Bathy 2010PC™ CHIRP Sub Bottom Profiler and Bathymetric Echo Sounder
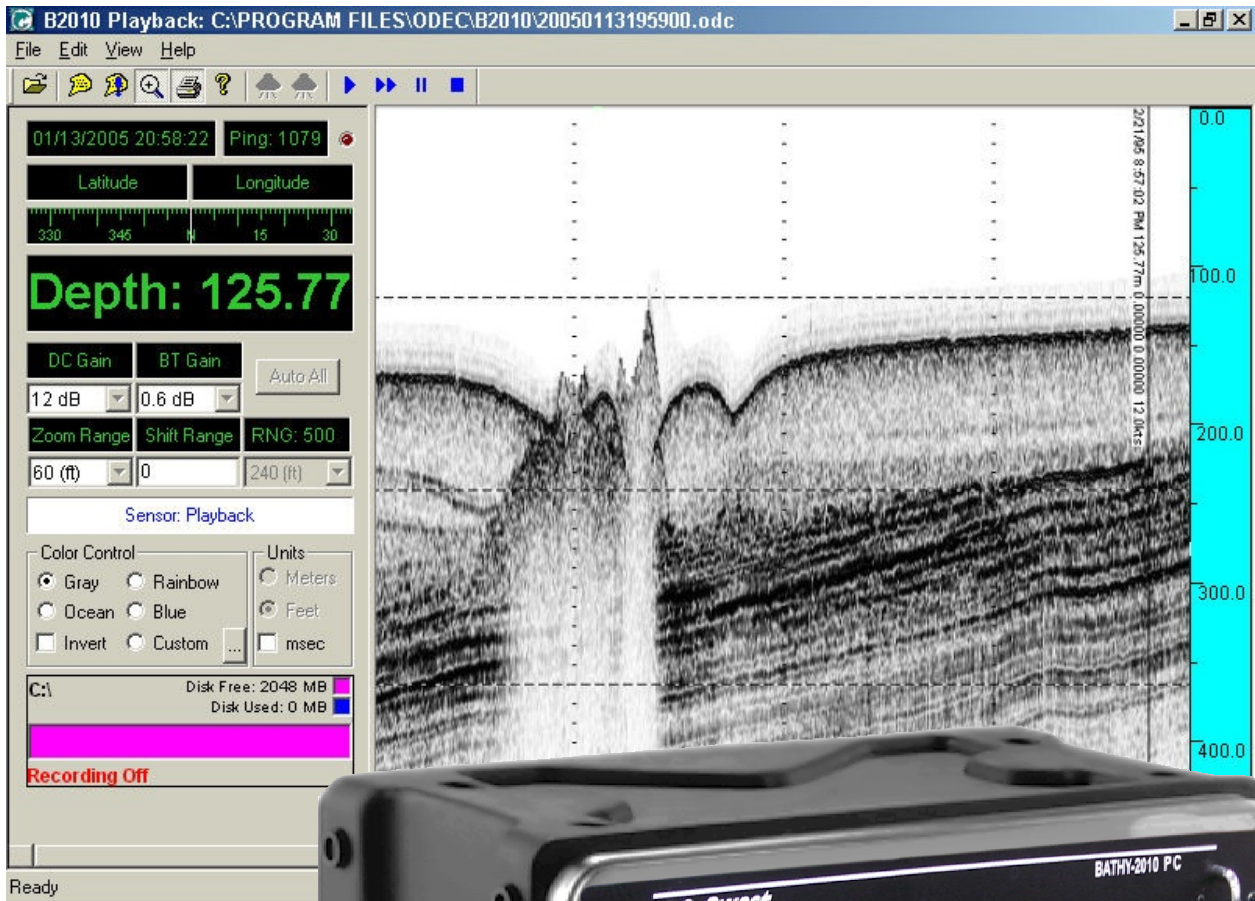

- **Installation**
- **Operation**
- **Maintenance**

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1.0 INTRODUCTION

The BATHY-2010 system provides high performance bathymetric and sub-bottom survey capability from shallow inland waterways to full ocean depth. The system configuration is extremely flexible and can be easily modified to accommodate the specific needs of individual customers. The BATHY-2010 system is comprised of the following electronic components:

•Bathy 2010 Data Acquisition System (Sonar/Sensor Unit)
•Hardcopy Support for a multitude of standard devices
 and one or more of the following transducers:

•TR-109   3.5KHz Transducer
•TC-12/34   12KHz Widebeam Transducer
•TC-12NB   12KHz Narrowbeam Transducer
•TC-2084   33KHz Transducer
An individual configuration may contain all or a subset of the above mentioned components.

1.1 Safety
The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS - Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE - Under no circumstances should any person reach into to enter the enclosure for the purposes of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION - Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

The following WARNINGS appear in the text of this manual and are repeated here for emphasis:

 -WARNING-

200Volts DC is present in the Bathy-2010PC Sensor Unit. Thus, the risk of electrical shock and serious injury is present. All precautions should be taken to insure no human contact is made to the unit while power is on. <u>Also note, High Voltage may be present until the High Voltage Capacitors discharge. Contact SyQwest support personnel before opening the Sensor unit at any time.</u>

The following CAUTIONS appear in the text of this manual and are repeated here for emphasis:

 -CAUTION-

This test involves contact with ESD (Electrostatic Sensitive Devices). Normal precautions involve the use of anti-static protection material and ground straps for test personnel.

1.2 List of Additional Items
There are no additional items required to operate the BATHY-2010 system.

1.3 Shipping and Handling
The BATHY-2010PC units are typically delivered in a roto-mold rack-mount case, additional items may be shipped in reinforced cardboard, with foam packing. The boxes and foam should be saved for future use. If saving the box and foam is not practical, equivalent packaging procedure should be used.

1.4 Emergency Operation and Shutdown
Under any emergency, adverse, or abnormal ship conditions, the BATHY-2010 system electronics should be powered down. The system is powered down by placing the rocker switch on the front panel of the unit into the **OFF** position.

2.0 SYSTEM OVERVIEW

The following paragraphs will provide an overview system components.

Each BATHY-2010PC system component has been designed in such a manner as to emphasize performance and flexibility. Four removable Printed Circuit Board (PCB) assemblies are used within the system; a dual channel transmitter for transmit functions, a DSP and receiver board utilizing the latest in microprocessor technology, and an I/O Board. These modular electronic components provide for simple installation and maintenance. Transducers with selectable frequencies ranging from 3.5 to 200kHz are compatible with the BATHY-2010PC frequency selected at time of purchase. Transducers can be selected for over-the-side mounting or hull mounting.

Optional hardware features include external storage, Thermal Display Unit (TDU), rack-mount kit, bulkhead mount kit, transducers and transducer mounts.
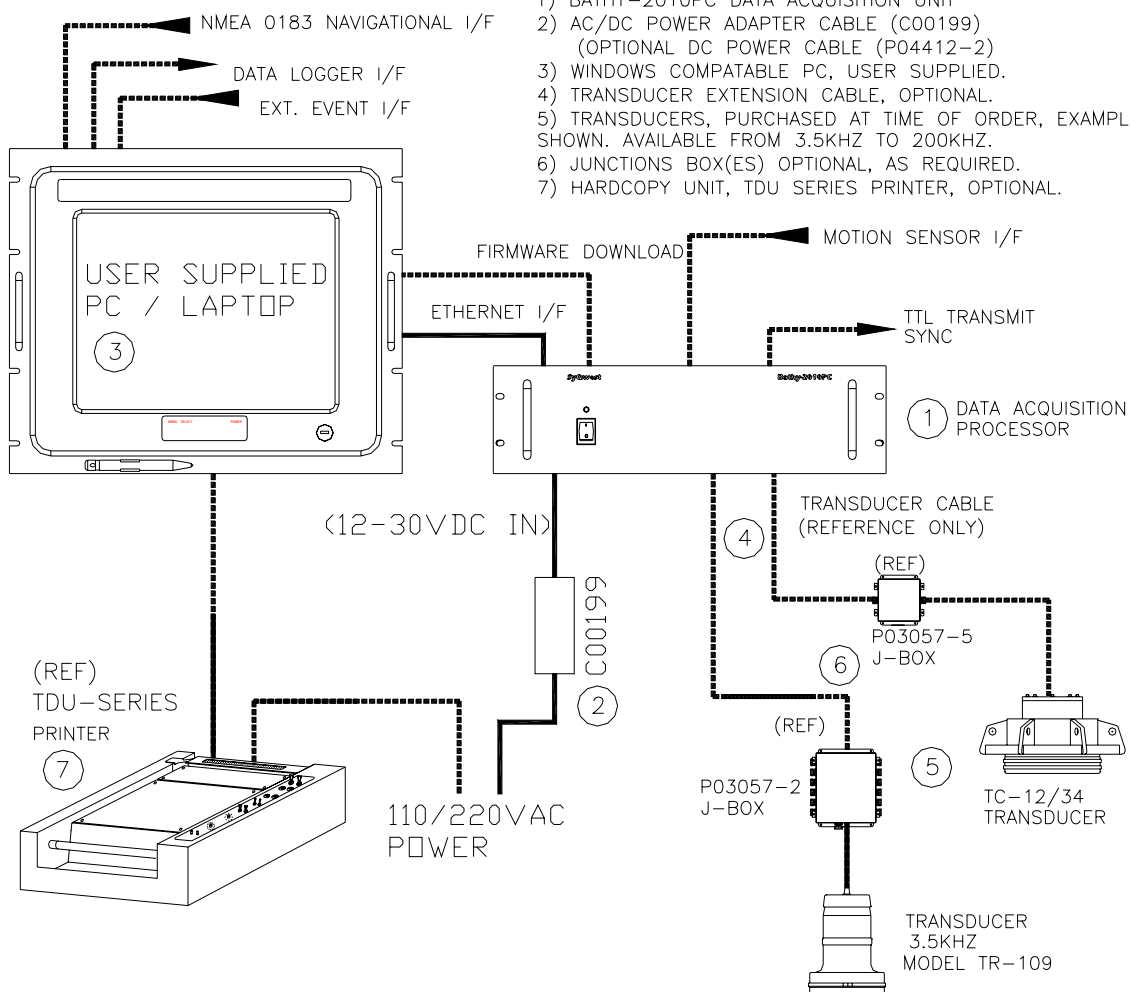
Figure 2-1 System Component Overview

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2.1 Bathy 2010 Data Acquisition and Playback
The Bathy 2010™ Host PC software is a Windows XP application providing a simple interface for reliable depth data acquisition in both fully automatic as well as manual mode.. The BATHY 2010 is designed for ease of operation and provides a hardcopy interface via a parallel port to gray-shade thermal recorders via the user supplied PC. The system is capable of real time display of sounding information as well as simultaneous depth digitizing, hardcopy and digital storage. A single Ethernet connection (CAT5 /100 Megabit) is used for all communication between the Bathy-2010PC Sensor Unit and the Host PC application. All of the acquired data can be stored and played back in the ODC format on a network drive or on the internal hard drive of the PC. The system is capable of interfacing to the standard Hydrographic Software packages (HYPACK, HYDROpro, …) via serial interfaces. It also interfaces directly to a GPS and/or Heave sensor. Firmware download is also available via a serial connection so all embedded processing updates can be made by the user. The Bathy-2010PC provides a completely integrated solution for marine surveys when used in conjunction with the appropriate navigation instruments and software.

The Bathy-2010PC Sensor Unit is packaged within a ruggedized, aluminum enclosure. The main processing elements are an embedded DSP for signal processing and an embedded RISC processor for handling the Ethernet interface. One CPU handles serial I/O and data acquisition and processing. The signal-processing element of the BATHY-2010 system The Bathy 2010 design utilizes an extremely flexible / re-programmable DSP architecture. This benefits the user by allowing it the ability to alter many of the Bathy 2010s transmit/receive signal processing characteristics. For example, the low frequency processing channel provides the user with both a linear FM and CW pulse mode of operation. In linear FM mode operation the user may select sweep bandwidths of 1 KHz, 2 KHz and 4 KHz. The user may also select between FM sweep duration's of 5, 10, 25msec.

CW pulse mode of operation allows for various pulse duration's with matching receiver bandwidths and waveform shapes. Transmit signal synthesis provides modulation and pulse shaping capability as well as pre-distortion of replica waveform to equalize transducer effects. The high frequency processing channel provides the CW pulse mode of operation only.
The analog front end provides automatic gain control (AGC), which expands the usable dynamic range of the unit to 144 db. The signal processing hardware utilizes the latest technology including two Texas Instrument DSPs to provide peak performance capability, which exceeds 65 MIPS The Bathy-2010PC design utilizes an extremely flexible DSP architecture. This benefits the user by allowing them the ability to alter many of the Bathy-2010PC transmit/receive signal processing characteristics to achieve the optimum system performance for a wide range of applications.

An external sync connection (J3) is provided on the Bathy-2010PC rear panel to facilitate Bathy-2010PC operation with other shipboard acoustic equipment. A TTL T0 pulse is also available along with a BNC connector with an analog representation of the A/D input signal for both acoustic channels.

2.2 Dual Channel Power Transmitter

The Bathy-2010PC drives the transducers with a Dual Channel Power Transmitter Circuit Card Assembly. The Transmitter is located inside the Bathy-2010PC Sensor Unit and is capable of delivering 2KW of pulsed power for each of the Acoustic channels. Power Control is available via the Host interface to allow for low power settings in shallow water and high power settings in deep depths. The output transformer for each channel is setup with multiple taps for impedance matching as required. Each Bathy-2010PC Transmit channel is capable of producing output power from 3.5KHz – 200KHz so multiple configurations can be supported with a single Bathy-2010PC Sensor Unit.

For some applications the transmitter output may be directed to multiple output transducers when transducer switch option is exercised. The switch is used to select the appropriate output transformer tap for various transducer power levels and impedance's. For applications that require the Transducer Switch, the switch may only be changed when the system is NOT PINGING or the TRANSMIT Power Level is shut OFF. Transmitting while the switch is being changed can result in voltage arching and possible transmitter failure.

2.3 Hardcopy
The BATHY-2010 is capable of interfacing to a variety of industry standard hardcopy devices. The table below lists the devices and their performance characteristics.

Device Type	Technology	Display Area	Resolution
TDU-850	Grey Scale Thermal	8.5 inches	300 DPI
TDU-1200	Grey Scale Thermal	12 inches	300 DPI
TDU-1200F	Grey Scale Thermal	12 inches	203 DPI
TDU-2000F	Grey Scale Thermal	20.16 inches	203 DPI

2.4 TR-109 (3.5KHz Transducer)
The TR-109 is a low frequency transducer suitable for bathymetric and sub-bottom profiling applications. It is rated at a maximum power level of 600 watts at 3.5KHz for a 30% duty cycle (30 degree beamwidth). BATHY-2010 systems use TR-109 transducers in array configurations to provide full power capability for deep water bathymetry and/or sub-bottom profiling.

2.4 TC-12/34 (12KHz Widebeam Transducer

The TC-12/34 is a dual frequency transducer capable of both 12 and 34 KHz operation suitable for bathymetric survey applications. It is rated at a maximum power level of 2000 watts at 12 KHz (30 degree beamwidth) and 500 watts at 34 KHz (10 degree beamwidth). It is used in the BATHY 2010 system for 12KHz widebeam applications.

2.5 TC-12NB (12KHz Narrowbeam Transducer)

The TC-12NB is a single frequency transducer capable of 12KHz operation suitable for full ocean depth bathymetric survey applications. It is rated at a maximum power level of 2000 watts at 15 degree beamwidth making it the preferred choice for deep water bathymetry. The TC-12NB is used in the BATHY 2010 system for 12KHz narrowbeam applications.

