IMAGENEX TECHNOLOGY CORP.

Model 837/A/B DeltaT
Multibeam Sonar System

"DeltaT.exe"
version 1.04.xx

Number	430 - 021	
Revision	**Date**	**Description**
0C	July 05, 2011	Initial internal release
00	July 20, 2011	Official release
01	July 25, 2011	Updated Appendix D, External Trigger information
02	July 30, 2012	Added Optional sensor calibration

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1.0 Introduction

The Model 837 DeltaT is an advanced high-speed, high-resolution multibeam sonar system that has been designed to provide simple, reliable, and accurate representation of underwater images.

The system consists of an underwater sonar head connected by Ethernet directly to a PC type computer and 24 Volt power supply. In the typical installation the power supply and PC are supplied by the customer. The cable which comes with the unit has a wet mate-able connector for the sonar side, and a standard RJ45 connector for the Ethernet. The cable is currently made up with bare wires for power, red goes to positive, black to negative. The sonar head draws approximately 0.2 A at 24 Volts, and we recommend a 1.0 Amp power supply. While there are various designs and configurations available to suit any requirement, there are two main variations of the DeltaT- Profilers, and Imagers.

This document covers both types of DeltaT's. Information that is common to both types of sonar's are covered with chapters dedicated to profilers and imagers respectively.

The profiling sonar has a narrow vertical beam, which is oriented fore-aft, and a wide horizontal beam port-starboard. They are generally used for surveying.
The imaging sonar has a wider vertical beam than the profiler but has the same wide horizontal beam. They are generally used for navigation.

2.0 Getting Started:

The DeltaT was designed to be user friendly and simple to set up in the field. It is generally recommended however to perform a preliminary setup before heading out into the field. Refer to **sections 2.1.1** through **2.1.3.2** for details on installation of the DeltaT system.

2.1 Step-By-Step Start Up Guide

1. Physically mount the sonar referring to **section 2.1.1** on **page 2** for details.
2. Ensure the power supply is providing +24Vdc.
3. Turn the power supply off.
4. Connect the Red wire from the cable to the +ve connection on the power supply.
5. Connect the Black wire from the cable to the -ve connection on the power supply.
6. Connect the RJ45 (looks like a large telephone connector) to the PC's network card.
7. Plug the underwater connector to the sonar.
8. Turn on the power supply.
9. Referring to **Appendix B – Ethernet Setup Guide**, configure the network cards IP address.
10. Launch the DeltaT.exe program

    - If file playback is desired, use the menu command "*File->DataFrom->File*" .
    - If real-time operation is desired, use the menu command "*File->DataFrom->Head*" .

2.1.1 Hardware Installation

2.1.1.1 Profiling Sonars

For producing sensible profiles of the seabed, the sonar head should be mounted with the transducers down (the transducers are in the Gray plastic). If the transducer position setting is incorrect, port-side data will be displayed on the starboard and vice-versa. The 'up/down' setting in software can be switched if the sonar must be mounted the opposite way.

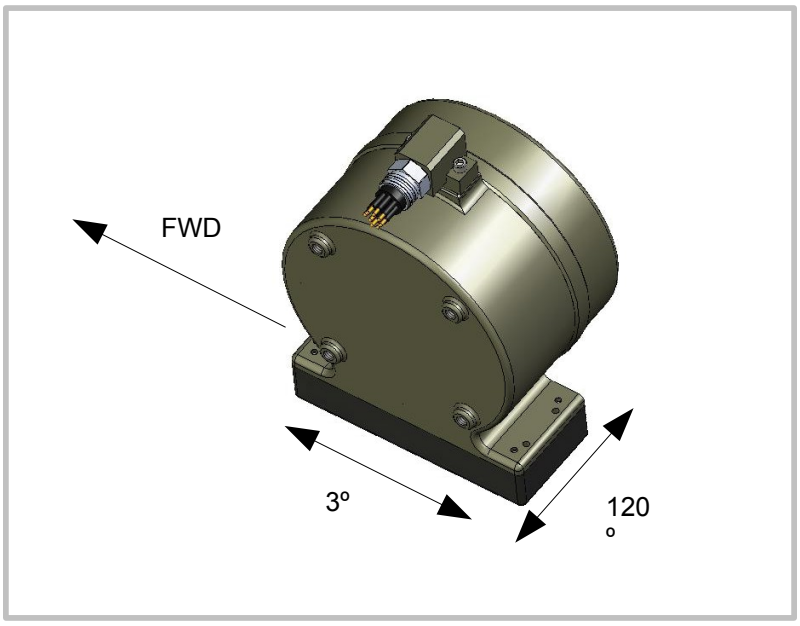


Figure 1: Orientation of the 837 sonar head for profiling applications.

Figure 1 ,above, shows the 837 profiling sonar with the connector pointing to the left or port side. Use the **Xdcr Position = Down** setting in the menu.

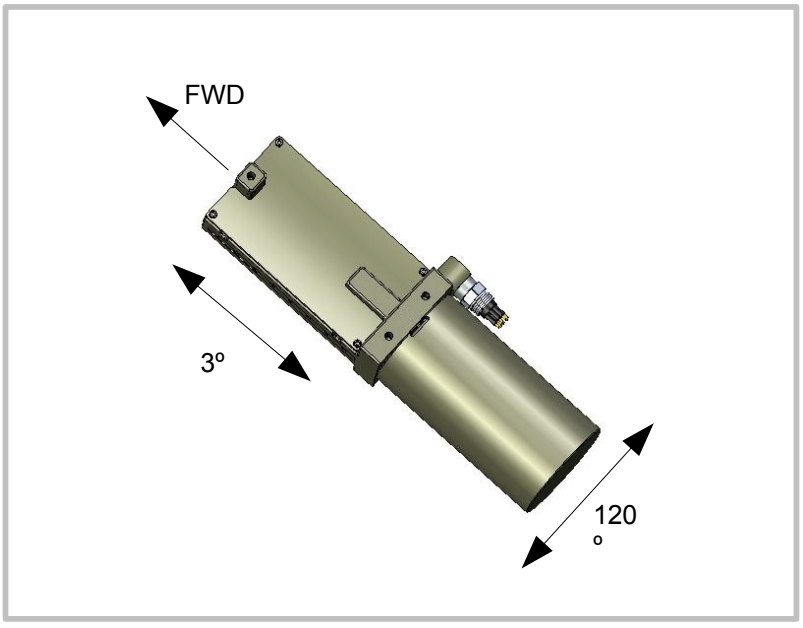


Figure 2: Orientation of the 837A sonar head for profiling applications.

Figure 2, above, shows the 837A profiling sonar with the connector on the right side. Use the **Xdcr Position= Up** setting in the menu.

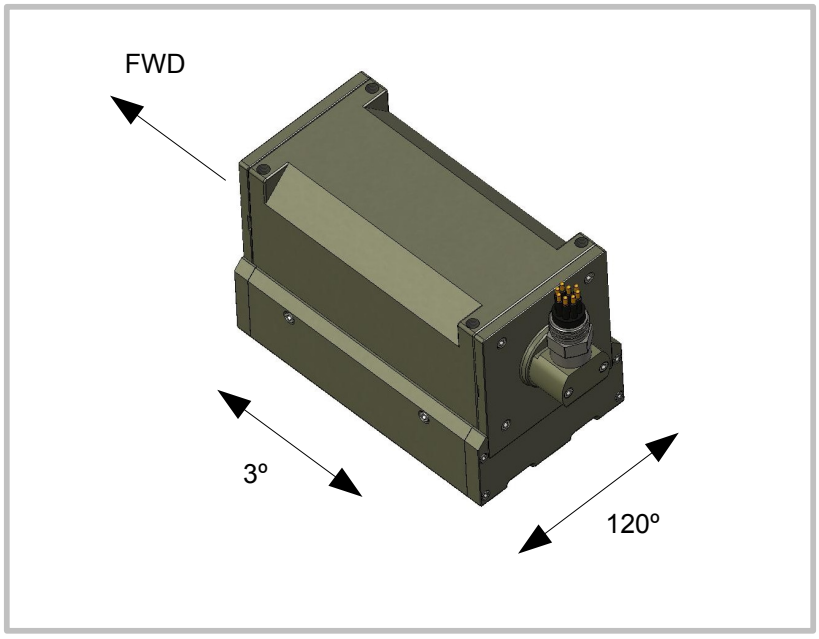


Figure 3: Orientation of the 837B sonar head for profiling applications.

Figure 3, above, shows the 837B profiling sonar with the connector on the Aft side. Use the **Xdcr Position= Down** setting in the menu.

2.1.1.2 Imaging Sonars

For producing sensible images, the sonar head should be mounted with the transducers forward (the transducers are in the Gray plastic). Refer to **Figure 4** for the Xdcr Position setting for your installation. If the Xdcr Position setting is incorrect, the image will be "flipped" left to right. The 'up/down' setting in software can be switched if the sonar must be mounted the opposite way.

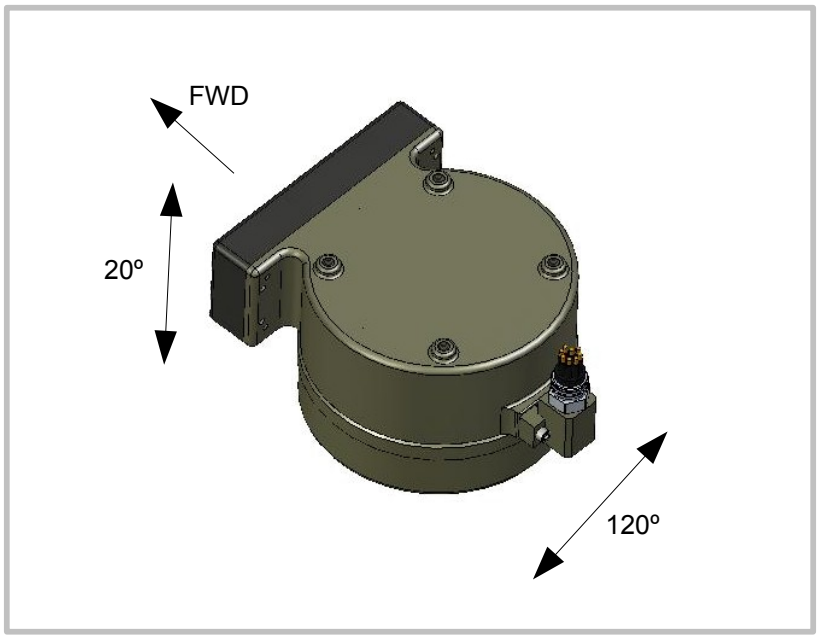


Figure 4: Orientation of the 837 sonar head for imaging applications.

Figure 4, above, shows the 837 imaging sonar with the connector pointing up. Use the **Xdcr Position = Down** setting in the menu.

2.1.2 Electrical Connection

The DeltaT system consists of an underwater sonar head connected by Ethernet directly to a PC type computer and a **24V$_{dc}$** power supply. In the typical installation the power supply and PC are supplied by the customer. The cable which comes with the unit has a wet mate-able connector for the sonar side, and a standard RJ45 connector for the Ethernet. The cable is currently made up with bare wires for power, red goes to positive, black to negative. The sonar head uses approximately 0.2 A at 24 Volts, and a **1.0A** power supply is recommend. To operate the sonar head, connect the RJ45 Ethernet connector from the sonar head cable into the LAN (Local Area Network) card on your PC

2.1.3 Software Setup

Refer to the **Step-By-Step Start Up Guide** on **page 1**, supplied with this manual, for a concise description of the initial connection and installation procedures of the DeltaT.

The requirements for the user supplied PC are: Windows XP©, Windows Vista©, or Windows 7©, an available Ethernet port, and at least 2 GHz Pentium IV processor. Standard software screen resolution is 1024x768. The sonar head needs to run with a static IP (Internet Protocol) address for both head and PC. The IP Address of the PC must be set to **192.168.0.X** where X is any number between 3 and 254. Also set the Subnet mask to 255.255.255.0. In Windows XP, these settings can be found in the 'Network Connections' item in the 'Control Panel'. Click on properties of the LAN adaptor, and properties of the TCP/IP. There is also a settings box for default gateway, but it can be left blank. The IP Address of the sonar head is fixed at **192.168.0.2** (optional IP Address's can be specified at time of order)

DeltaT.exe is a Windows program that controls, processes, displays and records data from the DeltaT Sonar. The program uses a high speed Ethernet connection (10Mbps) to communicate with the Model 837 sonar unit.

The installation of the software on the PC is straightforward. The executable is called **DeltaT.exe**. It can be installed in it's own directory, and run by double clicking, or you can create a shortcut from the desktop for it. We do not recommend using the "*New Program Wizard*" or any other installation program. The program may start up either in playback mode or in real-time mode. If it is in real-time mode and the sonar head is not connected there may be a delay before the prompt comes back. The menu item for selecting between real-time and file playback is called '*Data From…*', it is located under the 'File' pull-down menu, which is the leftmost upper pull-down menu item, as shown in the screen capture in **Figure 5**.

Note: There are several things that can cause lost or failed connection. One is that the user turned the sonar power off. The other is that the Ethernet connection is not configured correctly.

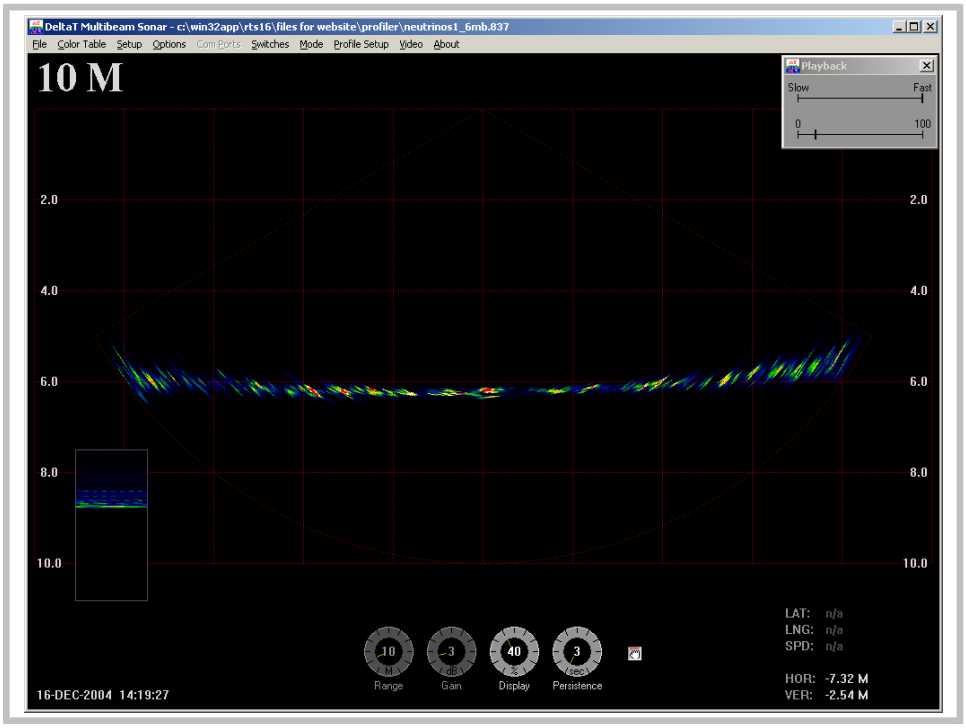


Figure 5: Screen capture from DeltaT program (file playback).

The bottom of the screen contains four rotary dial controls and a hand icon which acts as a Hold (or freeze frame) button. The Range knob controls the current acoustic operating range during real time operation. The Gain knob adjusts the amount of hardware amplification used in the receiver circuitry of the DeltaT sonar head. Adjust the Gain so that there is a minimum amount of Red displayed in the sonar data window. During file playback the Range and Gain knobs are not active, they simply reflect the setting that was used during the recording of the real time data acquisition. The Display knob is used to adjust the brightness of the sonar image (after the Gain has been adjusted or during file playback). The Persistence knob adds a decay feature to the sonar image (similar to a radar display). This feature is used for generating a trail behind moving targets. The more persistence used, the longer the trail generated. As long as you are recording the data, you can play back with different display gains and persistence values.

2.1.3.1 Basic Software Operation

There are ten menus at the top of the screen (see **Figure 5**). The File menu has the Data From… sub-menu to control whether the software is in real-time, or playback. Record Start is for starting data recording (onto the PC's hard drive) and supplies a dialogue box for file name and location. Playback supplies a dialogue box for selecting a file for playback. (data files are automatically given the extension '.837'). Copy Start is for copying sections of files into a file with a different name, for subdividing long data-files, Save Screen is a screen capture command which creates a .BMP bitmap image of the current screen for inclusion into documents etc.

The "*Color Table*" pull-down menu is for changing display colours Single target detection is often best using the 'NORM HI' colour table, while images of the bottom with shadows are usually best viewed in 'GREY' or 'BROWN-YELLOW'. These colours are for display only, the data can be played back with any colour scheme if desired.

The Setup menu contains the Xdcr Position setting (Up or Down), Measurement Units (Meters, Feet or Yards), enable/disable for Automatic file name generation when recording and a Sound Velocity user entry box.

Under Options, there are 'Grid' (On or Off), Sector Size (30, 60, 90 or 120 Degrees), Beamwidth (Wide: 3deg, Normal: 1.5 deg, Narrow: 0.75 deg and Narrow Mixed: 0.75 deg), Beams (120, 240 or 480 display beams), and Averaging (3 to 25 shots). While viewing the data in Sector Mode, 'Remove Background' can be used to display only the 'moving' targets of a static image. Press

the ‘Build Reference’ button to begin generating a background reference image, then press ‘Store Reference’. The background reference image will now be removed from the current image to produce an image with only ‘new’ or moving targets, you can then add Persistence to display a trail behind the moving targets. Other Option menu items include Gain Equalization to normalize the gain across the image, a GPS Lat/Lng Track Plotter window, Signal Level and Diagnostics displays.

To maximize the shot rate when recording to a .837 file, set the number of displayed beams to 120. This will not affect your angular resolution as the number of beams are used only for display purposes. The shot rate (or PRF) can be monitored via the Diagnostics page. This number is displayed in milliseconds (the lower this number is, the faster your update rate will be). When playing back the data file, you can select any number of beams.

‘Com Ports’ is applicable if a GPS is to be connected to the computer as well. GPS positions can be recorded into the data file and viewed in the Track Plotter window in real time (or playback). This information can be used for later mosaicing.

The ‘Mode’ pull down menu controls the different display modes. Again this does NOT affect the stored data so the data can be stored in SECTOR mode and played back in PERSPECTIVE mode if desired. BEAMTEST MODE simply shows the data from the individual channels without processing them into an image. The sonar will operate more quickly in this mode, but you can’t really see what it is looking at.

Enable Profile mode to profile a cross section of the seabed. Profile Point Setup is used for enabling the digitized profile point detection. You can set a Minimum Depth and Maximum Depth window for detection. Enabling the ‘Low Mix’ display type decreases the data level so it is easier to see the profile points. The profile points are output via Ethernet to a connected PC running Imagenex 3Dview.exe using the IP Address stored in “IPAddress_Output1” of the DeltaT.INI file, the points can also be saved to a separate profile point data file (.83P) via the “*Record To .83P...”* button in the “*Data Output*” menu. This operation can be performed in real time or during file playback.

While viewing the data in Profile Mode, ‘Profile Waterfall’ can be used to display consecutive cross-sections of the sea floor in a depth vs. colour window. To change the depth to colour ratio, position the cursor over the small profile image at the left side of the display and left-click to change the start depth then right-click to change the span.

The ‘Video’ pull down menu is used for displaying a video window from an optional video capture device such as a video camera plugged into a USB video converter (i.e. Adaptec AVC-1100 USB). Sub-menus include ‘Open Video Window’, Change Video Format’, ‘Record Enable’, and ‘Video Recording Rate’

The final pull-down displays information about the DeltaT software such as contact information and version number. Please provide the version number and date for any support assistance.

2.1.3.2 File playback

To open a “.837” data file to playback, use the menu command “*File->Data From…->File*”. The playback speed and playback file position may be altered by using the slider bars in the toolbar. See **page 18** for details on the File Playback Bars.

Once you open a sonar data file to playback, the operation of real-time sonar data acquisition will stop. You can open only one data file to play back at a time. But you can open another data file to playback during file playback by following the above procedure.

You can once again change the operation back to real time data interrogation by using the menu command ““*File->Data From…->Head*”. The system will then close the opened data file and begin to acquire data from the sonar head..

Note: Care must be taken to adjust the range, gain, and speed during real time operation as these settings are not able to be adjusted during file playback. The exception to this is the 2.5m range. This range is actually a 5m range in the sonar head and displayed as a 2.5m range in the DeltaT software.

