

SeaKing SONV3 Bathy System

Operator Manual

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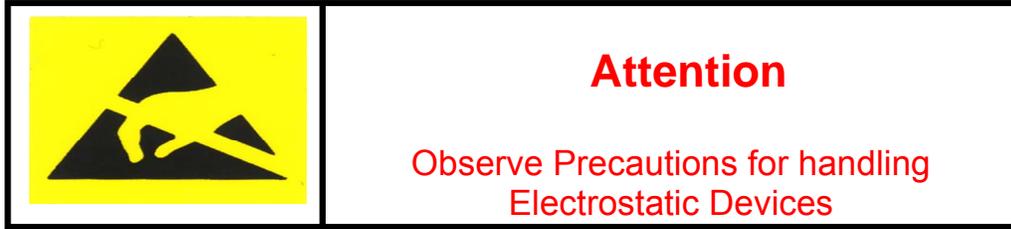
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Handling of Electrostatic-Sensitive Devices



Caution

Handling of Electrostatic-Sensitive Devices

Certain semiconductor devices used in the equipment are liable to damage due to static voltages.

Observe the following precautions when handling these devices in their unterminated state, or sub-units containing these devices:

- Persons removing sub-units from any equipment using electrostatic sensitive devices must be earthed by a wrist strap via a 1M Ω resistor to a suitable discharge reference point within the equipment.
- Soldering irons used during any repairs must be low voltage types with earthed tips and isolated from the Mains voltage by a double insulated transformer. Care should be taken soldering any point that may have a charge stored.
- Outer clothing worn must be unable to generate static charges.
- Printed Circuit Boards (PCBs) fitted with electrostatic sensitive devices must be stored and transported in appropriate anti-static bags/containers.

F110.0

Warranty Policy

Tritech International Limited herein after referred to as **TIL**

TIL warrants that at the time of shipment all products shall be free from defects in material and workmanship and suitable for the purpose specified in the product literature.

The unit/system warranty commences immediately from the date of customer acceptance and runs for a period of 365 days. Customer acceptance will always be deemed to have occurred within 72 hours of delivery.

Note: Any customer acceptance testing (if applicable) must be performed at either TIL premises or at one of their approved distributors unless mutually agreed in writing prior to despatch.

Conditions:

These include, but are not limited to, the following:

- 1 The warranty is only deemed to be valid if the equipment was sold through TIL or one of its approved distributors.
- 2 The equipment must have been installed and commissioned in strict accordance with approved technical standards and specifications and for the purpose that the system was designed.
- 3 The warranty is not transferable, except or as applies to Purchaser first then to client.
- 4 TIL must be notified immediately (in writing) of any suspected defect and if advised by TIL, the equipment subject to the defect shall be returned by the customer to TIL, via a suitable mode of transportation and shall be freight paid.
- 5 The warranty does not apply to defects that have been caused by failure to follow the recommended installation or maintenance procedures. Or defects resulting from normal wear & tear, incorrect operation, fire, water ingress, lightning damage or fluctuations in vehicles supply voltages, or from any other circumstances that may arise after delivery that is outwith the control of TIL.
(**Note:** The warranty does not apply in the event where a defect has been caused by isolation incompatibilities.)
- 6 The warranty does not cover the transportation of personnel and per diem allowances relating to any repair or replacement.
- 7 The warranty does not cover any direct, indirect, punitive, special consequential damages or any damages whatsoever arising out of or connected with misuse of this product.
- 8 Any equipment or parts returned under warranty provisions will be returned to the customer freight prepaid by TIL
- 9 The warranty shall become invalid if the customer attempts to repair or modify the equipment without appropriate written authority being first received from TIL.
- 10 TIL retains the sole right to accept or reject any warranty claim.
- 11 Each product is carefully examined and checked before it is shipped. It should therefore be visually and operationally checked as soon as it is received. If it is damaged in anyway, a claim should be filed with the courier and TIL notified of the damage.

Note: TIL reserve the right to change specifications at any time without notice and without any obligation to incorporate new features in instruments previously sold.

Note: If the instrument is not covered by warranty, or if it is determined that the fault is caused by misuse, repair will be billed to the customer, and an estimate submitted for customer approval before the commencement of repairs.

F167.1

Safety Statements



Caution!

Throughout the manual certain safety or operational related comments and requirements will be highlighted to the operator by indications identified by the adjacent symbol and text warning.

Technical Support

Contact your local agent or **Tritech International Ltd**



Mail

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Email

support@tritech.co.uk

Web

www.tritech.co.uk

An out-of-hours emergency number is available by calling the above telephone number

If you have cause to use our Technical Support service, please ensure that you have the following details at hand **prior** to calling:

- Serial Numbers of SEANET SCU and all scanning / profiling heads
- Software Revision Number
- Fault Description
- Any remedial action implemented

Due to the expansion of equipment capabilities and the fact that new sub-modules are continually being introduced, this manual cannot detail every aspect of the operation.

The name of the organisation which purchased this system is held on record at *Tritech International Ltd*. Details of new software and hardware packages will be announced at regular intervals. Depending on the module, free upgrades will be offered in keeping with our policy of maintaining the highest levels of customer support.

Tritech International Ltd can only undertake to provide software support for systems loaded with Operating System and Tritech Seanet software in accordance with the instructions given in the System Re-installation section of this manual. It is the customers responsibility to ensure the compatibility of any other package that they may choose to load unless with the prior consent of *Tritech*.

INTRODUCTION

The SEAKING700 Series of Bathymetric and Oceanographic Sensors are available in the following configurations:-

SEAKING700	Precision Depth Sensor
SEAKING701	Precision Depth Sensor and Altimeter
SEAKING702	Conductivity & Temperature Sensor
SEAKING703	Precision Depth Sensor with Conductivity & Temperature Sensor
SEAKING704	Precision Depth Sensor with Conductivity & Temperature Sensor and Altimeter
SEAKING705	Conductivity & Temperature Sensor and Altimeter

The units are comprised of combinations of the four high resolution sensors listed below.

Tritech PA500/6-S Precision Altimeter
 Paroscientific Digiquartz Precision Depth Sensor
 Falmouth Scientific Conductivity Probe
 Falmouth Scientific Temperature Sensor

The SEAKING700 range of sensors are designed to be integrated along with Tritech ST Sonar and Profiling heads to form a fully integrated oceanographic system, controlled from a SEAKING SCU Surface Control Unit.

Alternatively, the bathy can be operated as a stand-alone device and operated from either a SeaKing SCU or a dedicated Bathy Display and Control Unit (if applicable, see Bathy DCU Section).

For the purpose of this manual we relate any statements for the Bathymetric sensors to the SEAKING700 Sensor. These statements will also be relevant to the SEAKING701, SEAKING702, SEAKING703, SEAKING704, and SEAKING705 sensor units unless otherwise stated.

The SEAKING700 sensors are mounted on the endcap of a hard-anodised aluminium tube assembly. The electronics are contained within the body tube in dry air at one atmosphere pressure, and has a hard-anodised coating. The endcaps are retained by a threaded plastic ring. The conductivity sensors when fitted are protected by a nylon cage assembly.

All the SEAKING700 units use a similar mechanical and PCB arrangement, but with different sensors fitted as required. The depth, conductivity, and temperature sensors, along with the CPU PCB and its EPROM form a calibrated set. Therefore it is not possible to swap the boards or sensors between different SEAKING700 units without a re-calibration and revised software fitted.

A waterblock is fitted onto the connector endcap, on to which a 6-way underwater connector is secured with four cap screws. This connects the SEAKING700 unit to the system control unit (SEAKING SCU) and power source (18-36v dc). If the altimeter is fitted then a second waterblock and connector assembly are fitted, which powers and communicates with the altimeter. All connectors and waterblocks are sealed with an O-ring.

The Precision Altimeter PA500/6-S supplied with the system is configured specifically for the SEAKING700 unit, and cannot be connected into a Tritech survey system on its own. A cable is supplied which connects the altimeter to the SEAKING700 unit with a 6-way underwater connector on each end. This allows the PA500 Altimeter to be mounted separately in a suitable position.

