmmm,N,DDDMM.mmmmmm,E,2,12,A.AA,Z.ZZ, M,0.0,M,0.0,0000*hh*CRLF*

| Field | Description |
|---|---|
| $GPGGA, | Header (fixed) |
| HHMMSS.ss, | The valid time of the position |
| DDMM.mmmmmm, | Latitude |
| N, | Direction of latitude (N or S) |
| DDDMM.mmmmmm, | Longitude |
| E, | Direction of longitude (E or W) |
| 2,12, | Fixed values |
| A.AA, | Accuracy (semi-major axis) |
| Z.ZZ, | Height (depths displayed as negative values) |
| M,0.0,M,0.0,0000 | Fixed values |
| *hh | Checksum |
| CRLF | Terminator |

**Example**

`$GPGGA,123456.43,5020.234502,N,00134.324576,E,2,12,6.7,-56.78,M,0.0, M,0.0,0000*hh<CR><LF>`

### 12.2.3 PSONOG

**Description**

This report is the standard grid co-ordinate position sentence to be used to transfer vehicle positions to client navigation systems. The co-ordinates are related to the selected projection system.

**Format**

$PSONOG,Name,HHMMSS.ss,XXXXXXXXX.xx,YYYYYYYYY.yy,DDDD.dd,HHH.hh,CCC.cc, T,VVV.vv,AAA.A,BBB.B*hh*CRLF*

| Field | Description |
|---|---|
| $PSONOG | Header |
| Name | The name of the vehicle the string relates to |
| HHMMSS.ss | The valid time of the sentence, see Notes |

| | |
|---|---|
| EEEEEEEEE.ee | Grid Easting |
| NNNNNNNNN.nn | Grid Northing |
| DDDD.dd | Depth |
| HHH.hh | Heading |
| CCC.cc | Course made good (CMG.) |
| T | Heading type: G = grid, T = True, M = Magnetic |
| VVV.vv | Speed |
| AAA.A | Position accuracy (95%) |
| BBB.B | Depth accuracy |
| *hh | Checksum |
| CRLF | Terminator, return plus linefeed |

**Checksum**

Checksum value is the resultant XOR of all characters in the string that lie between the $ and * characters.

**Example**

`$PSONOG,Rangemaster,123443.56,419876.56,5567887.45,6789.07,234.56,235.67,T,2.4,1.2,0.9*hh<CR><LF>`

### 12.2.4 PSONALL

**Description**

This report is an extended version of the PSONOG grid co-ordinate position sentence to be used to transfer vehicle positions to client navigation systems. The co-ordinates are related to the selected projection system defined in Pharos.

**Format**

$PSONALL,Name,Offset,HHMMSS.ss,XXXXXXXXX.xx,YYYYYYYYY.yy,DDDD.dd,HHH.hh,CCC.cc,T,PP.PP,RR.RR,VVV.vv,AAA.A,BBB.B*hh*CRLF*

| Field | Description |
|---|---|
| $PSONALL | Header |
| Name | The name of the vehicle the string relates to |
| Offset | The offset on the vehicle the position refers to |
| HHMMSS.ss | The valid time of the sentence, see Notes |
| EEEEEEEEE.ee | Grid Easting |
| NNNNNNNNN.nn | Grid Northing |
| DDDD.dd | Depth |
| HHH.hh | Heading |
| CCC.cc | Course made good (CMG) |
| T | Heading type: G = grid, T = True, M = Magnetic |
| PP.PP | Vehicle Pitch |
| RR.RR | Vehicle Roll |
| VVV.vv | Speed |
| AAA.A | Position accuracy (95%) |
| BBB.B | Depth accuracy |
| *hh | Checksum |
| CRLF | Terminator, return plus linefeed |

**Checksum**

Checksum value is the resultant XOR of all characters in the string that lie between the $ and * characters.

**Example**

$PSONALL,Rangemaster,Dunker,123443.56,419876.56,5567887.45,6789.07,234.56,235.67,T,15.12,17.34,2.4,1.2,0.9*hh<*CR*><*LF*>

### 12.2.5 PSONPOS

**Description**

This report is grid position sentence. Where a choice is available the PSONOG sentence should be used in preference.

