DISCOVER SB Software

DISCOVER SUB-BOTTOM SOFTWARE USER'S MANUAL

Revision: 1.0 / May 2007

Email: info@EdgeTech.com
Web: http://www.EdgeTech.com

1141 Holland Drive, Suite 1
Boca Raton, FL 33487 - USA
Tel: 561 995-7767 / *Fax:* 561 995-7761

FORWARD

This manual is intended to provide the user with an understanding of the operation and care of the EdgeTech Model 3200-XS system and towed vehicles. General sub-bottom profiling information may be found in papers published in the Journal of the Acoustical Society of America, Offshore Technology Conference, IEEE Journal of Oceanic Engineering by L.R. LeBlanc and S.G. Schock.

The information, figures and specifications in this manual are proprietary. Materials in this manual are issued in strict confidence on condition that it not be copied, reprinted or disclosed to a third party either wholly or in part without the prior written consent of EdgeTech.

To quickly get familiar with the system, connect the components as described in the installation section, and follow the steps described in the First Deployment Section.

Although this manual has been revised to cover the latest operational features of X-STAR, some features may be periodically upgraded. Portions of this manual such as parts lists, schematics, and test features are subject to change and should be used for reference only.

EdgeTech has made every effort to document this product accurately and completely. However, EdgeTech assumes no liability for errors or for any damages that result from use of this manual or the equipment it accompanies. EdgeTech reserves the right to upgrade features of this equipment and to make changes to this manual without notice at any time.

Since clear and concise documentation is important for successful operation and understanding of the equipment, we invite you to contact us with any questions or comments, so that we may enhance this manual.

WARRANTY

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by EdgeTech, free of charge. Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose and there is no warranty of merchantability. This warranty applies only if:

i. The items are used solely under the operating conditions and in the manner recommended in Seller's instruction manual, specifications, or other literature.

ii. The items have not been misused or abused in any manner or repairs attempted thereon.

iii. Written notice of the failure within the warranty period is forwarded to Seller and the directions received for properly identifying items returned under warranty are followed.

iv. The return notice authorizes Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall be warranted for the remaining portion of the original warranty period only.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer's warranties.

WARNING

This equipment contains static sensitive devices that are extremely sensitive to static electrical charges, which may be developed on the body and the clothing. Extreme care should be taken when handling these devices both in and out of the circuit board. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

This equipment generates, uses and can radiate radio frequency energy, and if not installed properly may cause interference to radio communications. It has not been tested to compliance to the appropriate FCC rules designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user, at his own expense, will be required to take whatever measures needed to correct the interference. It is the user's responsibility to verify that the system complies with the applicable FCC emission limits.

High Voltage may be present in the tow fish, power amplifier and the topside processor. Use caution when the electronics are removed from their containers for servicing.

Operation with improper line voltage could cause serious damage to the equipment.

CONTENTS

CONTENTS

CONTENTS

FIGURES

TABLES

Quality

To our customers:

Thank you for purchasing one of our products. At EdgeTech, it is our policy to provide high quality, cost-effective products and support services that meet or exceed your requirements, to deliver them on time and to continuously look for ways to improve. We all take pride in the products we manufacture.

We want you to be entirely satisfied with your equipment. The information in this manual will get you started. It tells you what you need to get your equipment up and running, and introduces its many features.

We always enjoy hearing from people who use our products. Your experience with our products is an invaluable source of information that we can use to continuously improve what we manufacture. We encourage you to contact or visit us to discuss any issues whatsoever that relate to our products or your application.

The Employees of EdgeTech

1 INTRODUCTION

1.1 OVERVIEW

1.1.1 DISCOVER SUB-BOTTOM

Discover SB is a limited function, diagnostic topside for EdgeTech Full Spectrum® chirp sonar systems. Discover SB supports the 3200-XS sub-bottom system. It is furnished as an aid to help verify correct EdgeTech Full Spectrum® Sonar operation prior to or during deployment. Discover SB includes the following capabilities:

- A waterfall, reflection coefficient, and waveform data displays.
- Frequency data analysis for advanced system diagnostics.
- Data recording and playback.
- Limited thermal printer support for waterfall data output
- NMEA GPS navigation input
- Sonar command and control
- Sonar diagnostics

The Discover Sub-Bottom program is supported under Microsoft's Windows 98, Windows NT 4.0 (or higher), Windows 2000 and Windows XP operating systems. The data and control connections to the Discover SB program are entirely through TCP/IP connections.

The data and control connections to the Discover SB program are entirely through TCP/IP connections, allowing the Discover SB program to run (executed) on any Windows 98 / NT / 2000 based computer that can establish a TCP/IP connection to the EdgeTech Full Spectrum® sonar system. This connection may include, but is not limited to, computers connected directly using a crossover cable, computers connected via a standard Ethernet hub, or computers connected using the EdgeTech STARMUX™ digital telemetry link and FS-IU (topside Interface Unit). Discover SB can also be run on the actual EdgeTech Full Spectrum® sonar system computer.

EdgeTech Full Spectrum® sonar systems employ advanced Chirp technology to obtain high resolution, low noise data records. EdgeTech's advanced Chirp technology employs long duration, wide band frequency modulated transmit pulses. Return sonar echo data is processed to remove the FM carrier, and produce high-resolution images of the echo field. Discover SB allows monitoring of this normal de-chirped sub-bottom data, as well as raw chirped data. This latter data type is often useful for diagnostic purposes.

For compatibility with other EdgeTech products, the Discover SB program interfaces to a second program that is run in the background. Sonar.exe interfaces with the DSP and the analog interface boards to generate and transmit chirp pulses. A startup file launches the sonar.exe program automatically every time the system is booted.

1.1.2 APPLICATIONS

This system has the unique ability to strip away the world's oceans and provide high resolution sub-bottom images. This tool lends itself to various tasks that include:

- Imaging fluidized mud to a resolution of 8 cm
- Sediment classification
- Buried pipeline and cable location & routing
- Dredging studies for inlets
- Scour/erosion surveys in rivers and streams
- Marine geotechnical surveys
- Bridge erosion surveys
- Hazardous waste target location
- Geological surveys
- Archeological surveys
- Imaging biologics in water column
- Mapping clam populations
- Beach renourishment
- Military and Offshore Oil applications
- Full ocean depth sub-bottom imaging (hull mount systems)

1.2 SOFTWARE DISPLAYS

Real-time Video Display- The software displays Sub-bottom cross section data in a dedicated window.

Real-time Geo-referencing– The sub-bottom data are geo-referenced when navigation information is supplied.

Real time Processing– Real time processing includes removals of swell effect, adaptive automatic gain control and time variable gain. Data are logged in real time in native EdgeTech format or SEG-Y format that is a generic open format allowing data exchange.

Reflection Coefficient– Since the EdgeTech sonar is linear; the measured refection coefficient can be used to identify the type of material (i.e. sand, clay, mud etc.) on the bottom. A graph of the refection coefficient is displayed in real time.

Navigation- One of the computer's RS232 ports can be configured to receive navigation data from a navigation computer or from a GPS. A NMEA 0183 string can be recorded through this interface. Navigation information is stored in the trace header of the sonar data. The navigation message is displayed on the screen and is printed on the thermal printer.

Interactive screen interpretation- Using the mouse, the operator can get information on each ping.

Other Software features:

- Echo strength
- Layer depth
- Sonar return number, record number, file number, mark number
- Event/Fix marks
- Frequency data analysis for advanced system diagnostics
- Sonar Diagnostics

1.3 OPERATOR CONTROLS

- Two stage TVG
- Bottom tracking
- Display gain
- Preamp gain
- Horizontal and vertical zoom
- Waveform display of individual acoustic return
- Direct path suppression
- Heave removal
- Swell filter
- Display annotation & Event mark
- Pulse selection, rate and power
- A/D delay
- Printed and recorded media

2 DISCOVER SETUP

2.1 INSTALLATION

Discover Sub-Bottom consists of a single executable file "Discover-Sub-bottom.exe" and a standard Windows initialization file. The initialization file stores user options and configuration parameters. If the file does not exist, then default values are used, and it will be created when the current settings are saved or the program is exited.

Installation consists of copying the "Discover-Sub-bottom.exe" executable to a suitable directory on the Windows PC, e.g.: C:\Edgetech\Topside after the Install Shield has been run.

2.1.1 INSTALL SHIELD

To install Discover Sub-Bottom an Install shield must first be run; open the Install shield and click next.

Figure 2-1 Install Shield Window

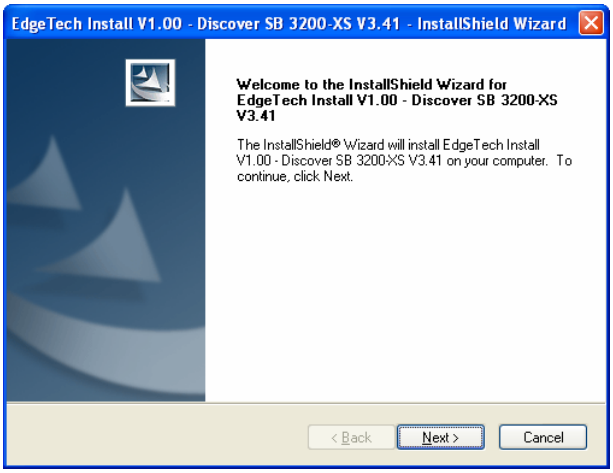


Figure 2-2 Install Discover SB

Please read through the warranty. To continue running the Install shield, click "I accept the license agreement".

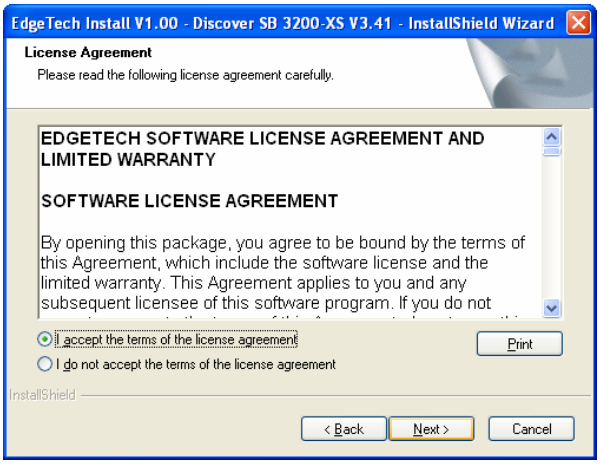


Figure 2-3 License Agreement Window

The Install shield must set up Discover on the computer. If "Complete" is selected, Discover SB and all affiliated files will be installed on the C:\ drive under the EdgeTech folder. If this is not convenient, select "Custom" and place Discover SB where it is easily accessible.

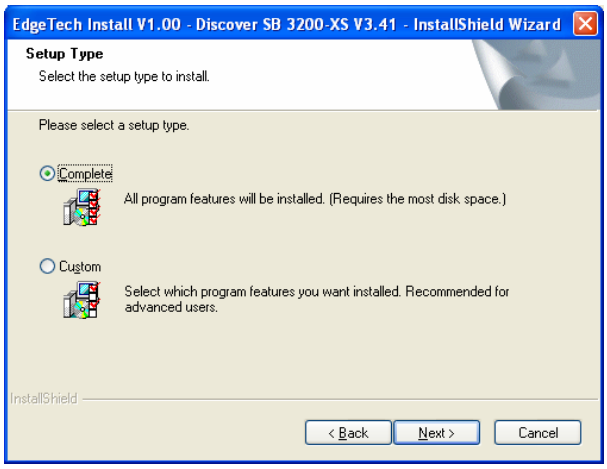


Figure 2-4-1 Setup Window

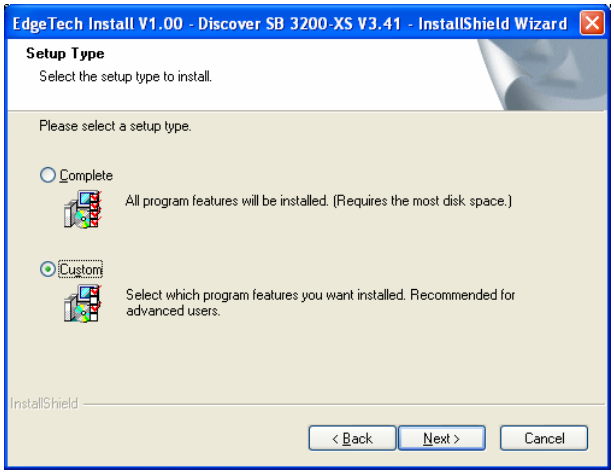


Figure 2-5-2. Setup Window

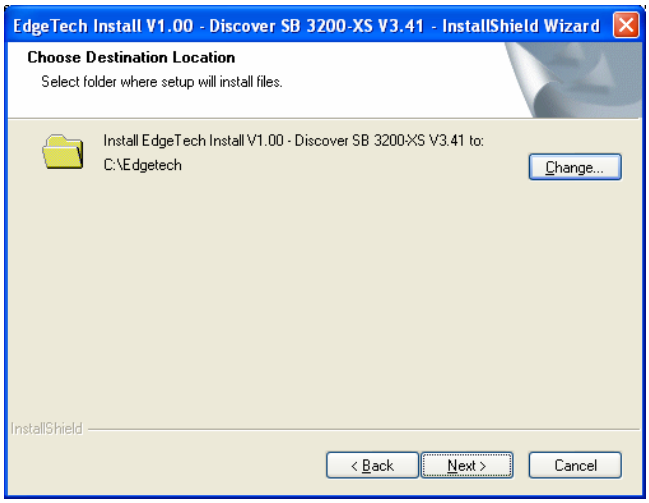


Figure 2-6 Destination Location Window

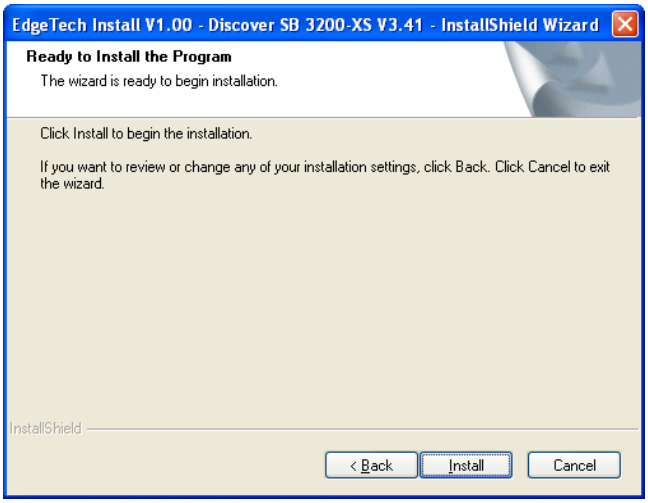


Figure 2-6 Ready to Install Window

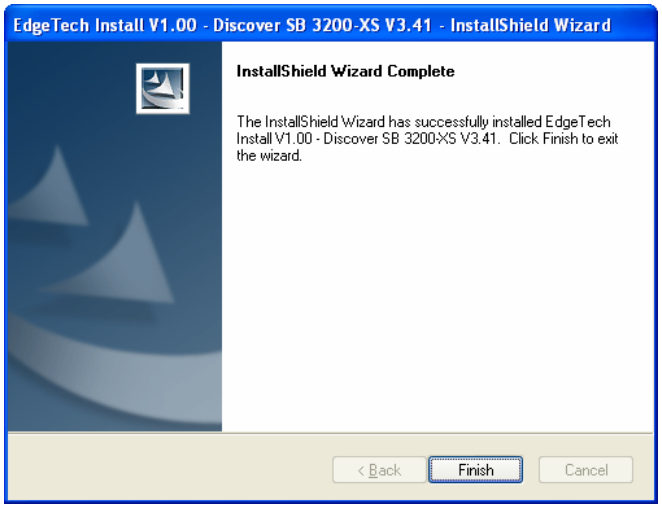


Figure 2-7 Install Complete

Possible error message: If Discover SB is already on the machine, when Install shield is opened, it will display the following message. This window is for uninstalling/removing or repairing the Discover SB program.

