HYDRO*pro*
Software Series

HYDRO*pro* Navigation
Technical Guide

Trimble

HYDRO*pro*™ Navigation

Technical Guide

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Trimble™

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About This Manual

Welcome to the *HYDROpro Navigation Technical Guide*. The HYDROpro™ Navigation software is a real-time navigation and data acquisition system. It is used for hydrographic survey activities such as port and harbour surveys, marine construction, geophysical surveys, and vessel management.

Scope and Audience

We assume that you are familiar with the fundamentals of Microsoft Windows. We assume that you know how to use a mouse, open a menu, select options from menus and dialog boxes, make selections from lists, and use standard Help commands. For a review of these techniques, consult your Windows documentation.

The following sections provide you with a guide to this manual, as well as other documentation that you may have received with this product.

Organisation

This manual contains the following:

- Chapter 1, Introduction, introduces you to this manual.
- Chapter 2, Technical References, describes the Navigation software configuration options, and the effects of any changes.
- Chapter 3, Geodesy Concepts, introduces you to geodesy concepts such as geoids, ellipsoids, datums, and map projections.
- Chapter 4, Echo Sounder and Heave Components, provides you with information about the NMEA equipment handler.
- Chapter 5, Heading Devices, provides you with information about Heading devices.
- Chapter 6, Position Devices, provides you with information about Position devices.
- Chapter 7, USBL and ROV Tracking Systems, provides you with information about USBL and ROV tracking systems.
- Chapter 8, Tide Gauges, provides you with information about Tide gauges.
- Chapter 9, Environmental Sensors and User Number Equipment Devices, provides you with information about environmental sensors and devices with numerical output.
- Chapter 10, Miscellaneous Equipment Devices, provides you with information about equipment handlers not covered in the previous chapters.
- Chapter 11, Technical Information, provides information on cards and boards supported by the Navigation software.
- Appendix A, Troubleshooting, lists common problems new users may encounter when trying to use the Navigation software.

Related Information

The following sections discuss other sources of information that introduce, extend, or update this manual.

Other Manuals

The *HYDROpro Navigation Software User's Guide* introduces you to the Navigation software.

The *HYDROpro NavEdit Software User's Guide* introduces you to the NavEdit™ software.

README.DOC File

A Readme.doc file contains important information added after the manuals went to print. The installation program also copies it into the program directory.

Release Notes

The release notes describe new features of the product, information not included in the manuals, and any changes to the manuals.

Other Information

This section lists sources that provide other useful information.

World Wide Web (WWW) Site

For an interactive look at Trimble visit our site on the World Wide Web (www.trimble.com). To visit the Marine Survey web page click on the Marine link from the Trimble home page. We recommend that you visit these web pages to view regular newsletters, technical tips, and equipment interface files (called DLLs).

File Transfer Protocol (FTP) Site

Use the Trimble FTP site to send files or to receive files such as software patches, utilities, and FAQs. The address is ftp://ftp.trimble.com.

You can also access the FTP site from the Trimble World Wide Web site (www.trimble.com/ support/support.htm).

To visit the Marine Survey FTP site click on the Pub link from the Trimble FTP home page, then the marine_survey link.

Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, *contact your local dealer.* Alternatively, request technical support using the Trimble World Wide Web site (http://www.trimble.com/support/support.htm).

Reader Comment Form

Thank you for purchasing this product. We would appreciate your feedback about the documentation. Your feedback will help us to improve future revisions. Contributors of particularly helpful evaluations will receive a thank-you gift.

To forward your feedback, do one of the following:

- send an email to ReaderFeedback@trimble.com
- complete and fax or post the reader comment form at the back of this manual to the attention of the Documentation Group. (If the reader comment form is not available, send comments and suggestions to the address in the front of this manual.)

All comments and suggestions become the property of Trimble Navigation Limited.

Thank you for your help.

Document Conventions

Italics identify software menus, menu commands, dialog boxes, and the dialog box fields.

Helvetica Narrow represents messages printed on the screen.

Courier Bold represents information that you must type in a software screen or window.

Helvetica Bold represents a software command button.

[Ctrl] is an example of a hardware function key that you must press on a personal computer (PC). If you must press more than one of these at the same time, this is represented by a plus sign, for example, [Ctrl]+[C].

'Select *Italics* / *Italics*' identifies the sequency of menus, commands, or dialog boxes that you must choose in order to reach a given screen.

Warnings, Cautions, Notes, and Tips

Warnings, cautions, notes, and tips draw attention to important information, and indicate its nature and purpose.

Warning – Warnings alert you to situations that could cause personal injury or unrecoverable data loss.

Caution – Cautions alert you to situations that could cause hardware damage or software error.

Note – Notes give additional significant information about the subject to increase your knowledge, or guide your actions.

Tip – Tips indicate a shortcut or other time- or labour-saving hint that can help you make better use of the product.

1 Introduction

This manual provides you with background information on:

- how the Navigation software handles data
- input and output data formats
- additional device information
- setup and configuration tips for the Navigation software

The Technical Guide is divided into the following main areas:

- Technical References
- Geodesy Concepts
- Equipment Interfacing
- Technical Information

It also contains an appendix on troubleshooting.

For more information see the following sections.

1.1 Technical References

This chapter describes how the Navigation software decodes devices. Details on how the Navigation software deskews the data and uses it are also provided. You can set filters in the Navigation software to make sure that incorrect data is not displayed and collected while you are in Survey mode. The three primary filters that you can use are:

- Moving range time span
- Velocity gate
- Stationary gate

For more information see Chapter 2, Technical References.

1.2 Geodesy Concepts

This chapter provides some brief background information about basic geodesy concepts used in the Navigation software. Explanations about the following are given:

- Geoids
- Geoid models
- Ellipsoids
- Datums
- Datum transformation
- Map projections
- Local sites

For more information see Chapter 3, Geodesy Concepts.

1.3 Equipment Interfacing

Chapters 4 to 10 list the equipment devices that the Navigation software supports.

Within each of these categories the formats of various strings are detailed. This lets you confirm that your equipment is capable of outputting the correct strings into the Navigation software, so that you can decode, display and record data in real time.

For more information see the following chapters:

- Chapter 4, Echo Sounder and Heave Components
- Chapter 5, Heading Devices
- Chapter 6, Position Devices
- Chapter 7, USBL and ROV Tracking Systems
- Chapter 8, Tide Gauges
- Chapter 9, Environmental Sensors and User Number Equipment Devices
- Chapter 10, Miscellaneous Equipment Devices

1.4 Technical Information

This chapter provides you with detailed information on:

- peripheral devices
- remote control software
- backing up your Navigation Projects on Windows 95 and Windows 2000 operating systems

For more information see Chapter 11, Technical Information.

2 Technical References

There are many and diverse hydrographic survey applications, each with different requirements and methods. The Navigation software is designed with the high degree of flexibility in configuration that is required to meet all demands.

The default Navigation software system configuration has been designed for standard applications and methods so that you do not need to make changes to the configuration.

This chapter discusses important Navigation software configuration options and effects. The purpose of this chapter is to make you consider system configuration and to help you make informed decisions. Only those configuration options that require you to have a conceptual understanding are discussed here.

2.1 Vessels

Vessels are vehicles with offset(s) on which your survey equipment is located. You ***must*** create a vessel before you begin to configure equipment.

To create a vessel click **Add** in the *Vessel Configuration* dialog. When you click **OK** in the *Add Vessel* dialog, a vessel is created, with a default offset called Origin and no shape. You can now begin configuring equipment on this vessel. If you want to define a shape for the vessel and more offsets click **Editor**.

You can configure as many vessels with as many offsets as you want. When configuring equipment use the *Located at* group fields (*Vessel* and *Offsets*) to select the vessel and the offset where the equipment is to be located.

2.2 Equipment Services

Setting up your equipment for navigation and data acquisition is as simple as selecting a piece of equipment and assigning it a communication port on your PC. However, underlying this simplicity is the important concept of services.

Data packets received from equipment are time tagged and decoded, individual items of information are extracted into separate streams that are called ‘services’. These services are then available to the system for use in displays, computations, logging, output, and so forth.

Using services improves performance and provides considerable flexibility to equipment configuration including advanced configuration options, such as handling of multiplexed data streams and extraction of specific information from data packets.

This section deals with services and how they are handled, used and related.

2.2.1 Time

Timing is arguably one of the most important aspects of a real-time navigation system. The following sections detail aspects of the latency calculations and time tagging components of the Navigation software.

Accurate System Time (AST)

Your computer clock time drifts with respect to world time, using this time would result in inaccuracy in data timing, positioning, and guidance.

The Navigation software uses an internal timer to provide an accurate system. When you start the Navigation software the computer clock time is observed. From this point on time is generated by the internal timer. As you will read in later sections AST is recorded with all data and events.

Note – Your computer clock time is adjusted by Windows 95, Windows 2000, or Windows NT to Greenwich Mean Time (GMT). Check your operating system time configuration is set to the correct Time Zone.

GPS Time Service

Most GPS receivers time stamp data packets with GPS time. Some receivers also supply GPS time synchronizing pulses (1 pulse per second). GPS time is highly accurate and universal. The Navigation software can be configured to use GPS time to provide both accurate and synchronized data timing, positioning, and guidance.

To use GPS time you must supply the Navigation software with a GPS Time service. That is, a GPS time and its instance.

An example of a GPS Time service is the NMEA ZDA time string. The Navigation software assumes that the first character of this string is the instance of the time contained in the string.

When the GPS Time service is available the Navigation software records a table of times and time differences that synchronizes GPS time with AST (GPS to AST offset).

AST to GPS offset is the result of a moving average calculation.

It is possible to provide the Navigation software with more than one Time service. If this is the case then one of the Time services ***must*** be set as the Master GPS Time Service.

To change the default from the *Configure* menu:

- choose *Master Services*.

The Navigation software records GPS time (when available) with all logged data. Since GPS time is a continuous time standard, if the time stamp in a data packet is UTC time, then the Navigation software adjusts it to GPS time. This is done by using the UTC to GPS time correction from the GPS leap seconds table. You ***must*** keep this table up to date to account for correction changes.

The Navigation software records all times as seconds since 0000 hours on the 1^{st} January 1960.

2.2.2 Heading

Vessel heading can be input to the Navigation software from a gyro or magnetic compass.

A magnetic compass provides vessel heading relative to Magnetic North. A gyro provides vessel heading relative to True North. Magnetic North is related to True North by Magnetic Variation.

The Navigation software operates on the projection (grid) and therefore needs a heading relative to Grid North for calculations. True North is related to Grid North by Convergence, which is calculated according to the vessel location on the projection. See Figure 2-1.

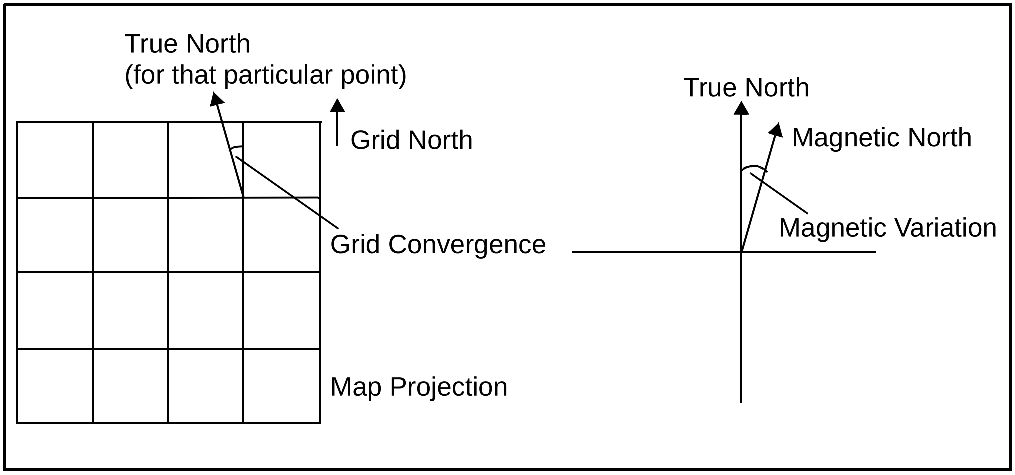


Figure 2-1 Relationship Between True North, Magnetic North and Grid North

Magnetic Compass Heading

The Navigation software time tags (generally at receipt of the first character) and extracts the heading from the input data packet. The extracted compass value is converted to a True North by applying the Magnetic variation specified in the *Constants* tab of the *Global Settings* dialog.

Any orientation correction entered in the *Equipment Properties* dialog is also applied to the heading.

Convergence is applied to obtain a grid heading for the Navigation software calculations.

Gyro Heading

The Navigation software time tags and extracts the heading from the input data packet. The extracted gyro value is adjusted for any orientation in the *Properties* dialog under the *Configure Equipment* dialog. The orientation takes account of misalignment of the gyro to the vessel axis. Convergence is applied to obtain a grid heading for the Navigation software calculations.

Dual Position Heading

You can configure the Navigation software to use the bearing between two position systems located on the vessel. When the vessel has two active position services the *Dual Position heading* option is automatically included for selection in the *Inputs* tab of the *Vessel Dynamics* dialog. This calculated heading is relative to Grid North.

Manual Heading

Vessel heading can be manually entered using Manual Data. You can configure the Navigation software to expect manual input heading as Magnetic, True or Grid in the *Custom* dialog under the *Configure Equipment* dialog. The Navigation software uses the appropriate adjustment procedures as discussed on page 2-5.

2.2.3 Velocity

Velocity is a vector consisting of three components, the Horizontal speed (SOG), the Vertical speed (Climb), and the direction. The Navigation software provides two velocity data streams:

- Offset Velocity – The calculated velocity of any vessel offset derived from two position updates
- Vessel Velocity – the calculated or given velocity of the offset associated with the current positioning system as derived from two position updates or the GPS Velocity service.

The Navigation software calculates velocity, or derives it from the GPS receiver output if required and available.

GPS Velocity Service

Certain GPS receivers supply information from which vessel velocity (track and speed) can be derived. For example, the Trimble Series 4000 GPS receiver supplies velocity east, north and height from which the vessel 2D velocity can be derived. There are serious limitations to the usefulness of GPS velocity. For example, a GPS antenna mounted on the mast of a vessel will have a greater track and speed variation as a result of pitch and roll than the vessel's actual track and speed.

By default, the *Use GPS Velocity* option is disabled. However, if the situation is suitable it can be enabled in the *Vessel Dynamics* dialog. If the *Use GPS Velocity* option is enabled it will be used in position estimation instead of the Calculated Velocity.

Offset Velocity

The velocity vector of individual offsets on the same vessel is not usually the same since the vessel may have a varying attitude (pitch, roll), heading, and heave. For this reason, the Navigation software position estimator calculates the SOG, Climb and Track of all vessel offsets. Attitude (pitch, roll), heading, and the vessel dynamics settings are taken into account.

Vessel Velocity

In the absence of any heading input the track component of the vessel velocity is used for heading if selected in the Vessel dynamics dialog. The event processor uses vessel velocity to predict distance along line events.

Track

Track is the horizontal direction of travel with respect to the earth. See Figure 2-2.

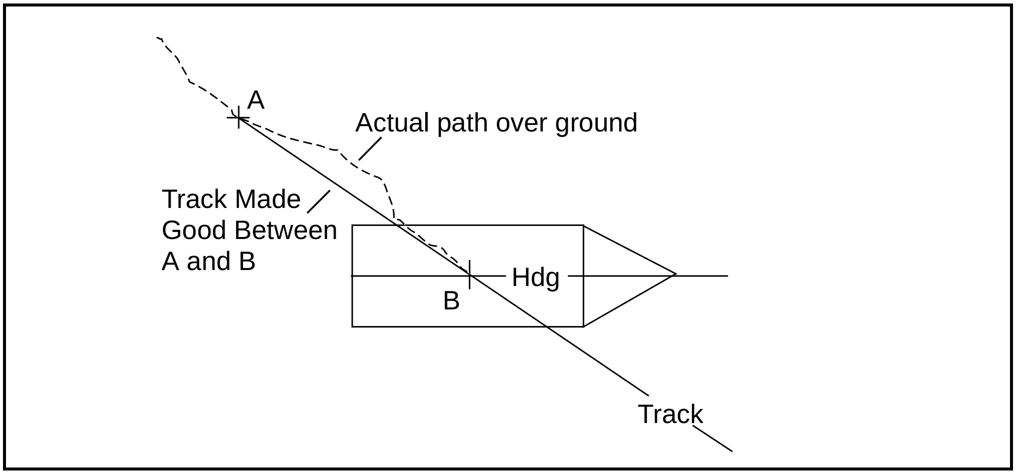


Figure 2-2 Track Made Good

2.2.4 Position

Often the input positions are not on the datum we want to work in. For example, WGS-84 latitudes and longitudes. The positions need to be converted, in real-time, to the local projection. Also events occur and displays update at different intervals to those of the incoming position updates. Therefore, some position estimation is required. The following outlines the concepts used in the Navigation software in this area.

GPS Position Service

The Navigation software decodes GPS latitude and longitude (LL) from the input data packet. It is transformed to the local datum using the specified transformation parameters. The local LL is then converted to your local projection to give GPS antenna Easting and Northing position. Positions of offsets, such as the echo sounder, are computed using the Offset parameters defined in the Vessel Editor and the Heading option you select.

Raw data strings and/or decoded GPS LL and latency values can be recorded with AST. For details on logging see Data Logging, page 2-19.

The *Equipment Monitor* real-time display shows decoded GPS LL. The *Survey Text* real-time display can display GPS LL, local LL, or East / North for the GPS position update.

Position Estimation

Position estimation provides continuous and instantaneous positioning. Without it your vessel position and guidance only updates when a position packet is received by the Navigation software and the latency of the received position is not accounted for.

Position estimation is essential for all dynamic survey activities. It makes sure that you obtain accurate positions at events, such as distance fixing, and that they are accurately generated. It also ensures that the *Plan View Map* and *Offline Bar* displays are real-time.

The Navigation software vessel dynamics is configured, by default, to use position estimation. The Navigation software’s estimator uses the latest GPS position, velocity (calculated or GPS) and AST to estimate the real-time position.

The vessel dynamics settings that you define are critical to good navigation and positioning.

The *Moving range time span* field in the *Vessel Dynamics* dialog defines the time interval over which the velocity (track and speed), used for estimating position, is calculated.

In Figure 2-3 the dots represent the position updates from the navigation receiver. The line drawn is the vector between the first and last position updates occurring within the time span. This vector is the calculated velocity.

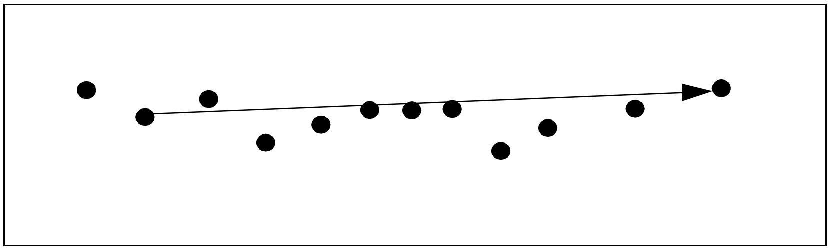


Figure 2-3 Moving Range Time Span

The *Velocity gate* field in the *Vessel Dynamics* dialog sets a gate on the calculated velocity making sure that bad position updates do not get used in the position estimation. If the velocity (calculated or GPS) exceeds the gate setting then it is rejected and the last valid velocity continues to be used.

You ***must*** set the moving range time span and the velocity gate to suit your survey operations and methods.

For example:

When your operations involve random maneuvering or static positioning, such as locating mooring points or fixing static objects, you should use a small or zero moving range time span. This makes sure that little or no estimation is used and therefore the vessel does not appear to drift between position updates. A useful option in these situations is the *Stationary gate* field. If the velocity (calculated or GPS) drops below this setting, estimation is turned off, the last valid heading is retained, and the vessel position is only updated when a position packet is received.

Standard bathymetric survey operations generally involve the vessel navigating along straight survey lines at constant speed and heading. In these cases a moving range time span of 10 to 20 seconds is suitable. However, if survey lines are short and your method of survey involves high speeds and rapid maneuvering, then you should consider reducing the moving range time span at least for turns and the early stages of lines.

Symptoms of Unsuitable Vessel Dynamics Settings

The effects of unsuitable vessel dynamics settings depend on your operation and survey method.

If you use a moving range time span when recording fixes to locate a static point you will find that the spread of fixes is likely to be larger than expected.

If your operation involves high vessel speeds and quick turns onto line and you have an excessive moving range time span then you will observe slow response in turns and erratic fix intervals at the start of a line.

If your navigation receiver is supplying erratic positioning and your moving range time span is too low then you will observe erratic fix intervals.

The *Survey Text* real-time display can show estimated positions for Primary, Secondary and all offset positions.

If you have active Primary and Secondary navigation devices configured, you can select which one to use to calculate offset positions, guidance and event generation.

2.2.5 Depth

This section covers the depth and depth adjustment concepts.

Echo Sounder

The Navigation software time tags extracts and calibrates depth values to obtain decoded depth from the input data packet. The raw data packet and/or decoded depths and latency values can be recorded with AST. For details on logging see Data Logging, page 2-19.

The *Equipment Monitor* real-time display shows the decoded depth.

The *Survey Text* real-time display shows decoded and adjusted depth. Adjusted depth is the decoded depth adjusted for tide, heave and transducer depth (defined as the Z component in the offset definition for your Echo Sounder, in the *Vessel Offsets* tab in the *Vessel Editor* dialog).

You can configure the *Echo Sounder Trace* real-time display to show decoded depths or depths adjusted for tide and/or heave and/or transducer depth.

Heave

The Navigation software time tags and decodes heave from the input data packet. The raw data packet and/or decoded heave and latency values can be recorded with AST. For details on logging see Data Logging, page 2-19.

The *Heave* field in the *Equipment Monitor* real-time display shows the decoded heave.

Heave can be used to adjust depth displays. The Navigation software interpolates and applies heave values for each sounding. Heave is not used if the time between heave updates exceeds the heave Timeout period.

The NavEdit™ software interpolates heave for depth adjustment in postprocessing.

Tide

The Navigation software time tags and decodes tide from the input data packet. The raw data packet and/or decoded tide and latency values can be recorded with AST. For details on logging see Data Logging, page 2-19.

The *Tide* field in the *Equipment Monitor* real-time display shows the decoded tide.

Tide can be used to adjust depth displays as required. The NavEdit software interpolates tide for depth adjustment in postprocessing.

A Tide service can be provided by a radio tide gauge or derived from the height component of an RTK position fix.

An added benefit when using RTK positions is that we can derive tide data from the heights. The following is a brief explanation on how the Navigation software calculates the tide level from the RTK height. We call this tide value RTK Tide.

Currently, the following equipment handlers support RTK Tide:

- NMEA – Altitude values from the GGK string
- Trimble Cycle Printout – Altitude values from the Cycle Printout Type II string
- Trimble 7400 – Altitude values from the binary position string
- Trimble MS750 – Altitude value from the binary position string

These equipment handlers have custom properties for the (RTK) Tide service to allow you to control how the tide data is calculated.

Typically there will be a *RTK Tide* tab in the equipment custom properties dialog with the following fields:

- *Use Averaging*
- *Sample Period*
- *Minimum GPS Quality*

When averaging is active the tide/altitude values received over the sample period are stored. When the sample period expires the average GPS time tag and tide values are calculated. The tide data is then passed onto the application. The tide quality is the last quality value in the sample.

When averaging is not active the first tide/altitude value in each sample (along with its GPS time stamp and quality) is passed onto the application.

The *Minimum GPS Quality* field determines the minimum GPS solution type that can be used for deriving tide values from. If the GPS quality does not meet this level then the corresponding altitude will not be used in the tide calculation. It is recommended that you use a minimum GPS quality of Fixed Int RTK.

We recommend that you set the latency for the RTK Tide to 0 seconds as any other values are not valid for this service.

In addition to the equipment custom properties dialog you will also need to configure the Tide service properties. The properties of most interest here are those on the *Calibration* tab in the *Service Properties* dialog. These calibration values are:

- Apply Vessel Offset Height (z)
- Datum separation

If you select the *Apply Vessel Offset Height (z)* check box then the z component of the offset the Tide service is assigned will be subtracted from the GPS altitude.

Use the *Datum separation* field to enter the separation between the Tide datum and WGS-84. The convention shown in Figure 2-4 is used; positive value indicates the tide datum is above WGS-84.

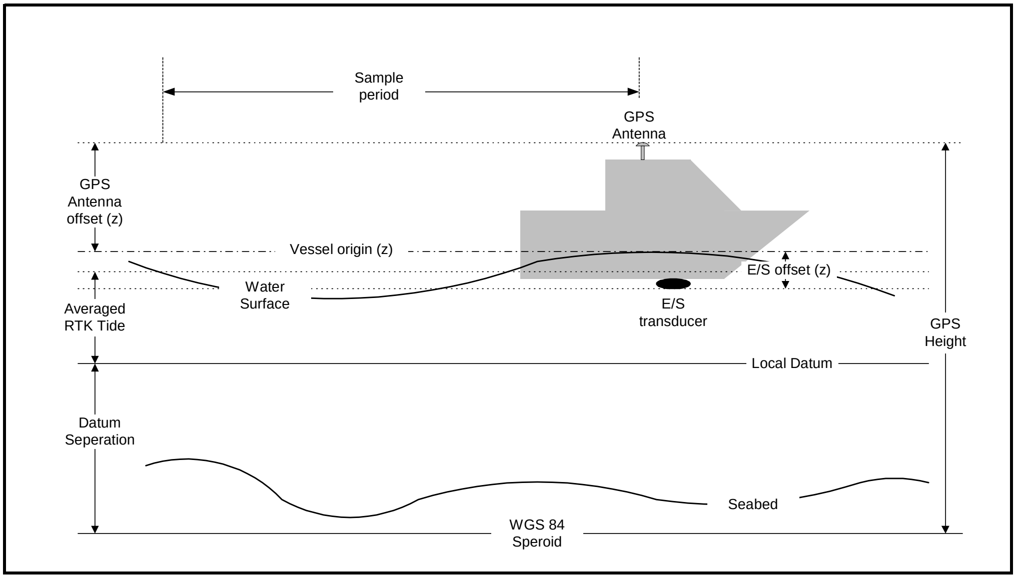


Figure 2-4 RTK Tide

2.2.6 Observers

An observer is a device that is used to track other vessels. An example is the Simrad HPR309 used to track a remotely operated vehicle (ROV).

An observer device outputs observed vessel position in Polar or Cartesian format (Bearing and distance or X,Y, Z coordinates). The position information can be relative to the vessel axis or to Magnetic or True North depending and what heading device(s) are configured and how.

Vessel Heading can be interfaced via the observer device and/or directly to the Navigation software.

The Navigation software uses the observer custom settings to reduce all observer information to the grid and to calculate the observed vessel's position.

When vessel heading is interfaced via the observer device the observations may be supplied relative to the vessel axis or to True, Magnetic or Grid North. You ***must*** define the input format in the *Custom* dialog in the *Configure Equipment* dialog. That is, in the *Observation type* box select either Polar or Cartesian and in the O*bserved bearing* box select Vessel, True, Grid or Magnetic.

When the vessel heading is interfaced directly to the Navigation software, you ***must*** advise the Navigation software that the observed vessel position information supplied is relative to vessel axis. This is done in the *Custom* dialog in the *Configure Equipment* dialog. That is, in the *Observation type* box select Polar or Cartesian and in the O*bserved bearing* box select Vessel.

Note – All vessels have position estimation active by default. If you do not want position estimation to be used for an observed vessel, for example, a remotely operated vehicle, then you ***must*** clear the *Use position estimation* check box in the *Vessel Dynamics* dialog.

Note – If the heading is available in the observer data packet and the equipment handler (DLL) can extract it, then it can be used for vessel heading. To do this you ***must*** enter the *Advanced Equipment Configuration* for the Observer and add the Heading service.

Towline

Towline is a special observer equipment configuration. The Towline configuration is used if you do not have equipment to track a towed object.

This configuration requires you to enter a horizontal distance to the object (a Layback distance) from a defined offset on the vessel.

The Navigation software uses heading and vessel offset parameters to compute the vessel offset position. The calculated or GPS track and the layback (entered in Towline) are then used to compute the towed vessel offset position.

2.2.7 Data Timing

The time of applicability of data must be determined as accurately as possible. This is so that the data can be correctly located and used in real-time and in postprocessing calculations.

For example, position and depth information must be accurately synchronized so that the correct position for a sounding can be determined.

Time of arrival is the time that the Navigation software recognizes the arrival of a data packet.

Time of data is the time of applicability of that data packet.

Latency is the difference between time of data and time of arrival. Latency can be determined from input information or entered as a constant.

To time a data stream is to work out the latency and time of applicability of a data packet.

The Navigation software determines a time of data for all inputs using one of the four options detailed below. The Navigation software detects and offers the options made possible by your system configuration and equipment.

Constant Timing

If the Navigation software is not supplied with the means to determine latency constant (for example, GPS time service or hardware pulse) then time of applicability of data packet can only be determined using a latency constant. Enter the latency constant in the *Latency constant* field in the *Equipment Properties* dialog.

Time of applicability = the time of arrival – the latency constant

Time Stamp

If a data packet contains a GPS time of applicability (a GPS time stamp) and you have provided the Navigation software with a GPS Time service (such as NMEA ZDA), then the Navigation software can determine the latency of the data packet.

Time of applicability = GPS time stamp – the AST to GPS offset

Hard Timing

Certain devices provide a synchronising hardware pulse corresponding to the time of applicability of a data packet. An example is the 1 pulse per second (1PPS) output by the Trimble Series 4000 GPS receiver. The pulse is output at each GPS second.

The Trimble Series 4000 GPS receiver is configured to output the 1PPS and ASCII Time tags. The Navigation software stores the AST for the pulse. The time tags, which precede each pulse by about 0.5 seconds, advise the GPS time of the next pulse.

For GPS positions that are measured at the GPS second, the GPS position data packets are time stamped with AST when received by the Navigation software. The packets are matched to the appropriate pulse by the GPS time stamp in the packet. The difference between the AST for the pulse and the AST for the data packet gives the latency for the packet.

Variable Timing

There are cases where latency may be dependent on the data values received. An example of this could be water depth. In 10 m of water the latency of a sound signal is less than 0.01 secs, however in 1000 m of water it is in the order of 0.67 secs.

This type of timing is only possible when using specialised equipment handlers (DLLs).

The Navigation software automatically uses the most appropriate timing method for each device you install using the *Equipment Configuration* dialog. You can modify the type of data timing that is used in the *Equipment Properties* dialog.

2.2.8 Data Logging

One of primary functions of the Navigation software is data acquisition. This section discusses the various options for the logging of data.

Decoded Data Logging

Decoded data is the individual sensor data item after it has been extracted from the data packet and decoded and calibrated. Decoded data logging is active, by default, when event data logging is active.

Modify decoded data logging in the *Equipment Properties* dialog.

Decoded data can be logged based on time or received packet interval when the Navigation software is online or event data logging is active.

For time based logging select the *On time interval* option in the *Logging* tab of the *Equipment Properties* dialog. Enter the required minimum time interval between consecutively logged records. For example, if you enter **`5 seconds`** the Navigation software waits a minimum of five seconds before logging another record. This means that if the Navigation software is receiving a data packet every four seconds, only the decoded sensor data from every second packet is recorded.

For packet based logging select the *On packet interval* option in the *Logging* tab of the *Equipment Properties* dialog. Enter the packet logging rate you require. For example, if you enter **1** a decoded sensor item is recorded for each packet received. If you enter **5** a decoded sensor item is recorded for every fifth packet received.

It is important that you carefully consider what data logging and rates you use. The quantity of data output from some equipment means that you can log large quantities of data in a short time. You ***must*** consider the following when configuring what data to log and how often to log it:

- your data requirements
- available computer memory
- available disk space
- downloading requirements
- computer performance capabilities

Event Data Logging

The Navigation software has various events that are automatically or manually generated. When an event occurs certain actions result. One of the actions available for any event is to Log Event Data.

The minimum data logged when event data logging is selected is time, event code, and symbol. Additionally, you can configure the Navigation software to record event grid coordinate data.

Note – Event grid coordinate data logging is essential if you want to obtain grid coordinate data from your survey and/or you want to use the NavEdit software processing.

This is only a brief explanation of event data logging. For more information see Events, page 2-27.

Data Logging for Harbor Surveys

A combination of decoded and event data logging is required for harbor surveys.

Decoded data logging is used to record all observed depth data. Event logging is used to mark and annotate the echo sounder roll and to record grid coordinates later used to interpolate positions for decoded depths.

To log all decoded depths:

1. From the *Equipment Properties* dialog select the *Logging* tab.
2. Select the *On packet interval* option and enter an interval of **1** (refer to Decoded data logging). Click **OK**.
3. Repeat this for other depth-related sensors such as tide and heave.

Grid coordinates for decoded depths are interpolated from the logged event grid coordinate data, therefore you must log event position data. Event grid coordinates are not required at the same frequency as decoded depth. Use the Time or Distance event names for event position logging.

For example, to log an Echo Sounder position every 10 metres:

1. From the *Configure* menu choose *Events*.

   The *Events Configuration* dialog appears.
2. Select the Distance Event name and click **Configure**.

   The *Distance Event Configuration* dialog appears.
3. Select the *General* tab and click **Active** to make the distance event active.
4. Select the *Interval* tab and set the *Distance interval* field to 10 metres.
5. Select the *Log Data* tab and select *Log vessel offset positions*.
6. Set the *Events per log* field to 1.

7. Select the vessel offset corresponding to the echo sounder position.

2.3 Guidance

This section discusses definition, selection, and use of guidance objects.

2.3.1 Guidance Objects

In their simplest form guidance objects (GOs) are single points, lines or routes. In their complex form they can be almost anything; a rectangle, disjointed lines, or a combination of points, lines, and routes.

GOs are used for guidance during navigation and data acquisition. They can also be used as background on your *Plan View Map* real-time display. For example, coastlines, cables, or pipelines.

The Guidance Object editor is used to add and edit GOs. The design developed for GO handling means that no matter what form the GO takes, its definition and use are the same.

The Navigation software also lets you import HYDRO DOS runline files as guidance objects. To do this, open the *Guidance Object Editor* dialog, click **Import** and select the *HYDRO/DOS HSR* option.

Guidance Object Groups

GOs are contained in one or more GO groups. Before you can add a GO you ***must*** add a GO group. If there are no existing groups, the *New group* dialog automatically opens when you enter the GO editor.

Using GO groups lets you order GOs and set Properties for all GOs within the group. Group properties include the Coordinate type for point entry (WGS 84 Lat/Long, Local Lat/Long, or NEE) and point and GO Annotation options, as well as specifying the tolerance circle details.

For example, one group can contain all GOs used for guidance during data acquisition. The property for this group for point entry can be configured to NEE coordinate format. Another group can contain GOs used for background on your *Plan View Map* real-time display. The property for this group for point entry can be configured to Local Lat/Long format.