SEAKING700 MECHANICAL INSTALLATION

The SEAKING700 Bathy Unit is supplied with their own penetrator/connector and a length of polyurethane jacketed cable (1 metre). Depending on the specification of the system, this cable will either need to be terminated to a suitable connector appropriate to the operators equipment, or may be supplied with a cable assembly to one or more additional connectors.

The connector may be disconnected from the unit by unscrewing the four securing Allen screws and removing the connector from the waterblock fitted to the endcap, do not remove the waterblock. Whilst the connector is removed from the unit, the blanking plugs supplied should be fitted to prevent the ingress of dirt or moisture.



Caution!

It is advisable that the conductivity sensor head should have a free radius around the head of 10cm minimum. Any objects that lay within this diameter must be stable(electrically), either a fixed dielectric or conductor, and its position fixed in relation to the sensor. Locate the sensor head away from such items as motors, sense coils, cameras, etc., to ensure accurate readings.

The unit is calibrated when mounted with the pressure inlet is vertically upwards (connectors downwards). It is possible to mount the unit in any orientation by applying an orientation zero offset - see system check-out section of manual.

The SEAKING700 unit should be secured by clamping on the cylindrical body section such that the sensor head is in a good water flow and not shielded. Any metallic clamps should be electrically insulated from the bodytube by means of rubber or plastic strips or mount brackets of at least 3 mm thickness and extending at least 3 mm beyond the clamp boundary to reduce any galvanic corrosion effect. Non-metallic clamps are preferable : if metallic clamps are used (especially if they are other than aluminium) they should be painted or lacquered with at least two or three coatings. Brass or bronze materials should be avoided unless they have an aluminium content as their copper content causes serious corrosion problems when in proximity to aluminium components.



Caution!

Although the SEAKING700 Bathy units are rugged, they should be handled with care, particularly the connector and sensor ends. It is strongly recommended that the unit is positioned so as to protect it from any impact damage.

Take care not to block the depth sensor inlet hole when mounting the SEAKING700 and SEAKING701 units. The SEAKING702, 703, 704, and 705 units have a cage fitted to protect the conductivity sensor and therefore prevent the depth sensor inlet from being covered.

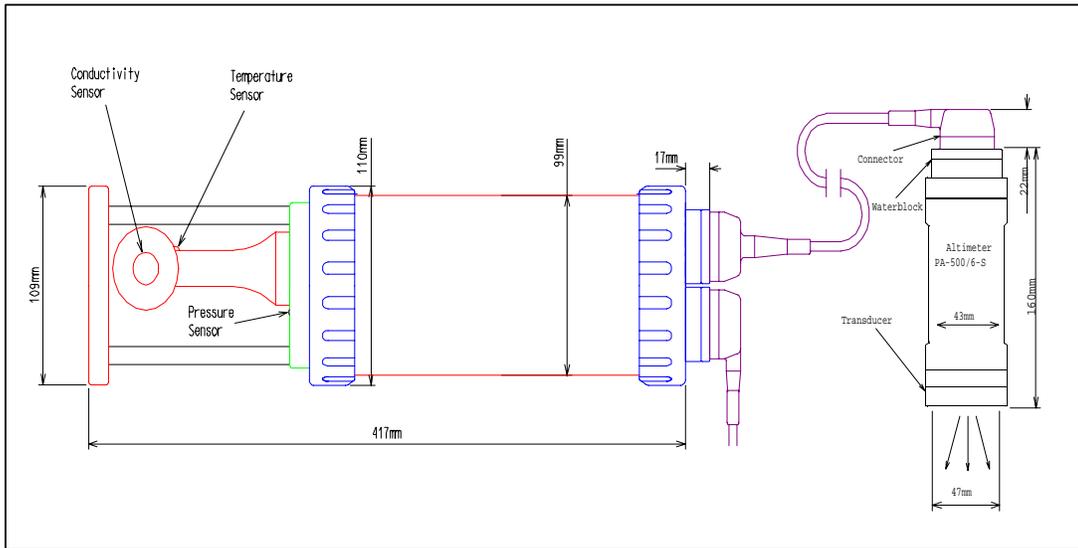


Fig. 1.1 SEAKING704 Bathing Unit Layout

SEAKING700 ELECTRICAL INSTALLATION

The SEAKING700 Bathing Unit is supplied with its own penetrator/connector and a length of polyurethane jacketed cable (1 metre). Depending on the specification of the system, this cable will either need to be terminated to a suitable connector appropriate to the operators equipment, or may be supplied with a cable assembly to one or more additional connectors.

The connector may be disconnected from the unit by unscrewing the four securing Allen screws and removing the connector from the unit's waterblock, do not remove the waterblock. Whilst the connector is removed from the unit, the blanking plugs supplied should be fitted to prevent the ingress of dirt or moisture.

The SEAKING 700 Series Bathing units are designed to work from a smoothed DC power supply of 18v-36V DC @ 250mA per head (Absolute Maximum 30v DC). If a switched mode power supply is used it is imperative that a good quality filter (using both inductive and capacitive elements) is used for suppressing switch mode spikes which may affect the AGC circuit within the altimeter.

If using a rectified transformer PSU, the output of the PSU must have a filter capacitor of not less than 470µF, for each unit being powered. If an unregulated PSU is used, then make sure that the voltage value measured at the unit is in the range 18-36V DC, in power on/off and running conditions. If powering the unit(s) down a long lead or umbilical, the maximum recommended loop resistance of the power line must not exceed 10Ω for one unit, 5Ω for two units, and 3Ω for three units.



Caution!

Never try to make the system units work down a long cable by increasing the PSU output voltage above 36V DC.

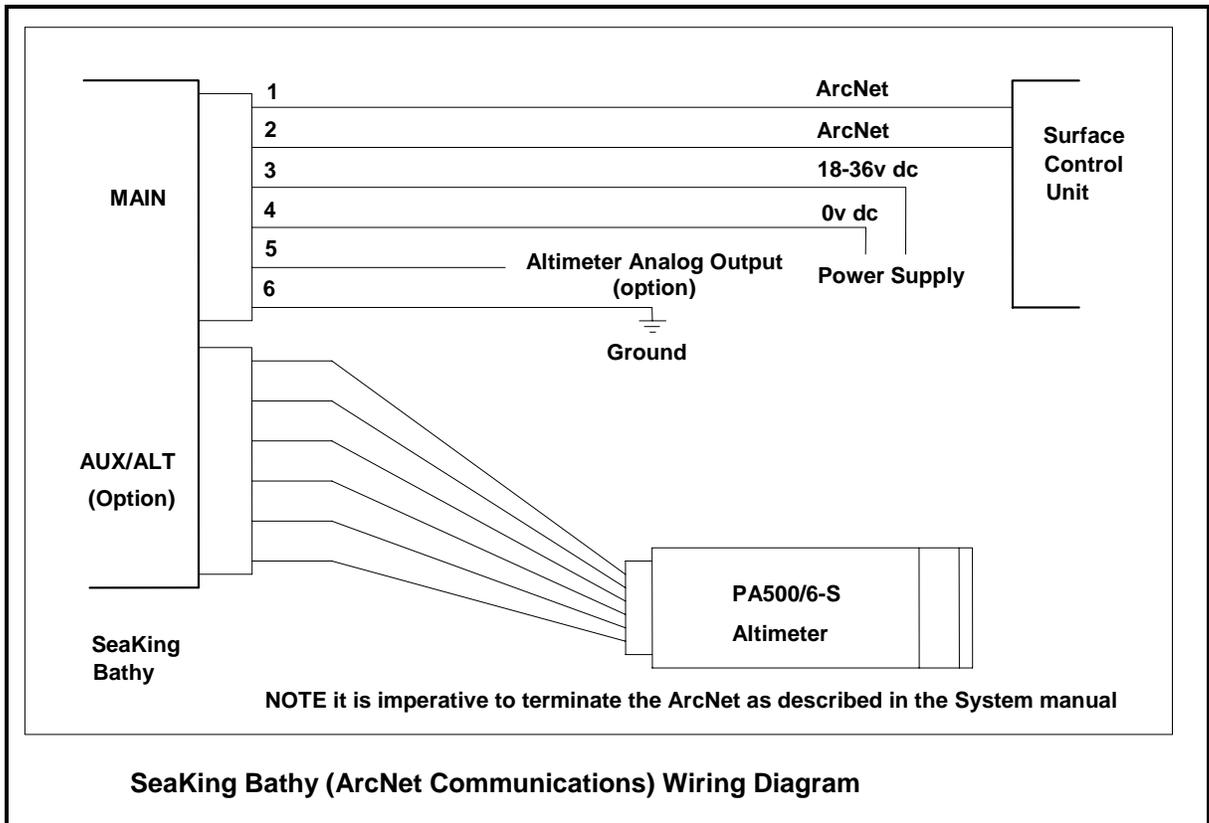


Fig. 1.2 SEAKING700 Series Bathy ArcNet Communications Wiring Schematic Diagram

SEAKING700 SUBSEA INTERCONNECT CABLING

The Standard Underwater Connector supplied is 6 way, the wiring code is shown below.

