IMAGENEX TECHNOLOGY CORP.

Model 837 DeltaT Azimuth Drive Sonar System

(CopperLink Model with Junction Box)

Imagenex Technology Corp.
209-1875 Broadway Street
Port Coquitlam, BC, Canada
V3C 4Z1

Telephone: (604) 944-8248
Fax: (604) 944-8249

Email: Imagenex@npsnet.com
World Wide Web: http://www.imagenex.com

Document Number	430 -024	
Revision	**Date**	**Description**
00	August 14, 2009	Initial Release

Table of Contents

Table of Figures

1.0 Introduction

The Model 837 Delta T Azimuth Drive is a rugged and powerful rotary actuator drive that can be coupled to an Imagenex 837B Delta T Multibeam Profiling Sonar. The two axes of rotation in this combined unit provide the capability to obtain accurate, high resolution range information in any direction. In standard applications, profiles may be made in any direction by simply commanding the Azimuth Drive to rotate the attached profiling sonar anywhere in a circle. The profiling sonar can then perform a cross-sectional scan before being rotated to a new azimuth angle. The Azimuth Drive uses the same Ethernet communications line and command structure as the Delta T head. A single, simple to use PC compatible computer program operates both.

The system consists of an underwater sonar head connected by Ethernet directly to the drive, and a top end Junction box which is connected via Ethernet to a Windows PC type computer and 24 (48) Volt power supply.

The Junction Box and the Azimuth Drive both contain a Patton CopperLink Ethernet Extender which is used to overcome the cable length limitations of the Ethernet interface specification. The Patton devices are transparent to the operation of the system.

In the typical installation the power supply and PC are supplied by the customer. The cable which comes with the unit has an underwater 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.

Figure 1 - The Imagenex Azimuth Drive with Junction Box

2.0 Getting Started:

The DeltaT Azimuth Drive 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 (+48Vdc upon request).
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 **8pin** underwater connector to the Junction Box.
8. Connect the supplied 6pin female to 6pin female to the Junction Box and the Azimuth Drive.
9. Referring to ***Appendix B – Ethernet Setup Guide***, configure the network cards IP address.
10. Turn on the power supply.
11. Launch the DeltaT_Azimuth.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

The Azimuth Drive has a built-in Pitch Roll and Heading Sensor. These are calibrated at the factory normalized with the sonar **DOWN**. If the Azimuth Drive is to be deployed with the sonar **UP**, The calibration must be re-done. Refer to "**Appendix A – Azimuth Drive Orientation Calibration Procedure**" on Page **37** for calibration procedures.

For producing sensible profiles of the seabed, the sonar head should be mounted with the transducers down (the transducers are in the gray plastic). Refer to **Figure** 3 for the transducer position setting for your installation. If the transducer position setting is incorrect. The 'up/down' setting in software can be switched if the sonar must be mounted the opposite way.

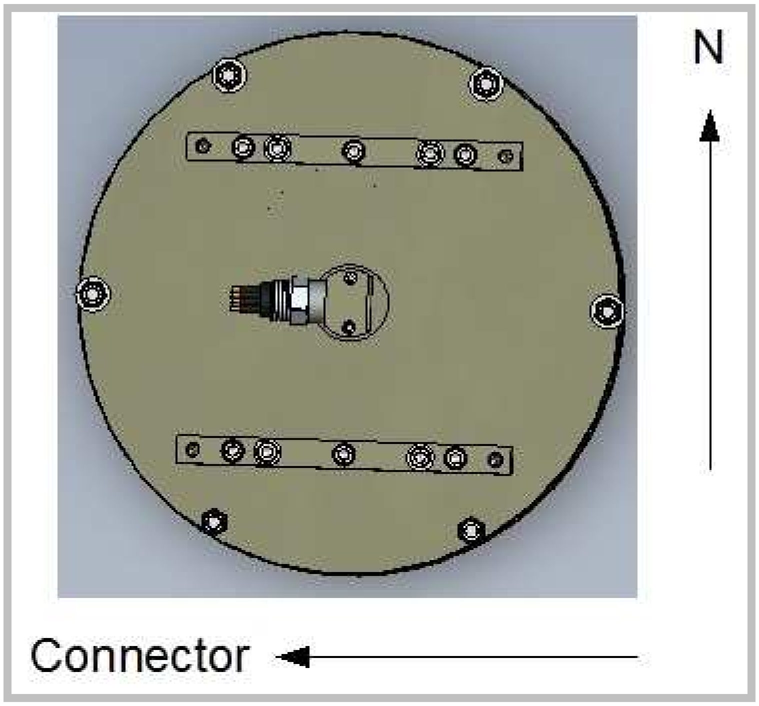


Figure 2 - Orientation of the Azimuth Drive – Sonar = DOWN

Figure 3 – Orientation of sonar head for XDCR = Down applications.

Figure 3 ,above, shows the sonar head aiming towards the bottom. Use the **Xdcr Position = Down** setting in the Azimuth drive menu. Refer **to Section 3.2** on **Page 9**.

2.1.1.1 Sonar Profile Tilt Angle

The DeltaT sonar may be mounted and various tilt angles by adjusting the mounting flange angle.
Profile tilt-angles of 0 º, +10 º, +20 º and +30 º can be set via two socket head screws on the sonar head flange. Figure 4 below indicates the mount locations.

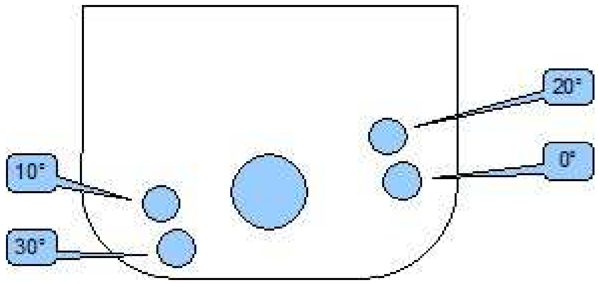


Figure 4 - Hole positions for Tilt Angle Adjustment

After adjusting the tilt angle physically, the user should enter of the corresponding profile tilt-angle into the "**Profile Tilt Angle**" menu (refer to **Section 3.8** on **Page 15** for details).

2.1.2 Electrical Connection

The DeltaT Azimuth Drive system consists of an underwater sonar head connected directly to the Azimuth drive. The Ethernet signals from the Azimuth Drive and the sonar are fed into a Patton CopperLink device, which converts the Ethernet signals to run over long distances. These CopperLink signals (and the Power lines) are fed into the Junction Box where they are converted back to Ethernet, and to a Windows OS computer and a **$48V_{dc}$** power supply. In the typical installation the power supply and PC are supplied by the customer. The cable which comes with the unit has an underwater 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 Azimuth Drive and Junction Box uses approximately 1A at 48Volts.

2.1.3 Software Setup

The requirements for the user supplied PC are: Windows XP©, 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 adapter, 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, 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.

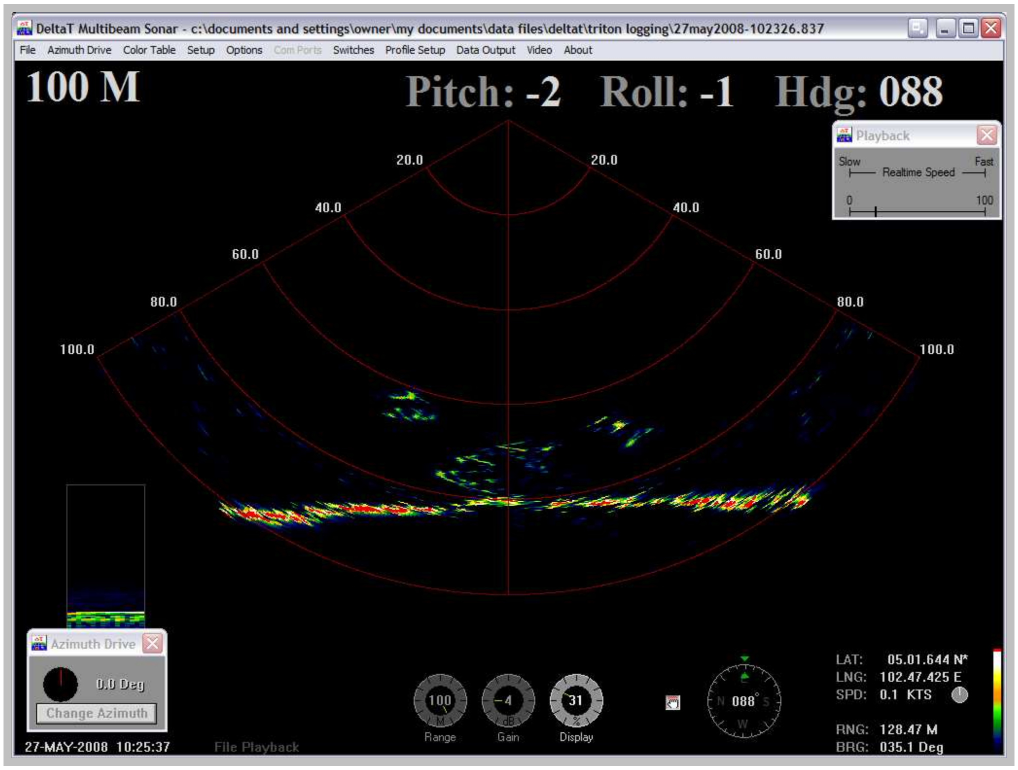


Figure 5 – Screen capture from DeltaT program (file playback).

The bottom of the screen contains three 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 "Signal Level" window located in the lower left-hand corner of the screen. This window is enabled via the Options menu. 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). As long as you are recording the data, you can play back with different display gains, and colors.

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 colors. Single target detection is often best using the 'NORM HI' color table, while images of the bottom with shadows are usually best viewed in 'GREY' or 'BROWN-YELLOW'. These colors are for display only, the data can be played back with any color scheme if desired.

The Setup menu contains the Xdcr Position setting (Up or Down), Measurement Units (Meters, Feet or Yards), enable/disable for Automatic filename 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 Image: 0.75 deg), Beams (120, 240 or 480 display beams), enable/disable Beam Output to IPAddress_Output1 (located in DeltaT.INI) and Averaging (0 to 10 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 the Minimum Range and Minimum Level 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 Profile Point File...' button. 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. color window. To change the depth to color 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 20** 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:

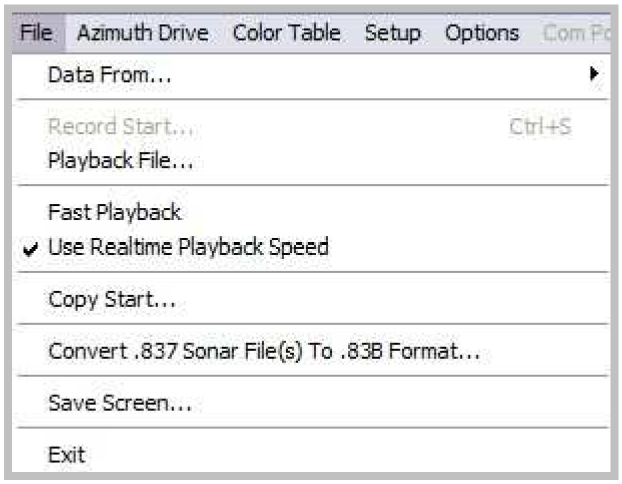


Figure 6 – The File Menu

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 11**. 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 increments 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 .83B Format…	Use this command to convert a single or multiples files to a .83B file format, which contains processed beam data. Before using this command, the processing scheme must be setup. Please refer to **Page 12** 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 Azimuth Drive Menu Commands

The Azimuth drive menu offers the following commands:

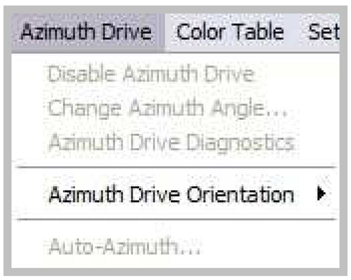


Figure 7 - The Azimuth drive menu

The Azimuth drive menu is used to set / configure various Azimuth Drive specific parameters.

Disable Azimuth Drive	Not Available.
Change Azimuth Angle…	Invokes the "Change Azimuth Dialogue Box. Refer to **Section** 5.6 on Page 25 for details.
Azimuth Drive Diagnostics	Displays diagnostic information pertaining to the Azimuth Drive. Refer to **Section** 5.4 on Page 24 for details.
Azimuth Drive Orientation	Provides the option for "Up" or "Down". If the sonar is pointed towards the bottom, set this to down.
Auto Azimuth…	Invokes the "Auto-Azimuth Dialogue Box to begin an automatic scan. Refer to **Section** 5.5 on Page 24 for details.

3.3 Color Table Menu Commands

The Color Table menu is used to change the sonar data color palettes for the sonar images. DeltaT uses colors (called a color table) to represent echo data strength (amplitude). For example, the Normal High intensity color table maps the echo data amplitude to 127 colors 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:

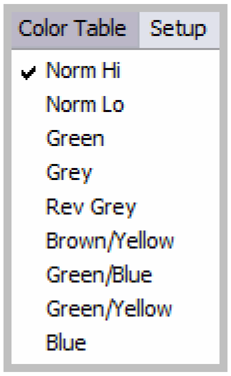


Figure 8 – The Color Table Menu

Table 2 – The Color Table Menu Items

Normal High	Standard color table used for mapping the echo data amplitude to 127 colors ranging from Black (low level), through Blue, Green, Orange, Yellow, White and Red (highest level).
Normal Low	Same colors as Norm Hi, but uses a lower color 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.

3.4 Setup menu commands

The View menu offers the following commands:

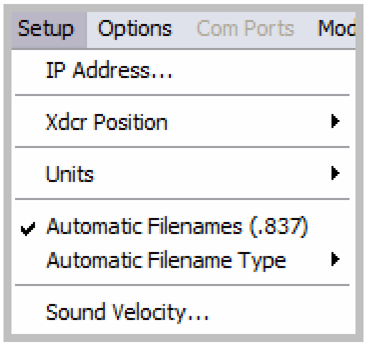


Figure 9 – The Setup Menu

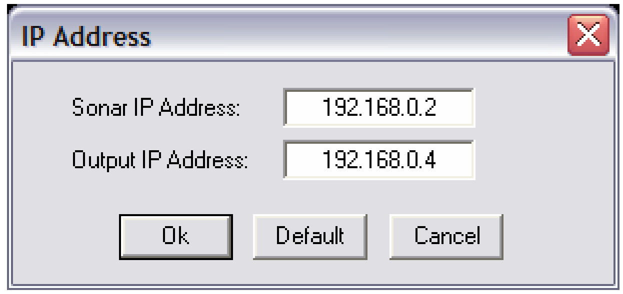


Table 3 – The View Menu Items

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 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 filenames. 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 filename 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.
Sound Velocity…	This item will need to be altered if the known speed of sound is different than 1500m/s.

3.5 Options Menu Commands

The Options menu offers the following commands:

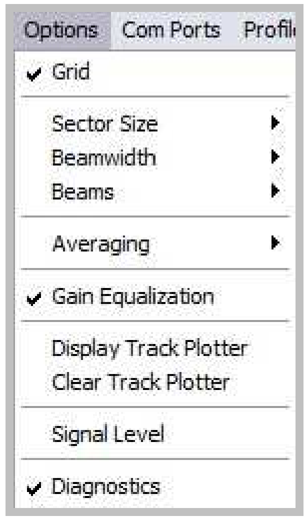


Figure 10 – Options Menu

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 7.4** on **Page 35**.
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 7.4** on **Page 35**.
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 7.4** on **Page 35**.
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.
Gain Equalization	This option is generally used only for profiling applications. Enabling it will increase the gain towards the edges of the display window. 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.

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. The gain must adjusted to ensure there is no red showing in the signal level window. This is very important as the gain setting is one of the few items other than range that can not be altered during file playback. Please refer to **Page 4** for further details on gain settings.
Diagnostics	Display the Sonar diagnostics. See **Section 5.3** on **Page 22** for details about sonar diagnostic items.