Guidance Object Points

A guidance object is made up of points. To open the *New Point* dialog, first open the *Guidance Object Editor* dialog, then click **Point** and select the *Insert* option. Use the *New Point* dialog to enter point information including Coordinate and Draw Operation. All points have a draw operation (Arc left, Big arc left, Arc right, Big arc right, Line, or Pen up). The draw operation defines how guidance operates for the GO.

A point with a Pen up draw operation is treated as a target. The Line draw operation joins the current point to the next point and is used to link points to form lines or routes. A single line joining two points is also considered a ‘segment’. A route is therefore made up of segments.

Examples of simple GOs:

- To define a GO that is a target, add a GO then enter a single point with the Pen up draw operation.
- To define a GO that is a single line, add a GO then enter a start point with the Line draw operation and an end point with the Pen up draw operation.
- To define a GO that is a single route, add a GO then enter all points with the Line draw operation except for the last point which is given the Pen up draw operation.

Sequence

Each GO group, GO, and point has a unique ‘sequence’. The sequence defines the order used when selecting GO groups, GOs, and points. For more information see Next and Prior buttons, page 2-25.

Sequence is useful for preconfiguring your survey program.

For example, you can send a survey crew into the field with predefined survey priorities or set up an unmanned vessel.

2.3.2 Steer-by Associations

The Navigation software requires that a vessel offset is linked to a guidance object in order for it to supply guidance information. The link is the steer-by association.

Steer-by Association Configuration

To obtain real-time guidance during data acquisition you ***must*** set up a steer-by association. A steer-by association involves selecting a vessel steer-by point and a guidance object by which to steer.

Use the *Configuration* tab in the *Steer-by Association* dialog to associate any vessel and offset with any GO in your project. Also use it to select any point within the GO as the current point on the GO.

Multiple Steer-by Associations

The Navigation software supports more than one steer-by association. You can configure as many steer-by associations as your survey requires. You can assign any number of steer-by associations to each vessel, offset, and guidance object. The only restriction is that each steer-by association has to have a unique name.

Current Steer-by Association

By default, the first steer-by association that you configure in a project becomes the current steer-by. At any stage during a survey, you can select a different steer-by to become the current steer-by.

The current steer-by is the steer-by association that is used in the Next, Prior, and Forward/Reverse operations, as well as being used for event actions.

Next and Prior buttons

You will notice that the terms, ***Next*** and ***Prior***, are used in several places in the Navigation software. There are **Next** and **Prior** buttons on the *Survey* toolbar. There is a *Next/Prior* tab in the *Steer-by Association* dialog, and there are automatic Next and Prior extended actions in the *Events Configuration* dialogs. These are all related.

Next and Prior are survey functions used to load the next or prior GO, segment, or point in the steer-by association. Next and Prior use the sequence number and the *Jump by* setting. The settings on the *Next/Prior* tab in the *Steer-by Association* dialog of the current steer-by association determine the actions of these buttons.

As discussed in the section Sequence, page 2-24, the sequence number defines the order of GO groups, GOs, and points (point sequence effectively orders segments). The *Jump by* setting is used to configure next or prior to missed GOs, segments, or points.

Next and Prior operations can be triggered automatically (for more information see Events, page 2-27), or manually (Survey toolbar / Next () and Prior ().

Use the *Next/Prior* tab in the *Steer-by Association* dialog to choose GO, segment, or point as the next or prior selection option. The default is the GO option as this is used for standard survey operations where you are going from one line to the next. The segment option is generally used where a GO contains disjointed lines as would be the case if you had to split a line because of some exclusion zones, or when surveying a route. The point option could be used when you have a set of targets contained within one GO, using this configuration you are provided with guidance to and between points.

Note – The **Next** and **Prior** buttons only affect the current steer-by association. All other steer-by associations remain unchanged.

2.4 Events

Navigation events are unique occurrences at which actions such as recording positions, updating event names, and selecting new GOs occur. Standard events are automatically generated based on time or distance. Other events can be manually generated using either of the two user event buttons or occur at start and end of GO or at logon and logoff, as well as digital events, for example, when using a Fix box.

There are nine event types each with its own configuration dialog. Access these dialogs through the *Event* command in the *Configure* menu or access them directly using the *Project Outline* view.

Event configuration is restricted when the system is online.

All event types have a *General* tab which lets you set the event type to active or inactive. It also includes fields for setting up event codes.

The *Next event code* field is used to set the event code for the next event of this type. You can enter any combination of alpha and numeric characters. If you require an incrementing or decreasing numeric component in the code then make sure that the numeric value is located at the end of the code name. Use the *Increment by* field to set the rate of change of the numeric component of the code name, this field supports positive and negative integers.

For example:

If the next code is TNL 00010 and the *Increment by* field is set to 10, the event codes will be as follows:

TNL 00010
TNL 00020
TNL 00030
....

Time and *Distance* events have an *Interval* tab in their configuration dialog.

Use the *Interval* tab to configure how and when Time and Distance events occur. The options in this tab are similar, however, there are variations specific to Distance or Time events.

The following notes discuss how the *Interval* tab is used to set up these event types.

2.4.1 Time Events

When configuring Time events the *Start Intervals From* group defines when Time events begin. The selection modifies the text for the next group fields in this tab.

The *Log on* option configures the Time event process to begin at log on, the first event occurs at the first time interval after log on. If an event is required at log on then you ***must*** select the *Event at log on* check box.

Selecting the *Event at log off* check box results in a Time event when you log off.

The *Start of Guidance Object* option configures the Time event process to start when the steer-by vessel offset crosses the start of GO, the first event occurs at the first time interval after the start of GO. If an event at the start of GO is required then select the *Event at start of Guidance Object* option.

Selecting *Event at end of Guidance Object* results in a Time event when the steer-by vessel offset crosses the end of GO.

Use the *Time interval* field to define the time interval required between events.

2.4.2 Distance Events

When you configure Distance events the *Start Interval From* group defines when Distance events begin and what distance intervals are based on (GO or travel distance). This selection modifies the text for the next group fields in this tab.

The *Log on (Distance traveled)* option configures the Distance event process to start after log on. It also configures distance intervals to be based on the distance travelled by the steer-by vessel offset. The first event occurs when the vessel offset has travelled the specified distance interval after log on. If you require an event at log on then select the *Event at log on* check box.

Selecting *Event at log off* results in a distance event when log off occurs.

The *Start of GO (Distance along line)* option configures the Distance event process to start after the steer-by vessel offset has crossed the start of the steer-by GO. It also configures Distance events to be based on the distance traveled along the steer-by GO. The first event occurs when the vessel offset has travelled the specified distance interval along GO beyond the start of GO. If you require an event at the start of GO then select the *Event at start of Guidance Object* option.

Selecting *Event at end of Guidance Object* results in a distance event when the steer-by vessel offset crosses the end of the steer-by GO.

Use the *Distance interval* field to define the distance interval required between events.

2.4.3 Log Data Tab

As the tab name suggests the event data logging functions of this event type are configured here.

In *Log Event Data* group you determine what data is to be logged (if any), as well as the frequency that the data is logged at. The event rate at which event positions are recorded is set by the *Events per log* field, For example, if this field is set to 10 then positions are only recorded every tenth event. If you select the *Log event only* option the event time, code name, and symbol is recorded. You must select the *Log vessel offset positions* option to record coordinates for the events.

Note – You do not need to record all vessel offset positions. However, if you are recording echo sounder data (see Decoded Data Logging, page 2-19) and you require positions for this data (refer to the *NavEdit Software User's Guide*) then you ***must*** select the echo sounder offset from the list at the bottom of the dialog.

Selecting offsets from the list at the bottom of the dialog results in the recording of the positions (NEE coordinates) of the selected vessel offsets in the project database at the time of the event.

2.4.4 Annot ES Tab

This tab is used to configure echo sounder annotation and marking.

The rate at which event annotation/marks are generated is set by the *Events per annotation/mark* field. For example, if this field is set to 10 then annotation/marks are only generated every tenth event.

Selecting the *Annotate with* field allows annotations to be sent to the echo sounder (provided it supports annotation). You can also select what annotation text is to be sent, using the *Annotate with* list. Selecting the *Mark* field causes fix marks to be sent to the echo sounder.

Last, you must select the echo sounders to send annotations and/or marks to. This is done by selecting the desired echo sounder equipment configuration from the bottom of the screen.

An example of a typical event configuration is:

Time event	Active
Start Intervals from	Log On
Time Interval	1.00s
Event at log off	Selected
Events per log	1
Log event data	Log vessel offset positions (and select the echo sounder offset from the list below)
Events per annotation/mark	10
Annotate with: Event time and code	Selected (and select the echo sounder equipment configuration to be annotated)
Mark	Selected

2.4.5 Log State Tab

The *Log State* tab appears in some equipment configurations. Use this tab to automatically control the current log status of the Navigation software. Options available in this tab depend on the event type being configured.

Example:

To configure the Navigation software to log off when the vessel reaches the end of a GO:

1. From the *Configure* menu choose *Events*.

   The *Events Configuration* dialog appears.

2. Make the End of GO event active and click **Configure**.

   The *End of GO Event Configuration* dialog appears.

3. Select the *Log State* tab and select the *Log off* option. Click **OK**.

2.4.6 Steer-by Tab

The function of this tab is similar to the *Log State* tab, except it applies to the selection of the current GOs. That is, the *Steer-by* tab is used to automatically select the next or prior GO to be surveyed.

Example:

To configure the Navigation software to select the next GO when the vessel reaches the end of the current GO:

1. From the *Configure* menu choose *Events*.

   The *Events Configuration* dialog appears.

2. Make the End of GO event active and click **Configure**.

   The *End of GO Event Configuration* dialog appears.

3. Select the *Steer-by* tab and select the *Next GO* option. Click **OK**.

The steer-by association details are listed in the *Steer-by Association* group. You can change these details in the *Steer-by Association* dialog. For more information see Steer-by Associations, page 2-24.

2.4.7 Digital In and Out Tabs

For Digital events, generally for use with the Trimble Fix Box, the *Digital In* and *Digital Out* tabs are available. For more information on the Trimble Fix Box see Fix Box, page 11-9.

2.4.8 Report Tab

This tab contains a list of all the real-time reports that exist in the project. Select the reports to be generated by this event.

2.5 Reports

Often data is required to be output or recorded in specific formats. An example of this is to output navigation data to another computer that analyses environmental data.

As reports can be used for many different purposes the reports need to be very flexible to satisfy the diverse requirements. The Navigation software is designed to let you configure your own real-time reports to meet your needs.

Reports have been broken down into two components:

- Output formats
- Real-time reports

2.5.1 Output Formats

To generate a real-time report you first need to specify the report format. This is where output formats come in. You can select the output formats as the header or format (body) for the reports.

In the *Output Format Editor* dialog you are given the building blocks to create the required string. An output format can consist of any combination of the following items:

- Real-time data (basically any data that can be displayed in the *Survey Text* real-time display)
- Control characters
- Bytes (entered as hexadecimal pairs)
- Text (manually typed text)
- Checksum

Where appropriate, field aspects can be defined, such as how the field is packed, width, alignment, and decimal places. These properties can vary from field to field in the data string.

As you add items to the string, they are displayed on the right side of the dialog. If you select an item on the right side its properties (if any) are displayed on the left side.

There is no limit to the number of output formats that a project can contain.

2.5.2 Real-Time Reports

Once one or more output formats have been added to a project real-time reports can be created.

Besides selecting which output format is used for the format and/or header of the report many other aspects are configured in the *Add Real Time Report* dialog. Other aspects include:

- the output interval
- where the report is to be output to
- when the reports are generated

In addition to setting an output interval, real-time reports can be generated when events occur. Each event type contains a report tab that contains a list of available events that can be selected to be generated when that event occurs.

The reports can be output to COM ports, printer ports, or to a file. The Navigation software must not contain any other configurations (equipment or real-time reports) for the selected COM port for the real-time report, otherwise no data will be output to that port.

There is no limit to the number of real-time reports configured in a project or to the number of times an output format is used.

3 Geodesy Concepts

This chapter covers the following geodesy concepts:

- Geoids
- Geoid models
- Ellipsoids
- Datums
- Datum transformations
- Map projections
- Local sites

3.1 Geoid

The Geoid may be described as the surface coinciding with the mean sea-level of all the oceans, and lying under the land at the level to which the sea would reach if admitted by small frictionless channels. More precisely it is a surface of constant gravitational potential. Irregularities in shape and density cause the geoid to depart from an ellipsoidal form.

3.2 Geoid Model

The geoid model estimates the amount of separation between the geoid and the reference ellipsoid at known points. Geoid models provide us with an estimate of the separation value, called N, between the reference surfaces at a particular point. The basic relationship that exists between these quantities is:

$h + N = H$

Where:

h = orthometric height (or height above sea-level)

N = geoid separation (estimated from geoid model)

H = ellipsoidal height

There are various models that describe the relationship between the geoid and the WGS-84 datum for the entire Earth. See Figure 3-1.

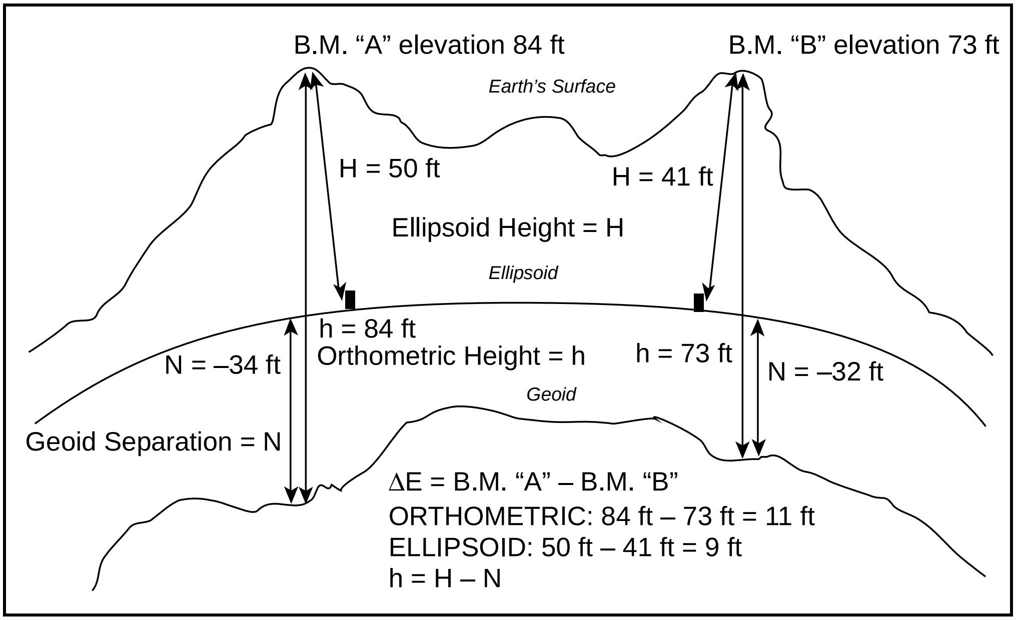


Figure 3-1 Reference Surfaces

3.3 Ellipsoid

The shape of the earth is highly irregular. We know that the earth is slightly flatter at the poles than at the equator, so we use a surface called an ellipsoid to approximate the shape of the earth. An ellipsoid is uniquely defined by two quantities: the semi-minor axis (a), and the semi-major axis (b). The ellipsoid is a 3-dimensional surface that is created by rotating the ellipse about the polar (semi-major) axis. See Figure 3-2.

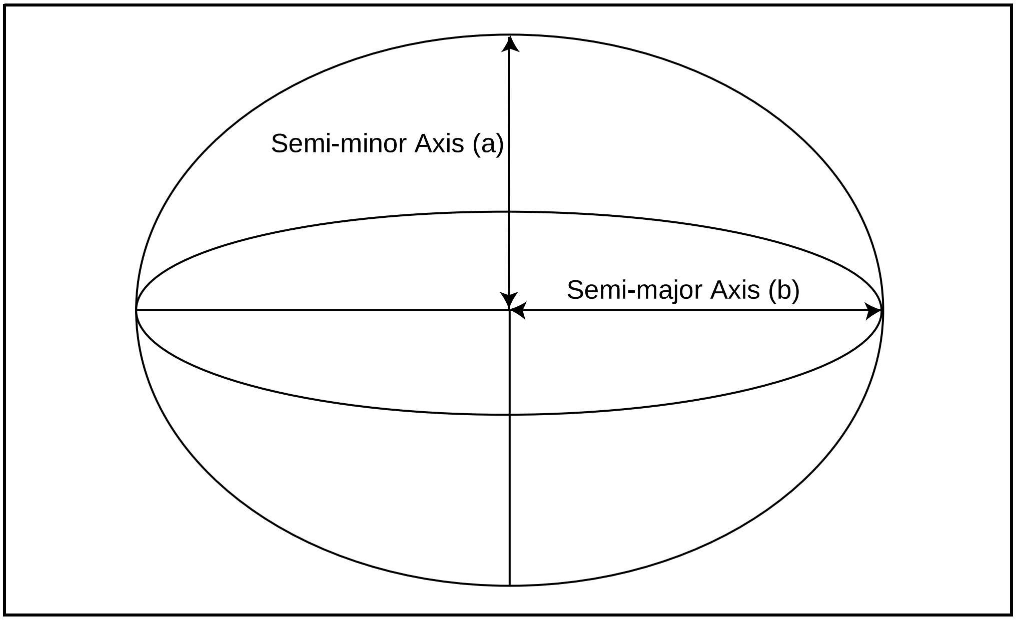


Figure 3-2 Ellipse in 3D

3.4 Datum

A datum is described as being a specifically oriented reference ellipsoid such that the ellipsoid conforms to the geoid over the desired region rather than the whole earth. A datum is usually designed for a specific area of the earth. For example, North America, or Europe. See Figure 3-3.

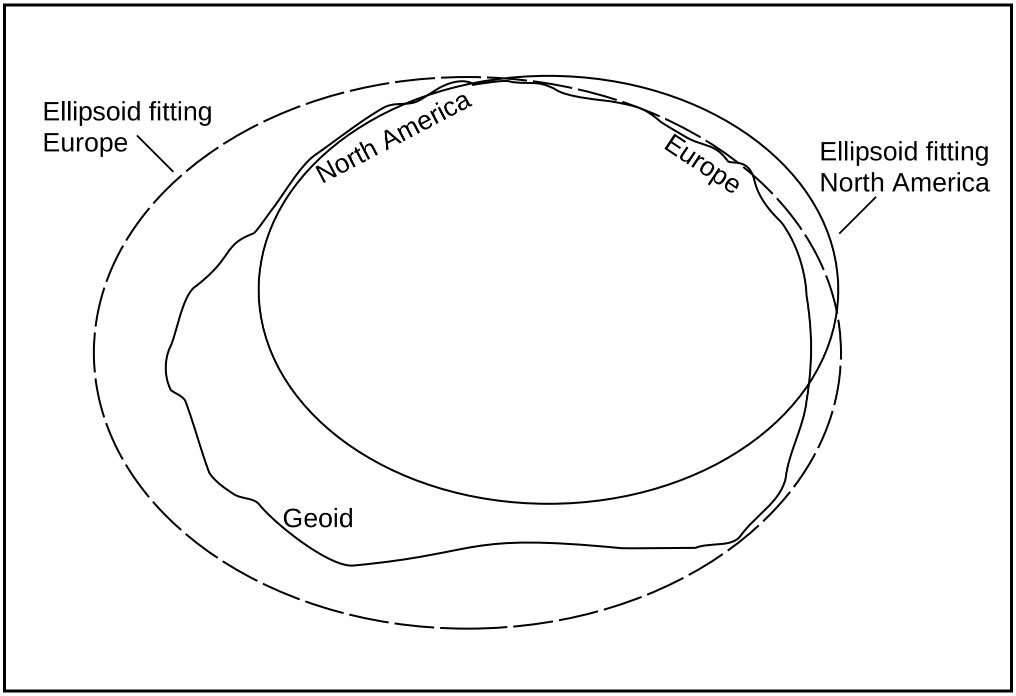


Figure 3-3 Working Surfaces

3.5 Datum Transformations

A datum transformation uses computed parameters to transform geographical coordinates based on one datum into geographical coordinates on another datum. Typically this involves transforming GPS latitude and longitude that is based on the WGS-84 reference datum to latitude and longitude on a user selected local datum.

Transformation parameters are obtained from local observations by comparing positions on the WGS84 datum with those for the same point on the local datum.

There are various transformation methods:

- 2-D Transformations
  - 2-Parameter Transformation
  - Datum Grid
- 3-D Transformations
  - Molodensky (3-Parameter)
  - 7-Parameter Transformation
  - Multiple Regression

The first two transformation methods are a simple datum shift of delta latitude delta longitude. Neither method accounts for height.

The remaining three transformation methods transform latitude, longitude and ellipsoidal height.

3.6 Map Projection

A map projection may be defined as ‘any systematic method of representing the whole or part of the earth upon a plane surface’. The number of ways this can be done is infinite. The curved surface of an ellipsoid cannot be opened into a plane without deformation. Ideally a projection would provide true direction and representation of length and area over the entire map, but this is not possible. It is possible, however, to devise projections that satisfy some of these requirements at the expense of others. See Figure 3-4.

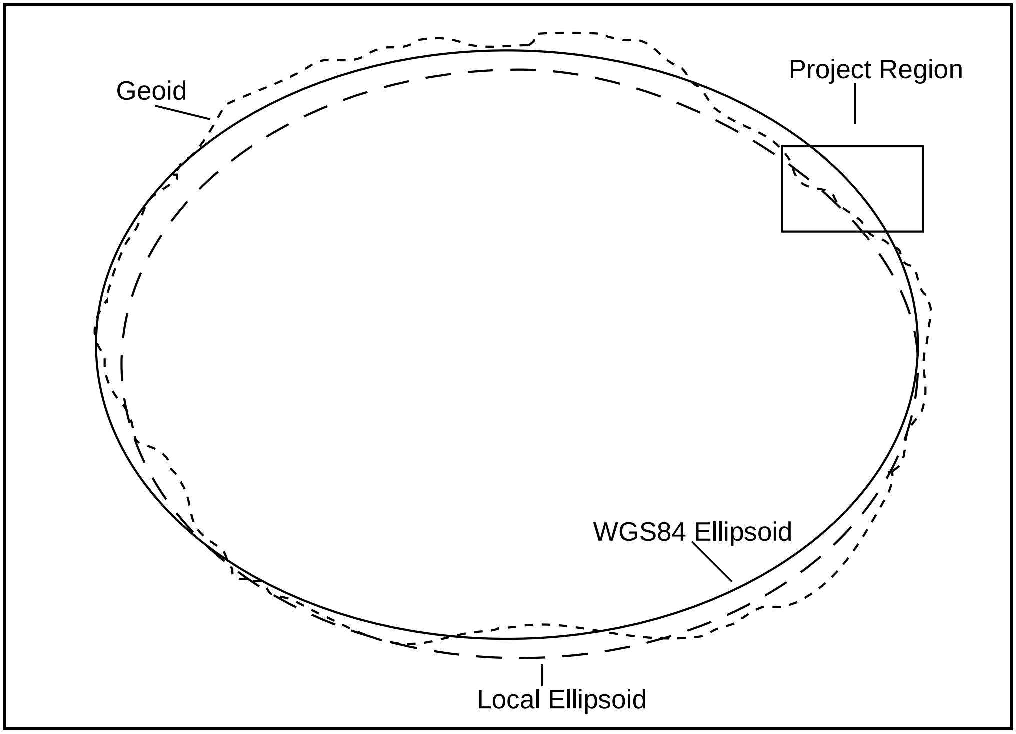


Figure 3-4 Geoid

3.7 Local Site

A local site is used when arbitrary local coordinates instead of map projection coordinates are required. A local site removes discrepancies that exist in easting and northing coordinate values by performing a 2-D transformation (rotation, translation, scale) commonly termed a Helmert transformation. A local site also allows for discrepancies in height values by performing an inclined plane adjustment. The adjustment calculation models the difference between the local ellipsoid and geoid as a sloping plane.

3.8 Geodetics and Map Projections

The Navigation software uses the Coordinate System Manager™ software to edit existing coordinate systems or to create new ones.

The Coordinate System Manager lets you:

- create or edit a coordinate system
- create or edit a zone
- select the projection used by a zone
- create or edit ellipsoids
- create or edit datums
- select the ellipsoid of any datum
- specify height and/or plane adjustments to a zone
- specify height and/or plane adjustments and save them as a named site
- select a height adjustment method
- assign the files to be used by a height adjustment or datum transformation
- specify the units to be used for coordinates and heights

For more information refer to the Coordinate System Manager online Help.

4 Echo Sounder and Heave Components

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (ftp://ftp.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- ELAC LAZ 4100 echo sounder
- ELAC LAZ 4420 echo sounder
- Generic echo sounder
- Innerspace 448 echo sounder
- Innerspace 449 echo sounder
- Kaijo-Denki PS-20R echo sounder
- Knudsen 320 echo sounder
- Navitronics S-10 echo sounder

- NMEA depth
- ODOM echo sounders
- ODOM Miniscan echo sounder
- Ross 800 Series echo sounders
- Senbon Denki PD-601 echo sounder
- Simrad EA300 echo sounder
- Simrad EA500 echo sounder
- STN Atlas Deso 14/15 echo sounder
- STN Atlas Deso 22/25 echo sounder
- TSS 320 motion sensor

4.1 ELAC LAZ 4100 Echo Sounder

The Navigation software supports the ELAC LAZ 4100 dual frequency echo sounder. Fix marks are supported for this device.

4.1.1 Default Communication Parameters

Baud rate:	2400
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.1.2 ELAC LAZ 4100

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *ELAC LAZ 4100 Custom Properties* dialog you can set whether the incoming depths are below the transducer or the water level (that is, have been adjusted for draft). Also, you can select which channel(s) to decode.

Note – To apply draft corrections to the depths select the *Offset height (z)* adjustment option in the relative display's properties dialog. Also, in the *ELAC LAZ 4100 Custom Properties* dialog you must select the *Depths below transducer* option. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Data String Format: ELAC LAZ 4100

Example:

```
12345,12327<CR><LF>
```

In the above example the high frequency depth is 123.45 m and the low frequency is 123.27 m.

Table 4-1 describes the data string format.

Table 4-1 ELAC LAZ 4100 Sentence Type

Field	Definition
1–5	High frequency depth (centimetres)[1]
6	Comma
7–11	Low frequency depth (centimetres)[1]
12	Carriage return
13	Line feed

[1]These depths may not use the full five characters, padding may or may not be used. Therefore the string length may vary.

If just one frequency is transmitted then the depth string is:

```
ddddd<CR><LF>
```

Annotation and Fix Marks

It is not possible to send an annotation to this device.

The Navigation software sends the following command to trigger a fix mark:

```
Z<CR><LF>
```

4.2 ELAC LAZ 4420 Echo Sounder

The Navigation software supports the ELAC LAZ 4420 dual frequency echo sounder. Annotation and fix marks are supported for this device.

4.2.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.2.2 ELAC LAZ 4420

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *Elac Laz 4420 Custom Properties* dialog you can select which channel(s) to decode.

Data String Format: ELAC LAZ 4420 – Standard Depth Format

Example:

```
$SDDBS,55.05,f,16.78,M,9.17,F*hh<CR><LF>
```

In the above example the depth is 55.05 ft, 16.78 m, or 9.17 fathoms.

Table 4-2 describes the data string format.

Table 4-2 ELAC LAZ 4420 – Standard Depth Sentence Type

Field	Definition
1	Header '$SDDBS'
2	Depth (feet)
3	Feet indicator 'f'
4	Depth (metres)
5	Metre indicator 'M'
6	Depth (fathoms)
7	Fathom indicator 'F'
8	Checksum '*hh'
9	Carriage return, line feed.

Note – The length of the depths in this string may vary. The string may only contain one depth (that is, the other depth fields may be blank).

Data String Format: ELAC LAZ 4420 – DHI Dual Frequency Format

Example:

```
$,1234.5,1234.6,<CR><LF>
```

In the above example the channel 1 (high frequency) depth is 1234.5 m and the channel 2 (low frequency) depth is 1234.6 m.

Table 4-3 describes the data string format.

Table 4-3 ELAC LAZ 4420 – DHI Dual Frequency Sentence Type

Field	Definition
1	Header '$'
2	Channel 1 (high) depth (metres)
3	Channel 2 (low) depth (metres)
4	Carriage return, line feed.

Note – The comma before the <CR> may or may not be present.

Annotation and Fix Marks

To send a fix mark to the echo sounder the Navigation software sends the following command:

```
$PHENM<CR><LF>
```

To send an annotation to the echo sounder the Navigation software sends the following command:

```
$PHENT text<CR><LF>
```

4.3 Generic Echo Sounder

The Navigation software supports a range of echo sounders through the generic echo sounder device. No fix marks or annotation are supported through this equipment handler.

4.3.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	Various

4.3.2 Generic Echo Sounder

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *Generic Echo Sounder Custom Properties* dialog you can set the string delimiters and terminator.

Select the data source numbers corresponding to the depth field(s) to be decoded in the depth string. The first numerical value that appears in the selected fields will be decoded as a high frequency depth.

Data String Format

Various formats are supported. The following rules apply:

- The maximum string length is 255 characters
- Message terminators can be a combination of <CR> and <LF> as defined in the *Generic Echo Sounder Custom Properties* dialog
- Any non-numeric ASCII characters will be ignored
- The Navigation software will look for the field delimiters as specified in the *Generic Echo Sounder Custom Properties* dialog
- Fields can be packed with spaces or zeros
- Up to 10 data sources can be configured
- The first numerical value in the field will be decoded as a high frequency depth
- All depths are treated as depths below the transducer

4.4 Innerspace 448 Echo Sounder

The Navigation software supports the Innerspace single frequency echo sounder. Annotations and fix marks are supported for this device.

4.4.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR>

4.4.2 Innerspace 448

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor*, *Guidance Monitor*, and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *Innerspace 448 Custom Settings* dialog you can set the units the incoming depths are in. This is due to there being no depth unit indication in the depth string. The choice is either Feet or Metres. The default is Metres.

Data String Format

`<STX>00930<CR>`

In the above example the depth is 9.3 ft or 9.3 m.

Table 4-4 describes the data string format.

Table 4-4 Innerspace 448 Sentence Type

Field	Description
1	Header, hex 02.
2–5	Depth in 1/10th foot or decimetres
6	Quality indicator. 0 = good. 1 = bad.
7	Carriage return

Annotation and Fix Marks

To send a fix mark the Navigation software sends a <Control F> command (hex 06) which commands the echo sounder to draw a fix mark on the paper trace.

To annotate the echo sounder, the Navigation software sends the following command:

`<STX>AT....<CR><ETX>`

Table 4-5 describes the annotation string.

Table 4-5 Innerspace 448 Annotation String

Field	Description
1	Header, hex 02.
2	8 bit binary character specifying the position of the annotation
3	Annotation text
4	Carriage return
5	Trailer, hex 03.

4.5 Innerspace 449 Echo Sounder

The Navigation software supports the Innerspace dual frequency echo sounder. Annotation and fix marks are supported for this device.

4.5.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR>

4.5.2 Innerspace 449

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

Data String Format

`<STX>0093p<CR>`

In the above example the channel 1 depth is 9.3 ft. The message alternates between frequencies (6-bit indicates the frequency to which the data relates).

Table 4-6 describes the data string format.

Table 4-6 Innerspace 449 Sentence Type

Field	Description
1	Header, hex 02.
2–5	Depth in $1/10^{th}$ foot, decimetres, or centimetres
6	Binary character. See Table 4-7 below.
7	Carriage return

Table 4-7 describes the 6-bit binary character.

Table 4-7 Innerspace 449 Binary Character Description

Bit	Level=0	Level=1	Function
0	Good Data	Bad Data	Data Flag
1	1/10 (ft – dm)	1/100 cm	Units
2	Black	Grey	Signal
3	x 1	x 10	Multiplier
4	Metric	Feet	Mode
5	(Reserved)	Depth	Depth
6	A (Frequency 2 Low)	B (Frequency 1 High)	Frequency
7	Positive	Negative	Sign

Annotation and Fix Marks

To send a fix mark the Navigation software sends a <Control F> command (hex 06) which commands the echo sounder to draw a fix mark on the paper trace.

To annotate the echo sounder, the Navigation software sends the following command:

```
<STX>AT....<CR><ETX>
```

Table 4-8 describes the data string format.

Table 4-8 Innerspace 449 Annotation String

Field	Description
1	Header, hex 02.
2	8 bit binary character specifying the position of the annotation
3	Annotation text
4	Carriage return
5	Trailer, hex 03.

4.6 Kaijo Denki PS-20R Echo Sounder

The Kaijo Denki model PS-20R is a precise single frequency shallow water echo sounder. No mark or annotation support is provided for this device.

4.6.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	None

4.6.2 Kaijo Denki PS-20R

The Navigation software extracts the depth information from the Kaijo Denki PS20R echo sounder and displays it in the *Equipment Monitor*, *Echo Sounder Trace*, and *Survey Text* real-time displays. The depth data is recorded in the Project database.

In the *Kaijo-Denki PS20R Custom Settings* dialog you can select whether the depths are below the transducer or the water line (draft corrected). You must also select what frequency to decode the incoming depths as.

Note – To apply draft corrections select the *Offset height (z)* adjustment option in the relative display's properties dialog. Also, in the *Kaijo-Denki PS20R Custom Settings* dialog you must select the *Depths below transducer* option. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Data String Format

```
:0A23190000039704021A
```

In the above example the depth is 3.97 m.

Table 4-9 describes the data string format.

Table 4-9 Kaijo-Denki PS-20R Sentence Type

Field	Definition
1	Header ':'
2–3	Length of the data string (not decoded)
4–7	The counter of the data (not decoded)
8–9	Record type (not decoded)
10–15	Depth (centimetre)
16–17	Average value of the movement (not decoded)
18–19	Status (not decoded)
20–21	Checksum

4.7 Knudsen 320 Echo Sounder

The Knudsen 320 echo sounder is a dual frequency, digital echo sounder. Heave can also be extracted from the depth string (if available). This sounder can emulate an ODOM output but there is no annotation available that way. The Navigation software supports the native Knudsen mode through which annotation is supported. Annotation is supported for this device.

4.7.1 Default Communication Parameters

Baud rate:	19200
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.7.2 Knudsen 320

The Navigation software extracts the depth and heave information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth and heave data is recorded in the Project database.

In the *Knudsen 320 Custom Settings* dialog you can set the units that the incoming depths are in. This is due to there being no depth unit indication in the depth string. The choice is Metres or Feet. The default is Metres.

Note – This custom setting only applies to the incoming depth, the heave values are always in centimetres regardless of the depth units.

Data String Format

Example 1 (depths up to 100 feet or metres):

```
12.34,12.45,+0056 <CR><LF>
```

In the above example the high frequency depth is 12.34 ft (or m), the low frequency depth is 12.45 ft (or m) and the heave is 0.56 m.

Example 2 (depths up to 1000 feet or metres):

```
124.4,124.5,+0056 <CR><LF>
```

In the above example the high frequency depth is 124.4 ft (or m), the low frequency depth is 124.5 ft (or m) and the heave is 0.56 m.

Example 3 (depths over 1000 feet or metres):

```
1234.,1245.,+0056 <CR><LF>
```

In the above example the high frequency depth is 1234 ft (or m), the low frequency depth is 1245 ft (or m) and the heave is 0.56 m.

