

OCEAN DATA EQUIPMENT CORPORATION

High Resolution Echo Sounders and Acoustic Systems
For Precision Seafloor Exploration

HydroBox™ Hydrographic Echo Sounder

- Installation
- Operation
- Maintenance



ver 03.03.05



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1.0 INTRODUCTION

1.1 General Information

The HydroBox™ is a portable, low power, high-resolution, and water-resistant marine hydrographic echosounding instrument capable of delivering cm resolution for bottom depth measurements. When used with ODEC's survey grade transducers the instrument provides depth measurement accuracy that meets all of the IHO requirements. It is designed exclusively for inshore and coastal hydrographic marine survey up to 800 meters of water depth and operates at either 33, 50, or 200kHz. An interleaved dual frequency option is also available for dual frequency surveys. Included with the HydroBox™ product is the following:

- [HydroBox™ Sensor Unit](#)
- [HydroBox™ Installation CD](#)
- [HydroBox™ Manual](#)

HydroBox™ Sensor Unit provides all of the transmit/receive electronics, and all of the signal processing functions. It is powered from a 10-30VDC source and consumes 10 watts of power. It interfaces to the Host PC via a single COM port. The mechanical case for the Electronics Unit is Water Resistant to the EN60529 IP65 Specification and is also UV Stable and Chemical Resistant.

There are a host of transducer options that may be used with the HydroBox™ Sensor Unit. Transducer selection depends upon a number of application parameters: maximum depth, bottom type, single or dual frequency operation. All of the Transducer assemblies are lightweight and designed for portable pole or small plate mounting. Transducer options are identified and described in further detail in the Installation section.

The HydroBox™ Installation CD will install the PC software used to configure, control, and acquire data from the HydroBox Sensor device. It will also include this manual in PDF format and any Release Notes that have been generated.

A hardcopy of the HydroBox™ Manual is also included so that the user may learn to install, operate, and maintain the HydroBox™ Equipment and Accessories. The manual also includes a section on acoustic theory.

The HydroBox PC software was designed for use with the Windows operating systems. We recommend the software be used on a PC with a processor speed of at least 266 MHz. The software requires at least 1 available Serial Port for connection to the HydroBox instrument, and optionally, additional Serial Ports for NMEA Navigation/GPS Input, NMEA Depth Out, and External Annotation. The software features Navigation Input, External Annotation, Data Storage, Zoom Modes, Thermal Printer output, Automatic/Manual Eventing, and more. The HydroBox software interface is divided into two fields. The **Controls** field is located on the left and contains navigation/depth information, configuration buttons, and system status. The **Data** field is located on the right and contains the actual acoustic echo data.

1.2 About This Manual

This manual contains important information regarding acoustic theory, installation, operation and maintenance of your new equipment. The user should take sufficient time to read the entire manual and to understand the full functionality of the HydroBox Sensor and PC Software.

The manual is organized into four chapters:

Operations And Maintenance Manual

- 1) An introduction (this section), which provides a system overview and basic outline of echosounding acoustics.
- 2) Installation, which provides details on how to properly mount all of the HydroBox System components. Details on installing the HydroBox PC Software package are included also.
- 3) Operational instructions describing how to operate the HydroBox Sensor unit and the HydroBox PC Software.
- 4) Maintenance, which provides information on replaceable parts and troubleshooting guidelines.

The user should pay attention to notes that are displayed in a gray box. These notes contain important information regarding installation and use of the HydroBox System. An example is given below:

NOTE: Important operation and installation information is provided in gray boxes throughout the manual.

1.3 Echo Sounding Principles

Basic echo sounding principles that should be understood by all operators of hydrographic equipment are provided in this section.

1.3.1 Underwater Acoustics

1.3.1.1 Decibels

The scale most often used to describe a measurement unit of sound is the decibel (abbreviated “dB”). The decibel system was selected for a number of reasons. First, it is a logarithmic system, which is useful for dealing with large changes in measured quantities. Decibel units make multiplication and division simple because they are reduced to an addition and a subtraction operation respectively. Secondly, for underwater acoustics, the primary concern is ratios of power levels and signal levels rather than absolute numeric values.

Transducer calibration values are typically provided in units of decibels, including source level, receive sensitivity and directivity index. These transducer calibration values are outlined later in this section. These quantities are used to predict performance levels of a given transducer used with a sonar system.

1.3.1.2 Sound Propagation

The sea, together with its boundaries, forms a remarkably complex medium for the propagation of sound. Figure 1-2 shows the interaction of a transmitted sound source and the water. Both signal loss and interference result from interactions with boundaries and components within the water column, causing the source to be delayed, distorted and weakened. The main components affecting sound propagation are spreading loss and attenuation loss.

Spreading Loss

As a transmitted pulse of sound leaves the transducer, it spreads out in all directions. At the transmission point, the sonar puts a fixed amount of energy into the water. As the pulse travels away from the transducer, it occupies a greater and greater volume. This effect is called spherical spreading. The general rule is that the intensity of the sound falls off as the square of the distance traveled. In respect to typical acoustic measurements, this mathematically becomes a loss of 6 decibels for each doubling of the distance.

For echo sounders, the distance actually traveled is two times the distance to the seafloor from the source transducer (from the transmission source, to the bottom and back again). This results in a significant source of signal loss for the system receiving the sound pulse, which must be compensated for at the receiver. Typically a Time Varied Gain (TVG) amplifier is used to correct for spherical spreading loss in an acoustic receiver. A TVG amplifier works by applying an increasing amount of gain to the return signal as time of travel increases.

Attenuation Loss

Attenuation of sound energy in the oceans comes from three factors: absorption, scattering (or reverberation) and bottom loss. Sound absorption takes place at two levels; one, absorption in the actual seawater medium, and two, absorption into the seafloor. Primary causes of absorption are viscosity and thermal conductivity in the molecules of water as the sound travels. At the molecular level, absorption is primarily related to frequency. At high frequencies- 500 kHz, for example, a loss of 0.14 dB/meter occurs in seawater, while at 50 kHz the loss is only 0.014 dB/meter. This is a major concern when selecting a transducer required to meet specified depth criteria. A graph showing the attenuation loss versus frequency is shown in Figure 1-1.

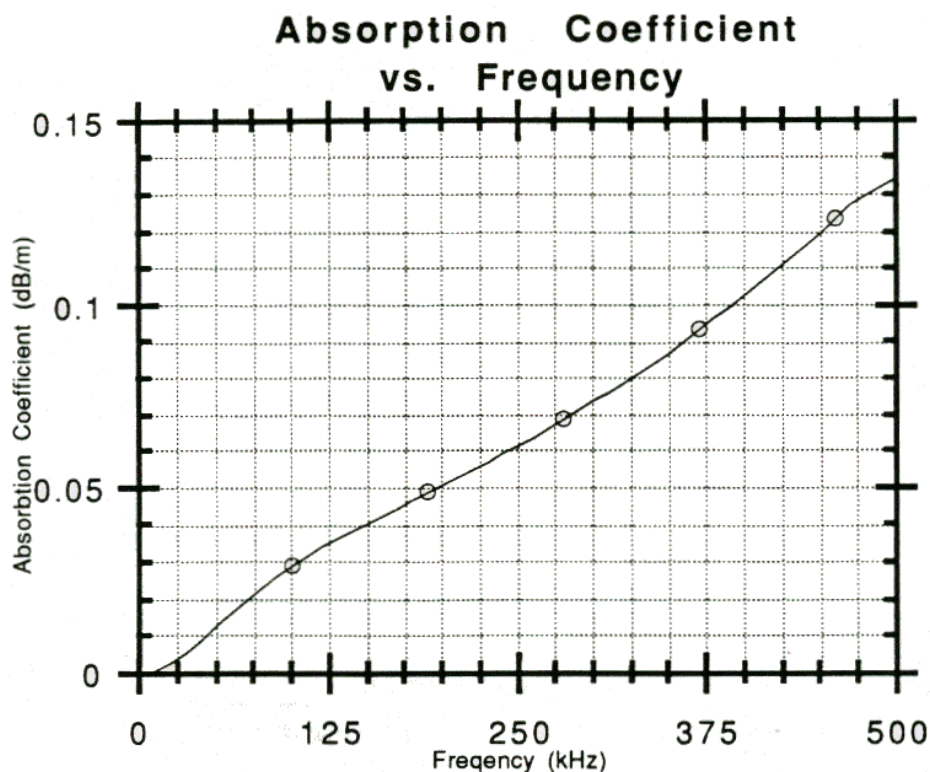


Figure 1-1 Absorption Coefficient Versus Frequency

Operations And Maintenance Manual

Sound reflected off the seafloor usually suffers a significant loss in intensity. Part of this loss is due to scattering (reflection) but most of it results from the portion of sound entering the new medium and traveling into the seafloor until it is completely absorbed. The amount of energy lost by this effect varies greatly and depends on bottom type, sound frequency, and the angle at which the sound intersects the seafloor. Total losses can vary from 10 dB to 40 dB, with hard bottoms (packed sand, rock outcrops) causing little loss, and soft bottoms causing a significant amount of energy loss (muddy, silt-like sediments). Therefore, it is necessary when designing an echo sounder to compensate for this wide range in signal variation.

Another form of attenuation is scattering, also called reverberation, which results when sound reflects off components in the water column. Some of these reflectors include boundaries (sea surface and bottom), bubbles, biological material, suspended particulate and water type boundaries such as thermoclines. As the sound pulse travels from the transducer, it will reflect off these objects in many different directions. The larger the area of the reflector compared to the wavelength of the transmitted sound, the more effective it is as a scatterer. During the scattering process, part of the sound is reflected back to the surface, and the rest is scattered in all directions. This will cause a reduction in the acoustic energy that can travel to the seafloor and back to the transducer. For echosounding, this causes a reduced signal strength, which complicates location of the bottom. In the extreme case, scatterers will cause such a good reflection it looks like the bottom to the echo sounder and corrections must be made by the user to properly determine the digitized bottom value.

Bottom reverberation occurs whenever a sound pulse strikes the ocean bottom. In deep water this condition normally does not cause serious problem, but in shallow water reverberation can happen multiple times, causing high background signal levels (i.e. the sound travels from the surface to the bottom and back again many times).

Noise Sources

Background noise can cause interference with the reception of the desired acoustic echo return from the seafloor. Unlike reverberation, however, noise does not result from the transmitted pulse but from active producers of noise located at the ship or in the water. Noise can be classified as self produced or ambient noise.

Self-noise

Self-noise is produced by noisy ship components, electrical circuitry, and water turbulence around the transducer, including noise caused by water flow and cavitation.

Machinery noise and other sonar systems are the main components of ship produced self-noise. The dominant source of machinery noise is the ship power plant, including the main engine, generators, and propellers. The only way to reduce the effect of these noise makers is in proper selection of the transducer frequency for the echo sounder, and to locate the transducer as far away as possible from the noise sources. Typically, these sources are of lower frequencies than the echo sounder, but some mechanical and electrical equipment will produce sound in the ultrasonic region (above 15 kHz) which can detrimentally affect the performance of a system.

In general echosounding, flow noise, cavitation, and sonar circuitry are more important than other noise sources. Flow noise results when there is a difference in the relative motion between the transducer and water surrounding it. As flow increases, friction between an object and water increases, resulting in increased turbulence and, thus, increasing noise due to varying static pressure in the water. Flow noise is directly related to the speed of the ship and, on an improperly mounted transducer, there is usually a certain speed threshold that will cause the echo sounder to start picking up unwanted noise. Increased flow noise over time can usually be attributed to growth of marine animals and plants on the bottom of the ship.

Cavitation is a result of the pressure on the face of the transducer reducing to a level that permits the water to boil (i.e. turn from a liquid to a gas). This is directly related to the flow around the transducer as described above. Cavitation is also related to the depth, source level, and frequency of the transducer being used. As the depth of the transducer increases, static pressure increases to levels that will prevent cavitation from occurring. If the transducer is mounted properly, with flow noise and cavitation levels considered, this phenomenon should never affect an echo sounder.

Cavitation may also occur on a ship's propeller. As the speed of the water increases over the surface of the propeller, turbulence causes changes in the static pressure of the water. At this point, if the pressure is low enough, boiling will occur. This process releases a large quantity of bubbles into the water, causing noise that can affect the performance of an echo sounder. Care should be taken to mount a transducer as far as possible from this noise source.

Ambient Noise

Ambient noise is always present in the ocean. This noise is caused by both natural or human-made events. For echosounding principles, ambient noise sources that are significant include hydrodynamic boundaries, ocean traffic and biological transmitters.

Hydrodynamic noise results from natural phenomenon such as wind, waves, rain or currents. The levels produced vary greatly, but are largely related to the sea state level. In severe storms, hydrodynamic noise can reach levels that make reception of a transmitted signal very difficult, if not impossible.

Ocean traffic noise is dependent on the number of ships, the distance from noise sources, and the current propagation conditions due to thermoclines and sea state. Ocean traffic generally produces acoustic noise that is not within the frequency bandwidth of most navigational echo sounders, except when ships pass very near to the receiving transducer.

