



Centaur/Echo

Operation Manual

Part Number: 5253-31-0001

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- 3 On completion of any warranty work, Sonavision Limited will return the equipment, freight prepaid.
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GENERAL WARNINGS

- 1 Lethal voltages are exposed within the surface control unit when the top cover is removed.
- 2 The surface control unit should always be disconnected from the mains supply before removing or operating any of the access panels.
- 3 The surface unit should be earthed at all times via the mains earth or the chassis stud at the rear of the control unit.
- 4 Both surface and subsea units contain electrostatically sensitive devices (ESSD).

RELATED INFORMATION

Description	Part Number
Centaur Installation Manual	5251-32-0002
Echo Installation Manual	5253-32-0001
Centaur/Echo troubleshooting manual	5253-33-0001
Echo transducer change manual	5253-35-0001
Technical sales brochure	-

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1 Introduction

The purpose of this manual is to describe the installation and operation of the software necessary to operate the Centaur Bathymetry System and Echo Altimeter.

The Centaur will default to UK94 emulation mode if the Sonavision software is not detected within 8 seconds of switch on. The Echo will also output a standard string in the same time period.

2 Software Installation

The software supplied on the CD allows the Centaur settings to be modified. It also allows real-time display of the data from the Centaur in either a stand-alone mode or as a sub-program of the Sonavision Sonar software (V5.2.0.0 onwards).

The software is installed by running the **Setup_5.2.0.0 and Centaur Echo.exe** (or later) from the CD (5253-22-0001). This should auto-boot when the CD is inserted. The Centaur/Echo application and support files will be placed in the same directory as the Sonavision files (defaults to C:\Sonavision but can be customized at installation). This operation will install a version of the Sonavision Sonar software, together with the application necessary to run a Centaur or Echo. The installation will set up separate Sonavision Sonar and Centaur/Echo Application entries in the **Programs** list under SonaVision, and generate separate desktop icons for these programs.

Once this has been done, the **Centaur/Echo Application** software can be run as a separate program or as an integral part of the Sonavision Surface software via a menu entry in the **View** pull-down menu. It should be noted that when running in this mode, the user must ensure that the Sonar and the Centaur are running on separate and valid COM (or virtual COM) ports. These can be changed under program control to avoid conflict.

If the product is a Centaur Bathymetry System, calibration software is supplied on a separate CD (5253-22-0002). This software allows the user to calibrate their Centaur in conjunction with a calibrated pressure source such as a dead-weight tester. This software should be installed by running **Setup Centaur Calibration.exe** from the CD. It need not be installed in the same directory as the application software but defaults to

C:\Sonavision. The installation will put a Centaur Calibration entry in the SonaVision Programs entry. A desktop icon will also be created.

Because of certain commonalities between the Centaur and Echo products, the same software is used to setup and control both. The software does vary slightly between products but this is automatically configured on establishing communications with the appropriate device. Despite this, the discussion of the operation of this software is described in separate Centaur and Echo sections (3 and 4) of this document.

The **Centaur Calibration** must be run as a separate program when calibration is to be carried out on the Centaur. This can only be used in conjunction with a suitable calibrated pressure source such as a dead-weight tester. The operation of this software is discussed in detail in section 5 of this document.

3 Starting the Configuration and Display Software

Selecting **Centaur/Echo Application** from the Windows **Program** menu, desktop icon or from the **View** menu in the SonaVision Sonar Software should result in the following **Configure** page appearing:-

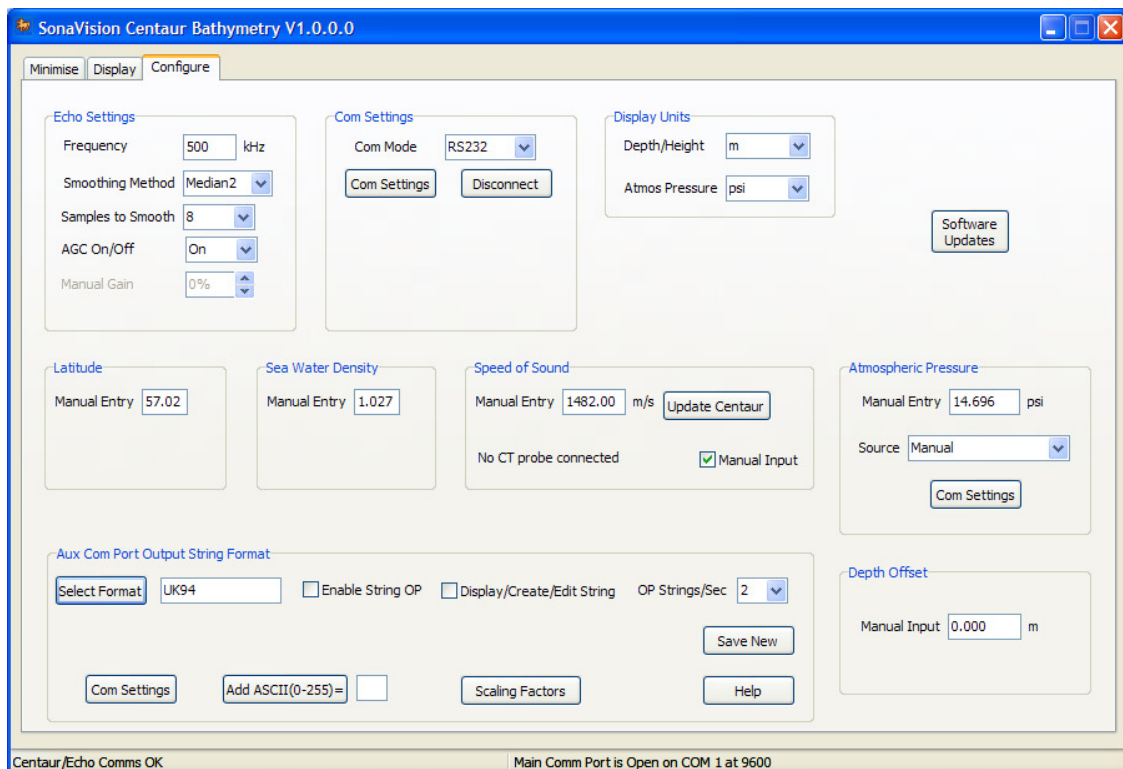


Figure 3.1

Select the **Com Mode** you are currently using between your computer and the Centaur /Echo (this defaults to RS232) and ensure that the com port and baud rate are correct via the **Com Settings** button. Note that the baud rate should match that of the Centaur since the Centaur baud rate cannot be changed until communications have been established.

Press the **“Connect”** Button. This will change to **“Disconnect”** and the status bar messages will change to **“WARNING:Centaur/Echo comms connecting”** and **“Main Com Port is Open on COM n at YYYY”**. **Now apply power to the Centaur**. Within a few seconds the right status bar should change to **“Centaur/Echo Comms OK”**. The right status bar indicates whether a com port is open and which one, producing a message **“Main Com Port is Open on COM n at YYYY”** when connected and **“Main Comm Port is Closed”** when disconnected.

Immediately following the establishment of communications the software will determine the type of device connected and the window will customise to display parameters suitable for that device. In the case of the Centaur, the display will remain as in Figure 3.1, but with the Frequency, Smoothing Method, Samples to Smooth, AGC ON/OFF, Latitude, Seawater Density, Speed of Sound and Atmospheric Pressure all displaying values read from the Centaur.

The Echo screen will be as shown in Figure 3.2 with the Frequency, Smoothing Method, Samples to Smooth, AGC ON/OFF, String Emulation, Emulation Com Mode, Strings Per second, Analogue O/P and Max Range all displaying values read from the Echo.

