VALEPORT LIMITED

MIDAS BathyPack

Installation & Operation Manual

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As part of our policy of continuous development, we reserve the right to alter, without prior notice, all specifications, designs, prices and conditions of supply for all our equipment.

CHAPTER	DESCRIPTION	PAGE

1   <u>INTRODUCTION</u>

This manual describes the operation of the Valeport MIDAS BathyPack bathymetry system, and its associated PC software BathyLog.

The purpose of the MIDAS BathyPack is to convert pressure measurements into depth data, taking account of the local variations in water density to ensure the highest possible accuracy. In addition, the MIDAS BathyPack also accepts data from an altimeter to provide height above the seabed, corrected using the on-board Valeport "time of flight" sound velocity sensor, thus giving an overall location of the device within the water column. Whilst the concept of such a bathymetry system is not new, the MIDAS BathyPack builds on the standard specification you would expect with several unique features that significantly enhance the performance of the product:

- Temperature compensated piezo-resistive pressure sensor gives ±0.01% accuracy with better stability and durability than a resonant quartz type. In addition, there is no oil reservoir to protect the sensor, allowing easier maintenance and faster deployment.

- Valeport's own inductive coil conductivity sensor, constructed from advanced composite materials to eliminate the effects of pressure on sensor performance. Most inductive cells distort under pressure, giving errors in the measurement – even a few μm is enough to put the sensor out of specification at depth. This cell has no such errors. Inductive cells also have an advantage over electrode conductivity sensors, in that they are less susceptible to contamination by oil, growth or debris.

- Full "in situ" factory calibration; inductive conductivity cells are affected by the presence of any object (conductive or non-conductive) that lies within the sensor's field (within approx. 5cm). Valeport's factory calibration against a salinometer, performed with all other sensors and guard in close proximity, guarantees in-field accuracy. A simple "resistor calibration" actually does nothing more than verify sensor operation. Further, the digital measurement technique virtually eliminates drift in sensor calibration, eliminating the need for "field calibration" procedures.

- Unique "synchronised sampling" means that all sensors are sampled at precisely the same instant, not in sequence. This removes alias errors from the measurements.

- Altimeter input fitted as standard; no need for upgrades – just plug in the sensor.

- Titanium housing as standard; no corrosion issues, and a maximum depth rating of 6000m. Note that a selection of pressure sensor ranges is available, so your instrument's depth rating may be limited to less than the full 6000m.

- Full UNESCO depth calculation for more accurate depth measurement; the system uses the standard UNESCO method of *integrating* the water density variations to calculate the depth from pressure, not the simplified method of just *averaging* the density.

- All data is viewed and stored on a topside PC, so no dedicated control unit is required. The intuitive BathyLog software allows you to setup the BathyPack, log all incoming data, and display and graph the data in real time.

- BathyLog also accepts data from Valeport's Modus IPS and miniIPS pressure sensors, applying the BathyPack's density profile to provide an accurate pressure / depth conversion for separate devices in the same locality.

In summary, the MIDAS BathyPack sets out to "de-mystify" the accurate calculation of depth from water pressure; state of the art sensing technology gives you accurate data; precise calculations give you accurate answers; simple PC software gives you total control. Getting the right answer has never been easier.

2 SPECIFICATION

2.1 SENSORS

The MIDAS BathyPack is fitted with integral Pressure, Conductivity, Temperature and Sound Velocity sensors, and will accept external inputs from 3rd party digital altimeters (currently Tritech, Kongsberg or Benthos / Datasonics). Specifications are given here for the integral sensors and the parameters calculated from them.

2.1.1 CONDUCTIVITY

Type	Valeport Inductive Coil
Range	0 – 80mS/cm
Accuracy	±0.01mS/cm
Resolution	0.002mS/cm
Stability	<±0.01mS/cm/year

2.1.2 TEMPERATURE

Type	Valeport PRT
Range	-5 to +35°C
Accuracy	±0.005°C
Resolution	0.002°C

2.1.3 SALINITY

Method	Calculation (PSS-78)
Range	0.02 – 42 (calculation unverified at higher salinities)
Accuracy	±0.017 (at 500m depth)
Resolution	0.001

2.1.4 DENSITY

Method	Calculation (EOS-80)
Range	994 – 1075 kg/m³
Accuracy	±0.016 kg/m³ (at 500m depth)
Resolution	0.001 kg/m³

2.1.5 SOUND VELOCITY (MEASURED)

Type	Valeport miniSVS (50mm type)
Range	1400 – 1600 m/s
Accuracy	±0.006 m/s
Resolution	0.001 m/s

2.1.6 SOUND VELOCITY (CALCULATED)

Method	Calculation (Chen & Millero 1977)
Range	1400 – 1600 m/s
Accuracy	±0.25 m/s (estimated)
Resolution	0.001 m/s

2.1.7 PRESSURE

Type	Piezo-Resistive Cell
Range	Various, 10Bar to 600Bar
Accuracy	±0.01% range (~ 1cm @ 10Bar range)
Resolution	0.002% range (~ 2mm @ 10Bar range)

2.1.8 DEPTH

Method	Standard UNESCO Calculation
Range	N/A
Accuracy	See Note Below
Resolution	1mm (software limited)

A Note About Depth Accuracy:

The true accuracy of the calculated Depth is a function of several parameters:

- The accuracy of the Pressure sensor itself
- The error in Density measurement resulting from accuracy of Conductivity measurement
- The error in Density measurement resulting from accuracy of Temperature measurement
- The error in Density measurement resulting from accuracy of Pressure measurement
- The significance of the above errors in relation to the depth range, and the ambient Salinity and Temperature conditions.
- The inherent accuracy of the equation used, which is estimated at 0.1m over 10000dBar

The overall Depth accuracy therefore relates to not only how good the sensors are, but will also vary according to the local conditions. For example, accuracy of Depth measurement in 500m water at 5°C and 35 Salinity will be different to that in 500m water at 1°C and 36 Salinity.   However, these variations are typically small, and it is therefore reasonable to assume that the accuracy will dominated by the accuracy of the pressure sensor and that of the UNESCO equation.

2.2   ELECTRONIC

Power Source	External Supply Only
Input Range	9 – 30vDC
Consumption	0.8W (BathyPack only)

BathyPack will route external power to altimeter; ensure sufficient power is supplied to suit the altimeter used.

> NB: 24v external supply will be required if using a Kongsberg 1007 altimeter

Data Output	RS232 & RS485 fitted as standard (choice made by pin selection on connector)
Protocol	8 data bits, 1 stop bit, no parity, no flow control
Baud Rate	User selectable from 2400 to 460800 (factory default 19200)
Update Rate	1Hz
Connector	Subconn MCBH10F (power / comms)
	Subconn MCBH6F (to altimeter)

2.3   PHYSICAL

Dimensions	435mm x 90mmØ max (excl. connectors)
Materials	Titanium housing
	Titanium temperature sensor
	Polyurethane and ceramic conductivity sensor
	Carbon composite, polycarbonate and titanium SV sensor
Max Depth	6000m (may be restricted by pressure sensor range)
Weight (Air)	6kg
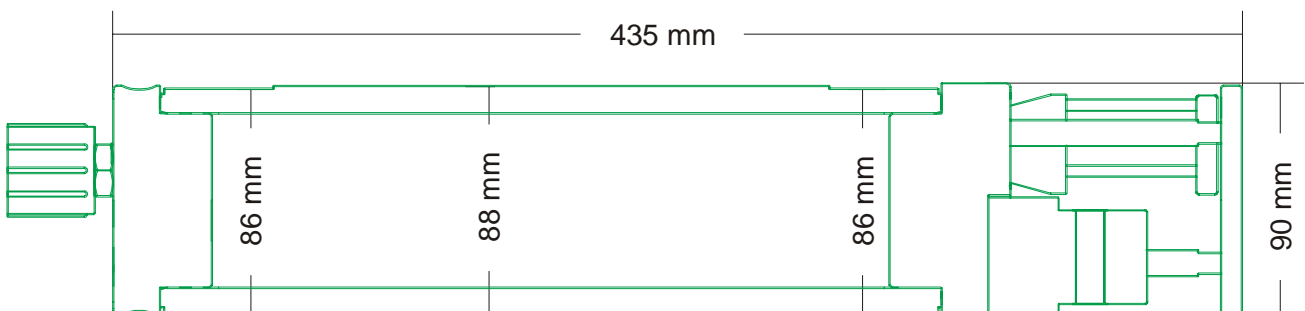
3   <u>PRINCIPLE OF OPERATION</u>

The principle of the MIDAS BathyPack is quite simple. The instrument passes real time data from its sensors to a surface PC running BathyLog software, which then uses the data it has collected to perform an accurate conversion of pressure readings into depth.

The relationship between pressure and depth is not so simple though, and is a function of the water density. More specifically, the water density at every single point in the water column affects the pressure depth relationship at the bottom of the column. You therefore have to know the density of water at every point above the pressure sensor in order to accurately calculate the depth from the pressure value. BathyLog software therefore builds an array table, or profile, of the water density at every single point in the water column as the BathyPack descends. It also updates this table as the BathyPack ascends, or moves around in the column during the deployment. The resolution of this profile is limited to a maximum of 6000 lines, which means that in 6000dBar of water pressure (approximately 6000m), it will store a Density value for every dBar (metre). Greater resolution is possible at shallower depths, e.g. 0.25dBar in 1500dBar pressure.