Biological noise producers include marine life such as shrimp, fish, and mammals. Mechanical movements of crustaceans, with their hard shells, may produce significant noise when in large schools. Likewise, certain fish species produce noise by reflecting noise off their swim bladder.

Transducer Properties

Properties of a chosen transducer affect sonar performance which directly relates to depth measurements. The source level, directivity index, and beam width of a transducer have a relationship with how the sonar system performs under different conditions.

Source Level

Sound is created by a transducer from a mechanical vibration of the ceramic material of which underwater transducers are made. The movement of the transducer face creates alternating regions of high and low pressure, resulting in an acoustic wave. The amount of energy transmitted into the water column is defined as the acoustic source level. A source level is expressed in units of decibels that describe the intensity of sound relative to a reference intensity at one unit distance from the sound source. For the user, a source level is useful for selecting a transducer for a particular use.

The amount of movement on the face of the transducer is linearly related to the voltage difference created across the ceramics of the transducer. Normally it would seem desirable to put as much power into the water as possible to achieve maximum depth performance. Cavitation, however, which results from high source levels and small transducer depths below the sea surface, is generally the limiting factor when driving a transducer. The electrical and mechanical design of the transducer, which has a maximum recommended input power level, must also be considered.

Beam Width

The beam width of a transducer is described as the width of the main lobe of a transmit pattern. The width is usually measured between the -3 dB points on either side of the beam pattern. Shown in Figure 1-2 is a transmit beam pattern for a 125 kHz transducer. The shape of the transducer beam pattern is a result of the transducer design. An array of ceramic elements, or a single ceramic element, emits sound at given frequency. The spacing of the elements and the frequency being used can control the shape of the beam pattern. At the center of the beam pattern is the main lobe of the transducer, with a width of 7 degrees (centered at zero degrees). The -3 dB point is shown as a dashed line on the graph. The side lobes of this transducer are the smaller lobes, approximately 18 dB below the level of the main lobe.

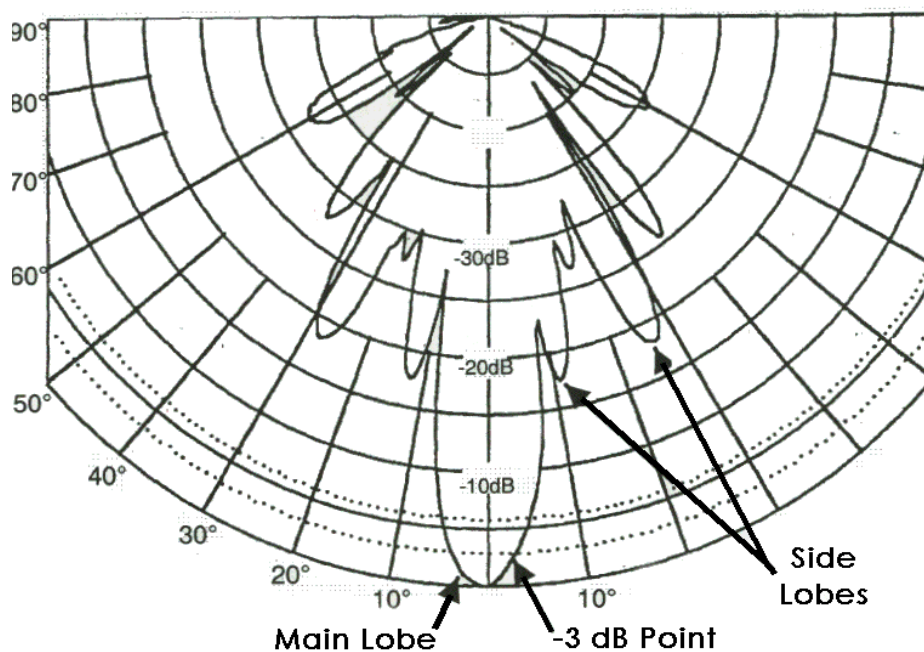


Figure 1-2 Acoustic Beam Pattern

The width of a beam is important for calculating how small an object the system can detect. If two objects fall within the main beam the object will appear as one object when it is received by the system. Thus, a narrow beam width is required for navigational echo sounders so it is capable of discriminating small objects.

The size of the transducer sidelobes (smaller beams off to the side of the main lobe) is important in determining how the system will behave on steep slopes. On steep slopes, transmitted acoustic energy from the side lobes will be received first and reveal a signal that looks like the actual bottom. In reality, the bottom is directly below the ship, and as seen by the main lobe, is much deeper. For this reason, it is important to select a transducer which has reduced sidelobes.

Directivity Index

The directivity index measures the ability of a transducer to reject noise from extraneous sources. In the ocean, noise may be coming from all directions, but a narrow beam transducer will only “hear” noise within the beam width pattern. A sonar systems signal to noise ratio (SNR) will be affected by the ability of a transducer to reject unwanted noise, and thus is related to the directivity index. The higher the directivity index of a transducer, the better the ability to reject unwanted noise.

1.4 Specifications**1.4.1 HydroBox Sensor Specifications**

Units	Feet or Meters
Depth Ranges	0-15, 30, 60, 120, 240, 450, 900, 1500, 2400 Feet. 0-5, 10, 20, 40, 80, 150, 300, 500, 800 Meters. Auto-ranging Modes in all units.
Data Offset	0 to 30 feet (0 to 10 meters)
Shift Range	1 foot increments in depths to 100 feet 10 foot increments in depths greater than 100 feet
Zoom Range	15, 30, 60, 120, 240, 480 feet; 5, 10, 20, 40, 80, 160 meters
Zoom Modes	Bottom Zoom, Bottom Lock, Marker Zoom, GUI Zoom (Playback Only)
Display	Normal Data, Zoom Data, Navigation, Depth, Command/Status, Color Control for Data: 4 Selections or Custom (User Input), Data Color Invert possible
Sound Velocity	4600 - 5250 ft/sec (1400 - 1600 mt/sec) 1 mt/sec int.
Depth Resolution	0.1 foot, 0.01 meters. (in less than 120 mts)
Depth Accuracy	± 0.5%
Data Output	NMEA 0183, DPT, DBT, PMC, Hypack & HydroPro Compatible
Geographic Position	NMEA 0183, GLL, GGA, RMC, VTG, VHW, HDT Selectable Baud Rates (RS-232): 4800, 9600, 19200, 38400
Data Interface	ODEC HydroBox Interface, 57600 Baud (RS-422)
Printer Output	Centronics (Parallel Port) interface to TDU Series Thermal Printers
Shallow Water Operation	< 1 meter; frequency dependant
Transmit Rate	Up to 10 Hz, depth and operator mode dependant
Event Marks	Periodic, External, and/or Manual (Periodic selectable in 1 minute intervals)
Data File Output	Stores Depth, Navigation, and Graphic Data in ODC format (Proprietary) Normal and Zoom Data stored is Pixel data and can be played back and/or printed
Data File Playback	Files can be played back and/or printed at Normal or Fast-Forward speed, with Pause and GUI Zoom available
Frequency Output	210 Khz (nominal) *33Khz, *50Khz (*optional)
Transmit Power	600 Watts (nominal) matched to transducer (1000 Watts capable)
Input Power	10-30 Volts DC, Nominal power 10 Watts, Reverse Polarity and Over Voltage Protected
Dimensions	25.4 cm (10”) Length, 15.876 cm (6.25”) Width, and 6.25 cm (2.5”) Height
Weight	0.9 kg (2.0 lbs)
Environmental	-25°C to +60°C Operating Temperature (-55°C to +90°C Storage) Water Resistant to EN60529 IP65 EMC meets EN60945 Emissions; CE Compliant

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2.0 INSTALLATION

2.1 - HydroBox System Installation Overview

This section presents instructions for initial setup and installation of the HydroBox Sensor. Physical and electrical installation details are provided for connecting, mounting, and getting started with the HydroBox. A summary is given of the software installation and setup procedure as well.

Although the HydroBox Sensor is designed to deliver the highest levels of quality and performance, it can best attain those standards when the equipment has been properly installed. Because of the great variety of vessels that will employ the HydroBox Sensor, it is not feasible to provide complete and detailed instructions that will fit all installation possibilities. Therefore, this section will provide practical guidelines to assist the user in planning a typical installation of the HydroBox System aboard the vessel.

Shown in Figure 2-1 is a system-interconnecting diagram. Optional items are shown with dashed lines. A minimum operational system configuration requires:

1. PC running Windows, Pentium II @ 266MHz or greater
2. HydroBox Sensor Unit
3. HydroBox Transducer Assembly
4. HydroBox Cables (Power, Data, Transducer)
5. 10-30 Volt DC Power Source (10 Watts)
6. Transducer Mounting Hardware

The GPS, NMEA Depth Out, and External Eventing connections are optional but, if used, will require the PC to have additional COM ports. The HydroBox Data I/O is compatible with both the Hypack & HydroPro Survey Software packages. For many portable PC's additional COM ports may be installed via one of the PCMCIA expansion slots.

The TDU Printer, if used, is attached via the PC's Printer Port.

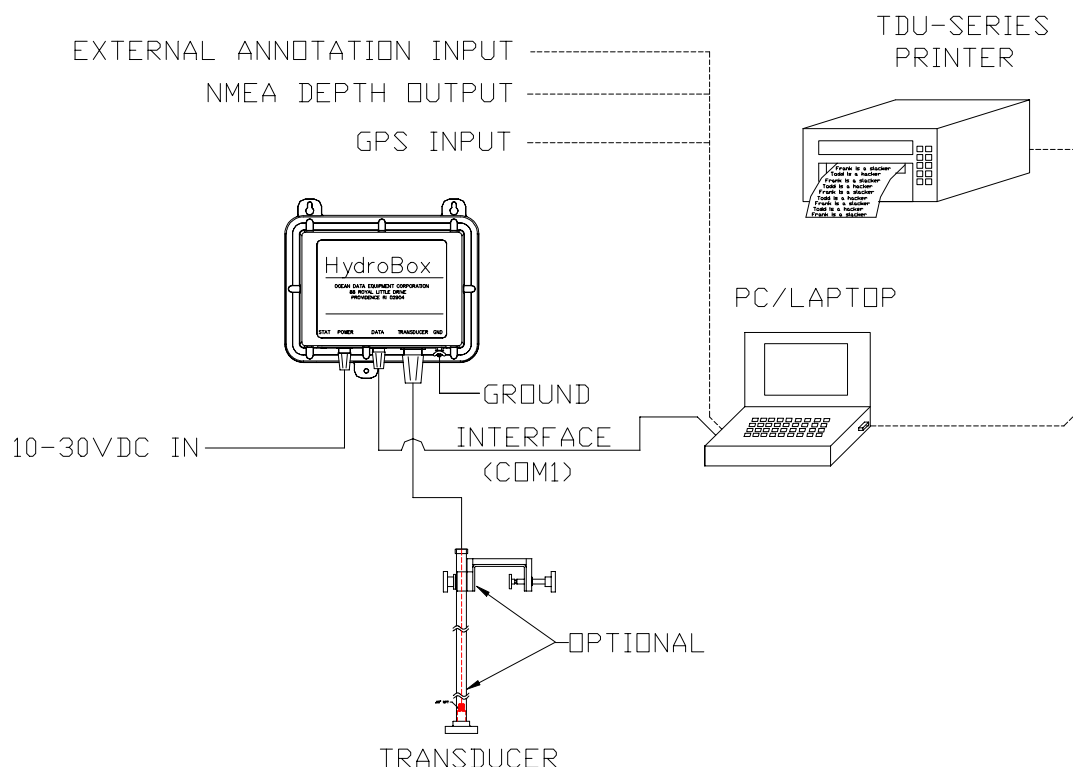


Figure 2-1 System Interconnect Diagram

2.1.1 - Getting Started

Unpacking and Inspection

Use care when unpacking the unit from its shipping carton to prevent damage to the contents. It is also recommended that the carton and the interior packing material be saved even after the unit has been installed on the vessel. In the unlikely event that it is necessary to return the unit to the factory, the original carton and packing material should be used. Verify that all parts described in the next section have been shipped with the unit.

Basic Equipment

The following (Table 2-1) is a list of the basic equipment supplied with the HydroBox Hydrographic Echo Sounder.

SINGLE CHANNEL SYSTEM			DUAL CHANNEL SYSTEM		
Part Number	Item	Quantity	Part Number	Item	Quantity
P04503	HydroBox Sensor Unit	1*	P04803	HydroBox Sensor Unit	1*
P04412	Power Cable (10 feet)	1	P04412	Power Cable (10 feet)	1
P04413	Data Cable (10 feet)	1	P04413	Data Cable (10 feet)	1
P04521	HydroBox Software CD	1	P04521	HydroBox Software CD	1
P04525	HydroBox Manual	1	P04525	HydroBox Manual	1

Table 2-1 Basic Equipment

Accessories and Options

The following items are available to complement and enhance the operation of the HydroBox echosounder. Please contact your authorized SyQwest distributor or visit our web site for information and assistance in obtaining any of these items.