3.0 Detailed Description of Menus

The DeltaT program provides several convenient ways (menu commands, dialogue boxes, and toolbar commands) to control the sonar unit's operations, operating parameters and data display windows.

3.1 File menu commands

The File menu offers the following commands:

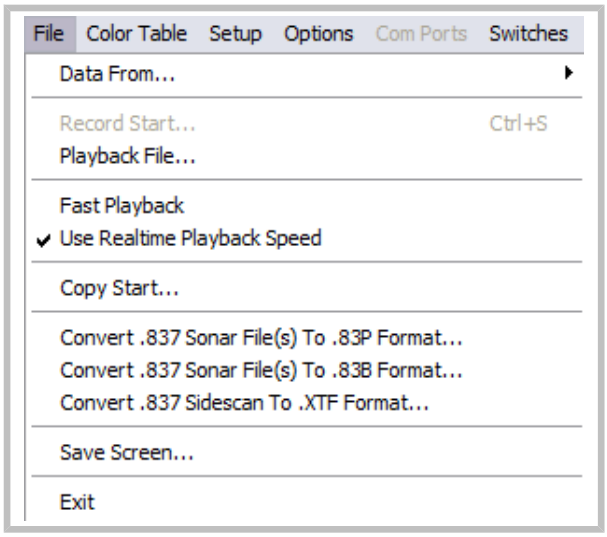


Figure 6: The File Menu

Table 1: The File Menu Items

Data From…	Use this command to switch between real time or file playback mode. If "*Head*" is selected, the DeltaT program will start to interrogate the sonar head to acquire data in real time. If "File" is selected, the DeltaT program will open the standard Windows "Open File" dialogue box where the user can select a previously recorded DeltaT sonar data file (with the file extension .837) to play back.
Record Start…	Use this command to save real-time sonar data to a .837 file. If the "*Automatic Filenames (.837)*" option is set (in the "Setup" menu), DeltaT will automatically generate the file name based on the active selection under the "*Automatic Filename Type*" (in the "Setup" menu). For more information on automatic file names, please refer to **page 9**. DeltaT will continue interrogating the sonar unit for data and at the same time recording the data to your named file. While recording data, the menu item will change to "*Record Stop*". Select this to stop recording the file.
Playback File…	Use this command to open a previously recorded DeltaT sonar data file (with the file extension . 837) to play back. The DeltaT program displays the "File Open" dialogue box so you can choose which file you want to open.
Fast Playback	Use this command to quickly scan through a file. It advances the file progress in steps to allow a quick overview of the file to determine if further inspection is required.
Use Realtime Playback Speed	Use this command to playback a file at the same rate as it was recorded in real time. It adjusts the playback speed to simulate Ethernet communication and acoustic times.

Copy Start…	Use this command to copy a section of a file during file playback to a new file. This is useful when viewing large files and only a section is needed. While copying data, the menu item will change to "*Copy Stop*". Select this to stop copying the file.
Convert .837 Sonar File(s) to .83P Format…	Use this command to convert single or multiple files to the .83P file format, which contains profile points. Before using this command, the profile point detection scheme must be setup. Please refer to **page 28** for further details.
Convert .837 Sonar File(s) to .83B Format…	Use this command to convert single or multiple files to the .83B file format which contains processed beam information. Before using this command, the processing schemes must be setup.
Convert .837 Sidescan to .XTF Format…	Use this command to convert the sidescan window data to a .XTF file format. Please refer to **page 25** for further details.
Save Screen…	Use this command to capture a .BMP bitmap image of the current screen for inclusion into documents etc.
Exit	Use this command to terminate your DeltaT program. The system will save your display layout, and sonar settings to a text file called DeltaT.ini. The next time the program is started, the system will load these settings from this file.

3.2 Color Table Menu Commands

The Color Table menu is used to change the sonar data colour palettes for the sonar images. DeltaT uses colours (called a colour table) to represent echo data strength (amplitude). For example, the Normal High intensity colour table maps the echo data amplitude to 127 colours ranging from Black (low strength level) though blue, green, orange yellow white and red (highest strength level).

The Color Table menu offers the following commands:

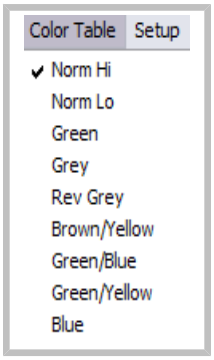


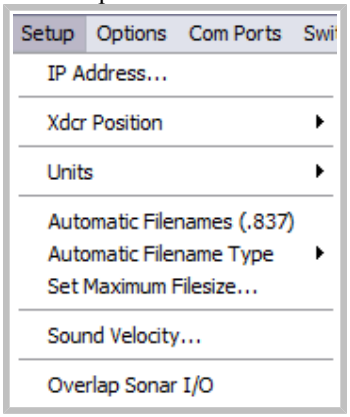
Figure 7: The Color Table Menu

Table 2: The Color Table Menu Items

Normal High	Standard colour table used for mapping the echo data amplitude to 127 colours ranging from Black (low level), through Blue, Green, Orange, Yellow, White and Red (highest level).
Normal Low	Same colours as Norm Hi, but uses a lower colour intensity.
Green	127 shades of green.
Grey	127 shades of Gray (White on Black).
Reverse Grey	127 shades of Gray (Black on White).
Brown/Yellow	127 mixed shades of brown and yellow.
Green/Blue	127 mixed shades of green and blue.
Green/Yellow	127 mixed shades of green and yellow.
Blue	127 shades of blue.

3.3 Setup menu commands

The Setup menu offers the following commands:



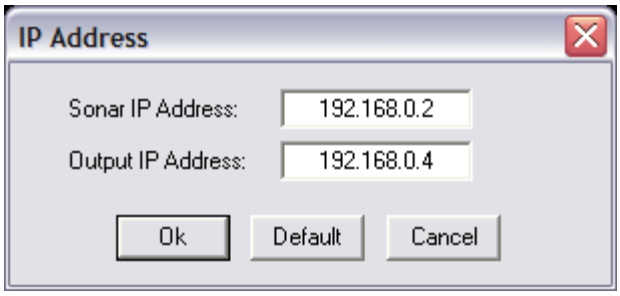


Figure 8: The Setup Menu

Table 3: The Setup Menu Items

IP Address…	Use this command to alter the destination IP addresses for communication to the sonar and the post processing software machine. This command does not alter the IP address of the sonar head. It simply lets the DeltaT software know what the IP address of the sonar is.
Xdcr Position	Use this command to set the display orientation of the DeltaT program to match the physical orientation of the sonar head. If the "*Xdcr Position*" setting is incorrect, port-side data will be displayed on the starboard and vice-versa. The 'up/down' setting in software can be switched if the sonar must be mounted the opposite way. Refer to the section on **Hardware Installation** on **page 2** for details.
Units	Use this command to change the display units to either Meters, Feet, or Yards.
Automatic Filenames (.837)	Use this command to enable the option to save real-time sonar data to a .837 file using automatically generated file names. If this option is disabled, the standard Windows dialogue box will prompt the user for input when recording a file.
Automatic Filename Type	If automatic file name generation is enabled, the file will be named according to the scheme selected here. The file names will be based on the system date and time as **DDMMMYYYY-hhmmss.837** or **DDMMMYYYY-nnnn.837** where 'n' will be incremented by one with each file created on the same date.
Set Maximum Filesize...	Use this command to set the maximum file size for recording data. When the file size is exceeded, a new file is generated with a '-001', '-002', etc. appended. The file size limitations are from 100MB – 1000MB.
Sound Velocity…	This item will need to be altered if the known speed of sound is different than 1500m/s.
Overlap Sonar I/O	If set, the computer will alter its' communication mode with the sonar to increase throughput by performing processing and plotting during the sonar acoustic time.

3.4 Options Menu Commands

The Options menu offers the following commands:

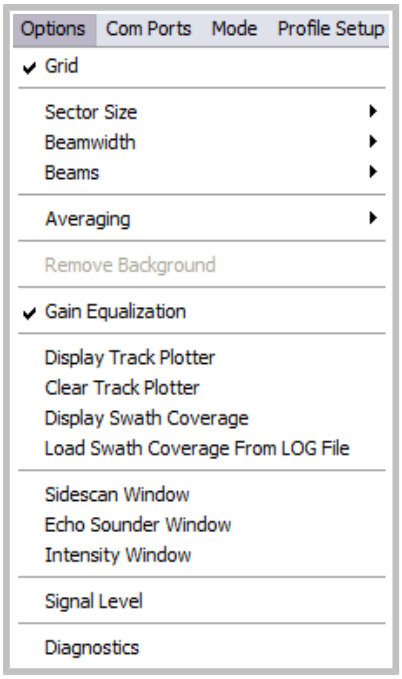


Figure 9: Options Menu

Table 4: The Options Menu Items

Grid	Use this command to either view or hide the grid overlay on the sonar image.
Sector Size	Use this command to set the display sector size to either 30º, 60º, 90º, or 120º. This function simply changes the processing and the display. The full data set is still recorded to the file. It is useful when only a small sector is visually required, such as when narrowing in on a location. By moving to a smaller sector, the required processing is reduced which results in a higher frame rate. This function is very important for post processing operation and is discussed in greater detail in **section 10.5** on **page 37**.
Beamwidth	Use this command to change the processing mode to "*Wide*" "*Normal*", "*Narrow*", and "*Narrow Mixed*". This function is very important for post processing operation and is discussed in greater detail in **section 10.5** on **page 37**.
Beams	Use this command to alter the number of beams used in the processing. This function simply changes the amount of processing required. The full data set is still recorded to the file. The higher the number of beams, the greater the angular resolution of the display and the greater the amount of processing required which will reduce the frame rate. This function is very important for post processing operation and is discussed in greater detail in **section 10.5** on **page 37**.
Averaging	Use this command to apply various amounts of averaging to the displayed image. Adjust this amount to "smooth" the image display. For example, an average of '3' will plot the average of the last 3 pings.
Remove Background	This item is a speciality option active only if the sonar is in sector mode. It will enable the option to remove stationary targets and plot only targets that move from shot to shot. Please refer to **page 39** for details.

Gain Equalization	This option is generally used only for profiling applications. Enabling it will normalize the gain across the image. This function simply changes the processing and the display. The full data set is still recorded to the file.
Display Track Plotter	Use this command to open another window, which displays the sonar (or the ship) track plotted according to the GPS provided latitude and longitude information. Left clicking in the track plotter window will zoom in the scale, while right clicking will zoom out the scale.
Clear Track Plotter	Use this command to erase the tracks in the track plotter window.
Display Swath Coverage	Use this command to indicate the sonar coverage in green in the track plotter window.
Load Swath Coverage from LOG File	Whenever a file is recorded with GPS data, a swath coverage log file is generated. When this file is loaded, the previous swath coverage information is displayed in grey in the track plotter window.
Sidescan Window	Use this command to open another window, which displays a Sidescan representation of the multibeam data. Please refer to **page 25** for details.
Echo Sounder Window	Use this command to open another window, which displays an Echo Sounder window using the multibeam data. Please refer to **page 24** for details.
Intensity Window	Use this command to open another window, which displays the intensity of the current profile.
Signal Level	This option enables the Signal Level window which will appear in the lower left corner of the screen. This window displays the raw data set from the sonar head with no processing.
Diagnostics	Display the Sonar diagnostics. See **section 5.3** on **page 20** for details about sonar diagnostic items.

3.5 Com Port Menu

The Com Port menu is only active in real time and is disabled during file playback. Selecting it will show the ComPort Setup dialogue box as shown below in **Figure 10**. Set the options to match the capabilities of the attached GPS unit. Please refer to **section 6** on **page 22** for GPS details.

This dialogue box is also used to set up a com port for sound velocity input from an external sound velocity sensor. If no external sound velocity sensor is present, the sound velocity may be entered manually from the "*Setup*" menu. The default sound velocity is 1500m/s. Refer to page 9 for details on the "*Setup*" menu.

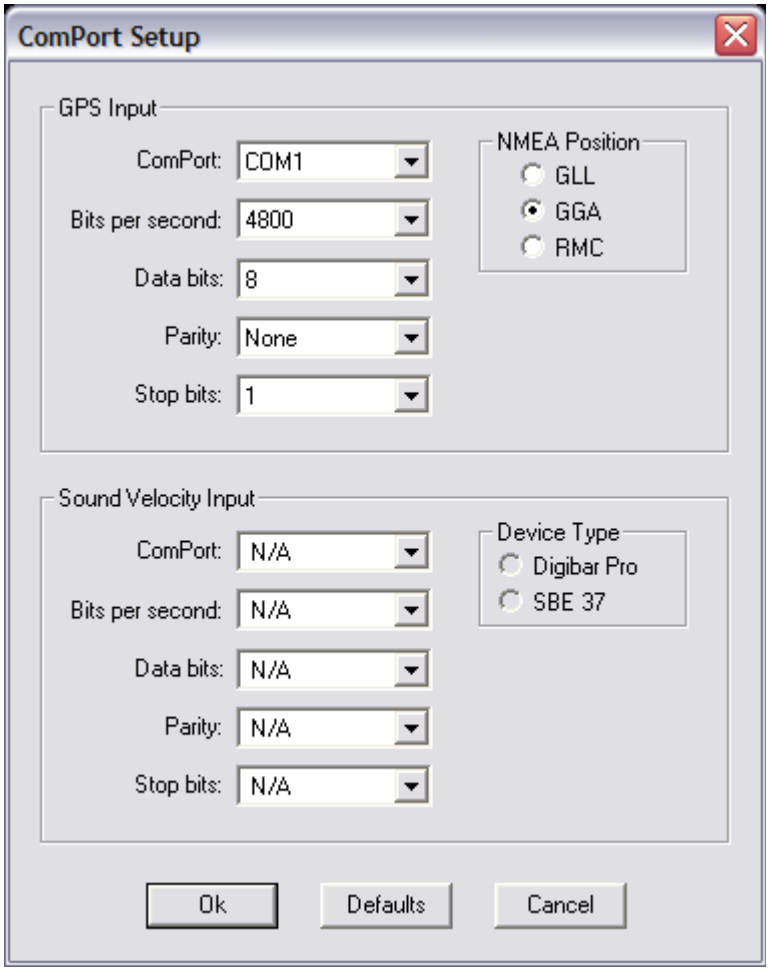


Figure 10: ComPort Setup Dialogue Box

3.6 Mode Menu Commands

The Mode menu offers the following commands:

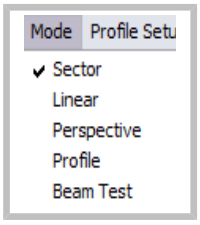


Figure 11: The Mode Menu

Table 5: The Mode Menu Items

Sector	Used only for imaging sonars, this command displays the sonar image in a forward looking plan position indicator (PPI) type display. The sonar location at the bottom of the screen.
Linear	Used for sonar diagnostic purposes only.
Perspective	Used only for imaging sonars, this command displays the sonar image in a pseudo three dimensional sector mode. This mode gives the illusion of target distance as targets farther away will appear smaller. Please refer **page 39** for details pertaining to imaging.
Profile	Used only for profiling sonars, this command assumes the sonar is looking down towards the seafloor. The sonar location at the top of the screen. Please refer to **section 10** on **page 28** for details pertaining to profiling.
Beam Test	Used for sonar diagnostic purposes only. No image processing is performed.

3.7 Profile Setup Menu Commands

The Profile setup menu offers the following commands:

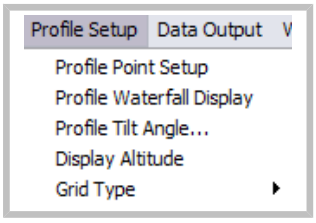


Figure 12: The Profile Setup Menu

Other than Profile Point Setup and Grid Type, all menu commands are deactivated in sector mode.

Table 6: The Profile Setup Menu Items

Profile Point Setup	This command displays the Profile Point Setup Dialogue box which contains options for profile point detection. Please refer **section 10.2** on **page 28** for details.
Profile Waterfall Display	Used only for profiling sonars. This option will display a history of profile data in a scrolling plan view.
Profile Tilt Angle	Used only for profiling sonars. This command displays the sonar tilt angle dialogue box. It is used when the sonar is physically mounted in an orientation other than straight down. Please refer to **section 10** on **page 28** for details pertaining to profiling.
Display Altitude	Used only for profiling sonars. This command displays the Sonar Altitude window. If profile point detection is disabled in the *Profile Point Setup* dialogue box, the altitude will display 'n/a'. Otherwise the altitude will display distance from the sonar head to the bottom in the units selected. 
Grid Type	Displays either a rectangular grid with horizontal and vertical measurements enabled, or a circular grid with range and bearing measurements enabled.

3.8 Data Output Menu Commands

The Data Output menu displays the Data Output dialogue box as shown below in **Figure 13**.

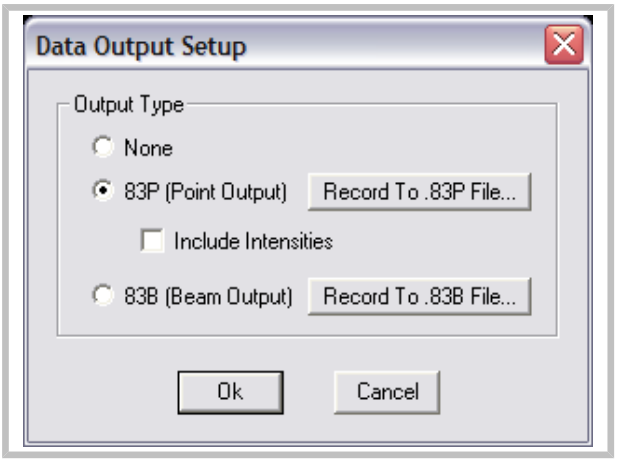


Figure 13: The Data Output Setup Dialogue Box

The data being output is sent to the IP address specified in the IP Address dialogue box in the "Output IP Address" section please refer to **section 10**.

Table 7: The Data Output Menu Items

None	Disables all data output functions
83P (Point Output)	Profile points generated will be sent to the IP address. Please refer to **section 10** on **page 28** for details on profiling.
Record To .83P File...	Profile points generated will be recorded to a .83P file. Please refer to **section 10** on **page 28** for details on profiling.
Include Intensities	Includes Intensities with the profile data. Please refer to **section 10** on **page 28** for details on profiling.
83B (Beam Output)	Generated beams will be sent to the IP address.
Record To .83B File...	Generated beams will be recorded to a .83B file.

3.9 Video Menu Commands

This Menu is only active if a video capture device is installed before running the DeltaT software.
The 'Video' pull down menu is used for displaying a video window from an optional video capture device such as a video camera plugged into a USB video converter (i.e. Adaptec AVC-1100 USB).

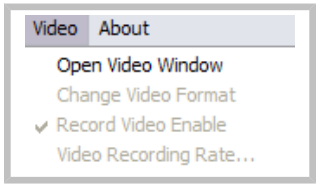


Figure 14: The Video Menu

Table 8: The Video Menu Items

Open Video Window	Opens a live video window
Change Video Format	Changes the video format
Record Video Enable	If this option is set, video information is recorded at the same time DeltaT data is recorded.
Video Recording Rate…	Sets the update rate at which video is captured.

3.10 About Menu Commands

The About menu displays the information window as shown below in **Figure 15**. It displays information about the DeltaT software such as contact information and version number. Please provide the version number and date for any support assistance.

Figure 15: The About Window

4.0 Controls and File Playback Dialogue

4.1 Main Controls

The bottom of the screen contains four rotary dial controls and a hand icon which acts as a Hold (or freeze frame) button. These tools provide quick mouse access to the most commonly adjusted settings used in the DeltaT program.

During file playback the Range and Gain knobs are not active, they simply reflect the setting that was used during the recording of the real time data acquisition.

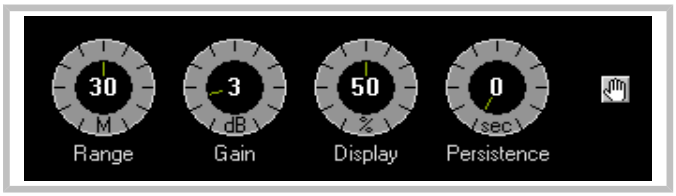


Figure 16: The Main Controls

Table 9 : The Main Control Items

Range	The Range knob controls the current acoustic operating range during real time operation.
Gain	The Gain knob adjusts the amount of hardware amplification used in the receiver circuitry of the DeltaT sonar head. Adjust the Gain so that there is a minimum amount of Red displayed in the sonar image.
Display	The Display knob is used to adjust the brightness of the sonar image (after the Gain has been adjusted).
Persistence	The Persistence knob adds a decay feature to the sonar image (similar to a radar display). This feature is used for generating a trail behind moving targets. The more persistence used, the longer the trail generated. As long as you are recording the data, you can play back with different display gains, persistence and colours
Hold	Hold icon places all communication and displays on hold.   Normal Held

4.2 File Playback Progress and Speed

These slider bars are not available during real time operation. When a file is opened a file playback progress bar and playback speed bar window will appear. Use these items to adjust the rate of file playback and location within the file to view.