**Format**

$PSONPOS,HH,MM,SS,EEEEEEE.ee,NNNNNNNN.nn,ZZZ.z,HHH.h,NAME*CRLF*

| Field | Description |
|---|---|
| $PSONPOS | Header (fixed) |
| HH,MM,SS | The valid time of the position |
| EEEEEEE.ee | Grid Easting |
| NNNNNNNN.nn | Grid Northing |
| ZZZ.z | Depth |
| HHH.h | Grid Heading |
| NAME | The name of the vehicle the string relates to |
| CRLF | Terminator |

**Example**

$PSONPOS,12,13,15,418956.67,5578956.78,234.5,123.5,Rangemaster<*CR*><*LF*>

## 12.3 Depth Instrument Formats

### 12.3.1 PSSIROV

**Format**

$PSSIROV,hhh.h,ppp.p,rrr.r,aaa.a,dddd.d,ttt.t[CRLF]

| Field | Description |
|---|---|
| $PSSIROV | Header (fixed) |
| hhh.h | Heading |
| ppp.p | Pitch |
| rrr.r | Roll |
| aaa.a | Altitude (Not used) |
| dddd.d | Depth |
| ttt.t | Temperature (Not used) |
| CRLF | Terminator |

**Example**

```
$PSSIROV,243.5,002.3,009.4,34.6,2376.6,12.6[CRLF]
```

### 12.3.2 SONDEP

**Format**

$SONDEP,ddddd.d,eeee.e,u[CRLF]

| Field | Description |
|---|---|
| $SONDEP | Header (fixed) |
| ddddd.d | Depth |
| eeee.e | Depth error (Not used) |
| u | Units (Not used) |
| CRLF | Terminator |

**Example**

```
$SONDEP,1874.6,1.8,M [CRLF]
```

### 12.3.3 Depth Instrument (SDDPT)

**Format**

$SDDPT,ddddd.d,zzz.z[CRLF]

| Field | Description |
|---|---|
| $SDDPT | Header (fixed) |
| ddddd.d | Depth |
| zzz.z | (Not used) |
| CRLF | Terminator |

**Example**

```
$SDDPT,999.9,000.0[CRLF]
```

### 12.3.4 Seaeye Depth (DBS)

**Format**

$DBS,ddddd.d [CRLF]

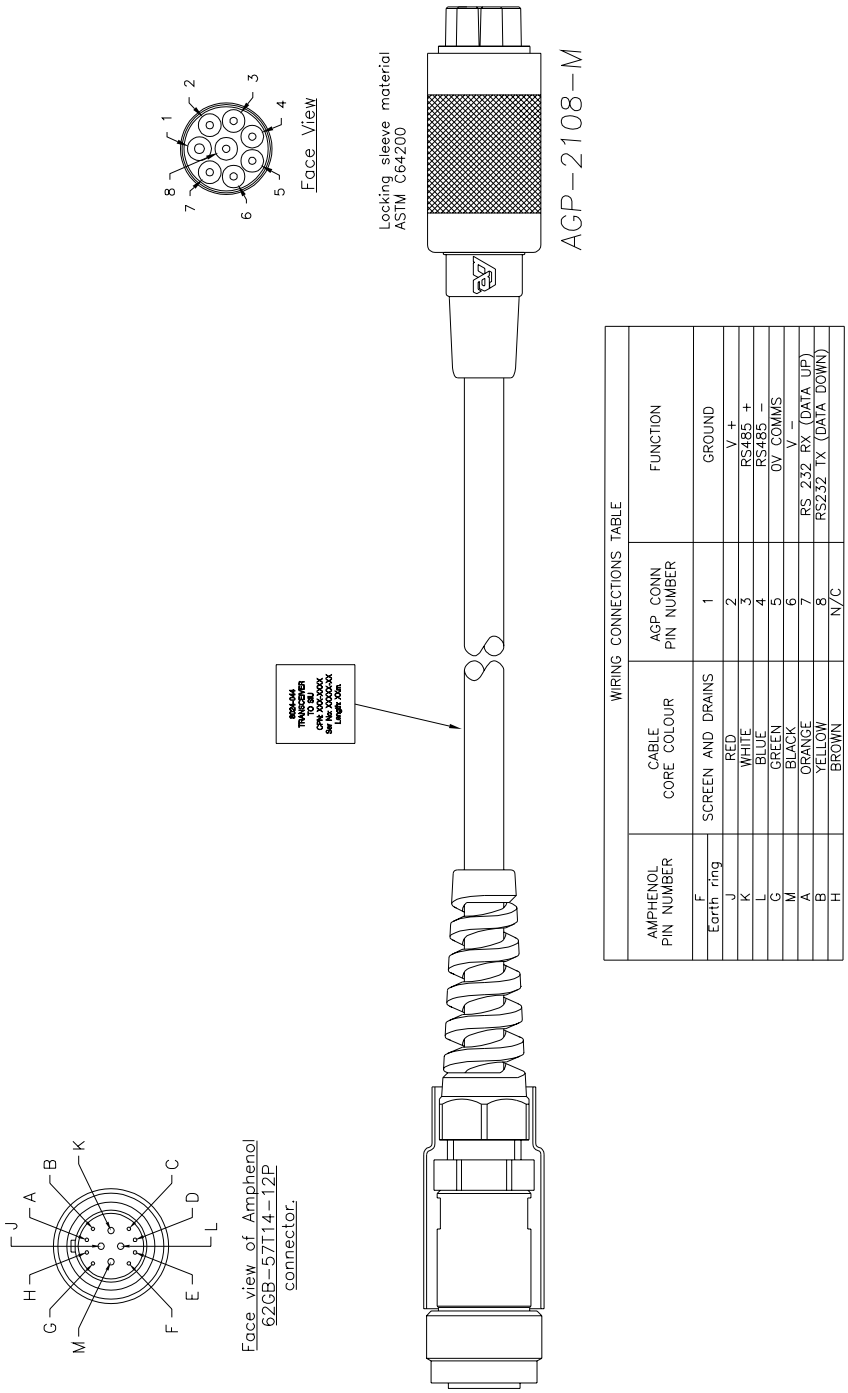
| Field | Description |
|---|---|
| $DBS | Header (fixed) |
| ddddd.d | Depth |
| CRLF | Terminator |