The benefit of creating and storing this density profile on PC, as opposed to storing it in the instrument itself or simply in a dedicated display unit, is that we can take advantage of the PC processing power to perform the Pressure / Depth calculations correctly, rather than using an approximate method. Historically, it has been common practice to just take an average of the Density readings throughout the profile, and use that to convert Pressure into Depth. However, the full UNESCO formula uses a Density integration function rather than Density averaging, and therefore properly accounts for the compressibility of water. In water depths of less than 100m, this distinction is negligible - less than 1mm - but the error due to use of the more simple averaging method increases dramatically at greater pressures, approaching 1m at 1000m depth.

The second advantage of using a PC to store the Density Profile and to perform the Pressure / Depth calculation, is that the data may be made easily available to other devices. Specifically, BathyLog software will also accept pressure readings from Valeport miniIPS and Modus IPS Pressure sensors, and use the same Density Profile to convert their readings into accurate Depth data. This is particularly useful where multiple points within the same locale need to be monitored, saving greatly on both equipment and deployment cost.

4   BATHYLOG SOFTWARE

BathyLog software has been created to perform all the functions traditionally associated with a dedicated topside display unit, allowing all data to be easily displayed and logged on a standard PC. BathyLog is supplied free of charge with each MIDAS BathyPack instrument.

Note that in addition to displaying and logging the data, BathyLog performs all the calculations required to generate an accurate pressure / depth conversion. The results of these calculations may also be applied to other pressure sensor devices such as the Valeport Modus IPS and miniIPS products operating in the same locality, and whose outputs are fed into the same PC. Further, all data is available for output on a separate serial port for other devices and packages.

4.1   INSTALLING BATHYLOG

BathyLog software is supplied on a CD-ROM with the MIDAS BathyPack; it is compatible with all versions of Windows from 98 onwards. As with all software, a more powerful PC will ensure better performance, but as a minimum we recommend the following specification:

Processor:	500MHz
RAM:	512Mbyte
Drive Space:	50Mbyte
Display:	1024 x 768, 16 bit colour.
Serial Ports:	1 x 9 pin serial port (additional ports may be required for additional functionality)

As an alternative, Valeport offer a 19" rack mount PC, configured specifically for and only operating BathyLog software.

If you are installing BathyLog on a PC running Windows NT, 2000, XP or Vista, please ensure that you have full administrator rights. The installation process will attempt to place some files into the Windows System directory, which may be protected from non-administrator users. This may result in an unsuccessful installation.

Place the BathyLog CD in the CD drive of your PC. The installation process should begin automatically, but if it does not, use Windows Explorer to locate the setup.exe file on the CD, and run it manually.

Follow the on-screen instructions to complete installation of BathyLog, which will be placed by default in the directory C:\Program Files\BathyLog

The program may be run by clicking the icon on your desktop.

4.2   USING BATHYLOG FOR THE FIRST TIME

When opened for the very first time, BathyLog will immediately show the following "blank" screen.
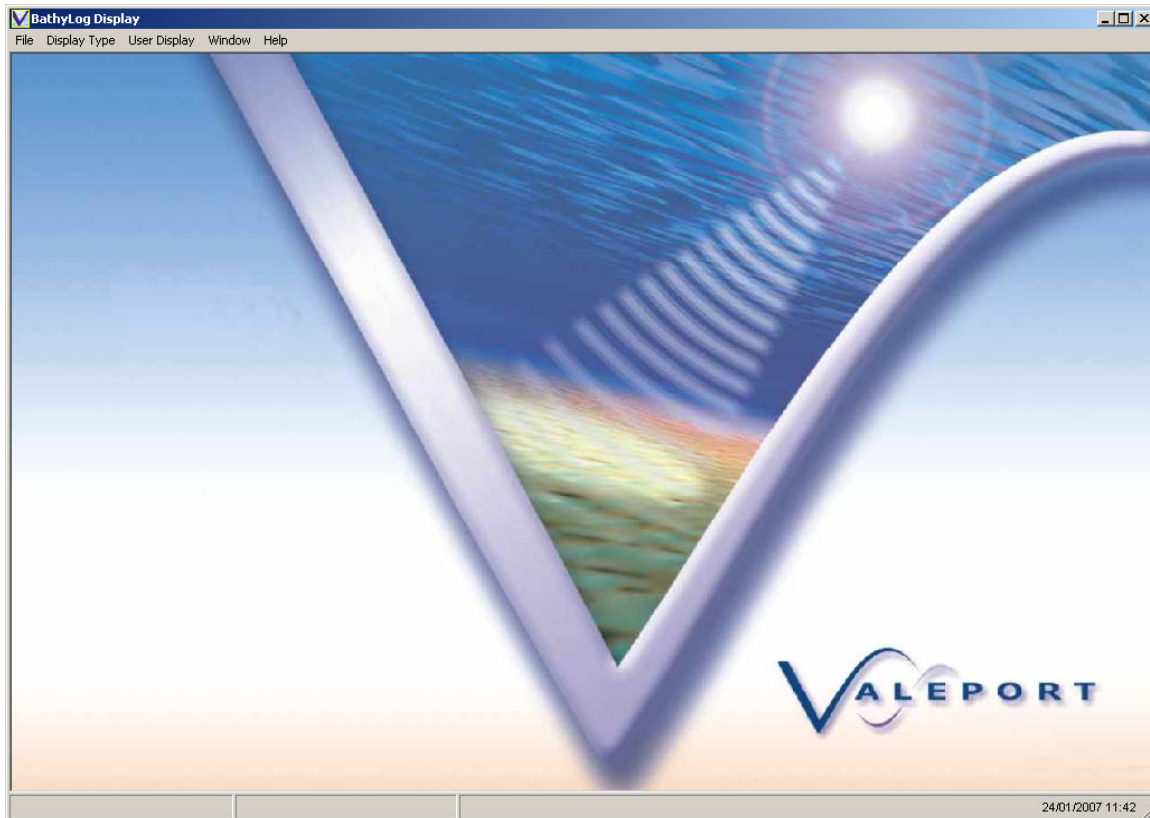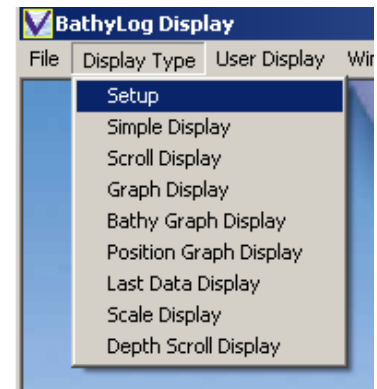

This background page is effectively a blank canvas onto which the user may create their own preferred data display format, using the range of display types available. These are described in Section 5.

On subsequent occasions, BathyLog will open with the same display in place as when the program was last closed.

4.3   SETUP

If the device is being used on a new deployment it is likely that some settings will need to be altered for correct operation. To access the instrument setup page, simply use the mouse to select "Setup" from the "Display Type" menu as illustrated.

The following screen will appear:

This screen controls the setup of all MIDAS BathyPack operating parameters, together with communications protocols for additional Modus IPS or miniIPS pressure devices.

4.3.1   PARAMETER

BathyLog will handle up to 7 separate "devices" which are as follows:

- MIDAS BathyPack
- Data Output Port
- Modus IPS or miniIPS (x4)
- Atmospheric Pressure sensor

If the device is checked under the "Parameter" heading, then BathyLog will attempt to accept (or output) data for that device. If the relevant box is not checked, then it will be ignored, even if there is actually data available. In addition, it will not be possible to alter any settings for a device unless it is checked.

In the above example, only the check box for the BathyPack itself is checked; only data from this device will be available.

4.3.2   COMMS

For each enabled device select whether communications are via RS232 or RS485. Note that RS232 should only be selected if the communications link is RS232 or full duplex from the PC all the way to the instrument. If an RS485 adaptor is being used to allow communications over a long cable length, then RS485 should be selected, even though the adaptor will actually use RS232 communications to the PC.
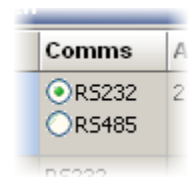
This is because Valeport uses a half-duplex RS485 method, where the same wire pair is used to both transmit and receive data. For this reason, both the instrument and the PC must allow a short delay between transmitting and receiving data; such a delay is not necessary for normal RS232 communications.