Product Code	Item	Quantity
P04515	Transducer, 210Khz	1
P04516	Transducer, 33Khz	1
P04517	Transducer 50Khz	1
P04816	Transducer, 33/210Khz	1
P04817	Transducer 50/210Khz	1
P02553	TDU-850 Thermal Printer	1
P03100	TDU-1200 Thermal Printer	1
P03120	TDU-2000F Thermal Printer	1
P03050	12 Channel DGPS System w/ Combo Antenna	1
Optional	Over-the-Side Mounting Kit (OTSM)	1

Table 2-2 Accessories and Options

2.2 TRANSDUCERS (DIMENSIONS & MOUNTING)

(Transducer drawings and specifications are for reference only and are subject to change; please contact ODEC for current transducer information.) For installation suggestions, please visit our website <http://www.oceandata.com/>

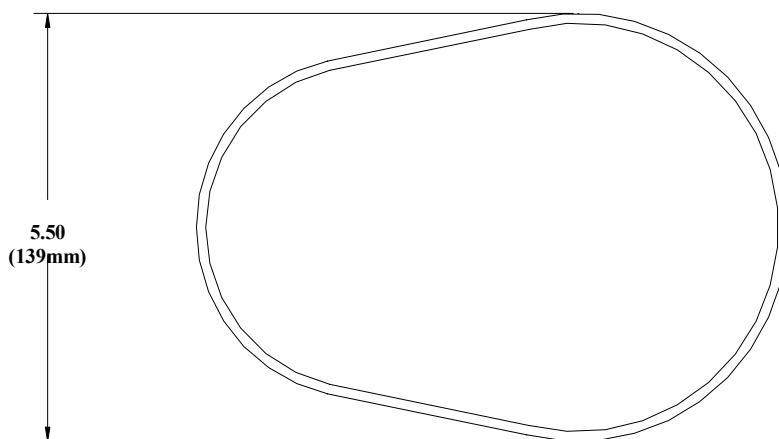
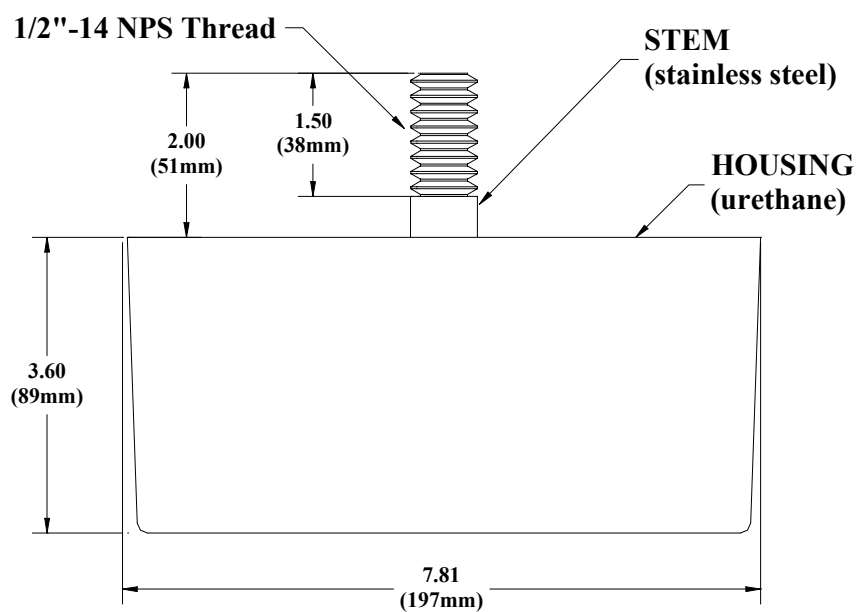
2.2.1 P/N P04816 TRANSDUCER 33/210Khz



Resonant Frequency:	33/210 KHz.
Nominal Impedance:	60/60 ohms
Beamwidth (@ 3 dB point):	33khz 23° 210khz 8°
Cable:	30 feet C44 (with plug)
Housing Material:	Urethane
Stem	Stainless Steel ½-14NPS Thread
Weight:	11 lbs (5 kg)

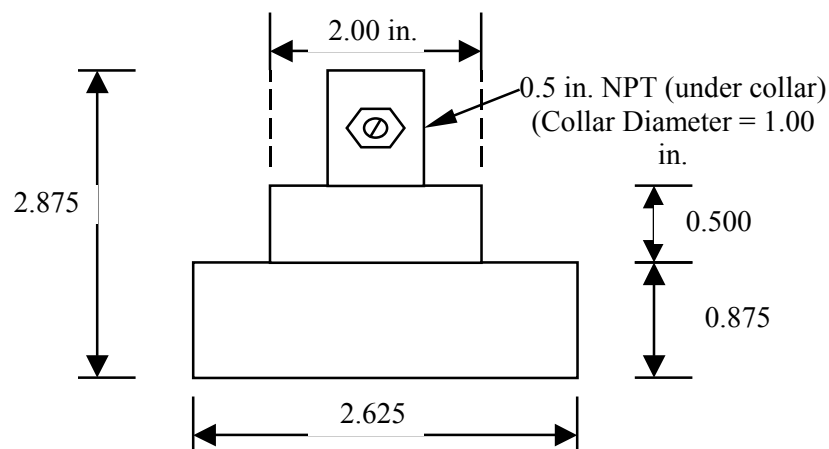
2.2.2 P/N P04817 TRANSDUCER 50/210Khz

Resonant Frequency:	50/210 KHz.
Nominal Impedance:	60/60 ohms
Beamwidth (@ 3 dB point):	50khz 210khz
Cable:	30 feet C44 (with plug)
Housing Material:	Urethane
Stem:	Stainless Steel, 1/2-14NPS Thread
Weight:	11 lbs (5 kg)

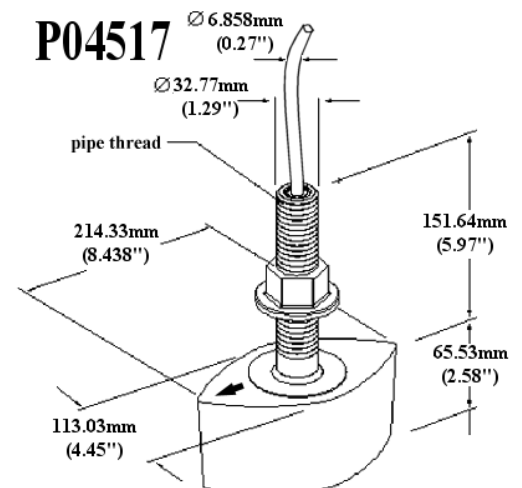


2.2.3 P/N P04515 TRANSDUCER 210Khz 8 deg

Resonant Frequency:	210 KHz. (nominal)
Nominal Impedance:	50 ohms
Beamwidth (@ 3 dB point):	8 degrees
Cable:	30 feet (with plug to mate with recorder)
Housing Material:	Brass (with urethane acoustic window)
Piezo Material:	Barium Titanate

**2.2.4 P/N P04517 TRANSDUCER 50Khz 18 deg**

Resonant Frequency:	50 KHz.
Nominal Impedance:	60 ohms
Beamwidth (@ 3 dB point):	18 degrees
Cable:	30 feet (with plug)
Housing Material:	Brass (with urethane acoustic window)
Piezo Material:	Barium Titanate



2.2.5 - Installing the HydroBox Electronics

Instructions are provided in this section regarding the physical installation of the HydroBox Sensor Unit and the PC that is used for the User Interface. Guidelines are provided for locating and/or mounting the HydroBox Sensor unit and the PC. The installer should refer to Section 2.2.7 for information on electrical hookup.

Selecting a Location for the Electronics

The HydroBox Sensor Unit is designed for portable, marine applications but maybe used in permanent installations as well. The user must determine if the HydroBox Sensor Unit is to be mounted on the vessel or just placed in a convenient place on-board the vessel. Either way the appropriate location for the unit needs to be determined. The following considerations should be investigated before deciding upon a location:

1. User Supplied Personal Computer

The first step in the equipment location process is to determine the optimum place for viewing the data. The unit should be positioned to provide the optimum viewing angle and within easy reach of the operator whenever possible. This will vary depending on the size of the vessel and type of Personal Computer (Desktop or Laptop) but is most important to insure the comfort and success of the user. The location selection should consider that standard PC displays are not easily readable in direct sunlight. Adequate space for the computer and any peripherals that need to be connected should be considered as well. Finally, provisions need to be made to properly secure the equipment for the worst sea conditions that may be encountered.

2. Cable Lengths.

Both the Data Interface Cable and the DC Power Cable supplied with the product are 10 feet long. Thus, the Sensor Unit must be installed within 10 feet of both the user supplied Personal Computer and a 10-30VDC Power Source. The unit must also provide adequate access for cabling termination without binding, and allow suitable space for servicing the equipment. (If necessary, the data cable may be extended beyond 10 feet. See Section 2.2.7 for more information)

3. Water Resistance.

The Sensor Unit has passed the EN60529 IP65 Water Resistance Standard which ensures that the unit is completely sealed and is Splash Proof. The unit should NOT however be installed in an area where the unit may be submerged in water.

4. Environmental.

The operating temperature of the HydroBox Sensor is -25C to +60C thus the operating temperature range of the PC is likely the limiting factor for temperature. The unit has also passed all of the EN60945 emission tests (radiation and immunity). For optimum system performance it is still recommended that the installer mount or place the Sensor unit in an area that is at least several feet away from any other electronic equipment or machinery on the vessel. The unit should also be mounted or placed in an area that won't be exposed to water if practical.

Mounting the Sensor Unit

This section outlines the steps for mounting the Sensor Unit. Refer to Figure 2-2 while installing. The unit may be mounted either horizontally or vertically. The keyhole slots make installation in hard to reach areas easier, but be sure to tighten all mounting hardware securely. Insure that adequate room is left for installing and removing the cable connections. Also, verify that the status indicator (labeled STAT) is visible.

- Step 1) Confirm that the area behind the intended-mounting surface on the bulkhead is clear of equipment, panels, electrical cables, conduits, hydraulic, air, water lines or pipes.
- Step 2) Using the Sensor Unit as a template mark a drill point for each of the mounting holes. Insure that the marks for the keyholes are placed in the smaller, slotted areas.
- Step 3) Drill three (3) holes that will work with the mounting hardware that has been selected (not supplied). The 3 holes on the Electronic unit are 0.195 inches in size (#8 size Screw recommended for installation).

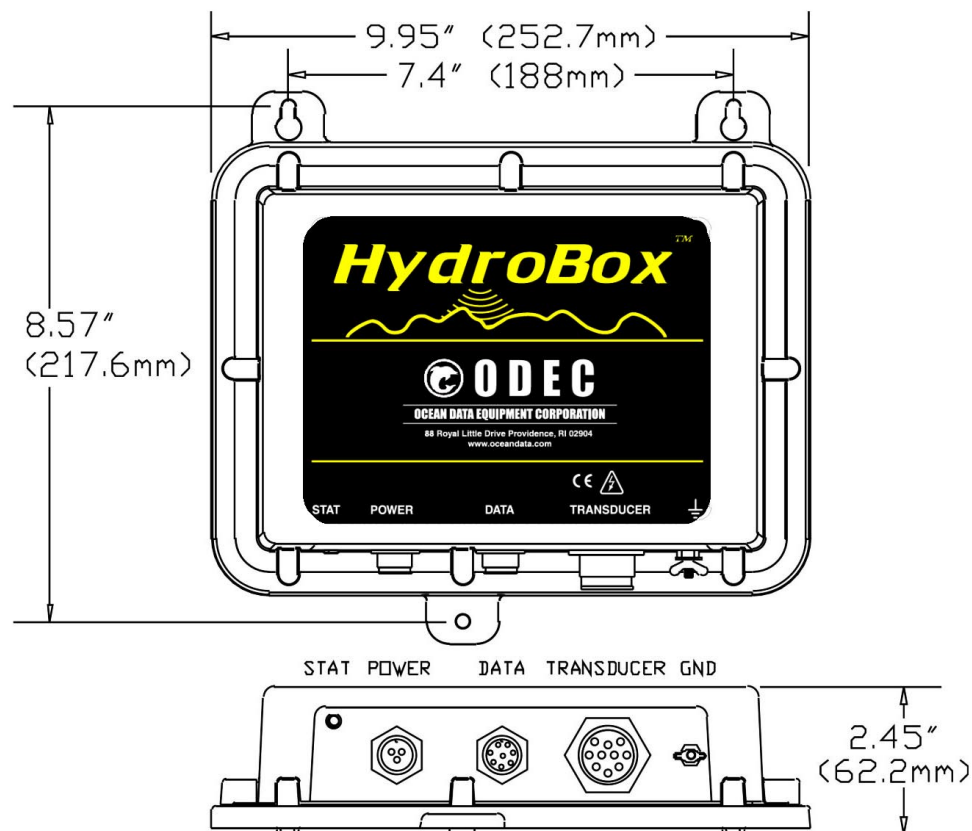


Figure 2-2 Bulkhead Mounting the Sensor Unit

2.2.6 - Installing the HydroBox Transducer

General Transducer

The HydroBox is offered equipped with a single frequency or dual frequency transducer that is designed for portable, over-the-side mount applications. It may also be used in permanent installations. Before installing the transducer, the installer should read and understand the appropriate section below to insure that all of the installation issues are considered.

