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4600 Swath Bathymetry and Side Scan Sonar

Startup Guide

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Warning—Read This First!

All personnel involved with the installation, operation or maintenance of the equipment described in this manual should read and understand the warnings and recommendations provided below.

Static Sensitive Devices

This equipment contains devices that are extremely sensitive to static electrical charges. Therefore extreme care should be taken when handling them as static electricity may be present on the body and clothing. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

Radiation

This equipment generates, uses, and can radiate radio frequency energy. Therefore if the equipment is not installed properly, it may cause interference with radio communications. The equipment has not been tested for compliance with the appropriate FCC rules designed to provide reasonable protection against such interference when operated in a commercial environment. Therefore when operating the equipment in a residential area, the user may be required to take whatever measures are needed and incur any expenses necessary to eliminate interference; it is the user's responsibility to verify that the system complies with the applicable FCC emission limits.

High Voltages

High voltages are present in the sonar head, the power amplifier and the topside processor. Always use caution when removing the electronics from these devices.

Improper Line Voltage

Operation with improper line voltage may cause serious damage to the equipment. Always ensure that the proper line voltage is used.

Foreword

This startup guide is intended to provide the user with an understanding of how to deploy and operate the 4600 System in order to complete a hydrographic survey using EdgeTech's DISCOVER and an approved 3rd Party Acquisition and Post-Processing Software. The approved 3rd Party Topside specific to this startup guide is HYPACK®'s Hydrographic Surveying Software.

EdgeTech assumes the end user has an assembled and tested 4600 System. It is also assumed that the user has a high level knowledge of the specific 3rd Party Topside Software, and if this is not the case, then training is required before proceeding.

The contents encompassed within this STARTUP GUIDE provide a brief overview of the 4600 System and its basic operations. All other information (i.e. Warranty, Complete System Installation, Technical Details, Care and Maintenance, etc.) regarding the 4600 System is described within the 4600 Reference Manual.

Contents

EdgeTech's 4600 Startup Guide

1. Introduction

The complete 4600 Bathymetry and Side Scan Sonar System consists of the 4600 Swath Bathymetry and Side Scan Sonar Head and the 4600 Topside Processing Unit (TPU).

Figure 1: 4600 Topside Processing Unit (Left) and Sonar Head (Right)

EdgeTech's 4600 is a combined, fully integrated swath bathymetry and side scan sonar system that produces real-time high resolution 3D maps of the seafloor while providing co-registered simultaneous side scan and bathymetric data. The 4600 Sonar Head's side scan sonar arrays are mounted on a streamlined body that is deployed over-the-bow of a survey vessel via a pole. Sonar data is transferred from the transceiver to the Topside Processing Unit on board via an Ethernet network interface. A detailed description of the 4600 Sonar Head configuration is presented in the REFERENCE MANUAL and its main components are illustrated in Figure 2.

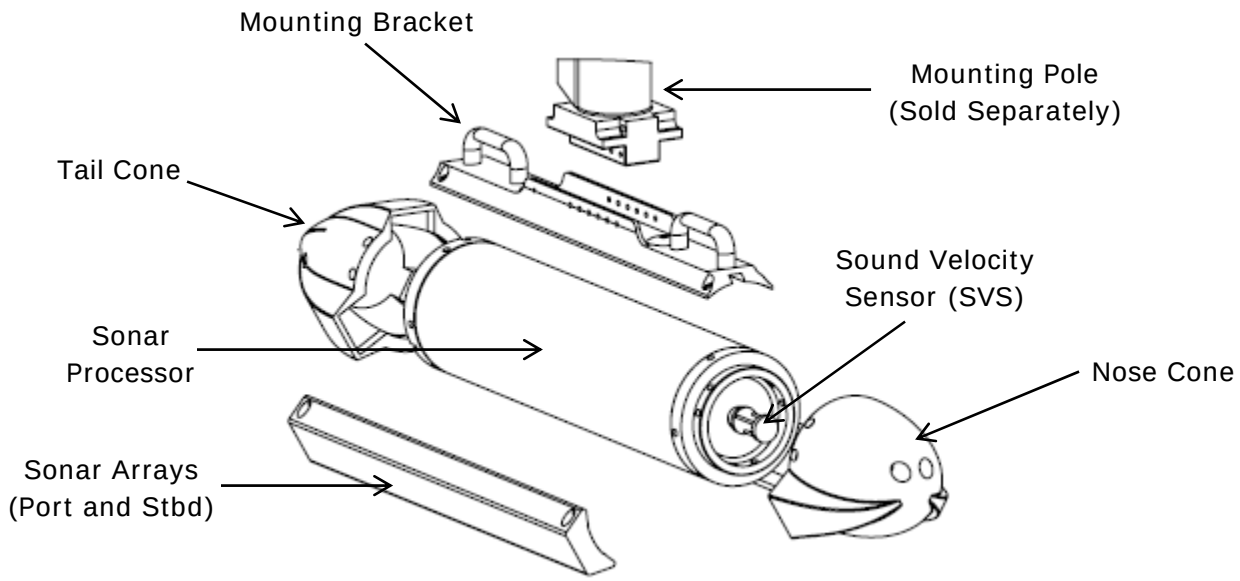


Figure 2: 4600 Sonar Head Components

The 4600 Swath Bathymetry and Side Scan Sonar Head comes standard with a Sonar Processor, Port and Starboard Sonar Arrays, a Sound Velocity Sensor (SVS), a Nose and Tail Cone, and a Mounting Bracket. A Mounting Pole may be purchased separately to secure the 4600 System to a survey vessel.

Note: Please become familiar with these terms in Figure 2, as they will be referenced throughout the rest of this startup guide.

The 4600 Topside Processing Unit includes a 4600 Sonar Interface and a Processor (Figure 3). The 4600 Interface provides power to the Sonar Head and a link between the Sonar Head, any supporting sensors, and the Processor running EdgeTech's DISCOVER 4600 Side Scan and Bathymetry Acquisition software and an approved post processing software.

Note 1: At this point, the only hydrographic surveying and post processing software that has been approved by EdgeTech to interface with the 4600 software is HYPACK®. EdgeTech has worked exclusively with this company to provide a user friendly interface for the 4600 System.

Note 2: The 4600 Topside Processing Unit comes standard with a third party software pre-installed unless the customer has specified otherwise upon time of purchase. Also, installing other software besides the ones supplied with the system can have undesirable

effects, such as poor and/or slow performance when acquiring bathymetry and side scan data, and the possibility of missing and/or incomplete data being acquired.

Figure 3: 4600 Topside Processing Unit

The end user needs only to supply a source of data for position (latitude/longitude) and heading measurements, as well as roll, pitch, and heave data, to complete the acquisition package. Some examples that provide these types of data are presented in Figure 4.

Figure 4: Optional GPS (Left)* and MRU (Right) Sensors**

*GPS provides position (latitude/longitude) and may or may not provide heading.

**MRU provides a source of roll, pitch, and heave measurements.

2. Product Specifications

	230 kHz Model	540 kHz Model
Physicals		
Size	: 1210 L x 260 W x 230 H (mm) 47.64 L x 10.13 W x 9.18 H (in)	1210 L x 260 W x 230 H (mm) 47.64 L x 10.13 W x 9.18 H (in)
Weight	: 44 kg (98 lbs)	44 kg (98 lbs)
Construction	: Aluminum and Polyurethane	Aluminum and Polyurethane
Color	: Yellow and Black	Yellow and Black
Sealing	: Watertight Cover O-ring Seal with Purge Valve	Watertight Cover O-ring Seal with Purge Valve
Side Scan Sonar		
Frequency	: 230 kHz	540 kHz
Range (per Side)	: 225 m (738 ft)	125 m (410 ft)
Range Resolution	: 30 mm (1.18 in)	15 mm (0.6 in)
Beam Width Along Track	: 0.64° (2-way)	0.5° (2-way)
Depression Angle	: 30°	30°
Interferometric Swath Bathymetry		
Maximum Swath	: 350 m	150 m
Range Resolution	: 60 mm (2.36 in)	30 mm (2.36 in)
Ping Repetition Rate	: 25 m (82 ft) = 30 Hz, 50 m (164 ft) = 15 Hz, 100 m (328 ft) = 7.5 Hz	25 m (82 ft) = 60 Hz, 50 m (164 ft) = 30 Hz, 100 m (328 ft) = 15 Hz
Max Depth Below Tx	: 120 m	50 m
Sonar Head Power Requirements		
DC Input	: 48 VDC	48 VDC
Power	: 100 Watts	100 Watts

Environment

Operating Temperature	: 0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)
Storage Temperature	: -20°C to 60°C (-4°F to 140°F)	-20°C to 60°C (-4°F to 140°F)
Relative Humidity	: Operating 0 to 80%, Non-Operating 0 to 100%	Operating 0 to 80%, Non-Operating 0 to 100%

Topside Interface

Interface	: 100 baseT Ethernet Serial RS-232	100 baseT Ethernet Serial RS-232
Power Supply	: 110/220 VAC Auto-Sensing	110/220 VAC Auto-Sensing

Topside Processor

Operating System	: Windows 7	Windows 7
Interface	: 100 baseT Ethernet, Serial RS-232	100 baseT Ethernet Serial RS-232
Display	: Dual 21" LCD Monitors, Expandable to 4	Dual 21" LCD Monitors, Expandable to 4
Storage	: 1TB min Hard Drive & RW-DVD	1TB min Hard Drive & RW-DVD
Power Supply	: 110/220 VAC Auto-Sensing	110/220 VAC Auto-Sensing

Supplied Components

- 4600 Swath Bathymetry and Side Scan Sonar System with 20 m (65 ft) Deck Cable (Please refer to the Cable Drawing in the Appendix).
- Sound Velocity Sensor (SVS, located in the nose section of the Sonar Head)
- 4600 Topside Processing Unit – 4600 Interface and Topside Processor with DISCOVER 4600 Side Scan and Bathymetry Acquisition Software
- Hypack® Survey and Post-Processing Software
- System Restore Software (DVD)
- 2 x HP 21 in LCD Monitors
- HP Keyboard and Mouse
- 2 x Power Cables
- Spares Kit
- Manuals on CD

Optional Equipment

- 4600 Mounting Pole (see drawing in Figure 5 on Page 8)
- Crescent VS100 Series Hemisphere GPS (Figure 4, Page 3)
- SMC IMU Sensor (Figure 4, Page 3)
- HP 25 in LCD Monitor
- Samsung 25 in LCD Monitor

Optional Mounting Pole Example:

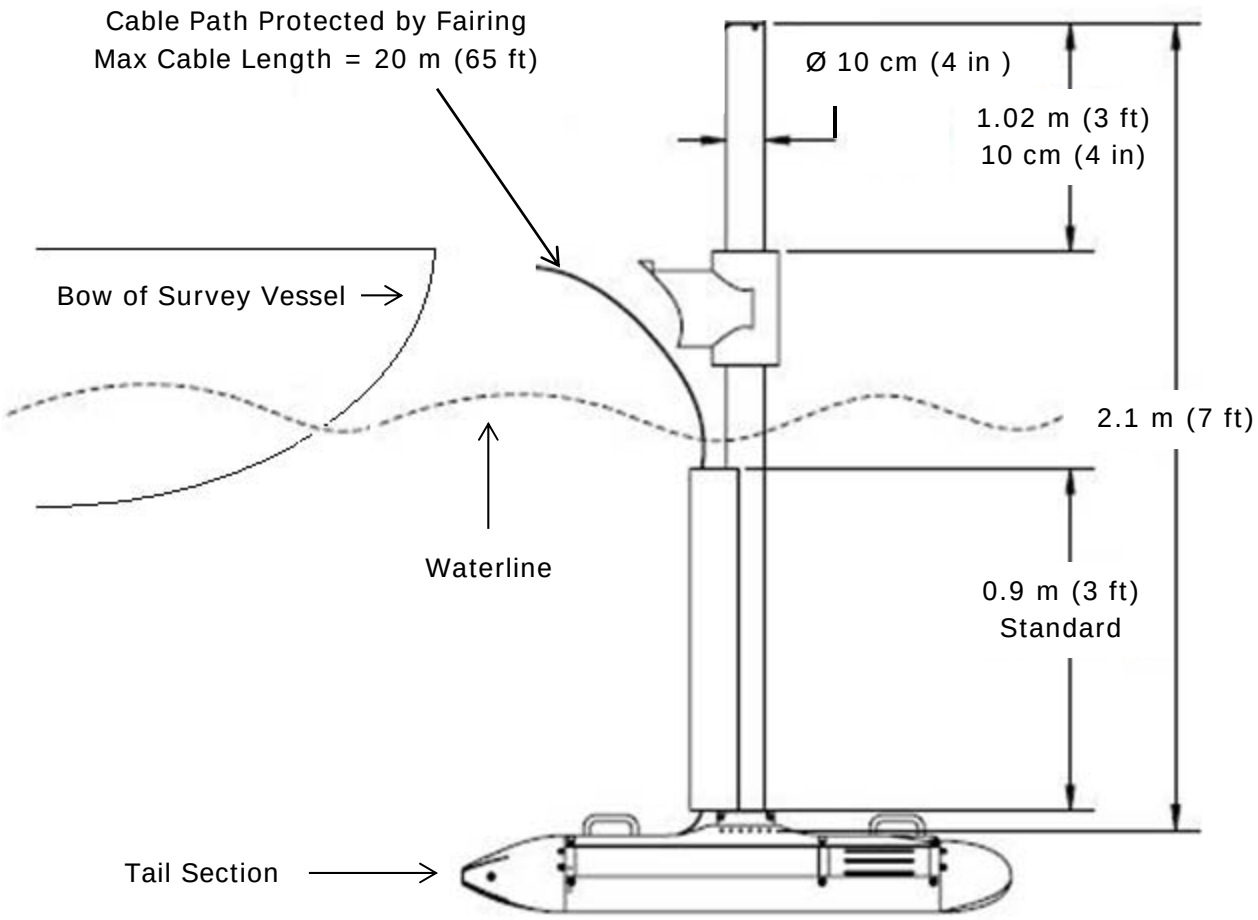


Figure 5: Mounting Pole Concept Drawing

3. Overview

3.1 Data Formats

In order to collect valid survey data, the following is required to support the survey operations and correct processing of the 4600 Bathymetry and Side Scan echo data:

a. GPS Position in NMEA format, latitude and longitude,
b. Heading data in NMEA format or EM1000 binary format,
c. Roll, Pitch and Heave data in TSS1 or EM1000 binary format, and
d. Time sync data in NMEA format.