Table 4-10 describes the data string format.

Table 4-10 Knudsen 320 Sentence Type

Field	Definition
1–5	High frequency depth in feet or metres[1]
6	Comma
3	Water depth in metres
7–11	Low frequency depth in feet or metres[1]
12	Comma
13	Sign of the heave. ‘+’ = crest of wave. ‘-’ = boat in trough[2 3]
14–17	Heave in centimetres[2 3]
18	Heave quality flag. ‘ ’ = good data. ‘?’ = bad data[2 3]
19	Carriage return
20	Line feed

[1]If a depth channel is not available (for example, no transducer then the corresponding depth field will be ‘00.00’).

[2] If no heave sensor is selected on the echo sounder then the Heave field will be ‘------’.

[3]If the heave sensor is selected on the echo sounder but is not attached then the Heave field will be ‘ 0000?’.

Annotation and Fix Marks

The Navigation software sends the following command to annotate the sounder paper:

`$PKEL02,`*`xxxx`*`<CR><LF>`

where *xxxx* is up to 68 characters of text.

Actual text will be as per the standard echo sounder annotations for all echo sounders.

4.8 Navitronics S-10 Echo Sounder

The Navitronics S-10 echo sounder is a single frequency digital echo sounder. Fix marks are supported for this device. However, annotations are not.

4.8.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<LF>

4.8.2 Navitronics S-10

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *Navitronics S-10 Custom Properties* dialog you can select whether the depths are below the transducer or the water line (draft corrected). You must also select what frequency to decode the incoming depths as.

Note – To apply draft corrections select the *Offset height (z)* adjustment option in the properties dialog of the relative real-time display. Also, in the *Navitronics S-10 Custom Properties* dialog you must select the *Depths below transducer* option. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Data String Format

```
9002340<LF><NULL>
```

In the above example the depth is 23.4 m.

Table 4-11 describes the data string format.

Table 4-11 Navitronics S-10 Sentence Type

Field	Definition
1	Quality (not used)
2	Always zero
3–6	Water depth in decimetres (no decimal point)
7	Always zero
8	Line feed
9	Null character (undocumented)

Annotation and Fix Marks

If the Navigation software is configured to send a fix mark to the echo sounder it will send an ASCII ‘F’ character (46H) to generate a mark on the analogue record.

4.9 NMEA Depth

A variety of NMEA strings contain depth information. Currently, the Navigation software supports the DBS, DBT, and DPT NMEA strings.

4.9.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.9.2 DBS: Depth Below Surface

The Navigation software extracts the depth value from the DBS sentence. The depth information is displayed in the *Equipment Monitor* and *Survey Text* real-time displays. The data is also displayed graphically in the *Echo Sounder Trace* real-time display. The Navigation software is able to decode the depth value in feet, metres, or fathoms. The depth value is recorded in the Project database in metres.

Note – You must select the *DBS – Depth Below Surface* option in the *Custom Properties* dialog before the Navigation software decodes the DBS NMEA string. Select the depth frequency type(s) that the depth is to be decoded as, from this dialog also.

If the *Both Frequencies (same value)* option is selected in the *Custom Properties* dialog then the NMEA depth is decoded as both high and low frequency depths.

Note – Any transducer depth corrections (z value of the echo sounder offset) will not be applied to these depths.

Data String Format

```
$SDDBS,55.05,f,16.78,M,9.17,F*hh<CR><LF>
```

Table 4-12 explains the DBS sentence type.

Table 4-12 DBS Sentence Type

Field	Definition
1	Water depth in feet
2	Fixed text ‘f’ indicating depth value is in feet
3	Water depth in metres
4	Fixed text ‘M’ indicating depth value is in metres
5	Water depth in fathoms
6	Fixed text ‘F’ indicating depth value is in fathoms
7	Checksum (*hh)
8	Carriage return, line feed.

4.9.3 DBT: Depth Below Transducer

The Navigation software extracts the depth value from the DBT sentence. The depth information is displayed in the *Equipment Monitor* and the *Survey Text* real-time displays. The data is also displayed graphically in the *Echo Sounder Trace* real-time display. When decoding this sentence, Navigation software assumes that the depth value is relative to the transducer and therefore has not been corrected for draft (transducer depth is entered as the z component of the echo sounder offset in the Vessel Editor) by the echo sounder device. Navigation software is able to decode the depth value in feet, metres, or fathoms. The depth value is recorded in the Project database in metres.

Note – You must select the *DBT – Depth Below Transducer* option in the *Custom Properties* dialog before the Navigation software decodes the DBT NMEA string. Also, select the depth frequency type(s) that the depth is to be decoded as from this dialog.

If the *Both frequencies (same value)* option is selected in the *Custom Properties* dialog then the NMEA depth is decoded as both high and low frequency depths.

To apply draft corrections select the *Offset height (z)* option in the relative display's properties dialog. The height component (if any) of the offset assigned to the echo sounder configuration will be used.

Data String Format

```
$SDDBT,55.05,f,16.78,M,9.17,F*hh<CR><LF>
```

Table 4-13 explains the DBT sentence type.

Table 4-13 DBT Sentence Type

Field	**Definition**
1	Water depth in feet
2	Fixed text ‘f’ indicating depth value is in feet
3	Water depth in metres
4	Fixed text ‘M’ indicating depth value is in metres
5	Water depth in fathoms
6	Fixed text ‘F’ indicating depth value is in fathoms
7	Checksum (*hh)
8	Carriage return, line feed.

4.9.4 DPT: Depth Below Transducer

The Navigation software extracts the depth information from the Depth sentence and displays it in the *Equipment Monitor*, *Survey Text*, and *Echo Sounder Trace* real-time displays. The depth data is recorded in the Project database.

Note – You must select the *DPT – Depth Below Transducer* option in the *Custom Properties* dialog before the Navigation software will decode the DPT NMEA string. Also, select the depth frequency type(s) that the depth is to be decoded as from this dialog.

If the *Both Frequencies (same value)* option is selected in the *Custom Properties* dialog then the NMEA depth will be decoded as both high and low frequency depths.

To apply draft corrections select the *Offset height (z)* adjustment option in the relative display's properties dialog. The height component (if any) of the offset assigned to that echo sounder configuration will be used. The offset component of the DPT string is ignored.

Data String Format NMEA v2.1

```
$SDDPT,34.7,1.2*2C<CR><LF>
```

Table 4-14 explains the DPT NMEA v2.1 sentence type.

Table 4-14 DPT NMEA v2.1 Sentence Type

Field	Definition
1	Water depth in metres
2	Transducer offset (positive from transducer to water level, negative from transducer to keel)[1]
3	Checksum (*hh)
4	Carriage return, line feed.

[1]The Navigation software will ignore this field.

Data String Format NMEA v2.3

```
$SDDPT,12.4,1.2,20*4d<CR><LF>
```

Table 4-15 explains the DPT NMEA v2.3 sentence type.

Table 4-15 DPT NMEA v2.3 Sentence Type

Field	Definition
1	Water depth in metres
2	Transducer offset (positive from transducer to water level, negative from transducer to keel)[1]
3	Maximum range scale in use[1]
4	Checksum (*hh)
5	Carriage return, line feed.

[1]The Navigation software will ignore this field.

4.10 ODOM Echo Sounder

ODOM manufacture a variety of echo sounders, of which, the Navigation software supports the Echotrac, Digitrace, and Hydrotrac. Fix marks and annotations are also supported for these echo sounders.

4.10.1 Default Communication Parameters

The ODOM echo sounder has the following default RS-232 communication parameters:

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR> or <CR><LF>

4.10.2 ODOM Digitrace

The ODOM digitrace is a digitizer system that can be installed inside the Raytheon 719 Series and the Atlas Deso 10 and 20. The output contains a single frequency depth. The Navigation software extracts the depth information and displays it in the *Equipment Monitor, Echo Sounder Trace,* and *Survey Text* real-time displays. The Navigation software treats the incoming depths as being below the water surface, and so, no transducer depth (echo sounder z offset) corrections will be applied. The depth data is recorded in the Project database.

The Digitrace can output depths in metric and imperial units. This is a factory setting on the unit. You must select *Metric* or *Imperial* on the *Depth* tab in the *ODOM Custom Properties* dialog, corresponding to the depth units output by your Digitrace device. Also, select the depth frequency type(s) that the depth is to be decoded as from this dialog.

Note – If the *Both Frequencies (same value)* option is selected in the *ODOM Custom Properties* dialog then the Digitrace depth will be decoded as both high and low frequency depths.

Data String Format

Example 1:

```
DT    357<CR>
```

In the above example the depth is 35.7 m, or 35.7 ft, depending on the factory setting of the device.

Example 2:

```
dt   1234<CR>
```

In the above example the depth is 12.34 m. Feet are not supported in this fine mode of measurement.

Table 4-16 explains the ODOM digitrace sentence type.

Table 4-16 ODOM Digitrace Sentence Type

Field	Definition
1	‘F’ if a fix mark, otherwise is a space.
2–3	Unit identifiers. ‘DT’ for decimetre or 1/10 foot output or ‘dt’ for cm output.
4	‘E’ if an error has occurred, otherwise is a space
5	Always a space
6–10	Depth in dm or cm. Depths are packed with spaces[1].
11	Carriage return

[1] When in dm (or 1/10 foot) format the decimal place is assumed to be between columns 9 and 10. When in cm format the decimal place is assumed to be between columns 8 and 9.

Note – Some of the new digitrace devices also output a line feed at the end of the string. For these devices the output string is the same except it is 12 characters long and ends with a line feed.

Annotation and Fix Marks

The digitrace supports fix marks. Depending on the firmware on your digitrace the fix marks can be activated by sending a Control F character or by asserting the RTS line. The Navigation software supports both of these methods.

To select the fix mark method to be used select the method in the *Mark Protocol* group in the *Protocol* tab in the *ODOM Custom Properties* dialog.

The digitrace does not support any text annotation, therefore you can ignore the settings in the *Annotation Protocol* group.

4.10.3 ODOM Echotrac/Hydrotrac

The ODOM Echotrac and Hydrotrac are digital echo sounders. These sounders support single frequency and dual frequency depths, as well as supporting heave information if interfaced to a TSS heave compensator. The Navigation software extracts the depth and heave (if present) and displays them in the *Equipment Monitor*, *Echo Sounder Trace*, and *Survey Text* real-time displays. The Navigation software treats the incoming depths as being below the water surface, and so no transducer depth (echo sounder z offset) corrections will be applied. The depth data is recorded in the Project database.

The Echotrac and Hydrotrac can output depths in metric and imperial units. This is a factory setting on the unit. You must select *Metric* or *Imperial* in the *Depth* tab in the *ODOM Custom Properties* dialog, corresponding to the depth units output by your echo sounder device. Also, select the depth frequency type(s) of the depth to be decoded from this dialog.

Note – If you select high frequency only depths to be decoded and the sounder only outputs low frequency depths then no depths will be decoded. Likewise, if you select the *Low frequency only* option.

Data String Format: Single Frequency – Type 1

Example 1:

```
ET    357<CR>
```

In the above example the depth is 35.7 m, or 35.7 ft, depending on the factory setting of the device.

Example 2:

```
et   1234<CR>
```

In the above example the depth is 12.34 m. Feet are not supported in this fine mode of measurement.

Table 4-17 explains the Single Frequency – Type 1 sentence type.

Table 4-17 Single Frequency – Type 1 Sentence Type

Field	Definition
1	‘F’ if a fix mark, otherwise is a space.
2–3	Unit identifiers. ‘ET’ for decimeter or 1/10 ft output or ‘et’ for cm output.
4	‘E’ if an error has occurred, otherwise is a space.
5	Always a space
6–10	Depth in dm or cm. Depths are packed with spaces[1]
11	Carriage return

[1] When in dm (or 1/10 ft) format the decimal place is assumed to be between columns 9 and 10. When in cm format the decimal place is assumed to be between columns 8 and 9.

Data String Format: Single Frequency –Type 2

Example:

```
ET H   357<CR>
```

The above example would be decoded as a high frequency depth of 35.7 m (or 35.7 ft depending on the setting in the *Factory Setting* group).

Table 4-18 explains the Single Frequency – Type 2 format.

Table 4-18 Single Frequency – Type 2 Sentence Type

Field	Definition
1	‘F’ if a fix mark, otherwise is a space.
2–3	Unit identifiers. ‘ET’ for decimeter or 1/10 ft output and ‘et’ for centimetre output.
4	‘E’ if there is a high frequency error. ‘O’ for a low frequency error. Otherwise is a space.
5	‘H’ or ‘L’ indicating high or low frequency depth
6	Always a space
7–11	Depth in dm or cm or 1/10 ft. Depths are packed with spaces[1]
12	Carriage return

[1] When in dm or 1/10 ft format the decimal place is assumed to be between columns 10 and 11. When in cm units, the decimal place is assumed to be between columns 9 and 10.

Data String Format: Single Frequency with Heave Compensation – Type 1

Example:

```
ET CH +234 23456<CR>
```

In the above example, the string would be decoded as a high frequency depth of 2345.6 m (or ft) uncorrected for heave, with a heave value of 23.4 m (or ft). The ‘+’ indicates that the direction of the heave is upwards.

Table 4-19 explains the Single Frequency with Heave Compensation – Type 1 sentence type.

Table 4-19 Single Frequency with Heave Compensation – Type 1 Sentence Type

Field	Definition
1	‘F’ if a fix mark, otherwise is a space.
2–3	Unit identifiers. ‘ET’ for decimetre or 1/10 ft output and ‘et’ for centimetre output.
4	‘E’ if there is a high frequency error. ‘O’ If there is a low frequency error, otherwise is a space.
5	‘C’ if heave correction enabled, otherwise is a space.
6	‘H’ or ‘L’ indicating high or low frequency depth
7	Always a space
8	‘+’ or ‘–’ indicating positive or negative heave (convention is positive up)
9–11	Heave value in dm or cm or 1/10 ft depending on the unit identifier mode. Zeros are displayed when in error condition and when heave is disabled[1].
12	Always a space
13–17	Depth in dm or cm or 1/10 ft. Depths are packed with spaces[2].
18	Carriage return

[1] When in dm or 1/10 ft format the decimal place is assumed to be between columns 10 and 11. When in cm format the decimal place is assumed to be between columns 9 and 10.

[2] When in dm or 1/10 ft format the decimal place is assumed to be between columns 16 and 17. When in cm format the decimal place is assumed to be between columns 15 and 16.

Data String Format: Single Frequency with Heave Compensation – Type 2

Example 1:

```
ET H 12345+2345<CR>
```

In the above example, the string would be decoded as a high frequency depth of 1234.5 m (or ft) and a heave of 23.45 m. The heave is in an upwards direction.

Example 2:

```
et L 23456-3456<CR>
```

In the above example, the string would be decoded as a low frequency depth of 234.56 m and a heave of –34.56 m. The heave in this case is in the downwards direction.

Note – The heave contained in this string is always in centimetres regardless of the imperial/metric unit setting and et/ET unit setting.

Table 4-20 explains the Single Frequency with Heave Compensation – type 2 sentence type.

Table 4-20 Single Frequency with Heave Compensation – Type 2 Sentence Type

Field	Definition
1	‘F’ if a fix mark. Otherwise is a space.
2–3	Unit identifiers. ‘ET’ for decimetre or 1/10 ft output and ‘et’ for centimetre output.

Table 4-20 Single Frequency with Heave Compensation – Type 2 Sentence Type (Continued)

4	‘E’ if there is a high frequency error. ‘O’ if there is a low frequency error, otherwise is a space.
5	‘H’ or ‘L’ indicating high or low frequency depth
6	Always a space
7–11	Depth in dm or cm or 1/10 ft. Depths are packed with spaces[1].
12	‘+’ or ‘–’ indicating positive or negative heave (convention is positive up)
13–16	Heave value in cm
17	Carriage return

[1] When in dm or 1/10 ft format the decimal place is assumed to be between columns 10 and 11, when in cm format the decimal place is assumed to be between columns 9 and 10.

Data String Format: Dual Frequency

Example:

```
et B 12345 23456<CR>
```

In the above example, the string would be decoded as:

High frequency equals 123.45 m

Low frequency equals 234.56 m

Table 4-21 explains the Dual Frequency sentence type.

Table 4-21 Dual Frequency Sentence Type

Field	Definition
1	'F' if a fix mark, otherwise is a space.
2–3	Unit identifiers. 'ET' for decimetre or 1/10 ft output and 'et' for centimetre output.
4	'E' if there is a high frequency error. 'O' for a low frequency error. 'D' for dual frequency errors, otherwise is a space.
5	'B' indicates both the channel's depths are output
6	Always a space
7–11	High frequency depth in dm or cm or 1/10 ft. Depths are packed with spaces[1].
12	Always a space
13–17	Low frequency depth in dm or cm or 1/10 ft. Depths are packed with spaces[2].
18	Carriage return

[1] When in dm or 1/10 ft format the decimal place is assumed to be between columns 10 and 11. When in cm format the decimal place is assumed to be between columns 9 and 10.

[2] When in dm or 1/10 ft format the decimal place is assumed to be between columns 16 and 17. When in cm format the decimal place is assumed to be between columns 15 and 16.

Data String Format: Dual Frequency with Heave Compensation – Type 1

Example:

```
et CB –234 12345 23456<CR>
```

In the above example, the string would be decoded as:

Heave equals –2.34 m (direction downwards)

High frequency equals 123.45 m

Low frequency equals 234.56 m

Table 4-22 explains the Dual Frequency with Heave Compensation – Type 1 sentence type.

Table 4-22 Dual Frequency with Heave Compensation – Type 1 Sentence Type

Field	Definition
1	‘F’ if a fix mark, otherwise is a space.
2–3	Unit identifiers. ‘ET’ for decimetre or 1/10 ft output and ‘et’ for centimetre output.
4	‘E’ if there is a high frequency error. ‘O’ for a low frequency error. ‘D’ for dual frequency errors, otherwise is a space.
5	‘C’ if heave correction enabled, otherwise a space.
6	‘B’ indicating both channel’s depths are output
7	Always a space
8	‘+’ or ‘–’ indicating positive or negative heave
9–11	Heave value in dm or cm or 1/10 ft depending on the Unit identifier mode. Zeros are displayed when in error condition and when heave is disabled[1].
12	Always a space
13–17	High freq depth in dm or cm or 1/10 ft. Depths are packed with spaces[2].
18	Always a space

Table 4-22 Dual Frequency with Heave Compensation – Type 1 Sentence Type (Continued)

19–23	Low freq depth in dm or cm or 1/10 ft. Depths are packed with spaces[3].
24	Carriage return

[1] When in dm or 1/10 ft format the decimal place is assumed to be between columns 10 and 11. When in cm format the decimal place is assumed to be between columns 9 and 10.

[2] When in dm or 1/10 ft format the decimal place is assumed to be between columns 16 and 17. When in cm format the decimal place is assumed to be between columns 15 and 16.

[3] When in dm or 1/10 ft format the decimal place is assumed to be between columns 22 and 23. When in cm format the decimal place is assumed to be between columns 21 and 22.

Data String Format: Dual Frequency with Heave Compensation – Type 2

Example:

```
ET B 12345 67890+2345<CR>
```

In the above example, the string is decoded as:

High frequency depth equals 1234.5 m (or ft)

Low frequency depth equals 6789.0 m (or ft)

Heave equals 23.45 m (direction upwards)

Note – The heave data in this string is always in centimetres regardless of the imperial/metric setting or et/ET mode.

Table 4-23 explains the Dual Frequency with Heave Compensation – type 2 sentence type.

Table 4-23 Dual Frequency with Heave Compensation – Type 2 Sentence Type

Field	Description
1	‘F’ if a fix mark, otherwise is a space.
2–3	Unit identifiers. ‘ET’ for decimetre or 1/10 ft output and ‘et’ for centimetre output.
4	‘E’ if there is a high frequency error. ‘O’ for a low frequency error. ‘D’ for dual frequency errors, otherwise is a space.
5	‘B’ indicating both channel’s depths are output
6	Always a space
7–11	High frequency depth in dm or cm or 1/10 ft. Depths are packed with spaces[1].
12	Always a space
13–17	Low frequency depth in dm or cm or 1/10 ft. Depths are packed with spaces[2].
18	‘+’ or ‘–’ indicating positive or negative heave

Table 4-23 Dual Frequency with Heave Compensation – Type 2 Sentence Type (Continued)

19–22	Heave value in cm
23	Carriage return

[1] When in dm or 1/10 ft format the decimal place is assumed to be between columns 10 and 11. When in cm format the decimal place is assumed to be between columns 9 and 10.

[2] When in dm or 1/10 ft format the decimal place is assumed to be between columns 16 and 17. When in cm format the decimal place is assumed to be between columns 15 and 16.

Annotation and Fix Marks

The Echotrac and Hydrotrac support fix marks. This is done by sending a Control F character.

Make sure that the *Send Ctrl-F (06)* field is selected in the *Mark Protocol* group in the *Protocol* tab in the *ODOM Custom Properties* dialog.

Text annotation is also supported by the Echotrac and Hydrotrac echo sounders. The Navigation software supports two annotation protocols, either with or without handshaking. Select the annotation protocol to be used with your echo sounder in the *Annotation Protocol* group on the *Protocol* tab in the *ODOM Custom Properties* dialog. Also, the amount of annotation text varies with the different echo sounder models. You can set the maximum annotation length in this dialog.

4.11 ODOM Miniscan Echo Sounder

The ODOM Miniscan echo sounder system consists of up to eight ODOM Echotrac single frequency transducers, all interfaced into a common control unit. The Navigation software supports fix marks for this device.

4.11.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.11.2 ODOM Miniscan

The Navigation software extracts the depth information from the ODOM Miniscan echo sounder and displays it in the *Equipment Monitor*, *Echo Sounder Trace*, and *Survey Text* real-time displays. The depth data is recorded in the Project database.

In the *ODOM Echo Sounder Custom Properties* dialog you can select whether the depths are below the transducer or the water line (draft corrected).

Note – To apply draft corrections select the *Offset height (z)* adjustment option in the relative display's properties dialog. Also, in the *ODOM Echo Sounder Custom Properties* dialog you must select the *Depths below transducer* option. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Data String Format

```
$FM  12.3  12.4  13.1  12.34  12  13.3  11.8
  12.9<CR><LF>
```

In the above example, there are eight depths. Each one is treated as a high frequency depth. The above string would be decoded as:

Transducer 1 = 12.3 m

Transducer 2 = 12.4 m

Transducer 3 = 13.1 m

Transducer 4 = 12.34 m

Transducer 5 = 12 m

Transducer 6 = 13.3 m

Transducer 7 = 11.8 m

Transducer 8 = 12.9 m

Table 4-1 describes the ODOM miniscan sentence type.

Table 4-24 ODOM Miniscan Sentence Type

Field	Description
1	Start character ‘$’
2	Space character, or fix mark ‘F’
3	Units – ‘F’ for feet, ‘M’ for metres
4–9	Transducer 1, high frequency depth
10–15	Transducer 2, high frequency depth
16–21	Transducer 3, high frequency depth
22–27	Transducer 4, high frequency depth
28–33	Transducer 5, high frequency depth
34–39	Transducer 6, high frequency depth
40–45	Transducer 7, high frequency depth
46-51	Transducer 8, high frequency depth

Table 4-24 ODOM Miniscan Sentence Type (Continued)

52	Carriage return
53	Line feed

The output string has a fixed length of 53 characters.

Each depth field is six characters including any decimal point in the depth. Any leading zeros are blanked with spaces (though the Navigation software will support leading zeros).

Any unused channels are blanked with spaces. A channel alarm will fill the channel with zeros. In either case the Navigation software will not decode that channel. Additionally, if any of the channels contains invalid data (example, alphabetic characters) the invalid channel will not be decoded.

Annotation and Fix Marks

The Miniscan supports fix marks. This is done by sending a Control F character or by asserting the RTS line, depending on which is selected on the *Protocol* tab in the *ODOM Echo Sounder Custom Properties* dialog. Trimble recommends that you use the Control F option.

Text annotation is also supported by the Miniscan echo sounder. The Navigation software supports two annotation protocols, either with or without handshaking. Select the annotation protocol to be used with your echo sounder in the *Annotation Protocol* group on the *Protocol* tab in the *ODOM Echo Sounder Custom Properties* dialog. Also, the amount of annotation text varies with the different echo sounder models. You can set the maximum annotation length in this dialog.

4.12 Ross 800 Series Echo Sounders

The Ross 800 series echo sounders include the Ross 850C and 851C ‘smart’ sounders and the Ross 875 Portable Survey Recorder. All the Ross 800 series echo sounders are dual frequency. Annotation and fix marks are supported for these devices.

4.12.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<LF>

4.12.2 Ross 800 Series

The Navigation software extracts the depth information from the Ross echo sounder and displays it in the *Equipment Monitor, Echo Sounder Trace*, and *Survey Text* real-time displays. The depth data is recorded in the Project database. No heave information is decoded from the sounders.

In the *Ross 800 Custom Properties* dialog you can select whether the depths are below the transducer or the water line (draft corrected). You must also select what frequency to decode the incoming depths as.

Note – To apply draft corrections select the *Offset height (z)* adjustment option in the relative display’s properties dialog. Also, in the *Ross 800 Custom Properties* dialog you must select the *Depths below transducer* option. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Data String Format

```
$SDRSL,210,kH,39.0,fHC,39.8,f,11.90,MHC,12.12,M,033
  ,kH,39.2,fHC,40.0,f,11.96,MHC,12.18,M<LF>
```

In the above example, the channel 1 depth is 12.12 m and the channel 2 depth is 12.18 m.

Table 4-25 describes the data string format.

Table 4-25 Ross 800 Series Sentence Type

Field	Description
1	Header ‘$SDRSL’
2	Channel 1 frequency (kHz)
3	KiloHertz indicator ‘kH’
4	Channel 1 depth corrected for heave (feet)
5	Heave corrected depth indicator for feet ‘fHC’
6	Channel 1 depth (feet)
7	Feet indicator ‘f’
8	Channel 1 depth corrected for heave (metres)
9	Heave corrected depth indicator for metres ‘MHC’
10	Channel 1 depth (metres)
11	Metre indicator ‘M’
12	Channel 2 frequency (kHz)
13	KiloHertz indicator ‘kH’
14	Channel 2 depth corrected for heave (feet)
15	Heave corrected depth indicator for feet ‘fHC’
16	Channel 2 depth (feet)
17	Feet indicator ‘f’
18	Channel 2 depth corrected for heave (metres)
19	Heave corrected depth indicator for metres ‘MHC’
20	Channel 2 depth (metres)
21	Metre indicator ‘M’
22	Line feed

The output string has a variable length.

Note – Only fields 10 and 20 (Channel 1 and 2 depths in metres) are decoded.

Annotation and Fix Marks

The Navigation software can send annotation and fix marks to the Ross echo sounders.

For event mark and annotation the following annotation command is sent:

```
$E, aaa,bbb<CR><LF>
```

Table 4-26 describes the data string format.

Table 4-26 Ross 800 Annotation Sentence Type

Field	Description
$E	Signifies annotation and fix mark
aaa	Top annotation. 8 characters or less. Either the guidance object name or the event code.
bbb	Bottom annotation, 8 characters or less. Local time provided by the Navigation software.
<CR>	Carriage return
<LF>	Line feed

If no annotation is selected in the Navigation software (fix mark only) then the aaa and bbb fields will be blank.

For annotation only the annotation command is:

```
$2,aaa<CR><LF>
```

This annotation command is only output when the *Annotate* option is selected and the *Mark* option is not selected in the event configuration.

As you can see there is no bottom annotation contained in this string and so no time is included in the annotation to the echo sounder.

4.13 Senbon Denki PD-601 Echo Sounder

The Senbon Denki model PD-601 is a shallow water precision echo sounder. The system consists of a four channel acoustic array with four separate transducers. No annotations or fix marks are provided for this device.

Note – The Navigation software will only decode channel 1 (high frequency) and channel 2 (low frequency) depths. The other channels (3 and 4) will be ignored.

4.13.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.13.2 Senbon Denki PD601

The Navigation software extracts the depth information from the Senbon Denki PD601 echo sounder and displays it in the *Equipment Monitor*, *Echo Sounder Trace*, and *Survey Text* real-time displays. The depth data is recorded in the Project database.

The Navigation will support up to two channels from this four channel echo sounder, namely channels 1 and 2. The Navigation software decodes the depth string containing all four channels—called Format 1. This occurs when the DIP Switch is set to Prg 1,2,3.

To get data to be output from the echo sounder, the Navigation software sends the following string when it goes online or when a Timeout occurs (that is, repeat after the timeout period): :S<CR><LF>

Note – It is assumed that the incoming depths are depths below the water surface. This means that the draft corrections must be made by the echo sounder and cannot be done by the Navigation software.

Data String Format

Example:

```
:0F121521123456023340234699999999999<CR><LF>
```

In the above example, the channel 1 depth (high frequency) is 23.34 m and the channel 2 depth (low frequency) is 23.46 m.

Table 4-27 describes the data string format.

Table 4-27 Senbon Denki PD-601 Sentence Type

Field	Description
1	':' Start of packet character 3A hex
2	Sync Signal. 30 hex is okay. 31 hex is not okay.
3	Fixed line signal (not decoded)
4–9	Time – hhmmss (not decoded)
10–12	Measured line data ASCII (not decoded)
13–15	Measured point number data ASCII (not decoded)
16–20	Channel 1 depth below surface. Depth in cm[1].
21–25	Channel 2 depth below surface. Depth in cm[1].
26–30	Channel 3 depth below surface (not decoded)
31–35	Channel 4 depth below surface (not decoded)
36	Carriage return
37	Line feed

[1]A 5 digit number 99999 will be used when the depth cannot be acquired (depth value error.

The output string for Format 1 is always 37 characters.

The Navigation software decodes only channel 1 (high) and channel 2 (low).

It is possible to have valid channel 2 data but no transducer on channel 1 (and vice versa). The Navigation software will only timeout if both channel 1 and channel 2 data is 99999.

Annotation and Fix Marks

No annotation or fix marks are supported.

4.14 Simrad EA300 Echo Sounder

The EA300 series are single frequency sounders. They are no longer produced but there are many systems in the market and the EA300 handler can also accept any generic depth string, including the Dredge Head Depth device from Trimble. Annotation and fix marks are supported for this device.

4.14.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.14.2 Simrad EA300 Series

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *Simrad EA300 Series Custom Settings* dialog you can set the units that the incoming depths are in. This is due to there being no depth unit indication in the depth string. The default units are Metres. You must also select whether the depths are below the transducer or the water line (draft corrected). Finally, you must select what frequency(s) to decode the incoming depths as.

Note – To apply draft corrections select the *Offset height (Z)* adjustment option in the relative display's properties dialog. Also, you must select the *Depths below transducer* option in the *Simrad EA300 Series Custom Settings* dialog. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

The EA300 echo sounder can output three message types:

- depth (this is decoded)
- event (this is string that occurs when the Fix button on the EA300 is pressed)
- annotation (this is a string that reflects what is sent from the computer to the sounder)

The Navigation software only supports the depth string (the others are ignored).

The Simrad EA300 also decodes a number of other data strings, such as the Tamaya TDM-9000 echo sounder. It can be used as a generic depth decoder. This equipment handler will detect the first valid numeric value in a string based on the following:

- A sign + or – can precede a depth value (it will not be decoded if it appears after a digit or decimal point).
- Spaces can appear in the string after the sign, but not after a digit or decimal point.
- A decimal point can appear at the start of a string, after the sign or after a digit.

Data String Format

Example:

```
123.4<CR><LF>
```

In the above example, the depth is 123.4 m (or whatever unit is selected in the custom settings).

Table 4-28 describes the data string format.

Table 4-28 Simrad EA300 Series Sentence Type

Field	Description
1	Depth
2	Carriage return
3	Line feed

Note – The depth is variable length and may be preceded by spaces or zeros.

The output depth is only to 2 decimal places when depths are less than 100 m.

If a heave compensator is connected to the echo sounder the output depths will be heave corrected.

Annotation and Fix Marks

The echo sounder can support up to 75 characters.

The Navigation software outputs the annotation text followed by a carriage return, line feed. This generates the fix mark and the annotation. There is no header, just straight annotation in ASCII format.

Example:

```
Event: 12345<CR><LF>
```

4.15 Simrad EA500 Echo Sounder

The Simrad EA500 is a digital echo sounder. This echo sounder can be configured with up to three transducers/frequencies (Model EA500). The Model EA501 is a one transducer only model, and Model EA502 is a two transducer model. The EA500P is the portable version. Fix marks and annotation are supported.

4.15.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><CR><LF>

4.15.2 Simrad EA500 Series

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. The depth data is recorded in the Project database.

In the *Simrad EA500 Series Custom Settings* dialog you can assign the incoming depth strings to frequencies. You must also select whether the depths are below the transducer or the water line (draft corrected).

Note – To apply draft corrections select the *Offset height (z)* adjustment option in the relative display's properties dialog. Also, in the *Simrad EA500 Series Custom Settings* dialog you must select the *Depths below transducer* option. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

The EA 500 sounder can output various message types. The Navigation software will only decode the Depth message (starts with a ‘D’). The other message type will be ignored.

Data String Format

Example:

```
D1,10024331,30.45,-17,7,-5<CR><CR><LF>
```

In the above example the depth is 30.45 m (or whatever unit is selected in the custom settings).

Table 4-29 describes the data string format.

Table 4-29 Simrad EA500 Series Sentence Type

Field	Description
1	Depth channel. Either ‘D1’, ‘D2’ or ‘D3’.
2	Time tag, always 8 characters (not decoded)
3	Depth in metres. May be 0, 1, or 2 decimal places.
4	Backscatter (not decoded)
5	Bottom slope (not decoded)
6	Bottom slope (not decoded)
7	Carriage return
8	Carriage return
9	Line feed

Note – The fields (except time) are variable length and may be preceded by spaces or zeros. The Navigation software will decode a maximum of two different depth channels. The depth channel(s) depend on your selections in the *Simrad EA500 Series Custom Settings* dialog.

Annotation and Fix Marks

The Navigation software sends the following command to generate the fix mark and the annotation:

`CS,`*`annotation text`*`<CR>`

where:

`annotation text` is the ASCII annotation

The EA500 expects annotation on the annotation serial port (port 2) whereas the data output is via port 1. Therefore, you will need a split ‘Y’ cable with input to Port 2 EA500 and output from Port 1 EA500.

The EA501P may differ in that Port 1 from this echo sounder may both output depths and receive annotation from the Navigation software. For details contact the SIMRAD supplier. At the time of writing this document it is understood that the above command sends a fix mark and annotation to the echo sounder.

4.16 STN Atlas Deso 14/15 Echo Sounder

This equipment devices supports the Deso 14 and 15 echo sounder interface. Annotation and fix marks are supported.

4.16.1 Default Communication Parameters

The STN Atlas Deso 14/15 has the following default RS-232 communication parameters:

Baud rate:	4800
Stop bits:	2
Parity:	Odd
Data bits:	7
Terminator:	<CR><LF>

4.16.2 STN Atlas Deso 14/15

The Deso 14 and 15 echo sounders are dual frequency echo sounders. Their output string supports both single and dual frequency soundings. The Navigation software extracts the depth information and displays it in the *Equipment Monitor*, *Echo Sounder Trace*, and *Survey Text* real-time displays. The depth data is recorded in the Project database.