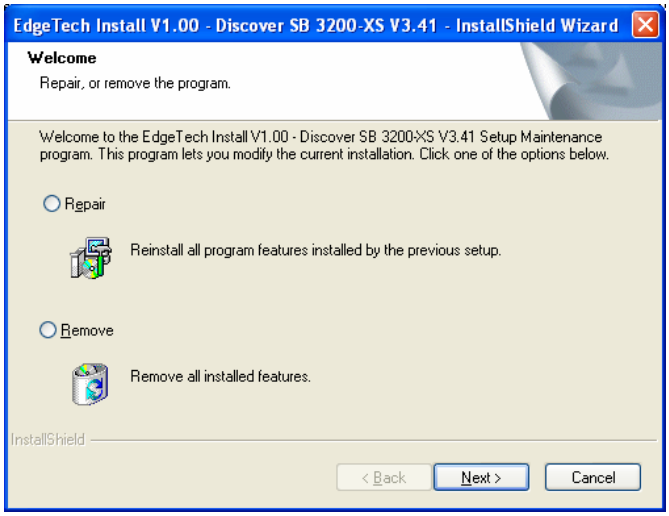


Figure 2-7 Repair or Remove Window

2.2 DISCOVER SUB-BOTTOM –RESTRICTED-

If Discover Sub-Bottom program is restricted this means that you are running an unlicensed version of Discover Sub-Bottom. To register go to the help drop down menu and click on Password Maintenance. Contact EdgeTech technical support at info@EdgeTech.com and include your Machine ID number. The Machine ID number will be in the upper left quadrant of the Insert Password Window, as seen in Figure 2-10. EdgeTech will provide a personalized password (machine specific).

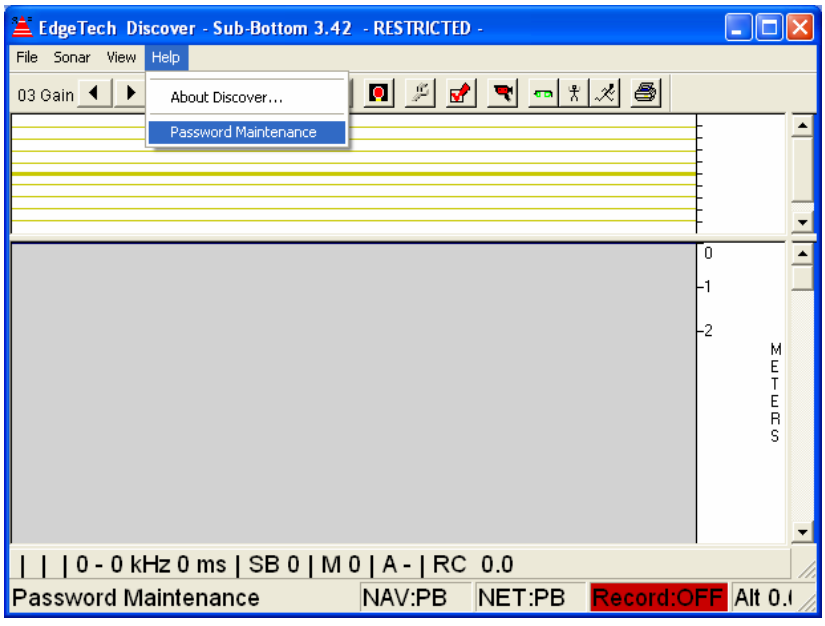


Figure 2-9 Discover Main Screen

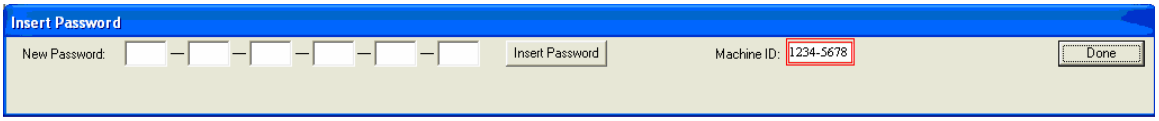


Figure 2-10 Insert Password Window

3 OPERATIONS

3.1 GENERAL

The purpose of this section is to provide general information on the operation of the Discover SB software. It is not intended to be a textbook for interpretation of the sub-bottom data. EdgeTech reserves the right to change the software features and operation of this product at any time to improve on the user or hardware interfaces. To upgrade your system to the latest configuration, contact the EdgeTech sales office.

3.2 OPERATOR INTERFACE

The operator communicates with the system through a video screen, keyboard and trackball.

All sonar controls are found in the pop up control panel window. The user interface consists of several tabs. For example there is a tab that sets up and controls the printer attached to Discover SB. A status bar in the lower part of the screen displays current operational parameters.

All of the panels have factory default settings. When changes are made to various settings, they are remembered when the system is shut down. Those default settings are stored in file **DiscoverSBPDefaults.Jni**. On power-up the settings in **DiscoverSBPDefaults.Jni** are loaded. The user can create and save different configuration.

3.3 DISCOVER SB USER UNTERFACE

The normal Discover SB display consists of the following:

- Main Sonar Data Display
- Pull Down Menus for Command and Control
- Toolbars for frequently used commands.
- Status bar for sonar control and sonar data status.
- Control Panels - tabbing dialog boxes for modifying parameters.

These items are described in greater detail below.

The main display is split into sections two ways horizontally and two vertically. Each window can be resized by moving the mouse pointer to its splitter, then moving the mouse while holding down the left mouse button.

3.3.1 WATERFALL DISPLAY

The data in the waterfall display is cached. Using the mouse a region can be selected to zoom in or out on the data or the scroll bars can be used to pan around inside the data set. Moving the mouse over a sonar data record in the waterfall will display information specific to that record in the status bar.

Item	Description
Waterfall Data	Displays the intensity of sonar return data. The display is cached so that data can be repainted when zooming or panning and statistics of the data can be displayed.
Mouse: Zoom Out	Click and release the left mouse button to zoom out on the display so that all data is displayed.
Mouse: Zoom In	Press the left mouse button and drag to select a zoom in region.
Scroll Bar	Scroll up or down to pan around inside the waterfall.
Mouse: Current Statistics and Information.	Move the mouse pointer to a ping and the selected status information will be displayed in the main status bar.
Dashed Line	A dashed line on the waterfall indicates that an event mark or annotation is present at that position.
Green Line	A green line is drawn 1 display unit above the current bottom track position. Line Color and offset can be customized

Table 3-1 Waterfall Display

3.3.2 WAVE FORM DISPLAY

The waveform display displays the signal amplitude as an X-Y plot of the current sonar data. The scope display is a convenient method of adjusting the bottom tracker.

Item	Description
Scope Plot	Plots the current trace in an x – y plot.

Red Vertical Line	Indicates the current bottom track threshold
Green Horizontal Line	Indicates the current bottom track position.
Blue Horizontal Lines	Indicates the bottom track range.
Scroll Bar	Scroll up or down to pan around inside the waterfall.
Mouse: Current Statistics and Information.	Move the mouse pointer to a ping and the selected status information will be displayed in the main status bar.
Mouse: Set bottom track position and threshold	Click and release the left mouse button to set the current bottom track position and threshold
Mouse: Set bottom track range	Press the left mouse button and drag to select the bottom track range. If only a very small drag is performed then the track range is set to zero and the tracker is disabled.

Table 3-2 Wave Form Display

3.3.3 MAIN STATUS LINE

The Main Status Line is located at the bottom of the display under the waterfall display.

Item	**Description**
GPS Status	Displays the status of the GPS input. If GPS is not being received blinks red (alert state), otherwise it is gray.
Network Status	Displays the status of the sonar TCP/IP link. If not connected blinks red (alert state).
Record Status	Displays the status of the disk recording. If not recording blinks red (alert state).
Altitude Status	Indicates the altitude above bottom as determined by the selected bottom tracker. If too close to the bottom blinks red (alert state).
Current Mouse Position Status / Help	Displays help on the control that the mouse is on or statistics about the ping the mouse is pointing to.
Current Run Time Status	Displays information about the current ping (e.g. GPS fix, ping number, signal strength, etc) as specified in the "Status Bar" options page.

Table 3-3 Main Status Line

3.3.4 TOOLBAR

The Tool bar is located on the top of the display window, above the Waterfall display and below the pull down menus. Toolbar buttons provide shortcuts for some of the most

common control panel items. All items in the toolbar are duplicated in a control panel item. Most of these options are summarized below:

Item	Description
Gain Control: Up / Down	The gain setting should normally be set to 00 (dB). This will cause data with similar amplitudes to be correctly displayed once the Normalize button is pressed. Increasing the gain will cause the data to be further amplified in the display. Decreasing the gain has the opposite effect. The gain may be adjusted from -40dB to +40dB. Gain values between -20dB and +20dB tend to be the most useful. Use right mouse click to reset to reference.
Gain Control: Normalize	This recalculates the scale factor, which is applied to the data prior to displaying it. This scale factor is chosen to cause the Peak value of the return to just reach maximum intensity on the displays, when the Associated gain value is set to 00dB. The scale factor is recomputed for each press of the normalization button.
TVG Control: Up / Down	Time Varying Gain in dB per 100 meters of depth to apply to the pixel data. The TVG is applied beginning at the seabed if the bottom tracker feature is enabled otherwise from the beginning of the record and continues until the MAX value is reached.
Ping On / Off	Turns pinging on and off for any of the three displays.
Show Control Panel	Displays and or hides the control panel.
Insert Mark	Inserts a new mark and increments the mark number.
Toggle Record or Playback	Toggles between disk record and idle, or if in playback mode, pauses playback.
Playback slower	Slows down the playback rate.
Playback faster	Speeds up the playback rate.
Printer On / Off	Turns the waterfall printout on and off.

Table 3-4 Toolbar

3.3.5 PULL DOWN MENUS

Item	Description
File / New Mark	Inserts a new event mark and increments the mark number.

File / Record to file	Toggles between disk record and idle, or if in playback mode, pauses playback.
File / Playback slower	Slows down the playback rate.
File / Playback faster	Speeds up the playback rate.
File / Printer On / Off	Turns the waterfall printout on and off
File / Save Configuration	Save current settings in JStar.ini
File / Exit / Don't Save Settings	Exits without saving settings.
File / Exit – Save	Exits and saves current settings in JStar.ini
Sonar / On SB , SSL, SSH	Turns pinging on and off
Sonar / Control Panel	Displays and or hides the control panel
View / Toolbar	Displays and or hides the toolbar
View / Status Bar	Displays and or hides the status bar
View / Gain Up – Down - Reset	Modifies current gain
View / Normalize	Modifies reference gain.
View / Zoom	Zooms in and out in waterfall
Help / Topics	Displays on line help (if present)
Help / About	Displays current J-STAR version information.
Help/Password Maintenance	Prompts for an authorization code to enable unrestricted option.

Table 3-5 Pull Down Menus

3.3.6 USING THE TRACKBALL

There are several areas on the screen where mouse or trackball clicks will modify the display or cause a function to execute.

3.3.6.1 Left Button

By clicking the mouse arrow in the oscilloscope waveform (envelope) display at the position of the seafloor, the tracking cursor can be reset to the seafloor. Clicking and dragging the left

cursor in the area around the pick will set the tracking window width (distance between the two blue lines).

By clicking the mouse arrow on the oscilloscope waveform (envelope) display, the vertical red threshold line can be adjusted to track either strong or weak reflections

NOTE:

The tracking algorithm searches below the upper blue line for the seafloor by comparing each envelope value with the threshold. The seafloor is defined as the first point (below the upper blue line) that the envelope exceeds the threshold. If none of the envelope values exceed the red line (threshold), the tracking cursor (horizontal red line) assumes the seafloor depth has not changed and the cursor (horizontal red line) does not move.

By clicking and dragging the arrow in the main data window, you can dynamically adjust the zoom factor. A double click will zoom out to maximum.

3.3.7 USING THE KEYBOARD

Discover SB functions and features were designed to minimize the use of a keyboard. The keyboard is mainly used for entering file names and annotations. Most commands can be executed from the control panel via the trackball.