3.6 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 11. Set the options to match the capabilities of the attached GPS unit. Please refer to **Section 6.0** on **Page 26** for GPS details.

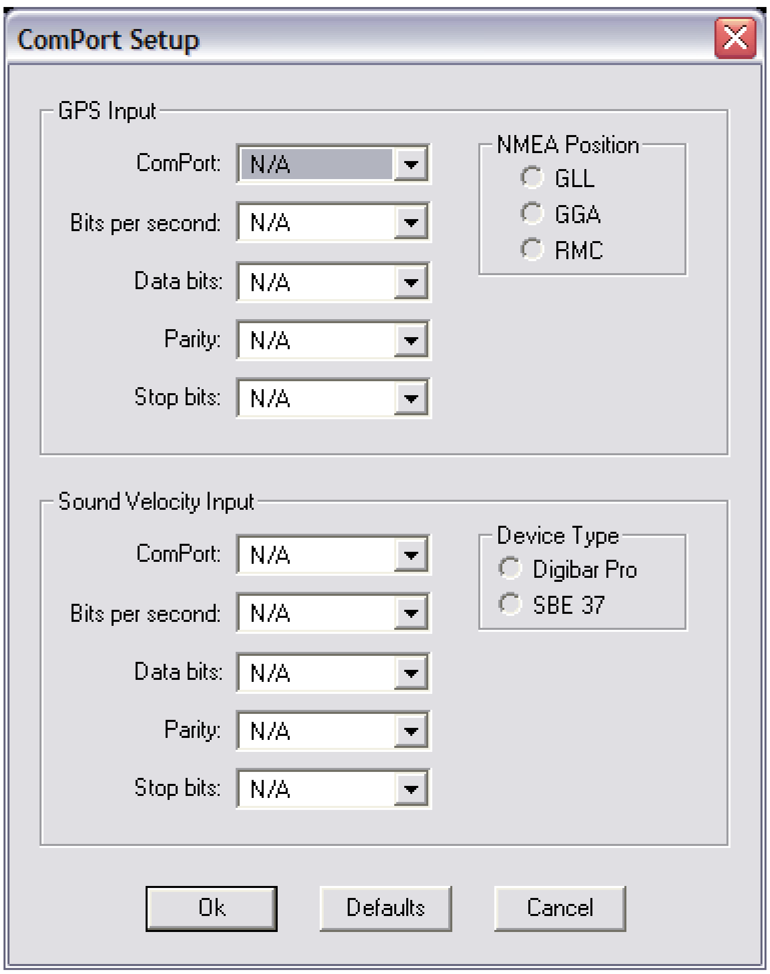


Figure 11 – ComPort Setup Dialogue Box

3.7 Switches Menu Commands

The Switches menu displays the Set Switches dialog box as shown below in Figure 12

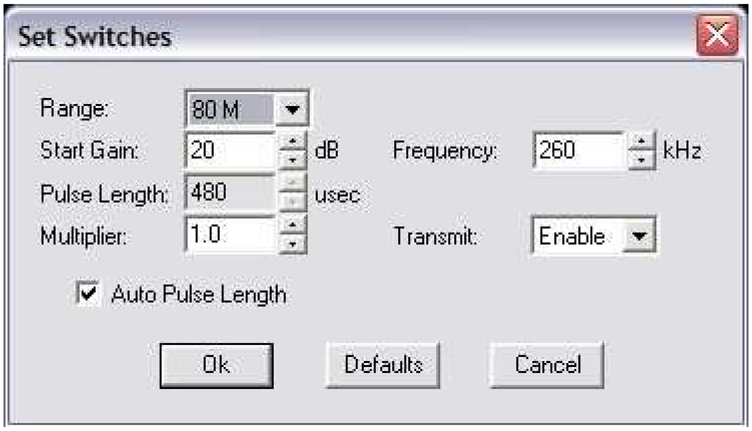


Figure 12 – The Set Switches Dialog Box

Note that Range and Start Gain can be controlled via the main screen dials. Pulse Length and Multiplier should be left at the default setting.

Range	Sets the operating range of the sonar.
Start Gain	Sets the sonar gain.
Pulse Length	Sets the pulse length of the sonar
Multiplier	This number is multiplied by the Pulse Length setting.
Auto Pulse Length	Deselect to override the pulse length
Frequency	Adjust this change the operating frequency of the sonar. 240kHz to 260kHz in 5kHz increments. This may be necessary to remove noise caused by external devices.
Transmit	Enables or disables the sonar transmitter.

3.8 Profile Setup Menu Commands

The Profile setup menu offers the following commands:

Figure 13 – The Profile Setup Menu

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

Profile Point Setup	This command displays the Profile Point Setup Dialogue box which contains options for profile point detection. Please refer **Section 7.2** on **Page 27** for details.
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 straight down. Please refer to **Section 7.0** on **Page 27** 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.

3.9 Data Output Menu Commands

The Data Output menu displays the Data Output dialog box as shown below in Figure 14

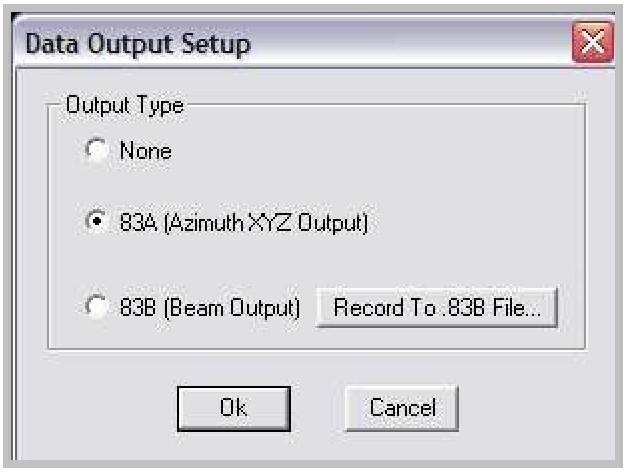


Figure 14 – The Data Output Setup Dialog Box

The data being output is sent to the IP address specified in the IP Address dialog box in the "Output IP Address" section please refer to **Section 3.4** on **Page 11**.

None	Disables all data output functions
83A (Point Output)	Profile points generated will be sent to the IP address.
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.

3.10 Video Menu Commands

This Menu is only active if a video capture device is install 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).

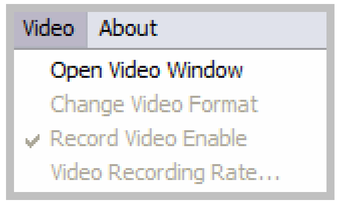


Figure 15 – The Video Menu

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 video is captured.

3.11 About Menu Commands

The About menu displays the information window as shown below in Figure 16. 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 16 – 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.

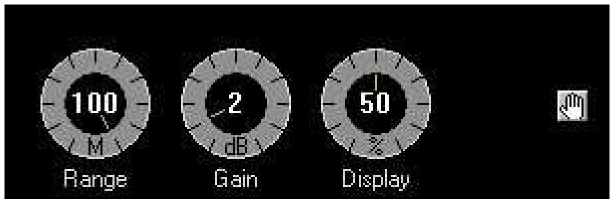
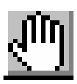


Figure 17 – The Main Controls

Table 4 – 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 "Signal Level" window located in the lower left-hand corner of the screen. This window is enabled via the Options menu.
Display	The Display knob is used to adjust the brightness of the sonar image (after the Gain has been adjusted).
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 18 – The File Playback Progress and Speed Bars

File Progress	A slider bar with a pointer showing file playback position. Dragging the pointer to 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. Dragging the pointer 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:

File Name	Type or select the filename 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:

File Name	Type a new filename 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 Dialogue Box

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

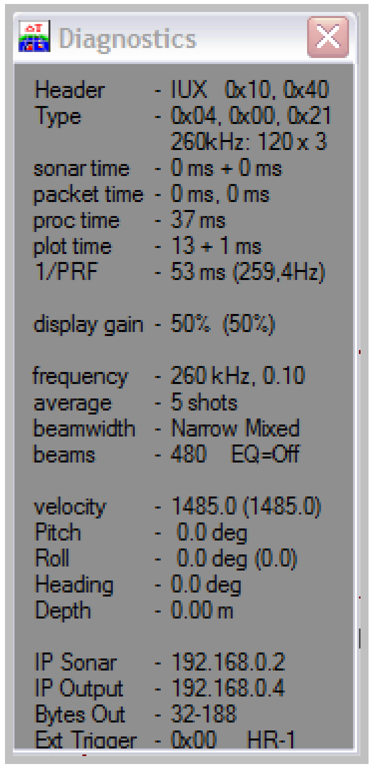


Figure 19 – The Diagnostics Dialogue Box

Table 5 – 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 acoustic time subtracted from when the sonar is interrogated to when the PC receives it's first reply. This number is dependant on the operating range.
packet time	The first number contains the time to receive the rest of the data packets for the current frame of data.
proc time	The time required to process the sonar data according to the options specified in the Options menu

plot time	The time that the program 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.
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.
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.
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.

5.4 Azimuth Drive Diagnostics Dialogue Box

The Azimuth Drive Diagnostics Dialogue Box is used to display important Azimuth Drive specific variables. This Dialogue box is very useful when trouble shooting the system in real-time.

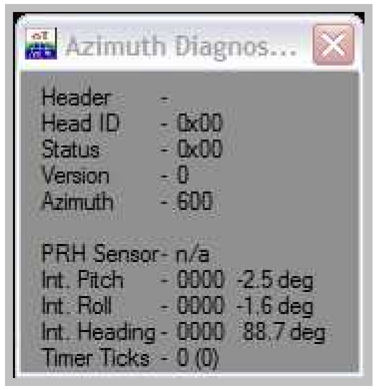


Figure 20 - Azimuth Drive Dialogue Box

5.5 Auto-Azimuth Dialogue Box

The Auto-Azimuth Dialogue Box is used to control important Azimuth Drive specific parameters.

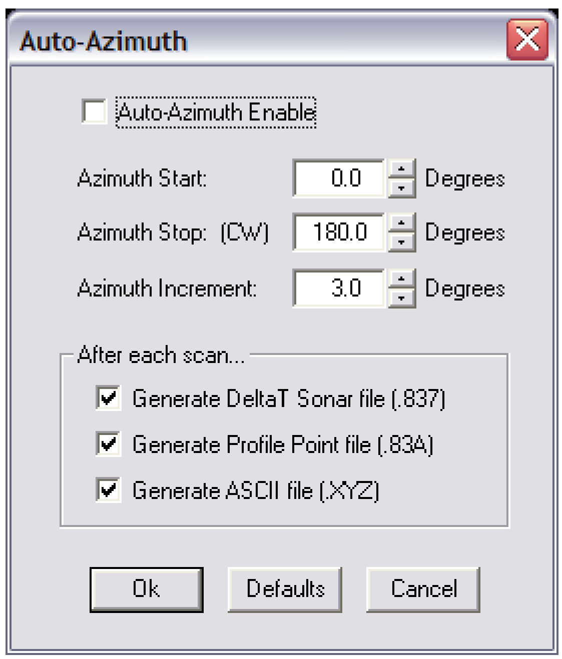


Figure 21 - Auto-Azimuth Dialogue Box

Auto-Azimuth Enable	Selecting this check-box will set the Azimuth Drive to automatically scan through the parameters described below.
Azimuth Start	Sets the starting location where the auto scan begins
Azimuth Stop (CW)	Sets the stopping location where the auto scan ends. The scan operates Clockwise.
Azimuth Increment	Specifies the step size in degrees for each sample.
Generate DeltaT Sonar file (.837)	After the current scan is complete a sonar file is generated in the standard .837 file format.

Generate Profile Point file (.83A)	After the current scan is complete a sonar file is generated in the standard .83A file format.
Generate ASCII file (.XYZ)	After the current scan is complete a sonar file is generated in the standard .XYZ file format.

5.6 Change-Azimuth Dialogue Box

Figure 23 - Change Azimuth Item

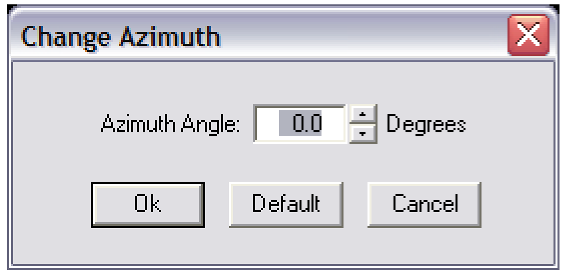


Figure 22 - Change Azimuth Dialog Box

Clicking on the "**Change Azimuth**" button will bring up the "**Change Azimuth**" Dialogue Box. Select the desired azimuth angle and select "OK". The Azimuth Drive will adjust to the specified location.

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 24. Set the options to match the capabilities of the attached GPS unit.

Note: Windows XP© has certain "issues" with RS232 to USB adapters. Please refer to *Appendix E – USB Data Converters and Windows XP©* on **Page 49** for important information on using these devices.

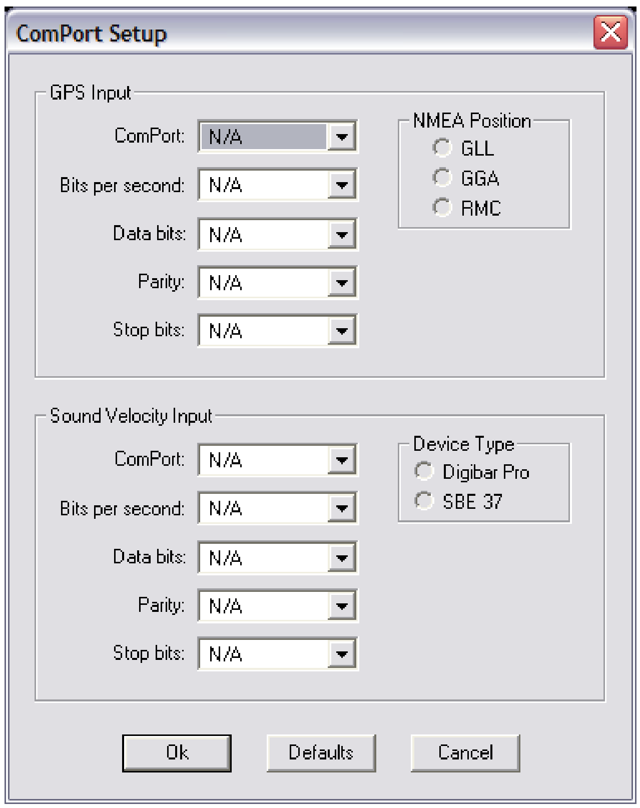


Figure 24 – ComPort Setup Dialogue Box

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 26. After GPS information is sent to the DeltaT program, the current Coordinates and speed will appear as shown in Figure 25.

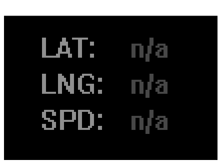


Figure 26 – No GPS information present

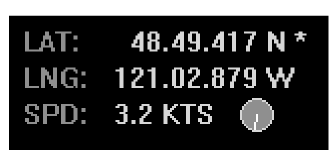


Figure 25 – GPS information present

7.0 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 partners), certain parameters need to setup before this can occur. This section will describe the procedure for generating profile data.

7.1 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 36** for details.

7.2 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 27.

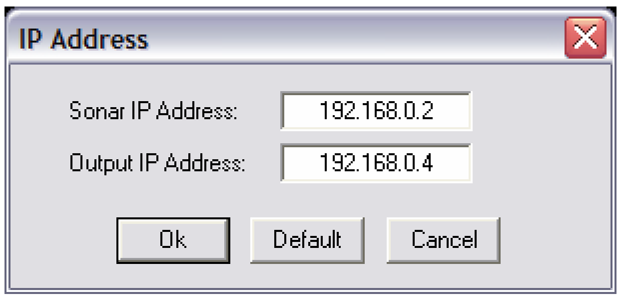


Figure 27 – IP Address Dialogue Box

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

7.3 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.