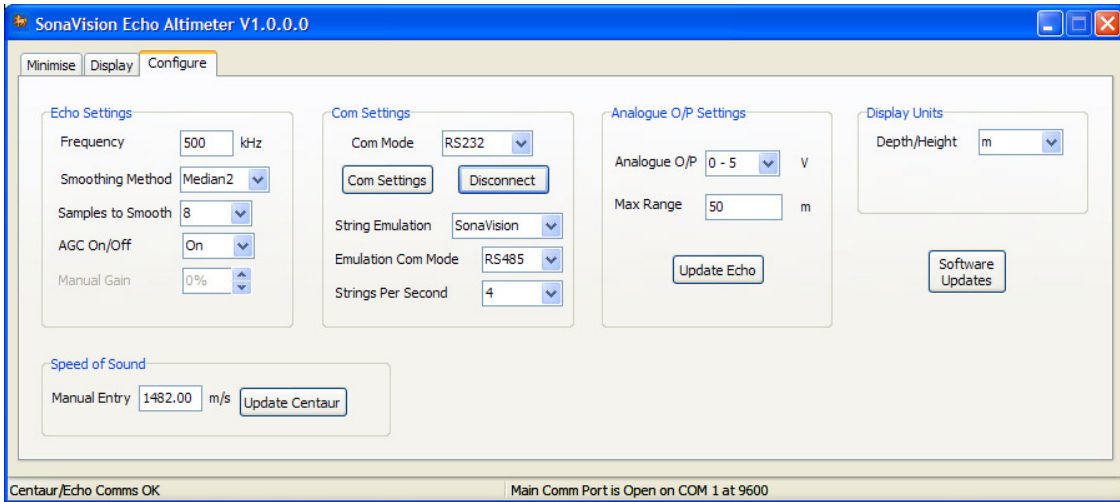


Figure 3.2

4 Centaur Application Software

4.1 Configuration Tab

The buttons and text boxes on the Configuration tab are as follows:-

Frequency

Once communications have been established, the configure page will show the altimeter operating frequency. This is not user-selectable.

Smoothing Method

The smoothing control allows the user to apply increasing amounts of smoothing to the data, to remove any glitches or erroneous values. The methods range from "Off" to Median3. The response time will in general become slower as a more advanced smoothing method is applied, although this is also related in the number of samples to smooth selected. A recommended smoothing setting is Median1, with 8 samples to smooth. The user may however experiment with any combination of values (see Appendix A for a further explanation of this feature).

Samples to Smooth

This control is used in conjunction with Smoothing Method to allow the user to select the number of samples over which the smoothing method. is applied. (See Appendix A for an explanation of this feature)

AGC On/Off

If enabled AGC will adjust the gain of the receiver in an appropriate fashion so that long range echoes are boosted increasing range capabilities and short range echoes are attenuated allowing accurate short range use. In normal operation AGC is **On**. When AGC is set to **Off** the **Manual Gain** control is enabled.

Manual Gain

This control is enabled when the AGC selector is Off, allowing the user to manually enter the altimeter gain. The value must be an integer lying between 100% to + 100%.

Com Mode

The Com Mode indicates the hardware communications mode of the control computer (RS232 or RS485). If this is set correctly, data will be sent to the Centaur and it will automatically detect and switch its communications mode to match. **If this value is wrongly set, the control computer will not establish communications with the Centaur.**

Connect / Disconnect

The Connect button must be pressed in order to establish communications. The legend on the button will change to "Disconnect". Initially the message **"Warning:Centaur/Echo comms connecting"** will appear, rapidly followed by **"Centaur/Echo Comms OK"**. If communications are lost, the message **"WARNING:Centaur/ Echo comms connecting"** will appear, shortly followed by **"Centaur/Echo Comms OK"**. The right status bar indicates whether a com port is open and which one, producing a message **"Main Com Port is Open on COM n at YYYY"** when connected and **"Main Comm Port is Closed"** when disconnected.

Com Settings

The Com Settings button produces a pop-up window allows the port and baud rate of the link between the computer and the Centaur to be changed. It is recommended that the data rate should be maintained at 9600.

Range Units

The Range box allows units of metres, feet or fathoms to be displayed on the depth and height settings. It also allows units of psi or mbar to be selected for the atmospheric pressure input value

Software Update

This button indicates the location on the SonaVision website via which software and firmware updates can be downloaded.

Latitude

The current latitude must be entered by the user in order to produce an accurate pressure to-depth conversion. A default value is initially presented.

Seawater Density

The seawater density must be entered by the user in order to produce an accurate pressure to depth conversion. This value lies in the range 0.900 to 1.200, with a default of 1.027 for normal seawater.

Speed of Sound

When the Centaur establishes communications with the computer, the current speed of sound, stored in the Centaur is displayed.

A Status message will appear in the speed of sound box to indicate whether or not the Centaur has detected a CT probe. If a probe has been detected, the conductivity reading from the CT probe is used to calculate a more accurate speed of sound and hence the altimeter height. The Centaur connects directly to a Valeport CT probe, such as a Model 620, via a Burton Subconn 6 connector (the Centaur is supplied with blanking plug on this connector). Even when a CT probe is connected, a manually-entered speed of sound can be selected by checking the **Manual Input** check box.

The speed of sound stored in the Centaur can be altered by the user, thus allowing a more accurate internal calculation of altimeter height. Once a value has been entered, The **Update Centaur** button will update the currently displayed speed of sound stored in the Centaur. This button is only enabled when the manual speed of sound is selected and cannot be updated when the speed of sound is calculated from a CT probe input.

Atmospheric Pressure

The atmospheric pressure must be entered by the user in order to produce an accurate pressure to depth conversion. A default value is initially presented.

The atmospheric pressure can be entered from an instrument via a COM port. At present a Druck DPI 740 is supported. This source is utilised by selecting the COM port with the **COM Settings** button and selecting the **Druck DPI 740** from the combo box. The default source is **Manual** and this can be re-selected at any time.

Depth Offset

This allows a value to be entered by the user in order to trim the depth value displayed to a known value (usually a zero reference). A positive or negative floating point number can be entered here. Depth Offset is initialized to 0.0.

Aux Com Port Output String Format

This set of controls allows the user to create and output a custom data string to a designated serial COM or virtual COM port. This string would typically be sent to a survey computer for logging or further processing. **This string will only be output**

when the Centaur is under the control of the Centaur/Echo application and the UK94 data string is not being output directly from the Centaur.

The function of each of the controls within this section are as follows :-

4.1.1 Select Format

This opens a file browser box. The user should navigate to the **String Formats Folder** located in the install folder, select the appropriate string format file and click the **Save** button. The string format is now set up to output data in that format.

If the user is creating a new string format, the file name should be typed into this box.

4.1.2 Enable String OP

This enables the output string from the default COM port. The COM port and baud rate can be changed using the **Com Settings** button.

4.1.3 Display/Create/Edit String

This displays the String Format text box and, if a string has been selected, displays its format in the box.

4.1.4 OP Strings/Sec

This allows the user to select the output string rate from 1 to 6 strings/sec.

4.1.5 String Format

Activated by the **Display/Create/Edit String** check box, this displays the currently selected string format. If the user is creating a new string, this box is edited appropriately with the format characters (see below).

4.1.6 Save New

This button causes the contents of the String Format text box to be saved to the currently selected file name. If the user is creating a new string format, ensure that the file name has been typed in otherwise the new format will overwrite the currently selected format.

4.1.7 Com Settings

The Com Settings button produces a pop-up window allows the port and baud rate of the auxiliary COM port to be changed.