2.6 TC-2084 (33KHz Transducer)

The TC-2084 is a single frequency transducer capable of 33KHz operation suitable for accurate shallow depth bathymetric survey applications. It is rated at a maximum power level of 1000 watts at 20 degree beamwidth making it the preferred choice for shallow water bathymetry. The TC-2084 is used in the BATHY 2010 system for high frequency channel processing.

2.7 System Power Up and Controls (Power switches)

The power switch is on the front panel of the the BATHY 2010 unit. Refer to Figure 2-2

2.8

2.8 System Interconnect and Controls

There is a power switch on the front of the unit that must be turned on for the Bathy-2010PC system to start up, once powered on, a green LED that indicates that power is present and has been turned on. The Bathy-2010PC is powered by an AC Power cable P/N: C00199. The AC Power cable includes a 24VDC, 100W power supply in line. Optionally, the P04412-2 DC power cable can be purchased, and connected to a 12-30 VDC source. The nominal power usage for the Bathy-2010PC Unit varies significantly depending on the Transmit Power Level. At low power levels only 20 Watts is used. At high power levels, up to 60 Watts can be necessary. The extra wattage goes to sourcing the power for the Transmitter outputs. The Bathy-2010PC may require a slightly overrated Power Supply that can current limit appropriately to accommodate a short current surge at system power up.
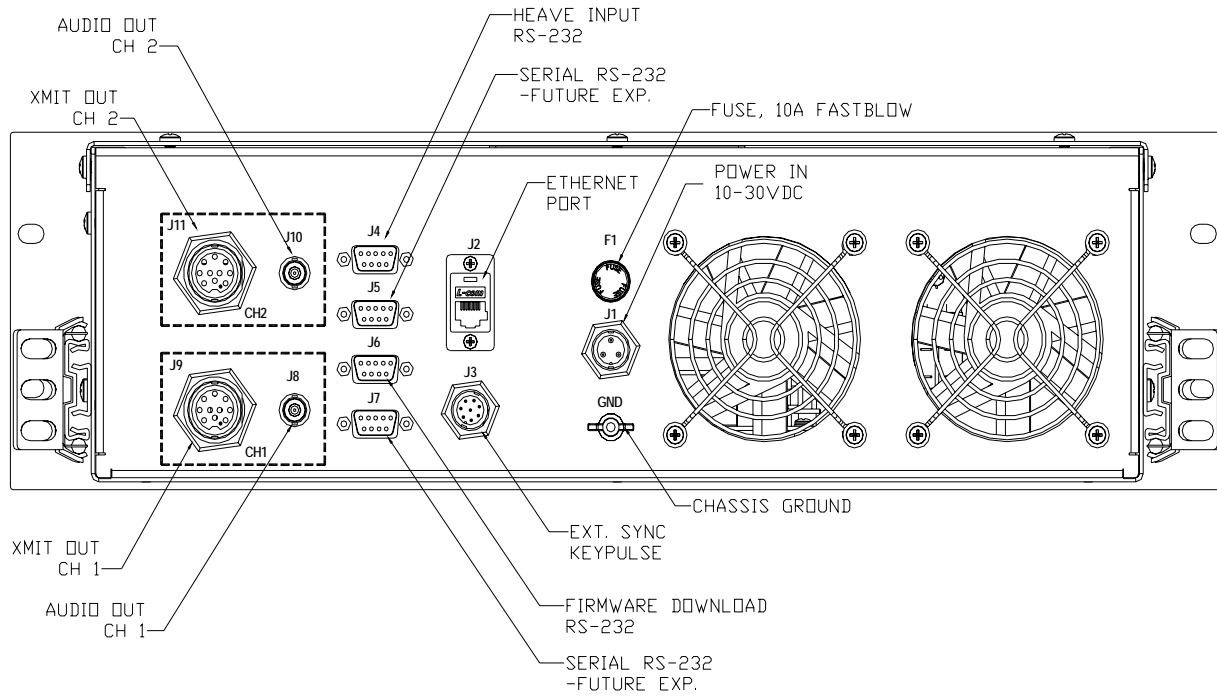
Figure 2-2 Bathy-2010pc Rear Panel Connections

Figure 2-3
Bathy-2010 Controls And Sysyem Indicators

2.8.1 System Indicators
A power indicator light, and power switch are located on the front panel..

Figure 2-1 shows the basic connections to the unit. In all installations, at least the Power (J1), Ethernet Port (J2), and Transducer(s) (J9,and or J11) connections must be made for the unit to function.

As shown above, there is an LED Power On indicator directly above the Power Switch. When system power has been energized the green LED will be illuminated. All of the connections are detailed below.

The AC Power cable and the Ethernet CAT5 cable are supplied and ready to plug into the Bathy-2010PC Sensor Unit. No user wiring is necessary. These cables associated with the Bathy-2010PC Sensor Unit are listed below (Table 2-1). The user should make sure that, after wiring is complete, that the power plug is firmly attached to the unit via the twist-lock mechanism and the Ethernet connections are snapped in place.

The transducer connections for the Bathy-2010PC will vary depending upon the needs of the customer. In some applications (small boats, temporary installations) the Transducer(s) will have the connector attached to the cable at the SyQwest manufacturing facility, if requested. In more complicated installations, the transducer connectors will be supplied in kits along with optional Junction boxes, and extension cables. This provides more flexibility to the user for running cables and terminating the wires as needed. The Transducer cables, kits, and junction boxes are all listed in Table 1-4 below as well. Note, that these additional items are to be purchased or supplied as required by the customer, so most but not all items are necessarily included in the Bathy-2010PC system.

Part Number	Item	Quantity
C00199	AC Power Adapter Cable	1 STD
C00200	Data Interface Cable (10 feet)	1 STD
P05706	Accy. Kit	1 STD
P04412-2	DC Power Cable (10 feet)	Optional
P03057-2	Junction Box, (1 in, 4 out)	Optional
P03057-5	Junction Box, (1 in, 1 out)	Optional
CAB001	Cable, DSS-3 (3.5-12Khz extensions)	Optional
CAB003	Cable, C43, (24-50Khz extensions)	Optional
CAB004	Cable, C33, (100-200Khz extensions)	Optional
Cable length to be specified at time of purchase		

Table 2-1 Bathy-2010PC System Cables

DC Power Connection –J1

When not using the supplied AC Power Cable C00199, follow these instructions:

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 50 watts of power to the unit. The power source should also be able to provide an initial in-rush current greater than 50 watts. Due to the high power amplifiers in the Bathy-2010PC product, it is generally better to power the system with a voltage that is greater than 20VDC if possible (lower current) although a 12V Battery will work fine with the system. The Bathy-2010PC Sensor unit is reverse polarity and over-voltage protected, however, 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 10 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 2-3.
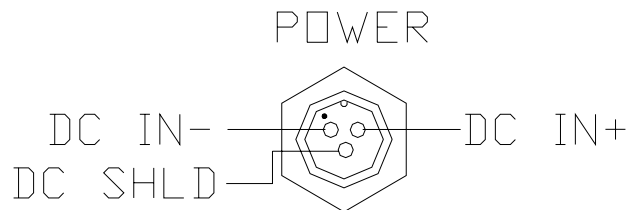
Figure 2-4 Bathy-2010PC Unit Power Connector

Electrical wiring standards require that the Bathy-2010PC Unit be properly attached to a solid chassis ground via the ground stud on the unit, or the Earth Ground wire (WHITE or GREEN) in the P04412 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 –J2

The Data Interface cable supplied with the Bathy-2010PC is 10 feet long. It is a standard CAT5 Ethernet cable and should interface to any Ethernet port on a standard PC. The user will need to setup the Ethernet port on the computer to support the fixed IP address associated with the Bathy-2010PC. Refer to the PC Software and Setup Section 3.2 for instructions on how to configure the PC Ethernet Port for operation with the Bathy-2010PC.

If the 10 foot length of cable is not enough, the Data Interface Cable may be extended by using an extension cable or a longer CAT5 cable can be purchased locally.

Transducer Connection J9, J11

The Bathy-2010PC transducer connector is either hardwired directly to the transducer or connected to the transducer through a Junction Box.

The standard transducer cable is 30 feet in length and has 2 conductors along with a shield thus, 3 connections are necessary for termination. Due to the wire AWG variations for different transducers, a 7 and or 10 pin connector will be used to connect the transducer to the Bathy-2010PC Sensor Unit. The appropriate mating connector(s) will be supplied with the Bathy-2010PC System. Only 3 of the pins on the connector are wired to the unit, both wiring types are shown below. They are defined as:

WHITE (or BLUE)- Transducer +
BLACK (or BROWN)   - Transducer –
GREEN   - Transducer Shield

The Transducer Connector on the Sensor Unit is shown below in Figure 2-5.

CONNECTOR P/N: 13182-7PG-331
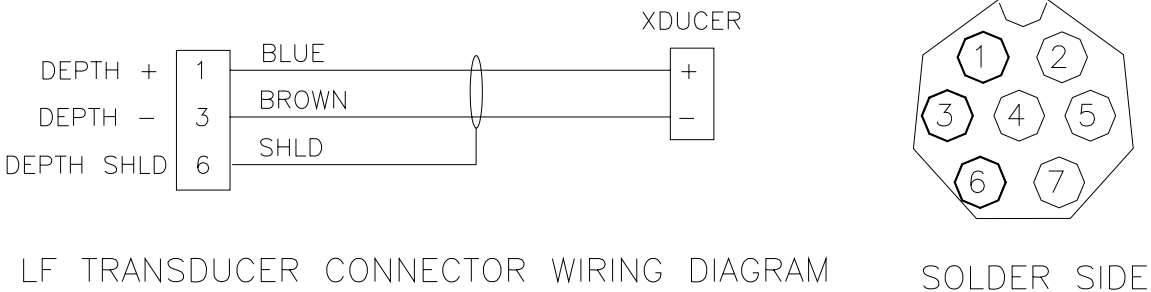
Figure 2-5 Bathy-2010PC LF Transducer Connector

CONNECTOR P/N: 13382-10PG-331
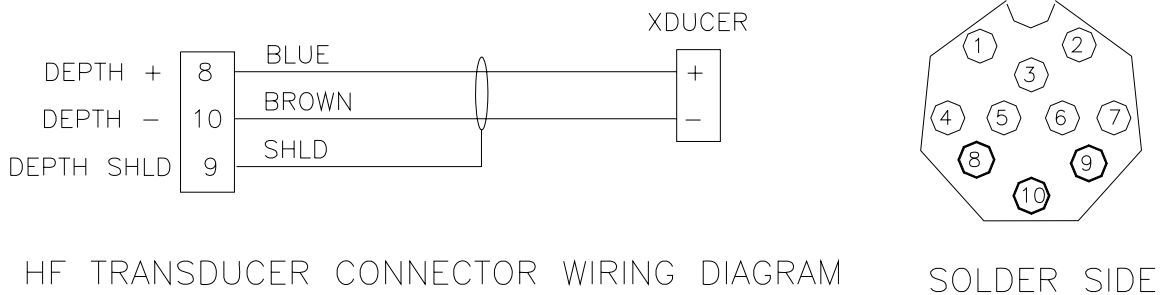
Figure 2-6 Bathy-2010PC HF Transducer Connector

Heave Input Connection - J4

The Heave input connection for the Bathy-2010PC system is made via the 9 pin D connector, J4 on the Bathy-2010PC Sensor Unit. The interface is a standard RS-232 connection running at 19.2KBaud. The Heave connection will require a user supplied 9 Pin D to 9 Pin D serial connection cable.

Firmware Download Connection – J6

The Firmware download connection for the Bathy-2010PC system is made via the 9 pin D connector, J6 on the Bathy-2010PC Sensor Unit. The interface is a standard RS-232 connection running at 115.2KBaud. The Firmware Download connection will require a user supplied 9 Pin D to 9 Pin D serial connection cable. Further instructions on performing a Firmware download are provided Firmware Flasher section of this manual.

Audio Output Channel 1(J8) and Channel 2 (J10)

The Audio output for each channel provides an analog signal that represents the raw analog signal present at the A/D Converter in the system. Bathy-2010PC users can use this output for a variety of purposes but is most useful to investigate operational issues and also can be connected to allow the logging of raw data from the system.

Host PC Electrical Connections GPS Connection

Connecting a GPS or other Navigation input to the PC running the Bathy-2010PC™ software allows the user to store and annotate Date, Time, Position, and Heading information to the Acoustic data returns.

The Bathy-2010PC PC Software supports the NMEA 0183 protocol on a COM port that is software selectable by the user. When selecting a PC to use with the Bathy-2010PC system the user should ensure that PC hardware supports multiple COM Ports if a Navigation input is desired. 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.

Depth Data Output & External Event Connections

The Bathy-2010PC PC Host application software also supports serial port connections for the Depth Data output and External Event input that are typical associated with interfacing to Hydrographic Software packages (i.e. HyPack, HyDroPro, ..).

Printer Connection

The Bathy-2010PC PC Software allows the user to interface to the all of the SYQWEST TDU Thermal Printers. The connection is established through the PC's Parallel Printer Port (25-pin D-Type) as shown below in Figure 2-6. Once the software has been started, all displayed acoustic data can be printed to the TDU in either Acquisition or Playback mode.
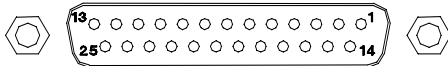
Figure 2-7 Printer Port

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.

3.0 Bathy-2010pc Pc Software Installation And Host Setup

This section describes how to install the Bathy-2010PC PC software package. It is assumed that the reader has a working knowledge of installing Windows XP/Vista® software. The installation software is located on the CD-ROM disc included with your Bathy-2010PC.

3.1 Installing The Software
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 Bathy-2010PC CD into an available drive. If **Auto Insert Notification** is enabled on the CD-ROM drive, then the Bathy-2010PC 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 Bathy-2010PC 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 Bathy-2010PC installation will continue automatically.

The InstallShield Wizard will guide you through the next step where you have the option of choosing an install directory. By default, the Bathy-2010PC PC software is installed in the Program Files folder under the sub-directory SyQwest.

In the next step, you may choose a **Typical**, **Minimal**, or **Custom** installation. Selecting Typical will perform a complete install of both the Bathy-2010PC application and Sample Data for playback. A Minimal installation will only install the Bathy-2010PC 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 Bathy-2010PC software as soon as you close the installer. If not, you can run the Bathy-2010PC PC software by using the Windows **Start** button to find the *Bathy-2010PC* menu under **Programs**, or simply double-click on the *Bathy-2010PC* icon located on your Desktop.