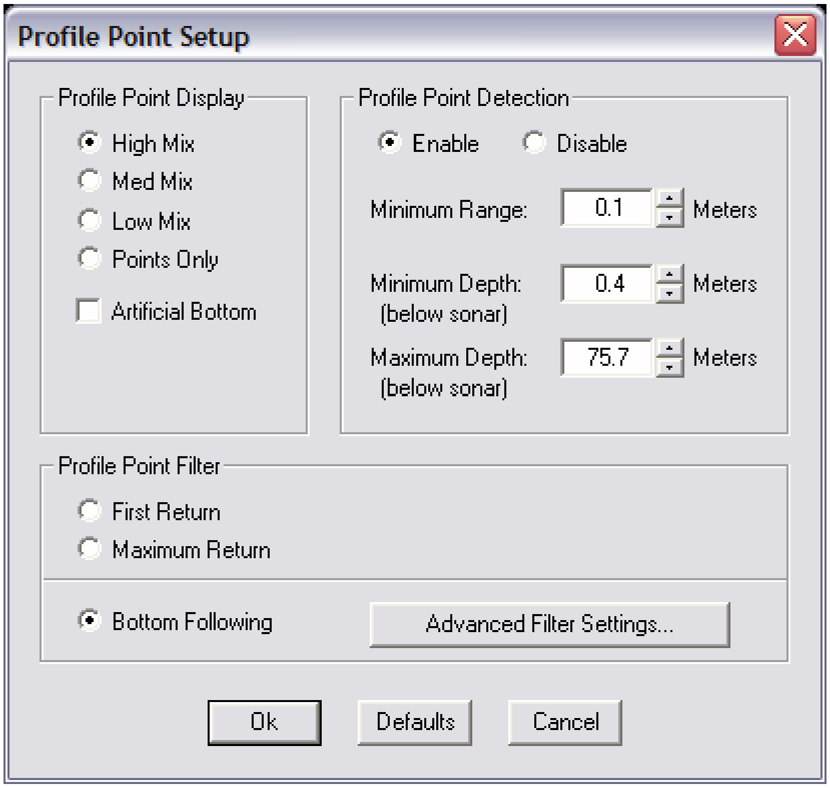


Figure 28 – The Profile Point Setup Dialogue

7.3.1 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 29 shows the effects of maximum profile depth. In the top image, the maximum profile depth is set a point beyond the bottom return. Thus, profile points are generated on the bottom. In the bottom image, The maximum profile depth is set 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.

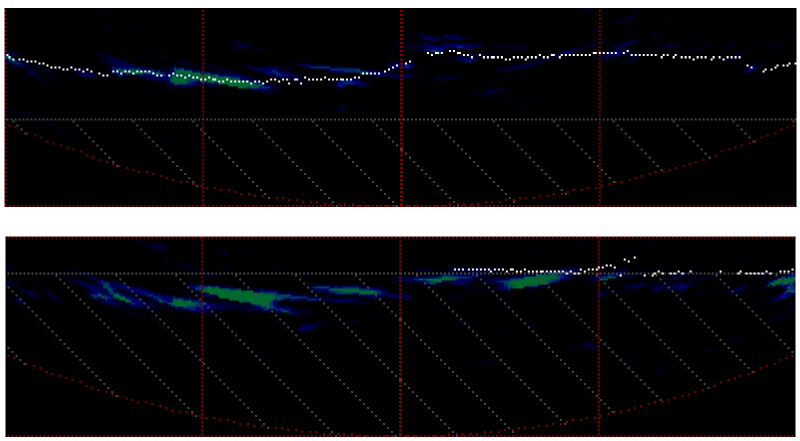


Figure 29 – Example of Maximum Profile Depth Adjustment

Figure 30 shows the effects of minimum profile depth. In the top image, the minimum profile depth is set a point closer than the targets. Thus, profile points are generated on the targets. In the bottom image, The minimum profile depth is set 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.

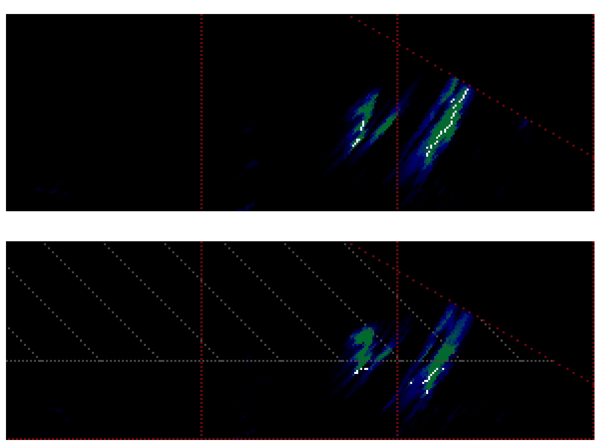


Figure 30 – Example of Minimum Profile Depth Adjustment

7.3.2 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 display at the normal intensity along with the generated profile points This shown below in Figure 31.

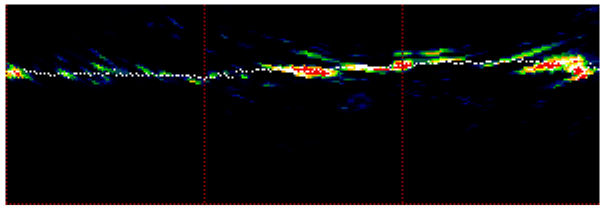


Figure 31 – High Mix Example

Med Mix
With Med Mix, Image data is display at a reduced intensity along with the generated profile points. This shown below in Figure 32.

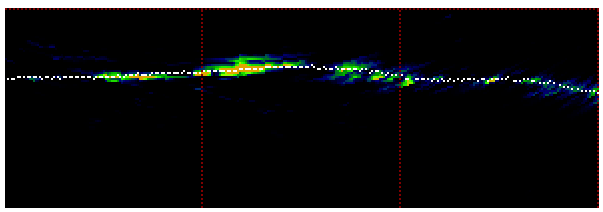


Figure 32 – Med Mix Example

Low Mix
With Low Mix, Image data is display at further reduced intensity along with the generated profile points. This shown below in Figure 33.

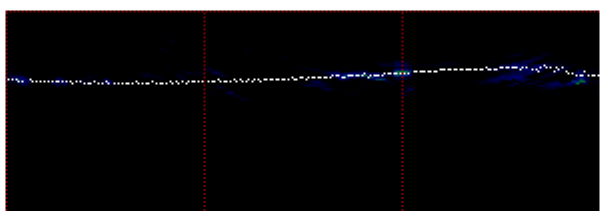


Figure 33 – Low Mix Example

Points Only
With Points Only, Image data is removed from the screen entirely and only profile points are displayed. This shown below in Figure 34.

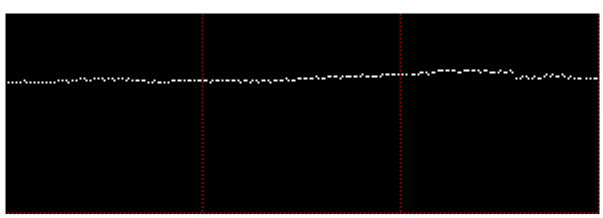


Figure 34 – Points Only Example

Artificial Bottom
Artificial Bottom enabled is shown below in Figure 35.

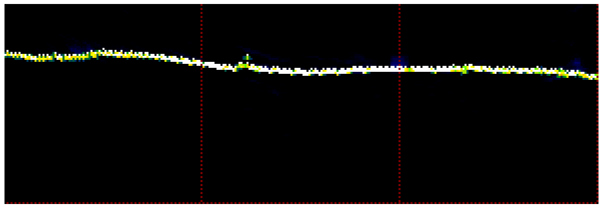


Figure 35 – Artificial Bottom with Low Mix Example

7.3.3 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 36**. 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.

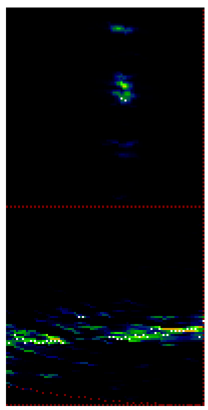


Figure 36 – First Return Filtering Example

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.

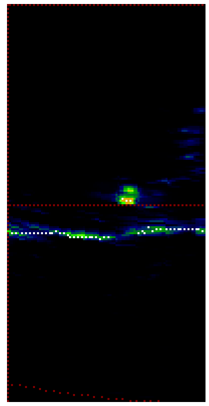


Figure 37 – Maximum Return Filtering Example

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. Also note that any small targets such as small rocks on the bottom will be ignored in order to approximate the bottom contour.

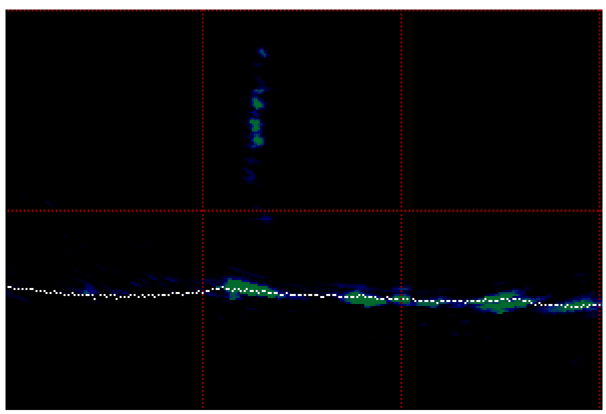


Figure 38 – Bottom Following Filtering Example

7.3.4 Advanced Filter Settings

This section is only available in DeltaT.exe v1.01.47 or higher.

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 Dialogue box.

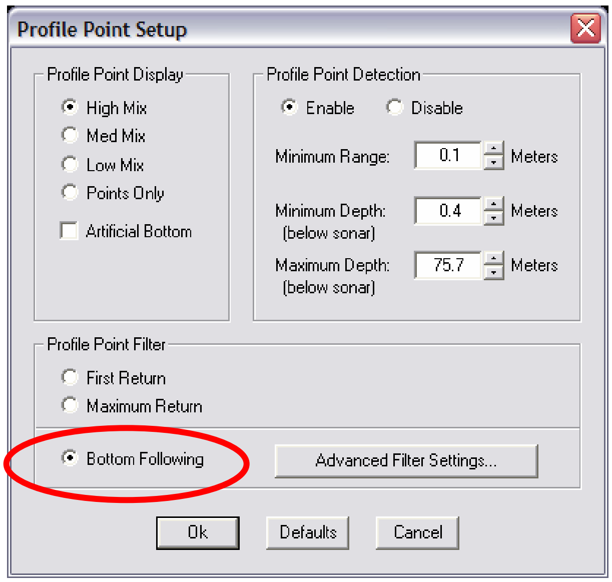


Figure 39 – Profile Point Setup Dialogue box

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…).

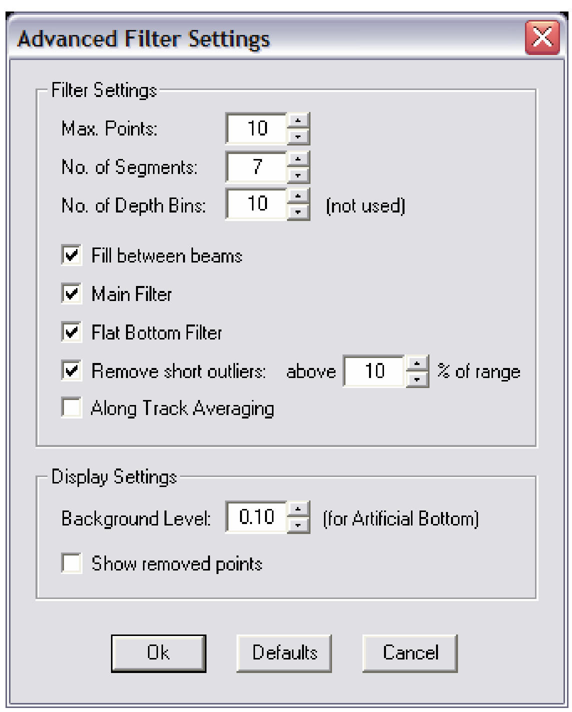


Figure 40 – Advanced Filter Settings Dialogue box

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.

7.4 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 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 Figure 41 through 42, 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.

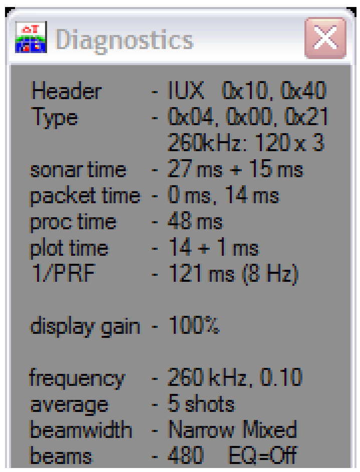


Figure 41 – PRF Example - 480 Beams, 120deg Sector

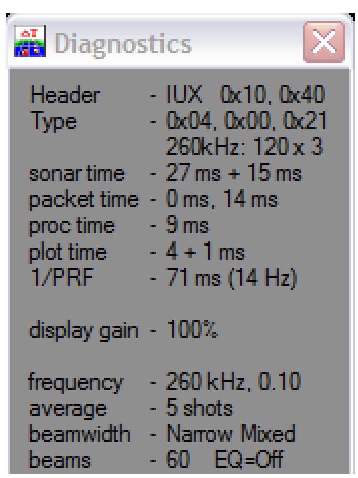


Figure 42 – PRF Example - 120 Beams, 60deg Sector

7.5 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

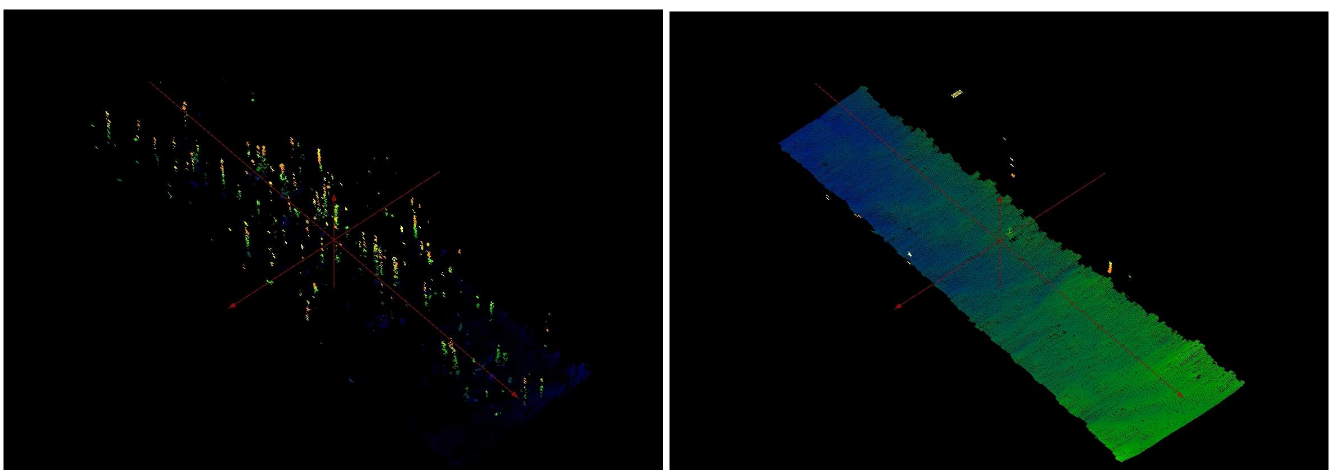
When First Return is selected, the profile points will be generated on the first target whose intensity is over a set threshold (and whose range is greater than the Minimum Range or Depth set by the user). The effect of this is that any objects in the water column will generate profile points.

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. Also note that any small targets such as small rocks on the bottom will be ignored in order to approximate the bottom contour.

The section of data shown below in Figure 43, 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 43 – Filtering Examples using 3DView.exe

Appendix A – Azimuth Drive Orientation Calibration Procedure

The Azimuth Drive has a built-in Pitch Roll and Heading Sensor. These are calibrated at the factory normalized with the sonar **DOWN**. If the Azimuth Drive is to be deployed with the sonar **UP**, The calibration must be re-done.