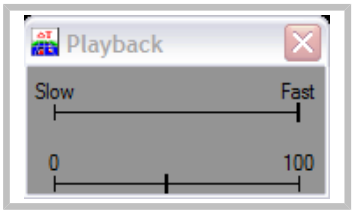


Figure 17: The File Playback Progress and Speed Bars

Table 10: File Playback Items

File Progress	A slider bar with a pointer showing file playback position. Clicking on a new position will cause the file playback to start at that position. The slider range represents the file size.
Play Back Speed	A slider bar with a pointer showing file playback speed setting. Clicking to the right will speed up file playback.

5.0 Dialogue Boxes

5.1 File Open Dialogue Box

The following options allow you to specify which file to open:

Table 11: The File Open Dialogue Items

File Name	Type or select the file name you want to open. This box lists files with the extension you select in the “List Files of Type” box.
List Files of Type	Select the type of file you want to open: The supported file extensions are “.837” if opening a sonar data file. The “.837” file extension is the standard DeltaT recorded file format.
Directories	Select the directory in which DeltaT control software stores the file that you want to open.

5.2 File Save As Dialogue Box

The following options allow you to specify the name and location of the file you're about to save sonar data into:

Table 12: The File Save As Dialogue Items

File Name	Type a new file name or select an existing file name to save sonar data into that named file.
List Files of Type	Select the type of file you want to save: The supported file extension is “.837

5.3 Diagnostics Window

The Diagnostics window is used to display important system variables. This window is very useful when trouble shooting the system in real-time.

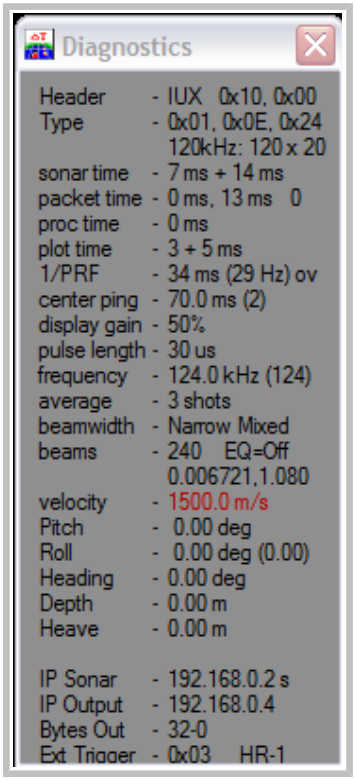


Figure 18: The Diagnostics Window

Table 13: The Diagnostic Items

Header	Sent by the sonar to tell the program what kind of data format it sent, IUX is for DeltaT sonar image. From left to right, the indicators are: Data Format (IUX), Head ID (0x10), Status (0x40 = Status OK) Please refer to the Ethernet specifications document for further details.
Type	Contains various information on the type of sonar that is connected and it's various capabilities. From left to right: Sonar Type, Transducer Type, Sonar Version Please refer to the Ethernet specifications document for further details.
sonar time	The first number contains the acoustic time for the current range. The second number contains the sonar overhead time. This number is dependant on the operating range.
packet time	The first number contains the time to send the first Ethernet packet. The second number is the time for the sonar return packets. The third number is packet errors.
proc time	The time required to process the sonar data according to the options specified in the Options menu

plot time	The time required to plot the sonar image to the display window.
1/PRF	The time required to complete one full frame of data including acoustic, communication, processing, and display. In file playback, this number will be less than real time as there are no communication and acoustic times.
center ping	The time from the current ping back to the centre ping of the group of averaged pings.
display gain	The first number indicates the current “Display” settings according to the “Display” knob. The second number (in brackets) indicates the “Display” settings from when the file was recorded.
frequency	Current operating frequency of the DeltaT sonar.
average	Current averaging setting as applied from the “Options” menu.
beamwidth	Current beamwidth setting as applied from the “Options” menu.
beams	Current beam setting as applied from the “Options” menu.
velocity	Current sound velocity as applied from the “Setup” menu or from the serial port.
pitch	If supplied with the optional Pitch, Roll, and Heading sensor, the pitch value for the current data frame will appear here.
roll	If supplied with the optional Pitch, Roll, and Heading sensor, the roll value for the current data frame will appear here.
heading	If supplied with the optional Pitch, Roll, and Heading sensor, the heading value for the current data frame will appear here.
depth	The depth value entered in the DeltaT.ini will appear here. Refer to **page 26** for details.
IP Sonar	The IP address of the sonar as applied in the “Setup” menu is displayed here.
IP Output	The IP address of the profile point or beam output as applied in the “Setup” menu is displayed here.
Bytes Out	The number of bytes sent out to the post processing machine are displayed here.
Ext Trigger	If supplied with the optional external trigger capability, the sonar sends up trigger status information for each data frame and is displayed here.

6.0 GPS Operations

The DeltaT software has the capability to read GPS strings, plot the track of the vessel, as well as record the GPS information to the recorded file.

In order to access GPS information, the DeltaT software needs to be told which com port is connected to the GPS unit. The Com Port menu is only active in real time and is disabled during file playback. Selecting it will show the ComPort Setup dialogue box as shown in Figure 19. Set the options to match the settings of the attached GPS unit.

Note: Windows XP© has certain "issues" with RS232 to USB adaptors. Please refer to **Appendix D – USB Data Converters and Windows XP©** on **page 50** for important information on using these devices.

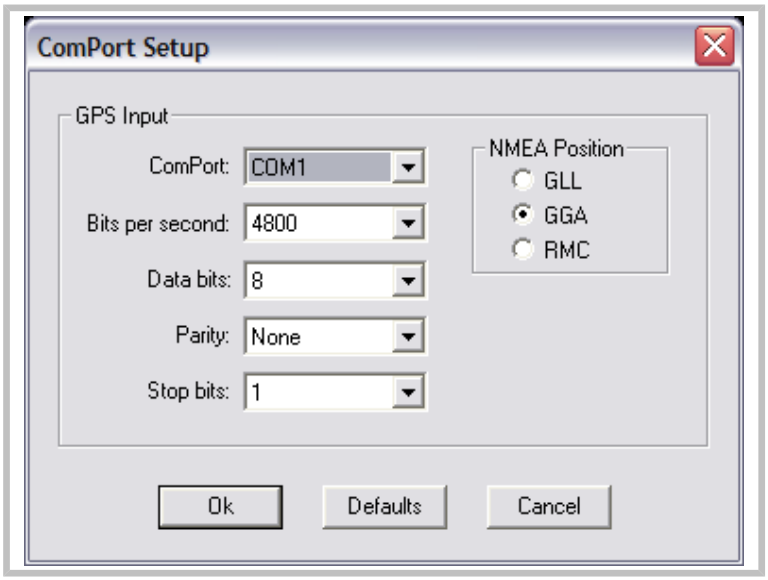


Figure 19: ComPort Setup Dialogue Box

Although the ComPort Setup NMEA Position area only indicates GLL, GGA, and RMC strings, when using GLL, or GGA, ensure that the VTG string is present as certain information is not present in the GGA and GGL strings. If using RMC, however, the VTG string is not necessary. Once the GPS setup is complete, it may take awhile for the GPS device to detect satellites. Until the GPS begins sending GPS information to the DeltaT program, the GPS information area located in the lower right corner of the display will appear as shown in **Figure 20**. After GPS information is sent to the DeltaT program, the current Coordinates and speed will appear as shown below.

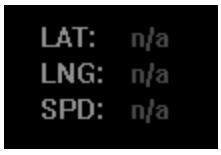


Figure 20: No GPS information present

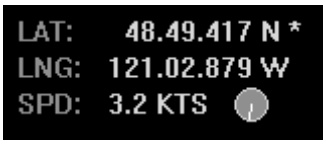


Figure 21: GPS information present

6.1 The Track Plotter

The DeltaT software offers the ability to show where the ship has been during it's course. As the ship moves outside the window edge, The image is automatically adjusted to re-center the ship (white square) in the Track Plotter Window.

The scale factor may be "zoomed" in or out as required.

"Zoom In" Left Click in window
"Zoom Out" Right Click in window

If the track plotter needs to be cleared, select "*Options->Clear Track Plotter*"

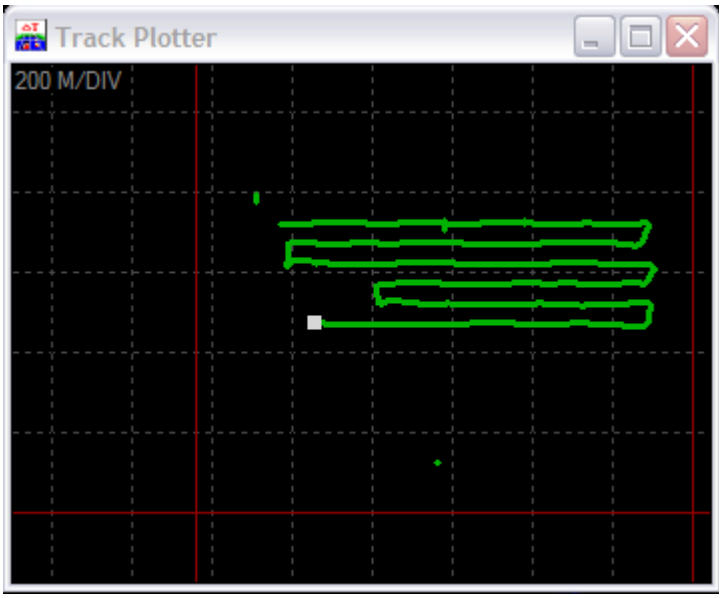


Figure 22: GPS Track Plotter Window

7.0 Echo Sounder and Sidescan Windows

The DeltaT software includes the capability to display pseudo echo sounder and sidescan data. .

7.1 The DeltaT Echo Sounder

Display the echo sounder window by selecting "*Options -> Echo Sounder Window*". Refer to **page 10**.

The echo sounder window is scalable by left clicking on the edge of the window and dragging it to the desired size. The signal strength is set from the main sonar data (i.e. Increasing the display gain or gain will increase the signals in the echo sounder window as well). The image is essentially a series of scrolling nadir beams. In **Figure 23**, the red data is the bottom and the blue green shapes in the water column are standing timber.

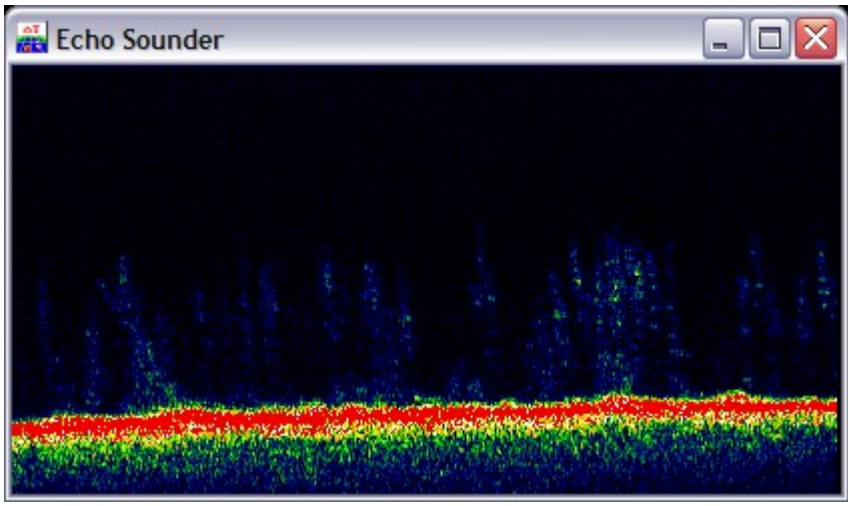


Figure 23: The DeltaT Echo Sounder Window

7.2 The DeltaT Sidescan

Display the Sidescan window by selecting "*Options -> Sidescan Window*". Refer to **page 10**. The Sidescan window is scalable by left clicking on the edge of the window and dragging it to the desired size. The signal strength is set from the main sonar data (i.e. Increasing the display gain or gain will increase the signals in the sidescan window as well). The image is assembled by "splitting" the beams to either side of centre to simulate a sidescan sonar such as the Imagenex Model 872 YellowFin. The degree of "splitting" can be controlled by left or right clicking in the window. Left clicking will adjust the "transducer" angle "steeper" or "down" while right clicking will adjust the "transducer" angle "wider" or "up". **Figure 24**, **Figure 25**, and **Figure 26** indicate the effect of adjusting the "transducer" angle to various settings.

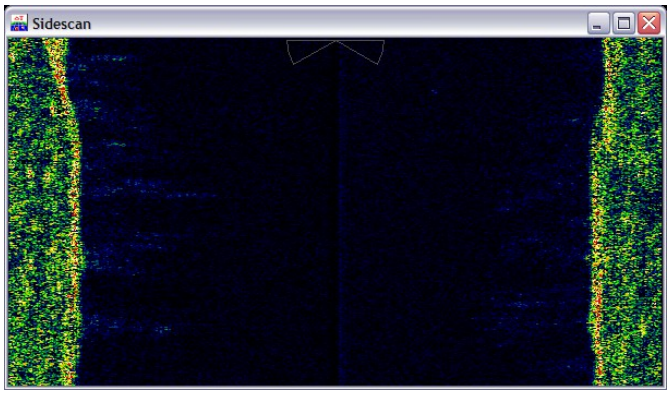


Figure 24: The Sidescan Window. Transducer angle set to widest setting.

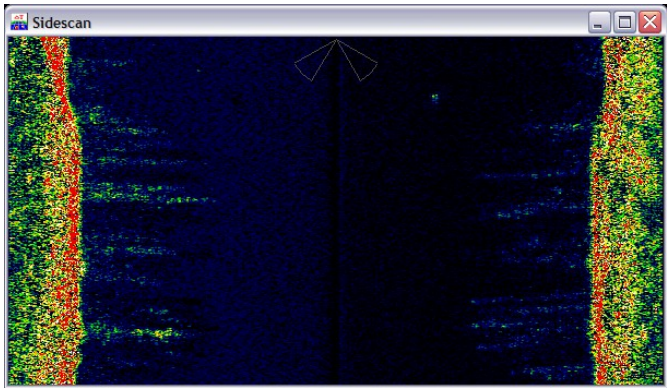


Figure 25: The Sidescan Window. Transducer angle set to about 20 degrees from vertical.

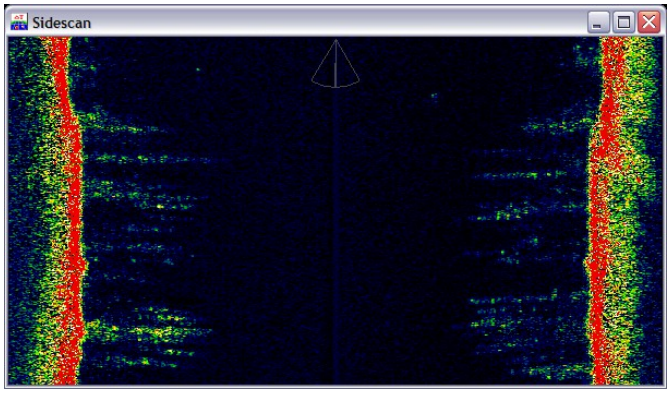


Figure 26: The Sidescan Window. Transducer angle set to steepest setting.

8.0 The DeltaT.INI File

The DeltaT.ini file is located in the same directory as the DeltaT.exe file. This file may be edited to alter various sonar operations.

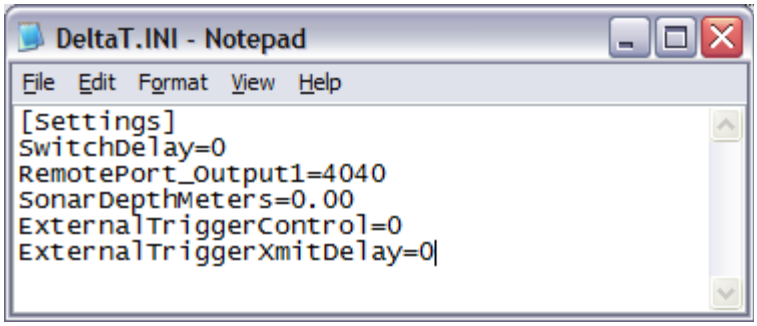


Figure 27: The DeltaT.ini file

While most of the settings should be adjusted from within the main program, the items indicated in **Figure 27** need to be edited in the DeltaT.ini file if their values need to be modified.

Table 14: The DeltaT.ini File Items

Item	Default	Description
SwitchDelay	0	This item controls how long the sonar head should delay for each ping. This is mainly used for diagnostics
RemotePort_Output1	4040	This item will need to be altered if there is a port conflict on the destination machine.
SonarDepthMeters	0	This item records the physical depth of the sonar head.
ExternalTriggerControl	0	This enables or disables external trigger detection and whether the trigger is positive or negative Bit 0: Trigger Edge: 0 = NEG, 1 = POS Bit 1: Enable: 0 = Disable, 1 = Enable
ExternalTriggerXmitDelay	0	This controls the time from an external trigger detection to when the sonar head transmits. 0 to 10000 in 100µsec increments

9.0 External Trigger Option Specification for DeltaT Sonar

The External Trigger Option must be specified at time of order.

The DeltaT sonar head requires a minimum pulse length of 100µs to detect a sync.

The pulse detection scheme is **level** sensitive.

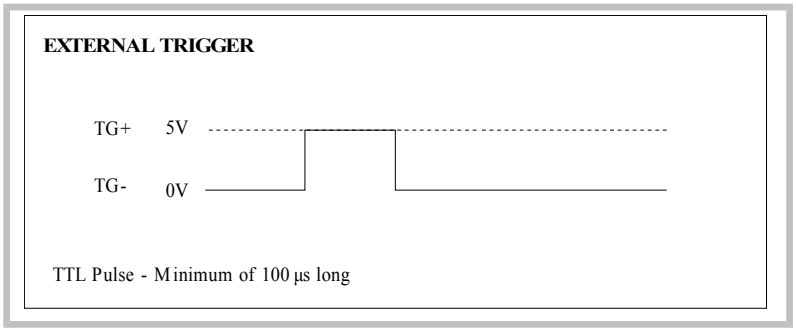


Figure 28: External Trigger

Where:

TG+ -> pin 7 on sonar connector (SUBCONN MCBH8M-SS-1/2”L THD).
TG- -> pin 8 on sonar connector (SUBCONN MCBH8M-SS-1/2”L THD).

Refer to Document # **837-200-261** on **page 58** for further details on cable pin outs.

9.1 Settings

To enable the DeltaT sonar head for external trigger mode, the DELTAT.INI provides the following controls:

ExternalTriggerControl Bit 0: Trigger Level: 0 = NEG, 1 = POS
Bit 1: Enable: 0 = Disable, 1 = Enable

Ex.
ExternalTriggerControl=0 Disable level trigger detection
ExternalTriggerControl=1 Invalid Setting
ExternalTriggerControl=2 Negative level trigger detection
ExternalTriggerControl=3 Positive level trigger detection.

When enabled for external trigger, the sonar head will transmit as soon as it detects the external trigger pulse. If a trigger pulse has not been found after a period of 2 seconds, the sonar will transmit as normal.

ExternalTriggerXmitDelay External Trigger Transmit Delay
Time from external trigger to sonar head transmit
0 to 10000 in 100µsec increments

Ex.
ExternalTriggerXmitDelay=500 50ms Delay

A Trigger Level setting of 0 (NEG) requires a negative TTL pulse (5V→0V→5V) at the external trigger input. A trigger Level setting of 1 (POS) requires a positive TTL pulse (0V→5V→0V) at the external trigger input. The minimum pulse length is 100µs.

10.0 Profiling Operations

In order to generate profile data for use in the Imagenex 3DView.exe software or various third party vendors (contact Imagenex for a list of compatible software programs), certain parameters need to be setup before this can occur. This section will describe the procedure for generating profile data.

10.1 Profiling Overview

It is important to remember that the DeltaT software only displays one shot at a given time. Thus, it can be difficult to determine what is being displayed on the screen. To alleviate this, Imagenex has developed the 3DView.exe application which sequentially plots one frame at a time to "build up" an image over time. Please refer to the section on 3DView on
page 38 for details.

10.2 Profile Point Setup

Before beginning to generate profile points, the profile point destination needs to be setup. This is done in two places. The first is under "IP Address" in the Setup Menu as shown below in **Figure 29**.

