APPLIED ACOUSTICS
Underwater Technology

Easytrak Portable

Ultra-Short Base Line Navigation System

Operations Manual

(For use with Win software Version 2.2 and above and the 902C Transducer only)

Document Number EZT-2650-8002/7

Version: 7

Contents

Introduction

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

USBL systems are used to position underwater items including Side Scan Sonars[1], ROVs[2], AUVs[3], and divers.

With no compass input, a position will be SHIP referenced, e.g. 123m 'X' means 123m from the starboard side of the ship, whereas, with a compass, a position can be NORTH referenced; 123m 'X' means 123m from the ship in an easterly direction.

A position can either be 'relative' for example 123m 'X' and 234m 'Y' from the vessel, or 'absolute' for example 412789m East 5823456m North if a radio navigation system and compass is available.

Easytrak Overview

A common complaint of many USBL systems is the long time and complexity in 'getting going'. Easytrak has EasyStart a Wizard guiding the user through the basic configuration of the system. Using internal batteries, or an external supply, the system can be ranging to beacons as soon as the transducer touches the water.

Favorite 'set-ups' can be saved and recalled at any time. The current set-up is automatically saved on power-down allowing a quick resumption of work on the next power-up.

A color LCD display not only gives positioning data in text form, but also graphically. Beacons are individually identified and color-coded, **GREEN** – position OK, **ORANGE** – caution, prediction being used, and **RED** – signal lost and cannot predict safely.

Either a grid or polar display can be selected; the scale of the display can be set to manual or automatic where the scale adjusts so that all targets are visible on the screen. The display color scheme can be changed to suit outdoors, indoors or night working.

Because of multi-path reflections and other types of acoustic interference, the position can occasionally be corrupted. Easytrak has the facility to 'gate-out' wild values of range, heading, depression angle, velocity, and horizontal distance moved per ping. The 'out of gate' positions are replaced by predicted values. Note, compass, pitch & roll inputs are required.

[1] Sonar system for seabed mapping
[2] Remotely Operated Vehicle
[3] Autonomous Underwater Vehicle

The Easytrak transducer can be fitted with an internal compass, and pitch & roll sensors. Unlike the flux gate compass (invented in the 1930's), the Easytrak transducer compass uses a three-axis magnetometer that allows for an in-situ calibration routine to counteract localized magnetic anomalies. The pitch and roll sensors work to ± 50°, more than sufficient for most boat work. An external compass/gyro and/ or roll and pitch sensors outputting common NMEA[4] strings can be interfaced to Easytrak if more precision is required.

Please note, very strong magnetic anomalies can be beyond the calibration range of the internal compass. It is advisable, that a bearing check is performed prior to use.

The necessity of determining an accurate velocity of sound (VOS) through water is critical. VOS accuracy is important in two areas, (1) across the face of the transducer (used for measuring the bearing and depression angle to a target), and (2), the distance to and from the target (the range). To help overcome this source of error, the operator can enter two values of VOS into Easytrak, one for the bearing/ depression angle, and a second for the range calculation. An option is available where the velocity of sound can be calculated using Medwin's formula by entering water temperature, salinity, and depth.

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

Easytrak also includes a series of telemetry commands allowing the secure control of release beacons and alike.

Easytrak Portable is ideal for small surveys. With a Global Positioning System (GPS) receiver, the common GPS NMEA data strings $GPGLL, $GPGGA and $GPRMC can be used. GPS allows the absolute positioning of sonar fish, ROVs, or seabed objects in UTM co-ordinates. With GPS, Easytrak can also be used to navigate to and from the worksite indicated by an entered waypoint. Of course should a GPS receiver not be available, Easytrak will work to a local relative grid. Once onsite the ROV or sonar fish can be fitted with a beacon, deployed, and work can begin.

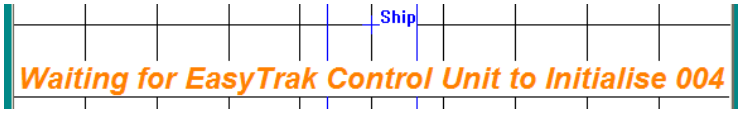
It should be noted, that when using GPS, bearings are relative to GRID North; without GPS, bearings are relative to TRUE North or to the vessel's Bow.

A serial printer or navigation computer can be connected to a COM1 on Easytrak's front panel to record target positions in a variety of formats.

Though Easytrak is simple to use, the system provides a very powerful and flexible tool for survey use.

[4] NMEA The National Marine Electronics Association

Please Note, Easytrak Lite takes about 1 minute to initialize from power up.



Basic theory

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

The receiving ceramics are so arranged that each can detect an acoustic signal from a target's transmission.

The acoustic signals may arrive at slightly different times due to their different signal paths. From these time differences, the bearing and depression angle[5] to the target are computed.

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

$$\text{Range} = \frac{\text{VOS x Traveltime}}{2} \text{ (m)}$$

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

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

$$\text{Range} = \text{VOS x Traveltime (m)}$$

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

[5] The vertical angle between the horizon and the target.

System Description

Easytrak consists of three basic parts, the command unit, the transducer, and the deck cable.

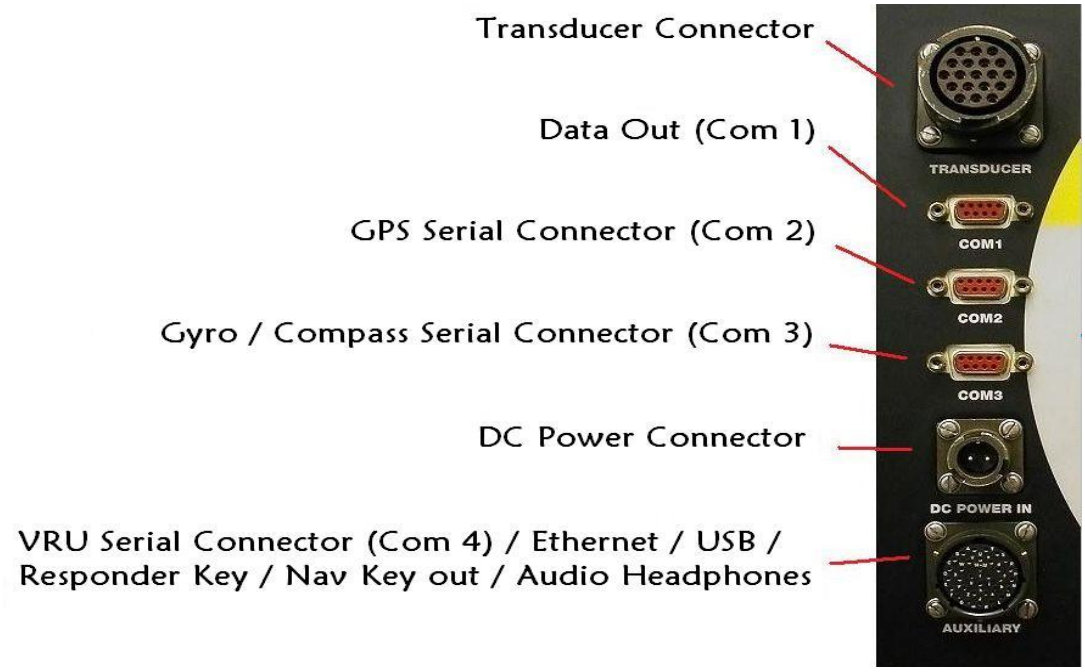
- Easytrak Command Unit

The main display consists of a 640 by 480 pixel color LCD display. All graphics and text are presented on this display.

The main keypad is to the right of the display. The keypad consists of sixteen keys, **numerical** 0 to 9, **decimal point**, **minus sign**, **left** and **right** arrows, **Next** and **Ent**(er).

Two keys in particular require further explanation.

- The **Left** arrow key when in a text box, if pressed, will delete any digit to the left of the cursor.
- The **Next** key responds similarly to the Tab key on a desktop computer.



Connectors are on the left of the unit. The top connector is for the transducer, the **COM** connectors 1, 2, and 3 are for **Printer**, **GPS receiver** and **Gyro/Compass** respectively. The **DC POWER IN** connector connects to the supplied power supply. The **Auxiliary** connector at the bottom is for additional connections- VRU in (Com4), Ethernet (remote display option), responder output, navigation key output, external trigger in, headphones and USB.

Five function keys F1 to F5 can be seen below the display. These keys are used to quickly control or activate help menu, audio volume, display scale, polar/rectangular display, and events.

- Transducer

The Easytrak Transducer contains receive ceramics and amplifiers that process the received signals prior to signal processing in the Easytrak command unit. The transducer also contains the interrogate ceramic. The transducer is fitted with a compass, pitch sensor, and roll sensor.

- Deck cable

The Easytrak deck cable connects the Easytrak command unit to the Transducer.

Various lengths of cable are available. Please contact Applied Acoustics or your local agent for details.

- Power Supply

The Easytrak power supply provides the Easytrak with a stabilized 18VDC. The power supply plugs into the ‘DC POWER IN’ connector on the front panel of the Easytrak front panel.

Planning an operation

What needs setting up?

The Easytrak wizard will guide you through the basic configuration.

Beacon selection: Ensure that if more than one beacon is to be used that each beacon is on a different channel and that the channels chosen do not have conflicting frequencies. Check that the channels selected on Easytrak agree with the settings on the beacons. Use the Easytrak channel list in Appendix 2 to plan the use of suitable beacons.

How often do you require positions to be available? The slower the rate, the longer the beacon's batteries will last. This also applies to the Easytrak control unit if running on batteries.

Should Easytrak be used in a confined environment, it is prudent to keep the update rate as low as possible to prevent reverberation from previous replies interfering with the current reply.

Where is the beacon/s to be positioned?

Find the best location for the beacon. Ensure that the beacon can be 'seen' by the Easytrak transducer i.e. it is not being obstructed. Try to avoid any acoustic reflectors that could lead to instability in bearing and range readings.

What equipment in the terms of beacons is required/ available?

If the target has the possibility of an electrical connection to the Easytrak Control unit, a responder is usually the best choice of beacon. The position calculation is more accurate as acoustic signals only have to travel from the responder to the transducer. The responder is not affected by local noise, for example, from the thrusters of a remotely operated vehicle (ROV).

Transponders are generally used where there can be no electrical connection to the Easytrak Control unit.

Pingers are stand-alone beacons that transmit at a regular interval, typically around once per second. Pingers are normally used as 'locators'. Pingers can be used in very high noise environments where due to local noise, the reception by a beacon of an interrogate pulse would be impossible. Knowing the depth of the pinger, the position of the pinger can be determined. With no depth, only a bearing can be computed.

How is the transducer going to be mounted?

Is a gate valve available? This provides a stable mount for the transducer. It also allows the transducer to be positioned deeper in the water, ideally below the propeller and wake. Deployment and recovery are usually straightforward. The major disadvantage is the expensive mounting hardware.

Ensure that the transducer is near to vertical when powering up Easytrak, otherwise the compass many not function.

When deployed it is advisable to keep the vessel's speed to 3knots and below to prevent possible damage to the transducer and mounting hardware.

Is it possible to mount the transducer over the side of the ship on a suitable pole? The transducer is then fixed securely to the vessel in an economical manner. It can however, be difficult to have a pole deep enough to be sufficiently clear (>1m) of the ship's hull. Deployment and recovery is usually not as easy as a gate valve mount due to the weight of the transducer, and the assembly / disassembly of guide wires etc.

The simplest method is just to hang the transducer over the side of the vessel. This method is suitable for the smaller vessel with minimal movement. However, should the vessel move too much, the transducer can be buffeted to the extent where the internal compass and roll & pitch sensors cannot compensate for the movement.

See the transducer installation section for further information.

Do you need an absolute position, or is a relative position sufficient?

A compass is required if the position is NORTH referenced, otherwise the position will be SHIP referenced. A relative position is a position that is relative to a local reference point, typically a position on a vessel, but can be a beacon that is on the seabed.

An absolute position is a position that conforms to a national or international geographical system; Easytrak uses Universal Transverse Mercator (UTM) referenced to the WGS84 ellipsoid. To have an absolute position, a compass is required, either Easytrak's internal compass, or a precision external unit; also a suitable (D)GPS receiver must be connected to Easytrak. Easytrak then uses the data from the compass and GPS receiver to derive an absolute position.

What local power is available?

Where possible, the Easytrak control unit should be run from the supplied power supply. Running on batteries Easytrak will run for the duration of the battery charge as specified in Appendix 1.

Should the beacon be on a sub-sea vehicle (or similar), it should be investigated whether local power is available. If power is available, the power can be supplied to the beacon removing the need for a battery pack and the subsequent requirement of battery charging. The power can be either from the vehicle's power supply or through an umbilical.

What range will you be working at?

Select a beacon suitable for the range you expect to be working at. Consult the manufacturer's beacon manual for specified working ranges. Easytrak has three different power levels, low to high; then select the level suitable for the working range. Note the internal batteries of Easytrak will last longer using the low power setting.

What accuracy do you require?

To improve accuracy keep ranges as short as possible; make local measurements of the velocity of sound in water; use depth beacons where appropriate, especially at low depression angles.

Installation

Easytrak Control unit

Ensure the unit is secure to prevent falling or sliding due to vessel movement. Easytrak has been designed to prevent accidental water ingress; however, it is recommended that placement of the unit is not prone to flooding if used in an open boat or on the back deck of a larger vessel.

When inside and powered externally it is recommended that the vents located on each side of the unit be opened to assist in cooling. These should be closed when in an area where water ingress may occur. NB The unit must be positioned to allow airflow – allow 25mm at each end.

It is advisable in direct sunlight to set the display color scheme to 'Outdoor' as this will make viewing easier. At night, the display color scheme can be set to dim the display.

If your Easytrak has the USB mouse option, plug a USB mouse into one of Easytrak's USB sockets. The mouse pointer will show when the **mouse left button is double-clicked**.

Transducer

Suspended over the side: This is the simplest method, however, the transducer is more prone to relative movement with respect to the vessel. Care must be taken that the transducer does not spin or strum as the internal compass and roll and pitch sensors have a limited data update rate.

Ensure that when deployed the transducer is below the draft of the vessel by at least 1 meter and has clear horizontal visibility through 360°.

Note this method cannot be used if the internal compass and pitch & roll are not enabled, as the system would have no orientation reference. Similarly, this method cannot be used if the system is in ship referenced mode.

Over the side on a pole: Using the optional transducer-mounting bracket, the Easytrak transducer can be fixed over the side of a vessel with a suitable pole. The diameter of the pole will depend on the length required and the anticipated maximum speed of the ship. It is recommended that the pole be secured by cables fore and aft to prevent bending and strumming when the ship is underway.

Ensure that when deployed the transducer is below the draft of the vessel by at least 1 meter and that it has clear horizontal visibility through 360°. Ensure the alignment mark on the transducer is inline (forward) with the forward/ aft line of the vessel.

Extreme care has to be taken in shallow water that the transducer does not strike the seabed otherwise, damage to the transducer and pole is likely to occur. Note that prior to a vessel going alongside, the rig has usually to be recovered.

Through a gate valve: Ensure the gate valve is of a suitable diameter to take the transducer and any mounting hardware. The transducer should be mounted on a suitable shaft; see appendix 1 for transducer dimensions.