3.3.8 STATUS LIGHTS

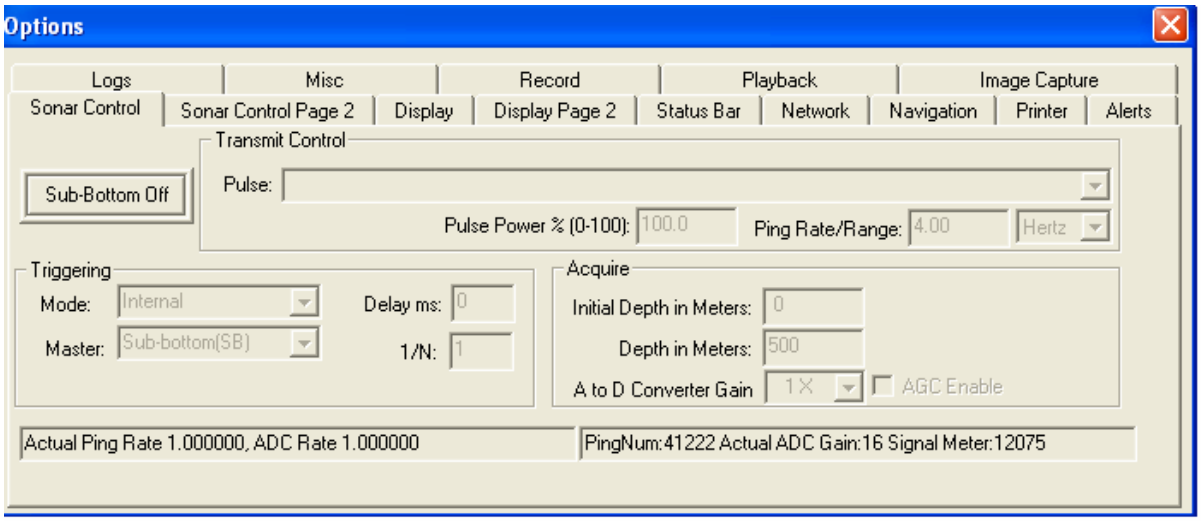
LED Color	Label	Definition
Amber	HARD DRIVE (H.D.D)	Activity Light
Green	POWER	System has Power
Green	RUNNING	Solid: System Ready Blinking: System is Transmitting (pinging)
Red	CHECK SYSTEM	Blinking: System Can Not Run
Amber	CAUTION	Solid: Topside Communication Inactive Blinking: Error Detected, Operation Still Possible

Table 3-1 Status Lights Definitions

3.4 SONAR CONTROLS

All sonar controls are accessible by clicking the Control Panel Icon or by selecting Control Panel in the Sonar Menu.

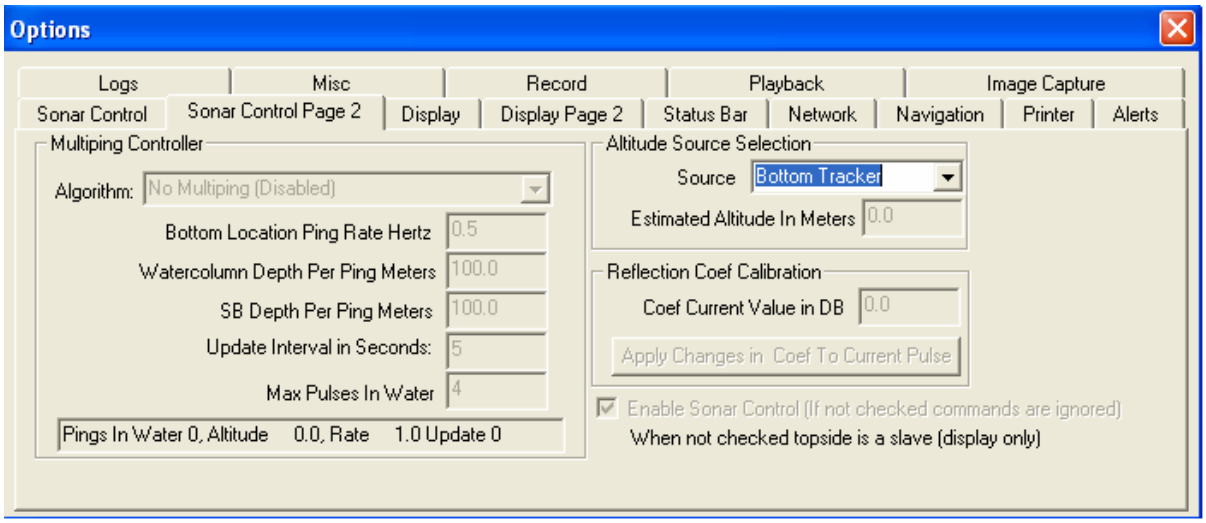
3.4.1 SONAR CONTROL



Item	Description
Sub bottom Sonar On	This button turns the sonar system ON or OFF. If the system is recording when the sonar is switched off, the archiving is paused. Turning the sonar back ON will also restart the recording to the same file. Note: To start a new file the recording must be stooped not the sonar.
Pulse	Currently selected transmit pulse. Each vehicle has a set of 3 or more pulses. Refer to section 3.6 for systems with multiple vehicles.
Pulse Power %	Pulse power level (0 to 100 %).
Pulse Rate/Range	Specifies the ping rate in hertz or ping range in meters.
Triggering Mode	See _Triggering_and_Coupling section
Triggering Delay in ms	Delay from the trigger event to when the sonar pings and begins collecting data.
Triggering 1/N	Trigger decimator. A value of 1 will ping on every trigger, 2 will ping on every other trigger, etc.
Acquire: Initial Depth in	Sets the data window. Samples before this value are

Meters	discarded by the Sonar to reduce network bandwidth. This can be used to exclude the water column from the displayed and stored data.
Acquire: Depth in Meters	Sets the data window. If zero, indicates that all data for the specified ping rate / range are returned.
ADC Gain	Analog to Digital Converter Gain
AGC Enable	Automatic Gain Control (Recommended)
Enable Sonar Control	When checked, parameters on this page are sent to the Sonar when they are modified. When not checked, the Discover X-STAR is in passive observer mode. In this case it will receive data but not send sonar commands.
Status Line	Displays the actual current status as reported from the sonar program.

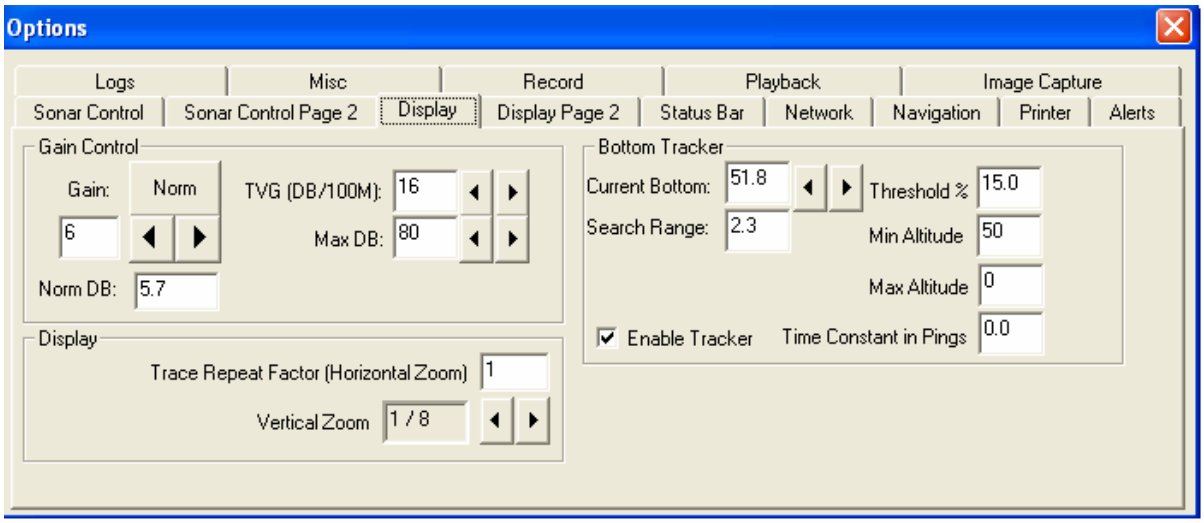
3.4.2 SONAR CONTROL PAGE 2



Item	**Description**
Multiping Controller Algorithm	When enabled, the Discover changes the ping rate and data window to support multiple pings in the water. A valid altitude source must be available to use the multiping controller. Please review the appending on "Supporting Multiple Pings in the Water" for details of usage of these options.
Bottom Location Ping Rate Hertz	Ping rate to use in bottom location mode. This is useful to lock onto the bottom when the altitude source is the bottom tracker before enabling multiping mode.
Watercolumn Depth Per	In multiping mode, specifies the amount of data to collect

Ping Meters	in the watercolumn (before the bottom).
SB Depth Per Ping Meters	In multiping mode, specifies the amount of data to cllect after the bottom.
Update Interval in Seconds	Interval at which the ping rate is updated when in multiping mode.
Max Pulses in Water	Maximum number of concurrent pings in the water when multiping is enabled
Altitude Source Selection	Source of the altitude estimate used for multiping and other processing.
Estimated Altitude in Meters	When the altitude source is "Estimated Altitude", this is the operator entered altitude used.
Reflection Coef Calibration value	This is a value, in tenths of a DB used to scale all data. A new value is only applied when the "Apply Changes" button is pressed. The calibration value is set for each pulse. It should be selected such that a perfect reflector (the air – water interface) yields the maximum value of 0(DB). The reflection coef, is the amplitude of the return at the peak near the bottom trackers current position.

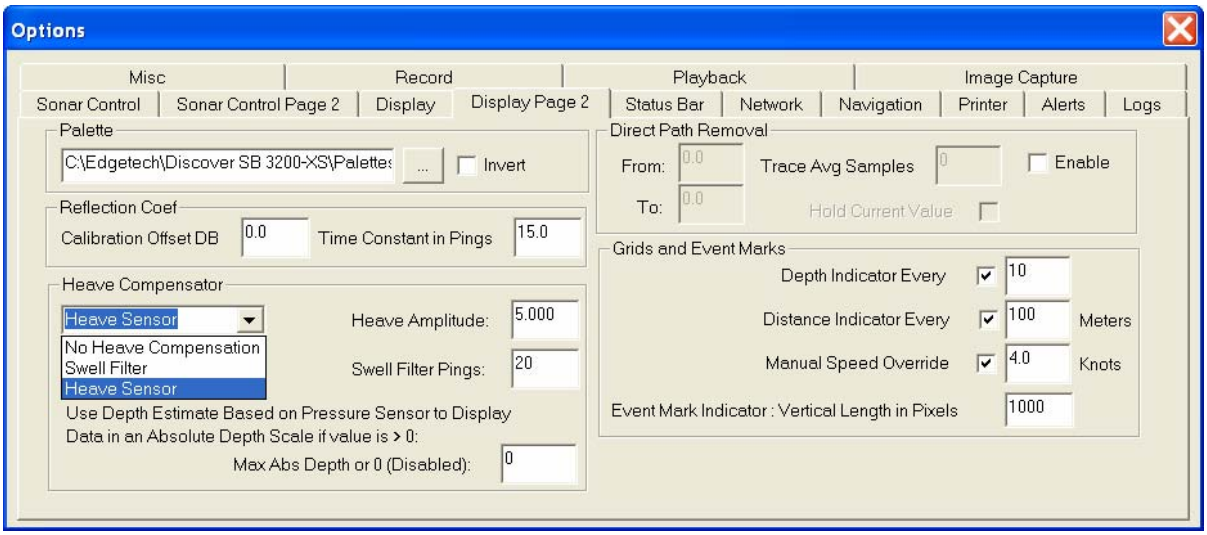
3.4.3 DISPLAY



Item	Description
Gain	Gain in dB to apply to every pixel of data
Norm	Normalize data. When pressed, the display data is re-scaled so that the maximum value of the next ping is set to

	display as maximum display intensity.
Norm DB	When the normalization is completed, the Norm dB field is set to the new overall scale factor.
TVG (DB/100M)	Time Varying Gain in dB per 100 meters of depth to apply to the pixel data. The TVG is applied beginning at the seabed if the bottom tracker feature is enabled otherwise from the beginning of the record and continues until the MAX value is reached.
Max DB	TVG Maximum value in dB
Display Max Abs Depth	When non-zero, this value is the total absolute depth in the waterfall and data is displayed on an absolute scale (where 0 is the surface of the water). To work properly, a pressure sensor must be present to estimate fish depth. This is an effective method to remove heave in rough seas.
Zoom	Sub-sampling or replication factor for pixel data.
Bottom Tracker Current Bottom	Current bottom in nominal display units. The bottom tracker adjusts this value when enabled. TVG is applied beginning at this position. Note that for a dual (side scan) display, a negative value indicates that the bottom tracker will operate on the first channel (usually port) and a positive value indicates that the tracker will operate on the second channel (usually starboard).
Bottom Tracker Range	Search range from the current bottom in display units for the bottom tracker algorithm. A value above threshold must be within this range of the current bottom for the tracker to adjust the current bottom. If 0 then the tracker is disabled.
Bottom Tracker Threshold	Minimum value required for a detected seabed bottom. The bottom tracker will not modify the current bottom unless the sonar return is above this value.
Bottom Tracker Hold off (Min altitude)	Minimum depth for the bottom tracker. The bottom tracker will not move the current bottom below this value.
Bottom Tracker Max Altitude	Max depth for the software to search for the bottom
Bottom Tracker Time Constant	When non-zero, the bottom trackers estimated altitude, which can otherwise be noisy / jagged, is smoothed out with a low pass filter.
Enable Tracker	Enable or disable the bottom tracking