4.1.8 Add ASCII (0-255)=

This button and the associated edit box allow the user to insert non-printable ASCII characters into the output string. The ASCII value between 0 and 255 should be entered in the edit box and the **Add ASCII (0-255)=** button clicked to enter the character at the cursor position in the format string. Note that most non-standard characters will not produce a viewable character. If they have been entered correctly and saved they will however be present in the output string.

4.1.9 Scaling Factors

This button produces a pop-up window which allows each of values to be pre-multiplied before being sent. This allows unit conversion factors or other scaling to be applied to the values before being sent to the remote computer. The internal parameters are unaltered by these factors.

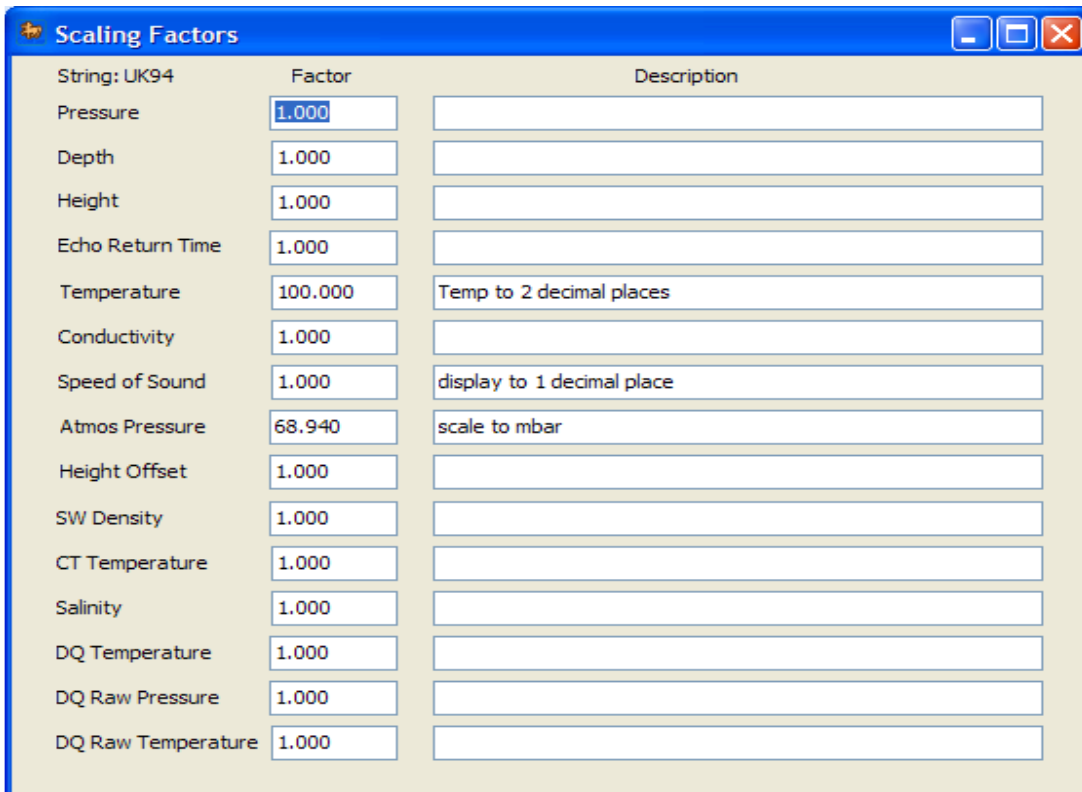


Figure 4.1

4.1.10 HELP

This button results in a pop-up, which explains the syntax of the **String Format** string.

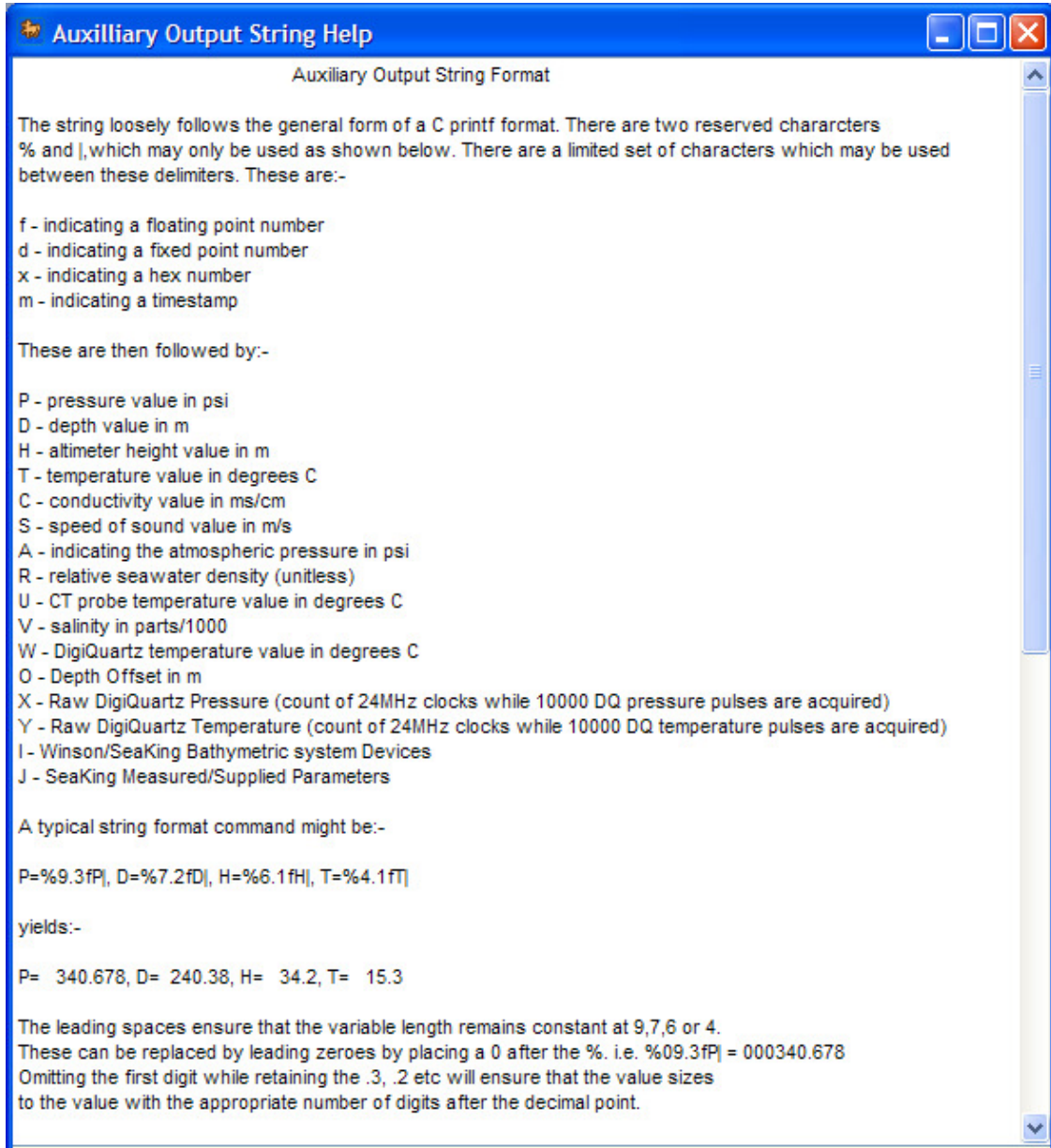


Figure 4.2

The string format syntax loosely follows the general form of a C printf format. There are two reserved characters % and |, which may only be used as shown below. There are a limited set of characters which may be used between these delimiters. These are:-

- f - indicating a floating point number
- d - indicating a fixed point number

x - indicating a hex number
m - indicating a timestamp

These are then followed by:-

P - pressure value in psi
D - depth value in m
H - altimeter height value in m
T - temperature value in degrees C
C - conductivity value in ms/cm
S - speed of sound value in m/s
A - atmospheric pressure in psi
R - relative seawater density (unitless)
U - CT probe temperature value in degrees C
V - salinity in parts/1000
W - DigiQuartz temperature value in degrees C
X - Raw DigiQuartz Pressure (count of 24MHz clocks while 10000 DQ pressure pulses are acquired)
Y - Raw DigiQuartz Temperature (count of 24MHz clocks while 10000 DQ temperature pulses are acquired)
I - Winson/SeaKing Bathymetric system Devices
J - SeaKing Measured/Supplied Parameters

A typical string format command might be:-

P=%9.3fP|, D=%7.2fD|, H=%6.1fH|, T=%4.1fT|

yielding:-

P= 340.678, D= 240.38, H= 34.2, T= 15.3

The leading spaces ensure that the variable length remains constant at 9,7,6 or 4. These can be replaced by leading zeroes by placing a 0 after the %. i.e. %09.3fP| = 000340.678. Omitting the first digit while retaining the .3, .2 etc will ensure that the value sizes to the value with the appropriate number of digits after the decimal point.