NOTE :



Caution!

The numbers shown relate to the schematic diagram, (not a DIN style format).

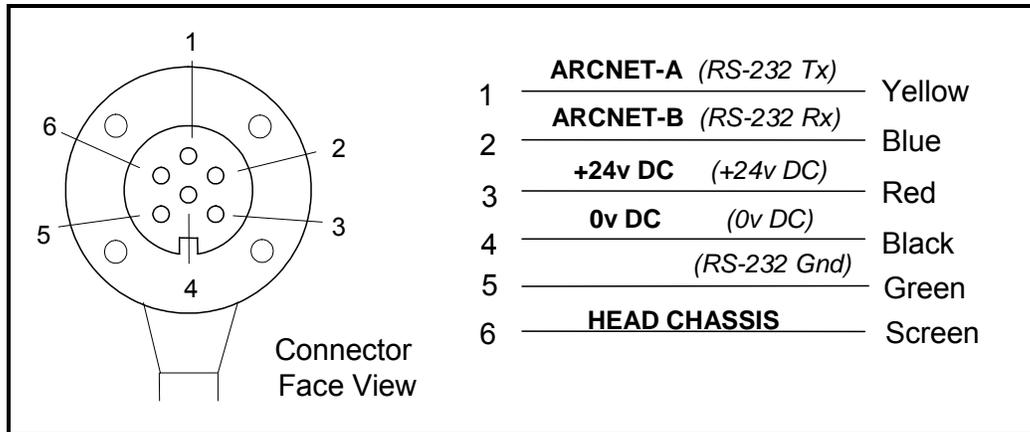


Fig 1.3 Tritech 6-Way Underwater Connector - Wiring Configuration

Pin-outs for optional single-node RS-232 communications are shown in italics.

See the “SeaKing Serial Communication Manual” for more information on RS232 configuration and baud setup.



Caution!

Customer specified connectors may be used as an option. The pin numbering and the orientation may be different - refer to your specific customer supplement for details.

GROUND FAULT MONITORING EQUIPMENT

Certain ground fault monitoring equipment can cause galvanic corrosion problems with the SEAKING700 units, particularly those which use pulsed dc or ac.

This galvanic corrosion is caused by an ac leakage path [i.e. pulsed dc acting as ac when stepping from 0V to whatever dc level it tests for leakage] between the units 0 Vdc rail and vehicle ground, such as the Bathy connector screen may be connected to.

The power supply within SEAKING subsea heads includes an electrically isolated DC-DC converter front end, There is a small capacitive connection to the sonar chassis which should not noticeably affect any impressed current ground fault indicator (GFI) equipment

SEAKING700 UNIT COMMUNICATION CONFIGURATION

The SEAKING700 ArcNet communications is described in the SeaKing System manual. It is imperative to follow the recommendations for termination of the twisted pair.

SEAKING700 UNIT SOFTWARE

Each SEAKING700 unit has software for its operation downloaded into Flash RAM from the SeaKing SCU by a SETUP program. Occasionally if new software has been issued it may be necessary to reprogram the unit following the procedures described in the System Manual.

All system calibration coefficients are held within the “user data” which can only be accessed for edit from the V3setup utility. You will need the unit specific calibration certificate in order to check the co-efficients are correct. The sensor serial number and coefficients may be viewed but not altered by the customer in the SONV3 program.

SEAKING700 SERIES BATHY OPERATING NOTES

Screen Display and Controls

The Main Areas of the Bathy Display are identified below:

The screenshot displays the 'Bathy Panel' software interface. On the left, a data table shows parameters such as Depth (419.31m), Altitude (1.210m), VDS (1475.0 m/s), Mean Density (1.027), Baro (1000 mbar), Temp (16.6 °C), Local Density (1.001), Cond (0.2 mS/cm), and Sal (0.1 pts/1000). The central area features a bathymetry profile graph with depth on the y-axis (0 to 1092m) and distance on the x-axis (0 to 780m). The right side contains a control panel with three analog-style gauges, buttons for Menu, Log, Hold, and various function keys (CYC, EXP, ZOOM, RES, KHE, REV). A status bar at the bottom shows 'Aif Bad', 'Rat N/A', '66', '04-Jun-1998 16:16:55', 'Log Percent', and 'Max'.

Labels and callouts in the image:

- 'Tools' menu (Spanner Icon)
- Display Header
- Bathy Pause
- RAT controls (Not functional for Bathy)
- Screen Freeze
- 'Log' Options
- 'Menu' Options
- Cursor measurements from Profiles graph. Click on (highlight) box to enable.
- Bathy data display boxes. 'Velocity of Sound', 'Density' and 'Baro' display are either Manual (System user values, setup within the Tools menu) or Auto (from Bathy CT and Barometer). 'Density', 'Conductivity' and 'Salinity' data displayed if CT probe installed.
- Bathy Profile Graphs. This window is enabled from the Tools menu; Installation - 'Profile Plot'.

Screen Display Boxes

- The Mean Density screen display box will be either;

- 1) The **System Density** (default factory = 1.027).
- 2) The **Auto Density** from the CT measurements (taken by Conductivity and Temperature probe).

If a CT probe is not installed on the Bathy sensor unit (i.e. SK701 unit) then the System Density figure is adopted.

If a CT probe is is installed (i.e. SK704 unit) then the Local Density is calculated from local Conductivity and Temperature measurements and the Mean Density through the water column is displayed.

Note that if a CT sensor is installed, the System Density figure would be adopted and displayed if;

- a) *Either the measured Conductivity or Temperature is out of range.*
- b) *The CT measurements are invalid or not present; perhaps due to failure of CT probe / Sensor PCB or a bad wiring connection.*

The System Density value should be manually entered / checked when on deck. If a good "average" density figure is known for the current location then this should be used. The default factory setting is normally 1.027 and should be used if a good average value is not known.

- The Velocity of Sound (VOS) screen display box will be either;

- 1) The **System VOS** (default factory = 1475m/s).
- 2) The **Auto VOS** from the CT measurements (taken by Conductivity and Temperature probe).

Similarly to Density, the System VOS figure is displayed in the screen display box if valid CT measurements are not present.

From valid CT measurements, the VOS displayed on the screen is a local measurement at all times.

DENSITY AND VELOCITY OF SOUND (VOS) PROFILING

SeaKing software V1.26 does not have the facility to profile Density or Velocity of Sound calculations in order to provide a running update of their Mean values during Bathy descent.

SeaKing surface software ("SONV3") version V1.50 and beyond does include facility to profile Mean Velocity Of Sound and Mean Density. This function provides a running mean update during bathy descent and this data is logged to look-up table. Details now follow...

Note: The displayed VOS at the surface will always be the measured value local to the sensor.

Format of Text Files for Bathymetry Profiling

(Look-Up Table for Mean Density and Mean Sound Velocity)

During descent, calculations and measurements taken by the Bathymeter are stored in a look up table at index intervals of 1psi. This is for the purpose of maintaining a running calculation of Mean Density and Mean Velocity of Sound during deployment down to operating depth.