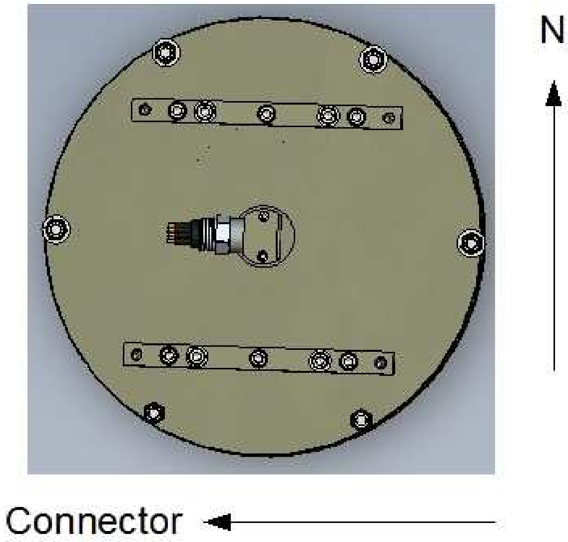


Figure 44 - Orientation of the Azimuth Drive – Sonar = DOWN

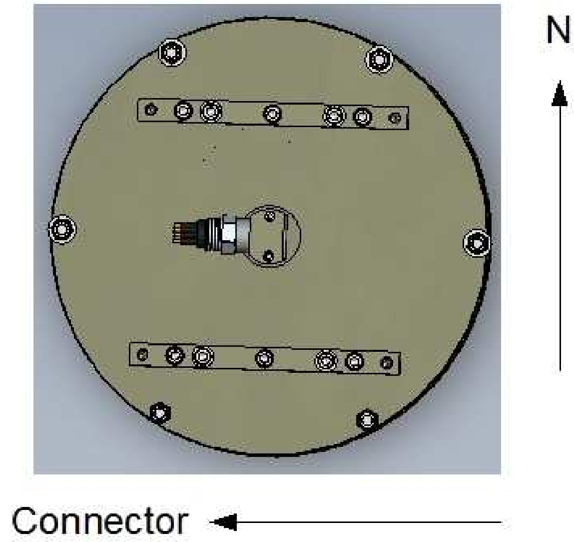


Figure 45 - Orientation of the Azimuth Drive – Sonar = UP

Pitch and Roll Calibration

Set the Azimuth Drive in the desired position (UP or DOWN), and accurately level the drive in both the pitch and roll directions. Run the program "**DeltaT_Azimuth_Drive_calibrate_pitch_roll.exe**", and follow the on-screen instructions.

Heading Calibration

Set the Azimuth Drive in the desired position (UP or DOWN), Run the program "**DeltaT_Azimuth_Drive_calibrate_compass.exe**", and follow the on-screen instructions. Rotate the Azimuth Drive **Clockwise**.

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 default statically assigned IP Address of **192.168.0.2** .

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

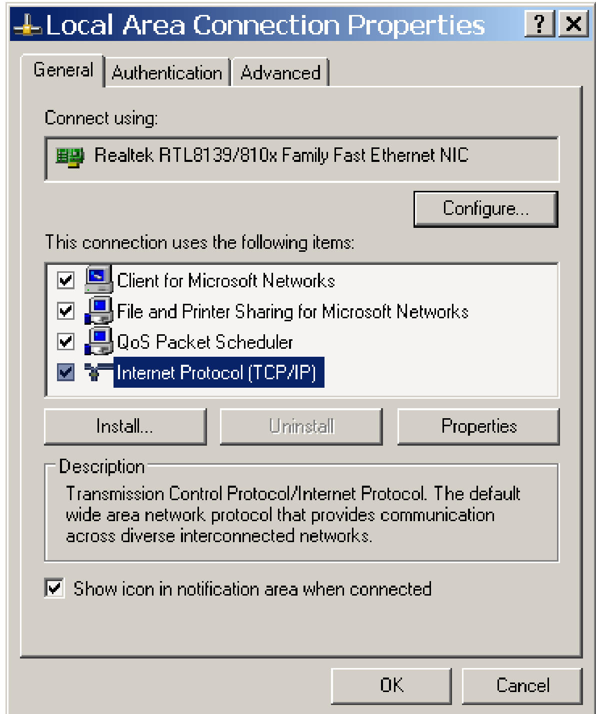


Figure 46 – Local Area Connection Properties Dialogue Box

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

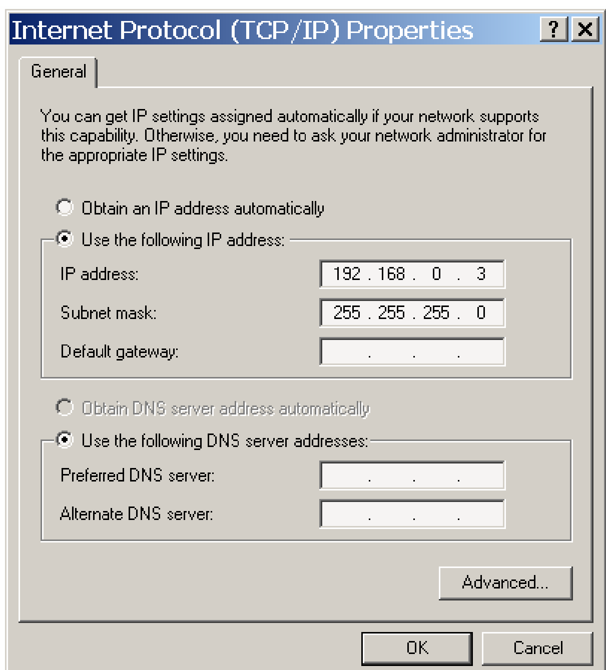


Figure 47 – TCP/IP Priorities Dialogue Box

4. Enter the information shown above in Figure 47 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 43**.

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 48. 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".

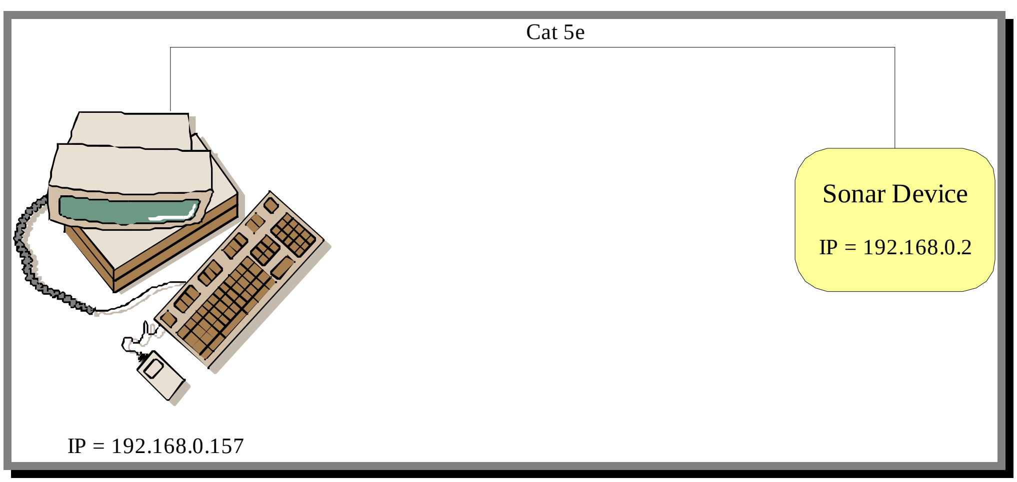


Figure 48 – Connecting the Sonar via Direct Connection

Setting up a LAN

To connect an Imagenex Ethernet Sonar System to a Local Area Network (LAN), refer to Figure 49. 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.

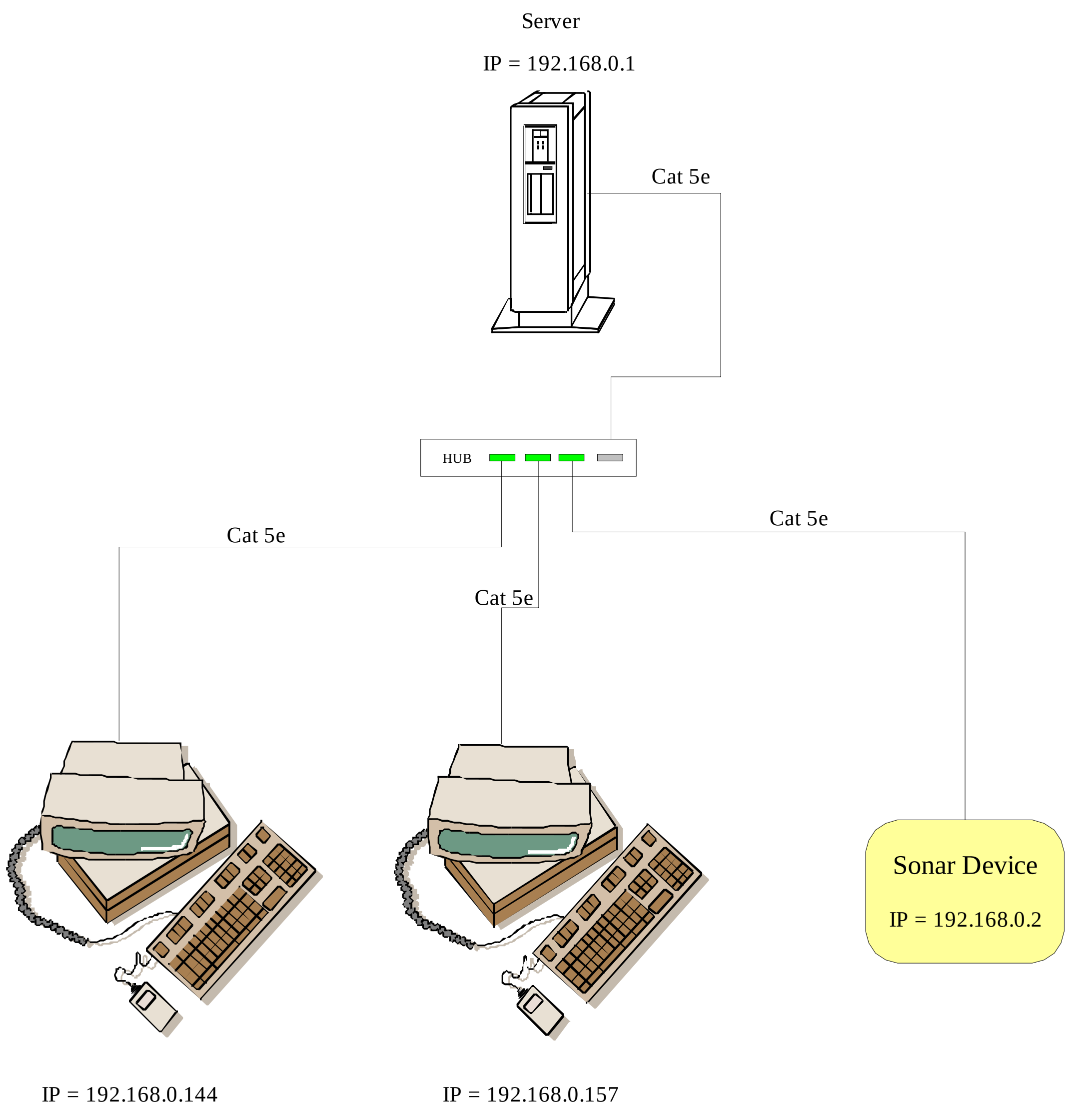


Figure 49 – Connecting the Sonar via a LAN

Setting up a Networked LAN

To connect an Imagenex Ethernet Sonar System to a networked Local Area Network (LAN), refer to Figure 50. 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.

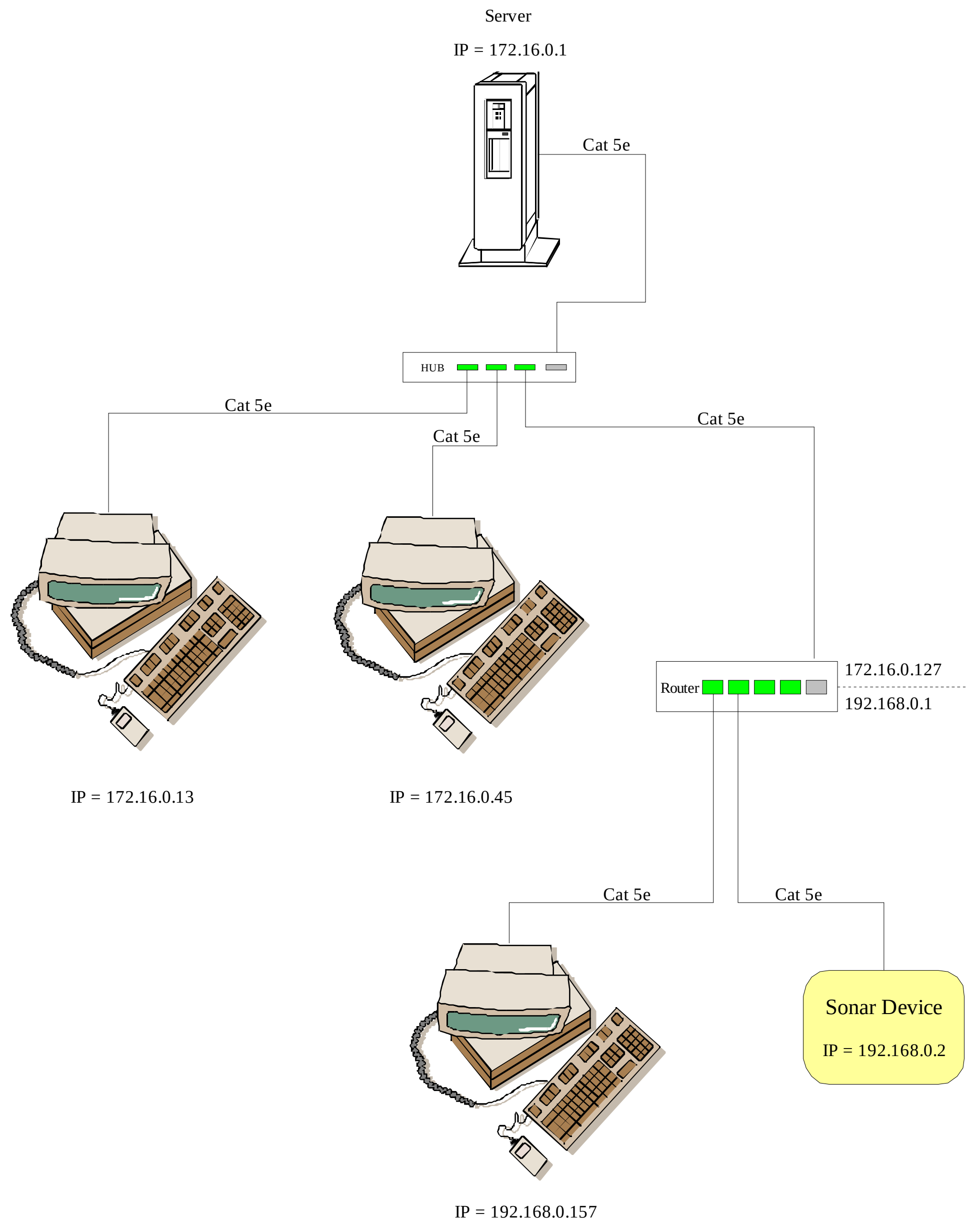


Figure 50 – Connecting the Sonar through a multiple LAN

Appendix C – Patton 3241 G.SHDSL Router Configuration

Follow the steps in the Patton “***Quick Start Guide***” to configure the IP address for the unit to match the network being used. For example if the sonar's IP address is 192.168.0.2, then the network would be configured as:

Table 6 - Default IP addresses

Device	**IP Address**	**Subnet Mask**
Sonar	192.168.0.2	NA
PC	192.168.0.3	255.255.0.0
Patton connected to PC (Central unit)	192.168.0.10	255.255.0.0
Patton connected to Sonar (Remote unit)	192.168.0.11	255.255.0.0

Each Patton device must be configured separately using HyperTerminal

Start Menu → All Programs → Accessories → Communications → HyperTerminal

- Enter “***superuser***” as Login
- Enter “***superuser***” as Password

Ensure to type:

system config save <enter>

to save the IP address to flash.