Selecting a Location for the Transducer

The location of the transducer is very important for maintaining reliable bottom tracking and optimum performance of the equipment. Avoid installing transducers in locations where the transducer will be subjected to turbulent water, air bubbles, or vibration. The best clear water location on most vessels meeting these criteria is approximately 1/3 the length of the vessel, aft from the bow.

For many portable applications and some permanent applications it is not practical to mount the transducer in the forward section of the vessel. For these applications the transducer can be located in the aft third of the vessel; away from and forward of shafts and propellers, clear of hull openings, sea chests, outlets or protuberances. It is preferable to mount the transducer on the side of the hull where the propeller blades are normally moving downwards. The upward motion of the propeller can generate pressure waves, which push air bubbles up against the hull. By mounting the transducer on the downward side, the hull will tend to protect the transducer from this effect.

The transducer should be mounted adjacent to the ship's centerline. The radiating face should be flush with the hull and, wherever practical, the face should be parallel to the waterline. A maximum deadrise angle of 3 degrees is allowable.

The transducer must be mounted such that it will always remain submerged during operation. Thus, the depth of the transducer should take into account the location on the vessel and the worst case sea state conditions. Turbulent flow across the radiating face of the transducer and/or the presence of air bubbles will degrade system performance significantly as well and must be considered.

The area selected for mounting must provide sufficient space for access to the transducer and cable, and for routing cable and conduit. In addition, there should be sufficient room to permit use of the necessary tools to facilitate the installation-mounting requirements. Ideally, the location would provide a relatively direct cable run to the site of the HydroBox Sensor Unit.

The cable path from the Electronics to the transducer should be routed as far as possible from other electrical cables. Although the cable is shielded, the acoustic reply from the transducer can be on the order of microvolts, thus any cable crosstalk emissions can cause a decrease in acoustic sensitivity.

Handling Transducers

The transducer is the heart of the HydroBox system and, in spite of its appearance and size, is a delicate instrument. Although it is designed to be in contact with and survive tough marine environments, it should not be dropped or mishandled during the installation. Caution is advised when handling the transducer to prevent any damage to the transducer face or radiating surface.

The transducer and mounting assembly should be as clean and smooth as possible so the path of the sounding energy is uninterrupted. The transducer face must not be painted with lead based bottom paint. In portable applications the transducer and mounting assembly should be cleaned with fresh water after use.

WARNING: Do not expose the transducer to any solvents when cleaning any excess sealants. Strong solvents may damage the face of the transducer.

Also, when handling the transducer, avoid lifting or pulling on the transducer cable. Although the cable appears thick and substantial, the internal cable wiring could be damaged by stress from the sheer weight of the transducer and cause a malfunction at the most inopportune time.

Portable Transducer Installation

Portable installations of the HydroBox transducer for most survey vessels will be of the over-the-side pipe mount type. This type of installation is achieved with the following list of materials:

Part Number	Item	Quantity
*	HydroBox Transducer w/connector	1
Optional	HydroBox Over the Side Mount (OTSM) Assembly (or can be user supplied pipe mount described below)	1 Kit
User Supplied	Silicone grease or petroleum jelly (Vaseline®)	1
User Supplied	Pipe coupling to attach to transducer	1
User Supplied	Pipe with threads to match the pipe coupling and length to give proper transducer depth	1
User Supplied	Pipe coupling adapter	1
User Supplied	Support Lines or cables (fore/aft)	2
User Supplied	Pipe Clamps to affix the Pipe to the 4x4	1 (or 2)
User Supplied	Pressure Treated 4x4x (Ship's Beam Width + 2 feet)	1
User Supplied	Large "C" Clamps to affix the 4x4 across the beam of the vessel	2
User Supplied	Protective Pads or Carpet Remnants	2
User Supplied	Mild Household Detergent (i.e., dishwashing liquid)	1

Table 2-3 Portable Transducer Installation Parts

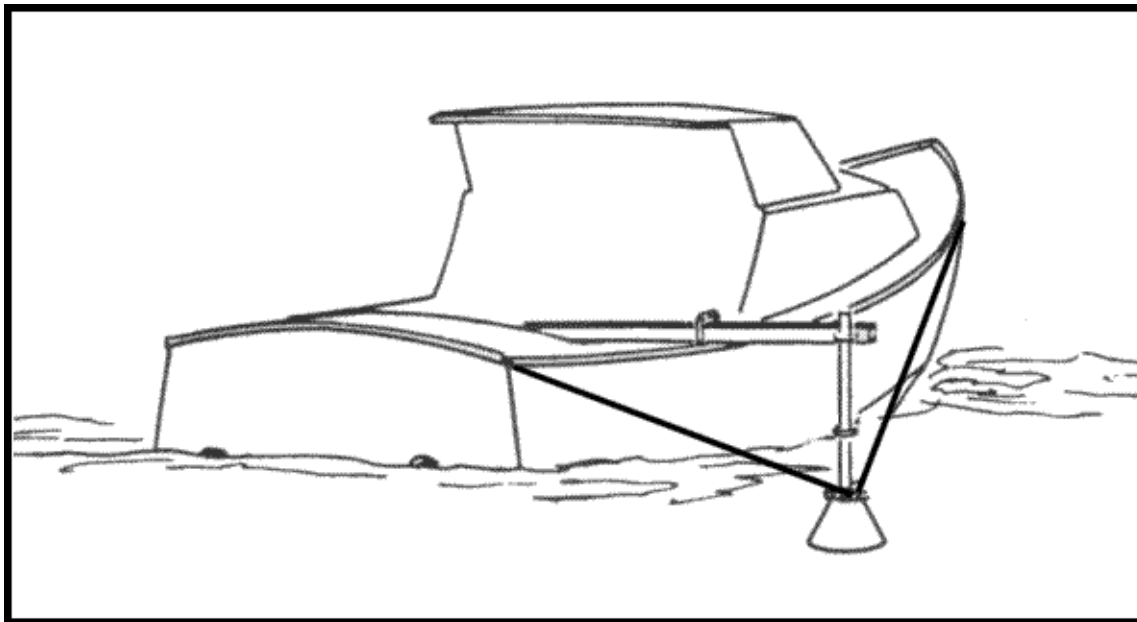


Figure 2-3 Typical Over the Side Mount (reference drawing)

Refer to **Figure 2-3** above while reading and implementing the Installation procedure listed below.



**Over The Side Transducer Mounting
(Example mount shown as reference
only)**

Figure 2-4 Over The Side Transducer Mounting Picture

CAUTION: Never pull, carry or hold the transducer by the cable as this may sever internal connections.

Installation Procedure:

1. Apply silicone grease or petroleum jelly to the threads of the pipe to facilitate later disassembly.
2. Twist the pipe coupling onto the pipe.
3. Push the transducer cable through the pipe. Alternately after the transducer is attached, clamp the cable to the outside of the pipe using cable clamps.
4. Apply silicone grease or petroleum jelly to the transducer stem. Insure that the grease does not smear the face of the transducer.
5. Attach 2 lines or cables to the Transducer Mounting Assembly. These lines or cables will support the pipe from the force of the water when the boat is underway.
6. Attach the Pipe Clamp(s) near the end of the 4x4 insuring that there is enough clearance for the transducer to hang over the side of the vessel.
7. Place the 4x4 across the beam of the vessel near the stern and fasten it to the gunnels with the C Clamps. Use the Protective Pads or Carpet Remnants to protect the gunnels of the vessel. Insure that the 2 foot extra length of the 4x4 extends beyond the beam of the vessel on the appropriate side and that the Pipe Clamp(s) attached to the 4x4 are on the extra length as well.
8. Attach the Transducer/Pipe Assembly to the 4x4 using the Pipe Clamps. Insure that the transducer is deep enough into the water that sea conditions will not cause the transducer to get to the surface.
9. Fasten the line(s) or cable(s) fore and aft with sufficient tension to support the pipe when the boat is underway.
10. Route the cable to the instrument being careful not to tear the cable jacket. To reduce electrical interference, separate the transducer cable from other electrical wiring. Coil any excess cable and secure it in a place with zip-ties to prevent damage.

Portable Transducer Maintenance

Aquatic growth can accumulate rapidly on the transducer's surface reducing its performance in weeks. Clean the surface, keeping it free of marine growth and petroleum residue, with a soft cloth and mild household detergent. Inspect the cable periodically for kinks, abrasions and cuts. Repair any damage using an approved waterproofing cable repair system. Inspect connections for indications of corrosion.

WARNING: NEVER USE SOLVENTS!

Certain cleaners, gasoline, paint, sealants and other products may contain strong solvents, such as acetone, which can attack many plastics dramatically reducing their strength. Clean surface of transducer with a mild detergent only.

Permanent Transducer Installation

For some applications it may be necessary and/or convenient to mount the HydroBox Transducer permanently in the hull of the vessel. Due to the construction of the HydroBox Transducer it may be directly affixed to the hull of the vessel. A Seachest Installation can be used, but is not required. Guidelines for performing a Seachest installation are described in the following sections.

Seachest Transducer Installation

Interior Seachest installations are best suited for solid fiberglass hulls to permit a minimum attenuation of acoustic reply signals. Hulls of other type material types may be considered but most other hull types will require that a Seachest design be built into the hull with an acoustic window across the face of the enclosure (i.e. a significant hole must be cut out of the hull).

Inside mounting to the hull does minimize drag to allow faster survey speeds, however, loss of performance may result due to the attenuation loss in the hull.

Locate the transducer where the hull is solid fiberglass resin to maximize sound transmission. Do not locate over balsa wood core material. Consult the hull manufacturer if you are unsure of the core material or the best location. Never bond large resin housings directly to the hull; always use a liquid-filled box.

In any permanent installation the intended final configuration should be tested before it is implemented, if possible.

For more information regarding the installation of a Seachest or other permanent transducer mount, refer to our website at <http://www.oceandata.com/support/install/xducer.htm>, or contact us directly.

2.2.7 - Electrical Connections

WARNING: Be sure to turn the vessel power off at the main switchboard before proceeding with the installation. If power is left on or turned on during the installation, then fire, electrical shock or other serious injury may occur.

There are 3 connections that need to be made to the HydroBox Sensor Unit and the PC for the system function properly. The user also has the option of connecting a GPS input and/or a Thermal Printer. The sections below describe the connection details for each.

All electrical connections to the HydroBox Sensor unit are to the side of the unit. Refer to the sections on each individual connector for information on connector type, recommended cable and wiring specifics. Figure 2-1 at the beginning of the chapter shows the overall systems interconnect for the system.

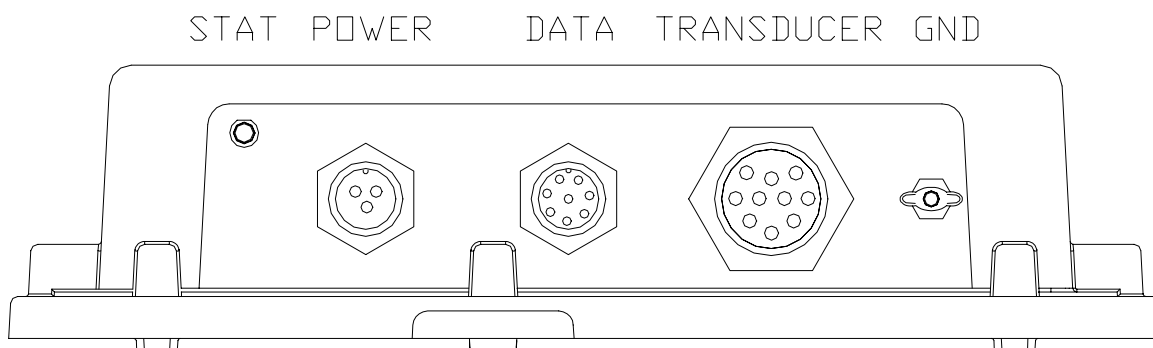


Figure 2-5 HydroBox Sensor Unit Connections

Figure 2-5 shows the basic connections to the unit. In all installations, all of the connections must be made for the unit to function. As shown above, there is a status indicator (STAT) and there are 3 connectors from left to right: DC Power (3 pins), Data Interface (8 Pins), and the Transducer (10 Pins). A grounding screw, located to the right of the Transducer connector, is provided to connect the HydroBox to the vessel's earth ground system. The cables supplied with the HydroBox are ready to plug into the HydroBox Sensor Unit. No user wiring is necessary. The cables associated with the HydroBox Sensor Unit are listed below (Table 2-4). The user should make sure that, after wiring is complete, each plug is firmly attached to the unit via the twist-lock mechanism.

Part Number	Item	Quantity
P04412	DC Power Cable (10 feet)	1
P04413	Data Interface Cable (10 feet)	1

Table 2-4 HydroBox System Cables

DC Power Connection

Before installing the power connection to the unit, the installer must first insure that the DC power source is in the range of 10-30VDC and is capable of providing 8 watts of power to the unit. Although the HydroBox Sensor unit is reverse polarity and over-voltage protected, it is always required that the power mains be turned off during system wiring for both personal and equipment safety.

