

TM

HydroBar

USER'S MANUAL

ENGLISH EDITION

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UNABARA

C O R P O R A T I O N

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Introduction

The total error in depth measurements during hydrographic surveys is mainly the result of variations in sound velocity in the water column, errors in transducer draft, tide values, and index errors. Using the HydroBar, the hydrographer can quantify and correct for these errors.

Depths shown on many of the world's hydrographic charts have been "normalized" to reflect a sound velocity of 1500 meters per second. However, this "normal" condition for sound velocity only occurs with a 0 degree Celsius water temperature, 35 parts per thousand salinity and 760 mmHg pressure.

In the true, dynamic world, surface sound velocity as well as velocities at various depths will vary widely. Any variation in bulk properties (i.e. elasticity and density) of the water will result in a shift in sound velocity in that medium.

From freshwater lakes and rivers, to the oceans, to hypersaline estuaries, sound velocities range from about 1375 meters per second to almost 1900 meters per second. An increase in salinity results in an increase in water density. At the same time this increase in salinity decreases the compressibility of seawater. The effect of this compression overtakes the effect of the increased density and thus we find sound velocity increases with increasing salinity. For each one part-per-thousand increase in salinity, sound velocity will increase about 1.3 m/s. Increasing temperature decreases water density thus resulting in an increase in sound velocity. For each one degree Celsius temperature increase, sound velocity will increase about 4.5 m/s. Pressure (depth) has a much smaller effect on sound velocity than salinity and temperature and is thus not a major factor in shallow water surveys. For each meter of increasing depth, sound velocity will increase only about 0.017 m/s.

The HydroBar contains a real-time sound velocimeter and temperature sensor which is depth referenced during cast profiles via an internal pressure sensor. In CAST mode, the user can generate a complete sound

velocity and temperature profile vs. depth, at user selected depth intervals. The HydroBar software APP can run standalone on your Windows PC or in the background of Hypack, HydroPro or other hydrographic mapping software; profile data points can be put directly into tabular form and used by your mapping software to correct for sound velocity.

Draft errors, of course, occur when the user does not properly measure or calculate the depth of the transducer face upwards to the water surface. Index errors refer the sum of inaccuracies due to electronic and mechanical components of the survey echo sounder, transducer characteristics and bottom reflectivity during a specific survey.

The velocimeter can only help the user compensate for sound velocity variations, not draft or index errors. Therefore, in combination with velocity casts, a bar check must periodically be performed. The bar check calibration procedure is a sequential process accomplished in the past by trial and error so that the sound velocity, draft and index errors are simultaneously minimized.

Using a smart, patent pending, algorithm, the software computes the three (3) bar depths and positions a user selectable gate window width around each bar to prevent unwanted echoes from entering the calibration at that bar depth.

The HydroBar has a 35.5 cm (14.0 inch) sonar target which can replace the less portable metal bar; or, the HydroBar can be attached to the user's existing bar if desired. The tether cable from the surface to the HydroBar target is precisely marked with depth in either metric or english units as ordered by the user.

The BAR CHECK mode of the HydroBar eliminates the time-consuming trial and error method; While logging velocity from the integral velocimeter, the user's echo sounder together with the sonar target ("bar") of the HydroBar is used to calculate sound velocity, draft and index; this is accomplished rapidly by solving a series of simultaneous equations using a three range solution of sonar transit times with common baselines. These calculations are automatic using the HydroBar program APP running on the user's PC.

In addition to storing cast profiles and tabular results in your PC, the HydroBar program APP provides a detailed analysis of velocimeter measured velocity vs. bar check calculated velocity at the various depths; Finally, a “residual” is calculated and displayed which gives the user the overall uncertainty of the procedure he has just performed. For example, a very small residual in the range of +/- 1.00 cm would be an indication the user has properly calibrated his survey system. This residual allows the user to determine an appropriate index value to use in his survey echo sounder.

Product Overview

The major deliverable of your HydroBar system is the underwater unit shown in Figure 1. This unit contains the precision sound velocimeter, pressure (depth) sensor, temperature sensor and internal electronics. Data is sent to the surface via a depth marked, Kevlar reinforced, tether cable. Markings are available either in metric or english units. The standard length tether cable is 20 meters (66 feet); optional longer lengths are available. Integral to this unit is the sonar target (“bar”) which has a surface texture designed to provide enhanced acoustic reflectivity. Below the target is an integral cable reel (patent pending) to allow convenient storage of the tether cable.

At the surface end of the tether cable is a weatherproof connector with protective storage cover. This connector mates with an adapter cable which plugs into any available USB port on your Windows computer. A stainless steel strain relief loop is provided at the weatherproof connector to secure the surface end.

The HydroBar’s Windows-based software APP with drivers for the adapter cable along with this HydroBar Operation Manual are contained on a USB-Memory Pod supplied with each HydroBar system.

When using the BAR CHECK mode, the HydroBar PC program will use the readings from the user's echo sounder to calculate errors. The echo sounder depth reading at a particular bar depth will be entered by the user via the PC keyboard; alternately, the user may use serial depth data from the echo sounder so that depth is provided to the HydroBar APP without the need for the user to enter depth via the keyboard. (See Appendix A for information on automatic depth input).

There is no power cable, power supply or battery pack included in the HydroBar deliverables as none is required; power for the HydroBar is supplied by the user's PC via the USB port.

Specification Overview

Parameters:

Sound Velocity Range: 1375 to 1700 meters/second
(4538 to 5610 feet/second)

Resolution (as displayed on APP): 0.1 meters/second
(0.1 feet/second)

Temperature Range: - 5 deg. C to 40 deg. C
(23 deg. F to 104 deg. F)

Resolution (as displayed on APP): 0.01 deg. C
(0.01 deg. F)

Depth Range: (defined by tether cable length)
(20 meters/ 66 feet STANDARD; other lengths optional)

Resolution (as displayed on APP): 0.1 meters
(1 foot)

Depth Measurement Note: Although the HydroBar has an integral pressure sensor for determining the HydroBar's depth during the CAST, this sensor is not used during the Bar Check Mode; when performing bar checks, the depth of the target needs to be known with millimeter certainty. The tether cable is of "no stretch" design and has a Kevlar jacket for extreme durability. This cable is precisely marked to insure accuracy when performing a bar check.

Cable Note: Specify English or Metric markings on tether cable for Bar Check when ordering.

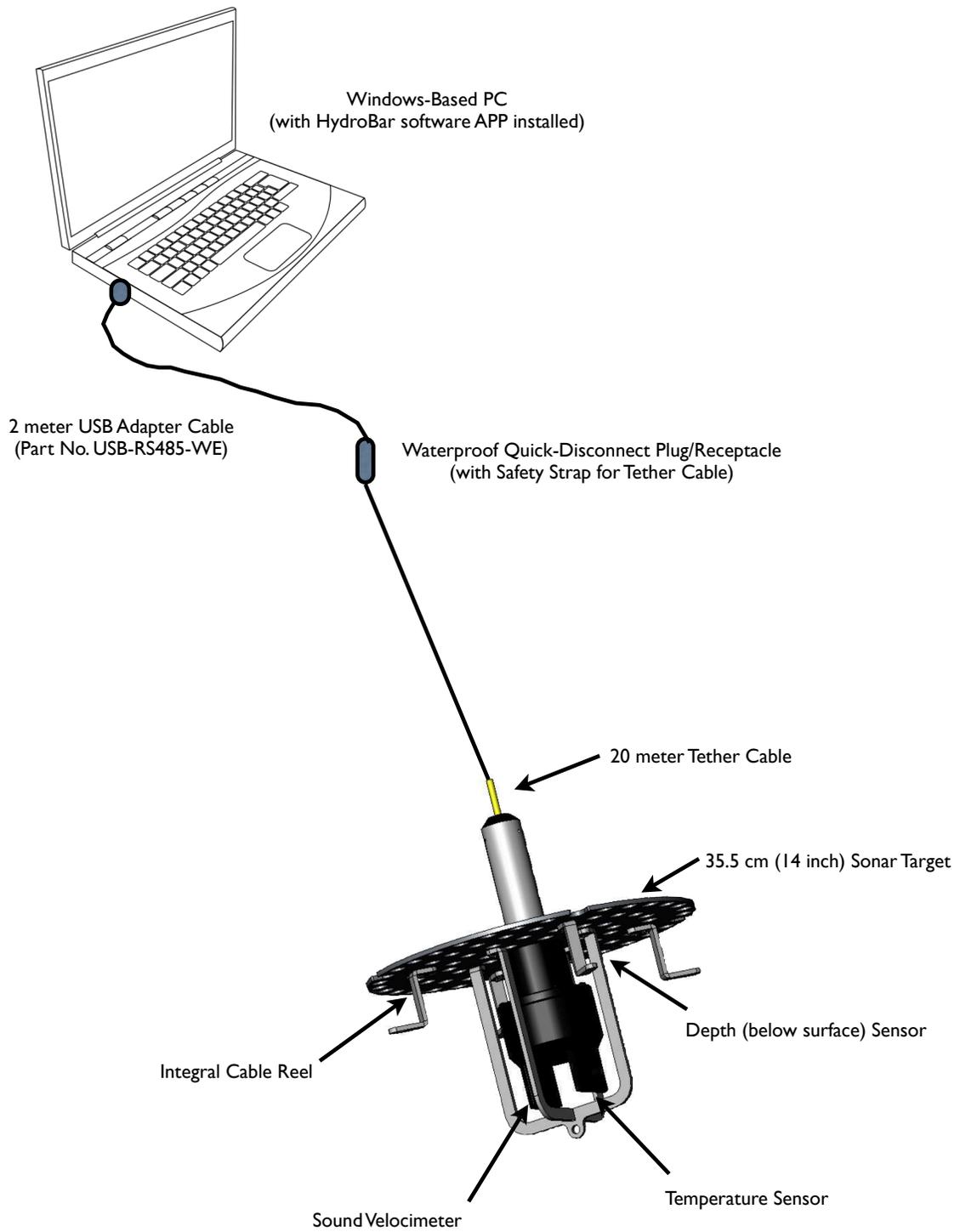


Figure I

Installing the HydroBar PC APP Software

Your HydroBar is supplied with a USB-Memory Pod which contains required software and this user manual (in PDF format). **The HydroBar APP may be loaded onto your Windows PC directly from this memory Pod.** This pod also has a minimum of 4GB of unused storage as to allow the user to save velocity casts and bar check data thereon. This is only one storage option available as the user may elect to store HydroBar generated data on his PC's hard-drive or other media.

Upgrade to the most recent version of the HydroBar PC APP is available for downloading under the SUPPORT tab at: www.hydrobar.info

After inserting the memory pod into your PC's USB port, simply select the HydroBar APP file. This will initiate the HydroBar Setup installer. You will be instructed through a six screen page APP installation process. Simply follow the on-screen directions. The second screen page will allow you to review the SOFTWARE LICENSE AGREEMENT. Before proceeding you must select the "box" indicating you accept the terms of the License Agreement; then select NEXT. (If you do not want to accept these terms, select CANCEL to exit the APP installation).

The third screen page denotes a default destination folder the installer has automatically selected for the HydroBar APP. Should you wish to change this destination folder for any reason, select CHANGE; otherwise enter NEXT to continue. The fifth screen page allows you to monitor the installation process then the sixth screen page will confirm when the installation process is complete.

The memory pod also contains a driver file to allow your echo sounder's serial depth data to be automatically fed to the HydroBar APP; without the need for the user to enter depth via the PC keyboard. Your HydroBar is provided with a RS-232 serial interface cable (from echo sounder to PC). Details for using this automatic depth entry function are provided in Appendix A to this manual.

“Running” the HydroBar APP for the First Time

After successful HydroBar APP installation, a shortcut will appear on your PC with the HydroBar icon. Use this icon to start the APP.

Upon running the HydroBar APP the first time after installation, you will be taken to the Configuration screen page as shown in Figure 2 on the next page of this manual.

Before using your HydroBar in either CAST (profile) mode or Bar Check mode you must make selections on the Configuration screen page and select ACCEPT to save your selections.

Under **Defaults** you are asked to make two selections using the toggle arrows to the right of the Mode and Unit Type windows. Whenever the HydroBar APP is restarted the APP will assume these two selections unless/until the user changes them. Select, as you desire, either CAST or Bar Check for the Mode; select either Meters or Feet for the Unit Type.