The profile should be started at the very start of the dive. More information concerning this can be found further on.

If an index interval is missed, interpolation is applied to the preceding and the next index entries for Mean Density and Mean Velocity of Sound data. Using Mean V.O.S. for example;

***5psi = 1472.2 m/s
6psi = No entry
7psi = No entry
8psi = 1472.8 m/s***

The missed entries will be filled by interpolation as...

***6psi = 1472.4 m/s
7psi = 1472.6 m/s***

The look up table is a delimited text file that can be imported into a spreadsheet or similar for post processing.

If measurements for Mean Density and Velocity of Sound are not available or unreliable for any reason, it is possible to load a saved profile from a previous dive (at the same geographical location) and this will be used during descent in place of real-time measurements from a CT probe.

More details on Loading/Saving and general operation of these Bathy Profiles can be found later in the 'Bathy Setup Tools Menu' section of this manual.

The structure of the delimited text file used to maintain the recorded Bathy Profile has been changed in Version 1.50 of the "SONV3" SeaKing software. This was to include an additional field (column) for recording Mean Velocity of Sound.

In earlier software versions this would have had to be post processed from each of the Local column Velocity of Sound calculations that are also stored in the Profile.

Consequently, the extension of the text file has been changed to reflect this alteration to the structure. In **SONV3 V1.50** (onwards), the Bathy Profile is stored in a delimited text file with the **.BP3** extension. Each column is space delimited and has a fixed width of 14 characters.

Line 1 of the text file shows the file type (.BP3) and number of stored records (2979 records in example below) along with the column Ids (introduced V1.52);

BP3 2979	Loc_Dens	Mean_dens	Psi	Temp	Salinity	Loc_VOS	Mean_VOS	Depth(mm)
----------	----------	-----------	-----	------	----------	---------	----------	-----------

Lines 2 onwards stores the profile data records, the structure of which is as follows;

Index	Local density	Mean density	Pressure Interval (Psi)	Temp. (CT probe)	Salinity	Local V.O.S.	Mean V.O.S.	Depth (mm)
0	0.997780	0.997780	0.304001	22.05933	2.78E-02	1488.531	1488.531	205
1	0.997788	0.997788	1.304001	22.05298	2.78E-02	1488.516	1488.516	881
2	0.997788	0.997788	2.303986	22.05298	2.78E-02	1488.531	1488.523	1557
3	0.997791	0.997789	3.303986	22.05298	2.78E-02	1488.547	1488.531	2232
4	0.997795	0.997790	4.304016	22.05933	2.78E-02	1488.578	1488.543	2908
5	0.997803	0.997793	5.304016	22.05933	3.60E-02	1488.594	1488.553	3584

N.B. Software versions preceding V1.50 use the same structure as the above but excludes the “Mean V.O.S.” and “Depth” column. These files have the **.BAP** file extension.

.BP3 (and **.BAP**) files may be imported into a spreadsheet for further analysis or reporting.

BATHY SETUP TOOLS MENU

These Bathy Setup controls are automatically remembered if the Setup Tools menu is closed using the 'Save and Exit' button.

Click the Toolbar 'Spanner' Icon to access the setup form options (shown below).

Bath Setup Form

Installation Environment **Profiles** DQ Cal. CT Cal.

DQ Serial No. 0 CT Serial No. 0

Bathy Vertical Offset (mm) 0

Altimeter Vertical Offset (mm) 0

Bathy Zero (mm) 0

Screen Plots
 Scroll Plot Profile Plot

V4 Serial O/P
 Message : WINSON Update : 0.5sec

Cancel Save and Exit

Start/Stop/Load/Delete Profiles and configure Profile plot boundaries.

Display of Digiquartz and CT Probe Calibration Coefficients.

Click on any of five buttons to show new page. Red button text is current page.

Display of Digiquartz Depth Sensor and CT Probe (if installed) serial numbers.

Vertical offsets should be applied if reference point exists on vehicle for depth and altitude.

Required when bathy not mounted with connector down OR as matter of course when true barometric figure not known. Apply Bathy Zero value of magnitude that zeroes depth display before diving / entering water, following guidelines in Appendix 1.

Enable 'Scroll Plot' and 'Profile Plot' windows.

Button to select Serial 'V4' Output Message type; 'Winson Raw', 'Winson Processed', 'SeaKing Long', 'SeaKing Short' or UK94 type.

Button to select Update Rate of Serial 'V4' Bathy strings.

Bath Setup Form

Installation **Environment** Profiles DQ Cal. CT Cal.

Manual Settings

Local Gravity 9.81675

Latitude [degs] 57

Velocity of Sound [m/s] 1475.0

Mean Density 1.027

Baro Pressure [mbar] 1000

Manual / Auto

V.O.S. Man Auto

Density Man Auto

Barometric Man Auto

Cancel Save and Exit

Manual entry of site Latitude. Local Gravity is equated from this figure and has a bearing on pressure measurements and consequently depth calculation.

'Radio' buttons for display selection of 'Manual' System values or 'Automatic' values calculated from CT measurements (VOS, Density) and measured from barometer.

Manual entry of System values for V.O.S., Density and Barometric pressure. These values are adopted if CT probe and / or Barometer are not installed.

Start, Stop/Save & Load Profile:
Start – Will start recording to a new profile beginning at the current depth.
Stop/Save – Store recorded profile to text file.
Load – Load profile for re-use of CT data stored from a previous dive

Append to Loaded Profile:
 Appends data when descending below max. stored depth of a loaded profile.

Autosave profile:
 Default = disabled. If enabled, use with caution as saving to disk will stall the Bathy updates.

Plot Boundaries:
 Sets the Plot limits for the Profile Graph. N.B.

Operation of Profiles

1. Power up System when SeaKing700 Bathy connected and on deck

On power up, a Bathy profile will be opened for recording automatically.

Important: *If the Bathy has not been zeroed at this point (see “Bathy Pre-Dive Setup” section - later in this manual) this should first be performed and a new Profile then re-started by either a) Re-setting the Surface Unit, b) Clicking on **Start Profile** (shown in ‘Bathy Setup Form’ above).*

2. Starting a New Profile

At any point, a New Profile can be started by clicking on the **Profiles** tab page (shown above) and then pressing **Start Profile**.

Delete profile:
 Deletes a saved profile text file (.bp3) from the Disk Drive.

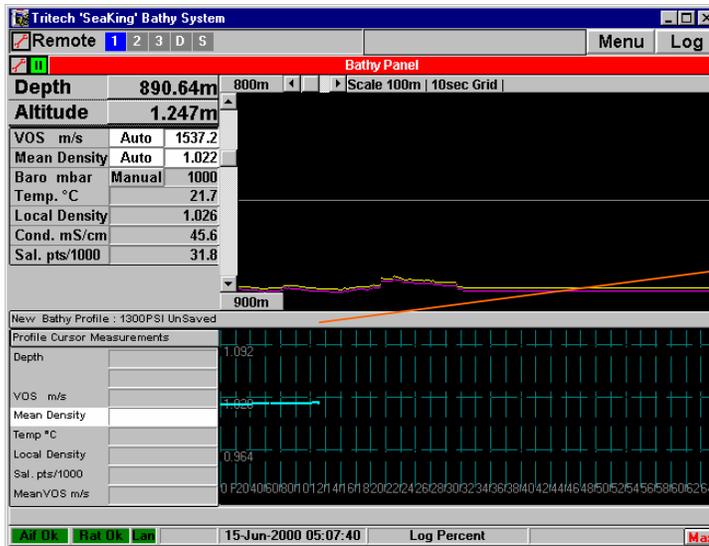


Caution!

The Profile should really be started immediately before the dive and after the Bathy has been zeroed. If a Profile is started when at depth, the Density and Sound Velocity entries up to that point will be filled in with the current measurements at the starting depth.

Back on the main display screen, the **Bathy Profile Caption Bar** will indicate that a New Profile has been started and also inform the user of the quantity of data recorded since last save (in PSI) – see **Fig 3.1**.