The Power Cable supplied with the system is 10 feet long, and includes 3 conductors. The wires in the power cable must be connected as follows:

- RED – Positive DC Voltage (Fused Lead), DC IN+
- BLACK – Negative DC Return, DC IN-
- WHITE (GREEN) – Earth Ground, SHLD

The DC Voltage lead includes a 3 Amp in-line Fuse. In the unlikely event that the fuse is blown it should be replaced with a fuse of the same amperage. Installing an incorrect fuse can result in damage or fire to the unit if it is not operating properly.

The Power Connector on the Sensor Unit is shown below in Figure 2-6.

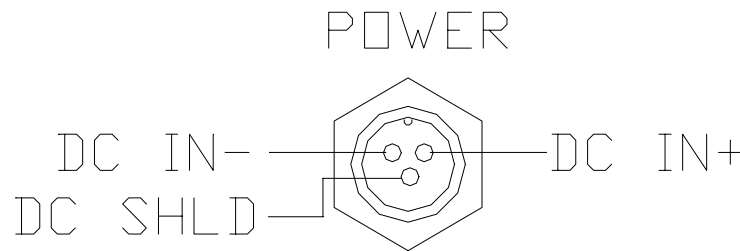


Figure 2-6 HydroBox Sensor Power Connector

Electrical wiring standards require that the HydroBox Sensor Unit be properly attached to a solid chassis ground via the ground stud on the bottom of the unit, or the Earth Ground wire (WHITE or GREEN) in the power cable. When connecting to the ground stud, a tinned copper braided wire (0.190 gauge or greater) is recommended.

NOTE: Connecting the Earth Ground is required for optimum system performance and safe operation. The white wire in the power cable OR (BUT NOT BOTH) a ground wire to the unit ground stud is needed. Connecting both the white wire and the ground stud to earth ground may degrade performance due to induced ground loops.

Data Interface Connection

The Data Interface cable supplied with the HydroBox is 10 feet long. It includes 8 conductors and an RS-422 to RS-232 conversion block. This block connects directly to the COM port of the PC and derives its input power from the DTR and/or RTS signal lines from the PC. For nearly all applications, the Data Interface can be connected as supplied.

If the 10 foot length of cable is not enough, the Data Interface Cable may be extended by using a standard, 1 to 1, 9 pin D to 9 pin D extension cable. This cable must be connected between the RS-422 side of the conversion block and the 9 pin D connector attached to the Data Interface cable. The extension cable must be shielded to guard against interference. The Data Interface Connector on the Sensor Unit is shown below in Figure 2-7

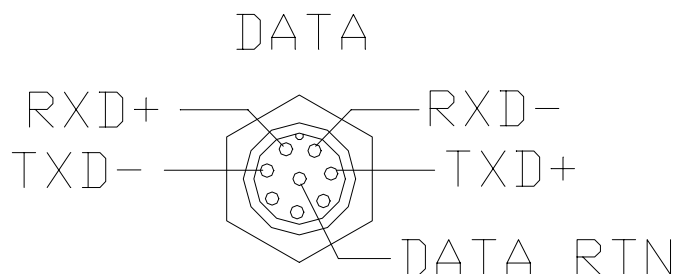


Figure 2-7 HydroBox Sensor Data Connector

Transducer Connection

The HydroBox transducer connector is typically hardwired direct to the transducer.

The standard cable is 30 feet in length and has the 10 pin connector that mates to the Transducer connector on the HydroBox Sensor Unit. Only 3 of the pins on the 10 pin connector are wired to the unit. They are defined as:

WHITE (BLUE) - Transducer +
 BLACK - Transducer -
 GREEN - Transducer Shield

The Transducer Connector on the Sensor Unit is shown below in Figure 2-8.

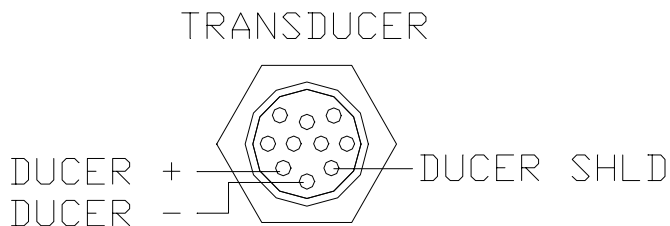


Figure 2-8 HydroBox Sensor Transducer Connector

GPS Connection

Connecting a GPS or other Navigation input to the PC running the HydroBox™ software allows the user to store and annotate Date, Time, Position, and Heading information to the Acoustic data returns.

The HydroBox PC Software supports the NMEA 0183 protocol on a 2nd COM port that is software selectable by the user. When selecting a PC to use with the HydroBox system the user should insure that PC hardware supports 2 COM Ports if a Navigation input is desired (the HydroBox Sensor/PC interface requires 1 COM port). For Portable PC's, a PCMCIA COM port card can often be used to provide a 2nd COM port.

The user should refer to the GPS NMEA 0183 output connection information in their GPS Manual as well as the PC COM port wiring information in their PC Manual to insure that the Navigation input is wired correctly.

Printer Connection

The HydroBox PC Software allows the user to interface to all of the ODEC TDU Thermal Printers. The connection is established through the PC's Parallel Printer Port (25-pin D-Type) as shown below in Figure 2-9. Once the software has been started, all displayed acoustic data can be printed to the TDU in either Acquisition or Playback mode.

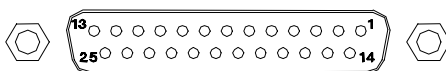


Figure 2-9 Printer Port

The standard TDU Printer cable is provided with the printer and is 12 feet long and does not require any user wiring. Installers must locate the printer accordingly.

2.3 - HydroBox PC Software Installation

This section describes how to install the HydroBox PC software package. It is assumed that the reader has a working knowledge of installing Windows 95/98/2000/NT/XP® software. The installation software is located on the CD-ROM disc included with your HydroBox.

NOTE: It is recommended that you exit all running applications before inserting the CD and beginning the installation.

To install the PC software, insert the HydroBox CD into an available drive. If **Auto Insert Notification** is enabled on the CD-ROM drive, then the HydroBox PC installer will begin automatically. If the CD does not auto-start, simply execute the **SETUP . EXE** file in the root directory of the CD.

Once the installer is running, it will verify that your operating system is compatible with the HydroBox software, and then it will check which version of the Windows Installer program is installed in your system. If the Windows Installer program is not found or out of date, it will update it and prompt you to restart your computer. Once restarted, the HydroBox installation will continue automatically.

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The InstallShield Wizard will guide you through the next step where you have the option of choosing an install directory. By default, the HydroBox PC software is installed in the Program Files folder under the sub-directory ODEC.

In the next step, you may choose a **Typical**, **Minimal**, or **Custom** installation. Selecting Typical will perform a complete install of both the HydroBox application and Sample Data for playback. A Minimal installation will only install the HydroBox application. Additionally, you can choose Custom to manually select what you would like installed. Click the next button to continue to the next step.

The rest of the installation process consists of verifying your settings and clicking the install button. Also, once the installation is complete, you can check the **Launch the program** box to execute the HydroBox software as soon as you close the installer. If not, you can run the HydroBox PC software by using the Windows **Start** button to find the *HydroBox* menu under **Programs**, or simply double-click on the *HydroBox* icon located on your Desktop.

END OF SECTION TWO

3.0 OPERATION

3.1 HydroBox PC Software

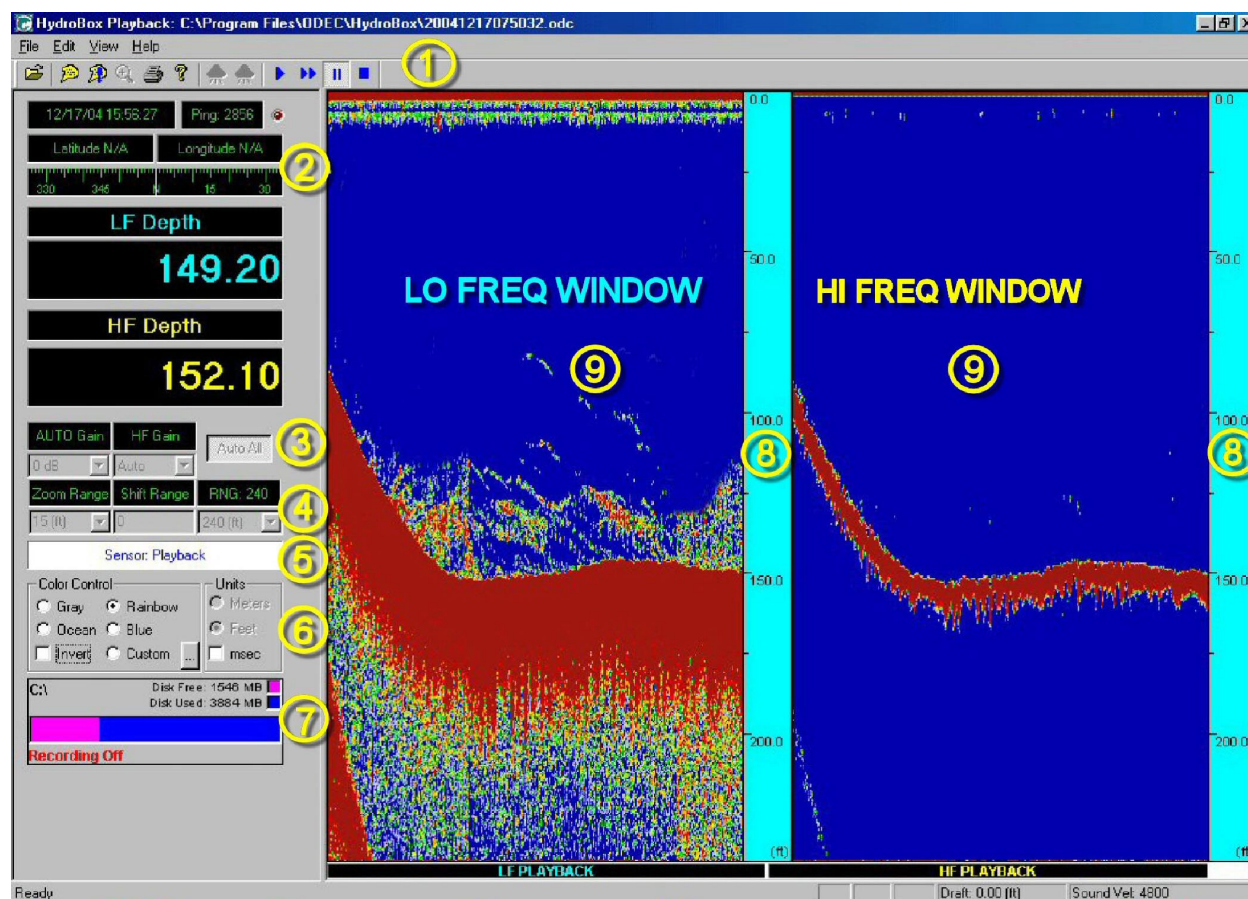
This section describes how to operate the HydroBox Sensor using the PC Software package included with your HydroBox.

3.1.1 - The Main Window

The HydroBox Main interface is divided into two fields, the **Controls and Status** field, and the **Data** field. The vertical window boundary between the fields may be positioned by the user as desired.

The **Controls and Status** field is located in the left portion of the window. It provides access to all of the user controlled parameters. Specifically, the **Controls and Status** field includes digital depth, an animated compass with heading marks in degrees, GPS Position, Time/Date, Ping Count, available disk space (for data storage), and HydroBox Sensor status.

The **Data** field is located in the right portion of the window. It displays the actual echo data. The **Data** field can be viewed in either *Normal* or *Zoom* mode. In Normal Mode, the entire **Data** field is used for displaying non-zoomed bottom data, or split screen for *Dual Channel Mode*. In Zoom Mode, the **Data** field is also divided in half to show zoomed data on the left and normal bottom data on the right. While echo data is being shown in either mode, the user may use the mouse to obtain a digital depth value anywhere in the water column by pointing and clicking. See the below picture and table for more info. (The picture reflects the software in Dual Channel mode)



NOTE: The current on-screen bottom image in both windows will be lost upon resizing the window

1. The Toolbar

Quick access to common HydroBox functions. From left to right they include:



Open A Playback File



Insert Text Annotation



Insert Manual Event Mark



Toggle Playback Zoom



Toggle TDU Printer On or Off



Get HydroBox Software And Version Info



Starts the HydroBox Sensor Pinging



Stops the HydroBox Sensor Pinging



Playback a Previously Recorded File



Toggle Fast Forward/Normal Playback



Pause Playback



Stop Playback

NOTE: Playback buttons are available in Playback mode only and will be disabled otherwise.

2. Navigation/Depth Display

These indicators provide navigation and digital depth info to the user in real-time. Navigation/Depth information includes the digital depth, current Date/Time, global position, and ping count.

The digital depth is shown to 1 decimal place in both Feet and Meters and is displayed in a large font to make viewing easier from a distance. The depth value is updated once per ping and will show -.- if the depth is not found or invalid.

The Date/Time shown is based on the user's PC clock by default and can be displayed in Local time or GMT (See User Preferences in Section 3.1.2.1). If the PC is connected to a GPS receiver that is receiving valid navigation data, the Date and Time on the user's PC can be synchronized to the UTC Date/Time transmitted from the GPS (See "Configure NMEA I/O" in Section 3.1.2.1 for more information).