4.3.3   ADDRESS

Devices operating on a multi-drop cable (for example, multiple miniIPS devices) must be assigned a unique address. Click in the "Address" cell for the appropriate instrument, and either type the required address number (1 to 99) or use the up/down arrows to select a value.
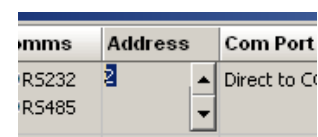
4.3.4   COM PORT

For each enabled device, select the Communications Port to which the device is connected. Note that each RS232 device should be assigned a dedicated port, and that all addressed instruments using a single RS485 adaptor should be assigned to the same port. Only available ports are listed.
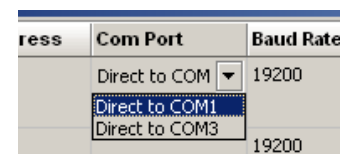
4.3.5   BAUD RATE

The communications chip in the MIDAS BathyPack is capable of baud rates from 2400 to 460800. When choosing a baud rate it is important to consider the length of the cable and the quantity of data that is being transmitted; it is also worth noting that only specialist high quality PC serial ports will be capable of achieving the highest baud rates. Generally speaking, a baud rate of 19200 (which is the factory default) will allow RS232 communications over 100m cable with no problems. For longer cables, use a lower baud rate.
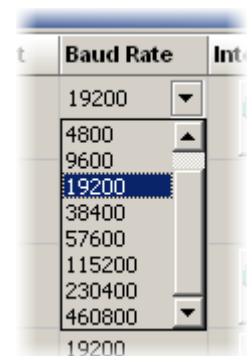
Multi-drop devices using RS485 communications through the same serial port (i.e. through an RS485 / RS232 adaptor) must use the same baud rate; the standard IPS RS485 Controller unit from Valeport requires a baud rate of 38400.

4.3.6   INTERRUPT

Once the correct Com port settings have been chosen, apply power to the instrument, and click the Interrupt button (illustrated). The software will now try to establish communications with the BathyPack or IPS.

4.3.7   STATUS

The right hand side of the Setup display features a column labelled "Status". This column will indicate the current status of each device, according to the following convention:

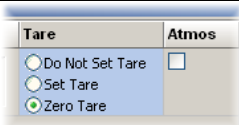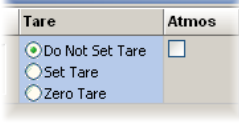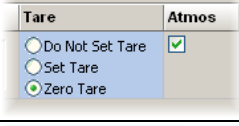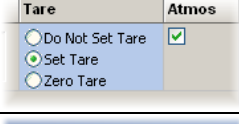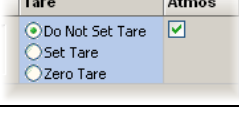|	
N/A	Device not enabled
Waiting	Device enabled, no data yet received
Interrupted	Communications established with device to alter setup
<Data>	If the device is operational and outputting data, it will be indicated in this column

4.3.8   TARE & ATMOS SETTINGS

The pressure sensor in the BathyPack is an absolute sensor, that is to say it measures the full pressure acting on it, including atmospheric pressure. Since the Pressure / Depth conversion algorithm assumes that the Pressure is just pressure of water, it is desirable to remove the atmospheric pressure value from the raw sensor value before conversion. BathyLog offers 2 methods of doing this:

Tare This method takes a single reading from the pressure sensor as it sits at atmospheric pressure, and subtracts this value from all subsequent data points. This function may be implemented in a variety of ways.

Atmos A Valeport IPS sensor measuring atmospheric pressure continuously may be interfaced to the software, and the readings from this may be subtracted from the sensor reading. This function may be switched on or off via a checkbox (provided the "Atmospheric" sensor input is enabled).

These functions may be implemented in various combinations, as discussed in the table below:

| Tare & Atmos Settings	Notes
	No adjustment made to the raw pressure data. Depth readings will therefore over-read by approximately 10m water.
	A measurement of atmospheric pressure is made by the BathyPack, and subsequently subtracted from all readings. The Tare should be carried out at sea level, with the instrument in the same orientation as it will be deployed. Note that this method does not account for subsequent variations in atmospheric pressure through the deployment.
	The system will continue to use the Tare value that was previously set. This value and the time and date on which it was taken are indicated at the bottom of the screen. This may be useful for data consistency on a series of short deployments. Tare Value 9.1629 Tare Date Time 20/07/2007 12:24:36
	Data from the atmospheric pressure sensor (if available) will be subtracted from the raw data. Note that differences in sensor range and accuracy may result in the BathyPack data being not exactly zero at sea level, but this variation will remain consistent (within tolerance) as changes in atmospheric pressure are accounted for.
	The most desirable setting. Real time atmospheric pressure readings are subtracted from the BathyPack data, and a Tare function is used to adjust the data to read zero at sea level. This will ensure that the calculated depth data from the system will be accurate as possible.
	The system will remove atmospheric pressure values in real time, but will continue to use the Tare value that was previously set. This value and the time and date on which it was taken are indicated at the bottom of the screen. This function should be used with care, ensuring that the Tare value previously set is still applicable.

4.3.9   CLOCK SETTINGS

The MIDAS BathyPack's internal clock may be set to the same time as the PC by clicking the "Set Time" button.
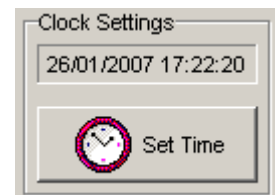
4.3.10   DENSITY ARRAY

The Density Array function is key to the operation of the BathyLog software. These two settings should be used set the resolution of the Density Array; set the maximum operating depth of the current deployment, and the required array resolution, both in dBar (approx 1m) - the array may contain up to 6000 lines of data. Please refer to Section 3 for an explanation of the function of the Density Array.
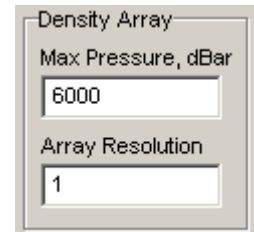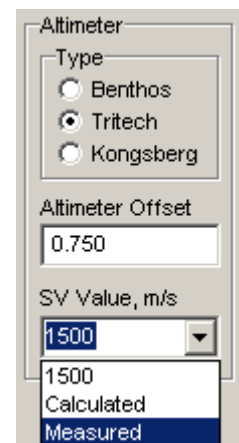
4.3.11   ALTIMETER

4.3.11.1   Type

The MIDAS BathyPack is currently able to accept data input from Tritech, Kongsberg or Benthos / Datasonics digital altimeters, or mimics of their outputs. Simply select the appropriate type. If no altimeter is connected to the BathyPack, then this setting has no function.

4.3.11.2   Offset

It is common for an altimeter to be positioned above the lowest point of the vehicle to which it is fitted. Enter a value (in metres) in the Offset box that equates to the distance between the altimeter and the bottom of the vehicle. This value will be subtracted from any altimeter data, therefore giving distance below vehicle, rather than distance below sensor.

4.3.11.3   SV Value

The reading from an altimeter is dependent on the speed of sound in the water, which is itself a function of Salinity, Temperature and Pressure. An altimeter can only therefore give truly accurate data if the output is adjusted to account for the local sound speed conditions. BathyLog assumes that the altimeter itself is set to use a standard SV value of 1500m/s, and will adjust the reading according to the settings in this box. This drop-down box had three options:

a)   Fixed value (default 1500m/s). BathyLog will adjust the altimeter readings for a fixed sound speed entered by the user.

b)   Calculated. BathyLog will use Chen & Millero (1977) to calculate the sound velocity at the current position from the Conductivity, Temperature and Pressure sensors, and will correct the altimeter reading using that value.

c)   Measured. BathyLog will correct the altimeter readings using the sound speed measured by the integral Valeport time of flight SV sensor. This is the most accurate method, and is the one we recommend.

4.3.12   LATITUDE

Accurate conversion of pressure to depth is dependent on local gravity, which is primarily a function of the operating latitude. Enter the latitude (using decimal fractions of degrees) in the box illustrated.

4.3.13   MAX VIEWABLE DATA POINTS

BathyLog software generates and stores a large amount of data. In order to simplify some of the displays, particularly graphical displays, it may be desirable to limit the amount of data shown at any one time. This box allows the user to set such a limit – in this example 3600 points equates to 1 hour of data (update rate is 1Hz). Data older than one hour will be retained in saved data files, but will no longer be shown on the data displays in real time. The purpose of this feature is two-fold:

- a)   to allow simplified data viewing in real time
- b)   to conserve PC RAM for other applications

There is no maximum value for this figure.

4.3.14   IPS SAMPLING RATE

Valeport Modus IPS and miniIPS sensors may be set to provide data at a choice of rates using this drop down menu. The maximum rate is 4Hz (i.e. 250ms update), but it is suggested that an update rate of 1Hz (1000ms) is most sensible, matching the update rate from the BathyPack itself.

4.3.15   SET

Once all the settings have been made as necessary, simply click the "Set" button to confirm any changes in the instrument itself.