**Example**

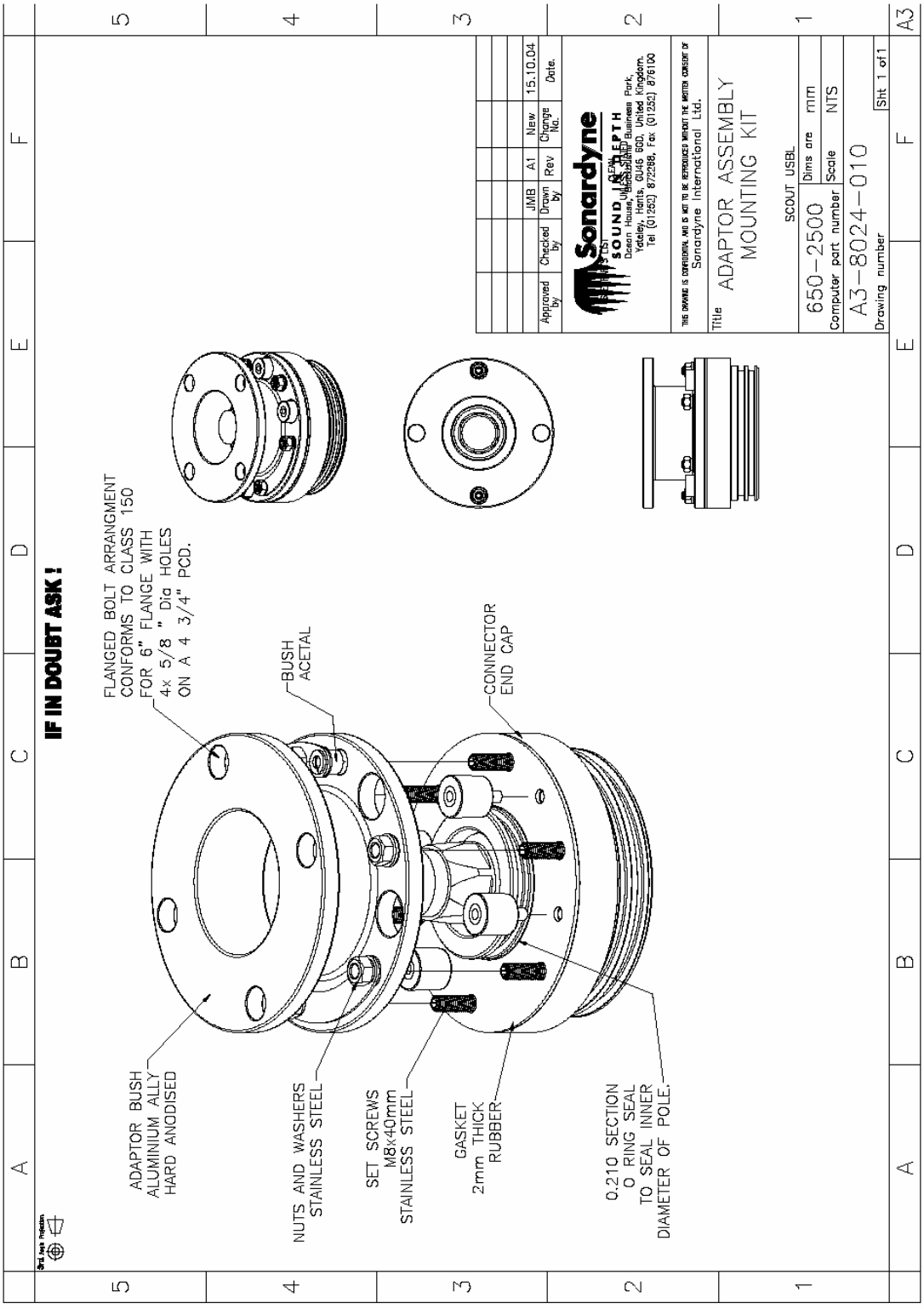
```
$DBS,267.8[CRLF]
```

## 12.4 Hardware

### 12.4.1 Transceiver Cable



### 12.4.2 Transceiver Mounting Bracket



## 12.5 Computer Requirements

The following section details the minimum and recommended system requirements for the customer-supplied personal computer (PC) used to run the Scout USBL tracking software.

### 12.5.1 Hardware Requirements

The minimum PC specification needed to run Scout USBL with a Surface Interface Unit (SIU) is as follows:

- Pentium 3 750MHz processor
- 256 MB of RAM
- Monitor (minimum 1024 x 768)
- Graphics Card 16-Bit colour at 1024 x 768
- CD-ROM drive
- 20 GB hard disk
- Parallel port
- Minimum 2 serial ports
- USB port

The recommended PC specification is as follows:

- Pentium 4  2.0GHz processor
- 512 MB of RAM
- 17” monitor (minimum 1024 x 768)
- Graphics Card 32-Bit colour at 1024 x 768
- CD-ROM drive (read / write)
- 60 GB hard disk
- Parallel port
- Minimum 4 serial ports
- USB port

### 12.5.2 Software Requirements

- Windows XP (Service Pack 2 or higher)
- Microsoft Internet Explorer 5.0 (or higher)

