

DISCOVER AUV

USER SOFTWARE MANUAL

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We, the employees at EdgeTech, would like to thank you for purchasing the DISCOVER BATHYMETRIC Acquisition software. At EdgeTech, it is our policy to provide high quality, cost effective products and support services that meet or exceed your requirements. We also strive to deliver them on time and to continuously look for ways to improve them. We take pride in the products we manufacture and want you to be entirely satisfied with your equipment.

Purpose of this Manual

The purpose of this manual is to provide the user with information on EdgeTech's DISCOVER AUV Acquisition software. For detailed information relating to the hardware, refer to the appropriate user hardware manual.

Although this manual encompasses the latest operational features of DISCOVER AUV, some features may be periodically upgraded. Therefore the information in this manual is subject to change and should be used for reference only.

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CAUTION! Identifies a potential hazard that could be damaging to equipment or could result in the loss of data.

NOTE: Recommendations or general information that is particular to the material being presented. It may also refer to another part of this manual or to another manual.

Revision History

REVISION	COMMENTS	DATE	APPROVAL
A	Release to Production	04/13/2016	LNB

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COMPANY BACKGROUND

EdgeTech (formerly EG&G Marine Instruments) traces its history in underwater data acquisition and processing back to 1966. EdgeTech has designed, developed, and manufactured products, instruments, and systems for the acquisition of underwater data, including marine, estuarine, and coastal applications for over 45 years.

The company has responded to the needs of the scientific, Naval and offshore communities by providing equipment, such as sub-bottom profilers, side scan sonar, acoustic releases, USBL positioning systems, and bathymetric systems that have become standards in the industry.

EdgeTech has also consistently anticipated and responded to future needs through an active research and development program. Current efforts are focused on the application of cutting edge CHIRP and acoustic technology.

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1.0 OVERVIEW

The DISCOVER AUV software is designed to operate EdgeTech's Hosted Sonar Products onboard autonomous platforms such as Autonomous Underwater Vehicles (AUVs) and Autonomous Surface Vessels (ASVs). DISCOVER AUV also stores data using EdgeTech's native binary format: ***.JSF** to the hosted platform's local hard disk or internal data drive provided with the 2205 electronics. For further information regarding the JSF file format, please refer to the [JSF Data File Description](#) (EdgeTech Part No 0004824).

DISCOVER AUV communicates and controls the sonar systems via a remote interface onboard the hosted platform and usually does not require input directly from the user. Typically, the DISCOVER AUV software runs in a minimized mode, and does not contain any imagery displays in order to save processing power and memory for long term deployments. DISCOVER AUV is usually maximized only to check the system's health prior to deployment. Refer to the [EdgeTech Interface Support Package](#) (Part No 0018164) for more information on how to control DISCOVER AUV from an external interface.

Furthermore, in the event that there is no external interface available on the vehicle, DISCOVER AUV can also control the sonar system automatically by using the default settings and a limited configuration file called the **AUVConfig.ini file** (see section 4.0). To alter these default settings (if desired) such as recording directory, file naming, default sub-bottom pulse, and bathymetric processing parameters, the DISCOVER AUV software is utilized.

This manual explains how to setup the default settings and how to perform the necessary system health checks prior to deployment using DISCOVER AUV. This manual also explains all of the dialogs available in the DISCOVER AUV software (known as the Controller Module), introduces the Bathymetric Processor (software responsible for computing bathymetric soundings, if bathymetry is equipped), how to use the AUVConfig.ini file, and explains the various file types possible in DISCOVER AUV logging.

1.1 Supported Configurations

DISCOVER AUV can run several hardware configurations. These hardware configurations include, but are not limited to:

- Dual Frequency Side Scan Sonar
- Dual Frequency Side Scan Sonar with Dynamic Focus on one Frequency
- Combined Dual Frequency Side Scan Sonar with Sub-Bottom
- Dual Frequency Side Scan Sonar with Bathymetry on one Frequency
- Triple Frequency Side Scan with Bathymetry on one Frequency and Sub-Bottom

1.2 Pre-deployment Checks

Prior to deploying the hosted platform, there are various health checks performed and default settings assigned using the DISCOVER AUV software. These vary by subsystem type and hardware configuration. Typical pre-deployment checks include:

1. Confirm DISCOVER AUV is connected to SONAR using the Status Bar (NET: ON in [2.2](#)).
2. Confirm Bathymetric Processing is ON, if bathymetry is equipped ([2.2](#)).
3. Confirm the External Interface is connected to DISCOVER AUV ([2.3.3.2](#)).
4. Confirm there are no port errors and time sync is valid ([2.3.3.3](#)).
5. Select a default sub-bottom pulse and potentially adjust the Start Delay and Window Size ([2.1.2](#)), if sub-bottom hardware is equipped.
6. Setup a default recording directory, if logging in DISCOVER AUV is desired ([2.1.3](#)).
7. Set the blanking range and adjust the bathymetric filter settings, if desired ([0](#)).
8. Click on the File menu, and then Exit / Save Settings, so that each time the software boots from now on will use the default settings allocated in steps 5 through 7.
9. Make sure to reboot DISCOVER AUV prior to mission start.

2.0 CONTROLLER MODULE

The DISCOVER AUV Controller Module launches in a minimized mode and must be maximized from the Windows task bar before viewing any of the available controls. In other words, DISCOVER AUV usually runs in the background and controls the sonar system via the commands from the onboard hosted software (i.e., AUV Controller).

Typically this window is only maximized to confirm the receipt of controls from the third party interface, or diagnosing/troubleshooting a particular issue. It can also be used to setup certain default parameters prior to mission launch.

The main window is illustrated **FIGURE 2-1** below where each control is described in the following subsections.

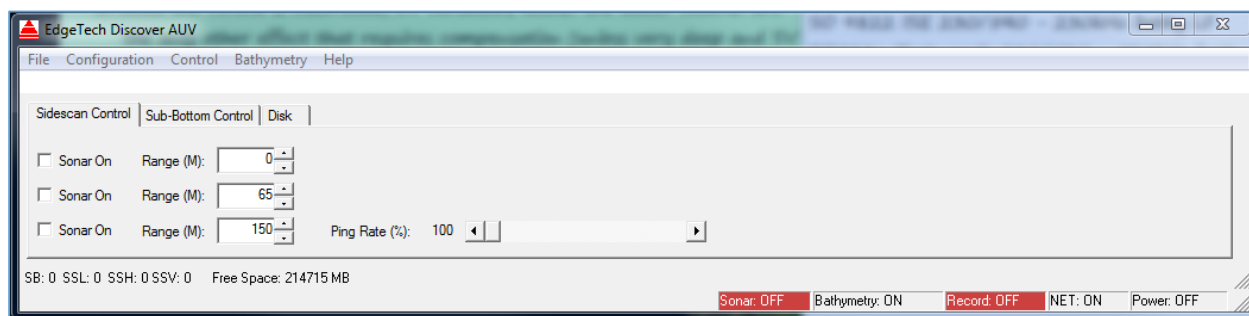


Figure 2-1: DISCOVER AUV Controller Window

2.1 Tabs

The Controller has three tabs: **Sonar Control**, **Sub-Bottom Control**, and **Disk**. The first two of these tabs control the sub-system that bare their name. The third tab, or Disk tab, controls the recording state (on off, file name, etc.) and logging directory. See [2.1.1](#), [2.1.2](#), and [2.1.3](#) for complete descriptions of these tabs.

2.1.1 Sidescan Control Tab

The available side scan controls (**FIGURE 2-2**) include turn pinging on or off and set the range for any one of the active side scan frequencies. The receipt of external side scan controls is visualized here.