Note that it is particularly important to interrupt and set any Modus IPS or miniIPS sensors on first deployment, since they may have been previously utilised in another application and therefore configured in a manner inappropriate for use with BathyLog software. Interrupting and Setting these sensors will therefore ensure that they function correctly within this application.
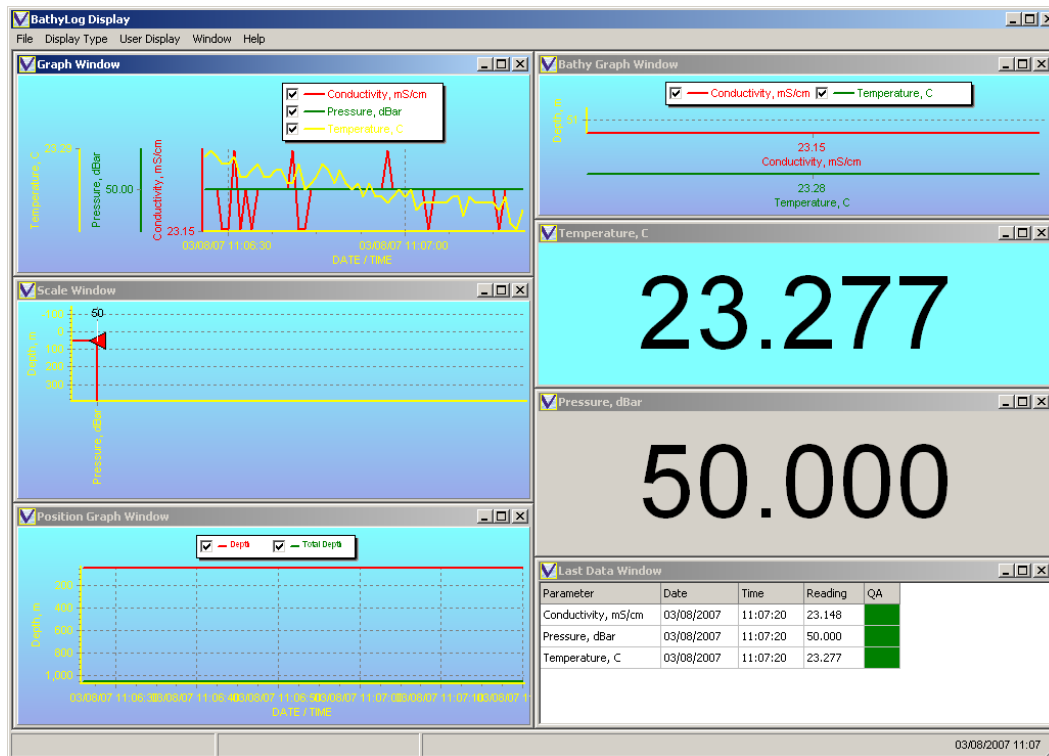
4.3.16   RUN

Finally, when all sensors have bee set as required, simply click the "Run button" to begin sampling each sensor. Note that when running, data should appear in the Status bar for each sensor.

5 DATA DISPLAY FUNCTIONS

When the BathyPack is first enabled and Run, the software will show the default Valeport data display screen:

This screen is presented simply to indicate the variety of display types available – each window may be sized, closed or changed as required by the user, to suit their own preference.

5.1 SIMPLE DISPLAY

The Simple Display gives the latest reading of any single chosen parameter, and is therefore best used for viewing real time data. Select "Simple Display" from "Display Type" menu, and this box will appear:


Using the mouse, Right-click in the display box to show the options for this display type.

Firstly, you must choose which parameter you want to display. Click "Sensor List", and the available parameters will be displayed. Choose the parameter of interest – Temperature in this example.
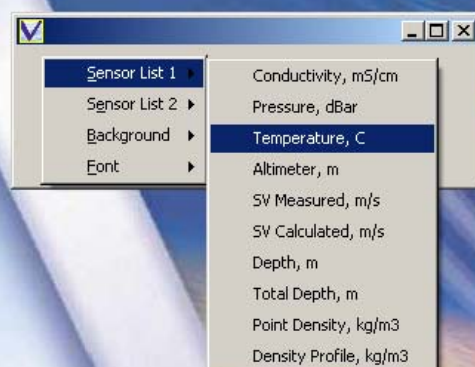
The box will now display the most recent data value from that parameter, updating as new data is received.
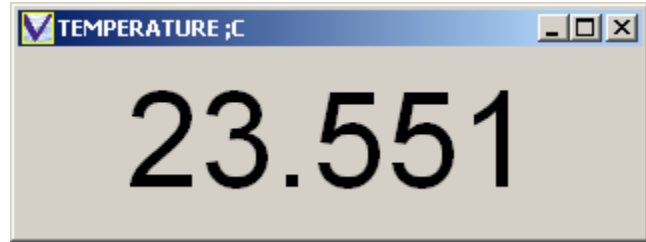
This box may be moved around the screen, and the size changed by dragging the corners. The text will automatically adjust to the largest size that can fit in the box.
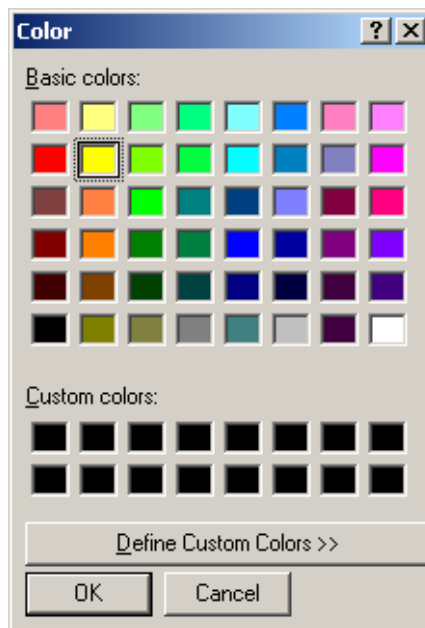

In order to improve the visibility of this display, you can change the properties of the text and the background to suit your preference.

5.1.1   CHANGING BACKGROUND

To change the background colour, right click in the box and select "Background", "Select Color" as shown:
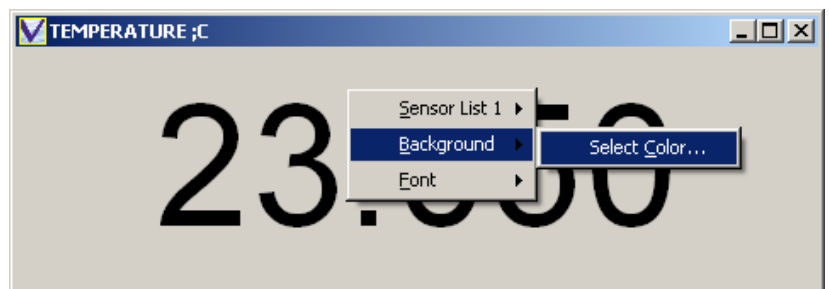
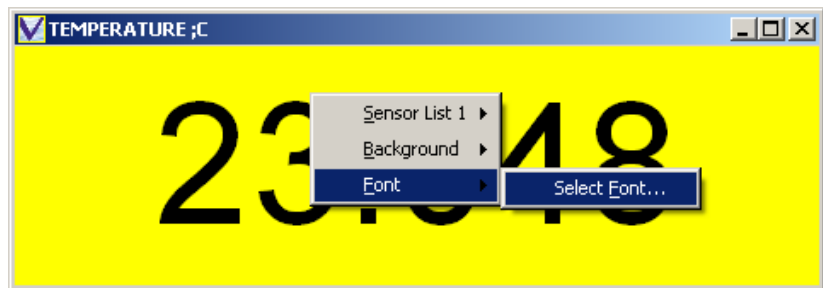The display shown below will appear:

Select your desired colour from those available, and click OK.

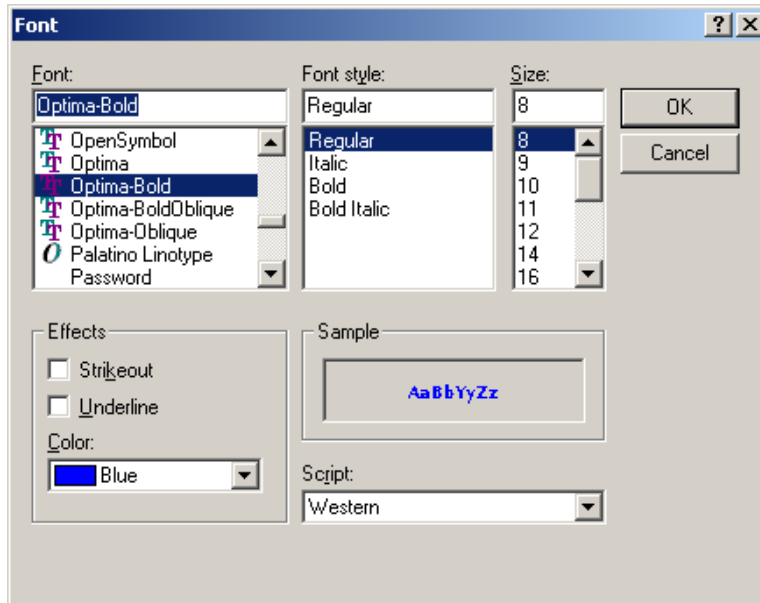The display background will now appear in your chosen colour:

5.1.2 CHANGING FONT

To change the style and colour of the text, right click in the box, and select "Font", "Select Font" as shown:

The following display will appear:

Choose your preferred Font and colour as shown. Do not adjust the size, since it will automatically fill the available space anyway.

Then Click "OK". Your display will be given in your chosen Font.