Under **Echo Sounder Input for Bar Check** you must select the Manual Input “box” if you will be entering depths (as read from your echo sounder display at the various bar depths) manually via the PC’s keyboard. If you will be using automatic serial data depth input, do not select the Manual Input; then refer to Appendix A for instructions on how to select Depth Data String, Com Port, Baud Rate, Target Gate Width and Number of Samples; Appendix A also contains wiring connections to allow input of serial depth data from your echo sounder to your PC.

Under **Velocimeter**, always select baud rate as 19,200. Then select the respective USB COM port on your PC. Proper communication between the HydroBar and your PC is denoted by the “OK” status in the upper left corner on the screen pages and by blinking of the LED indicators on the USB plug of the HydroBar adapter cable.

HydroBar Configuration

Defaults

Mode

Unit Type

Echo Sounder Input for Bar Check

Manual Input

Depth Data String

Com Port

Baud Rate

Target Gate Width m

Number of Samples

Velocimeter

Com Port

BaudRate

Accept Cancel

Figure 2

Caution: YOU MUST DEPRESS “**Accept**” AFTER ANY CHANGE

The user may return to the Configuration screen from any of the CAST or Bar Check screen pages via the pull-down menu under File located at the top left of the screen; see Figure 3. Also, the user may change from CAST to Bar Check mode or vice-versa by the pull-down menu under Mode.

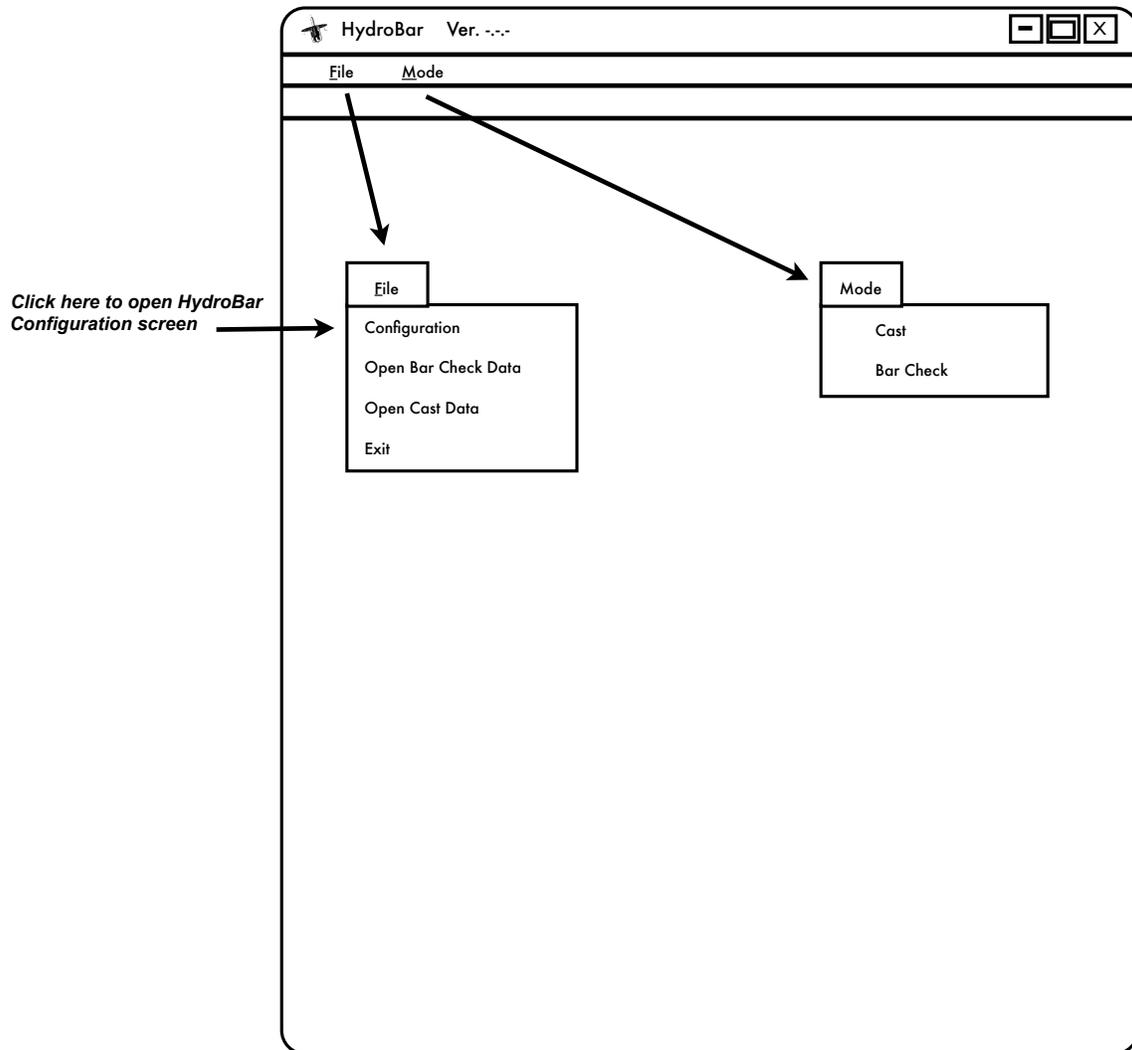


Figure 3

Performing a Cast (Sound Velocity Profile)

After selecting CAST mode, the screen page shown in Figure 4 will be displayed. If you have selected the Unit Type as METERS, sound velocity will be displayed in meters per second, temperature in degrees Celsius, and depth in meters. These displays under **Real Time Data** allow the user to observe the measured values during the cast; or at any other time the user wishes to obtain real-time measurements.

If Unit Type is selected as FEET, sound velocity will be displayed in feet per second, temperature in degrees Fahrenheit, and depth in feet.

Proper delivery of data from your HydroBar unit to your PC can be verified by observing the “OK” indication on the **HydroBar SV Status** line in the upper left corner of any screen page.

Follow the **Operator Instructions** on the first CAST screen page as shown in Figure 4. Under **Cast Mode Input Data**, enter the desired Maximum Cast Depth and Log Interval.

(Note: Examples herein and on all other screen pages use the METERS Unit Type; if English units are selected as the Unit Type, FEET, of course, will be displayed on all screen pages).

For this example, input data on Figure 4 has been entered to reflect a maximum cast depth of 15.0 meters with parameter measurements at 0.5 meter intervals.

After entering the above maximum depth and interval as denoted above and selecting NEXT STEP, the screen page in Figure 5 will be displayed. As with the previous screen page, follow the instructions given under **Operator Instructions**. Once you begin lowering the HydroBar, data will be displayed under **Real Time Data** and **Cast Status**.