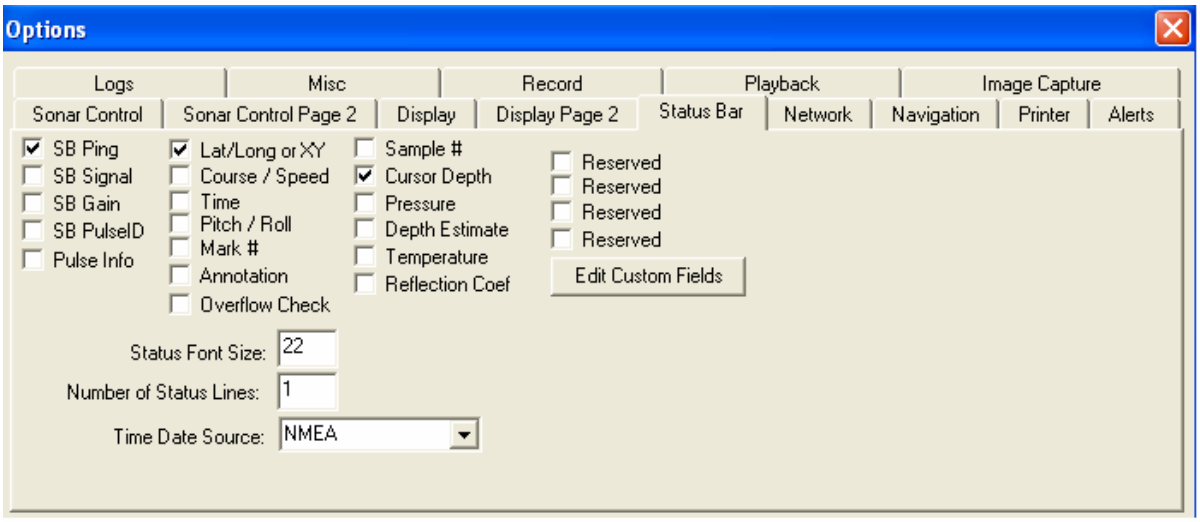
3.4.4 DISPLAY 2



Item	Description
Palette	Used to select a color palette file for data display. Different linear and logarithmic pallets are available for better visualizing the data
Invert	If checked, the data is inverted prior to being processed by the palette.
Reflection Coef Calibration Offset DB	Additive offset in DB for the reflection coef display. The reflection coef. Calibration value on the Sonar / Advanced tab only applies to acquired data. This is an additional bias / temporary adjustment that can be used during playback as well. This value is not saved with the data and is for display purposes only.
Reflection Coef Time Constant in Pings	When non-zero, the reflection coef values are smoothed with a low pass filter.
Heave Compensator	The selected heave sensor readings will be used to adjust the display and printout.
Heave Amplitude	This will only be applicable if the heave sensor is selected as the Heave Compensator. The heave amplitude can be increased or decreased with in a thousandth of a degree. (Recommended correction from ± 0.1 to ± 1.5)
Swell Filter Pings	This will only be applicable if the swell filter is selected as the Heave Compensator. As an alternative to a heave sensor, a swell filter can be applied to the bottom track position and used to adjust the display and printout. A value of 0 disables the swell filter.

Direct Path Removal From	Specifies a range for estimation and removal of the direct path signal. The "direct path" is typically the acoustic direct path between the transducer and hydrophone sensors. This can generate a repeatable constant pattern at the start of a data set which can be estimated and subtracted out.
Direct Path Removal To	End of range for direct path estimation and removal.
Trace Avg Samples	Time constant for low pass filter used to estimate the direct path.
Direct Path Removal Enable	When enabled, the estimated direct path is subtracted from the sonar data prior to displaying in the waterfall.
Hold Current Value	When checked, the calculated direct path is held (fixed), when not checked the signal is continuously estimated.
Trace repeat Factor	When greater than 1, each ping of data is repeated the specified number of times on the waterfall display. This is useful for a close up inspection of the data but not recommended for normal operation.
Event Mark Samples	Specifies the length of event mark indicators on the waterfall display. If there are a lot of event marks, a long indicator line can obscure the waterfall data.
Grids	Horizontal and vertical grid marks can be painted on the waterfall display at the intervals specified if these check boxes are checked.
Manual Speed Override	When checked, the NMEA speed is ignored and the specified constant value is used for painting the distance grid marks.

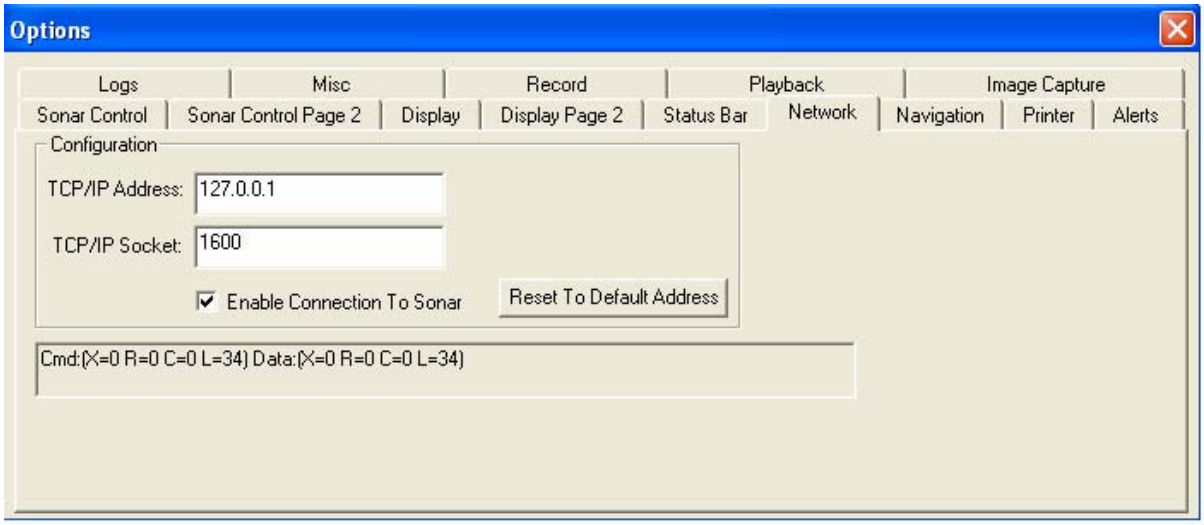
3.4.5 STATUS BAR



Item	Description
SB Ping	Displays the ping number on the main status line if checked
SB Signal	Displays the signal meter value in tenths of a percent on the main status line if checked.
SB Gain	Displays the ADC gain on the main status line if checked
SB Pulse ID	Displays the unique pulse identification number
Lat/Long	Display the GPS position fix on the main status line if checked
Course / Speed	Displays the GPS derived course and speed on the main status line if checked
Time	Displays the GPS derived time on the main status line if checked
Pitch / Roll	Displays the pitch and roll reading on the main status line if checked and the system is fitted with the optional motion sensor
Mark	Displays the mark number and annotation on the main status line if checked.
Overflow Check	Displays the data overflow counter on the main status line if checked. If the overflow count increases then some data is being dropped, either inside the bottle or in the topside. It is normal to see this value increment when the

	pinging is turned on or off. Since it is based on a discontinuity this can also happen if a trigger decimator is not 1 in some triggering modes (eg coupled mode).
Sample #	Displays the sample # of the mouse pointer on the main status line if checked.
Cursor Depth	Displays the depth in user units of the mouse pointer on the main status line if checked
Pressure	Displays pressure reading from the optional pressure sensor.
Depth Estimate	Displays towfish depth estimated form the pressure reading
Water Temp	Displays water ambient temperature FS-DW systems only
Reflection Coef	Displays the actual sea floor reflection coefficient
Status Font Size	Used to select the font (text size) of the status display
Number of Status Lines	Used to select the number of status lines drawn in the bottom of the screen
Edit Custom Fields	In addition to the predefined items above, a 240 byte header (similar to Segy-Y) is maintained for each ping. Any field from this header can be displayed on the status line using these custom field options.

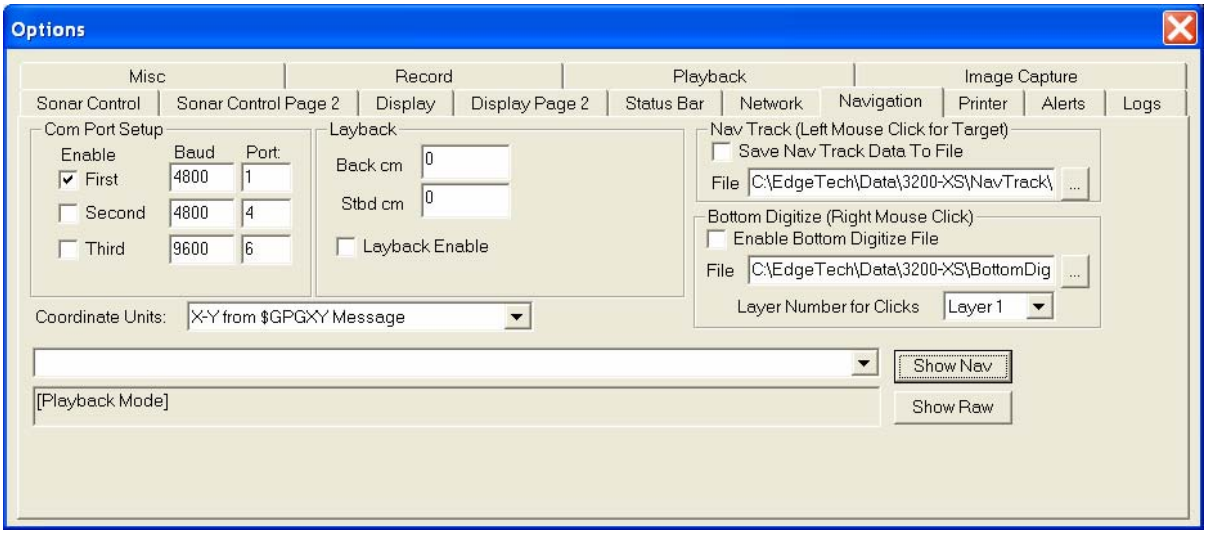
3.4.6 NETWORK



Item	**Description**
TCP/IP Address	Address of the sonar computer or FS-IU topside to connect to. This should be in the form of four digits

	separated by periods, e.g. 192.10.0.100
TCP/IP Socket	Socket number of the sonar computer to connect to. This should be a decimal integer and is typically 1700
Reset to Default Address	Resets the TCP/IP address and socket number to 127.0.0.1 (the same computer Discover is running on) adn 1600. These are the default values if connecting to the EdgeTech ETSI (EdgeTech Sonar Interface) application.
Enable Connection to Sonar	When checked, Discover connects to the sonar via the TCP/IP address / socket pair. When not checked, Discover does not connect to the sonar (useful for playback only mode).
Status Line	Displays the current status of the command and data sockets. If the connect count is odd (C=1 for example) then the socket is connected. When both the data socket and the command socket are connected then network status on the main status bar should change from blinking red to gray.

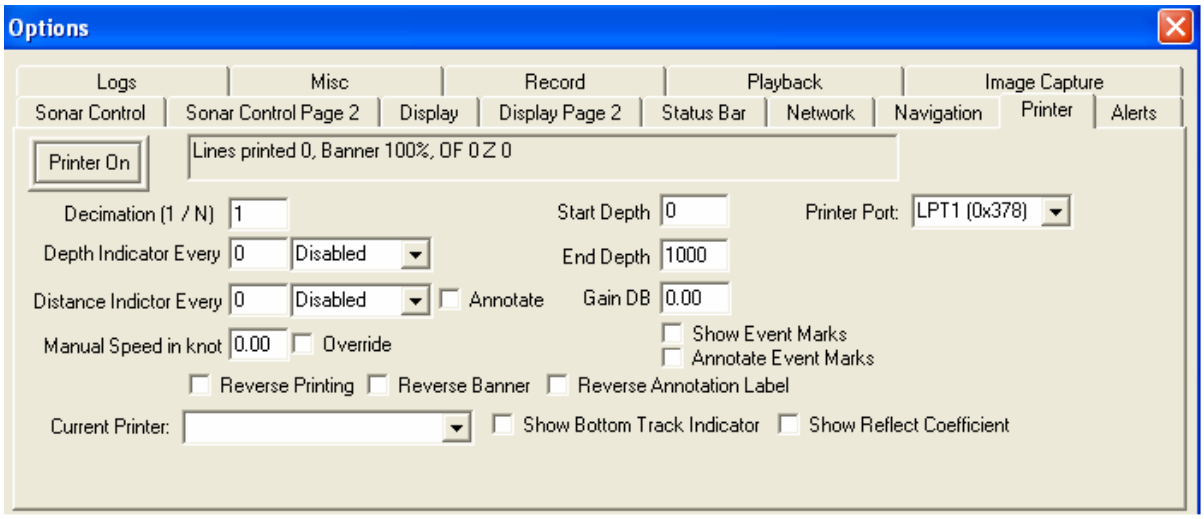
3.4.7 NAVIGATION



Item	Description
Com Port Setup Enable First, Second, Third	GPS and other data can be picked up from up to 3 serial ports. In addition, if connecting to ETSI this type of data can also be received from ETSI via a TCP/IP link.
Com Port Setup / Baud	Specifies the baud rate of the input data. For standard NMEA inputs 4800 baud is recommended.
Com Port Setup / Port	This is the actual port number (eg 1 for COM1:) that the

	NMEA device is attached to.
Layback Back cm	Layback from the GPS source to the tow body.
Layback Stbd cm	Layback from the GPS to the tow body – port / stbd bias.
Layback Enable	When enabled, GPS coordinates are biased by the layback values.
Coordinate Units	Specifies which NMEA sentence to used for coordinate display.
Nav Track File and Enable	When enabled, navigation track information is written to the specified file.
Bottom Digitization File and Enable	When enabled, bottom digitization information is written to the specified file.
Show Nav	Press this button to update the pull down list box with the most recent navigation values parsed.
Show Raw	Press this button to update the pull down list box with the raw NMEA strings most recently received. A "?" character is prefixed to each string that Discover does not parse / recognize.