If the Font does not automatically adjust to fill the box, simply adjust the size of the box minutely to force the text to expand.
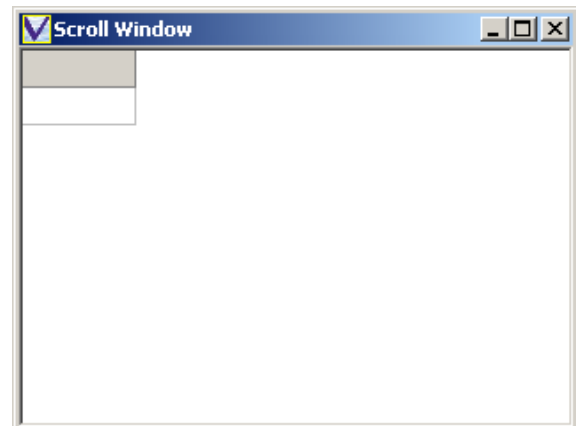
Note: When changing Fonts and Backgrounds, it is sensible to choose colours that have a high contrast to enable the display to be easily read.
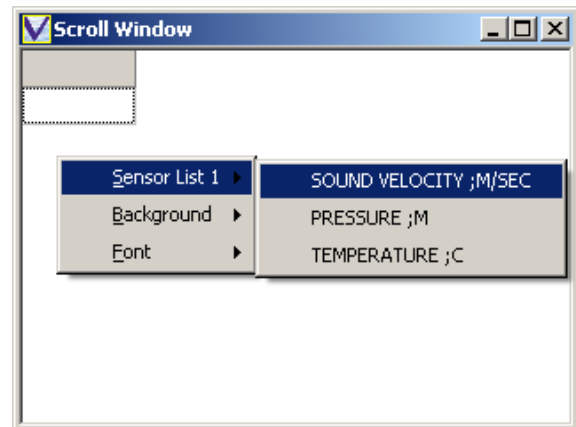
5.2   SCROLL DISPLAY

The scroll display is a tabular list of the data, and is suitable for showing either real time data, or data from a saved or uploaded file.

The Scroll window initially appears as shown:

Right – click in the Window, and select the parameter you wish to view from the "Sensor Lists". Note that you can repeat this process to add parameters to the scroll window

The final Scroll Window will look something like this.

Date	Time	SOUND VELOCITY;M/SEC	PRESSURE;M	TEMPERATURE;C
13/06/2006	15:07:46	1542.627	9.197	29.162
13/06/2006	15:07:46	1542.635	9.819	29.162
13/06/2006	15:07:46	1542.65	10.564	29.163
13/06/2006	15:07:44	1542.672	12.056	29.163
13/06/2006	15:07:44	1542.686	12.801	29.165
13/06/2006	15:07:44	1542.7	13.671	29.165
13/06/2006	15:07:43	1542.717	14.79	29.166
13/06/2006	15:07:43	1542.738	15.784	29.166
13/06/2006	15:07:43	1542.757	16.654	29.171

The following points should be noted about the Scroll Window:

- The most recent data point is at the top of the list, the oldest at the bottom
- Large data files may take a few seconds to open with this display
- The columns widths are adjustable using the mouse
- The entire display may be positioned and resized using the mouse
- Background colour and Font may be adjusted as with the Simple Display

5.3   GRAPH DISPLAY

BathyLog will show a Time Series Graph of any chosen parameter, from either saved data files or as it is received in real time.

Choose "Graph Display" from the "Display Type" menu and this screen will appear:

Right – click the box and choose the required parameter from the Sensor Lists, as shown.
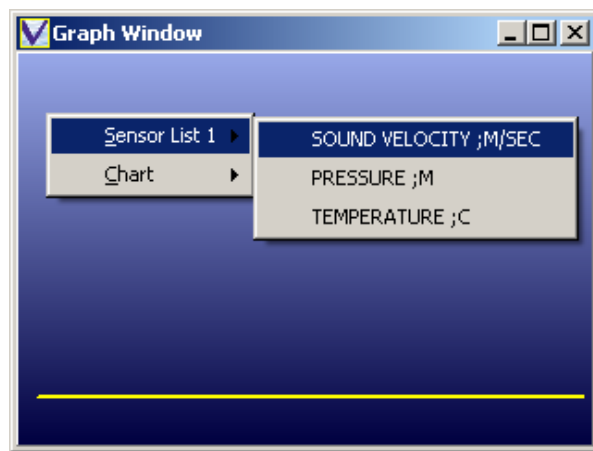
Repeat to add more parameters to the same graph, which will be shown in a different colour, and on individual axes, as shown below:
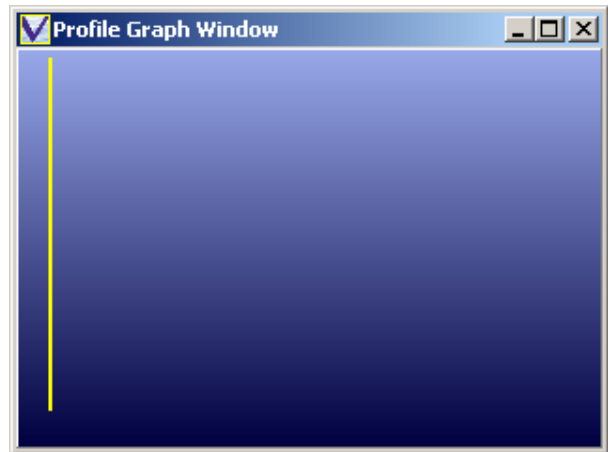

The Graph Window may be moved and sized using the mouse. By default, the graph scales will "Autoscale" to fit the displayed data. Control of this feature and other graph functions are described in Section 5.9.
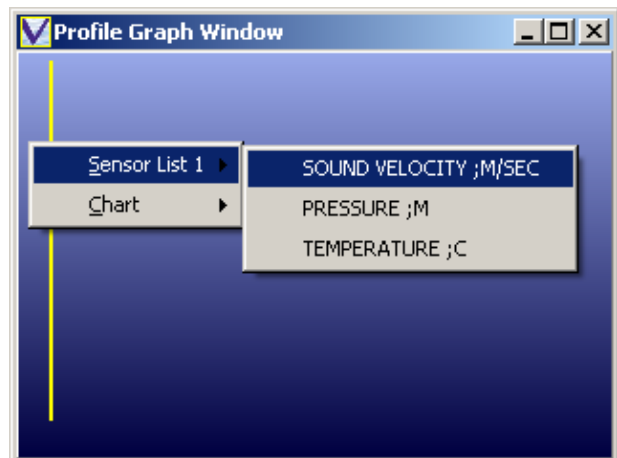
5.4   BATHY GRAPH DISPLAY

BathyLog will display data as a Profile, i.e. plotting each
parameter against Depth rather than against Time. This
type of display is suitable for use with either recorded data
files or with real time data.

Choose "Bathy Graph Display" from the "Display Type"
menu and this screen will appear:

Right – click the box and choose the required parameter
from the "Sensor List", as shown.

Repeat to add more parameters to the same graph, which
will be shown in a different colour, and on individual axes, as
shown:

The Bathy Graph Window may be moved and sized using
the mouse. By default, the graph scales will "Autoscale" to fit
the displayed data. Control of this feature and other graph
functions are described in Section 5.9.
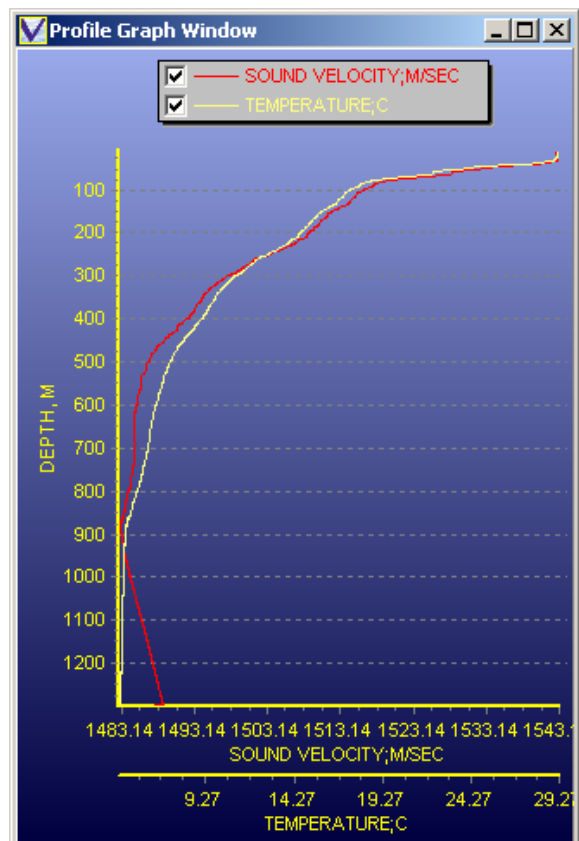
5.5 **POSITION GRAPH**

Select Position Graph from the Display Type menu, and the following graphical display will appear:

This display features two traces – the Depth of the BathyPack, and the total water depth, calculated as the sum of the BathyPack Depth and the reading from the altimeter. This is a time series plot, giving a visual indication of the proximity of the vehicle (red trace) with respect to the bed (green trace).