Position info is also provided when a GPS receiver is connected to the PC and the HydroBox Software is configured and receiving valid GPS data. When GPS Position data is not available, the display will show "Latitude N/A" and "Longitude N/A". If the HydroBox PC Software is receiving position data, it will be provided in Decimal Minutes format. (i.e. 41° 22.74402' N, 71° 36.25902' W)

The ping count is included to provide the user with a means of estimating how fast the HydroBox Sensor is pinging, and also for how long. The ping count is reset to zero when any of the following events occur:

- The HydroBox PC Software is restarted.
- A Recording or Playback file has begun.
- The HydroBox Sensor has temporarily lost power and reset.

In addition, the HydroBox software features an animated compass which displays the current heading. The compass is located underneath the GPS position information.

3. Gain and Auto Controls

The Gain controls consist of 2 pull-down menus which control the HydroBox Sensor's gain settings. For a single channel system only 1 of the pull-down menus shall be available for selection. The dual channel systems allow the user access to both pull-down menus. The menus are labeled **LF Gain** and **HF Gain** for Low Frequency Gain and High Frequency Gain respectively. The gain for each frequency is controlled via the appropriate menu and can be set either from 0-75 dB in Manual Mode, or to Auto Mode.

Depressing the **Auto All** button sets the HydroBox Sensor to automatically choose the best Range (Refer to next section for more information on Range) and hardware Gain settings, making bottom tracking easier for the user. Clicking the **Auto All** button again will toggle the HydroBox back to manual mode.

NOTE: When in Auto All mode, the Gain control is not available and will be controlled by the HydroBox automatically.

4. Range, Zoom Range, and Shift Controls

The **Range** control allows you to choose a manual range for the HydroBox Sensor. It includes 9 range settings presented in either Feet or Meters.

The **Zoom Range** control has 6 settings which are used to set the range of the Zoom window. These values will be in either Feet or Meters depending on which units are currently selected.

The **Shift Range** control allows you to choose a manual offset to the start depth on the graphic display. The user enters an integer value, in either Feet or Meters depending on which is currently selected, to set the top of the water column. The water column viewed will reflect the shift depth at the upper limit of the display and will extend the entire range amount.

For example, if a range of 0 – 80 meters is selected, and a Shift value of 10 is selected, the water column range will become 10 – 90 meters. The Shift value cannot exceed 450 feet, or 750 meters. It will also NOT be available nor have any effect while in **Auto All** mode.

NOTE: When in Auto All mode, the Range control is not available and will be controlled by the HydroBox automatically. While the Range control is disabled, it will indicate the current Range setting that the Sensor has chosen. Shift Range will also not be available nor have any effect in Auto All mode.

Operations And Maintenance Manual

5. Sensor State

This indicator shows the current state of the HydroBox Sensor. There are a total of 6 different states:

Unknown	- No communication is present between the Sensor and PC Software.
Power On	- Power has been applied to the HydroBox and the Sensor has begun communicating.
Initializing	- The HydroBox software is handshaking with the Sensor to establish a reliable connection.
Idle	- A connection between the PC and the HydroBox Sensor has been established, but no commands have been received yet.
Pinging	- The HydroBox Sensor is transmitting and receiving real-time bottom data.
Playback	- The PC Software is displaying previously recorded data from a playback file.
POST Failure	- The HydroBox Sensor did not pass the initial Power On Self Test (POST). This error will always include an error code.

6. Color Palette and Unit Controls

The HydroBox PC Software allows you to choose from 4 standard color palettes by clicking on one of the radio buttons located in the **Color Control** section. If you wish to create your own palette, you can do so by selecting **Custom** and clicking on the button to right of it. You can also reverse the current palette by using the **Invert** box.

Along side the Color Control is the Units control. You can choose to display depth and range information in Feet or Meters. You can also check the Milliseconds box to display range and zoom range scale bars in Milliseconds rather than Feet or Meters.

7. File Capture Status

This unique feature allows the user to view the Recording status when capturing data to a hard disk. The status shows the drive letter of the destination drive as well as a graph depicting how much free/used space is present on that drive. During recording, the current file size will be shown also.

8. Range Markers

These scalebars show the full range of the data windows and are based in the current unit selected. Also, if GUI Zoom is activated, two slider bars will be visible on the right scalebar. They are used to specify the GUI zoom window boundaries. In addition, when Marker Zoom is enabled, a single slider bar will appear and is used to specify where the water column will begin in the marker zoom window.

9. Mouse Depth Fields

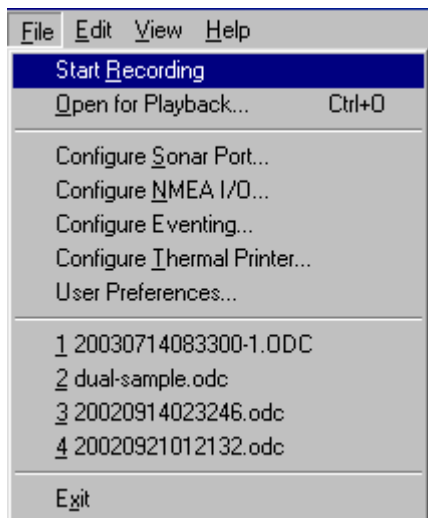
These fields are where the actual echo return data appears in the HydroBox PC Software. By using the mouse, the user may obtain a digital depth value anywhere in the water column by pointing the mouse cursor and clicking the left mouse button. A window will appear containing the digital depth value in feet or meters, depending on which has been selected. This window may be conveniently moved anywhere on the screen and will remain open until it is closed. Each time the user points and clicks in a Mouse Depth Field, this window will re-open unless it is already open.

NOTE: To fine-tune in on a depth value, the user may point, click the left mouse button, and HOLD it down while slowly moving the mouse pointer. The digital depth shown in the Mouse Depth display will be continuously updated until the mouse button is released.

3.1.2 – The Menu Bar

The HydroBox PC Software has 4 menus on the menubar including **File**, **Edit**, **View**, and **Help**. Most of the HydroBox Software Preferences and Navigation configuration are accomplished through these menus.

3.1.2.1 – The File Menu



Start Recording

Creates a new file on the specified hard disk for capturing acquisition data. If the HydroBox Sensor is already pinging, then the software will start the data recording immediately. The filename is based on the date/time in the following format:

<path>YYYYMMDDhhmmss.odc

<path> - This represents the path to a directory where the recorded files should be stored. Refer to **User Preferences** in this section for information on manually setting the path.

YYYY - 4-digit Year

MM - 2-digit Month

DD - 2-digits Days

hh - 2-digits for Hours

mm - 2-digits for Minutes

ss - 2-digits for Seconds

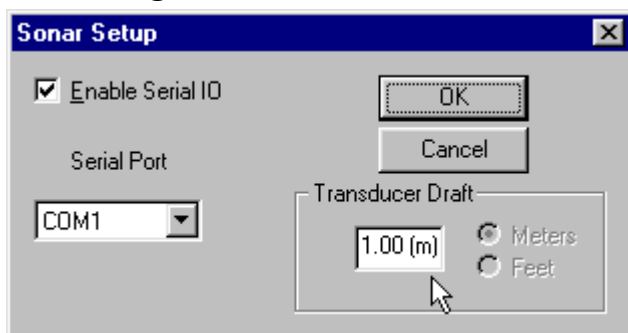
.odc - ODEC's Proprietary File Extension

NOTE: Once recording is started, this option will become “Stop Recording”.

Open for Playback

Opens a previously recorded file for reviewing. All other Playback functions are controlled by the coinciding buttons in the toolbar. Playback filenames are created based on the date/time. (Refer to the above section for more information)

3.1.2.2 Configure Sonar Port



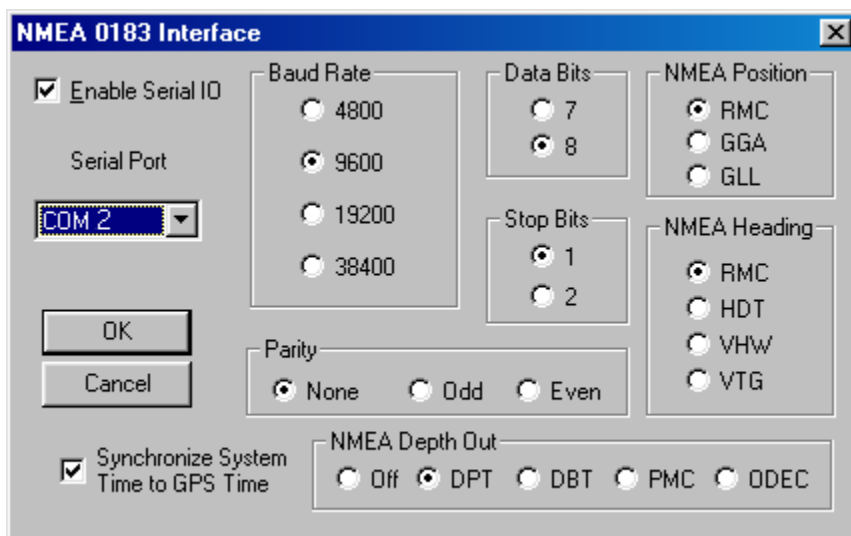
Select Serial Port

This menu allows you to choose which PC COM port the HydroBox Sensor is connected to. In addition, you can enable/disable communication to the sensor by toggling the “Enable Serial IO” check box. It also allows you to input the transducer draft in either feet or meters.

Transducer Draft

The Configure Sonar Port menu brings up the Transducer Draft menu shown above. The Draft value is entered here. The draft setting is 0-30 feet or 0-10 meters in hundredths of the selected units. It is very important that these values are entered as accurately as possible to assure that the displayed/stored digitized depth value is correct. Once the value is entered, the new draft value will be displayed in the bottom right hand corner of the screen. Depth values are measured with respect to the transducer location by using the appropriate Draft Note that changes to this parameter will offset the value of the depth shown in the Depth Window and should be fully understood by the operator.

3.1.2.3 Configure NMEA I/O



This menu allows the user to configure the HydroBox software to receive NMEA 0183 navigational information from a GPS receiver, or equivalent. The user may also use this menu to select an output format for digital depth. Both the GPS NMEA 0183 and NMEA Depth Out functions operate on the one COM port chosen by the user. An adapter from ODEC may be required to use both functions simultaneously. Using the “Enable Serial IO” checkbox, you can enable/disable NMEA Input/Output. When enabled, you can choose the appropriate PC COM port and communication parameters.

Most GPS units are setup to use 8 Data bits, No Parity, 1 Stop bit, and either 4800 or 9600 Baud. In addition, you must choose which NMEA format the software will use to collect navigational data. Make sure you choose a format compatible with your GPS receiver. Check your GPS manual for more information.

The “Synchronize System Time to GPS Time” option is provided as a means to synchronize the internal PC clock to the UTC Date/Time from the GPS. The RMC Sentence is the only one which includes GPS Date and Time and so this option is only available when the RMC Sentence is selected for “NMEA Position”. It will be disabled otherwise.

The user may also choose to enable digital depth output by selecting one of the 3 output formats, including NMEA DPT, NMEA DBT, or ODEC’s PMC. The PMC format is fully compatible with the Bathy-500MF output format and can be interfaced to any third party software, such as HyPack, which supports the Bathy-500MF. To disable digital depth output, simply select OFF under “NMEA Depth Out”.

NOTE: Since Navigation Data Input and Digital Depth Output both use the same COM Port, both devices must use the same communication parameters, such as Baud Rate, Data Bits, Parity, and Stop Bits.

3.1.3 Data Outputs

This section lists the various data output formats available from the Data I/O at the HydroBox. This section provides more detailed, information for each format (sentence) to allow the user to interface with external peripheral devices Hardware pin-out connections are shown in Figure 2-7

3.1.3.1 ODEC Depth (dpt) Format

Sample data strings

```
$$SDODC,00:00:00,N33.43.7300,W118.15.7300,B,0.0,M,V
$$SDODC,11:18:00,N33.43.9400,W118.15.9400,B,20.4,F,A
```

This data output string is ODEC's comma delimited proprietary format containing Time and Position (from a GPS device), true depth, and depth status. This format is depicted below:

```
$ S D O D C , h h : m m : s s , a y y . y y . y y y y , o x x . x x . x x x x , f , x x x x . x , u , v
<CR><LF>
```

Where h h = UTC Hours m m = UTC Minutes s s = UTC Seconds

a = N / S Latitude y y . y y . y y y y = Latitude Degrees, Minutes, Decimal Minutes

o = W / E Longitude x x . x x . x x x x = Longitude Degrees, Minutes, Decimal Minutes

f = Depth Frequency (A = Low Frequency or Only Frequency, B = High Frequency)

x x x x . x = True Depth u = Units (M = Meters, F = Feet) v = Depth Status (A = Valid, V = Invalid)

3.1.3.2 PMC Depth (dt) Format

Sample data strings

```
FDT L 11.1 FT EDT H 0.0 FT DT H 21.0 FT DT L 11.1 FT
```

Proprietary depth output string. Format described below.

