SeaBat 7125 SV
High-Resolution Multibeam Sonar System

OPERATOR'S MANUAL

Part Number 86000149

Version 3

March 2010

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Notice

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Version

March 2010 Version 3

RESON strives to maintain up-to-date information and may, as necessary, review and revise this manual. If the information contained in this manual is unclear, please contact your nearest RESON office for clarification.

Maintenance Release

Release FP1

This manual is consistent with the indicated software and firmware maintenance release.

Electronic File Version

This manual is available from RESON in the Adobe® Acrobat® Portable Document Format (PDF). The selected PDF process preserves the interactive index and cross-reference features of the original Microsoft Word document.

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PREFACE

How to Use This Manual

This manual is designed to accommodate both the first time user, who needs detailed instructions, and the experienced technician, who only requires a reference tool. It provides detailed procedures for the correct installation, operation, and maintenance of the SeaBat system.

Read this manual thoroughly and follow the steps provided to maintain optimal safety standards and to obtain the best system performance.

Standards of Measurement

All physical measurements represented in this document are based on the metric system. All temperatures are represented in degrees Celsius.

Document Conventions

The following information will make it easier for the reader to interpret the text presented in this document.

Document Conventions

Convention	Definition
Hyperlink	Indicates a hyperlinked cross-reference. Click the word to be taken to the specified reference point.
Numbered list	Indicates stepwise instructions to be followed in a particular order.
Bulleted list	Indicates items of a list without any particular order.

Notes, Cautions, and Warnings

Notes, Cautions, and Warnings are included in this text to provide valuable information and to help the operator prevent damage to the sonar or to personnel.

Notes, Cautions, and Warnings will be shown in the following format:

NOTE
This is a Note. Notes provide explanatory information that may be useful to the operator, but is not necessarily vital to the operation of your SeaBat™ system.

CAUTION
This is a Caution. Cautions provide important information regarding your SeaBat™ system. Disregarding information provided in a Caution box may result in accidental misuse or damage to your SeaBat™ system.

WARNING!
This is a Warning. Warnings provide important information regarding your SeaBat™ system. Disregarding information provided in a Warning box may prove harmful to personnel working with or near the system.

Chapter Arrangement

All RESON manuals are designed with the same basic structure. The following chapters are included in this document:

- ***Introduction*** provides a short summary of the SeaBat 7125 SV sonar system, including an overview of the architecture and the main features.
- ***Safety Precautions*** provides important safety information about the SeaBat 7125 SV sonar system.
- ***System Startup and Shutdown*** provides detailed information about how to start and shut down the SeaBat 7125 SV sonar system.
- ***System Configuration*** provides detailed information about how to configure the SeaBat 7125 SV sonar system.
- ***System Operation*** provides detailed information about the user interface and operation of the SeaBat 7125 SV sonar system.
- ***Active Sonar Usage*** provides detailed information about the practical usage of the SeaBat 7125 SV sonar system.
- ***System Performance and Data Types*** provides information about the types of data produced by the SeaBat 7125 SV sonar system.

In addition to the above chapters, these appendixes have been included for reference:

- ***Appendix A***: Troubleshooting
- ***Appendix B*****:** Installation Instructions
- ***Appendix C*****:** Reference Documentation
- ***Appendix D*****:** SeaBat 7125 SV System Options
- ***Appendix E*****:** Available SeaBat 7125 Configurations
- ***Appendix F*****:** Warranty Information
- ***Appendix G*****:** Glossary of Terms

If you require additional information or need clarification of any part of this document, please contact RESON Customer Support for assistance at support@reson.com.

1 INTRODUCTION

1.1 System Overview

The SeaBat 7125 SV (for Surface Vessel) is a high-resolution multibeam sonar system that measures relative water depths over a 128° (or 140°[1]) wide swath perpendicular to the vessel's track.

The SeaBat 7125 SV is designed for convenient installation on small surface vessels and operates as a single-frequency system at 400kHz. The addition of a second projector operating at 200kHz allows the system to operate as a dual-frequency system providing long-range functionality with the 200kHz unit and high-resolution functionality with the 400kHz unit.

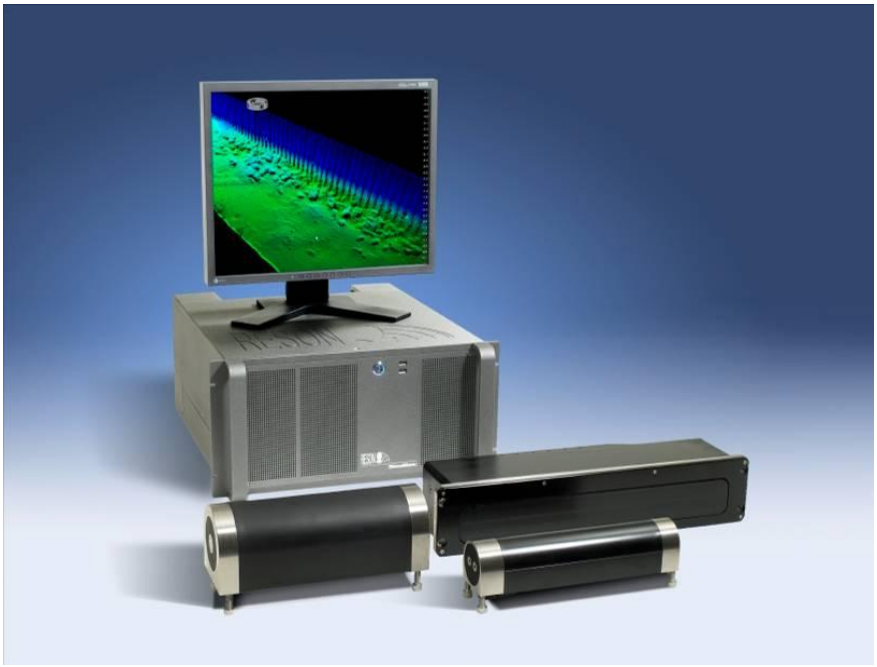


Figure 1: SeaBat 7125 SV Sonar System

For available feature packages, see *Appendix E.2 Feature Packages*.

1.2 System Architecture

The SeaBat 7125 SV multibeam sonar system consists of a combined sonar interface and processing unit, known as the transceiver, a receiver unit, and a projector unit (or two projector units). 25 meter cables connect the receiver and projector units to the transceiver. User displays and system control originate within the transceiver.

[1] Available with the Efficiency feature package (see *Table 20*).

For details on the various system components, see *Appendix B Installation Instructions*.

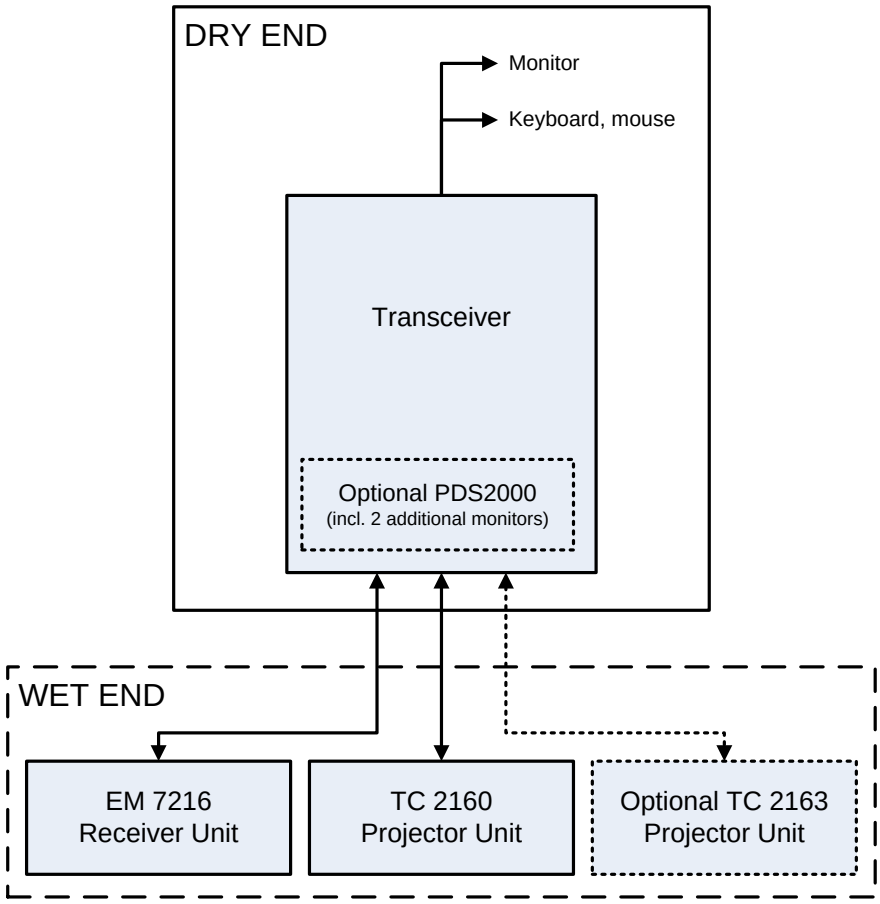


Figure 2: SeaBat 7125 SV System Configuration[2]

For available configurations, see *Appendix E Available SeaBat 7125 Configurations*.

For available system options, see *Appendix D SeaBat 7125 SV System Options*.

1.3 System Operation

The projector unit of the sonar head assembly transmits a pulse of acoustic energy, which travels through the water medium and is reflected by the seafloor or any objects in its path. The reflected signal is received by the receiver unit of the sonar head assembly, digitized by internal electronics, and sent to the topside transceiver for beamforming and processing. The transceiver generates the video displayed on the monitor and formats a digital output to be used by a peripheral bathymetric data processing system (or the optional PDS2000 DAC preinstalled on the transceiver) while functioning as the control interface between the operator and the sonar system.

[2] It is possible to connect four monitors to the transceiver.
Receiver unit EM 7216 has replaced EM 7200.

1.4 System Features

The main features of the SeaBat 7125 SV system are summarized below. Depending on the feature package purchased[3], all features may not be available (see *appendix E.1.1 7125 SV Configuration*).

- **Resolution:** Dynamic, focused beamforming maintains ultra-high resolution, even at short ranges. A receiver sample rate of 34kHz provides unprecedented range resolution and complements the narrow beam, thus providing the user with ultimate data quality and resolution.
- **Fast Update:** The entire 128° (or 140°) swath is illuminated with a single transmission at an update rate of up to 50Hz (range selection dependent), maintaining 100% bottom coverage, even at high speed.
- **Depth Rating:** The SeaBat 7125 SV is depth-rated to 50 meters.
- **Data Output:** The SeaBat 7125 SV exports the standard hydrographic records of bathymetry, side-scan, and snippets as well as water column data and other data for more scientific applications.
- **Beamforming:** The transceiver performs initial signal processing, a combination of time delay and phase rotation beamforming.
- **Bottom Detection:** The special bottom detection algorithm uses a combination of center-of-energy and phase-zero crossing algorithms to detect the bottom in each individual beam with the highest possible accuracy.
- **Uncertainty Output:** Uncertainty is computed for each sounding and presented graphically on various UI (user interface) displays.
- **Variable Swath Coverage:** This feature gives the operator control of the swath coverage. It includes swath width settings ranging from 45º to 128º (or 140º) in increments of 5° as well as a choice of beam density mode.
- **Auto Pilot:** This feature allows for automatic update of certain sonar settings. When Autopilot mode is initiated, the SeaBat analyzes bottom detection data to determine the average bottom depth and maximum usable swath angle, then optimizes the sonar settings accordingly consistent with a user-configurable look-up table.
- **Real-Time QC Display:** The SeaBat 7125 SV generates a real-time display with an intensity image on a high resolution 19-inch LCD monitor. Overlaid on this intensity image is the bottom detection display, giving the operator an excellent QC (quality control) tool.
- **Equidistant Footprint Selection:** The SeaBat 7125 SV offers the operator a choice between 256 and 512 equiangular or equidistant beams with the 400kHz frequency. All four options are dynamically focused. The optional 200kHz frequency operates with 256 equiangular or equidistant beams.
- **Hardware Sync Pulse Out:** A TTL pulse (synchronous with the transmitter pulse) is available from the transceiver.

[3] Feature Packages include Standard and Efficiency.

- **1PPS Pulse Handling and Time Stamping:** Data time stamping is referenced to an incoming 1PPS and associated time message.
- **External Trigger:** The system may be triggered using a standard 7k Center software remote command or by a TTL incoming trigger pulse.
- **Adaptive Gating:** Three different gate settings are available for application to the bottom detection process: No Gates, Absolute Gates, and Adaptive Gates.
- **Beam Data Recording:** The SeaBat 7125 SV is capable of producing a stream of beam data that is operator configurable and may be written to either the transceiver local hard drive or an optional external RAID hard disk array. Data logging software controls recording, playback, and data storage functions.
- **Built-In Test Environment (BITE):** BITE is an integral part of the transceiver, monitoring the status of internal subsystems and the wet-end units.

1.5 Typical Applications

The SeaBat 7125 SV is RESON's third generation of sonar systems and is based around the 7125 SV transceiver. This modular approach allows great flexibility and provides support for a wide range of applications including:

- Harbor mapping
- River surveys
- Breakwater mapping
- Revetment surveys
- Pre- and post-dredging and condition surveys
- As-built surveys
- Pipeline route surveys
- Coastal mapping
- Pipeline inspection surveys
- Hydrographic surveys to IHO Special Order and to U.S. Army Corps of Engineers Special Order
- Site clearance surveys
- Underwater inspection and object location
- Search and recovery

2 SAFETY PRECAUTIONS

WARNING!
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. RESON assumes no liability if this product is operated in an unsafe manner.

2.1 Operator Safety

The SeaBat™ system should be handled with attention to operator safety as well as protection of the hardware components. General precautions include:

- **DO NOT** connect or disconnect cables with the power on.
- **DO NOT** attempt to open and service the projector or receiver units.
- **DO NOT** attempt to open and service the transceiver without specific instructions from RESON.
- **DO NOT** operate the system while divers are in the water and closer than two meters from the projector and receiver units. High-powered ultrasonic energy can be hazardous to human physiology.

For safety reasons the SeaBat™ must be connected to protective earth. The protective earth pin in the mains appliance inlet is the protective conductor terminal of SeaBat™.

WARNING!
 This icon on any of the SeaBat components implies hazardous voltage on output connection.

2.2 Equipment Safety

Each SeaBat™ component is sufficiently robust for shipboard storage while in its own transit case or shipping box, which include handles and tie-down rings. Use appropriate discretion in lifting these components, as the cases may be awkward and heavy.

2.2.1 Safe Handling

To ensure safe handling of the equipment:

- Inspect each transit case or shipping box for physical damage prior to opening, and each component for physical damage before installation.
- Use original shipping boxes to provide adequate packaging and shock absorption when shipping or storing the equipment.