This data may be supplied by 1, 2, or 3 individual sources.

a. Position Data – this may be supplied via any of the following NMEA type sentences/messages:
    i. $xxGGK ** (Applanix PosMV Format)
    ii. $xxGGA
    iii. $xxGLL
    iv. $xxRMC
    v. $PTNL, GGK, … ** (Trimble Format)

    ** = Non-NMEA standard sentences

b. Heading Data – this maybe input via:
    i. NMEA, $xxHDT sentence, or
    ii. EM1000 binary format along with attitude data

c. Roll, Pitch, and Heave Data – this may be input via:
    i. EM1000 binary format, or
    ii. TSS1 format

d. Time Input - supported sentences are in order of (priority/use)
    i. $xxZDA
    ii. $xxGGK (derived from data in item *a.* above)
    iii. $xxGGA
    iv. $xxRMC
    v. $xxGLL

At minimum, items *a.*, *b.*, and *c.* above are required and must be supplied.

The rest of this section presents an overview of the systems connections, data flow, and installation considerations for the 4600 System.

3.2 System Connections and Data Flow

3.2.1 Ethernet LAN Connections

The Ethernet LAN connection from the Sonar Head to the 4600 Topside Interface is made using a physical wired connection via the standard 15 m deck cable. This cable is fixed to the Sonar Head and provides a 20 pin Amphenol Industrial connector for direct connection from the Sonar Head to the 4600 Sonar Interface. The 4600 Sonar Interface then connects to the Topside Processor via a standard RJ-45 Ethernet plug. The Topside Processor auto-senses straight and crossover Ethernet cables.

3.2.2 COM Ports

There are three COM ports provided on the 4600 Sonar Interface. COM1 and COM2 have been configured for high speed and high accuracy (10Mbps). COM3 is configured for standard connections. These COM ports are provided to intake the navigation, heading, roll, pitch, and heave data from the supporting sensors.

3.2.3 Hardware Connections

The following is a block diagram that illustrates the interconnections between the 4600 Swath Bathymetry and Side Scan Sonar Head, the 4600 Topside System, and all supporting sensors.

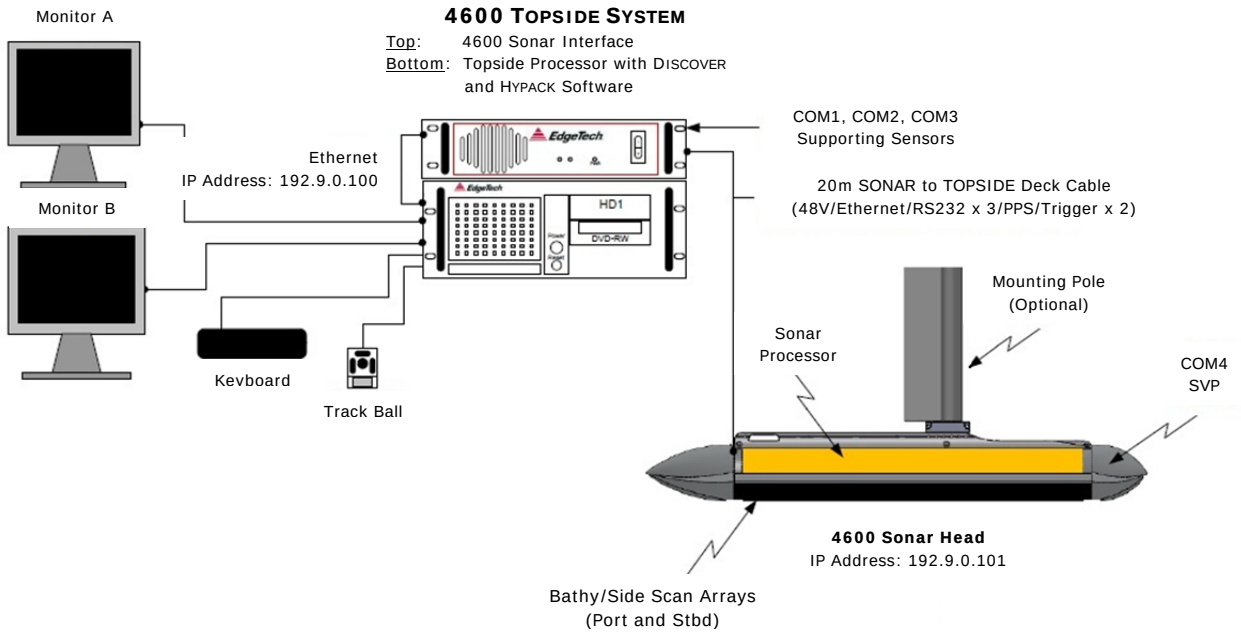


Figure 6: Hardware Data Flow Diagram for the 4600 System

A larger representation of Figure 6 is provided in the *Appendix*.

A more detailed block diagram demonstrating the interconnections and inputs to the 4600 Sonar Interface (Top section of the 4600 Topside Processing Unit) is shown in Figure 7. This illustration also gives three examples of possible sensor configurations.

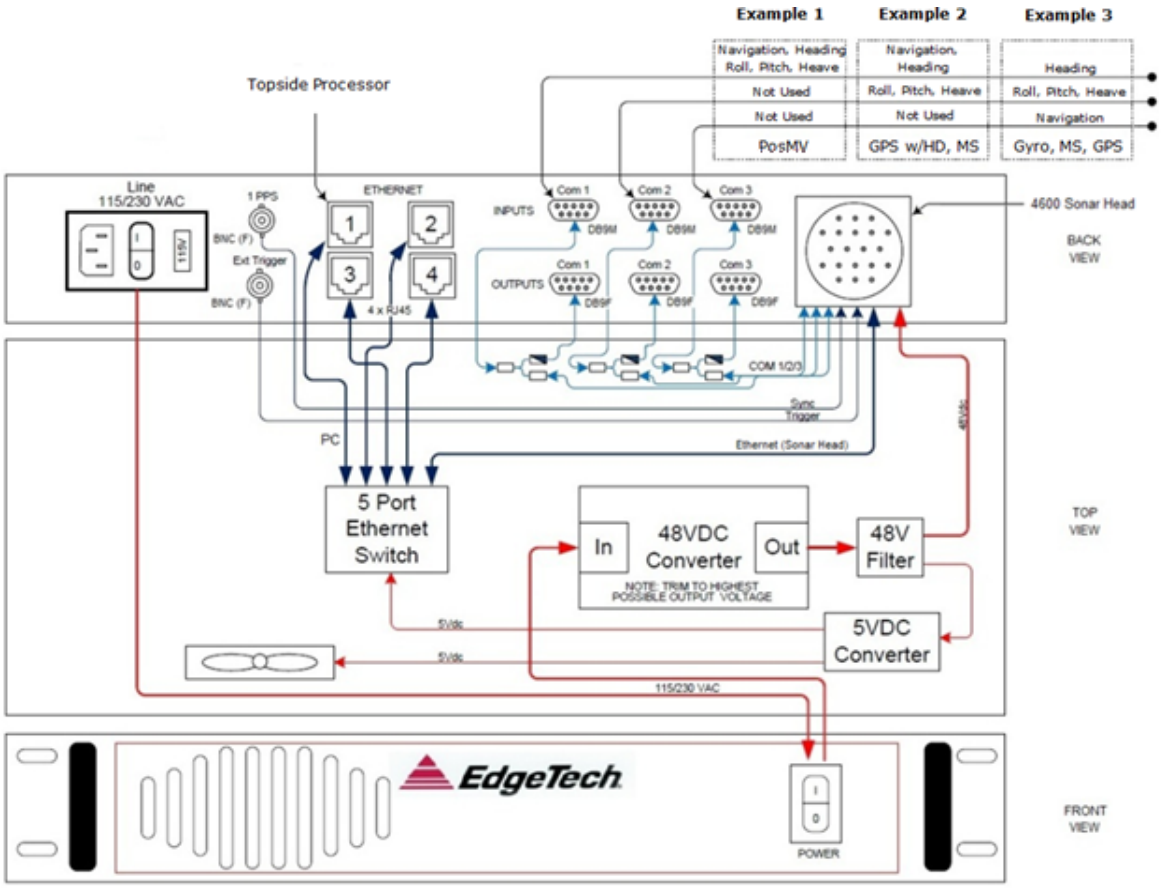


Figure 7: Sonar Interface Connections

Here, the 4600 Sonar Interface connects to the Sonar Head via the 20 pin Amphenol connector and Deck Cable. Navigation, heading, roll, pitch, and heave data from the supporting sensors via COM ports 1, 2, and/or 3, are inputted at the Sonar Interface, passed through the Deck Cable, and logged by the Sonar Processor in the Sonar Head. These data are then transmitted, along with the raw side scan data, with a common timestamp up the deck cable to the 4600 Sonar Interface, and passed to the Topside Processor via Ethernet Port 1 (IP Address: 192.9.0.100) via the Deck Cable. The Topside Processor then processes these data using the DISCOVER and BATHYMETRY software to send amplitude, angle and range data to the HYPACK® software for logging and post processing. This process is explained in further details in the following section. The HYPACK® and DISCOVER Side Scan/Bathymetry processors all run on the same computer.

The first example depicts an Applanix PosMV system interfacing to the 4600 Sonar Interface. This type of system provides navigation (latitude/longitude), heading, roll,

pitch, and heave data and so no other sensor is required. The PosMV should be connected to COM1 or COM2.

The second example shows the most common interfacing scenario, a GPS that provides navigation and heading data, accompanied by a motion sensor for attitude measurements. The COM ports should be assigned as such:

COM1 = GPS (Navigation and Heading)
COM2 = MRU (Roll, Pitch, Heave)

These assignments may be interchanged between COM1 and COM2 because both ports have been configured for high speed and high accuracy.

The third and last example portrays the situation where the supplied GPS does not provide heading data. In this case, three sensors are required – a GPS for navigation (latitude/longitude), a Gyro for heading, and a motion sensor for roll, pitch, and heave measurements. Therefore, all three COM ports should be used and assigned as follows:

COM1 = Gyro (Heading)
COM2 = MRU (Roll, Pitch, Heave)
COM3 = GPS (latitude/longitude)

The sensors allocated to COM1 and COM2 may be interchanged because of the same reason stated above in the second example. The GPS data, or latitude and longitude data, must be allotted to COM3 because it is not as important as the first two measurements.

3.2.4 Sonar Data Flow

To illustrate the data flow between DISCOVER, the BATHYMETRY PROCESSOR, and HYPACK®, the following block diagram is used.

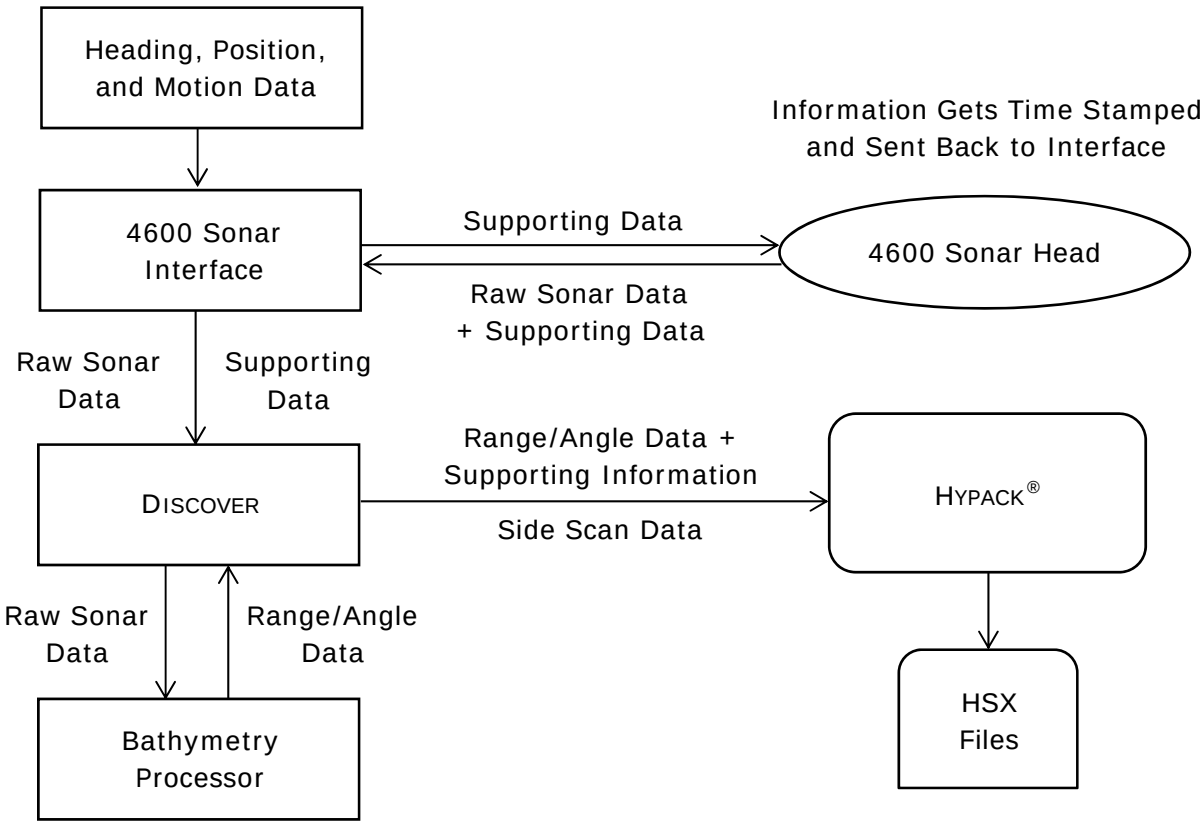


Figure 8: Sonar Data Flow

As demonstrated by the flow chart, the 4600 Sonar Interface acquires the heading, position (latitude/longitude), and motion (roll, pitch, and heave) data and relays this information to the 4600 Sonar Head via the Deck Cable. Here, the information is combined with the raw sonar data, time stamped with a common value, and sent back to the 4600 Sonar Interface. DISCOVER intakes the raw sonar data and sends it to the BATHYMETRY PROCESSOR, where the raw data is converted to range and angle data. The BATHYMETRY PROCESSOR transmits this range/angle data back to DISCOVER, where it is then displayed on the monitor, recorded as a *.JSF file, and packaged with the heading, position, motion, and side scan data. This complete data package is then sent to and used by HYPACK to generate three-dimensional bathymetry data files and to display side scan and bathymetry data on a monitor. Finally, these

three-dimensional bathymetry data files (.HSX) can be used post survey to generate hydrographic final products.