You are required to match a frequency to a channel in the *Deso 14/15 Custom Properties* dialog. The default sets high frequency to channel 2 and low frequency to channel 1. Also, in this dialog you must set whether the depths are below the transducer or water surface. The default selection is depths below the surface.

The Navigation software prompts the Deso 14 or 15 with a R1<LF> to put the sounder into ‘native’ mode. Once the sounder responds to this the Navigation sends a R0<LF> prompting the sounder to output depth data. This is done on a regular basis. If the echo sounder times out or when the Navigation software goes online then a R1<LF> command is sent again.

Note – To apply draft corrections select the *Offset height (Z)* adjustment option in the relative display's properties dialog. Also, you must select the *Depths below transducer* option in the *Deso 14/15 Custom Properties* dialog. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Note – Make sure that you configure the frequency options correctly in the *Deso 14/15 Custom Properties* dialog as this determines what channels are decoded and logged and what frequencies they are decoded as.

Data String Format

Example:

```
*..900122590012369000000<CR><LF>
```

In the above example the channel 1 depth is 12.25 m and the channel 2 depth is 12.36 m. The heave equals 0 m.

Table 4-30 explains the Deso 14 and 15 sentence type.

Table 4-30 Deso 14/15 Sentence Type

Field	Definition
1–3	Preamble
4	Channel 1 quality factor (range 0–9)
5	Dummy character
6–10	Channel 1 depth in centimetres
11	Channel 2 quality factor (range 0–9)
12	Dummy character
13–17	Channel 2 depth in centimetres
18	Heave quality factor (range 0–9)
19	Dummy character
20–24	Heave in centimetres

Table 4-30 Deso 14/15 Sentence Type (Continued)

25	Carriage return
26	Line feed

This is a 26 character string. Fields will be padded with leading zeros to full length.

Note – The Deso 11 depth string is the same as the Deso 14 and 15 however it is terminated with a line feed only (it does not output a carriage return). The Navigation software has been designed to accept this string as well. The Deso 11's initialization routine differs from that of the Deso 14 and 15, and so may not work with this interface.

Note – The Deso 14 and 15 can emulate the Deso 25 depth string as well.

Annotation and Fix Marks

The Deso 14 and 15 support annotation and fix marks.

Depending on your settings in the Events configuration one of the following commands will be sent to the echo sounder:

Annotate & Mark:	`*`*`text`*`<LF>`
Annotate only:	`W`*`text`*`<LF>`
Mark only:	`*<LF>`

where:

`text` is the annotation text generated and sent by the navigation software.

When annotation is sent to the echo sounder, the annotation is held until the next 0.125 second interval, and then is sent before another depth is requested.

The maximum annotation length is 86 characters, annotations exceeding this length will be truncated.

4.17 STN Atlas Deso 22/25 Echo Sounder

This equipment devices supports the Deso 22 and 25 echo sounder interface.

4.17.1 Default Communication Parameters

The STN Atlas Deso 22/25 has the following default RS-232 communication parameters:

Baud rate:	4800
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.17.2 STN Atlas Deso 22/25

The Deso 22 and 25 echo sounders are dual frequency echo sounders. Their output string supports both single and dual frequency soundings. The Navigation software extracts the depth information and displays it in the *Equipment Monitor*, *Echo Sounder Trace*, and *Survey Text* real-time displays. The depth data is recorded in the Project database.

You are required to match a frequency to a channel (DA and DB) in the *Deso 22/25 Custom Properties* dialog. The default sets high frequency to channel 2 (DB) and low frequency to channel 1 (DA). Also, in this dialog you must set whether the depths are below the transducer or water surface. The default selection is depths below the surface.

Note – To apply draft corrections select the *Offset height (Z)* adjustment option in the relative display's properties dialog. Also, you must select the *Depths below transducer* option in the *Deso 22/25 Custom Properties* dialog. Then, the height component (if any) of the offset assigned to that echo sounder configuration will be used.

Note – Make sure that you configure the frequency options correctly in the *Deso 22/25 Custom Properties* dialog as this determines what channels are decoded and logged and what frequencies they are decoded as.

Data String Format: Deso 22 Single Frequency

Example:

```
DA00123.78 m<CR><LF>
```

or

```
DB00123.45 m<CR><LF>
```

In the above example the channel 1 depth is 123.78 m and the channel 2 depth is 123.45 m.

Table 4-31 explains the Deso 22 Single Frequency sentence type.

Table 4-31 Deso 22 Single Frequency Sentence Type

Field	Description
1–2	DA signifies channel 1. DB signifies channel 2.
3–10	Depth including decimal point and two decimal places
11–12	Units either ‘ft’ or ‘m’ for feet or metres
13	Carriage return
14	Line feed

Note – The depth fields are always assumed to be 8 characters (that is, padding with spaces or zeros is used).

Note – The equipment condition string ‘OMxx’ may appear between any of the lines in the Deso 22 strings.

Data String Format: Deso 22 Dual Frequency

Example:

```
DA00123.78 mDB00123.45 m<CR><LF>
```

or

```
DA00123.78 m<CR><LF>
DB00123.45 m<CR><LF>
```

In the above examples, the channel 1 depth is 123.78 m and the channel 2 depth is 123.45 m.

Table 4-32 explains the Deso 22 Dual Frequency sentence type.

Table 4-32 Deso 22 Sentence Dual Frequency Sentence Type

Field	Description
1–2	DA. Signifies channel 1.
3–10	Channel 1 depth including decimal point and two decimal places
11–12	Units either ‘ft’ or ‘m’ for feet or metres
13–14	DB. Signifies channel 2
15–22	Channel 2 depth including decimal point and two decimal places
23–24	Units either ‘ft’ or ‘m’ for feet or metres
25	Carriage return
26	Line feed
or	
First String	
Field	**Definition**
1–2	DA. Signifies channel 1.
3–10	Channel 1 depth including decimal point and two decimal places
11–12	Units either ‘ft’ or ‘m’ for feet or metres

Table 4-32 Deso 22 Sentence Dual Frequency Sentence Type (Continued)

13	Carriage return
14	Line feed
Second String	
Field	**Definition**
1–2	DB. Signifies channel 2.
3–10	Channel 2 depth including decimal point and two decimal places
11–12	Units either ‘ft’ or ‘m’ for feet or metres
13	Carriage return
14	Line feed

Note – The depth fields are always assumed to be 8 characters (that is, padding with spaces or zeros is used).

Note – The equipment condition string ‘OMxx’ may appear between any of the lines in the Deso 22 strings.

Data String Format: Deso 25 Dual Frequency

Example:

```
DA00123.78 m<CR><LF>
DB00123.45 m<CR><LF>
BC23.45<CR><LF>
*<CR><LF>
```

In the above example, the channel 1 depth is 123.78 m and the channel 2 depth is 123.45 m.

Table 4-33 explains the Deso 25 sentence type.

Table 4-33 Deso 25 Sentence Type

First String	
Field	**Definition**
1–2	DA. Signifies channel 1.
3–10	Channel 1 depth including decimal point and two decimal places
11–12	Units either ‘ft’ or ‘m’ for feet or metres
13	Carriage return
14	Line feed
Second String	
Field	**Definition**
1–2	DB. Signifies channel 2.
3–10	Channel 2 depth including decimal point and two decimal places
11–12	Units either ‘ft’ or ‘m’ for feet or metres
13	Carriage return
14	Line feed
Third String (ignored)	
Field	**Definition**
1–2	BC. Signifies bottom condition.

Table 4-33 Deso 25 Sentence Type (Continued)

3–7	Bottom condition value (00 soft to 99 hard)
8	Carriage return
9	Line feed
Fourth String (ignored)	
Field	**Definition**
1	‘*’. Signifies end of block
2	Carriage return
3	Line feed

Note – The depth fields are always assumed to be 8 characters (that is, padding with spaces or zeros is used).

Note – The equipment condition string OMxx may appear between any of the lines in the Deso 25 strings.

Annotation and Fix Marks

The Deso 22 and 25 supports the following annotation commands:

```
TXyyy...yyyy<CR><LF>
EMx<CR><LF>
*<CR><LF>
```

Table 4-34 describes the annotation string.

Table 4-34 Deso 22/25 Annotation Sentence Type

Field	Description
TX	Signifies text string
yyy...y yyy	Text to be printed, supports up to 50 characters.
EM	Triggers the event marker, that is, writes the text.

Table 4-34 Deso 22/25 Annotation Sentence Type

x	Determines the type of marker trigger. The options are 0 to 3. The Navigation software uses 3.
*	EOB (End Of Block)

The Navigation software supports both annotation and fix mark outputs.

Annotation and Optionally Mark Output

```
TXyyy...yyyy<CR><LF>
EM3<CR><LF>
*<CR><LF>
```

Where yyy...yyyy is the annotation specified in the event configuration.

Mark Only Output

```
TX<CR><LF>
EM3<CR><LF>
*<CR><LF>
```

Where no annotation text is sent.

4.18 TSS 320 Motion Sensor

This device can interface to a number of common echo sounders. It receives raw depths from the echo sounder, collects heave, and adds the two values together, as well as outputting pitch and roll values. The Navigation software supports the TSS single and dual frequency strings. Annotation is supported.

The navigation computer is interfaced to serial port A in the TSS heave compensator. Either the TSS output format or the echo sounder format can be selected. Data from port A (on the TSS 320) will not flow unless pins 4 and 5 are jumpered together.

4.18.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.18.2 TSS 320 Motion Sensor

The Navigation software extracts the depth, heave, and attitude (pitch and roll) information from the string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The data can also be displayed graphically in the *Echo Sounder Trace* real-time display. The data is recorded in the Project database.

In the *TSS 320 Custom Properties* dialog you can set the format of the incoming data string. The format may be single or dual frequency with high or low frequency first. Additionally, you can select whether the depths are below the surface or below the transducer.

The services that the TSS 320 motion sensor can provide are:

- depth
- heave
- attitude (pitch and roll)

The conventions that the TSS data string uses are:

Positive (+) heave	=	Upwards motion
Positive (+) roll	=	Starboard side down, port side up
Positive (+) pitch	=	Bow up, stern down

Data String Format: Single Frequency Depth

Example:

```
:000123 003752 003740 +0012 +0012 -0123<CR><LF>
```

In the above example, the raw depth is 37.52 m, the heave corrected depth is 37.40 m, and the heave is 0.12 m above mean water level. The roll is 0.12° (starboard side down) and the pitch is 1.23° (bow down).

Table 4-35 describes the data string format.

Table 4-35 TSS 320 – Single Frequency Depth Sentence Type

Field	Description
1	Start of packet character ‘:’
2–3	Horizontal acceleration (not decoded)
4–7	Vertical acceleration (not decoded)
8	Space
9–14	Uncorrected depth straight from echo sounder (centimetres)
15	Space
16–21	Heave corrected depth (centimetres)
22	Space

Table 4-35 TSS 320 – Single Frequency Depth Sentence Type (Continued)

23	Sign of heave ‘+’ or ‘–’
24–27	Heave (centimetres)
28	Quality status. ‘ ’ – pass. ‘?’ – fail.
29	Sign of roll ‘+’ or ‘–’
30–33	Roll (0.01 degrees)
34	Space
35	Sign of pitch ‘+’ or ‘–’
36–39	Pitch (0.01 degrees)
40	Carriage return
41	Line feed

Data String Format: Dual Frequency Depth

Example:

```
:000123 004312 004334 -0034 +0028 -0145<CR><LF>
```

In the above example, the channel 1 heave corrected depth is 43.12 m, the heave corrected channel 2 depth is 43.34 m, and the heave is 0.34 m below the mean water level. The roll is 0.28° (starboard side down) and the pitch is 1.45° (bow down).

Table 4-36 describes the data string format.

Table 4-36 TSS 320 – Dual Frequency Depth Sentence Type

Field	Description
1	Start of packet character ‘:’
2–3	Horizontal acceleration (not decoded)
4–7	Vertical acceleration (not decoded)
8	Space
9–14	Heave corrected depth, channel 1 (centimetres).
15	Space

Table 4-36 TSS 320 – Dual Frequency Depth Sentence Type (Continued)

16–21	Heave corrected depth, channel 2 (centimetres).
22	Space
23	Sign of heave ‘+’ or ‘–’
24–27	Heave (centimetres)
28	Quality status. ‘ ’ – pass. ‘?’ – fail.
29	Sign of roll ‘+’ or ‘–’
30–33	Roll (0.01 degrees)
34	Space
35	Sign of pitch ‘+’ or ‘–’
36–39	Pitch (0.01 degrees)
40	Carriage return
41	Line feed

Annotation and Fix Marks

The 320 Series motion sensor is being operated in ‘free running’ mode so the Navigation software is able to send an annotation to it, which is then sent to the echo sounder.

The Navigation software will send the following annotation command:

`xxxx <CR><LF>`

Where:

`xxxx` is up to 68 characters of annotation text.

4.19 TSS 335B/DMS Motion Sensor

The 33X/DMS series motion sensors (includes 330, 332, 333, 335B) do not output any depth data. Usually these devices are connected directly to the echo sounder and the echo sounder outputs the heave (pitch and roll if required) corrected depth or they are interfaced directly to the navigation computer.

4.19.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

4.19.2 TSS 335B/DMS Motion Sensor

The Navigation software extracts the heave and attitude (pitch and roll) information from the string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The data can also be applied to depths graphically in the *Echo Sounder Trace* real-time display. The data is recorded in the Project database.

The services that the TSS 335B/DMS motion sensor can provide are:

- heave
- attitude (pitch and roll)

The conventions that the TSS data string uses are:

Positive (+) heave	=	Upwards motion
Positive (+) roll	=	Starboard side down, port side up
Positive (+) pitch	=	Bow up, stern down

Data String Format

Example:

```
:010023 –0273 –0311  0421<CR><LF>
```

In the above example, the heave value is 2.73 m below the mean water level, the roll is –3.11° (port side down) and the pitch is 4.21° (bow up).

Table 4-37 describes the data string format.

Table 4-37 TSS 335B/DMS Sentence Type

Field	Description
1	Header ‘:’
2–3	Horizontal acceleration (not decoded)
4–7	Vertical acceleration (not decoded)
8	Space
9	Sign of heave ‘ ’ or ‘–’
10–13	Heave (centimetres)
14	Status flag[1 2]
15	Sign of roll ‘ ’ or ‘–’
16–19	Roll (0.01 degrees)
20	Space
21	Sign of pitch ‘ ’ or ‘–’
22–25	Pitch (0.01 degrees)
26	Carriage return
27	Line feed

[1] For the TSS 335B motion sensor the quality flag is either a blank space ‘ ’ to indicate that the data is good or a question mark ‘?’ to indicate that the data is suspect.

[2] For DMS models the quality flag options are shown in Table 4-38.

Table 4-38 shows the quality flag options for DMS models.

Table 4-38 DMS Quality Flag Options

Field	Description
U	Unaided mode – settled condition
u	Unaided mode – settling
G	GPS aided mode – settled condition
g	GPS aided mode – settling
H	Heading aided mode – settled condition
h	Heading aided mode – settling
F	Full aided mode – settled condition
f	Full aided mode – settling

The DMS will only output one letter type as detailed in the above list. The letter will either be capital to indicate that the DMS is in a settled condition or it will be in lower case indicating that the DMS is still awaiting the end of the settling period.

The type of letter will only change if the DMS is receiving input data from either a GPS or gyrocompass device or both.

5 Heading Devices

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (ftp://ftp.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- Generic heading
- NMEA heading
- SG Brown Gyro heading

5.1 Generic Heading

Many gyros and compasses can output simple heading strings. The Generic Heading device is designed to accept most of these simple heading strings. The generic heading device has been designed to accept True, Magnetic, or Grid headings in DDD.ddd, DDD.MMmmm, or DDD.MMSSsss. It will decode any string less than 256 characters long ending in a <CR><LF>. The heading is deemed to be the first numeric value in the string. Any '+' or '–' signs will be ignored.

5.1.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

5.1.2 Generic Heading

The generic heading device has been designed to accept True, Magnetic or Grid headings in DDD.ddd, DDD.MMmmm, or DDD.MMSSsss. It will decode any string less than 256 characters long ending in a <CR><LF>. The heading is deemed to be the first numeric value in the string. Any '+' or '–' signs will be ignored.

The Navigation software extracts the heading information from the heading string and displays it in the *Equipment Monitor*, *Guidance Monitor*, and *Survey Text* real-time displays. The heading data is recorded in the Project database.

You must enter the correct settings in the *Generic Heading Custom Settings* dialog for the Navigation software to be able to correctly decode the incoming heading strings. The *Generic Heading Custom Settings* dialog lets you select the heading format (for example, DDD.ddd, DDD.MMmmm) and what the heading type is (for example, magnetic, true, or grid).

If required, an orientation correction can be entered in the *Calibration* tab of the *Equipment Properties* dialog. For magnetic headings the magnetic variation entered in the *Constants* tab of the *Global Settings* dialog is used.

Data String Format

Since this is a generic heading device all possible strings cannot be listed. However, Table 5-1 provides some examples on how the heading is decoded.

Table 5-1 Examples of Generic Heading Sentence Types

Format	Fields	Min	Max	Example
DDD.ddd				$DBS0023.666C,AC234,<CR><LF>
	DDD.ddd	0.0	359.999	23.666, decoded as 23°39'57.6"
DDD.MMmmm				$DBS0023.3996C,AC234,<CR><LF>
	DDD	0	359	23
	MMmmm	0.0	0.59999	0.3996, decoded as 23°39'57".6
DDD.MMSSsss				$DBS023.395760C,A234,<CR><LF>
	DDD.	0	359	23
	MM	0	.59	.39
	SSss	0.0	0.005999	0.005760, decoded as 23°39'57.6"

Note – Each field of the heading value is extracted and range checked separately.

Values must be within the min/max range for the specified format. If a value is out of range then the entire string is discarded. For example:

Decode `$DBS023.39620C,A234,<CR><LF>` as `DDD.MMSSsss`

DDD = 23
MM = 0.39
SSsss = 0.00620

The string is rejected because SSsss (0.00620) is out of range (> 0.00599999)

5.2 NMEA Heading

A variety of NMEA strings supply Heading information. Currently, the Navigation software supports the HDM, HDT, VHW, and MWD NMEA heading strings.

5.2.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

5.2.2 HDM: Heading Relative to Magnetic North

The Navigation software extracts the heading information from the HDM sentence and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The heading data is recorded in the Project database.

Note – You must select the *HDM/HDT – Heading* option ***and*** the *Magnetic heading* option in the *NMEA Custom Properties* dialog, before the Navigation software decodes the NMEA HDM string.

The orientation correction for the heading device is entered in the *Equipment Properties* dialog.

The magnetic variation correction is entered in the *Constants* tab in the *Global Settings* dialog.

Data String Format

`$HCHDM,167.4,M*2d<CR><LF>`

Table 5-2 explains the HDM sentence type.

Table 5-2 HDM Sentence Type

Field	Definition
1	Heading, degrees from magnetic north.
2	Fixed text. ‘M’ shows that heading is relative to magnetic north.
3	Checksum (*hh)
3	Carriage return, line feed.

5.2.3 HDT: Heading Relative to True North

The Navigation software extracts the heading information from the HDT sentence and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The heading data is recorded in the Project database.

Note – You must select the *HDM/HDT – Heading* option ***and*** the *True heading* option in the *NMEA Custom Properties* dialog, before the Navigation software decodes the NMEA HDT string.

The orientation correction for the heading device is entered in the *Equipment Properties* dialog.

Data String Format

```
$HEHDT,167.4,T*2b<CR><LF>
```

Table 5-3 explains the HDT sentence type.

Table 5-3 HDT Sentence Type

Field	Definition
1	Heading, degrees from true north.
2	Fixed text. 'T' shows that heading is relative to true north.
3	Checksum (*hh)
3	Carriage return, line feed.

5.2.4 VHW: Water Speed and Heading

The Navigation software extracts only the heading information from the VHW sentence and displays the information in the *Equipment Monitor, Survey Text*, and *Vessel Monitor* real-time displays. Navigation software accepts both the magnetic and true heading values from the VHW sentence depending on which value is selected. The heading data is recorded in the Project database.

Note – You must select the *VHW – Heading* option in the *NMEA Custom Properties* dialog before the Navigation software decodes the VHW NMEA string. Also, select whether the magnetic or true heading is to be decoded from this dialog.

The orientation correction for the heading device is entered in the *Equipment Properties* dialog. The magnetic variation correction is entered in the *Constant* tab in the *Global Settings* dialog.

Data String Format

```
$--VHW,221.4,T,224.1,M,5.34,N,9.88,K*45 <CR><LF>
```

Table 5-4 explains the VHW sentence type.

Table 5-4 VHW Sentence Type

Field	Definition
1	Heading, degrees from true north.
2	Fixed text. ‘T’ shows that the heading is relative to true north.
3	Heading, degrees from magnetic north.
4	Fixed text. ‘M’ shows that the heading is relative to magnetic north.
5	Speed in knots
6	Fixed text. ‘N’ shows that speed is in knots.
7	Speed in kilometres / hour
8	Fixed text. ‘K’ shows that speed is in kilometres / hour.

Table 5-4 VHW Sentence Type (Continued)

9	Checksum (*hh)
10	Carriage return, line feed.

5.2.5 MWD: Wind Speed and Direction

The Navigation software extracts the heading information from the MWD sentence and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The heading data is recorded in the Project database.

Note – You must select the *MWD – Wind Direction (Used as Heading)* in the *NMEA Custom Properties* dialog before the Navigation software decodes the MWD NMEA string. Also, select whether the magnetic or true wind heading is to be decoded from this dialog.

The orientation correction for the heading device is entered in the *Equipment Properties* dialog. The magnetic variation correction is entered in the *Constant* tab in the *Global Settings* dialog.

Data String Format

```
$WIMWD,123.8,T,119.8,M,5.34,N,2.74,M,*55<CR><LF>
```

Table 5-5 explains the MWD sentence type.

Table 5-5 MWD Sentence Type

Field	Definition
1	Wind heading degrees from true north
2	Fixed text. ‘T’ shows that heading is relative to true north.
3	Wind heading degrees from magnetic north
4	Fixed text. ‘M’ shows that heading is relative to magnetic north.
5	Wind speed over ground in knots
6	Fixed text. ‘N’ shows that speed over ground is in knots.

Table 5-5 MWD Sentence Type (Continued)

7	Wind speed over ground in metres/second
8	Fixed text. ‘M’ shows that speed over ground is in knots.
9	Checksum (*hh)
10	Carriage return, line feed.

5.3 SG Brown Gyro ASCII Heading Device

The SG Brown Gyro provides heading relative to True North.

The SGB 1000A Gyro Compass system provides four serial output formats. The Navigation software interfaces to the SGB ASCII format.

The SGB ASCII format is selected by setting the gyros programming switches 4,5,6,7 to 0,1,0,0. The data output rate is 100 ms (10 times a second).

Note – This gyro also has a NMEA output option which is supported by the Navigation software's NMEA equipment handler.

5.3.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

5.3.2 SG Brown Gyro ASCII

The Navigation software extracts the heading information from the heading string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The heading data is recorded in the Project database.

The SG Brown gyro can display the degrees to either 1/6 of a degree or 1/10 of a degree, depending on the equipment (older versions tend to be 1/6 degree). This setting is entered the *SG Brown Gyro Custom Properties* dialog.

If required, an orientation correction can be entered in the *Calibration* tab of the *Equipment Properties* dialog.

Note – Heading values obtained from the gyro are assumed to be True headings.

Data String Format

Example:

```
0452<CR><LF>
```

In the above example, the heading is decoded as 45°20' or 45°12' depending on the custom settings (1/10 or 1/6 degree resolution).

Table 5-6 describes the data string format.

Table 5-6 SG Brown Gyro Sentence Type

Field	Description
1–3	Heading in decimal degrees, packed with zeros.
4	1/6 or 1/10 degree reading, depending on the gyro.
5	Carriage return
6	Line feed

The SG Brown ASCII string is a 6 character string. The heading will be packed with zeros to achieve this length.

6 Position Devices

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (ftp://ftp.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- Generic NEE Position
- Geodimeter 400/600
- NMEA GPS
- STN Atlas Polartrack Total Station
- Trimble 7400 GPS
- Trimble cycle printouts GPS
- Trimble MS750 GPS

6.1 Generic NEE Position

This device is designed to extract northings, eastings, elevations, and some related information from incoming ASCII strings.

6.1.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	various

6.1.2 Generic NEE Position

The Navigation software extracts the position information from the strings and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The positional data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the Project database.

This equipment handler allows you to specify the format of the incoming position string. The following fields can be extracted from the incoming position string:

- Northing
- Easting
- Elevation
- GPS Time
- Accuracy
- Data source

These selections are made in the *Generic NEE Custom Properties* dialog. The field delimiters, message terminators, and NEE units are also set in this dialog.

Additionally, more than one vessel may be tracked on the same port, provided that each vessel's string has a unique ID number and the corresponding number is set up in the NEE position equipment configuration. An NEE position service needs to be added to the advanced equipment configuration for each additional string to be decoded.

Data String Format

A variety of string formats are supported. The following rules apply:

- Maximum string length is 600 characters
- Terminators must be a combination of <CR> and <LF> as defined in the custom properties.
- Fields can be delimited by either spaces, commas, or tabs as defined in the custom properties.
- When spaces are selected as the field delimiter, multiple consecutive spaces will be treated as one delimiter.
- Any non-numeric ASCII characters will be ignored.
- Fields may be packed with spaces or zeros.
- If more than one data string is to be supported then the data strings must contain an ID number that matches the data source number set in the respective NEE Position service's properties.
- A minimum of Easting and Northing components must be configured for decoding.
- A data field can only be selected once.
- Any unspecified data fields are ignored.
- The first number that appears in a selected field is decoded.

- GPS time is always decoded as GPS time (UTC time is not supported).
- The supported format for GPS time is seconds since the start of GPS time.
- Both positive and negative numbers are supported in the Northing, Easting, and Elevation fields.

Warning – The Navigation software assumes the same geodetic setup is being used to generate the Northings, Eastings, and Elevations as has been set in the software to display and use them.

6.2 Geodimeter 400/600 Total Station

The Navigation software supports the Geodimeter 400/600 total stations, provided they have been set up correctly.

6.2.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

6.2.2 Geodimeter 400/600

The Navigation software extracts the position information from the strings and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The positional data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the Project database.

The Geodimeter equipment handler interfaces to a Geodimeter total station which has been configured as follows:

- Serial Data coms turned ON (MNU, 4,1,2)
- COM = 1,8,0,9600
- Table – 0 (This outputs the default table HA, VA, and SD)
- Reg Key? No
- Slave? Yes
- Instrument set to Tracking mode (TRK)

The default Geodimeter serial output table (Table 0) consisting of horizontal angle, vertical angle, and slope distance is decoded as an Observer service. A NEE service is used to supply the station North, East, and Elevation. The station coordinates are entered in the *Geodimeter 400/600 Custom Properties* dialog.

The total station must be defined as an individual vessel using the vessel editor. Trimble recommends that the station has two offsets—one for the coordinated point (that the total station is set up over), and the other for the instrument's vertical axis. Alternatively, incorporate the instrument height in the station coordinates when you enter them in the *Geodimeter 400/600 Custom Properties* dialog (in which case you only need one offset and no z value).

Since the Geodimeter 400/600 equipment handler uses an Observer service there must be at least two vessels in the project before configuring the service—one being the actual boat (observed) and the other being the Geodimeter total station (observer).

By default, the station coordinates are ***not*** logged. To log the station coordinates change the NEE Position service logging properties to log when online.The station coordinates are ***not*** transmitted to the Geodimeter.

Data String Format

```
0<CR><LF>
7=123.4512<CR><LF>
8=90.1234<CR><LF>
9=99.312<CR><LF>
```

The four strings are defined as:

• Status	0 (OK)	(see Table 6-1)
• Horizontal Angle	123°45'12"	(see Table 6-2)
• Vertical Angle	90°12'34"	(see Table 6-3)
• Slope Distance	99.312 m	(see Table 6-4)

Table 6-1 Status String

Field	Description
1	Status. ‘0’ or ‘>0’ is okay. Anything else is invalid data.
2	Carriage return
3	Line feed

Table 6-2 Horizontal Angle String

Field	Description
1	String ID. ‘7’ – Horizontal Angle.
2	Always ‘=’
3	Horizontal angle. (DDD.MMSS) The range is 0 – 359.5959. This field may be packed with zeros or spaces.
4	Carriage return
5	Line feed

Table 6-3 Vertical Angle String

Field	Description
1	String ID. ‘8’ – Vertical Angle.
2	Always ‘=’
3	Vertical angle. (DDD.MMSS) range is 10 to 170°. 0° is vertical, 90° is horizontal, 180° is straight down. This field may be packed with zeros or spaces.
4	Carriage return
5	Line feed

Table 6-4 Slope Distance String

Field	Description
1	String ID. ‘9’ – Slope Distance.
2	Always ‘=’
3	Slope distance. (mmm.mmm) The range is 0 – 9999.999. Values must be greater than 0. This field may be packed with zeros or spaces.
4	Carriage return
5	Line feed

6.3 NMEA GPS

The Navigation software supports NMEA (2.1 and 2.3) messages relating to GPS information. The position, position quality, GPS time, and tide can all be extracted from these strings.

6.3.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

6.3.2 NMEA <GPS>

The Navigation software extracts the position related information from the strings and displays it in the *Equipment Monitor, Survey Text*, and *Vessel Monitor* real-time displays. The position data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the project database.

The primary purpose of this equipment handler is to support the NMEA GGA, GLL, and GGK strings. However, this equipment handler also extracts information from the following messages and signals if they are available:

- NMEA GSA
- NMEA GST
- NMEA GSV
- NMEA VTG
- NMEA ZDA
- Trimble UTC time tag

- 1 Pulse Per Second (1PPS)

Refer to the following sections for details on these messages and signals.

Due to the wide scope of this equipment handler there are several equipment custom properties that can be configured for this device. The relevance of these custom settings depend on what information you are extracting from the receiver, as well as, what mode of operation the receiver is in.

If you are using your receiver as a time source you will need to configure the settings in the *GPS Time* tab of the *NMEA Custom Properties* dialog.

From the *Time Input* group select the time source to be used. The options are: *ZDA (Time/Date)*, *Trimble UTC Time Tag*, or *Trimble Time Tag with 1PPS*. If none of these are available then constant latency will be applied.

On the *GPS Position* tab the position string to be decoded must be selected. The position strings supported are GGA (default), GLL, and GGK. Also, set the *Minimum GPS Quality* field on this tab. Any GPS solutions falling below this quality will be rejected.

Note – The options available in the *Minimum GPS Quality* field and the availability of this field itself depend on what has been selected as the position input string.

For surveys using RTK positions with the GGK position string the Navigation software will derive RTK tide information from the GPS heights. The settings for this are contained in the *RTK Tide* tab.

- *Use averaging* check box

  Select this check box for RTK averaging, then set the parameters in the *Sample period* field. Clear this check box to calculate RTK tide directly from the height in the message.

- *Sample period* field

  Enter a sample period to calculate an average tide over; or how often the tide is calculated directly from the GGK string (depending on the previous selection).

- *Minimum GPS Quality* field

  Select the minimum solution you will accept for the RTK Tide calculation. The options are Autonomous, RTK Float/DGPS, Code Phase DGPS, or RTK Fixed-Integer.

In addition to the custom settings there are some properties that can be configured for the Tide service, if configured. The following are some recommendations for the RTK Tide service:

- Timing

  Select or confirm the latency and timeout period for this service. These value are directly related to the RTK Tide custom settings (averaging and sample period).

  Trimble recommends you set the latency to 0s for the Tide service.

  A suggestion setting for the timeout is: the sample period $\times$ 2 + the time interval between position updates.

- Calibration

  Choose whether or not to apply the vessel offset height (antenna height) and enter the datum separation, the separation between WGS-84 and local datum (+ve above WGS-84)

Note – The RTK Tide can only be calculated from the NMEA GGK string, if any other strings are selected then the RTK Tide will time out.

Data String Format: NMEA GGA

```
$GPGGA,172814.0,3723.46587704,N,12202.26957864,W,2,
6,1.2,18.893,M,-25.669,M,2.0,0031*4F <CR><LF>
```

Table 6-5 explains the GGA Sentence Type.

Table 6-5 GGA Sentence Type

Field	Definition
1	UTC (HH:MM:SS.ss) time of position
2	Latitude (DDMM.mmmmmm)
3	Direction of latitude (N or S)
4	Longitude (DDDMM.mmmmmm)
5	Direction of longitude (E or W)
6	GPS Quality indicator: 0: Fix not valid 1: GPS SPS fix 2: Differential GPS fix 3: GPS PPS fix 4: Fixed Int RTK fix 5: Float RTK fix 6: Estimated fix 7: Manual fix 8: Simulator fix
7	Number of SVs in use. 00 to 12.
8	HDOP
9	Antenna height, MSL reference.
10	M is fixed text indicating that the unit of measure for altitude is metres
11	Geoidal separation
12	M is fixed text indicating that the unit of measure for geoidal separation is metres
13	Age of differential GPS data record, Type 1 or Type 9. Null when DGPS not used.

Table 6-5 GGA Sentence Type (Continued)

14	Reference Station ID. 0000–1023, Null when any reference station ID is selected and no corrections are received.
15	Checksum (*hh)
16	Carriage return, line feed.

Data String Format: NMEA GLL

```
$GPGLL,3723.454333,N,12202.269667,W,151933,A*3E<CR>
<LF>
```

Table 6-6 explains the GLL sentence type.

Table 6-6 GLL Sentence Type

Field	Definition
1	Latitude (DDMM.mmmmmm)
2	Direction of latitude (N or S)
3	Longitude (DDDMM.mmmmmm)
4	Direction of longitude (E or W)
5	UTC time of position (HH:MM:SS.ss)
6	Fixed text shows that data is valid (A is valid)
7	Checksum (*hh)
8	Carriage return, line feed.

Data String Format: NMEA GGK

```
$PTNL,GGK,020210.00,040297,4332.692625,S,17235.4854
93,E,3,07,1.4,EHT36.858,M*55<CR><LF>
```

Table 6-7 explains the GGK sentence type.

Table 6-7 GGK Sentence Type

Field	Definition
1	UTC time of position (HHMMSSss)
2	UTC date of position (MMDDYY)
3	Latitude (DDMM.mmmmmm)
4	Direction of latitude (N or S)
5	Longitude (DDDMM.mmmmmm)
6	Direction of longitude (E or W)
7	GPS quality indicator 0 – Fix not valid 1 – Autonomous GPS fix 2 – Differential (Float) GPS fix or DGPS 3 – Fixed-Integer fix 4 – Code Phase DGPS
8	Number of SVs in use. 00 to 16.
9	PDOP
10	Ellipsoidal height of fix
11	M is fixed text indicating that the unit of measure is metres
12	Checksum (*hh)
13	Carriage return, line feed

Data String Format: NMEA GST

```
$GPGST,172814.0,0.006,0.023,0.020,273.6,0.023,0.020
,0.031*6A<CR><LF>
```

Table 6-8 explains the GST sentence type.