Single Frequency Operation

```
_D T _ _ x x x x . x _FT <CR><LF>
```

```
_D T _ _ x x x . x x _MT <CR><LF>
```

Dual Frequency Operation

```
_D T _f _ x x x x . x _FT <CR><LF> (English mode)
```

```
_D T _f _ x x x . x x _MT <CR><LF> (Metric mode)
```

During normal operation the "space" in front of the "D" will be blank; An "E" in this space indicates an error such as lost bottom while an "F" indicates a Fix Mark. The second character after the "T", represented above by an f, indicates which frequency return the depth value applies to. "H" indicates a High frequency depth, and "L" indicates a Low frequency depth.

3.1.3.3 NMEA Depth Below Transducer (dbt) format

Sample data strings

```
$SDDBT, 11.1,f, 3.4,M, 1.9,F $SDDBT, 21.0,f, 6.4,M, 3.5,F
```

Industry standard NMEA 0183 string. Water depth referenced to the transducer. Format described below.

```
$ S D D B T , x x x x . x , f , x x x . x x , M , x x x . x , F <CR><LF>
```

Where x x x x . x = feet (f)

x x x . x x = meters (M)

x x x . x = fathoms (F)

3.1.3.4 NMEA Depth (dpt)

Sample data strings

\$SDDPT, 3.4, 0.0 \$SDDPT, 6.4, 0.0 \$SDDPT, 6.4, 0.2

Industry standard NMEA 0183 string. Water depth relative to the transducer and offset of the measuring transducer.

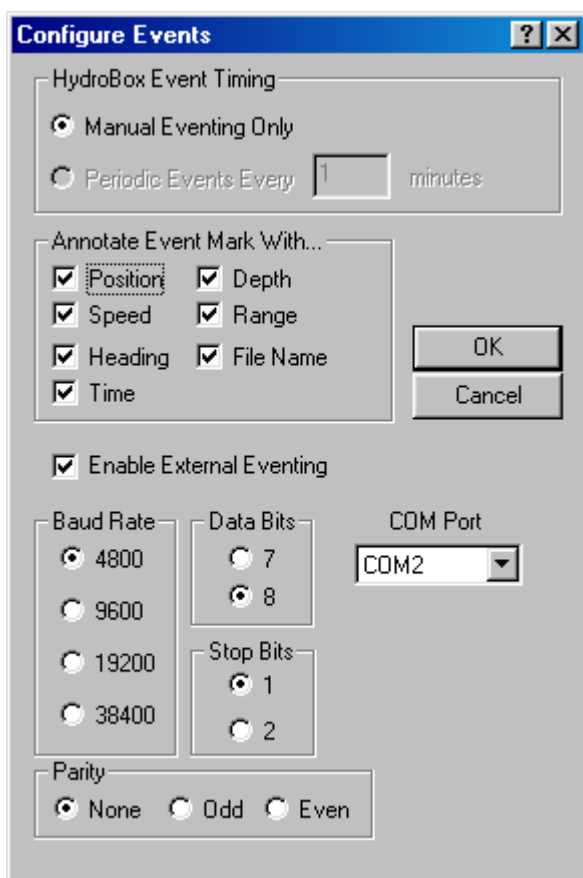
Format described below.

\$ S D D P T , x x x x . x , y y . y <CR><LF>

Where x x x x . x = Depth from transducer in meters

y y . y = Offset from transducer, meters

3.1.3.5 Configure Events



This menu is used to configure eventing and annotation. Events may be generated by using the toolbar button, or the corresponding menu option “Insert Event Mark” under the *Edit* menu. An event is a vertical marker which appears on both the screen and printer. A number of real-time parameters may be included with the events as derived by the user. These parameters are shown in the previous picture under “Annotate Event Mark With...”. In addition, the user may choose between 3 Eventing trigger methods including, *Manual*, *Periodic*, or *External*. When in “*Manual Eventing*”, event marks are inserted only when one is requested by the user using one of the methods described above. “*Periodic Eventing*” allows the HydroBox software to insert events at a specific interval, depending on the number of minutes entered by the user. While in periodic mode, the user may still insert manual event marks in addition to the periodic ones. “*External Eventing*” has been implemented as means of allowing third party software, such as HyPack, to remotely generate Event marks and annotation in the HydroBox software. It can be configured by enabling the “*External Eventing*” option and

setting the communication parameters such as COM Port, Baud Rate, Start Bits, Stop Bits, and Parity to match the configuration of the third party software. The HydroBox software accepts external annotation/eventing with the same format that the Bathy-500MF uses. That format is as follows:

(CTRL F) (CTRL A) (Annotation String) (CTRL D)

- Generates an event mark containing the text in the Annotation String

(CTRL F)

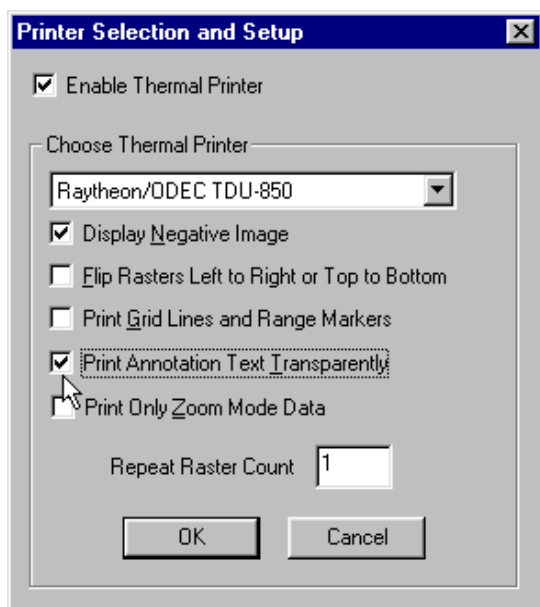
- Generates an empty event/fix mark

NOTE: External Eventing requires an additional free COM Port. If there are no more available COM Ports on your PC, contact ODEC for an expansion card.

NOTE: Periodic Eventing is not available when External Eventing has been enabled.

NOTE: All event marks and text annotation shown on the screen are inserted BETWEEN the acquired bottom data so that there is no loss of information.

3.1.3.6 Configure Thermal Printer

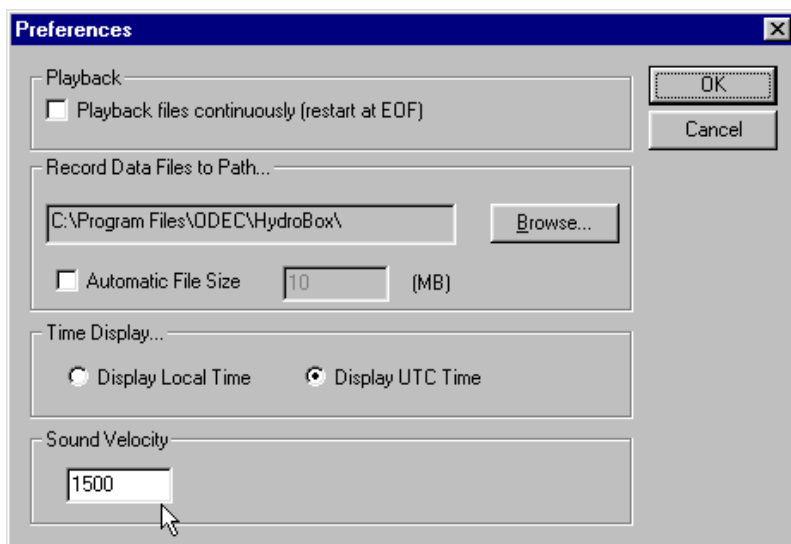


This menu allows you to configure a thermal printer for use with the HydroBox software. It supports 3 different models from the Raytheon/ODEC TDU series, including the TDU-850, TDU-1200, and the TDU-2000, all TDU models are available from SyQwest Inc.

In addition to Enabling or Disabling the printer, there are a number of other options available to the user. These settings only affect the thermal printout, not the on-screen display. They include:

- Display Negative Image
 - Enabling this option will invert the gray scale colors on the thermal printout.
- Flip Rasters Left to Right or Top to Bottom
 - Enabling this option will print a mirror image of the event/annotation marks. This option is to be used in conjunction with the L/R dip switch located on the back of the TDU Printer (Refer to your TDU Manual for more information). By default, the switch is set to the L position and so this option should not be enabled. However, if the dip switch is set to R, enable this option to print the event/annotation marks correctly.
- Print Grid Lines and Range Markers
 - Enabling this option will print the data along with 4 grid lines and periodic range markers.

- Print Annotation Text Transparently
 - By default, this option is not enabled and annotation is printed with a solid background so that the text is always readable. This will cause some bottom data not to be shown on the printout, but will still be present on the display and recording file (if recording is on). Enabling this option will print annotation text without a solid background. This may make annotation text hard to read when printed over bottom data.
- Repeat Raster Count
 - A Repeat Raster Count can be entered between 1 and 10. The default count is 1 Raster. Increasing this value will cause the printout to be stretched horizontally. This option is useful when using a TDU-1200 or TDU-2000 printer which has a finer vertical resolution. (i.e. Pixels are small)



3.1.3.7 User Preferences

This menu allows you to configure recording and playback options. By selecting “Playback files continuously”, the current playback file will repeat from the beginning when it reaches the end. The HydroBox software stores recorded data files in the same directory as the application by default, however, you can select an alternate location by clicking the “Browse” button and specifying another directory. Additionally, you can limit the maximum recorded file size by enabling the “Automatic File Size” option. If the recording file reaches the specified size, it will create additional files to save the remaining data. This option is useful if your data will be transferred to removable media where space is limited.

The “Time Display” control allows the user to specify which Time Zone the Date/Time should be based on. The Date/Time shown on the display will also be the value recorded to a file if recording is active. Choosing “Local Time” will enable whichever Time Zone is currently selected in the Windows operating system. (Refer to your Windows User Guide for more information regarding Time Zones). Selecting “UTC Time” will display Date/Time information based on the GMT Time Zone.

In addition, both the Local Time and UTC Time zones can be synchronized to GPS Time provided that a GPS Receiver is connected to the HydroBox PC Software and configured correctly. (Refer to **Configure NMEA I/O** in Section 3.1.2.1 for more information)

Sound Velocity

The User Preferences Menu brings up the Preferences Window shown above. Sound Velocity is a critical parameter when performing surveying work. The Preferences >Sound Velocity Selection allows the user to enter a calibrated Sound Velocity into the system for calculating an accurate depth measurement. A Sound Velocity of 1400 - 1600 meters/second or 4595 to 5250 feet/second can be selected (depending on current units selection).

Sound Velocity Calculations

The user may determine the sound velocity applicable to a specific survey using three methods:

- A) Obtaining the measured sound velocity value from an external sound velocimeter.
- B) Performing a “BAR-CHECK” using the HydroBox Survey Echo sounder. To accomplish such, a plate (bar) is placed at a known depth below the transducer face. The user then varies the sound velocity value until the exact depth is displayed in the DEPTH field on the display (and, the chart). At that point of agreement the entered sound velocity value will be correct for the specific survey area and time. In effect, the HydroBox contains an integral sound Velocimeter.
- C) Estimating the sound velocity by considering the salinity and temperature of the given survey area. The table below provides a matrix of sound velocity values for various combinations of salinity and temperature.

Table 3-1 Sound Velocity (Celcius versus part per thousand)

SAL	0	5	10	15	20	25	30	35	40
TEMP	ppt.	ppt.	ppt.	ppt.	ppt.	ppt.	ppt.	ppt.	ppt.
0 deg. C	1400	1407	1414	1421	1481	1435	1442	1449	1445
5 deg. C	1424	1431	1437	1444	1451	1457	1464	1470	1447
10 deg. C	1445	1452	1458	1464	1471	1477	1483	1490	1496
15 deg. C	1464	1470	1476	1482	1488	1495	1501	1507	1513
20 deg. C	1481	1487	1493	1498	1504	1510	1516	1521	1527
25 deg. C	1496	1502	1507	1513	1518	1523	1529	1534	11540
30 deg. C	1510	1515	1520	1525	1530	1535	1540	1546	1551
35 deg. C	1522	1526	1531	1536	1541	1546	1551	1555	1560
40 deg. C	1532	1537	1541	1546	1551	1555	1560	1564	1569

(Sound Velocity values are in meters per second)

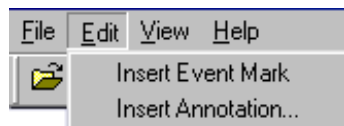
Recent Files

The HydroBox software keeps a list of the 4 most recently opened playback filenames for easy access. These filenames are found between the “User Preferences” and “Exit” menu options. Clicking one will immediately begin playback of the file.

Exit

You can exit the HydroBox PC Software by either using the “Exit” on this file menu, or by simply clicking on the windows default close button.