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

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

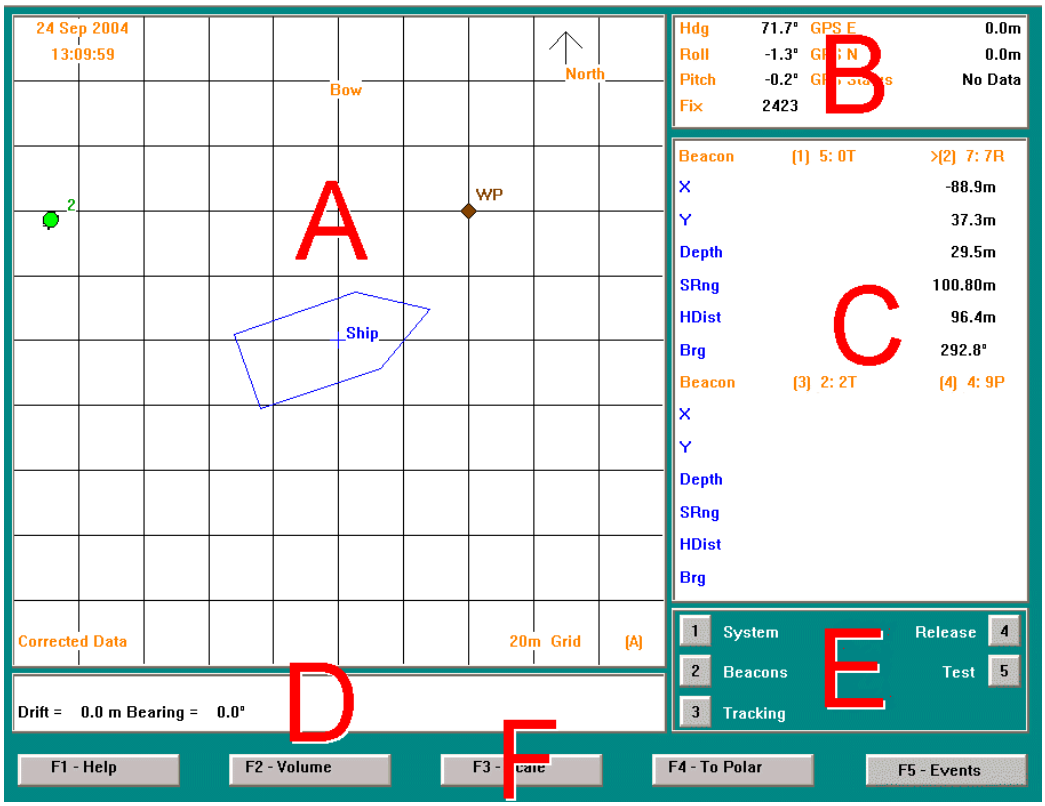
Extreme care has to be taken in shallow water that the transducer does not strike the seabed otherwise damage to the transducer, pole, and in extreme circumstances, the ship.

Deck Cable

To prevent damage to the cable and minimize potential problems, please ensure the following points are observed:

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

Around the Easytrak Portable Display



A This is the main **Plotting Window** where the ship and targets are displayed.

- The ship is colored blue; a blue cross signifies the ship's position reference point.
- Waypoints (WP) are diamond shaped and colored brown.
- Events are diamond shaped and colored yellow.
- Depending on type, beacons can be represented by three different shapes. Transponders are square, responders circular, and pingers triangular. The color of the target depends on the position quality. Please refer to the beacon section for further information.

The type of data i.e. ship referenced, north referenced, gated, or smoothed used for displaying and outputting (COM1) is displayed on the bottom left-hand side. The scale is displayed on the bottom right-hand side. Alongside the scale is the symbol (A) meaning Auto-range scaling, this can be seen above. When the scale is manually set, the (A) would be replaced by a (M).

If a target goes outside the plotting area, a line is drawn from the centre of the plotting area in a direction of the target. The color of the line depends on the quality of the last position update.

B This Window displays **Utility Data** including heading, roll & pitch, fix number, and the GPS receiver's data. When GPS data is not required and switched off, the GPS legend is not displayed.

C This is the main data Window where the **Position Data** for each beacon is displayed including X (or Eastings), Y (or Northings) and Z.

D This Window is used for **Displaying Messages** such as interrogation status, distance and bearing etc. These messages are 'switched on' through menu selection or automatically by Easytrak. Due to the nature of these messages, it is possible for them to overlap.

E These are the Main control buttons for Easytrak. For example, by pressing '**1**' on the keypad, the **SYSTEM** menu window will be displayed.

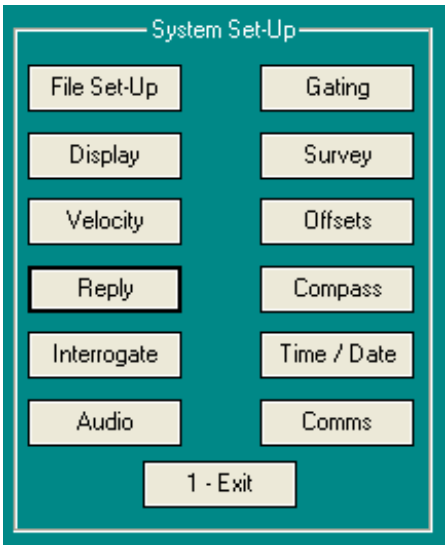
F These represent the **Hot Keys** F1 to F5 on the front panel of Easytrak.

Main Control Menu

Main Control Buttons

System Menu

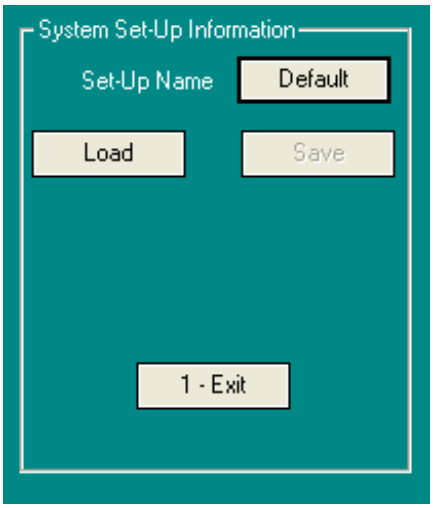
To select the System Menu press '1'. The system menu presents many of the control options of Easytrak.



System Set-Up

File Set-Up Menu

By selecting the **File Set-Up** Menu, the following window appears:-



File Set-Up

Set-Up Name button:

The Set-Up name button selects names **Start-up**, **Alpha**, **Beta**, **Gamma**, **Delta,** and **Default**.

Names **Alpha** to **Delta** are used to save and load favorite set-ups. If Easytrak is being used at more than one location, a 'set-up' can be saved for each, allowing an immediate start next time you move back to a site.

Load button:

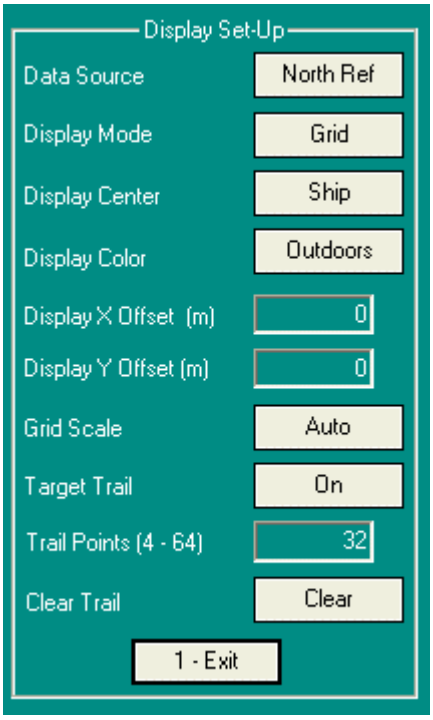
System parameters and operator options such as beacon selection and display preferences are loaded and take immediate effect. The **Start-up** file automatically loads when Easytrak is switched on. When selected, the **Default** file loads factory set-up system parameters. This allows the operator to return to a know set-up state.

Save button:

System parameters and operator options such as beacon selection and display preferences are saved. Note, as 'Start-Up' is automatically saved on power down and 'Default' is 'factory' set, there is no 'Start-Up' or 'Default', save option.

Display Menu

By selecting the **Display Set-up** button, the following screen appears:-



Display Set-up

- **Data Source** button

This feature determines the type of data used in calculating the graphics positioning, the displayed beacon data, and the serial output data.

Ship Ref: Positions are referenced to the bow of the SHIP. No adjustments are made due to the compass, though the position is pitch & roll corrected. Offsets are applied. The positions derived in this mode are not affected by any gating or smoothing setting.

North Ref: Positions are referenced to the NORTH. Compass, pitch & roll, and offset values are applied to the computed position.

A Compass must be used to be north referenced, otherwise it will be ship referenced. The position derived in this mode is not affected by any gating or smoothing setting.

Gated: Positions are referenced to the NORTH. Basic North referenced values are used except where a value falls outside a user selected 'Gate' or a reply is lost. The lost reply or 'out of gate' position is replaced by an estimated position based on previous positions. This gate can be a maximum velocity, maximum horizontal distance moved etc.

Compass and pitch & roll inputs must be used otherwise incorrect positions will be produced.

Smoothed: Positions are referenced to the NORTH. The current position is estimated from the last 'N' positions. The degree of smoothing is set in the 'Gate' menu.

Compass and pitch & roll inputs must be used otherwise incorrect positions will be produced.

- **Display Mode** button

  The display mode button determines whether the graphical display is in either grid or polar format.

- **Display Center** button

  This button allows the centre of the graphical display to be referenced to the **Ship**, **Beacon 1** to **4,** or **Waypoints 1** to **10**.

- **Display Color** button

  Switches between three display color schemes suited to different operating environments – Normal/ 'indoors use' - Night/ 'low lighting use' - Bright/ 'outdoors use'.

- **Display (X/Y) offset** text box

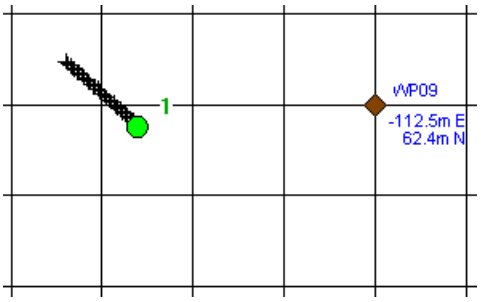
  The center of the display can be offset from the 'Display center' chosen allowing the operator to zoom into a particular area of interest. X and Y are in meters.

- **Grid/Ring Scale** button

  This feature determines the scaled distance between individual rings or grid lines. Auto scaling adjusts the scale to ensure all targets can be viewed on the plotting area. Scales available are:- 1m, 2m, 5m, 10m, 20m, 50m, 100m, 200m, 500m, and Auto per ring or grid line.

- **Display target trail** button

  When selected **ON**, a snail's trail of all target's paths are plotted.



Target Trail

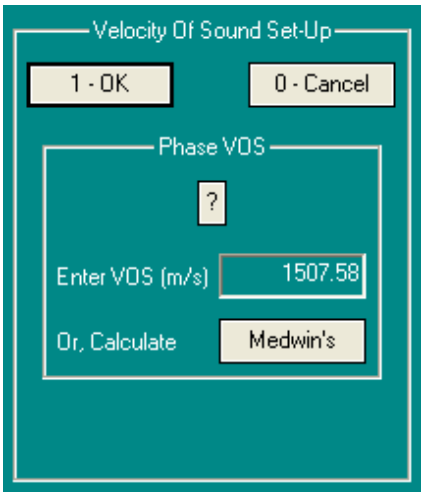
- **Trail Points (4-64)** text box

  The number of trail points required.

- **Clear trail** button

  Clears all trail points.

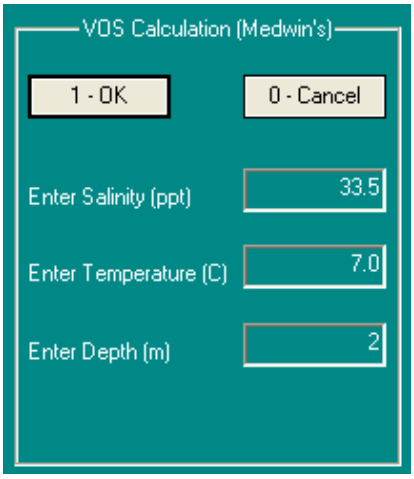
Velocity Menu



Velocity Of Sound Set-Up

This menu window allows the user to enter the Velocity Of Sound (VOS) through water used in phase measurements rather than in range calculation. This value is the VOS at the transducer i.e. sea level.

VOS can be entered manually or calculated internally by using Medwin's method of calculation. To use Medwin's, the following window is displayed:-



VOS calculation using Medwin's formula

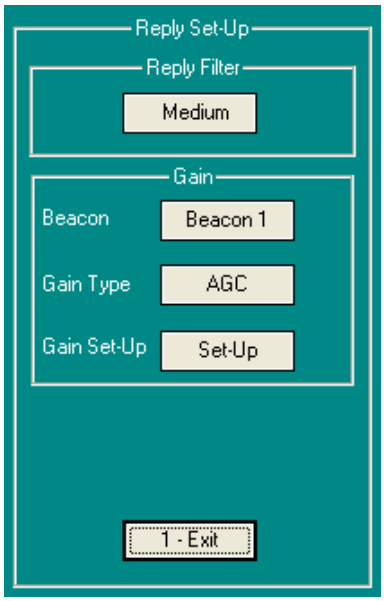
Salinity (ppt): Water salinity in Parts Per Thousand ***(ppt)***.

Temperature (C): Water temperature in centigrade.

Depth (m): Depth of the transducer below water level in meters.

If Medwin's option is used, the 'Enter VOS (m/s)' text box will be automatically filled with the result.

Reply Menu



Reply Set-Up

This menu controls the reception of signals from targets.

- **Reply filter** button

  Provides a band pass filter for received signals. The filters can improve bearing stability but will not affect range. The settings are NONE, WIDE, MEDIUM, and NARROW.

- **(Gain) Beacon** button

  Selects the beacon for the **Gain type** and **Set-Up**.

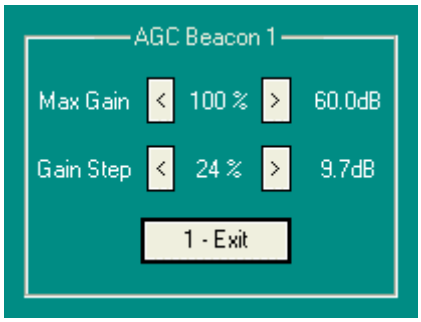
- **Gain type** button

  Determines Easytrak's type of reply (receiver) gain control, **Manual**, or **AGC**.

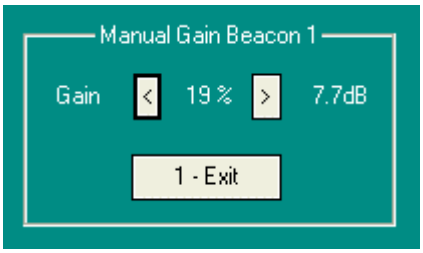
- **Gain Set-Up** button

  The window displayed on selecting this button depends on the **Gain Type** button.

AGC: Automatic Gain Control is the recommended gain control system for all types of beacons and is suitable for most applications. AGC automatically adjusts the gain of the Easytrak receiver for optimum signal levels. Through the **Gain Set-Up** button, the maximum gain can be set, and the maximum gain step sets the maximum change in gain AGC can make in one interrogation cycle.

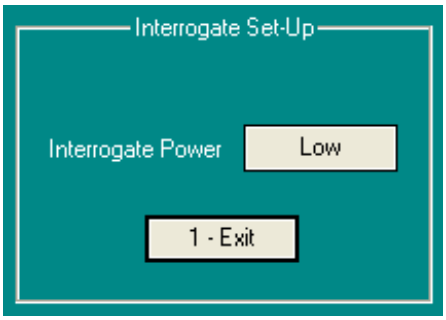


Manual: Selecting the **Gain Set-Up** button, the gain can be set between 0 – 100% of full system gain. The beacon selected is displayed in the title. The gain control is through the using left (gain down) and right (gain up) arrows on the window.



If too much gain is set, a warning message will appear in the **Display Message** area.