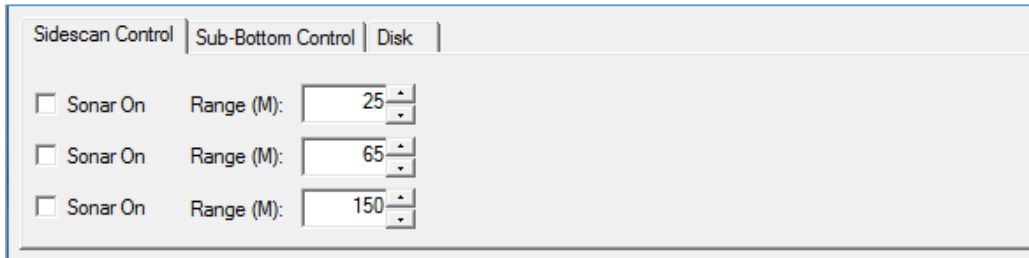


Figure 2-2: Sidescan Control tab

The position of the controls designates the hierarchy of the frequency selections. The highest in the list is to control the Side Scan Very High (SSVH), the middle for Side Scan High (SSH), and the bottom for Side Scan Low (SSL).

NOTE: Only two of the three available side scan frequencies can operate simultaneously. DISCOVER AUV prevents the user from doing so by deactivating the third.

2.1.2 Sub-Bottom Control Tab

The sub-bottom controls consist of turn pinging on or off, choose a pulse, set the ping rate, and set a data window size (**FIGURE 2-3**). The receipt of external sub-bottom controls is visualized here.

Different pulses are used for distinct sediment types and desired penetration. Each pulse has a maximum ping rate associated with it. The requested ping rate and actual ping rate may differ, depending on the pulse selected and the master/slave subsystem. Both the requested and actual ping rates are shown in the Sub-Bottom Control tab (**FIGURE 2-3**). The *Actual Ping* rate is displayed once pinging has begun.

NOTE: when using Discover AUV for the first time, a sub bottom pulse must be chosen as the default (if sub-bottom is equipped). Once a pulse has been chosen, close the software to save the settings. Reboot Discover AUV and confirm the default is saved.

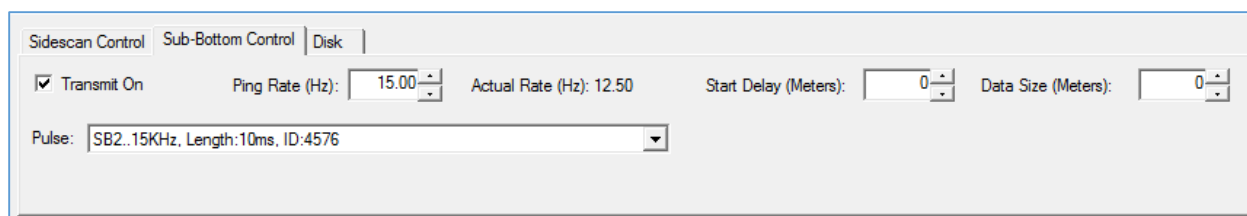


Figure 2-3: Sub-Bottom Control tab

The data window is specified by using the *Start Delay* and *Data Size* parameters in meters. The *Start Delay* field sets the beginning of the data window so any samples before this value are discarded. This setting is typically used to reduce network bandwidth or exclude the water column from the displayed and stored data. The *Data Size* field sets the acquisition window size. If any of these fields are set to zero, DISCOVER AUV acquires all data for the specified range/ping rate.

2.1.3 Disk Tab

The Disk tab allows the user to browse for the file folder they would like to store data in. It also contains the record and stop commands (**FIGURE 2-4**).

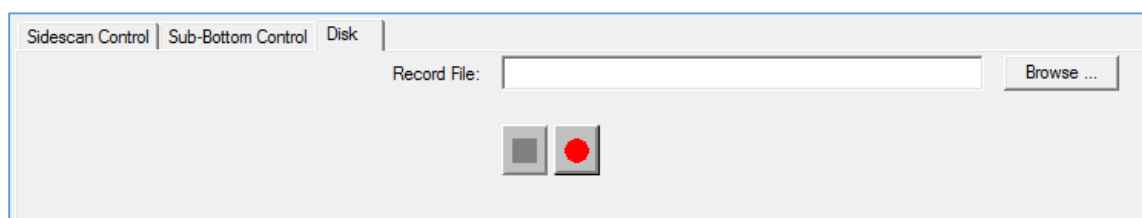


Figure 2-4: Disk Tab

NOTE 1: When using DISCOVER AUV for the first time, a recording directory must be specified or it will return an error.

NOTE 2: Unlike other versions of EdgeTech's DISCOVER software, DISCOVER AUV only has recording functions (i.e., no playback capability).

2.2 Status Bar

The Status Bar lies at the bottom of the Controller module, and shows the active sonar subsystems along with the amount of free space located on the data disk (**FIGURE 2-5**). These displays are typically used in real time applications where remote session is possible (ASVs) or development of a new interface where receipt of commands are checked.

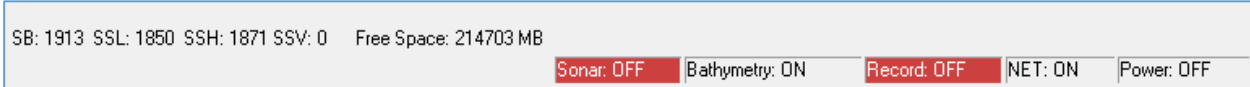


Figure 2-5: Status Bar

Further information provided by the status bar includes the following:

Pinging State: defines whether the sonar is on or off.

Bathymetry Status: is only valid if the sonar hardware is configured for bathymetry. The possible options are on (enabled and no errors), off (disabled), or error (enabled but missing either sound velocity or roll compensation). If there's an error DISCOVER AUV also pops up the appropriate dialog box ([FIGURE 2-6](#) and [FIGURE 2-7](#)). These warnings will not disappear until the issues are resolved.

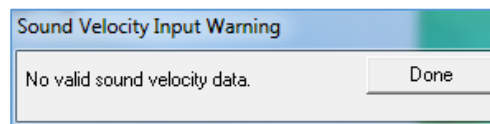


Figure 2-6: Missing Sound and Velocity Warning

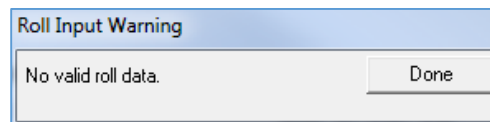


Figure 2-7: Missing Roll Warning

Record State: describes whether recording is on or off.

Network Connection: states whether the network is connected (on) or disconnected (off) to the subsea software called SONAR.

Power Levels: shows the power level for the active side scan subsystem and can either be off, or full.

2.3 Top Menu

The DISCOVER AUV Top Menu consists of the File, Configuration, Control, Bathymetry, and Help sub-menus. A description for each is provided in this section.

2.3.1 File Menu

The File menu allows the user to load or save the current DISCOVER AUV default settings and configurations (**FIGURE 2-8**).

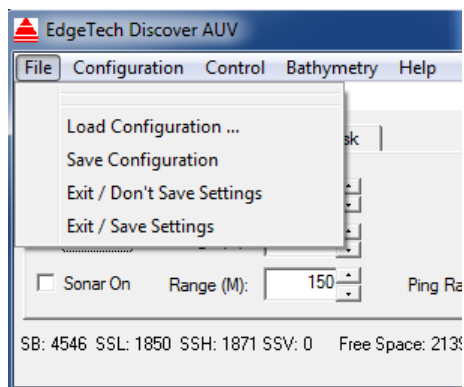


Figure 2-8: File Menu

2.3.2 Configuration Menu

The Configuration menu (**FIGURE 2-9**) provides a way to adjust several settings, as described below:

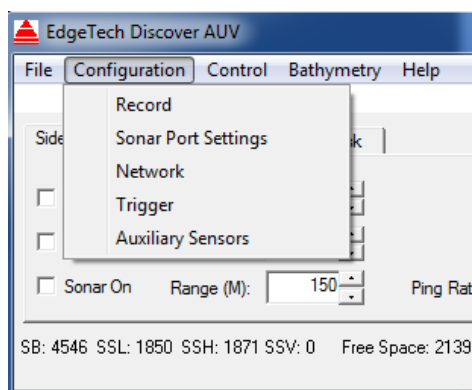


Figure 2-9: Configuration Menu

2.3.2.1 Record Configuration

The Record Configuration window specifies a maximum file size in megabytes (MB) and a free space warning in MB. It also allows the user to select whether or not they would like to record diagnostic (unprocessed stave) data.