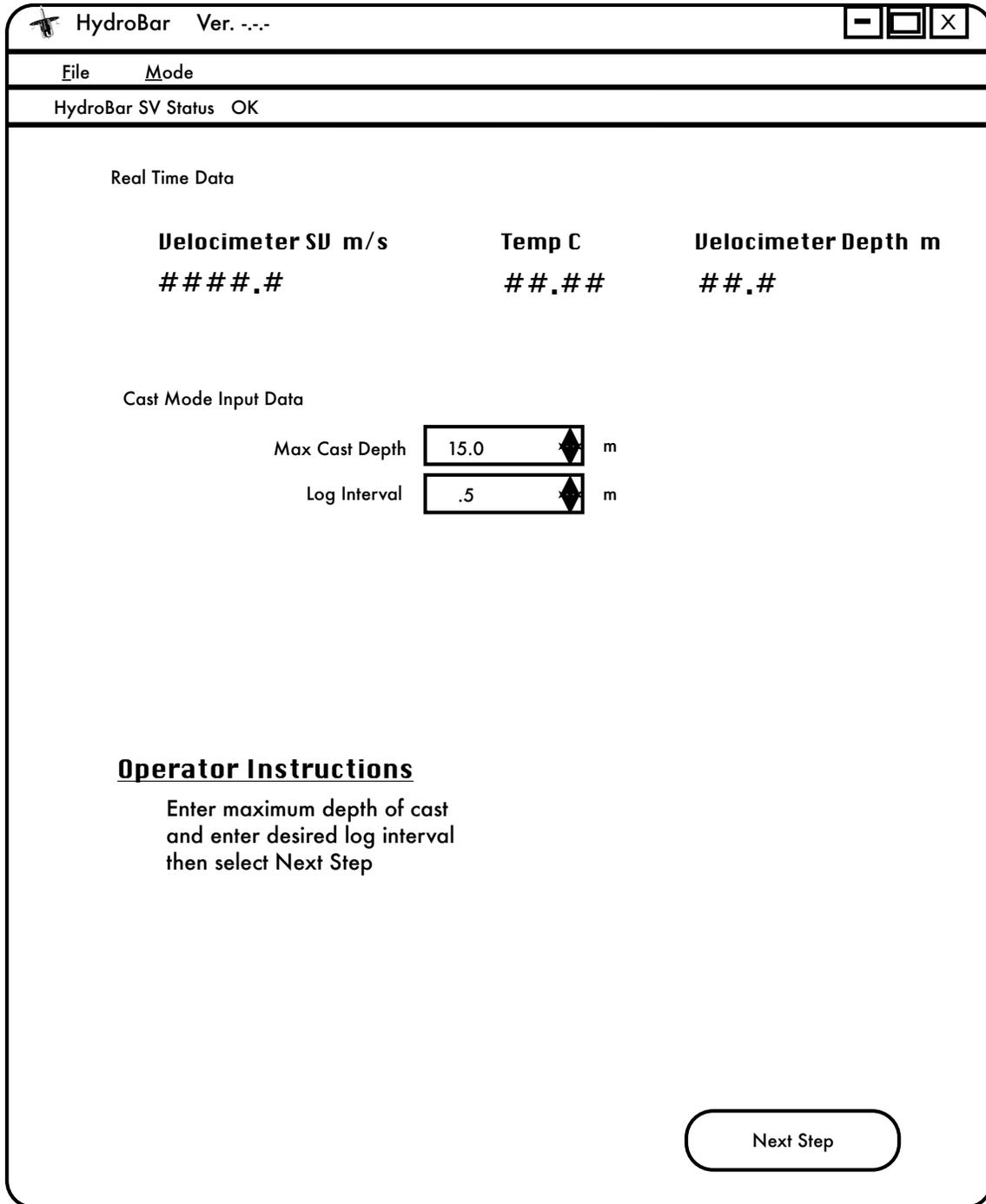


Figure 4

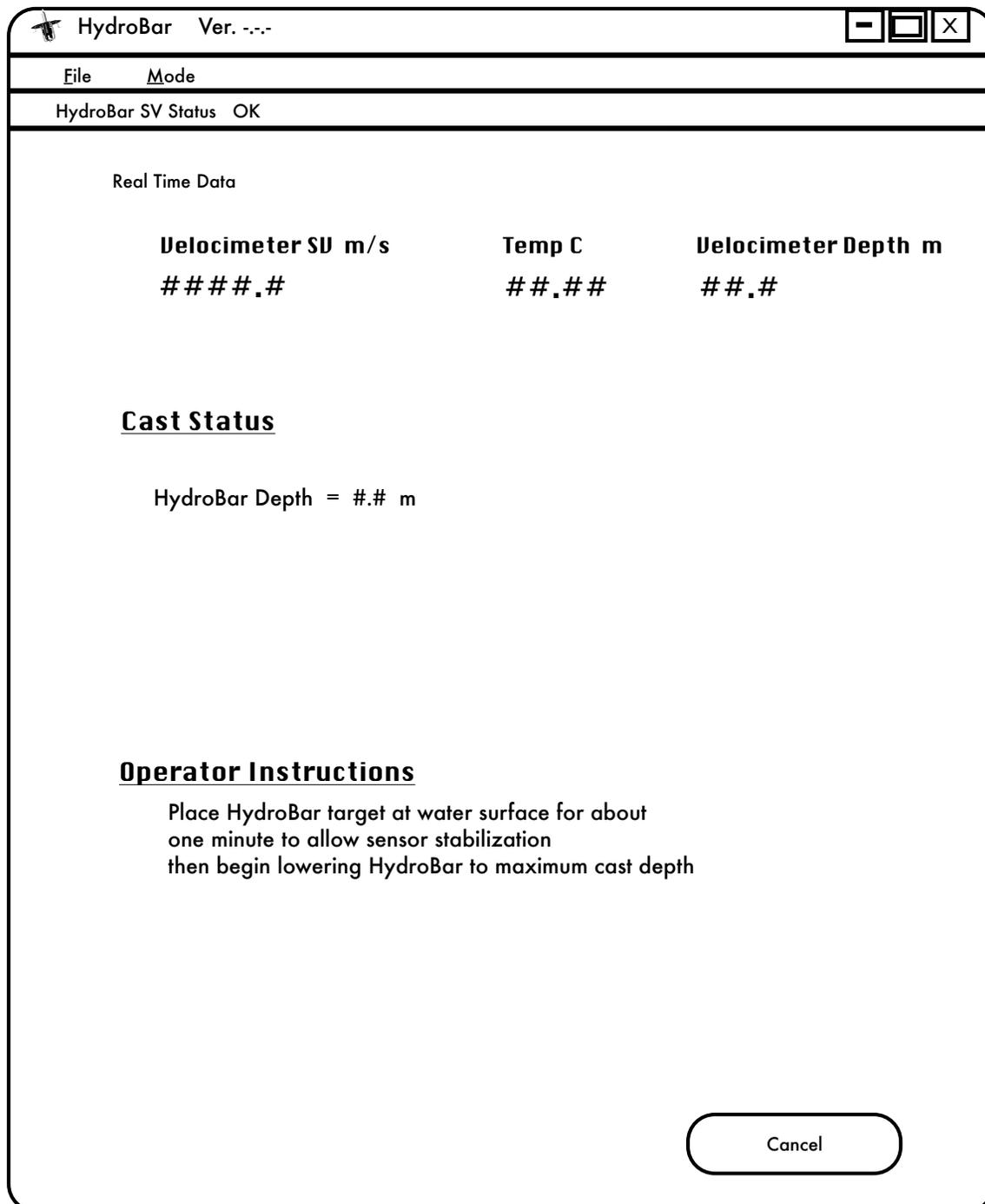


Figure 5

Once the HydroBar reaches the selected Maximum Cast Depth, a graphical presentation of sound velocity and temperature vs. depth will be displayed as shown in Figure 6. This profile can be saved aboard the USB memory pod or other storage location in the user's PC. At the same time all of the data is also saved in tabular form. The data is saved in two file formats for each cast profile; one file is simple CSV (comma separated values) while the other is saved as a sound velocity correction file in the .VEL format. Files in .VEL format can be directly loaded into the SINGLE BEAM EDITOR in the HYPACK hydrographic mapping software.

HYPACK is a registered trademark of Hypack, Inc. (formerly Coastal Oceanographics, Inc.)

Figure 7 is a table of data points which generated the profile shown in Figure 6. You may view this table by selecting DISPLAY TABLE on the graph screen.

Figure 8 shows the .VEL file generated from the same profile as above. Before the cast is begun, the user will select where on his PC he wishes to save this file for then importing into HYPACK.

Figure 9 demonstrates how the user can apply standard Windows controls to adjust the graph to full screen and use interactive functions as explained under this figure.

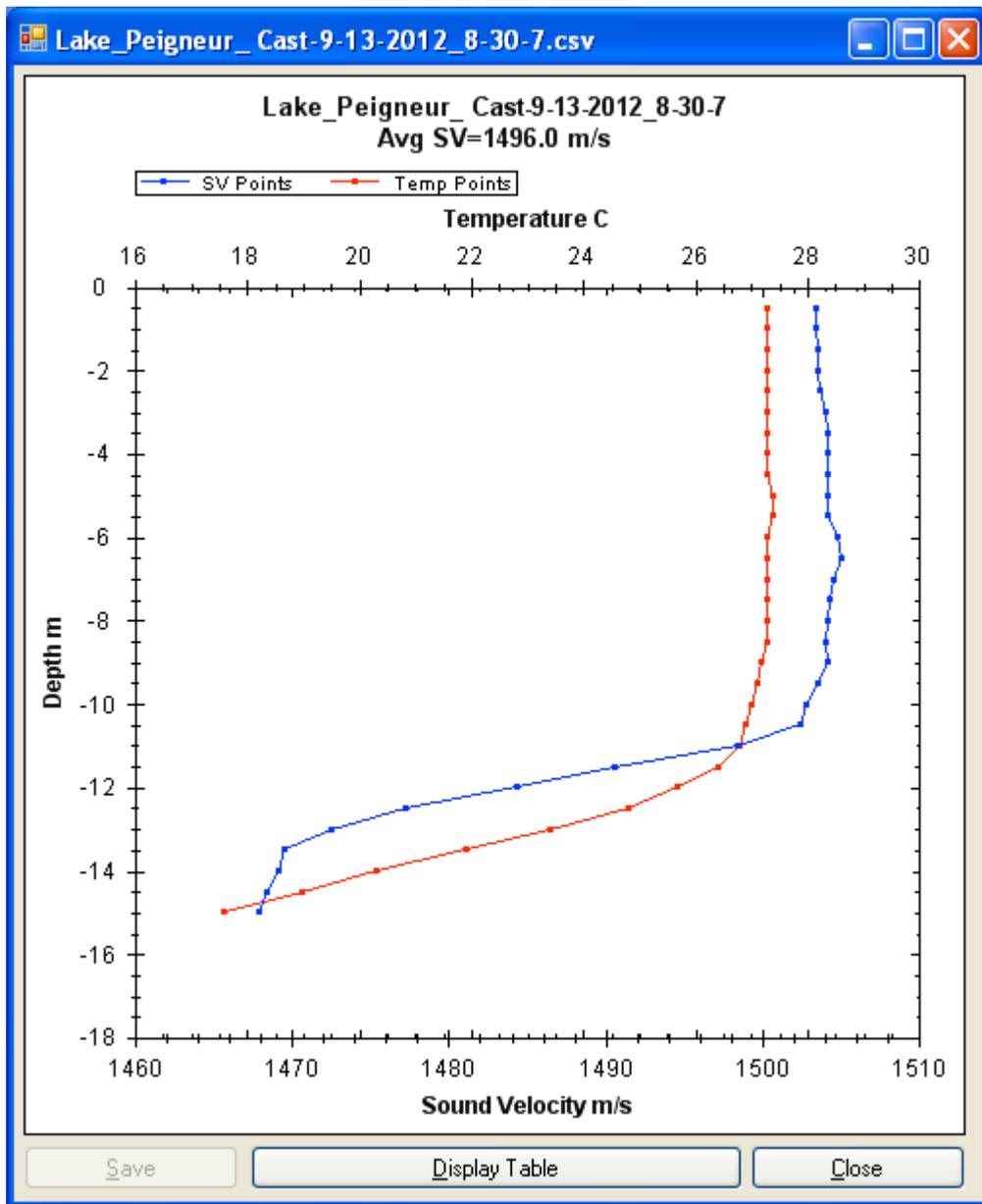


Figure 6

Lake_Peigneur_Cast-9-13-2012_8-30-7.csv

Depth m	Sound Velocity m/s	Temperature C
0.5	1503.4	27.3
1.0	1503.4	27.3
1.5	1503.5	27.3
2.0	1503.6	27.3
2.5	1503.7	27.3
3.0	1504.1	27.3
3.5	1504.2	27.3
4.0	1504.2	27.3
4.5	1504.2	27.3
5.0	1504.2	27.4
5.5	1504.2	27.4
6.0	1504.8	27.3
6.5	1505.1	27.3
7.0	1504.5	27.3
7.5	1504.3	27.3
8.0	1504.2	27.3
8.5	1504.1	27.3
9.0	1504.2	27.2
9.5	1503.5	27.1
10.0	1502.8	27.0
10.5	1502.4	26.9
11.0	1498.4	26.8
11.5	1490.6	26.4
12.0	1484.4	25.7
12.5	1477.3	24.8

Save Display Graph Close

Figure 7

FTP NEW 2
0.5, 1503.4
1.0, 1503.4
1.5, 1503.5
2.0, 1503.6
2.5, 1503.7
3.0, 1504.1
3.5, 1504.2
4.0, 1504.2
4.5, 1504.2
5.0, 1504.2
5.5, 1504.2
6.0, 1504.8
6.5, 1505.1
7.0, 1504.5
7.5, 1504.3
8.0, 1504.2
8.5, 1504.1
9.0, 1504.2
9.5, 1503.5
10.0, 1502.8
10.5, 1502.4
11.0, 1498.4
11.5, 1490.6
12.0, 1484.4
12.5, 1477.3
13.0, 1472.5
13.5, 1469.6
14.0, 1469.2
14.5, 1468.4
15.0, 1467.9

Figure 8

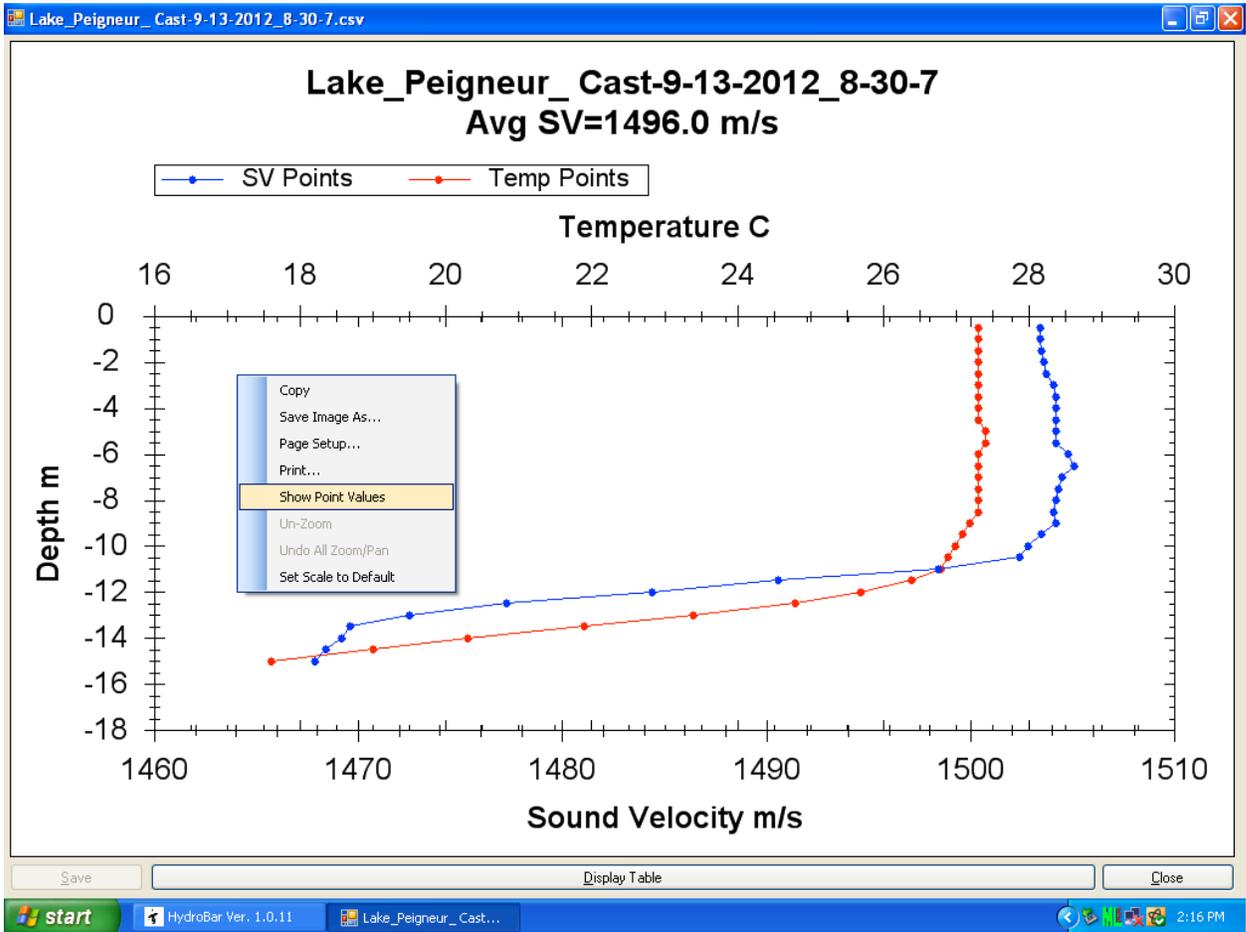


Figure 9

In this figure we see how the user can expand the graph to full-screen and enable utilities available in the HydroBar program. “Right-clicking” with the cursor on any part of the screen, causes the utility menu (block) to appear on the screen. Use of such features as Print, Page Setup, etc. are self-explanatory. The Show Point Values feature is always active even without right-clicking to show the utility block. The user simply brings his cursor over a data point to view the values; see examples in Figures 10 & 11.