Table 6-8 GST Sentence Type

Field	Definition
1	UTC (HH:MM:SS.ss) time of GGA position fix associated with this sentence.
2	RMS (Root mean square) value of the pseudorange residuals (including carrier phase residuals during periods of RTK [float and fixed RTK processing])
3	Error ellipse semi-major axis 1 sigma error (metres)
4	Error ellipse semi-minor axis 1 sigma error (metres)
5	Error ellipse orientation (degrees from true north)
6	Latitude 1 sigma error (metres)
7	Longitude 1 sigma error (metres)
8	Altitude 1 sigma error (metres)
9	Checksum (*hh)
10	Carriage return, line feed.

Data String Format: NMEA GSV

```
$GPGSV,4,1,13,02,02,213,,03,-
3,000,,11,00,121,,14,13,172,05*67<CR><LF>
```

Table 6-9 explains the GSV sentence type.

Table 6-9 GSV Sentence Type

Field	Definition
1	Total number of messages in the sequence. 1 to 3.
2	Message number. 1 to 3.
3	Total number of satellites in view
4	SV PRN number (#1)

Table 6-9 GSV Sentence Type (Continued)

5	Elevation in degrees, 90° maximum.
6	Azimuth in degrees from true north, 000° to 359°.
7	SNR (signal to noise ratio). 00–99 dB (null when not tracking).
8	SV PRN number (#2)
9	Elevation in degrees, 90° maximum.
10	Azimuth in degrees from true north, 000° to 359°.
11	SNR (signal to noise ratio). 00–99 dB (null when not tracking).
12	SV PRN number (#3)
13	Elevation in degrees, 90° maximum.
14	Azimuth in degrees from true north, 000° to 359°.
15	SNR (signal to noise ratio). 00–99 dB (null when not tracking).
16	SV PRN number (#4)
17	Elevation in degrees, 90° maximum.
18	Azimuth in degrees from true north, 000° to 359°.
19	SNR (signal to noise ratio), 00–99 dB (null when not tracking).
20	Checksum (*hh)
21	Carriage return, line feed.

Data String Format: NMEA GSA

```
$GPGSA,A,3,19,28,14,18,27,22,31,29,,,,,1.7,1.0,1.3*
35<CR><LF>
```

Table 6-10 explains the GSA sentence type.

Table 6-10 GSA Sentence Type

Field	Definition
1	Mode: ‘M’ = Manual, forced to operate in 2D or 3D ‘A’ = Automatic, 3D/2D
2	Mode: ‘1’ = Fix not available ‘2’ = 2D ‘3’ = 3D
3	ID of SVs used in position fix (null for unused fields)
4	ID of SVs used in position fix (null for unused fields)
5	ID of SVs used in position fix (null for unused fields)
6	ID of SVs used in position fix (null for unused fields)
7	ID of SVs used in position fix (null for unused fields)
8	ID of SVs used in position fix (null for unused fields)
9	ID of SVs used in position fix (null for unused fields)
10	ID of SVs used in position fix (null for unused fields)
11	ID of SVs used in position fix (null for unused fields)
12	ID of SVs used in position fix (null for unused fields)
13	ID of SVs used in position fix (null for unused fields)
14	ID of SVs used in position fix (null for unused fields)
15	PDOP
16	HDOP
17	VDOP
18	Checksum (*hh)
19	Carriage return, line feed.

Data String Format: NMEA VTG

`$GPVTG,221.4,T,224.1,M,5.34,N,9.88,K*45 <CR><LF>`

Table 6-11 explains the VTG sentence type.

Table 6-11 VTG Sentence Type

Field	Definition
1	Track, degrees from true north.
2	Fixed text. ‘T’ shows that track made good is relative to true north.
3	Track, degrees from magnetic north
4	Fixed text. ‘M’ shows that track made good is relative to magnetic north.
5	Speed over ground in knots
6	Fixed text. ‘N’ shows that speed over ground is in knots.
7	Speed over ground in kilometres / hour
8	Fixed text. ‘K’ shows that speed over ground is in kilometres / hour.
9	Checksum (*hh)
10	Carriage return, line feed.

Data String Format: NMEA ZDA

```
$GPZDA,172809,12,07,1996,00,00*45<CR><LF>
```

Table 6-12 explains the ZDA sentence type.

Table 6-12 ZDA Sentence Type

Field	Definition
1	Time (HH:MM:SS), in UTC.
2	Day. 01 to 31.
3	Month. 01 to 12.
4	Year
5	Local time zone offset from GMT. 00 to ± 13 hours.
6	Local time zone offset from, minutes.
7	Checksum (*hh)
8	Carriage return, line feed.

Data String Format: Trimble UTC Time Tags and PPS

```
UTC 97.12.21 20:21:16 56<CR><LF>
```

Table 6-13 Current Time (Type 15 Record)

Field	Description
1–3	UTC (header)
4	Space
5–12	Year, month, and date (yy.mm.dd).
13	Space
14–21	UTC time (in 24Hr) (hh:mm:ss)
22	Space
23	Position fix type[1]
24	Number of SVs tracked. ‘:’ for 10. ‘;’ for 11. or ‘<’ for 12)[1].
25	Carriage return
26	Line feed

[1]Sentences containing ‘??’ in the Position fix type and number of SVs tracked fields are discarded as this indicates that the UTC time is based on the receiver clock rather than satellite signals.

1 Pulse Per Second

This equipment handler detects a change of state in the CTS signal (caused by the 1PPS) and then accurately generates a time of arrival for the signal. This is used with the UTC time tag to provide GPS Time service when the *Trimble UTC Time Tag with 1PPS* option is selected in the *GPS Time* tab of the *NMEA Custom Properties* dialog.

6.4 STN Atlas Polartrack Total Station

The Navigation software supports the STN Atlas Polartrack total station.

6.4.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	7
Terminator:	<CR>

6.4.2 Polartrack

The Navigation software extracts the position information from the strings and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The positional data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the Project database.

The Polartrack total station must be configured in Remote Control mode.

The Polartrack total station measures the range, azimuth, and vertical angle from a shore-based station to a prism on a vessel, to which the data is then transmitted. This data is decoded as an Observer service. An NEE service is used to supply the Navigation software with the shore-based station north, east, and elevation coordinates.

To do this, you must first create two vessels in the Navigation software. The first one for the shore-based station (the observer vessel) and the second for the vessel being tracked (the observed vessel).

On the observer vessel (shore-based station) configure a Manual NEE Position service. Then configure the Polartrack Observer service (by using the *Configure Observer Equipment* dialog), make sure that the *Located at* vessel is the shore-based station and that the *Observed* vessel is the vessel being tracked.

When you go online, open the *Manual Data Sheet* dialog and select the Manual NEE Position equipment configuration. Enter the easting, northing, and elevation values for the observer vessel (shore-based station) and click **Use**. The elevation should include the instrument height. Though the manual NEE position will not time out, it will need to be re-entered each time that you initially go online after the Navigation project has been opened.

An orientation angle (RO Azimuth) can be added to the decoded horizontal angle. Enter this in the *Calibration* tab of the *Equipment Properties* dialog in the observer equipment configuration.

Each time the Navigation software goes online the following initialisation strings are sent to the Polartrack:

1<CR>

5000010<CR>

These strings intialise the Polartrack and set the output to long data blocks (26 bytes). These strings are also sent at 5 second intervals during timeout periods.

When Navigation goes offline the following command is sent:

8<CR>

This is sent to ‘de-initialise’ the Polartrack.

Data String Format

```
1332380625041027681332143<CR>
```

In the example the range is 1332.38 m, horizontal angle is 62.504° and the vertical angle is 102.768°. No other fields are decoded.

Table 6-14 describes the Polartrack sentence type.

Table 6-14 Polartrack Sentence Type

Field	Description
1–6	Range (centimetres).
7–12	Horizontal angle (1/1000 degree) The range is from 0 to 359999.
13–18	Vertical angle (1/1000 degree) The range is 10000 to 170000. 0 is vertical, 90000 is horizontal, and 180000 is straight down.
19–25	Status and additional information (not decoded).
26	Carriage return.

The data format is a fixed length string of 26 characters.

Fields may be packed with zeros or spaces.

6.5 Trimble 7400 GPS

The Navigation software supports some of the Trimble 7400 receiver’s binary output strings. The position, position quality, velocity, GPS time, satellite information, and RTK tide data can be extracted from these strings.

6.5.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

6.5.2 Trimble 7400

The Navigation software extracts the position and position related information from the strings and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The positional data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the Project database.

The custom settings in this equipment configuration provides an interface that lets you configure the output from the Series 7400 (or 4400) receiver from within Navigation. You can also set parameters that govern the receiver’s calculations and performance. The Trimble Series 7400 receiver supports various streamed binary output formats (40h record packets) as well as ASCII Time Tags and 1PPS (1 Pulse Per Second).

The Trim7400.dll supports the following GSOF message type records:

- Position Time (01h)
- Position WGS84 (02h)

- Velocity Data (08h)
- PDOP Information (09h)
- Position Sigma Information (0Ch)
- Detailed SV Information (0Eh)
- Current Time (10h)

In the *Trimble 7400 Custom Properties* dialog set the following parameters on the *GPS* tab:

- *Elevation mask angle (Deg)* field

  This value determines the lowest allowable satellite elevation to be used in the position calculation.

- *Disable satellites* field

  Enter the satellite identification numbers to be excluded from the position calculation.

- *PDOP mask* field

  Set the maximum allowable PDOP value, if this value is exceeded then the solution will be rejected.

- *Measurement rate* field

  Set the rate at which the receiver will calculate positions. This value can not exceed the position output rate.

Note – The default latency has been set to 0.2 seconds which matches that of a 5 Hz measurement rate. Trimble recommends that you change the latency value used by the Navigation software if you set the measurement rate to 1 Hz.

- *Position output rate* field

  Set the rate at which the receiver outputs positions. This value cannot be set smaller than the measurement rate.

- *RTK/DGPS switch range (km)* field

  At this distance from the base station the receiver will switch from RTK to DGPS mode.

- *Minimum GPS solution* field

  Select the minimum GPS solution type to be accepted by the Navigation software.

- *Time Output* group

  Select the GPS time source. You can select the standard 7400 time record or the ASCII time tag with the 1PPS.

Note – The 1PPS requires additional hardware. For more information see Chapter 2, Technical References.

- *Initialize when going online*

  Check this field to update the 7400 receiver’s configuration with the selections you have made on this tab when the Navigation software goes online.

The *RTK Tide* tab determines how the RTK tide data is derived (if configured).

- *Use averaging* check box

  Select this check box for RTK averaging then set the parameters in the *Sample period* field. Clear this check box to calculate RTK tide directly from the height in the message.

- *Sample period* field

  Enter a sample period to calculate an average tide over, or how often the tide is calculated directly from the message (depending on the previous selection).

- *Minimum GPS solution* field

  Select the minimum solution you will accept for RTK Tide calculation. The options are Non-Differential, Differential, Float RTK, or RTK Fixed Integer.

In addition to the custom settings there are some properties that can be configured for the Tide service, if configured. The following are some recommendations for the RTK Tide service:

- Timing

  Select or confirm the latency and timeout period for this service. These values are directly related to the RTK Tide custom settings (averaging and sample period).

  Trimble recommends that you set the latency to 0 for the Tide service.

  A suggested setting for timeout is: the sample period $\times$ 2 + the time interval between position updates.

- Calibration

  Choose whether or not to apply vessel offset height (antenna height) and enter the datum separation, the separation between WGS-84 and local datum (+ve above WGS-84).

Data String Format: Report Packet 40h Structure

The Trim7400.dll supports the following message records:

- Position Time (01h)
- Position WGS84 (02h)
- Velocity Data (08h)
- PDOP Information (09h)
- Position Sigma Information (0Ch)
- Detailed SV Information (0Eh)
- Current Time (10h)

Table 6-15 to Table 6-21 describes these message records.

Table 6-15 Position Time (Type 1 record)

Byte	Description
0	Position Time Output Record
1	Record length
2–5	GPS Time (ms)
6–7	GPS week Number (count since January 1980)
8	Number of satellites used in the position calculation
9	Position Flags 1
10	Position Flags 2
11	Initialization Number

Table 6-16 Position WGS84 (Type 2 record)

Byte	Description
0	Output record type (Lat, Long, and Hgt output record)
1	Record length
2–9	Latitude (WGS-84 datum)

Table 6-16 Position WGS84 (Type 2 record) (Continued)

10–17	Longitude (WGS-84 datum)
18–25	Height (WGS-84 datum)

Table 6-17 Velocity Data (Type 8 record)

Byte	Description
0	Output record type (Velocity Data Output Record)
1	Record length
2	Velocity flag status
3–6	Horizontal speed
7–10	Heading (true north heading on WGS-84 datum)
11–14	Vertical velocity

Table 6-18 PDOP Information (Type 9 record)

Byte	Description
0	Output record type (PDOP Information Output Record)
1	Record length
2–5	PDOP (Positional Dilution of Precision)
6–9	HDOP (Horizontal Dilution of Precision)
10–13	VDOP (Vertical Dilution of Precision)
14–17	TDOP (Time Dilution of Precision)

Table 6-19 Position Sigma Information (Type 12 record)

Byte	Description
0	Output record type (Position Sigma Information Output Record)
1	Record length

Table 6-19 Position Sigma Information (Type 12 record)

2–5	Position RMS (root mean square of position error calculated for overdetermined positions)
6–9	Sigma East
10–13	Sigma North
14–17	Covariance East-North
18–21	Sigma Up
22–25	Semi-major axis of error ellipse
26–29	Semi-minor axis of error ellipse
30–33	Orientation of semi-major axis, clockwise from True North.
34–37	Unit Variance Valid only for overdetermined solutions. Unit variance should approach 1.0. A value of less than 1.0 indicates that apriori variances are too pessimistic.

Table 6-20 SV Detailed Info (Type 14 record)

Byte	Description
0	Output record type (Detailed Satellite Information Output Record)
1	Record length
2	Number of satellites included in the record
	The following bytes are repeated for Number of SVs
	PRN (pseudorandom number of satellite)
	Flags1 (first set of satellite status bits)
	Flags2 (second set of satellite status bits)
	Elevation (angle of satellite above horizon)
	Azimuth (azimuth of satellite from true north)

Table 6-20 SV Detailed Info (Type 14 record) (Continued)

	SNR L1 (signal-to-noise ratio of L1 signal (multiplied by 4))
	SNR L2 (signal-to-noise ratio of L2 signal (multiplied by 4))

Table 6-21 Current Time (Type 16 record)

Byte	Description
0	Output record type (Current Time Output Record)
1	Record length
2–5	Time when packet is sent from receiver, in GPS milliseconds of week
6–7	GPS Week Number (week number since start of GPS time)
8–9	UTC Offset (GPS to UTC time offset)
10	Flags (flag bits indicating validity of Time and UTC offset parameters)
Length+4	Checksum
Length+5	ETX (end transmission)

For more information on the streamed binary data records output by the 4400 / 7400 GPS receivers please refer to the *Series 7400 Operation Manual*.

Data String Format: Trimble UTC Time Tags and PPS

`UTC 97.12.21 20:21:16 56<CR><LF>.`

Table 6-22 describes the data string format.

Table 6-22 UTC Time Tags Sentence Type

Field	Description
1–3	‘UTC’ (header)
4	Space
5–12	Year, month, and date (yy.mm.dd).
13	Space
14–21	UTC time (in 24 hr) (hh:mm:ss)
22	Space
23	Position fix type[1]
24	Number of SVs tracked. ‘:’ for 10. ‘;’ for 11. or ‘<’ for 12[1].
25	Carriage return
26	Line feed

[1]Sentences containing ‘??’ in the Position fix type and number of SVs tracked fields are discarded as this indicates that the UTC time is based on the receiver clock rather than satellite signals.

1 Pulse Per Second

This equipment handler detects a change of state in the CTS signal (caused by the 1PPS) and then accurately generates a time of arrival for the signal. This is used with the UTC time tag to provide GPS Time service when the *Trimble UTC Time Tag with 1PPS* option is selected in the *GPS* tab of the *Trimble 7400 Custom Properties* dialog.

6.6 Trimble Cycle Printout

The Navigation software supports Trimble’s Cycle Printouts. The position, position quality, GPS time, and tide information can all be extracted from these strings.

6.6.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

6.6.2 Trimble Cycle Printout

The Navigation software extracts the position and position related information from the strings and displays it in the *Equipment Monitor*, *Vessel Monitor*, and *Survey Text* real-time displays. The positional data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the Project database.

The primary purpose of this equipment handler is to support the Cycle printout ‘Type1’ and ‘Type2’ messages. However, this equipment handler also extracts information from the following messages and signals if they are available:

Position Quality Stats	$PTNL,QA
Position and fix related data	$__GGA
Trimble UTC time tag	
1 Pulse Per Second (1PPS)	

For details on these messages and signals see the following sections.

Due to the wide scope of this equipment handler there are several custom properties that may be configured for this device. The relevance of these custom settings depend on what information you are extracting from the receiver as well as what mode of operation the receiver is in.

Set the following parameters:

- *GPS Time Input* group

  Select the GPS time input. Select the *Trimble UTC Time Tag* or the *Trimble UTT Time Tag without 1PPS* option.

  If neither are available, constant latency applies automatically.

- *Minimum GPS solution* field

  Select the minimum solution you will accept for positioning. The options are Non-Differential, Differential, RTK Float/DGPS, or RTK Fixed Integer.

Enter the following parameters to set the calculation of the RTK tide (used if you have selected this service):

- *Use averaging* check box

  Select this check box for RTK averaging then set the parameters in the *Sample period* field. Clear this check box to calculate RTK tide directly from the height in the message.

- *Sample period* field

  Enter a sample period to calculate an average tide over, or how often the tide is calculated directly from the message (depending on the previous selection)

- *Minimum GPS solution* field

  Select the minimum solution you will accept for RTK Tide calculation. The options are Non-Differential, Differential, RTK Float/DGPS, or RTK Fixed Integer.

In addition to the custom settings there are some properties that can be configured for the Tide service, if configured. The following are some recommendations for the RTK Tide service:

- Timing

  Select or confirm the latency and timeout period for this service. These values are directly related to the RTK Tide custom settings (averaging and sample period).

  Trimble recommends you set the latency to 0 for the tide service.

  A suggested setting for timeout is:
  the sample period × 2 + the time interval between position updates.

- Calibration

  Choose whether or not to apply vessel offset height (antenna height) and enter the datum separation, the separation between WGS-84 and local datum (+ve above WGS-84).

Note – The RTK Tide service is 'timed out' (if selected) when the Cycle Printout 'Type 1' message is detected—this is because the height in this message is truncated to the metre and is therefore not valid for RTK tide calculations.

Data String Format: Cycle Printout – Type 1

Example (trailer removed):

```
[00 TUE 118 28-APR-98 02:23:51d43:32.7054S
172:35.4933E -0032 02.0 457485 +000.20 000.19
353.3 -7.9591E-07 0050 3 12,13,24]
```

In the above example the GPS position is 43°32.7054'S and 172°35.4933'E and 32 metres below the WGS-84 ellipsoid. The position is a differential 3D (Lat Long with fixed height) solution with a PDOP of 2.0. The satellites used in the position were 12, 13, and 24.

Table 6-23 describes the data string format.

Table 6-23 Cycle Printout – Type 1 Sentence Type

Field	Description
1	Header '['
2	Space
2–3	ID (not decoded)
4	Space
5–7	Day (note decoded)
8	Space
9–11	Day of the year (not decoded)
12	Space
13–21	Date (dd-mmm-yy)
22	Space
23–30	Time (hh:mm:ss)
31	Solution type. d=differential, f=float, i=fixed integer, space=Autonomous.
32–41	Latitude (dd:mm.mmmm)
42	Hemisphere ('N' or 'S')
43	Space
44–54	Longitude (ddd:mm.mmmm)
55	'E' or 'W'

Table 6-23 Cycle Printout – Type 1 Sentence Type

56	Space
57–61	Height above WGS-84 ellipsoid (metres)
62	Space
63–66	PDOP
67	Space
68–73	Clock (not decoded)
74	Space
75–81	Vertical velocity (knots)
82	Space
83–88	Horizontal velocity (knots)
89	Space
90–94	Heading (degrees)
95	Space
96–106	Frequency offset (not decoded)
107	Space
108–111	Number of cycles without loss of lock (not decoded)[1]
112	Space[1]
113	Solution type[1] 0=clock with fixed lat/long/height 1=height/clock with fixed lat/long 2=lat/long with fixed height and clock 3=lat/long/clock with fixed height 4=lat/long/height/clock
114	Space[1]
115–Various	Satellite ID numbers[2]
Various	Trailer ‘]’

[1]If the receiver is tracking more than six satellites then these fields will be left out and replaced with the satellite ID numbers.

[2]The SV ID numbers are comma delimited.

The equipment handler automatically detects whether a position record is Type 1 or Type 2. This is done by checking for the ‘[’ ‘]’ characters that only the Type 1 record has.

Data String Format: Cycle Printout – Type 2

Example (trailer removed):

```
21MAY93 15:26:07d37:23.454333N 122:02.269493W -
00046.453 01.6 447984 -000.05 000.00 000.0 -
5.1645E-07 0868 4 19,28,14,18,27
```

In the above example the GPS position is 37°23.454333'N and 122°02.269493'W and 46.453 m below the WGS-84 ellipsoid. The position is a differential 3D (lat, long, and height) solution with a PDOP of 1.6. The satellites used in the position were 19, 28, 14, 18, and 27.

Table 6-24 describes the data string format.

Table 6-24 Cycle Printout – Type 2 Sentence Type

Field	Description
1–7	Date (ddmmmyy)
8	Space
9–16	Time (hh:mm:ss)
17	Solution status. d=differential, f=float, i=fixed integer, blank=Autonomous
18–29	Latitude (dd:mm.mmmmmm)
30	Hemisphere (‘N’ or ‘S’)
31	Space
32–44	Longitude (ddd:mm.mmmmmm)
45	‘E’ or ‘W’
46	Space
47–56	Height above WGS-84 ellipsoid (metres)

Table 6-24 Cycle Printout – Type 2 Sentence Type

57	Space
58–61	PDOP
62	Space
63–68	Clock (not decoded)
69	Space
70–76	Vertical velocity (knots)
77	Space
78–83	Horizontal velocity (knots)
84	Space
85–89	Heading (degrees)
90	Space
91–101	Frequency offset
102	Space
103–106	Number of cycles without loss of lock (not decoded)[1]
107	Space[1]
108	Solution type [Note 1] 0=clock with fixed lat/long/height 1=height/clock with fixed lat/long 2=lat/long with fixed height and clock 3=lat/long/clock with fixed height 4=lat/long/height/clock
109	Space[1]
110– variable	Satellite ID numbers[2]

[1]If the receiver is tracking more than eight satellites then these fields will be left out and replaced with the satellite ID numbers.

[2]The SV ID numbers are comma delimited.

The equipment handler automatically detects whether a position record is Type 1 or Type 2. This is done by checking for the '[' ']' characters that only the Type 1 record has.

Data String Format: Cycle Printout Satellite Status Records

Example (trailer removed):

```
01 26 088 13 0368 0040 +181450.000 09.6
```

In the above example the GPS details for SV 01 are provided, such as, 26° elevation angle, 88° azimuth, SNR of 13 for L1 and 9.6 for L2 etc. A message like this would be generated for each satellite tracked.

Table 6-25 describes the data string format.

Table 6-25 CPO Satellite Status Sentence Type

Field	Description
1–2	Satellite's PRN number
3	Space
4–5	Elevation (degrees)
6	Space
7–9	Azimuth (degrees)
10	Space
11–12	Signal to noise ratio of the L1 signal
13	Space
14–17	IODC (not decoded)
18	Space
19–22	Number of cycles without loss of lock (not decoded)
23	Space
24–34	GPS Time
35	Space
36–39	Signal to noise ratio of the L2 signal

Data String Format: Trimble UTC Time Tags and PPS

```
UTC 97.12.21 20:21:16 56<CR><LF>
```

Table 6-26 describes the data string format.

Table 6-26 UTC Time Tag Sentence Type

Field	Description
1–3	‘UTC’ (header)
4	Space
5–12	Year, month, and date (yy.mm.dd).
13	Space
14–21	UTC time (in 24Hr) (hh:mm:ss)
22	Space
23	Position fix type[1]
24	Number of SVs tracked. ‘:’ for 10. ‘;’ for 11. or ‘<’ for 12[1].
25	Carriage return
26	Line feed

[1]Sentences containing ‘??’ in the Position fix type and number of SVs tracked fields are discarded as this indicates that the UTC time is based on the receiver clock rather than satellite signals.

1 Pulse Per Second

This equipment handler detects a change of state in the CTS signal (caused by the 1PPS) and then accurately generates a time of arrival for the signal. This is used with the UTC time tag to provide GPS time service when the *Trimble UTC Time Tags with 1PPS* option is selected in the custom dialog.

Data String Format: Cycle Printout Position Quality Statistics

```
$PTNL,QA,152545,0.41,0.45,0.81,0.00,3.47,0.45,0.41,
179.80,1,1*34<CR><LF>
```

The position quality statistics string provides data for the GPS Error Ellipse service. Table 6-27 describes the data string format.

Table 6-27 CPO Position Quality Statistics Sentence Type

Field	Description
1	Fixed header ‘$PTNL’
2	String type ‘QA’ Position Quality Statistics
3	UTC time of position fix (hhmmss)
4	Longitude sigma, east is positive and west is negative (metres) (not decoded)
5	Latitude sigma, north is positive and south is negative (metres) (not decoded)
6	Height sigma (metres) (not decoded)
7	Covariance between longitude and latitude sigma values (not decoded)
8	Values of unit (relationship between sigma values and actual error) (not decoded)
9	Semi-major axis of error ellipse (metres)
10	Semi major axis of error ellipse (metres)
11	Orientation Semi major axis of error ellipse (degrees)
12	‘1’ if position is overdetermined, ‘0’ if underdetermined (not decoded).
13	Position solution. 0=autonomous, 1=differential (not decoded)
14	Checksum delimitor (not decoded)
15	NMEA checksum (not decoded)
16	Carriage return
17	Line feed

This string is comma delimited.

The field lengths in this string may vary.

Data String Format: NMEA GGA

This equipment handler extracts only the RTCM Age from the NMEA GGA message.

For information on the NMEA GGA string see Data String Format: NMEA GGA, page 6-12.

On receipt of each GGA string the age of the differential GPS data record field is extracted and stored along with its TimeOfArrival. When the Cycle Printout position record updates the GPS Diff Status service it retrieves the age and uses this as the DiffAge value.

6.7 Trimble MS750 GPS

The Navigation software supports some of the Trimble MS750's binary output strings. The position, position quality, velocity, GPS time, satellite information, and RTK tide data can be extracted from these strings.

6.7.1 Default Communication Parameters

Baud rate:	38400
Stop bits:	1
Parity:	None
Data bits:	8

6.7.2 Trimble MS750

The Navigation software extracts the position and position related information from the strings and displays it in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The positional data is also graphically displayed in the *Plan View Map* real-time display. The data is recorded in the Project database.

The custom settings in this equipment configuration provides an interface that lets you configure the output from the MS750 receiver from within Navigation. This equipment handler supports the RS232 interface protocol and uses the Data Collector format for command and report packages. Although the MS750 is capable of outputting both NMEA and GSOF type messages only the latter is supported by this DLL. Use the NMEA equipment handler to support the NMEA strings from this device. You can also set parameters that govern the receiver's calculations and performance.

The Trimms.dll supports the following GSOF message type records:

- Position Time (01h)
- Position WGS84 (02h)
- Velocity Data (08h)
- PDOP Information (09h)
- Position Sigma Information (0Ch)
- Detailed SV Information (0Eh)
- Current Time (10h)

In the *Trimble MS750 Custom Properties* dialog set the following parameters on the *GPS* tab:

- *RTK Mode* group.

  Select either *Synchronous* or *Low latency* depending on the GPS mode required.

  The Synchronous mode provides better than 1 cm accuracy but the latencies depend on the differential data link. Both the Base and Rover must be synchronised at either 1 or 5 Hz and the differential data link must be capable of handling the data flow.

Tip – If you are intending to use the 5 Hz Synchronous mode your radios will need a 'through the air' baud rate of 9600 or better.

  The Low latency mode provides a 2 cm solution at up to 20Hz with a constant latency of 20 ms irrespective of the base station output rate.

  For more information please refer to the *MS750 Operation* manual.

Tip – You may need to adjust the default constant latency value in the equipment properties to reflect the selection made here.

- *Elevation mask angle (Deg)* field

  This value determines the lowest allowable satellite elevation to be used in the position calculation.

- *Disable satellites* field

  Enter the satellite identification numbers to be excluded from the position calculation.

- *PDOP mask* field

  Set the maximum allowable PDOP value, if this value is exceeded then the solution will be rejected.

- *Position output rate* field

  Set the rate at which the receiver outputs positions to the Navigation software. This value depends on the GPS Mode selection.

- *RTK/DGPS switch range (km)* field

  At this distance from the base station the receiver will switch from RTK to DGPS mode.

- *Minimum GPS solution* field

  Select the minimum GPS solution type to be accepted by the Navigation software.

- *Initialize when going online*

  Check this field to update the MS750 receiver's configuration with the selections you have made on this tab when the Navigation software goes online.

The *RTK Tide* tab determines how the RTK tide data is derived (if configured).

- *Use averaging* check box

  Select this check box for RTK averaging then set the parameters in the *Sample period* field. Clear this check box to calculate RTK tide directly from the height in the message.

- *Sample period* field

  Enter a sample period to calculate an average tide over, or how often the tide is calculated directly from the message (depending on the previous selection)

- *Minimum GPS solution* field

  Select the minimum solution you will accept for RTK Tide calculation. The options are Non-Differential, Differential, Float RTK, or RTK Fixed Integer.

In addition to the custom settings there are some properties that can be configured for the Tide service, if configured. The following are some recommendations for the RTK Tide service:

- Timing

  Select or confirm the latency and timeout period for this service. These values are directly related to the RTK Tide custom settings (averaging and sample period).

  Trimble recommends that you set the latency to 0s for the Tide service.

  A suggested setting for timeout is: the sample period × 2 + the time interval between position updates.

- Calibration

  Choose whether or not to apply vessel offset height (antenna height) and enter the datum separation, the separation between WGS-84 and local datum (+ve above WGS-84).

Data String Format: Report Packet 40h Structure

The Trimms.dll supports the following message records:

- Position Time (01h)
- Position WGS84 (02h)
- Velocity Data (08h)
- PDOP Information (09h)
- Position Sigma Information (0Ch)
- Detailed SV Information (0Eh)
- Current Time (10h)

Table 6-28 to Table 6-34 describes these message records.

Table 6-28 Position Time (Type 1 Record)

Byte	Description
0	Position Time Output Record
1	Record length
2–5	GPS Time (ms)
6–7	GPS week Number (count since January 1980)
8	Number of satellites used in the position calculation
9	Position Flags 1
10	Position Flags 2
11	Initialization Number

Table 6-29 Position WGS84 (Type 2 Record)

Byte	Description
0	Output record type (Lat, Long, and Hgt output record)
1	Record length
2–9	Latitude (WGS-84 datum)

Table 6-29 Position WGS84 (Type 2 Record) (Continued)

10–17	Longitude (WGS-84 datum)
18–25	Height (WGS-84 datum)

Table 6-30 Velocity Data (Type 8 Record)

Byte	Description
0	Output record type (Velocity Data Output Record)
1	Record length
2	Velocity flag status
3–6	Horizontal speed
7–10	Heading (true north heading on WGS-84 datum)
11–14	Vertical velocity

Table 6-31 PDOP Information (Type 9 Record)

Byte	Description
0	Output record type (PDOP Information Output Record)
1	Record length
2–5	PDOP (Positional Dilution of Precision)
6–9	HDOP (Horizontal Dilution of Precision)
10–13	VDOP (Vertical Dilution of Precision)
14–17	TDOP (Time Dilution of Precision)

Table 6-32 Position Sigma Information (Type 12 Record)

Byte	Description
0	Output record type (Position Sigma Information Output Record)
1	Record length
2–5	Position RMS (root mean square of position error calculated for overdetermined positions)
6–9	Sigma East
10–13	Sigma North
14–17	Covariance East-North
18–21	Sigma Up
22–25	Semi-major axis of error ellipse
26–29	Semi-minor axis of error ellipse
30–33	Orientation of semi-major axis, clockwise from True North.
34–37	Unit Variance. Valid only for overdetermined solutions. Unit variance should approach 1.0. A value of less than 1.0 indicates that apriori variances are too pessimistic.

Table 6-33 SV Detailed Info (Type 14 Record)

Byte	Description
0	Output record type (Detailed Satellite Information Output Record)
1	Record length
2	Number of satellites included in the record
	The following bytes are repeated for Number of SVs
	PRN (pseudorandom number of satellite)
	Flags1 (first set of satellite status bits)
	Flags2 (second set of satellite status bits)
	Elevation (angle of satellite above horizon)
	Azimuth (azimuth of satellite from true north)
	SNR L1 (signal to noise ratio of L1 signal (multiplied by 4))
	SNR L2 (signal to noise ratio of L2 signal (multiplied by 4))

Table 6-34 Current Time (Type 16 Record)

Byte	Description
0	Output record type (Current Time Output Record)
1	Record length
2–5	Time when packet is sent from receiver, in GPS milliseconds of week.
6–7	GPS Week Number (week number since start of GPS time).
8–9	UTC Offset (GPS to UTC time offset)
10	Flags (flag bits indicating validity of Time and UTC offset parameters)
Length+4	Checksum
Length+5	ETX (end transmission)

7 USBL and ROV Tracking Systems

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (ftp://ftp.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- ORE LXT
- ORE Trackpoint II
- Simrad HPR 300P
- Simrad HPR 309

7.1 ORE LXT

The ORE LXT is a portable, low cost, USBL underwater tracking system. It is capable of tracking a maximum of two target transponders from one fixed transducer, which the Navigation software supports.

7.1.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

7.1.2 ORE LXT

The Navigation software extracts the remotely operated vehicle (ROV) positional information as well as the heading of the vessel (if available from the data string). The data is then displayed in the *Equipment Monitor*, *Survey Text*, and *Vessel Monitor* real-time displays. The vessel and ROV can also be viewed in the *Plan View Map* real-time display. The ROV positional information, along with the vessel heading (if present) and ROV depth (if present) data are all recorded in the Project database.

There are two measurement modes that the ORE LXT can use:

- Depression angle
- Analog depth

The depression angle method uses the horizontal and vertical angle between the transducer on the vessel and the transponder on the ROV, as well as, the slant range to determine the position of the ROV relative to the vessel.

The analog depth method uses the horizontal angle and slope range between the transducer on the vessel and the transponder on the ROV, as well as, the analog depth from the transponder to the water level. A correction to adjust this depth to the level of the transducer must be entered.

Whatever method is used the format of the message sent is the same just the context of the fields change.