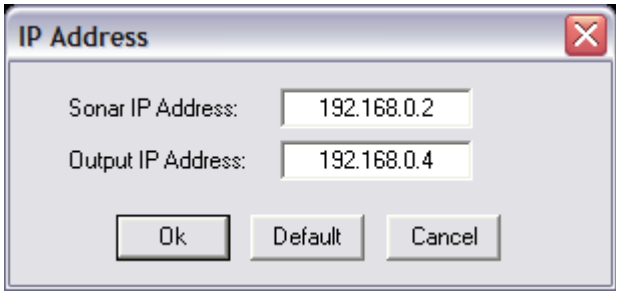


Figure 29: IP Address Dialogue Box

If the profile points are to be sent to 3DView running on another PC, set the "Output IP Address" to the address of that PC. If the profile points are to be sent to 3DView running on the same PC, set the "Output IP Address" to

127.0.0.1

This special IP address is often referred to as the "**Local Host**". Now when profile detection, and data output, is enabled, the detected profile points are sent to the IP address set in the above dialog box.

10.3 Data Output Enable

After the IP Address is setup, The DeltaT program needs to know what, if any, information is to be sent out. This section deals only with profile points. For beam output information, contact Imagenex.

Referring to the **section Data Output Menu Commands** and **Figure 30**, below, select the radio button “83P (Point Output). If intensities are required to be sent with the profile range numbers, also select “Include Intensities”. The button to record the profile data to a file may also be used, but it is recommended to do this after previewing the profile data generation first.

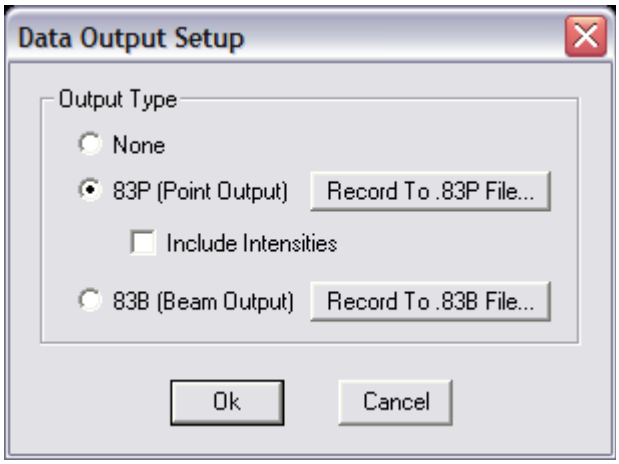


Figure 30: Data Output Setup

10.4 Profile Point Setup

In order to actually generate the profile points, the DeltaT software needs to know how to display the image (Profile Point Display), Whether to generate profile points or not and also where in the image to detect profile points (Profile Point Detection). Also, the DeltaT program has various filter settings (Profile Point Filter) to facilitate generating profile points on the desired type of data.

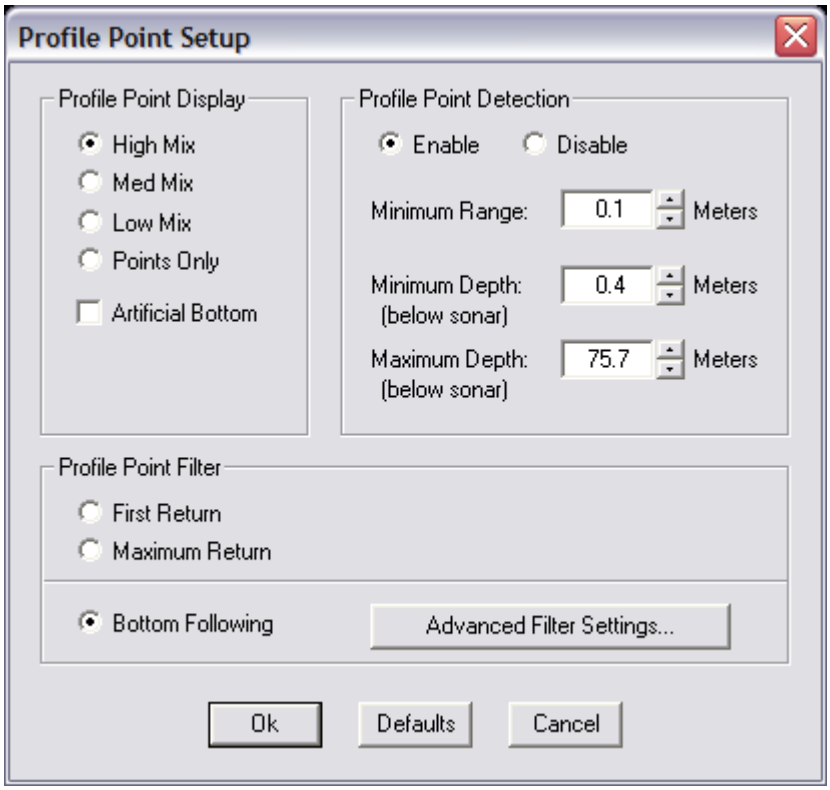


Figure 31: The Profile Point Setup Dialog

10.4.1 Profile Point Detection

To enable profile point detection select the “Enable” radio button. The Minimum range box allows the user to begin profile point detection at a certain slant range below the sonar. Any data that is closer to the sonar than the minimum range setting will not generate profile data points. This is very advantageous if propeller wash is present in the data.

There are two methods of setting the minimum profile depth and the maximum depth. The first is directly in the Profile Setup Dialogue Box as shown above. The second is locate the mouse at the top of the display until the mouse changes from the arrow to a vertical double-ended arrow similar to the one that appears when resizing a window. Left click the mouse and drag down. As the mouse is dragged, a Gray-diagonally striped area will follow the mouse. Release the mouse button when the desired minimum range is set. Likewise, the same can be accomplished with the maximum depth except the starting point is at the bottom of the screen.

Figure 32 shows the effects of maximum profile depth. In the top image, the maximum profile depth is set to a point beyond the bottom return. Thus, profile points are generated on the bottom. In the bottom image, the maximum profile depth is set to a point just at the bottom return. Thus, profile points are generated only on the part of the bottom that is less than the maximum depth setting.

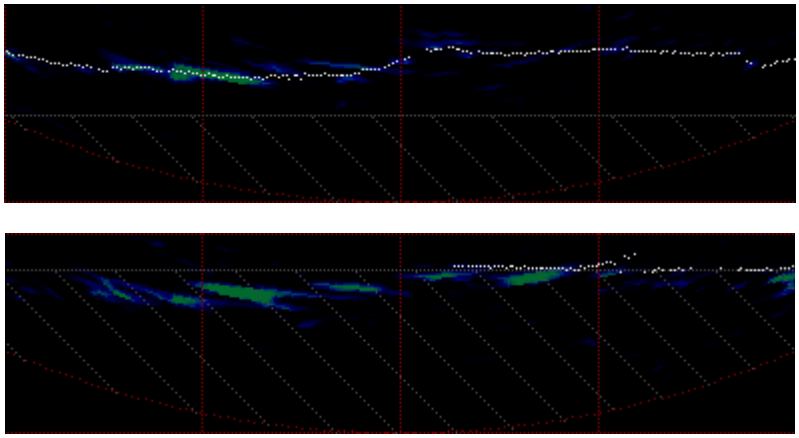


Figure 32: Example of Maximum Profile Depth Adjustment

Figure 33 shows the effects of minimum profile depth. In the top image, the minimum profile depth is set to a point closer than the targets. Thus, profile points are generated on the targets. In the bottom image, the minimum profile depth is set to a point just at the targets. Thus, profile points are generated only on the part of the targets that are farther away than the minimum depth setting.

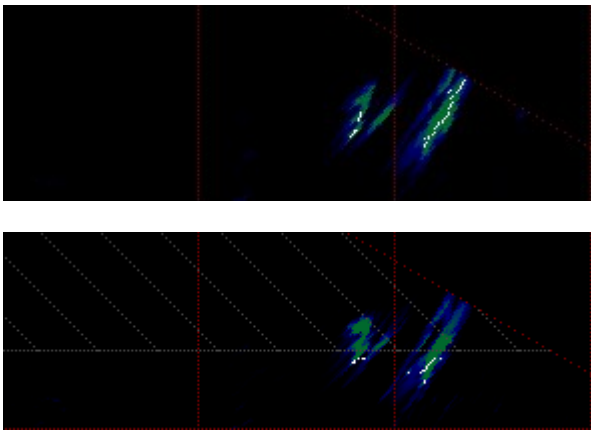


Figure 33: Example of Minimum Profile Depth Adjustment

10.4.2 Profile Point Display

This section of the Profile Point Setup dialogue box sets the method for displaying sonar data on the screen.

High Mix
With High Mix, Image data is displayed at the normal intensity along with the generated profile points This is shown below in **Figure 34**.

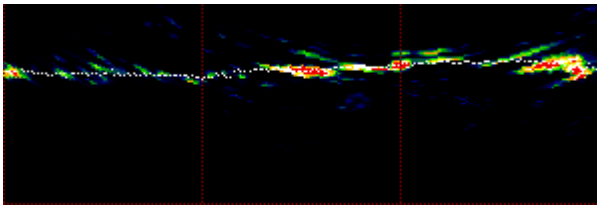


Figure 34: High Mix Example

Med Mix
With Med Mix, Image data is displayed at half intensity along with the generated profile points. This is shown below in **Figure 35**.

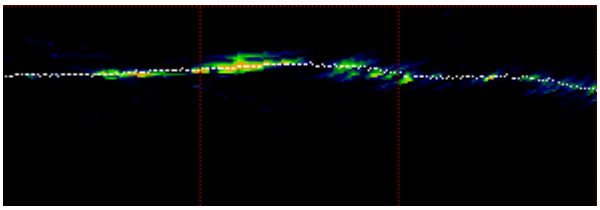


Figure 35: Med Mix Example

Low Mix
With Low Mix, Image data is displayed at quarter intensity along with the generated profile points. This is shown below in **Figure 36**.

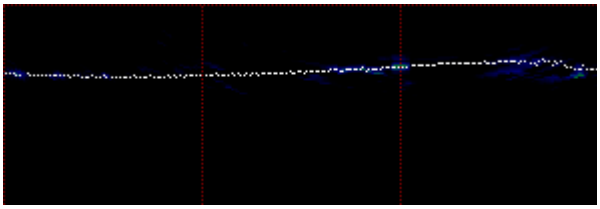


Figure 36: Low Mix Example

Points Only
With Points Only, Image data is removed from the screen entirely and only profile points are displayed. This is shown below in **Figure 37**.

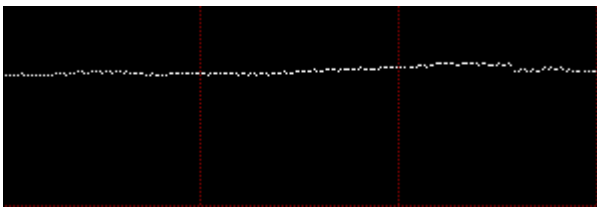


Figure 37: Points Only Example

Artificial Bottom
Artificial Bottom enabled is shown below in **Figure 38**.

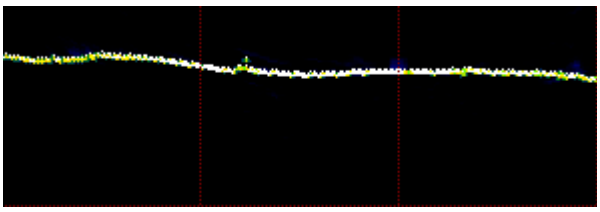


Figure 38: Artificial Bottom with Low Mix Example

10.4.3 Profile Point Filter

Profile Point Filters enable the user to generate profile data focusing on certain areas of interest. By selecting various filter settings, the resulting profile data image can be altered significantly. This area is also covered more visually in the 3DView Section on **page 38**. Using 3DView, the filtering results are much more apparent as it shows multiple pings at once rather than a "slice" of time as the DeltaT software does.

First Return
When First Return is selected, the profile points will be generated on the first target whose intensity is over a set threshold (and whose range is greater than the Minimum Range or Depth set by the user). The effect of this is that any objects in the water column will generate profile points.

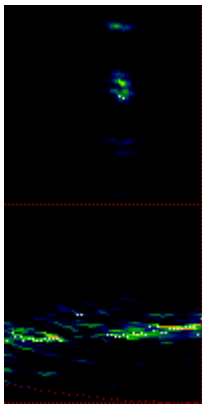


Figure 39: First Return Filtering Example

Maximum Return
When Maximum Return is selected, the profile points will be generated on the target whose intensity is the greatest for that beam (and whose range is greater than the Minimum Range or Depth set by the user). The effect of this is that any objects in the water column which generate weaker returns than the bottom will not generate profile points.

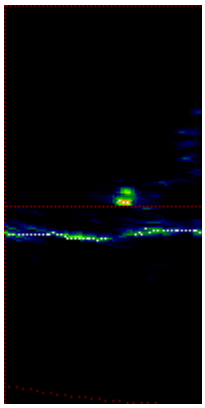


Figure 40: Maximum Return Filtering Example

Bottom Following
When the Bottom Following filter is selected, the profile points will be generated based on a determination on the bottom return. It attempts to “map” or “follow” the bottom in order to generate contours. The effect of this is that any objects in the water column which generate weaker returns than the bottom will not generate profile points.

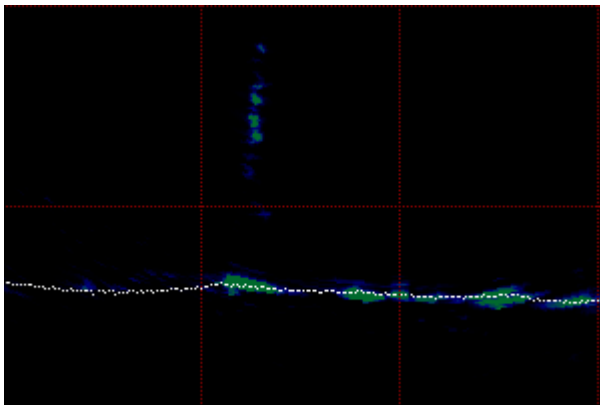


Figure 41: Bottom Following Filtering Example

10.4.4 Advanced Filter Settings

There are numerous filter parameters which can be changed when using the “Bottom Following” profile point filter. To change these parameters, select the Advanced Filter Settings button in the Profile Point Setup dialog box.

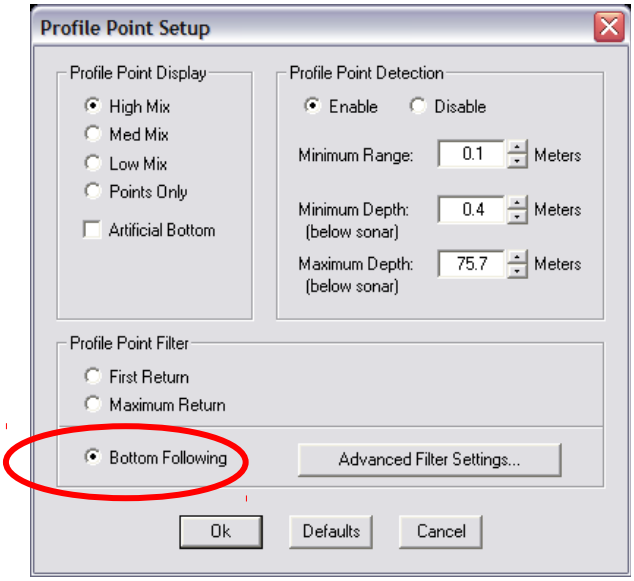


Figure 42: Profile Point Setup dialogue box

All Filter settings are active in real-time or during file playback, so experimentation with these settings will not affect the stored data. The various filter settings may need to be changed depending on the bottom type and/or if there are targets on the bottom or in the water column (i.e. rocks, shipwrecks, fish schools, pilings, etc…).

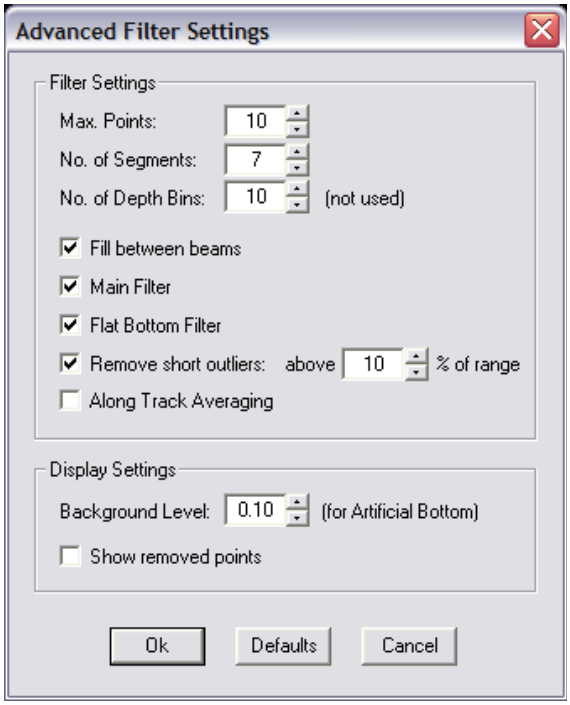


Figure 43: Advanced Filter Settings dialogue box

Max Points
the bottom detection filter detects up to “Max Points” and returns the range point with the highest summed power, assuming the bottom echo contains the highest power. A maximum of 10 points can be detected, however a setting between 2 and 5 will generate good results. Use a setting of 1 to detect all targets in the water column.

No. of Segments
number of segments is used to help the filter work on complex bottoms (i.e. bottoms that are not flat). The bottom is divided into equal horizontal segments so the filter can act on smaller, less complex sections. Values between 3 and 5 produce good results for typical bottom types. A value of 1 could be used for a very flat bottom.

No. of Depth Bins
not used at this time

The following sequence is a good starting point for experimenting with the various parameters (check the result of each setting before moving to the next parameter):

1. **Fill between Beams**
   This setting generates a bottom range point for beams that don’t contain valid range to bottom values. The detected range points from adjacent beams are used for interpolating between the beams.

2. **Main Filter**
   The main filter smoothes the detected range points and positions the points in the center of the returned pulse. This helps to generate a truer bottom profile specially on the outer beams where the grazing angle is such that the returned pulse can be scattered.

3. **Flat Bottom Filter**
   The flat bottom filter reduces bottom artifacts directly beneath the transducer. All beams within +/-30 degrees of nadir are analyzed. Use this filter only if important vertical features such as pilings or seawalls are not present.

4. **Remove short outliers**
   Short outliers are unwanted targets above the bottom and in the water column. The “% of range” entry sets the effective “height off bottom” setting for the filter. This setting is entered as a percentage of the current range scale. For example, if the current range scale is 20m, a value of 20% would mean that all targets higher than 4m above the bottom will be removed. A setting of 20% can be used for relatively flat bottoms, lower settings can be used for very flat bottoms. Increase to 100% to keep all water column targets.

   Select “**Show removed points**” to display the removed points as enlarged green blocks (using the Norm Hi Color Table). Lower the “**Background Level**” setting to 0.1 or until the removed points are easily seen. This is a good diagnostic tool for evaluating the short outlier removal filter.

5. **Along Track Averaging**
   This filter generates bottom ranges by averaging a number of consecutive pings. It uses the same ping average setting as the Options | Averaging menu. Along track averaging can be used with any of the above filters.

10.5 Processing Effects on Profile Data

The type of processing performed on the raw data affects the resulting profile data greatly. It is recommended that the least amount of processing is performed during data acquisition as extra processing reduces frame rate, and thus reduces the quality of the final project. Think of it as digital photography. If while taking pictures of a football game, you pause between each picture to crop it, and rotate it, you will miss the big touch down. If, however, you simply take pictures as fast as your camera will allow, you will get a great photo of that touchdown. You can always crop, and rotate that picture later. It is the same with sonar. Because the “raw” sonar data is always stored, you can post process the data at a later date. If the best quality data is desired, try and reduce the amount of processing to the minimum amount to get the job done. Then, during playback and profile generation, increase the amount of processing to improve the results.

For example, in **Figures 44** through **45**, the amount of processing was altered. The sonar head was run at 30m range with Narrow Mixed processing. The first two indicate the effect of altering the number of beams only. With 480 beams being processed, the PRF was 121ms (8Hz). By changing the number of beams to 120, the PRF was reduced to 82ms (12Hz). By further reducing the processing required (setting the sector size to 60 degrees rather than 120 degrees, the PRF was further reduced to 71ms (14Hz). The sonar achieved an extra Six pings per second. Assuming a 3 knot cruising speed, the data collection rate went from ~5 pings per meter up to ~9 pings per meter.

Note however, that these numbers are strictly for example only, and may or may not be reasonable in the field. Experimentation will need to be done to determine the minimum amount of processing to get the job done.