Service and G.SHDSL Configuration

To save the settings to the internal Flash memory,
Navigate to “*System Configuration → Save*” to Save current settings to flash.

Once the IP Addresses are configured, connect the remote unit to the computer via Ethernet and open a web browser. Type ***192.168.0.11*** in the Address Bar to connect to the remote units web configuration page. Enter “***superuser***” as Login and “***superuser***” as Password

1. Navigate to “*Services Configuration*” → *WAN*
2. Select “*Create a new service...*”
3. Select “*PPP bridged*”
4. Ensure the settings are as shown below.
5. Navigate to *G.SHDSL → Configuration*
6. Ensure the settings are entered as shown below to disable Error Control.

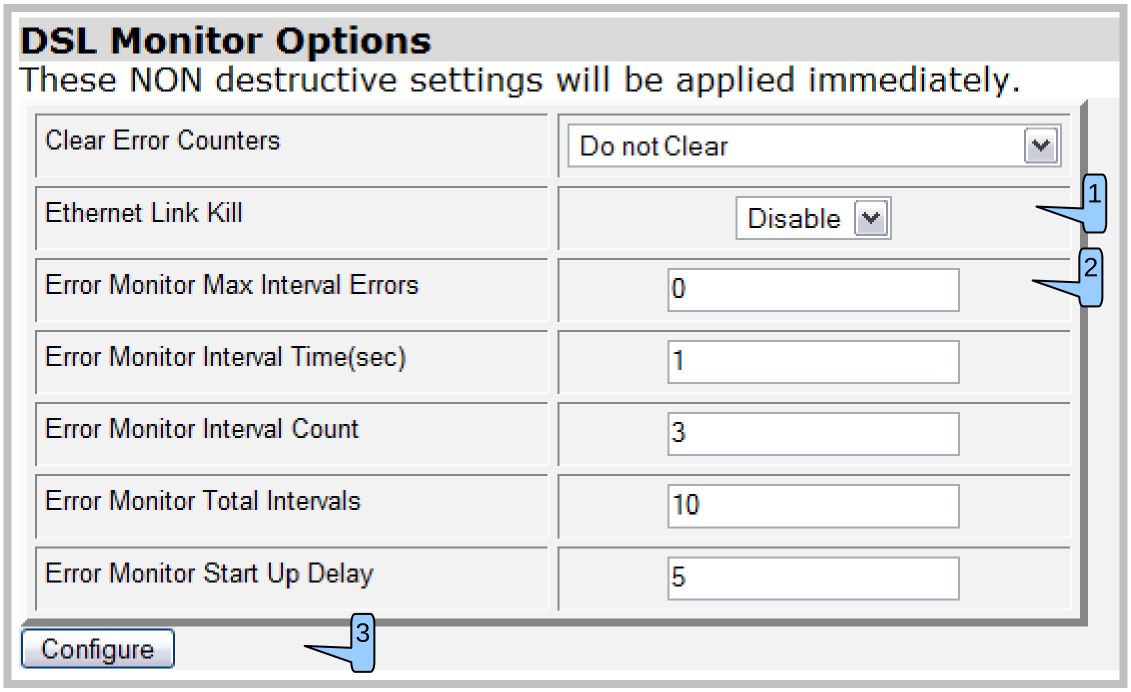


Figure 51 - Patton Central DSL Monitor Setup

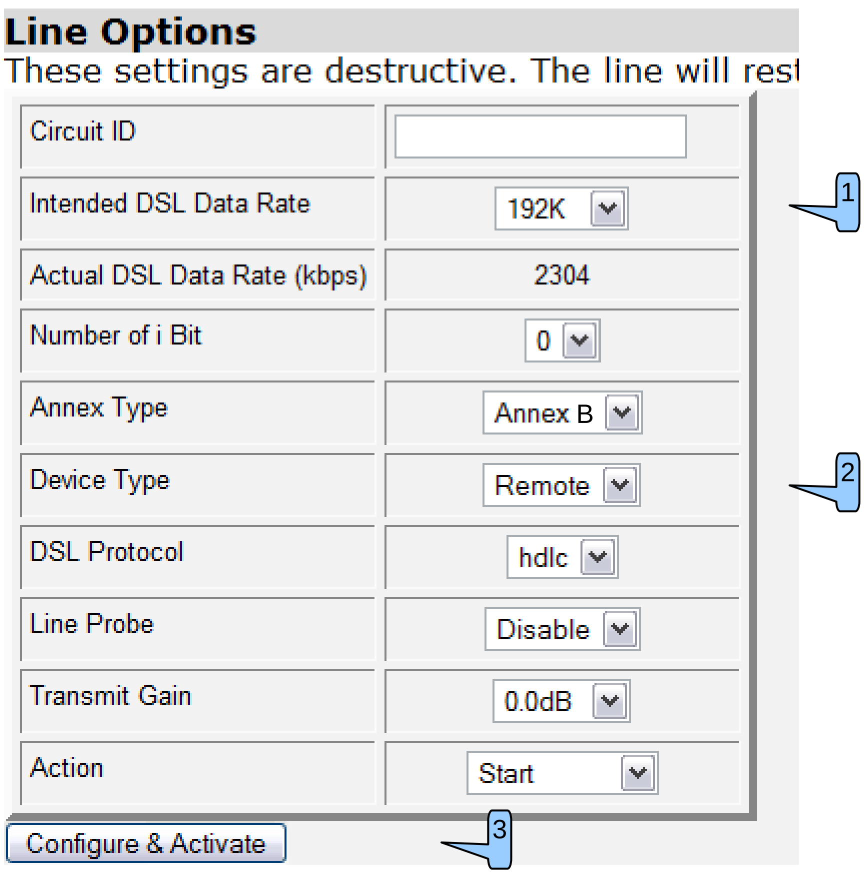


Figure 52 - Patton Central Line Options

After Selecting “***Configure & Activate”*** wait for about one minute.

To save the settings to the internal Flash memory,
Navigate to “*System Configuration* → *Save*” to Save current settings to flash.

Disconnect the Remote unit from the PC and Connect the Central unit to the PC via Ethernet and open a new tab in the browser (or a new browser window). Type ***192.168.0.10*** in the Address Bar to connect to the central units web configuration page.

1. Navigate to “*Services Configuration*” → *WAN*
2. Select “*Create a new service...*”
3. Select “*PPP bridged*”
4. Ensure the settings are as shown below.
5. Navigate to *G.SHDSL* → *Configuration*
6. Ensure the settings are entered as shown below to disable Error Control.

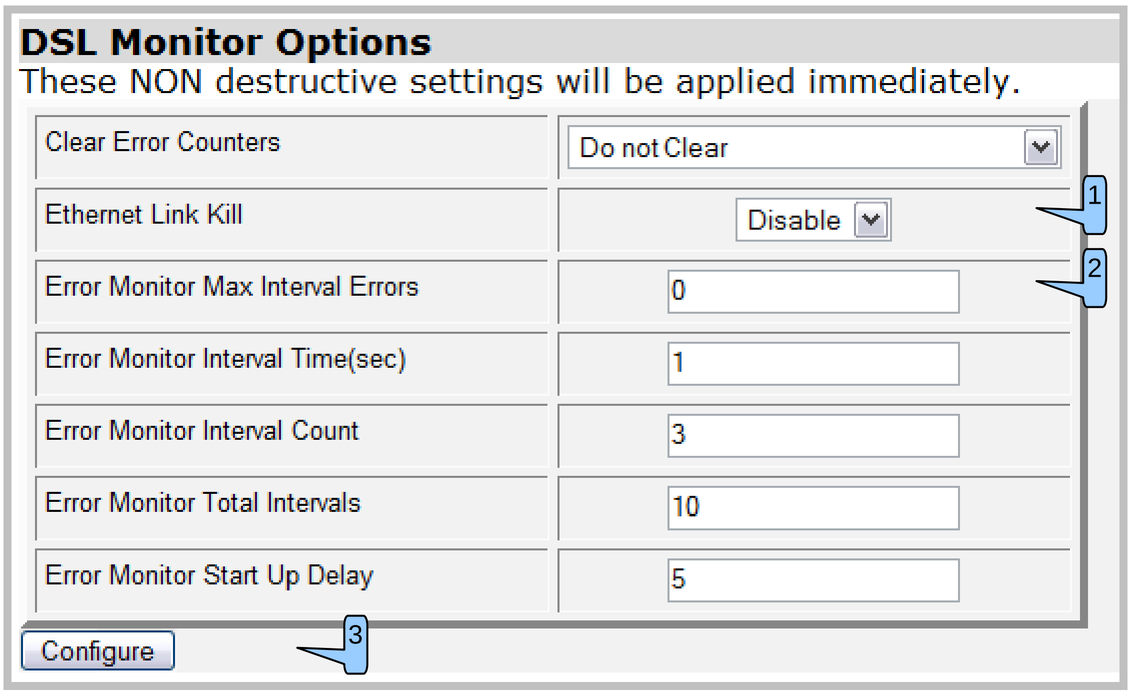


Figure 53 - Patton Remote DSL Monitor Setup

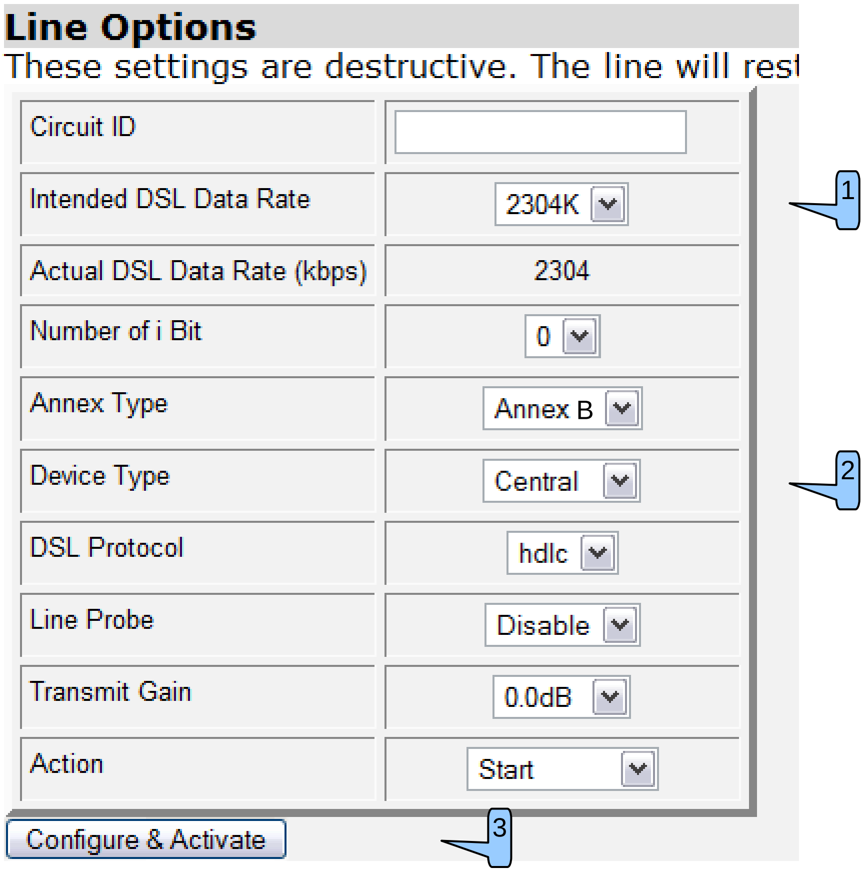


Figure 54 - Patton Remote Line Options

To save the settings to the internal Flash memory,
Navigate to "*System Configuration* → *Save*" to Save current settings to flash.

Note the difference in **Device Type** and Intended **DSL Data Rate**. The Remote unit is set for the MINIMUM Data Rate, while the Central unit is set for the MAXIMUM Data Rate. The Remote unit will up it's Data Rate to match the Data Rate of the Central unit.

Navigate to the '***Home***" page for the Central Patton device. Leaving the Central unit connected to the PC, connect the cabling to the "***Line***" ports on the units. It will take about a minute to set up the DSL link.

The home page will display something like:

Status of 3241/R G.SHDSL Access Device

DSL Link Status:	In Progress
DSL Link Rate Timeslot:	34
Local IP Address:	192.168.0.101
PP CPU Usage:	16%
NP CPU Usage:	1%
Up-Time:	1 day, 20 hours
Current Time:	, -20816 Jan 1970 - -3:-19:-48
Alarm State:	Major

Wait until this is displayed:

Status of 3241/R G.SHDSL Access Device

DSL Link Status:	Normal Operation
DSL Link Rate Timeslot:	34
Local IP Address:	192.168.0.101
PP CPU Usage:	3%
NP CPU Usage:	1%
Up-Time:	1 day, 20 hours
Current Time:	, -20816 Jan 1970 - -3:-18:-49
Alarm State:	No Alarms

Navigate to the '***Home***" page for the Remote Patton device. The home page will display the same. Ensure the DSL Link Rate Timeslot is the same for both the Remote and Central.

Line Errors

Navigate to *G.SHDSL → Status*

If The ***Noise Margin*** drops below an acceptable level, and/or excessive ***CRC Errors*** are present, Adjust the data rate on the Central unit to a lower value in the G.SHDSL Configuration page.

Appendix D – 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.

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 E – 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.

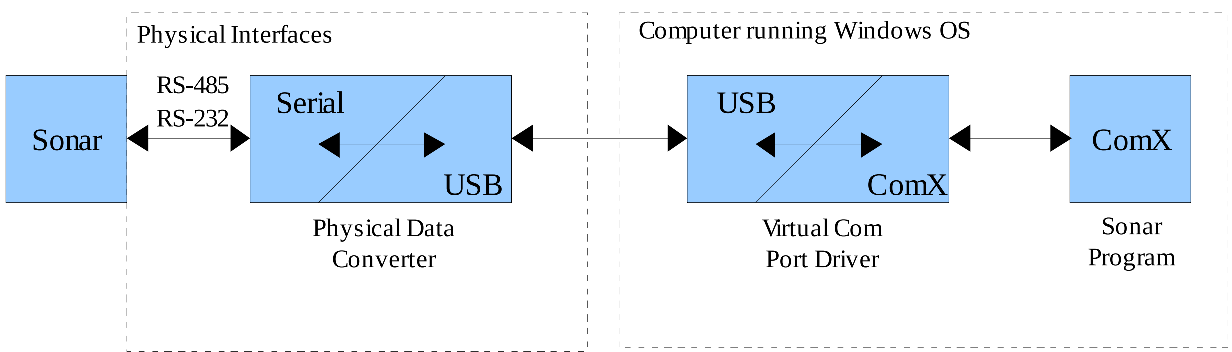


Figure 55 – Overview of USB Data Converter Logic Flow

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 <--> 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 7 – 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 <--> 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 56 – System Properties