3.3 System Installation

The 4600 System's installation on the survey vessel is the customer's responsibility, and certain considerations need to be kept in mind. The Sonar Head can be mounted on the side of a vessel, but it is recommended to secure the 4600 to the bow of the boat. Consideration must be given to keel clearance for both cases. This section outlines the 4600 Sonar Head deployment options.

Note: If interested in purchasing the optional mounting pole for the 4600 installation, please contact Customer Service for a quotation using the information provided on page 46.

3.3.1 Over-the-Bow Deployment

The first and recommended option is to mount the 4600 Sonar Head to the bow of the survey vessel. An example of an over-the-bow deployment is depicted in the photographs in Figure 9. A larger representation of these photographs is given in the *Appendix*. If help is needed with this type of installation, please do not hesitate to contact EdgeTech using the information provided in the *Customer Service Section* on page 46 of this manual.

Figure 9: 4600 Deployment, Option 1: Over-the-Bow

3.3.2 Over-the-Side Deployment

An alternative to the latter is to mount the 4600 Sonar Head over the side of the survey vessel. An example of an over-the-side deployment is illustrated in the images in Figure 10. A larger representation of these photographs is given in the *Appendix*. If help is needed with this type of installation, please do not hesitate to contact EdgeTech using the information in the *Customer Service Section* on page 46 of this manual.

Figure 10: 4600 Deployment, Option 2: Over-the-Side

4. Principles of Operations

4.1 Sensor Installation

This section outlines the steps taken to install the 4600 Sonar Head and supporting sensors used to collect navigation, heading, roll, pitch, and heave data.

1. Mount the 4600 Swath Bathymetry and Side Scan Sonar System to the hull of the survey vessel. Please read the deployment configurations in *Section 3.2* on page 15 and 16 for Sonar Head installation.

2. Position and secure a motion sensor to the vessel. Two positions for this are considered.
   a. *Position 1*: Mount the motion reference unit (MRU) at the vessel's center of motion. This method requires a very stiff mounting of the Sonar Head to the boat. Any angular displacements between the sensor and the Sonar Head, induced as a result of roll/pitch motion and pole/mount bending, will be transferred to the final dataset. This method subjects the MRU to the least amount of lateral accelerations during vessel roll/pitch. Lever arm corrections for heave displacements must be applied. (Recommended)
   b. *Position 2*: An alternative method is to attach the MRU to the top of the Sonar Head's mounting pole. In this case, the pole mount to the vessel needs to be stiff only in the yaw place, so that the vessel heading is still accurately coupled to the Sonar Head heading. This method is best if the pole/boat coupling is not ideal. Lever arm corrections for heave displacements are not required. However, long term roll angles changes (due to crew movement, etc.) are not corrected for.

3. Measure the depth of the Sonar Head and its location relative to the MRU sensor. If the MRU was attached to the Sonar Head's mounting pole, measure the relative location of the MRU sensor to the vessel's center of motion. Record these measurements as they will be used later as **Offsets** in HYPACK.

4. Setup the GPS as described in the GPS' user manual.

5. Connect the Sonar Head to the 4600 Topside Interface via the 20 pin Amphenol Industrial connector.

6. Connect the GPS to COM1 and the MRU to COM2 (assuming the GPS provides heading as well as position in latitude and longitude).

   Note: An alternative configuration might require a third sensor, such as a Gyro for heading data. In this case, the Serial port assignments should be Gyro = COM1, MRU = COM2, and GPS Position = COM3. Refer to *Section 3.2.3* for more details.

7. Ensure the Ethernet from Port1 of the 4600 Topside Interface is plugged into the Ethernet Port1 of the Topside Processor (labeled SONAR).

8. Turn the Sonar Head ON by using the switch on the front side of the 4600 Topside Interface.

9. Wait several minutes. This waiting period allows the Sonar Head's processing unit to connect with the Topside Processor.

4.2 Confirming Supporting Data is Present

To ensure the Sonar Head's processing unit is communicating properly with the Topside Processor, follow these steps.

1. On the Desktop, launch **Shortcut to sonar.exe**. The following window should appear.

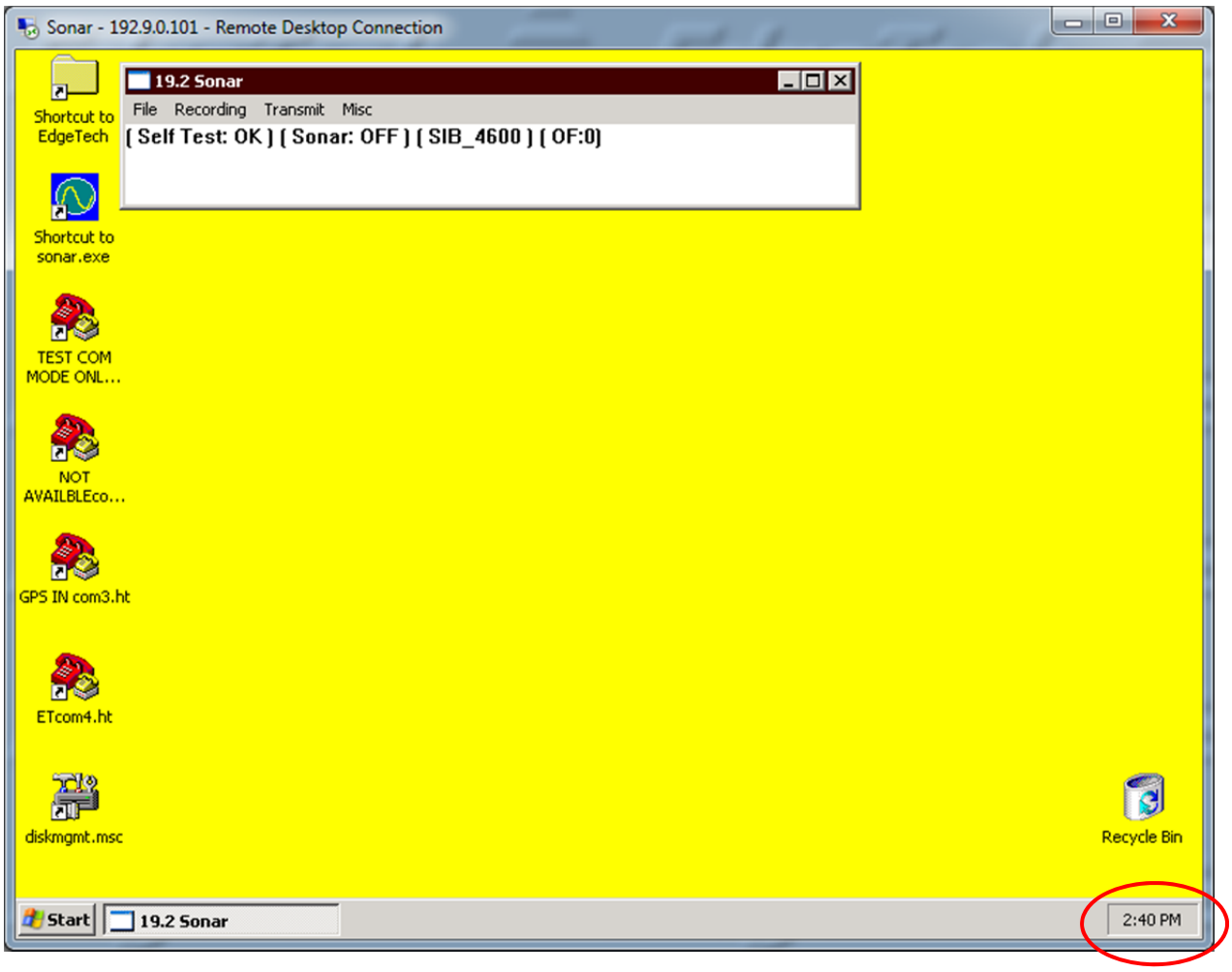


Figure 11: Sonar 192.9.0.101 Remote Desktop Connection Window

2. Check the clock time of the sonar (bottom right hand corner of Figure 11) with the clock time from the GPS and the Topside Processor. Ensure all three have the same time stamp.

3. Click on Menu > **Misc** > **Serial Port Information…**

4. Check each COM port in the drop down menu to ensure data is coming through for each device and in the correct format (Figure 12).
   a. COM1 = MRU
   a. COM2 = GPS
   b. COM4 = Sound Velocity Sensor in the nose of the Sonar Head

   Note: The GPS and MRU are interchangeable on COM1 and COM2 as long as the appropriate baud rate is set in the drop down menu next to the channel assignment in the Serial Port Information Window (Figure 12, red arrow).

   If all systems are working properly, close this window and proceed to Step 5. If there is an issue with one of the ports, please contact *Customer Service* using the provided information on page 46.