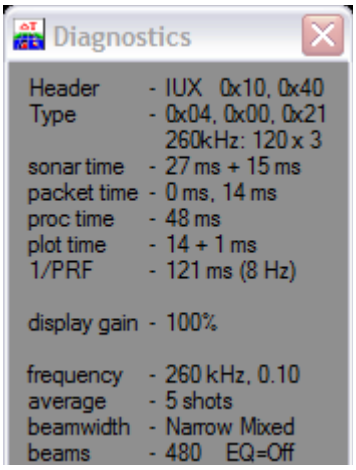


Figure 44: PRF Example - 480 Beams, 120deg Sector

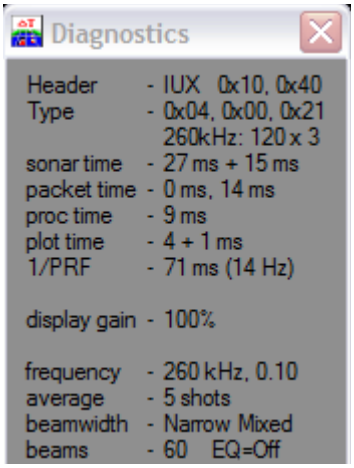


Figure 45: PRF Example - 120 Beams, 60deg Sector

10.6 Profile inspection using 3DView

It is important to remember that the DeltaT software only displays one shot at a given time. Thus, it can be difficult to determine what is being displayed on the screen. To alleviate this, Imagenex has developed the 3DView.exe application which sequentially plots one frame at a time to “build up” an image over time. This section demonstrates the effect of profile filtering using the 3DView images.

First Return

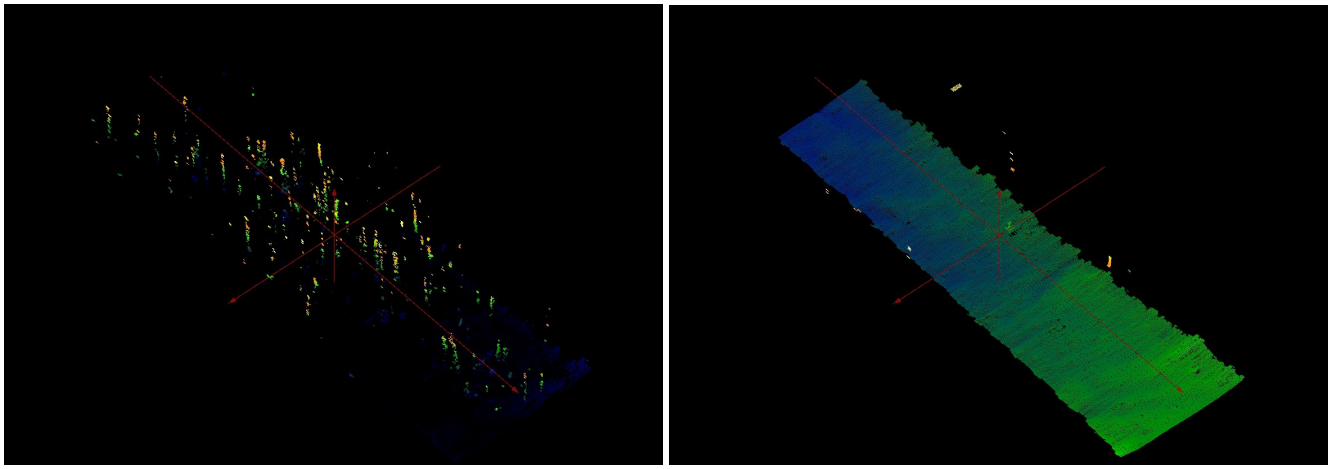
When First Return is selected, the profile points will be generated on the first target whose intensity is over a set threshold (and whose range is greater than the Minimum Range or Depth set by the user). The effect of this is that any objects in the water column will generate profile points.

Bottom Following

When the Bottom Following filter is selected, the profile points will be generated based on a determination on the bottom return. It attempts to “map” or “follow” the bottom in order to generate contours. The effect of this is that any objects in the water column which generate weaker returns than the bottom will not generate profile points.

The section of data shown below in **Figure 46**, is the same. The first was done using the First Return filter, while the second was done using the Bottom Following filter. The first image shows clearly the standing timber that was present, while the second clearly shows the bottom contour of where the trees were standing.

The 3DView program provides the capability to zoom in and rotate the image to give varying perspectives of the data. The images below were rotated to illustrate the timber more clearly. Also, the bottom returns (where there were no trees) was masked off in the 3DView program to further isolate the trees.



First Return *Bottom Following*

Figure 46: Filtering Examples using 3DView.exe

11.0 Imaging Operations

This section will describe the various functions that are specific for imaging DeltaT's

11.1 Background Removal

Background removal can be used to display only the 'moving' targets of a static image. Press the '**Build Reference**' button to begin generating a background reference image, then press '**Store Reference**'. The background reference image will now be removed from the current image to produce an image with only 'new' or moving targets, you can then add Persistence to display a trail behind the moving targets.

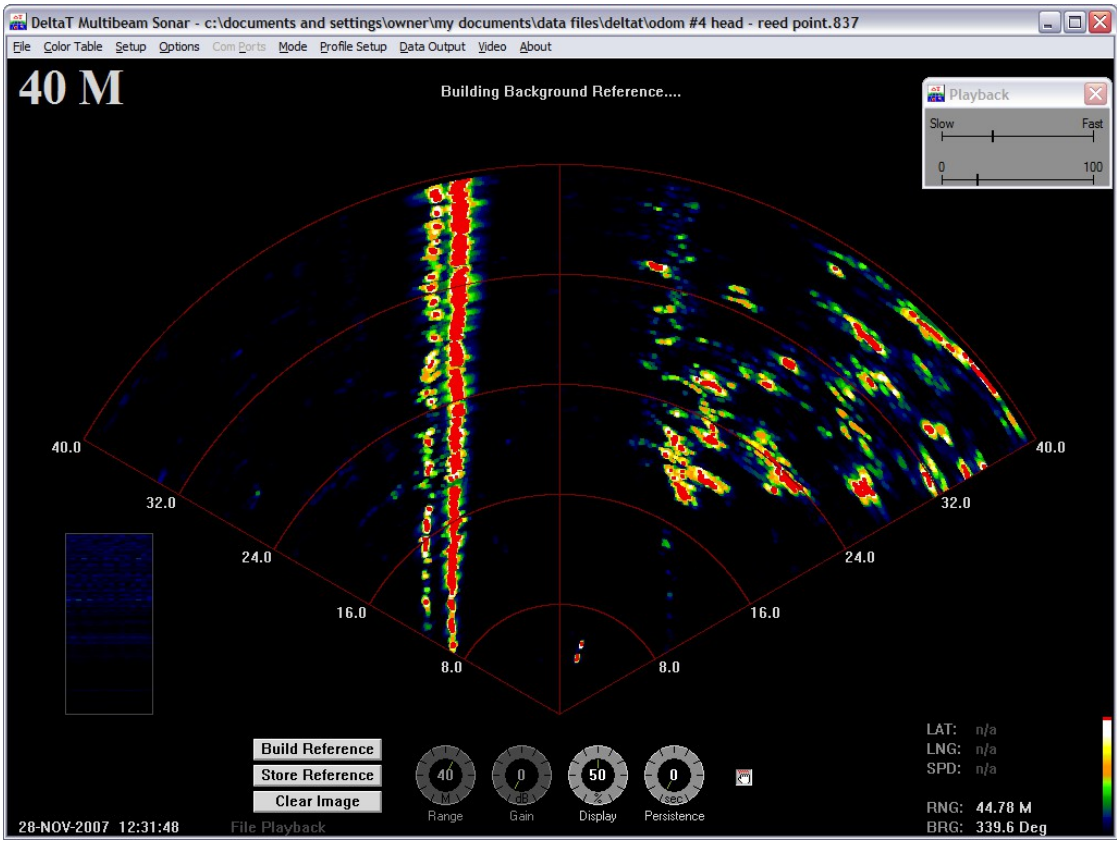


Figure 47: Background Removal

11.2 Perspective Mode

In order to aid in navigation, the DeltaT software has an imaging mode called “Perspective”. This mode displays sonar data in pseudo “3D” in order to give the user a sense of distance. To access this mode select “*Mode -> Perspective*” (**page 13**). **Figure 48** shows the standard Sector display mode while **Figure 49** shows the same data in Perspective mode.

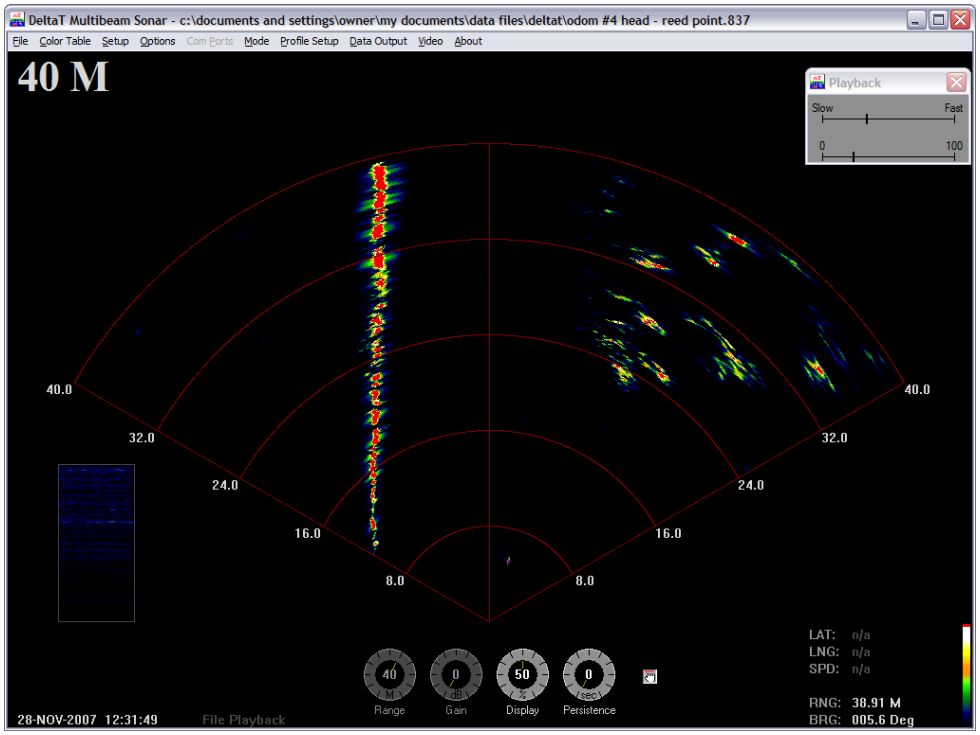


Figure 48: Sector Display Mode

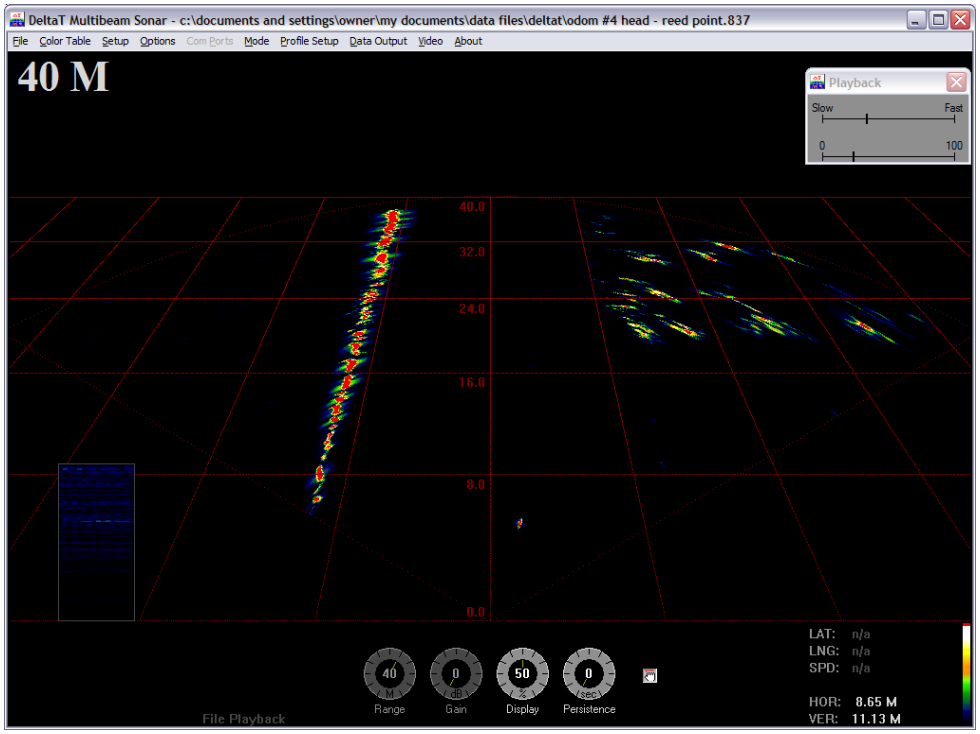


Figure 49: Perspective Display Mode

Appendix A – Optional Sensor Calibration

The DeltaT has an optional, built-in Pitch Roll and Heading Sensor. These are calibrated at the factory and while the pitch and roll should not generally need to be re-calibrated, the heading may need to be re-calibrated in the field due to external influences.

Pitch and Roll Calibration

Set the DeltaT in the desired position, and accurately **level** the sonar in both the pitch and roll directions. Run the program "**DeltaT_calibrate_pitch_roll.exe**", and follow the on-screen instructions.

Heading Calibration

Set the DeltaT in the desired position. Run the program, "**DeltaT_calibrate_compass.exe**", and follow the on-screen instructions. The calibration rotation may be performed either **Clockwise**, or **Counter-Clockwise**. When installed on a ship, rotate the entire vessel through 360 degrees.

Appendix B – Ethernet Setup Guide

The Imagenex Model 837 DeltaT sonar system consists of an underwater sonar head connected via Ethernet directly (or indirectly) to a Windows © based computer.

This document covers the necessary setup procedures to enable your Windows© XP© based PC to communicate with the sonar.

Ethernet Cable
The included Ethernet cable specifications are:

- Cat 5e
- RJ-45
- 568B wiring scheme

If this cable needs to be replaced, ensure that the above specifications are met.

Configuration of Windows XP Ethernet Communications

For the DeltaT system, the following Address's are used

PC

IP Address	192.168.0.X
Subnet Mask	255.255.255.0

Where 'X' is a decimal number between 3 and 224. The number '1' is reserved for a network server '2' is reserved for the DeltaT sonar head, and 255 is reserved for broadcasting.

The DeltaT sonar head has a statically assigned IP Address of **192.168.0.2** . This is the number to enter for "*Sonar IP Address*" in the "*Setup*" menu, as shown in **section 3.3**, on **page 9**.

The Recommended PC's IP address and Subnet Mask on the PC are:

IP Address	192.168.0.3
Subnet Mask	255.255.255.0

On a Windows© XP© based machine, this is done as follows:

1. Navigate to the Control Panel and double click "Network Connections"
2. Right click on the Ethernet interface you wish to connect with and select "Properties"

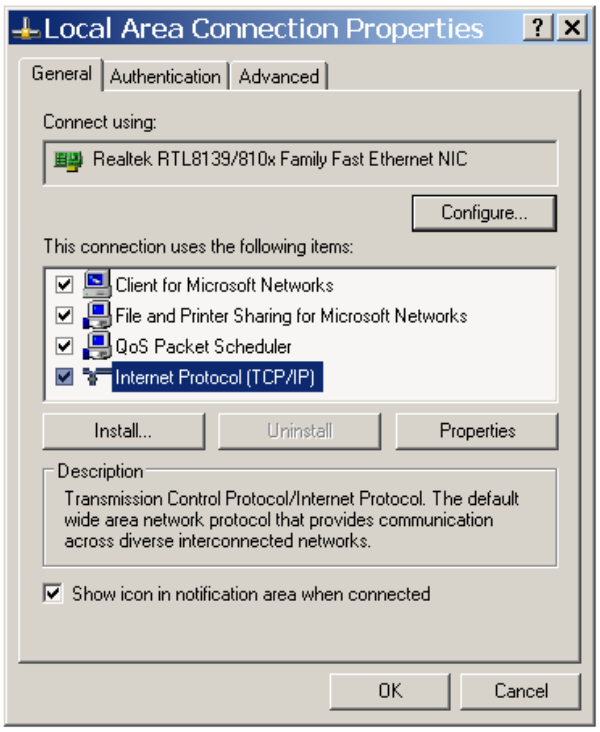


Figure 50: Local Area Connection Properties Dialogue Box

3. Select Internet Protocol (TCP/IP) and select "Properties"

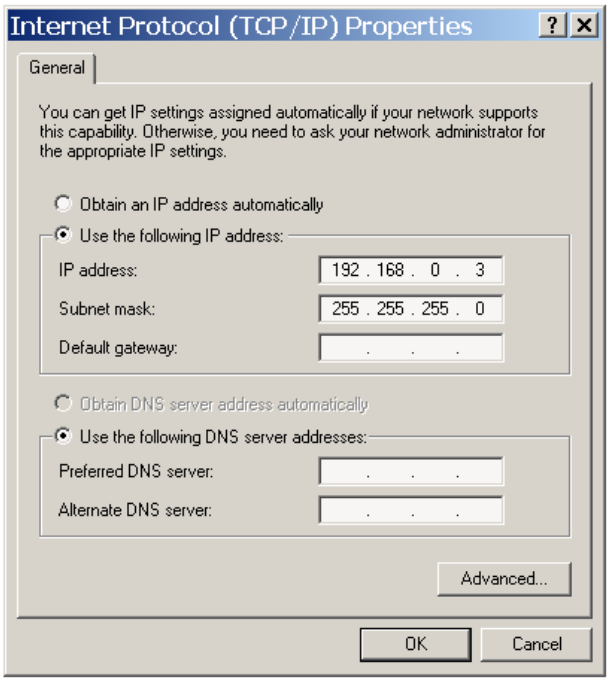


Figure 51: TCP/IP Priorities Dialogue Box

4. Enter the information shown above in **Figure 51** and click "OK" to accept the changes.
5. Click "OK" again to accept the changes.

Now your computer is on the same "*Network*" as the sonar head. When starting the DeltaT.exe program, the IP address stored in the "DeltaT.INI" file is read and a connection will be established.

The sonar head has a statically assigned IP Address of **192.168.0.2** . Enter this number in the menu item "*Setup -> IP Address*".

The sonar head will run fine. However, if communication to the head does not function properly, try the suggestions located on **page 49**.

Configuration of Windows 7 Ethernet Communications

Windows 7 requires a few more steps than XP for network configuration, but is generally the same.