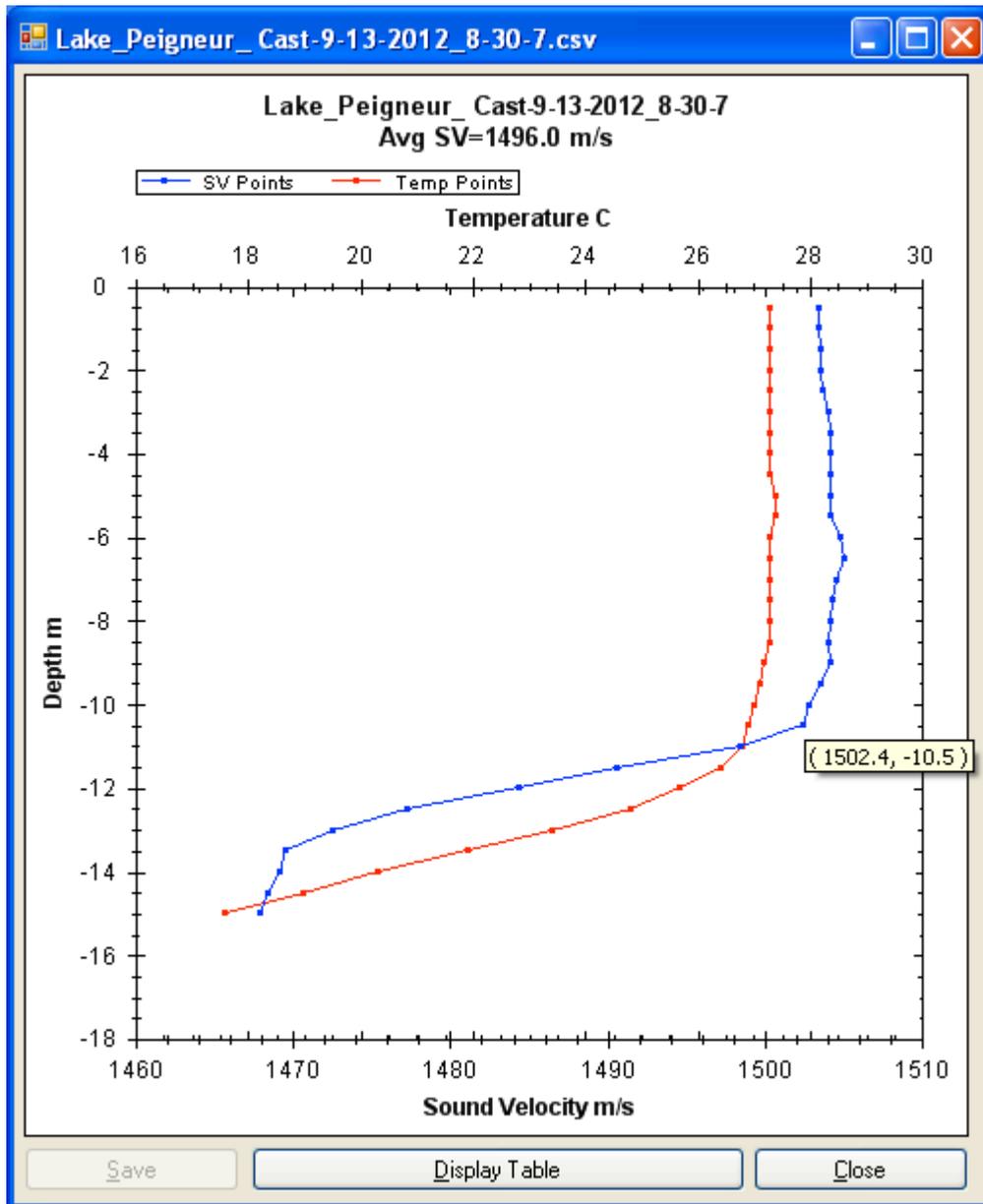


Figure 10

In this example, the user has selected the data point on the sound velocity plot at 10.5 meters depth; the velocity of 1502.4 m/s is then shown for that depth.

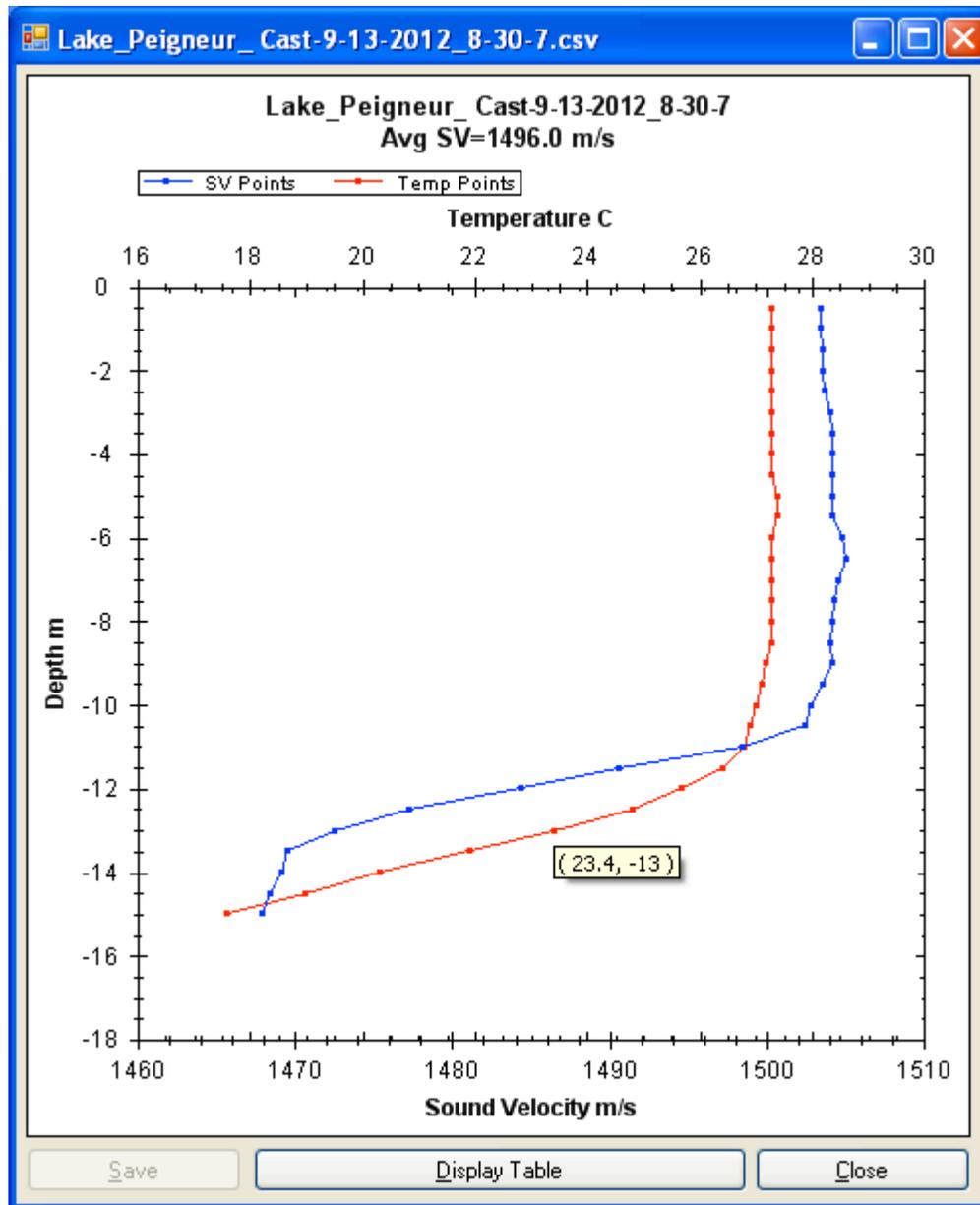


Figure 11

Here the user selects the data point on the temperature plot at 13.0 meters to view the temperature as 23.4 degrees C.

If the user inadvertently entered a Maximum Cast Depth which is deeper than the actual water depth, an error would be shown in the form of the message shown on the screen in Figure 12 below.

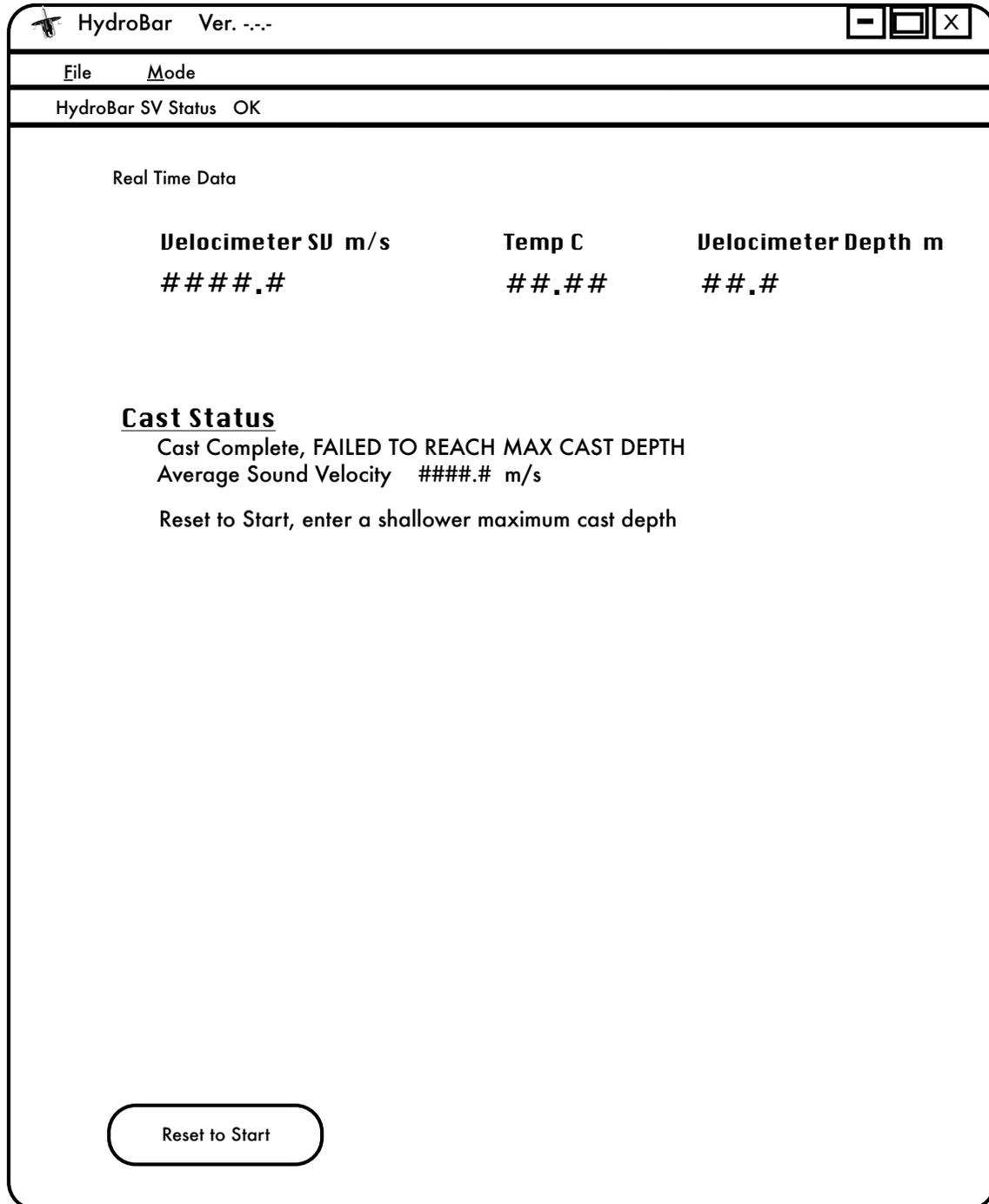


Figure 12

Overview of Bar Check Mode

To perform a Bar Check, the HydroBar is lowered precisely to three user selected depths using the depth markings on the tether cable. At each bar depth the user reads the displayed bar depth from his echo sounder and enters that depth into the HydroBar APP via the keypad on his PC.