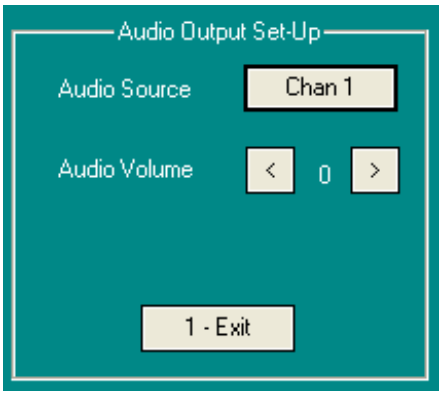
Interrogate Menu



Interrogate Set-Up

- Interrogate power. This selects the relative power level of Easytrak transmission from **Low**, **Medium,** and **High**. Note the High power setting is only valid when running on the external power supply; otherwise, the High power setting will be same as Medium power setting.

Audio Output Set-Up Menu



Audio Output Set-Up

- **Audio Source** button

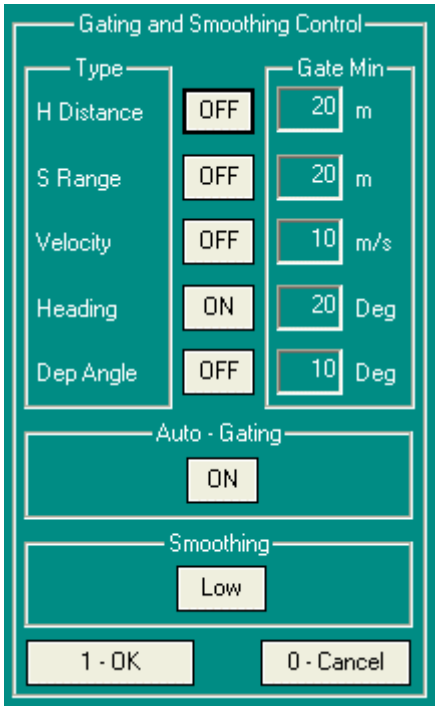
  The audio source button allows the operator to listen to reply channels 1 to 3 using the internal speaker or optional headphones. This feature is useful in that it allows the operator to listen for sources of interference. Note channel 4 is not currently used.

- **Audio volume** button

  Adjusts the volume level from 0 (off) to 8 (maximum).

Gating Menu

Gating can be used to remove spurious positions made with **Easytrak** due to signal reflections, excessive environmental noise etc. Parameters that can be gated include Distance (horizontal), Range, Velocity, Heading, and Depression Angle. Gating limits the deviation a particular parameter may change between fixes. A value can be entered in a text box to define the gate size, or, in the case of automatic gating mode, the minimum size of the gate.



Gating and Smoothing Control

- **Auto - Gating** button

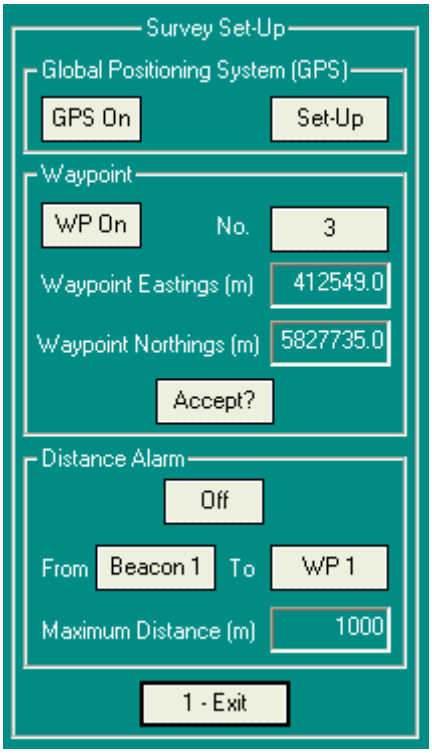
  In automatic gating mode, a gate starts very large, and then halves in size as a set of five good readings is obtained. The gate shrinks until the user defined minimum gate size is reached. Should there be five "out of gate" readings, the gate doubles in size until stable "in gate" readings are obtained.

- **Smoothing** button

  This button determines the amount of smoothing of the data when **the Data Source is in smoothed mode**. The options are LOW based on four fixes, MEDIUM based on eight fixes, or HIGH based on sixteen fixes.

Survey Menu

This window allows the user to set up survey parameters including Universal Transverse Mercator (UTM), waypoints, and a distance alarm.

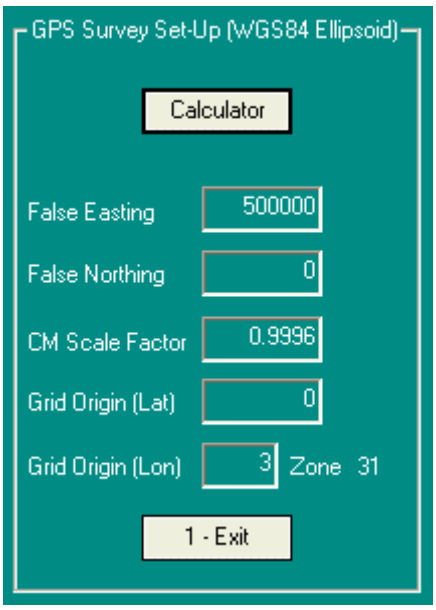


Survey Set-Up

- **Global Positioning System** (GPS) – (Optional)

  Using GPS allows the absolute positioning of sub-sea targets. Note in Easytrak, all UTM calculations are based on the WGS84 ellipsoid. Please note, the "GPS On/Off" button in the menu above, is grayed out if the 'GPS' option has not been selected. **It should be noted, that when using GPS, bearings are relative to GRID North; without GPS, bearings are relative to TRUE North or to the vessel's Bow.** The current convergence value can be viewed through the test menu.

GPS On/ off selects whether Easytrak goes into GPS mode.

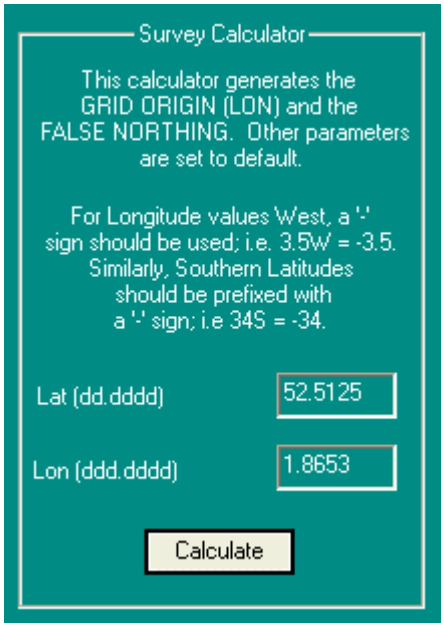


GPS Survey Set-Up

Set-up allows the operator to enter UTM set-up parameters:
- False Easting
- False Northing
- Central Meridian Scale Factor
- Grid Origin – Latitude
- Grid Origin – Longitude

Longitude Grid Origin and False Northing can be calculated by selecting the Calculator button at the top of the window. The UTM Zone determined alongside the Longitude Grid Origin for reference only.

On selecting the Calculator button, the following window is displayed.



GPS Survey Calculator

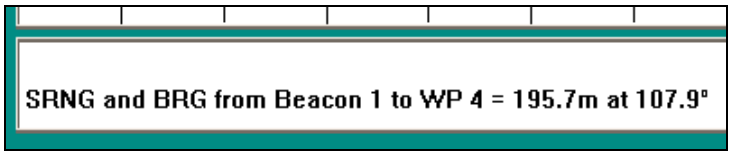
The calculator also sets the other parameters in the GPS Survey Set-Up window to default values. Enter the degrees and decimal degrees of your local latitude and longitude.

- **Waypoints**

  This allows the entry of a grid position into text boxes, typically in Eastings and Northings. Waypoints are used as references or markers, say for a shipwreck or to indicate the center of a worksite. Waypoints are represented onscreen by a brown diamond. Select ‘Accept’ to save the position. The use of each waypoint can be switched on or off.

- **Drift alarm**

  When selected, the distance and bearing between 'From' and 'To' is calculated. If the **slant range distance** exceeds 'maximum distance', an audible alarm sounds. 'From' and 'To' can be selected from Ship, Beacon 1, Beacon 2, Beacon 3, Beacon 4, and Waypoint. The drift alarm is useful as an audible warning, for example, should the distance between a ROV and the mother ship be in danger of exceeding the ROV's umbilical length.



Distance and bearing information

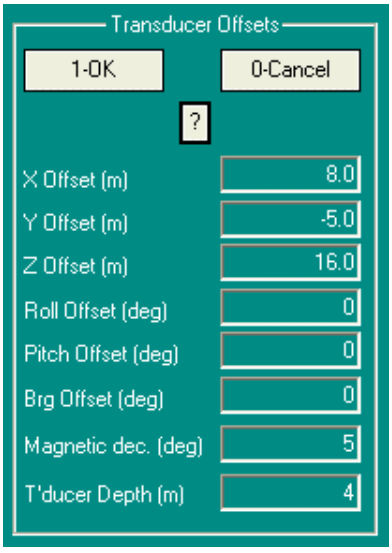
GPS can also be used to navigate to and from the worksite. Using the 'Distance Alarm', a range (SRNG) and bearing (BRG) to a waypoint containing the site's coordinates would be displayed. Just ensure that the 'maximum distance' is set high enough otherwise the audio alarm will continually sound!

Offsets Menu

By default, the position given by Easytrak is that of the transducer. In many cases however, the position needs to be referenced to another part of the vessel, for example, the navigation antenna.

The following offsets are available:- X offset (m), Y offset (m), Z offset (m), Roll offset (degrees), Pitch offset (degrees), Heading offset (degrees), Magnetic dec(lination)and Transducer depth (m) below water line.

Note, the Bearing offset is an acoustic bearing offset and does not affect the compass heading. Magnetic declination offset will affect the compass heading.



Transducer Offsets Set-Up

Magnetic declination is the angle between magnetic north and true north. Declination is considered positive when the angle measured is east of true north and negative when west.[6] Magnetic declination varies throughout the world changing slowly over time. Magnetic declination is entered into Easytrak in the following format: - SDDD.DD, where 'S' is the sign + (East) or – (West), and 'D' are degrees and decimal degrees. In the "Transducer Offsets Set-Up" figure on the previous page, an example of 5.0 East has been entered. The transducer internal compass and external compass strings other than $HCHDT are affected by the declination offset.

[6] http://www.ngdc.noaa.gov/seg/geomag/faqgeom.shtml

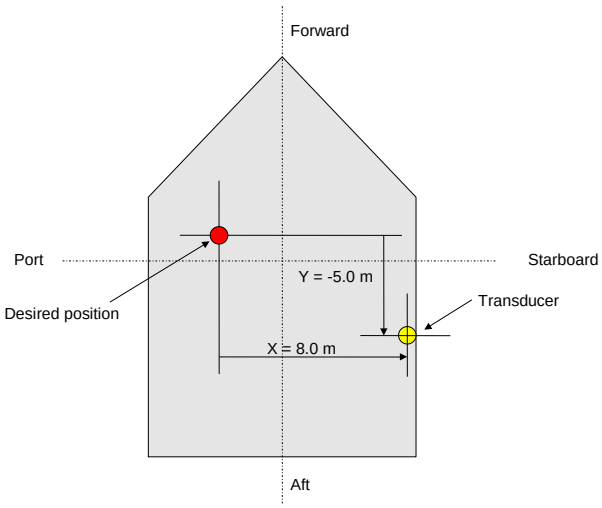
Offsets are the measured distances **from the desired position to the transducer**.

X is +ve if the transducer is starboard of the desired point, -ve if port, similarly, Y is +ve if the transducer is forward of the desired point, and –ve if aft.

The two diagrams below show examples of typical scenarios where the positions desired is the navigation antenna (typical with GPS positioning).

Fictitious offsets values have been given to demonstrate how the measurements are made, and in particular their signs.

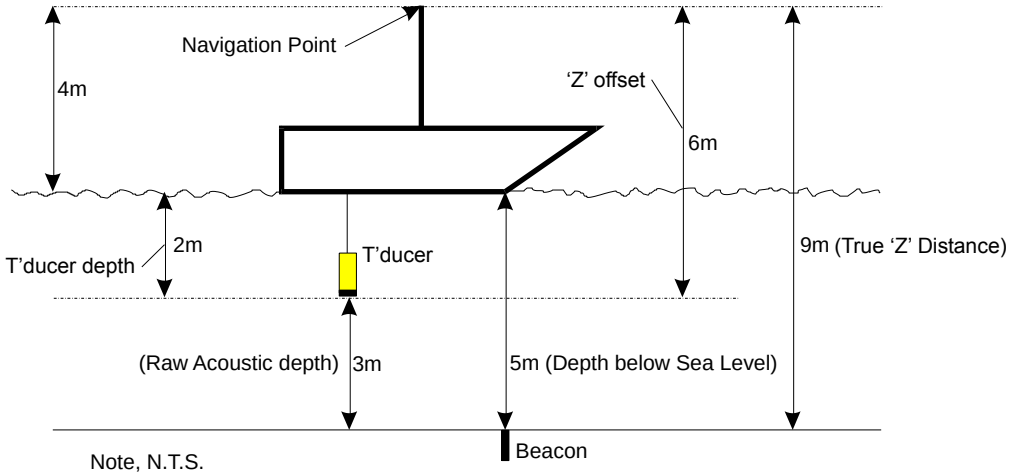
If X, Y, and Z offsets are to be used, the transducer MUST be fixed with the alignment mark facing forward using either an over the side pole or through a gate valve.



The above diagram shows the plan view of a vessel. The alignment mark on the transducer must point forward.

Overleaf shows examples as to how Easytrak handles the ‘Z’ offset and transducer depth parameters. The Z offset is +ve where the transducer is below the navigation point. Transducer depth below sea level is +ve.

‘Z’ and T’ducer offsets



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

1. Acoustic depth (Where Easytrak uses acoustics (using the depression angle) to calculate the depth)

True ‘Z’ distance = Raw Acoustic Depth (3) + ‘Z’ Offset (6) = 3 + 6 = 9m

2. Manual Depth (Where the depth is entered manually, or the depth is sent serially)

True ‘Z’ distance = Manual depth to target (5) + ‘Z’ Offset (6) – T’ducer depth (2) = 5 + 6 -2 = 9m

3. Depth Beacon (Telemetry etc.)

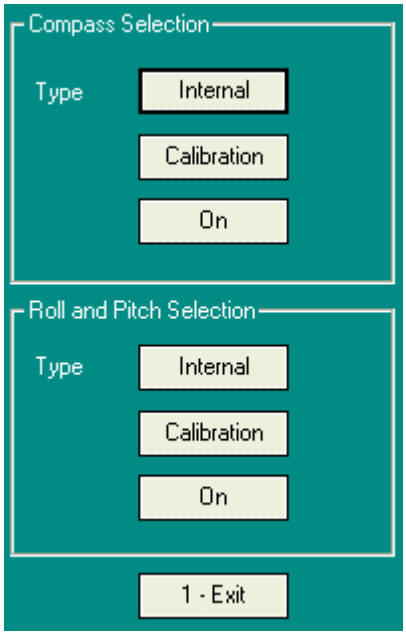
True ‘Z’ distance = Telem. depth to target (5) + ‘Z’ Offset (6) – T’ducer depth (2) = 5 + 6 -2 = 9m

Note that if the navigation point is at sea level, then the depth of transducer – the Z offset – would be +2m in the above examples entered into the offsets menu. However, the transducer depth entry is **only required** in examples 2 and 3 above, i.e. manual depth entry or when using a depth telemetry beacon.

Compass Menu

A compass input is used to compensate for the rotation of the boat allowing grid positions to be 'NORTH' referenced. The Easytrak transducer has an in-built compass, and pitch & roll sensors. If more precision is required, an external compass and pitch & roll can be used. The option of 'no compass' can also be selected.