On a Windows© 7 based machine, this is done as follows:

1. Go to the Start Menu and select "Control Panel".
2. Select "Network and Sharing Center".

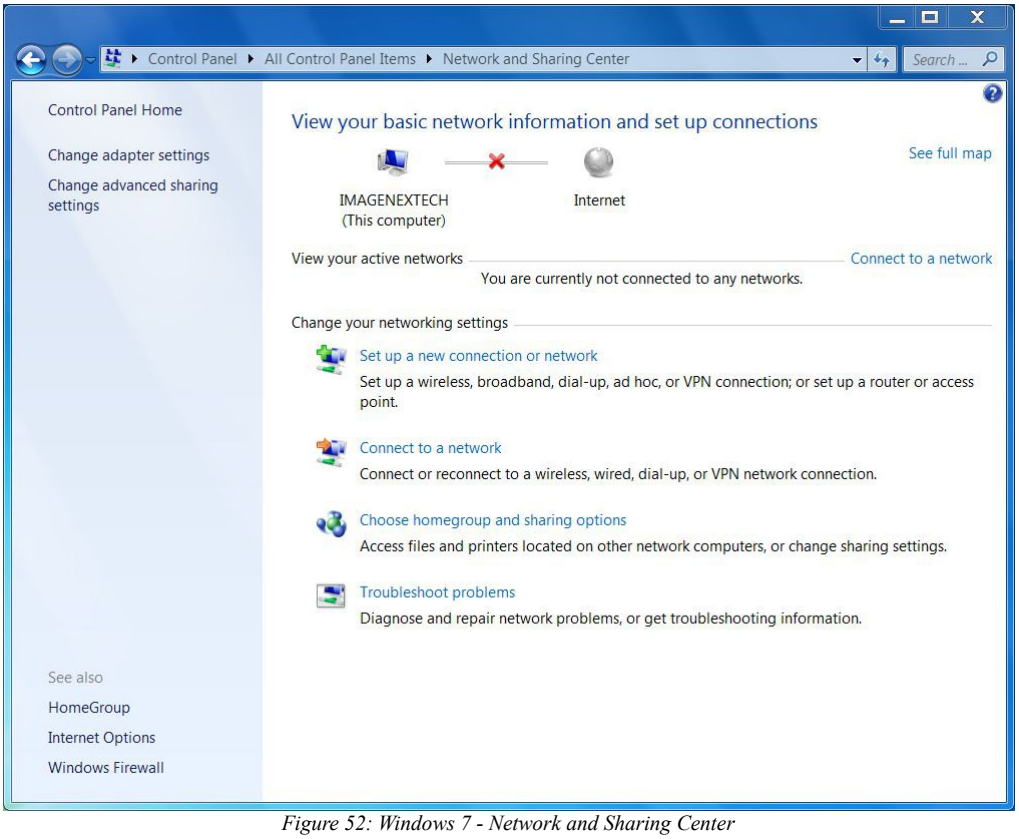


Figure 52: Windows 7 - Network and Sharing Center

3. Select "Change adapter settings".

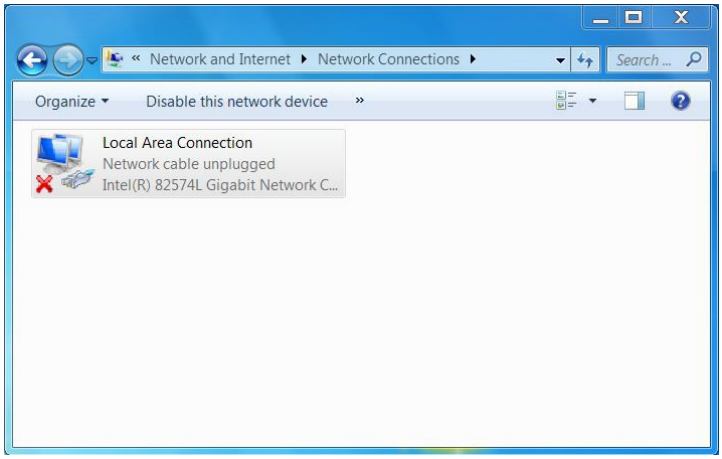


Figure 53: Windows 7 - Network Connections

4. Right-click on “Local Area Connection” and select “Properties”.

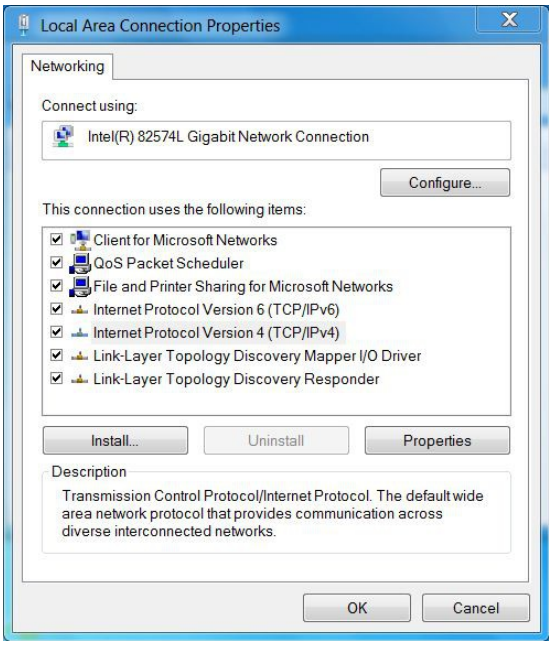


Figure 54: Windows 7 - Local Area Connection Properties

5. Select “Internet Protocol Version 4 (TCP/IPv4)” and select “Properties”.
6. Continuing from item 4 and **Figure 51**, on page **43**, enter the required information.

Sharing an Ethernet Device with the Sonar and Internet

If the computer will be using the same Ethernet card for both the sonar and Internet uses (**NOT** at the same time), set the card for the sonar using the above procedures. When using the Internet, you will need to reset the IP, Subnet, Default Gateway, and DNS Server to correspond to your Internet Service Provider. On most modern systems, this may be as simple as setting the system to "Obtain settings Automatically" This will set the computer to use the DHCP protocol.

The DeltaT sonar head has a statically assigned IP Address of 192.168.0.2 . To re-use the sonar, the above procedures **MUST** be followed

Setting up a Direct Connection

This is the simplest way to connect to an Imagenex Ethernet Sonar System to a computer (**PC**) as shown in **Figure 55**. In this configuration, there is simply a direct connection between the sonar and the operating PC. Note that the PC has a static IP address of "192.168.0.157".

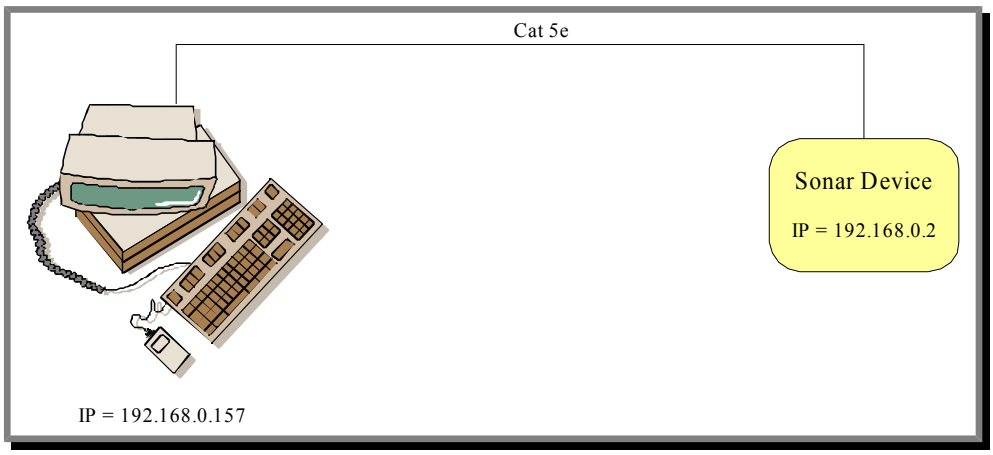


Figure 55: Connecting the Sonar via Direct Connection

Setting up a LAN

To connect an Imagenex Ethernet Sonar System to a Local Area Network (LAN), refer to **Figure 56**. The advantage of this setup is that the sonar may be operated from any computer that is connected to the LAN. Note that the server computer must be running Windows© XP© PRO in order to set up a LAN. This is because only XP© PRO contains the necessary DHCP server component to auto-configure the client PC's. The server also has a static IP address of "192.168.0.1" and no other PC on the network may have this IP. Currently, the sonar **does not support DHCP** and is simply "piggy-backing" the network by using an IP that is on the same Subnet Mask as the LAN.

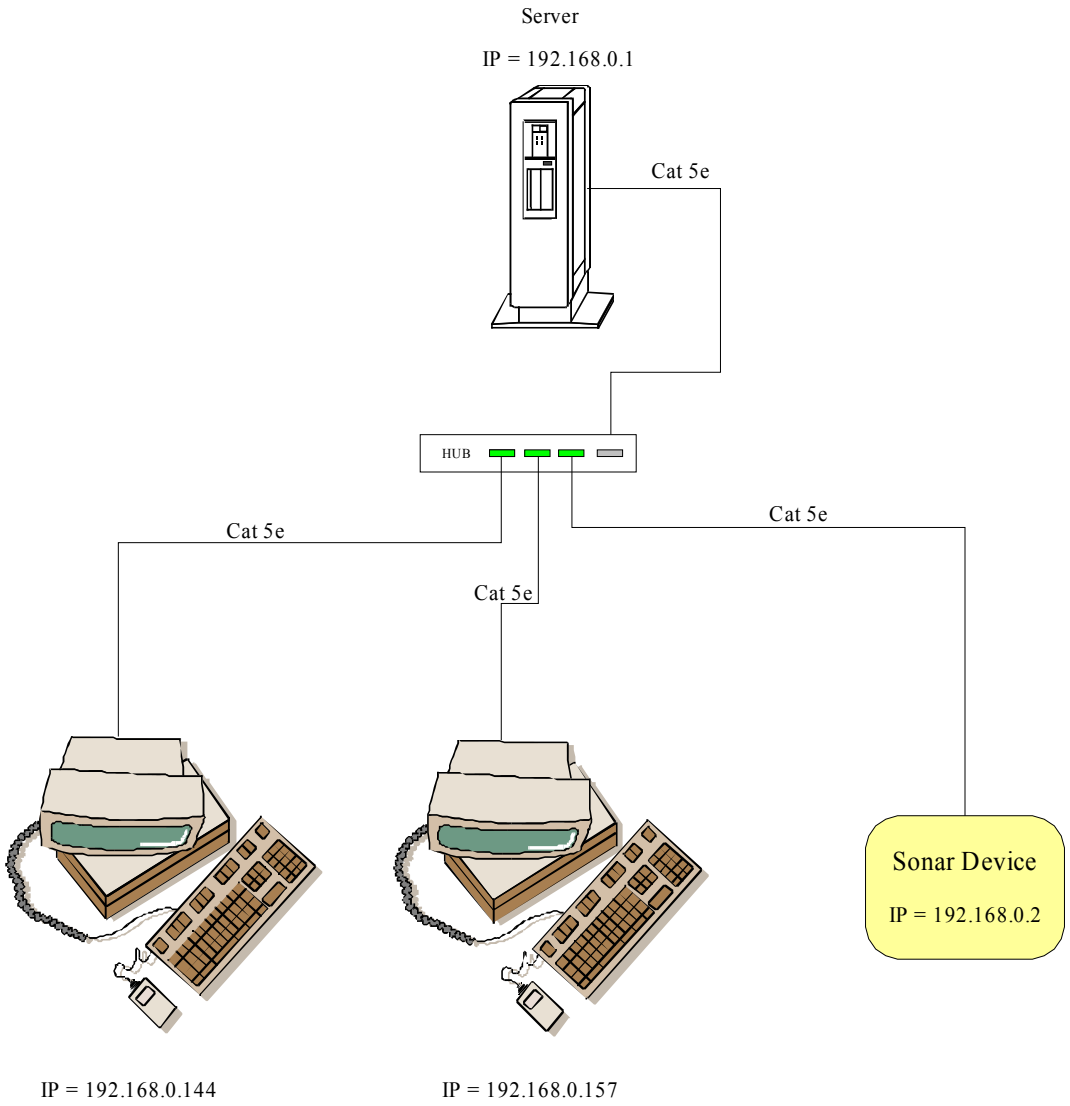


Figure 56: Connecting the Sonar via a LAN

Setting up a Networked LAN

To connect an Imagenex Ethernet Sonar System to a networked Local Area Network (LAN), refer to **Figure 57**. This setup consists of two LAN's interconnected via a router. The router acts as a server to the LAN that is directly connected to the sonar. The advantage of this setup is that the sonar may be operated from any computer that is connected to either LAN. The server has a static IP address of (for example) "172.16.0.1". The router essentially has two sides. One side is configured as a client ("172.16.0.127") and the other side is configured as a server ("192.168.0.1"). Currently, the sonar **does not support DHCP** and is simply "piggy-backing" the network by using an IP that is on the same Subnet Mask as the LAN.

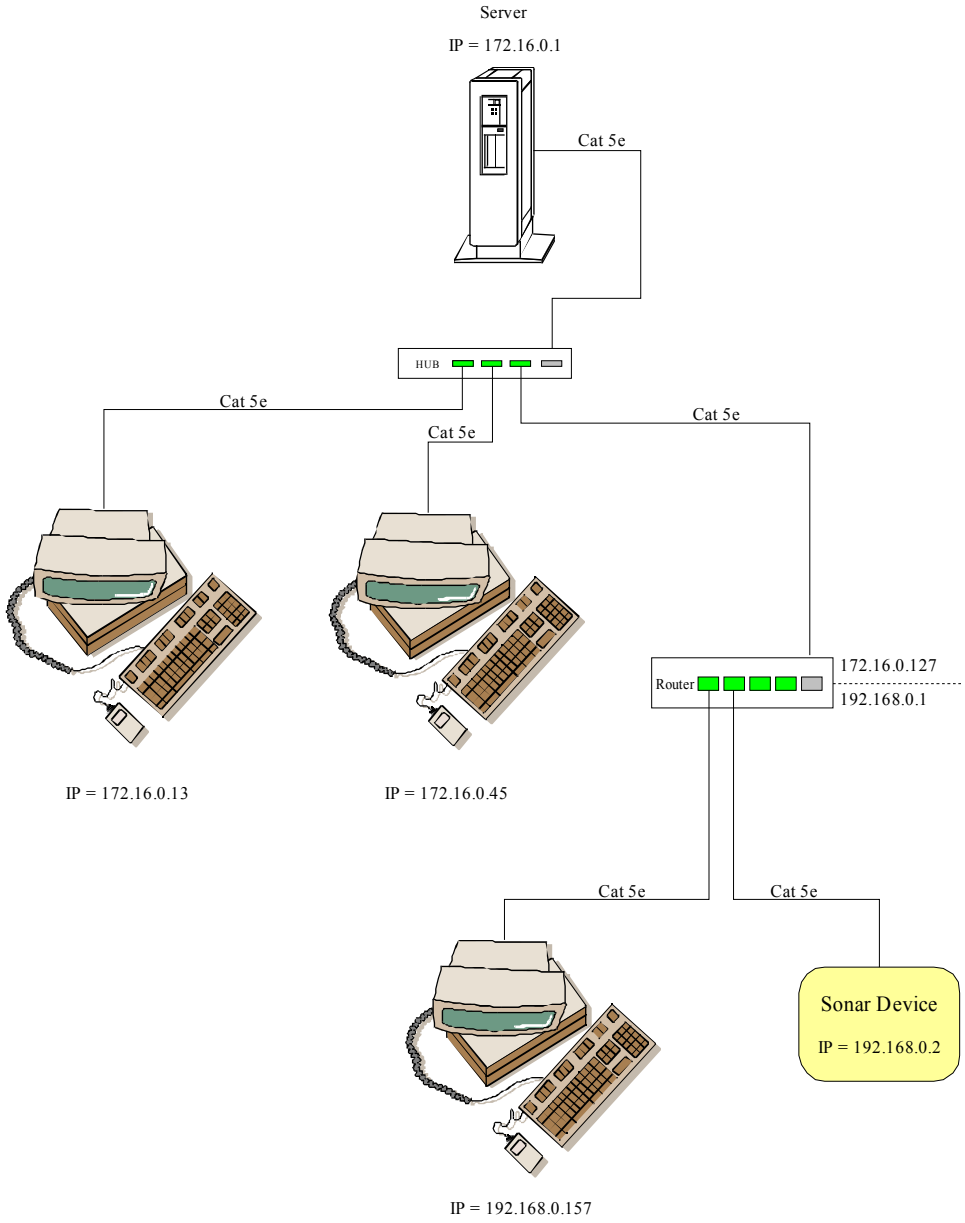


Figure 57: Connecting the Sonar through a multiple LAN

Appendix C – Troubleshooting Communications

Disable any network bridges that are present

- A network bridge allows a separate port, such as "USB", or "Firewire" to piggyback the Ethernet connection.
- Under "Network Connections", if there is a network bridge icon, disable it.

Disable any other network devices that are present on the computer

- Often, if there are multiple network cards present, Windows may get confused on which one to communicate through. This is more of an issue on laptops with wireless connections.
- Right-click on each connection and select "*Disable*".

Under "Network Connections", right-click on the Ethernet card and select properties.

Clear unnecessary network protocols

- De-select all services except for "*Internet Protocol (TCP/IP)*"

Remove any firewalls present (Note that Windows© XP© has a rudimentary firewall built into it. Disable this one first).

- Select the "Advanced" Tab. De-select the Firewall option (if present).

Click on "Configure" (in the "General" tab) and a new dialogue box will appear.

Set Link speed to "Auto" or "10Mbps"

- In the "Advanced" tab, select "Link Speed / Duplex Mode" and set to either "*Auto Mode*" or "*10 Full Mode*".

Disable any power saving that shuts down the Ethernet card.

- In the "Advanced" tab, select "Link Down Power Saving" and set to "*Disable*".
- In the "Power Management" tab, de-select any power saving option.

Repair the Ethernet connection.

Windows remembers the hardware address for each socket. To clear the Windows settings:

- Right click on the Local Area Connection.
- Select "Repair".

Appendix D – USB Data Converters and Windows XP©

With the proliferation of the "*Universal Serial Bus*" (USB) compatible devices available for notebook and desktop computers, manufacturers are rapidly omitting physical serial ports on there products in order to cut production costs. The USB bus is extremely versatile as there are no Com Port conflicts, no IRQ's to deal with, and has support for up to 256 devices on one bus (while there are usually multiple USB ports on a computer, there are usually only two physical USB buses) .

With all that is going for it, one would wonder why use serial devices at all. Good question. Major factors in retaining a true physical serial device are:

Cable length – USB has a maximum cable length support of 5m (~16')
Latency – USB is a packet driven technology and as such delays occur due to USB driver packaging schemes.

Virtual Communication Ports

To get a serial device (RS-232 or RS-485) connected to a computer that only has USB ports, a converter needs to be installed in-line between the USB port and the serial device. These converters install a special driver in Windows called a "Virtual Com Port" This software will emulate a serial port so that serial enabled software can simply "see" the USB port as a serial port. See the figure below for an overview.

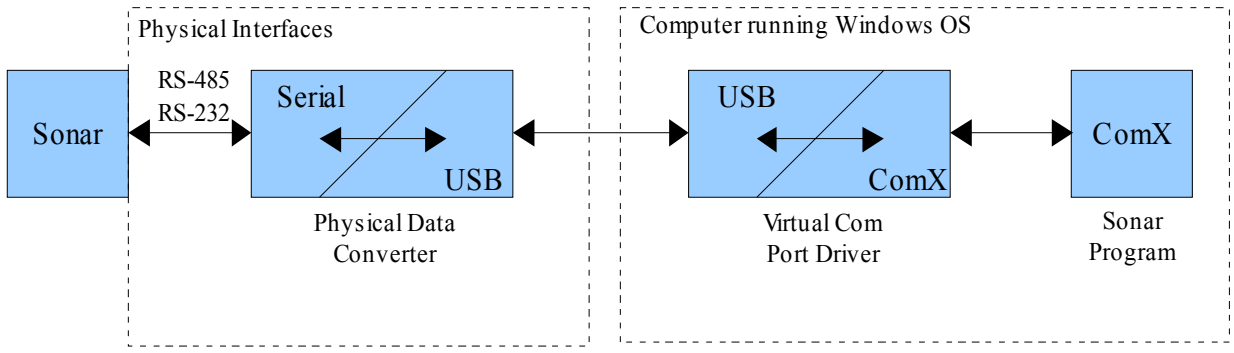


Figure 58: Overview of USB Data Converter Logic Flow

One caveat is that Windows can get "confused" if a device is plugged into a USB port while there is data being transmitted through it. Windows thinks that the device is a "pen mouse" and the mouse cursor will behave erratically. If this happens, the computer will need to be restarted. To circumvent this phenomena, **DO NOT** connect GPS, or other devices to the USB adapter until the adapter is fully functional (i.e. plug the converter into the computer and wait until Windows sets it up and assigns it a Com Port number BEFORE plugging a serial device into the converter).

Generally, once a converter is correctly installed, Windows will assign a Com Port number to **A PARTICULAR** device on **A PARTICULAR** USB port. Once this is done, things run pretty smoothly....until the operator changes something....

Common Windows© Issues related to all USB to Serial Converters

This section is directed towards a USB device that is encoded with a serial number. If the USB is not encoded with a serial number, Windows will not assign a different Com Port number for each device. It will still, however, assign a different Com Port number for each physical USB port.

Windows XP will assign a Com Port number to a USB device when it is first installed in the system. However, it will assign a **DIFFERENT Com Port** number to the same device when it is plugged into a **DIFFERENT USB port** on the same computer. To further complicate matters, Windows XP will assign a **DIFFERENT Com Port** number to a **DIFFERENT** device when it is plugged into the **SAME USB port** on the same computer.

Table 15: Windows Com Port Assignment Scheme

Converter	USB Port	Assigned Com Port
A	A	4
A	B	5
A	A	4
B	A	5

The table above indicates a possible scenario where various converters are plugged into various USB ports. The assigned Com Port numbers above are only for illustration purposes. Windows will actually assign the device the next available Com number.

For example, If you first plug the device into the BACK USB port of the laptop, Windows will assign it a Com Port number of (for arguments sake) '4' When you start the DeltaT software, you set the GPS Com Port to '4', and it runs fine. The next time you use the device, you plug the same device into the SIDE USB port on the laptop. Windows will then assign the device a Com Port number of (again, for arguments sake) '5'. Now when you start the DeltaT software, it cannot open, or find, Com Port '4' as the device is now set to Com Port '5'. You set the Com Port in DeltaT to '5' and it again runs fine.

There is no solution for this behaviour. It is a Windows function, and Imagenex has no control as to how the Com Ports are assigned to a device.

Our suggestion is to only use the same USB port for each device. For example, only use the BACK USB port for GPS input.

Also, if a different serial device is plugged into the same USB port, Windows will assign it a different Com Port again. For example, if Com Ports '4' and '5' are already taken, Windows will assign it Com Port '6'.