**Operations
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3.2 Setting Up The Bathy-2010pc Ethernet Interface

3.2.1 Setting a Static IP Address for Network Connection
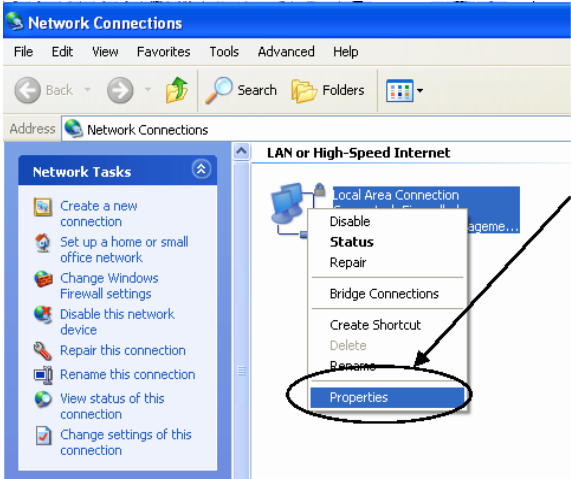
To set up your computer, follow these steps.
Go to: Start Settings Network Connections

Right click on the "Local Area Connection" icon and select "Properties"
You should see the following screen:
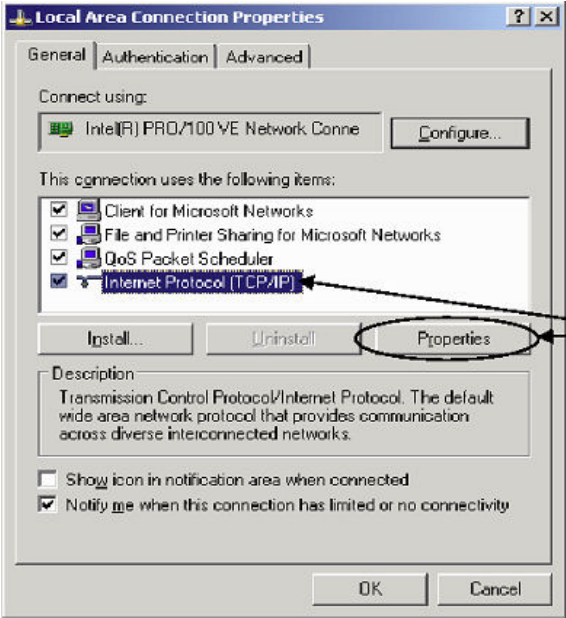
Scroll to and Click on "Internet Protocol" and then on "Properties"
You should see the "Internet Protocol (TCP/IP) Properties" window.
Click on the "Alternate Configuration" Tab

You can either set up the interface under the "General" setup or the "Alternate Configuration" tab.
If you have 2 or more Network connections available, you may want to use the "General" settings on your selected Network card. Click the "Use the following IP address" radio button and set it up with the IP address shown below (same as the alternate). If you already use that connection, or you are limited on your network connections, you can select the alternate tab. When selected it will be displayed with "Automatic private IP address" selected.
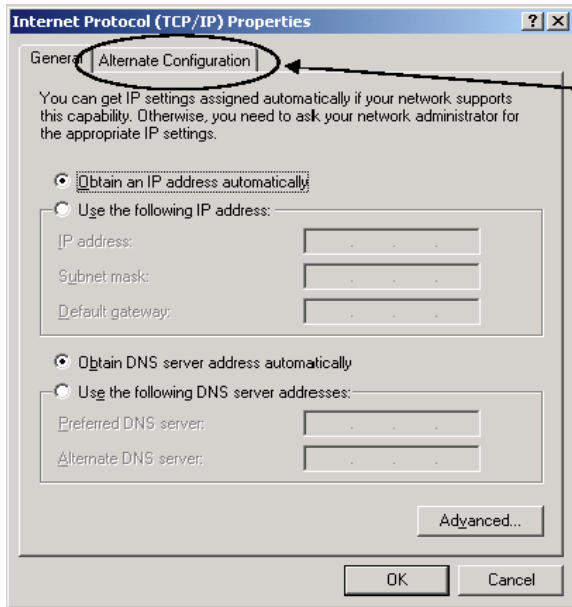
Click the "Use the following IP address" radio button
Enter the IP address information shown below
Select "OK"

For use with the Bathy-2010PC, it is required that you use the 192.168.199.113 address.
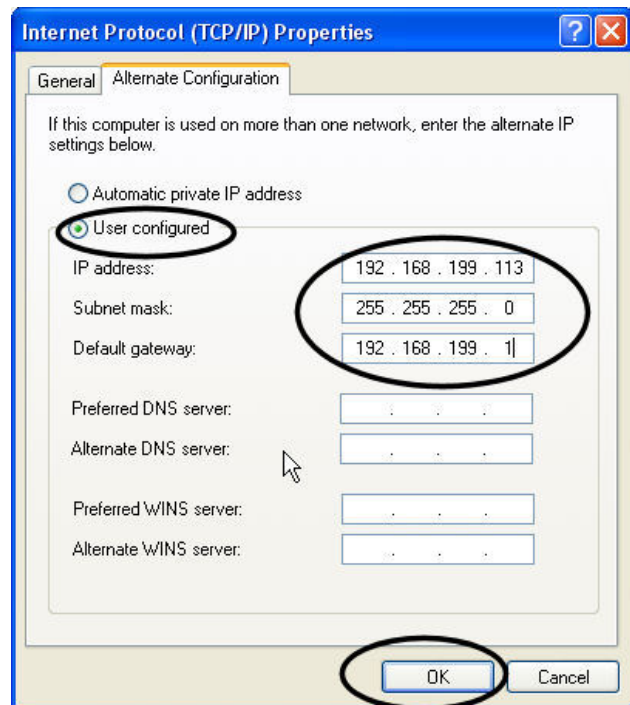
If you have only one network connection, and you move the network cable from your standard network connection to the Bathy when collecting data, you may prefer to set up the "alternate configuration" as shown to the left. This will preserve your "main" network settings, and default to these only when plugged into the Bathy.

3.2.2 Setting an Alternate Static IP Address for Network Connection

If you move your computer from being connected from a LAN using DHCP to your Bathy-2010PC or other equipment that uses a static IP address, you can set your computer up to automatically switch to the "alternate" static IP address.

The use of the alternate IP address occurs when the computer cannot find a DHCP server such as when it is connected to your Bathy-2010PC.

END OF SOFTWARE INSTALLATION SECTION

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4.0 THEORY OF OPERATION

The BATHY-2010 system is configured as a flexible acoustic measurement sensor device capable of both shallow/deep water hydrographic and sub-bottom profiling applications. Each of these applications depend on certain characteristics in order to perform accurately and reliably. For hydrographic applications, the BATHY-2010 is capable of providing sophisticated algorithms for peak signal detection, automatic modes of: receiver gain, bottom tracking, pulse length and power level controls greatly reduce the probability of inaccurate bottom detection/tracking. For sub-bottom profiling applications the BATHY-2010 is capable of providing high energy/wide bandwidth transmit waveforms and an advanced bottom triggered TVG processing algorithm to facilitate both maximum bottom penetration along with high resolution layer definition.

4.1 Hydrographic Data Processing
The BATHY-2010 receiver electronics operate under microprocessor control and have the following salient characteristics:

- +26 dB Pre-Amp Gain
- 5 Khz Signal Processing Bandwidth
- 60 dB Controlled AGC
- Programmable Balanced Modulator
- 24 Bit Analog to Digital Conversion
- 144 dB Signal Processing Dynamic Range

The output of the receiver is processed by two advanced TI Digital Signal Processors. They implement square law detection processing followed by post-detection matched filters which are set according to transmit pulse length. The HYDROGRAPHIC system gain mode applies peak detection normalization as follows:

- The system calculates an average peak signal value for a 4 ping cycle integration period. The average peak signal value is calculated utilizing a sliding integration window which is 2 times the transmitted pulse length in value. The average peak value is then used to normalize the detected signal by applying a gain factor which is proportional to the maximum signal level (gain factor=max value/average peak value). This is done dynamically for each processed output sample.

The Bathy 2010 then performs bottom detection/tracking functions. The bottom detection predictive filter algorithm uses ships speed, detection threshold and fully automatic operation to provide reliable "hands off" digital depth data under the majority of operating conditions. This is facilitated by offering automatic modes of pulse length and power level control. The peak detection mode of bottom digitizing provides the most accurate representation of the mid-point of the acoustic beam and serves as a method of increasing the accuracy of a wide acoustic beam system. Sub-Bottom Profiling Data Processing

The BATHY-2010 system incorporates FM wide bandwidth signal processing (CHIRP) to provide penetration and resolution for sub-bottom profiling applications. The system employs a matched replica correlation algorithm with normalization to obtain the raw sub-bottom data. A user selectable bottom-triggered time varied gain (BT-TVG) is then applied to offset sediment attenuation resulting in optimum highlighting of deep sub-bottom layers. The BATHY-2010 typically is operated at a center frequency of 3.5 KHz with a swept FM signal, which can be programmed up to a 8KHz frequency sweep. The maximum sweep should always be used as it results in the finest resolution and highest SNR. In sub-bottom mode the output of the receiver is processed by 2 TI Digital Signal Processors. They implement the correlation detection (matched replica filter) processing. Filter replica coefficients are calculated by transmitting a waveform into the receiver electronics. The SUB-BOTTOM system gain mode applies a BT-TVG to the raw data in .5dB/m steps from 0.0 - 4.0dB/m and should be applied as follows.

•The amount of BT-TVG gain applied should be inversely proportional to the sediment attenuation characteristics. This produces an effect that causes an embedded layer in the sub-bottom that is harder or softer than the surrounding sediment to be highlighted. The harder the bottom, the greater the echo attenuation as it travels thru bottom layers, and consequently the greater the applied gain factor shall be. As in HYDROGRAPHIC mode of operation, the hardware receiver gain is controlled as a function of ambient RMS background noise levels.

4.2 Pinger Mode Theory of Operation

Pinger Mode is provided to track object depths in the water column by receiving unsynchronized transmit pings of known frequency and pulse width at a given transmit rate. The asynchronous nature of the pinger and the fixed ping rate make the evaluation of pinger echo returns difficult under certain pinger and bottom depth conditions. The operating mode is briefly described below.

In this mode the direct and bottom returns simply mirror each other with the direct return reflecting the pinger path through the water column. When the pinger is descending the descending return reflects the direct path and vice-versa on pinger ascent. Each crossing reflects a 1 second boundary in time or 2400 feet (750m) in depth assuming a nominal sound velocity of 4800 ft/sec (1500m/sec). Once the final crossing has been logged the pinger is less than 2400 feet from the bottom. Thus, the operator should monitor the returns and pinger descent speed to insure the desired results are accomplished. Listed below is a detailed step-by-step procedure for determining pinger location:

PASSIVE PINGER MODE- Listen Only Mode Procedure:

1. Verify that the BATHY-2010 system is digitizing on a valid bottom by observing the" DEPTH" parameter in the lower left portion of the display (Transmit Mode = CW Frequency 12kHz). Note that the pinger should not be pinging during this step as it will cause problems with the depth digitizing process.

2. Record the Bottom Depth and calculate the number of crossings as follows: integer [Bottom Depth/1200ft(or 750m)]. Where integer [x] is truncate (i.e. 1.7=1, 1.3=1, .99=0).

3. Select Listen only by selecting under the View Menu "Passive Pinger".

4. Select the appropriate pulse length to match the BATHY-2010 system to the pinger's transmit pulse length. Valid pulsewidths are: 2msec, 5msec, and 10msec.

5. Commence pinging and set the DC GAIN to a gain where both returns are strong and consistent. Note that the pinger direct return may appear stronger than desired but once the pinger depth is greater than 100-150 feet the returns will appear similar in magnitude.

6. Monitor the returns and note each time the returns cross paths.

7. When the calculated numbers of crossings have been noted monitor the returns and insure that they do not cross path again. Crossing again would indicate that the pinger has hit the bottom.

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5.0 OPERATION

This section describes how to operate the Bathy 2010 Data Acquisition / Playback Unit using the PC Software package included with your Bathy 2010.
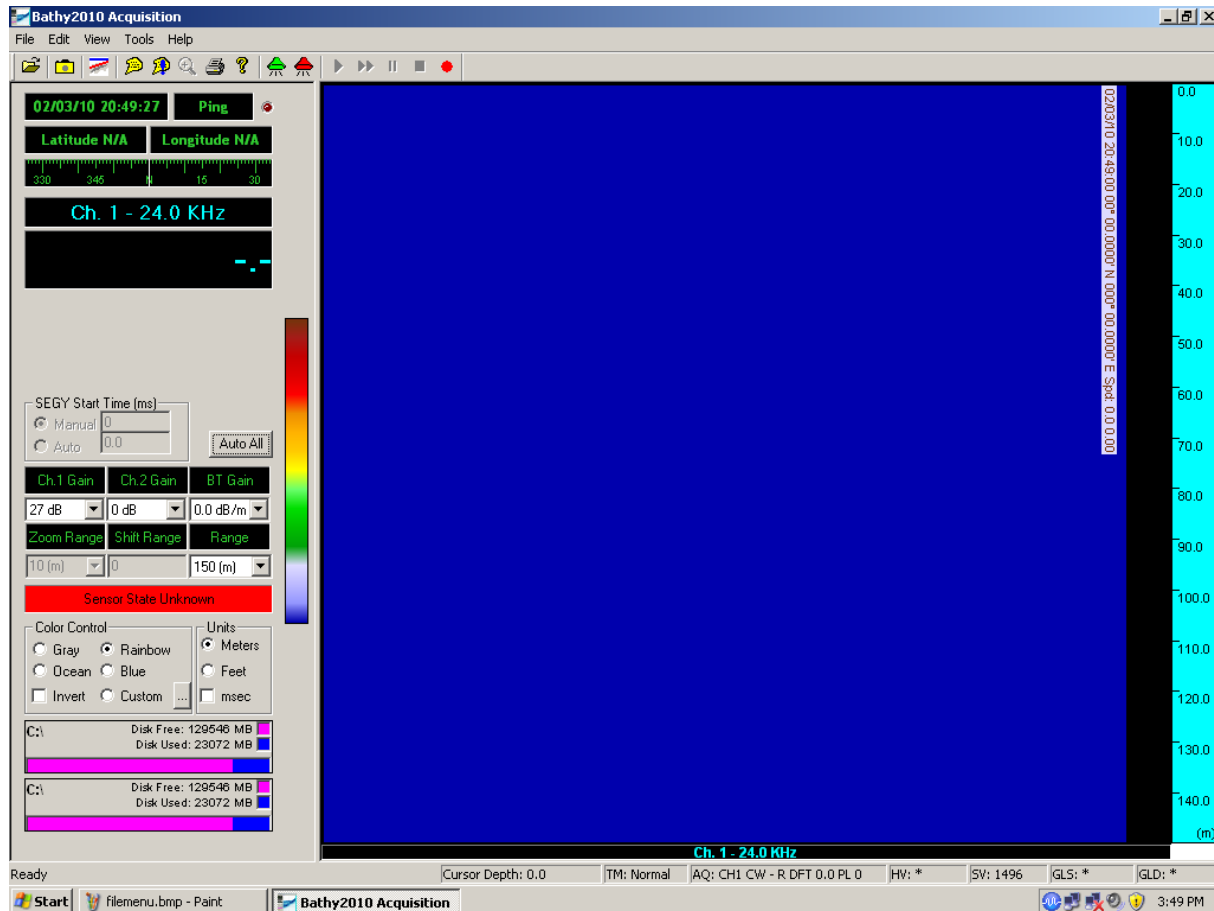
Figure 5-1 Main Window