- Do not drop the equipment.
- Do not connect or disconnect cables at the rear of the transceiver or from the sonar head assembly while the transceiver is running. This can damage the internal workings.
- Do not bend cables beyond the recommended limits.
- Do not place the sonar head in an area where the face may be scratched or damaged. If an array must be placed on the ground, it should be placed on a flat surface and covered with a protective padded sheet.
- Do not place liquids on or near the equipment.
- Do not smoke or spill ashes on or near the pointer device.
- Ensure that the equipment is properly secured before putting out to sea.
- When the sonar head is in air and switched on, the transmit power should be switched off except when performing system checks, where power should be increased to a level which is audible for a short time only on a slow repetition rate (follow instructions in *appendix B.7 System Check*). A higher setting may damage the transmit array ceramics. **The system should only be operated in air for very short periods of time.**
- Do not exceed operating and storage temperature limits.

CAUTION
Do not operate transmitters in air except during system checks.

2.2.2 Cleaning and Maintenance

2.2.2.1 Projector and Receiver

The acoustic window molded over the front of the projector and receiver arrays is made of high-density polyurethane. A long range of chemicals will destroy the polyurethane, which include, but are not limited to:

- Acids
- Automotive brake fluid
- Base
- Grease
- Halogenated hydrocarbons (carbon tetrachloride, trichloroethylene)
- Hydraulic fluids
- Ketenes (MEK, acetone)
- Nitro hydrocarbons (nitrobenzene, aniline)
- Oil
- Ozone
- Petrol
- Phosphate ester

The following recommendations are made to protect the arrays while in use and in storage.

- For cleaning, use a mild, nonabrasive soap, fresh lukewarm water, and a soft brush.
- Rinse the sonar with fresh water after every use.
- Do not clean the array or sonar by using hot or cold pressure washers. The high-velocity water spray will cut through the polyurethane or damage the interface between the polyurethane and the sonar metal housing.
- Do not apply any antifouling paint on the acoustic window unless the type is recommended by RESON. The antifouling paint will affect the acoustic performance.
- To scrape away marine growth from the arrays, use only a wooden tool.

2.2.2.2 Transceiver Dust Filter

The transceiver is equipped with filters to prevent dust and other particles to enter the unit. The dust filters need to be changed at least once a year:

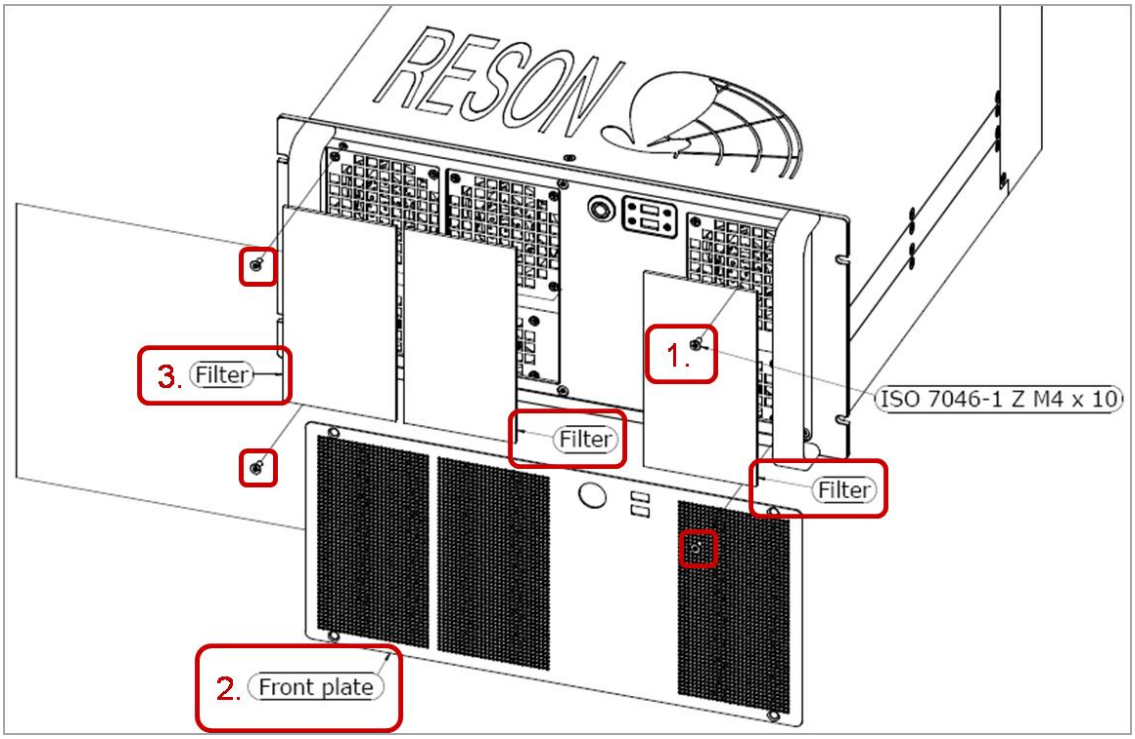


Figure 3: Transceiver Filter Location

1. Unscrew the four corner screws.
2. Lift off the front panel.
3. Replace the three dust filters.
4. Reassemble the transceiver.

2.2.2.3 Replacement of Battery on PC Motherboard

CAUTION
Battery to be changed by authorized personnel only. Noncompliance may affect warranty situation (see *Appendix F Warranty Information*).

Use only the correct type of onboard CMOS battery as specified by the manufacturer. Do not install the onboard battery upside down to avoid possible explosion.

2.3 Electrical Isolation

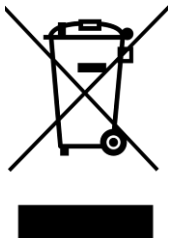
Electrical isolation for both titanium and aluminum components may be achieved by using nonconductive bushings, washers, and isolation plates to insulate them from the mounting brackets. Common nonconductive materials include Delran, G-10/FR4 glass fiber sheets, and high-density polyethylene sheets.

NOTE
Contact RESON for additional information on schemes for electrical isolation.

2.4 Exposure to Sunlight

Do not allow the projector and receiver arrays to sit in direct sunlight when not in use, but cover the arrays with a bag. In addition to furthering corrosive effects, continued exposure to ultraviolet (UV) rays will damage the polyurethane array face.

2.5 Safe Disposal of Waste (WEEE Directive)



The use of the crossed-out dustbin logo indicates that this product is subject to directive 2002/96/EC, known as the Waste Electrical and Electronic Equipment Directive. The WEEE Directive specifies that used electric/electronic equipment may not be treated as household waste, but must be sorted separately for disposal. These rules concern all your RESON products (computer, monitor, transducer, processor, probe, etc.) and also all accessories (keyboard, mouse, etc.). By ensuring this product is disposed of correctly, you will help protect the environment.

For more detailed information about the recycling of this product, please contact your local authority, your household waste disposal service provider, or RESON Customer Support (support@reson.com)

2.6 CE Marking

This product carries the CE mark which indicates that it conforms to the essential health, safety, and environmental requirements of the relevant European Directives.

CE

Declaration of Conformity

Manufacturer: Reson A/S
Fabriksvangen 13
DK – 3550 Slangerup
Denmark

Product: SeaBat 7125-SV

We declare under our sole responsibility that the products, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EEC Member States relating to the following:

Directives

Electromagnetic compatibility (2004/108/EC).
Low Voltage Directive (2006/95/EC)

Standards

EN 61326-1: 2006
EN 61000-3-2: 2006
EN 61000-3-3: 1995 + A1: 2001 + A2: 2005
EN 60945: 2002 part 9 and 10

EN 61010-1: 2001

Date: 30 Oct. 09 Location: Slangerup, Denmark

Name: Kim Lehmann

Position: CEO

Signature

3 SYSTEM STARTUP AND SHUTDOWN

3.1 Chapter Overview

This chapter includes detailed instructions on the following subjects (click the emphasized hyperlink to be taken to the section):

- ***System Startup Instructions:*** Consists of startup details.
- ***Starting the 7k Control Center and Sonar*****:** Consists of a description of the options available for setting up the sonar system for operation.
- ***System Shutdown Instructions*****:** Consists of details on stopping the system.
- ***Installing a License:*** Consists of details on installing a license file.

NOTE
For information on configuration of the system (including I/O module configuration, remote operation, and folder management), see *section 4 System Configuration*. For information on the user interface and operation of the system, see *section 5 System Operation.* For information on the practical use of the sonar, see *section 6 Active Sonar Usage.*

3.2 System Startup Instructions

After the SeaBat hardware has been installed (see *Appendix B Installation Instructions*), the system may be started. To do this, press the power buttons on both the transceiver and the color monitor.

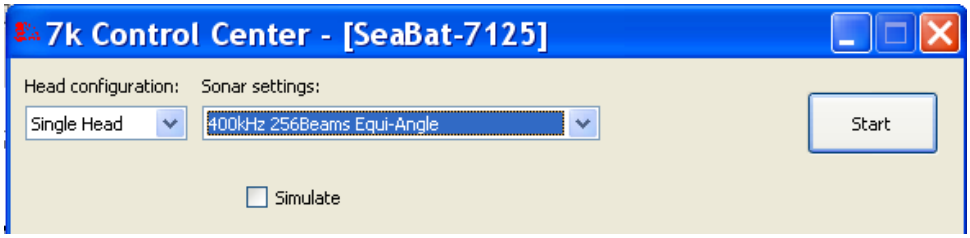
NOTE
The transceiver power button will be red, when power is connected to the unit; it will turn blue, when the system is turned on.

The transceiver will power up and boot directly into Windows. No user name or password is required for standard systems.

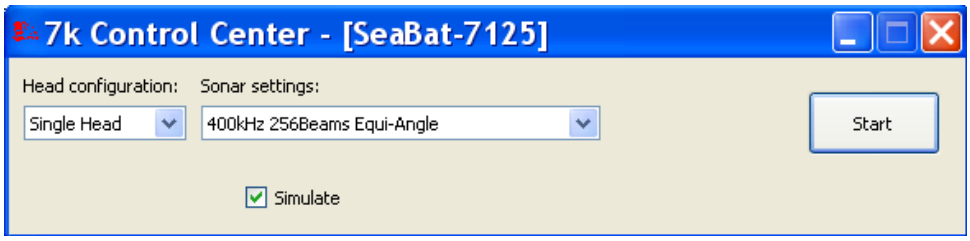
NOTE
In the unlikely event that the system is hanging, press the power button on the transceiver for 10 seconds to shut down the system.

3.3 Starting the 7k Control Center and Sonar

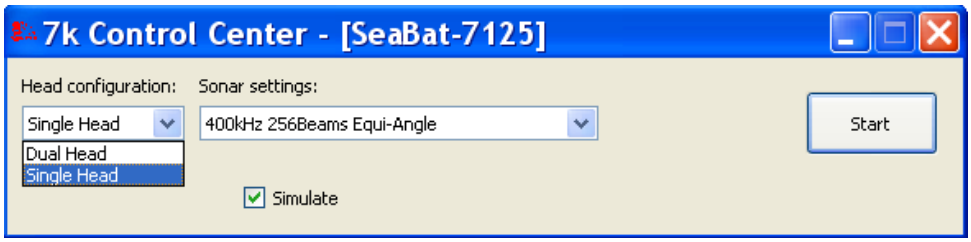
Once the system has been powered up, the 7k Control Center dialog appears.



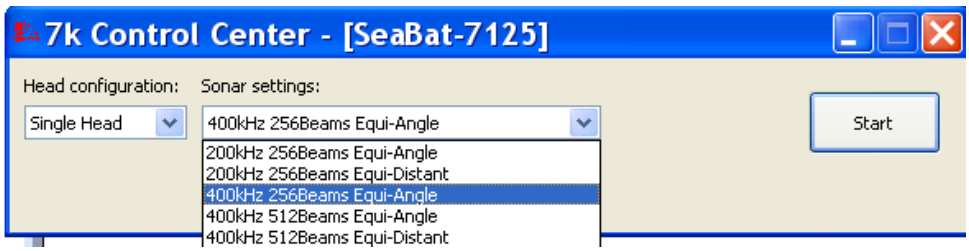
1. Select the operating mode:
   The 7k Control Center can operate the 7k Center and SeaBat display in real sonar operating mode or in simulator mode:
   - Simulator mode: Select the Simulate check box. Operating in simulator mode, where the system displays a flat seabed, can be useful during the installation and setup stages. Note that the sonar head need not be connected to operate in this mode.
   - Real sonar mode: If the Simulate check box is unchecked, the system operates in real sonar mode.



2. Select the sonar head configuration:
   If the sonar head has dual-head capability, the drop-down menu options are Single Head and Dual Head. Otherwise, Single Head is the only option.



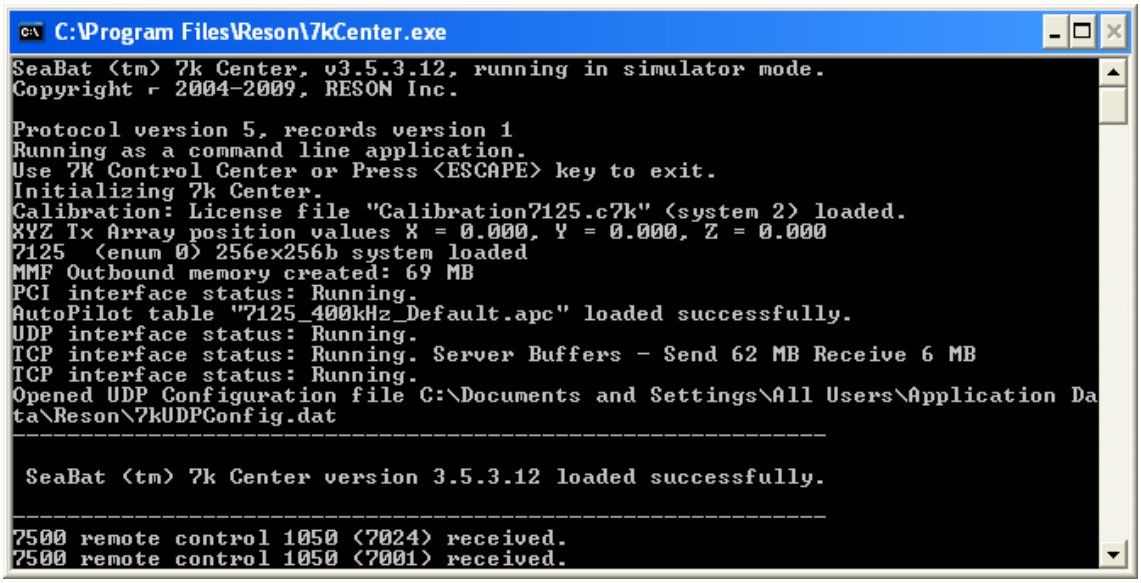
3. Select the sonar settings:
   The Sonar settings drop-down menu includes all of the possible sonar head configurations. This selection completes the configuration of the system to be started.