As with other graphical display types, the Position Graph Window may be moved and sized using the mouse. By default, the graph scales will "Autoscale" to fit the displayed data. Control of this feature and other graph functions are described in Section 5.9.
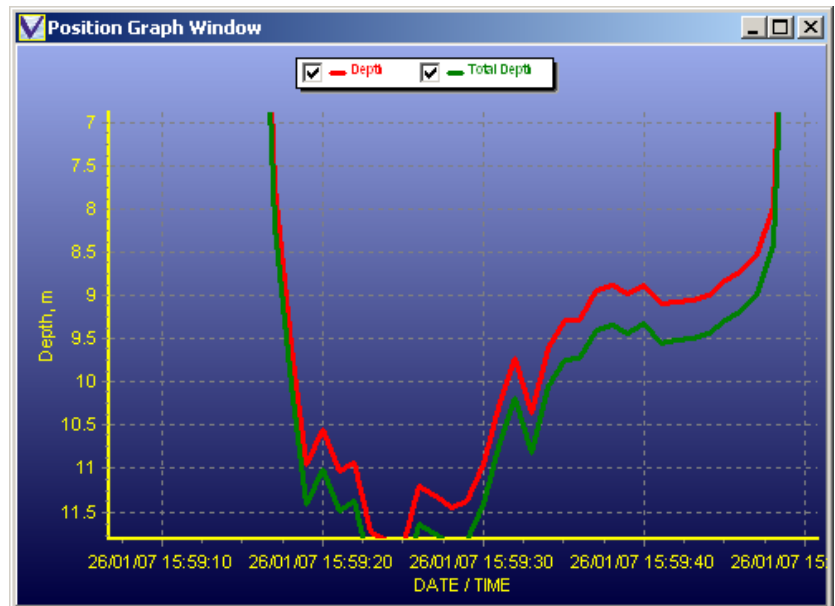
5.6 **LAST DATA DISPLAY**

The Last Data Display is a simple tabular display of the last piece of data received for each parameter. It is suitable for use with real time data. Initially the screen will appear as indicated:

Right click the mouse in the box to select the required parameters from the "Sensor List", repeating the process to add more sensors.

The following points should be noted about the Last Data Window:
- The QA box is a crude indication of data validity, showing green if data is OK, or Red if the software detects abnormal readings. This judgement is based on the calculated Salinity of the water, which will be outside normal ranges if one of the sensors has malfunctioned.
- The columns widths are adjustable using the mouse
- The entire display may be positioned and resized using the mouse
- Background colour and Font may be adjusted as with the Simple Display

5.7   SCALE DISPLAY

The Scale Display is particularly useful when BathyLog is being used with multiple IPS sensors, allowing the relative position of each sensor with in the column to be seen.

Select Scale Display form the Display Type menu, and the following window will appear:

Right – click the box and choose the required parameters from the "Sensor List". Calculated Depths from the BathyPack and the IPS sensor may be shown on separate lists.
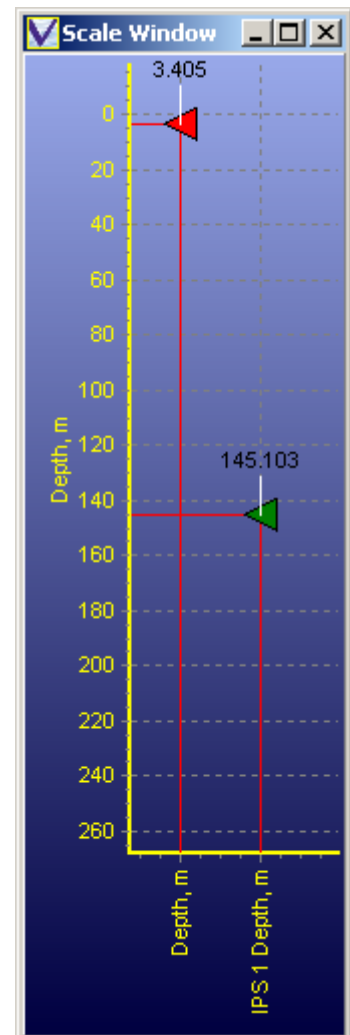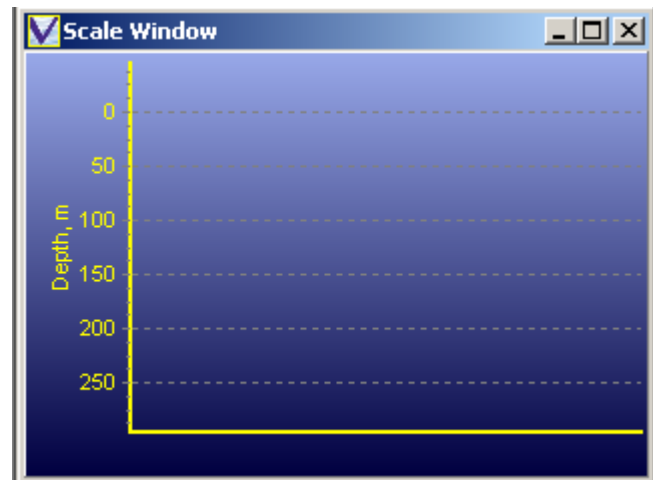
The scale display will indicate the relative positions of the sensors as shown:

As with other graphical display types, the Scale Display may be moved and sized using the mouse. By default, the graph scales will "Autoscale" to fit the displayed data. Control of this feature and other graph functions are described in Section 5.9.

5.8   DEPTH SCROLL

The Depth Scroll Window is effectively the Array data that BathyLog creates for each point in the profile, at the defined resolution. This Array (previously referred to as a Density Array) actually contains data for all parameters at each depth; the Depth Scroll window may therefore be used to view the value of any particular parameter at any depth within the profile.

Select Depth Scroll from the Display Type menu:
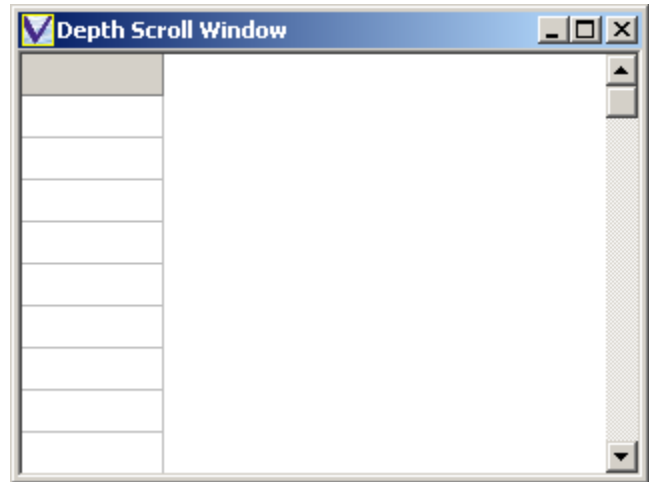
Add parameters to this display by right clicking, and selecting the required sensors from the Sensor Lists.

The following points should be noted about the Last Data Window:
- The columns widths are adjustable using the mouse
- The entire display may be positioned and resized using the mouse
- Background colour and Font may be adjusted as with the Simple Display

5.9   GRAPH AND PROFILE DISPLAY FEATURES

5.9.1   ZOOMING

A particular Section of the graph may be "zoomed in" for closer viewing by simply drawing a box with the mouse over the area of the graph of interest. Draw the box from top left to bottom right.
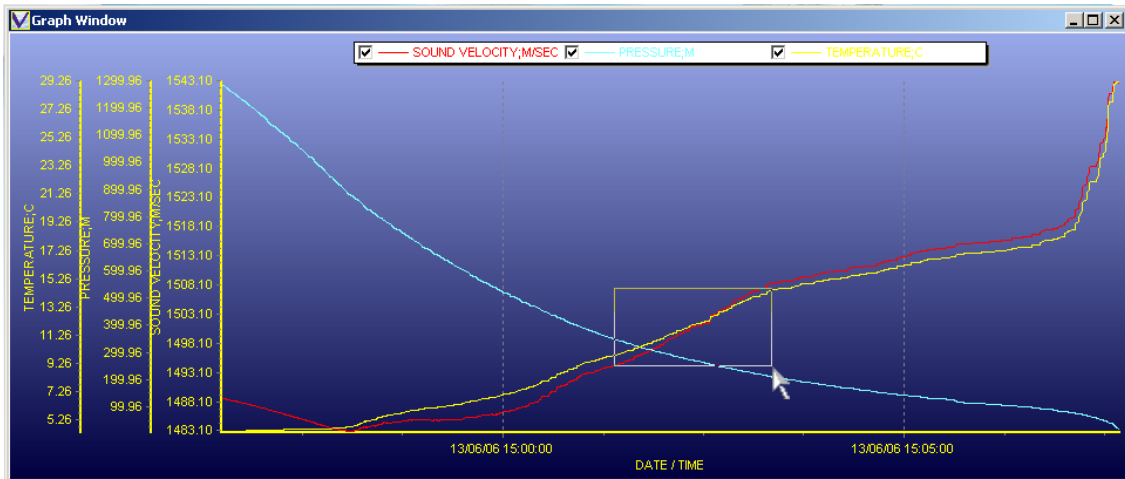

To zoom out, simply draw a box with the mouse from bottom right to top left, anywhere in the graph window
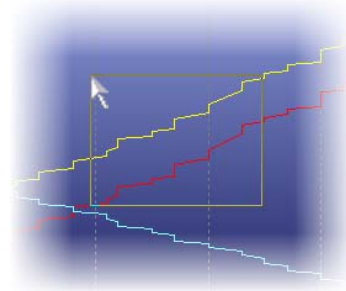

5.9.2   ADJUSTING SCALE

By default, the scale for each parameter will "Autoscale" to suit the range of data being displayed. However, it is possible to manually control the scale if preferred.

Right click on the scale to be adjusted – click on the actual line of the scale as shown.
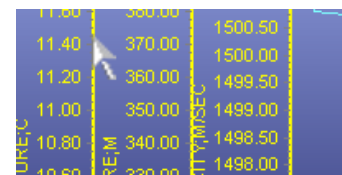
Then, enter the required minimum and maximum values for the scale, and click OK.