## 12.6 Scout USBL Technical Specifications

**Operating Range:** 1 to 500 metres

**Acoustic Coverage:** ± $90^0$ below transceiver

**Range Accuracy:** ±2.75% slant range using internal sensor
±0.5% slant range with external VRU and gyro

**System Positional Stability:** ±1 metres at 200 metres
(63% of fixes within circle of 2m radius)

**Frequency Band:** Sonardyne HF (35kHz to 55kHz)

**Surface Command Unit (SCU) Version**

**IP Rating:** IP65 – Dust tight and water jets with all connectors or dust caps fitted, USB must have dust cap fitted

**Operating Temperature:** 0 to $50^0$C

**Storage Temperature:** -20 to $60^0$C

**Electrical Supply:** Auto sensing 90-264 VAC 47–63Hz
42W 2.6 A max @ 16 VDC

**Surface Interface Unit (SIU) Version**

**Operating Temperature:** 0 to $50^0$C

**Storage Temperature:** -20 to $60^0$C

**Electrical Supply:** Auto sensing 90-264 VAC 47–63Hz

**Note:** This value is indicative only as system performance depends on a number of factors such as the quality of external attitude sensors, the deployment method and the noise levels at the transceiver.

# 13 GETTING TECHNICAL SUPPORT

E mail support is available for Scout USBL and telephone support during office hours.

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