To make a long story short. Windows assigns a specific Com Port to a specific serial device plugged into a specific USB port. If any combination changes, Windows will assign a different Com Port.

Determining the Assigned Com Port For All USB to Serial Converters

This section describes various procedures for determining the assigned Com Port of a converter. This document assumes the Windows XP Pro operating system and other computers may appear differently. However, the procedures will be similar regardless of the Windows version.

To access the Device Manager from the Desktop:

1. Right click on “My Computer”
2. Left click “Properties”
3. Follow the following Illustrations to Set the Com Port Number of the Device. Note that these Illustrations are for the ATEN UC-232A Device. Also, Ignore the baud rate settings. Imagenex software automatically opens the port at the correct parameters.

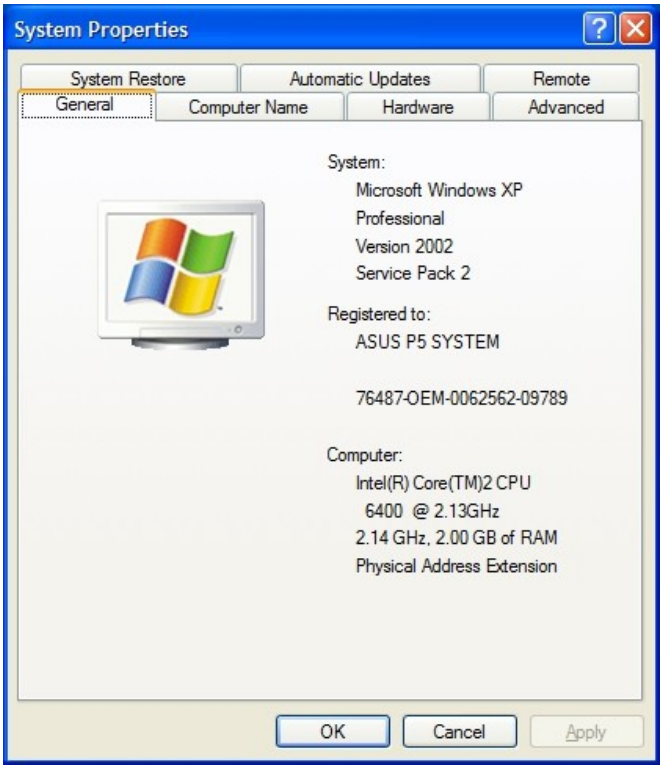


Figure 59: System Properties

Figure 60: System Properties - Select Hardware Tab

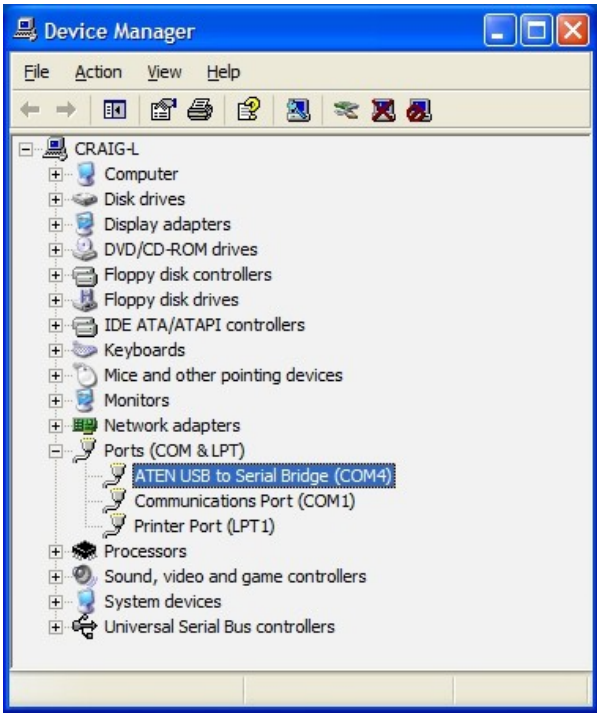


Figure 61: Device Manager – Select Ports and double click device

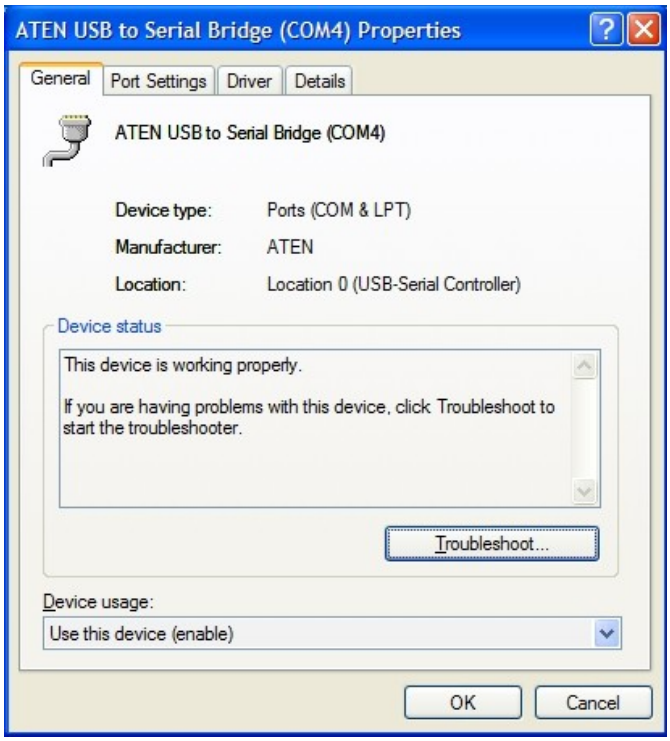


Figure 62: Port Properties – Select "Port Settings"

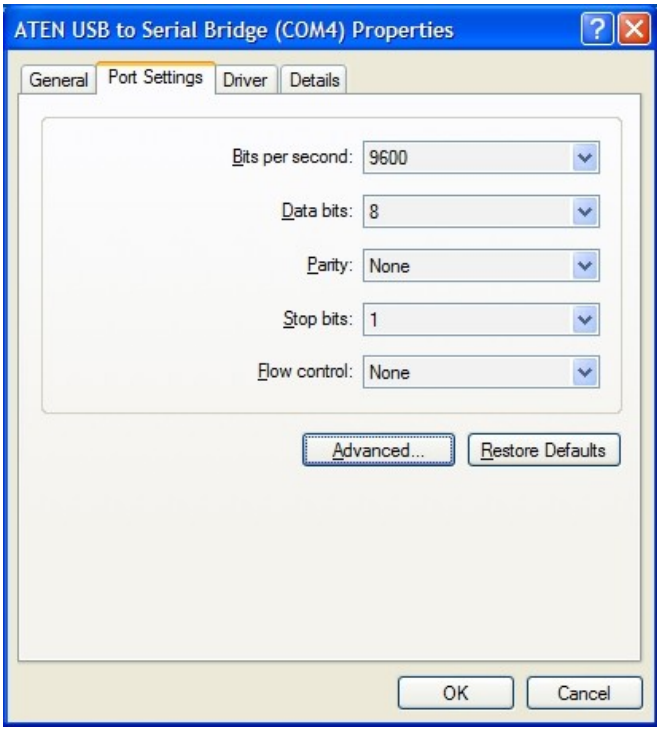


Figure 63: Port Properties - Click "Advanced"

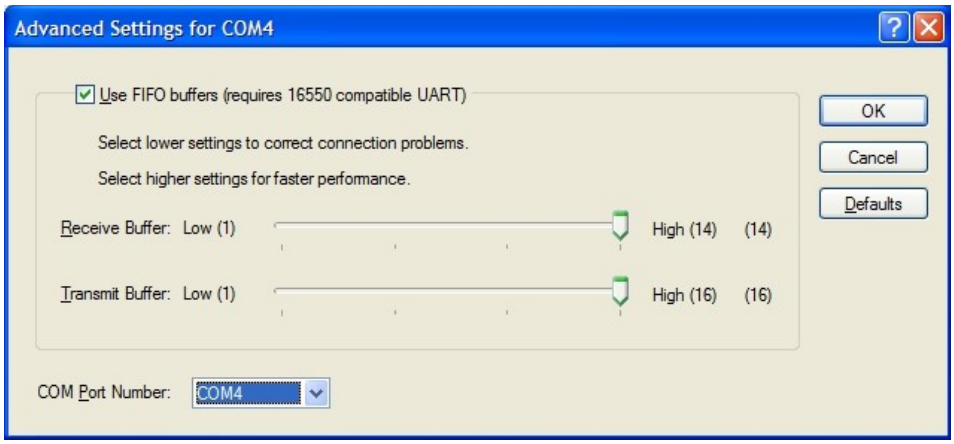


Figure 64: Advanced Port Properties - Select Com Port Number

Quick Tip

To make a shortcut to the Device Manager on the Windows desktop:

1. Right click on the Windows desktop
2. Select “New” --> Shortcut
3. Enter “devmgmt.msc”
4. Select “Next”
5. Enter “Device Manager”
6. Select Finish