To return to the Autoscale mode, simply click "Auto".
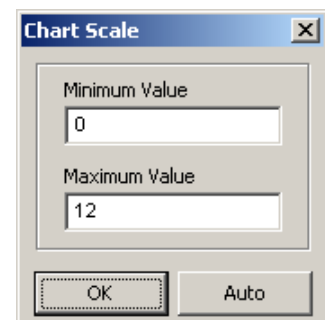
5.9.3   EXPORTING GRAPHS

The image of a Graph or Profile may be made available to other packages, for use in presentations and reports. Right click the Graph and select the "Chart Option", then choose to either "Copy" the image to the PC clipboard for simple pasting, or "Save" it to disk as a bitmap or metafile image.
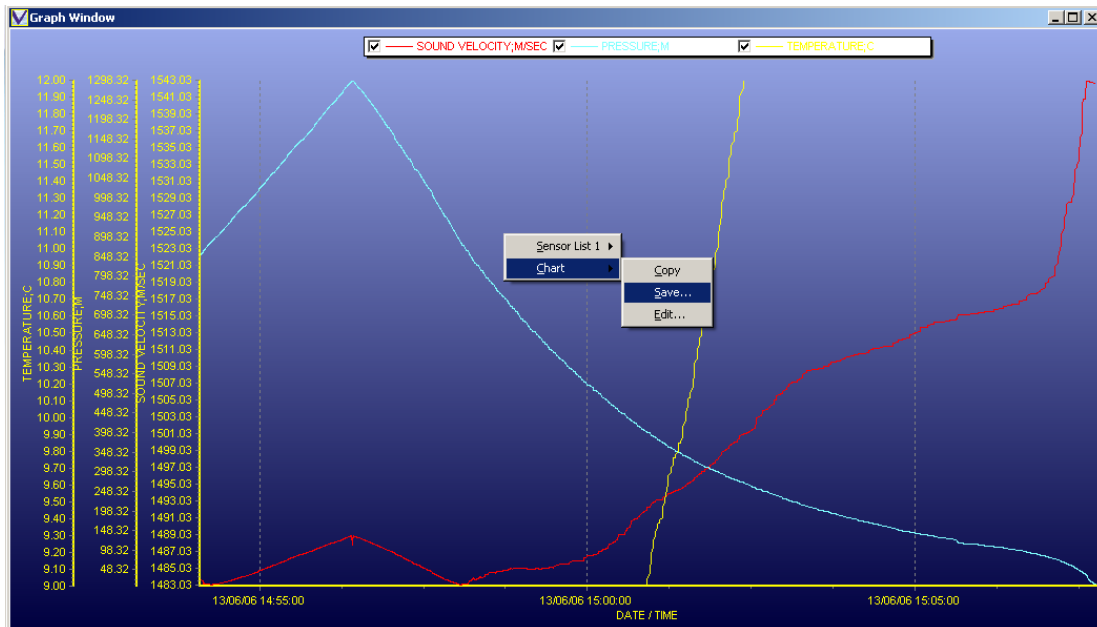

5.10   SAVING YOUR DISPLAY

Having decided on which types of data display you require, it is possible to arrange them on the screen by moving and resizing them as appropriate. An example of how the screen could look is shown here:
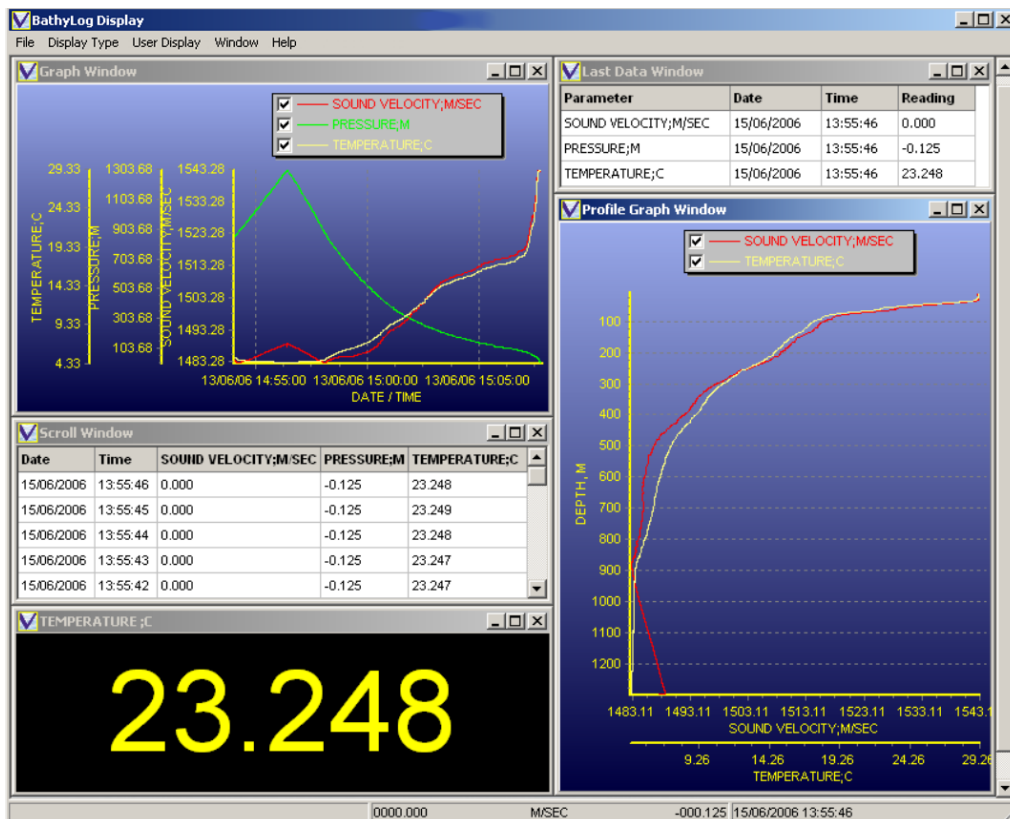
Having finalised your design, it is possible to save it for future use as one of 5 "User Displays". Click "User Display" on the menu bar, then choose the appropriate User Display Number, and finally "Save". The screen format will be recorded accordingly.

Note that you cannot overwrite the default Valeport Display format.
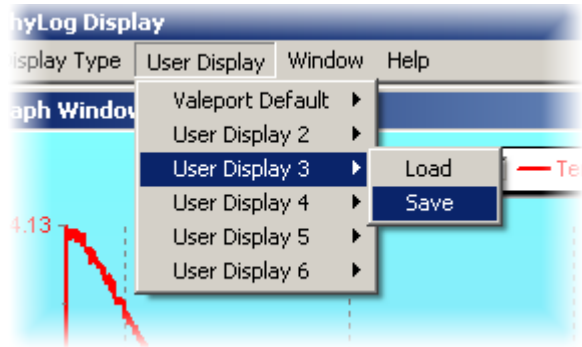
To call up a previously saved display format, simply select the appropriate User Display, and "Load". Note that it may take a few seconds to load all the data into the various displays.
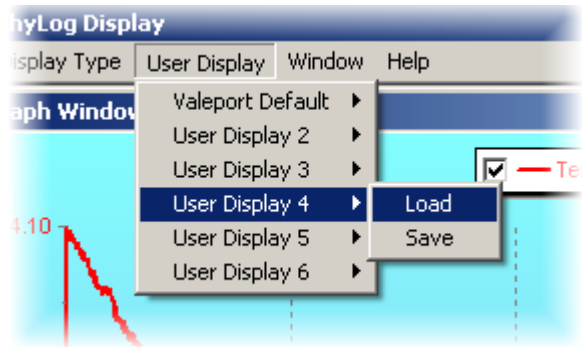
6   DATA HANDLING

6.1   INCOMING DATA

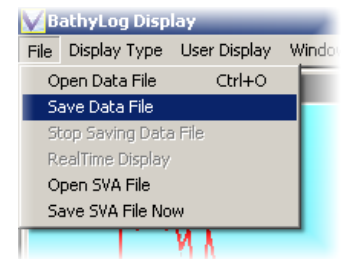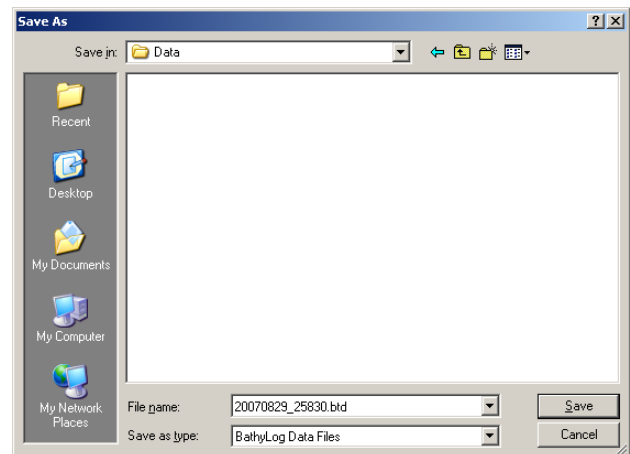### 6.1.1   SAVING DATA

Incoming data from the BathyPack or other sensors may be saved to disk. To begin saving data, simply click 2Save Data File" from the File menu as indicated:
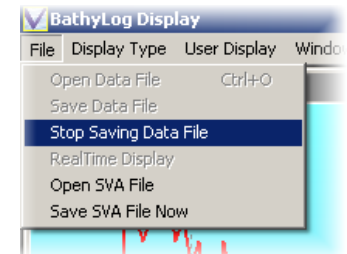
A standard Windows "Save As" window will appear:

The default file name is the date (yyyymmdd), followed by the instrument serial number (25830 in this example). The file extension is .btd, which may not be changed.