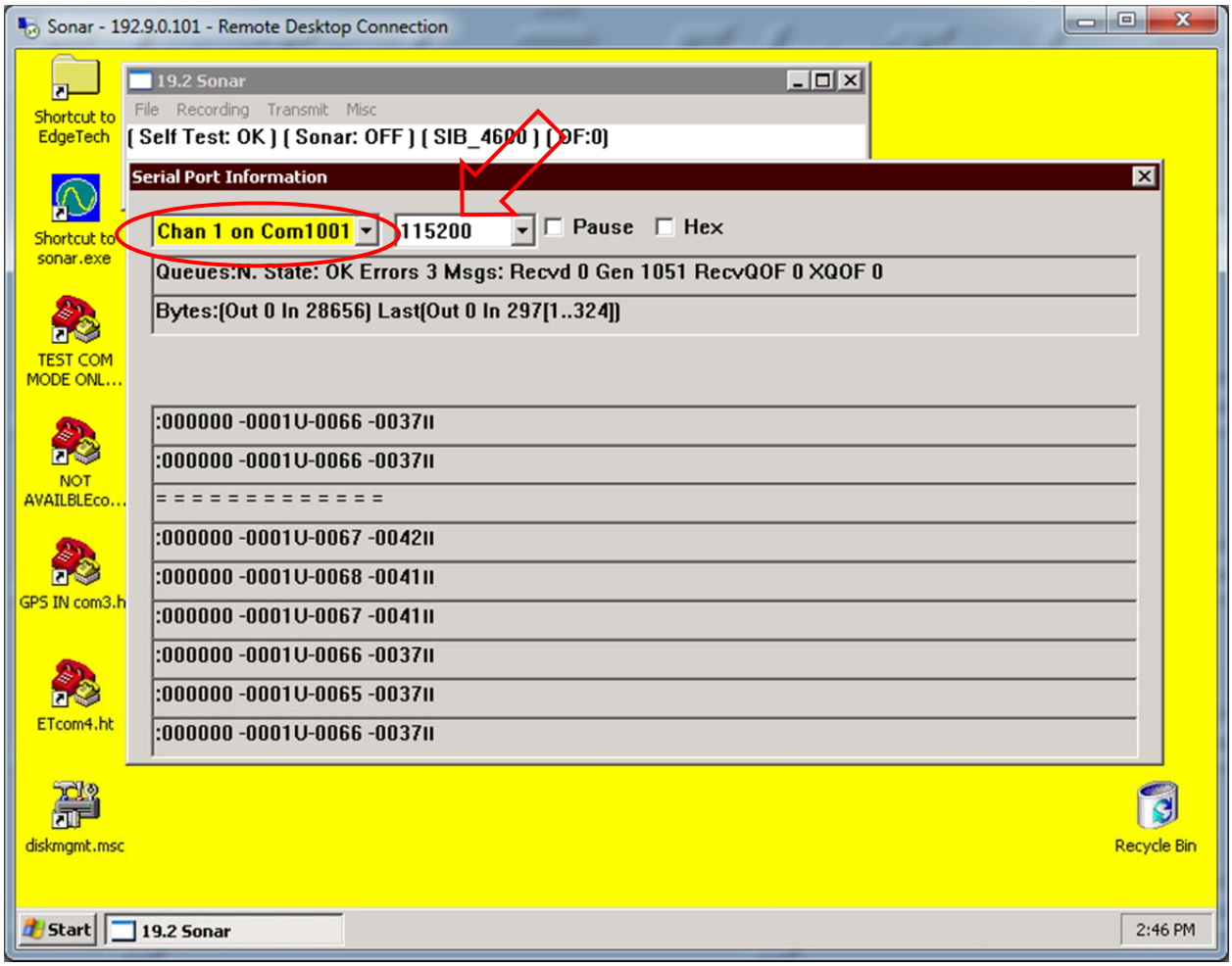


Figure 12: Serial Port Information Window

5. Now click on Menu > **File** > **Show Status**. The *System Status* window will appear as shown in Figure 13.

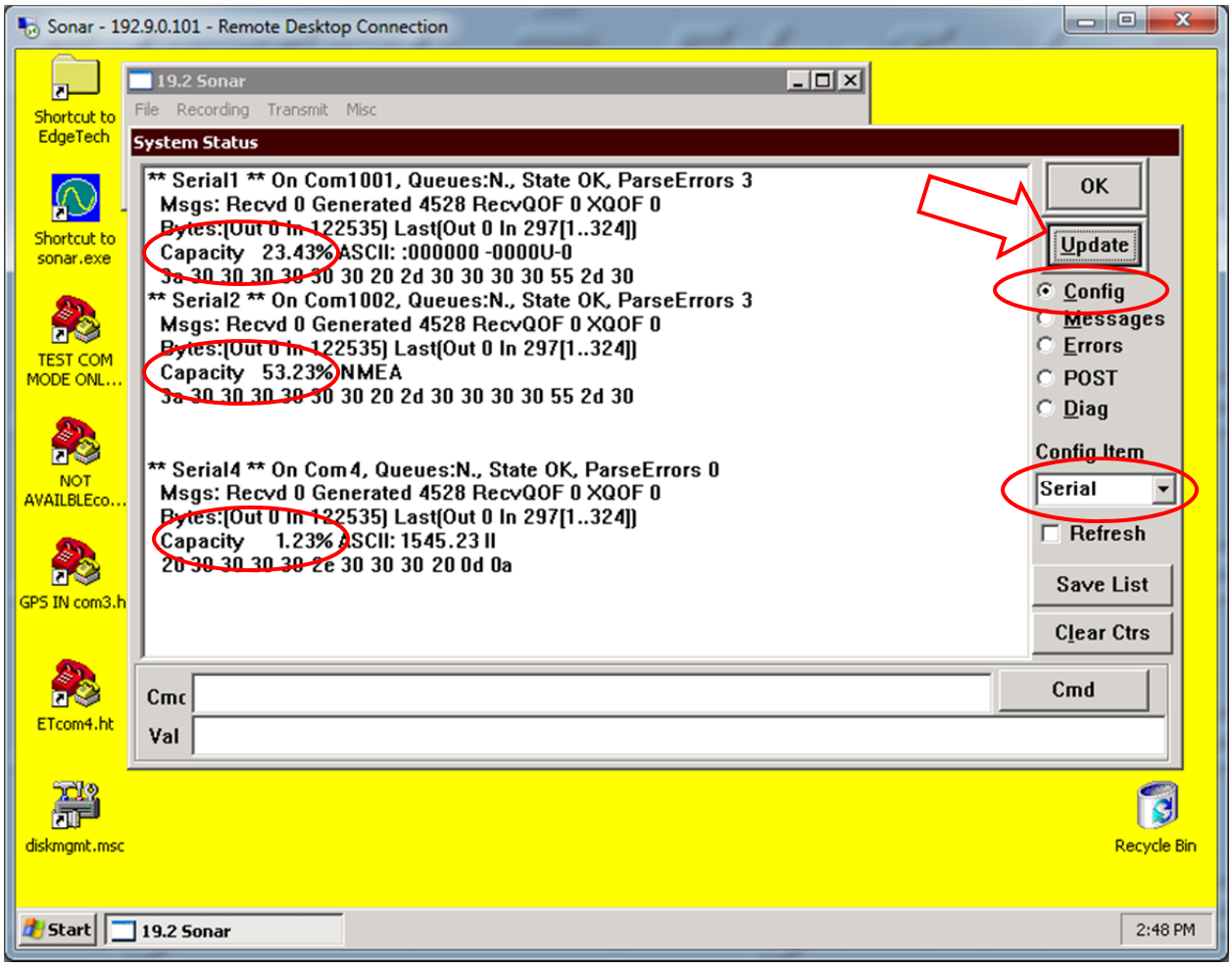


Figure 13: System Status Window

6. On the right hand side of the window, click on the **Config** bullet under the **Update** button and then on the drop down menu named **Config Item**.

7. Select **Serial** and then click the **Update** button several times.

8. Check to make sure all sensors' usage percentages are well below 80%. If they are not; increase the baud rates of the sensors until these percentages drop.

9. When satisfied with the incoming data, press OK in the *System Status* window, and then minimize the **Sonar – 192.9.0.101 – Remote Desktop Connection** window.

4.3 DISCOVER 4600 AND THE BATHYMETRIC PROCESSOR

EdgeTech's DISCOVER display and control application allows recording of side scan and range/angle bathymetry data in the binary EdgeTech JSF file format. The JSF file format has been in use for 10+ years and has new public extensions to support the additional bathymetry data messages. This section states the basic functions of DISCOVER and the BATHYMETRIC PROCESSOR and how to operate them during a survey. A full description of DISCOVER is given in the 4600 REFERENCE MANUAL. If you are not familiar with previous versions of DISCOVER, please read *Section 5.2* of the REFERENCE MANUAL before continuing.

1. Launch DISCOVER 4600 using the Desktop shortcut. The two main windows will appear as in Figure 14 and Figure 15.

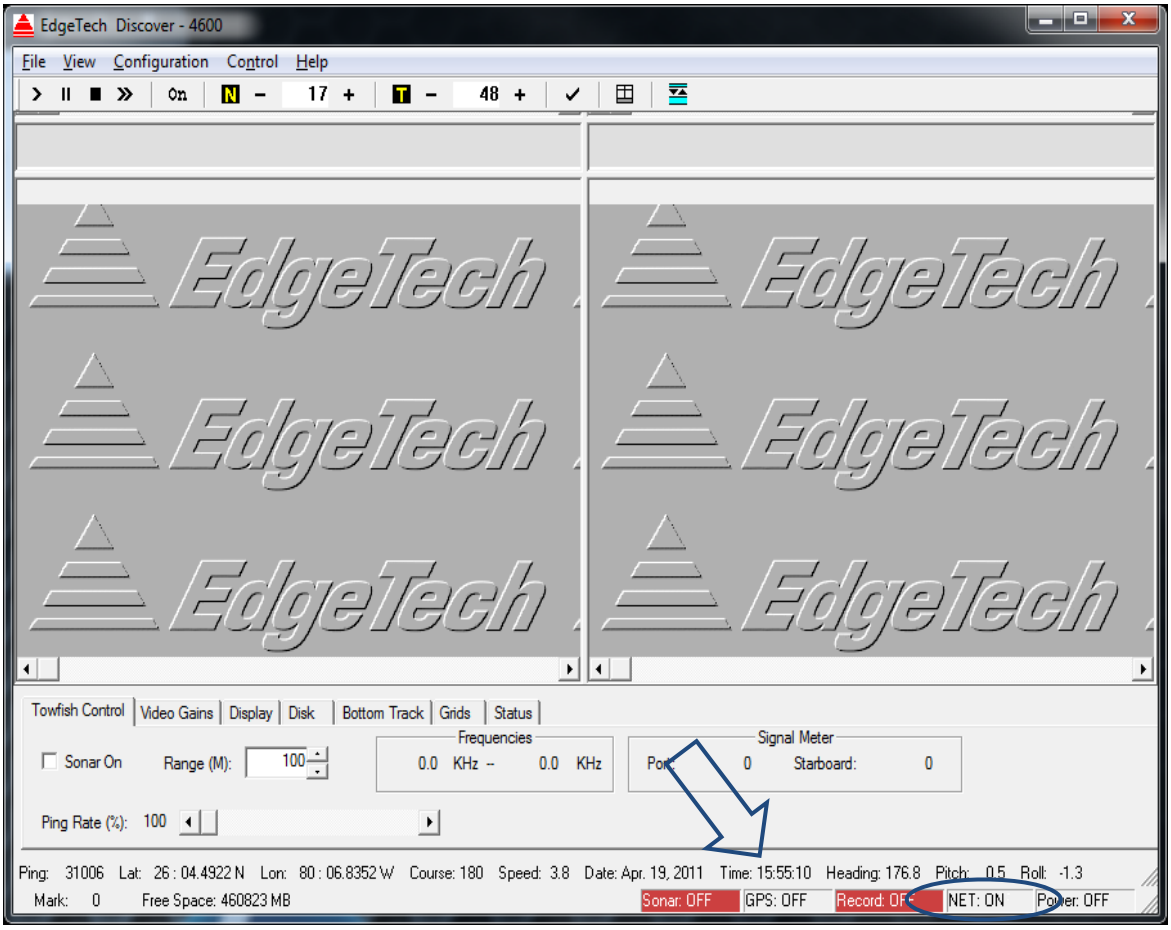


Figure 14: DISCOVER Main Window

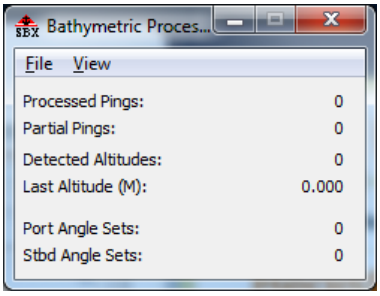


Figure 15: BATHYMETRIC PROCESSOR Main Window

2. Ensure that the Sonar Head is connected to DISCOVER by ensuring the network is on (**NET: ON**) down in the right hand corner of the DISCOVER main window (Figure 14, circled in blue).

3. Check the clock time in DISCOVER and ensure it corresponds to the sonar, GPS, and Topside Processor's clocks. This is done by looking at the time stamp listed next to the word **Time:** (Figure 14, arrow indicator in blue).

4. Navigate to the *Towfish Control* Tab and check the **Sonar On** box to turn **ON** the Sonar Head.

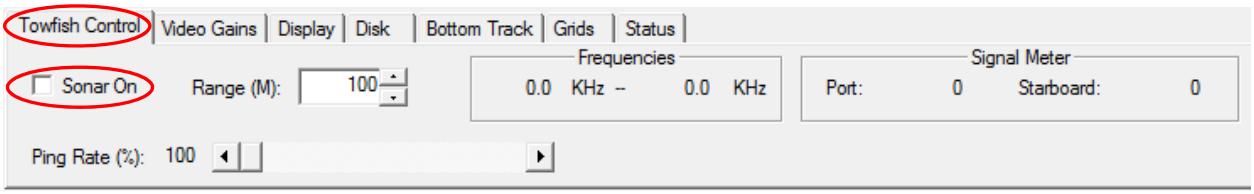


Figure 16: Towfish Control Tab - Turning the Sonar On

Note: If at any time, one or more of the systems (i.e. GPS, MRU, Sonar Head) have been disconnected or are not sending data to DISCOVER while the Sonar Head is turned on, a window (Figure 17) will appear displaying the unavailable system(s).

If this window appears, check the connection to the unavailable system(s). If the problem persists, please call Customer Service using the information provided on page 46.

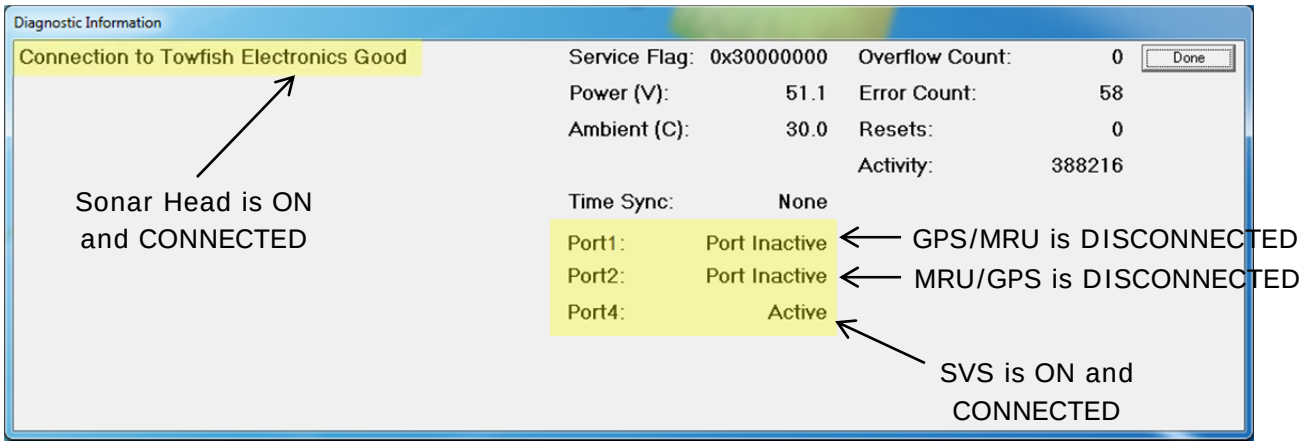


Figure 17: Diagnostic Information Window

5. Ensure the correct supporting information is being inputted to the system on the appropriate COM ports by choosing *View* > *Situation Status* on the Bathymetric Processor main window (Figure 18 and Figure 19).

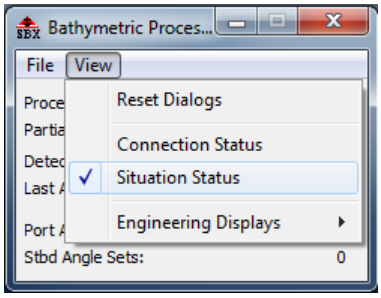


Figure 18: Selecting the Appropriate Ports

The choices available are OFF, ANY, COM1, COM2, etc. Ensure the correct strings (i.e. GGA, HDT, VTG, etc.) are set to ANY or set to their corresponding COM port. If only one source of each piece of information is provided to the system, the *Situation Status* window may look like the one presented in Figure 19. Also, the processed or not processed pitch/roll data is presented in this window as well.

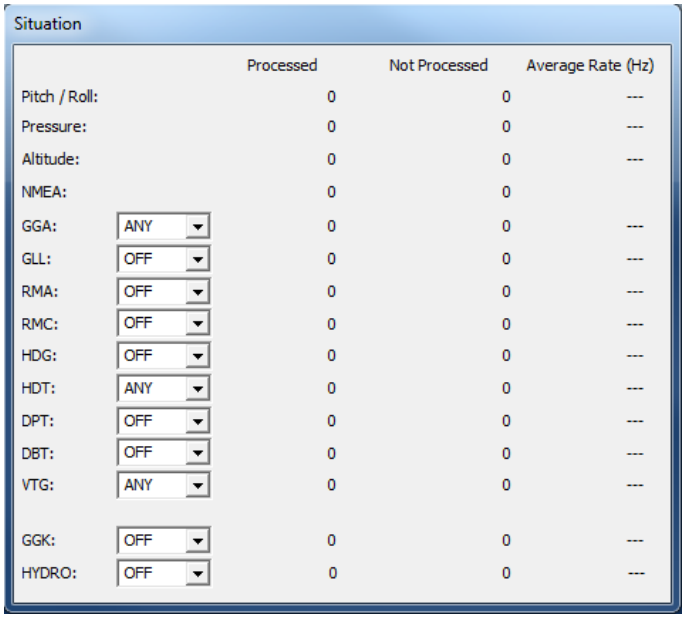


Figure 19: Situation Status Window

6. To set up a recording directory, navigate to the *Disk* Tab and click **Browse** next to the **Record File** box. Usually the recording directory is located on the F:\Data Disk.

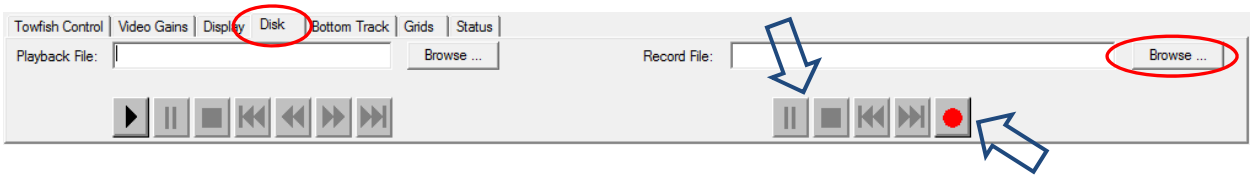


Figure 20: Disk Tab in DISCOVER - Record

7. When ready, press the **Record** button on the right hand side of the *Disk* Tab. The name of the file will appear in the **Record File:** text box. To stop or pause a file, select the appropriate function button.