Figure 57 – System Properties - Select Hardware Tab

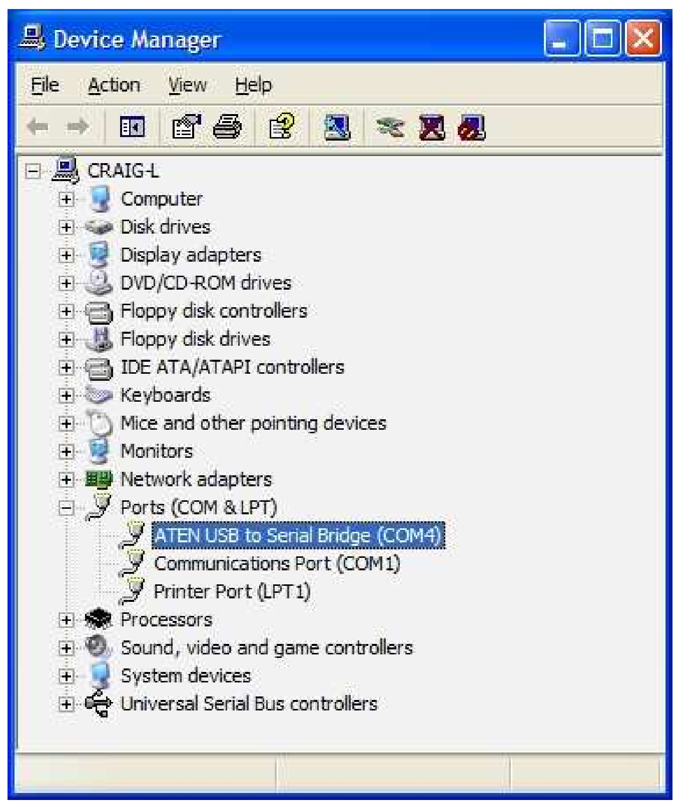


Figure 58 – Device Manager – Select Ports and double click device

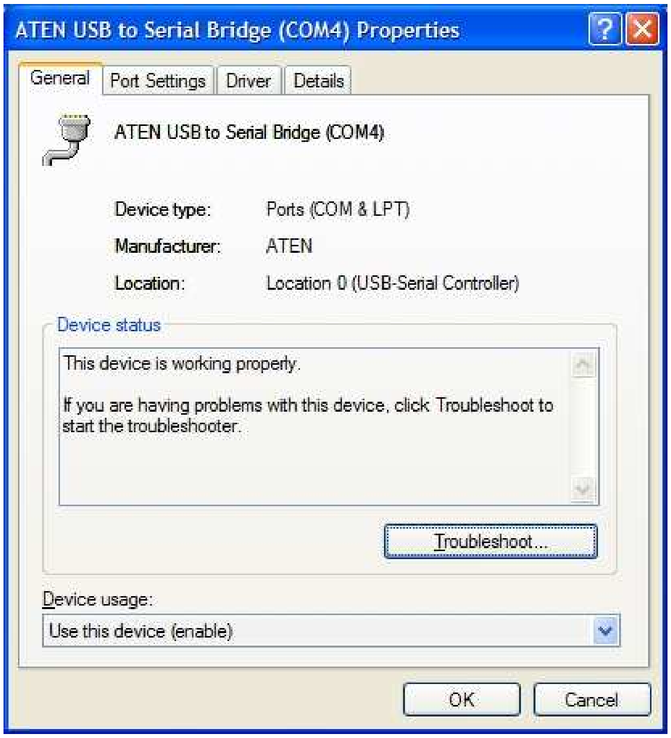


Figure 59 – Port Properties – Select "Port Settings"

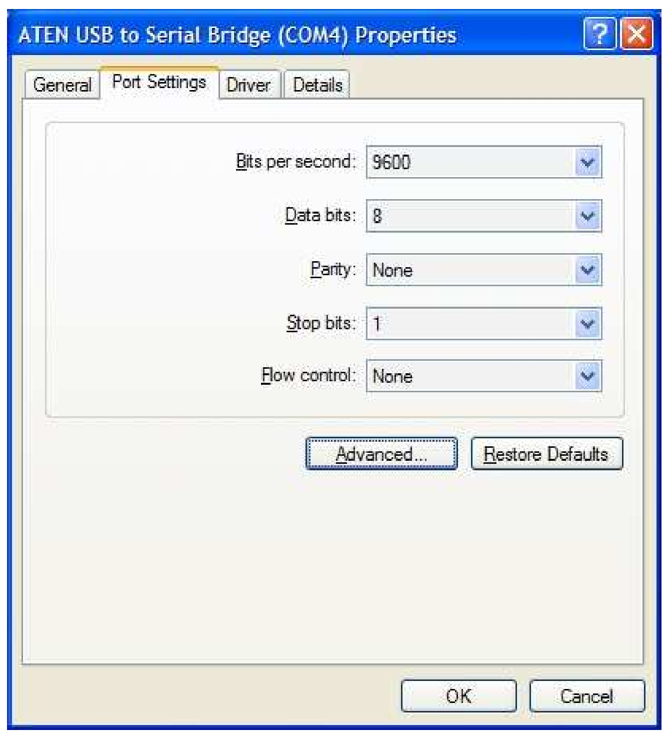


Figure 60 – Port Properties - Click "Advanced"

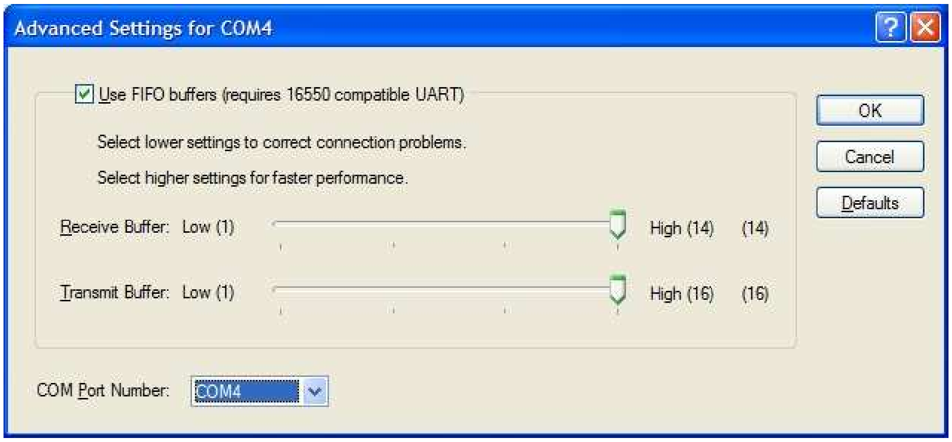


Figure 61 – Advanced Port Properties - Select Com Port Number

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

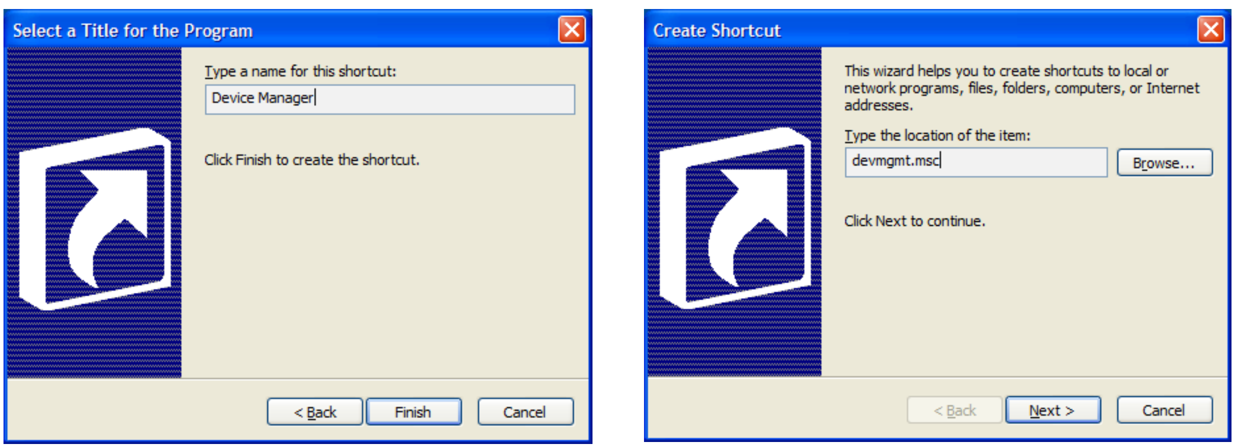


Figure 62 – Creating a Device Manager Shortcut

Appendix F – Data Storage File Format (.837)

When recording the sonar data to a **.837** file, the following bytes are appended and saved to the file every 'shot':

Byte #	Description
0 to 99	**File Header** (100 Bytes)
100 to 111	**Sonar Return Data Header** (12 Bytes)
112 to **xxxx**	Sonar Return Echo Data (IUX mode: 8 * 1000 Bytes) (IVX mode: 16 * 1000 Bytes) **xxxx** = 8111 or 16111
xxxx+1	Sonar Return Termination Byte **(always 0xFC)**
xxxx+2 to **yyyy**	Extra Bytes + Zero Fill **yyyy** = 8191 or 16383
yyyy+1 to **zzzz**	Video Frame **(if available)**

FILE HEADER

Bytes 0 through 99 contain the following **File Header** information:

Byte 0 **ASCII '8'**
Byte 1 **ASCII '3'**
Byte 2 **ASCII '7'**

Byte 3 **nToReadIndex** - Index for Number of Data Bytes
10 = 8000 Data Bytes (IUX data)
11 = 16000 Data Bytes (IVX data)

Bytes 4-5 **Total Bytes** - number of bytes that are written to the disk for this shot

Byte 4								**Byte 5**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
8192 (for IUX) or 16384 (for IVX)															

Bytes 6-7 **nToRead** - Number of Bytes from the sonar

Byte 6								**Byte 7**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
8013 (for IUX) or 16013 (for IVX)															

Bytes 8-19 **Date** - null terminated date string (12 bytes)
"**DD-MMM-YYYY**"

Bytes 20-28 **Time** - null terminated time string (9 bytes)
"**HH:MM:SS**"

Bytes 29-32 **Hundredth of Seconds** - null terminated string (4 bytes)
"**.hh**"

Bytes 33-36 **Video Frame Length** (if available)

length = 54 + (video_window_width * video_window_height * 3)

Byte 33		Byte 34	Byte 35	Byte 36
7	6 - 0	7 – 0	7 – 0	7 - 0
1	**Video Frame Length**			

Bit 7 of Byte 33 is set to 1 if video frame available.

Byte 37 **Xdcr Up/Down, Display Mode**

Byte 37							
7	6	5	4	3	2	1	0
Rsvd	**Xdcr**	**Reserved**			**Display Mode**		
1	0=Dn 1=Up	0			0 = Sector 1 = Linear 2 = Perspective 3 = Profile 4 = Beamtest		

Byte 38 **Start Gain**

0 to 20 in 1 dB increments

Bytes 39-40 **Profile Tilt Angle**

Byte 39								Byte 40							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
T	**[Tilt Angle (in degrees) + 180] * 10**														

If '**T**' = 0, Tilt Angle = 0 degrees

If '**T**' = 1, Tilt Angle = [((Byte 39 & 0x7F)<<8) **|** (Byte 40)]/10 **-**180

Byte 41 **Reserved**

always 0

Byte 42 **Reserved**

always 10

Byte 43 **Reserved**

always 0

Byte 44 **Pulse Length**

Byte 44 = pulse_length/10 → 1-250 = 10 to 2500 microseconds

Byte 45 **Reserved**

Always 0

Bytes 46-47 **Sound Velocity**

Byte 46								**Byte 47**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
V	**Sound Velocity (in meters/second) * 10**														

If '**V**' = 0, Sound Velocity = 1500.0 m/s
If '**V**' = 1, Sound Velocity = [((Byte 46 & 0x7F)<<8) **|** (Byte 47)]/10.0

Bytes 48-61 **GPS Ships Position Latitude** – text string (14 bytes)
"**_dd.mm.xxxxx_N**"
dd = Degrees
mm = Minutes
xxxxx = Decimal Minutes
_ = Space
N = North or S = South

Bytes 62-75 **GPS Ships Position Longitude** – text string (14 bytes)
"**ddd.mm.xxxxx_E**"
ddd = Degrees
mm = Minutes
xxxxx = Decimal Minutes
_ = Space
E = East or W = West

Byte 76 **GPS Ships Speed**
Speed = (Byte 76)/10 in knots

Bytes 77-78 **GPS Ships Heading**

Byte 77								**Byte 78**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Heading * 10 (in degrees)															

Byte 79 **Reserved**
Always 0

Bytes 80-81 **Operating Frequency**

Byte 80								**Byte 81**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Operating Frequency (in kHz)															

Bytes 82-83 **Pitch**

Byte 82								**Byte 83**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
P	**Pitch**														

If '**P**' = 0, Pitch Angle not available
If '**P**' = 1, Pitch Angle = [((Byte 82 & 0x7F)<<8) **|** (Byte 83) – 900] / 10

Bytes 84-85 **Roll**

Byte 84								**Byte 85**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
R	**Roll**														

If '**R**' = 0, Roll Angle not available
If '**R**' = 1, Roll Angle = [((Byte 84 & 0x7F)<<8) **|** (Byte 85) – 900] / 10

Bytes 86-87 **Heading**

Byte 86								**Byte 87**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
H	**Heading * 10**														

If '**H**' = 0, Heading not available
If '**H**' = 1, Heading = [((Byte 86 & 0x7F)<<8) **|** (Byte 87)]/10

Bytes 88-89 **Repetition Rate** – Time between pings

Byte 88								**Byte 89**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Repetition Rate (ms)															

Byte 90 **Display Gain**
0 to 100 percent

Bytes 91-99 **Reserved**
always 0

SONAR RETURN DATA HEADER

Bytes 100 through 111 contain bytes 0-11 of the **Sonar Return Data Header** that is acquired directly from the sonar head (refer to the DeltaT Ethernet Interface Specification):

Byte 100 **ASCII 'I'**
Byte 101 **ASCII 'U' or ASCII 'V'**
Byte 102 **ASCII 'X'**
Byte 103 **Head ID**
Byte 104 **Serial Status**
Byte 105 **Packet Number**
Byte 106 **Version**
Byte 107 **Range**
Byte 108 **Reserved**
Byte 109 **Reserved**
Byte 110 **Data Bytes (HI)**
Byte 111 **Data Bytes (LO)**

SONAR RETURN ECHO DATA

Byte 112 **Start of Echo Data**
IUX mode: 8000 byte block
IVX mode: 16000 byte block

Byte xxxx **End of Echo Data**
IUX mode: xxxx = 8111
IVX mode: xxxx = 16111

SONAR RETURN TERMINATION BYTE

Bytes xxxx+1 **Termination Byte** – always 0xFC

EXTRA BYTES + ZERO FILL

Bytes xxxx+2 **Sonar X-Offset** – 4 bytes, single precision IEEE floating point standard

Bytes xxxx+6 **Sonar Y-Offset** – 4 bytes, single precision IEEE floating point standard

Bytes xxxx+10 **Sonar Z-Offset** – 4 bytes, single precision IEEE floating point standard

Bytes xxxx+14 to yyyy **Zero Fill**
IUX mode: yyyy = 8191
IVX mode: yyyy = 16383

VIDEO FRAME

Bytes yyyy+1 to zzzz **Video Frame** (if available)

Appendix G – 83A PROFILE POINT OUTPUT (.83A)

DeltaT Azimuth – 83A XYZ OUTPUT

(83A UDP/IP Ethernet Datagram, .83A File Format)

For each ping, the following bytes are output during the 83A UDP datagram. If recording to a .83A file, the following bytes are appended and saved to the file for each ping. The total number of bytes '**N**' for each ping will vary depending on the number of beams selected.

Byte #	Byte Description
0-255	**File Header** (256 bytes)
256-**nnn**	**XYZ for current ping** with Intensities **nnn** = 256 + (14*number_of_beams) – 1 (3 floats + 2 bytes = 14 bytes)

FILE HEADER

Bytes 0 through 255 contain the following **File Header** information:

Byte 0 **ASCII '8'**
Byte 1 **ASCII '3'**
Byte 2 **ASCII 'A'**

Byte 3 **.83A File Version**
0 = v1.00

Bytes 4-5 **Total Bytes 'N'** - number of bytes that are written to the disk for this ping

Byte 4								Byte 5							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
N = 256 + (14*number_of_beams) → Max = 6976 bytes (480 beams)															

Byte 6 **Azimuth Drive Status**
Bit 0 => Orientation
0 = Down
1 = Up
Bits 1 – 7 Reserved = 0

Byte 7 **Reserved** - always 0

Bytes 8-19 **Sonar Ping Interrogation Timestamp**
Date – system date, null terminated string (12 bytes)
"**DD-MMM-YYYY**"

Bytes 20-28 **Sonar Ping Interrogation Timestamp**
Time – system time, null terminated string (9 bytes)
"**HH:MM:SS**"

Bytes 29-32 **Sonar Ping Interrogation Timestamp**
Hundredths of Seconds – system time, null terminated string (4 bytes)
"**.hh**"

Note: see Bytes 112-116 for Milliseconds.