4. Click the Start button to the start the sonar.

The 7k Center starts first and is followed a few seconds later by the SeaBat display and user interface.

A console window similar to the one shown below appears upon startup, but is automatically hidden by the UI (see also *section 5.8 7k Center Console Window*).



3.4 System Shutdown Instructions

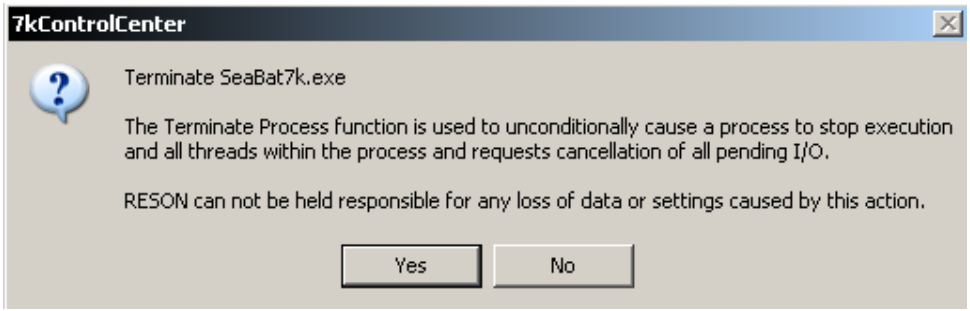
CAUTION
Improper shutdown of the transceiver can result in software problems.

After the system starts, the 7k Control Center Start button is replaced by a Stop button.

1. Click the Stop button to shut down both the 7k Center and the SeaBat display.
   This does not terminate the 7k Control Center. The 7k Control Center remains active, ready to start the 7k Center and SeaBat display again with the same or different selection of sonar settings (see *section 3.3 above*).

NOTE

If an error occurs, while the 7k Control Center is attempting to shut down the SeaBat display, the following dialog will appear:



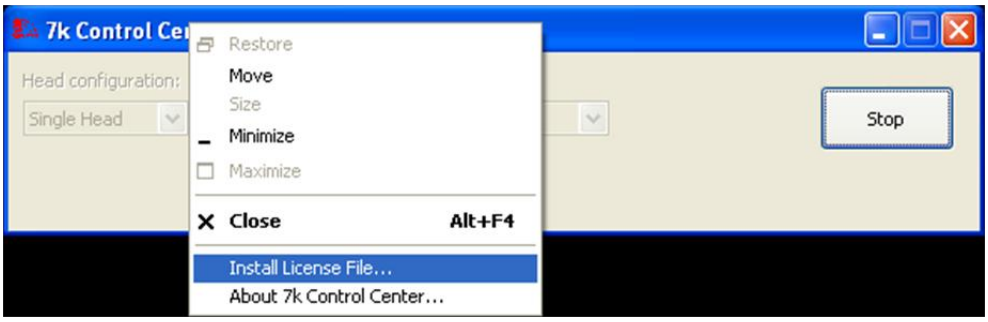
If there is any unprocessed data when the error occurs, it is possible that portion will be lost. It is also possible that the current sonar settings (Depth, Range, etc.) are not saved the next time the sonar is started.

2. Click the cross in the upper right corner of the 7k Control Center to terminate the Control Center.
3. To shut down the transceiver press the power button (or follow normal Windows procedure).

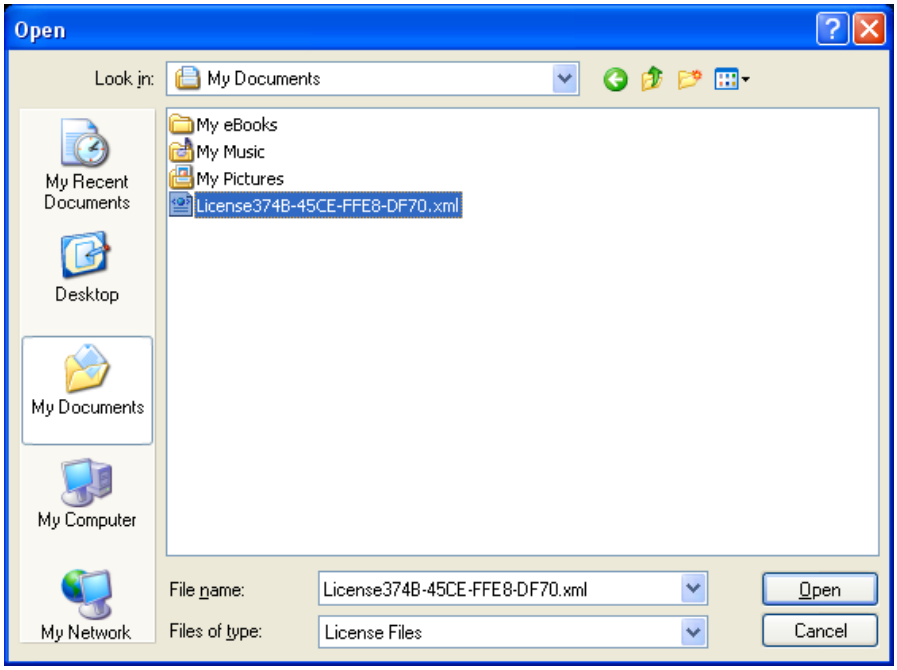
3.5 Installing a License

Your SeaBat 7125 SV comes with a license file installed that match the feature package you purchased (see *Table 20: SeaBat 7125 Feature Packages*). If upgrading to another feature package, the corresponding new license file must be installed.

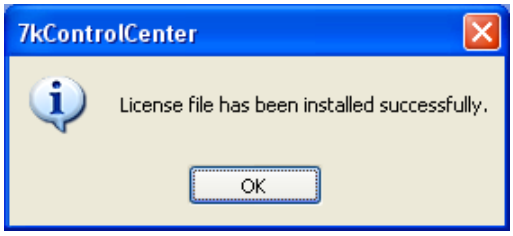
1. Right-click the title bar of the 7k Control Center or the taskbar, and select Install License File.



2. Save the license file in a folder of your choice.
The default file location is the My Documents folder.



3. Click Open to load the license file.



4 SYSTEM CONFIGURATION

4.1 Chapter Overview

This chapter includes detailed instructions on the following subjects (click the emphasized hyperlink to be taken to the section):

- ***Configuration Menu Options:*** Consists of detailed instructions on setting up the parameters that determine the way the sonar system behaves.
- ***Channel Normalization:*** Consists of detailed instructions on how to use this feature.
- ***I/O Module Configuration:*** Consists of detailed instructions on setting up peripheral sensors (such as SVP and clock) and a presentation of the 7k external I/O monitor window.
- ***Remote Operation:*** Consists of instructions on how to control the sonar from a remote PC.
- ***Folder Management:*** Consists of instructions on file sharing and renaming of computer or workgroup.

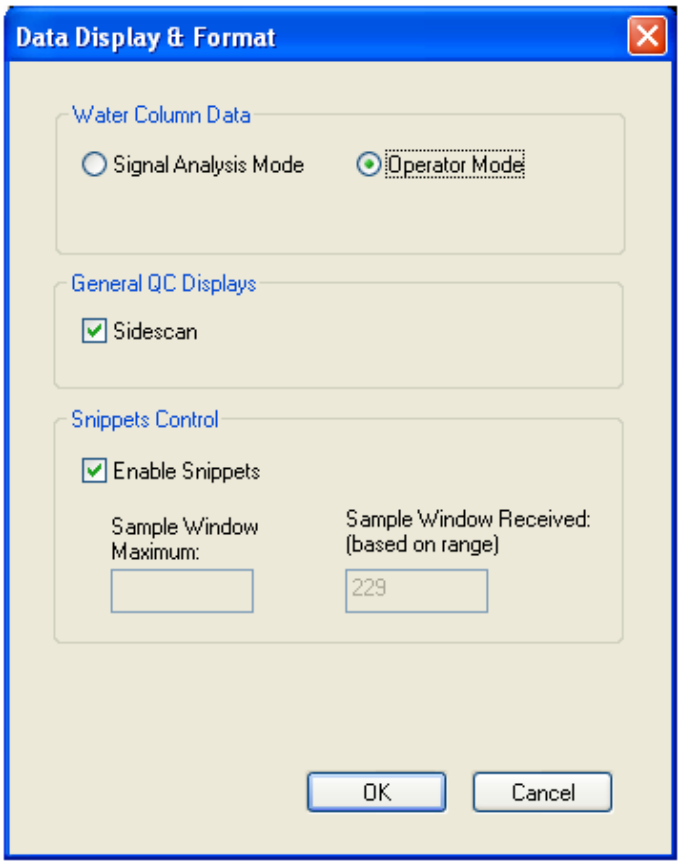
NOTE
For information on starting, stopping, and setting up the SeaBat sonar system, see *section 3 System Startup and Shutdown*.
For information on the user interface and operation of the system, see *section 5 System Operation.*
For information on the practical use of the sonar, see *section 6 Active Sonar Usage.*
For information on installation and details on the various system components, see *Appendix B Installation Instructions*.

4.2 Configuration Menu Options

The various configuration options available for the SeaBat 7125 SV sonar system are shown in the following illustration and are described in detail in the subsections below.

4.2.1 Data Display & Format

The Data Display & Format dialog controls the type of 7k records that are generated and displayed. These selections also determine what data is displayed.



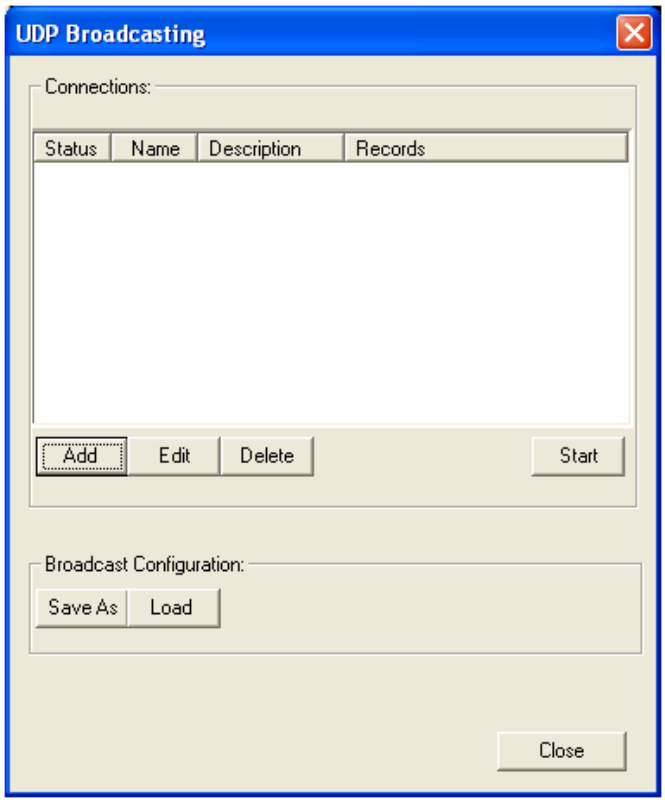
- **Water Column Data:** Use the radio buttons to select either amplitude only or full beam data for display in the A-scan window to the left of the sonar wedge and for output over the Ethernet broadcast or storage to a windows file.
    - Signal Analysis Mode: Magnitude and phase data are both transmitted to the user interface. This allows for phase data to be analyzed in the A-scan displays. As this option increases the CPU usage for the SeaBat, RESON recommends that this option only be used when inspecting phase data.
    - Operator Mode: The SeaBat extracts only the magnitude from the ping data. This data is then compressed to a maximum of 1024 samples. If less than 1024 samples are received in the ping, no compression occurs. This feature improves the performance of the system, but eliminates the ability to inspect the phase data.
- **General QC Displays:** Select additional displays:
    - Sidescan: Select the check box to display the Side Scan tab.
- **Snippets Control:** Select the check box to display the Snippets tab.
    - Sample Window Maximum: Not available.
    - Sample Window Received: Not configurable.

4.2.2 UDP Broadcasting

The UDP Broadcasting dialog allows the operator to broadcast selected records to a remote IP address and UDP port.

From this dialog, you can:

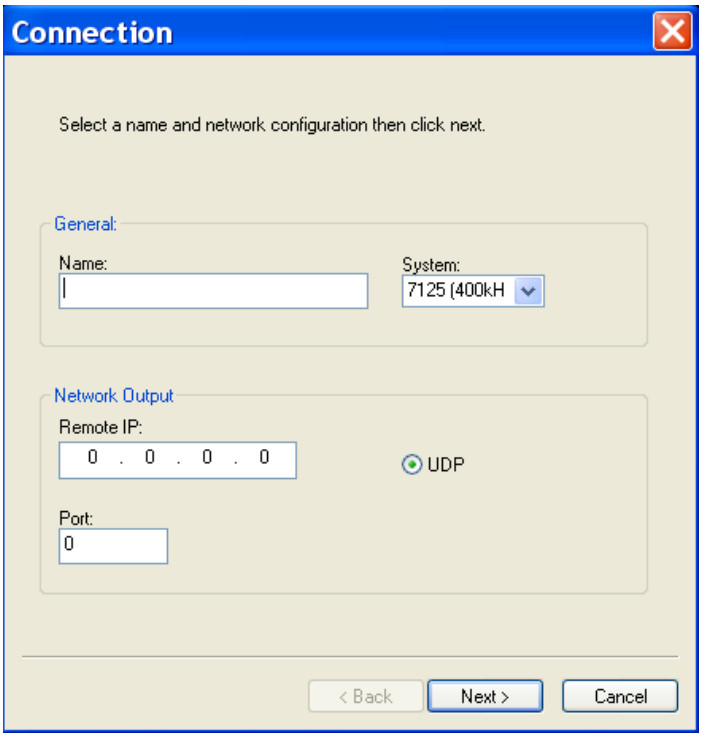
- Add, edit, or delete broadcast addresses.
- Start or stop the broadcast process.
- Save or load an existing broadcast configuration.