At any time, double-clicking on the Caption Bar will perform a quick save. The file will be named according to the current time and date, e.g. **I1259-29.bp3** is the designated filename for a file saved at **12:59** on the **29th** day of the month.



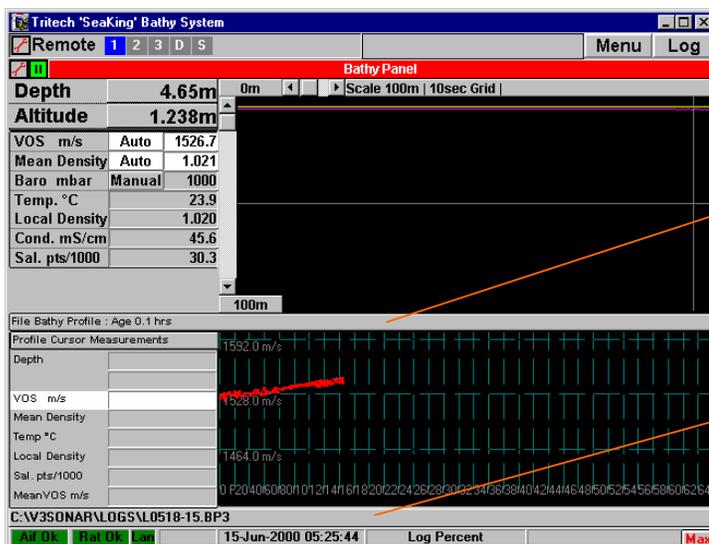
Bathy Profile Caption Bar:
When a Bathy Profile has been started (either automatically on power-up or by clicking on 'Start Profile') the Caption bar will indicate a New Profile has been started and also the quantity of data since last saved (as shown on example to left).
N.B. Double-Click on caption bar to quick save profile – note this may periodically stall the Bathy update.

Fig 3.1 Example of Caption Bar Status during new Profile recording

3. Stopping and Saving a Profile

It is very important to remember to save and therefore close off a recorded profile. Depending on the length of descent to the working depth, a profile can take several seconds to be saved to disk. **It is recommended that any saving of profiles be performed when the Bathy is NOT in descent** – the update of Bathy data will be periodically stalled during the save routine and this may result in areas where interpolation has to be used to fill in the missed intervals within the recorded profile.

When a Bathy Profile has been saved to file (.bp3), the **Bathy Profile Foot Bar** will indicate this by displaying the saved Bathy Profile filename. Also, the Bathy Profile Caption Bar will change status to display that it has been saved to File – *see Fig 3.2.*



Bathy Profile Caption Bar:
Indicating that the current Profile is from data stored on File.

Bathy Profile Foot Bar:
Indicating the Name of the Saved File

Fig 3.2 Example of Caption/Foot Bar Status when Profile Saved to File

4. Append To Loaded Profile

It is recommended that this control only be disabled when it is not desired to add to a saved profile (.bp3 file).

When this control is enabled it will allow for additional data to be appended to the currently loaded profile. Data will be appended when diving to a greater depth than the last (maximum) depth entry stored in the loaded profile.

The Bathy Profile Caption Bar will indicate that an append operation has been enabled and also inform the user the quantity of data unsaved (in PSI) – see Fig 3.3.

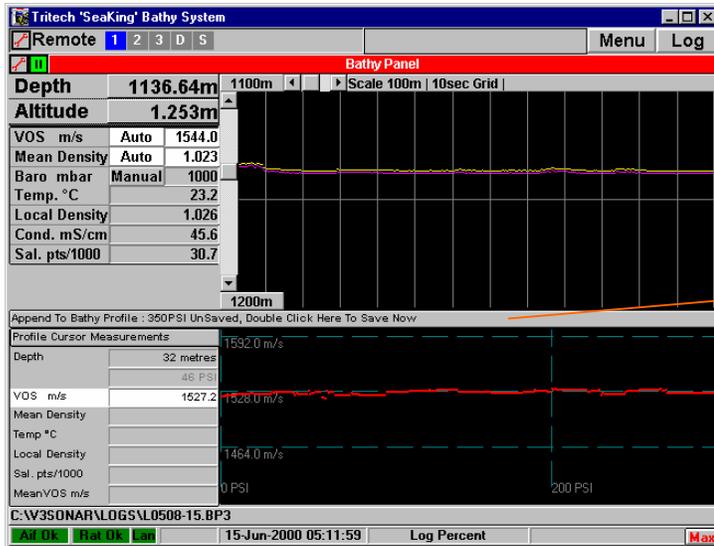


Fig 3.3 Example of Caption Bar Status when Append feature enabled

SYSTEM CHECKOUT

The SEAKING700 Unit heads can be checked for serviceability on the bench before undertaking any testing underwater. Before applying power to the unit, ensure that it is in physically good condition with no damage to the sensors or housing.

The units are calibrated prior to shipment and do not require any alterations whilst in service. The SEAKING SCU has a Setup menu for the Environment for the SEAKING700 which allows the input of the local barometric pressure (mbar) and the Specific Density of water being operated in (factory set to 1.027). There is also a Setup menu for position which allows the user to enter a Bathy zero offset and vertical offsets for the positions of the pressure sensor and altimeter.



Caution!

The zero offset can only be set after the correct barometric pressure has been set.

For new sensors the zero offset is nominally zero when the bathy is vertical with the pressure port up and must be adjusted for any other orientation. For re-calibrated sensors, calibrated offsets are shown for port up and port down on the re-calibration documents. Operators may prefer to set an exact zero on the surface rather than use the calibrated figures, but the offset should always be within a few centimetres of the calibration window. Further details are given in the set-up procedures and Appendix 1.



Caution!

The position and zero offsets affect the displayed data, but not raw data sent via the survey link.

When power is to the unit, the surface control unit (SEAKING SCU) will display the appropriate status messages to show that the unit is functioning. If the SEAKING700 is working correctly then the Status Box will display an OK message. The SEAKING SCU display will show temperature, conductivity, depth, altitude, speed of sound, salinity, and other data as required. If the SEAKING700 unit is fitted which only has a depth sensor, then only a depth value will be shown, the other data display boxes will remain blank. If a sensor in a unit fails or is faulty the display may show an INVALID message. The SEAKING700 can be paused during use.

The SEAKING700 unit will dissipate about 1 watt of heat, this should not cause any overheating problems when left running continuously in air or water.

REMOTE COMMUNICATION TO SEAKING SCU

If the SEAKING700 data output is to be controlled using Remote Communications (e.g. RS-232 on COM1) then this option requires to be enabled in the SEAKING SCU system Remote Setup Menu. Use of COM 3 or COM 4 is an option. The SEAKING SCU Remote Communications Manual (SeaKing V4) gives full details and examples of the data formats and protocols used.

MAINTENANCE OF THE SEAKING700

There are no user-serviceable parts in the SEAKING700 Bathy Units, and no components requiring routine maintenance other than cleaning.

It is recommended that unit be rinsed down with fresh water after each dive and especially if the unit is not going to be used for extended periods. Although the anodised aluminium and plastic components are very resistant to corrosion, using fresh water is a simple way of minimising the chance of corrosion.

The conductivity sensor should be cleaned to remove any build-up of dirt, oil, mud etc. Excessive build up in the centre section of the sensor may reduce sensitivity and result in a lowered conductivity measurement. These deposits on the conductivity sensor can be removed with a plastic bottle brush or similar.

Wherever possible, avoid any prolonged exposure to extreme climatic and weathering conditions to reduce any ageing effects on the components and connectors.

BATHY PRE_DIVE SETUP (ON DECK)

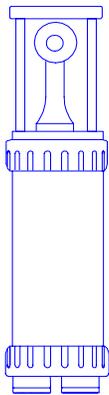
As follows...

In the Bathy Setup Tools-Environment menu

- 1) Enter / check **Latitude**.
- 2) Enter/check **System Density** ("Mean Rel. Density", default = 1.027).
- 3) Enter / check **System Velocity of Sound** ("Velocity of Sound", default = 1475.0 m/s).
- 4) Enter **Atmospheric Pressure** ("Baro Pressure" in Bathy Setup Tools menu, default = 1000 mBar).