Due to the complex nature of the equipment configuration there are several corrections and settings that may need to be entered before the Navigation software can decode these strings correctly.

In the *Configuration* tab of the *ORE LXT Custom Properties* dialog enter the following parameters:

- *Depth adjustment* field

  Enter the depth correction (positive upwards) to be applied to the analog depth value received in the ORE LXT data string. This is to adjust the analog depth to the transducer depth on the observer vessel as opposed to the sea surface.

Note – This correction is ***only*** used in the observed vessel (target transponder) position calculation.

- *Slant Range/Depth Units* group

  Select the unit type of the incoming depths and slant ranges.

- *Transponder Position Calculations* group

  The options in this group only apply to the transponder target 1 string sent from the ORE LXT device. Analog depth is only output for transponder (target) 1, transponder (target) 2 will always use the depression angle.

- *Use depression angle* field

  The transponder position of the target will be calculated using the slant range and depression angle. If a second target string is output from the ORE LXT device then it will ***always*** use the depression angle to calculate the transponder position.

  Horizontal Distance = COS(Depression Angle) × Slant Range

  Height = SIN(Depression Angle) × Slant Range

- *Use analog depth* field

  The transponder 1 position will be calculated using the slant range and analog depth contained in the data string. The Depth Adjustment value will also be used in this calculation. This only applies to the target 1 data string.

  Horz Dis = SQRT ((Slant Range × Slant Range – Depth – Depth Adjust) × (Depth – Depth Adjust))

  Height = Depth – Depth Adjustment

Note – If the analog depth value is not present in the data string the Navigation software will use the depression angle calculation.

The *Accuracy* field displayed in the *Equipment Monitor* and *Survey Text* real-time display shows either:

- `1`

  indicating that the Depression angle is being used

- `2`

  indicating that the Analog depth is being used

The *Observer* tab determines how the observed target's elevation is calculated.

- *Oberving vessel's origin (+ below)* option

  Select this option to calculate the target's elevation using the transducer depth and height difference from the observations. Thus, the observed target's elevation will be based on the observer vessel's height origin (generally assumed to be the water line). GPS height is not used in this calculation.

- *Observing vessel's elevation* option

  Select this option to calculate the target's elevation from the observer vessel's position service elevations. Typically, this would be the GPS height – antenna offset height – transducer depth – observation depth difference.

Note – The *Observers elevation* option should only be selected when using RTK heights as heights from other GPS solutions are not of suitable accuracy.

On the *Heading* tab in the *ORE LXT Custom Properties* dialog the settings relate to gyro inputs that may be interfaced to the ORE LXT device. Enter the following parameters:

- *Gyro is interfaced* check box

  Select this check box if the ORE LXT data string contains gyro information. When selected, the gyro heading will be extracted from the data string and used in the application. When selected, the observed bearing to the target is referenced to magnetic or true north, depending the heading type selected in the *Heading Type* group. When this check box is not selected, the gyro heading is ignored and the observed heading to the target is referenced to the vessel centre-line.

Warning – If the *Gyro is interfaced* check box is selected, the Navigation software assumes that the Observed bearing is referenced to True or Magnetic north (whichever is selected). Likewise, if this option is not selected, the Observed bearing is assumed to be referenced to the vessel centre-line, regardless of whether it actually is or not.

Note – If the *Gyro is interfaced* check box is selected but no gyro value is available in the data string (spaces), no data will be decode (timeout situation will occur).

- *Heading Type* group

  When using the gyro heading contained in the data string you must set whether it is referenced to true north or magnetic north.

As well as the custom setting there are also some individual service equipment calibration properties to be configured. The ORE LXT is an advanced equipment configuration. This means that the equipment configuration contains more than one service. The services contained in the equipment configuration are:

- Heading (default)
- Observer (default)
- User Number (not default)

Each of these services has its own properties. These are:

- Heading service properties – *Calibration* tab

  Here you can enter the orientation correction to be applied to the Gyro heading.

  This value is added to the input heading.

- Observer service properties – *Calibration* tab

  Here you can enter the orientation correction to be applied to the Observed heading. If the observer bearing is north orientated then the correction must compensate for the gyro orientation misalignment as well as for the misalignment of the transponder. This value is added to the heading to the observed target.

- User Number service properties – *Calibration* tab

  This tab lets you apply a scale factor and a constant value to the Depth contained in the data string. The scale factor is applied first and then the constant correction. These calibration values are not used in the observed target calculation.

For each of the above services make sure that they are assigned to the correct vessel and offset.

The ORE LXT data string start with the transponder being tracked (target) which can either be ‘1’ or ‘2’. The Navigation software must have the Observation ID set to match the target number to be decoded (example to decode the target 1 data string the ORE LXT configuration must have an Observation ID of ‘1’). To do this:

1. Highlight the Observer service in the *Configure Advanced Equipment* dialog.
2. Click **Observed**.

   The *Observed Vessel Offsets* dialog appears.
3. Click **Edit**.

   The *Observed Vessel Offset* dialog appears.
4. In the *Observation ID* field change the observation ID to match the target number being tracked.

   You may also need to change the vessel and offset selections in this dialog.
5. Click **OK**.

If you are tracking two targets then you will need to add a second observed vessel offset. To do this:

1. Highlight the Observer service in the *Configure Advanced Equipment* dialog.
2. Click **Observed**.

   The *Observed Vessel Offsets* dialog appears.
3. Click **Add** to add a new vessel (target) to be tracked.

   The *Observed Vessel Offset* dialog appears.
4. In the *Observation ID* field change the observation ID to match the target number being tracked.

   You may also need to change the vessel and offset selections in this dialog.
5. Click **OK**.

Data String Format

Example 1:

```
1  233.4 191.3 35.2 157.2  136.6 433.2   <CR><LF>
```

In the above example, the string is from target 1. The slant range is 233.4 m (or ft or yards) and the bearing from the vessel to the target is 191.3° (assumed to be referenced to north due to there being a gyro heading in the string). The depression angle is 35.2°, the gyro heading of the vessel is 157.2° and the analog depth is 136 m (or ft or yards). The analog depth is the depth of the target below the water level and so needs to be corrected for the transducer depth. The rest of the fields are not decoded.

Example 2:

```
2  233.4 191.3 35.2 433.2 <CR><LF>
```

In the above example, the string is from target 2. The slant range is 233.4 m (or ft or yards) and the bearing from the vessel to the target is 191.3° (assumed to be referenced along the centre-line of the vessel due to there being no gyro heading in the string). The depression angle is 35.2°. The rest of the fields are not decoded.

Table 7-1 ORE LXT Sentence Type

Field	Description
1	Transponder number (target being tracked). Either 1 (pentagon) or 2 (circle).
2	Space
3–8	Slant range. The range is 0.0–9999.9 (metres, feet, or yards)[1].
9	Space
10–14	If a gyro / compass is interfaced to the ORE LXT, the bearing value is relative to north, otherwise it is referenced to the vessel's centre-line. The range is 0.0–359.9.
15	Space
16–19	Depression angle to target (decimal degrees). A value of 89.9° indicates that the transponder is directly beneath the transducer. The range is 0.0–89.9.
20	Space
21–25	Gyrocompass or vessel heading (decimal degrees). If no gyro / compass is interfaced, then field is blank (spaces). The range is 0.0–359.9.
26	Space
27–32	Analog Depth (metres, feet, or yards). Field is blank (spaces) if analog depth turned off. The range is 0.0– 9999.9[1 2].
33	Space
34–38	Telemetry data. Field is blank (spaces) if telemetry turned off. The range is 0.0–899.9 (not decoded)[3].
39	Space

Table 7-1 ORE LXT Sentence Type (Continued)

40–41	Warning code. The range is Null, 1–26 (not decoded).
42	Carriage return
43	Line feed

[1]The slant range depth can be in metres, feet, or yards. The user selects unit type in LXT control panel. The default is metres.

[2]Analog depth value is the vertical distance between the transponder and the sea surface. No transducer depth offset has been taken into account. The analog depth value only applies for target #1.

[3]The telemetry data is the difference between the navigation pulse and the telemetry pulse in milliseconds (100–900 ms). It can be used to output various scaled sensor information from telemetering transponders such as depth, roll, pitch, heave, and heading. This is not decoded.

7.2 ORE Trackpoint II USBL System

The ORE Trackpoint II is an underwater tracking system. It is capable of tracking a maximum of nine target transponders from one fixed transducer, which the Navigation software supports.

7.2.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

7.2.2 ORE Trackpoint II

The Navigation software extracts the ROV positional information as well as the heading of the vessel (if available) from the data string. The data is then displayed in the *Equipment Monitor, Guidance Monitor*, and *Survey Text* displays. The vessel and ROV can also be viewed in the *Plan View Map* real-time display. The ROV positional information, along with the vessel heading (if present), and ROV depth data are all recorded in the Project database.

Due to the complex nature of the equipment configuration there are several corrections and settings that may need to be entered before the Navigation software can decode these strings correctly.

In the *Configuration* tab of the *ORE Trackpoint II Custom Properties* dialog enter the following parameters:

- Depth Adjustment – Enter the depth correction (positive upwards) to be applied to the depth value received in the ORE Trackpoint II data string. This is to adjust the depth to the transducer depth on the observer vessel as opposed to the sea surface.

Note – This correction is ***only*** used in the observed vessel (target transponder) position calculation.

- Distance Units – select the unit type of the incoming depths and horizontal distances.

On the *Observer* tab of the *ORE Trackpoint II Custom Properties* dialog select the reference frame of the observations.

The *Bearing Relative To* group lets you select either;

- Vessel centre-line – all measurements will be relative to the observer vessel's current heading, or
- North orientated – all measurements will be relative to north.

Note – If you have selected North orientated but the Trackpoint II string shows a blank value in the compass field then the string will be deemed invalid and a timeout will occur.

The *Elevation Calculated Relative To* group determines how the observed target's elevation is calculated.

- *Oberving vessel's origin (+ below)* option

  Select this option to calculate the target's elevation using the transducer depth and height difference from the observations. Thus, the observed target's elevation will be based on the observer vessel's height origin (generally assumed to be the water line). The GPS height is not used in this calculation.

- *Observing vessel's elevation* option

  Select this option to calculate the target's elevation from the observer vessel's position service elevations. Typically, this would be the GPS height – antenna offset height – transducer depth – observation depth difference.

On the *Heading* tab in the *ORE Trackpoint II Custom Properties* dialog relate to gyro inputs that may be interfaced to the ORE Trackpoint II device.

Heading Type group – When using the gyro heading contained in the data string you must set whether it is referenced to true north or magnetic north.

As well as the custom settings there are also some individual service equipment calibration properties to be configured. The ORE Trackpoint II is an advanced equipment configuration. This means that the equipment configuration contains more than one service. The services contained in the equipment configuration that are available are:

- Heading (default)
- Observer (default)

Each of these services has its own properties. These are as follows:

- Heading service properties – *Calibration* tab

  Here you can enter the orientation correction to be applied to the Gyro heading.

  This value is added to the input heading.

- Observer service properties – *Calibration* tab

  Here you can enter the orientation correction to be applied to the Observed values. If the observer bearing is north orientated then the correction must compensate for the gyro orientation misalignment as well as for the misalignment of the transponder. This value is added to the heading to the observed target.

- User Number service properties – *Calibration* tab

  This tab lets you apply a scale factor and a constant value to the Depth contained in the data string. The scale factor is applied first and then the constant correction. These calibration values are not used in the observed target calculation.

For each of the above services confirm that they are assigned to the correct vessel and offset.

The ORE Trackpoint II data string starts with the transponder being tracked (target) which can either be ‘0’ or ‘9’. The Navigation software must have the Observation ID set to match the target number to be decoded (for example, to decode the target 1 data string the ORE Trackpoint II configuration must have an Observation ID of ‘1’). To do this:

1. Highlight the Observer service in the *Configure Advanced Equipment* dialog.
2. Click **Observed**.

   The *Observed Vessel Offsets* dialog appears.
3. Click **Edit**.

   The *Observed Vessel Offset* dialog appears.
4. In the *Observation ID* field change the observation ID to match the target number being tracked.

   You may also need to change the vessel and offset selections in this dialog.
5. Click **OK**.

If you are tracking more than one targets then you will need to add additional observed vessel offsets. To do this:

1. Highlight the Observer service in the *Configure Advanced Equipment* dialog.
2. Click **Observed**.

   The *Observed Vessel Offsets* dialog appears.
3. Click **Add**.

   The *Observed Vessel Offset* dialog appears.
4. In the *Observation ID* field change the observation ID to match the target number being tracked.

   You may also need to change the vessel and offset selections in this dialog.
5. Click **OK**.

Data String Format

Example 1:

```
1 09:13:33 142,21.8,137.3,49.6,124.0,37.8,23.5
<CR><LF>
```

In the above example the string is from target 1. The horizontal distance east is 49.6 m (or ft or yards) and the horizontal distance north is 124.0 m (or ft or yards) The depth is 37.8 m (or ft or yards). The depth is the depth of the target below the water level and so needs to be corrected for the transducer depth. The heading of the vessel is 142° and there is not warning code (indicating this is a valid string). The rest of the fields are not decoded.

Note – If the custom settings were configured for vessel centre-line orientation then the horizontal distances would provide values in the starboard and forward directions.

Table 7-2 ORE Trackpoint II Sentence Type

Field	Description
1	Transponder number (target being tracked). The range is 0 (demo mode)–9.
2	Space
3–10	Hours, minutes, seconds – HH:MM:SS (not decoded).
11	Space
13–14	Compass heading (degrees). If this is not interfaced then field will be blank. The range is 0–359.
15	Space
16–20	Bearing to target (degrees and decimal degree). The range is 0.0–359.9 (not decoded).
21	Space
22–28	Slant range (metres, yards, or feet). The range is 0.0–10000.0 (not decoded)[1].
29	Space

Table 7-2 ORE Trackpoint II Sentence Type (Continued)

Field	Description
30–37	Horizontal distance to target (metres, yards, or feet). This is preceded by a ‘ ’ or ‘–’. A space is positive indicating starboard or east. The range is ± 10000.0[1 2].
38	Space
39–46	Horizontal distance to target (metres, yards, or feet). This is preceded by a ‘ ’ or ‘–’. A space is positive indicating forward or north. The range is ± 10000.0[1 2].
47	Space
48–54	Depth of target below sea surface. Positive down. The range is 0.0–10000.0[1].
55	Space
56–63	Telemetry data (Not decoded)
64	Space
65–66	Warning code[3]
67	Carriage return
68	Line feed

[1]These fields can either all be metres, feet, or yards. Please make sure that the correct setting is selected in the *ORE Trackpoint II Custom Properties* dialog.

[2]If the ORE is set to Bow Reference these values are with respect to the centre-line of the vessel. If the ORE is set to North Reference they are with respect to North. Again confirm the correct setting is selected in the *ORE Trackpoint II Custom Properties* dialog.

[3]If the *Warning code* field is not blank then there is an error and the data string is rejected.

7.3 Simrad HPR 300P USBL System

The Simrad HPR 300P is a portable USBL acoustic positioning system.

7.3.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	2
Parity:	Odd
Data bits:	7
Terminator:	<CR><LF>

7.3.2 Simrad HPR 300P

The Navigation software extracts the ROV positional information as well as the heading of the vessel (if available) from the data string. The data is then displayed in the *Equipment Monitor* and *Survey Text* real-time displays. The vessel and ROV can also be viewed in the *Plan View Map* real-time display. The ROV positional information, along with the vessel heading (if present) data are all recorded in the Project database.

The HPR 300P can define the ROVs position whether by bearing, range, and depth (polar) observations or by delta X,Y,Z (cartesian) coordinates.

Whatever method is used the format of the message sent is the same just the context of the fields change.

Due to the complex nature of the equipment configuration there are several corrections and settings that may need to be entered before the Navigation software can decode these strings correctly.

In the *Observer* tab of the *Simrad HPR 300P Custom Properties* dialog set the following parameters:

- *Observation Type* group

  Does the data string contain cartesian coordinates or polar observations? Select the appropriate option.

  If the observation type is polar then you must also select whether the bearing to the ROV is orientated to north (magnetic or true depending on the selection on the *Heading* tab) or to the vessel centre-line in the *Bearing Relative To* group. This group is not available when the *Cartesian* option is selected.

The *Elevation Calculated Relative To* group determines how the observed target's elevation is calculated.

- *Oberving vessel's origin (+ below)* option

  Select this option to calculate the target's elevation using the transducer depth and height difference from the observations. Thus, the observed target's elevation will be based on the observer vessel's height origin (generally assumed to be the water line). The GPS height is not used in this calculation.

- *Observing vessel's elevation* option

  Select this option to calculate the target's elevation from the observer vessel's position service elevations. Typically, this would be the GPS height – antenna offset height – transducer depth – observation depth difference.

In the *Heading* tab of the *Simrad HPR 300P Custom Properties* dialog relate to gyro inputs that may be interfaced to the HPR 300P device.

- Gyro is interfaced

  Select this check box if the Simrad HPR 300P data string contains gyro information. When selected, the gyro heading will be extracted from the data string and used in the application.

- Heading Type

  When using the gyro heading contained in the data string you must set whether it is referenced to true north or magnetic north.

As well as the custom setting there are also some individual service equipment calibration properties to be configured. The Simrad HPR 300P is an advanced equipment configuration. This means that the equipment configuration contains more than one service. The following services may be contained in the equipment configuration are:

- Heading (default)
- Observer (default)

Both of these services has its own properties. These are:

- Heading service properties – *Calibration* tab

  Here you can enter the orientation correction to be applied to the Gyro heading.

  This value is added to the input heading.

- Observer service properties – *Calibration* tab

  Please make sure that any Heading service calibration values are also included in the Observer service calibration values when using data that is north orientated. The observers calibration tab orientation correction should include not only the correction for the HPR300P transducer alignment but for the heading device alignment as well. If cartesian coordinates or vessel centre-line options are used then the calibration value need only correct for the transducer misalignment.

  Example:

  Orientation Calibration = Transducer alignment correction + gyro alignment correction

Note – This ***only*** applies when the HPR300P has been set to output North orientated data.

For each of the above services make sure that they are assigned to the correct vessel and offset.

The header of the Simrad HPR 300 data string is the transponder being tracked (target) which can either be a number from 1–9 or 11–55. The Navigation software must have the Observation ID set to match the target number to be decoded (for example, to decode the target 1 data string the Simrad HPR 300 configuration must have an Observation ID of ‘1’).

To set the Observation ID to match the target number to be decoded:

1. Highlight the Observer service in the *Configure Advanced Equipment* dialog.
2. Click **Observed** to open the *Observed Vessel Offsets* dialog.
3. Click **Edit** to change the Observation ID (change to match the target number being tracked).
4. You may also need to change the vessel and offset selections in this dialog.
5. Click **OK**.

Data String Format

Example 1:

```
33 1  W  OK   312.0  214.1  101.8   99.7   1.1  OK
179.2  250.4<CR><LF>
```

In the above example, the tracked target ID is 33 and transducer 1 is being used. The course of the vessel is 312°. The next three fields will be decoded as per the selection on the *Simrad HPR 300P Custom Properties* dialog (that is, is it cartesian or polar, as well as north orientated or north orientated). If the *Cartesian* option was selected then the target would be 214.1 m to the port of the vessel, 101.8 m forward of the vessel and 99.7 m below the transducer. Alternatively, if the *Polar* option was selected then the target would be 214.1 m away from the vessel on a bearing of 101.8° and 99.7 m below the transducer. The position quality is 1.1 m. The rest of the fields are not decoded.

Table 7-3 Simrad HPR 300P Sentence Type

Field	Description
1–2	Transponder number. 11–55, 1–9.
3	Space
4	Transducer number. 1 or 2 (not decoded).
5–6	Spaces
7	Beam used (not decoded). W = wide beam M = medium beam N = narrow beam
8–9	Spaces
10–12	Reply status. OK = reply okay NRY = no reply MRY = missing reply REJ = reply rejected
13	Space

Table 7-3 Simrad HPR 300P Sentence Type (Continued)

14–19	Vessel course. 0-359.9 with sign (degrees)
20	Space
21–26	X-coordinate (metres) or Range with sign (metres)
27	Space
28–33	Y-coordinate (metres) or Bearing with sign (degrees)
34	Space
35–40	Z-coordinate (metres) or Depth with sign (metres)
41	Space
42–46	QUA. Position quality based on the four last positions. If NRY or REJ occurs the QUA = QUA * 3 (metres).
47–48	Spaces
49–51	Riser Angle status (not decoded). OK = reply ok NRY = no reply MRY = missing reply REJ = reply rejected
52	Space
53–58	Riser X-angle or tilt with sign (not decoded).
59	Space
60–65	Riser Y-angle or azimuth with sign (not decoded).
66	Carriage return
67	Line feed

Note – For figures larger than 999.9, the point is left out and the data will be without decimals. For example, 1001 metres.

Negative values are proceeded by a negative ‘–’ sign.

Space(s) is (are) transmitted to separate the data. Leading zeros are transmitted as spaces.

7.4 Simrad HPR 309 USBL System

The Simrad HPR 309 is a USBL acoustic positioning system.

7.4.1 Default Communication Parameters

Baud rate:	4800
Stop bits:	2
Parity:	Odd
Data bits:	7
Terminator:	Hex 40

7.4.2 Simrad HPR 309

The Navigation software extracts the ROV positional information as well as the heading of the vessel (if available) from the data string. You can also extract the attitude of the vessel (pitch and roll) if required. The data is then displayed in the *Equipment Monitor*, *Guidance Monitor*, and *Survey Text* real-time displays. The vessel and ROV can also be viewed in the *Plan View Map* real-time display. The ROV positional information, along with the vessel heading (if present) and attitude (if present) are all recorded in the Project database.

The HPR 309 can define the ROVs position whether by delta X,Y, Z (cartesian) coordinates or by bearing, range, and depth (polar) observations.

Whatever method is used the format of the message sent is the same just the context of the fields change.

The Navigation software will handle up to 16 individual transponders tracked by a HPR309 device. The following coordinate frames are supported:

- Polar, vessel orientated
- Polar, north orientated

- Cartesian, vessel orientated
- Cartesian, north orientated

Due to the complex nature of the equipment configuration there are several corrections and settings that may need to be entered before the Navigation software can decode these strings correctly.

On the *Observer* tab of the *Simrad HPR 309 Custom Properties* dialog set the following parameters:

- *Observation Type* group

  Does the data string contain cartesian coordinates or polar observations? Select the appropriate option.

- The *Bearing Relative To* group

  The options in this group determine how the data is orientated, that is, are the bearings or coordinates orientated to north or along the vessel centre-line.

The *Elevation Calculated Relative To* group determines how the observed target's elevation is calculated.

- *Oberving vessel's origin (+ below)* option

  Select this option to calculate the target's elevation using the transducer depth and height difference from the observations. Thus, the observed target's elevation will be based on the vessel's height origin (generally assumed to be the water line). The GPS height is not used in this calculation.

- *Observing vessel's elevation* option

  Select this option to calculate the target's elevation from the observer vessel's position service elevations. Typically this would be the GPS height – antenna offset height – transducer depth – observation depth difference.

On the *Heading* tab in the *Simrad HPR 309 Custom Properties* dialog relate to gyro inputs that may be interfaced to the HPR 309 device.

- Heading Type

  When using the gyro heading contained in the data string you must set whether it is referenced to true north or magnetic north.

As well as the custom setting there are also some individual service equipment calibration properties to be configured. The Simrad HPR 309 is an advanced equipment configuration. This means that the equipment configuration contains more than one service. The following services may be contained in the equipment configuration are:

- Heading (default)
- Observer (default)
- Attitude (not default)

Each of these services has its own properties. These are:

- Heading service properties – *Calibration* tab

  Here you can enter the orientation correction to be applied to the Gyro heading.

  This value is added to the input heading.

- Observer service properties – *Calibration* tab

  Please make sure that any Heading service calibration values are also included in the Observer service calibration values when using data that is north orientated. The observer's calibration tab orientation correction should include not only the correction for the HPR309 transducer alignment but for the heading device alignment as well. If cartesian coordinates or vessel centre-line options are used then the calibration value need only correct for the transducer misalignment.

Example:

Orientation Calibration = Transducer alignment correction + gyro alignment correction

Note – This ***only*** applies when the HPR309 has been set to output North orientated data.

- Attitude service properties – *Calibration* tab

  Here you can enter a pitch correction to be applied to the pitch values, as well as a roll correction that is applied to roll values.

  This value is added to the pitch or roll values.

For each of the above services make sure that they are assigned to the correct vessel and offset.

The header of the Simrad HPR 309 data string is the transponder being tracked (target). The Navigation software must have the Observation ID set to match the target number to be decoded (example to decode the target 1 data string the Simrad HPR 309 configuration must have an Observation ID of ‘1’).

To set the Observation ID to match the target number to be decoded:

1. Highlight the Observer service in the *Configure Advanced Equipment* dialog.
2. Click **Observed**.

   The *Observed Vessel Offsets* dialog appears.
3. Click **Edit**.

   The *Observed Vessel Offset* dialog appears.
4. In the *Observation ID* field change the observation ID to match the target number being tracked.

   You may also need to change the vessel and offset selections in this dialog.
5. Click **OK**.

Data String Format

The HPR309 system transmits binary sentences, each consisting of 32 bytes.

Table 7-4 Simrad HPR 309 Sentence Type

Field	Length
Head	1 byte
Roll (or X-angle) (degrees)	2 bytes
Pitch (or Y-angle) (degrees)	2 bytes
Course (degrees)	2 bytes
Transponder Index (see table below)	1 byte
X-Pos (metres) or Range (metres)	3 bytes
Y-Pos (metres) or Bearing (degrees)	3 bytes
Z-Pos (metres) or Depth (metres)	3 bytes
Status	1 byte
Timeout	1 byte (not decoded)
TP's in the Sequence	3 bytes (not decoded)
Tracking TD-angle	2 bytes (not decoded)
Test	1 byte (not decoded)
Transponder Type	1 byte (not decoded)
Transponder Specification	1 byte (not decoded)
Transducers	1 byte (not decoded)
TD Status	1 byte (not decoded)
Kalman Filter Window (metres)	1 byte (appears in Quality field)
Checksum	1 byte
End of Telegram (Hex 40)	1 byte

Table 7-5 details how the various transponder IDs are represented.

Table 7-5 Transponder Index Table

Simrad Beacon Type	Simrad Beacon Number	HYDROpro Observation ID	Hex Code in Simrad Message
1–9	1–9	1–9	01–09
Square	11	10	0A
Circle	22	11	0B
Triangle	33	12	0C
X	44	13	0D
Y	55	14	0E
A	66?	15	0F
B	77?	16	10

8 Tide Gauges

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (ftp://ftp.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- Endeco WLR 1029
- Hazen HTG5000
- Van Essen
- Vyner (multiple)
- Vyner (single)

8.1 Endeco WLR 1029 Radio Tide Gauge

The Navigation software supports the Endeco WLR 1029 Radio tide gauge data string. The tide data can be used to correct the depths in real time.

8.1.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	Various

8.1.2 Endeco WLR 1029

The Navigation software extracts the tide information from the string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The tide data is also used in the *Echo Sounder Trace* real-time display to adjust the displayed depths. The tide data is recorded in the Project database.

The tide gauge does not require prompting for tide output. The output intervals are preconfigured on the Tide gauge.

Note – For intervals greater than 11 minutes Trimble recommends that you adjust the *Timeout period* field accordingly in the *Timing* tab of the *Equipment Properties* dialog. If you do not, the tide gauge will periodically timeout.

In the *Endeco WLR 1029 Custom Properties* dialog you can select the incoming tide units. The default units are metres. Other custom properties to be configured are the upper and lower tide limits. Values that fall outside these limits will be discarded as bad data. Also the tide string’s terminator is selected here.

If required, a datum separation correction can be entered in the *Calibration* tab of the *Equipment Properties* dialog (this will adjust the tide values by the entered amount). The vessel offset correction is intended for use when deriving tide information from RTK heights.

Data String Format

```
1.53   <CR><LF>
```

In the above example the tide is 1.53 m (or feet/inches/centimetres depending on the custom properties).

Table 8-1 Endeco WLR 1029 Sentence Type

Field	Description
1	Tide value in metres, feet, inches, or centimetres. This field may be preceded and/or followed by zeros or spaces.
2	Carriage return
3	Line feed

This is a variable length string of up to 25 characters.

8.2 Hazen HTG5000 Tide Gauge

The Navigation software supports the Hazen HTG5000 tide gauge data string. The tide data can be used to correct the depths in real time.

The Hazen HTG5000 is a multi-station tide gauge. The Navigation software will support up to 100 stations.

8.2.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	2
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

8.2.2 Hazen HTG5000

The Navigation software extracts the tide information from the string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The tide data is also used in the *Echo Sounder Trace* real-time display to adjust the displayed depths. The tide data is recorded in the Project database.

As the Hazen HTG5000 is a multi-station tide gauge the Navigation software must be correctly configured to decode the desired tide station(s). The data source number for the tide service configured must match the station ID. By default, the data source is ‘0’ which corresponds to a station ID of ‘00’.

To change the data source number:

1. Open the *Configure Equipment* dialog for this equipment device and click **Advanced**.

   The *Configure Advanced Equipment* dialog appears.

2. Highlight the service and click **Properties**.

   The *Service Properties* dialog appears.

3. Select the *Configuration* tab and change the number in the *Data source* field to match that of the station to decode. Trimble also recommends that you change the name in the *Data name* field to reflect the data source number selected.

4. Click **OK**.

To add additional stations:

1. Open the *Configure Equipment* dialog for this equipment device and click **Advanced**.

   The *Configure Advanced Equipment* dialog appears.

2. Click **Add**.

   The *Add Service* dialog appears.

3. In the *Service* list, select Tide.

4. In the *Data source* list, select the data source number to match the desired station.

5. Click **Properties**.

   The *Service Properties* dialog appears.

6. Enter the rest of the details as required.

7. Click **OK**.

8. Repeat this procedure for each of the stations to be decoded.

The tide gauge requires prompting for tide output. The output intervals are set in the *Custom Properties* dialog. The Navigation software will prompt the tide gauge receiver with an ASCII ‘R’ at the sample period interval. If no reply is received within 10 seconds then the request is sent again.

Note – For intervals greater than five minutes Trimble recommends that you adjust the *Timeout period* field accordingly in the *Timing* tab of the *Equipment Properties* dialog. If you do not, the tide gauge will periodically time-out.

In the *Custom Properties* dialog you can also select the incoming tide units. The default units are metres.

If required, enter a datum separation correction in the *Calibration* tab of the *Equipment Properties* dialog (this adjusts the tide values by the entered amount). The vessel offset correction is intended for use when deriving tide information from RTK heights.

Data String Format

```
11271522+01.6400<CR><LF>
```

In the above example the tide at station 00 is 1.64 m (or feet/US feet depending on the custom properties).

Table 8-2 Hazen HTG5000 Sentence Type

Field	Description
1–8	Time of data (MMDDHHmm). Not used.
9	Sign ‘+’ or ‘–’
10–14	Tide (metres, feet, or US feet)
15–16	Station ID (00 to 99)
17	Carriage return
18	Line feed

This is a fixed length string of 18 characters.

8.3 Van Essen Tide Gauge

The Navigation software supports the Van Essen Tide Gauge's data string. The tide data can be used to correct the depths in real time.

8.3.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR>

8.3.2 Van Essen RGC920

The Navigation software extracts the tide information from the string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The tide data is also used in the *Echo Sounder Trace* real-time display to adjust the displayed depths. The tide data is recorded in the Project database.

The Navigation software prompts the tide gauge for the average tide value every 30 seconds once online. If a reply is not received within 10 seconds then another request is sent, and so on.

You must enter the station ID of the tide gauge to decode in the *Van Essen Custom Properties* dialog. The incoming tide units are also selected in this dialog. The default units are centimetres.

If required, a datum separation correction can be entered in the *Calibration* tab of the *Equipment Properties* dialog (this will adjust the tide values by the entered amount). The vessel offset correction is intended for use when deriving tide information from RTK heights.

Data String Format

Example of prompt sent by the Navigation software:

```
T1C1A<CR>
```

In the above example the Navigation software is requesting station 1, channel 1, averaged data be sent.

Table 8-3 Tide Level Request Sentence Type

Field	Description
1	Always capital ‘T’
2	Tide station number 0–9 or A–F **Note** – In the Navigation software, the user types in a number 0 to 15.
3	Always a capital ‘C’
4	Channel number 1–6, set to 1 for this interface.
5	Set to ‘A’ for Average Tide (‘P’ for instantaneous Tide, ‘D’ for difference, are not supported)
6	Carriage return

This is a fixed length string of 6 characters.

Example of first message sent by the tide gauge:

```
LOW WATER MARK       100.0    cm<CR>
```

In the above example, the message reads that there is a tide level of 100 cm (1 m) referenced to the low water mark. The Navigation software will only decode the 100.0 portion of the string and use whatever units are set in the *Van Essen Custom Properties* dialog.

As the units portion of the string is entered by the user it would make correct decoding of the units impossible (for example, you could enter c, cm, centm, CM to indicate the units are in centimetres).

Table 8-4 Van Essen Tide Level Sentence Type

Field	Description
1–16	Parameter identification, user defined (not decoded).
17–26	Parameter value (tide level)
27–32	Parameter units, user defined (not decoded).
33	Carriage return

This is a fixed length string of 33 characters.

Example of second message sent by the tide gauge:

```
101<CR>
```

In the above example the message reads that there is a timeout condition in the tide gauge.

Table 8-5 Van Essen Quality Sentence Type

Field	Description
1–3	Result code – 101 is a timeout (refer to the Van Essen manual for all codes) Valid data is ‘2*x*0’ where *x* can be 1 to 6
4	Carriage return

This is a fixed length string of 4 characters.

If the Result Code is 2*x*0 then HYDROpro decodes the tide data as it is correct.

Any other Result Code is an error/timeout condition and will eventually lead the service to time out in the Navigation software.

8.4 Vyner (Multiple) Tide Gauge

The Navigation software supports the Vyner Tide Gauge's data string for when a multiple tide gauges are interfaced. The tide data can be used to correct the depths in real time.

8.4.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

8.4.2 Vyner Multiple Mk2

The Navigation software extracts the tide information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The tide data is also used in the *Echo Sounder Trace* real-time display to adjust the displayed depths. The tide data is recorded in the Project database.

The Vyner tide gauge system may consist of up to 10 tide gauges transmitting tide data in one of 4 formats to a multi-coded (optional) receiver on the survey vessel. In the simplest (and most common) case a single tide gauge will transmit CODED TIDE ONLY data to a single coded receiver on the survey vessel. For multiple tide gauge support the Navigation software decodes the ALL CHANNELS format which is the same as the CODED TIDE ONLY format but is made up of a block of data lines (one for each coded channel).

The data output rate is determined by the tide gauge, it is suggested you use a period of five minutes or less.

If required, a datum separation correction can be entered in the *Calibration* tab of the *Equipment Properties* dialog (this will adjust the tide values by the entered amount). The Vessel Offset correction is intended for use when deriving tide information from RTK heights. This will need to be done for each of the tide gauges configured in the project.