3.1- The Main Window

The Bathy 2010 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, most used system parameter controls, available disk space (for data storage), and Bathy 2010 Data Acquisition / Playback Unit 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. In Zoom Mode, the **Data** field is 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 dragging the mouse in the window and the value will display in the status bar. See the below picture and table for more info. (The picture reflects the software in Zoom mode)
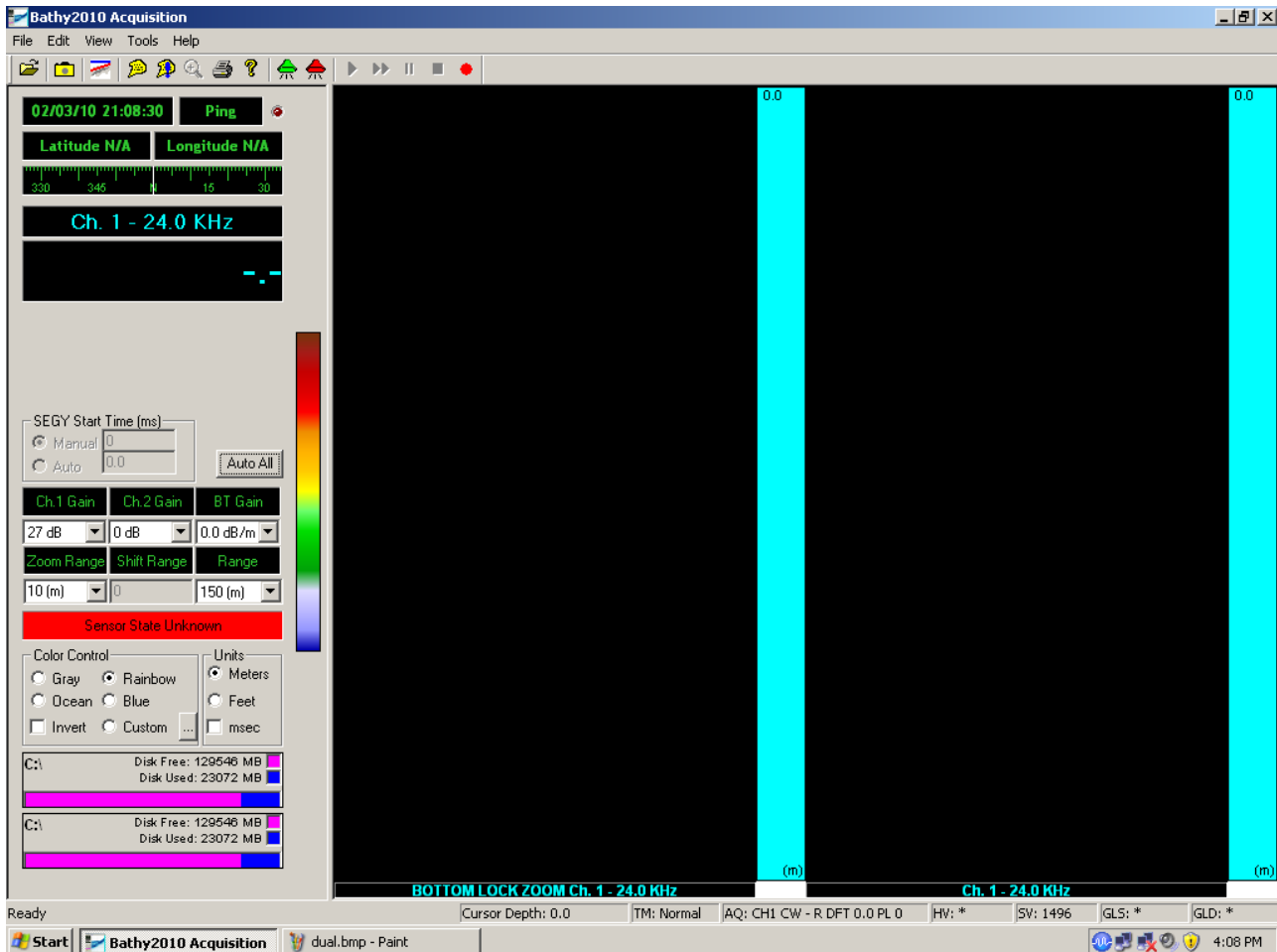
Figure 5-2 Zoom Mode

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

5.1 The Toolbar

Quick access to common Bathy 2010 functions. From left to right they include:

Open A Playback File

Capture Screen

 Slope Measurement (Optional)

Insert Text Annotation

Insert Manual Event Mark

Toggle Playback Zoom

Toggle TDU Printer On or Off

Get Bathy 2010 Software And Version Info

Starts the Bathy 2010 Data Acquisition / Playback Unit Pinging

Stops the Bathy 2010 Data Acquisition / Playback Unit Pinging

Playback a Previously Recorded File

Toggle Fast Forward/Normal Playback

Pause Playback

Stop Playback

 Playback Slide Bar

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

5.2 Function Key Controls

The Function Keys on the Keyboard are setup to allow the operator easy access to the most frequently used parameter controls in the Bathy 2010 system. A mouse or trackball can be used to access all of the parameters as well but often in shipboard conditions, the use of pointing devices can be difficult so having "Hot Keys" is beneficial.

Function Keys F1 through F11 are all available and the use of each is described on the list below:

- **F1** – Gain

- **F2** – System Range

- **F3** – System Power Level

- **F4** – BT Gain

- **F5** – Playback, Play Button

- **F6** – Playback, Fast Forward Button

- **F7** – Playback, Pause Button

- **F8** – Playback, Stop Button

- **F9** – Manual Event Mark

- **F10** – Manual Annotation
- **F11** – Toggle Auto All Button

NOTE: When changing the system parameters press the corresponding Hot Key and use the up/down key on the directional pad to select the desired parameters.

5.3 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. Position info is also provided when a GPS receiver is connected to the PC and the Bathy 2010 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 Bathy 2010 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 Bathy 2010 Data Acquisition / Playback Unit is pinging, and also for how long. The ping count is reset to zero when any of the following events occur:

- The Bathy 2010 Software is restarted.
- When the "Start Ping" icon is depressed.
- The Bathy 2010 Data Acquisition / Playback Unit has temporarily lost power and reset.

In addition, the Bathy 2010 software features an animated compass, which displays the current heading. The compass is located underneath the GPS position information.

5.4 Gain and Auto Controls

The Gain controls consist of 2 pull-down menus, which control the Bathy 2010 Data Acquisition / Playback Unit's gain settings. The Bathy 2010 *Hardware* gain is controlled by the **Ch. 1 or Optional Ch. 2 Gain** control and can be set either from 0-60 dB, or to Auto Mode. The **BT Gain** controls the *Bottom Triggered* gain, which allows the user to amplify acoustic returns in the sub-bottom sediments. The **BT Gain** is first applied at the bottom depth value and increases over time at the selected dB/unit increment. It can be set from 0.1 - 4.0 dB/unit (Either Feet or Meters, depending on which is currently enabled) in 0.1 increments. For example, consider the following:

Bottom Depth is 40.0 meters
Range is set to 0 - 80 meters
BT Gain is set to 0.5 dB/m
Ch. 1 or Optional Ch. 2 Gain is set to 30 dB

From 0 – 40 meters, the total gain will remain 30 dB as set by the **Ch. 1 or Optional Ch. 2 Gain** control. After 40 meters, however, the total gain will increase by 0.5 dB every meter, giving you 35 dB of total gain at 50 meters, 40 dB at 60 meters, etc. The **BT Gain** can only apply up to 30 dB of additional gain.

Depressing the **Auto All** button sets the Bathy 2010 Data Acquisition / Playback Unit 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 Bathy 2010 back to manual mode.

The **BT Gain** is not auto-controlled in Auto All mode. This allows the user to select the BT Gain best suited to the bottom features present for their application.

NOTE: When in Auto All mode, the Ch. 1 or Optional Ch. 2 Gain control is not available and will be controlled by the Bathy 2010 automatically. While the control is disabled, it will indicate which hardware gain setting that the Data Acquisition / Playback Unit has chosen. Also BT Gain is applied as the data is viewed in acquisition or playback and is NOT stored to the data in the ODC or SEGY files. This allows the user to adjust the BT Gain in playback as needed.

5.5 Range, Zoom Range, and Shift Controls

The **Range** control allows you to choose a manual range for the Bathy 2010 Data Acquisition / Playback Unit. It includes 12 range settings presented in either Feet or Meters.

The **Zoom Range** control has 7 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 150 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 Bathy 2010 automatically. While the Range control is disabled, it will indicate the current Range setting that the Data Acquisition / Playback Unit has chosen. Shift Range will also not be available nor have any effect in Auto All mode.

5.6 Data Acquisition / Playback Unit State

This indicator shows the current state of the Bathy 2010 Data Acquisition / Playback Unit. There are a total of 6 different states:

Unknown - No communication is present between the Data Acquisition / Playback Unit and the Bathy 2010 Software.

Power On - Power has been applied to the Bathy 2010 and the Data Acquisition / Playback Unit has begun communicating.

Initializing - The Bathy 2010 software is handshaking with the Data Acquisition / Playback Unit to establish a reliable connection.

Idle - A connection between the Bathy 2010 Software and the Bathy 2010 Data Acquisition / Playback Unit has been established, but no commands have been received yet.

Pinging - The Bathy 2010 Data Acquisition / Playback Unit is transmitting and receiving real-time bottom data.

Playback - The Bathy 2010 Software is displaying previously recorded data from a playback file.

Post Failure - The Bathy 2010 Data Acquisition / Playback Unit did not pass the initial Power On Self Test. This error will always include an error code.

Flash Failure -The sensor unit had a self test failure.

5.7 Color Palette

The Bathy 2010 PC Software allows you to choose from 4 standard 256 level 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.

5.8 Unit Controls

Alongside 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.

5.9 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.

5.10 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 the 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.

5.11 Cursor Depth Tool

Using the mouse, the user may obtain a digital depth value anywhere in the water column by moving the cursor within the Normal or Zoom data display windows. The cursor depth field on the lower left side of the window shows 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.

NOTE: To fine-tune in on a depth value, the user just has to move the mouse over the data screen. The digital depth shown in the status bar display will be continuously updated.

5.12 – File menu

5.12.1 Start/Stop Recording

Creates a new file on the specified hard disk for capturing acquisition data. If the Bathy 2010 Data Acquisition / Playback Unit is already pinging, then the software will start the data recording immediately.   The filename is based on the system date/time in the following format:

<path>YYYYMMDDhhmmss.odc

<path>   - This represents the path to a directory where the recorded files should be stored. The file path is selected with the Data Confirmation Window (see below) using the associated "Browse" button for ODC and SEGY files. CSV files are stored with the same directory with ODC files.

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   - SYQWEST, INC.'s Proprietary File Extension
.seg   - Standard SEG-Y format
.csv   -ASCII file that stores data logger output information

NOTE: Once recording is started, this option will become "Stop Recording".
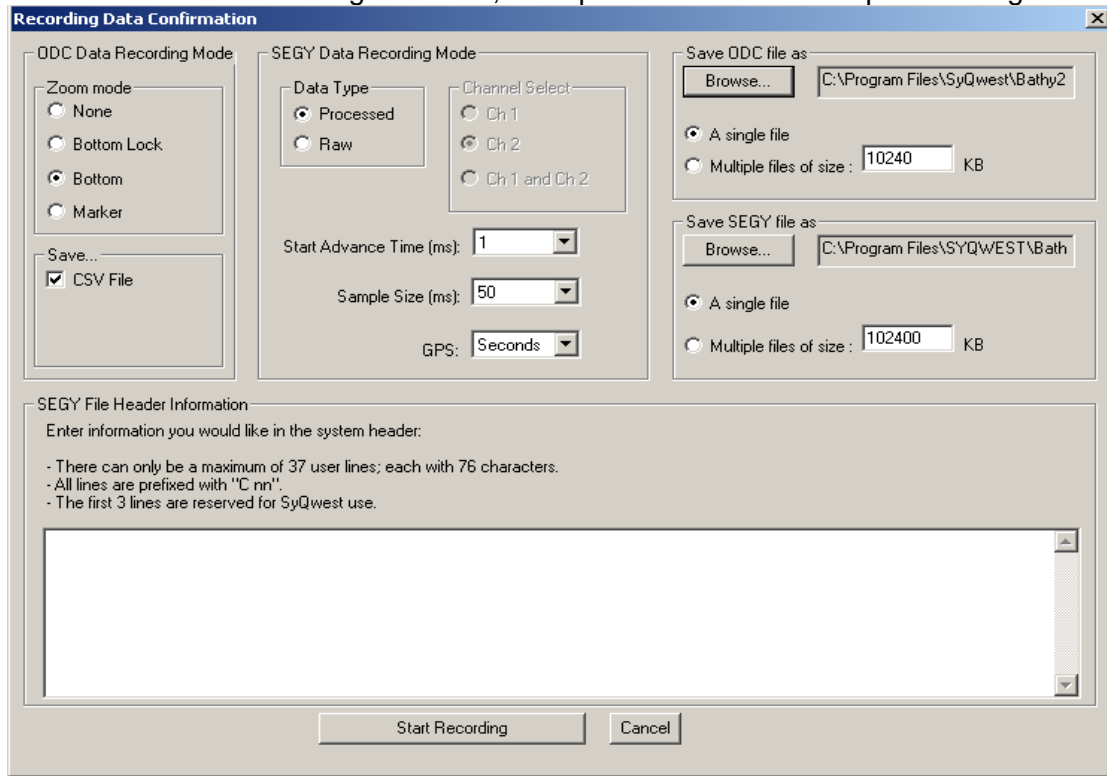
Recording Data Confirmation

Allows the user to select the data storage format, file size and annotate SEG-Y header information.

ODC Data Recording Mode

Zoom Mode

In most data applications it is best to make use of a zoom mode. Zoom mode allows for high resolution viewing of the bottom or sub-bottom. The high resolution zoom data is ONLY STORED in the ODC file if one of the zoom modes are enabled. In deeper water application much of the sub bottom layering information will not be available with the ODC file if a zoom mode is not enabled (it will still be available with the SEGY file).

> None – This mode displays the normal bottom data by itself without any zoom information.

> Bottom lock – Locks the bottom data to the upper portion of the zoom screen so the user can monitor the sub-bottom data.

> Bottom – Centers the zoom display at the current depth

> Marker – The user controls the portion, which the zoom display focuses on.

Save CSV File

Comma Separated Variable File. If this is checked, a CSV file is stored with all of the serial data logger output information.

SEGY Data Recording Mode

Data Type

The Data setting has two options, Processed and Raw. The Processed option is used for data stored after FM (correlation) or CW (energy detection) processing. The Raw option is used for 16 bit, two's complement value, directly from the analog to digital converted. Raw reflects the signal that has been amplified and filtered but no DSP process to signal.

Start Advanced Time

The start advanced time option allows the user to choose the amount of acoustic data that is recorded above the bottom. The time intervals offered are 1, 2, 5, and 10 ms. The total sub bottom data recorded is the difference of the start advanced time and the sample size i.e.(50 ms with a 5ms start time will record 45ms below the bottom. In most cases the 1,2 ms options are best. In certain situations where the bottom digitizer is jumping due to softer sediments choose the 5 or 10 ms option to ensure no sub bottom data is lost.

Sample Size (ms)

The sample size setting has two options, 50mS and 100mS. These numbers represent how much sub-bottom data is being recorded and are dependent upon the sound velocity that the user has selected.

GPS

The GPS setting has two options, seconds and degrees. The user should set this option to the format that is best suited for their post processing software. "Seconds" is for GPS output data in "Degrees, Minutes, Seconds" format and "Degrees" is for GPS output data in "Decimal Degrees" format.

SEGY File Header Information

The SEGY header is a 40 line, 80 bytes per line, EBCDIC header. The user can enter file information in this text box. There are 37 user lines, which can store up to 76 characters per line. The first three lines are reserved for SyQwest information.

Recommended information for the EBCDIC header is:
- Client
- Company
- Geographical Area
- Start date of the Recording
- Observer Name

Save ODC and SEGY File

The option menus to save the data as ODC or SEGY files allow the user to browse the file directory. it also allows the user to save the data in a single file or as multiple files. The Multiple file option allows the user to create sequential files of a certain size (in KB) so that the data can be transferred easier. Multiple files are denoted by a -1, -2, -3…etc. extension after the date/time on the base file name. The SEGY has CHx (1or 2) to indicate the channel followed by the frequency (3.5 or 120 for 3.5 kHz or 12kHz) and indicates whether the data is processed or raw (P or R) added after the date/time on the file base.