P=%09.3fP|, D=%07.2fD|, H=%06.1fH|, T=%04.1fT|

yields:-

P=0340.678, D=0240.38, H=034.2, T=015.3

A timestamp can also be added by including:-

mA| - date and time
mD| - date
mT| - time

Note: All timestamps are without a leading %

#SV %09.3fP|,%09.3fD|,%04.1T|,%04xH|,mD|

will produce:-

#SV 000340.678,000240.385,015.3,0022,10122007

All values except I and J can be pre-multiplied before being converted and output. This allows floating point data to be transmitted as a scaled fixed point value which is converted back to floating point by later division by the multiplication factor. It also allows unit conversions to be applied e.g. X 68.94 converts psi to mbar/hPa.

Example:

Pressure of 340.696 psi above could be sent as 340696 fixed point by setting the pressure multiplier to 1000 and using %6dP| to get 6 digit accuracy.

The receiving software would have to perform the division by 1000 to restore this to a correctly scaled floating point number.

4.2 Display Tab

Selecting the Display tab will result in the following display:-

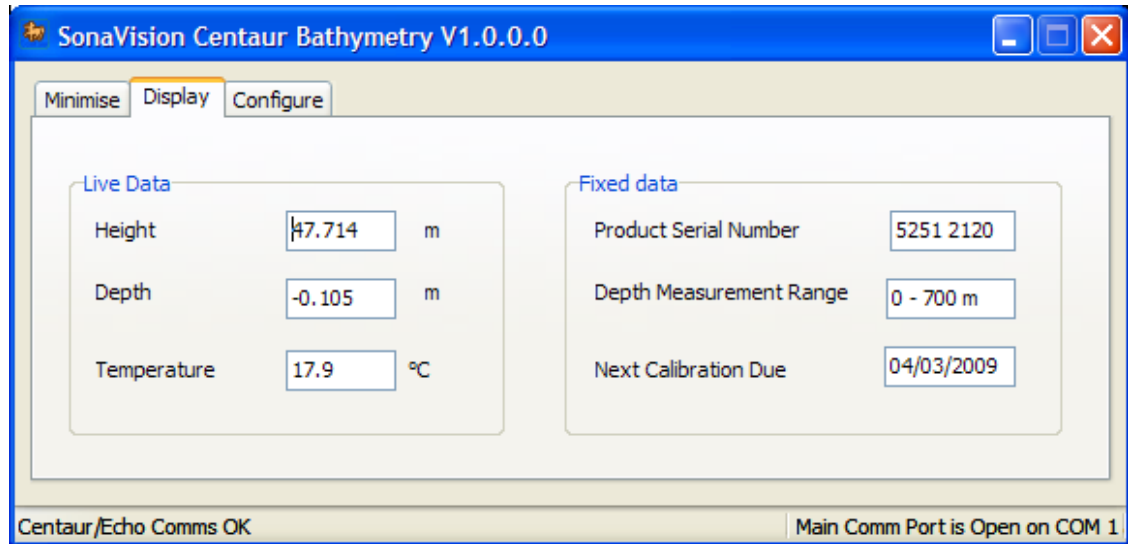


Figure 4.3

If the Centaur is in greater than 0.4m of water, the **Height** field should indicate the height above the seabed.

The **Depth** field indicates the depth of the Centaur below the surface.

The **Temperature** field displays the sea temperature as measured on the outer casing of the Centaur.

The **Product Serial Number** should display 5251 xxxx, where 5251 is the Centaur product code and xxxx is a unique unit number.

The **Depth Measurement Range** indicates the limit achievable with the unit and the currently fitted Digiquartz unit rating.

The **Next Calibration Due** indicates the date one year after the last calibration. To maintain measurement accuracy it is recommended that the Centaur should be re-calibrated on or around this date.

4.3 Minimise Tab

Selecting the Mimimise tab will result in the following display:-

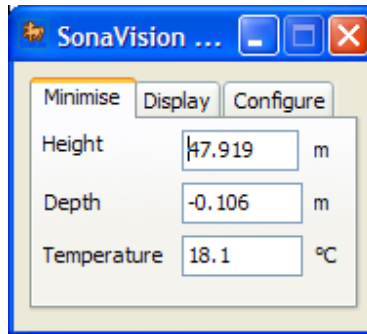


Figure 4.4

This only displays the essential Centaur parameters of height, depth and temperature and is intended for use as a window which can be used to overlay other software, such as the Sonavision Sonar software, without greatly impeding the use of that software. The larger display window, or the configure window, can be restored at any time by selecting the appropriate tab.

5 Echo Application Software

5.1 Configuration Tab

The buttons and text boxes on the Configuration tab are as follows:-

Frequency

Once communications have been established, the configure page will show the altimeter operating frequency. This is not user-selectable.

Smoothing Method

The smoothing control allows the user to apply increasing amounts of smoothing to the data, to remove any glitches or erroneous values. The methods range from “Off” to Median3. The response time will in general become slower as a more advanced smoothing method is applied, although this is also related in the number of samples to smooth selected. A recommended smoothing setting is Median1, with 8 samples to smooth. The user may however experiment with any combination of values (see Appendix A for a further explanation of smoothing methods).

Samples to Smooth

This control allows the user to select the number of samples over which the smoothing method is applied, and can be varied from 8 to 31. As the number increases, the response time to quick variations in height slows.

AGC On/Off

This allows the automatic gain control to be turned on/off. In normal operation AGC is **On**. In this mode the altimeter automatically adjusts its gain in order to maintain optimal signal returns. When this is set to **Off** the **Manual Gain** control is enabled, allowing the user to set the gain to a fixed value.

Manual Gain

This control is enabled when the AGC selector is Off, allowing the user to manually enter the altimeter gain. The value must be an integer lying between 100% to + 100%.

Com mode

The Com Mode indicates the hardware communications mode of the control computer (RS232 or RS485). If this is set correctly, data will be sent to the Centaur and it will automatically detect and switch its communications mode to match. **If this value is wrongly set, the control computer will not establish communications with the Centaur.**

Connect / Disconnect

The Connect button must be pressed in order to establish communications. The legend on the button will change to "Disconnect". Initially the message **"Warning:Centaur/Echo comms connecting"** will appear, rapidly followed by **"Centaur/Echo Comms OK"**. If communications are lost, the message **"WARNING:Centaur/ Echo comms connecting"** will appear, shortly followed by **"Centaur/Echo Comms OK"**. The right status bar indicates whether a com port is open and which one, producing a message **"Main Com Port is Open on COM n at YYYY"** when connected and **"Main Comm Port is Closed"** when disconnected.