In the Bathy Setup Tools-Installation menu

- 5) Set all offsets to zero. The displayed Depth in the Bathy window on Main Display may now be zeroed by adjusting the **Bathy Zero Offset** figure following the guidelines in Appendix 1. **
- 6) If required enter **Bathy** and **Altimeter Vertical offsets** (A non-zero datum ref. point is to be used on the vehicle above or below Bathy and Altimeter).
- 7) Whenever new Bathy offsets have been entered or immediately before consecutive dives, a new **Bathy Profile** will need to be started ('Profiles' page of Bathy Setup Tools menu). Refer to earlier section 'Operation of Profiles' for more details. Note that whenever the surface unit is powered up, a new Bathy Profile will start automatically.



*Pressure Port
Up Orientation*

*** The digiquartz pressure sensor is a fluid filled instrument. The weight of this fluid acting on the sensor's diaphragm varies with the orientation of the sensor and this affects the pressure reading. The unit is calibrated with the pressure port inlet up (i.e. Bathy bottle connector ports down).*

With an accurate Barometric Pressure applied and with the Bathy mounted in the orientation as was when calibrated, the Depth output should be very close to zero when on deck. Local Gravity figures will also slightly affect the pressure readings. A default value of Local Gravity is applied in the software and in the Environmental Setup menu this can be adjusted by entering an approximate Latitude figure for the geographical location for which the Bathy will be operated in.

SEAKING700 FSI CONDUCTIVITY & TEMPERATURE SENSOR CALIBRATION

The conductivity sensor fitted to the SEAKING700 Bathy Units are supplied calibrated to primary standards by Falmouth Scientific Inc., USA.

Conductivity Calibration

The conductivity sensor is calibrated at two stable reference conductivity values for a low point (C1 zero in air) and a high point (C2 >55 mmho/cm) near to the end points of its range. At each value the two calibration voltages and the conductivity output voltages are measured. This is solved to provide the reference voltage values at that conductivity. These are then used to compute the conductivity from the output value Vc.

Low Point: SEAKING1 = 0 Air Conductivity
 Z1 = Zero Ref.
 S1 = Scale Ref.
 C1 = Conductivity

High Point: SEAKING2 = Standard Conductivity
 Z2 = Zero Ref.
 S2 = Scale Ref.
 C2 = Conductivity

To Find A = (S1 - C1) / (Z1 - C1)

To Find B = (S2 - C2) / (Z2 - C2)

To Find Cf $M_c = (C_o - SEAKING1) / (Z1 - C1)$
 $B_c = SEAKING1 - (M_c * C1)$

Find Cf = (Mc * S1) + Bc

Find Co = [(SEAKING1*A) - (SEAKING2*B) + SEAKING2 - SEAKING1] / (A - B)

Temperature Calibration

The temperature sensor is calibrated at two stable reference temperatures low point (T1 <1 deg Celsius) and high point (T2 >28 deg Celsius). At each value the two calibration voltages and the temperature output voltages are measured. This is solved to provide the reference voltage values at that temperature. These are then used to compute the temperature from the output value Vt.

Low Point: T1 = 0 Standard Temperature
 Z1 = Zero Ref.
 S1 = Scale Ref.
 C1 = Temperature

High Point: T2 = Standard Temperature
 Z2 = Zero Ref.
 S2 = Scale Ref.
 C2 = Temperature

To Find A = (S1 - C1) / (Z1 - C1)

To Find B = (S2 - C2) / (Z2 - C2)

To Find Tf Mt = (To - T1) / (Z1 - C1)
 Bt = T1 - (Mt * C1)

Find Cf = (Mt * S1) + Bt

Find To = [(T1*A) - (T2*B) + T2 - T1] / (A - B)

Note : Co, Cf, To, Tf are provided By FSI, USA. Vc, Vt, Vo, and Vf are measured by the SEAKING700 Sensor PCB and values computed with the fixed reference values to provide the output data.

SEAKING700 DIGIQUARTZ PRESSURE CALIBRATION

The Pressure Transducers fitted to the SEAKING700 Bathy Units are supplied calibrated to primary standards by Paroscientific Inc., USA. The outputs from the pressure transducer and temperature sensor are a frequency signal, as the temperature and pressure change so does their output frequency. The SEAKING700 Bathy Unit uses a precision 10MHz clock oscillator to accurately measure the time period for each output signal. The clock is used to measure 10,000 cycles of the pressure reading and 40,000 cycles of the temperature reading so that the time period of each of the two frequencies can be measured. The 10MHz clock oscillator in each SEAKING700 Unit is individually calibrated and the actual frequency of the clock is used in the calculation of the time period.

The exact frequency of the 10MHz reference is measured with an instrument whose accuracy is certified to one part per million (PPM) and is traceable to the UK National Physics Laboratory Standard frequency.

Pressure Coefficients

T = Pressure Period (μsec)

$$C = C_1 + C_2U + C_3U^2$$

$$D = D_1 + D_2U$$

$$T_o = T_1 + T_2U + T_3U^2 + T_4U^3 + T_5U^4$$

$$\text{Pressure } P = C (1 - T_o^2/T^2) * (1 - D (1 - T_o^2/T^2)) = \text{psia}$$

Values for C₁, C₂, C₃, D₁, D₂, T₁, T₂, T₃, T₄, T₅ are provided by Paroscientific, Inc. USA for use in the calculation of the output data. The measurement of these values by Paroscientific, Inc. USA, for each sensor is traceable to a calibrated US standard, further details are available on request.

Recalibrations are normally performed at VSEL in Barrow under exceedingly closely controlled environmental conditions within their calibration facility.

Temperature Coefficients

X = Temperature Period (μsec)

$$U = X - X_0$$

$$\text{Temperature} = Y_1U + Y_2U^2 + Y_3U^3$$

Values for X₀, Y₁, Y₂, Y₃ are provided by Paroscientific, USA for use in the calculation of the output data. The measurement of these values by Paroscientific, Inc. USA, for each sensor is traceable to a calibrated US standard, further details are available on request.

BATHY EQUATIONS

Calculation of Depth

The following equation is used in Tritech Bathymetric sensors...

$$\text{Depth} = [((p - (a * 0.01450377)) * 0.70307) / d] * [G_{\text{std}} / G_{\text{local}}]$$

(version 1.54 + software)

where;

Depth is calculated depth in metres.

p is Absolute pressure measured by Digiquartz in psi.

a is Surface atmospheric pressure in mbar.

d is (1) Mean density update from SK704 Bathy (with CT probe)
or (2) Fixed System density if SK701 Bathy (no CT probe).

0.01450377 is mbar to psi conversion factor

0.70307 is psi to metres conversion factor for water of standard density (1gm/cc in standard gravity of $G_{\text{std}} = 9.80665 \text{ m/sec}^2$)

G_{local} is the local acceleration due to gravity.(Latitude dependant - entered into Surface software menu) - see below.

Local Gravity (G_{local}) Equation...