5.13 Open for Playback

Allows the user to select a stored ODC or SEG-Y file from file storage for playback and Post-Processing.

5.14 Capture Picture

The Capture function is a very useful feature. By depressing the Camera Icon on the Tool Bar, the user will cause a Screen Shot of the entire Bathy-2010 display to be sent to the path selected in the User Preferences dialog box. The file format for the Screen Shot is Jpeg and thus can be shared and viewed using any standard picture viewing software package. The file name for the screen shot reflects the date and time of capture:

YYYYMMDDHHMMSS.jpg where:

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
.jpg   - Standard Jpeg File extension

The Capture Screen Shot feature is most useful for storing historical information as it provides an instantaneous shot of any interesting bottom contour activity. When used in conjunction with a GPS (the position will be stored in the screen shot as well if a GPS is connected), the exact location, date, and time are all accessible at a moments notice

5.15 Recent Files

The Bathy 2010 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 Bathy 2010 PC Software by either using the "Exit" on this file menu, or by simply clicking on the windows default close button.

5.16 Edit Menu
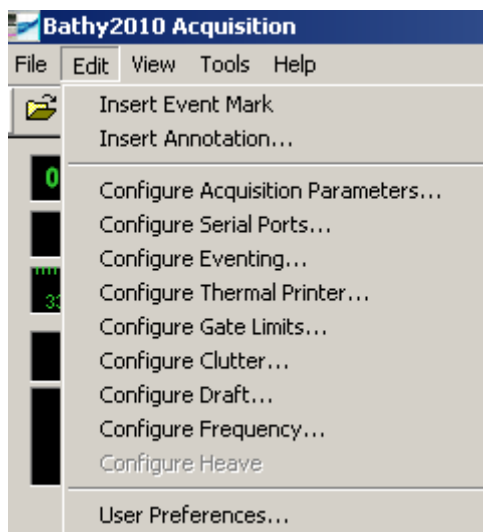
5.16.1 Insert Event Mark

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)

5.16.2 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)

5.16.3 Configure Acquisition Parameters

Allows the user to select the Operational mode, Pulse Window, Power Level, Sweep Bandwidth, Sound Velocity, and Detection Threshold adjustments.

Operating Mode

Selects transmit waveform and detection processing mode of operation. Selectable modes are: CW as well as FM sweep.

Transmit Rate

The transmit pulse repetition rate varies from 0.1Hz to 4.0Hz dependent on depth range and selected pulse length. The Transmit Rate is selected automatically to provide the maximum bottom coverage for a given depth range.

Pulse Length

The transmit pulse length varies from 0.2ms to 50ms (.2ms, .5ms, 1 ms, 2ms, 5ms, 10ms, 25ms, 50ms) and is dependent upon the operating mode (CW or FM) and the depth range selection. The transmit Pulse Length is selected automatically by the system to provide the optimum system performance based on the processing mode selected and depth of operation.

Pulse Window

Transmit waveform shaping is provided to allow for maximum average power or a reduction in range side lobes, resulting in higher resolution sub-bottom profiles and slope tracking. Selectable windows are: Rectangular, Cosine, Hamming, or Blackman

Sound Velocity

Allows the user to adjust the speed of sound adjustment 1400-1600 meters/second or 4595-5250 feet/second, in 1 unit increments.

Sweep Bandwidth

FM sweep frequency bandwidth. User selectable bandwidths are: Auto, 1 , 2, 4 and 8kHz (only available with wideband transducers).

Detection Threshold

The Detection Threshold value is provided to allow the user to vary the echo reply level that is recognized by the Bottom digitizing function as a valid bottom echo. For some bottom conditions the default value of "0" is fine for bottom digitizing.

The "0" setting sets the digitizer to the higher threshold, which works well in moderate and deeper depths. In shallow water and soft sediment survey conditions a lower threshold is required to consistently digitize on the bottom without saturating the first few meters of strata penetration. The Detection Threshold value can be varied from 0 -> 9 with 9 representing the lowest echo threshold.

5.16.4 Configure Serial Ports

Allows the user to select the serial inputs and output as required for Navigation, Data Logging, External Events, Sonar Port and SEGY storage settings. Sonar port must always be enabled for system operation. SEGY must be enabled to permit SEGY storage.   Data Logger, Navigation, and External Events are optional.
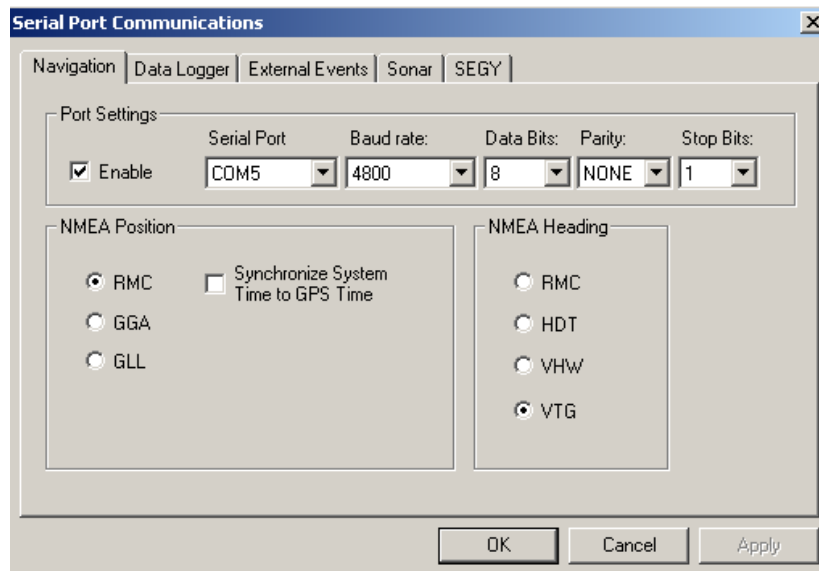
5.16.5 Configure Events
This menu is used to configure events and annotation.
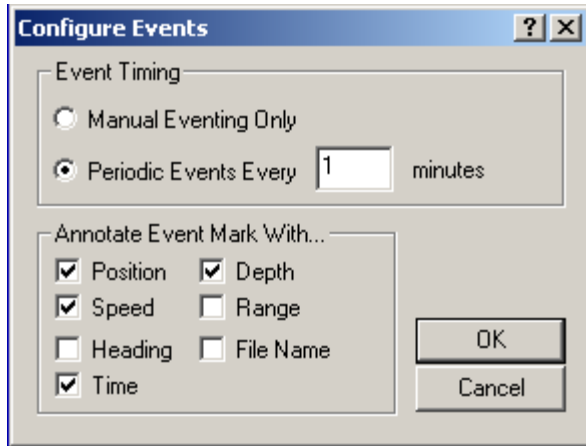
Events may be generated by using the toolbar button, or the corresponding menu option "Insert Event Mark" under the *Edit* menu. An event is a vertical marker which appears on both the screen and printer. A number of real-time parameters may be included with the events as derived by the user. These parameters 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 Bathy 2010 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 Bathy 2010 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 Bathy 2010 accepts external annotation/eventing with the following format.

(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: 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.

5.16.6 Configure Thermal Printer

Allows the user to select to choose the model of Thermal Printer used for hardcopy recording and the recorder settings.
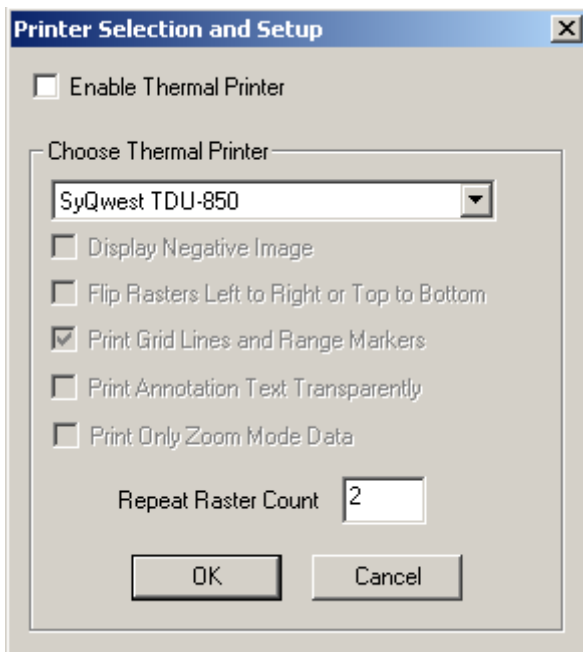
This menu allows you to configure a thermal printer for use with the Bathy 2010 software. It supports 6 different models from the Raytheon/SYQWEST, INC. TDU series, including the TDU-850, TDU-1200, TDU-2000, TDU-8.5IE and EPC 9800 series and the HSP-100 models.

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)

5.16.7 Configure Gate Limits

Allows the user to select to the minimum and maximum limits on which the Bathy 2010 will look for a valid bottom return.
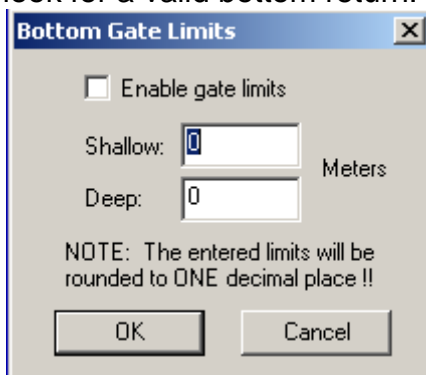
5.16.8 Configure Clutter

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 setting from 1 to 9 can be selected to the user liking. Level 1 permits the lowest signal levels to be viewed.   The optimum values for most applications are in the 4-6 range.
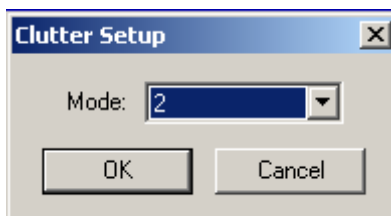
5.16.9 Configure Draft
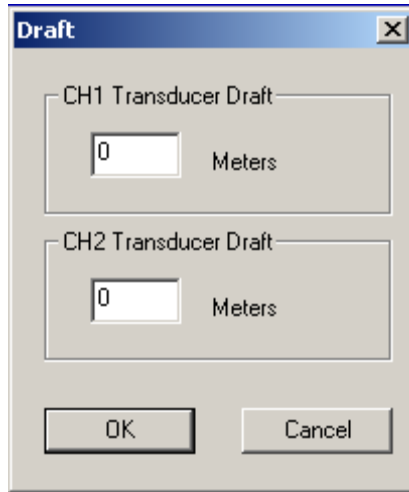
Allows the user to compensate all sounding data for transducer location and ship's draft. The value can be entered in tenths of units.

5.16.10 Frequency Configuration
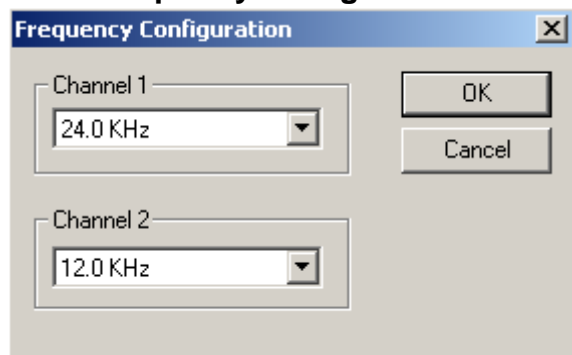
Allows user to choose the frequency of operation for CH1 and CH2.

Note: The system that is being used should be configured so that you should only be able to select frequencies that are compatible with your transducers.

5.16.11 Configure Heave

When enabled this will compensate for the heave of the vessel and correct the value of the depth being recorded

5.16.12 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 "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.

This menu also allows the user select the Alarm Count which is a threshold on which if the bottom is lost for a user selectable number of pings the Bathy 2010 will then signal; bottom lost.
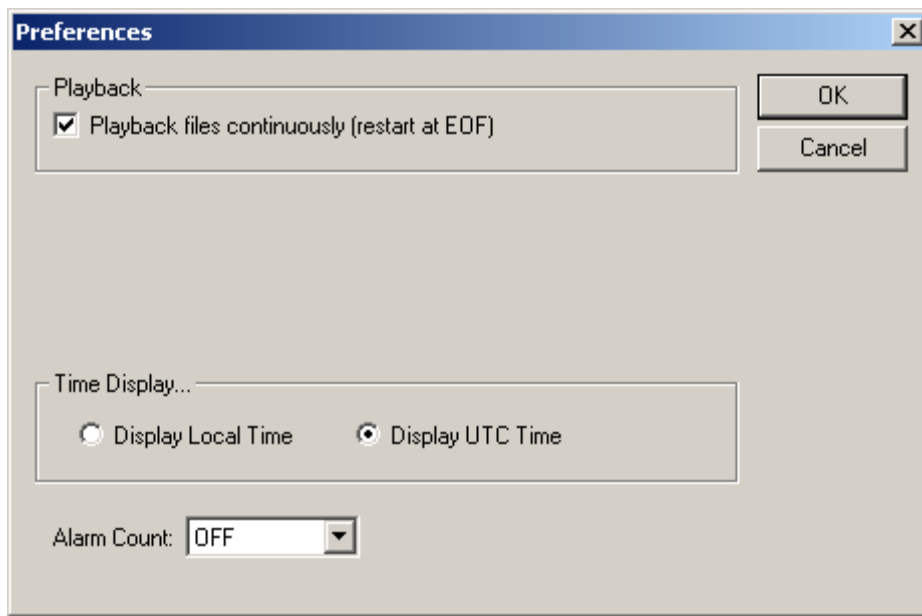
5.17 View Menu

5.17.1 Toolbar

When selected the toolbar is visible in the Main Window.

5.17.2 Status Bar

When selected the Status bar is displayed.

NOTE: The Toolbar and Status Bar should always be selected for the users convenience while using the Bathy2010.

5.17.3 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 Bathy 2010 Data Acquisition / Playback Unit'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.

NOTE: GUI Zoom does not provide increased data resolution. It simply magnifies the pixels shown in the normal window. To view data with higher resolution Bottom Zoom, Bottom Lock Zoom, or Marker Bottom must be selected during data acquisition.

5.17.4 Transmit Mode

<u>Active</u>- In active mode the system provides the transmit waveform while in pinger echo sounder mode, the system automatically synchronizes to and passively processes a periodic active acoustic pinger source

<u>Passive Pinger</u>- Listen Only Mode(refer to section 4.2)

<u>Ext. Trigger</u>- .. The External Trigger allows an external source to trigger a Bathy 2010 ping cycle. The External Trigger is used with external synchronization (refer section 5.21).

Channel Selection

<u>Ch. 1 Only</u>- Allows the user to display the Bathy 2010's High Frequency Channel. Available frequencies are: 3.5, 12, 16, or 33 kHz

<u>Ch. 2 Only (Optional)</u>- Allows the user to display the Bathy 2010's Low Frequency Channel., available frequencies are: 12,16,18,33 or 34 kHz

<u>Dual Channel (Optional)</u>- Allows the user to display the both of the Bathy 2010's High and Low Frequency Channels.

5.17.5 Display Modes

The Bathy 2010 Data Acquisition / Playback Unit 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).   For optimum data acquisition one of the zoom modes should be enabled to provide the most detailed representation of the bottom and sub bottom acoustic data.