   Note: If a file is recorded in DISCOVER while data is being recorded in HYPACK, the file can be re-processed for bathymetric estimation using different parameters post-survey. This recorded DISCOVER file provides useful for debugging and training purposes.

7. For basic playback, navigate to the *Disk* Tab (Figure 21) and select **Browse** next to the **Playback File:** box. Locate the desired JSF file and use the function buttons to play, stop, fast forward, etc. (boxed in green).

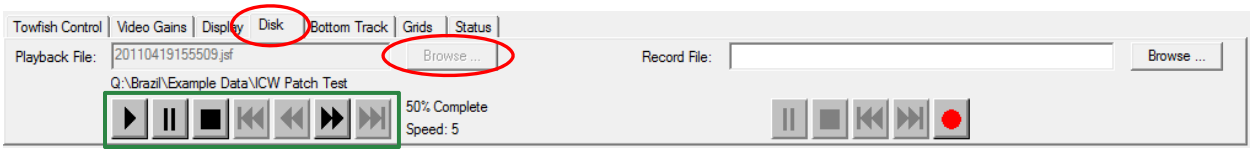


Figure 21: Disk Tab in DISCOVER - Playback

8. To adjust the basic bathymetric processing parameters in DISCOVER, select **Bathymetry** from the *Top Menu* and then **Processing Parameters** (Figure 22 and Figure 23).

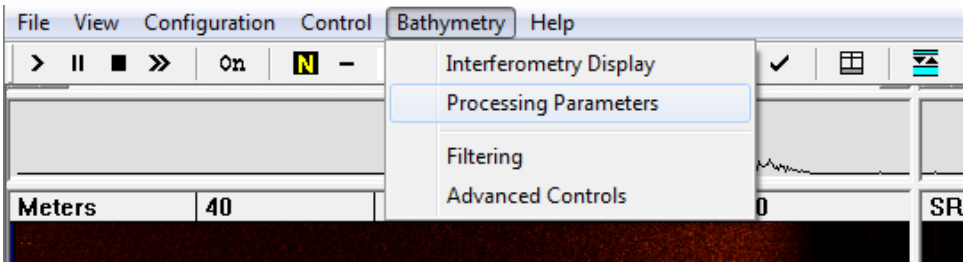


Figure 22: Discover 4600 Top Menu - Selecting Bathymetric Processing Parameters

Here you can turn on/off the BATHYMETRIC PROCESSOR, adjust the echo strength (1/10%), SNR filter (dB), and Minimum Process Range (m). This window also allows you to specify if you would like to use/not use the external limits given by the 3rd Party Interface. The recommended parameters are shown in Figure 23 for a silty/sand type seafloor.

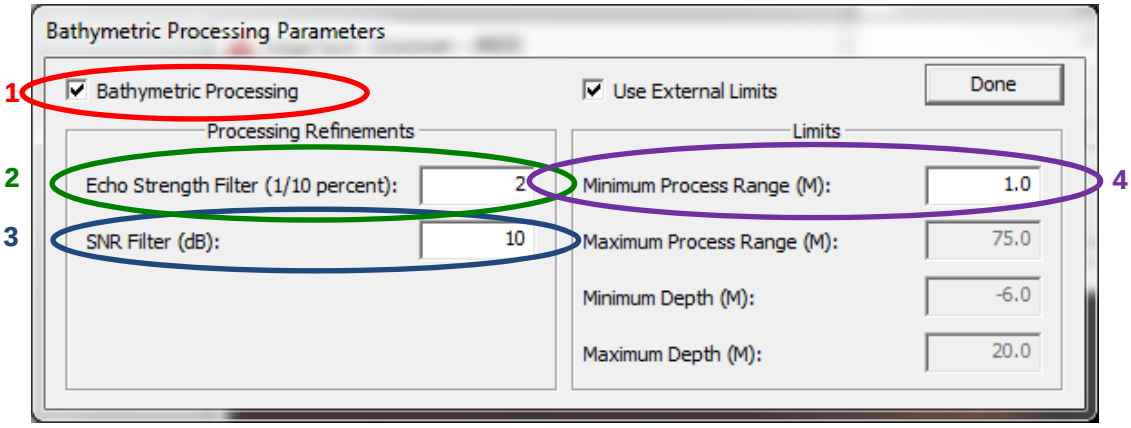


Figure 23: Basic Bathymetry

Note 1: Ensure the *Bathymetric Processing* box is checked while recording a file, otherwise no bathymetry data will be processed or sent to Hypack.

For a full description of all the functions in DISCOVER and the BATHYMETRIC PROCESSOR please refer to *Section 5.2* in the 4600 REFERENCE MANUAL.

4.4 Operating HYPACK®

The processed bathymetry and side scan data is sent in real-time to the HYPACK®/HYSWEEP® survey applications. These application display and record the bathymetric data in HYPACK's HSX format. These HSX files can then be used off line in the MBMAX, SIDE SCAN MOSAIC, and other proprietary packages that support these formats, to edit, clean, and mosaic the collected data. This segment briefly explains how to use HYPACK® in order to complete a hydrographic survey. For more information on how to use HYPACK with the EdgeTech 4600 System, please refer to the EDGETECH 4600 HYPACK SOFTWARE GUIDE.

Note: This section assumes the end user has a high level knowledge of HYPACK. If not, it is the sole responsibility of the customer to acquire training/support from HYPACK.

1. Place the white HYPACK Dongle in the front USB port of the 4600 Topside Processor in order to activate the HYPACK License.

2. Launch HYPACK and copy the EdgeTech4600 Project. This will copy all the necessary files in order to complete a survey with the 4600 system (Figure 24).

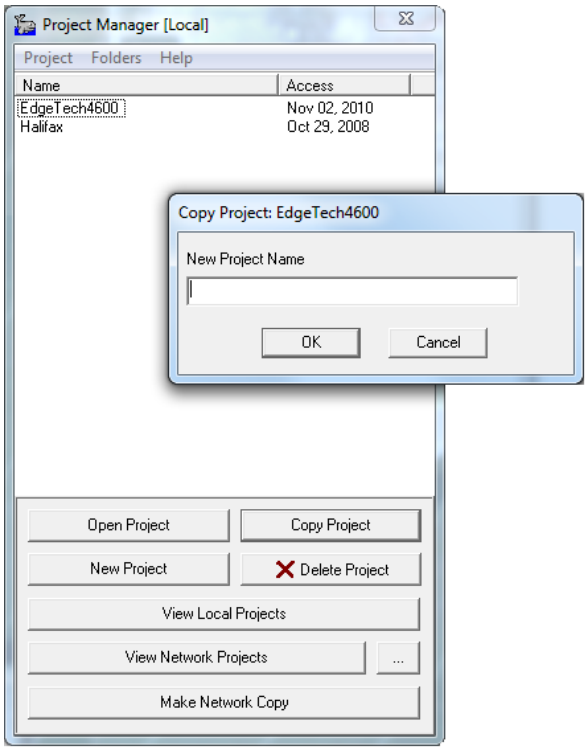


Figure 24: Copy Project Window

3. Give the copied project a relevant name, such as the area to be surveyed and the date (i.e. Port Everglades 10-28-2010).
4. Now, configure the Geodetic Parameters for the survey area.
    a. Select **Preparation** from the top menu in the HYPACK Shell (Figure 26, circled in red) and click on **Geodesy**. This same window may be reached by choosing the Geodesy shortcut from the shortcut menu (designated by red arrow in Figure 26). The following window should appear:

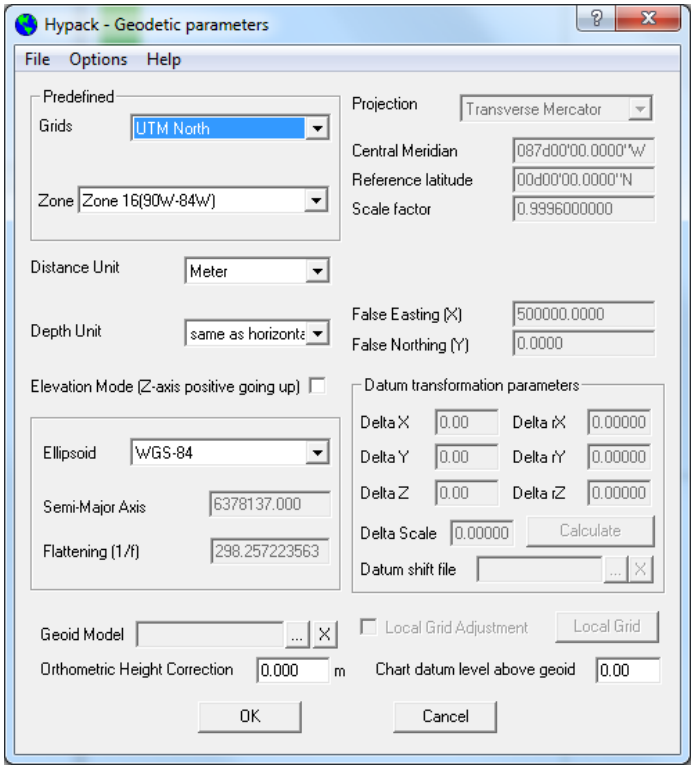


Figure 25: Geodetic Parameters Window

    b. Configure the parameters according to the survey area.
    c. When finished, click **OK**.

5. Load any necessary background files needed to complete the survey.
    a. Under **Project Files** on the left side of the HYPACK main window (Shell, Figure 26), right click on the **Background Files** and select **Add Files**.
    b. Locate the background files needed and select **Open**.

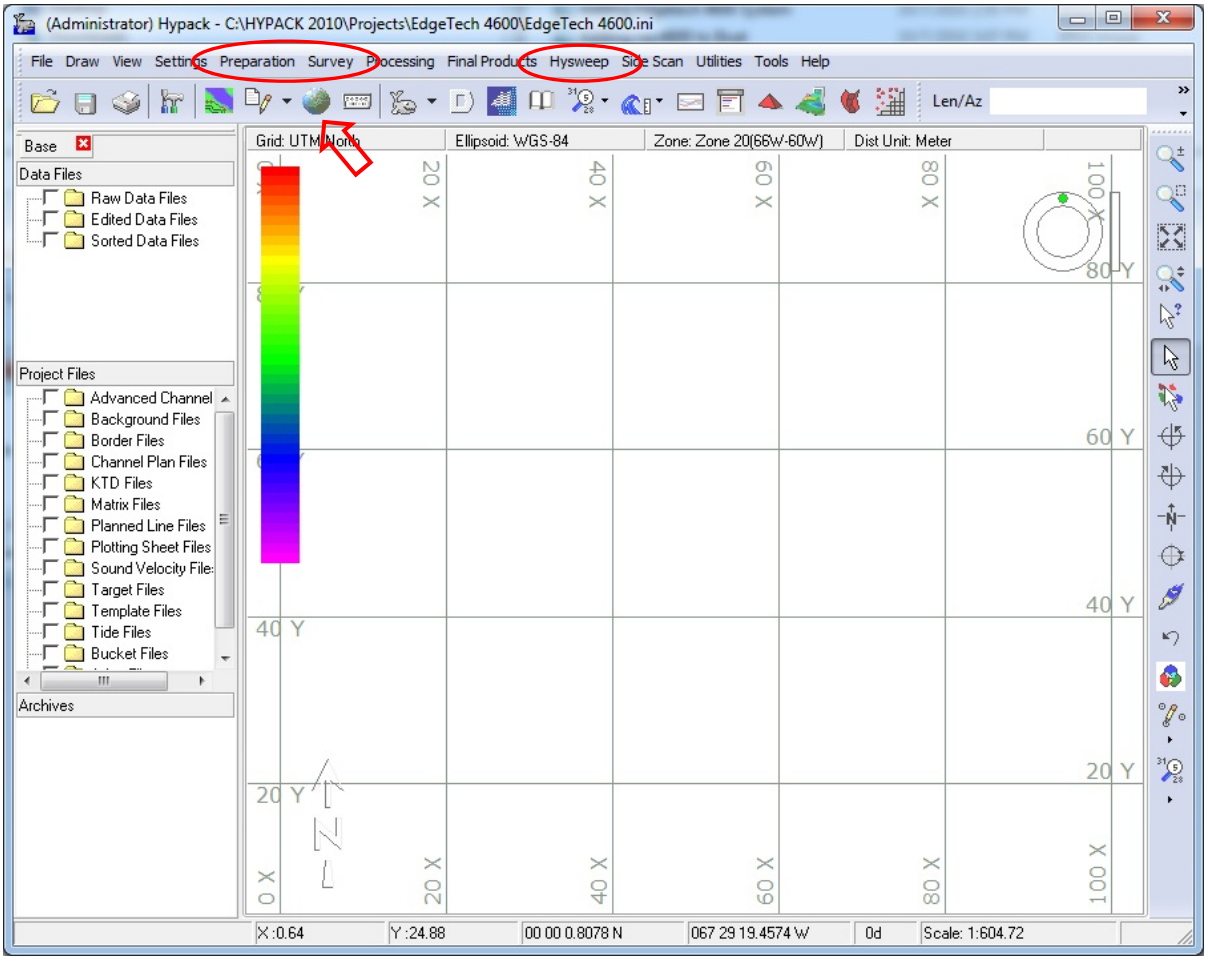


Figure 26: Hypack Main Window (Shell)

6. Input any offsets for the 4600 Bathymetry and Side Scan Sonar System. (These values depend on how the system was mounted).
    a. Select **Hysweep** from the top menu of the HYPACK Shell (Figure 26, circled in red) and click on **Hysweep Hardware**. (Please refer to Figure 27 and Figure 28).
    b. Ensure the EdgeTech 4600 system is highlighted.
    c. Select the **Offsets** Tab at the top.
    d. Enter the offsets for Sonar Head 1, Sonar Head 2, and the MRU. In HYPACK, **Sonar Head 1** and **Sonar Head 2** represent the array on the port and starboard side of the underwater unit (Figure 2), respectively. Both sonar heads should have the same **Forward** and **Vertical** Offsets, while the **Starboard** offset should differ according to the acoustic centers. (Please refer to the Appendix for the Acoustic Center locations of each array).

e. When finished, click **Close**.