3.1.3.8 – The Edit Menu



Insert Event Mark

Selecting this option will generate and insert a formatted event mark on the display, in the recorded file (if recording is on), and if enabled, the thermal printout. The event mark contents can be configured by selecting “Configure Events...” under the File menu. In addition, an event mark can also be inserted by clicking the corresponding toolbar button. (See Section 3.1.1)

Insert Annotation

Selecting this option will allow you to enter a custom text message to be inserted on the display, the recorded file (if recording is on), and if enabled, the thermal printout. In addition, annotation text can also be inserted by clicking the corresponding toolbar button. (See Section 3.1.1)

3.1.3.9 – The View Menu



Toolbar

Selecting this will toggle the toolbar on and off. (Refer to Section 3.1.1 for more information on toolbar).

Status Bar

Selecting this will toggle the Status Bar on and off. The Status bar is located at the bottom of the HydroBox application and displays extended information about a particular button or function.

Raster View / Wiggle Trace

The HydroBox software allows the user to display bottom information in two formats, Raster view or Wiggle Trace. In Raster view, bottom information is depicted graphically with bottom intensity being represented by the different colors in a specified color palette. In Wiggle Trace view, the bottom information is shown ping by ping with acoustic energy being represented horizontally.

Diagnostic View

Selecting this option will allow you to view the current sensor status, which helps when doing system diagnostics with customer support

Clutter

The Clutter Level setting allows the user to dynamically adjust the color palette to eliminate low level noise in areas where the water is contaminated. The AUTO setting is good for most applications but manual Clutter settings from 1 to 9 can be selected to the users liking. Level 1 permits the lowest signal levels to be viewed and Level 9 permits only the strong to moderate reply levels to be viewed. The optimum values for most applications are in the 4-6 range.

Detection Threshold

The Detection Threshold parameter allows the user to vary the bottom digitizing detection threshold to account for particular bottom conditions. This parameter does not need adjustment in most applications. Only in very shallow (<1 m) or very deep water (frequency dependent) will this parameter possibly require adjustment. The Detection Threshold is normally set to 0 and may be adjusted from 0-9. When the Detection Threshold parameter increases, the actual bottom detection threshold decreases proportionally. Thus, a setting of 8 or 9 will result in a weak bottom return being digitized. This is useful in certain constrained applications but severely reduces the digitizing function's ability to block out noise. This parameter needs to be used carefully.

NOTE: Wiggle Trace mode is only available in the Normal display. All zoom data will appear in Raster mode.

Enable GUI Zoom

This option allows the user to digitally scale bottom data from a playback file and can function as a manual zoom. This feature was included in order to provide a method to zoom in on bottom data previously recorded without one of the HydroBox Sensor's enhanced zoom modes enabled. When enabled, two zoom bars will appear on the scalebar of the Normal Data window. These bars can be dragged up or down in order to set the GUI zoom range. Data displayed in GUI Zoom is derived from recorded Normal data.

Hi Freq Only

This selection displays the Hi frequency channel data only. When selected, this mode will use the entire viewing area.

Lo Freq Only

This selection displays the Lo frequency channel data only. When selected, this mode will use the entire viewing area

Dual Channel

This selection displays both Hi and Lo frequency data. The Lo frequency data will be located in the left part of the viewing screen, and the Hi frequency data will be located to the right.

Display Modes

The HydroBox Sensor features an enhanced multi-mode zoom. It provides a smooth, magnified high-resolution window of the bottom. The enhanced zoom modes are acquired in real-time and are displayed/recorded at higher sample rates than the Normal data (assuming the zoom range is smaller than the normal range).

There are 4 display modes available with HydroBox software, including 3 Zoom modes, and 1 without any zoom. They include:

Normal

This mode displays the normal bottom data by itself without any zoom information. When selected, this mode will use the entire viewing area.

Bottom Zoom

When selected, this mode will split the viewing area in half. The left side will be used to show zoom information, and the right side will show normal bottom data. Bottom Zoom mode initially centers the zoom display about the current depth then allows the user to follow the bottom trace up and down the water column at a higher resolution. The Zoom Range Control may be used to zoom in or out in the current units. In Bottom Zoom mode the Range Scales only change when the bottom trace approaches either the top or bottom of the Zoom window. When a change does occur the range is adjusted in **Zoom Range / 2** increments to place the bottom trace back to the middle of the display window. This mode allows the user to view the area about the bottom in higher resolution while retaining the bottom slope features.

Bottom Lock Zoom

When selected, this mode will split the viewing area in half. The left side will be used to show zoom information, and the right side will show normal bottom data. Bottom Lock Zoom mode centers the zoom data about the Zoom display window and adjusts the associated Zoom Range Scales appropriately. The resulting Zoom display exhibits the bottom as a horizontal trace across the center of the Zoom window. The effect of this mode is to remove all changes in the bottom slope to allow comparisons of bottom types and other matter just above the bottom. The user can use the Zoom Range Control to zoom in or out in the selected units.

Marker Zoom

Like in the other modes, Marker Zoom provides a high-resolution zoomed view of the water column, however in this mode, the user can specify where in the water column the zoom range will begin. This is accomplished by dragging the marker zoom bar up or down the normal view scalebar to the point you want the zoom range to begin. The start of the zoom range can be observed at the top of the zoom window while you drag the marker zoom bar, but the marker zoom isn't set until the mouse button is released.

3.1.3.10 – The Help Menu

This menu includes a software **Help** guide along with an **About HydroBox** option. Clicking it will display a window with information such as the HydroBox software version and ODEC company information. In addition, the software will request and display Hardware/Firmware version information from the HydroBox Sensor providing the Sensor is connected and communicating properly.

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END OF SECTION THREE

4.0 MAINTENANCE

4.1 – POST (Power On Self Test)

Each time power is applied to the HydroBox Sensor, it performs a series of self-tests to ensure that it is working optimally. The tests occur as follows:

Test 1 – Initialization Test

Checks overall functionality of the sensor hardware to verify it is operational.

Test 2 – RAM Test

Verifies that the system RAM is operational.

Test 3 – Serial EPROM Test

Verifies that the Serial EPROM is operational and it's checksum is valid.

Test 4 – Flash Memory Test

Verifies that the Flash Memory is working and it's checksum is valid.

If Test 1, 2, or 3 fail, the Sensor's green LED will blink rapidly at 4 Hz indicating an error. The HydroBox Sensor will not be operational and the user should contact ODEC's Support Dept. for assistance. If the Sensor fails Test 4, the green LED will blink normally at 1 Hz, but will not function until it is reprogrammed. The HydroBox PC Software will detect this problem and notify the user. (Refer to **Troubleshooting** Section 4.4)

If the Sensor passes these tests, the green LED will blink at 1 Hz indicating that it's working and waiting for communication with the PC and HydroBox PC Software.

4.2 – LED Indicator

The HydroBox Sensor is equipped with a green LED which was designed to give the user immediate information regarding the Sensor's status. When power is supplied to the Sensor and it is working properly, the LED will blink at 1 Hz indicating that the unit has powered up correctly and is waiting for communication with the PC and HydroBox software. Once communication is established, the LED will stay on continuously. However, if the unit is powered up and the green LED blinks at 4 Hz, then the unit is problematic and will not be able to communicate with the PC until the problem is rectified. (See **Troubleshooting** Section 4.4)

4.3 – Firmware Update

The HydroBox Sensor is a self-contained unit and has it's own set of Firmware. Periodically, ODEC may offer Sensor Firmware upgrades which add new features and functionality. This section describes the process involved in updating that firmware.

4.3.1 – Connection

The HydroBox Sensor Firmware does not need any special connection cables or connectors to perform an update. The Sensor is connected to an available COM port (Usually COM 1) on a Portable PC as if it were being used to acquire data. (See **Data Interface Connector** in Section 2.2.7).

4.3.2 – Firmware Update File

If a Firmware Update file is available, ODEC can send the user a disk containing the file, or it may be downloaded from our website (<http://www.oceandata.com>). The file will always be called HydroFW.hex. This file should NOT be renamed because the HydroBox PC Software is configured to only detect it's specific filename.

This file should always be **COPIED** from the disk to the PC rather than being moved. This allows the user to retain a copy of the file on disk for backup purposes. Before copying the file, the HydroBox PC Software should **NOT** be running. The file should be copied to the same directory as the HydroBox executable file. (Usually C:\Program Files\ODEC\HydroBox, unless otherwise specified).

4.3.3 – HydroBox PC Software Firmware Update

The HydroBox PC Software is designed to automatically detect the presence of a firmware update file upon startup. If the file is detected, the user will be notified and asked whether the firmware update should take place. If the user chooses “No”, then the HydroBox PC Software continues to run normally.

NOTE: If the user chooses “No”, the firmware file will REMAIN in the HydroBox directory. The file must be manually removed to avoid being detected each time the software is run.

Before the user chooses “Yes”, the HydroBox Sensor must be reset back to the Power-up state. This can be done by removing power from the Sensor (Either at the connector, or power supply) and then reapplying it. The green LED on the Sensor should be blinking at 1 Hz indicating that it's in the Power-up state. For more information regarding the LED indicator, see Section 4.2.

When the user clicks “Yes”, then the PC Software will attempt to communicate with the HydroBox Sensor while giving the user status message updates. If there are no problems, the firmware upload will begin and a progress indicator will be shown to the user. Refer to Section 4.4 for troubleshooting information.

NOTE: If the firmware update is successful, the firmware file WILL be removed from the HydroBox directory to prevent it from being detected again. Make sure you have a backup copy of this file.

4.4 – Troubleshooting

4.4.1 – HydroBox Sensor Troubleshooting

Symptom	Possible Cause	Solution
Green LED on Sensor does not turn on	Sensor is not receiving power	Check the power supply, inline fuse, and connections to the Sensor with a voltmeter
Green LED on Sensor blinks rapidly at 4 Hz	Power on Self Test 1, 2 or 3 has failed	Contact ODEC Support Dept for assistance
Green LED on Sensor blinks at 1 Hz but cannot establish communication with PC software	1) Connection problem between PC and Sensor 2) PC Software not setup to use correct COM port 3) Flash Memory is corrupt	1) Check connections between PC and Sensor 2) Select the correct COM port in the “Sonar Port” menu 3) Contact ODEC Support Dept for assistance

4.4.2 – HydroBox PC Software Troubleshooting

Symptom	Possible Cause	Solution
Sensor State always shows <i>Unknown</i>	PC Software not receiving communication from Sensor	1) Check connections between PC and Sensor 2) Make sure the Sensor’s LED is blinking at 1 Hz indicating that is ready for communicating 3) Verify the software is setup to use the correct COM port for communicating with Sensor
Sensor State stuck in Power-up	PC Software was executed after Sensor has already been initialized	Cycle (remove then reapply) power to the HydroBox Sensor
PC Software not receiving GPS information	1) PC Software is not setup correctly 2) There is a connection problem between the PC and GPS Receiver	1) Correctly configure PC Software in the “NMEA I/O” menu to the correct COM port and to a compatible NMEA string with your GPS Receiver 2) Check connections between PC and GPS Receiver
PC Software is non-responsive or lagged	Thermal Printing is enabled but no TDU is connected	Check connection between PC and TDU or disable Thermal Printing in software

OPTIONAL EXTERNAL INTERFACE CONNECTIONS

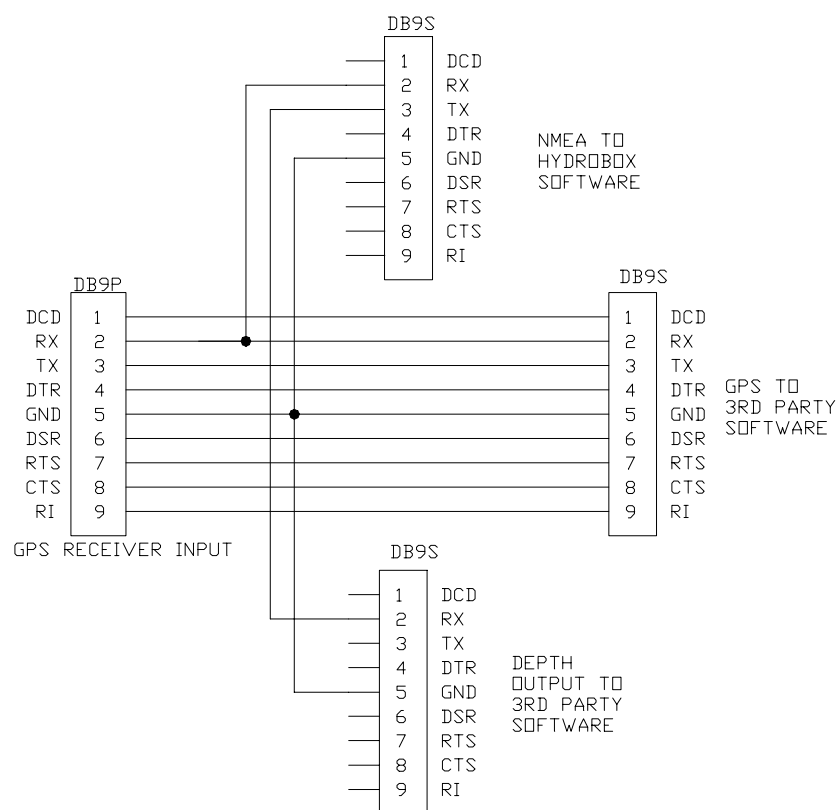


Figure 4-1 Optional Interface Connections

END OF MANUAL