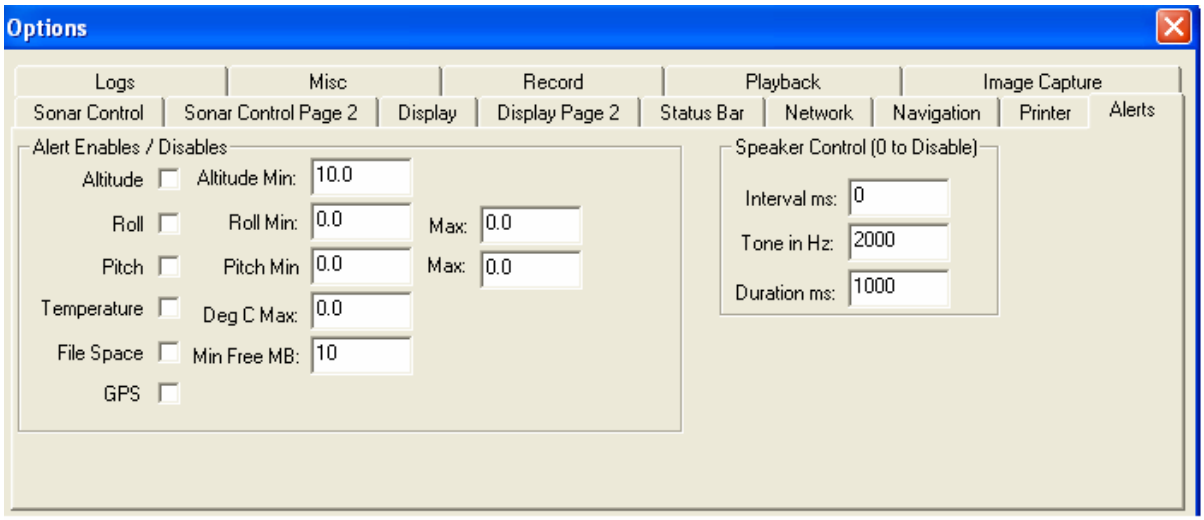
3.4.8 PRINTER



Item	**Description**
Printer On	When checked enables data output to the printer.
Status Line	Indicates the depth of the printer queue. If the printer is not fast enough then data to be printed may be dropped in record mode. In this case the overflow count in the status will increment.

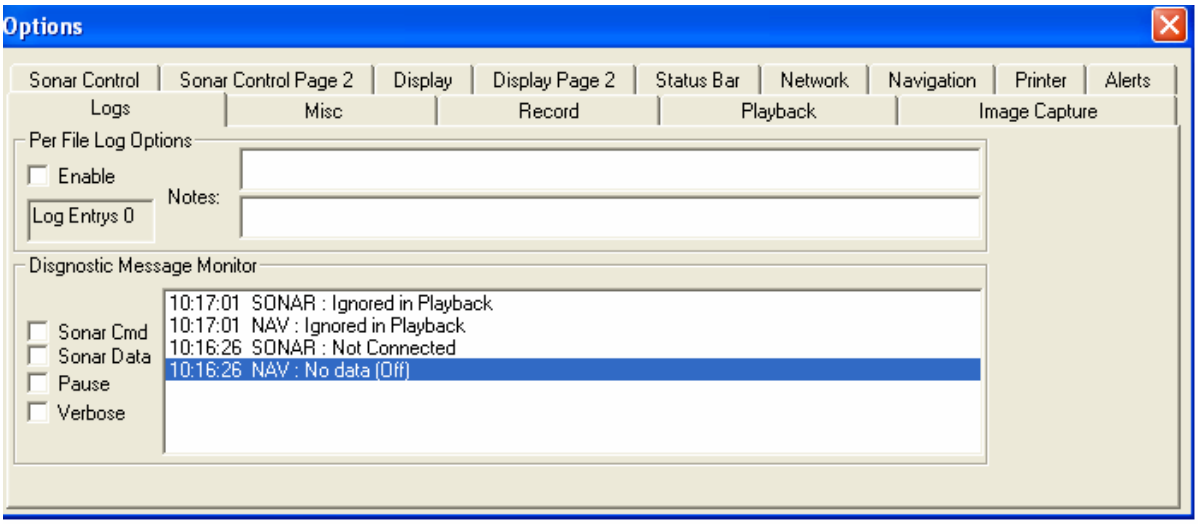
Decimation (1..N)	Positive value. A decimation of 1 will print every ping of data, 2 every other line, etc. For a slow printer increasing the decimation factor should reduce or eliminate printer queue overflows and provide a more uniform printout.
Depth Indicator	When enabled draws a depth grid on the printer at the specified intervals.
Distance Indicator	When enabled draws a distance grid on the printer at the specified intervals.
Annotate (grid)	When checked, text labels are displayed on the grid.
Manual Speed in knot	Used to draw the distance indicator based on the constant specified velocity if enabled (and ignores the NMEA supplied speed).
Gain DB	Additional gain to be applied to the printout.
Port	LPT port IO address that the printer is attached to.
Reverse Printing	When checked, the waterfall is printed in the reverse orientation, so that the top of the page becomes the bottom and vice versa.
Reverse Banner	When checked, the navigation information in the lower part of the printout is printed in reverse order
Show / Annotate Event Marks	When checked, event marks are shown by a line down the page and optionally a text label (annotation) is displayed for each one.
Current Printer	Select one of the supported printers
Start Depth	Starting depth in display units for the printout.
Total Depth	Total depth in display units for the printout.

3.4.9 ALERTS



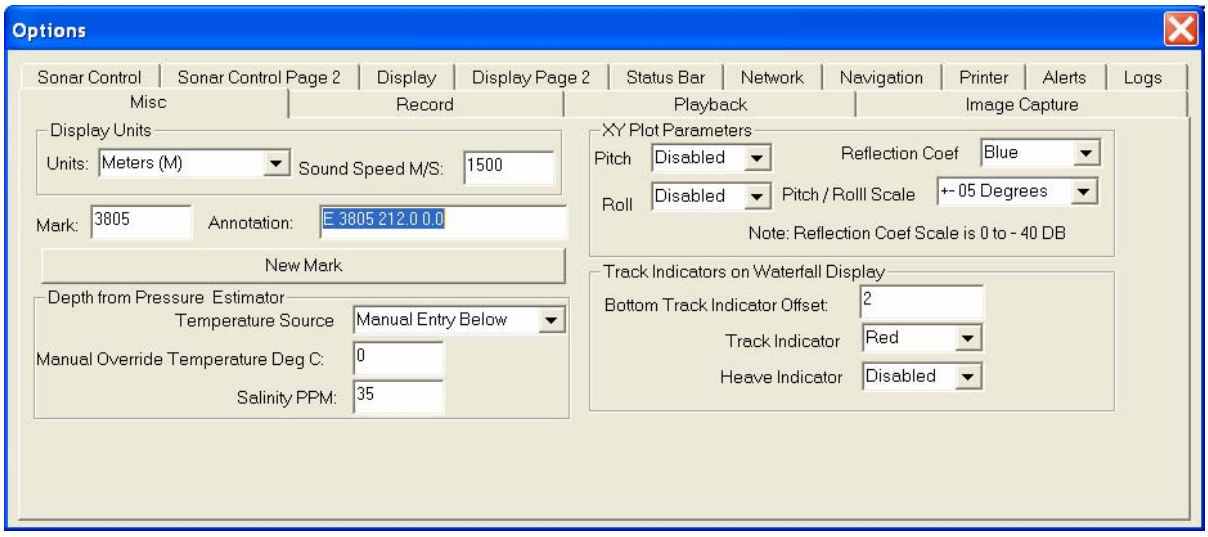
Item	Description
Altitude	Enable an alert if the altitude is below the specified value
Pitch / Roll	Enable an alert if the pitch roll sensors (if present) report values outside the specified range.
Temperature	Enable an alert if the temperature sensor (if present) exceeds the specified range. This is not implemented for most towfish.
File Space	Enable an alert if the file space available for recording data to is below the specified value.
GPS	Enable an alert if there is no current GPS position fix.
Speaker Control	When alert condition exists, an audible sound can be generated from the built in speaker to alert an operator.
Interval ms	Interval between tones.
Tone in Hz	Frequency of tone in Hz.
Duration ms	Length of tone in MS.

3.4.10 LOGS



Item	Description
Per file Log Options	When enabled, an ascii text file is created for each .jsf file and displays the settings at the beginning of the file. New entrys are added to this file when a setting (such as the ping rate) changes.
Enable	Enable per .jsf file log file.
Notes	Text to insert in the log file.
Message Log	The sonar communicates to Discover via messages. Example messages are a pitch roll reading or a ping of sonar data. The message log displays the most recent messages received, and is useful for diagnostic purposes.
Sonar Cmds	Show sonar commands in the log.
Sonar Data	Show sonar data in the log.
Pause	Pause the log to make it easy to read the entrys.
Verbose	Show more information.

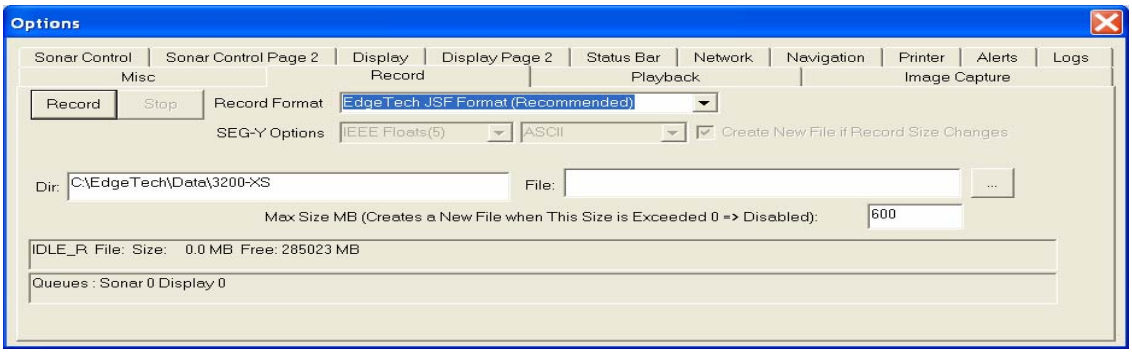
3.4.11 MISC

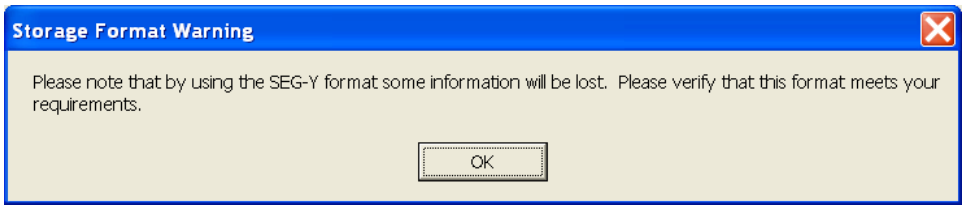


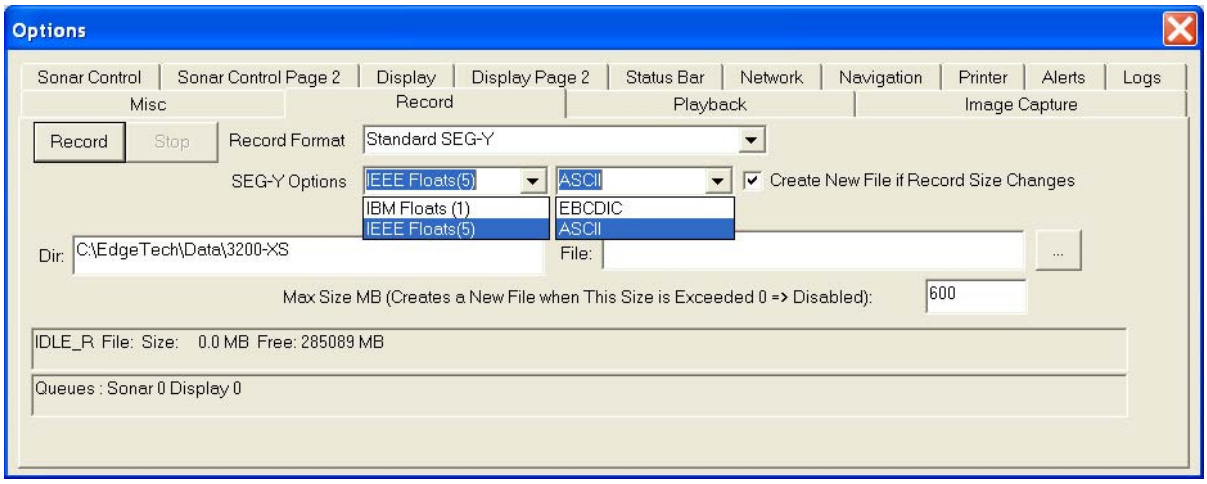
Item	Description
Display Units	Sets the display user units for most displays. The waterfall axis will display the scale in these units.
Sound Speed M/S	Enter value used for depth calculation (1500m/s default)
Mark	When changed, a mark number / annotation will be inserted into the data stream. There is also a button on the toolbar (and here) to increment the mark number and insert an event mark.
Annotation	When changed, a mark number / annotation will be inserted into the data stream.
Depth From Pressure Estimator	Depth is estimated from pressure (if a pressure sensor is present) based on these values. For normal sea water a salinity value of 35 should be used. For fresh water use 0.
XY Plot Parameters Pitch	Select the color for the optional pitch data displayed on the XY plot on the top of the waterfall.
XY Plot Parameters Roll	Select the color for the optional roll data displayed on the XY plot on the top of the waterfall.
XY Plot Parameters Reflection Coef	Select the color for reflection coefficient data displayed on the XY plot on the top of the waterfall.
Bottom Track Indicator Offset	Bottom track indicator confirms that reflection coefficient data is calculated from the water sea floor interface. The offset unit is based on the display unit (m, ms or samples)
Tack Indicator	Select the color for the bottom track indicator

Heave Indicator	Select the color for the heave indicator. The heave indicator displays the heave amount offset from the bottom track indicator. Most systems do not have a heave sensor, and so the heave indicator should be disabled.