There are actually two methods by which echo sounder bar depths can be inputted into the HydroBar APP; 1) MANUAL INPUT as described above; and, 2) AUTO DEPTH ENTRY which uses bar depth obtained from the user's echo sounder via serial data (RS-232) depth sentence. Setup of your PC and echo sounder for AUTO DEPTH ENTRY, as well as step by step instructions for performing a Bar Check in AUTO DEPTH ENTRY, is detailed in Appendix A to this manual.

At the end of the Bar Check procedure, the user will be presented with the average sound velocity determined via the Bar Check, average sound velocity (from the three bar depths) as determined by the HydroBar's precision sound velocimeter, transducer draft, and "Residual" sometimes referred to as "Index".

Performing a Bar Check (with Manual Input of Depth)

It is assumed the user has selected "Manual Input" (check the box on Configuration Screen Page) of depth data as shown in Figure 2.

For this example, we have selected the values for Transducer Draft, First Bar Depth, and Bar depth Spacing as shown on Figure 13. The Echo Sounder Sound Velocity used is whatever velocity (in this case 1500 m/s) your echo sounder is presently set to.

After completing the entries and selecting NEXT STEP on the first screen of the Bar Check mode, follow the **Operator Instructions** on the screen Page shown on Figure 14 for **Bar Check Step # 1**.

HydroBar Ver. ...

File Mode

HydroBar SV Status OK

Real Time Data

Delocimeter SV m/s
###.#

Temp C
##.##

Bar Check Input Data

Measured Transducer Draft Offset m

First Bar Depth m

Bar Depth Spacing m

No. of Bars

ES Sound Velocity Used m/s

Operator Instructions
Enter parameters above then
select Next Step

Next Step

Figure 13

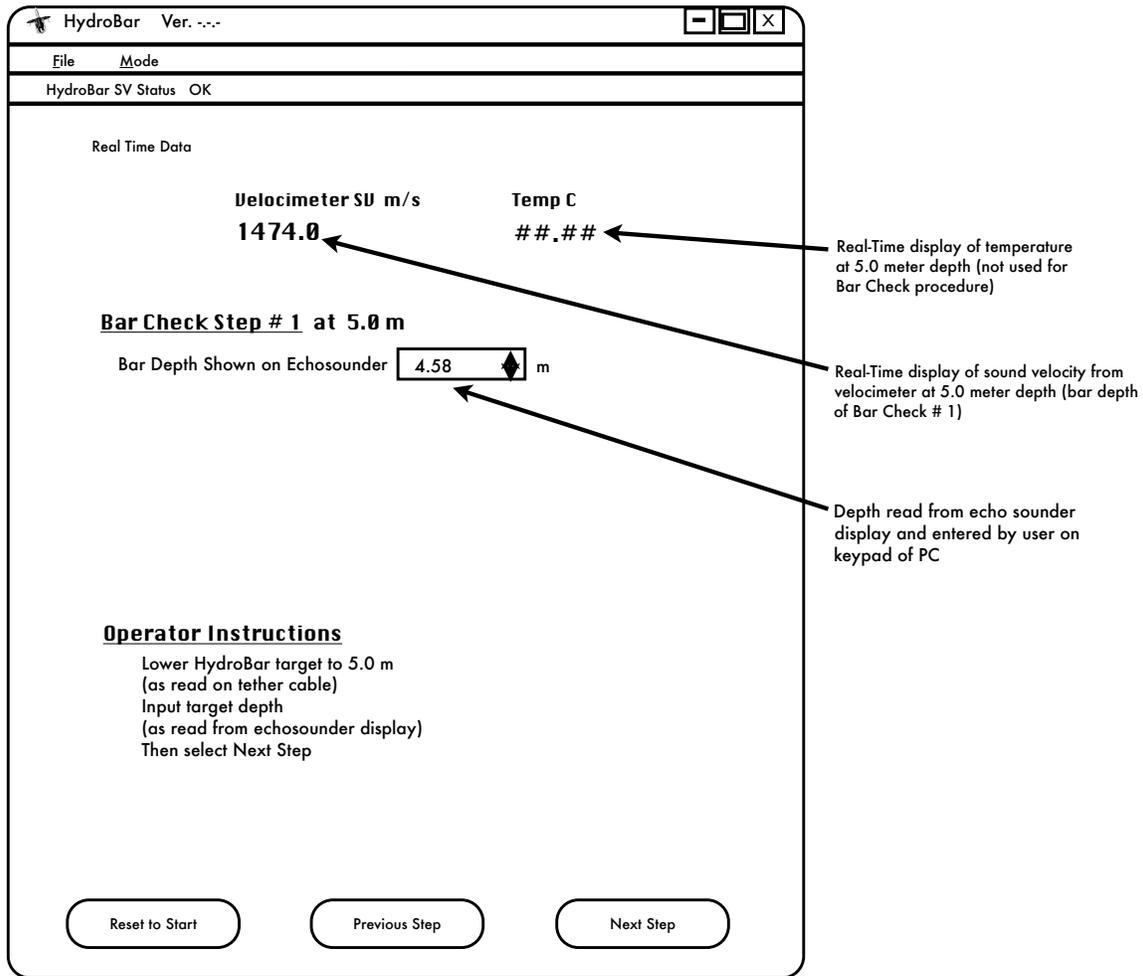


Figure 14

The HydroBar (target) is placed directly below the echo sounder's transducer at a depth (as measured on the tether cable) of 5.0 meters from the water surface. The user then reads the depth from the echo sounder's display (4.58 meters). After entering 4.58 meters in the **Bar Depth Shown on Echosounder** box, the user selects NEXT STEP.

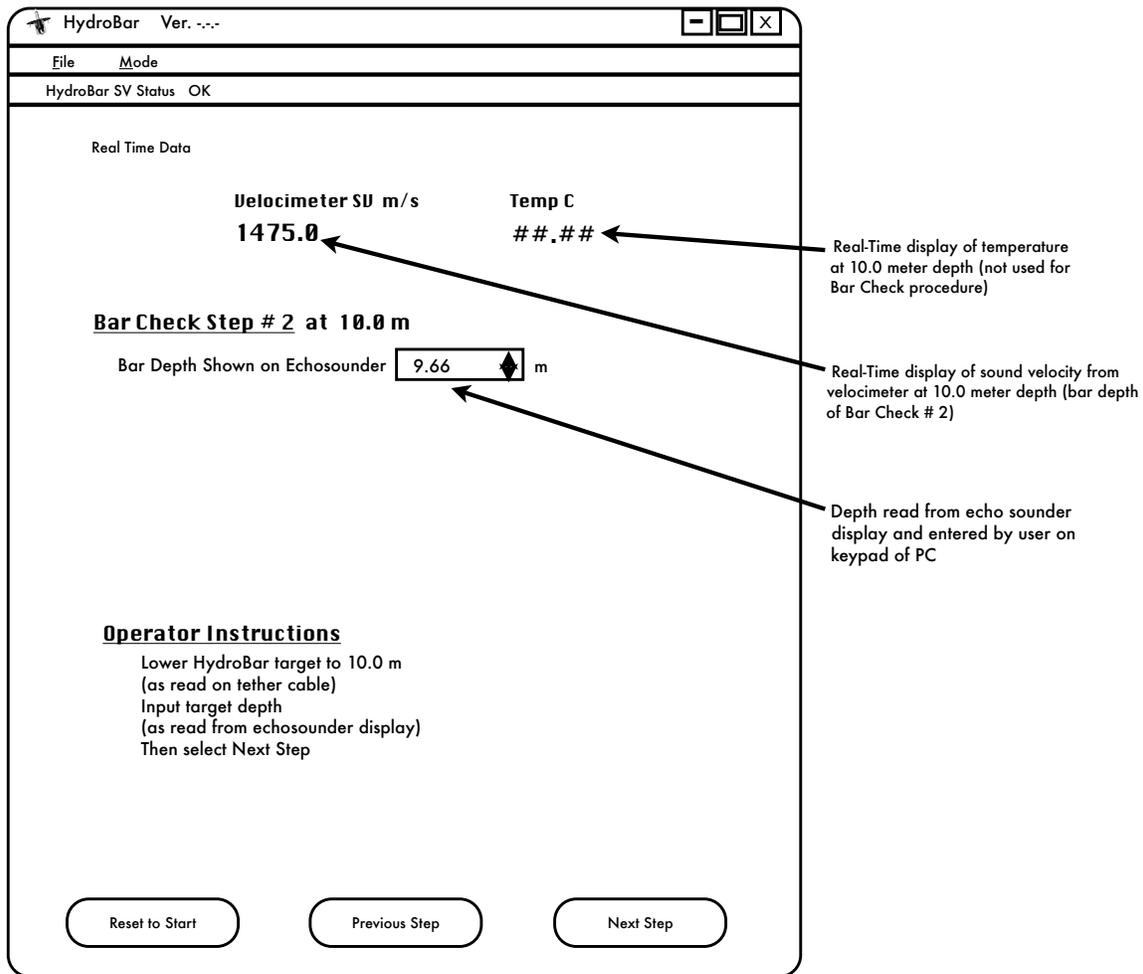


Figure 15

Once the HydroBar (target) is at a 10.0 meter depth, the user reads the echo sounder depth and enters that reading (in this case, 9.66 meters) in the **Bar Depth Shown on Echosounder** box above; then select NEXT STEP.

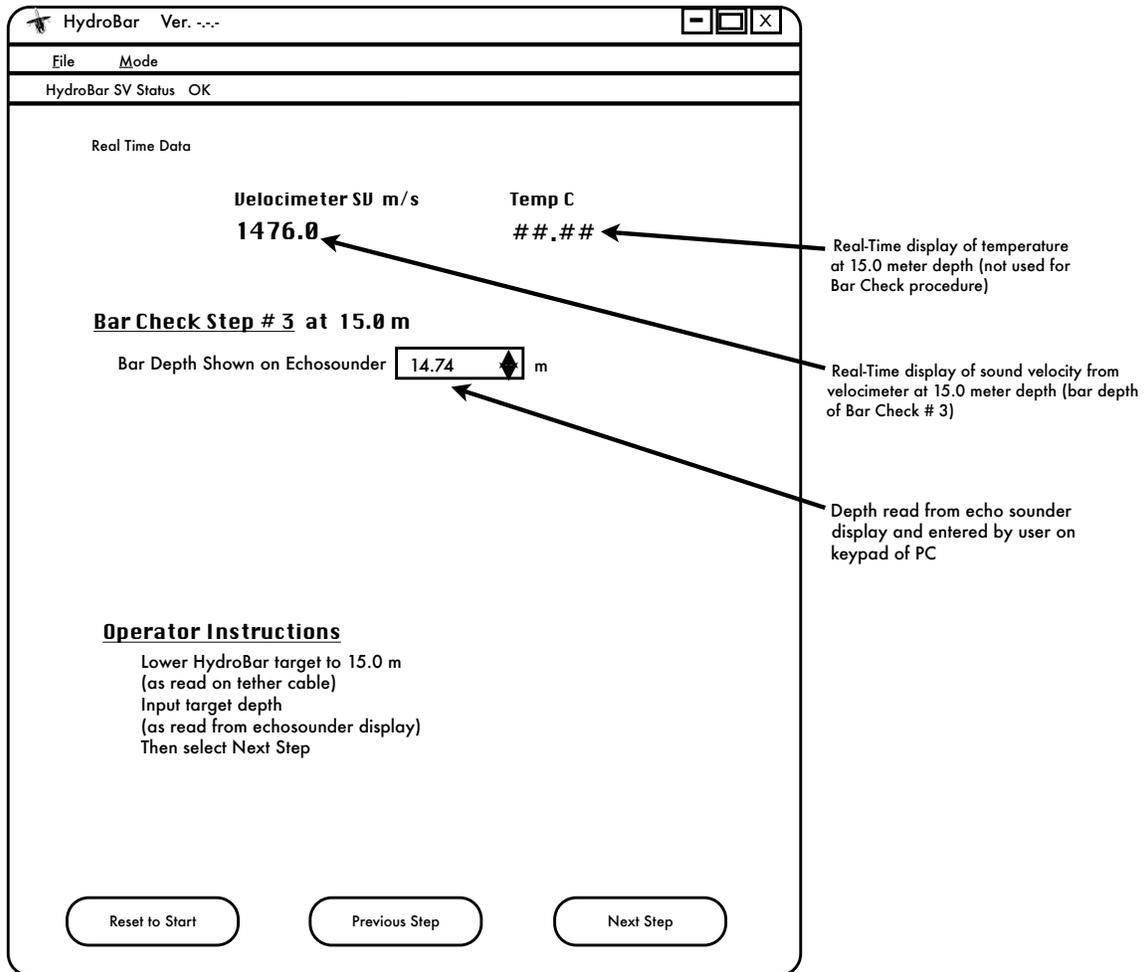


Figure 16

Like in the steps for Bar Check Step # 1 & 2, enter the echosounder's depth reading at the third and final bar depth. Upon selecting NEXT STEP, a results screen will appear as shown in Figure 17; then a **Bar Check Data Summary** as shown in Figure 18.