There are 4 display modes available with Bathy 2010 software, including 3 Zoom modes, and 1 without any zoom. They include:

<u>Normal</u>

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 for normal bottom data. Bottom Zoom mode centers the zoom display around the current depth allowing you to follow it up and down the water column at a high resolution. In addition, the user can use the Zoom Range Control to zoom in or out. The Zoom Range value represents the zoom range in whichever units are currently selected. When the zoom window moves up or down to track the bottom, it does so in Zoom Range / 2 increments.

Bottom Lock Zoom

This mode functions the same way as Bottom Zoom, however it does not show the bottom moving through the water column. Instead, it will lock the bottom to the upper portion of the zoom view so that the user may continuously monitor sub-bottom information.

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.

5.18 Help Menu

This menu includes a software Help guide along with an About Bathy 2010 option. Clicking it will display a window with information such as the Bathy 2010's software version and SyQwest, Inc.'s company information. In addition, the software will request and display Hardware/Firmware version information from the Bathy 2010's DSP to ensure it is connected and communicating properly.

5.19 SEG-Y File Storage

The B2010 system stores sub-bottom data in the industry standard SEG-Y format which was created by the Society of Exploration Geophysicists for storage of seismic information for many post processing applications.

The SEG-Y files can be stored and re-played with the B2010 system in either a "Raw" or "Processed" data format. There are a number of seismic data post processing software tools that can then be used to evaluate, modify, and process the data sets.

In Section 5.12 the SEG-Y storage file names, data type, sample size and EBCDIC header information were all identified and described which aides in starting the SEG-Y data collection process.

In this section all of the other pertinent details regarding SEG-Y data collection and the Bathy2010 system are addressed. Specifically, the proper techniques for optimum data collection are addressed along with the SEG-Y file formatting.
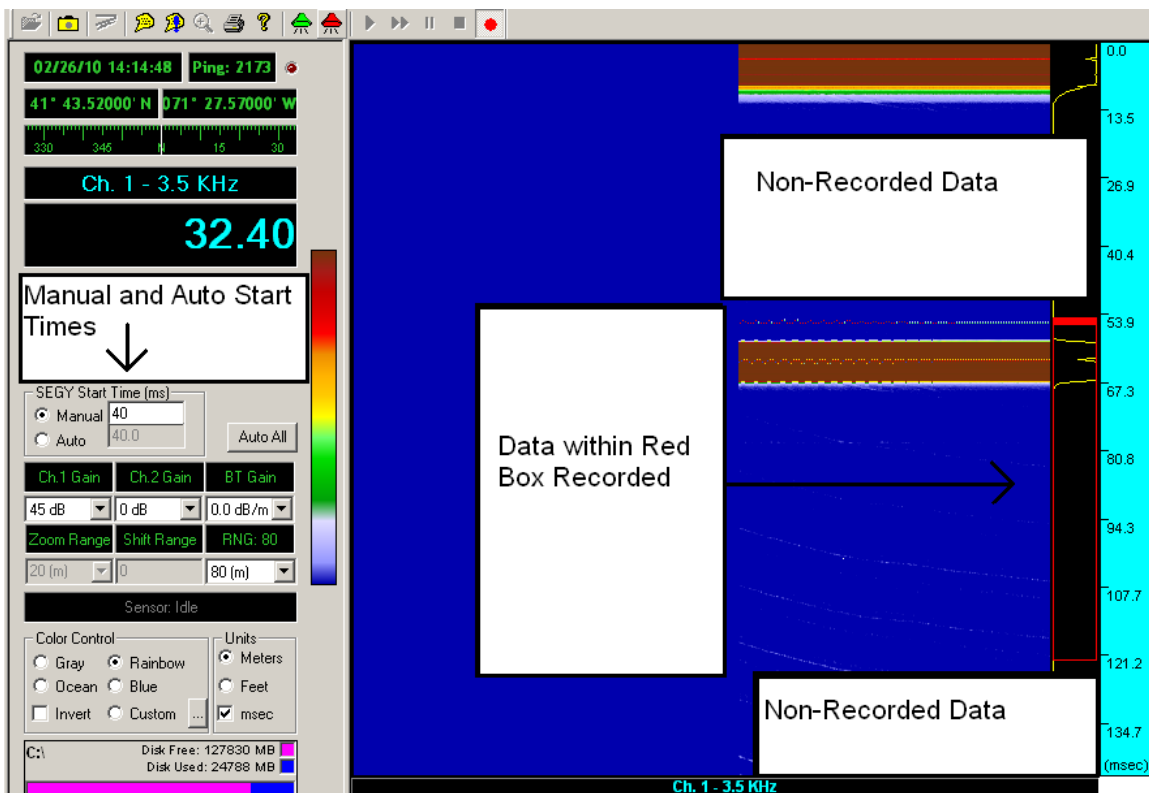
Figure 5-3 SEG-Y Data Collection Screen

When recording data in SEG-Y format the user has the options of selecting a Manual or Automatic Start time (ms). The user will also notice a red box on the right hand side of the screen.

Manual and Automatic Start Time(ms)
While the manual option is selected the user is able enter a specific recording start time in the text box or click and drag the red box to encompass the data that is desired to be recorded.(when using this option it is helpful to select the (msec) option in the unit selection box)

While in Automatic mode the user allows the application to determine the start time and the red box will automatically move to record the information from the top of the sub-bottom.

NOTE: ONLY the data contained in the area of the Red Box will be recorded, any data above or below will not be recorded.

Start Point

The Start Point refers to a specific time in samples (or milliseconds) that the SEGY data collection is initiated. The Start Point is important because there is often a significant amount of time in a ping cycle that consists of "water column data". The "water column data" is of no use to the geophysicists who interpret the data and hence this data merely burdens the system by using system bandwidth and storage space. By selecting the optimum Start Point for data collection, the user allows the system to store only the data in the region of interest for each ping cycle. Over the course of a long survey, the time and space savings is substantial.

Automatic SEG-Y start Point mode

While the automatic mode is selected the start point is determined by the depth digitizer function along with a few parameters that affect the depth offset and the rules when a valid bottom is not present. This option allows the system to continue to operate without an attentive user and keep an accurate start point. In the automatic mode the Red Box will track the bottom even as it changes rapidly. If the bottom is not detected that data will be recorded from the top of the surface to a depth of either 50 or 100 msec depending on which is selected. There are a number of issues that can affect the performance of the bottom digitizer and the proper selection of the SEGY start point is completely dependent upon the accuracy of the bottom digitizing algorithm. There are 3 distinct states for the Bottom Tracking Algorithm:

Bottom track state- This is when the bottom digitizer algorithm has acquired and is tracking a valid sea floor bottom. While in this state the start point will be in the proper location. The system should be in this state nearly all of the time while acquisition surveys are being executed.

Bottom Coast State- This state occurs when the bottom digitizer is in the track state and has NOT received a valid sea floor bottom contact within the tracking gates. When this occurs, the Bottom Digitizer transitions to the Bottom Coast state and the start point will remain at the last start point recognized by the Bottom Track state. The bottom Coast state can only occur after the Bottom Track state has been realized. When in the bottom coast state the digitizer either returns to the bottom track state if a valid bottom is found or transitions to the Bottom Lost state after a designated number of pings.

Bottom Lost State- The bottom Lost State covers all other bottom digitizer conditions. The Bottom Lost state exists when the system is started up or a range change occurs and also whenever a valid bottom return is not attainable. The start point is lost and the start time is defaulted to "0". In most cases the SEG-Y data collection will not be useful and the operator should switch to the manual start point option.

SEG-Y Manual Start Point Mode

The manual mode requires a specific start point to be selected by the user and the user must update it manually as required. This option is ideal when recording data in shallow water or specific areas of interest. A useful feature of this option is that during playback mode the contour lines of the bottom have detail to the viewer.

The Host application to Sensor interface will make sure that the start time delay value is sent as a part of a command/response sequence when it is selected and also the value will be sent with every SEG-Y data sentence that is sent from the Sensor to the Host. This start delay value is part of the SEG-Y trace header and will be stored for each trace collected.

Sample Duration
The Sample Duration is the length of time in samples (or milliseconds) that the SEGY is collected and stored for later use. For the Bathy 2010 system, sediment information can be collected for up to an effective penetration of 200 meters. The Sample Duration is selected by the user and can be set in increments of 50 milliseconds from
50 msec -> 300 msec (current system only supports 50 msec and 100 msec). Since this parameter is manually selected by the user in all applications, the information above is sufficient to allow the developer to implement the function.

Sample Duration	Effective Penetration
50 msec	37.5m
100 msec	75m

5.20 ODC to SEG-Y Conversion Tool

The ODC to SEG-Y file conversion function is accessible from the task bar under the tools section.
1.) Select the (convert file or batch convert) ODC to SEGY option
Convert a File to SEG-Y- converts a single ODC file to SEG-Y format
Batch Convert a Folder to SEG-Y- converts an entire folder of ODC files to
SEG-Y format.

2.) Select the File which you wish to convert
3.) Convert either zoom or normal(Zoom is recommended because the sub-bottom layers will contain more detail)
4.) System will prompt user to enter a SEGY File Header
5.) Playback of the file will occur

5.21 External Synchronization

External or Remote Synchronization of the B2010 system to another Sonar System is accomplished via a 2 signal interface. In most cases only 1 of the 2 signals is required to synchronize the sonars but for certain cases both signals may be used if necessary.

Most interference issues that occur between two sonars are the result of one sonar transmitting when the other sonar is receiving and vice versa. There is a simple technique that is used to synchronize the T0 transmission of both sonars so that the high energy transmit pulse for both occurs at the start of the ping cycle when the sonar receivers are both saturated with signal anyway. The sonars are synchronized by making one sonar system the "master" and the other sonar system the "slave" with respect to the T0 pulse in time.

Specifically, when the B2010 system is used along with a Multibeam system, the Multibeam system is used as the T0 "master" and the B2010 is "slaved" to the T0 of the Multibeam. The B2010 has a hardware interface for a T0 pulse to be received and will commence transmit on the edge of the T0 pulse from the multibeam sonar.

In certain cases, the customers have required that the entire B2010 data acquisition cycle be synchronized with another sonar. The T0 pulse is used in the same manner as in the simpler synchronization case but a Standby or Holdoff signal is also sent from the B2010 system to the other sonar. The other sonar will wait for the B2010 system to complete its entire data acquisition cycle and then perform an acquisition cycle of its own. This method ensures that the data collected has no interference from the other sonar but it reduces the amount of data that is collected by a factor of two.

The B2010 can support either method of operation but most users have had good success with the simpler method of sonar synchronization. Connection to the Bathy-2010PC is via the rear panel connector J3, refer to Figure 5-4 on following page.

SENSOR UNIT

CONNECTOR P/N: 6282-8SG-522

DIFF IN
- DIFF + — 1
- DIFF − — 2
- GND — 3

DIFF OUT
- DIFF + — 7
- DIFF − — 8
- GND — 4

TTL IN
- TTL — 5
- GND — 6

J3

SOLDER SIDE

EXTERNAL SYNC / KEYPULSE CONNECTOR WIRING DIAGRAM
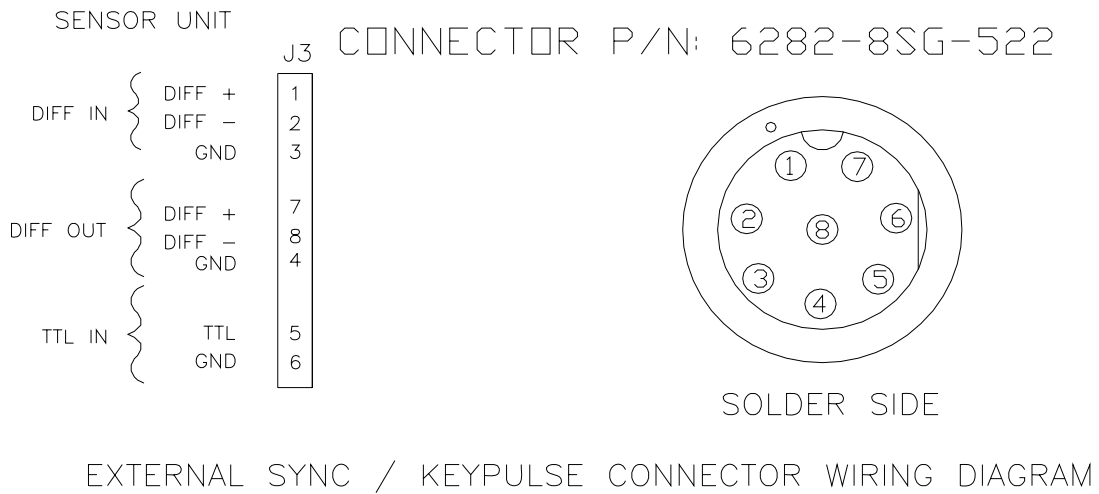
Figure 5-4 External Sync Wiring

6.0 (DATA LOGGER) SERIAL INPUT/OUTPUT PROTOCOL

6.1 Digitized Depth

The BATHY-2010 provides digitized depth and operating mode parameter data via an RS-232 serial output. This serial ASCII data output string can be programmed by the operator via the Serial Port Communication menu under the Data Logger tab to provide one of four types of fixed string length outputs. The first type of string contains digitized depth and time/date tags while the second type of string contains this information plus encoded operating parameter data. The operator can disable serial output data transmission via the operating mode menu upon demand. The serial port is full duplex and allows the user to input a data string for chart annotation and to set system time/date. The following is a synopsis of the Data Logger Serial I/O Protocol for both single and dual channel sounders.

Hardware Characteristics (All Data Formats)

Data Bits Per ASCII Character	User Selectable
Start Bits	User Selectable
Parity	User Selectable
Stop Bits	User Selectable
Baud Rate	User Selectable
Voltage Levels	RS-232

6.1.1 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   Dual Frequency Operation
_D T_ _ x x x x . x _FT <CR><LF>   _D T_f _ x x x x . x _FT <CR><LF>   (English mode)
_D T_ _ x x x . x x _MT <CR><LF>   _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.