The compass, roll and pitch can be switched off as far as calculations and plotting are concerned. However, the compass and pitch & roll values are still displayed even when switched off providing 'Type' is not set to None.



Compass, Roll, and Pitch selection

- **Compass** Selection

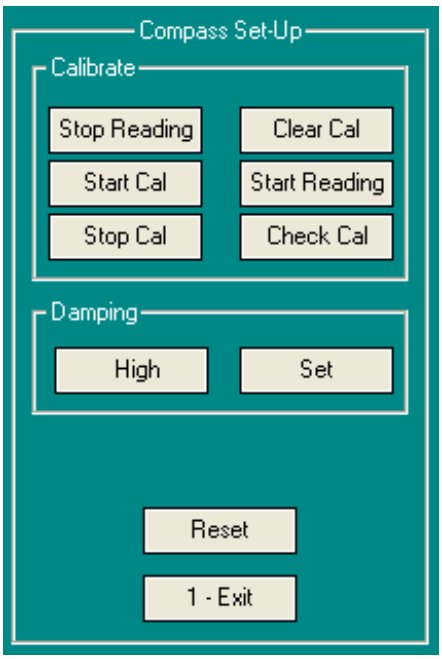
  Type

  Internal: This selection uses the compass in the transducer if present.

  External: The following strings can be read, **$HCHDM**, **$HCHDT**, **$HCHDG**, the PNI Corporation **TCM2.X** string, SG Brown strings **HTDt** and **HTDS,** and **$HEHDT**. The type of string is selected in the Serial Comms set up for compass.

  None: No compass is used in the calculation of position.

Calibration (Only when **Internal Type** is selected)



Compass Set-up

The transducer's internal compass can be calibrated on-site. Data from the compass is displayed in the Message Display area of the screen.

To **calibrate** the internal compass, see Appendix 8.

Commands available are **Stop reading**, **Clear Cal**, **Start Cal**, **Start reading**, **Stop Cal**, **Check Cal**, and **Reset**.

Compass damping to reduce jitter can be set between NONE and HIGH depending upon the operating circumstances. Should the transducer be deployed in a static or near static situation, HIGH damping can be used; in a very dynamic situation, low or none can be chosen for a quicker response.

To change the damping selection, select the damping choice – NONE, LOW, MEDIUM, and HIGH, and then select SET.

Compass damping is only available with ARM board software version 0.006 and above. The version can be viewed in 'About'.

ON/OFF

When **ON**, the compass heading is used in computations and outputted in appropriate data output strings. When **OFF**, the compass heading is **NOT** used in computations and the position is ship referenced, but the compass heading is still outputted as appropriate in data output strings.

- **Roll and Pitch** Selection

Type

Internal: This selection uses the roll & pitch sensors in the transducer if present.

External: The following strings can be read, **$HCXDR**, the PNI Corporation **TCM2.X** string, and TSS string **TSS1**. The type of string is selected in the Serial Comms set up for VRU.

None: No roll and pitch is used in the calculation of position.

Calibration

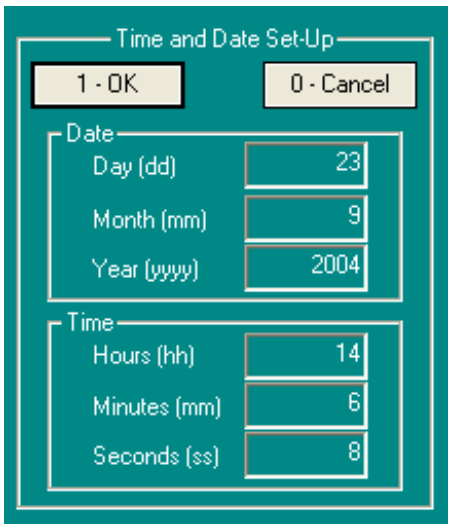
Calibrates the internal compass and pitch & roll sensors. Calibration is only available when **Internal Type** is selected. This is the same routine used with the compass calibration. Using the Calibration routine in the 'Compass' section will simultaneously calibrate the Roll and Pitch sensors, and vice versa.

ON/OFF

When **ON**, pitch & roll is used in computations and outputted in appropriate data output strings. When **OFF**, pitch & roll is **NOT** used in computations, but is still outputted as appropriate in data output strings.

Time and Date Menu

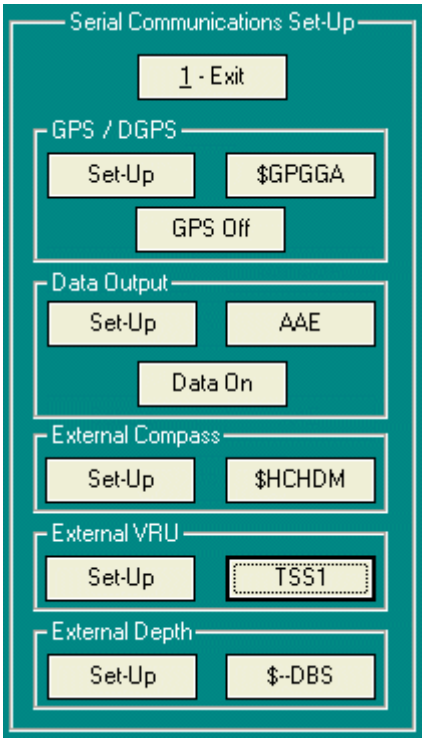
This sets Easytrak's internal clock used for all record timestamps.



Time and Date Set-Up

Comms (Communications) Menu

This window allows the configuration of the three communication connectors on the front panel COM 1, 2, 3 and the serial lines on the auxiliary connector.

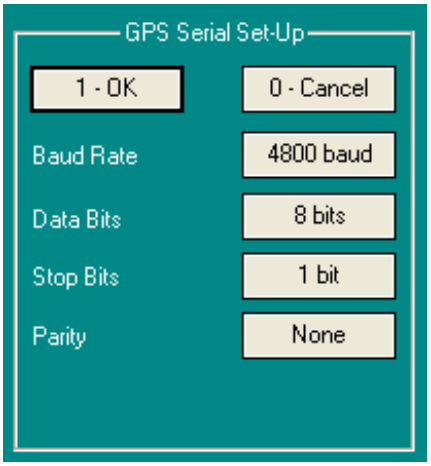


Serial Communications Set-Up

- **GPS/DGPS** serial Set-Up

  This is the RS232C communications set-up for the GPS serial input **COM2**. The set-up has to agree with the set-up of the GPS receiver. Please note there is no hardware or software handshaking in either direction.

  Serial set-up



GPS Serial Set-Up

Baud rate: 1200, 2400, 4800, 9600, 19200, or 38400.

Data bits: 6, 7, or 8.

Stop bits: 1, or 2.

Parity: None, Even, or Odd.

Format

Standard GPS NMEA data formats.

$GPGLL

$GPGGA

$GPRMC

Input

Switches GPS usage on or off.

GPS On/off.

Please note the “GPS On/Off” button is grayed out if the ‘GPS’ option has not been selected in the ‘Options’ menu.

Data Output serial Set-Up.

This is the RS232C communications set-up for the output of serial data from **COM1**, typically to a printer or navigation computer. The RS232C Serial set-up has to coincide with the set-up of the printer or navigation computer. Data is outputted after each Fix is processed and not at a pre-defined rate. Data Source i.e. Raw, North Referenced etc. is determined in the Display Menu. Please note there is no hardware or software handshaking in either direction.

Serial set-up:

Baud rate: 1200, 2400, 4800, 9600, 19200, or 38400.

Data bits: 6, 7, or 8.

Stop bits: 1, or 2.

Parity: None, Even, or Odd.

Format:

Please see Appendix 3 for string details.

AAE: Applied Acoustic Engineering's string.

TPII-2EC: Simplified version of the Trackpoint 2EC string.

TP-EC W/PR: Trackpoint string including pitch & roll.

Simrad 300P: Simplified version of the Simrad string.

Simrad 309: Simplified version of the Simrad string.

$PSIMSSB & PSIMSNS*NMEA format strings.

$GPRMC* Pseudo GPS format string.

Output:

Switches serial data output on or off.

Data On/off

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

- **External Compass** serial Set-Up

  This is the RS232C communications set-up for an external compass.

  Easytrak interprets the common NMEA compass strings **$HCHDM, $HCHDT, $HCHDG,** strings from the SG Brown compass **HTDt** and **HTDS** formats, and **$HEHDT**. The PNI Corporation **TCM2.X** format can also be interpreted. The communication parameters set-up has to agree with the set-up of the compass.

  Please note there is no hardware or software handshaking in either direction.

  Serial set-up.

Baud rate:	1200, 2400, 4800, 9600, 19200, or 38400.
Data bits:	6, 7, or 8.
Stop bits:	1, or 2.
Parity:	None, Even, or Odd.

- **External VRU** serial Set-Up

  This is the RS232C communications set-up for a VRU.

  Easytrak interprets the common NMEA pitch and roll string **$HCXDR** and TSS's **TSS1** string. The PNI Corporation **TCM2.X** format can also be interpreted. The communication parameters set-up has to agree with the set-up of the VRU.

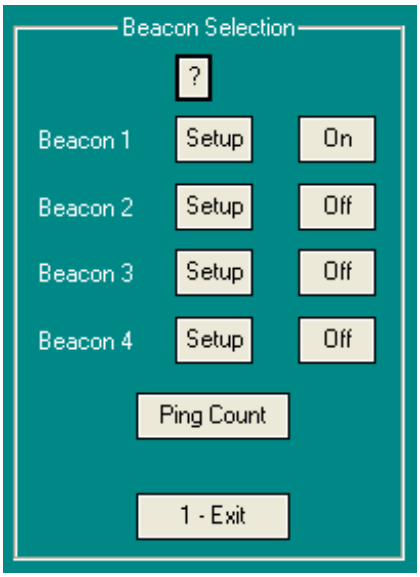
  Please note there is no hardware or software handshaking in either direction.

  Serial set-up.

Baud rate:	1200, 2400, 4800, 9600, 19200, or 38400.
Data bits:	6, 7, or 8.
Stop bits:	1, or 2.
Parity:	None, Even, or Odd.

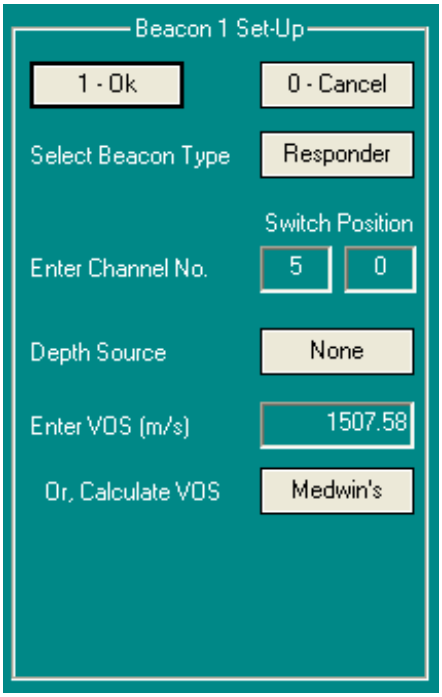
Beacons Menu

By pressing '2' on the keypad, the Beacon Selection Window is displayed. This selection sets up the type, channel number, and VOS for individual beacons (targets).



Beacon Selection

Beacon Set-Up



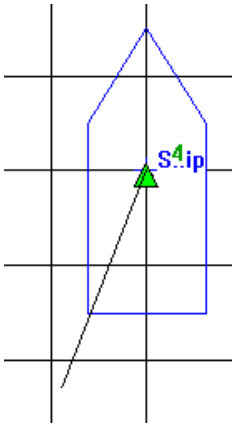
Beacon Set-Up

- **Select beacon type** Button

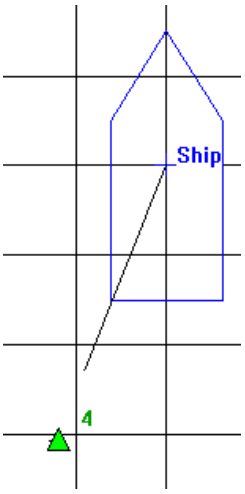
  Transponder: A beacon that will receive an acoustic interrogate signal at a particular frequency, and then reply (transmit) after a set time (turn around delay) on a different frequency. The frequencies are determined by the channel number set on the transponder. Ensure that the channel number set on Easytrak and the beacon are the same.

  Responder: A beacon that will reply (transmit) after receiving an electrical rather than acoustic signal. Easytrak outputs a 12V positive going pulse through the auxiliary connector on the front panel, which is usually wired directly to the responder connector. Please refer to the appropriate beacon manual for wiring details. The reply frequency is determined by the channel number set on the responder. Ensure that the channel number set on Easytrak and the beacon are the same.

  Pinger: A beacon that transmits at set intervals without being interrogated. The transmit interval is typically around once per second. The pinger transmit frequency is determined by the channel number set on the beacon. Pingers generally can only give a bearing and depression angle.

  The bearing for a pinger is indicated on-screen by a line from the ship.

  However, if the depth of the pinger is known, and entered in the manual depth option in beacon set-up, Easytrak can compute the pinger's position.

  Release: Works as a transponder, but allows communications with certain releases.

  Ensure that the channel number set on Easytrak and the beacon are the same.

- **Channel number**

  Onscreen Channel entry is based on the switch settings layout on an Applied Acoustics 900 series beacon. Enter the switch positions in the text boxes for switch 1 and switch 2.

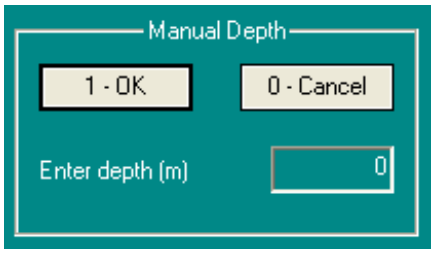
- **Depth source** Button

  None:

  Any depth value for the target is derived from the target range and depression angle.

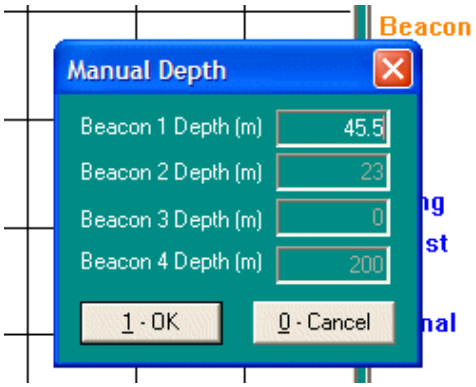
  Manual:

  If manual is selected, the following window will be displayed after the **channel set-up Window**.



Manual Depth entry Window

If the manual depth option is selected, the entered value will override that derived acoustically. This option is useful when the target is static for example, on a wellhead or marking a wreck and the depth is known.



Depth Hotkey

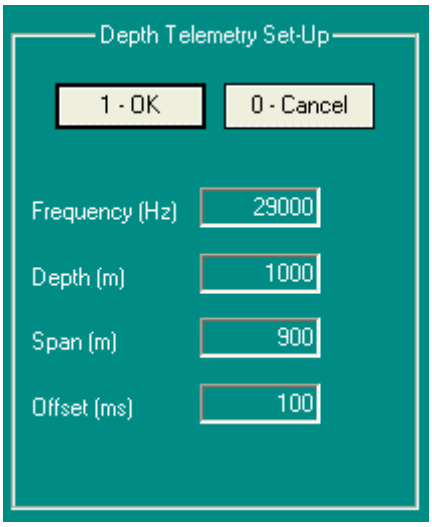
To enter manual depths quickly, a hotkey is available. By pressing the '.' (Period) key on the keypad, the window opposite will be seen. A depth can only be entered if the beacon depth setup is selected to manual, and the beacon is selected on, otherwise respective text boxes will be grayed out, as with beacons 2, 3, and 4. A manual depth of 45.5m has been entered for beacon 1 in the example above.