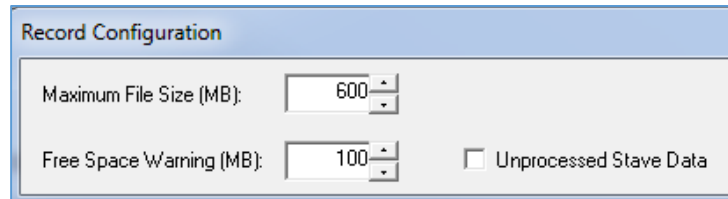
The image shows a software dialog box titled "Record Configuration". It contains two numeric input fields: "Maximum File Size (MB)" with a value of 600, and "Free Space Warning (MB)" with a value of 100. To the right of these fields is a checkbox labeled "Unprocessed Stave Data" which is currently unchecked. The dialog box has a standard Windows-style title bar and a light gray background.

Figure 2-10: Record Configuration

NOTE: By default diagnostic (unprocessed stave) data logging is set to off (unchecked). Typically this kind of data is only recorded for troubleshooting or training purposes.

2.3.2.2 Sonar Port Settings

The Sonar Port Settings dialog box ([FIGURE 2-11](#)) is used pre-deployment to configure the RS-232 serial ports on the 2205 electronics. To configure them, enable the desired port and then set the baud rate and parser. Incoming supporting data is confirmed in the SONAR software.

These serial ports are provided to intake the attitude (roll, pitch, and heave), heading and navigation data from the supporting sensors. Attitude and heading data must be connected to Ports 1 and 2, since they are configured for high speed and high accuracy (10Mbps). Ports 3 and 4 are configured for standard RS-232 serial connections and are used to intake the navigation data if more than two serial ports are required. Most common setups use Ports 1 and 2 to ingest attitude and position, whereas Ports 3 and 4 are used for sound velocity and platform depth inputs, as these can tolerate larger latencies.

For more information on the available serial ports and how to confirm incoming auxiliary data, refer to the [EdgeTech Interface Support Package User Guide \(Part Number 0018013\)](#).

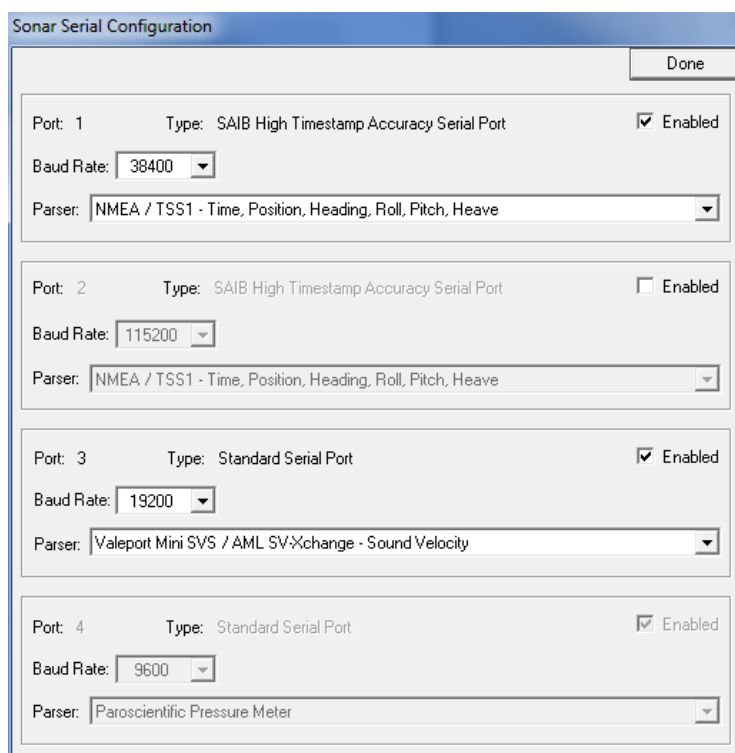


Figure 2-11: Sonar Port Settings

NOTE: A grayed out port suggests it is hard coded for a specific sensor and is active but cannot be altered.

There are two other possibilities the user can encounter with the Sonar Port Settings dialog box. The first (shown in [FIGURE 2-12](#)) displays a warning when DISCOVER AUV is not connected to the SONAR software. The second notice states that no ports exist ([FIGURE 2-13](#)). In order to activate the ports, the *SonarSerial.ini* file must be used.

For more information on the *SonarSerial.ini* file, please refer to the *EdgeTech Interface Support Package User Guide (Part Number 0018013)*.

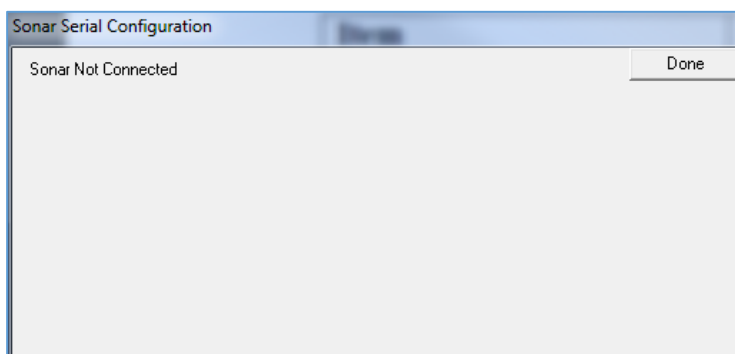


Figure 2-12: DISCOVER AUV not connected to SONAR warning

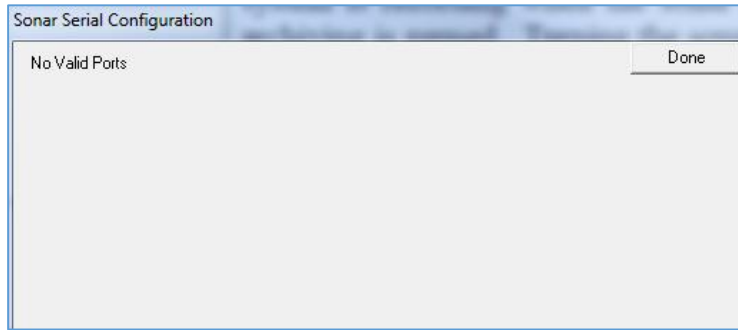


Figure 2-13: DISCOVER AUV no valid ports warning

If one or more of the activated ports incur an error, the Diagnostic Window will appear (FIGURE 2-14). The possible port statuses are given in subsection 2.3.3.3.