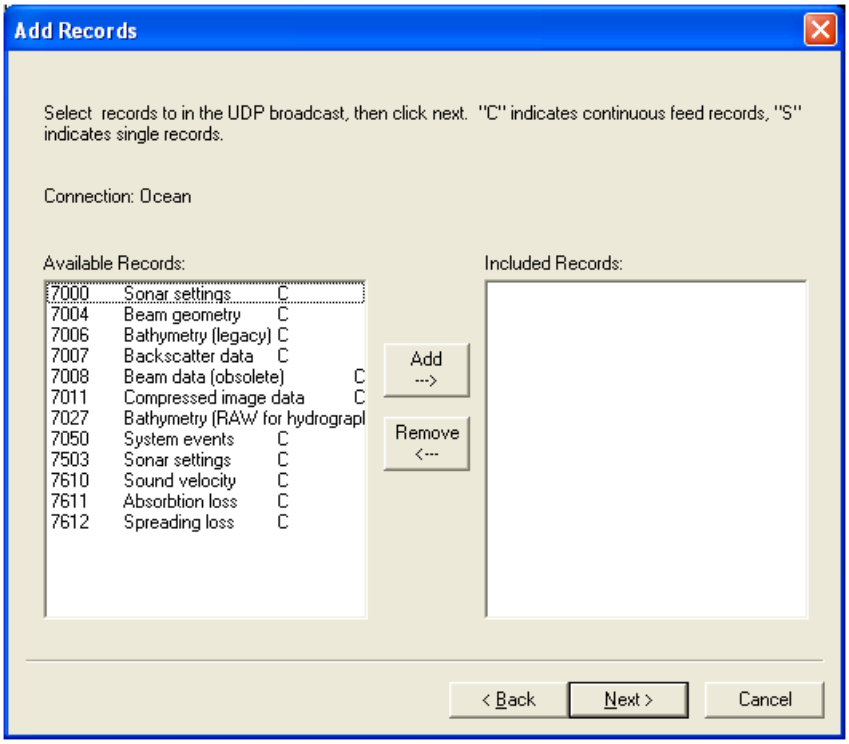
4.2.2.1 Add a New Broadcast

The Add button allows the creation of a new broadcast. To create a new broadcast:

1. Click the Add button to open the Connection dialog.



2. In the Connection dialog:
   a. Enter a name for the broadcast in the Name field.
   b. Enter the IP address of the target computer in the Remote IP field.
   c. Enter the port number for the target computer (a valid port number is required).
   d. Click Next to open the Add Records dialog.



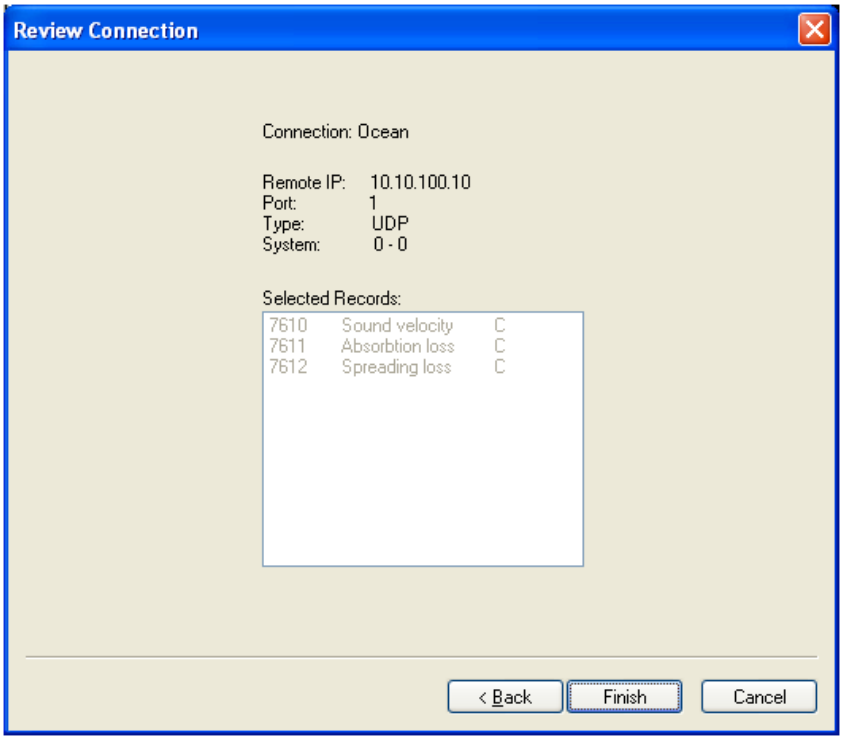
3. In the Add Records dialog:

   a. Select the records you want included in the broadcast by clicking on the record in the Available Records frame. Hold down the Ctrl key when selecting records, if you wish to add more than one record at a time.

   b. Click the Add button to add the selected record(s) to the broadcast. Successfully added records will appear in the Included Records frame.

   c. Once you have selected the records required for your broadcast, click Next to open the Review Connection dialog.

NOTE
Refer to the Data Format Definition document for information regarding the records you require (see *Appendix C Reference Documentation*).



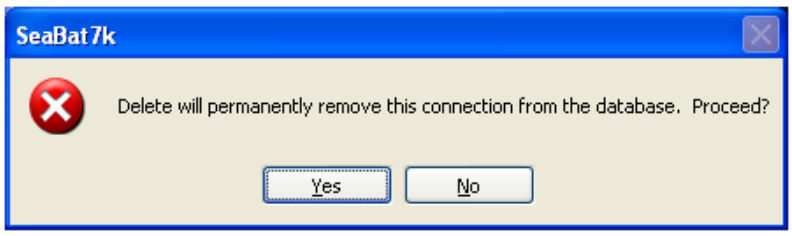
4. In the Review Connection dialog, review the information entered to make sure it is correct.
    a. If you want to make changes, click Back to move back through the previous steps.
    b. If you are satisfied that this is the connection you wish to create, click Finish to complete the process.
    c. If you decide not to create a broadcast at this time, click Cancel to terminate the process without creating the new broadcast.

4.2.2.2 Edit an Existing Broadcast

To edit an existing broadcast, select the broadcast you wish to edit in the UDP Broadcasting dialog and click the Edit button, and then follow the same instructions as in *section 4.2.2.1 Add a New Broadcast*.

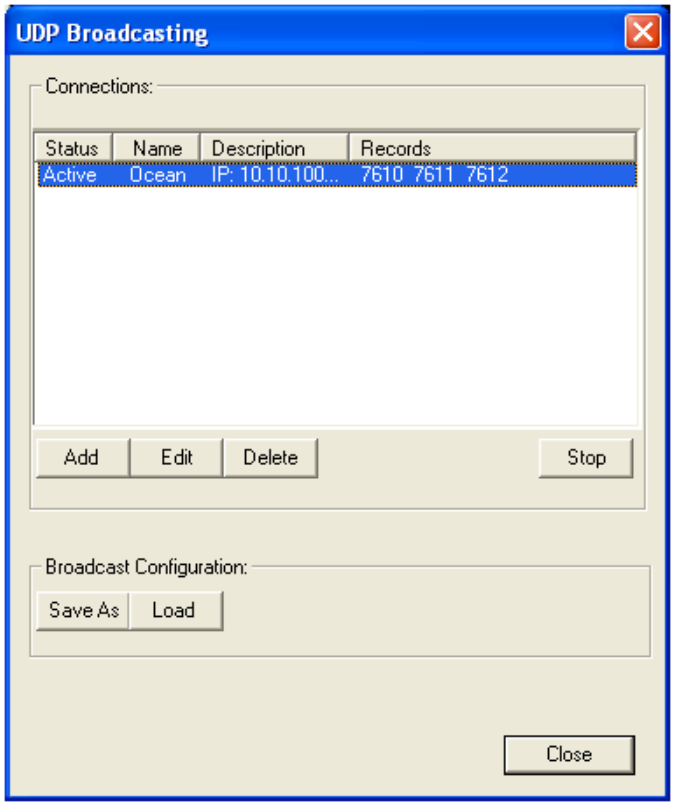
4.2.2.3 Delete a Broadcast

To delete an existing broadcast, select the broadcast you wish to delete in the UDP Broadcasting dialog and click the Delete button. A pop-up window will appear, asking you to confirm that you wish to delete the selected record. Click Yes to continue.



4.2.2.4 Start or Stop the Broadcast Process

To start a broadcast or stop an active broadcast, select the broadcast configuration from the UDP Broadcasting dialog list. The command button will indicate either Start for idle broadcast configurations or Stop for active configurations. Click the command (Start/Stop) button. The status indicates Active if the system is broadcasting messages to that address, or Idle if the system is not broadcasting messages to that address.



Active broadcast configurations are saved by the 7k Center software when it is stopped. On startup, these broadcasts are resumed. Active broadcasts may also be viewed in the Remote Connections list on the 7kCenter BITE tab (see *section 5.6.2.6 7kCenter Tab*).

4.2.2.5 Save or Load an Existing Broadcast Configuration

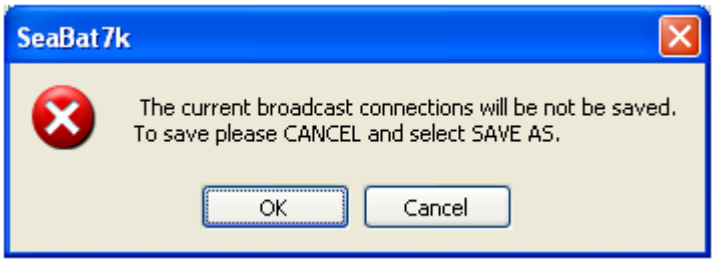
The most recent broadcast configuration is automatically saved and loaded whenever you start the SeaBat. In some cases, however, the operator may want to save a particular configuration for later use or load a different (previously saved) configuration instead of setting it up manually.

<u>To Save a Configuration:</u>

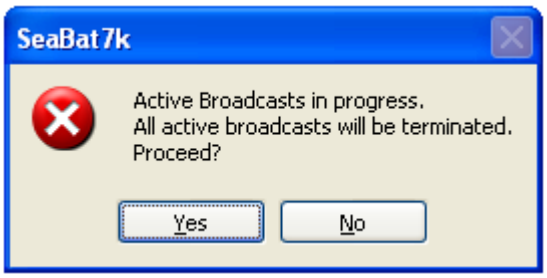
1. Make sure the configuration is set up correctly.
2. Click the Save As button.
3. Enter a file name and choose the location to which you want this file saved. The file extension is automatically set to (*.bcg).
4. Click Save.

To Load an Existing Configuration:

1. Click the Load button.
2. A warning box indicates that
   a. The new configuration file will completely overwrite the current configuration, if the system is not broadcasting (is idle). Click OK if you want to continue.



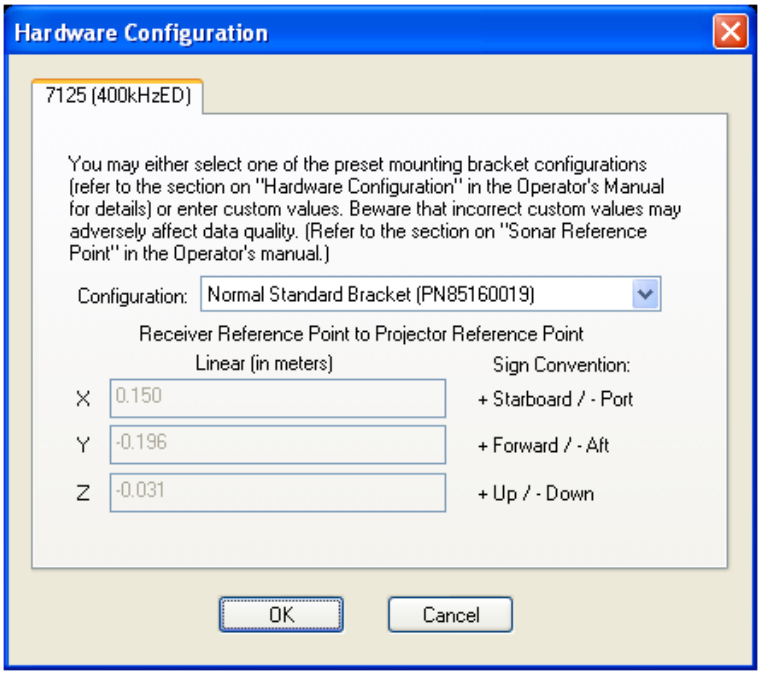
   b. The new configuration file will terminate active broadcasts. Click Yes if you want to continue. Click No if you want to stop and save a broadcast in progress.



3. Browse to the correct location and select the .bcg file you want to load.
4. Click Open.

4.2.3 Hardware Configuration

The Hardware Configuration dialog controls the one-time transmit array and projector settings. These settings should be set to reflect the initial installation of your system and should not require modification unless the physical installation changes. For details on sonar head installation, see *appendix B.6.5 Sonar Head Assembly Orientation*.



- **Standard Mounting Brackets:**
  - PN 85160019:

7125 Mounting Bracket. See also *appendix D.3 7125 Mounting Bracket*.

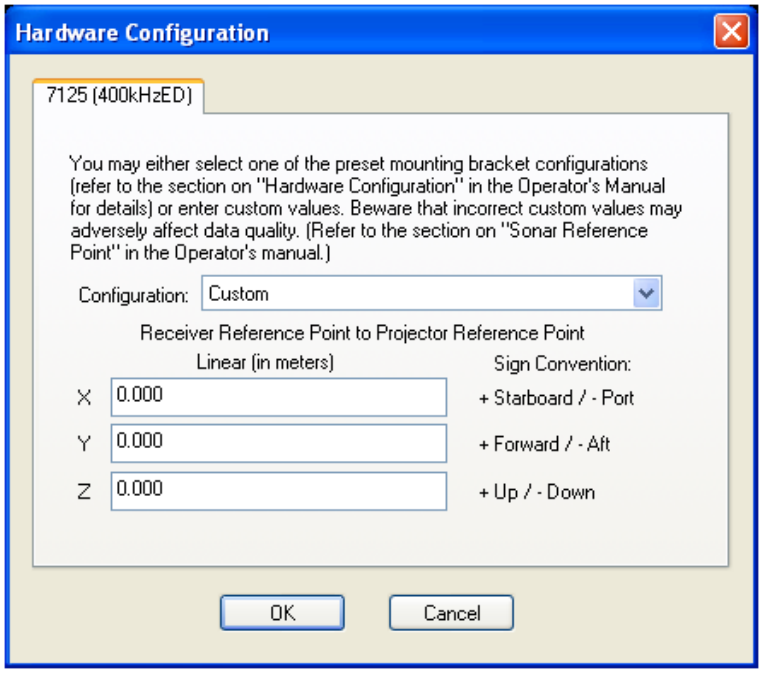
  - PN 85001559[4]:

SeaBat 7125 Mounting Kit and Fairing.

- **Preset Configurations:**
  - Normal: When the receiver is mounted with the connector to the left, the Configuration selection should be one of the Normal Standard Brackets (see *appendix B.6.5 Sonar Head Assembly Orientation*).
  - Reversed: When the receiver is mounted with the connector to the right, the Configuration selection should be one of the Reversed Standard Brackets (see *appendix B.6.5 Sonar Head Assembly Orientation*). Note that this normalizes the image only and does not affect data output.

[4] Observe that this bracket is no longer available for purchase.