Telemetry:

Using telemetry, gives a more accurate indication of beacon depth particularly at low depression angles than using acoustics. Depth beacons, rather than transmitting one pulse, transmit two, where the time difference between the two pulses is proportional to the depth of the beacon below sea level.

The four parameters used by manufacturers to allow the calculation of depth are **Frequency**, **Gauge Depth range**, **Offset** and **Span**. **Offset** is the delay between the two pulses at zero depth. **Span** is the conversion factor for calculating the depth from the additional time delay.

If telemetry has been selected, the following window will show after the **channel set-up Window**.



Depth Telemetry Set-Up Window

The values of Frequency, Depth (gauge range), Span, and Offset are automatically set into text boxes according to the channel selected and mode of the channel selected, e.g. a TPII channel, or a HPR3 channel etc.

For TPII beacons, the above values can be changed to suit different 'depth range' gauges. Note, for HPR3 and HPR4 channels, only frequency is displayed, as HPR3 beacons by default work out at 2 meters per ms, and HPR4 1 meter per ms. The above window shows TPII channel 50 using a 1000m depth gauge.

The depth beacon manufacturer's user manual should be consulted to determine the frequency, depth range, span, and offset used.

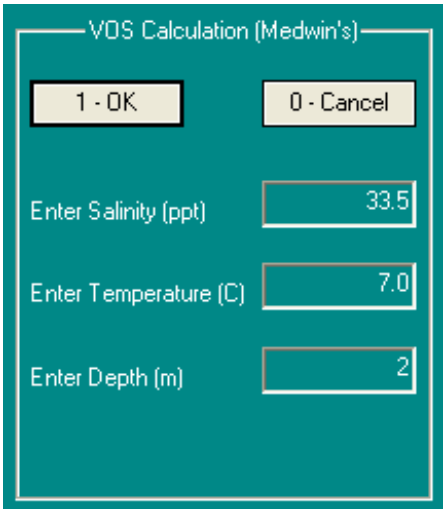
Note if the channel number is subsequently changed, the values will be set to the new channel's mode.

If depth telemetry is selected, this value will override that derived acoustically or any previously entered manually.

- **Enter VOS (m/s).**

  This menu selection allows the user to enter the Velocity Of Sound (VOS) for transmission through water used in **range calculation**.

  VOS can be entered manually or can be calculated by using Medwin's method of calculation. If a VOS profile is known for the working area, an average VOS can be entered into Easytrak. To use Medwin's method, the following window is displayed:-



VOS calculation using Medwin's formula

Salinity (ppt): Water salinity in Parts Per Thousand ***(ppt)***.

Temperature (C): Water temperature in degrees centigrade.

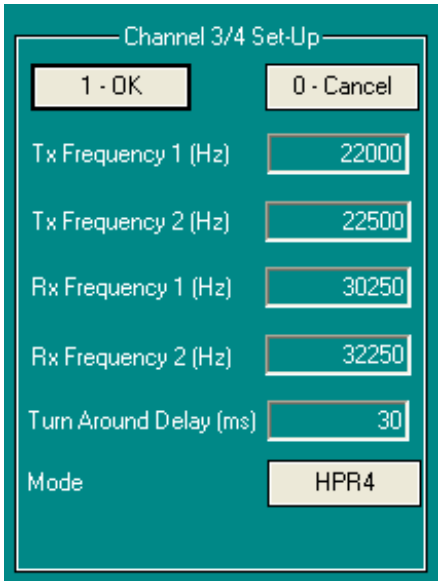
Depth (m): Half the depth of the beacon below water level in meters.

If Medwin's is used, the 'Enter VOS (m/s)' text box in the 'Beacon Set-Up' Window will be automatically filled with the result.

When the **channel set-up Window** is closed, a window is shown giving default set-up details for the channel and beacon type chosen.

These details can be changed if so wished; e.g., the turn-around-delay (TAD) on certain Trackpoint beacons can be varied, and therefore it would be necessary to change the TAD in Easytrak for the beacon to prevent erroneous ranges.

The Window for a **transponder** set to channel **3/4** can be seen to the right.



Channel Set-Up Window

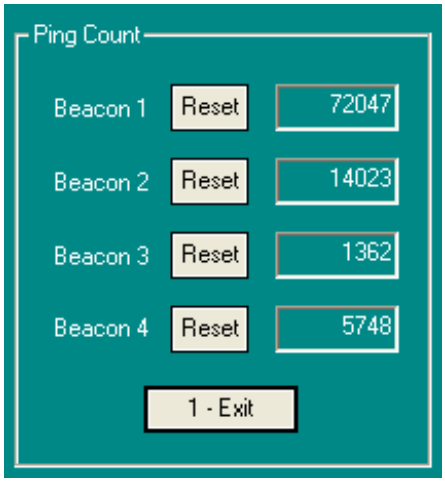
Channel set-up windows for **Transponders**, **Responders,** and **Pingers** are in the same format, however, only information that is relevant to the beacon is shown.

Beacon 1 – 4 On/Off Buttons:

These buttons start or stop the interrogation of the appropriate beacon.

Ping Count Button:

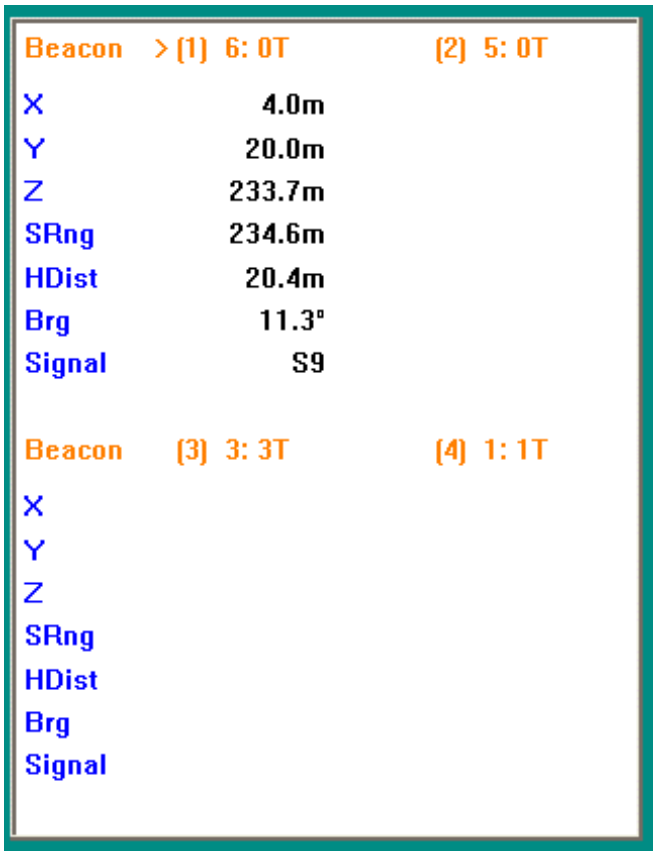
The ping count is the number of attempted interrogations Easytrak has made for a particular beacon. In certain circumstances, the count can be used to give an indication as to the battery life of a beacon.



Ping Count

- **Reset**: Selecting the reset button clears the count for that beacon.
- **Count** text box**:** Individual ping count.

Position Data Screen



Position Data Screen

- The '>' indicates the beacon being interrogated.
- [1], [2], [3], [4], indicates the beacon identification number.
- The channel number is in the form of 'nn:nn'. The number is based on the switch settings layout on an Applied Acoustics beacon; switch 1 followed by switch 2.
- The letter following the channel number indicates the type of beacon, 'T' = transponder, 'R' = responder, and 'P' = pinger.
- **X** and **Y** (or Eastings and Northings) indicate the relative of absolute co-ordinates on the horizontal plane in meters.
- **Z** is the distance of the target below the transducer or reference point in meters.
- **SRng** is the slant range to the target in meters.
- **HDist** is the horizontal distance to the target in meters.
- **Brg** is the bearing to the target in degrees.
- **Signal** is an indication of signal level **S0** (Minimum) to **S9** (Maximum)

On-screen Beacon color-coding scheme

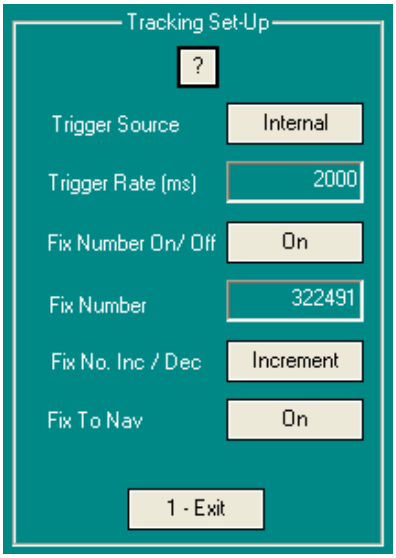
Green: Good reply, correct received frequency, and the derived position fits within all gating windows **selected** when in GATED or SMOOTHED display modes.

Orange: The latest derived position falls outside one or more gating widows, or the wrong received frequency, or the signal lost where the number of times the signal has been lost is less or equal to the degree of smoothing selected. Only used in display GATED or SMOOTHED modes.

Red: Where the number of times the signal has been lost is greater than the degree of smoothing selected in gated or smoothing modes, or for each signal lost in display Ship or North referenced modes.

Tracking Menu

By pressing '3' on the keypad the following Tracking Set-Up Window is displayed:-



Tracking Set-Up

Trigger source button

This button determines whether fixes are triggered by an **internal** timer or through an **external** 12V pulse, from for example a navigation computer. See Appendix 4 for details.

Trigger rate (ms) text box

This entry determines in milliseconds (ms) the rate at which targets are interrogated when the trigger source is set to 'Internal'. The minimum and maximum trigger rates are **900ms (0.9s)** and **30000ms (30s)** respectively.

Fix number On/off button

When on, the fix number will increment or decrement after each **cycle** of interrogations, if for example beacons 1, 3 and 4 are switched on, the fix number will increment or decrement by one after beacons 1, 3 and 4 have been interrogated.

Fix number text box

Allows the user to set the fix number.

Fix No. Inc/ Dec button

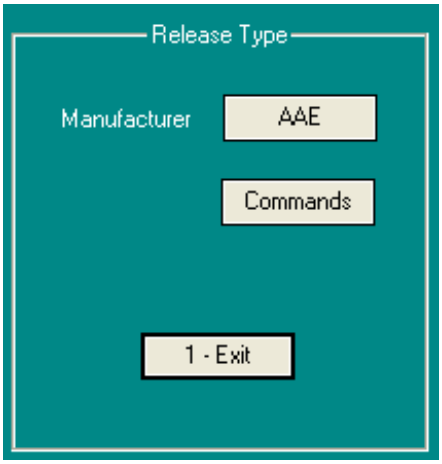
Selecting the fix number inc/dec button decides whether the fix number is incremented or decremented.

Fix to Nav button

When selected ON, a 12V positive going pulse is available from the Auxiliary connector. See Appendix 4 for details.

Release Menu (Optional)

To select the **Release** menu press '4'. This button enables Easytrak to monitor and control certain release beacons.



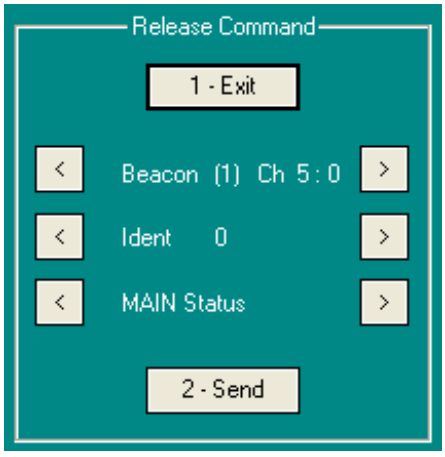
Release Set-Up

Manufacturer button

Each manufacturer of release beacons has a different protocol for monitoring and control. This button selects the manufacturer, defining the command set to be used. The standard Easytrak has only the protocol for AAE releases.

Commands button (Disabled if option not selected)

This button opens a 'Command' Window determined by which 'Manufacturer' has been selected. The Window below is for Applied Acoustic's releases. Please read the Release manual for the correct sequence of commands.



Release Commands

- Beacon (1 to 4)

  The channel number for the particular beacon is shown.

- Ident (0 to 15)

  AAE release beacons are internally set to a particular **ident**ification number.

- Commands

  These are the commands transmitted from Easytrak to the Release. Easytrak will display the response from the Release in a Window beneath the Release Command Window. Should the Release not reply or only a partial message is received, a **Timeout message** is displayed.

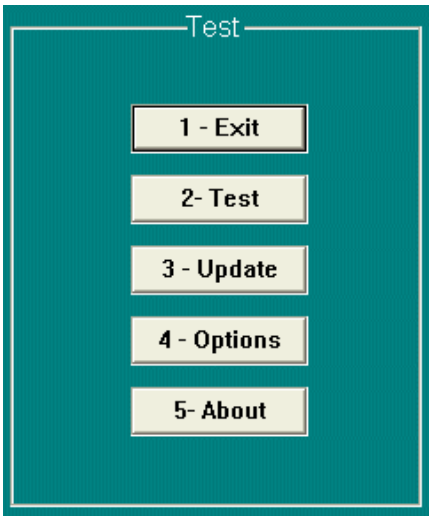
  The following commands are available for the AAE release beacon:-

	Command	Action	Reply
0	Main Status	A request for beacon status	Shows if release is armed, if tilt is enabled, if release is faulty, and if release is asleep.
1	Tilt status	A request for tilt status.	Status of tilt sensor 1 and 2.
2	Battery status	A request for battery status	Battery status indication, if the release has jammed, if the motor is faulty, or if the shaft is broken.
3	Arm release	Arms the release	Reply same as ‘0’
4	Fire release	Fires the release.	Reply same as ‘0’
5	Prime release	Primes the release.	Reply same as ‘0’
6	Put to sleep	Puts the release in power saving sleep mode.	Reply same as ‘0’
7	Wake up	Wakes the release up from power saving mode.	Reply same as ‘0’
8	Anti-jam	Prevents the jamming of the release.	Reply same as ‘0’
9	Reset release.	Resets the electrics and mechanics of the release.	Reply same as ‘0’

For further information, please refer to the manual supplied with the release beacon.

Test Menu

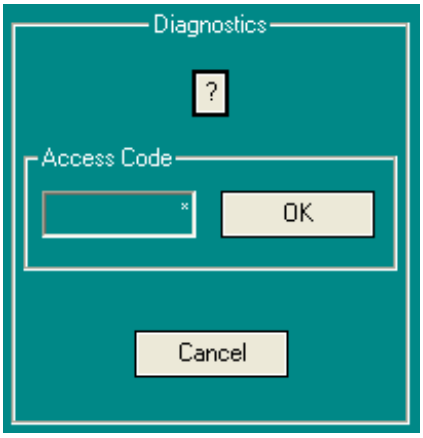
To select the **Test** menu press ‘4’ and the following screen appears:-.



Test and Diagnostics

Diagnostics Menu

The diagnostics menu allows access to additional data such as gating information and signal to noise values for individual receiving channels.



Diagnostics menu

- **Access code** text box

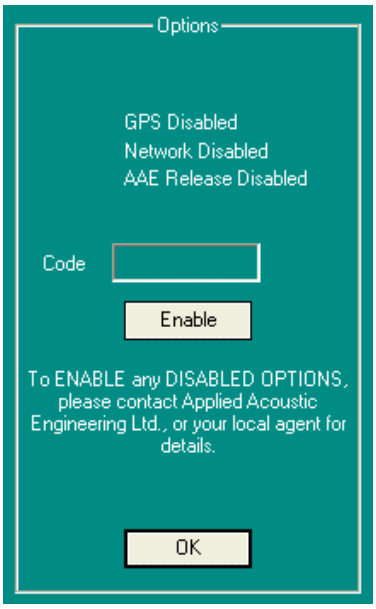
  Refer to the Help menu [?] for available codes.