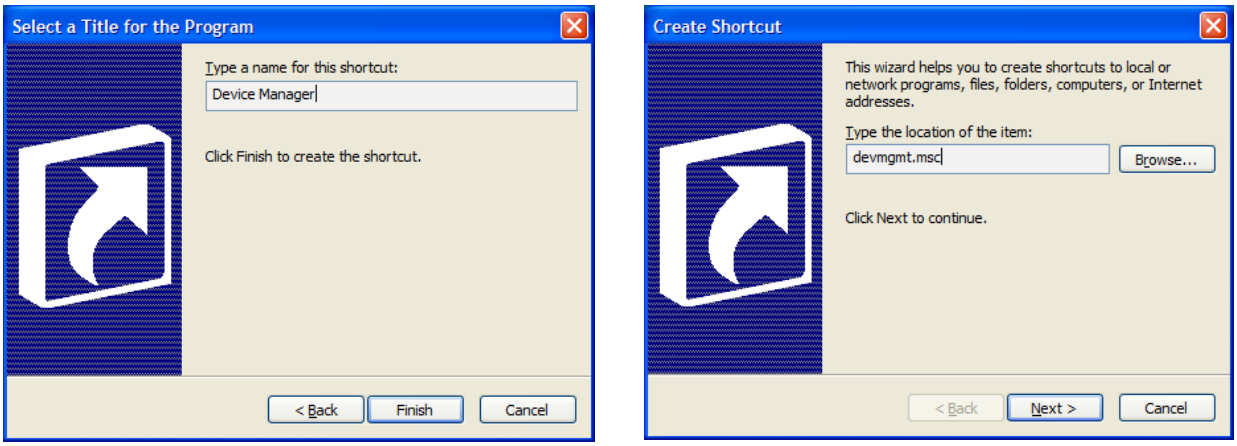


Figure 65: Creating a Device Manager Shortcut

Appendix E – Setup With Customer Supplied Real Time AUV Navigation Computer

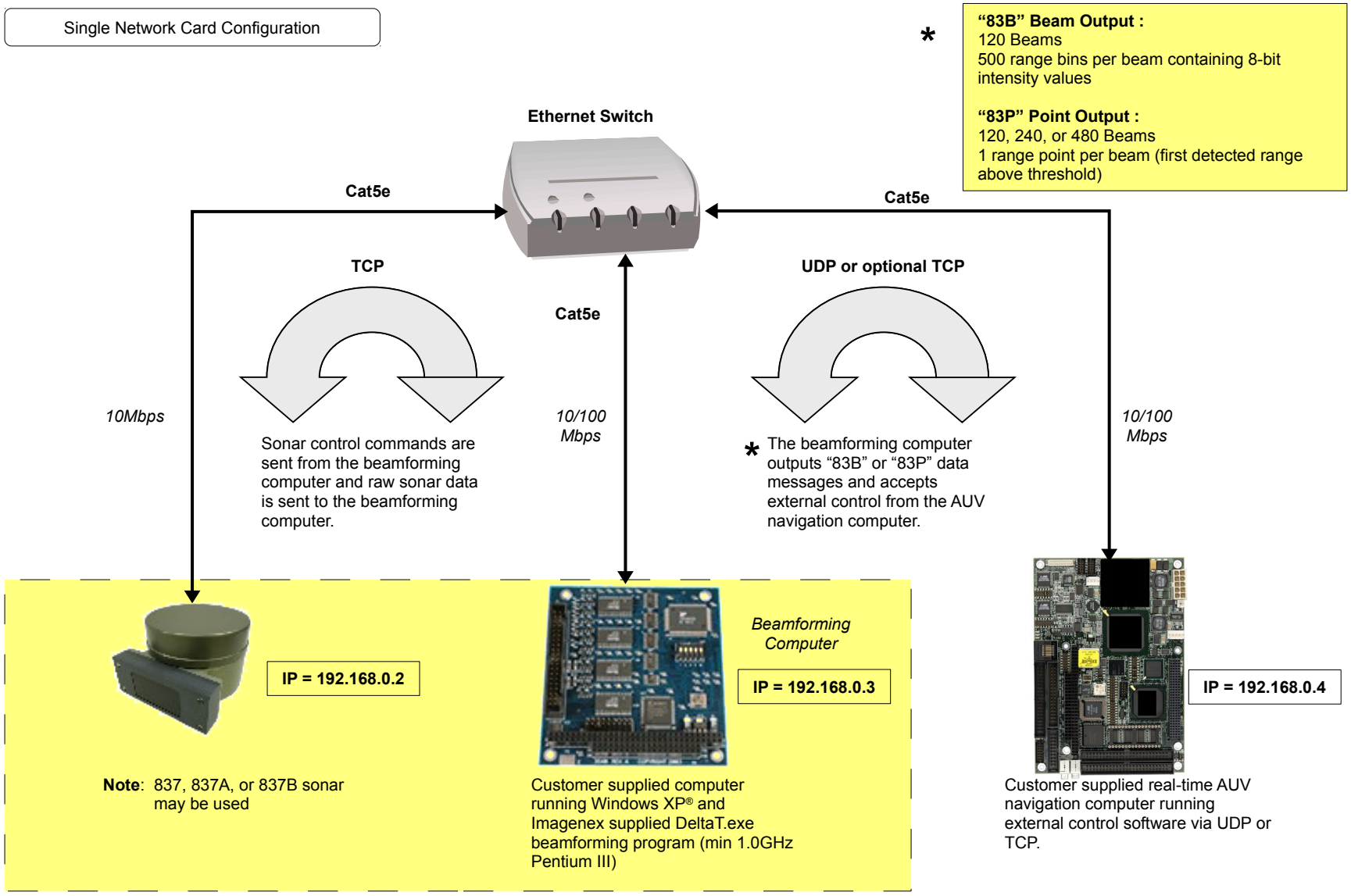


Figure 66: Setup With Customer Supplied Real Time AUV Navigation Computer

Appendix F – Cable Diagrams

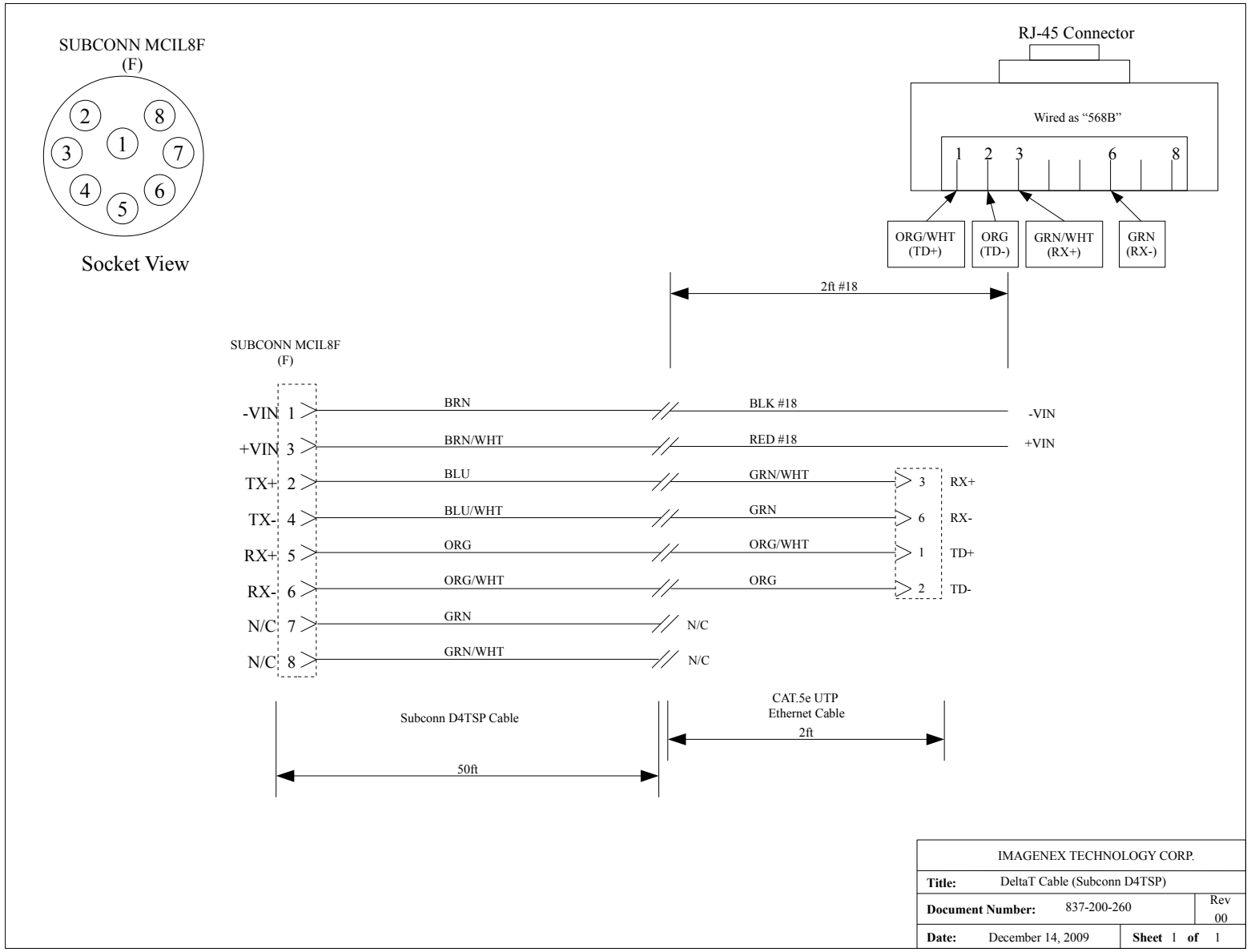


Figure 67: DeltaT Style Sonar Cable

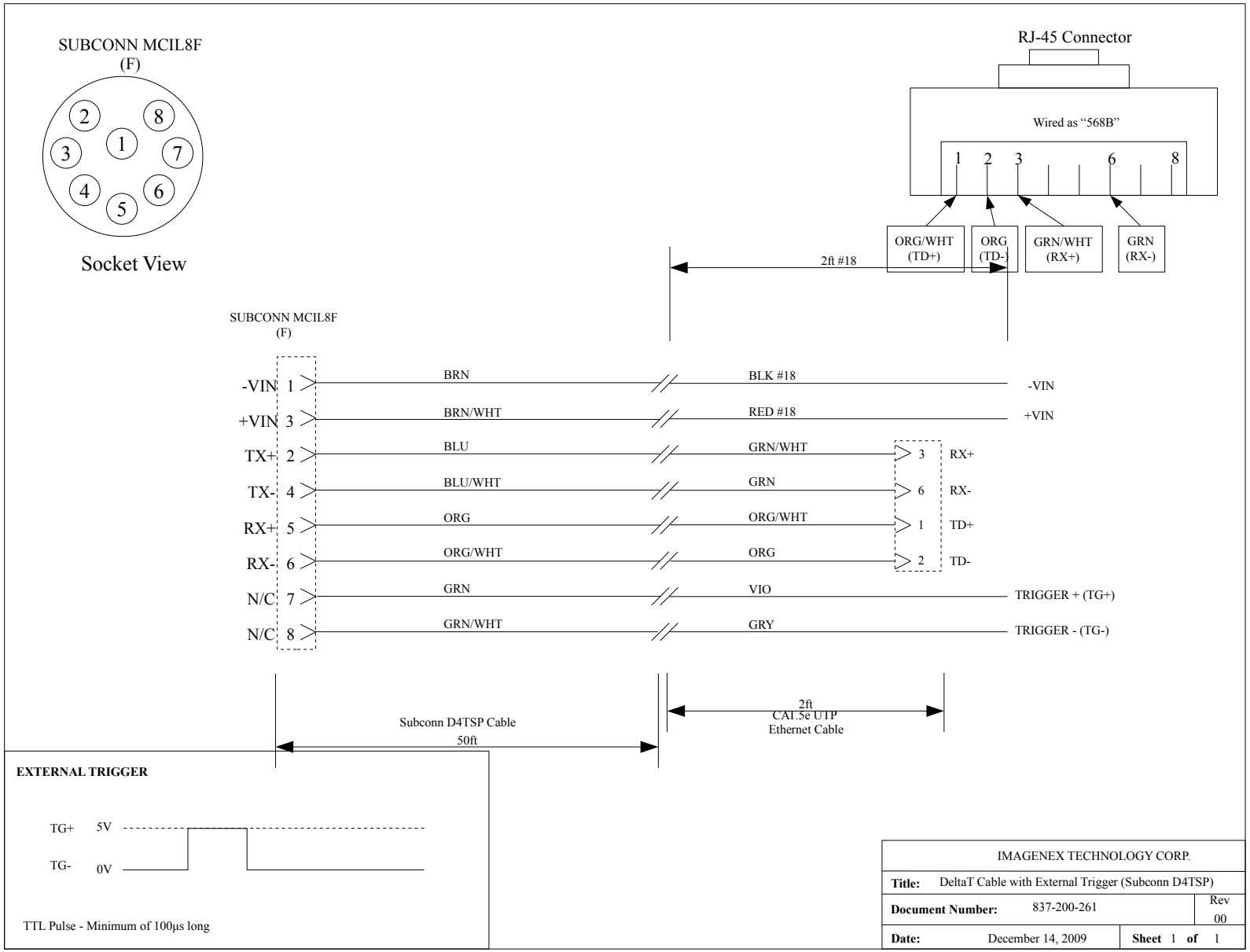


Figure 68: DeltaT Style Sonar Cable with External Trigger

Appendix G – Mechanical Diagrams

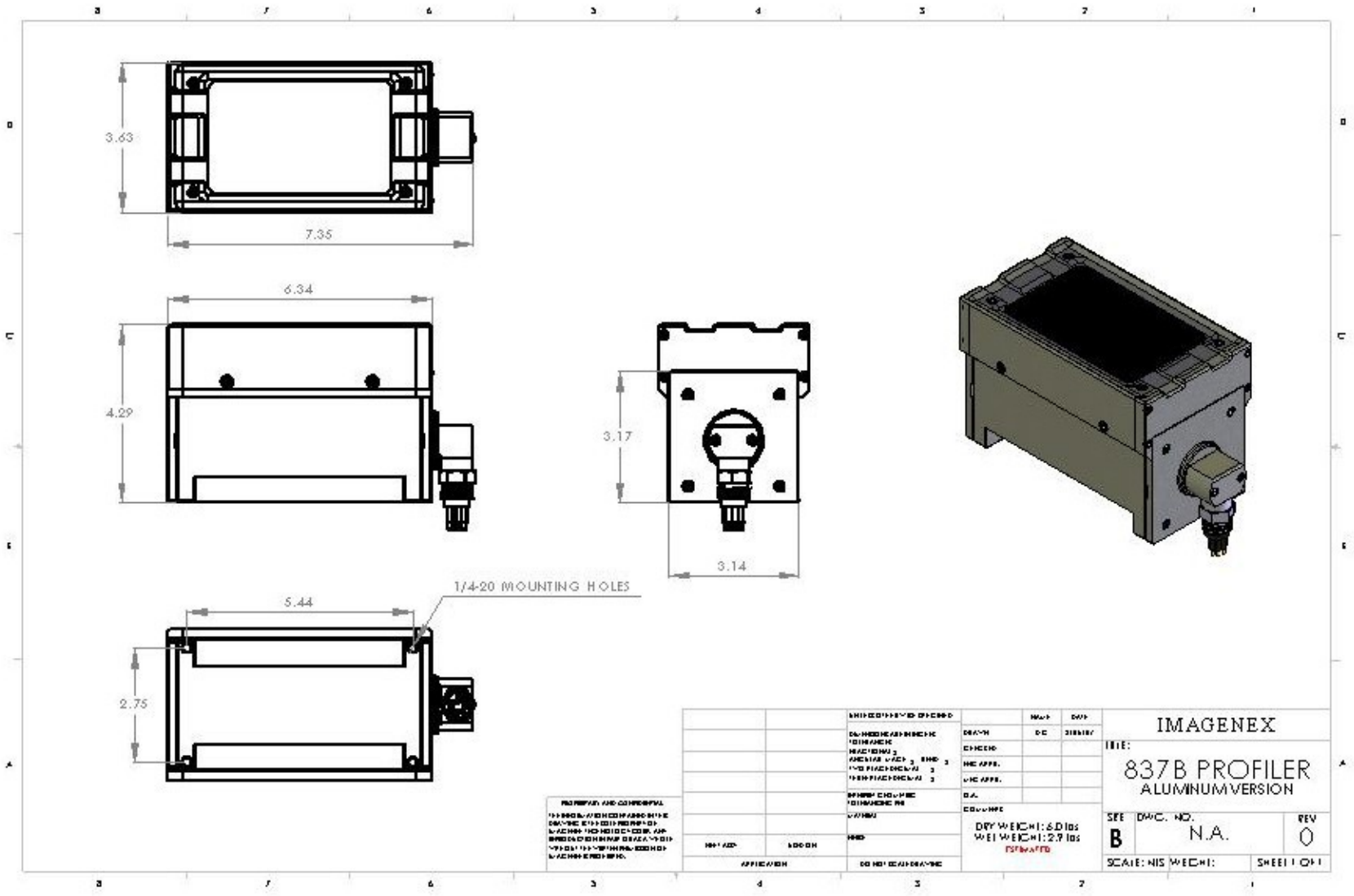


Figure 69: 837B 1000m Aluminium Profiler

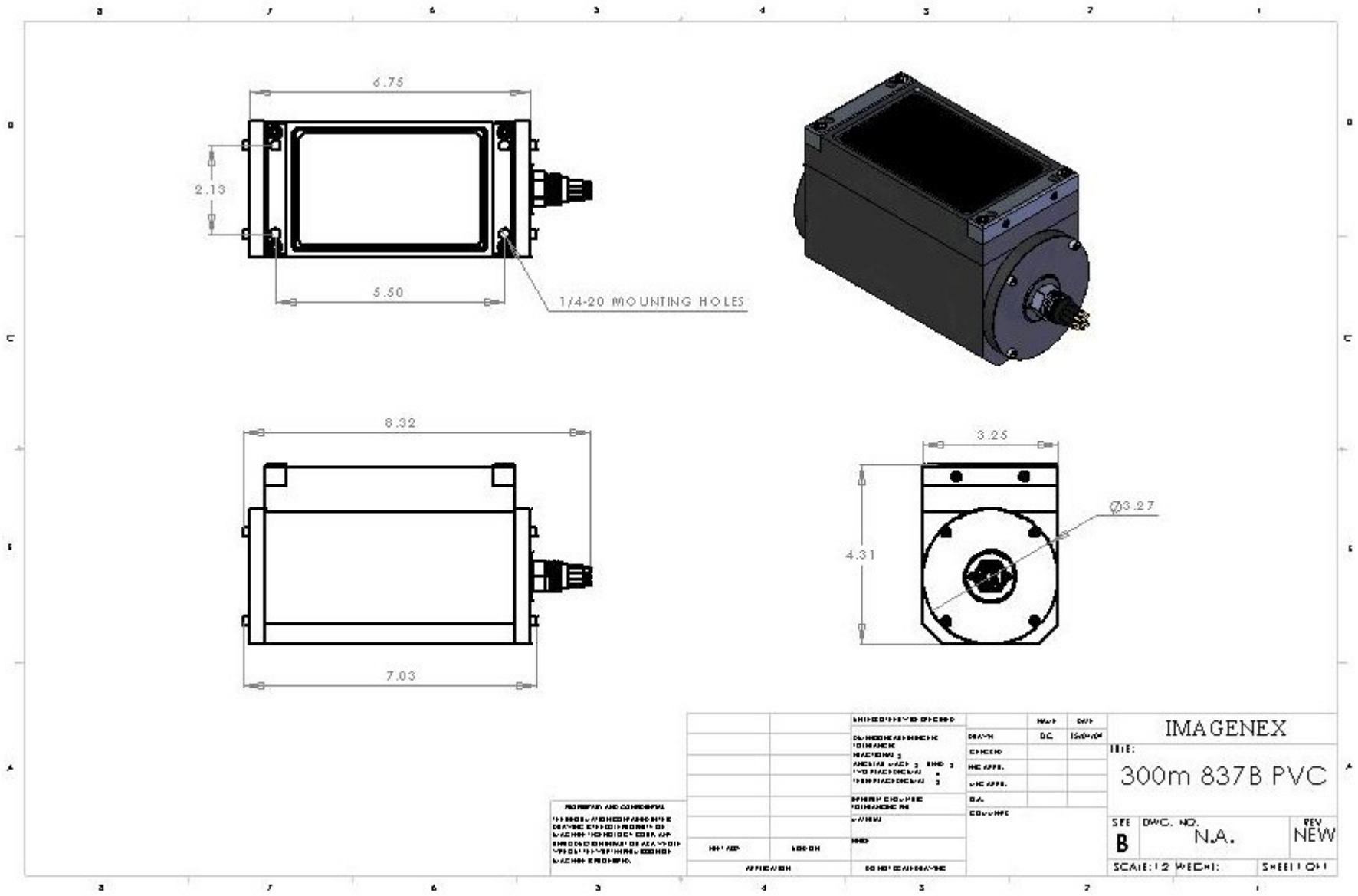


Figure 70: 837B 300m PVC Profiler

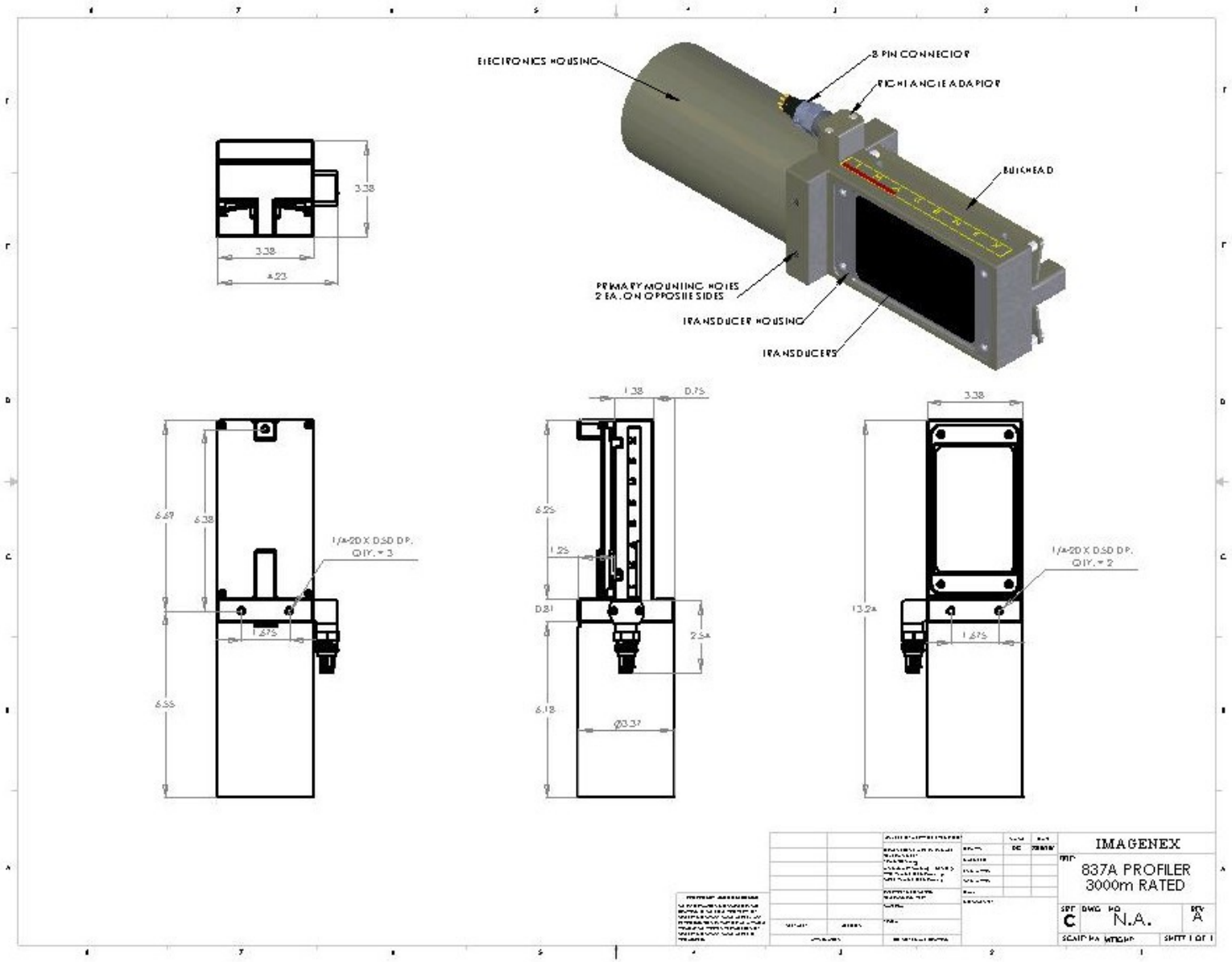


Figure 71: 837A 3000m Aluminium Profiler

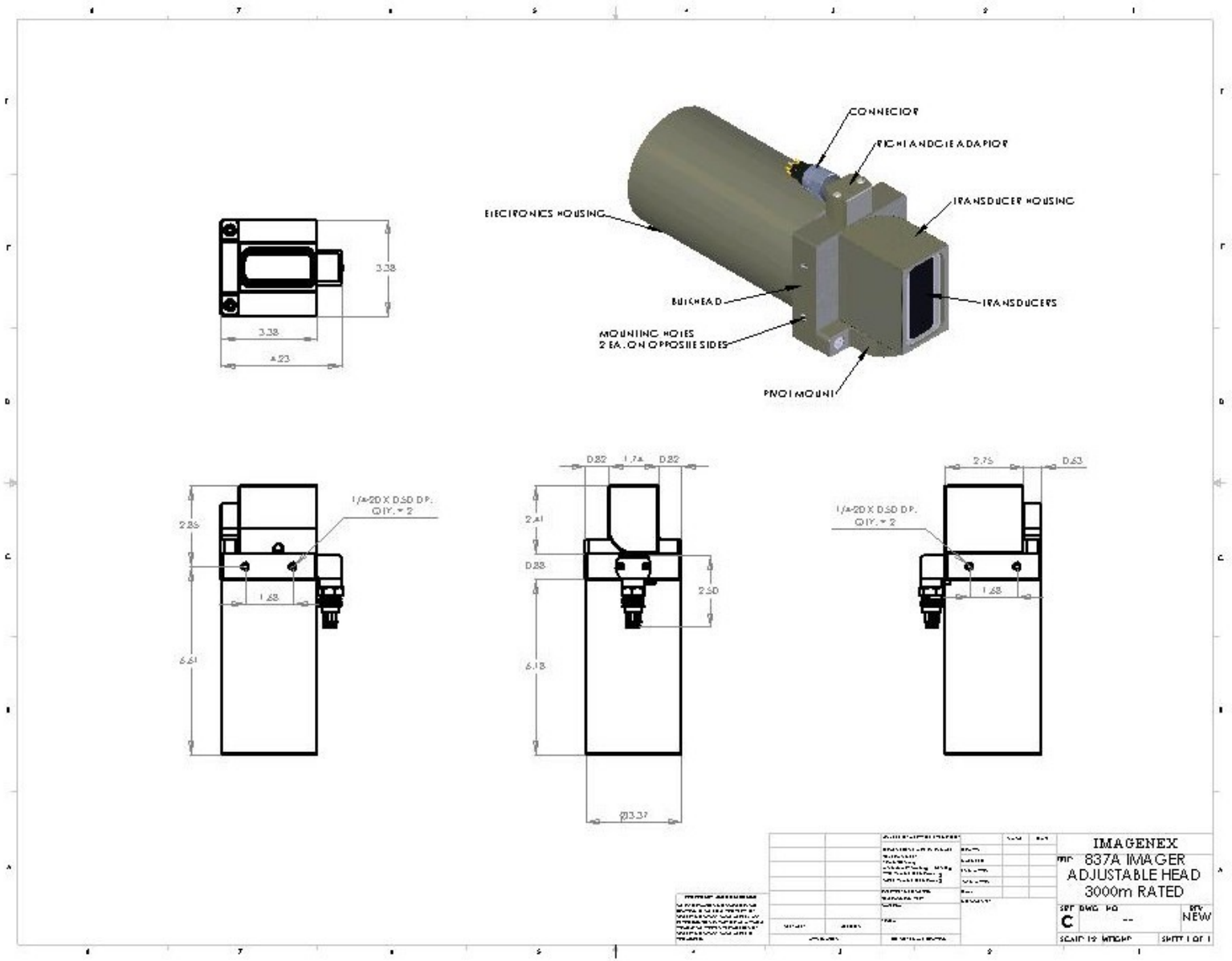


Figure 72: 837A 3000m Aluminium Tilt Adjust Imager

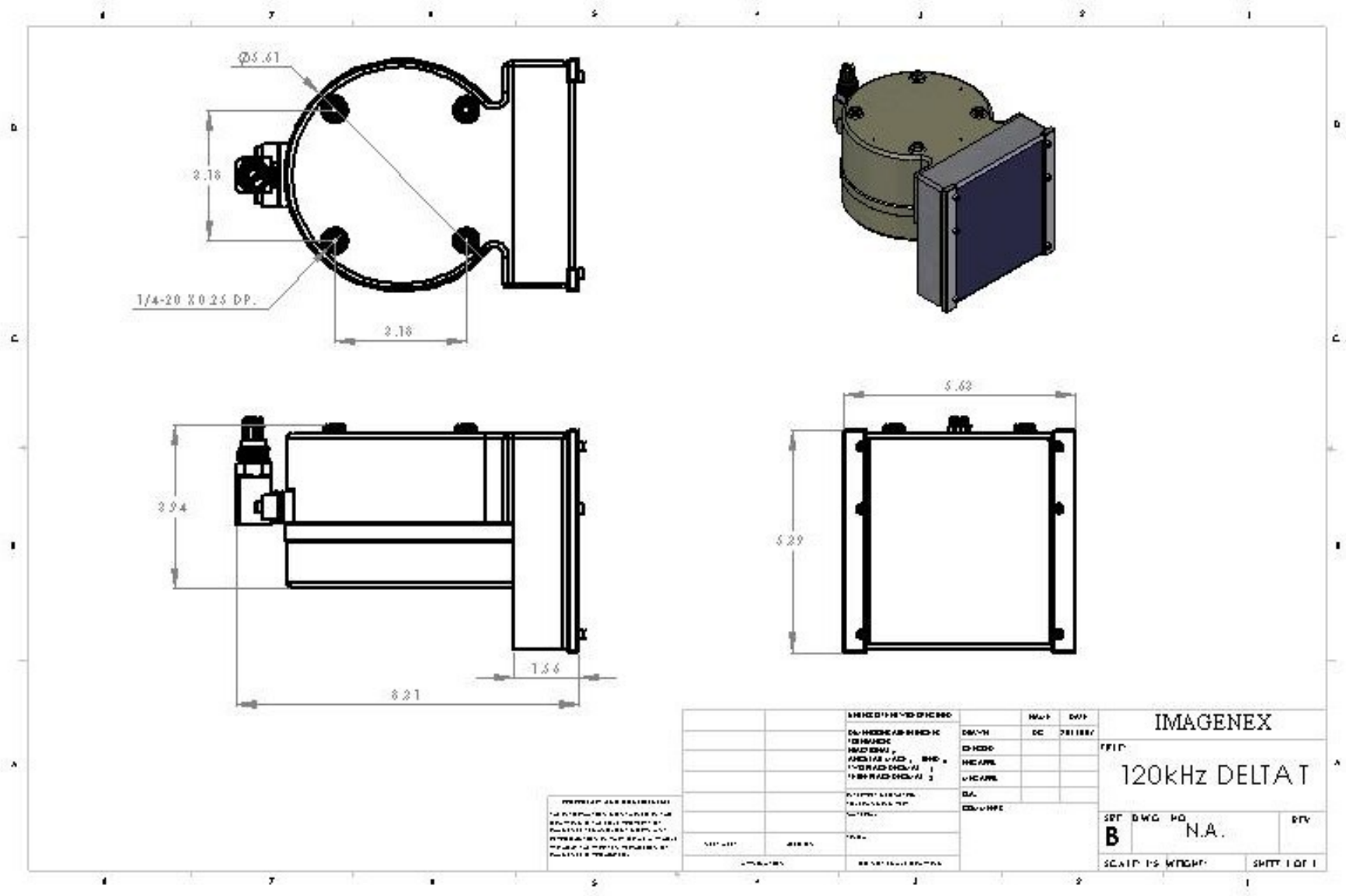


Figure 73: 837 300m Aluminium 120kHz Imager