3.4.12 RECORD



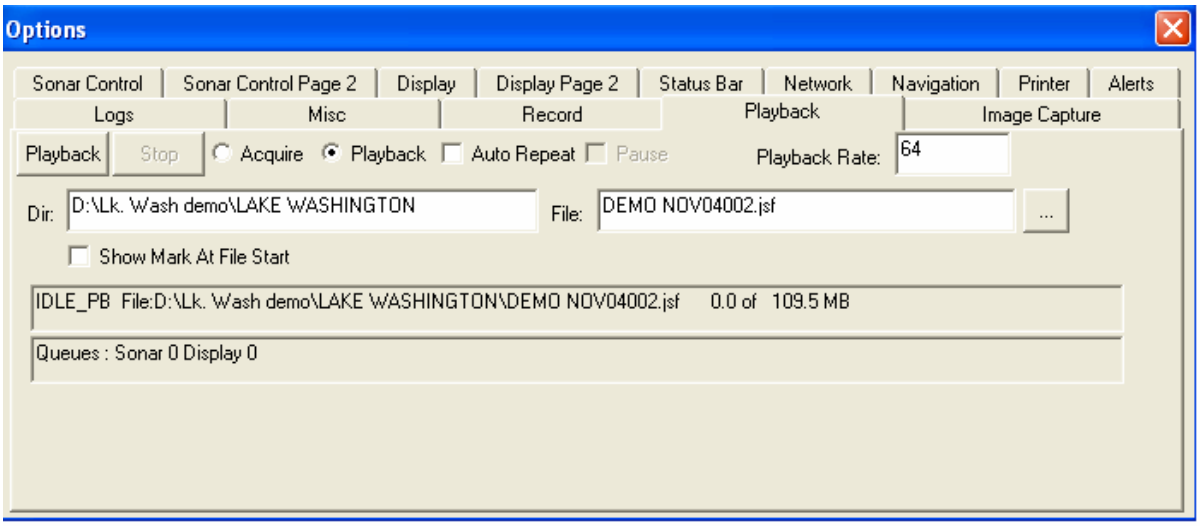




Item	Description
Record	When pressed, begins recording data to the record file. The record file name includes a sequence number, which is incremented when recording begins.
Stop	When pressed, stops recording, the file is closed, and the next time the record button is pressed a new file will be created.

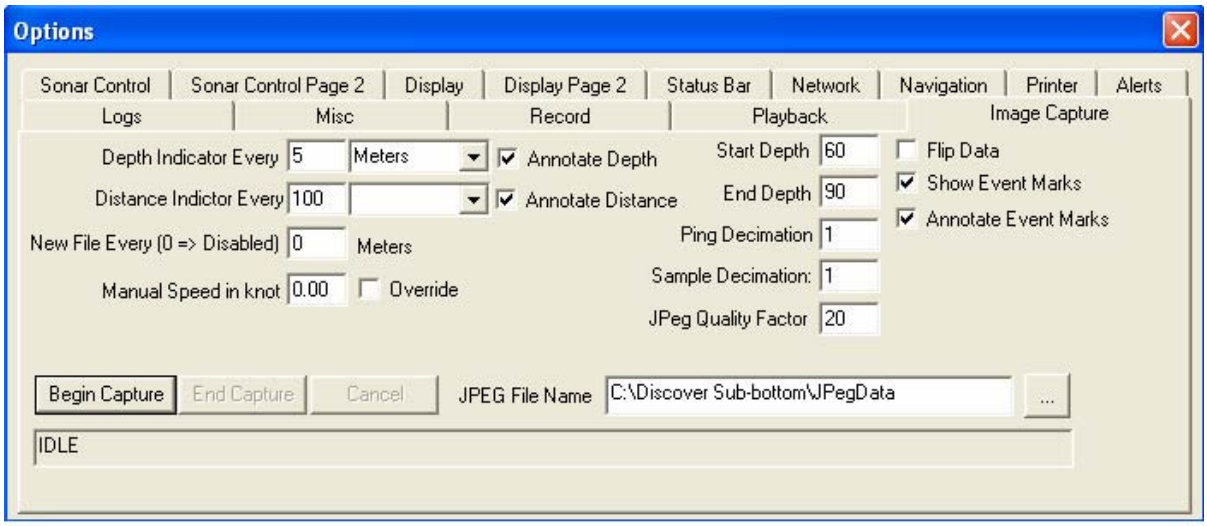
File		Base file name for recording
Dir		Base directory for recording
Record Format		You can record in either JSF for “standard SEG-Y” formats. We strictly adhere to the SEG-Y standard which severely restricts the information that can be recorded. Therefore it is highly recommended that during acquire mode all data be recorded in JSF file format ONLY. It is possible to playback and record at the same time to transcribe the data into SEG-Y for use by other applications as a post acquisition step.
SEG-Y Options	IBM Floats (1)	Original stanrdard for SEG-Y
	IEEE Floats (5)	Predominate floating point representation for the last 25 years.
	EBCDIC	Extended Binary Coded Decimal
	ASCII	American Standard Code for Informational Interchange
Max Size MB		A new file with the same base name and sequential numerical extension will be created when the max file size limit is reached. The max size should be set to less than 650MB in order to archive the data on a CD.
Status Line		Indicates the current state of disk IO. Indicates the true record file name when recording is active (including the sequence number).
Queue Status Line		Indicates the internal queue status of the record queue. The record queue holds the data pending to be written to disk. If the processor / disk combination is not fast enough for the data rate then data inside the queues could be dropped. This status line indicates whether the performance is adequate.

3.4.13 PLAYBACK



Item	Description
Playback	When pressed, begins playback of data from the playback file.
Stop	When pressed, stops playback.
Acquire	Discover operates in two major modes: Acquire – which acquires data in real-time and playback, which plays back data previously acquired. Turning pinging on will switch automatically to acquire mode.
Playback	Second operating mode. When the "Playback" button is pressed Discover is automatically switched to playback mode (and real-time data, if present IS IGNORED).
Auto Repeat	Continuously play back the same file for demo or analysis purposes. When the end of file is reached the same file is reopened again if auto-repeat is enabled.
File	Current file name for playback.
Dir	Base directory for playback.
Playback Rate	Sets the playback rate in messages per second. A message is normally a channel of data.
Show Mark at File Start	Prints a vertical line on the screen when a new file starts

3.4.14 IMAGE CAPTURE



As an alternative to printing out the waterfall on thermal paper, a standard .JPG file can be created and viewed on screen or printed on a standard printer. This section specifies parameters for and controls for creating a .JPG image. To use this feature, select the desired generation parameters, begin playing back the file, press the "Begin Capture" button, wait till the end of the desired region, and finally press the "End Capture" button. It is important to note that while very large .JPG images can be created, both Discover and .JPG readers have practical limitations on the size of a .JPG image. If the image becomes too large excessive CPU resource can be required or the creation can fail. Therefore, creation of .JPG images SHOULD NOT be done during real-time acquisition.

Item	Description
Depth Indicator	Enable to display a depth grid on the .JPG image
Distance Indicator	Enable to display a distance grid on the .JPG image.
New File Every	Specify a non-zero value to generate a sequence of .JPG images. This is important for a very long line. Most .JPG readers have problems with file sizes near or bigger than 1 MB in size.
Manual Speed	Used to override the NMEA speed for the distance indicators.
Start and End Depth	Used to create an image only for the specified altitude (if in relative mode on the Display Tab) or depth range.(if in absolute depth mode).

Ping Decimation	For large lines, a decimation factor greater than 1 can help to pack more into a single image. This will of course reduce image resolution.
Sample Decimation	For large lines, a decimation factor greater than 1 can help to pack more into a single image. This will of course reduce image resolution.
JPEG Quality Factor	This is a value between 0 and 100. A value of 100 is perfect quality (very poor compression). A value of 0 is extremely poor quality. Values between 20 and 80 tend to yield good quality and compression tradeoffs.
File Name	File name of generated .JPG file.
Begin Capture	Start capturing trace data.
End Capture	End capturing trace data and create the JPG image.
Cancel	Cancel data capture and discard all data. Do not create an image.

4 THEORY OF OPERATION

4.1 FILE FORMAT

Data can be archived to the hard drive of the system in two formats, the EdgeTech format and the SEG-Y format. We **STRONGLY** recommend that the EdgeTech format is used all the time as the EdgeTech Format stores much greater amount of information than the standard SEG-Y.

NOTE:

Data stored in EdgeTech format can be converted to SEG-Y format by playing it back on the Discover SB program.

WARNING

Data initially stored in SEG-Y format cannot be transferred back. All the information not supported by the standard will be permanently lost.

4.1.1 EDGETECH NATIVE FILE FORMAT

Details can be found in the JSF file format manual Doc. 990-0000048-1000.

4.1.2 STANDARD SEG-Y FORMAT

The SEG-Y format is one of several tape standards developed by the Society of Exploration Geophysicists (SEG). It is the most common format used for seismic data in the exploration and production industry.

NOTE

The included file, SegyStandardType.h is provided below.

4.1.2.1 Description

When Standard Segy format is selected:

- All sonar data in traces is represented via IBM 32-Bit floating point numbers (as per the standard).

- All fields are byte oriented as per the standard (Big Endian). That is, for a 32-bit integer, the 8 MSBs are in the first byte.
- The EBCDIC header is really in EBCDIC (and not ascii).

For Intel based processors, all of the above are not standard and will require conversions. For example, the sonar data must be converted from IBM to IEEE floating point. Integers must be converted from Big Endian to Little Endian, and the EBCDIC header must be converted to ASCII. ONLY envelope data is saved (one float per sample).

4.1.2.2 Trace Header

For the standard 240 byte trace header, the following fields are filled in. All other fields not listed below are set to 0.

sgy->reelSeq:
Reel ping number (starts at 1).
sgy->lineSeq:
Reel ping number again (starts at 1)
sgy->channel_number:
Channel number of data (starts at 1). Always 1 for a single channel system.
sgy->event_number:
Ping number
sgy->traceID:
Always set to 1
sgy->vertSum:
Always set to 1
sgy->horSum:
Always set to 1
sgy->dataUse:
Always set to 1

If XY Coordinates:
sgy->coordUnits:
1 for XY
sgy->coordScale
Scale factor (Value is currently 1)
sgy->recLongOrX
X Source Coordinate as defined in JSF Format.
sgy->recLatOrY:
Y Source Coordinate as defined in JSF Format.
If Lat/Long Coordinates:
sgy->coordScale:
-100
sgy->coordUnits:
2 for Lat long

sgy->recLongOrX:
X Group Coordinate as defined in JSF Format * 0.6
sgy->recLatOrY:
Y Group Coordinate as defined in JSF Format * 0.6

sgy->sourceLongOrX:
Same as recLongOrX
sgy->sourceLatOrY:
Same as recLatOrY

sgy->sampleLength:
Samples in trace
sgy->deltaSample:
Sample interval in us
sgy->correlated:
Always 1
sgy->sweepStart:
Start frequency
sgy->sweepEnd:
End frequency
sgy->sweepLength:
Sweep Length
sgy->sweepType:
Always 1
sgy->aliasFreq:
Alias frequency (1/2 of sample rate)
sgy->year:
Current year
sgy->day:
Current day
sgy->hour:
Current hour
sgy->minute:
Current minute
sgy->second:
Current second
sgy->timeBasisCode:
2 for GMT

4.1.2.3 Binary Header

The binary header structure is also listed below. There is a single binary header at the start of every segy file. We fill in the following fields in the binary header:

binHeader.lineNum:
Incremented on each file

binHeader.reelNum:
  same as lineNum
binHeader.tracesPerRecord = 1;
binHeader.samplesPerTrace:
  Samples per trace. If the operator changes parameters to cause a new value, a new file is created.
binHeader.samplesPerTraceOriginal:
  Same as samplesPerTrace
binHeader.format = 1;
binHeader.sampleIntervalus:
  Sample interval in us
binHeader.sampleIntervalusOriginal:
  Same as sampleIntervalus
binHeader.measurementSystem = 1;
binHeader.cpdFold = 1;
binHeader.traceSortCode = 1;
binHeader.verticalSumCode = 1;
binHeader.sweepFreq0:
  Start frequency
binHeader.sweepFreq1:
  End frequency
binHeader.sweepLengthms:
  Sweep length
binHeader.sweepType = 1;

4.1.2.4 EBCDIC Header

The EBCDIC header at the start of every segy file contains the card number and names EdgeTech as the source but has no information useful for interpreting the data.