Update Menu

Program files in the Easytrak system can be updated using the data serial connector COM1. The communications parameter set-up for **Update** is automatically configured. Note on the completion of **Update**, COM1’s communications set-up reverts to the settings prior to **Update**. Note, when in this mode, the interrogation of targets is disabled.

Options Menu

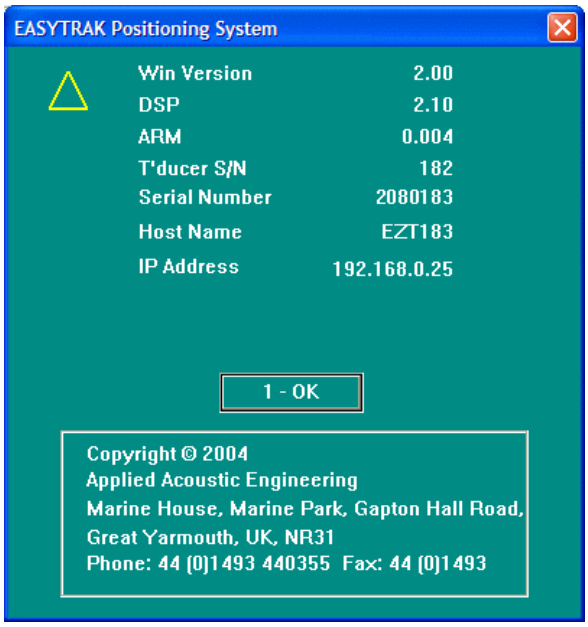
This window shows which options are enabled or disabled. To enable a disabled option, contact Applied Acoustic Engineering Ltd., or your local agent for details.



Options Menu

About screen

This display gives Company contact details, software version numbers, and the unit serial number.



'About' screen

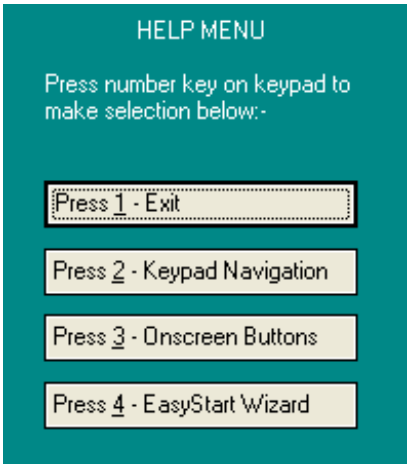
The IP address will only be present if Easytrak is connected to a network, or directly to a PC using a crossover cable.

Front panel hot keys F1 to F5

Front Panel Hot Keys

The Front Panel Hot keys allow quick access to popular functions including Help and volume control. To use the hot keys F1 to F5 press the corresponding buttons on the Easytrak front panel.

F1 – Help Button



Help Menu

- Keypad Navigation (screen)

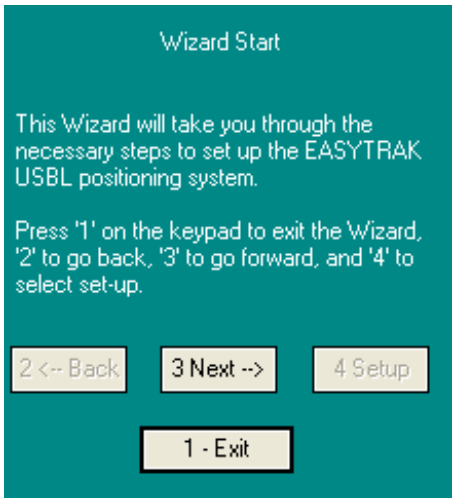
  This opens a Window describing the actions of the keys on the Easytrak keypad.

- Buttons (screen)

  This opens up a Window describing the actions of the buttons in the Easytrak Windows.

- EasyStart Wizard

  EasyStart is a Wizard guiding the user through the basic configuration of the system.



Easytrak Wizard

EasyStart sets up:-

- **Offsets**
- **Velocity of sound**
- **Beacons**
- **Tracking**

F2 – Volume Button

Each press of F2 Increases the volume to the maximum level, after which, another press returns the volume to the minimum level.

F3 – Scale Button

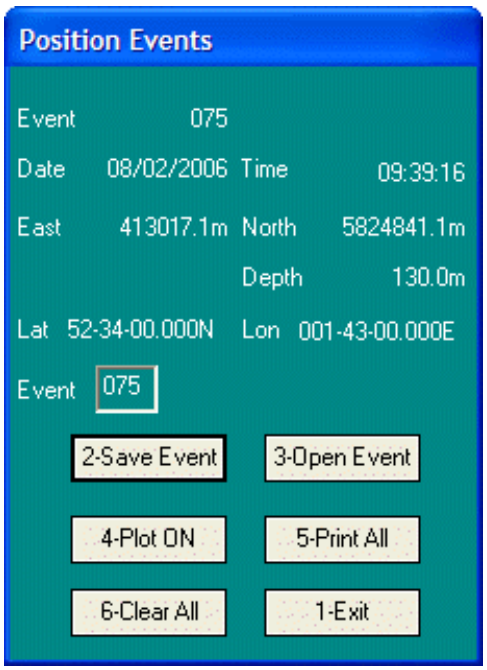
Each press of F3 selects the next display scale. Scales available are:- 1m, 2m, 5m, 10m, 20m, 50m, 100m, 200m, 500m, and Auto per ring or grid line. The scale is displayed on the right hand side of the plotting widow.

F4 – Display mode Button

Each press of F4 switches between Grid and polar display.

F5 – Events Button

On pressing F5, the following dialog box is displayed, showing the current date, time, and position of the last interrogated beacon.

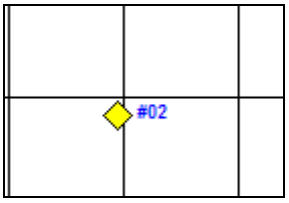


Position Events

The dialog box has six keys:

1. On selecting **1-Exit**, the dialog box closes down without saving the event.
2. On selecting **2-Save Event**, the event is saved and the dialog box closes down.
3. **3-Open Event** allows the inspection of a previous event. Enter the event number in the 'Event' text box then select **3-Open Event**, the time, date and position of that event will be displayed.

4. By default, events are plotted on the screen if they are within the screen area. **4-Plot** toggles plotting on or off for that particular event.
5. On selecting **5-Print All**, each event's information is outputted through Data Port2. Ensure the Data port is set up correctly.
6. On selecting **6-Clear All**, all event information is cleared.



Position Event #02 displayed

When events are saved (selecting 2), the event number is automatically incremented; however, if '1' is selected, the event number will not be incremented. On clearing the events, the event number returns to one.

Remote Display Option

To provide remote viewing of the Easytrak display, an Ethernet connection is available from the auxiliary connector. This can either be connected to a ship's network, or when using a crossover cable, directly to a PC.

The status of the network connection can be seen in the utility window on the Easytrak display.

The Host name and assigned IP address of Easytrak can be viewed in the 'About Box' selected from the Test menu.

For further information, please see the leaflet/manual supplied with the Easytrak Remote program.

Note the remote display program is not supplied with Easytrak Portable as standard.

Easytrak Power Supply

Easytrak can be powered from two sources, the external power supply, or the internal battery.

The external power supply will also charge the battery whilst running Easytrak.

Easytrak can be run on the internal battery for between 3 to 4 hours depending on charge and the life of the battery. It typically takes 10 hours to fully charge the battery, after which, the battery will trickle charge. The battery cannot be overcharged.

Should the unit be running on batteries and the charge in the battery is too low, the unit will audibly beep and the message **"WARNING LOW BATTERY, Closing Down Soon"** will be displayed on the screen. Prior to automatically switching off, the current system and user set-up will be saved. Should a power supply be connected to Easytrak before the automatic powering down, the beep will stop and the warning message will disappear after a short while.

Maintenance

There are no user replaceable parts within the Easytrak control unit other than the main battery pack that should only be replaced with a unit from AAE. All internal fuses are thermal resettable other than an internal ‘one-shot’ fuse within the battery pack.

Cleaning:

Front panel and case. To clean the front panel and case of the Easytrak control unit a lightly damped cloth should be used rather than a solvent. Solvents are not recommended.

Ensure the transducer is clean and uncontaminated prior to installation. Grease can have an adverse affect on the transducer. A lightly damped cloth should be used. Solvents are not recommended. On recovery, wash the transducer in fresh water to remove any mud and salt deposits.

Battery refitting:

Unscrew the 10 front panel screws using an appropriate Allen key. Please note that the battery pack and all circuit boards are attached to the front panel.

1. Carefully lift the front panel out of the case.
2. Place the front panel face down on a soft surface to prevent scratching.
3. The battery pack can be seen on the side opposite to the front panel connectors.
4. Unplug the in-line connector between the battery pack and unit.
5. Remove the four sets of screws, washers, and nuts attaching the battery cover to the unit.
6. Replace the battery pack.
7. Refit by reversing the actions of instructions 1 to 5.

Product Recycling / Disposal

Within the EU all electronic components and batteries must be taken for separate collection at the end of their working life under EU WEEE directives. Applied Acoustics as a manufacturer within the EU will responsibly dispose of any returned end of life Applied Acoustics components / batteries through a registered WEEE scheme. In order to prevent uncontrolled waste disposal and promote re-cycling please return any end of life Applied Acoustic components postage paid by sender to our UK head office. Please contact Tech Support for a RMA number prior to shipping.

Troubleshooting

Fault / Symptoms	Possible Causes	Comments
No display and no key backlighting	Switched off/ Discharged battery	Switch on/ Connect power supply.
Unit appears to freeze, where key presses are ineffective.	Windows CE problem.	Reset the unit by pressing the '-', '.' and 'NEXT' key simultaneously for about ten seconds. The unit should then switch off.
Unstable positions (General)	Transducer not deep enough in the water.	Ensure the transducer is deep enough in the water. It is recommended the transducer is below the draft of the vessel by at least 1 meter.
Unstable positions (Bearing instability but range fairly stable)	Bearing instability but range fairly stable	This may be due to multipath (reflective) interference close to the transducer or close to the target. It may be due to vessel movement especially if no form of compass/ pitch/ roll compensation is being used. Try lowering the transducer further in the water.
Unstable positions (Bearing instability and range unstable.)	Bearing instability and range unstable.	This may be due to multipath interference away from the transducer e.g. pipelines, underwater structures, and thermoclines. If the sea is flat calm, it is common for the water / air interface to give strong reflections.
Unstable positions (General)	Acoustic noise	This very much depends from where the noise originates. This noise may be audible via the internal speaker or headphones. The noise can be vessel borne such as from the propeller (try running at different revs), sonar systems (try synchronizing so that the sonar's transmission does not overlap Easytrak's receive time. It is known in certain parts of the world for marine animals to generate quite loud acoustic signals.
	Electrical noise	This can be from generators, welding kits, radio communications, sonar systems etc. This noise may be audible via the internal speaker or headphones. If possible, switch off the equipment one system at a time until the offending piece of equipment can be identified.
	Channel	Does the channel selected on Easytrak agree with that selected on the beacon?
	Beacon interrogation power	This may be due to a partially discharged battery, fouled transducer, or beacon fault. Try using another beacon.
	Transducer interrogation power	Try increasing Easytrak's interrogate power. Check that the transducer's transducer is not damaged or fouled.

Troubleshooting cont.

Fault / Symptoms	Possible Causes	Comments
	Beacon reply insensitivity	This may be due to a fouled transducer, or beacon fault. Try using another beacon.
	Transducer reply insensitivity	Check that the transducer is not damaged or fouled.
	Electrical noise	See above.
No ranging or lack of range:	Acoustic noise	See overleaf.
	Thermoclines	This is due to abrupt changes of VOS in water due to variances of water temperature and / or salinity. The effect of this can be to 'tunnel' the acoustic signal away from either the target or transducer.
	Obstruction	The signal may be blocked by submerged parts of the vessel, seabed objects – manmade and natural. Bubbles of air and gas produced by the vessel's propeller.
Incorrect internal compass	Not Calibrated	Calibrate the compass. See appendix 8.
	Magnetic anomaly	Strong magnetic anomalies can be beyond the calibration range of the internal compass. Should this be the case, it is recommended that an external gyrocompass is used. If you are using a metal pole, make sure it is not made of iron or other magnetic material!

Appendix 1 - System Specification

System Performance

Beacon Types	Transponders, Responders, and Pingers.
Interrogation Rate	0.9 - 30 seconds or external key.
Slant Range Resolution-	10cm.
Position Accuracy	Standard 1.4° RMS, 2.5% of slant range. High accuracy 0.6° RMS, 1.0% of slant range. Excluding effects due to incorrect VOS, ray bending, compass, roll, and pitch effects, and acceptable S/N ratio.
Heading Sensor Accuracy	When level 0.8° RMS When tilted 0.8° RMS
Tilt Sensor Accuracy	Accuracy ± 0.2° RMS Range ± 50°

Electrical

Power supply

Input: 100 – 240V~ 47-63Hz typically 1.0A.
Output: 18V ⎓ 4.4 A maximum.

Battery

The Easytrak internal battery is charged using the supplied power supply. Note Easytrak can be used for positioning whilst the battery is charging.
Type NiMH.
Fully charged battery life is typically 3 - 4 hours.
Charging time is typically 10 hours.

Transducer

Reply bandwidth 23 to 33 kHz (for accurate tracking).
Reply beam pattern – Hemispherical.

Interrogate power:-

Low:	typically 180 re. 1µPa@1m
Medium:	typically 186 re. 1µPa@1m
High:	typically 188 re. 1µPa@1m

Interrogate bandwidth 17 to 27 kHz.
Interrogate beam pattern – Hemispherical.

Communications

All RS232C inputs must comply with EIA (Electronics Industry Association) RS232C standard.

Mechanical

Dimensions

Enclosure 400 x 300 x 1900 (mm).
Transducer 330 x 100 diameter (mm).
Cable 12.5 mm diameter, yellow polyurethane sheathed, various lengths are available.

Weight

Enclosure 8Kg approx.
Transducer 10Kg in air, 6.5Kg in water approx.

Protection

Enclosure is splash proof with IP67 rated connectors.
Transducer housing Material Transducer **AliBronze or AliSilicon**.

Operating Temperature -5 to 30°C.

Storage Temperature -5 to 45°C.

Miscellaneous

Display:	Color TFT VGA display.
Keypad:	Membrane keypad with backlight.
Channels:	4 channels displayed from 108 stored.

Specification is subject to change without notice.