For Multiple Tide Gauge operation each different station ID is assigned a unique data source number to distinguish it from other incoming tide values. Table 8-6 shows how the data source numbers are assigned.

Table 8-6 How the Data Source Numbers are Assigned for the Multiple Tide Gauge Operation

Station ID	Data Source Number
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
I	8
J	9

By default, all the data source numbers (station IDs) are selected. If you do not require some of them, then deselect the ones not required.

Data String Format

Example:

```
A+12.34<CR><LF>
B+12.45<CR><LF>
C+12.37<CR><LF>
```

In the above example, the tide level is +12.34 m at station A, +12.45 m at station B, and +12.37 m at station C.

Table 8-7 Vyner Multiple Mk2 Sentence Type

Field	Description
1	Station ID, may be any character from ‘A’ through to ‘J’.
2	Sign of the tide value, either ‘+’ or ‘–’.
3–7	Tide value in metres, packed with zeros if necessary.
8	Carriage return
9	Line feed

This is a fixed length string of 9 characters.

A string is received for each of the transmitting tide gauges.

8.5 Vyner (Single) Tide Gauge

The Navigation software supports the Vyner Tide Gauge’s data string for when a single tide gauge is interfaced. The tide data can be used to correct the depths in real time.

8.5.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

8.5.2 Vyner Single Mk2

The Navigation software extracts the tide information from the string and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The tide data is also used in the *Echo Sounder Trace* real-time display to adjust the displayed depths. The tide data is recorded in the Project database.

The Navigation software decodes the CODED TIDE ONLY format output by the tide gauge.

The station ID of the tide gauge must be set to ‘A’ for the Navigation software to decode the message.

The data output rate is determined by the tide gauge, it is suggested you use a period of five minutes or less.

If required, a datum separation correction can be entered in the *Calibration* tab of the *Equipment Properties* dialog (this will adjust the tide values by the entered amount). The Vessel Offset correction is intended for use when deriving tide information from RTK heights.

Data String Format

Example:

```
A+12.34<CR><LF>
```

In the above example the tide level is +12.34 m at station A.

Table 8-8 Vyner Single Mk2 Sentence Type

Field	Description
1	Station ID. It must be ‘A’ to be decoded.
2	Sign of the tide value. Either ‘+’ or ‘–’.
3–7	Tide value in metres, packed with zeros if necessary.
8	Carriage return
9	Line feed

This is a fixed length string of 9 characters.

9 Environmental Sensors and User Number Equipment Devices

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (fttp://.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- Gemsystem Mag
- Generic User Number
- Geonics EM-31 Mag
- Geonics EM-61 Mag
- Met/Ocean Data
- YSI

9.1 Gemsystem GSM19 Dual Magnetometer

The Navigation software supports the Gemsystem GSM19 magnetometer. To allow the data to be extracted from the project by NavEdit this device is handled as an echo sounder (meaning you are required to set the Equipment Type to echo sounder).

9.1.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

9.1.2 Gemsystem Mag

The Navigation software extracts the magnetometer data and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The data is also graphically displayed in the *Echo Sounder Trace* real-time display. The magnetometer data is recorded in the Project database (as depth data).

The incoming data will be decoded and recorded as metres, so it is recommended that you set the depth units to metres to view the actual values sent by the magnetometer.

The Navigation software supports the fast grad and fast mag operation modes. To select which incoming string format is to be decoded and the rate at which the data is polled use the *Gemsystem Mag Custom Properties* dialog.

If fast grad mode of operation is selected, the Navigation software initially polls the magnetometer with a Hex 50 when going online. Then, at the poll frequency a Hex 103 prompt will be sent.

The magnetometer value is decoded as a high frequency depth and the gradient value as a low frequency depth.

If fast mag mode of operation is selected, the Navigation software initially polls the magnetometer with a Hex 49 when going online. Then, at the poll frequency a Hex 102 prompt will be sent.

The magnetometer value is decoded as a high frequency depth.

Data String Format

Example of Fast grad data string:

```
000200.1 01125.76-8216.82<CR><LF>
```

The magnetometer value would be decoded as 1125.76 (m as it is handled as a high frequency depth) and the gradient read as -8216.82 (m as it is handled as a low frequency depth).

Table 9-1 Fast Grad Sentence Type

Field	Description
1–8	Time to 1 decimal of a second (not decoded)
9	Always a space
10–17	MAG1 (may be packed with zeros)
18	Sign, either a space or '–' (negative)
19–25	Gradient (may be packed with zeros)
26	Carriage return
27	Line feed

Example of Fast mag data string:

```
000406.1 02068.93<CR><LF>
```

The magnetometer value would be decoded as 2068.93 (m as it is handled as a high frequency depth).

Table 9-2 Fast Mag Sentence Type

Field	Description
1–8	Time to 1 decimal of a second (not decoded)
9	Always a space
10–17	MAG1 (may be packed with zeros)
18	Carriage return
19	Line feed

9.2 Generic User Number

The generic user equipment handler can be used to decode, display, and record numerical data from a wide range of sensors.

9.2.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	Various

9.2.2 Generic User Number

The Navigation software extracts the depth information from the strings and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The user number data is recorded in the Project database.

In the *Generic User Number Custom Properties* dialog you can set the string delimiters and message terminator.

Select the data source numbers corresponding to the user number field(s) to be decoded in the data string. The first numerical value that appears in the selected fields will be decoded as a user number.

You can select up to 10 fields in the data string to be decoded as user numbers. Each number can have its own vessel and offset, timing, and logging properties.

Data String Format

Various formats are supported. The following rules apply:

- The maximum string length is 255 characters
- Message terminators can be a combination of <CR> and <LF> as defined in the custom properties
- Any non-numeric ASCII characters will be ignored
- The Navigation software will look for the delimiters as specified in the *Generic User Number Custom Properties* dialog
- Fields can be packed with spaces or zeros
- Up to 10 data sources can be configured
- The first numerical value in the field will be decoded as the user number
- Negative values are supported

9.3 Geonics EM-31 Magnetometer

The Navigation software supports the Geonics EM-31 magnetometer. To allow the data to be extracted from the project by NavEdit this device is handled as an echo sounder (meaning you are required to set the Equipment Type to echo sounder).

9.3.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR>

9.3.2 Geonics EM-31 Type

The Navigation software extracts the magnetometer data and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The data is also graphically displayed in the *Echo Sounder Trace* real-time display. The magnetometer data is recorded in the Project database (as depth data).

The incoming data will be decoded and recorded as metres, so Trimble recommends that you set the depth units to metres to view the actual values sent by the magnetometer.

The Navigation software supports both channels from the Geonics EM-61. Channel 1 will be decoded as a high frequency depth and channel 2 as a low frequency depth.

The incoming channels can be scaled independently. The scale factors can be set in the *EM Series Magnetometers Custom* dialog.

Data String Format

The data string contains a mixture of ASCII and HEX data. Table 9-3 describes the data string format.

Table 9-3 Geonics EM-31 Sentence Type

Field	Description
1	Start byte. ‘T’ = Auto or Wheel mode, ‘M’ = Manual mode. (not decoded).
2	Gain and range (HEX number) (not decoded)
3	Sign of channel 1 ‘+’ or ‘–’
4–7	Channel 1 value
8	Sign of channel 2 ‘+’ or ‘–’
9–12	Channel 2 value
16	Carriage return

This data format is a fixed length string of 13 characters.

9.4 Geonics EM-61 Magnetometer

The Navigation software supports the Geonics EM-61 magnetometer. To allow the data to be extracted from the project by NavEdit this device is handled as an echo sounder (meaning you are required to set the Equipment Type to echo sounder).

9.4.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR>

9.4.2 Geonics EM-61 Type

The Navigation software extracts the magnetometer data and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The data is also graphically displayed in the *Echo Sounder Trace* real-time display. The magnetometer data is recorded in the Project database (as depth data).

The incoming data will be decoded and recorded as metres, so Trimble recommends that you set the depth units to metres to view the actual values sent by the magnetometer.

The Navigation software supports both channels from the Geonics EM-61. Channel 1 will be decoded as a high frequency depth and channel 2 as a low frequency depth.

The incoming channels can be scaled independently. The scale factors can be set in the *EM Series Magnetometers Custom* dialog.

Data String Format

The data string contains a mixture of ASCII and HEX data. Table 9-4 describes the data string format.

Table 9-4 Geonics EM-61 Sentence Type

Field	Description
1	Start byte. ‘T’ = Auto or Wheel mode, ‘M’ = Manual mode. (not decoded)
2	Gain and range (HEX number) (not decoded)
3	Sign of channel 1 ‘+’ or ‘–’
4–7	Channel 1 value
8	Sign of channel 2 ‘+’ or ‘–’
9–12	Channel 2 value
13–15	Battery voltage to 1 decimal place (135 is 13.5 V) (not decoded)
16	Carriage return

This data format is a fixed length string of 16 characters.

9.5 Met/Ocean Data

The Met/Ocean handler decodes wind, current, and wave data for two berth locations. These are decoded as user numbers.

9.5.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

9.5.2 Met/Ocean Data

The Navigation software extracts the environmental data and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The environmental data is recorded in the Project database (as user numbers).

Data String Format

Example:

```
2.1,153.2,1.0,120.1,0.6,9,1.0,117,0.8,9<CR><LF>
```

Fields can be variable length. However, the total data string length must be 79 characters or less.

Table 9-5 Met/Ocean Data Sentence Type

Field	Description
1	Wind speed
2	Wind direction
3	Current speed at first location
4	Current direction at first location

Table 9-5 Met/Ocean Data Sentence Type (Continued)

5	Wave height at first location
6	Wave period at first location
7	Current speed at second location
8	Current direction at second location
9	Wave height at second location
10	Wave period at second location

The Met/Ocean data string is comma delimited. The fields in the data string can contain decimal places. Fields can be blank.

9.6 YSI Environmental Sensor

The YSI is an environmental sensor that measures (among other things) water depth, turbidity, and dissolved oxygen. The primary purpose of the YSI equipment handler is to decode these three fields.

To allow the data to be extracted from the project by NavEdit this device is handled as an echo sounder (meaning you are required to set the Equipment Type to echo sounder).

9.6.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

9.6.2 YSI

The Navigation software extracts the environmental data and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The data is also graphically displayed in the *Echo Sounder Trace* real-time display. The environmental data is recorded in the Project database (as depth data).

The YSI is handled as an echo sounder device, and so, one field will be decoded as a high frequency and another as a low frequency depth. This allows the Navigation software to display the profiles on the *Echo Sounder Trace* real-time display. To decode further fields from the device you must split the input cable and connect it to another communications port on the computer and configure the YSI equipment handler to decode the relevant fields from that port (two fields per port can be decoded).

The incoming data will be decoded and recorded as metres, so it is recommended that you set the depth units to metres to view the actual values sent by the environmental sensor.

As output from the sensor is configurable you are required to select the fields to be decoded in the *YSI Custom Properties* dialog.

Data String Format

Example:

```
# data<CR>
9.36 0.010 8.5<CR><LF>
```

If the ‘# data<CR>’ string is present it will be ignored.

The second string is decoded as per the setting in the *YSI Custom Properties* dialog.

The Navigation software assumes the fields in the string are delimited with spaces.

The depth, dissolved oxygen**,** and turbidity values must fall within the ± 9999 range.

The first numerical part of the field is decoded. For example, ‘23v2’ is decoded as ‘23’.

Other fields in the string (if any) may be alphanumeric values.

The data in the string must not exceed 120 characters and not have more than 8 data fields.

10 Miscellaneous Equipment Devices

New equipment devices are being added all the time to the Navigation software. For the latest list of equipment devices, please check with your local Trimble dealer or visit our FTP site (ftp://ftp.trimble.com/pub/marine_survey/dll/).

Information on equipment devices added after this manual went to print are contained in the readme.doc file accompanying the software. You can request individual equipment text files from Trimble Navigation New Zealand Limited (contact your local Trimble dealer for details).

The Navigation software supports equipment devices through equipment handlers (DLLs). The following sections provides you with some background information about the Navigation software equipment handlers.

The following equipment devices are covered:

- Coda DA Series
- Dredge Hd Trk (Depth Sensor)
- Reson Seabat 6042
- Sokkia SI10 Attitude Sensor
- Submetrix
- Trimble fix box
- Triton ISIS
- Tug tracking

10.1 Coda DA Series

The Navigation software sends navigation data to the Coda DA Series multibeam data acquisition system.

10.1.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

Coda DA Series

The Navigation software sends navigation information to the Coda multibeam acquisition system. The Navigation software, however, does not decode or record any multibeam data.

The Coda Format string is supported. This has all the fields necessary to make sure that features such as on-screen measurement and cursor position reporting, function correctly. Navigation data is sent every second.

Timing aspects to do with the generated navigation output string are controlled in the *Coda DA Series Custom Properties* dialog. You can select whether the output delay of the navigation string is calculated by the Navigation software or if a manually entered one is used. The output delay is the time between when the equipment handler receives the position from the application and when the string is ready for transmission by the computer operating system.

Note – The equipment handler has no control over when the computer operating system transmits the navigation string.

If the *Calculated and adjusted* option is selected then the total output delay is calculated as shown in Table 10-1.

Table 10-1 How Total Output Delay is Calculated

Output Delay Type	Calculation
For Estimated positions	Total Output Delay = Actual transmit time – Position calculation time
For Actual positions (position received from position service)	Total Output Delay = Actual transmit time – Position time of data

If the *Manual entry* option is selected then the manually entered value will be used.

The *Moving range time span* field in the custom properties dialog defines the time period that the vessel's velocity will be calculated over.

Finally, the speed of sound in water is entered in the custom properties dialog.

As the current GO name (Line) is output in the navigation string to the Coda system the Navigation software will output whichever GO is configured in the Current Steer-by. Make sure that your current steer-by is correctly configured.

The current event (Fix) is output as well. Events must be configured for event codes to be generated. The latest occurring event will be output in the navigation string.

The position output in the navigation string depends on the vessel and offset selected for the NEE Position Out service. You should select the vessel and offset corresponding to the multibeam sensor for this service.

To populate the navigation string with the GO name Trimble recommends that you make the At Log On event active (in the *Events Configuration* dialog), select the *Annot ES* tab then select the *annotate with* option of Guidance Object name, date and time. The Coda device must be selected for annotation. This updates the GO name field in the navigation string being sent to the Coda system.

Note – You are required to log off before changing the selected guidance object in use by the Navigation software.

To update the event code field in the navigation string enable the Time or Distance events (in the *Events Configuration* dialog), select the *Annot ES* tab and set the *Annotate with* field to Event code and time. Again, select the Coda device to send the annotation to.

Tip – Remember to set the *Events per annotation/mark* field in the *Annot ES* tab in the *Event Configuration* dialogs to 1. This allows the navigation string to be updated with the latest event code (as opposed to the default of every 10th event).

For all fields to be populated correctly in the navigation string Trimble recommends that you have the Navigation software in a ***Logged On*** state.

Note – The events must be configured correctly for the navigation string to contain the correct GO name and event code details.

Data String Format

Example:

```
CODA 123.354 33998.005 0 0 0 0 4.3 031.8 RFP1002
344 1503.45 1.03 797619096.002<CR><LF>
```

Table 10-2 CODA Format Sentence Type

Field	Description
1	String header
2	Easting of sensor (metres)
3	Northing of sensor (metres)
4	Along track kilometre point (kilometres). Not supported.
5	Distance cross course (metres). Not supported.
6	Depth below surface (metres). Not supported.
7	Altitude of the sensor (metres). Not supported.
8	Sensor speed (knots)
9	Sensor grid heading (decimal degrees). The range is 0 to 359.999.
10	Number component of the current GO name[1]
11	Last valid event code (fix)[2]
12	Speed of sound in water (metres per second)
13	Output delay of the navigation string—time between obtaining the fix data and transmission of string (seconds)
14	Transmission time of the navigation string in GPS Time (seconds since January 1st 1970)
15	Carriage return
16	Line feed

[1]This is a 15 character ASCII string that contains no spaces (the equipment handler will remove any spaces appearing in the GO name). If necessary, the GO name will be truncated from the left to 15 characters.

[2]No alpha characters are supported (the equipment handler will strip these out) The last numeric value will be extracted from the event code. For example, an event code of ABC123EFG456 will be output as 456 to the Coda system. The limit is 32 bits (4294967295).

The string is space delimited.

Zeros are output for unsupported fields.

10.2 Dredge Head Tracking

Using the dredge head tracking device allows the Navigation software to calculate the dredge head position and depth.

10.2.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	Various

10.2.2 Dredge Hd Trk (Depth Sensor)

The Navigation software extracts the depth data and displays it in the *Equipment Monitor* and *Survey Text* real-time displays. The depth data is also graphically displayed in the *Echo Sounder Trace* real-time display. Additionally, position information of the dredge head is calculated and is displayed in the *Equipment Monitor*, *Survey Text*, and *Plan View Map* real-time displays. Depth and position data are recorded in the Project database.

This equipment handler is not a simple sensor decoder. This handler uses the decoded depth sensor value along with the vessel heading and equipment custom properties to calculate the dredge position and depth. Two services are configured when you select this device—the Observer service to calculate the dredge head position and the Depth service to decode depths from the dredge head depth sensor.

Before you configure this equipment device you need to configure two vessels, one for the dredge and the other for the dredge head. You do not need to create a vessel shape for the dredge head ‘vessel’.

Tip – For ease of equipment configuration, Trimble recommends that you create the dredge vessel first, then create the dredge head 'vessel'.

Due to the complex nature of this equipment configuration you must configure several custom properties:

- The *Message terminator* field must be selected to match the terminator sent by the depth sensor device.
- You need to select an option in the *Depth/distance units* list. These determine which units the incoming depths as well as the entered distance units are decoded as.
- You are required to enter the total arm length in the *Dredge arm length* field.
- For the *Depth sensor offset* field, enter the length along the dredge arm that the depth sensor is installed to the dredge head.
- Next, enter the water line to the dredge hinge distance. This is the vertical distance between the water line and where the dredge arm is hinged to the dredge. The distance is a negative value if the water line is above the hinge point.
- Select whether the dredge arm extends forward or in the aft direction on the dredge.
- As this is an advanced equipment configuration you must make sure that observer and echo sounder equipment properties are configured correctly.

The Observer service is required as you are observing the position of the dredge head. The dredge head is 'observed' from the point at which the dredge arm is hinged to the dredge.

At the equipment configuration stage it is assumed that you have already configured a vessel for the dredge with an offset for the location of the GPS antenna and another offset for the dredge hinge point, as well as configuring a vessel for the dredge head.

To select the observation point on the dredge:

1. Open the *Configure Advanced Equipment* dialog for this equipment device.
2. Highlight the Observer service and click **Properties**.
3. Select the *Configuration* tab.
4. Select the dredge as the *Located At Vessel* and the hinge point as the *Located At Offset*.
5. Click **OK**.

To select the observed point (dredge head):

1. Open the *Configure Advanced Equipment* dialog for this equipment device.
2. Highlight the Observer service and click **Properties**.
3. Select the the *Configuration* tab.
4. Select the dredge head vessel as the *Located At Vessel* and the origin as the *Located At Offset*.
5. Click **OK**.

The echo sounder service, too, has properties to be configured. The Echo Sounder service is used for the vertical position of the dredge head. This position is calculated using the observer, custom, and depth sensor data. This value must be assigned to the dredge head ‘vessel’. To do this:

1. Open the *Configure Advanced Equipment* dialog for this equipment device.
2. Highlight the Echo Sounder service and click **Properties**.
3. Select the *Configuration* tab.
4. Select the dredge head vessel as the *Located At Vessel* and the origin as the *Located At Offset*.
5. Click **OK**.

Note – The dredge head vertical position is the dredge head depth below the waterline unless it is related to a datum by a tide adjustment (either RTK Tide or tide gauge).

Data String Format

The Dredge Hd Trk (Depth Sensor) attempts to decode any string that has a terminator of any combination of <CR> and/or <LF> and is no longer than 256 characters (including the terminators).

The depth value is the first set of numeric characters detected in the string. The value may or may not be surrounded by non-numeric values.

Note – Signs prefixing the value (– or +) are ignored. Decimal points that do not have a numerical value after them are also ignored.

The ‘Dredge Head Depth Device’ format is:

```
<LF>172.34<CR>
```

The depth would be read as 172.34 m (or feet).

Table 10-3 Dredge Head Depth Device Sentence Type

Field	Description
1	Line feed
2	Depth in feet or metres. Depth may be packed with spaces or zeros or unpacked.
3	Carriage return

10.3 Reson Seabat 6042

The Navigation software sends navigation data to the Reson Seabat 6042 multibeam data acquisition system.

10.3.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

10.3.2 Reson Seabat 6042

The Reson 6042 is a computer software package that collects, time-tags, and stores data from multibeam and related sensors. HYDROpro is used to control the navigation guidance and outputs a position string to the 6042. The Navigation software does not record any multibeam data.

The ‘Navibat nav’ option is supported. The navigation data is sent every second.

Timing aspects to do with the generated navigation output string are controlled in the *Reson Seabat 6042 Custom Properties* dialog. You can select whether the output delay of the navigation string is calculated by the navigation software or if a manually entered one is used. The output delay is the time between when the equipment handler receives the position from the application and when the string is ready for transmission by the computer operating system.

Note – The equipment handler has no control over when the computer operating system transmits the navigation string.

If the *Calculated and adjusted* option is selected then the total output delay is calculated as shown in Table 10-4.

Table 10-4 How Total Output Delay is Calculated

Output Delay Type	Calculation
For Estimated positions	Total Output Delay = Actual transmit time – Position calculation time
For Actual positions (position received from position service)	Total Output Delay = Actual transmit time – Position time of data

If the *Manual entry* option is selected then the manually entered value will be used.

As the current GO name (Line) is output in the navigation string to the Coda system the Navigation software will output whichever GO is configured in the current steer-by association configuration. Make sure that your current steer-by is correctly configured.

The position output in the navigation string depends on the vessel and offset selected for the NEE Position Out service. The vessel and offset corresponding to the multibeam sensor should be selected for this service.

To update the GO name field in the navigation string enable the Time or Distance events (in the *Events Configuration* dialog), select the *Annot ES* tab and set the *Annotate with* field to GO name, date, and time. Select the Reson device to send the annotation to.

Tip – Remember to set the *Events per annotation/mark* field in the *Annot ES* tab in the *Event Configuration* dialogs to 1. This allows the GO name in navigation string to be updated with each event (as opposed to the default of every 10th event).

For all fields to be populated correctly in the navigation string Trimble recommends that you have Navigation software in a ***Logged On*** state.

Note – The events must be configured correctly for the navigation string to contain the correct GO name.

Data String Format

Example:

```
0    0 16:24:44.61  338628.11  732544.03 .050
0.00   0.00    0.000 0 S602S000<CR><LF>
```

Table 10-5 Navibat Nav Format Sentence Type

Field	Description
1	0. Not supported.
2–7	Spaces
8	0. Not supported.
9	Space
10–20	GPS time of position (HH:MM:SS.ss)
21	Space
22–32	Easting of sensor (metres), right justified.
33	Space
34–44	Northing of sensor (metres), right justified.
45	Space
46–50	Output delay of navigation string—time between obtaining fix data and transmission of string (seconds)
51	Space
52–60	0.00. Not supported, right justified.
61	Space
62–67	0.00. Not supported, right justified.
68	Space
69–76	0.000. Not supported, right justified.
77	Space

Table 10-5 Navibat Nav Format Sentence Type

78	0. Not supported
79	Space
80–87	Current GO name, right justified[1].
88	Carriage return
89	Line feed

[1]This is a 8 character ASCII string that contains no spaces (the equipment handler will remove any spaces appearing in the GO name). If necessary the GO name will be truncated from the left to 8 characters.

Fields are packed with spaces.

10.4 Sokkia SI10 Attitude Sensor

The Navigation software supports the Sokkia SI10 Attitude sensor. The SI10 is a pitch roll device.

10.4.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

10.4.2 Sokkia SI10 Pitch/Roll

The Navigation software extracts the pitch and roll data from the Sokkia SI10 sensor. The pitch and roll data is displayed in the *Equipment Monitor*, *Vessel Monitor*, and *Survey Text* real-time displays. The data is also used in offset calculations.

Pitch and roll calibration values can be entered on the *Calibration* tab in the *Equipment Properties* dialog in the Sokkia equipment configuration.

To change the pitch and roll calibration values:

1. Select the Sokkia SI10 Pitch/Roll Attitude equipment configuration in the *Equipment Configure* dialog.
2. Click **Configure**.

   The *Configure Equipment* dialog appears.
3. Click **Properties**

   The *Equipment Properties* dialog appears.
4. Select the *Calibration* tab.
5. Change the calibration values and click **OK**.

Data String Format

Example:

```
P/+11.05'  ,R/-16.51'  <CR><LF>.
```

Table 10-6 describes the data string format.

Table 10-6 Sokkia SI10 Sentence Type

Field	Description
1	Pitch indicator ‘P’
2	ASCII 47 character ‘/’
3	Sign of pitch ‘+’ or ‘-’
4–8	Pitch in degrees and minutes (DD.MM). Range is +/-45.00.
9	ASCII 39 character ‘’’
10–11	Spaces
12	ASCII 44 character ‘,’
13	Roll indicator ‘R’
14	ASCII 47 character ‘/’
15	Sign of roll ‘+’ or ‘-’
16–20	Roll in degrees and minutes (DD.MM). Range is +/-45.00.
21	ASCII 39 character ‘’’
22–23	Spaces
24	Carriage return
25	Line feed

This data format is a fixed length string of 25 characters.

If any part of the string is invalid the whole string is rejected (you cannot decode the pitch and discard the roll).

Note – The NATO standards dictate that:
– positive pitch indicates the bow is up
– positive roll indicates the starboard side is down
The Sokkia uses the same pitch convention. However, the positive roll indicates that the starboard side is up. The Navigation software will standardise these readings and so reverses the sign of the roll as it is decoded. This is done ***before*** any calibration values are applied. The roll value displayed and logged in the Navigation software is the opposite convention to that measured on the Sokkia device.

10.5 Submetrix Multibeam Data Acquisition System

The Navigation software sends navigation data to the Submetrix multibeam data acquisition system.

10.5.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

10.5.2 Submetrix

The Navigation software sends navigation information to the Submetrix multibeam acquisition system. The navigation software however, does not decode or record any multibeam data.

The navigation data is sent every second.

Timing aspects to do with the generated navigation output string are controlled in the *Submetrix Custom Properties* dialog. You can select whether the output delay of the navigation string is calculated by the Navigation software or if a manually entered one is used. The output delay is the time between when the equipment handler receives the position from the application and when the string is ready for transmission by the computer operating system.

Note – The equipment handler has no control over when the computer operation system transmits the navigation string.

If the *Calculated and adjusted* option is selected then the total output delay is calculated as shown in Table 10-7.

Table 10-7 How Total Output Delay is Calculated

Output Delay Type	Calculation
For Estimated positions	Total Output Delay = Actual transmit time – Position calculation time
For Actual positions (position received from position service)	Total Output Delay = Actual transmit time – Position time of data

If the *Manual entry* option is selected then the manually entered value will be used.

The *Moving range time span* field in the custom properties define the time period that the vessel's velocity will be calculated over.

The position output in the navigation string will depend on the vessel and offset selected for the NEE Position Out service. The vessel and offset corresponding to the multibeam sensor should be selected for this service.

Data String Format

Example:

```
000000300000.00,000000700000.00,001.000,
002.000,12:13:14,21/07/1998<CR><LF>
```

Table 10-8 Submetrix Sentence Type

Field	Description
1–15	Easting of sensor (metres to 2 decimal places)
16	Comma
17–31	Northing of sensor (metres to 2 decimal places)
32	Comma
33–39	Elevation of sensor (metres to 2 decimal places)
40	Comma
41–47	Speed (metres per second to 3 decimal places)
48	Comma
49–56	GPS time of the position with output delay added (HH:MM:SS)
57	Comma
58–67	Date displayed as day/month/year (dd/mm/yyyy)
68	Carriage return
69	Line feed

Fields are packed with zeros.

Whenever there is no data for a field '#'s will be used to replace each character in the missing field.

10.6 Trimble Fix Box

The Fixbox.dll supports the Fix Box triggering device for:

- external triggering (from say another device to trigger an event in the Navigation software)
- internal triggering (from the Navigation software to an external device)

The fix box is an interface between the Navigation software and third party equipment such as geophysical instruments. The computer software triggers the fix box at user-defined event intervals.

10.6.1 Default Communication Parameters

Baud rate:	1200
Stop bits:	1
Parity:	None
Data bits:	8

10.6.2 Trimble Fix Box

The Navigation software displays the digital state of the fix box in the *Equipment Monitor* and *Survey Text* real-time displays. The digital data is recorded in the Project database.

The Trimble fix box is generally used with events.

Example 1

When a certain event occurs it will cause the fix box to output a pulse to mark and echo sounder trace.

Example 2

When the fix box is triggered from an external source, say, the firing of a seismic air gun, causes the Navigation software to log the position of the air gun.

Once a fix box has been added to an equipment configuration an extra tab (the *Digital Out* tab) appears on the event configuration dialogs. This lets you trigger the fix box by that event if desired.

Any number of fix boxes can be configured and you can select each one individually in the *Digital Out* tabs, letting you trigger different external devices with separate fix boxes triggered by different events.

Example:

> You could configure a fix box to annotate the echo sounder on a time interval and configure another fix box to trigger the air guns to fire on a distance interval.

As well as there being *Digital Out* tabs in events there is also a Digital In event and *Digital In* tab. When configuring a Digital In event you must select one fix box to trigger the Navigation software. When a trigger is received from the fix box you can configure the Digital In event to log data, annotate a device, or even trigger another fix box.

Fix Box Details

The fix box's plugs and connectors:

All trigger connectors are type BNC. There are three output closures which have variable closures from 50 m to 500 m in length:

- BNC 1) Normally open but closes during a fix event
- BNC 2) Delivers a +5 VDC pulse during a fix event
- BNC 3) Normally closed but open during a fix event

The external trigger is via the BNC labelled FIX IN. The fix in is triggered by shorting the BNC contacts. The Navigation software detects the negatively edged pulse, then fires the output closure. Connector to computer is a DB9 female. The time of the closure or pulse is variable from 50 ms to 500 ms (0.5 sec). The LED glows ***green*** if externally triggered, or glows ***red*** if computer triggered.

The fix box is triggered by sending any ASCII character, typically an 'F'. The Navigation software is triggered by the fix box operating on the RTS/DTR status lines.

10.7 Triton ISIS

The Navigation software sends navigation data to the Triton ISIS multibeam data acquisition system.

10.7.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

10.7.2 Triton ISIS

The Navigation software sends navigation information to the Triton ISIS multibeam acquisition system. The Navigation software, however, does not decode or record any multibeam data.

Triton has developed an equipment handler specifically for HYDROpro Navigation. Select the HYDROpro option in the Triton ISIS system. The navigation data is sent every second.

Timing aspects to do with the generated navigation output string are controlled in the *Triton Isis Custom Properties* dialog. You can select whether the output delay of the navigation string is calculated by the Navigation software or if a manually entered one is used. The output delay is the time between when the equipment handler receives the position from the application and when the string is ready from transmission by the computer operating system.

Note – The equipment handler has no control over when the computer operating system transmits the navigation string.

If the *Calculated and adjusted* option is selected then the total output delay is calculated as shown in Table 10-9.

Table 10-9 How Total Output Delay is Calculated

Output Delay Type	Calculation
For Estimated positions	Total Output Delay = Actual transmit time – Position calculation time
For Actual positions (position received from position service)	Total Output Delay = Actual transmit time – Position time of data

If the *Manual entry* option is selected then the manually entered value will be used.

The *Moving range time span* field in the custom properties dialog defines the time period that the vessel's velocity will be calculated over.

As the current GO name (Line) is output in the navigation string to the Coda system the Navigation software will output whichever GO is configured in the Current Steer-by. Make sure that your current steer-by is correctly configured.

The current event (Fix) is output as well. Events must be configured to for event codes to be generated. The latest occurring event will be output in the navigation string.

The position output in the navigation string depends on the vessel and offset selected for the NEE Position Out service. The vessel and offset corresponding to the multibeam sensor should be selected for this service.

Additionally, the Navigation software can be used to start and stop the Triton ISIS multibeam data logging.

The Navigation software sends a start logging message whenever an At Log On annotation message is sent. This requires you to make the At Log On event active (in the *Events Configuration* dialog), select the *Annot ES* tab then select the *Annotate with* option of Guidance Object name, date and time. The Triton ISIS device must be selected for annotation. This causes the Navigation software to send a start logging command to the Triton ISIS system everytime the system logs on. The Triton ISIS system then opens a new file based on the line name contained in the start logging command. This also updates the GO name field in the navigation string being sent to the Triton ISIS system.

An end logging command is sent via the At Log Off annotation message. This requires you to make the At Log Off event active and select any annotation option for the Triton ISIS equipment devices. This causes the Navigation software to send an end logging command to the Triton ISIS system everytime the system logs off.

Note – You are required to log off before changing the selected guidance object in use by the Navigation software.

To update the event code field in the navigation string enable the Time or Distance events (in the *Events Configuration* dialog), select the *Annot ES* tab, then set the *Annotate with* field to Event code and time. Again, select the Triton device to send the annotation to.

Tip – Remember to set the *Events per annotation/mark* field in the *Annot ES* tab in the *Event Configuration* dialogs to 1. This allows the navigation string to be updated with the latest event code (as opposed to the default of every 10^{th} event).

For all fields to be populated correctly in the navigation string Trimble recommends that you have Navigation software in a ***Logged On*** state.

Note – The events must be configured correctly for the navigation string to contain the correct GO name and event code details and to prompt the Triton ISIS to start and stop logging.

Data String Format

Example of HYDROpro format string:

```
$,10,08,1998,03:45:23.454,500245.56,
703098.03,0.12,45.47,2034.54,-
8.53,56.78,5.20,0.0,T.00203,Line0001*hh<CR><LF>
```

Table 10-10 HYDROpro Format Sentence Type

Field	Description
1	String header '$'
2	GPS day (dd)
3	GPS month (mm)
4	GPS year (yyyy)
5	GPS time of the position (HH:MM:SS.sss)
6	Easting of the sensor (metres)
7	Northing of sensor (metres)
8	Output delay of the navigation string—time between obtaining the fix data and transmission of the string (seconds)
9	Sensor grid heading (decimal degrees). Range 0 to 359.9.
10	Along track distance (kilometres). Not supported.
11	Offline distance (metres). Not supported.
12	Water depth below the surface (metres). Not supported.
13	Speed of sensor (knots)
14	Altitude of sensor above seafloor (metres). Not supported.
15	Last valid event[1]

Table 10-10 HYDROpro Format Sentence Type

16	Current GO name[2]
17	Checksum (*hh)
18	Carriage return
19	Line feed

[1]This is an ASCII field that contains up to 15 characters with no spaces (the equipment handler will remove any spaces appearing in the Event name). If necessary the Event name will be truncated from the left to 15 characters.

[2]This is an ASCII field that contains up to 15 characters with no spaces (the equipment handler will remove any spaces appearing in the GO name). If necessary the GO name will be truncated from the left to 15 characters.

The string is comma delimited.