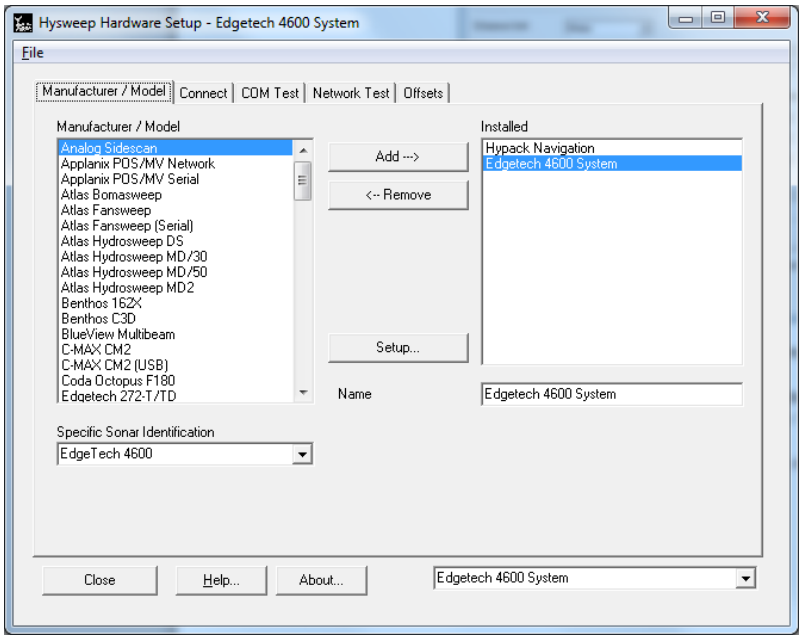


Figure 27: Hysweep Hardware Window

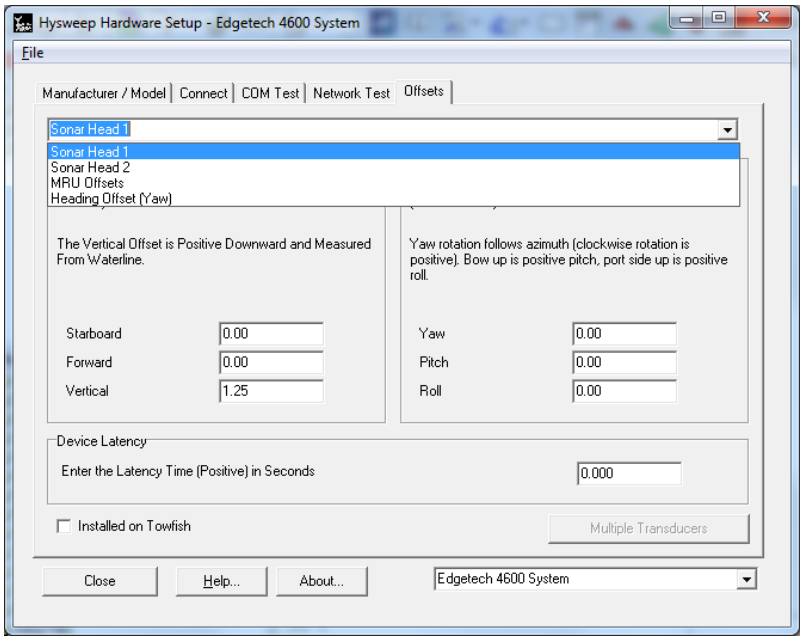


Figure 28: Hysweep Hardware Offsets

Note: These offsets are measured with respect to the vessel's center of motion and should have been collected during sensor installation.

7. Select **Survey** on the top menu of the HYPACK Shell (Figure 26, circled in red) and choose **Survey and Hysweep Survey**. Five windows will appear as in Figure 29 and Figure 30: *(1) Survey*, *(2) GPS NMEA-0183 with RTK Tide Option*, *(3) Edgetech 4600 Navigation*, *(4) Hysweep Survey*, and *(5) Hysweep Interface*.

   Note: The *GPS NMEA-0183 with RTK Tide Option* and *Edgetech 4600 Navigation* windows will only appear if you have configured the mobile devices properly as described in *Section III* of the EDGETECH 4600 HYPACK SOFTWARE GUIDE. This is why it is important to *copy* the *EdgeTech 4600* project as these devices are already configured for EdgeTech's system.

8. Before continuing, ensure all systems and inputs are green in the **Hysweep Survey** window (Figure 30, top). Green indicates that each system and input is connected properly and all devices are on. If a device is highlighted in red, DISCOVER should have already displayed a warning message. Check the connection between the device and the Topside Processor. If problems persist, please contact Customer Service using the information provided on page 46.

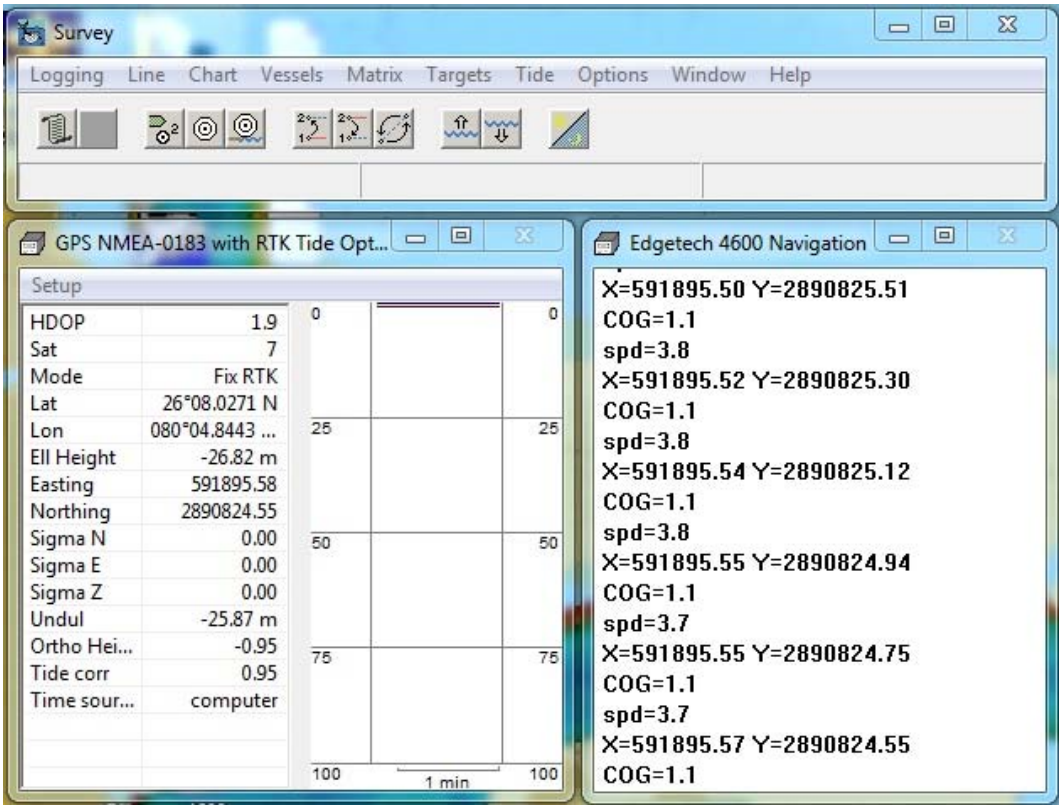


Figure 29: Survey and Hysweep Survey Windows – Windows 1 through 3

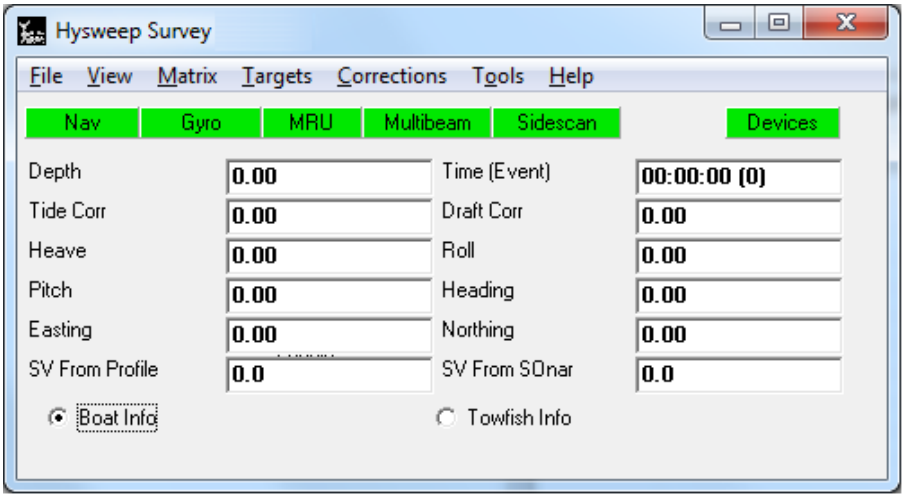


Figure 30: Survey and Hysweep Survey Windows – Windows 4 and 5

9. On the *Hysweep Survey w*indow (Figure 30, top), choose **View** > **Interferometry** to bring up the interferometry window.

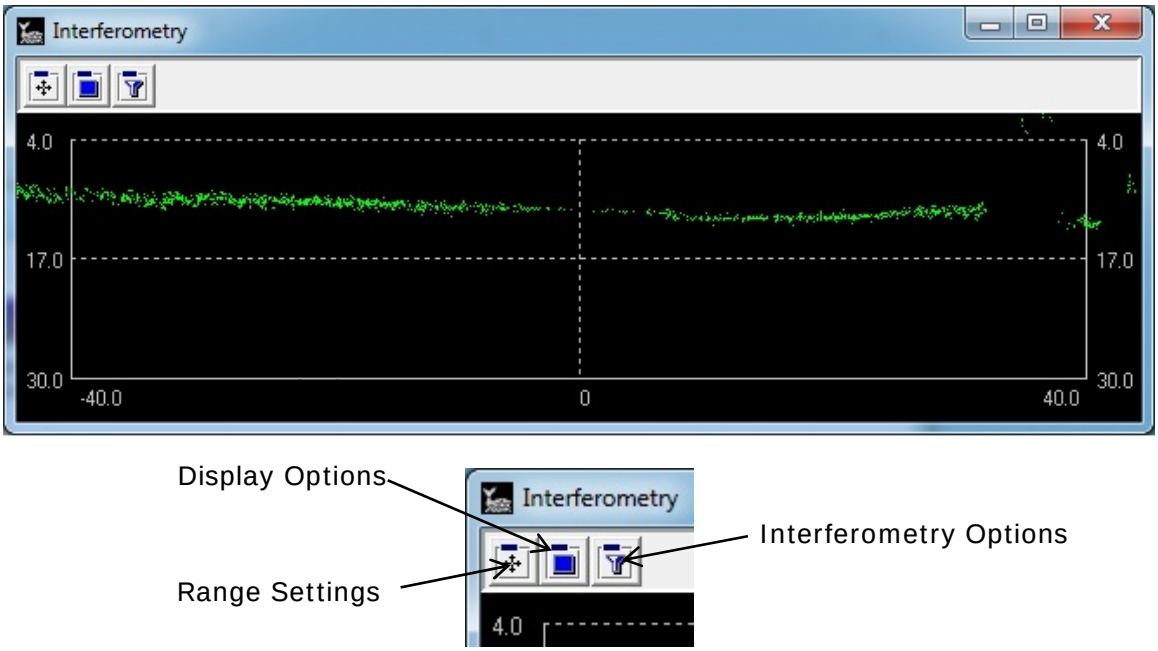


Figure 31: Interferometry Window

10. Select the first button in Figure 31 to access the **Ranges** tab in the *View Options* window (Figure 32).

    This window allows the user to control the **Minimum** and **Maximum Depth**, **Port and Starboard Offset Limits**, **Port and Starboard Angle Limits**, and the **Depth Range to Overlap Colors** limit.

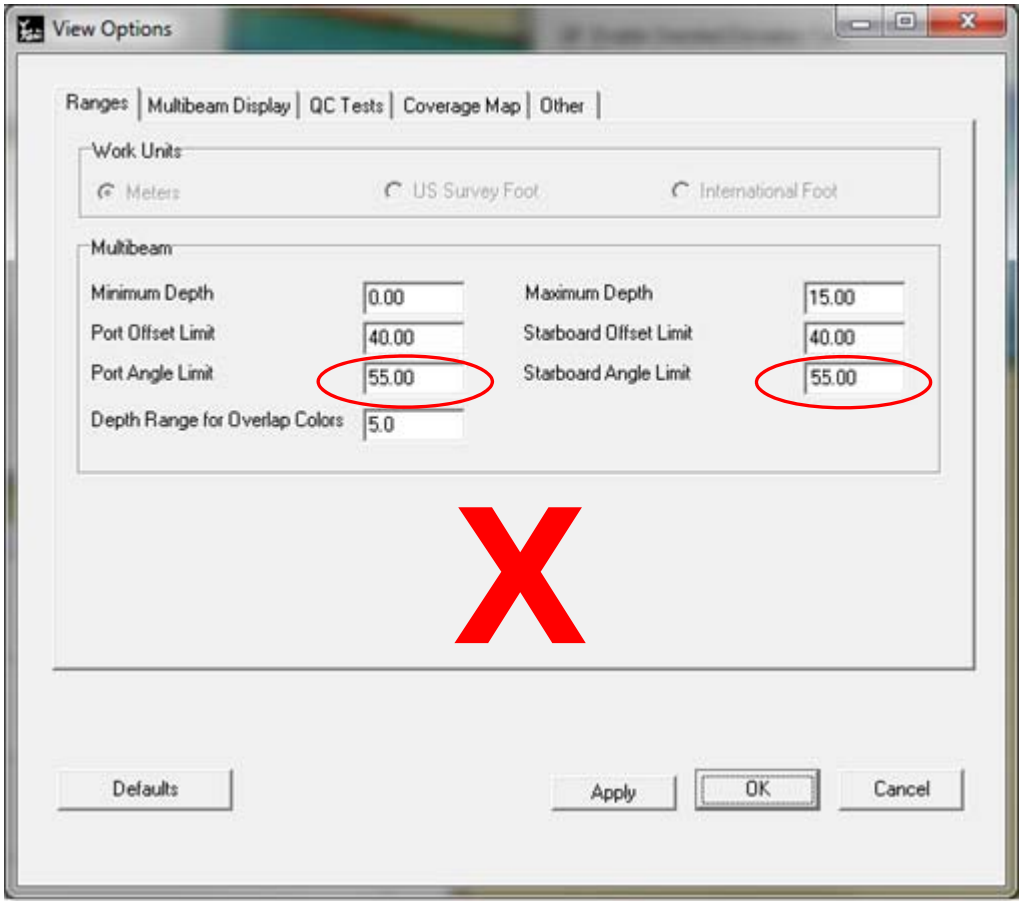


Figure 32: View Options Window – Incorrect Way of Limiting Data

Note 1: It is important to note here that it is not a good idea to limit your data by setting the **Port and Starboard Angle Limits** under the **Ranges** tab (Figure 32). When the **Port and Starboard Angle Limits** are set too low (> 90°), the data becomes biased, resulting in a false curvature of the seafloor. Figure 33 and Figure 34 illustrate this "biasing" concept.