4.1.2.5 Include File

```
/* ------------------------------------------------------------------- */
/* SegyStandardType.h                                                  */
/* ------------------------------------------------------------------- */
/*                                                                     */
/* (c) Copyright 2002  EdgeTech,                                       */
/*                                                                     */
/* This file contains proprietary information, and trade secrets of    */
/* EdgeTech, and may not be disclosed or reproduced without the prior  */
/* written consent of EdgeTech.                                        */
/*                                                                     */
/* EdgeTech is not responsible for the consequences of the use or misuse */
/* of this software, even if they result from defects in it.           */
/*                                                                     */
```

```
/* Disk storage an playback of data.                                    */
/* -------------------------------------------------------------------- */

#ifndef SEGYSTANDARDTYPE_H__
#define SEGYSTANDARDTYPE_H__

typedef struct
{ /*  Offset Description                                  */

  /*   0 Sequence numbers within line                     */
  long  lineSeq;
  /*   4 Sequence numbers within reel                     */
  long  reelSeq;
  /*   8 Original field record number or trigger number          */
  long  event_number;
  /*  12 Trace channel number within the original field record    */
  long  channel_number;
  /*  16 X                                        */
  long  energySourcePt;
  /*  20 X                                        */
  long  cdpEns;
  /*  24 X                                        */
  long  traceInEnsemble;
  /*  28 Trace identification code: seismic data = 1          */
  short traceID;
  /*  30 X                                        */
  short vertSum;
  /*  32 X                                        */
  short horSum;
  /*  34 X                                        */
  short dataUse;
  /*  36 X                                        */
  long  sourceToRecDist;
  /*  40 X                                        */
  long  recElevation;
  /*  44 X                                        */
  long  sourceSurfaceElevation;
  /*  48 X                                        */
  long  sourceDepth;
  /*  52 X                                        */
  long  datumElevRec;
  /*  56 X                                        */
  long  datumElevSource;
  /*  60 X                                        */
  long  sourceWaterDepth;
  /*  64 X                                        */
  long  recWaterDepth;
```

```
/*  68 Elevation Scaler: scale = 1                          */
short elevationScale;
/*  70 Coordinate Scaler: scale = 1                         */
short coordScale;
/*  72 X                                                    */
long  sourceLongOrX;
/*  76 X                                                    */
long  sourceLatOrY;
/*  80 X                                                    */
long  recLongOrX;
/*  84 X                                                    */
long  recLatOrY;
/*  88 Coordinate Units:  = 2 (Lat/Long)                    */
short coordUnits;
/*  90 X                                                    */
short weatheringVelocity;
/*  92 X                                                    */
short subWeatheringVelocity;
/*  94 X                                                    */
short sourceUpholeTime;
/*  96 X                                                    */
short recUpholeTime;
/*  98 X                                                    */
short sourceStaticCor;
/* 100 X                                                    */
short recStaticCor;
/* 102 Total Static in MILLISECS added to Trace Start Time (lower 2 bytes)*/
short totalStatic;
/* 104 X                                                    */
short lagTimeA;
/* 106 X                                                    */
short lagTimeB;
/* 108 X                                                    */
short delay;
/* 110 X                                                    */
short muteStart;
/* 112 X                                                    */
short muteEnd;
/* 114 Number of samples in this trace (unless == 32767)    */
short sampleLength;
/* 116 Sampling interval in MICROSECONDS (unless == 1)      */
short deltaSample;
/* 118 Gain Type: 1 = Fixed Gain                            */
short gainType;
/* 120 Gain of amplifier                                    */
short gainConst;
/* 122 X                                                    */
```

```
short initialGain;
/* 124 X                                */
short correlated;
/* 126 X                                */
short sweepStart;
/* 128 X                                */
short sweepEnd;
/* 130 X                                */
short sweepLength;
/* 132 X                                */
short sweepType;
/* 134 X                                */
short sweepTaperAtStart;
/* 136 X                                */
short sweepTaperAtEnd;
/* 138 X                                */
short taperType;
/* 140 X                                */
short aliasFreq;
/* 142 X                                */
short aliasSlope;
/* 144 X                                */
short notchFreq;
/* 146 X                                */
short notchSlope;
/* 148 X                                */
short lowCutFreq;
/* 150 X                                */
short hiCutFreq;
/* 152 X                                */
short lowCutSlope;
/* 154 X                                */
short hiCutSlope;
/* 156 year of Start of trace                    */
short year;
/* 158 day of year at Start of trace                */
short day;
/* 160 hour of day at Start of trace                */
short hour;
/* 162 minute of hour at Start of trace                */
short minute;
/* 164 second of minute at Start of trace                */
short second;
/* 166 Time basis code: 2 = GMT                */
short timeBasisCode;
/* 168 X                                */
short traceWeightingFactor;
```

```
  /* 170 X                                          */
  short phoneRollPos1;
  /* 172 X                                          */
  short phoneFirstTrace;
  /* 174 X                                          */
  short phoneLastTrace;
  /* 176 X                                          */
  short gapSize;
  /* 178 X                                          */
  short taperOvertravel;
  /* 180-240 : User defined area                              */
  char userDefined[60];
} SegyStandardType;
/* end of segy trace header */

#endif /* SegyStandardType       */

/* ---------------------------------------------------------------------- */
/*                      end StorageFormats.cpp                    */
/* ---------------------------------------------------------------------- */
```

4.1.3 RAW DATA CAPTURE FORMAT

The Graph tab of the Control Panel has an option to capture it current data and save it to a file. This data is stored with no header as 32-bit floating-point values (IEEE). The size of the file determines the number of samples in the trace.

4.1.4 SONAR DATA TYPES

The Discover SB supports three types of sonar data, which are useful to display.

Raw Data: Unprocessed data directly from the ADC. This data is useful for diagnostic purposes only.

Analytic Signal: Match filtered data. This data is complex and consists of real and imaginary pairs. Sub-bottom data is normally transmitted in this format because it contains additional frequency information not present in envelope data.

Envelope: This is the square root of the sum of the squares of the real and imaginary components of the analytic signal data. This is how waterfall data is normally displayed. Only ½ the bandwidth is required as compared to analytic signal data.

4.1.5 PALETTE FILE FORMAT

Each display channel can have a color palette, which is specified by a .jsp file. These files are text files with numbers separated by white space. The numbers must be ordered in groups of 4. For each group the values are:

- Index (0 to 255)
- Red Intensity (0 to 255)
- Green Intensity (0 to 255)
- Blue Intensity (0 to 255)

The indices must be increasing in value. If there are gaps in the index then intermediate color values will be interpolated. Here is an example table for a linear gray step wedge type palette:

```
0      0      0      0
255    255    255    255
```

4.2 TRIGGERING AND COUPLING

To avoid interference the Discover SB system supports the following different type of triggering Modes:

Internal Trigger: In this mode the user may specify the ping rate in Hertz (e.g. 3Hz) or ping range (in Meters). The system will use the closest available inter-ping interval (e.g. 332.99ms), and repeatedly re-trigger the system at the expiration of this period.

Coupled Mode: This mode applies only to a combined sub-bottom and side scan system. In coupled mode the applicable subsystem is triggered when the master subsystem triggers. The trigger timing for coupled systems takes account of differing transmit pulse lengths and minimizes inter channel interference.

Gated: Gated and internal trigger modes are similar in that an internal timer determines the trigger rate. However, in gated mode a hardwired trigger input line is monitored. Whenever the trigger line is asserted (active low), the trigger is inhibited for the trigger delay period (as described below). If the next ping time is longer than the specified delay, then the asserted trigger input has no effect.

External Trigger: In this mode the system is triggered by the external event received via the Trigger IN BNC connector in the back of the system. When the hardware trigger is asserted (active log) a new ping occurs.

Note that there is a minimum trigger interval (maximum rate) of each subsystem which is dependant on the Pulse Type used, and is proportional to the pulse length. That is, a longer pulse will also set a longer minimum interval, to keep the ON|OFF duty cycle of the Power Amplifier below the maximum allowed, typically 1:10. The actual trigger interval used will be the LARGER of the user interval and the Power Amplifier imposed limit.

4.3 NAVIGATION

The following information describes the serial port interface parameters for acquiring navigation strings from a connected GPS unit or integrated navigation computer to the MP-X serial port.

Several of the messages conform to the NMEA 0183 protocol. For additional information refer to:

NATIONAL MARINE ELECTRONICS ASSOCIATION

NMEA 0183

STANDARD FOR INTERFACING MARINE ELECTRONICS NAVIGATIONAL DEVICES

Version 2.00

January 1, 1992

4.3.1 NMEA APPROVED SENTENCE STRUCTURE

The following provides a summary explanation of the approved sentence structure:

$aabbb,c---c*hh<CR><LF>

ASCII	HEX	DESCRIPTION
"$"	24	Start of Sentence

aa		Dummy characters to start the Address Field (e.g. GP), not used by EdgeTech products.
bbb		Sentence Formatter. Mnemonic code identifying the data type and the string format of the successive fields.
“,”	2C	Field Delimiter. Starts each field except Address and Checksum fields. If it is followed by a null field, it is all that remains to indicate no data in the field.
c---c		Data Sentence Block. Data field(s) preceded and separated by delimiters.
“*”	2A	Optional Checksum Delimiter.
hh		Optional Checksum Field
<CR><LF>	0D 0A	Terminates Sentence

4.3.2 PORT PARAMETERS

Interface: RS-232C

Com Port: 2

Baud Rate: 4800

Data Bits: 8

Start Bits: 1

Stop Bits: 1

Parity: none

Handshaking: none

4.3.3 INPUTS

The following are the approved NMEA sentences recommended for use with the DISCOVERY based systems.

GLL – Geographic Position – Latitude/Longitude

Latitude and Longitude of the present vessel position, time of position fix and status.

$--GLL,xxxx.xxx,a,yyyyyy.yyy,b,hhmmss.ss,A*hh<CR><LF>

xxxx.xxx	Degrees|Minutes.decimal - 2 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimal fractions of minutes. Leading zeros always included for degrees and minutes to maintain fixed length.
a	N for North Latitude or S for South Latitude

yyyyy.yyy	Degrees|Minutes.decimal - 3 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimal fractions of minutes. Leading zeros always included for degrees and minutes to maintain fixed length.
b	E for East Longitude or W for West Longitude
hhmmss.ss	Time of position fix. Hours|Minutes|Seconds.decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds and a variable number of digits for decimal fractions of seconds. Always pad with leading zeros. This field is optional
A	Status. Single character field: A = Yes, Data Valid, Warning Flag Clear V = No, Data Invalid, Warning Flag Set

GXY-Geographic Position-X and Y Coordinates

X and Y coordinates of the present vessel position, time of position fix and status.

$--GXY,xxxxxx.xxx,a,yyyyyy.yyy,b,hhmmss.ss,*hh<CR><LF>

xxxxxx.xxx	Double floating point numeric, may have leading negative sign. Represents horizontal axis of plane (X coord)
a	Character label for X (Must be valid ASCII character, but value is ignored)
yyyyyy.yyy	Double floating point numeric, may have leading negative sign. Represents horizontal axis of plane (Y coord)
b	Character label for Y (Must be valid ascii character, but value is ignored)
hhmmss.ss	Time of position fix. Hours|Minutes|Seconds.decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds and a variable number of digits for decimal fractions of seconds. Always pad with leading zeros.

NOTE:

The hhmmss.ss field is optional.

GGU - Geographic Position - X and Y Coordinates

X and Y coordinates of the present vessel position, time of position fix and status.

$--GGU,xxxxxxxx.x,a,yyyyyyyy.y,b,hhmmss.ss,*hh<CR><LF>

xxxxxxxx.x	Double floating point numeric, may have leading negative sign. Represents horizontal axis of plane (X coordinate).
a	Character label for X (Must be a valid ASCII character, but value is ignored).
yyyyyyyy.y	Double floating point numeric, may have leading negative sign. Represents vertical axis of plane (Y coordinate).
b	Character label for Y (Must be a valid ASCII character, but value is ignored).
hhmmss.ss	Time of position fix. Hours|Minutes|Seconds.decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits for seconds and a variable

number of digits for decimal fractions of seconds. Always pad with leading zeros.

NOTE:

The hhmmss.ss field is optional.

VTG – Track Made Good and Ground Speed

The actual track made good and speed relative to the ground

$--VTG,x.x,T,x.x,M,x.x,N,x.x,K*hh<CR><LF>

x.x	Floating point numeric
T	Degrees True
M	Degrees Magnetic
N	knots
K	Kilometer/hour

NOTE:

Magnetic heading corrected for local deviation and Easterly/Westerly variation would provide more accurate True vessel heading in degrees.

ZDA - Time & Date

UTC, day, month, year, and local time zone

$--ZDA,hhmmss.ss,dd.mm,yyyy,ll,zz*hh<CR><LF>

hhmmss.ss	Universal Time Coordinated (UTC). Hours|Minutes|Seconds.decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds and a variable number of digits for decimal fractions of seconds. Always pad with leading zeros.
dd.mm	Day(01 to 31)|.Month(01 to 12)
yyyy	Year
ll	Local zone description, 00 to ±13 hour. This field is optional and ignored.
zz	Local zone minutes description, same sign as local hours This field is optional and ignored.

NOTES:

Zone description is the number of whole hours added to local time to obtain GMT, Zone description is negative for East longitudes.

The GLL string provides a more accurate time reference since it is related to the position fix.

Time and date from the computer CPU are also recorded and could be displayed if GPS time and date are not available.

Fix marks are bars across the time zero line in all channels.

EVT - Event & Annotation (EdgeTech custom)

Event mark and related annotation provided by an integrated navigation system

$EGEVT,S,<Message>,<Message>,<Message>,...*hh<CR><LF>

S	ASCII character status flag. M = Print and Store event mark
Message	Event annotation or just annotation message up to 80 characters long with a maximum number of messages being 10

NOTES:

Only the first 23 characters of the first message is saved in the data segy data.

A maximum of 10 <Messages> separated by commas may be sent.

Annotation and event marks are placed on the screen when received, printed on the printer if on, and stored on disk along with time, date and coordinates.

Event marks are displayed on the top of the screen as a tick mark and mark number.

NOTE:

A shortcut to the Windows HyperTerminal application is provided to check the navigation input. You must quit the MP-X application before running, and may need to modify the properties if not running at 4800 baud. A sample display is shown below.

$GPGLL,2600.0100,N,800000.0000,W,151228.99,A*67
$GPVTG,315.65,T,314.15,M,3.8,N,7.0,K*48
$GPZDA,151229.25,28.08,1997,06,00*45
$EGEVT,M,EventNo,Time,Position,Annotation,*73

$GPGLL,2600.0125,N,8000.0025,W,151229.50,A*84
$GPVTG,316.65,T,315.15,M,3.9,N,7.1,K*33

$GPZDA,151229.75,28.08,1997,06,00*45
$EGEVT,M,EventNo,Time,Position,Annotation,*48

$GPGLL,2600.0150,N,800000.0050,W,151229.99,A*12
$GPVTG,315.85,T,314.65,M,3.8,N,7.0,K*58
$GPZDA,151230.25,28.08,1997,06,00*72
$EGEVT,M,EventNo,Time,Position,Annotation,*48

NOTES:

The number of incoming strings should be limited to the five mentioned above.

For accurate fixes, the navigation strings should be updated once a second or faster.

5 TROUBLESHOOTING

The Discover SB program has build in diagnostics to assist in determining the source of any acoustic anomaly.

Some typical diagnostic tests are described below. Each use requires somewhat different parameter settings. It is recommended that the troubleshooting configuration be saved in a parameter file different that the ones used for acquisition.

5.1 DIAGNOSTIC

5.1.1 RUB TEST

A rub test provides a rough check, of operation of a sub-bottom hydrophone. When performing a rub test it is recommended that you display envelope data format. To perform a rub test:

- Start the Discover SB
- Set the appropriate settings in the desired sonar control tab and turn pinging on.
- Data should begin scrolling on the waterfall display.
- Normalize the display.
- Set the gain between 0 – 3dB
- Rub the appropriate sensor.
- You should see increased signal return.
- You should perform a rub test at least once when the system is operating properly, so that you are familiar with the expected display behavior when the system is rubbed.