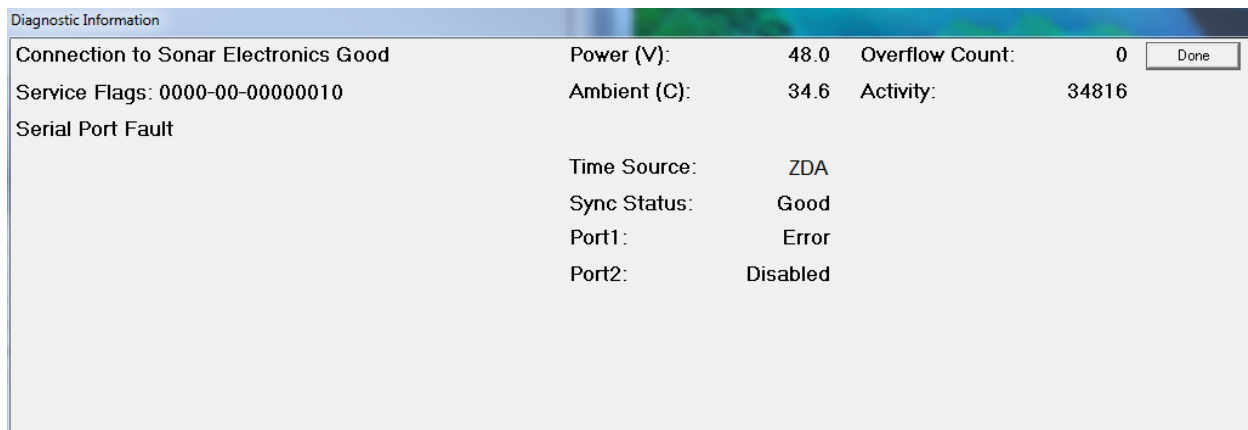


Figure 2-14: Diagnostic Window

2.3.2.3 Network Settings

The Network Settings window provides a way to configure the IP Address and Port Number for DISCOVER AUV to connect to the embedded software called SONAR. Typically these two programs run on the same embedded CPU onboard the Hosted Platform so the local IP Address is used (FIGURE 2-15). If DISCOVER AUV and SONAR run on separate machines, the IP Address that corresponds to SONARs computer should be used instead.

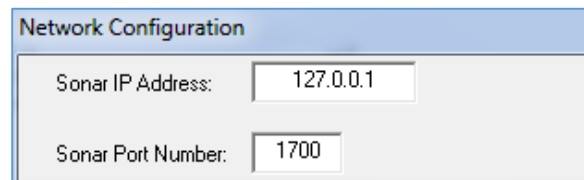


Figure 2-15: Network Configuration

Typically these settings are programmed prior to delivery of the system and should not be changed. Only under certain circumstances is this required.

2.3.2.4 Trigger Settings

The Trigger Configuration window sets the master trigger to the desired subsystem. For bathymetric operations, this trigger is set to the side scan frequency hosting the bathymetric functions by default. This is the desired and recommended setting.



Figure 2-16: Trigger Configuration Window

NOTE: Setting this parameter to anything other than the bathymetry sub system will result in decreased data density along track.

To prevent interference, an external trigger is used to synchronize all acoustic devices onboard the hosted platform. If it is desired to run the EdgeTech sonar system in a slave mode, the *External Trigger* box is checked.

2.3.2.5 Auxiliary Sensors

The Auxiliary Sensors window is used to configure the incoming auxiliary messages. Typically this dialog is used to prevent redundant message sources and is used pre-deployment.

Sensor Name	Status	Total	Not Processed	Average Rate (Hz)
Pitch / Roll:	ON	0	0	---
Pressure:	ON	1	1	---
Altitude:	ON	0	0	---
SV:	ON	1	0	---
NMEA:		0	0	
GGA:	COM1	0	0	---
GLL:	OFF	0	0	---
RMA:	OFF	0	0	---
RMC:	OFF	0	0	---
HDG:	OFF	0	0	---
HDT:	COM2	0	0	---
DPT:	OFF	0	0	---
DBT:	OFF	0	0	---
VTG:	COM1	0	0	---
ETC:	OFF	0	0	---
GGK:	OFF	0	0	---
HYDRO:	OFF	0	0	---
PASHR:	OFF	0	0	---
HEAVEA:	OFF	0	0	---

Figure 2-17: Auxiliary Sensor Messages

CAUTION! Redundant messages may cause time stamping issues within the data so please ensure this does not occur!

2.3.3 Control Menu

The Control Menu provides a way to adjust the advanced sonar controls and show the connection and diagnostic information. The control menu is shown in [FIGURE 2-18](#).

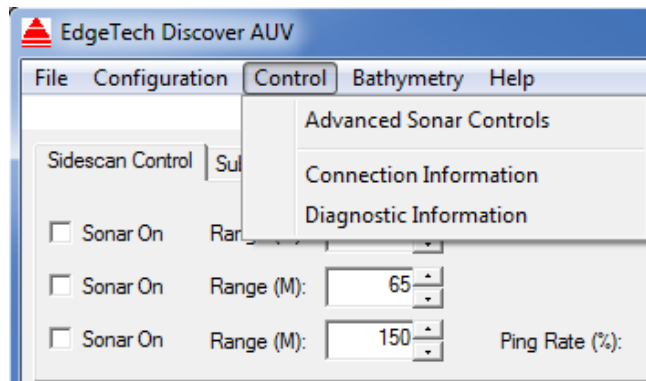


Figure 2-18: Control Menu

2.3.3.1 Advanced Sonar Controls

The Advanced Sonar Controls dialog box is used to control the transmit levels and override the side scan pulses. For side scan subsystems, the transmit power is either on (FULL) or off, whereas the Sub-Bottom power is specified as a percentage (0-100%).

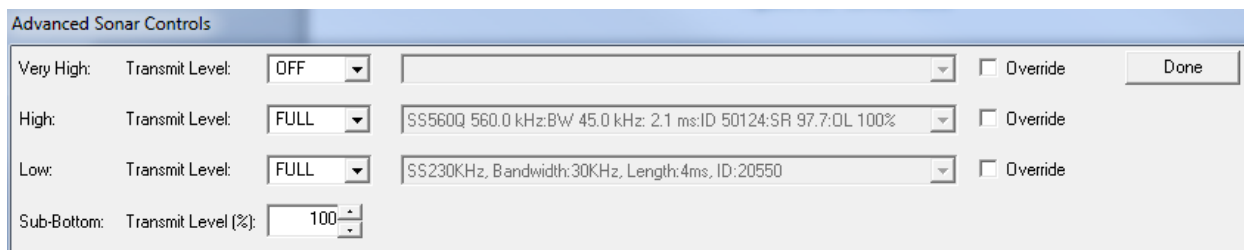


Figure 2-19: Advanced Sonar Controls

WARNING! Do not modify the side scan parameters, unless a corresponding change has been made to the sonar subsystem. This should only be done in truly exceptional circumstances, by expert users, or system administrators.

2.3.3.2 Connection Information

The Connection Information displays the connection status between DISCOVER AUV and the External Topside Interface. Note the Sonar Control and Sonar Data Ports are set to 1900 and 1901, respectively.

Typically, this window is used to confirm the external interface has connected to DISCOVER AUV pre-deployment.

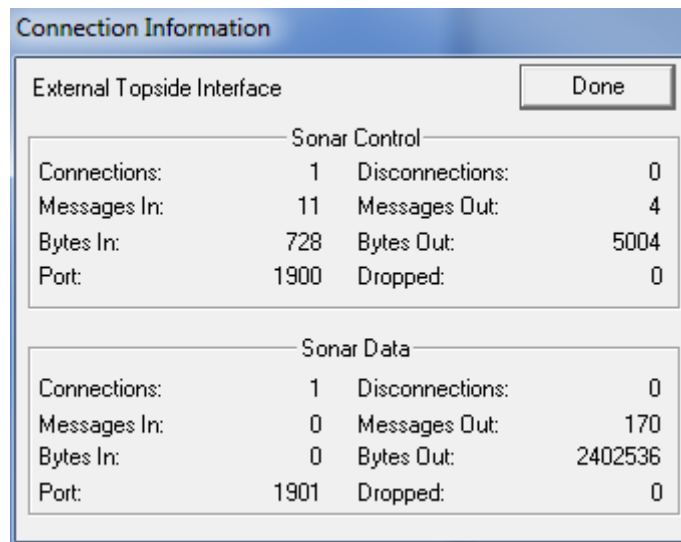


Figure 2-20: Connection Info

2.3.3.3 Diagnostic Information

The Diagnostic Window provides valuable information about the sonar system, such as the connection status, service flags (if there are any errors), system's power and temperature readings, time sync source and status, port states, overflows and activity on the network.