Note 2: The **Port** and **Starboard Angle Limits** in this example have been set to 55°, the field of view of a traditional multibeam!

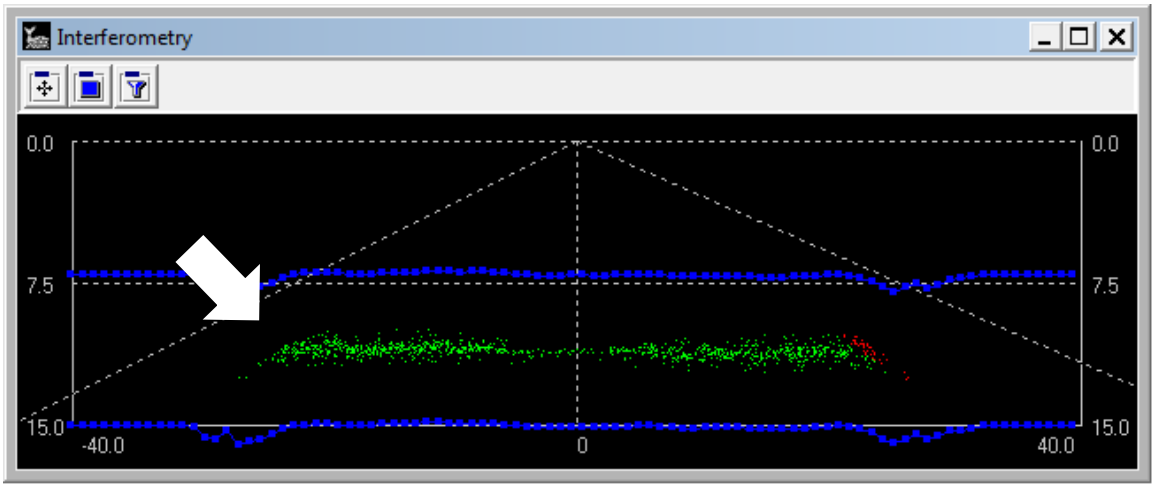


Figure 33: Interferometry Window Illustrating a Biased Data Set Caused by too low of a Port and Starboard Angle Limit

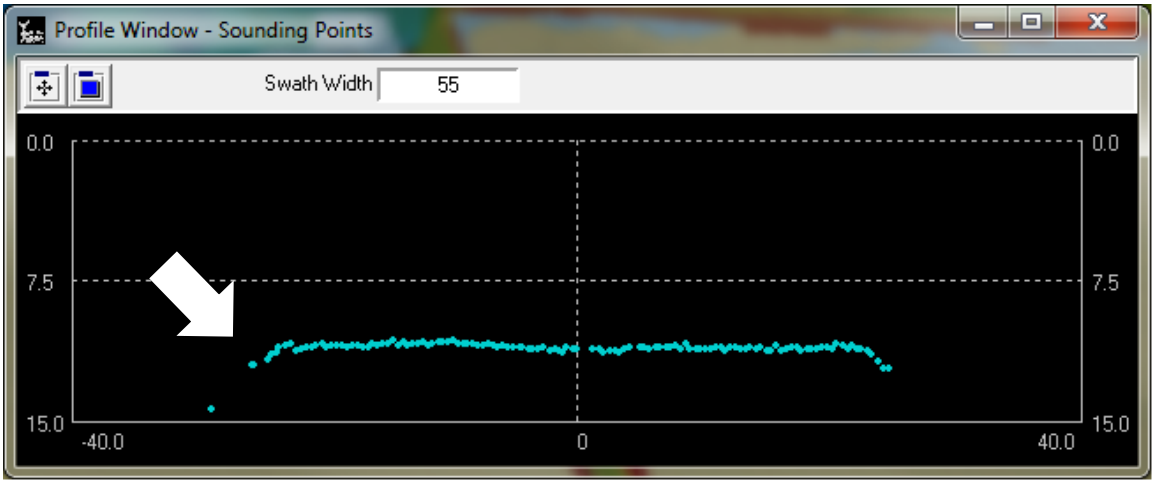


Figure 34: Profile Window Illustrating a Biased Data Set Caused by too low of a Port and Starboard Angle Limit

Since the 4600 System has a 200˚ field of view, the correct way to limit the bathymetry data is setting the **Port Angle Limit** and the **Starboard Angle Limit** set to 100˚ (Figure 35).

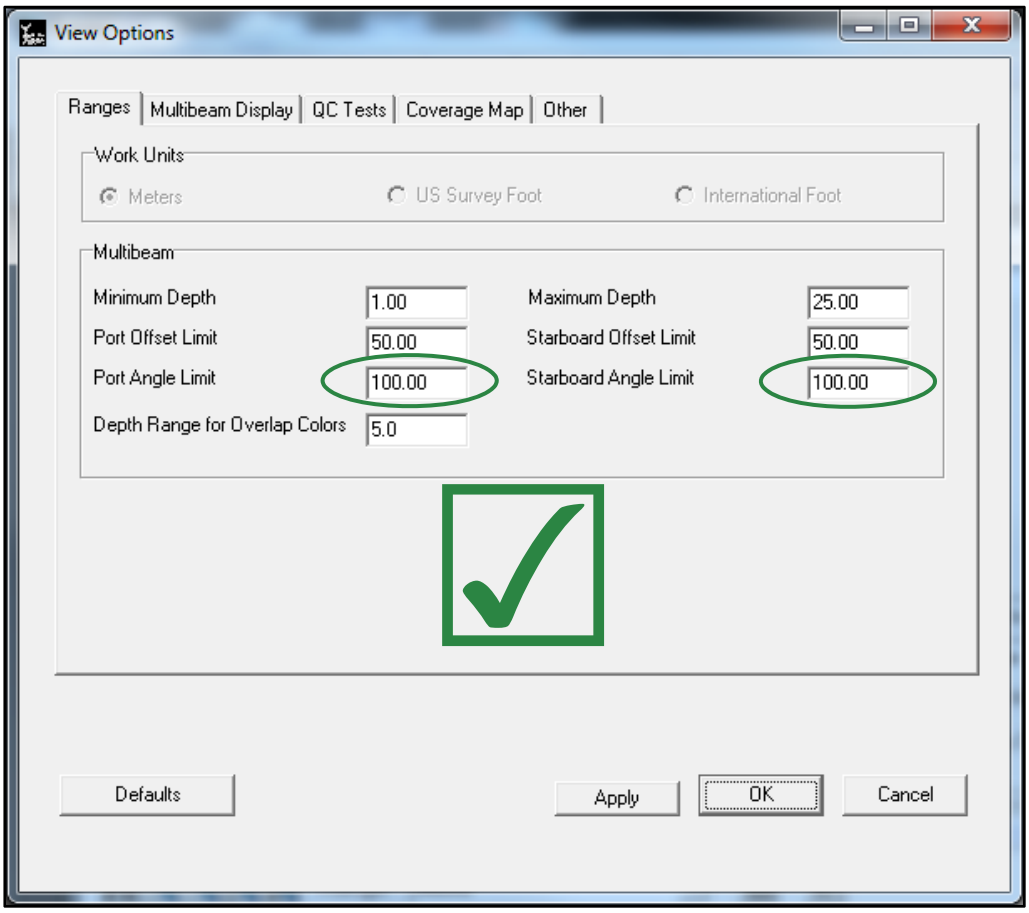


Figure 35: View Options Window – Correct Way of Limiting Data

If the data needs to be limited, adjust the **Port and Starboard Offset Limits** instead. This will only keep the data points included within the horizontal range specified by these offset limits without biasing the data points. A proper way to threshold the data is demonstrated in Figure 36 and Figure 37.

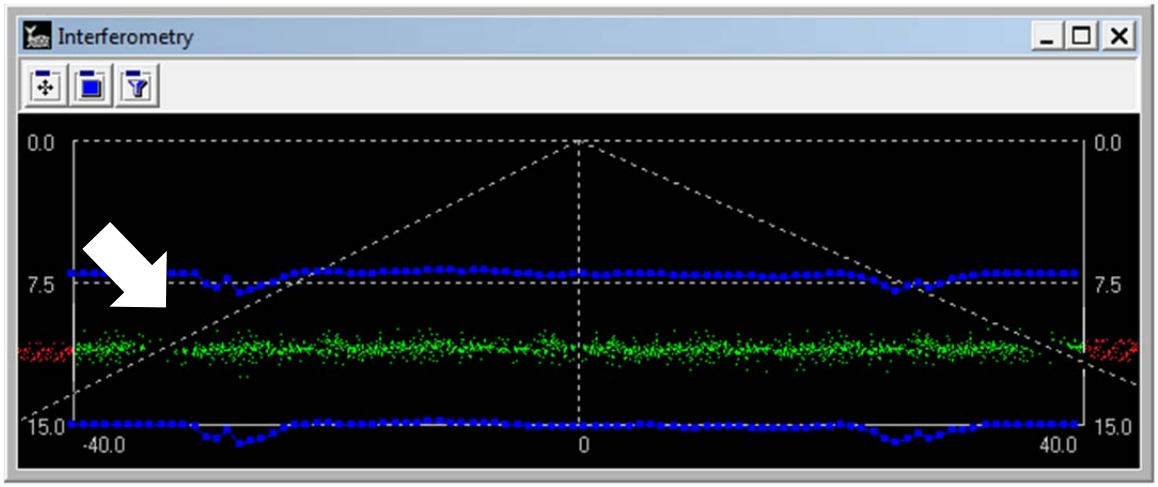


Figure 36: Correct Window Thresholding (Interferometry Window)

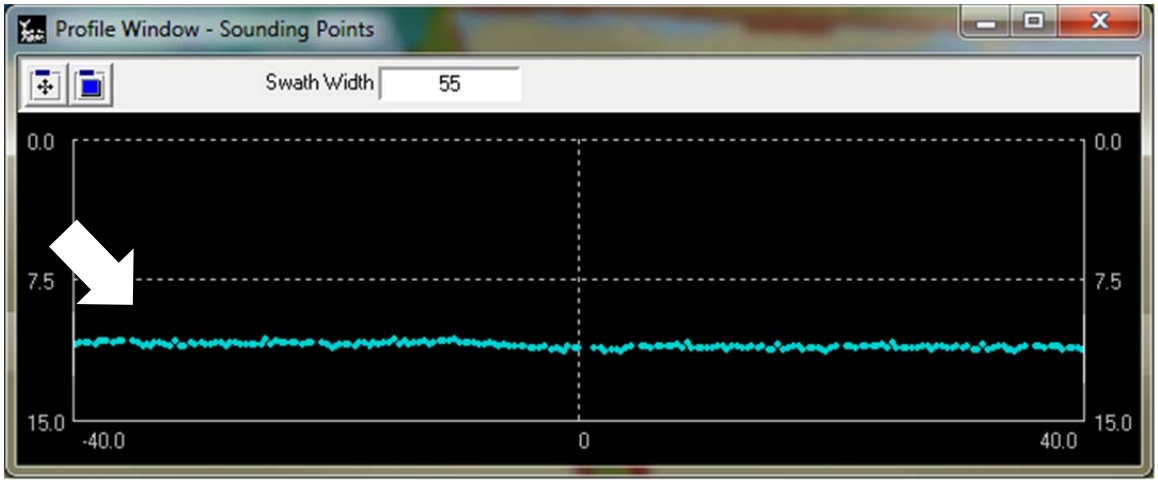


Figure 37: Correct Window Thresholding (Profile Window)

11. Select the third button in Figure 31 to access the *Interferometry Options*. This window may also be accessed by right clicking on the Interferometry window and selecting *Options*.

12. Check the *Filter along track* box under **Filtering** (boxed in red in Figure 38). Set the number of bins to 50 and set the Height/Weight between (2-5)/(0.3-0.6). The parameters shown below work well for rejecting bad data when the seafloor is behind an object.

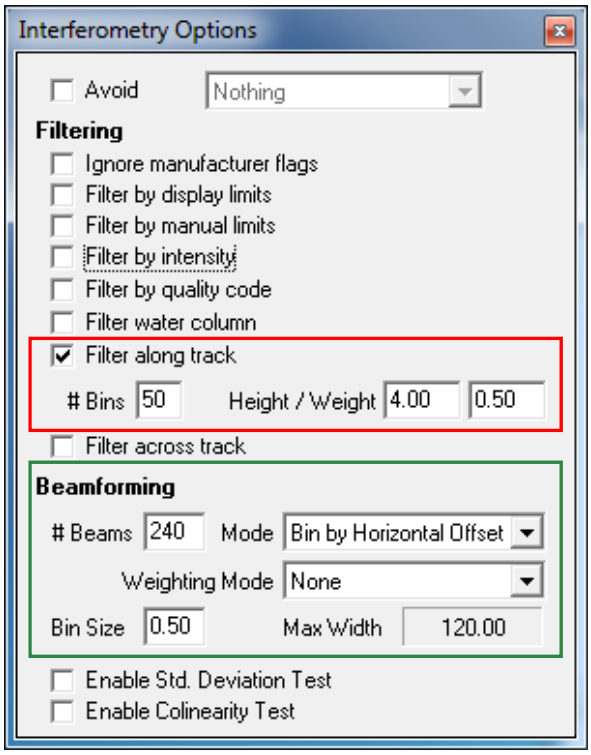


Figure 38: Interferometry Options

13. Under **Beamforming** (boxed in green, Figure 38), the number of beams or number of points per swath should typically be less than or equal to 400.

14. Ensure that the *Mode* drop down menu is set to **Bin by Horizontal Offset**.

15. The *Bin Size* should be set to a value that will get the desired ***Max Width*** (or max swath coverage). Here the number of beams was set to 240 and the bin size was set to 0.5 m to acquire the desired swath coverage of 120m.

    Note: For higher resolution, the recommended settings are 400 Beams, by 0.25m Bin Size to achieve a total swath of 100m. If a smaller/larger swath is desired the

Bin Size can be adjusted accordingly, or the Port and Starboard Offset Limits can be fine-tuned.