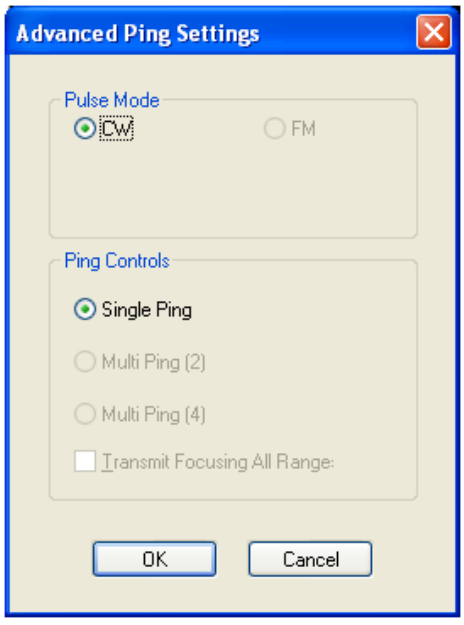
- **Custom Configuration:**
  - For details on receiver and projector reference points, see *appendix B.6.6 Sonar Reference Point*.



CAUTION
Incorrect offset settings could severely affect data quality.

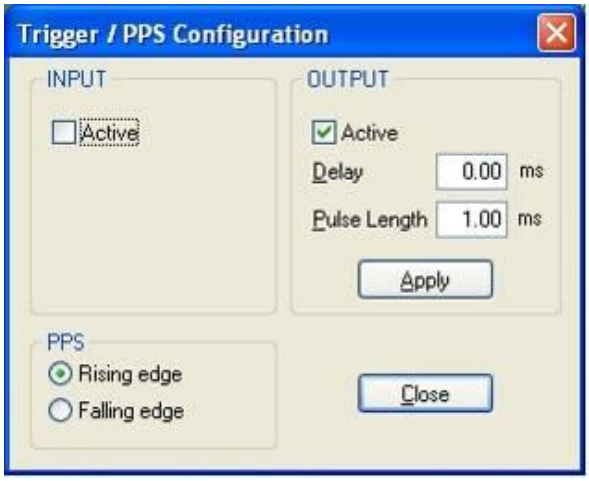
4.2.4 Advanced Ping Settings

The Advanced Ping Settings dialog is not configurable. Default settings are Continuous Wave (CW) and Single Ping.



4.2.5 Triggering

The Trigger/PPS Configuration dialog allows the operator to control the pulse length and delay characteristics.



4.2.5.1 Trigger Input

- **Active:** The Active check box is not selected (inactive) by default. When selected, the ping will occur upon receipt of the input trigger pulse. If the trigger pulse rate exceeds the sonar's actual maximum ping rate for that range setting, some trigger input pulses may be dropped. Deselecting the check box will return the sonar to ping at the rate dictated by the settings on the Main Sonar Settings tab.

4.2.5.2 Trigger Output

A TTL trigger out pulse, approximately synchronous with the transmit pulse, is available via a BNC connector marked Trig Out on the rear panel of the transceiver (see *appendix B.3.3 Transceiver Cable Connections*). *Figure 4* shows a pulse example.

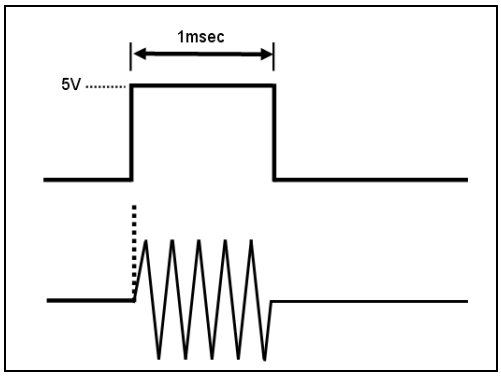


Figure 4: Example of Trigger Output: Delay = 0, Pulse Width = 1

- **Active:** The Active check box is selected by default. When selected, a pulse will be generated in conjunction with the sonar ping.

- **Delay:** The default setting is 0.00ms. This setting allows the operator to specify how many milliseconds after the sonar ping the output pulse will be sent.
- **Pulse Length:** The default setting is 1.00ms. This setting allows the operator to change the pulse length of the transmitted output signal. For the SeaBat 7125 SV, the pulse length plus the delay must be slightly less than 20ms.
- **Apply:** Click the Apply button to finalize changes.

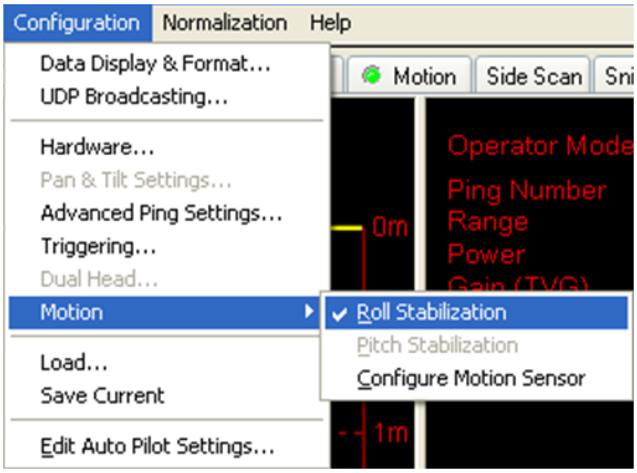
4.2.5.3 1PPS Polarity

- **Rising edge:** By default, the SeaBat system accepts positively polarized (rising edge) 1PPS pulses to perform accurate time stamping.
- **Falling edge:** If a negatively polarized (falling edge) 1PPS is used, the Falling edge button in the Trigger/PPS Configuration dialog must be selected to ensure accurate timing.

The 1PPS selection will appear on the sonar image control portion of the Primary Display tab (see also *section 5.3.4 1PPS Input Indicator*).

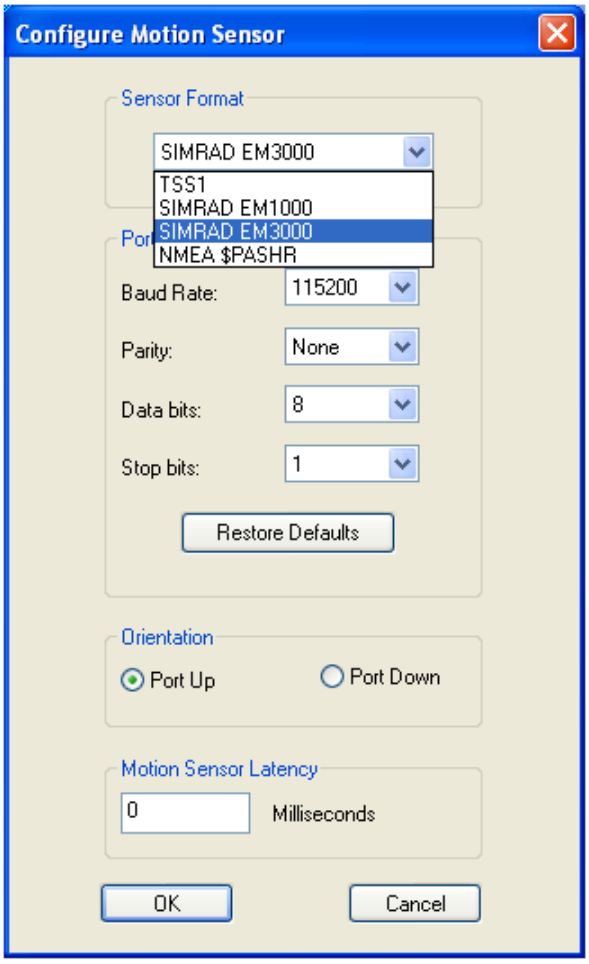
4.2.6 Motion[5]

Electronic compensation for roll is included in the system, meaning that the system can operate with almost full performance within a +/-10° roll area, with the exception of the outer sectors/beams.



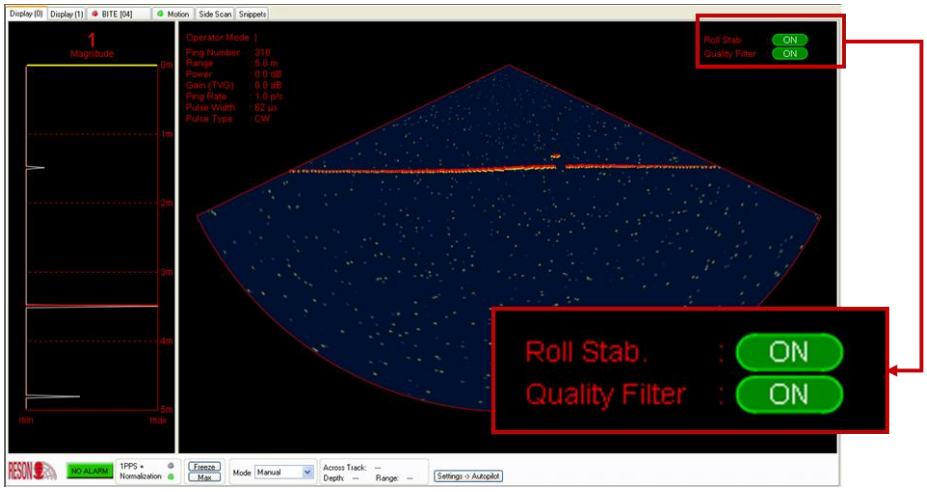
- Select Motion and then Roll Stabilization to activate (or deactivate) this functionality.
- Select Motion and then Configure Motion Sensor to open the following dialog.

[5] Available with the Efficiency feature package (see *Table 20*).



- From the Sensor Format drop-down menu, select the required option and any other control settings for the motion sensor.
- From the Baud Rate drop-down menu, select the desired option. For best performance, the 115200 setting is recommended.

- The status of Roll Stab is reported on the Primary Display tab (see also *section 5.3 Primary Display Tab*).



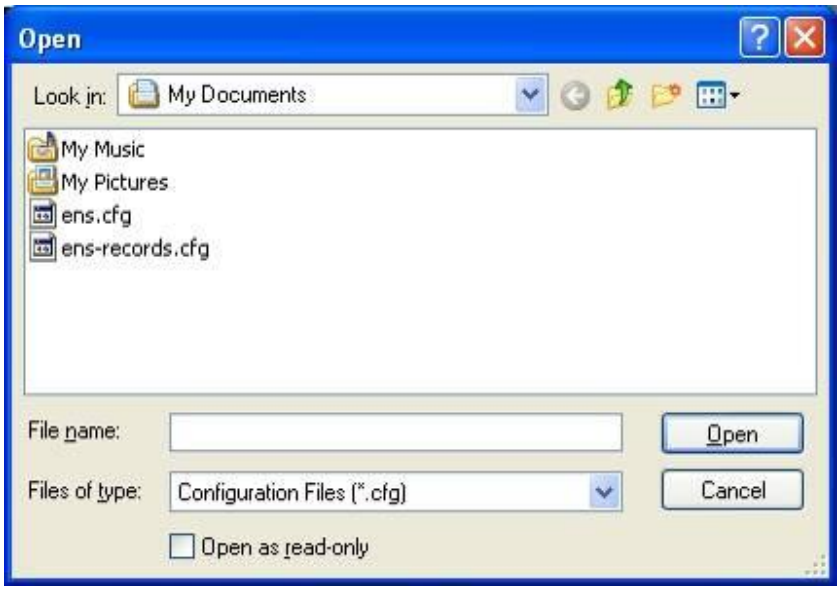
- On the Motion tab it is possible to view motion format information and current data as well as a variable graphical display of roll history (see *section 5.4 Motion Tab*).

NOTE
The system will recall the motion settings used during the last sonar operation. In the event that the default settings are used, Roll Stabilization will be enabled on startup.

4.2.7 Load

The Load option allows the operator to load a set of saved sonar settings from a file. For example, you may develop specific settings that are optimal for mapping in a certain location or region. Upon returning to that area, the saved settings can be loaded from a file. The sonar must be pinging to load a configuration.

1. Verify the Mode is set to Manual and the Max Rate slider on the Main Sonar Settings tab is not OFF (see appropriate subsections in *chapter 5 System Operation*).
2. Select the Load option from the Configuration menu to access the Open dialog.

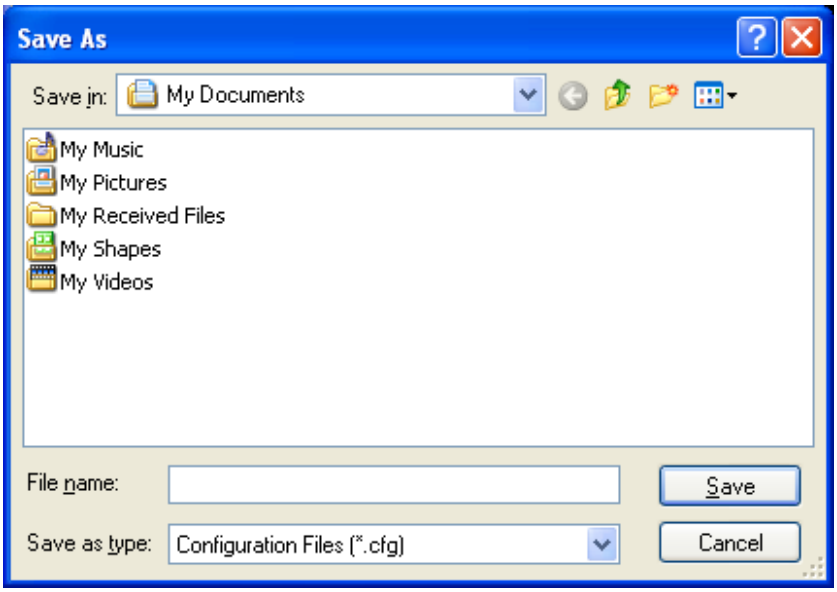


3. Browse to the correct location and select the .cfg file you want to load.
4. Click Open.

4.2.8 Save Current

The Save Current option allows the operator to save the current sonar settings to a file, to be loaded later in matching environments.

1. Verify the Mode is set to Manual and the Max Rate slider on the Main Sonar Settings tab is not OFF (see appropriate subsections in *chapter 5 System Operation*).
2. Select the Save Current option from the Configuration menu to access the Save As dialog.



3. Browse to the location where you want the file saved and enter a file name. The file extension is automatically set to (*.cfg).
4. Click the Save button.