Typically, this window is checked for issues prior to deployment of the AUV vehicle.

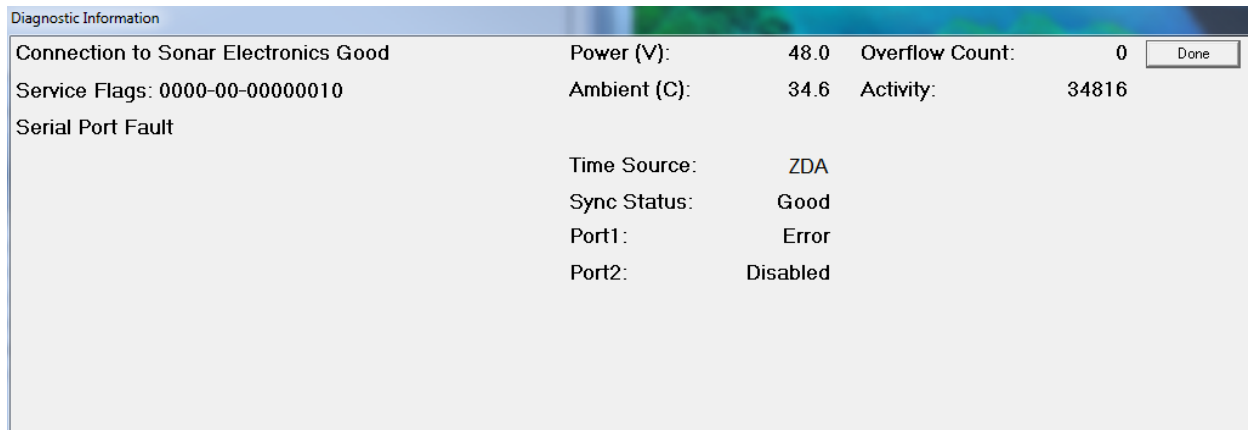


Figure 2-21: Diagnostic Window

In the example presented in **FIGURE 2-21**, the sonar electronics are on and connected to DISCOVER AUV, the time sync source is good and is set to ZDA, while Port 1 has an error and Port 2 is disabled. The Service Flags are indicating there is an error and is usually defined just below it (e.g., Serial Port Fault).

There are several possible port statuses. A full list is given below. All statuses apply to both serial or Ethernet interfaces, unless otherwise stated.

Active: the port is enabled and is receiving data. There are no errors.

Disabled: the port is disabled and there are no errors.

(Inactive) No Data: the port is enabled but is not receiving data.

Parse Errors: the port is enabled but the incoming data has unknown characters.

Error: the port is enabled but there is an error opening the port or the physical port does not exist.

No Valid Data: the port is enabled and receiving data but does not match the selected parser or baud rate.

Too Much Data: the port is enabled but the baud rate setting is too low for the incoming data stream.

Configuration Error: the port is enabled but incorrectly configured in the SonarSerial.ini file. Refer to the Data IO Reference Document for more information.

No Connection: the port is enabled and is not receiving data from an Ethernet based device (TCP/UDP connections only).

Trying to Open: the port is enabled but the embedded software is attempting to open the port.

Open Failed: the port is enabled but could not be opened because it is in use by another program or it does not exist.

Not Authorized: the port is enabled but not authorized and requires authentication in the embedded software. Please contact customer service if this occurs.

Unknown: any other port error not defined above.

2.3.4 Bathymetry Menu

The Bathymetry Menu allows the user to access the bathymetry control windows and only applies to sonar systems outfitted with bathymetry.

There are three possible to choose from: basic, advanced, and engineering.

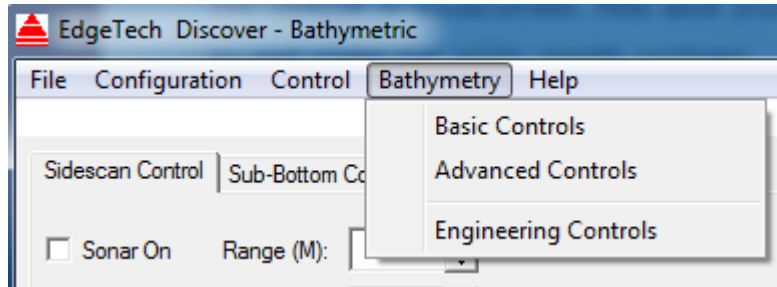


Figure 2-22: Bathymetry Menu

These control dialog boxes are explained in subsections 0 through 2.3.4.3 below.

2.3.4.1 Basic Controls

The *Basic Bathymetric Controls* are shown in **FIGURE 2-23** and provide the ability to turn Bathymetric Processing on/off, set limits and gates, and choose a binning mode. These options are usually set via an external interface but the defaults can also be used.

Figure 2-23: Basic Bathymetric Controls

Each one of these options has been defined in detail within this section.

BATHYMETRIC PROCESSING

The *Bathymetric Processing* check box (boxed in red in *Figure 2-24*) is used to turn on or off the **Bathymetric Processor Module** responsible for computing the seafloor soundings. This setting should always be checked during acquisition, but can be turned off by unchecking the box (or sending the external control). This command must be sent prior to pinging.

Figure 2-24: Bathymetric Processing and Limits

LIMITS

The *Limits* section ([FIGURE 2-24](#)) sets the minimum and maximum processing depths, blanking range, and maximum swath. The minimum and maximum depth, along with the maximum swath, defines the acquisition area, whereas the blanking range is used to filter out excess noise around the Sonar Head, or ignore a hull/keel echo.

All of these limits are set manually by typing into the field box or adjusting the slider bars next to their corresponding field. These limits must be set prior to mission start and cannot be changed mid mission.

GATING

The *Gating* section provides a way to filter out excess noise on the outer ends of the swath. These are active during real time acquisition and have immediate effect. These gates are controlled by specifying them numerically as shown in [FIGURE 2-25](#).

Gating				
Port	Limit (M):	50.00	Angle (degrees): 100.00	Reset
Starboard	Limit (M):	50.00	Angle (degrees): 100.00	Reset
Limit Maximum Swath as a Function of Water Depth (X):			8.0	☐ Maximum Swath Gate

Figure 2-25: Gating

These gates must be set prior to mission start and cannot be changed mid mission.

BINNING

The basic controls also provide a way to adjust the bin mode. The possible options are *Distance Binning* and *Angle Binning*.

The *Distance Binning* method is the default mode and breaks up the seafloor into equi-distant boxes (or bins), so that the number of points is uniform across the entire swath. It is defined by specifying the bin size in meters.

For this mode, the total number of bins is fixed to 800.

A dialog box for configuring distance binning. It contains two radio buttons: 'Distance Binning' (selected) and 'Angle Binning'. To the right of the 'Distance Binning' radio button is the label 'Bin Size (M):' followed by a text input field containing the value '0.30'.

Figure 2-26: Distance Binning Parameters

The [Angle Binning](#) method breaks up the sonar's field of view into equi-angular sectors (or beams/bins) and is primarily used to map vertical objects such as dock or sea walls, pilings, etc. As before, the binning option is defined by specifying the bin size, but this time in degrees.

A dialog box for configuring angle binning. It contains two radio buttons: 'Distance Binning' and 'Angle Binning' (selected). To the right of the 'Angle Binning' radio button is the label 'Bin Size (Degrees):' followed by a text input field containing the value '0.50'.

Figure 2-27: Angle Binning Parameters

For this mode, the total field of view of the sonar is hard coded to 200°.