5.1.2 FREQUENCY PLOTS AND RAW DATA TIME SERIES ANALYSIS

The ability of the Discover SB program to request and display raw data (directly from the ADC converter) is invaluable in diagnosing many potential failure modes. Raw data (as opposed to processed and chirped data) allows direct interpretation (via scope like display).

This helps to determine noise levels, and the proper operation of, transmit power electronics. The Discover J-STAR program also assists interpretation with FFT analysis, that shows interfering noise sources by frequency distribution and spectral amplitude.

The Discover J-STAR program may also be used to acquire raw data, and log this data to disk for offline analysis. Having recorded raw data available for analysis by EdgeTech engineers will often speed up the resolution of suspected problems. Such files may be sent to EdgeTech in CDROM format or if small as email attachments. Many system control and setup parameters are recorded in these raw data files which will assist in problem diagnosis.

The Graph tab on the Control Panel will display any channel of data and its FFT (frequency spectrum).

- Start the Discover J-STAR
- Turn pinging on
- Go to the Graph Tab in the Control Panel
- You should now see something like the following figure:

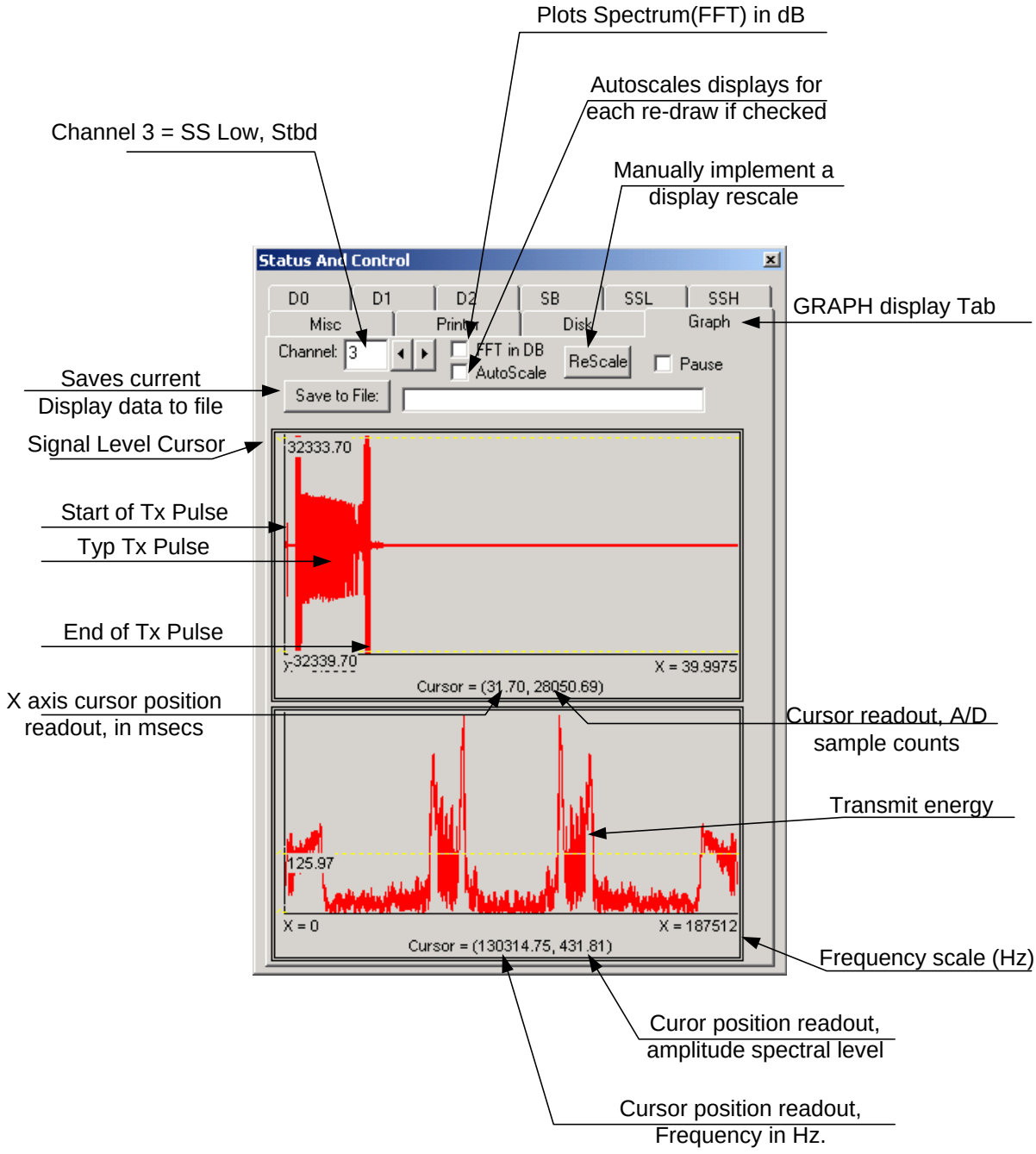


Figure 5-1 Raw Graphic display

The above figure show a typical raw data display for a sidescan channel. The left half of the graph display shows one thousand samples of the raw ADC (analogue to digital converter) output, plotted as time vs. amplitude on the X –Y axes.

The right half shows a frequency analysis (FFT) of the time series in the top half. The axes are Frequency (Hz) vs. Amplitude (x - y).

This raw data display was obtained by first setting the sub-bottom system to send raw data (as opposed to de-chirped envelope data).

Display Description: (Refer to figure above for item/check box locations)

Channel Selector: [Edit Box] Accessed using the mouse / cursor. Type in the desired data channel to display:

0 = SB	- sub-bottom
2 = SSL	- Side Scan Low Port
3 = SSL	- Side Scan Low Starboard
4 = SSH	- Side Scan High Port
5 = SSH	- Side Scan High Starboard

FFT in dB: [Check Box] If checked displays the FFT amplitudes in dB (a logarithmic display scale). If unchecked displays vertical scale as linear spectral amplitudes.

Autoscale: [Check Box]. If checked the displays are re-scaled for EACH redraw / data update, so that the min / max amplitudes of the current data span the available display range. This can be confusing to the eye if the amplitudes of the signals vary greatly from ping to ping, as each display will appear to have the same amplitude unless the axes values are carefully observed. It is SAFEST to leave this unchecked, and manually ReScale as required.

ReScale: [Push Button] A one time (for each push) activation of the display re-scale function. (See above description)

Save to File: [Push button and Edit Window]. The displayed graph data can be saved to a disk file for sending to EdgeTech Tech Support, for analysis. Enter a file save name in the edit window. (Hint, Use the pause check box to freeze the display, to make sure of the data

being saved.) NOTE: ONLY the data being displayed is saved, i.e. channel 3 in this case. No other channels are saved.

Signal Level Cursor: These 2 yellow lines can be dragged vertically to mark and display amplitude levels. For raw data, the amplitudes are in A/D counts. The ADC values are represented in 16 bits, which allows for 65536 discrete levels. These are interpreted as bipolar signals with an amplitude range of +/-32767.

Raw Data Display: All the raw data acquired by the A/D subsystem is displayed in the top window. The A/D capture sequence begins immediately prior to the start of the Transmit pulse for the channel ($\tau = 0$). The entire transmit pulse (which is unavoidably coupled into the receive channel) is visible in the early part of the display. Following the transmit pulse (τ = 8.3msecs in this case) the lower amplitude received echo data is visible. The A/D converter is overloaded during the Transmit pulse by the extremely large amplitude signals injected into the receiver. For this reason, the signal may appear to collapse slightly during the Transmit pulse, but the display should show +32767 and –32767 amplitudes during the Transmit interval. See the figure below for raw data display where the Transmit power for the channel is set to zero.

In this case transmit power for the side scan channel has been set to zero in the SSL control tab. The Power Amplifier turn on and turn off transients, are still visible in the time record and indicate that the power to the amplifiers is good, and that the power amplifier on/off control is working correctly. The absence of transmit energy would indicate a failure in the transmit signal generator, if the power were not intentionally set to zero.

5.2 HARD DISK RESTORATION PROCEDURE

The Discover X-STAR has an IDE hard disk. A disk archive is saved on the CD-ROM supplied with your system.

To build a new disk follow these procedures:

1. Open up the X-STAR computer and remove its hard disk. Remove the 40-pin data cable and power connector from the disk.
2. Jumper the new hard disk as a master. On most systems, the CD-ROM drive is jumpered as a slave and shares the same cable as the hard disk.
3. Insert the new hard disk into the X-STAR and connect the power and data cables. The red stripe on the data cable indicates pin 1 on the 40-pin cable. Pin 1 is normally closest to the power supply connector.
4. Make sure that the CD-ROM drive is still connected.
5. Insert the EdgeTech bootable CD-ROM then turn the system ON.
6. The system should boot from the CD-ROM and display a menu of choices. To build a bootable system you must do menu items 1 (Partition disk), 2 (Format disk), and 3 (Restore) in this order. You will be prompted for the type of disk you are building during menu item 3 (Restore).
7. Under Menu item 1 (Partition Disk)
   - Create Logical DOS
   - Enable Large Disk Support
   - Make Partition Active
   - Reboot
8. Menu item 2 (Format)
9. Menu item 3 (Restore)
10. Insert Windows 2000 CD-ROM. Reboot
    - Watch for message “Press Any Key to boot from CD”
    - Boot into Windows 2000 Set up
    - Once Set Up has launched, select Repair Window Installation using Console.

- Log on to “1” partition
- No Password
- Type fixboot C: <CR>
- Type :Y” to confirm new boot sector
- Type “exit”
- Remove Windows CD-ROM and reboot.

11. The system is now ready for operation with the new disk.

NOTES:

Any software upgrade mailed on a CD-Rom, emailed or downloaded will have to be re-installed separately.

6 CUSTOMER SERVICE

6.1 STATEMENT

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year.

In order to be able to serve you faster, please address any concerns related to the X-STAR system to the plant in Milford, Massachusetts.

If the situation requires sending equipment back for repair please refer to the following page for detailed shipping procedures.

Our customer service personnel in both plants enjoy hearing from the people who use our products. Your experience with our products is a valuable source of information that we will use to continuously improve our products. We encourage you to contact or visit us to discuss any issues related to our products.

sales@EdgeTech.com
http://www.EdgeTech.com

PO Box 850
4 Little Brook Road
West Wareham, MA 02576
Tel: (508) 291-0057
Fax: (508) 291-0975

6.2 RETURNED MATERIAL AUTHORIZATION

It is necessary to obtain a Returned Material Authorization (RMA) number prior to returning any equipment to EdgeTech. This will help EdgeTech in recognizing your equipment when it arrives at our receiving dock, and to assist us in tracking your equipment while it is at our facility. The material should be shipped to the address indicated above.

Please refer to the RMA number on all documents and correspondence as well.

All returned material must be shipped prepaid. **Freight collect shipments will not be accepted.**

The following steps apply only to material being returned from outside the Continental United States. These steps should be followed carefully to prevent delays and additional costs.

1. All shipments must be accompanied by three copies of your proforma invoice, showing the value of the material and the **reason for its return,** if the reason is for repair it must be clearly stated in order to come through customs faster and without duties being charged. Whenever possible, please send copies of original export shipping documents with the consignment.

2. If the value of the equipment is over $1000, the following Shipper's oath must be sent with the invoice. This oath can be typed on the invoice, or on a separate letterhead.

   "I, _____, declare that the articles herein specified are the growth, produce, or manufacture of the United States; that they were exported from the United States from the port of _____, on or about _____; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means; and that no drawback, or allowance has been paid or admitted hereof."

   Signed _____

3. If there is more than one item per consignment, a packing list must accompany the shipment. It is acceptable to combine the proforma invoice and packing list as long as the contents of each carton are clearly numbered and identified on the invoice.
4. Small items can be shipped prepaid directly to EdgeTech by FedEx, DHL, UPS, Airborne, etc.
5. If the equipment is the property of EdgeTech (formerly EG&G Marine Instruments Division) please insure for full value.
6. Fax one invoice, packing list, and copy of airway bill to EdgeTech upon shipment.

6.3 SOFTWARE SERVICE AGREEMENT (SSA)

Software maintenance is included free of charge for one year following purchase of an EdgeTech system. The Software Service Agreement covers the following services that enable an EdgeTech customer to continue to receive software updates, documentation and enhanced telephone, fax and e-mail support after the first year. In addition, customers with a current SSA receive a 10% discount on spare parts for the covered system.

Software Updates and Enhancements

SSA customers receive regular new software releases along with any technical and user's manual changes.

NEW SOFTWARE RELEASES CONSIST OF:

Software enhancements that are not on the price list

Software fixes and changes

Product integration

Beta site testing

Documentation updates to on-line help

Tests for compatibility with other modules

SOFTWARE PATCHES CONSIST OF SOFTWARE THAT HAS UNDERGONE:

Minor software enhancement

Software fixes and changes

Software Performance Report

A customer may also submit reports by means of a SPR (Software Performance Report) form to EdgeTech. The report may be related to a problem, an inquiry or a specific request for a

software enhancement. We will attend to the SPR at a priority level depending on the seriousness of the problem and the availability of a work-around.

Software Telephone, Fax and E-mail Support

The SSA entitles a customer to contact EdgeTech User Support representatives by telephone, fax or e-mail to report a difficulty, discuss a problem or receive advice on the best way to do a task. EdgeTech User Support will:

Respond within 24 hours

Immediately attend to serious problems affecting customer's operations

Attempt to find an immediate work-around

Annual Software Maintenance Agreement Fee ***Contact Sales Dept.***

TERMS

This agreement is for one calendar year and is renewable upon payment to EdgeTech.

If the agreement lapses, paying that year's maintenance fee can renew it.

Regular software releases with all modifications and enhancements will automatically be forwarded to the user.

This agreement DOES NOT address CUSTOMER-SPECIFIED modifications and/or enhancements, which may be ordered separately.

EdgeTech software upgrade is meant for the sole use of the clientele, which have purchased a system within a year or have a Software Service Agreement. Any reproduction or file sharing is strictly prohibited.