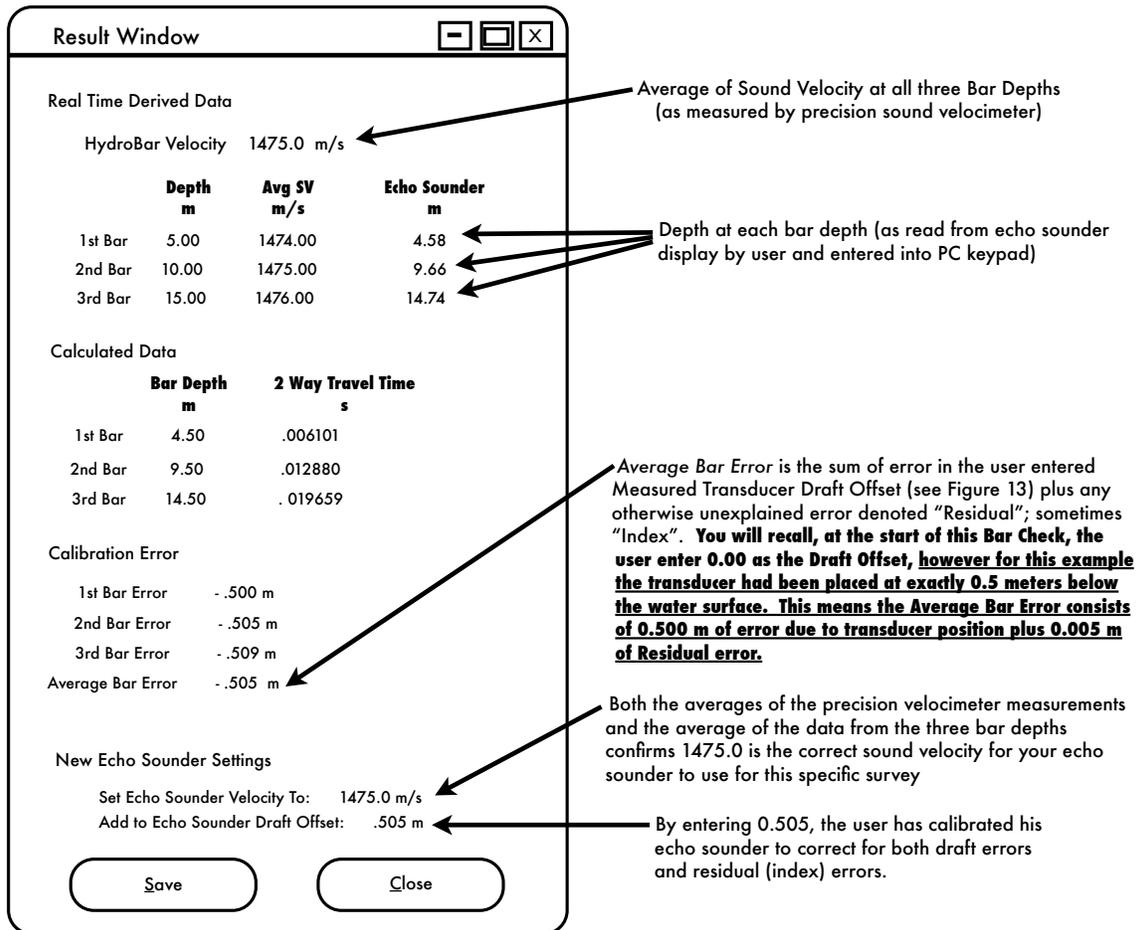


Figure 17

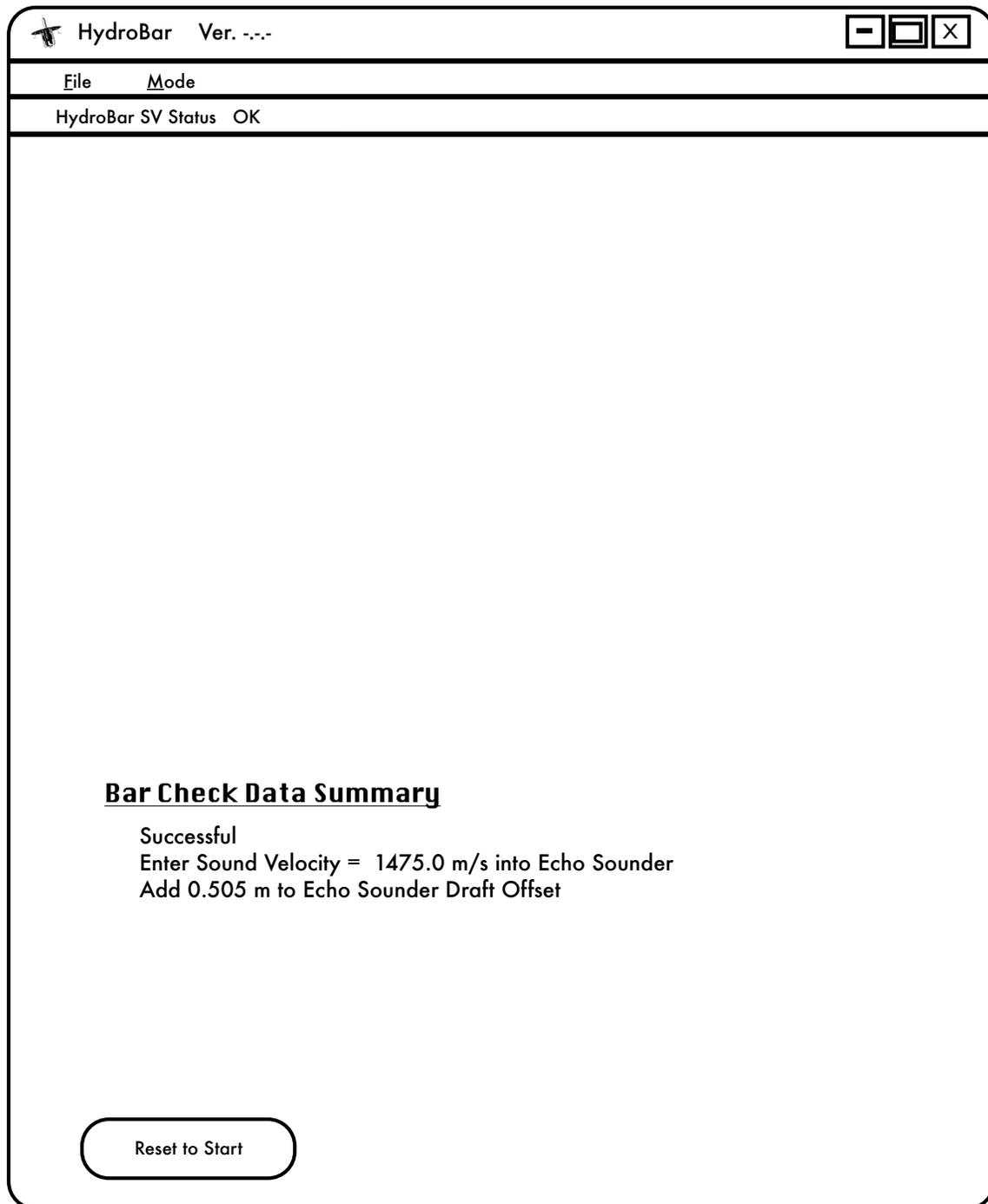


Figure 18

Appendix A

**AUTO DEPTH ENTRY to HydroBar
(allows use of your echo sounder serial depth
output to automatically enter measured bar
depths in Bar Check Mode)**

Auto Depth Setup

Your HydroBar deliverables include a Part Number UC232R-10 RS-232 to USB Adaptor cable. This cable allows you to input serial depth data directly from the RS-232 output of your echo sounder (Unabara Hydro-Book or other hydrographic echo sounder) into your Windows PC via a USB port. Once this is accomplished, the HydroBar PC APP can use this depth data at each bar check depth; in short, there will be no need for the user to visually read the depth from the echo sounder's display and then enter that depth via the PC keypad at each bar depth.

The adaptor cable has a USB A plug on the PC end and a D-SUB 9 Pin male connector on the echo sounder end. Figure 19 shows the D-SUB end; typical connection to echo sounders use Pins 2, 3 & 5.

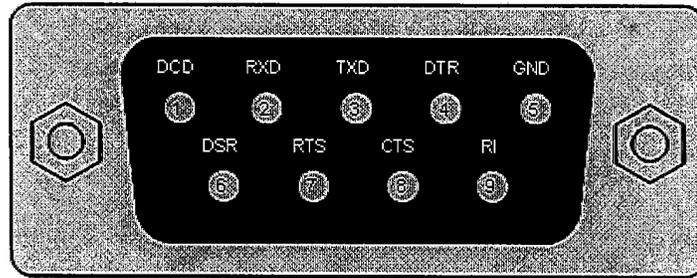
You will recall when setting up the Configuration screen page (Figure 2), for manual input of depth when performing bar checks, the Manual Input "box" was selected (checked). When using AUTO DEPTH ENTRY, de-select this "box".

Upon de-selecting, the five windows below the Echo Sounder Input for Bar Check heading will become active. First select the serial data string to match what your echo sounder outputs. Then select the applicable Com Port and baud rate, typically 9600 baud.

Using the Target Gate Width, the user selects the "window", above and below the HydroBar's target, outside of which he wants echo returns ignored. Lastly, he selects the number of samples (returned echoes) which he wants averaged to determine the bar depth(s).

Figure 20 shows the setup of the Configuration screen page for the AUTO DEPTH ENTRY Bar Check example to follow herein.

RS232 Connection Pin Out



RS232 DB9 Pin Out

DB9 Pin No.	Name	Type	Description
1	DCD	Input	Data Carrier Detect control input
2	RXDATA	Input	Receive Asynchronous Data input.
3	TXDATA	Output	Transmit Asynchronous Data output.
4	DTR	Output	Data Terminal Ready control output / Handshake signal
5	GND	Gnd	Device ground supply pin.
6	DSR	Input	Data Set Ready control input / Handshake signal
7	RTS	Output	Request To Send Control Output / Handshake signal
8	CTS	Input	Clear to Send Control input / Handshake signal.
9	RI	Input	

Figure 19

HydroBar Configuration

Defaults

Mode: Cast

Unit Type: Meters

Echo Sounder Input for Bar Check

Manual Input:

Depth Data String: DESO-25

Com Port:

Baud Rate: 9600

Target Gate Width: 0.5 m

Number of Samples: 20

Velocimeter

Com Port:

BaudRate: 19200

Accept Cancel

Figure 20

Performing a Bar Check (with Auto Depth Entry)

Figure 13, earlier in this manual, showed the setup parameters for our example of a Bar Check performed with manual input of depth. Figure 21 on the next page is the initial page for the bar check in auto depth mode; it uses the same setup parameters as did the manual input of depth example.

Figures 22 thru 27 take you through the three bar depth steps while demonstrating how the auto depth entry functions. Otherwise, the procedures for both manual depth entry and auto depth entry are the same; and the results are the same. See Figures 17 & 18 to review how bar check results is presented.