Com Settings

The Com Settings button produces a pop-up window allows the port and baud rate of the link between the computer and the Centaur to be changed. It is recommended that the data rate should be maintained at 9600.

Range Units

The Range box allows units of metres, feet or fathoms to be displayed on the depth and height settings. It also allows units of psi or mbar to be selected for the atmospheric pressure input value

Software Update

This button indicates the location on the SonaVision website via which software and firmware updates can be downloaded.

Data Output

There are three methods of accessing the information acquired by the Echo altimeter

5.1.1 Data on request via the SV protocol

Reading are requested and received by a system communicating with the SV protocol

5.1.2 Streamed output

The Echo can be configured to stream data on either RS232 or RS485 at a user specified repetition rate up to a maximum of 20 outputs per second. A list and format of the current strings are specified in the appendix section of this manual.

5.1.3 Analogue Voltage Output

An analogue output representing the Echo's reading is always available to the user via a pin on the connector. The voltage range is selectable between 2 configurable voltage ranges. The factory default configurations are calibrated as 0 – 5 volts and 0 – 10 volts. The user can select either the 0 – 5 voltage range or 0 – 10 voltage range. These voltage ranges are also user configurable.

Note: The range selection determines what the maximum voltage output represents.

e.g. Max Range = 30 meters analogue voltage range = 0 – 5 volts

0 V = 0 meters or greater than 30 meters

2.5 V = 15 meters

5 V = 30 meters

5.1.4 Range Selection

The Echo allows a maximum range to be set by the user. This distance is from the Echo's transducer to the object (one way). Any echo's received beyond this range are ignored.

If it is known that the Echo is working no more than a certain distance from a target then it is recommended to set the maximum range to slightly more than this distance. This will focus and optimize the echo's AGC, analogue output and ping rate to the working distance.

5.2 Display Tab

Selecting the Display tab will result in the following display:-

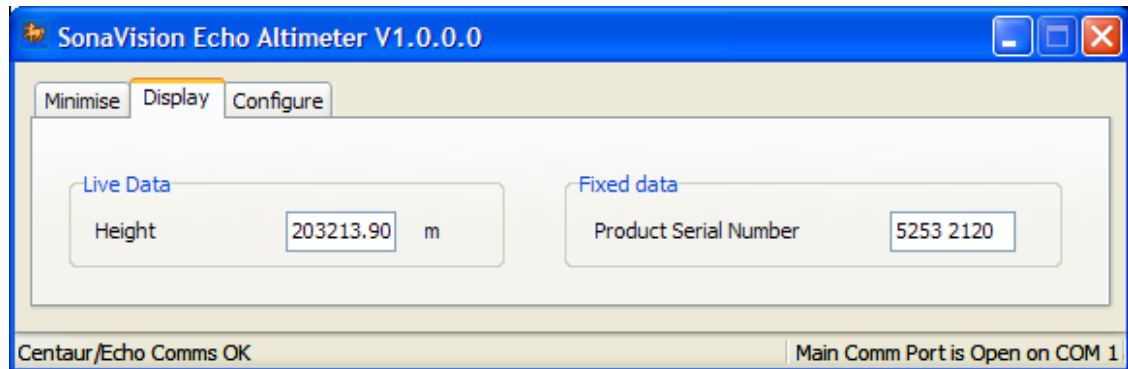


Figure 5.2

If the Echo is in greater than 0.4m of water, the **Height** field should indicate the height above the seabed..

The **Temperature** field displays the sea temperature as measured on the outer casing of the Echo.

The **Product Serial Number** should display 5253 xxxx, where 5253 is the Echo product code and xxxx is a unique unit number.

The **Next Calibration Due** indicates the date one year after the last calibration. To maintain measurement accuracy it is recommended that the Echo should be re-calibrated on or around this date.

5.3 Minimise Tab

Selecting the Mimimise tab will result in the following display:-

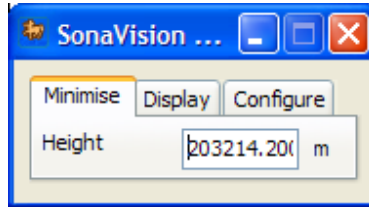


Figure 5.3

This only displays the essential Echo parameters of height, and temperature and is intended for use as a window which can be used to overlay other software, such as the Sonavision Sonar software, without greatly impeding the use of that software. The larger display window, or the configure window, can be restored at any time by selecting the appropriate tab.

6 Centaur Calibration Software

The calibration program is invoked by running the Centaur Calibration.exe file from the programs menu tab. Or directly from the C:\SonaVision directory.

6.1 Enter Values Tab

Selecting **Centaur/Echo Calibration** from the Windows **Program** menu should result in the following **Enter Values** page appearing:-

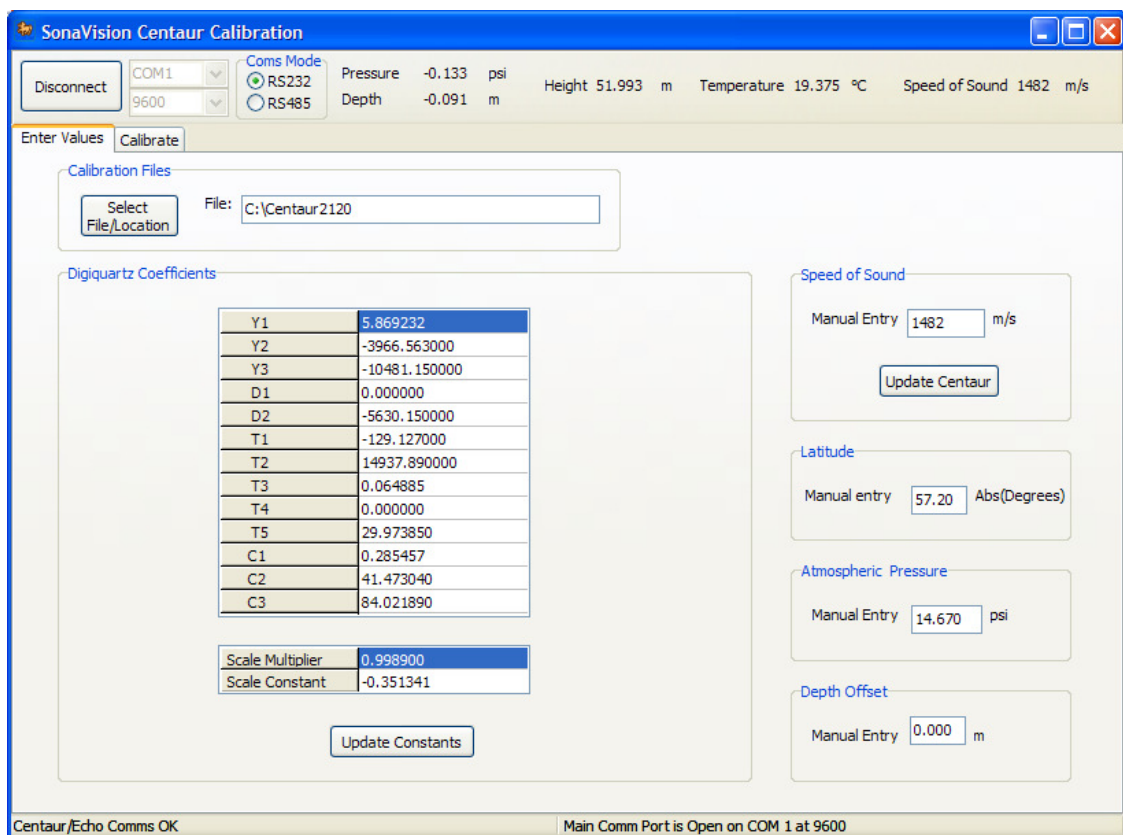


Figure 6.1

Connect / Disconnect

The **Connect** button must be pressed in order to establish communications. When activated, the legend on the button will change to **Disconnect** and an initial message **Warning:Centaur/Echo comms connecting** will appear in the left status bar and **Main Com Port is Closed** in the right status bar. This will be rapidly followed by **Centaur/Echo Comms OK** in the left status bar and **Main Comm Port is Open on Com n at YYYY** in the right status bar. If communications are lost, the message

“**WARNING:Centaur/ Echo comms connecting**” will reappear, shortly followed by “**Centaur/Echo Comms OK**”.