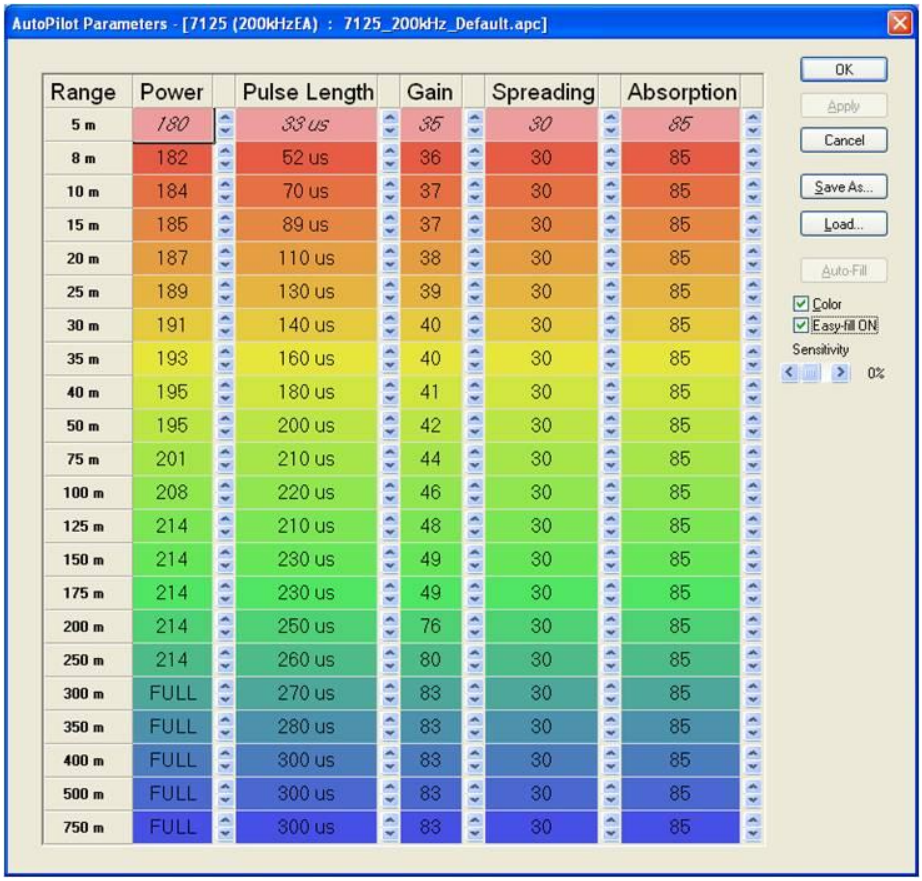
4.2.9 Edit Auto Pilot[6] Settings

The data contained within the look-up table is specific to a sonar type and may be manually edited. These settings are specified by the operator prior to initiating Auto Pilot mode (see *section 5.3.8 Change Modes*). A default set of values are included in the table which may require modification based on the specific conditions encountered.

To modify the default parameters:

1. Select Edit Auto Pilot Settings from the Configuration menu.
2. Make changes by using the arrow buttons next to the desired setting:
   a. Press one of the arrow buttons, and
   b. Drag the pointer to pull the appearing slider up or down to modify the setting.
3. Click Apply to carry out the changes. (Clicking OK will also close the dialog).

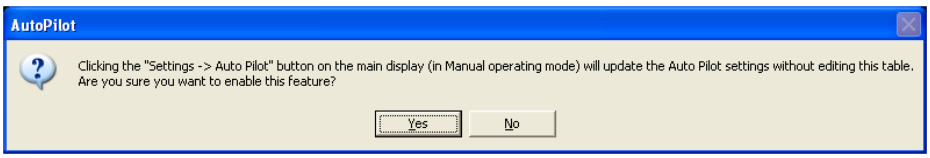
[6] Available with the Efficiency feature package (see *Table 20*).



Range	Power	Pulse Length	Gain	Spreading	Absorption
5 m	180	33 us	35	30	85
8 m	182	52 us	36	30	85
10 m	184	70 us	37	30	85
15 m	185	89 us	37	30	85
20 m	187	110 us	38	30	85
25 m	189	130 us	39	30	85
30 m	191	140 us	40	30	85
35 m	193	160 us	40	30	85
40 m	195	180 us	41	30	85
50 m	195	200 us	42	30	85
75 m	201	210 us	44	30	85
100 m	208	220 us	46	30	85
125 m	214	210 us	48	30	85
150 m	214	230 us	49	30	85
175 m	214	230 us	49	30	85
200 m	214	250 us	76	30	85
250 m	214	260 us	80	30	85
300 m	FULL	270 us	83	30	85
350 m	FULL	280 us	83	30	85
400 m	FULL	300 us	83	30	85
500 m	FULL	300 us	83	30	85
750 m	FULL	300 us	83	30	85

Additional options include:

- **Save As:** Store any number of user-defined tables.
- **Color:** Click the check box to display the dialog in color.
- **Easy-fill ON:** Click the check box to update the Auto Pilot settings automatically when in Manual operating mode.
  - Click Yes when asked to allow it.



  - Click the Settings -> Autopilot button to update the table.

- **Sensitivity:** The slider bar controls how much “extra margin” the Auto Pilot allows when calculating the range setting to use based on the recent ping’s bathymetry detections.

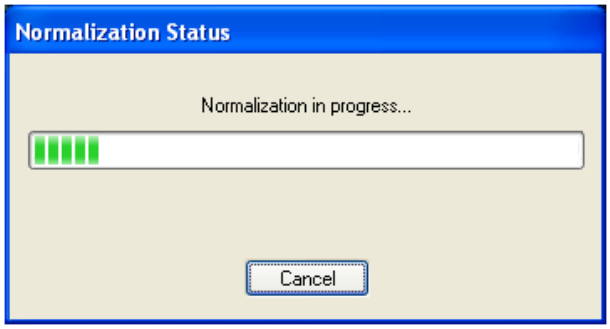
For examples on how to use this feature, see *section 6.3.1 Auto Pilot*.

4.3 Channel Normalization

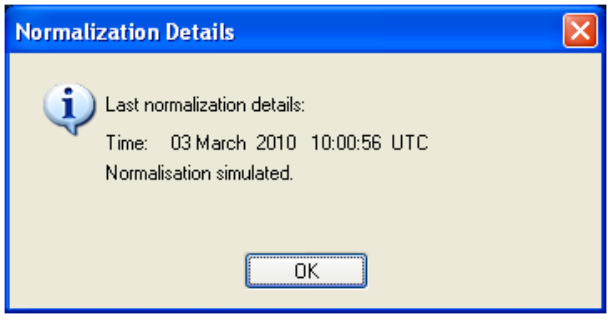
The channel normalization process is performed manually via the Normalization menu.

The channel normalization feature provides a method of measuring and correcting for the gain and phase offsets for each individual electrical channel of the receiver. This is achieved by injecting a highly stable tone into each receiver channel. The application of the gain and phase offsets prior to beamforming improves the sidelobe suppression.

- Selecting Normalize will start the channel normalization process.



  - The Normalization Status dialog is modal, which means that the system automatically switches in and out of I/O mode during the process; nothing else can be done while it is in progress.
  - Clicking Cancel will return the display to the previous channel normalization state.
  - The user is also given the option of retaining the previous channel normalization, if the new one fails.
- Selecting Details from the Normalization menu will display the time and date of the last normalization.



The current channel normalization status of the system appears on the sonar image control portion of the Primary Display (see also *section 5.3.5 Normalization Indicator*).

4.4 I/O Module Configuration

The I/O Module Setup tab is the primary means of configuring data flow into the SeaBat from RS-232 devices attached to the system (such as SVP and/or clock). Configuration through this interface sets up the I/O module installed on the transceiver. The data acquired by the I/O module is routed to the SeaBat in real time to allow for accurate time stamping and beamforming.

For instructions on how to monitor the I/O module devices, see *section 4.4.3 below.*

For instructions on how to install the I/O module devices, see a*ppendix B.4 Auxiliary Sensors*.

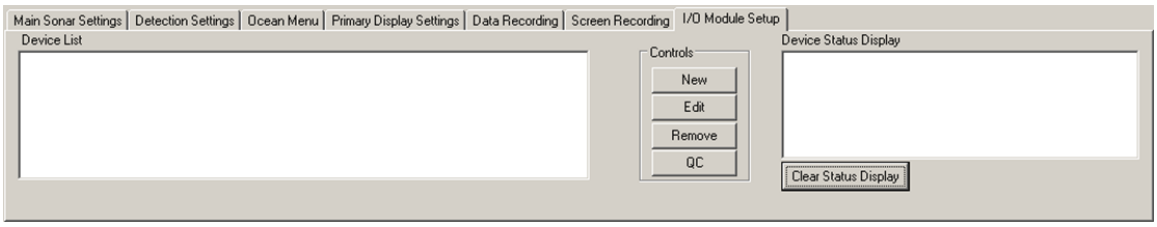


Figure 5: Sample of I/O Module Setup Tab

- **Device List:** This frame displays the current list of devices.
- **New:** Create a new I/O device.
- **Edit:** Edit an existing I/O device.
- **Remove:** Delete an I/O device from the list.
- **QC:** Launch the 7k external I/O monitor window (if the I/O Module is running).
- **Device Status Display:** Shows the status of the corresponding device in the Device List frame.
- **Clear Status Display:** Clears and resets the status display.

NOTE
Accuracy of the bathymetric data depends entirely on valid time sync and SVP input from this module, unless another solution such as PDS2000 is being used to perform this function. In the absence of time sync, a software time stamp is employed. However, this usually results in poor data quality, as the time stamp is applied AFTER the last sample is received. In the absence of online SVP input, the input from the Ocean Menu tab (see *section 5.7.3.3 Set the Sound Velocity*) is used instead.

4.4.1 Device Types

NOTE
If data is to be logged in the S7K format, it may be advantageous to log position and heading as well. To achieve this, position and heading sensors should be interfaced though the I/O module in addition to the mentioned sensors.

4.4.1.1 Sound Velocity Probe

To achieve correct beam steering in equidistant mode, the sonar needs to have an up-to-date sound velocity measurement from the water in the area of the sonar head. The sound velocity must always be entered in the I/O module, even if PDS2000 or a different acquisition system is used. For installation instructions, see *appendix B.4.1 Sound Velocity Input*.

4.4.1.2 Clock (1PPS)

To achieve correct time stamping of transmitted pulses it is necessary to send time to the transceiver. The SeaBat uses the GPS PPS system to achieve this. The Data Acquisition System (DAC) should also be synchronized to this. From the GPS receiver, the SeaBat needs the TTL 1PPS pulse and the qualifying time message (normally ZDA). The clock synchronization must always be entered in the I/O module. For installation instructions, see *appendix B.4.3 Time Input*.

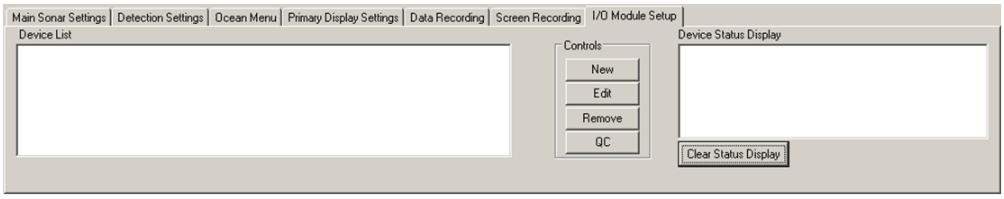
4.4.1.3 Motion Sensor

To achieve roll stabilization the sonar needs to receive input from a motion sensor. The roll input to the sonar should be the observed roll at the sonar head. If PDS2000 or a different acquisition system is used, the motion sensor should not be entered in the I/O module. The motion sensor data for the roll stabilization is read directly from the FPGA. For installation instructions, see *appendix B.4.2 Motion Sensor Input*.

4.4.2 Adding a Device

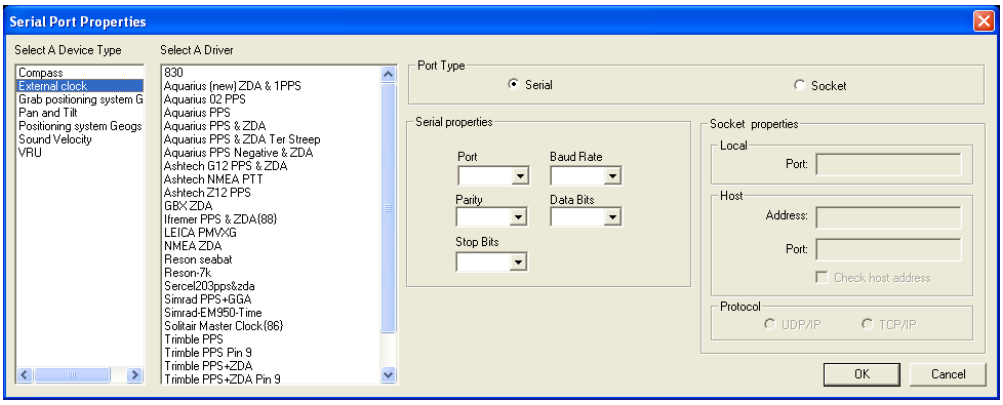
To add a new I/O module device, follow these steps:

1. Start the 7k user interface and select the I/O Module Setup tab.



2. Click New to add the relevant device (e.g. SVP, clock, motion sensor).
3. Select device type and driver.
4. Click the required Port Type.
5. Select the appropriate settings under Serial or Socket properties, Host, and Protocol (the settings may be preselected).

6. Click OK.



7. On the I/O Module Setup tab, click the QC button to bring up a 7k external I/O window, which shows the raw data and the associated decoded data.

   The status should be green (see section *4.4.3 below*). If the status is not green, this might be due to:

   - An incorrect driver
   - An error in the port parameters
   - No data or 1PPS pulse coming in

If the PPS pulse is not detected during sonar operation, the PPS status LED changes from green to red and a warning appears and an alarm is generated in the SeaBat.

4.4.3 I/O Module Setup Check

The I/O module devices can be monitored on the main 7k external I/O window (see *Figure 6*). This window is a property sheet with one tab for each sensor, the Clock and Sound Velocity, and an Output tab.