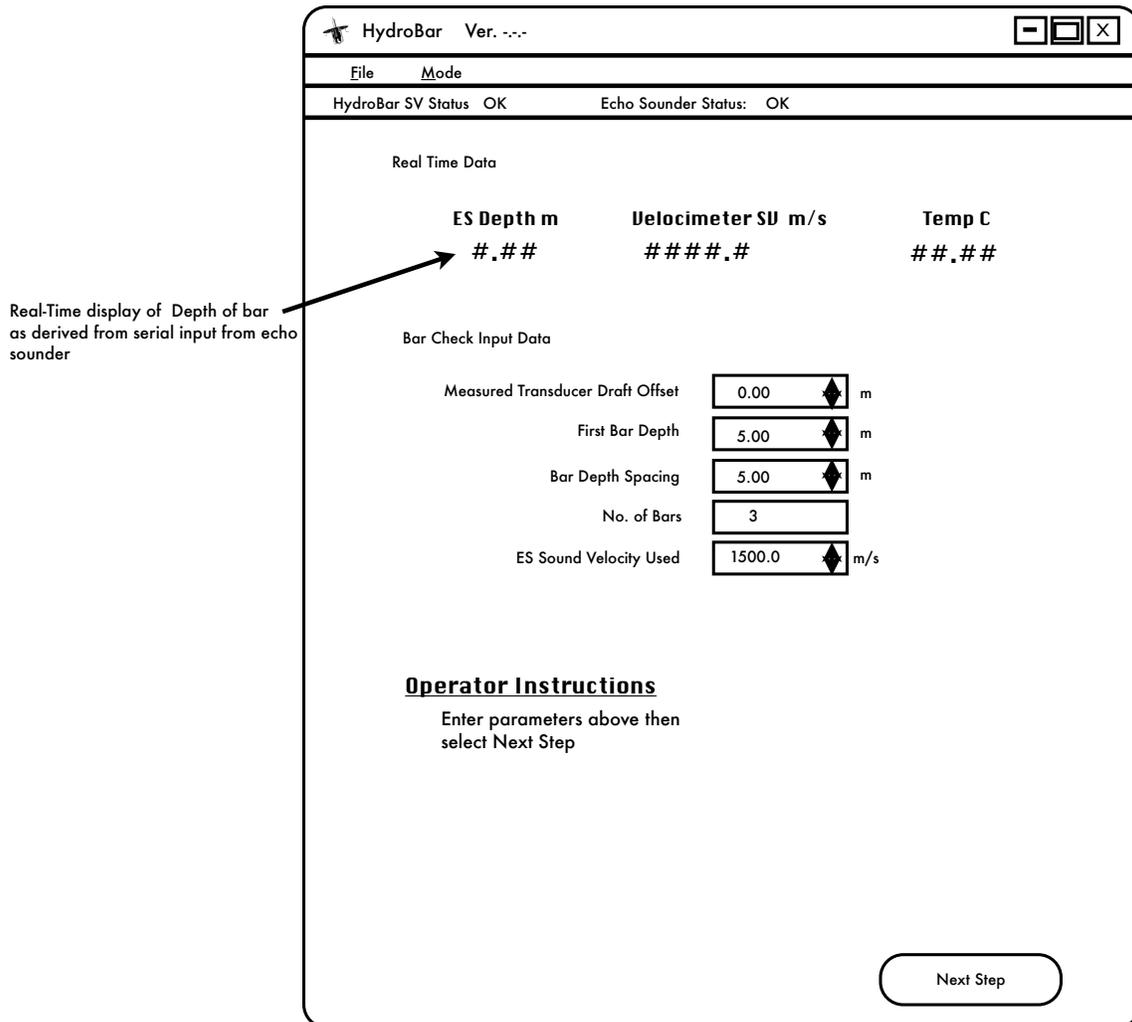


Figure 21

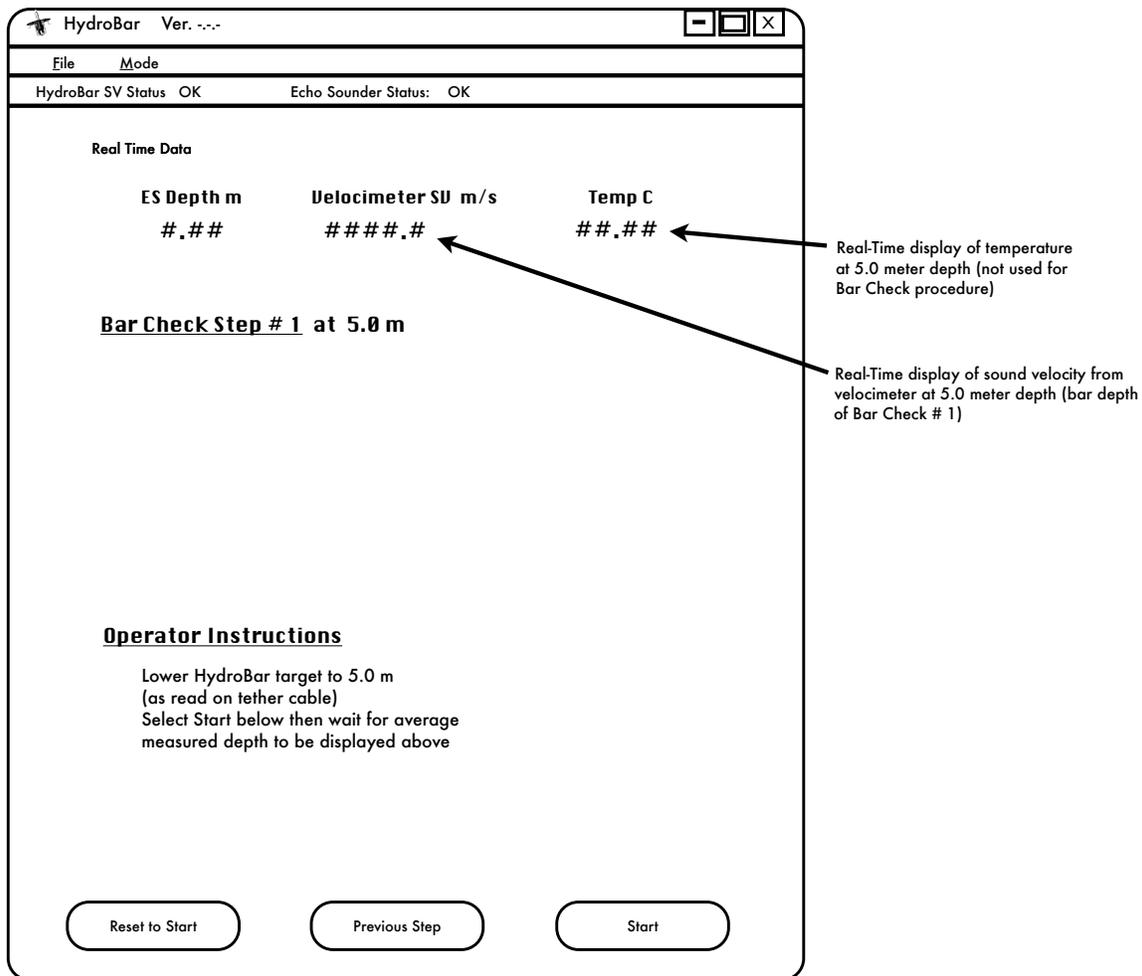


Figure 22

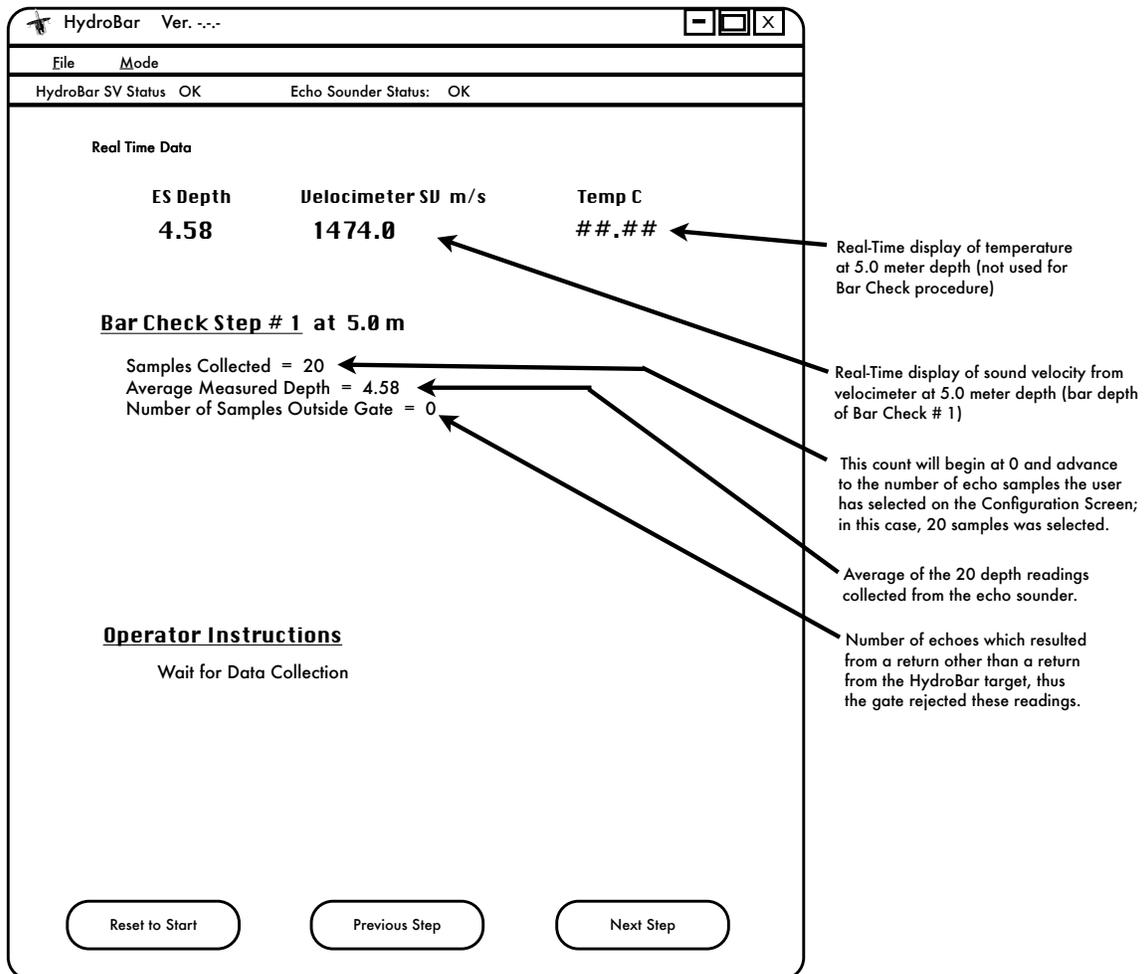


Figure 23

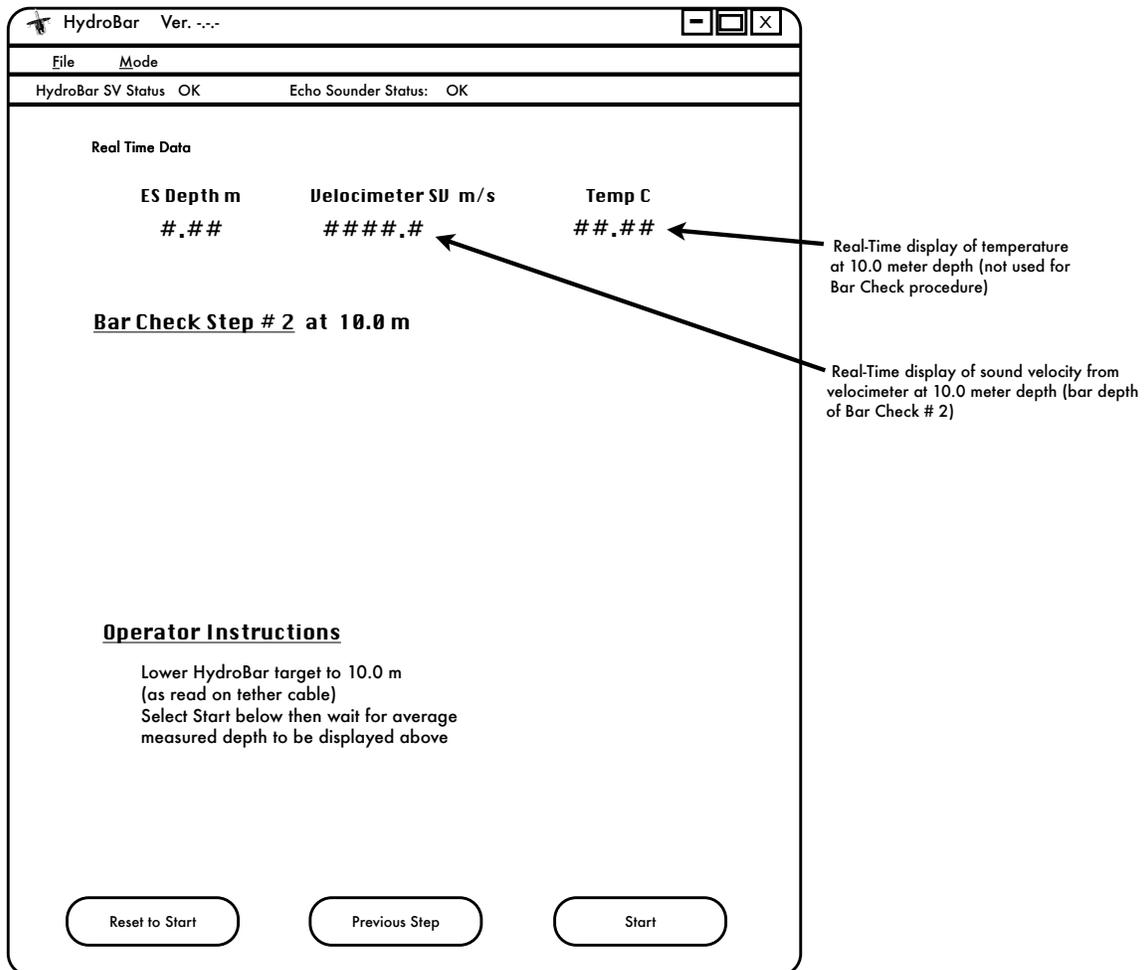


Figure 24

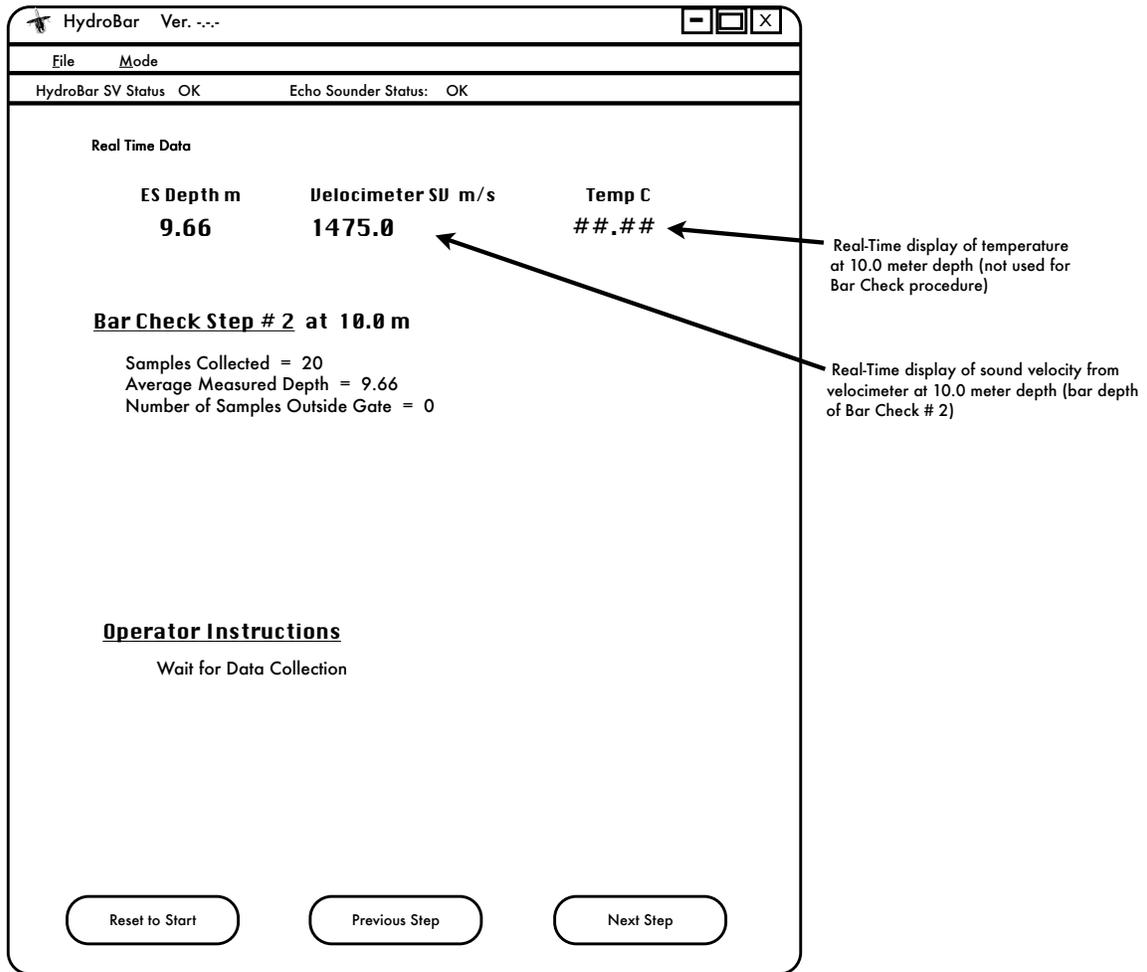