Bytes 33-46 **GPS Ships Position Latitude** – text string (14 bytes)
"**_dd.mm.xxxxx_N**"
dd = Degrees
mm = Minutes
xxxxx = Decimal Minutes
_ = Space
N = North or S = South

Bytes 47-60 **GPS Ships Position Longitude** – text string (14 bytes)
"**ddd.mm.xxxxx_E**"
ddd = Degrees
mm = Minutes
xxxxx = Decimal Minutes
_ = Space
E = East or W = West

Byte 61 **GPS Ships Speed**
Speed = (Byte 61)/10 in knots

Bytes 62-63 **GPS Ships Heading**

Byte 62								**Byte 63**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Heading * 10 (in degrees)															

Bytes 64-65 **Pitch Angle (from Orientation Module)**

Byte 64								**Byte 65**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
P	**(Pitch Angle*10) + 900**														

If '**P**' = 0, Pitch Angle = 0 degrees
If '**P**' = 1, Pitch Angle = [[((Byte 64 & 0x7F)<<8) **|** (Byte 65)]-900]/10

Bytes 66-67 **Roll Angle (from Orientation Module)**

Byte 66								**Byte 67**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
7.5.	**(Roll Angle*10) + 900**														

If '**R**' = 0, Roll Angle = 0 degrees
If '**R**' = 1, Roll Angle = [[((Byte 66 & 0x7F)<<8) **|** (Byte 67)]-900]/10

Bytes 68-69 **Heading Angle (from Orientation Module)**

Byte 68								**Byte 69**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
7.5.	**Heading Angle*10**														

If '**H**' = 0, Heading Angle = 0 degrees
If '**H**' = 1, Heading Angle = [((Byte 68 & 0x7F)<<8) **|** (Byte 69)]/10

Bytes 70-71 **Beams**

Byte 70								Byte 71							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Number of Beams															

Bytes 72-73 **Samples Per Beam**

Byte 72								Byte 73							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Number of Samples Per Beam															

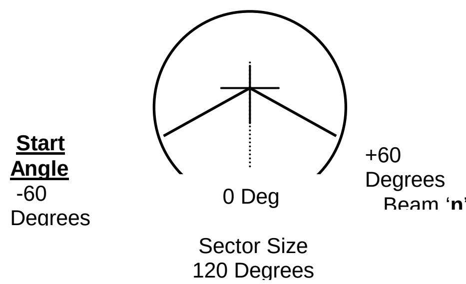
Bytes 74-75 **Sector Size**

Byte 74								Byte 75							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sector Size (in degrees)															

Bytes 76-77 **Start Angle** (Beam 0 angle)

Byte 76								Byte 77							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
[Start Angle (in degrees) + 180] * 100															

Example:



Byte 78 **Angle Increment**

Angle spacing per beam = (Byte 78)/100 in degrees

Bytes 79-80 **Acoustic Range**

Byte 79								Byte 80							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Acoustic Range (in meters)															

Bytes 81-82 **Acoustic Frequency**

Byte 81								Byte 82							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Acoustic Frequency (in kHz)															

Bytes 83-84 **Sound Velocity**

Byte 83								Byte 84							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
V	**Sound Velocity (in meters/second) * 10**														

If '**V**' = 0, Sound Velocity = 1500.0 m/s
If '**V**' = 1, Sound Velocity = [((Byte 83 & 0x7F)<<8) **|** (Byte 84)]/10.0

Bytes 85-86 **Range Resolution**

Byte 85								Byte 86							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Range Resolution (in millimetres)															

Bytes 87-88 **Reserved** – always 0

Bytes 89-90 **Profile Tilt Angle** (mounting offset)

Byte 89								Byte 90							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Profile Tilt Angle (in degrees) + 180															

Bytes 91-92 **Repetition Rate** – Time between pings

Byte 91								Byte 92							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Repetition Rate (in milliseconds)															

Bytes 93-96 **Ping Number** – increment for every ping

Byte 93	Byte 94	Byte 95	Byte 96
7 – 0	7 – 0	7 - 0	7 - 0
Ping Number			

Bytes 97-99 **Reserved** - always 0

Bytes 100-103 **Sonar X-Offset** – 4-byte single precision floating point number

Byte 100	Byte 101	Byte 102	Byte 103
7 – 0	7 – 0	7 - 0	7 - 0
Sonar X-Offset (in meters)			

Bytes 104-107 **Sonar Y-Offset** – 4-byte single precision floating point number

Byte 104	Byte 105	Byte 106	Byte 107
7 – 0	7 – 0	7 - 0	7 - 0
Sonar Y-Offset (in meters)			

Bytes 108-111 **Sonar Z-Offset** – 4-byte single precision floating point number

Byte 108	Byte 109	Byte 110	Byte 111
7 – 0	7 – 0	7 - 0	7 - 0
Sonar Z-Offset (in meters)			

Bytes 112-116 **Sonar Ping Interrogation Timestamp Milliseconds** – system time, null terminated string (5 bytes) "**.mmm**"

Byte 117 **Reserved** - always 0

Bytes 118-119 **Ping Latency** – Time from sonar ping interrogation to actual ping

Byte 118								Byte 119							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Ping Latency (in units of 100 microseconds)															

Bytes 120-121 **Data Latency** – Time from sonar ping interrogation to 83A UDP datagram

Byte 120								Byte 121							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Data Latency (in units of 100 microseconds)															

Time Since Ping = Data Latency – Ping Latency

Byte 122 **Sample Rate**
0 = Standard Resolution (1 in 500)
1 = High Resolution (1 in 5000)

Byte 123 **Option Flags**
Bit 0 – 1 = data is corrected for roll
Bit 1 – 1 = data is corrected for ray bending
Bit 2 – 0
Bit 3 – 0
Bit 4 – 0
Bit 5 – 0
Bit 6 – 0
Bit 7 – 0

Byte 124 **Reserved** - always 0

Byte 125 **Number of Pings Averaged**
0 to 25

Bytes 126-127 **Center Ping Time Offset** – The Sonar Ping Interrogation Timestamp (Bytes 8-19, 20-28 and 112-116) is the timestamp for the current ping. But due to ping averaging, the ping time of the center ping (of a group of averaged pings) may be required (i.e. for roll stabilization). The Center Ping Time Offset is the time difference between the center ping interrogation and the current ping interrogation.

Byte 126								Byte 127							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Center Ping Time Offset (in units of 100 microseconds)															

Center Ping Time = Sonar Ping Interrogation Timestamp – Center Ping Time Offset + Ping Latency

Note: Profile data from the current ping should be used when subtracting the Center Ping Time Offset.

Bytes 128-129 **Azimuth Head Position**

Byte 128								Byte 129							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0-1199															

Bytes 130-133 **Estimated Heave –** 4 byte single precision float

Byte 130	Byte 131	Byte 132	Byte 132
7-0	7-0	7-0	7-0
Estimated Heave (meters)			

Bytes 134-137 **Depth –** from depth sensor

Byte 134	Byte 135	Byte 136	Byte 137
Depth			

Bytes 138 - 255 **Reserved** - always 0

START OF XYZ POINTS (2 bytes/point)

Bytes 256 – (256 + 14 * Beams)

Byte	X	Y	Z	Intensity	Beam
256	4 Byte Float	4 Byte Float	4 Byte Float	2 Bytes	0
270					1
284					2
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
256 + 14 * Beams -14					N-1

256+14*480 = 6720 bytes => 6976 Bytes max

Appendix H – Sonar Ethernet Specification (V1.01)

OVERVIEW

The Model 837 DeltaT Sonar Head communicates over an Ethernet communications link. To interrogate the head and receive echo data, a command program sends a Switch Data Command string to the sonar head. When the Switch Data command is accepted, the sonar head transmits, receives and sends one packet of echo data back to the command program. The command program must interrogate the sonar head multiple times in order to receive all packets of echo data before the data can be processed.

Unless otherwise specified, the DeltaT sonar head will have a statically assigned IP Address of **192.168.0.2** .

SWITCH DATA COMMAND

The head accepts 27 bytes of switch data from the command program and must see the switch data header (2 bytes: **0xFE** and **0x44** HEX) in order to process the switches. The head will stop accepting switch data when it sees the termination byte (**0xFD** HEX). The termination byte must be present for the head to process the switches.

Table 8 – Model 837 Switch Data Command To Sonar Head

Byte #	Description							
0 – 7	**0xFE**	**0x44**	Head ID	Range	Reserved 0	Reserved 0	Reserved 0	Reserved 0
8 – 15	Start Gain	Reserved 1	Reserved 10	Reserved 0	Reserved 0	Packet Number	Pulse Length	Reserved 0
16 – 23	External Trigger	Ext Trig. Delay HI	Ext Trig. Delay LO	Data Points	Data Bits	Reserved 0	Reserved 0	Reserved 0
24 – 26	Switch Delay	Freq-uency	Term. **0XfD**					

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' (hexadecimal) prefix.

Byte 0 **Switch Data Header (1st Byte)**
Always **0xFE** (254 decimal)

Byte 1 **Switch Data Header (2nd Byte)**
Always **0x44** (68 decimal)

Byte 2 **Head ID**
0x10

Byte 3 **Range**
5 = 5m
10 = 10m
20 = 20m
30 = 30m
40 = 40m
50 = 50m
60 = 60m
80 = 80m
100 = 100m

Bytes 4 - 7 **Reserved**
Always 0

Byte 8 **Start Gain**
0 to 20dB in 1dB increments

Byte 9 **Reserved**
Always 1

Byte 10 **Reserved**
Always 10

Bytes 11-12 **Reserved**
Always 0

Byte 13 **Packet Number Request**
0 to 7 – for 8000 data point mode
0 to 15 – for 16000 data point mode
When the packet number request is 0, the sonar head will transmit, receive and send the first 1000 bytes of echo data (the '0' packet). The packet number request should then be incremented so that the sonar head will return the next 1000 bytes of echo data (the '1' packet). The sonar head does not transmit or receive if the packet number request is greater than 0. The packet number request should be incremented each time until the total number of echo data bytes have been returned. The packet number request should always follow the 0 to 7 (or 0 to 15) sequence.

Byte 14 **Pulse Length**
Length of acoustic transmit pulse.
1-100 → 10 to 1000 µsec in 10 µsec increments
Byte 14 = pulse_length_in_microseconds / 10

The following pulse lengths are recommended for each range:

5m: 30µs
10m: 60µs
20m: 120µs
30m: 180µs
40m: 240µs
50m: 300µs
60m: 360µs
80m: 480µs
100m: 600µs

Byte 15 **Reserved**
Always 0

The following External Trigger Control bytes are valid only for DeltaT Sonar Heads supplied with the External Trigger Hardware Option.

Byte 16 **External Trigger Control**
Bit0: Edge: 0 = NEG, 1 = POS
Bit1: Enable: 0 = Disable, 1 = Enable

Byte 17-18 **External Trigger Transmit Delay**
Delay from external trigger to sonar head transmit pulse

Byte 17								**Byte 18**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0 to 10000 (in 100 µsec increments)															

Byte 19 **Data Points**
8 - 8000 data points are returned by the head. The return data will have an ASCII '**IUX**' header.

16 - 16000 data points are returned by the head. The return data will have an ASCII '**IVX**' header.

Byte 20 **Data Bits**
Resolution (number of data bits) of the returned echo data
8 - Data width = 8 Bits, 1 data point per byte

Bytes 21-23 **Reserved**
Always 0

Byte 24 **Switch Delay**
The head can be commanded to pause (from 0 to 500ms) before sending its return data to allow the commanding program enough time to setup for the return of the data.
0 to 250 in 2ms increments
Byte 24 = delay_in_milliseconds/2

Byte 25 **Frequency**
86 = 260khz

Byte 26 **Termination Byte**
The head will stop looking for Switch Data when it sees this byte.
Always **0xFD** (253 decimal)

SONAR RETURN DATA

For every Switch Data Command, the head returns a 32 Byte header, 1000 bytes of echo data and a terminating byte value of 0xFC. The **total number of bytes** (**N**) returned will be 1033. For **IUX** data, a total of 8 Switch Data Commands are required to receive the full 8000 data points from the sonar head. For **IVX** data, a total of 16 Switch Data Commands are required to receive the full 16000 data points from the sonar head.

Table 9 – Model 837 Sonar Head Return Data

Byte #	Description					
0 - 5	ASCII 'I'	ASCII 'U' or 'V'	ASCII 'X'	Head ID	Serial Status	Packet Number
6 - 11	Version	Range	Reserved 0	Reserved 0	Data Bytes (HI)	Data Bytes (LO)
12 - 16	Ext Trig. Status	Reserved 0	Reserved 0	Reserved 0	Reserved 0	
17 - 21	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	
22 - 26	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	
27 - 31	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	
32 – 1031	Echo Data 1000 Bytes					
1032	Term. **0xFC**					

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.
N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**
ASCII '**IUX**' or '**IVX**'
'I' = 0x49, 'U' = 0x55', 'V' = 0x56, 'X' = 0x58

ASCII '**IUX**'
In response to a Switch Data Command with Data Points = 8
N = 1033, (32 Header bytes, 1000 Data bytes, 1 Terminating byte)
8 Switch Data Commands are required with Packet Number Request incrementing from 0 to 7 in order to receive all 8000 data bytes from the sonar head.

ASCII '**IVX**'
In response to a Switch Data Command with Data Points = 16
N = 1033, (32 Header bytes, 1000 Data bytes, 1 Terminating byte)
16 Switch Data Commands are required with Packet Number Request incrementing from 0 to 15 to receive all 16000 data bytes from the sonar.

Byte 3 **Head ID**
0x10

Byte 4	**Serial Status**	
	Bit 0	- 1
	Bit 1	- 1 = Internal Test
	Bit 2	- 0
	Bit 3	- 0
	Bit 4	- 0
	Bit 5	- 0
	Bit 6	- 1 = Switches Accepted
	Bit 7	- 1 = Character Overrun

Byte 5 **Packet Number**
0-7 for 'IUX' data
0-15 for 'IVX' data

Byte 6 **Firmware Version**
0x00 – 12 Header bytes, 8000 Data bytes, 1 Terminating byte
0x01 – 32 Header bytes, 1000 Data bytes, 1 Terminating byte using Packet Numbers 0 through 7
0x02 – add 16000 Data byte 'IVX' mode, Packet Numbers 0 through 15

Byte 7 **Range**

5	=	5m
10	=	10m
20	=	20m
30	=	30m
40	=	40m
50	=	50m
60	=	60m
80	=	80m
100	=	100m

Byte 8 **Reserved**
Always 0

Byte 9 **Reserved**
Always 0

Byte 10 - 11 **Data Bytes**

Number of Echo Data Bytes returned for current packet

Byte 10								**Byte 11**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Data Bytes (HI)								**Data Bytes (LO)**							

Data Bytes = (Byte 10 << 8) **|** Byte 11

Byte 12 **External Trigger Status**

Bit 0 - 0 = External Trigger Not Supported
1 = External Trigger Supported
Bit 1 - 0 = External Trigger is configured as an Output
1 = External Trigger is configured as an Input
Bit 2 - 0
Bit 3 - 0
Bit 4 - 0
Bit 5 - 0
Bit 6 - 0
Bit 7 - 0 = Transmit occurred after 100ms timeout (no trigger found)
1 = Transmit occurred after trigger (trigger found)

Byte 13 - 31 **Reserved**

Always 0

Byte 32-1031 **Echo Data** - 1000 Bytes of data for current packet (proprietary format)

Byte 1032 **Termination Byte**

0xFC

Appendix I – Azimuth Drive Ethernet Specification (V1.02)

OVERVIEW

The Model **837** Azimuth Drive communicates over a 10Mbps (10BaseT) Ethernet data transmission line. To interrogate the drive and receive sensor data, a "*Switch Data Command*" string is sent via an Ethernet command program. When the switch data command is accepted, the device moves to a new step angle, transmits, receives and sends its return data back to the command program.