Com Port

The Com Port list box allows the com port of the link between the computer and the Centaur to be selected.

Baud

The Baud list box button allows the baud rate of the link between the computer and the Centaur to be changed. It is recommended that the data rate should be maintained at 9600.

Coms Mode

The Com Mode indicates what mode the system is currently in. The user must change this to the mode in which the system is currently configured before communications can be established.

Pressure, Depth, Height ,Temperature and Speed of Sound

Once the calibration process is begun, these, located at the top of the window, indicate the values currently being read from the Centaur.

Select File/Location

This button results in a standard windows file/directory selection pop-up. The filename should indicate a unique identifier for the Centaur such as the serial number or a DigiQuartz identifier. The file can be placed anywhere and can have any name but **it must not have an extension**. The calibration program will automatically pick up or create filename.cal and filename.ver files. **It is important that a filename is entered here since all measurements taken during the calibration and verification process will be saved to files using this name. If no file is specified, no data will be saved.**

Digiquartz Coefficients

These coefficients are supplied with the Digiquartz transducer and are unique to it. The values shown have been entered at manufacture and should never need to be changed for that transducer. The only time that this facility will be used is when a Digiquartz transducer has been changed. The **Scale Multiplier** and **Scale Constant** values are not user configurable and are read only. Any changes to the Digiquartz coefficients are permanently changed in the Centaur by the **Update Constants** button.

Speed of Sound

The value stored in the Centaur is displayed in the speed of sound box. The user can manually modify this and update the value held in the Centaur via the **Update Centaur** button.

Latitude

The absolute latitude between 0 and 90 degrees must be entered by the user in order to produce an accurate pressure-to-depth conversion. A default value is initially presented.

Atmospheric Pressure

The value of atmospheric pressure is vital to the calibration process. The local value at the time of calibration should be obtained to a high accuracy and entered in this box. A default value is initially entered. **If calibration is performed with an invalid atmospheric pressure value, the whole calibration will be invalid and must be repeated.**

Depth Offset

This allows the user to enter a value, in order to trim the depth value displayed to a known reference (usually a zero reference). A positive or negative floating point number can be entered here. Depth offset is initialized to 0.0.

6.2 CalibrationTab

Selecting the **Calibration** tab results in the following:

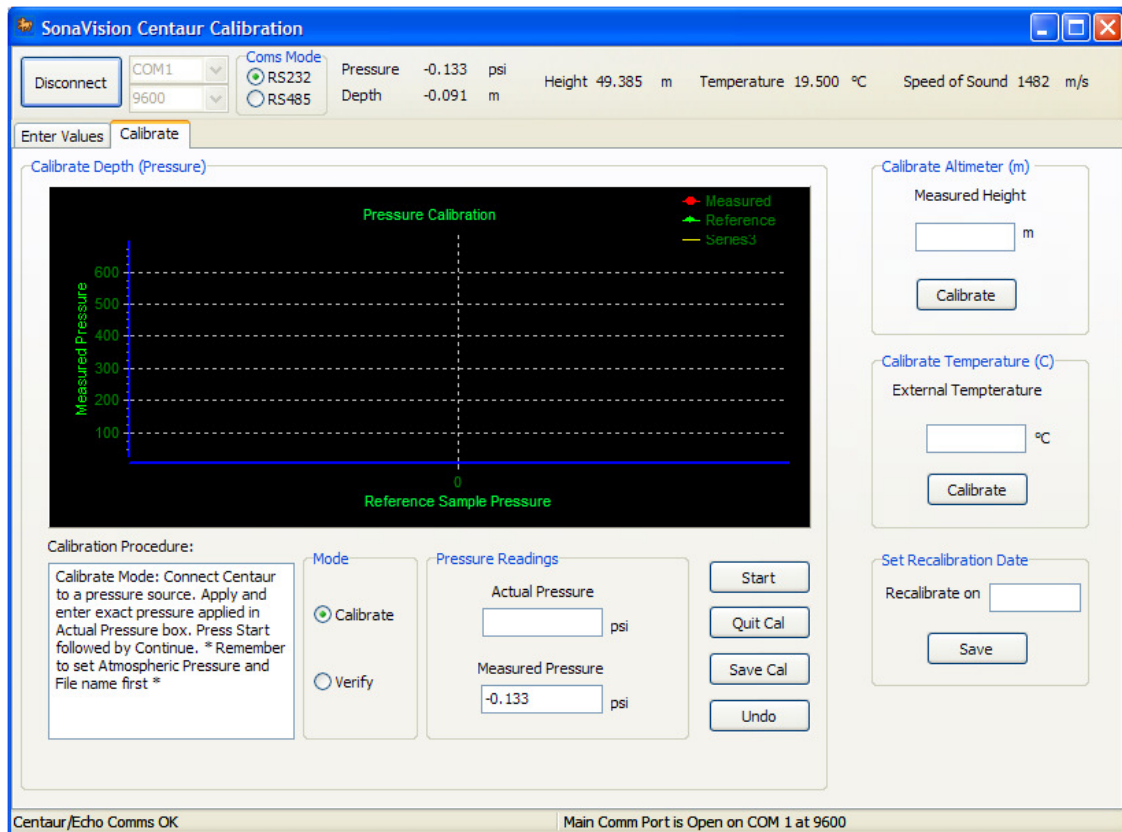


Figure 6.2

The calibration tab is the page where the interactive calibration process takes place.

The process is carried out by applying a set of known pressure values to the Centaur from a calibrated source such as a dead-weight tester (dwt).

The user should firstly ascertain that the pressure source is capable of producing pressure values representing all, or most, of the range of operation. In addition, some 20 to 40 representative values which can be applied. Possible limitations (e.g. due to the dwt calibrated weight availability) should be identified.

Before beginning calibration, ensure that the correct atmospheric pressure value and that the calibration filename and location on the Enter Values tab have been entered.

The user initiates the measurement and logging process by entering the known applied pressure in the **Actual Pressure** box and clicking on the **Start** button. The **Start** button will change to **Continue** which should also be pressed. This button will be deactivated (greyed out) for several seconds until the measured pressure value stabilises. When the **Continue** button re-activates, the data values will be plotted on the graph and logged.

The user should then continue by applying each new pressure, entering its exact value and clicking on **Continue**. This process continues until a set of pressure values, which adequately cover the desired measurement range, have been applied. As this process is proceeding, two slightly differing red and green lines should be displayed on the graph.

When all calibration values have been entered clicking on the **Save Cal** button results in a confirmation pop-up, to ensure that this is indeed the desired action. Acceptance of this causes the calibration correction factors to be calculated and downloaded to the Centaur. A yellow corrected line will also be drawn on the graph. This also causes the new calibration factors **Scale Multiplier** and **Scale Constant** to be updated on the Enter Values page.

While carrying out the calibration, the measurement process can be aborted at any time by clicking on the **Quit Cal** button. If a measurement is made and is obviously in error (seen via the graph) the **Undo** button will delete that measurement and allow it to be taken again.