Computed Depth calculations take into account the Gravity of the operating location, which is a function of latitude. The local gravity value used in the Depth calculations is computed from the following formula (Intl. Assoc of Geodesy, Sp.Pub.Bull. geodesy 1970):

$$G_{\text{local}} = G_e * (1 + B1 * \sin^2(\text{lat}) + B2 * \sin^2(2*\text{lat}))$$

where;

$G_e = 9.7803184 \text{ m/sec}^2$

B1 = 0.0053024

B2 = - 0.0000059

Lat = local Latitude in degrees

Salinity Calculation (REF: Unesco '81)

T = CT Probe Temperature Measurement
 PP = Sea Pressure Measurement (Bar)
[= Absolute Pressure Measured by Digiquartz – Barometric Pressure]
 C = CT Probe Conductivity Measurement
 P = PP / 10.0
 T2 = T * T
 T3 = T2 * T
 T4 = T3 * T
 R = C / 42.914
[42.914 = Standard Conductivity @ S=35, T=15deg.C, P=0]
 Γt = 0.6766097 + 0.0200564 * T + 0.0001104259 * T2
 - 0.00000069698 * T3 + 1.0031E-9 * T4
 Denom = 1.0 + 0.03426 * T + 0.0004464 * T2
 + (0.4215 - 0.003107 * T) * R
 Rp = 1.0 + P * (0.0000207 - 0.00000000637 * P + 3.989E-15 * P
 * P) / Denom
 Rt = R / Rp / Γt
 R1 = √Rt
 R3 = Rt * R1
 R4 = Rt * Rt
 R5 = R4 * R1
 Ft = (T - 15.0) / (1.0 + 0.0162 * (T - 15.0))
 DelS = Ft * (0.0005 - 0.0056 * R1 - 0.0066 * Rt - 0.0375 * R3
 + 0.0636 * R4 - 0.0144 * R5)
 S = 0.008 - 0.1692 * R1 + 25.3851 * Rt + 14.0941 * R3
 - 7.0262 * R4 + 2.7081 * R5
Salinity = S + DelS

Local Density Calculation
(Ref: Journal of Geographical Research '85)

T = CT Probe Temperature Measurement
 PP = Sea Pressure Measurement (Bar)
 [= Absolute Pressure Measured by Digiquartz – Barometric Pressure]
 S = Calculated Salinity (Refer to Salinity Calculation)

T2 = T * T
 T3 = T2 * T
 T4 = T3 * T
 T5 = T4 * T

A = 999.842594 + 6.793952E-2 * T - 9.095290E-3 * T2
 + 1.001685E-4 * T3 - 1.120083E-6 * T4 + 6.536332E-9 * T5
 B = 8.24493E-1 - 4.08990E-3 * T + 7.64380E-5 * T2
 - 8.24670E-7 * T3 + 5.38750E-9 * T4
 C = -5.72466E-3 + 1.0227E-4 * T - 1.6546E-6 * T2
 D = 4.8314E-4
 E = 19652.21 + 148.4206 * T - 2.327105 * T2
 + 1.360477E-2 * T3 - 5.155288E-5 * T4
 F = 54.6746 - 0.603459 * T + 1.09987E-2 * T2
 - 6.67E-5 * T3
 G = 7.944E-2 + 1.6843E-2 * T - 5.3009E-4 * T2
 H = 3.239908 + 1.43713E-3 * T + 1.16092E-4 * T2
 - 5.77905E-7 * T3

I = 2.2838E-3 - 1.0981E-5 * T - 1.6078E-6 * T2
 J = 1.91075E-4
 M = 8.50935E-5 - 6.12293E-6 * T + 5.2787E-8 * T2
 N = -9.9348E-7 + 2.0816E-8 * T + 9.1697E-10 * T2
 S15 = S^{1.5}
 S20 = S * S
 P0 = A + B * S + C * S15 + D * S20
 K = E + F * S + G * S15 + (H + I * S + J * S15) * PP
 + (M + N * S) * PP * PP
 Denom = 1.0 – PP / K

Density = P0 / Denom / 1000.0

Local Water Column Velocity of Sound Calculation(Ref: Chen & Millero 1977 Formula)

T	=	CT Probe Temperature Measurement	
P	=	Sea Pressure Measurement (Bar) [= Absolute Pressure Measured by Digiquartz – Barometric Pressure]	
S	=	Calculated Salinity (Refer to Salinity Calculation)	
A00	=	1.3890E+00	B00 = -1.9220E-02
			C00 = 1402.388
A01	=	-1.2620E-02	D00 = 1.727E-03
			B01 = -4.4200E-05
A02	=	7.1640E-05	C01 = 5.03711
A03	=	2.0060E-06	C02 = -5.80852E-02
A04	=	-3.2100E-08	C03 = 3.3420E-04
			C04 = -1.47800E-06
			C05 = 3.1464E-09
A10	=	9.4742E-05	B10 = 7.3637E-05
			C10 = 0.153563
			D10 = -7.9836E-06
A11	=	-1.2580E-05	B11 = 1.7945E-07
			C11 = 6.8982E-04
A12	=	-6.4885E-08	C12 = -8.1788E-06
A13	=	1.0507E-08	C13 = 1.3621E-07
A14	=	-2.0122E-10	C14 = -6.1185E-10
A20	=	-3.9064E-07	C20 = 3.1260E-05
A21	=	9.1041E-09	C21 = -1.7107E-06
A22	=	-1.6002E-10	C22 = 2.5974E-08
A23	=	7.9880E-12	C23 = -2.5335E-10
			C24 = 1.0405E-12
A30	=	1.1000E-10	C30 = -9.7729E-09
A31	=	6.6490E-12	C31 = 3.8504E-10
A32	=	-3.3890E-13	C32 = -2.3643E-12
T2	=	T * T	
T3	=	T2 * T	
T4	=	T3 * T	
T5	=	T3 * T2	
P2	=	P * P	
P3	=	P * P2	
S2	=	S * S	
SRoot	=	√S	
S3by2	=	SRoot * SRoot * SRoot	
Cwtp	=	C00 + (C01 * T) + (C02 * T2) + (C03 * T3) + (C04 * T4) + (C05 * T5) + (C10 + (C11 * T) + (C12 * T2) + (C13 * T3) + (C14 * T4))*P + (C20 + (C21 * T) + (C22 * T2) + (C23 * T3) + (C24 * T4))*P2 + (C30 + (C31 * T) + (C32 * T2))*P3	
Atp	=	A00 + (A01 * T) + (A02 * T2) + (A03 * T3) + (A04 * T4) + (A10 + (A11 * T) + (A12 * T2) + (A13 * T3) + (A14 * T4))*P + (A20 + (A21 * T) + (A22 * T2) + (A23 * T3))*P2 + (A30 + (A31 * T) + (A32 * T2))*P3	
Btp	=	B00 + (B01 * T) + ((B10 + (B11 * T))*P)	
Dtp	=	D00 + (D10 * P)	
Velocity Of Sound	=	Cwtp + (Atp * S) + (Btp * S3by2) + (Dtp * S2)	

APPENDIX 1 - GETTING THE MOST OUT OF YOUR BATHY DEPTH MEASUREMENTS

1.0 WHAT AFFECTS THE DEPTH MEASUREMENT

1.1 Water density

A bathy sensor measures seawater pressure.

In order to calculate depth it must also know the density throughout the water column from the surface to operating depth.

This value changes with the temperature and salinity of the water and will vary as you move down through the water column and with time. Density can vary by up to 5% and we are targeting an accuracy approaching 0.01%!

1.2 Atmospheric pressure

The pressure measured includes the atmospheric pressure imposed on the surface of the water. A bathy system must know this pressure and subtract it from the total pressure measured. 1mbar is worth 1cm in the depth measurement. For sudden changes of barometric pressure as a weather front moves across there may be a significant lag in the transmittal of the effect to pressure measurements maybe up to an hour.

The height of barometric measurement above sea level may need to be accounted for if this is significant. (10m air height is equivalent to 1cm difference in depth reading)

1.3 Tidal movement

Tidal movement does not directly affect the depth measurement from the surface, but is needed to establish the datum for survey. The surveyor will need to correct the depth measurements to mean seawater levels.

1.4 Local Gravity

Gravity varies with position on the earth's surface.

To a good approximation it varies as a function of latitude and can be calculated using known geodetic formulae.

1.5 The instrument accuracy and stability

1.5.1 Pressure

Tritech uses the industry standard range of pressure sensors manufactured by Paroscientific Inc.

They specify a repeatability of 0.01% and hysteresis of 0.01% of full range.

These figures represent one standard deviation. Repeatability means that they will return to the same figure within 0.01% if the pressure is varied and returned to the same value from the same direction.

Hysteresis allows a further error of 0.01% if the unit is returned to the same pressure from the opposite direction. The effects can be accumulative, so statistically they allow for a variation of 0.015% for general random measurements.

When accompanied by a valid certificate of calibration these figures may be used to represent the accuracy of the instrument for the measurement of pressure.

THE MOUNTING ORIENTATION OF THE UNIT CAUSES SIGNIFICANT OFFSET VARIATIONS (can be up to 1.5m) These may be accounted for by setting the zero offset (see 3.0)

1.5.2 Density

Tritech manufacture two types of sensor, one that just has a pressure sensor (model 701) and one that also measures temperature and seawater conductivity in order to calculate density (model 704).