16. On the *Hysweep Survey Window* (Figure 30, top) choose **View** > **Profile Window** to bring up the two-dimensional profile of the seafloor (Figure 39).

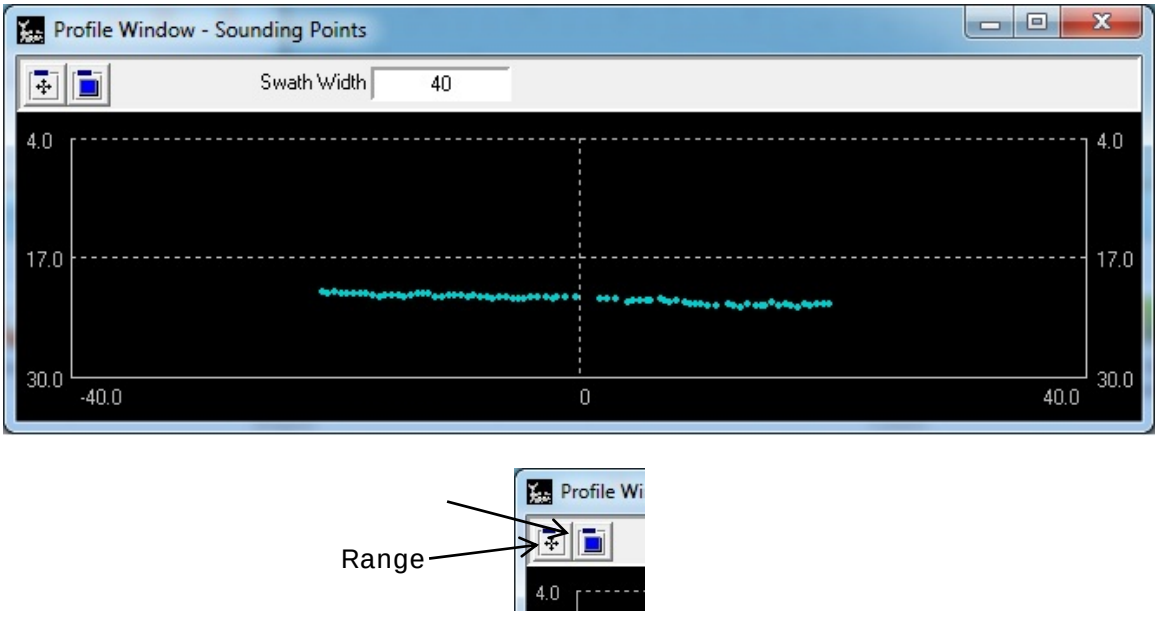


Figure 39: Profile Window using Sounding Points Viewing Option

17. Click on the second button in Figure 39 to bring up the *Display Options*. This window may also be accessed by right clicking on the **Profile Window** and selecting *Options*, or by hitting the **F9** key.

18. This window allows the user to pick and choose different viewing methods of the data. Choose each one and hit **Apply** to see what the data looks like. (The preferred viewing is shown in Figure 40). When finished, click **OK**.

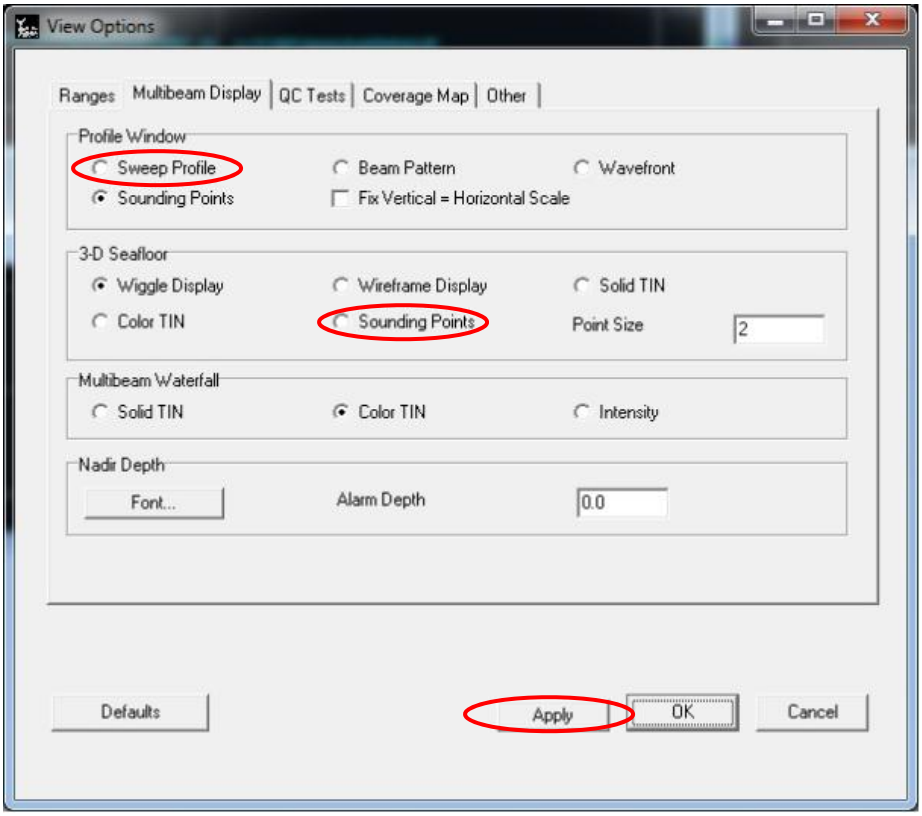


Figure 40: View Options Interface, Display Tab

19. On the *Hysweep Survey Window* choose **View** > **Multi-Beam Waterfall** to bring up the waterfall view of the seafloor.

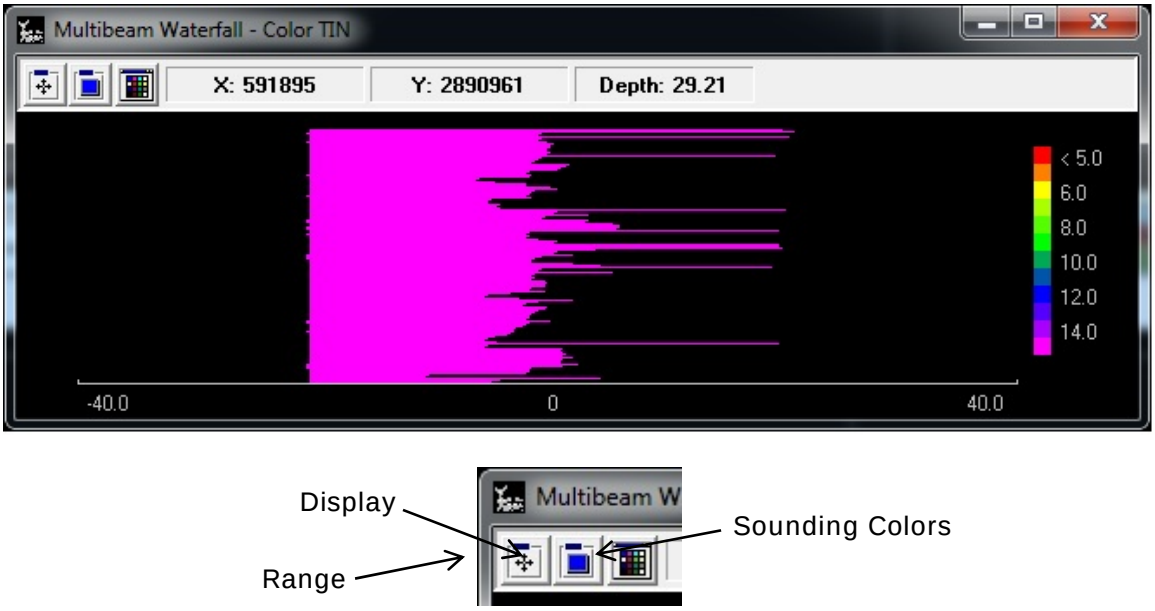


Figure 41: Multibeam Waterfall using Color Tin Viewing Option

Note 1: *Range Settings* and *Display Options* buttons for all three windows, portray the same settings from the same window. The *Sounding Colors* button allows the user to change the color scheme of the **Multibeam Waterfall** window.

Note 2: There are other windows that *Hysweep Survey* provides and these are accessed the same way as in step 16.

20. When ready to collect data, select the **Start Logging** feature from the *Survey* window by **Logging** > **Start Logging…** or by selecting the shortcut key  .

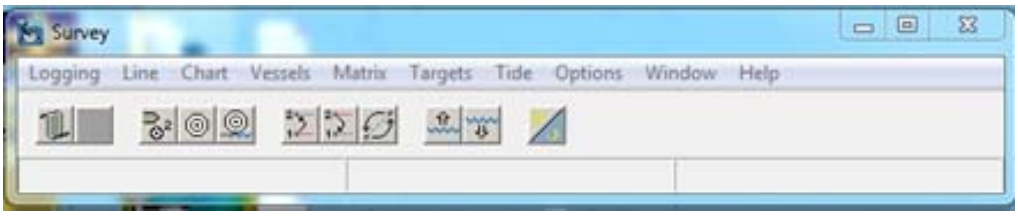


Figure 42: Survey Window (First Display Window in Figure 30).

Note: DISCOVER could be recording simultaneously as HYPACK is logging data. If desired, navigate to DISCOVER and click the **Record** button from the **Disk** tab.

19. When finished with collecting data, select the **Stop Logging** feature from the *Survey* window by **Logging** > **Stop Logging…** or by selecting the shortcut key  .

    Note: If DISCOVER was recording, please make sure to stop this recording too. For more details on logging survey data please refer to *Section IV* of the EDGETECH 4600 HYPACK SOFTWARE GUIDE.

20. Repeat Steps 20 and 21 for as many data files as needed to complete the survey.

21. When completed with the survey, save and exit out of all applications and turn off the 4600 system using the power switch on the Topside Interface.

22. Shut down the Topside Processor by exiting out of all programs, then **Start** > **Shut Down**.

5. Contact and Service Information

For product service or support, please contact:

EdgeTech
4 Little Brook Road
West Wareham, MA 02576

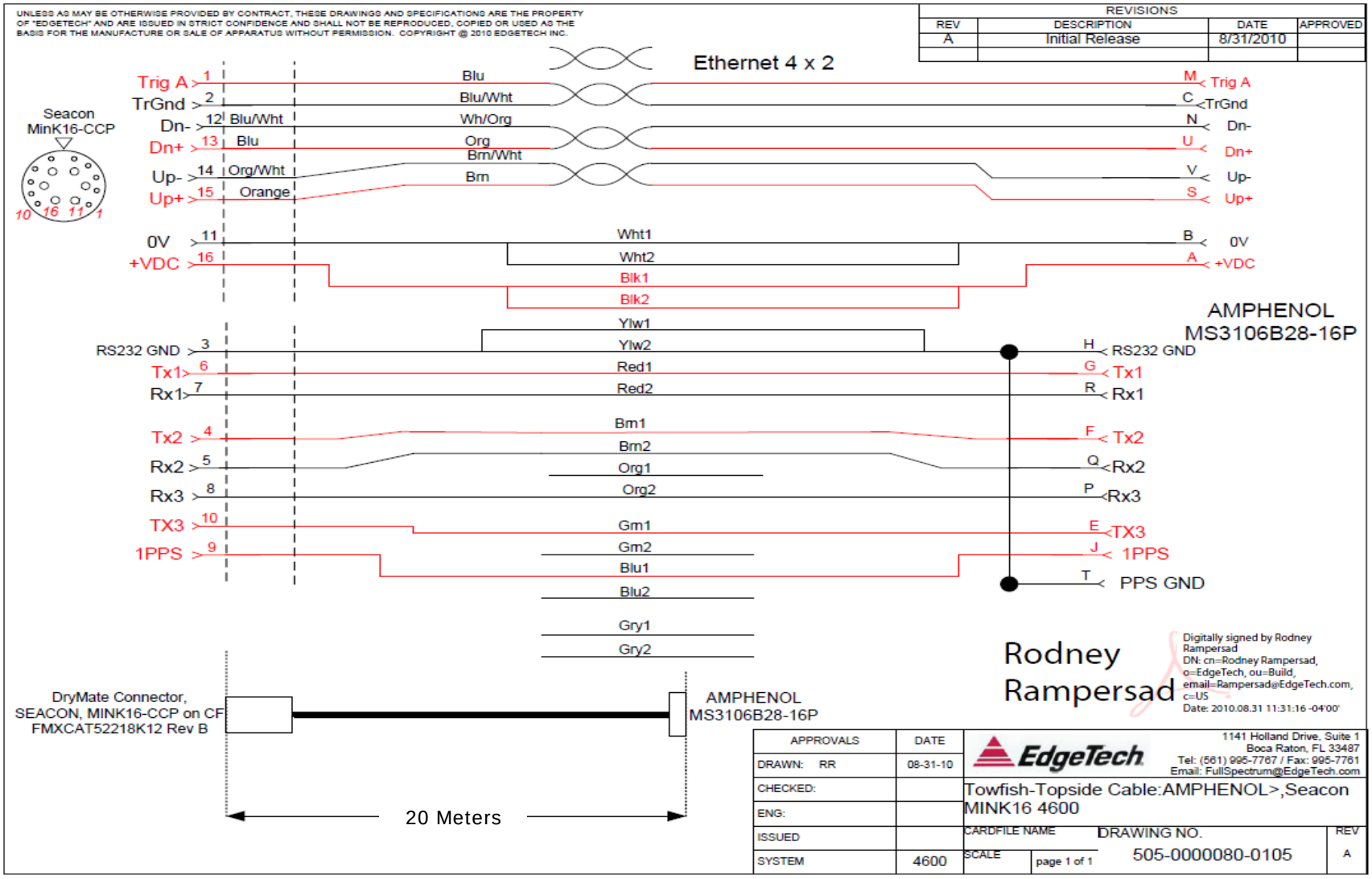
Tel: (508) 291-0057
Fax: (508) 291-2491

Email: service@edgetech.com

Note: If it is necessary to return the equipment for service, a Returned Material Authorization (RMA) number is required prior to returning any equipment to EdgeTech. This is to assist EdgeTech in recognizing the returned equipment when it arrives at EdgeTech's receiving dock, and to assist customer service representatives in tracking the returned equipment while it is at EdgeTech's facilities. Please refer to the 4600 REFERENCE MANUAL for the correct RMA Procedure.

APPENDIX A

Deck Cable Drawing



4600 Acoustic Centers (Standard Body Type)