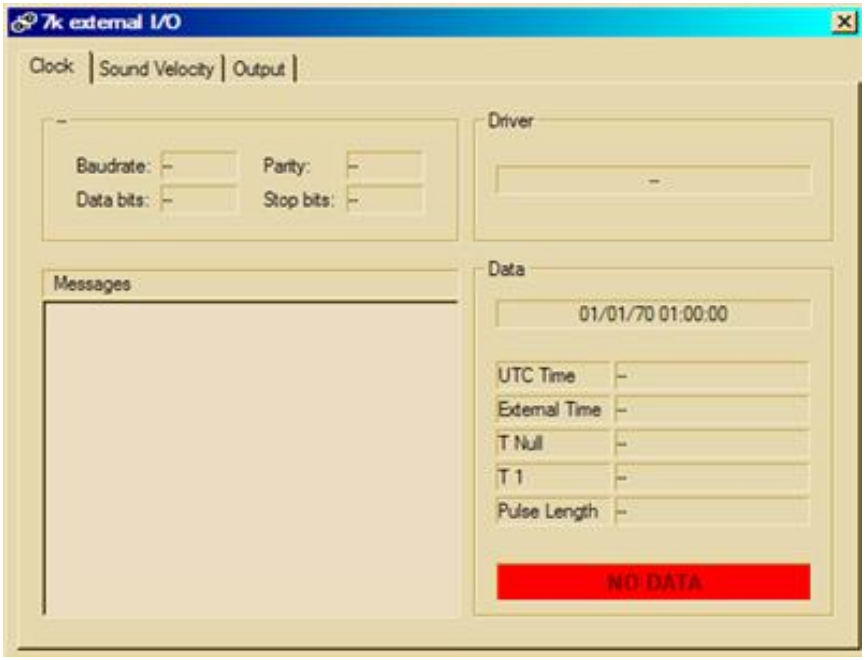


Figure 6: 7k External I/O Window

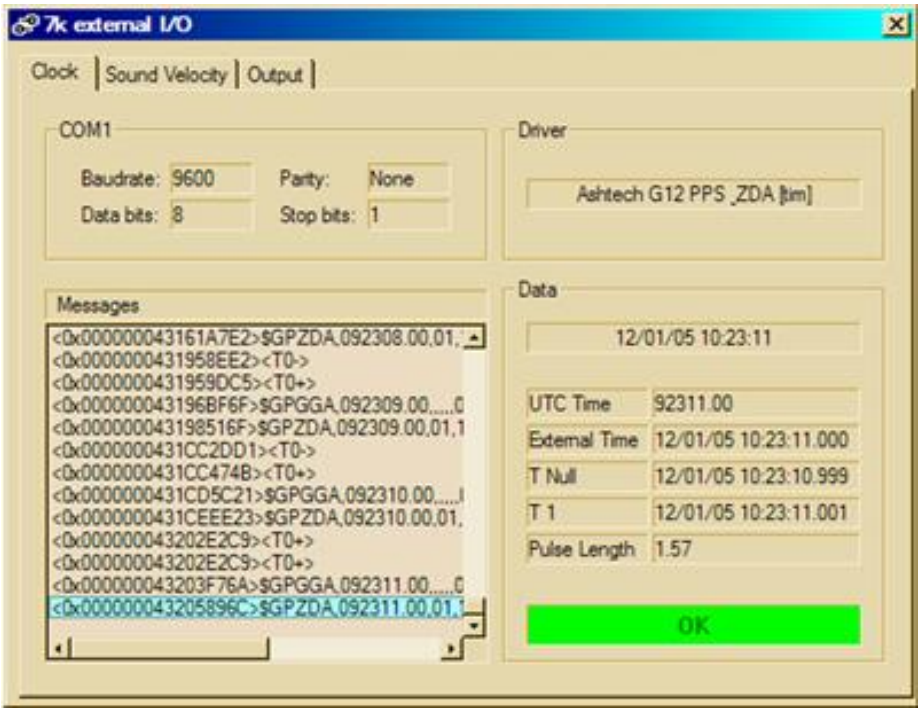
NOTE
The 7k external I/O window only monitors the I/O Module's operation. All user input (creating or changing the configuration) is done on the I/O Module Setup tab of the 7k user interface (see *section 4.4 above*). The I/O Module automatically saves configuration information and loads the last settings upon restart.

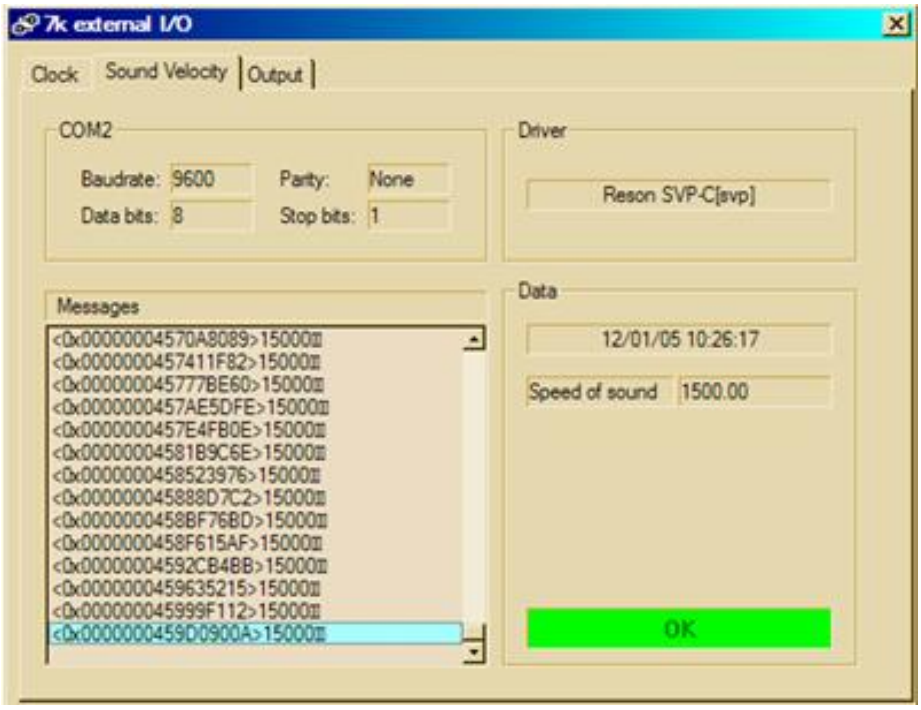
Right-clicking the I/O Module icon that appears in the Windows notification area opens the following menu.

- **Show:** Displays the main window.[7]
- **Hide:** Hides the main window.
- **About:** Displays a dialog with version information.
- **Exit:** Stops the I/O Module.

The Clock tab and the Sound Velocity tab show the port settings, names of the selected driver, raw data messages, and decoded values of the incoming data and a status indicator. Once configured by the 7k user interface (see *section 4.4 above)* and running and receiving data, messages will begin to appear in the Messages frame.

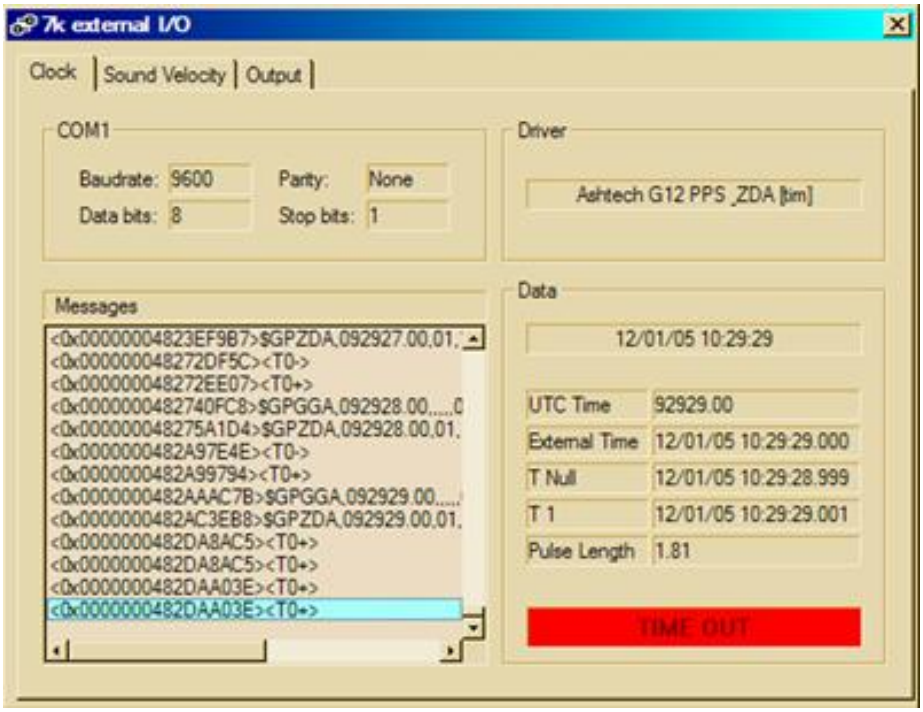
[7] Clicking the QC button on the I/O Module Setup tab will also launch the 7k external I/O window.



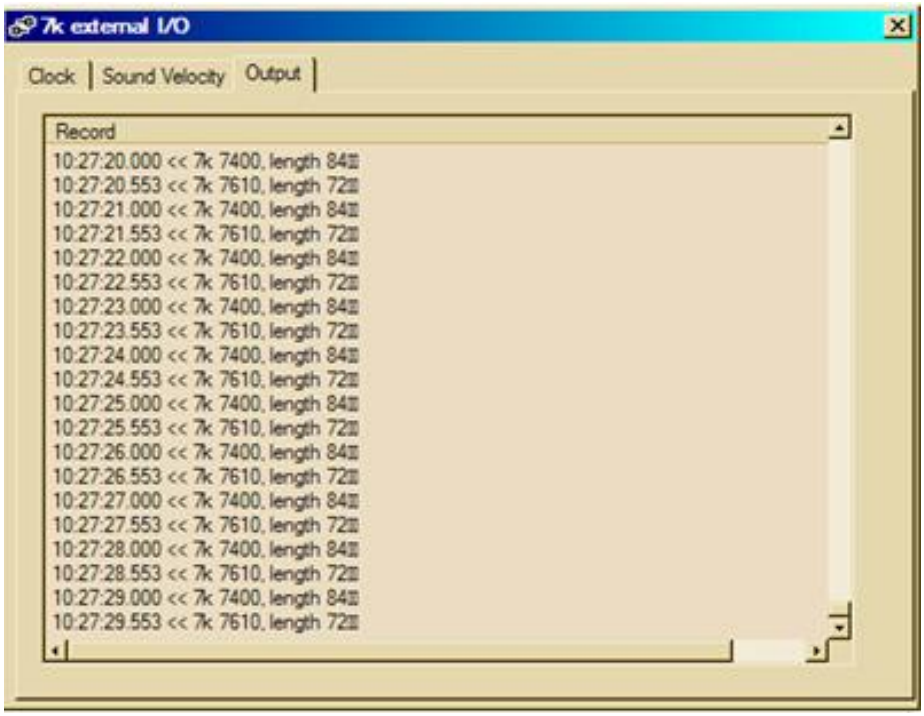


The status indicator shows OK in green when the data flow is normal.

When a problem occurs in the data flow (for example, when a serial cable is disconnected or unexpected data is received), the status indicator changes to red and shows the new status. When the data flow has been recovered, the status returns to OK.



The Output tab shows the 7k messages that are being sent to the 7k Center. For example, when an external clock and a sound velocity device are connected and generating data, the Output tab will show 7400 messages (external clock) and 7610 messages (sound velocity).



4.5 Remote Operation

The 7k series software architecture is built on a client/server concept. The 7k Center running on the transceiver controls the sonar, performs data processing, and exports data to external clients connected via TCP IP or UDP Ethernet connections. It is normal to run client applications such as the GUI (Graphical User Interface) on the transceiver platform, but clients may also be run remotely.

If the 7k GUI (SeaBat7K.exe) is started on a remote machine which does not have a 7k Center running, the user is prompted to enter an IP address for the machine running the center. This way the GUI can be run remotely.

Depending on Ethernet bandwidth and traffic load, remote operation may result in reduced performance or, in some severe cases, data loss.

The following files, all from the RESON directory on the transceiver, must be copied to a directory on the remote PC (RESON recommends placing these files in the "Program Files" directory).

- SeaBat7k.exe
- MathUtils.dll
- TrueTimeSDK.dll
- XGRAPH10.dll
- RSBDirTree.dll

NOTE
A shortcut to SeaBat7k.exe can be placed on the desktop for easy program start.

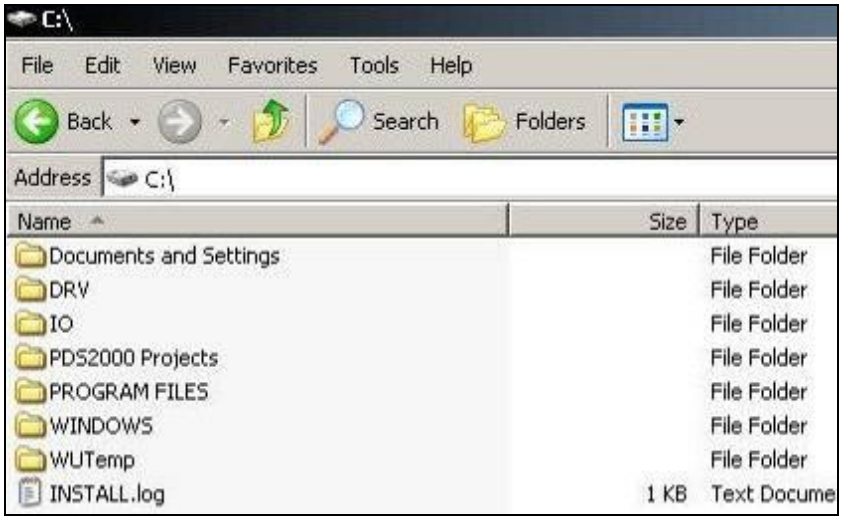
4.6 Folder Management

4.6.1 Sharing a Folder on a Network

This section describes how to create a shared folder on the transceiver. Shared folders allow users to access and move data off the transceiver to another network-connected PC.

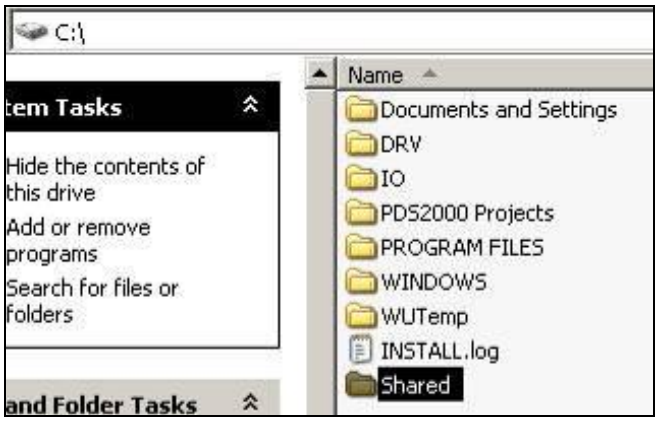
NOTE
A network switch is recommended for ease of file sharing and high-speed data transfer reliability.