For the 701 it is the user's responsibility to enter a correct value for density and the accuracy of this figure will affect the accuracy of the depth measurement.

For the 704 the sensor uses a Falmouth Scientific Inc conductivity and temperature sensor. The measurements from this are used to calculate density local to the instrument using standard oceanographic equations. Tritech's application software then maintains a record of the measurements at all depths as the unit is lowered through the water column, in order to give a mean value for the density throughout.

THIS IS ONLY VALID AT THE TIME OF THE DESCENT

If water conditions change with time e.g. varying temperatures or salinity the value becomes historic and may induce errors.

The value created automatically by the 704 system can be overwritten with a manually entered value at any time if a better figure is known.

Generally speaking it is expected that density variations could double the uncertainty of a depth measurement to 0.03% of full scale.

1.5.3 Atmospheric Pressure

Tritech can supply a barometric sensor as an option. These are accurate to 1mbar. If the option is not used then the user must enter his own values into the system.

1.5.4 Calibration

The calibration interval is normally 1 year but may be client driven. Intermediate calibrations may be necessary if the unit has suffered mechanical shock or exceeded its specified pressure rating by more than 10%

2.0 DATUMS AND ZEROES

2.1 Tidal movement

Tidal movement does not directly affect the depth measurement from the surface, but is needed to establish the datum for survey. The surveyor will need to correct the depth measurements to mean seawater levels.

2.2 Position on the vehicle

Usually a datum is established on the vehicle as a survey datum. This is generally not where the bathy unit is actually mounted. Tritech software allows for a position offset to be entered which corrects the displayed data.

THE SURVEY DATA STREAM MAY OR MAY NOT INCLUDE THIS OFFSET ACCORDING TO THE SURVEY MESSAGE CHOSEN.

2.3 Zeroing on decks

Normally you expect a bathy depth measurement to be close to zero on deck but:-
VARIATIONS ARE EXPECTED!

Zeroing a bathy on deck is quite a complex process to achieve an accurate result. It cannot be done quickly and resetting before each dive is not recommended (see section 3.0).

3.0 RECOMMENDED PROCEDURES

First decide if the survey is simply requiring to establish relative measurements, or if absolute measurements to the surface are required.

Relative measurements may be applicable to such tasks as

- a) Pipe line out of straightness
- b) Template levelling
- c) Spool piece measurement

Absolute measurements apply only when the full depth from the mean seawater level is needed accurately.

3.1 Relative measurements

For relative measurements it is unimportant to zero the unit on deck since any error here is a constant offset.

Gravity effects are also negligible.

The important parameters are variations in atmospheric pressure, water column mean density and tidal corrections for the duration of the measurements.

For relative measurements, bathy units may be mounted in any orientation and with the correct atmospheric pressure entered an approximate zero offset entered such that the output depth reading is zero. It is recommended that no further alteration is made to the zero settings on deck for the duration of the job.

3.2 Absolute measurements

All effects mentioned under section 1 are important including the zero offset applied.

With the Paroscientific sensor although temperature compensated for stable temperatures it can take up to 2 hours to stabilise with the surrounding environment. To get a reading the unit needs to be powered up and stabilise completely. When removed from the seawater into either a hot deck environment or very cold the readings can be significantly in error.

There are two alternative approaches to setting the zero offset.

- a) Ensure the unit is mounted either port up or port down and use the zero offset figure published on the build and calibration sheet for the instrument.
This figure should not be altered unless a full check is completed as in b) below even if errors show when on deck. The results at depth will be consistent and accurate.
- b) Perform a thorough deck zero check as follows. The check is best completed at a temperature close to that of the seawater at the operating depth. This can be achieved by keeping a bucket of water at close to the required temperature in the control van by adding ice (from the galley) or hot water as necessary and removing the bathy from the vehicle to immerse to a known depth. The unit should be powered up for a minimum of 2 hours and the correct atmospheric pressure must be entered in the system, the correct latitude, and the position offset set to zero. The zero offset can then be set such that the correct immersion depth is shown. Practically this can only be achieved with the bathy orientation vertical and port down, so if using this method the unit will need to be mounted on the vehicle this way. Unless a full check following this procedure is repeated no further change to the zero setting should be made for the duration of the job.

4.0 INSTALLATION AND OPERATIONAL CONSIDERATIONS

4.1 Electrical Installation

The pressure measurement inside the bathy units is via a quartz crystal oscillation which as a frequency source is subject to violation in the presence of electrical noise. Electrical noise may be propagated around an ROV in a number of ways, by poor shielding via power supplies and via ground paths.

Typical interference sources include gyro 400Hz supplies, variable lighting switching circuits and switched ground fault detect circuits. If noise sources are present they may be identified by selectively switching off possible sources. Other than good noise management practice quick fix solutions to a noise problem may be

- a) Using a different or dedicated power supply
- b) Placing a line filter in the power to the bathy
- c) Connecting the bathy chassis ground (pin 6) to a vehicle high quality ground. (Note if the vehicle ground is not good this may be counterproductive)
- d) Moving the unit to a new position on the vehicle

The altimeter will need a minimum of 22Vdc to work properly

4.2 Physical position

In positioning a bathy the following should be taken into account

- a) The unit measures seawater pressure and must be clear of any thruster wash
- b) It is best placed nearer the centre of a vehicle where pitch and roll effects are minimised
- c) For absolute measurements it is preferred fitted in a vertical position and if it is desired to perform rigorous deck zero checks in a position where it can be easily removed and replaced in the same position ideally with sufficient cable slack to avoid removing the connectors. This will also assist with maintenance of the unit as in 4.3
- d) Model 704 units with the CT sensor should ideally be mounted such that the conductivity sensor is 150mm away from metal structures and away from any electrical motors or transformers
- e) Preferably high on the vehicle away from sand and silt
- f) The altimeter should be mounted near the bottom of the vehicle with a clear view of the seabed

4.3 Post dive

On recovery the units should be washed down with a fresh water hose paying particular attention to the pressure port area to remove all salt deposits.

Avoid allowing the bathy bottle to reach high temperatures on deck – keep it shaded from direct hot sunlight.

Ideally the unit should be kept wet at all times to avoid any risk of salt deposits. If the vehicle is on deck for more than a few hours the unit should be removed from the vehicle and the port submerged in a bucket of water. The higher the ambient temperature, then the greater the importance.

4.4 Operation

Whether or not barometric pressure, density or velocity of sound are to be calculated automatically during a mission representative manual figures should be entered. If there is any disruption to the automatic measurements the system will revert to the manually entered figures and this will cause apparent jumps in readings unless the manual figures are correct.

It is good practice to update these manual figures as necessary throughout a dive.

4.4.1 Prior to launching the vehicle

ensure

- a) Barometric pressure has been entered
- b) A zero offset has been set according to the appropriate method as in section 3.0
- c) Any required position offsets are entered
- d) A representative manual density and velocity of sound figure has been entered and any required/valid auto selections made
Note – in air readings on deck may cause invalid data blocking the selection of auto density. This will clear as soon as the unit is submerged.
- e) The correct survey data string and port settings have been made

4.4.2 During the dive

- a) With 704 systems save the automatically created depth profile when working depth is reached (or during a long dive pause and save – this will avoid the need to return to the surface if there is a system problem since a saved profile may be loaded)
- b) If there are significant changes in density or velocity of sound update the manually entered figures (this will avoid jumps if the system drops out of auto)
- c) With 704 systems do not start a new profile at depth – this will lose the water column data above the current depth and back fill with interpolated data. This function is to allow a new profile to be started on or near the surface without restarting the system
- d) Regularly review barometric pressure and update if necessary

5.0 REFERENCES

Specific Gravity Equation
Intl. Assoc of Geodesy, Sp.Pub.Bull. geodesy 1970

Salinity Calculation
Unesco '81

Local Density Calculation
Journal of Geographical Research '85

Velocity of Sound Calculation
Chen & Millero 1977 Formula