Appendix 2 - Easytrak Channels available

Switch [1] [2] & Comments	Rxf1 (Hz)	Rxf2 (Hz)	Txf1 (Hz)	Txf2 (Hz)	Mode	TAT (ms)
[0] [0] ***DO NOT USE ***	*********	*********	*********	*********	******	*********
[0] [1]	29762	31762	20492	18500	HPR	30
[0] [2]	30488	32488	21552	19550	HPR	30
[0] [3]	31250	33250	22124	20125	HPR	30
[0] [4]	31847	29847	22727	20725	HPR	30
[0] [5]	32468	30468	23364	21375	HPR	30
[0] [6]	27173	29173	24038	22050	HPR	30
[0] [7]	27777	29777	24510	22500	HPR	30
[0] [8]	28409	30409	25000	23000	HPR	30
[0] [9]	29070	31070	26042	24050	HPR	30
[0] [10]	24000	0	18000	0	TPII	15
[0] [11]	24000	0	17000	0	TPII	15
[1] [0] TP LXT Code 1	23000	0	17000	0	TPII	15
[1] [1] Sonadyne's 11 'Square'	27173	29173	21552	23550	HPR	30
[1] [2]	29250	31250	21000	21500	HIPAP	30
[1] [3]	29750	31750	21000	22000	HIPAP	30
[1] [4]	30250	32250	21000	22500	HIPAP	30
[1] [5]	30750	32750	21000	23000	HIPAP	30
[1] [6]	27250	29250	21000	23500	HIPAP	30
[1] [7]	27750	29750	21000	24000	HIPAP	30
[1] [8]	28250	30250	21000	24500	HIPAP	30
[1] [9]	25000	0	18000	0	TPII	15
[1] [10]	25000	0	16000	0	TPII	15
[1] [11]	26000	0	21500	0	TPII	15
[2] [0] TP LXT Code 2	25000	0	19000	0	TPII	15
[2] [1]	28500	30500	21500	21000	HIPAP	30
[2] [2] Sonadyne's 22 'Circle'	28409	30409	22727	24725	HPR	30
[2] [3]	29500	31500	21500	22000	HIPAP	30
[2] [4]	30000	32000	21500	22500	HIPAP	30
[2] [5]	30500	32500	21500	23000	HIPAP	30
[2] [6]	27000	29000	21500	23500	HIPAP	30
[2] [7]	27500	29500	21500	24000	HIPAP	30
[2] [8]	28000	30000	21500	24500	HIPAP	30
[2] [9]	26000	0	18000	0	TPII	15
[2] [10]	28500	0	17500	0	TPII	15
[2] [11]	26500	0	18500	0	TPII	15
[3] [0] TP LXT Code 3	27000	0	17000	0	TPII	15
[3] [1]	28750	30750	22000	21000	HIPAP	30
[3] [2]	29250	31250	22000	21500	HIPAP	30
[3] [3] Sonadyne's 33 'Delta'	29762	31762	23923	21925	HPR	30
[3] [4]	30250	32250	22000	22500	HIPAP	30
[3] [5]	30750	32750	22000	23000	HIPAP	30
[3] [6]	27250	29250	22000	23500	HIPAP	30
[3] [7]	27750	29750	22000	24000	HIPAP	30
[3] [8]	28250	30250	22000	24500	HIPAP	30
[4] [0] TP LXT Code 4	29000	0	19000	0	TPII	15
[4] [1]	30000	28000	22500	21000	HIPAP	30
[4] [2]	29000	31000	22500	21500	HIPAP	30
[4] [3]	29500	31500	22500	22000	HIPAP	30
[4] [4] Sonadyne's 44 'X'	31250	29250	25126	0	HPR	30
[4] [5]	30500	32500	22500	23000	HIPAP	30
[4] [6]	27000	29000	22500	23500	HIPAP	30
[4] [7]	27500	29500	22500	24000	HIPAP	30
[4] [8]	28000	20000	22500	24500	HIPAP	30
[4] [9] 1000ms cycle, 5ms pulse	26000	0	0	0	Pinger	0
[4] [10] 995ms cycle, 5ms pulse	27000	0	0	0	Pinger	0
[4] [11] 990ms cycle, 5ms pulse	28000	0	0	0	Pinger	0
[5] [0] TP LXT Code 5	30000	0	17000	0	TPII	15
[5] [1]	28750	30750	23000	21000	HIPAP	30
[5] [2]	29250	31250	23000	21500	HIPAP	30

Switch [1] [2]	Rxf1 (Hz)	Rxf2 (Hz)	Txf1 (Hz)	Txf2 (Hz)	Mode	TAT (ms)

[5] [3]	29750	31750	23000	22000	HIPAP	30
[5] [4]	30250	32250	23000	22500	HIPAP	30
[5] [5] Sonadyne's 55 'Y'	32468	30468	26455	0	HPR	30
[5] [6]	27250	29250	23000	23500	HIPAP	30
[5] [7]	27750	29750	23000	24000	HIPAP	30
[5] [8]	28250	30250	23000	24500	HIPAP	30
[5] [9] 985ms cycle, 5ms pulse	29000	0	0	0	Pinger	0
[5] [10] 980ms cycle, 5ms pulse	30000	0	0	0	Pinger	0
[5] [11] 1000ms cycle, 10ms pulse	37500	0	0	0	Pinger	0
[6] [0]	28000	0	18000	0	TPII	15
[6] [1]	28500	30500	23500	21000	HIPAP	30
[6] [2]	29000	31000	23500	21500	HIPAP	30
[6] [3]	29500	31500	23500	22000	HIPAP	30
[6] [4]	30000	32000	23500	22500	HIPAP	30
[6] [5]	30500	32500	23500	23000	HIPAP	30
[6] [6] HPR3 Test (TAT 330ms)	29762	0	23923	0	HPR	30
[6] [7]	27500	29500	23500	24000	HIPAP	30
[6] [8]	28000	30000	23500	24500	HIPAP	30
[6] [9]	23000	0	16000	0	TPII	15
[6] [10]	23000	0	18000	0	TPII	15
[6] [11]	23000	0	20500	0	TPII	15
[7] [0]	30000	0	18000	0	TPII	15
[7] [1]	28750	30750	24000	21000	HIPAP	30
[7] [2]	29250	31250	24000	21500	HIPAP	30
[7] [3]	29750	31750	24000	22000	HIPAP	30
[7] [4]	30250	32250	24000	22500	HIPAP	30
[7] [5]	30750	32750	24000	23000	HIPAP	30
[7] [6]	27250	29250	24000	23500	HIPAP	30
[7] [7] TPII Test (TAT 315ms)	29000	0	19000	0	TPII	15
[7] [8]	28250	30250	24000	24500	HIPAP	30
[7] [9]	24000	0	17000	0	TPII	15
[7] [10]	24000	0	19000	0	TPII	15
[7] [11]	25000	0	17000	0	TPII	15
[8] [0]	29000	0	21000	0	TPII	15
[8] [1]	28500	30500	24500	21000	HIPAP	30
[8] [2]	29000	31000	24500	21500	HIPAP	30
[8] [3]	29500	31500	24500	22000	HIPAP	30
[8] [4]	30000	32000	24500	22500	HIPAP	30
[8] [5]	30500	32500	24500	23000	HIPAP	30
[8] [6]	27000	29000	24500	23500	HIPAP	30
[8] [7]	27500	29500	24500	24000	HIPAP	30
[8] [8] HiPAP Test (TAT 330ms)	30000	32000	21500	22500	HIPAP	30
[8] [9]	26000	0	17000	0	TPII	15
[8] [10]	33000	0	21000	0	TPII	15
[8] [11]	31000	0	18000	0	TPII	15
[9] [0] (Not assigned)						
[9] [1] Sonardyne Ch1 CRF	26042	0	19230	0	HPR	125.8
[9] [3] Sonardyne Ch1 CRF	26042	0	20491	0	HPR	125.8
[9] [4] Sonardyne Ch1 CRF	26042	0	21186	0	HPR	125.8
[9] [5] Sonardyne Ch1 CRF	26042	0	21929	0	HPR	125.8
[9] [6] Sonardyne Ch1 CRF	26042	0	22522	0	HPR	125.8
[9] [7] Sonardyne Ch1 CRF	26042	0	23148	0	HPR	125.8
[9] [8] Sonardyne Ch1 CRF	26042	0	23810	0	HPR	125.8
[9] [A] Sonardyne Ch1 CRF	28733	0	24752	0	HPR	125.8
[9] [B] Sonardyne Ch1 CRF	29411	0	24752	0	HPR	125.8

Switch [1] [2]	Rxf1 (Hz)	Rxf2 (Hz)	Txf1 (Hz)	Txf2 (Hz)	Mode	TAT (ms)
[10] [0] EasyTrak default CH1	30000	0	17500	0	AAE	30
[10] [1] EasyTrak default CH2	28000	0	18500	0	AAE	30
[10] [2] EasyTrak default CH3	26000	0	19500	0	AAE	30
[10] [3] EasyTrak default CH4	29000	0	20500	0	AAE	30
[10] [4]	27000	0	21500	0	AAE	30
[10] [5]	30000	0	22500	0	AAE	30
[10] [6]	27000	0	18000	0	AAE	30
[10] [7]	28000	0	18000	0	AAE	30
[10] [8]	30000	0	18000	0	AAE	30
[10] [9]	29000	0	18000	0	AAE	30
[10] [10] (Not assigned)						
[10] [11] (Not assigned)						
[11] [0]	30000	0	20000	0	AAE	30
[11] [1]	29000	0	20000	0	AAE	30
[11] [2]	28000	0	20000	0	AAE	30
[11] [3]	27000	0	21000	0	AAE	30
[11] [4]	26000	0	21000	0	AAE	30
[11] [5]	28000	0	21000	0	AAE	30
[11] [6]	30000	0	21000	0	AAE	30
[11] [7]	26000	0	22000	0	AAE	30
[11] [8]	25000	0	17000	0	AAE	30
[11] [9]	25000	0	19000	0	AAE	30
[11] [10] (Not assigned)						
[11] [11] ***DO NOT USE***	*********	*********	*********	*********	******	*********

Switch [1] denotes the left-hand switch and [2] refers to the right-hand switch on an AAE beacon.

TPII refers to ORE Trackpoint II / II+ and HPR refers to Simrad 300 and 400 series (not HiPAP).

Using any frequencies above that are outside EasyTrak's standard specification may incur a loss of performance and give spurious positions.

Appendix 3 – Data output strings

Applied Acoustic Engineering (AAE) Data string

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

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

Description	String code
Beacon identification (1 to 4)	i
Data type: Ship ref (0), North ref (1), Gated (2), Smoothed (3)	t
Hour	h
Minute	m
Second	s
X (or Eastings)	x
Y (or Northings)	y
Z (Depth)	z
Slant range	r
Bearing to target	b
Depression angle	d
Compass	c
Roll	R
Pitch	p
Status (see overleaf)	S
Carriage return (CR)	C
Line Feed (LF)	L

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

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

Example strings

"Normal" string

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

"GPS" string

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

Note * = space.

Error codes

Any error code is constructed by adding the following.

Interrogation has timed out	001
Outside range gate	002
Outside bearing gate	004
Outside depression angle gate	008
Outside horizontal distance gate	016
Outside velocity gate	032
GPS error	064
Reply frequency incorrect	128
Reply signal overload	256

For example, if the error code is 048, two errors have occurred, 016 (outside horizontal distance gate) + 032 (outside velocity gate) = 048.

An error code of '000' means no error.

Trackpoint 2EC Data string

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

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

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

Note * = space.

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

Example:-

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

Note * = space.

Error codes

No error	00
Lost signal	06

Simrad HPR 300P Data string

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

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

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

Note * = space.

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

Example:-

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

Note * = space.

Error codes

No error	' OK'
No reply	'NRY'

Trackpoint STD-EC W/PR Data string

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

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

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

Note * = space.

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

Example:-

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

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

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

Note * = space.

Error codes

No error	00
Lost signal	06

Simrad HPR 309 Data telegram

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

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

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

Comments on the Simrad HPR309 Telegram

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

Comments on the Simrad HPR309 Telegram cont'd

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

Simrad $PSIMSSB Data string

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

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

Example string

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

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

Simrad $PSIMSNS Data string

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

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

Example string

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

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

Pseudo $GPRMC Data string

RMC - Recommended Minimum Navigation Information.

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

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

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

Example String

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

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

Appendix 4 – Default Set-Up

This appendix contains the set-up enabled if “DEFAULT set-up information file” is loaded from the System File Set-up menu.

Description	**Setting**
(1) System Menu	
System set-up information (file)	Start-Up
Display setup	
Data source	North Ref
Display mode	Grid
Display center	Ship
Display X Offset	0m
Display Y Offset	0m
Grid scale	Auto
Target trail (on/off)	On
Trail points	32
Velocity of sound (Phase)	1500m/s
Reply Set-Up	
Beacon (1 to 4)	
Gain type	AGC
Setup	
AGC max gain	100%
AGC gain step	12%
Manual	0%
Interrogate	
Interrogate power	Low
Audio	
Audio source	Channel 1
Audio volume	1

Default Set-Up /Cont…

Gating	
Horizontal Distance (dist)	20m
Horizontal Distance (on/off)	On
Slant Range (dist)	20m
Slant Range (on /off)	Off
Velocity (velocity)	10m/s
Velocity (on /off) Off	
Heading (Bearing)	20°
Heading (on /off)On	
Depression Angle (Bearing)	10°
Depression Angle (on /off)	Off
Auto gating (on/off)	On
Smoothing	Low
Survey Set-Up	
GPS (on/off)	Off
Set-Up	
Calculator	Lat and Lon = 0°
False easting	500000m
False northing	0m
Central Meridian Scale factor	0.9996
Grid origin (latitude)	0°N
Grid origin (longitude)	3°E
Waypoints	
Waypoints (on/off)	Off
Waypoints easting	0m
Waypoints northing	0m
Distance Alarm	
(on/off)	Off
From	Ship
To	Beacon 1
Maximum distance	100m
Offsets	
X offset	0m
Y offset	0m
Z offset	0m
Roll offset	0°
Pitch offset	0°
Heading offset	0°
Magnetic Declination	0°
Transducer depth	0m

Default Set-Up /Cont…

Compass	
Compass type	Internal
Roll and Pitch	Internal
Time and date	Not affected
Serial Communications Set-up	
GPS / DGPS	
Set-up	
Baud rate	4800 baud
Data bits	8 bits
Stop bits	1 bit
Parity	none
Format	$GPGGA
Input (on/off)	Off
Data output (printer)	
Set-up	
Baud rate	9600 baud
Data bits	8 bits
Stop bits	1 bit
Parity	none
Format	AAE
Output (on/off)	Off
Compass	
Set-up	
Baud rate	9600 baud
Data bits	8 bits
Stop bits	1 bit
Parity	none
VRU	
Set-up	
Baud rate	9600 baud
Data bits	8 bits
Stop bits	1 bit
Parity	none

Default Set-Up /Cont…

(2) Beacon selection Menu

Beacon 1

Beacon (on/off)	Off
Beacon type	Transponder
Channel number	10/0
Depth source	None
Velocity of sound (Range)	1500 m/s
Manual depth	0m
Rxf1	30.0 kHz
Rxf2	0.0 kHz
Txf1	17.5 kHz
Txf2	0.0 kHz
TAT	30ms
Mode	AAE
Telemetry Frequency	29.0 kHz
Telemetry depth	1000 m
Telemetry offset	100
Telemetry span	900

Beacon 2

Beacon (on/off)	Off
Beacon type	Transponder
Channel number	10/1
Depth source	None
Velocity of sound (Range)	1500 m/s
Manual depth	0m
Rxf1	28.0 kHz
Rxf2	0.0 kHz
Txf1	18.5 kHz
Txf2	0.0 kHz
TAT	30ms
Mode	AAE
Telemetry Frequency	27.0 kHz
Telemetry depth	1000 m
Telemetry offset	100
Telemetry span	900

Default Set-Up /Cont…

Beacon 3

Beacon (on/off)	Off
Beacon type	Transponder
Channel number	10/2
Depth source	None
Velocity of sound (Range)	1500 m/s
Manual depth	0m
Rxf1	26.0 kHz
Rxf2	0.0 kHz
Txf1	19.5 kHz
Txf2	0.0 kHz
TAT	30ms
Mode	AAE
Telemetry Frequency	25.0 kHz
Telemetry depth	1000 m
Telemetry offset	100
Telemetry span	900

Beacon 4

Beacon (on/off)	Off
Beacon type	Transponder
Channel number	10/3
Depth source	None
Velocity of sound (Range)	1500 m/s
Manual depth	0m
Rxf1	29.0 kHz
Rxf2	0.0 kHz
Txf1	20.5 kHz
Txf2	0.0 kHz
TAT	30ms
Mode	AAE
Telemetry Frequency	28.0 kHz
Telemetry depth	1000 m
Telemetry offset	100
Telemetry span	900