Zeros are output for unsupported or unavailable fields.

Example of Start Logging string:

```
START_LOGGING Line0002<CR><LF>
```

Table 10-11 Start Logging Sentence Type

Field	Description
1	String header ‘START_LOGGING’
2	Space
3	GO name[1]
4	Carriage return
5	Line feed

[1]This is an ASCII field that contains up to 15 characters with no spaces (the equipment handler will remove any spaces appearing in the GO name). If necessary the GO name will be truncated from the left to 15 characters.

Example of End Logging string:

```
END_LOGGING<CR><LF>
```

Table 10-12 End Logging Sentence Type

Field	Description
1	String header ‘END_LOGGING’
2	Carriage return
3	Line feed

10.8 Tug Tracking

This equipment device is designed for use with the HYDRObms™ (Barge Management Software – DOS software). While the main barge would be configured with the HYDRObms software it would communicate to each of the tugs running HYDROpro Navigation software through this equipment device.

10.8.1 Default Communication Parameters

Baud rate:	9600
Stop bits:	1
Parity:	None
Data bits:	8
Terminator:	<CR><LF>

10.8.2 Tug Tracking

The Tug Tracking equipment handler is used to relay target, tug and barge positions between the tugs and barge. Also, the anchor status is communicated. NMEA type messages are used for communication.

The detail of the message format for the communications protocol between HYDROpro Tug and HYDRObms are documented in the following section.

The barge and tugs use this NMEA type protocol to communicate across a radio network. The messages have a maximum length of 255 characters and all fields in the string must be present.

A message can contain more than one message packet but messages that require a reply or confirmation from more than one recipient are not combined (this avoids collisions on the radio network).

How to Configure the Tug Tracking Equipment

After you select the Tug Tracking equipment handler and finish the Add equipment wizard, the *Configure Advance Equipment* dialog is opened. By default, four services are loaded. The vessel and offset are also loaded by default

You ***must*** configure the appropriate vessel offset for each of the services.

To do this, highlight the service and click **Properties**. Select the appropriate vessel and offset for the service and click **OK**.

The NEE Position service is used for the update of the barge position. Select the Barge vessel and the barge offset on which the prime position system is installed.

The Heading service is used for the update of the barge heading. Select the Barge vessel and the barge offset on which the prime position system is installed

The Guidance Update service is used to update anchor position and status information and for new anchor targets for the tug, select the tug vessel and steer-by offset (normally the centre of the stern roller of the tug).

The NEE Position Out service is used for the output of the tug steer-by offset. Select the tug vessel and steer-by offset.

You ***must*** also configure the Tug ID. This is used to identify input and output messages to and from this tug. To do this, click **Custom** in the *Configure Advanced Equipment* dialog. Set the Tug ID number to match that configured in the HYDRObms software.

Data String Format: Strings Received by the Tug

Example – Master Data Request:

```
$MDR,1,0*5a<CR><LF>
```

This message is from the HYDRObms software requesting a position update from the specified tug.

Table 10-13 Master Data Request Sentence Type

Field	Description
1	Master Data Request message ‘$MDR’
2	Tug ID. Number from 1 to 255.
3	Barge ID, always 0
4	Checksum delimiter (*)
5	NMEA type checksum
6	Carriage return
7	Line feed

Example – Master Position Broadcast:

```
$MPB,0,0,700901.0,300901.0,0,45.0,0*68<CR><LF>
```

This message is from the HYDRObms software updating all tugs with barge position and heading.

Table 10-14 Master Position Broadcast Sentence Type

Field	Description
1	Master Position Broadcast ‘$MPB’
2	GPS week number (always 0)
3	GPS second of the week (always 0)
4	North coordinate (metres) of Barge (position 1 offset)
5	East coordinate (metres) of Barge (position 1 offset)
6	Elevation (always 0)
7	Heading (Grid) of barge

Example – Master Anchor Broadcast:

```
$MAB,1,700800.1,300800.2,0,3*57<CR><LF>
```

This message is from the HYDRObms software updating all tugs with anchor positions and status.

Table 10-15 Master Anchor Broadcast Sentence Type

Field	Description
1	Master Anchor Broadcast ‘$MAB’
2	Name of the anchor (usually a number 1–12)
3	North coordinate (metres) of anchor
4	East coordinate (metres) of anchor
5	Elevation of anchor (always 0)
6	Anchor status. 0 = none, 1 = surveyed, 2 = anchor up, 3 = anchor down.
7	Checksum delimiter ‘*’
8	NMEA type checksum
9	Carriage return
10	Line feed

Example – General Target Update:

```
$GTU,1,0,2,700901.0,300901.0,0,2*5f<CR><LF>
```

The HYDRO(DOS) bms system sends this message to a tug to provide it with a new target to steer to. The tug must acknowledge this message.

Table 10-16 General Target Update Sentence Type

Field	Description
1	General Target Update ‘$GTU’
2	The vessel to which the message is intended (Tug)
3	The vessel from which the message was sent (barge = 0)
4	Name of the anchor (usually a number 1–12)
5	North coordinate (metres) of anchor

Table 10-16 General Target Update Sentence Type

6	East coordinate (metres) of anchor
7	Elevation of anchor (always 0)
8	Anchor status. 0 = none, 1 = surveyed, 2 = anchor up, 3 = anchor down.
9	Checksum delimiter (*)
10	NMEA type checksum

Example – Acknowledge:

```
$ACK,1,0*48<CR><LF>
```

This acknowledge message is sent by the HYDRObms software to the tug in response to a GTU message from the tug. This message acknowledges receipt of an updated anchor position.

Table 10-17 Acknowledge Sentence Type

Field	Description
1	Acknowledge ($ACK)
2	The vessel to which the message is intended (tug)
3	The vessel from which the message was sent (barge = 0)
4	Checksum delimiter (*)
5	NMEA type checksum
6	Carriage return
7	Line feed

Possible message groupings for messages received by tug:

GTU
GTU+ACK
MDR+MAB
MDR+MPB
MDR+MAB+ACK
MDR+MPB+ACK

Data String Format: Strings output by the Tug

Example – Slave Position Update:

```
$SPU,0,1,0,0,700800.1,300800.2,0,1*51<CR><LF>
```

This message is a steer-by offset position update from the tug system to the barge system. This message is sent in response to a Master Data Request from the barge specifically to this tug.

Table 10-18 Slave Position Update Sentence Type

Field	Description
1	Slave Position Update '$SPU'
2	Barge ID (always 0)
3	Tug ID (number from 1 to 255)
4	GPS week number (always 0)
5	GPS second of the week (always 0)
6	North coordinate (metres) of Tug steer-by offset
7	East coordinate (metres) of Tug steer-by offset
8	Elevation of Tug steer-by offset (always 0)
9	Tug position status. 0 = position OK, 1 = position timed out.
10	Checksum delimiter '*'
11	NMEA type checksum
12	Carriage return
13	Line feed

Example – General Target Update:

```
$GTU,0,1,2,700901.0,300901.0,0,3*5f<CR><LF>
```

A Tug sends this message to the HYDRObms software to provide it with an updated anchor position whenever the anchor is recovered or laid. The HYDRObms software must acknowledge this message.

Table 10-19 General Target Update Sentence Type

Field	Description
1	General Target Update '$GTU'
2	The vessel to which the message is intended (barge = 0)
3	The vessel from which the message was sent (tug)
4	Name of the anchor (usually a number 1–12)
5	North coordinate (metres) of anchor
6	East coordinate (metres) of anchor
7	Elevation of anchor (always 0)
8	Anchor status. 0 = none, 1 = surveyed, 2 = anchor up, 3 = anchor down.
9	Checksum delimiter '*'
10	NMEA type checksum
11	Carriage return
12	Line feed

Example – Acknowledge:

```
$ACK,0,1*48<CR><LF>
```

This acknowledge message is sent by the tug to the HYDRO(DOS) bms system in response to a GTU message from the barge. This message acknowledges receipt of a new target to steer to.

Table 10-20 Acknowledge Sentence Type

Field	Description
1	Acknowledge ‘$ACK’
2	The vessel to which the message is intended (barge =0)
3	The vessel from which the message was sent (tug)
4	Checksum delimiter ‘*’
5	NMEA type checksum
6	Carriage return
7	Line feed

Possible message groupings for messages sent by the Tug Tracking equipment handler are:

- SPU
- SPU+ACK
- SPU+GTU
- SPU+GTU+ACK

11 Technical Information

This chapter details additional cards and boards that can be used with the Navigation software.

11.1 Intelligent Asynchronous Serial Communication Boards (RS232)

These allow for more serial communication ports. Typically, the Navigation software requires one port for each device to be interfaced to. For example, one for position and one for depth.

11.1.1 Quatech QSP – 100 (Quad Serial Port PCMCIA Card)

One of the newest PCMCIA cards on the market is the QSP-100 Four channel RS232 Serial Adaptor card. This Type II PCMCIA card has been satisfactorily tested with Windows 95 applications. See Figure 11-1.

Figure 11-1 Quad Serial Port PCMCIA Card

Until now if you wanted more than one or two serial ports on your Notebook PC, a docking station was required to take a multiport expansion board, or you had to choose the more expensive option of an industrial laptop with built-in expansion slots. Now this multi-port card lets you use a Notebook PC to run the HYDROpro software.

Installation of the QSP100 is a matter of reading the instructions and installing the necessary files that come on disk—just follow the easy instructions. Also make sure you have up-to-date PCMCIA 'Services' which are available from your PC supplier.

Installing two QSP-100 cards is just as simple and gives you up to eight extra serial ports, enough for most applications.

For more information and pricing contact Quatech:

Web site	http://www.quatech.com
Phone	+1-330 434 3154 (USA)
Fax	+1-330 434 1409

or the local dealer.

11.1.2 Socket Ruggedised Serial PC Cards

Socket Communications produce ruggedised variations of the PC communication cards. These are available in single and dual port options. They incorporate a number of features that enhance their use for marine applications on laptops. These features include:

- fully integrated fixed cables
- molded strain relief to minimise stress and seal out dust and moisture
- low power consumption

Figure 11-2 Ruggedised Dual Serial PC Card

These PC Cards work in type II or III PCMCIA card slots. For use on NT machines NT drivers are available from Socket.

For more information and pricing contact Socket Communications:

Web site	http://www.socketcom.com/sioprods.htm
Email	info@socketcom.com
Phone	+1-510 744 2700 (USA)
Fax	+1-510 744 2727

or contact your local dealer.

11.1.3 Digiboard PC/Xe Boards

The Digi PC/4e and PC/8e and the AccelePort 4e and AccelePort 8e boards are ISA standard boards for PCs. These boards are collectively referred to as Xe boards and include the PC/Xe and AccelePort Xe boards, which are functionally identical.

The unit comes with a connector assembly (four or eight 25-pin connectors), the ISA board and device driver disks/manuals.

The manufacturer states: “The standard length of run for the interface cable is 46 feet. If you can obtain 12.5pF/ft cable then the length of run can be 184 feet”.

For more information and pricing contact DigiBoard:

Web site	http://www.digibd.com
Phone	+1-612-943-9020 (USA)
Fax	+1-612-943-5398

or the local dealer.

11.2 Dual VGA Video Boards

This allows a separate SVGA display for the helmsman, not just a repeat of the operator's screen.

11.2.1 Colorgraphic Dual VGA

These boards let you drive two separate screens, one for the survey operator and one for the helmsman. The operator has one 'virtual' screen and can push various window displays onto the helmsmans screen and keep other displays on their own screen.

The ISA board that the Navigation software supports is the Super Warp.

For more information and pricing contact Colorgraphic:

Web site	http://www.colorgfx.com:80/
Phone	+1-770-455-3921 (USA)
Fax	+1-770-458-0616

or the local dealer.

Note – The dual VGA card works on desktop PCs in which the onboard VGA can be either disabled or removed. The dual VGA card will not work on many laptops. For more information please contact Colorgraphic.

11.3 Remote Control Software

There are various packages available that enable you to remotely view and access another computer. The Virtual Network Computing (VNC) software from AT&T Laboratories Cambridge is one product that Trimble has successfully used with the Navigation software. The VNC software has the added bonus of being freely available[1].

11.3.1 Virtual Network Computing (VNC) Software

This software lets you view a computer and access it from anywhere on a network. It is platform independent, so you could have a Windows CE palmtop viewing an NT machine. No ‘state’ is stored on the viewer’s PC, so if the connection between the computers is lost, then there is no loss of data when the link is restored.

There are two parts to the software. At the host PC end (the one running the Navigation software) you configure it to be a ***server***. On the remote PC end (the one viewing the host PC) you configure it to be the ***viewer***. The VNC software requires a TCP/IP connection between the server and the viewer.

The Windows server is not multi-user. That means everyone viewing the computer will see the same screen.

The web site (listed below) contains considerable documentation on how to install the software as well as useful tips. The following are a few tips on improving the performance of VNC:

- Use a plain desktop, rather than a patterned or detailed backdrop image
- Reduce the color depth

  On machines of low specification it may be necessary to reduce the colors to an 8-bit palette, however it is generally recommended that you use a 16-bit color palette.

[1] At the time this manual went to print.

- Reduce the screen resolution

  The lower the screen resolution the fewer pixels there are to update.

- SSH (Secure SHell) software can be incorporated to make the connection more secure and faster through encryption and compression

To obtain a copy of the VNC software, contact AT&T Laboratories Cambridge:

Web site	http://www.uk.research.att.com/vnc/index.html
Phone	+44-1223-343000 (UK)
Fax	+44-1223-313542

11.4 Fix Box

The Fix box (see Figure 11-3) is triggered by the Navigation software every time there is a mark/print command.

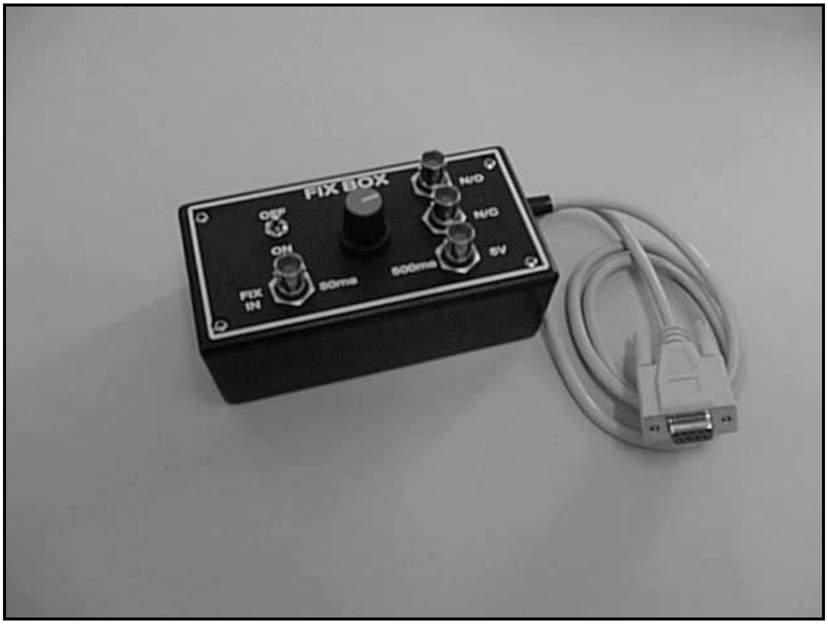


Figure 11-3 Fix Box

It allows:

- Triggering from computer to external device(s) (for example, to echo-sounder)
- External triggering from external device to computer (for example, from shooting source)
- External triggering from external device (for example, from shooting source) back to external device(s) (for example, to echo sounder)

There are three male BNC connectors that are triggered simultaneously:

- BNC 1 – Normally open but closes during a fix
- BNC 2 – Delivers a +5 VDC pulse during a fix
- BNC 3 – Normally closed but open during a fix

Operation

Connect the Fix box to the desired Com port. Turn the Fix box switch on and the LED should flash red. If not then the internal battery could be flat.

Power

Required 4 × 1.5 volt batteries (for example, AA cells). Turn ***off*** if not used. Carry spare batteries.

Plugs and Connectors

All trigger connectors are BNC female. There are three output closures which have variable closures from 50 ms to 500 ms in length:

- Normally open, but closed on the fix
- Normally closed, but open on the fix
- Sends a +5 VDC pulse

The external trigger is via the BNC labeled FIX IN. The fix-in is triggered by shorting the BNC contacts. HYDROnav detects the negatively edged pulse, then fires the output closure (see the Operation section above). Connector to computer is DB9 female. Make sure that Fix Box is selected in the Navigation software.

LED

Glows ***green*** if external triggered, glows ***red*** if computer triggered. The time of the closure or pulse is variable from 50 ms to 500 ms (0.5 sec).

For more information and pricing contact Trimble:

Part Number 19740

Manufactured by:

New Zealand Ocean Technology Ltd.

Phone +64-9-486-6806

Fax +64-9-486-6807

11.5 Backing Up Your Navigation Projects

When recording decoded data such as position, depth, and heave, Navigation projects can become very large. This is because all data is contained in a single database file. If you need to put your data onto disk to send elsewhere you may find that the database file size exceeds the floppy disk size.

In addition, it is generally recommended that you regularly back up your data to protect yourself from accidental loss due to hardware failure.

Products such as WinZip can be purchased to compress files and save them to disk. WinZip supports compressing files over several disks.

Some operating systems come complete with useful backup utilities.

11.5.1 Windows 95

Windows 95 includes a utility called Microsoft Backup, which lets you select a file or files for backup to any location such as your floppy disk. In doing the backup, the utility compresses the file or files. If you are backing up to floppy disks you are directed to enter additional disks as required.

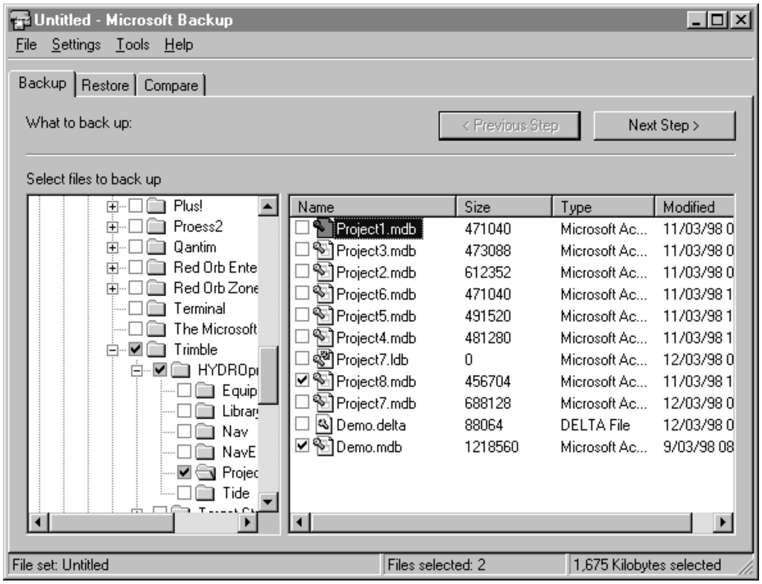
This utility also includes a Restore option, which restores backup files to their original state and location.

This utility is ideal for copying projects from one HYDROpro computer to another.

The following instructions give you an outline of how to use the Backup and Restore options to download projects from hard disk to floppy disk and back to hard disk. For details on this utility, please refer to the Microsoft Help.

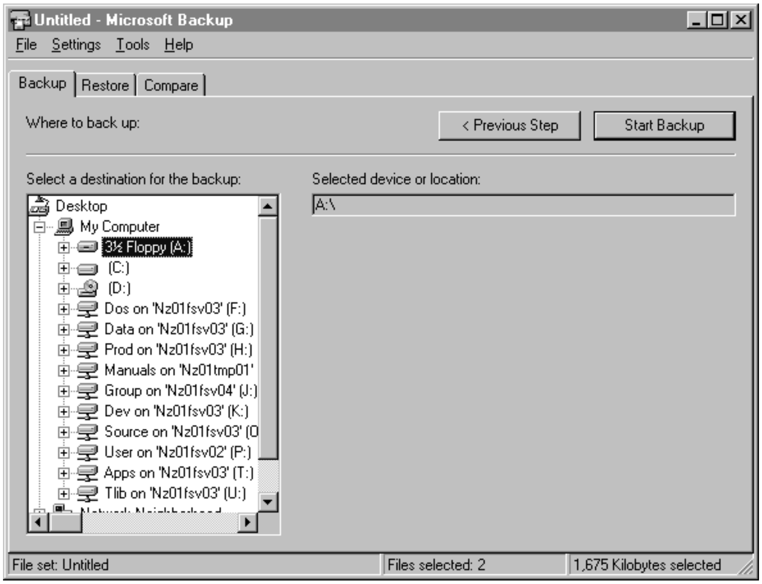
To back up a project:

1. The Microsoft Backup software can be found in Windows 95 under System Tools. From the *Start* menu select *Programs* / *Accessories* / *System Tools* / *Backup*. The following dialog appears:



2. Select the *Backup* tab and expand the tree, in the left side of the window to the HYDROpro Projects directory.
3. Select the Project or projects (database files) you want to back up. To do this, select the adjacent check boxes.

4. Click **Next Step >** and select where to back up. To backup to floppy disks first make sure you have inserted a floppy disk, then select 3½ Floppy [A:]:



5. Click **Start Backup**.

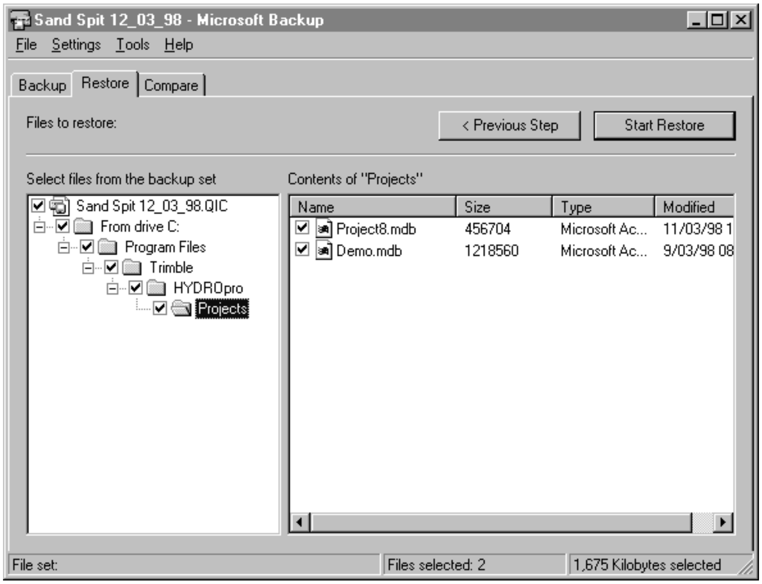
6. Enter a backup set Label (a name for the backup file) and click **OK**.

7. Follow the instructions to insert disks as required. Mark your disks to keep them in order.

To restore a project:

Restore returns the backup file to its original state and location, if necessary, setting up the original directory structure.

1. The Microsoft Backup software can be found in Windows 95 under System Tools. From the *Start* menu select *Programs* / *Accessories* / *System Tools* / *Backup*.
2. Select the *Restore* tab.
3. Insert the ***last*** of your backup floppy disks and select Floppy [A:].
4. Select the Backup file (*.qic) by highlighting and click **Next Step >**. The following dialog appears:



5. Expand the tree in the left side of the window until the Projects folder is displayed.
6. Double-click to open the folder.

7. Select the required project check boxes in the right side window and click **Start Restore**.

   You are instructed when to change disks until the restore process is complete.

11.5.2 Windows 2000

As part of the Windows 2000 there is a utility called Backup. This, in essence, does the same as the Microsoft Backup utility for Windows 95. However, it does have several other useful options. These additional options include:

- creating an emergency repair disk to help repair system files should they get erased or corrupted.
- copying the computer's system state (registry settings, boot files, and system files).
- scheduling regular automated backups.
- storing backups on either FAT or NTFS volumes.

To use backup on Windows 2000 you must have administrator or backup operator rights.

You can find this utility in *Start / Programs / Accessories / System Tools*.

11.6 1PPS (1 Pulse per Second) Computer Interface

Figure 11-4 shows the standard configuration of 1PPS Interface, Coaxial cable and 4000DSi.

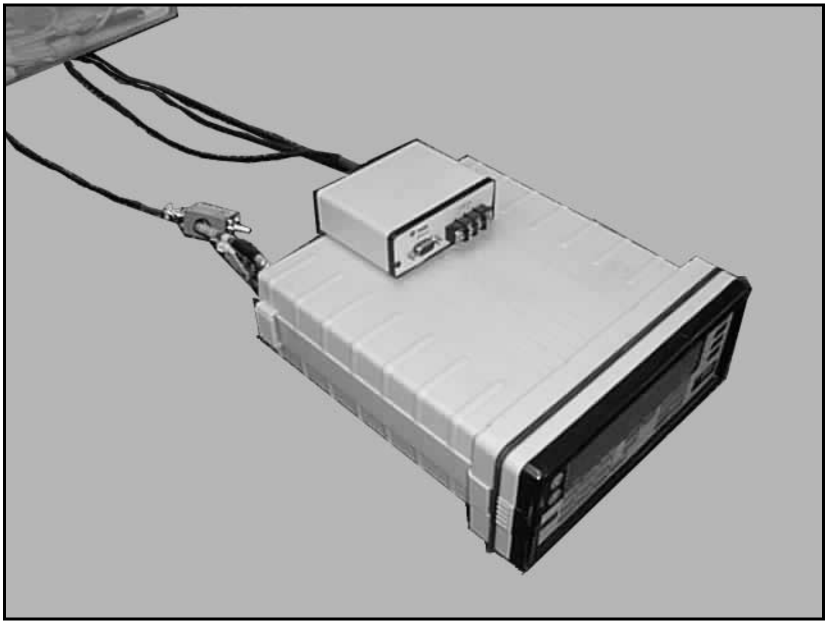


Figure 11-4 1PPS Computer Interface

Part Number: 29529-00

11.6.1 Overview

GPS receivers such as the 4000Dsi and 7400Dsi output a precise Pulse Per Second to mark the exact second interval. This pulse is not in a form suitable for a computer running the Navigation software to use so this interface box converts the short pulse to a change in status (from hi to low, then vice versa) of the CTS line. The receivers also output an ASCII Time Tag (RS232) which precedes the 1PPS and is required in the Navigation software.

The HYDROpro software will use this device to allow the computer clock to be synchronized with UTC time or exact local time. It is also an excellent way to make sure that precise time stamping of data when recording. The Navigation software will also use it to determine the latency of the GPS position.

11.6.2 Features

- Interfaces to the 4000DSi or 7400DSi receivers for use with HYDRO for precise time control.
- To be used if you need to synchronize the PC clock to the GPS time standard
- To be used if you require the exact Latency when using DGPS or RTK positioning (or any service with GPS time tags).
- Converts the GPS 1PPS to a signal that a PC running HYDRO can use (it changes the state of the CTS line each second)
- Can be powered by the GPS receiver
- Supplied with the coaxial cable to connect into the Aux ‘pigtail’ (part number 16454)
- Simple installation

A Troubleshooting

This appendix lists common problems new users may encounter when trying to use the Navigation software.

A.1 Raw Data Test Dialog Remains Blank

Symptom

No data appears in the *Raw Data Test* dialog when checking communications between the computer and sensor.

Solutions

- Confirm that the sensor is turned on and outputting data.
- Confirm that the cable between the sensor and computer is connected, wired correctly, and is not damaged.
- Confirm that the correct com port has been specified.
- Confirm that the com port is working.

The sensor may require prompting from the Navigation software. Use the *Equipment Monitor* real-time display to test while online.

A.2 Data Appears Corrupted/Garbled in the Raw Data Test Dialog

Symptom

Data appears as random characters in the *Raw Data Test* dialog, instead of sensible ASCII strings.

Solution

Check that the communication parameters set on the sensor match in the Navigation software.

A.3 No Data Appears in the Real-Time Displays

Symptom

No data appears in any of the real-time displays.

Solutions

- Check A.1 and A.2 solutions.
- Confirm that the Navigation software is online.
- Confirm that the sensor is not in ‘time out’ mode.
- Confirm that the string sent from the sensor matches that documented in this manual.

A.4 Data Appears in the Real-Time Displays but is Incorrect

Symptom

Incorrect data appears in the real-time displays.

Solutions

- Confirm the sensor is outputting data in the correct units (refer to documentation for specific device in this manual or in the Readme.doc file).
- Confirm that any units set in the equipment custom properties dialog match what the device is outputting.

A.5 Intermittent Data Received on Com Port

Symptom

Sporadic data is received on the com port, which may or may not be corrupted.

Solution

- Confirm that the personal computer does not have a conflict on that particular com port. Commonly ports 1 and 3, and 2 and 4 can conflict.

  In Windows 95 you can check for a conflict on a port. To do this, open the Windows Control Panel and select *System* / *Device Manager* / *Ports* (com and LPT). Select the problem port and select the *Resource* tab—this will advise you of any conflicting devices. You must resolve the conflict or avoid using one of the conflicting ports.

A.6 Sensor String Unsupported

Symptom

Navigation software does not support your sensor’s string.

Solutions

When manufacturers have deviated from the documented format Trimble recommends that you contact them and get the string corrected.

Trimble may be able to modify/create an equipment handler to support your sensor. If this is to be done Trimble requires a capture file of the data from the sensor accompanied with a full explanation of the string. Also document the fields you expect to be supported.

A.7 Security Key Not Detected on Personal Computer

Symptom

Laptop/personal computer does not recognize the HYDROpro security key on the parallel port.

Solution

Some laptops/personal computers are not compatible with the security key. The security key manufacturers have re-engineered the security key to overcome this problem. To arrange to get your security key replaced, please contact your Trimble dealer.

A.8 Equipment Handlers Not Appearing in Equipment Configuration Wizard

Symptom

After upgrading the Navigation software or downloading equipment handlers from the World Wide Web, equipment handlers no longer appear in the equipment configuration wizard.

Solutions

- Confirm that the equipment handlers are installed on your computer. By default, they are located in C:\Program Files\Trimble\HYDROpro\Equip.
- Confirm that the equipment handlers are compatible. Generally the equipment handlers should have the same date as the Navigation.exe file. For equipment handlers that have been downloaded from the web please check the accompanying text file for details on what Navigation software version it is compatible with.

A.9 General Protection Fault

Symptom

General Protect Fault message appears when trying to run HYDROpro on some IBM personal computers.

Solution

Some IBM personal computers have been shipped with a corrupt MDAC file. Manually install the MDAC file from the HYDROpro CD.

A.10 Lines Not Appearing on the Plan View Map, Echo Sounder Trace, or Offline Bar Real-Time Display

Symptom

Lines, guidance objects, and/or DXF details do not appear on the *Plan View Map, Echo Sounder Trace, or Offline Bar* real-time display.

Solution

This problem has been experienced on some Compaq laptops. This is a Compaq driver problem.

Generally, these problems have been experienced when using a colour setting of 256 colours. Try setting your computer to 16-bit colour. Remember to restart your computer when changing your colour setting.

If this does not resolve your problem please contact your Compaq supplier for alternative graphics drivers.

A.11 The Plan View Map Real Time Display Freezes

Symptom

The *Plan View Map* real-time display freezes and does not continue to update.

Solution

This problem has been experienced on some Compaq laptops. This is a Compaq driver problem.

Generally, these problems have been experienced when using a colour setting of 256 colours. Try setting your computer to 16 bit colour. Remember to restart your computer when changing your colour setting.

If this does not resolve your problem please contact your Compaq supplier for alternative graphics drivers.

A.12 Project Database Files Become Excessively Large

Symptom

Project database files remain large, even after data has been deleted from the project.

Solution

Microsoft Access has a tool called *Compact Database*. Open your project in Microsoft Access and select *Tools / Database Utilities / Compact Database*.

This will rearrange how a fragmented database is stored on disk. This generally results in reduced database file size and may improve performance.

A.13 Rebuilding Databases

Symptom

Project database has been corrupted (for example, due to a power failure) and cannot be opened by the Navigation or NavEdit software.

Solution

The Windows operating system provides a utility for rebuilding databases.

Open the Windows Control Panel and double-click ODBC (32 bit) to open the *ODBC Data Source Administrator* dialog.

Note – There are slight variations on where the ODBC driver information is located on the various Windows operating systems. Please refer to your operating systems online Help for the correct ODBC location.

The *ODBC Data Source Administrator* dialog contains various data sources linked to specific drivers. It is more than likely that there will be a HYDROpro data source in the list linked to the **Microsoft Access Driver (*.mdb)**. There may be several other sources linked to this driver.

If there are no data sources linked to the Microsoft Access Driver (*.mdb) you will need to create one:

1. Click **Add** in the *ODBC Data Source Administrator* dialog.

   This *Create New Data Source* dialog appears.

2. Select the Microsoft Access Driver (*.mdb) (the version should be 4.00.4202.00 or later) and click **Finish**.

To repair the database:

1. Highlight one of the data sources linked to this driver and double-click it.

   The *ODBC Microsoft Access Setup* dialog appears

2. Click **Repair**.

3. Locate the corrupted project and click **OK**.

   Once the file has been repaired a message is displayed stating the success of the repair.

A.14 PC Clock Looses Time and Displays Stop Updating

Symptom

On some laptops (Toshiba Satellite 2510, but may occur on other laptops) the PC clock loses large amounts of time when the Navigation software is online for long periods. Also, some displays almost completely stop updating.

Solution

This problem is resolved by simply altering the power save mode. Change the setting to CPU/ON to overcome this problem.

A.15 Software Crashes

Symptom

In the event that the software repeatedly crashes during a certain operation, please document all the steps that led to the software failure and contact your local Trimble dealer. When detailing the problem please include details about your PC, operating system, and any other applications running at the same time. To help Trimble further isolate the problem we have included a debug component on the HYDROpro installation CD.

Solution

1. Copy Navigate.dbg and Navigate.map from the Util folder on the installation CD to C:\Program Files\Trimble\HYDROpro\Nav (the folder where the Navigate.exe resides).
2. Repeat the crash.

   This time when the crash occurs a debug dialog appears providing some details of the ‘assert’. At the same time an error file will be created in your Nav folder called Navigate.rpt.

3. Please forward the error file with the rest of the information to your Trimble dealer. The details contained in the error report file provide Trimble with an insight into the problem.

A.16 Security Key Not Recognised

Symptom

One or more HYDROpro modules display a message stating that the security key cannot be detected.

Solution

There are several possible solutions to this problem.

- It may be due to a faulty security key. Trimble received a batch of security keys from our manufacturers that were faulty. It seemed that the keys would work correctly for a while and then stop working.

  If you suspect that this has occurred, please advise your local Trimble dealer of the security key serial number and the approximate date when it was shipped. If this is the problem, a replacement security key will be provided.

- Your computer may be checking the security key too quickly. Try the tip mentioned in section 2.4.3 of the Navigation Software User's Guide.
- The security key device driver may need to be updated. The updated drivers are contained in ssddriv.zip in the Util folder on the HYDROpro Installation CD. This zip file contains Readme files on how to install the updated security key drivers. These may overcome the problem you are experiencing.

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Reader Comment Form

HYDRO*pro* Navigation Technical Guide **June 2001**
P/N 34816-00-ENG **RevisionA**

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____

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