Following calibration, the Verification radio button should be selected. The user should then repeat the calibration process over the measurement range. The measured and reference graphs should now be almost coincident. The **Save Verify** button should be used at the end of this process, leading to the generation of a calibration data file. A confirmation pop-up appears to ensure that this is indeed the desired action. The verification file generated will form the basis of the calibration certificate.

Throughout the calibration and verification process the **Calibration Procedure** message box in the lower left of the window will prompt the user with the desired action.

It should be noted that, for convenience, the calibration procedure is the default mode on entering the program and this changes to verification on acceptance of the calibration values. The user can override this via the radio buttons where, for instance, it is required to immediately follow a calibration with another. Once calibration has been performed, verification can be performed at any later time (the program may be closed and re-run). It is however recommended that these operations directly follow each other since the environmental conditions of atmospheric pressure, temperature and location will be the same. Each time calibration and verification is confirmed, the values measured are appended to the .cal and .ver text files, along with a time/date stamp, thereby keeping a historical record of all calibrations and/or verifications carried out on that Centaur. The user must ensure that the files are stored in a secure place and that backup copies are archived following each calibration. There therefore may be the requirement to manually edit, via a simple editor such as notepad, the .cal and .ver files. The data format of these files is comma separated, allowing direct importation into programs such as Excel or Word. A template calibration certificate cal_cert.xls is included in the install directory.

In order to create a calibration certificate, the Excel template centaur_cal_cert.xls should be opened and the .ver file imported using comma delimiters. The data should be located in columns B, C and D beginning at B23. The spreadsheet will automatically format the data. The resulting file should be saved and printed or customised to the user's requirements. Note that the template is read only, to avoid accidentally saving calibration data to the template. The file must therefore be given an alternative name. It is recommended that the file is saved to the same name as the .cal and .ver files i.e. centaur_serial_number_cal_cert.xls.

The person carrying out the calibration should then sign and date the document.

Calibrate Altimeter

The Altimeter is calibrated by entering the accurately measured height in metres into the **Measured Height** text box. The **Calibrate** button causes the offset to be calculated and saved to the Centaur. A confirmation pop-up appears to ensure that this is indeed the desired action. Because of the mm accuracy of the altimeter, the height value must be measured and entered to this accuracy (i.e. 3 decimal points).

Calibrate Temperature

The Temperature sensor is calibrated by entering the accurately measured temperature of the Centaur housing (ideally in water) in °C into the **External Temperature** text box. The **Calibrate** button causes the offset to be calculated and saved to the Centaur. A confirmation pop-up appears to ensure that this is indeed the desired action. The measured value should be measured and entered to an accuracy of 0.1°C.

Save

Pushing this button saves the re-calibration date shown in the Centaur. The date can be saved in any form up to a total length of 10 digits. The normal form is dd/mm/yyyy.

APPENDIX A Altimeter Smoothing Methods

Various forms of smoothing can be applied to the data coming from the altimeter prior to display. The **Smoothing Method** and **Samples to Smooth** controls are used to set this.

Smoothing Method allows no smoothing, mean, median, median1, median2 and median3 methods to be selected. These are then applied over a user-selectable number of echo returns, varying from 8 to 31, selected by **Samples to Smooth**.

A further explanation of the function and effect of the smoothing methods is

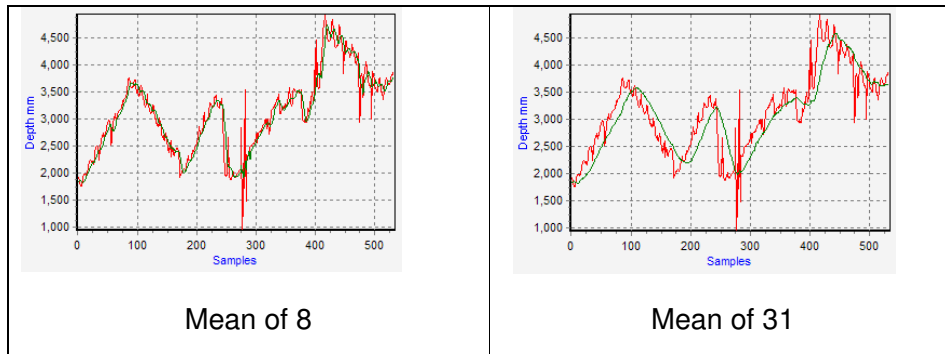
The data output from the device can be filtered using 1 of 5 filtering methods. Each method has 24 intensities meaning that 120 unique algorithms for smoothing data are available.

Filter Method	Description
Mean	Add n number of samples and divide by n
Median	Order n samples in a sequential fashion and return the middle value.
Median 1	Order n samples in a sequential fashion and return the mean of the middle and 2 adjacent samples. (Average of 3 center values).
Median 2	Order n samples in a sequential fashion and return the mean of the middle and 4 adjacent samples. (Average of 5 center values).
Median 3	Order n samples in a sequential fashion and return the mean of the middle and 6 adjacent samples. (Average of 7 center values).

The Sample to smooth value, n can take any integer value between 8 and 31
Increasing this value increasingly removes variations in the data.

The following figures illustrate the effects of various smoothing settings:-

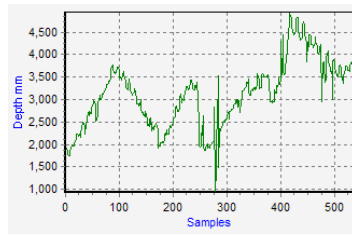
Increasing the number of samples in the filtering method will delay the output data by the number of samples in the filtering method. If the Mean of 8 filtering method is applied then the output will be delayed by 8 samples. The effect can be seen below, where the green line is the filtered version of the raw data.



6.2.1 Choosing a Filtering Method

The choice of algorithm and the intensity to which it is used is based upon the environment and desired output. The Mean algorithm will smooth out any variations but not remove extremes so data may contain spikes that are error readings.

The Median type algorithms will very likely exclude any extremes and output only true measurements. Taking the mean of the center sample as Median 1 does effectively smoothes the true measurements. The further the sample is from the center the more likely it could be an incorrect reading. So using Median 3 on 8 samples of data is much more prone to errors than Median 1 on 8 samples. Increasing the number of samples will improve this but introduce delay.



Unfiltered Data

Filtered Data:-

	8 Samples	16 Samples	31 Samples
mean			
Median			
Median 1			
Median 2			
Median 3			

Appendix B Echo Output String Formats

There are two methods of accessing the information acquired by the Echo altimeter

- Data on request via the SV protocol (via Sonavision software only).
- As an analogue voltage, directly proportional to height.
- ASCII strings automatically output at a user specified rate

The currently available ASCII string formats, pre-defined in the Echo firmware, are:-

6.2.2 Sonavision

Format: #SV,%.3fP|,%.3fD|,%dH|,%.1fT|<CR><LF>

Example: #SV,14.7760.055,43835,26.1|<CR><LF>

6.2.3 Sonavision Time

Format: #SV,%dE|<CR><LF>

Example: #SV,235188|<CR><LF>

E is the time in 125 nano second units for the ultrasound to travel from the transducer's face to the object (one way).

The length of t varies from 1 to 10 characters and there are no leading 0's. t has the range 0 to 4294967296.

With a speed of sound of 1500m/s, 125 ns equates to 0.1875 mm of sound travel. This is the highest resolution this string can provide.

Formula to convert to depth:

$$\text{Depth} = E \times 0.000000125 \times \text{Speed of sound}$$

Example:

$$\begin{aligned} t &= 9000, \text{ Speed of sound} = 1500 \text{ m/s} \\ 9000 \times 0.000000125 \times 1500 &= 1.6875 \text{ m} \end{aligned}$$

6.2.4 UK94

Format: STXU%08.0fP|%05.0fT|%04xH|<CR><LF>

Example: U0014773102606002C|<CR><LF>

Note: STX (ASCII 02) may not appear in the viewable string (dependant on terminal mode) because it is a non-printable character.