Ping count

Beacon 1	0
Beacon 2	0
Beacon 3	0
Beacon 4	0

(3) Tracking Menu

Trigger source	Internal
Trigger rate	2000ms
Fix number (on/off)	On
Fix number	0
Fix number inc/dec	Inc
Fix output to Nav (on/off)	Off

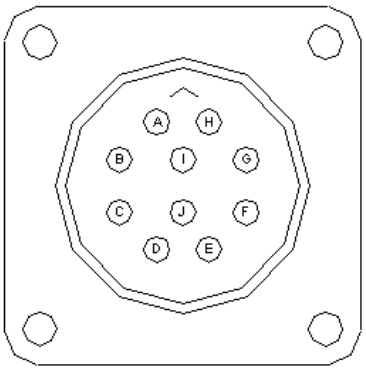
(4) Release Menu (Optional)

Manufacturer	AAE

Appendix 5 - Connector pin outs

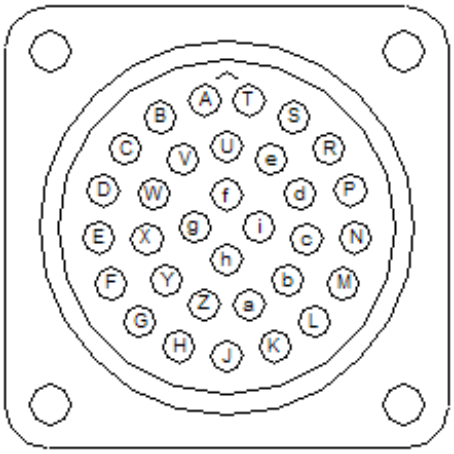
- **Auxiliary Connector (Old)**

A	Responder +ve
B	Responder Gnd
C	Navigation out +ve
D	Navigation Gnd
E	External Trigger in +ve
F	External Trigger in Gnd
G	Phones Switch Gnd
H	Phones audio Gnd
I	Phones audio +ve
J	Phones Switch +ve



- **Auxiliary Connector (New)**

A	N/C
B	N/C
C	N/C
D	N/C
E	Ethernet TX+
F	Ethernet TX-
G	COM4 GND (Future use)
H	COM4 TX (Future use)
J	USB VBUS1
K	USB D1-
L	USB D1+
M	USB GND
N	Responder Out
P	Headphone GND
R	Headphone Out
S	External Fix in
T	External Fix GND
U	N/C
V	N/C
W	N/C
X	Ethernet RX+
Y	Ethernet RX-
Z	COM4 RX (Future use)
a	USB VBUS2
b	USB D2-
c	Responder GND
d	NAV OUT
e	NAV GND
f	Headphone enable GND
g	USB GND
h	USB D2+
j	Headphone enable relay



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- **Power connector**

A +16 to +18VDC
B 0V

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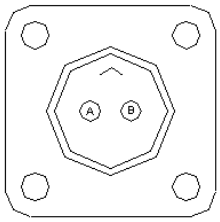
<td> 
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- **Transducer Connector**

U Ref channel+
N PS channel+
M PS channel-
A Ref2 channel+
E Transmitter +
R Transmitter Gnd
D Transmitter Screen
H RS232 Rx
S RS232 Tx
L Ref channel-
B Ref2 channel-
P Power +Ve
V Power -Ve
G RS232 Gnd
K FA Channel+
J FA Channel+
C Power Gnd

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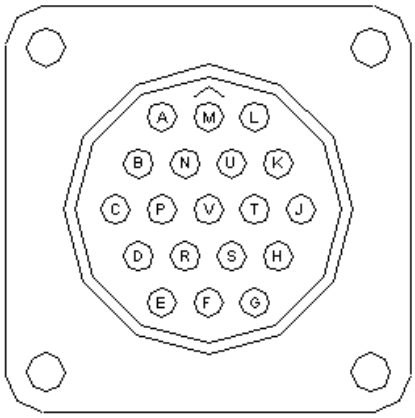
<td> 
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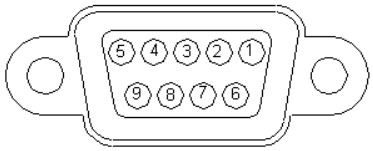
- **Serial Connectors**

2 Transmit Data from Easytrak(Tx)
3 Receive Data into Easytrak (Rx)
5 Gnd

</td>
<td> 
</td>
</tr>
</table>

Appendix 6 - Transducer Cable

Cable:

Outer jacket: Polyurethane

Diameter: 13.0mm (+/- 0.4mm)

Weight (air): 23.7 kg per 100m

Weight (water): 10.4 kg per 100m

Transducer end Connector:

Type – Souriau Jupiter 'M' Series **Part number** FED F 20M T 21.14.SA.

Easytrak end connector:

Type – AB Heavy Duty Sealed Bayonet coupling. **Part number** (Free plug) AB06T 20A48P SN, (Cable clamp) SB 20A48 CCA.

Transducer End	Description	Easytrak End
1	Ref channel+	U
2	PS channel+	N
3	PS channel-	M
4	Ref2 channel+	A
5	Ref2 channel Screen	N/C
6	Transmitter +Ve	E
7	Transmitter Ground	R
8	Transmitter Screen	D
9	RS232 Rx	H
10	RS232 Tx	S
11	FA Channel Screen	N/C
12	Ref channel-	L
13	Ref channel Screen	N/C
14	PS Channel Screen	N/C
15	Ref2 channel-	B
16	Power +Ve	P
17	Power –Ve	V
18	RS232 Ground	G
19	FA Channel+	K
20	FA Channel+	J
21	Power Ground	C

Appendix 7 - Medwin's Formula

Easytrak allows the option of either entering the velocity of sound through water manually or by using an inbuilt calculator.

Easytrak uses Medwin's formula for calculating the velocity of sound in water.

$$\mathbf{V = 1449.2 + 4.6 \times T - 0.055 \times T^2 + 0.00029 \times T^3 + (1.34 - 0.01 \times T) \times (S - 35.0) + 0.0158 \times D}$$

Where: **V** = velocity of sound through water (m/s)

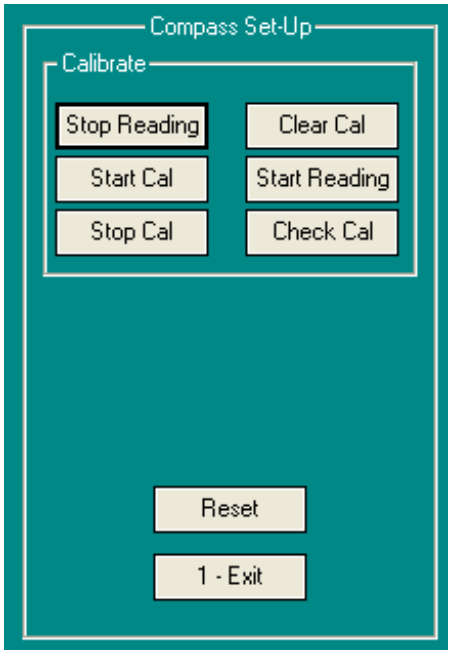
T = Temperature of the water (°C)

S = Salinity in parts per thousand (ppt)

D = depth of the water (m)

Appendix 8 - Easytrak Compass and Roll & Pitch Calibration

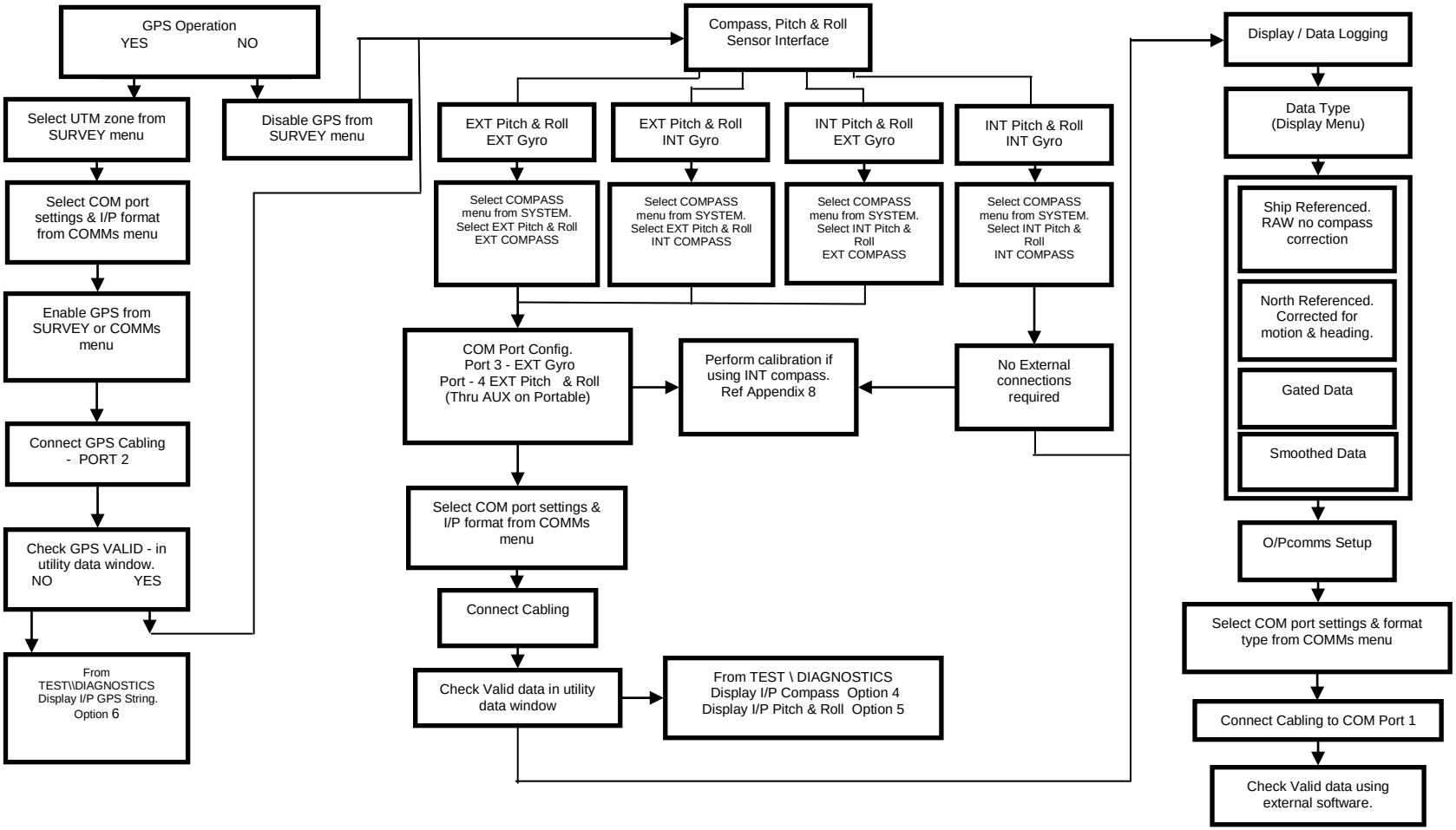
Nearby Iron such as a ship's hull can distort the local magnetic environment resulting in a need for the Easytrak transducer internal compass to require re-calibration. The compass can be calibrated by performing the following steps.



Select button 1 – **System menu**; select the compass menu.

1. Ensure that both Compass selection and Roll and Pitch selection are set to Internal.
2. Select 'Calibration' from either compass or roll & pitch selection.
3. Halt reading by selecting **'Stop Reading'** button.
4. Clear previous calibration values, by selecting **'Clear Cal'.**
5. Start calibration by selecting **'Start Cal'.**
6. Start continuous read by selecting '**Start Reading'.**
7. Rotate the transducer at least twice through 360 degrees slowly (1 min per revolution) with as much roll and pitch as possible.
8. Halt reading by selecting **'Stop Reading'.**
9. Disable the calibration mode by selecting '**Stop Cal'**.
10. Check the quality of the calibration by selecting **'Check Cal'**, the result is presented in the form **HnVnMm.mm** in the bottom data area. The 'n' following H and V should be approaching 9. A low H indicates two circles were not either completed or completed too quickly. A low V indicates not sufficient tilting of the transducer during calibration. The m.mm after "M" indicates the magnitude of the local magnetic field and should be as low as possible, typically around 10.0. The value 30.0 is too high. Repeat from step 3 until the calibration result is satisfactory.
11. Start continuous read by selecting **'Start Reading'.**

Appendix 9 - Easytrak Configuration Guide



Appendix 9 - Easytrak Configuration Guide

Easytrak Configuration Examples		
Desired Configuration	Settings Required	
GPS Referenced Internal Compass Internal Pitch / Roll Data O/P – NMEA String	GPS ON	• Select UTM Zone from SURVEY menu. • Enable GPS from SURVEY menu. • Set Com port settings from COMMs menu. (GPS I/P = USB Port 3)
	Internal Sensors	• From COMPASS menu select INTERNAL for compass & pitch / roll. • A calibration for local magnetic fields can be performed from the CALIBRATION menu – ref Appendix 8.
	Data O/P	• From DISPLAY menu, Data Source must be set to North Referenced to apply heading corrections. (NB as Ship ref is raw with no compass correction applied) • From COMMS menu, Data format – currently supports GPRMC NMEA string this is a pseudo GPS string. Note: In GPS mode grid co-ordinates are substituted in place of x and y co-ordinates in data string Data O/P = USB Port 2
Not GPS Referenced Internal Compass Internal Pitch / Roll Data O/P – Applied Acoustics	GPS OFF	• Disable GPS from SURVEY menu.
	Internal Sensors	• From COMPASS menu select INTERNAL for compass & pitch / roll. • A calibration for local magnetic fields can be performed from the CALIBRATION menu – ref Appendix 8.
	Data O/P	• From DISPLAY menu, Data Source must be set to North Referenced to apply heading corrections. (NB as Ship ref is raw, no compass correction applied only P&R) • From COMMs menu, set port settings and select desired string format – AAE. (Data O/P = USB Port 2)
Not GPS Referenced External Compass - CSI Vector (HEHDT) Internal Pitch / Roll Data O/P – Applied Acoustics	GPS OFF	• Disable GPS from SURVEY menu.
	Sensors	• From COMPASS menu select INTERNAL for pitch / roll. • From COMPASS menu, select EXTERNAL for compass. • From COMMs menu, set Compass port settings and set format – HEHDT.
	Data O/P	• From DISPLAY menu, Data Source set to North Referenced. • From COMMs menu, set port settings and select desired string format – AAE. (Data O/P = USB Port 2)

Appendix 9 - Easytrak Configuration Guide

Easytrak Configuration Examples	
Desired Configuration	Settings Required
Not GPS Referenced External Compass - CSI Vector (HEHDT) External Pitch / Roll - TSS Data O/P – Track Point II	GPS OFF • Disable GPS from SURVEY menu. Sensors • From COMPASS menu, select EXTERNAL for pitch / roll. • From COMMs menu, set VRU port settings and set format – TSS1. From COMPASS menu select EXTERNAL for compass. • From COMMs menu, set Compass port settings and set format – HEHDT Data O/P • From DISPLAY menu, Data Source set to North Referenced. • From COMMs menu, set port settings and select desired string format – TPII (2 Options with / without pitch and roll) Data O/P = USB Port 2

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APPLIED ACOUSTICS
Underwater Technology

Applied Acoustic Engineering Ltd
Marine House
Marine Park
Gapton Hall Road
Great Yarmouth
NR31 0NB UK

Phone: +44 (0) 1493 440355
Fax: +44 (0) 1493 440720

E-mail techsupport@appliedacoustics.com
www.appliedacoustics.com