SWITCH DATA COMMAND

The device accepts up to 27 bytes of switch data from the Ethernet interface and must see the switch data header (2 bytes: **0xFE** and **0x46** HEX) in order to process the switches. The header bytes must be present for the device to process the switches.

Table 10 - Model 837 Azimuth Drive Switch Data Command From Surface.

Byte #	Description							
0 – 7	**0xFE**	**0x46**	Head ID	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
8 – 15	Reserved 0	Reserved 0	Reserved 0	Azimuth LO	Azimuth HI	Reserved 0	Reserved 0	Reserved 0
16 – 23	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	PRH Command	Reserved 0	Calibrate
24 - 26	Switch Delay	Reserved 0	Term **0xFD**					

BYTE DESCRIPTIONS
Note: All Byte values are shown in decimal unless noted with a '0x' (hexadecimal) prefix.

Byte 0 **Switch Data Header (1st Byte)**
Always **0xFE** (254 decimal)

Byte 1 **Switch Data Header (2nd Byte)**
Always **0x46** (70 decimal)

Byte 2 **Head ID**
Always 0x1F

Byte 3-10 **Reserved**
Always 0

Byte 11-12 **Azimuth Step Angle (LO and HI)**
0 to 1199 (-180.0 Deg to +179.7 Deg) in 0.3 Degree steps.
Azimuth Step Angle = (angle_in_degrees+180)/0.3
0 = -180.0 Degrees
300 = -90.0 Degrees
600 = 0 Degrees
900 = 90 Degrees
1199 = 179.7 Degrees

Byte 11 = Azimuth Step Angle & 0x7F
Byte 12 = (Azimuth Step Angle & 0x3F80)>>7

Bytes 13 - 20 **Reserved**
Always 0

Byte 21 **PRH Command**
for MicroStrain 3DM-GX1 Pitch / Roll / Heading sensor
0x00 – Don't interrogate PRH sensor
0x02 – Start compass calibration
0x03 – Stop compass calibration
0x04 – Start Pitch / Roll calibration
0x05 – Stop Pitch / Roll calibration
0x80 – Output gyro stabilized Euler angles

Byte 22 **Reserved**
Always 0

Byte 23 **Calibrate**
0 = Normal Operation
1 = Calibrate Azimuth Drive Motor (move to 0º)

Byte 24 **Switch Delay**
The head can be commanded to pause (from 0 to 500 msec) before sending its return data to allow the commanding program enough time to setup for the return of the data.
0 to 250 in 2 msec increments
Byte 24 = delay_in_milliseconds/2

DO NOT USE A VALUE OF 253

Byte 25 **Reserved**
Always 0

Byte 26 **Termination Byte**
The head will stop looking for Switch Data when it sees this byte.
Always **0xFD** (253 decimal)

AZIMUTH RETURN DATA

Every shot, the Azimuth drive returns the required information depending on the command it receives, an error status, and the Sequence Number. The **total number of bytes** returned will be 40.

Table 11 - Model 837 Azimuth Drive Return Data.

Byte #	Description							
0 – 7	ASCII 'I'	ASCII 'A'	ASCII 'X'	Head ID	Command Status	Reserved 0	Version	Reserved 0
8 – 15	Reserved 0	Reserved 0	Azimuth (LO)	Azimuth (HI)	Reserved 0	PRH Status	Pitch (LO)	Pitch (HI)
16 – 23	Roll (LO)	Roll (HI)	Heading (LO)	Heading (HI)	Timer (LO)	Timer (HI)	Reserved 0	Reserved 0
24 - 31	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
32 - 39	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Term **0xFC**

BYTE DESCRIPTIONS

Bytes 0 - 2 **Imagenex Return Data Header**
ASCII '**IAX**'
'I' = 0x49, 'A' = 0x41, 'X' = 0x58

Byte 3 **Head ID**
Always 0x1F

Byte 4 **Command Status**

Bit	Value	Description
0	0	Adjust Step Successful
	1	Adjust Step Error
1	0	Start Compass Calibration Successful
	1	Start Compass Calibration Error
2	0	Stop Compass Calibration Successful
	1	Stop Compass Calibration Error
3	0	Pitch and Roll Calibration Successful
	1	Pitch and Roll Calibration Error
4	0	Send Gyro Stabilized Euler Angles Successful
	1	Send Gyro Stabilized Euler Angles Error
5	0	Motor Calibration Successful
	1	Motor Calibration Error
Others	0	Reserved

Byte 5 — Firmware Version
0 = DAz_2Aa -> DAz_2Ad
1 = DAz_2Ae

Bytes 6 - 9 — **Reserved**
Always 0

Bytes 10 - 11 — **Azimuth Angle**

Byte 5								**Byte 6**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Azimuth (LO)**							**0**	**Azimuth (HI)**						**L**

Azimuth Angle = 0.3 * ([(Byte 6<<7) **|** (Byte 5)] -600), in degrees

Byte 12 — **Reserved**
Always 0

Byte 13 — **Pitch / Roll / Heading Sensor Status**
0 = No sensor installed
1 = MicroStrain 3DM-GX1

Bytes 14-15 — **Pitch**
These two bytes contain the Gyro-Stabilized Euler Pitch Angle from the Orientation Sensor.

Byte 12								**Byte 13**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Pitch (LO)								**Pitch (HI)**							

Pitch Angle = -32768 -> 32767 => -180°-> +180°

$$= \frac{[(Pitch(Hi) \ll 8) \mid Pitch(Lo)] * 360}{65536}$$

Bytes 16-17 — **Roll**
These two bytes contain the Gyro-Stabilized Euler Roll Angle from the Orientation Sensor.

Byte 12								**Byte 13**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Roll (LO)								**Roll (HI)**							

Roll Angle = -32768 -> 32767 => -180°-> +180°

$$= \frac{[(Roll(Hi) \ll 8) \mid Roll(Lo)] * 360}{65536}$$

Bytes 18-19 **Heading**

These two bytes contain the Gyro-Stabilized Euler Yaw Angle from the Orientation Sensor.

Byte 12								**Byte 13**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Yaw (LO)								**Yaw (HI)**							

Yaw Angle = -32768 -> 32767 => -180°-> +180°

$$= \frac{[(Yaw(Hi) << 8) \mid Yaw(Lo)] * 360}{65536}$$

Bytes 20-21 **Timer**

These two bytes contain the Timer output from the Orientation Sensor. This counter is incremented every 6.5536ms.

Byte 12								**Byte 13**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Timer (LO)								**Timer (HI)**							

Timer = 0 -> 65536

$$= [(Timer(Hi) << 8) \mid Timer(Lo)]$$

Bytes 22-38 **Reserved**

Always 0

Byte 39 **Termination Byte**

Always **0xFC** (253 decimal)

Appendix J – GPS String Formats for DeltaT.exe

GLL: Geographical **L**atitude and **L**ongitude (Ship's Position)

$GPGLL,ddmm.xxxxx,N,dddmm.xxxxx,W<CR><LF>

Where:

- dd = Degrees
- mm = Minutes
- xxxxx = Decimal Minutes
- N = North or S = South
- W = West or E = East

*Note: if using GPGLL string, use GPVTG for ship's speed and heading

VTG: **V**ector **T**rack and **G**round Speed (Ship's Speed SOG and Heading)

$GPVTG,ttt.t,T,mmm.m,M,nn.n,N,kk.k,K<CR><LF>

Where:

- ttt.t = Track in Degrees (True)
- mmm.m = Track in Degrees (Magnetic)
- nn.n = Ground Speed (Knots)
- kk.k = Ground Speed (Km/Hr)

GGA: Geographical (Ship's Position)

$GPGGA,uuuuuu.uu,ddmm.xxxxx,N,dddmm.xxxxx,W,q,s,hhh,aaa,M,gggg,M<CR><LF>

Where:

- uuuuuu.uu = UTC of Position
- dd = Degrees
- mm = Minutes
- xxxxx = Decimal Minutes
- N = North or S = South
- W = West or E = East
- q = Quality Indicator (0 = GPS not available, 1 = GPS available)
- s = Number of satellites being used
- hhh = Horizontal dilution of precision (HDOP)
- aaa,M = Antenna Height in Meters
- gggg,M = Geoidal Height in Meters

*Note: if using GPGGA string, use GPVTG for ship's speed and heading

<u>RMC:</u> <u>(Ship's Position)</u>

$GPRMC,tttttt,A,ddmm.xxxxx,N,dddmm.xxxxx,W,kk.k,ccc.c,ddmmyy,vv,E<CR><LF>

Where:

- tttttt = UTC Time
- A = Status (A = valid, V = invalid)
- dd = Degrees
- mm = Minutes
- xxxxx = Decimal Minutes
- N = North or S = South
- W = West or E = East
- kk.k = Speed over Ground in knots
- ccc.c = COG (Track) in Degrees True
- ddmmyy = Date (day, month, year)
- vv = Variation sense (E = East, W = West)

*Note: GPVTG is not required when using the GPRMC string

Serial Port Settings:

4800bps, No Parity, 8 Data Bits, 1 Stop Bit

Appendix K – Beam Output Format (83B)

After each sonar ping, the following bytes are output via Ethernet to “IPAddress_Output1” as initialized in the DELTAT.INI configuration file. The total number of bytes ‘**N**’ for each ping will vary depending on the number of beams used.

NOTE: as of this writing, number of beams is limited to 120

Byte #	Byte Description
0-255	**Header** (256 bytes)
256-**nnnnn**	**Beam Output for current ping** (500 range bins / beam) **nnnnn** = 256 + (500*number_of_beams) – 1

HEADER
Bytes 0 through 255 contain the following **Header** information:

Byte 0 **ASCII '8'**
Byte 1 **ASCII '3'**
Byte 2 **ASCII 'B'**

Byte 3 **83B Version**
2 = v1.02

Bytes 4-6 **Total Bytes ‘N’ -** number of bytes that are output for this ping

Byte 4								**Byte 5**								**Byte 6**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
N = 256 + (500*number_of_beams)																							

Byte 7 **Reserved** - always 0

Bytes 8-19 **Date** – system date, null terminated string (12 bytes)
"**DD-MMM-YYYY**"

Bytes 20-28 **Time** – system time, null terminated string (9 bytes)
"**HH:MM:SS**"

Bytes 29-32 **Hundredths of Seconds** – system time, null terminated string (4 bytes)
"**.hh**"

Bytes 33-46 **GPS Ships Position Latitude** – text string (14 bytes)“ **_dd.mm.xxxxx_N**”

- dd = Degrees
- mm = Minutes
- xxxxx = Decimal Minutes
- _ = Space
- N = North or S = South

Bytes 47-60 **GPS Ships Position Longitude** – text string (14 bytes)

- "**ddd.mm.xxxxx_E**"
- ddd = Degrees
- mm = Minutes
- xxxxx = Decimal Minutes
- _ = Space
- E = East or W = West

Byte 61 **GPS Ships Speed**

Speed = (Byte 61)/10 in knots

Bytes 62-63 **GPS Ships Heading**

Byte 62								**Byte 63**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Heading * 10 (in degrees)															

Bytes 64-65 **Pitch Angle (from Orientation Module)**

Byte 64								**Byte 65**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
P	**(Pitch Angle*10) + 900**														

If '**P**' = 0, Pitch Angle = 0 degrees
If '**P**' = 1, Pitch Angle = [[((Byte 64 & 0x7F)<<8) **|** (Byte 65)]-900]/10

Bytes 66-67 **Roll Angle (from Orientation Module)**

Byte 66								**Byte 67**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
R	**(Roll Angle*10) + 900**														

If '**R**' = 0, Roll Angle = 0 degrees
If '**R**' = 1, Roll Angle = [[((Byte 66 & 0x7F)<<8) **|** (Byte 67)]-900]/10

Bytes 68-69 **Heading Angle (from Orientation Module)**

Byte 68								**Byte 69**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
H	**Heading Angle*10**														

If '**H**' = 0, Heading Angle = 0 degrees
If '**H**' = 1, Heading Angle = [((Byte 68 & 0x7F)<<8) **|** (Byte 69)]/10

Bytes 70-71 **Beams**

Byte 70								**Byte 71**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Number of Beams															

Bytes 72-73 **Samples Per Beam**

Byte 72								**Byte 73**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Number of Samples Per Beam															

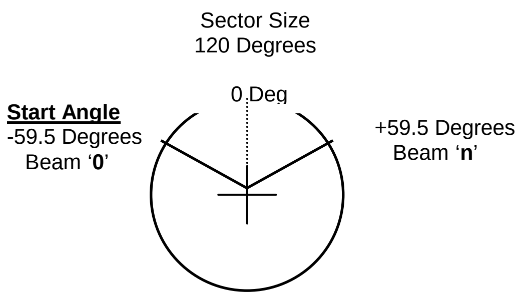
Bytes 74-75 **Sector Size**

Byte 74								**Byte 75**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sector Size (in degrees)															

Bytes 76-77 **Start Angle** (Beam 0 angle)

Byte 76								**Byte 77**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
[Start Angle (in degrees) + 180] * 100															

Example:



Byte 78 **Angle Increment**

Angle spacing per beam = (Byte 78)/100 in degrees

Bytes 79-80 **Acoustic Range**

Byte 79								**Byte 80**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Acoustic Range (in meters)															

Bytes 81-82 **Acoustic Frequency**

Byte 81								**Byte 82**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Acoustic Frequency (in kHz)															

Bytes 83-84 **Sound Velocity**

Byte 83								**Byte 84**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
V	**Sound Velocity (in meters/second) * 10**														

If '**V**' = 0, Sound Velocity = 1500.0 m/s
If '**V**' = 1, Sound Velocity = [((Byte 83 & 0x7F)<<8) **|** (Byte 84)]/10.0

Bytes 85-86 **Range Resolution**

Byte 85								**Byte 86**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Range Resolution (in millimetres)															

Bytes 87-88 **Pulse Length**

Byte 87								**Byte 88**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Pulse Length (in microseconds)															

Bytes 89-90 **Profile Tilt Angle** (mounting offset)

Byte 89								**Byte 90**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Profile Tilt Angle (in degrees) + 180															

Bytes 91-92 **Repetition Rate** – Time between pings

Byte 91								**Byte 92**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Repetition Rate (in milliseconds)															

Bytes 93-96 **Ping Number** – increment for every ping

Byte 93	**Byte 94**	**Byte 95**	**Byte 96**
7 – 0	7 – 0	7 - 0	7 - 0
Ping Number			

Bytes 97-99 **Reserved** - always 0

Bytes 100-103 **Sonar X-Offset** – 4-byte single precision floating point number

Byte 100	**Byte 101**	**Byte 102**	**Byte 103**
7 – 0	7 – 0	7 - 0	7 - 0
Sonar X-Offset (in meters)			

Bytes 104-107 **Sonar Y-Offset** – 4-byte single precision floating point number

Byte 104	**Byte 105**	**Byte 106**	**Byte 107**
7 – 0	7 – 0	7 - 0	7 - 0
Sonar Y-Offset (in meters)			

Bytes 108-111 **Sonar Z-Offset** – 4-byte single precision floating point number

Byte 108	**Byte 109**	**Byte 110**	**Byte 111**
7 – 0	7 – 0	7 - 0	7 - 0
Sonar Z-Offset (in meters)			

Bytes 112-255 **Reserved** - always 0

START OF BEAM OUTPUT BYTES (500 range bins per beam)

Bytes 256-755	**Beam 0:** 500 range bins (0-499), intensity value for each bin is 0-255
Bytes 756-1255	**Beam 1** 500 range bins (0-499), intensity value for each bin is 0-255
Bytes nnnnn-499 to nnnnn	**Beam N** 500 range bins (0-499), intensity value for each bin is 0-2