All incoming data from this point on will be appended to the chosen data file. To stop saving data, simply click "Stop Saving Data" from the File menu:

6.1.2   OPENING DATA FILES

To open an existing data file, select "Open Data File" from the File menu, navigate to your chosen *.btd file, and open. The data may take a few seconds to load, but will subsequently be available for display in all appropriate display screens (see Section 5).
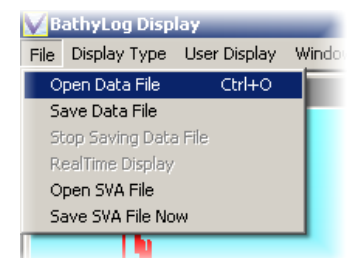
Note that while a data file is being viewed, real time data will not be shown by BathyLog.

To close the data file and return to real time data viewing, select "Real Time Display" from the File menu. Note that any previous unsaved real time data will be lost.
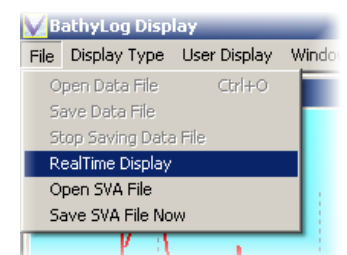
6.2   DENSITY ARRAY DATA

6.2.1   SAVING ARRAY FILES

The Density Array is a table of data calculated from the real time data coming in from the BathyPack, and it is used to convert pressure data into depth. The table is dynamic, updated with real time data coming in from the BathyPack, but at any point during the deployment, the Array may be saved to disk. The primary purpose of doing this wo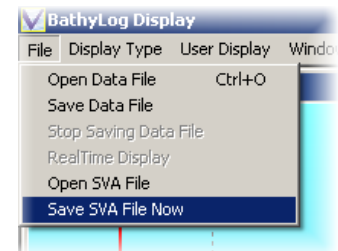uld be to capture the Density profile at a given location to use in future pressure / depth conversions at the same location (if a BathyPack were not available at the time).

To capture the Density Array at any given instant, select "Save SVA File Now" from the file menu:

Enter a suitable file name and save the SVA file in your chosen location. We would recommend choosing a file name to reflect the date, time and location of the data.
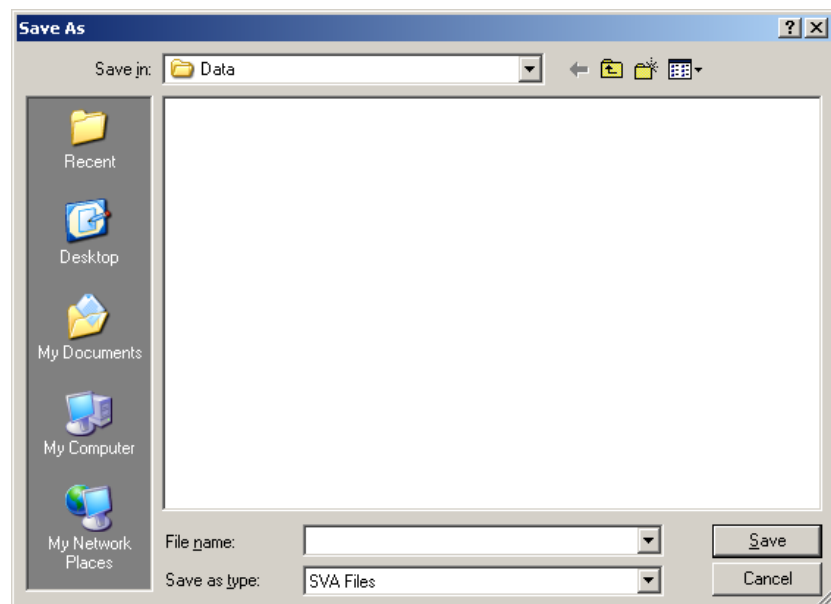
6.2.2   OPENING ARRAY FILES

To open an array file, typically so that you may use existing BathyPack data to convert pressure into depth for a Valeport IPS sensor, click "Open SVA File" from the File menu. Navigate to the chosen SVA file, and click Open.
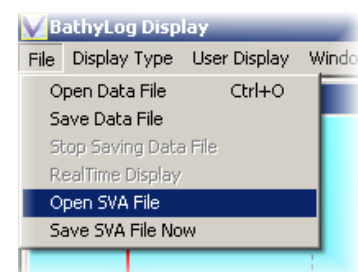
Note that an opened SVA file will "over-write" any data in the real-time Density array, so this function should be used with care if a BathyPack is being used to collect a profile at the time.

6.3   DATA OUTPUT FORMAT

One of the functions of the BathyLog software is to provide a real time data output on a spare PC serial port, for input to other packages, or to provide a backup data storage capability. To enable this function, simply check the "Output Port" box in the setup screen (refer to Section 4.3). Choose the correct Com Port on which you wish to output the data, and the desired baud rate.

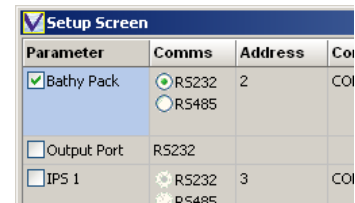The data output string is a long string of tab separated data in ASCII text format. The full string is as follows:

Date<TAB>Time<TAB>Conductivity<TAB>Pressure<TAB>Temperature<TAB>Altimeter<TAB>SV Measured<TAB>SV Calculated<TAB>Depth<TAB>Total Depth<TAB>Point Density<TAB>Density Profile<TAB>Salinity<TAB>Barometric Pressure<TAB>IPS 1<TAB>IPS 2<TAB>IPS 3<TAB>IPS 4<TAB>IPS 1 Depth<TAB>IPS 2 Depth<TAB>IPS 3 Depth<TAB>IPS 4 Depth<TAB><CR><LF>

Parameter	Format / Notes
Date	dd/mm/yyyy
Time	hh:mm:ss (24 hour clock)
Conductivity	Real time data from BathyPack in mS/cm
Pressure	Real time data from BathyPack in dBar
Temperature	Real time data from BathyPack in °C
Altimeter	Real time data from accessory altimeter (if fitted) in metres
SV Measured	Time of flight Sound Velocity data from BathyPack in m/s
SV Calculated	Sound Velocity calculated by BathyLog from CTD parameters using Chen & Millero, in m/s
Depth	Actual Depth of BathyPack in metres, as calculated by BathyLog software
Total Depth	Total water depth in metres, calculated by BathyLog as sum of Actual Depth and Altimeter output (if fitted)
Point Density	Theoretical Density value (kg/m³) from EOS80 formula, calculated by BathyLog
Density Profile	Actual Density (kg/m³) taking into account the integrated density variations in the water column
Salinity	Salinity value of the water, calculated by BathyLog using PSS78 formula (no units)
Barometric Pressure	Real time data from dedicated Air Pressure sensor, if available (mBar)
IPS*n*	Actual Pressure in dBar from an accessory mini or Modus IPS sensor, if fitted (up to 4 max)
IPS*n* Depth	Actual Depth in metres from accessory sensor, calculated by BathyLog using the Density profile from the BathyPack itself.

Note: If a sensor is not fitted or available, then parameters from that device will not be included in the string

7   WIRING DETAILS

7.1   BATHYPACK MAIN BULKHEAD CONNECTOR

10 Way Female Subconn MCBH10F	Function
1	Power Ground
2	Power +V
3	RS422TxA
4	RS422TxB
5	RS422RxA
6	RS422RxB
7	RS232 Tx (To PC)
8	RS232 Rx (From PC)
9	RS232 Ground
10	N/C

Note: For half-duplex RS485 communications link Pin 3 to Pin 5, and Pin 4 to Pin 6 in signal cable.

7.2   BATHYPACK ALTIMETER BULKHEAD CONNECTOR

6 Way Female Subconn MCBH6F	FUNCTION
1	Sensor Power Ground / RS232 Ground
2	RS232 Rx In to BathyPack
3	RS232 Tx Out of BathyPack
4	Sensor Power (+24V max)
5	RS485B
6	RS485A

7.3   RS232 3M Y LEAD (AS SUPPLIED)

10 Way Male Subconn MCIL10M	3m Cable	1m Power Cable	4mm Banana Plugs	1m Data Cable	9 Way D Type	Function
1	WHITE	BLUE	BLACK			Power Ground
2	PINK	BROWN	RED			Power +V
3	N/C					
4	N/C					
5	N/C					
6	N/C					
7	GREY			YELLOW	2	RS232 Tx (To PC)
8	BLUE			BLUE	3	RS232 Rx (From PC)
9	GREEN			GREEN	5 (link to 1,6,8,9)	RS232 Ground
	SCREEN			SCREEN	SHELL	
10	YELLOW					Link to RS232 Ground