The bin size is based upon water depth, hence the deeper the water, the larger the bin size. The system produces bin sizes equal to that of a multi-beam echo sounder (MBES) footprint of approximately 0.5 x 1 degree (i.e., in 10m of water this equates to approximately 17 cm). The default values are shown in [FIGURE 2-26](#) and [FIGURE 2-27](#) above.

Both of these settings can be set via the external interface or set prior to mission start.

2.3.4.2 Advanced Bathymetric Controls

The Advanced Bathymetric Controls allows access to the built in filters for the system. Please note this control window includes all of the basic controls, along with the added filter section at the bottom. Since there is repetition here, only the *Filters* section is described below. For all others, please refer to 0.

Advanced Bathymetric Controls

☒ Bathymetric Processing ☐ Use External Limits Done

Limits

Minimum Depth (M):

Maximum Depth (M):

Blanking Range (M):

Maximum Swath (M):

Gating

Port Limit (M): Angle (degrees): Reset

Starboard Limit (M): Angle (degrees): Reset

Limit Maximum Swath as a Function of Water Depth (X): ☒ Maximum Swath Gate

Filters

☒ Automatic Echo Strength Thresholds ☒ Water Column Filter

Automatic Echo Filter Sensitivity:

Echo Strength Filter (1/10 %):

SNR Filter (dB):

Quality Filter (%):

☐ Distance Binning ☒ Angle Binning Bin Size (Degrees):

Figure 2-28: Advanced Bathymetric Controls

FILTERS

The Filters section (**FIGURE 2-29**) provides a way to alter several system filters. These include the Echo Strength, Water Column, SNR, and Quality filters. These filters have been optimized for the system and should not be changed unless absolutely necessary.

Filters

☒ Automatic Echo Strength Thresholds ☒ Water Column Filter

Automatic Echo Filter Sensitivity:

Echo Strength Filter (1/10 %):

SNR Filter (dB):

Quality Filter (%):

Figure 2-29: Filter Settings

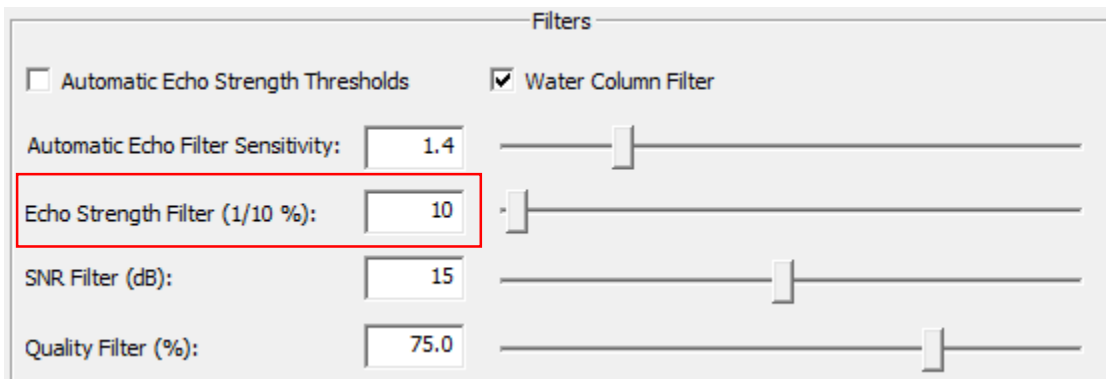
A description of each filter has been provided on the following page.

ECHO STRENGTH FILTER

The *Echo Strength Filter* is a fundamental attribute that is used primarily to exclude or trim weak echo points from the bathymetric data (i.e. water column and very weak backscatter amplitudes). The data points have an amplitude that can span 0 to 32,767. Typical sea floor echoes are above 300 to 1800, depending on the bottom type.

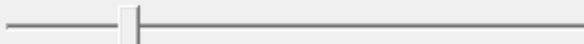
The *Echo Strength* filter by default is set to automatic, whereby the system measures the intensity of the echoes returned from the sea floor +/- 30 degrees from Nadir and compares it to the intensity of the water column noise and weaker echoes surrounding the sea floor estimates. If they differ significantly, then it flags these points as bad. The automatic *Echo Strength* filter has a sensitivity slider to adjust how aggressive or how conservative the filter is. The default value of 1.4 works well under most conditions.

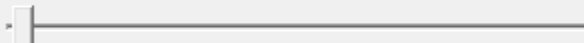
In the case where the automatic setting fails (too many points at nadir and surrounding region are trimmed), then the user can turn off the automatic setting (uncheck the box) and set the parameter manually. The values manually inputted to the system are based on 1/10% of this span, meaning that an echo strength of 3200 is realistically $3200/32767 \times 100\% = 9.80$, and so the value inputted to the system is 10 as shown in **FIGURE 2-30**.



Filters

☐ Automatic Echo Strength Thresholds ☒ Water Column Filter

Automatic Echo Filter Sensitivity: 

Echo Strength Filter (1/10 %): 

SNR Filter (dB): 

Quality Filter (%): 

Figure 2-30: Manual Echo Strength Filter Setting

WATER COLUMN FILTER

The Water Column filter only has an on/off option and by default is active (checked box). This filter uses the bottom tracker to find the depth to the seafloor and then subtracts an offset that is pre-determined by depth to set the filtering range. This offset is larger in deeper water, than it is for shallow.

This filter can potentially be an issue when surveying close to a steep bank, as it may filter out part of a rapidly rising seafloor as shown in **FIGURE 2-31**.

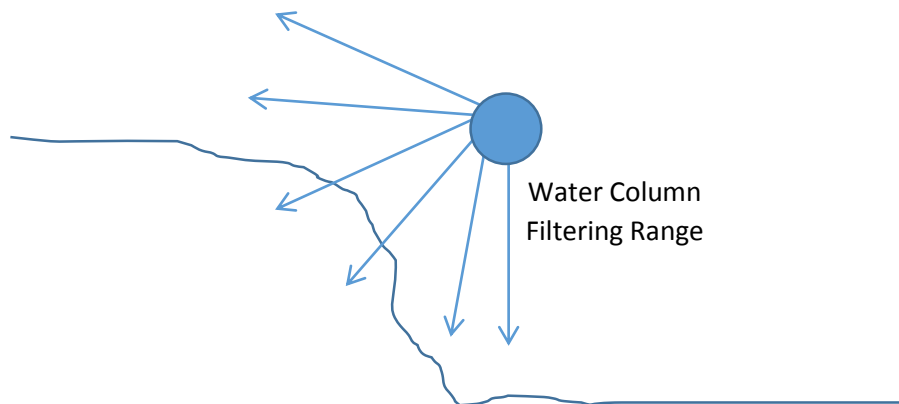


Figure 2-31: Water Column Filtering Range

If this is the case, it is suggested to either turn off the filter by unchecking the box, or deviating away from the bank until this effect is reduced.

SNR FILTER

The *SNR* (or Signal to Noise Ratio) filter is a valuable statistic used to trim bad data points near the outer swath, where the angle noise is high due to multipath effects. *SNR* values greater than 20 dB are excellent in terms of angle estimation noise, and less than 5 dB is very poor. Useful thresholds are between 10 – 20 dB, depending on the desire to have maximum swath (more noise) or lower noise and less swath. Typically this filter is set between 12 and 15 dB.

QUALITY FILTER

In practice, measured interstave phases may either agree quite well ($\pm 5^\circ$ to 10°) or not at all (up to $\pm 90^\circ$). The quality filter metric is a measure of how good the interstave measurements are and is defined as in the list below (i.e., setting the quality factor to 100% will exclude all data points as this is not possible in real scenarios). For most cases any data with a quality factor less than 50% should be discarded. By default, this setting is set to 75%.