6.1.2 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)

6.1.3 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

6.1.4 Depth Only Output String (34 ASCII Characters)

;FDDDDD.DUN@MM/DD/YY,HH:MM:SS.SS<CR><LF>
;   start of string character
F   valid digitized bottom flag for LOW FREQ channel
                    I=invalid or lost bottom
                    V=valid digitized bottom
DDDDD.D   digitized depth in selected units for LOW FREQ channel
                    5 significant digits to the left of the fixed decimal point and 1 digit to the right
UN   units in feet(FT),meters(ME),or fathoms(FA)
@   date tag delimiter
MM/DD/YY   date in month/day/year format
,   time tag delimiter

HH:MM:SS.SS time in hours/minutes/seconds/hundreths format

<CR><LF>   end of string sequence carriage return/line feed

6.1.5 All Data Output String (90 ASCII Characters)

;FDDDDD.DUN@MM/DD/YY,HH:MM:SS.SS PWX PFX SFX PLX MOX SBX POX TXX   TRX
GMX SSSS DD.D -BB.B<CR><LF>

;	start of string character
F	valid digitized bottom flag
	I=invalid or lost bottom
	V=valid digitized bottom
DDDDD.D	digitized depth in selected units
	5 significant digits to the left of the fixed decimal
	point and 1 digit to the right
UN	units in feet(FT),meters(ME),or fathoms(FA)
@	date tag delimiter
MM/DD/YY	date in month/day/year format
,	time tag delimiter

HH:MM:SS.SS time in hour/minute/second format

space delimiter

PWX   transmit pulse window type
X=1 Rectangular
X=2 Hamming
X=3 Cosine
X=4 Blackman

space delimiter

PFX   primary transmit frequency
X=1 3.5 Khz
X=2 12.0 Khz
x=3 16.0 Khz or 18 Khz (system dependent)
x=4 33.0 Khz or 34 Khz (system dependent)
x=5 Dual Channel LO/HI

space delimiter

SFX   synchronization source
                  X=1 Internal
                  X=2 External

       space delimiter

PLX   transmit pulse length
                   transmit mode=CW
                  X=1 200 usec
                  X=2 500 usec
                  X=3 1 msec
                  X=4 2 msec
                  X=5 5 msec
                  X=6 10 msec
                  X=7 25 msec
                  transmit mode=FM
                  X=1 5 msec
                  X=2 10 msec
                  X=3 25 msec
                  X=4 50 msec

       space delimiter

MOX   system operating mode
                  X=1 CW parametric
                  X=2 CW
                  X=3 FM parametric
                  X=4 FM

space delimiter

SBX   frequency sweep bandwidth
                  X=1 1 Khz
                  X=2 2 Khz
                  X=3 4 Khz

       space delimiter

POX   transmit power level

X=0 0 dB	X=4 -24 dB	X=8 OFF
X=1 -6 dB	X=5 -30 dB	
X=2 -12 dB	X=6 -36 dB	
X=3 -18 dB	X=7 -42 dB	

Software Protocol (Cont.)

     space delimiter

TXX   transmit mode
               X=1 single ping active
               X=2 pinger listen
               X=3 multiping TR
               X=4 multiping TTRR
               X=5 multiping TTTRRR
               X=6 multiping TTTTRRRR
               X=7 multiping TTTTTRRRRR

     space delimiter

TRX   transmit rate
               X=3 4 Hz
               X=4 2 Hz
               X=5 1 Hz
               X=6 .5 Hz
               X=7 .33 Hz
               X=8 .25 Hz
               X=9 .20 Hz
               X=: .10 Hz
               X=; .05 Hz

     space delimiter

GMX   system gain mode
               X=0 hydrographic AGC
               X=1 thru 9 hydrographic +3dB thru +27dB manual
               X=ASCII A thru D hydrographic +30 thru + 60 dB manual
               X=ASCII E thru K sub-bottom 1 thru sub-bottom 7

     space delimiter

SSSS   speed of sound in selected units

     space delimiter

DD.D   draft setting in selected units to nearest tenth

space delimiter
Software Protocol (Cont.)

-BB.B   background noise level in fixed point referenced to dB/V

<CR><LF>   end of string sequence carriage return/line feed

Software Protocol for Dual Channel Echosounders

6.1.6 Depth Only Output String (60 ASCII Characters)

;FDDDDD.DUNEEE.E,FDDDDD.D,EEE.E,SHHHH@MM/DD/YY,HH:MM:SS.SS<CR><LF>

;   start of string character
F   valid digitized bottom flag for LOW FREQ channel
                       I=invalid or lost bottom
                       V=valid digitized bottom
DDDDD.D   digitized depth in selected units for LOW FREQ channel
                       5 significant digits to the left of the fixed decimal point and 1 digit to the
right
UN   units in feet(FT),meters(ME),or fathoms(FA)
EEE.E   echo strength value in dBs for LOW FREQ channel
,   high freq channel data delimiter
F   valid digitized bottom flag for HIGH FREQ channel
                       I=invalid or lost bottom
                       V=valid digitized bottom
DDDDD.D   digitized depth in selected units for HIGH FREQ channel 5 significant digits to the
                       left of the fixed decimal point and 1 digit to the right
,   data delimiter
EEE.E   echo strength value in dBs for HIGH FREQ channel
,   heave data delimiter
S   heave data sign (" " for + heave, "-" for - heave)
HHHH   heave data in centimeters
@   date tag delimiter
MM/DD/YY   date in month/day/year format
,   time tag delimiter
HH:MM:SS.SS time in hours/minutes/seconds/hundreths format
<CR><LF>   end of string sequence carriage return/line feed

6.1.7 All Data ASCII Output String (115 ASCII Characters)

;FDDDDD.DUNEEE.E,FDDDDD.D,EEE.E,SHHHH@MM/DD/YY,HH:MM:SS.SS
PWX PFX SFX PLX MOX SBX POX TXX TRX GMX SSSS DD.D -BB.B<CR><LF>

;	start of string character
F	valid digitized bottom flag for LOW FREQ channel
	I=invalid or lost bottom
	V=valid digitized bottom
DDDDD.D	digitized depth in selected units for LOW FREQ channel 5 significant digits
	to the left of the fixed decimal point and 1 digit to the right
UN	units in feet(FT),meters(ME),
EEE.E	echo strength value in dBs for LOW FREQ channel
,	high freq channel data delimiter
F	valid digitized bottom flag for HIGH FREQ channel
	I=invalid or lost bottom
	V=valid digitized bottom
DDDDD.D	digitized depth in selected units for HIGH FREQ channel 5 significant
	digits to the left of the fixed decimal point and 1 digit to the right
,	data delimiter
EEE.E	echo strength value in dBs for HIGH FREQ channel
,	heave data delimiter
S	heave data sign (" " for + heave, "-" for - heave)
HHHH	heave data in centimeters
@	date tag delimiter
MM/DD/YY	date in month/day/year format
,	time tag delimiter
HH:MM:SS.SS	time in hours/minutes/seconds/hundreths format
	space delimiter

PWX	transmit pulse window type
	X=1 Rectangular
	X=2 Hamming
	X=3 Cosine
	X=4 Blackman

space delimiter

PFX	primary transmit frequency
	X=1 3.5 Khz
	X=2 12.0 Khz
	x=3 16.0 Khz or 18 Khz (system dependent)
	x=4 33.0 Khz or 34 Khz (system dependent)
	x=5 Dual Channel LO/HI

Software Protocol for Dual Channel Echosounders (Cont.)

     space delimiter

SFX   synchronization source
               X=1 Internal
               X=2 External

     space delimiter

PLX   transmit pulse length

               transmit mode=CW
               X=1 200 usec
               X=2 500 usec
               X=3 1 msec
               X=4 2 msec
               X=5 5 msec
               X=6 10 msec
               X=7 25 msec

               transmit mode=FM
               X=1 5 msec
               X=2 10 msec
               X=3 25 msec
               X=4 50 msec

     space delimiter

MOX   system operating mode
               X=1 CW parametric
               X=2 CW
               X=3 FM parametric
               X=4 FM

     space delimiter

SBX   frequency sweep bandwidth
               X=1 1 Khz
               X=2 2 Khz
               X=3 5 Khz

     space delimiter

Software Protocol for Dual Channel Echosounders (cont.)

POX   transmit power level
                  X=0 0 dB   X=4 -24 dB   X=8 OFF
                  X=1 -6 dB   X=5 -30 dB
                  X=2 -12 dB   X=6 -36 dB
                  X=3 -18 dB   X=7 -42 dB

        space delimiter

TXX   transmit mode
                  X=1 single ping active
                  X=2 pinger listen
                  X=3 multiping TR
                  X=4 multiping TTRR
                  X=5 multiping TTTRRR
                  X=6 multiping TTTTRRRR
                  X=7 multiping TTTTTRRRRR

        space delimiter

TRX   transmit rate
                  X=3 4 Hz
                  X=4 2 Hz
                  X=5 1 Hz
                  X=6 .5 Hz
                  X=7 .33 Hz
                  X=8 .25 Hz
                  X=9 .20 Hz
                  X=: .10 Hz
                  X=; .05 Hz

        space delimiter

GMX   system gain mode
                  X=0 hydrographic AGC
                  X=1 thru 9 hydrographic +3dB thru +27dB manual
                  X=ASCII A thru D hydrographic +30 thru + 60 dB manual
                  X=ASCII E thru K sub-bottom 1 thru sub-bottom 7

        space delimiter

Software Protocol for Dual Channel Echosounders (cont.)

SSSS   speed of sound in selected units

    space delimiter

DD.D   draft setting in selected units to nearest tenth

    space delimiter

-BB.B   background noise level in fixed point referenced to dB/V

<CR><LF>   end of string sequence carriage return/line feed

6.2 SEGY File Storage Format

6.2.1 SEGY File Header Information

C1   80 ASCII Bytes per line. All lines are prefixed with "C nn".
        The first three lines are reserved for SyQwest use.

C40   End Textual Header

Total of 3200 bytes within this header.
One header per file.

6.2.2 Reel Identification Header Part2

Byte #   Description

Byte #	Description
3200-3204	job id=1
3205-3208	line =0
3209-3212	reel=1
3213-3214	traces/record=1
3215-3216	aux traces/record=0
3217-3218	sample interval in microseconds=60
3219-3220	sample interval in microseconds=60
3221-3222	number of samples within a data trace
3223-3224	number of samples within a data trace
3225-3226	fixed point representation (2 bytes)=3
3233-3234	sweep frequency at start of sweep=2750

3235-3236	sweep frequency at end of sweep=3750,4750or 6750 Hz
3237-3238	sweep length=25,50 or 100 mSec.
3239-3240	sweep type,linear=1
3249-3250	correlated=2
3251-3252	binary gain recovered=2 ,no
3253-3254	amplification recovery record=1,none
3255-3256	units:1=meters,2=feet

6.2.3 Trace Identification Header

<u>Byte #</u>   <u>Description</u>

5-8	trace sequence number this reel
49-52	source depth
61-64	water depth at source
73-76	longitude coordinate 32 bit floating point
77-80	latitude coordinate 32 bit floating point
109-110	delay to recording time in mSec
127-128	start sweep frequency=2750
129-130	end sweep frequency=3750,4750 or 6750 Hz.
131-132	sweep length=25,50,100 msec.
157-158	year
159-160	day of year
161-162	hour
163-164	minute
165-166	second
201-240	trace annotation
241-x	trace data samples
x to x+320	playback parameters

6.3 Navigation Input

The Bathy 2010 accepts ship's position and heading interface via serial data from several external devices including DGPS Positioning Systems and Heave Compensators. The position and heading data is displayed on the BATHY-2010 main display and is stored to the hardrive or network storage for playback when storage is being utilized.   There are currently three selectable software protocols available via the Serial Port Configuration Menu under the Navigation tab. PMC, GGA and GLL. The hardware characteristics are the same for all three and are exhibited below:

<u>Hardware Characteristics</u>

Data Bits Per ACSII Character	User Selectable
Start Bits	User Selectable

Parity	User Selectable
Stop Bits	User Selectable
Baud Rate	User Selectable
Voltage Levels	RS-232

RMC - NMEA has its own version of essential gps pvt (position, velocity, time) data. It is called RMC, The Recommended Minimum, which will look similar to:

$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A

Where:
    RMC   Recommended Minimum sentence C
    123519   Fix taken at 12:35:19 UTC
    A   Status A=active or V=Void.
    4807.038,N Latitude 48 deg 07.038' N
    01131.000,E Longitude 11 deg 31.000' E
    022.4   Speed over the ground in knots
    084.4   Track angle in degrees True
    230394   Date - 23rd of March 1994
    003.1,W   Magnetic Variation
    *6A   The checksum data, always begins with *

GLL - Geographic Latitude and Longitude is a holdover from Loran data and some old units may not send the time and data active information if they are emulating Loran data. If a gps is emulating Loran data they may use the LC Loran prefix instead of GP.

  $GPGLL,4916.45,N,12311.12,W,225444,A,*31

Where:
    GLL   Geographic position, Latitude and Longitude
    4916.46,N   Latitude 49 deg. 16.45 min. North
    12311.12,W Longitude 123 deg. 11.12 min. West
    225444   Fix taken at 22:54:44 UTC
    A   Data Active or V (void)
    *31   checksum data

GGA - essential fix data which provide 3D location and accuracy data.

 $GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,*47

Where:
   GGA   Global Positioning System Fix Data
   123519   Fix taken at 12:35:19 UTC
   4807.038,N   Latitude 48 deg 07.038' N
   01131.000,E Longitude 11 deg 31.000' E
   1   Fix quality: 0 = invalid
                    1 = GPS fix (SPS)
                    2 = DGPS fix
                    3 = PPS fix
                        4 = Real Time Kinematic
                        5 = Float RTK
                  6 = estimated (dead reckoning) (2.3 feature)
                        7 = Manual input mode
                        8 = Simulation mode
   08   Number of satellites being tracked
   0.9   Horizontal dilution of position
   545.4,M   Altitude, Meters, above mean sea level
   46.9,M   Height of geoid (mean sea level) above WGS84
           ellipsoid
   (empty field) time in seconds since last DGPS update
   (empty field) DGPS station ID number
   *47   the checksum data, always begins with *

6.4 Heave Data

The BATHY-2010 system provides a serial data channel for receiving heave information from a Ship's Motion Sensor or Vertical Reference Unit. For high resolution survey requirements the heave input is used to correct the digitized depth values and the real time sounding data for the vertical motion of the vessel. The Heave value is displayed on the system video monitor as well.

The user can configure and enable the ship's motion serial interface as required under the Serial Port Communication menu under the Heave tab and will use the data for depth processing. The serial data format for the motion data output is based on the serial output of a VT/ TSS DMS-5 Roll-Pitch-Heave Sensor.

The transmission format for the serial data channel is exhibited below:
Transmission Format

Data Bits Per ACSII Character	User Selectable
Start Bits	User Selectable
Parity	User Selectable
Stop Bits	User Selectable
Baud Rate	User Selectable
Voltage Levels	RS-232

Software Protocol

:XXXXXXSMHHHHXXXXXXXXXXXX<CR><LF>

-Note-
"S" in the above string is always a data delimiter
"X" is a don't care, however, it must be filled with data

:	Record Start Character
XXXXXX	Don't Cares (Not used by BATHY-2010)
M	Sign of Heave (<SP> if positive, else "-")
HHHH	Real-Time Heave in CM
XXX-->X	All X's are Don't Cares (Not used by BATHY-2010)
<CR><LF>	Carriage Return, Line Feed Record End Characters

7.0 EQUIPMENT SPECIFICATIONS

The following paragraphs will address the BATHY-2010PC equipment design specifications and operating characteristics.