Figure 25

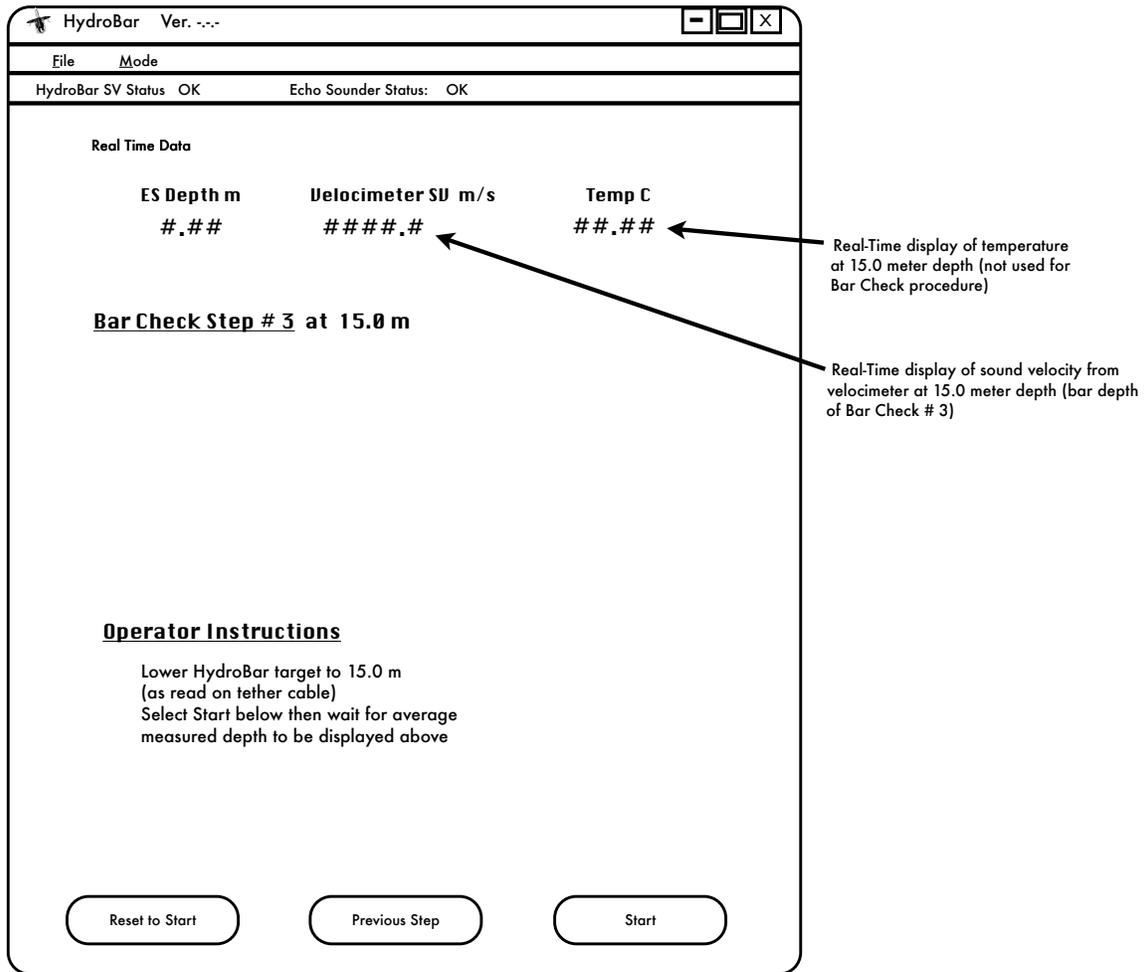


Figure 26

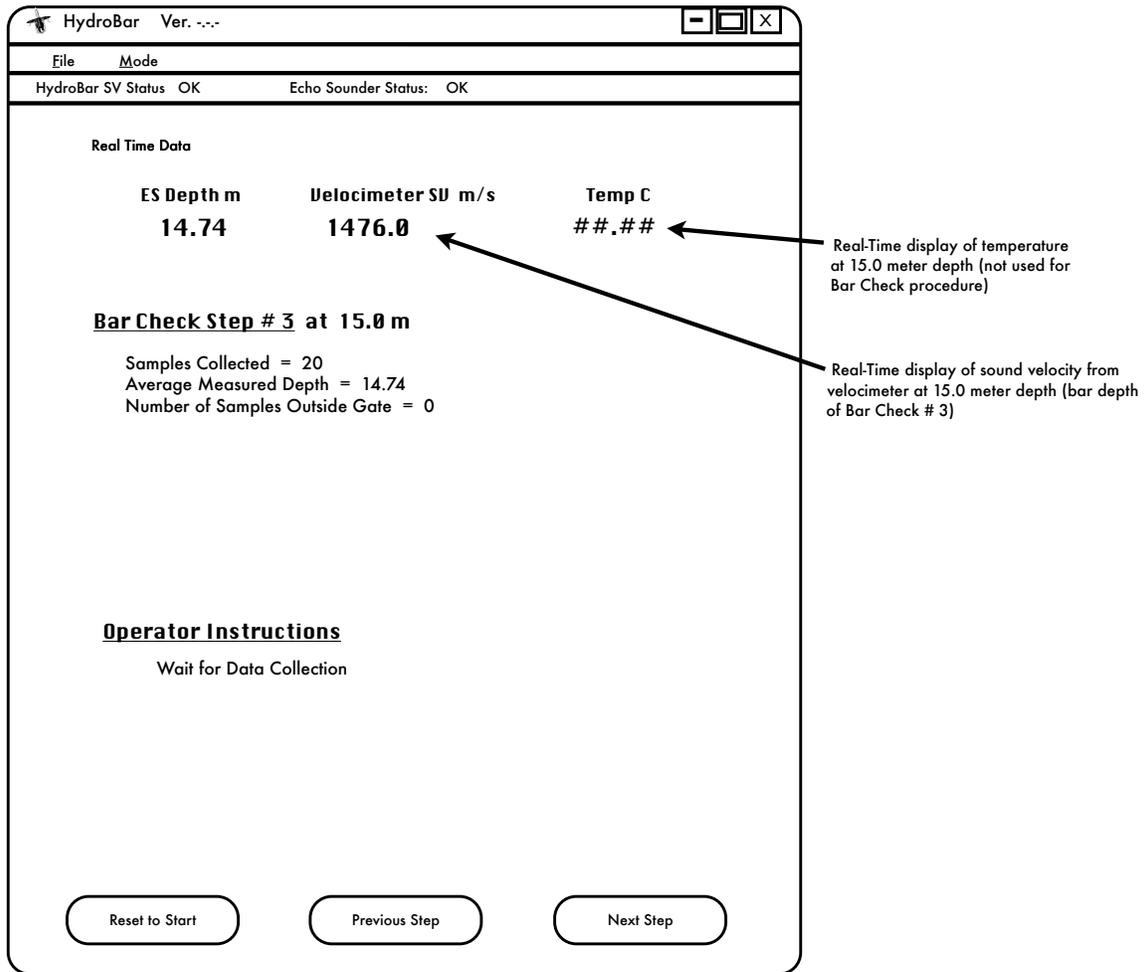


Figure 27

At the completion of Bar Check Step # 3, the Results Window will be displayed; see previous Figure 16 which shows results for this example.