- 80% = has a $\pm 20^\circ$ tolerance
- 70% = has a $\pm 30^\circ$ tolerance
- 60% = has a $\pm 40^\circ$ tolerance
- 50% = has a $\pm 50^\circ$ tolerance
- 25% = has a $\pm 90^\circ$ tolerance
- 0% = allows all data points to pass through.

2.3.4.3 Engineering Controls

The *Engineering Controls* disable/enable *Auto Detect Altitude*, adjust the *Multipath Suppression Levels* and the *Maximum Across Track Average Size*, and refine the *Processing Parameters*.

Bathymetric Processing Engineering Parameters

Warning: Changing these parameters will have significant effects on the data. These parameters should not be altered unless the user has a complete understanding of the consequences.

Altitude Determination

☐ Auto Detect Altitude

Manual Altitude:

This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.

Processing Refinements

Bottom Track Data Source:

TVG (dB / 100M):

Max TVG (dB):

Advanced Processing Refinements

Multipath Suppression Level:

Maximum Across Track Average Size (M):

Done

Figure 2-32: Engineering Controls

NOTE: The parameters under the Engineering Controls must not be changed unless it is directed by a member of the EdgeTech customer support staff or expert user.

AUTO DETECT ALTITUDE

The Auto Detect Altitude function tells the **Bathymetric Processor** to use its algorithms to track the bottom. By default, the *Auto Detect Altitude* is on and should not be turned off, unless the bottom tracker fails repeatedly. If the *Auto Detect Altitude* box is unchecked, then the user can input a manual value in which they think the bottom resides (see **FIGURE 2-33**).

Altitude Determination

☐ Auto Detect Altitude

Manual Altitude:

This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.

Figure 2-33: Auto Detect Altitude Disabled

EXAMPLE

See **FIGURE 2-34**. This is a complex environment for the Bathymetric Processor whereby the user is surveying next to a large coral reef. The port array sees the reef bank and the starboard array looks out to an open ocean. The seafloor on the starboard side is also too deep for the sensor and so no acoustic data is received (hence the similar resemblance to water column data).

In such a case, the Bathymetric Processor would consistently fail to determine the altitude and the user would disable the *Auto Detect Altitude*. Then the user would determine the range to the reef bank using the side scan waterfall and input this estimate into the *Manual Altitude* box (**FIGURE 2-35**). For the example below, the user would input 32 m (**FIGURE 2-35**). The **Bathymetric Processor** will then start looking for the bottom around 32m until it locks onto the reef's edge.

The Bathymetric Processor would then use this override to plot the seafloor correctly. The user would then continue to monitor the Bathymetric Processor to ensure it does not fail again. If another failure occurs, the user would adjust the *Manual Altitude* as needed.

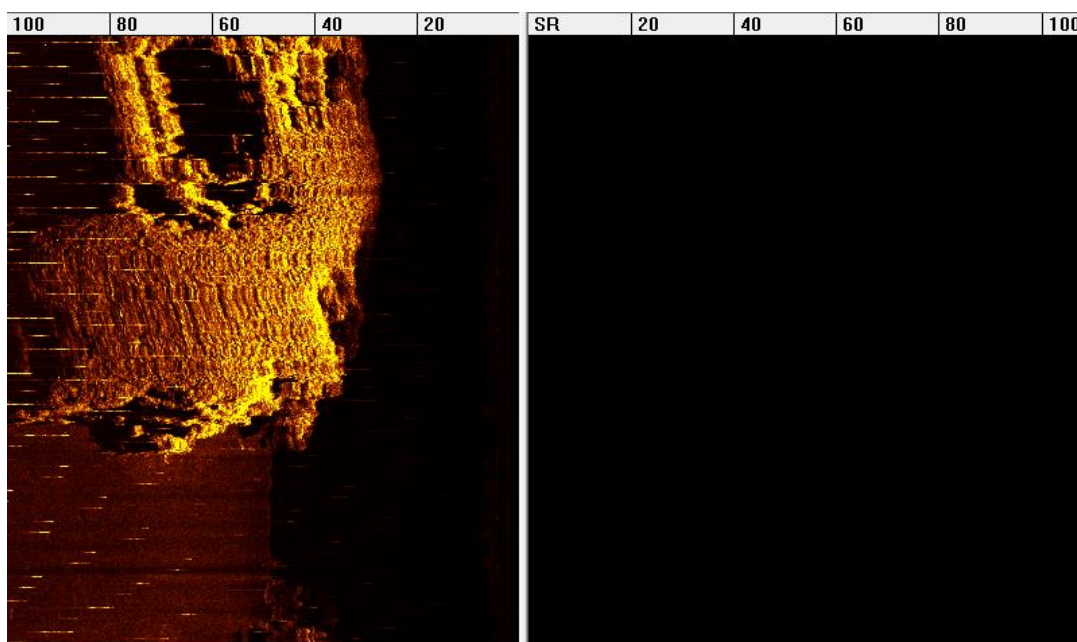


Figure 2-34: Example Extreme Circumstance - Surveying next to a reef bank

Altitude Determination

☐ Auto Detect Altitude

Manual Altitude:

This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.

Figure 2-35: Example Extreme Circumstance - Input Approximate Depth

MULTIPATH SUPPRESSION LEVEL

The multipath suppression level is a parameter that is used to specify how the beam forming is calculated. The data from the 10 half wavelength spaced elements can be combined prior to phase estimation processing to combat the effects of multipath signal propagation.

Seafloor echoes arriving at the array from single or multiple bounces off the seafloor and the sea surface are the primary cause of poor angle estimation and across track range limitations in a shallow water deployed system.

In deep water deployments, as may be seen on ROV or AUV mounted systems; this effect is much reduced, if not eliminated. This parameter can take values between 1 and 3 and increasing this value combines more of the elements to combat the effects of multipath echoes.

- If this is set to 1, then no multipath suppression is applied and all 10 staves are used in the angle estimations. In the absence of multipath errors, this will result in good data.
- If this is set to 2, then adjacent element pairs are combined to help reject weak multipath echoes, resulting in 9 synthesized half wavelength spaced elements.
- If this is set to 3, then 3 adjacent elements are combined to help reject strong multipath echoes, resulting in 8 synthesized half wavelength spaced elements.

In normal shallow water deployed systems, using a value of 3 gives the best result. This parameter is adjusted in [FIGURE 2-36](#). It is not recommended to change this parameter unless it is directed by a member of the EdgeTech customer support staff or expert user.

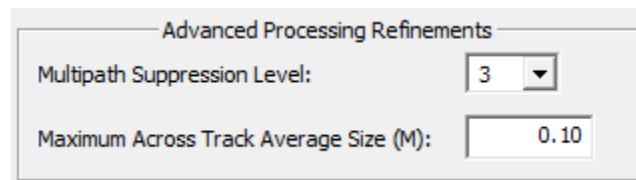


Figure 2-36: Advanced Processing Refinements

MAXIMUM ACROSS TRACK AVERAGE SIZE

In estimating the angles across track, multiple adjacent time samples may be combined to improve the signal to noise ratio prior to phase estimation. This is also a form of spatial averaging, which can be applied to the data prior to the angle estimation processing. This parameter determines the maximum across track region size that is used in forming these averages, and is specified in meters ([FIGURE 2-36](#)).

For output data with very high across track resolution, this value should be kept small, for example 0.05 to 0.5m (5 to 50 cm). For less resolution and more averaging, region sizes up to 1-meter can be used to produce reasonable effects in some cases (deep water).

PROCESSING REFINEMENTS

These parameters are explained in detail in order of appearance:

Figure 2-37: Processing Refinements - Advanced Controls

The default setting for the *Bottom Track Data Source* is *Product*. This means the **Bathymetric Processor** takes the product of the information coming from both arrays to estimate the seafloor depth. This setting seems to work well in most scenarios, especially for heavy boat traffic areas where boat wake is prominent, but two other parameters have been added for those special cases a user may face. These three other settings are *Port* and *Starboard*.