7.1 Bathy 2010PC Specifications

|	
Units	**Feet or Meters**
Depth Ranges	**30, 60, 120, 240, 480, 800, 1500, 2400, 3000, 6000, 15000 Feet** **10, 20, 40, 80, 150, 300, 500, 750, 1000, 2000, 5000 Meters**
Shift Range	**0-450 Feet in 1 Foot increments** **0-150 Meters in 1 Meter increments**
Zoom Range	**15, 30, 60, 120, 240, 480, Feet** **5, 10, 20, 40, 80, 160, Meters**
Zoom Modes	**Bottom Zoom, Bottom Lock Zoom, 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**
Strata Resolution	**8 cm with >300 Meters of bottom penetration (bottom type dependant)**
Depth Resolution	**0.1 Feet, 0.1 Meters**
Depth Accuracy	**Meets or exceeds all current IHO hydrographic requirements for single beam echosounders. 0-40m 2.5cm, 40-200m 5.0cm, >200m 10.0cm; or +/- .1%of depth corrected for sound velocity.**
Speed of Sound	**User Selectable 1500 Meters/Second, 4800 Feet/Second, adjustable in increments of 1m/sec or 1ft /sec**
Geographic Position	**NMEA 0183, GLL, GGA, RMC, VTG, VHW, HDT** **Selectable Baud Rates (RS-232): 4800, 9600, 19200, 38400**
Printer Output	**Centronics (Parallel Port) interface to TDU Series Thermal Printers**
Shallow Water Operation	**< 1 Meter; bottom type 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) & Standard SEG-Y 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 and a Playback Scroll Bar for ease of file playback.**
Frequency Output	**3.5 to 200 KHz**
Transmit Output Power	**4KW (Pulsed, maximum) *5KW option available, contact sales for more**
Input Power	**12-30 Volts DC, Nominal power 75 Watts** **110/220 VAC with optional adapter (*100/240 VAC when 5KW option is installed)**
Dimensions	**Depth 37.51 cm (14.63"), Width 48.26cm (19"), and Height 13.33 cm (5.25").** **55.88 x 54.61 x 19.68cm (22" x 21.5" x7 75") external case dimensions**
Weight	**8.16kg (18 lbs) electronics unit (32lbs including case)**
Environmental	**0 to 50 degrees C Operating Temperature 0 to 95° non-condensing**
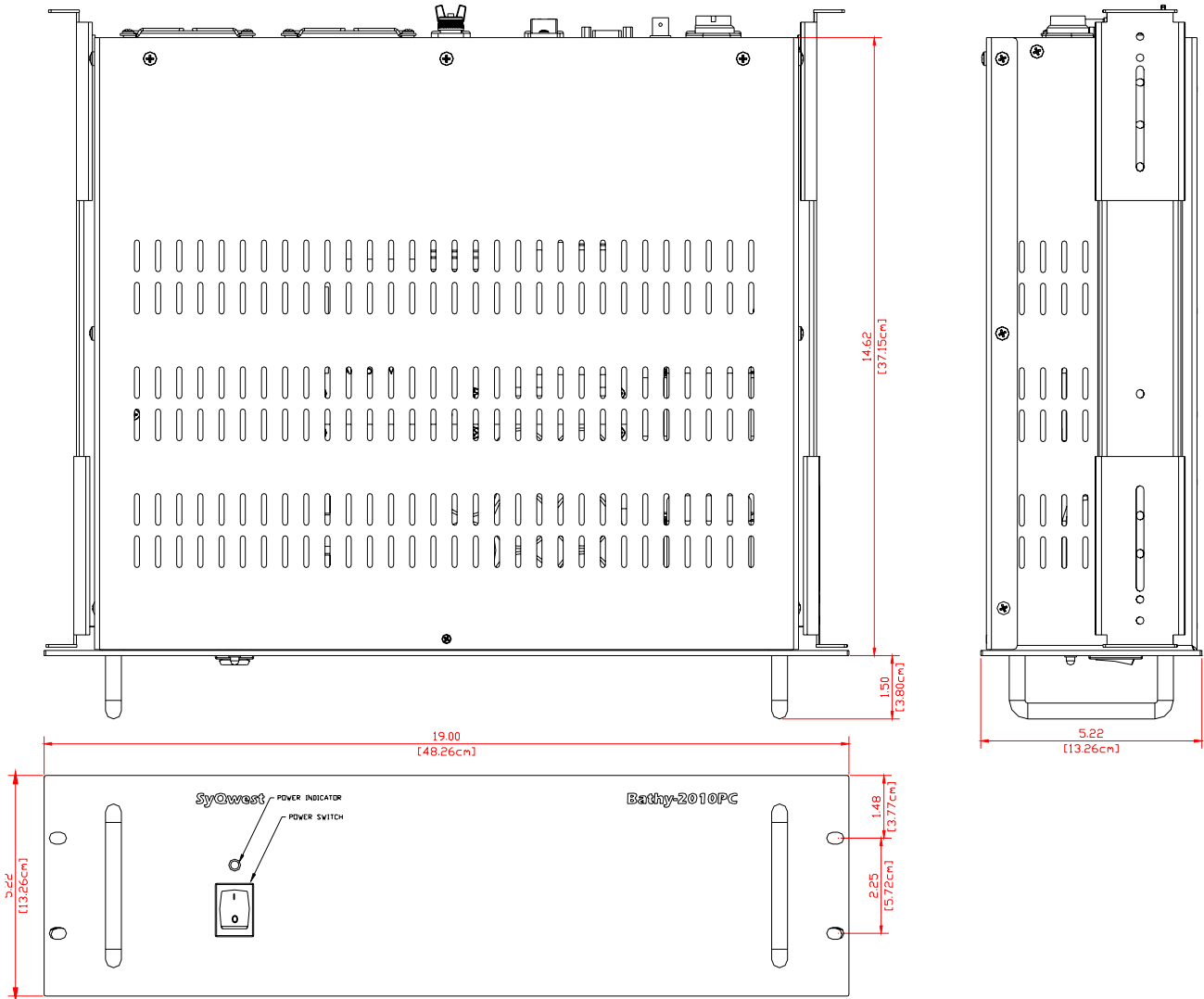
Figure 7-1 Bathy 2010pc Dimensions

8.0 MAINTENANCE

8.1 POST (Power On Self Test)

Each time power is applied to the Bathy-2010PC 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 any of the Tests fail, one of the 8 Green LEDs on the DSP CCA will remain illuminated. Note that during POST all 8 of the Green LEDs will flash once to indicate that the associated tests have been run. If one of the LED's remains illuminated, and the blue LED does not flash at a 1Hz rate, the Bathy-2010PC Sensor will not be operational and the user should contact SyQwest's Support Dept. for assistance.   The Sensor may just need to have its flash reprogrammed but SyQwest should be notified anyway. The Bathy-2010PC PC Software will detect a problem with the Sensor as well.   The problem will show up on the GUI in the System Status window as a "Sensor State Unknown" or other error condition.

If the Sensor passes these tests, the blue LED on the DSP CCA (visible through slots in top cover of Sensor Unit) will blink at 1 Hz indicating that it's working and waiting for communication with the PC and Bathy-2010PC PC Software.

8.2 Firmware Update

The Bathy-2010PC Sensor is a self-contained unit and has it's own set of Firmware. Periodically, SyQwest may offer Sensor Firmware upgrades which add new features and functionality. This section describes the process involved in updating that firmware.

8.3 Firmware Update Connection

The Bathy-2010PC Sensor Firmware requires a user supplied 9 pin D to 9 pin D serial data cable to be connected from the Host PC to the Sensor (J6). The Sensor is connected to the COM1 port on the Host PC.

8.4 Firmware Update Process

Get the latest version of the Bathy-2010PC Firmware from SyQwest and copy the file onto the appropriate memory device so it can be accessed by the Bathy-2010PC Host Computer. The format for the file should be as follows: EBOX_V61D.hex. The Firmware Version Number is the "61" and the "S" indicates a Single Channel System (a "D" in this location is for Dual Channel Systems). Then perform the following step to update the Bathy-2010PC Sensor Firmware.

1. Start up the current Bathy-2010PC Host Application and go to the "Help" menu selection. Then select "About Bathy-2010PC". When the dialog box appears with the version information, write down the current Firmware Version number (i.e. 61, 62). The .hex file from step 1 above should have a higher number than the current Firmware Version number.

2. Exit the Bathy-2010PC Host Application and cycle power on the Bathy-2010PC Sensor Unit.

3. Connect a Serial Cable from J6 on the Bathy-2010PC Sensor Unit to the COM1 port on the Host PC.

4. After the reboot is complete, find the DSP Firmware Flasher Application either on the Desktop or from the "All Programs" selection under Syqwest, Bathy-2010PC. (Start>Programs>SyQwest>Bathy-2010PC>Util)

5. When the DSP Firmware Flasher program is started, the Windows Host and the Sensor will communicate via the selected serial port. The communication is logged to the display and should look like the figure below.
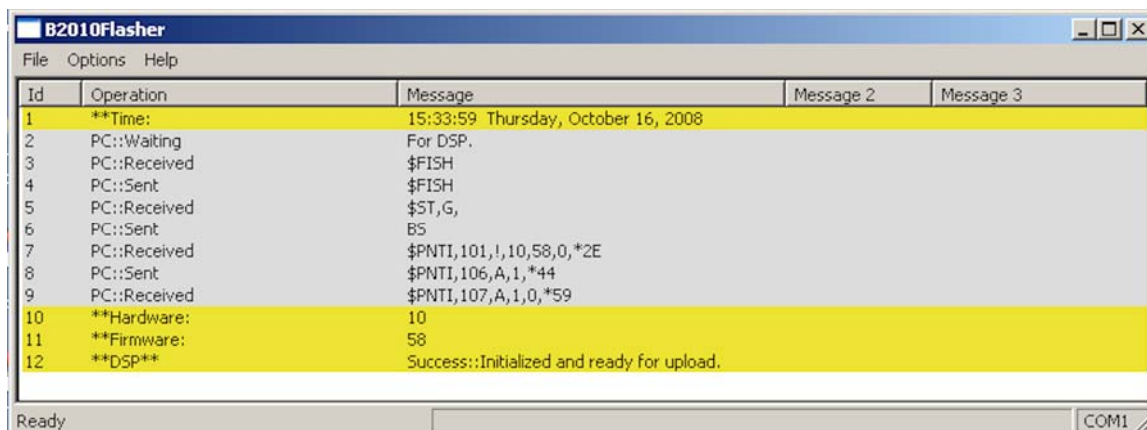
6. Once the communication has been established, select File, and Upload Firmware. You will be prompted to select a file so you will need to browse to the location where the (firmware) hex file from step 1 is located.

7. Select the file and hit OK. **Do not do anything with the Host computer or the sensor during the Firmware download sequence.** It will take about 2-5 minutes depending on the speed of your PC.

8.   A message will appear when the update is complete. Sometimes it reports an error, *but it is always okay, ignore the error*.

9.   Cycle power on the system and check the Firmware Version as described in step 2 above. The Firmware version number should reflect the number on the .hex file in step 1.

10. The Firmware update is complete.

8.5 Transducer Impedance Test

The transducer impedance may be tested previous to installation or after installation by using the following equipment and procedures.

Test equipment required:

• Dual channel oscilloscope.

• Signal generator,10 VRMS, frequency range up to 200 khz

• Decade resistor box,0-500 ohms in 1 ohm steps
Impedance measurement should be made under the following conditions to prevent damage:

• Transducer immersed under water

• Impedance of transducer should be predominantly resistive
Connect the transducer as per the Figure 8-1
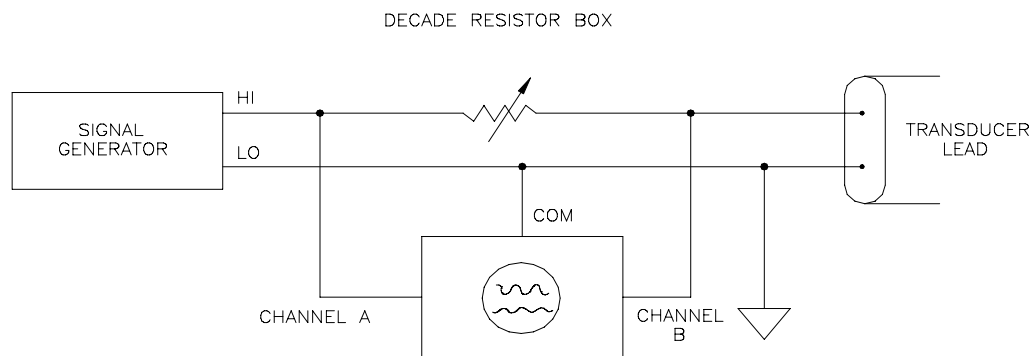
Figure 8-1 TRANSDUCER IMPEDANCE TEST DIAGRAM

Step 1   Set the signal generator for approximately 10 VRMS output at the center frequency of the transducer.
Step 2   Measure the signal generator output with channel A.
Step 3   Measure the voltage drop across the transducer with channel B.
Step 4   Adjust the decade resistor box so that channel B is exactly one half of channel A.
Step 5   Read the value of the decade resistor box. This value is the resistance of the transducer.

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9.0 General Information

General Transducer

The Bathy-2010PC 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.

9.1 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 Bathy-2010PC 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.

9.2 Handling Transducers

The transducer is the heart of the Bathy-2010PC 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.

9.3 Portable Transducer Installation

Portable installations of the Bathy-2010PC transducer for most survey vessels will be of the over-the-side pipe mount type. This type of installation is achieved with items listed, or similar to the following list of materials: (* denotes optional items, not supplied with standard system)

| Part Number	Item	Quantity
* P04515	Bathy-2010PC Transducer , 200Khz 10 deg	1
* P01735	Over the Side Mount (OTSM) Assembly (for P04515 above) (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 9-1 Portable Transducer Installation Parts
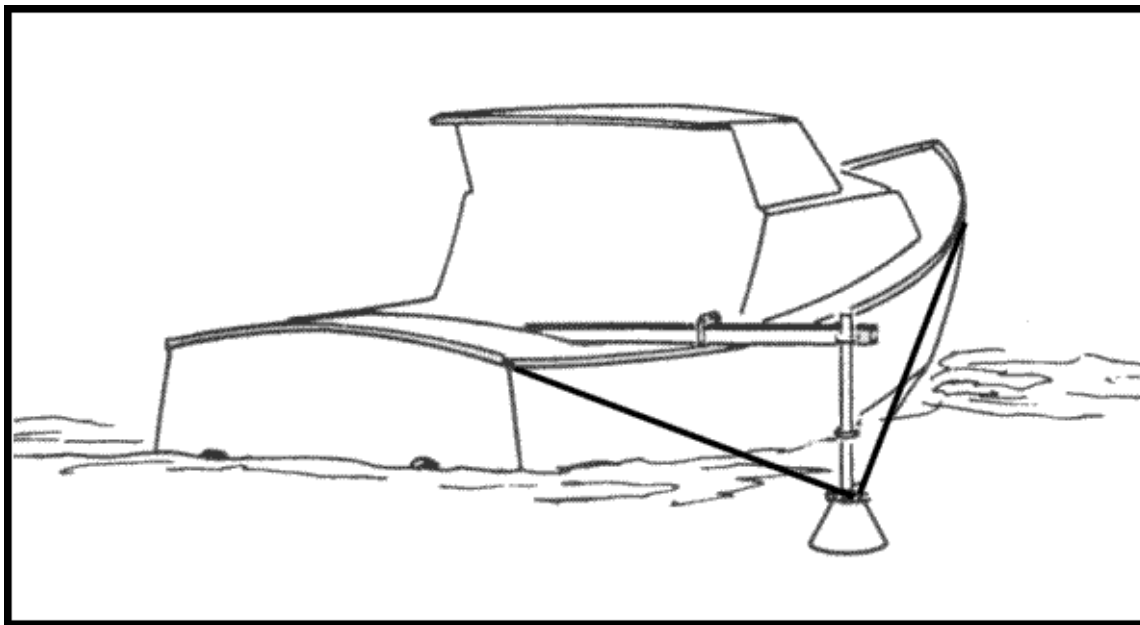
Figure 9-1 Typical Over the Side Mount (reference drawing)

Refer to **Figure 9-1** above while reading and implementing the Installation procedure listed below.

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

Figure 9-2 Over The Side Transducer Mounting Picture

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

Typical Transducer Installation Procedure:

1. Apply silicone grease or petroleum jelly to the threads of the pipe to facilitate later disassembly.
   DO NOT GET ANY GREASE ON THE TRANSDUCER FACE
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.

9.3.1 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.

9.4 Permanent Transducer Installation

For some applications it may be necessary and/or convenient to mount the Bathy-2010PC Transducer permanently in the hull of the vessel. Due to the construction of the Bathy-2010PC 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.

9.5 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.syqwestinc.com, or contact us directly.

SYQWEST, INC.
http:www.syqwestinc.com   tech-support@syqwestinc.com

END OF MANUAL