Appendix C Centaur Auxiliary Output String Formats

There are two methods of accessing the information acquired by the Centaur

- Data on request via the SV protocol (via SonaVision software)
- As a UK94 ASCII string automatically output.

However, as described previously, the Sonavision software can direct a user-definable string out of another COM port for logging purposes.

The currently available pre-defined ASCII string formats, defined in the OP string Format defined earlier, are:-

6.2.5 Sonavision

Format: #SV,%.3fP|,%.3fD|,%dH|,%d.1fT|<CR><LF>

Example: #SV,14.7760.055,43835,26.1|<CR><LF>

Scaling Factors Applied:-

Pressure = 1
Depth = 1
Height = 1
Temperature = 1
Conductivity = 1
Speed of Sound = 1
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1
Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

6.2.6 Sonavision Time

Format: #SV,%dE|<CR><LF>

Example: #SV,235188|<CR><LF>

Scaling Factors Applied:-

Pressure = 1

Depth = 1
Height = 1
Temperature = 1
Conductivity = 1
Speed of Sound = 1
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1
Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

E is the time in 125 nano second units for the ultrasound to travel from the transducer's face to the object (one way).
t has the range 0 to 4294967296.
With a speed of sound of 1500m/s, 125 ns equates to 0.1875 mm of sound travel. This is the highest resolution this string can provide.

Formula to convert to depth:

$$\text{Depth} = E \times 0.000000125 \times \text{Speed of sound}$$

Example:

$$t = 9000, \text{ Speed of sound} = 1500 \text{ m/s}$$
$$9000 \times 0.000000125 \times 1500 = 1.6875 \text{ m}$$

6.2.7 UK94

Format: STXU%08.0fP|%05.0fT|%04xH|<CR><LF>

Example: U0014773102606002C|<CR><LF>

Note: STX (ASCII 02) may not appear in the viewable string (dependant on terminal mode) because it is a non-printable character.

Scaling Factors Applied:-

Pressure = 10000
Depth = 1
Height = 1
Temperature = 100
Conductivity = 1
Speed of Sound = 1
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1

Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

Pressure is in 10000ths of a psi and Temperature is in 100ths of a °C

6.2.8 Alternative1

Format: %05dD|,%04dH|<CR><LF>

Example: 00005,4499|<CR><LF>

Scaling Factors Applied:-

Pressure = 1
Depth = 100
Height = 100
Temperature = 1
Conductivity = 1
Speed of Sound = 1
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1
Salinity = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

Depth is in 100ths of a m and Altimeter height is in 100ths of a m

6.2.9 Alternative2

Format: %06dD|,%04dH|<CR><LF>

Example: 00005,4339|<CR><LF>

Scaling Factors Applied:-

Pressure = 1
Depth = 100
Height = 100
Temperature = 1
Conductivity = 1
Speed of Sound = 1
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1

Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

Depth is in 100ths of a m and Altimeter height is in 100ths of a m

6.2.10 MB1000/2000

Format: D%06.2fD| A%05.2fH| T%2dT| P%06.1fA| V%6.1fS|
d%06.4fR|<CR><LF>

Example: D000.05 A42.84 T26 P1013.1 V1482.0 d1.0270<CR><LF>

Scaling Factors Applied:-

Pressure = 1
Depth = 1
Height = 1
Temperature = 1
Conductivity = 1
Speed of Sound = 1
Atmospheric Pressure = 68.94
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1
Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

Atmospheric Pressure is in mbar

6.2.11 WINSON Raw

Format: +05dT|%010dP|+%05dW|%010dX|%010dY|-00000
|%05dC|+%05dU|%05dV|%05dS|+%010dE|%03dI|+%010dD|mT|
<CR><LF>

Example: +05d0000147731+0249800023923610001875634-
0000000000+000000000014820+0000145273013
+000000005211500150<CR><LF>

Scaling Factors Applied:-

Pressure = 10000
Depth = 1000
Height = 1
Temperature = 10
Conductivity = 1000

Speed of Sound = 10
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 0.625
CT Probe Temperature = 100
Salinity = 1000
DigiQuartz Temperature = 100
DigiQuartz Raw Pressure = 0.333333
DigiQuartz Raw Temperature = 1.333333

Pressure is in 10000ths of a psi, Depth is in mm, Conductivity is in $\mu\text{S}/\text{cm}$,
Echo return time is a count of 200ns clocks, CT Probe Temperature is in 100ths
of a $^{\circ}\text{C}$, Salinity is in parts per million, DigiQuartz Temperature is in
100ths of a $^{\circ}\text{C}$, DigiQuartz Pressure Raw is a count of 8MHz clocks and
DigiQuartz Temperature Raw is a count of 8MHz clocks.

6.2.12 WINSON Processed

Format: +05dT|010dP|+05dW|010dX|010dY|-00000
 |05dC|+05dU|05dV|05dS|+010dE|03dI|+010dD|mT|
 <CR><LF>

Example: +05d0000147731+0249800023923610001875634-
 0000000000+000000000014820+0000044547013+00000000521
 1501400<CR><LF>

Scaling Factors Applied:-

Pressure = 10000
Depth = 1000
Height = 1000
Temperature = 10
Conductivity = 1000
Speed of Sound = 10
Atmospheric Pressure = 1
Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 100
Salinity = 1000
DigiQuartz Temperature = 100
DigiQuartz Raw Pressure = 0.333333
DigiQuartz Raw Temperature = 1.333333

Pressure is in 10000ths of a psi, Depth is in mm, Conductivity is in $\mu\text{S}/\text{cm}$,
CT Probe Temperature is in 100ths of a $^{\circ}\text{C}$, Salinity is in parts per million,
DigiQuartz Temperature is in 100ths of a $^{\circ}\text{C}$, DigiQuartz Pressure Raw is a count
of 8MHz clocks and DigiQuartz Temperature Raw is a count of 8MHz clocks.

6.2.13 SeaKing Long

Format: mT|%010dD|%05dS|0000000000
 |%010dA|%06dE|%05dT|%05dC|0000000000
 |%03dI|%03dJ|<CR><LF>

Example: 11501950000000005214820000000000
 0000001013147298%05%050000000000
 013000<CR><LF>

Scaling Factors Applied:-

Pressure = 100000
Depth = 1000
Height = 1000
Temperature = 100
Conductivity = 1000
Speed of Sound = 10
Atmospheric Pressure = 68.94
Relative Seawater Density = 1
Echo Return Time = 0.625
CT Probe Temperature = 1
Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

Pressure is in 100000ths of a psi, Depth is in mm, Altimeter Height is in mm,
Conductivity is in $\mu\text{S/cm}$, Speed of Sound is 10* actual value in m/s,
Atmospheric Pressure is in mbar.

6.2.14 SeaKing Short

Format: mT|%010dD|%05dS|0000000000
 |%010dA|%03dI|%03dJ|<CR><LF>

Example: 11502200000000005214820000000000
 0000001013013000<CR><LF>

Scaling Factors Applied:-

Pressure = 1
Depth = 1000
Height = 1000
Temperature = 100
Conductivity = 1
Speed of Sound = 10
Atmospheric Pressure = 68.94

Relative Seawater Density = 1
Echo Return Time = 1
CT Probe Temperature = 1
Salinity = 1
DigiQuartz Temperature = 1
DigiQuartz Raw Pressure = 1
DigiQuartz Raw Temperature = 1

Pressure is in 10000ths of a psi, Depth is in mm, Altimeter Height is in mm,
Speed of Sound is 10* actual value in m/s, Atmospheric Pressure is in mbar.