The *Port* and *Starboard* settings state that the **Bathymetric Processor** should use the port or starboard side *only* to compute the seafloor depth. A case where *Port* or *Starboard* may be used is if one of the arrays should fail during a survey (highly unlikely), or the seafloor is beyond the limits of the sonar (as discussed in [FIGURE 2-34](#)). This way the user will still be able to carry out a survey, even though one side of the system does not work, or does not see the seafloor.

TIME VARYING GAIN (TVG)

The TVG option allows the user to apply Time Varying Gain in dB per 100m to the bathymetry solutions. EdgeTech has incorporated this feature to increase the bathymetric range in soft bottom conditions. This parameter can have one of two options: Default and Manual.

The *Default* option adjusts the TVG according to the operating frequency and requires no input from the user. It is 20 dB for a 230 kHz bathymetry system and 50 dB for a 540 kHz system.

The *Manual* option allows the user to input a manual TVG value. This number is specified in the box to the right of the drop down menu. When this option is selected, the user can also specify a maximum TVG value in the **Max TVG (dB)** field (see [FIGURE 2-38](#)).

Figure 2-38: Inputting a Manual TVG

NOTE: If TVG mode is activated, then the Echo Strength Filter in the Advanced Bathymetry Controls can be increased (if auto is not applied) to reduce noise at the extremities of the bathymetry solutions.

2.3.5 Help Menu

The Help menu shows the information pertaining to the particular software version and customer support information.

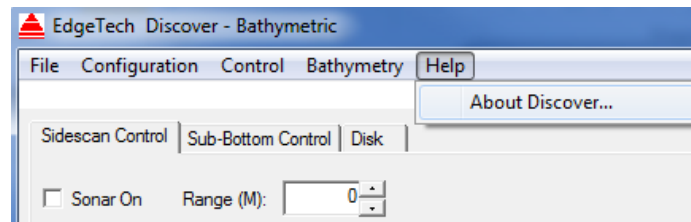


Figure 2-39: Help Menu

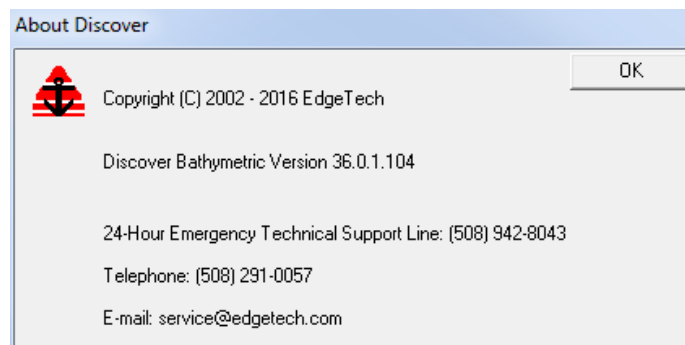


Figure 2-40: About Discover Dialog Box

3.0 BATHYMETRIC PROCESSOR

DISCOVER AUV also has a built in module that is responsible for computing seafloor solutions called the *Bathymetric Processor*. This module displays the number of processed pings, the last altitude found, the sound velocity, and the number of angle sets used in the seafloor calculations (2.1.1).

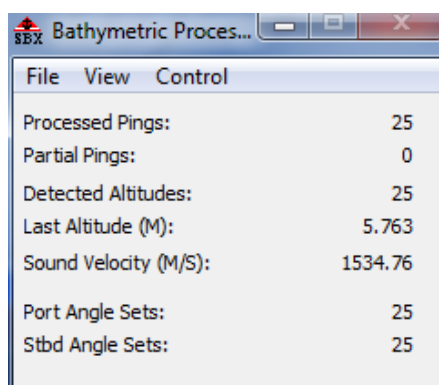


Figure 3-1: Bathymetric Processor Dialog Box

NOTE 1: This module only applies to bathymetric systems, and typically remains minimized unless troubleshooting.

NOTE 2: The Bathymetric Processor will restart if you press the "x" up at the top right corner. In doing so, the Bathymetric Processor will delete all current settings and revert back to its factory default configuration. Please refrain from pressing the "x" on the Bathymetric Processor window.

4.0 AUVCONFIG.INI FILE

The **AUVConfig.ini** file is a simple configuration file that programs certain mission parameters, such as range, ping state, and recording. Typically this file is not used, unless no other method of control exists (i.e., external interface, AUV controller, etc.).

This configuration file only allows certain parameters to be programmed prior to deployment. A more complete list of commands, presented in the **Interface Control Document** (Part Number 0017670), can be used via the external interface.

To use the file, navigate to the DISCOVER AUV root directory, or *C:\EdgeTech\Discover AUV*, and open the **AUVConfig.ini**. The file is displayed in **FIGURE 4-1** below.

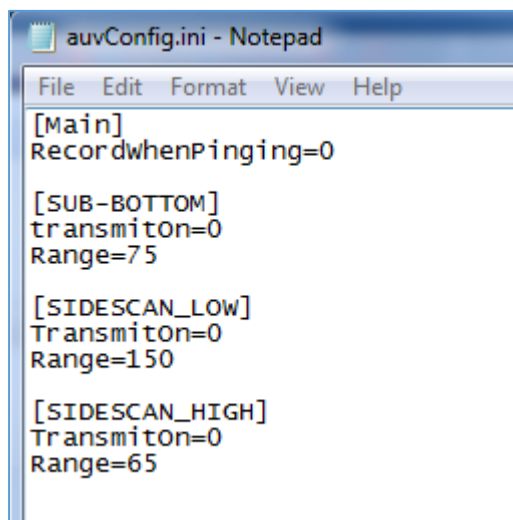


Figure 4-1: AUVConfig.ini File

Here the mission planner can program to record while pinging, set the ping state (on/off) and specify a range for each sonar subsystem. On is equal to a 1, and off is 0. The range is specified in meters. Once the desired parameters are set, save the file and launch DISCOVER AUV. As soon as DISCOVER AUV makes a connection to the SONAR software it begins the mission as programmed by this file.

NOTE 1: If the system is a bathymetry system the basic controls should be checked to ensure the mission parameters are correct, prior to running the **AUVConfig.ini** file.

NOTE 2: This configuration file cannot be changed in the middle of a mission.

5.0 FILE TYPES

This section describes the two different output files DISCOVER AUV can produce. These file types include a diagnostic (unprocessed stave) and a sonar (binned) file.

NOTE: All file types include all of the supporting information necessary to correct the bathymetry (time, position, heading, attitude, sound velocity, and if available, GPS status and geoid height).

5.1 Diagnostic Data File

A diagnostic data file contains all of the unprocessed stave, or individual receiver, data that is used to compute the solutions of the seafloor. This file type does not contain bathymetry and is designated by the keyword “_Stave.” This keyword is appended to the end of every diagnostic file. An example file name used to designate a stave file is 20130829150420_Stave.jsf.

NOTE 1: For legacy systems, a diagnostic file may be designate by the word “Stave” without the underscore.

NOTE 2: Also, sometimes in an AUV case the files downloaded from the vehicle are all stave files and must be post-processed with DISCOVER BATHYMETRIC before any other work can begin. These stave files can be identified if the filename doesn’t contain the word “Stave” or “Binned”.

5.2 Sonar Data File

A sonar data file contains bathymetry (range and angle data) in which the multiphase echo sounder (MPES) data has been binned based on a user defined number of beams (or bins) and total swath. This format closely resembles the output format of a traditional dual headed multibeam.

A sonar data file can be identified by the keyword “_Binned” and is the standard output format of DISCOVER AUV. This keyword is appended to the end of every sonar data file. An example file name used to designate a sonar data file is 20130829150420_Binned.jsf.