1. Go to My Computer and open the C:\ drive, and right-click on the blank area in the middle of the window.

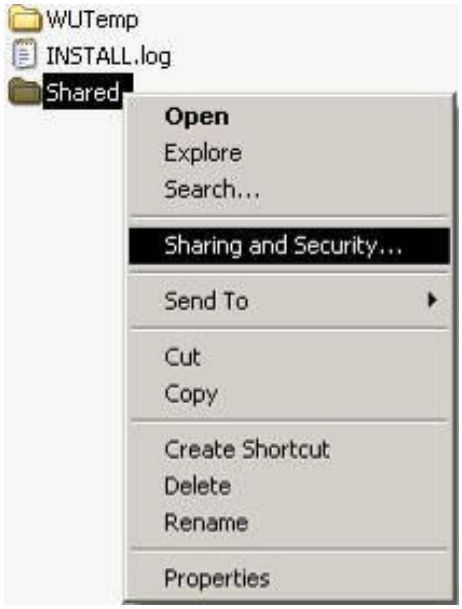


2. Select New | Folder.

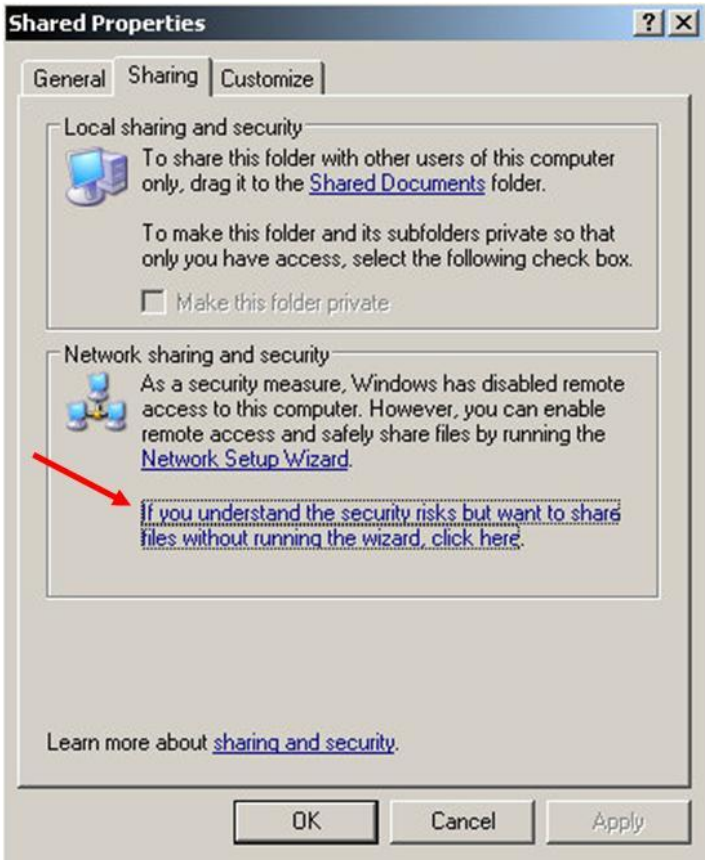
3. Change the name of the folder to Shared.



4. Right-click on the Shared folder and select Sharing and Security from the menu.

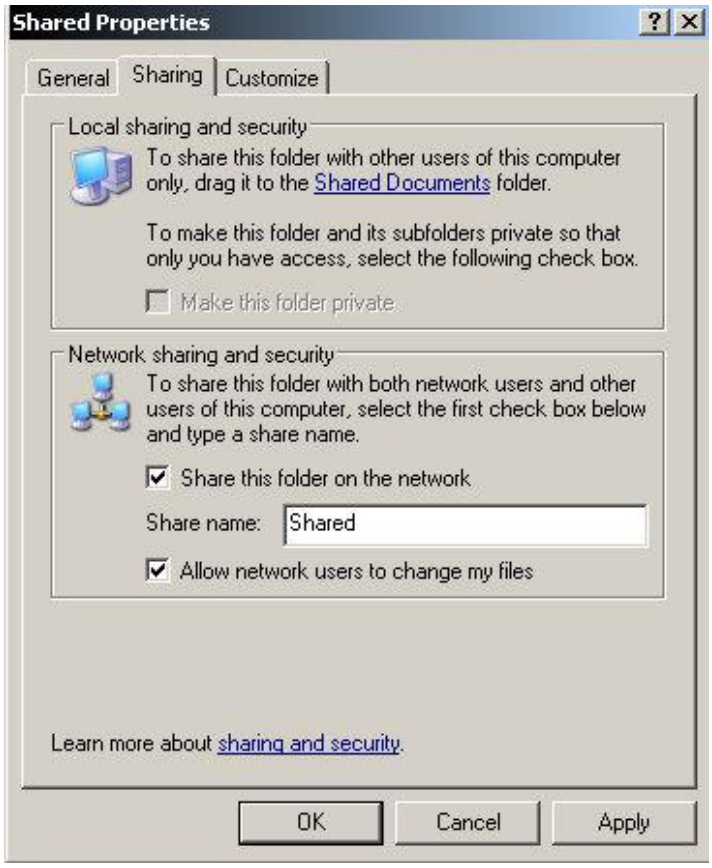


5. In the Shared Properties dialog, select the Sharing tab and click the hyperlink (indicated by the red arrow) in the Network sharing and security frame.



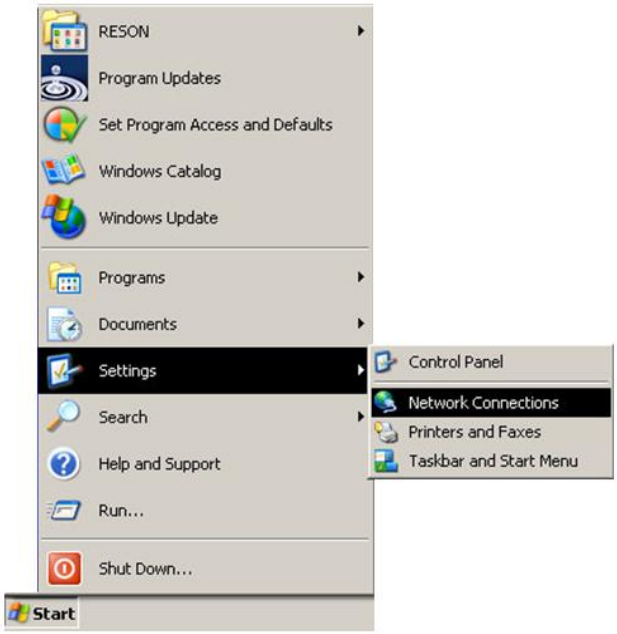
6. In the Enable File Sharing pop-up window, select the Just enable file sharing button and click OK.

7. In the Shared Properties dialog, select the two check boxes in the Network sharing and security frame and click OK.

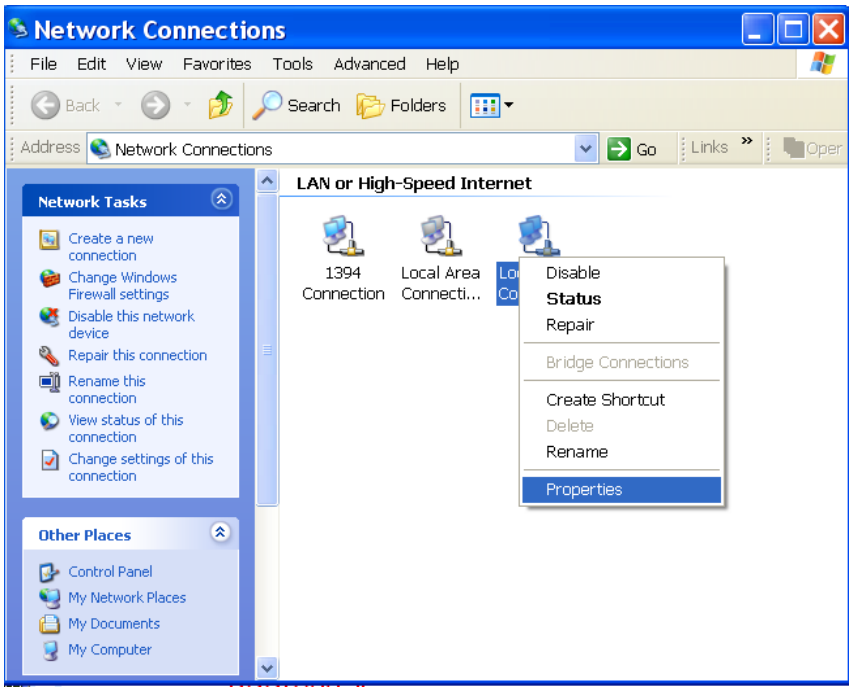


8. Navigate to the C:\ drive and verify that the folder Shared has a sharing icon (indicated by a hand holding a folder).

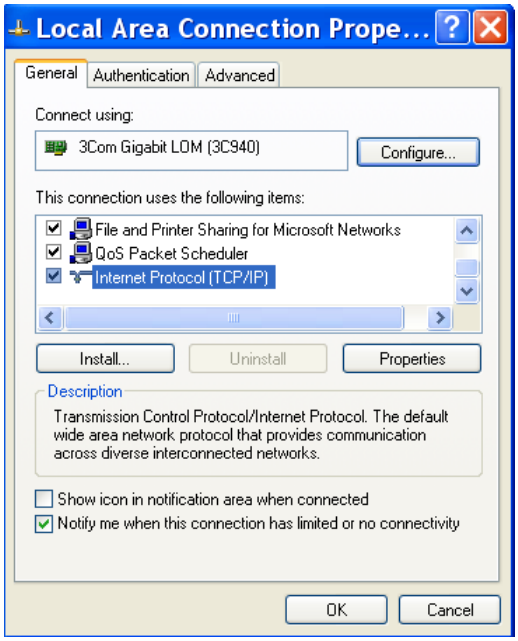
9. Go to the Start menu and select Settings | Network Connections.



10. In the Network Connections window, right-click on the active Local Area Connection and select Properties from the menu.



11. In the Local Area Connection Properties window, double-click the Internet Protocol (TCP/IP) selection.



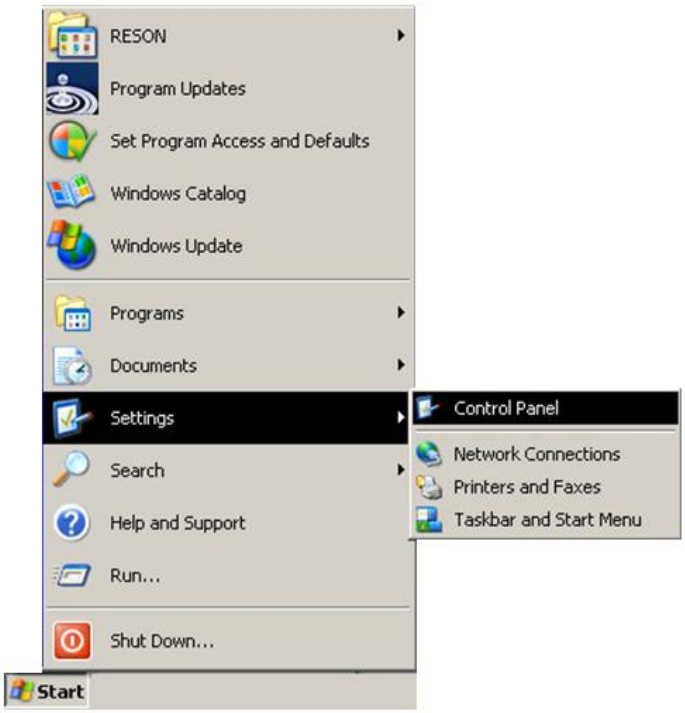
12. The Internet Protocol (TCP/IP) Properties window appears. By default, the transceiver automatically obtains an IP address. Click OK or set up your own parameters.

4.6.2 Verifying or Changing the Computer Name and/or Workgroup Name

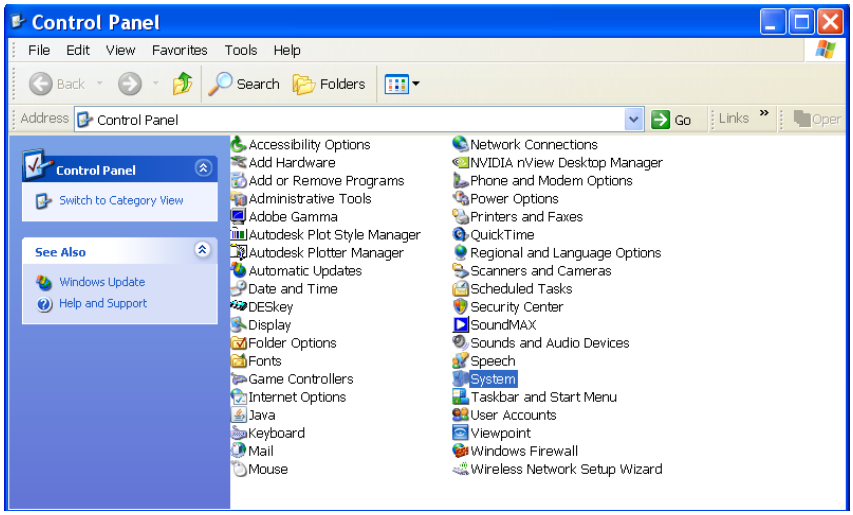
NOTE
If changing the Computer Name, a restart of the transceiver is required before the new name takes effect.

The default workgroup name for the transceiver is *Workgroup* and can be found on the network workgroups. Use the following steps to verify or change the computer name and/or workgroup name.

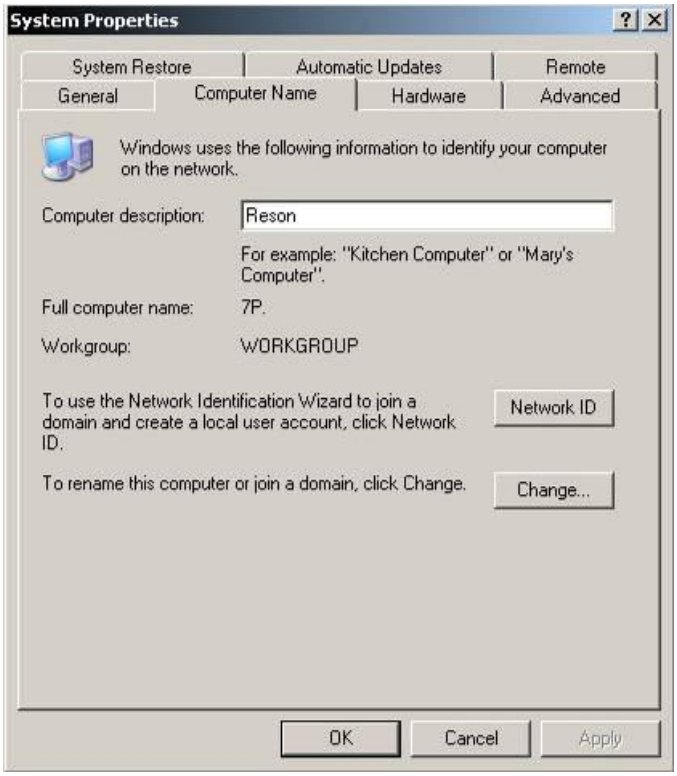
1. Go to the Start menu and select Settings | Control Panel.



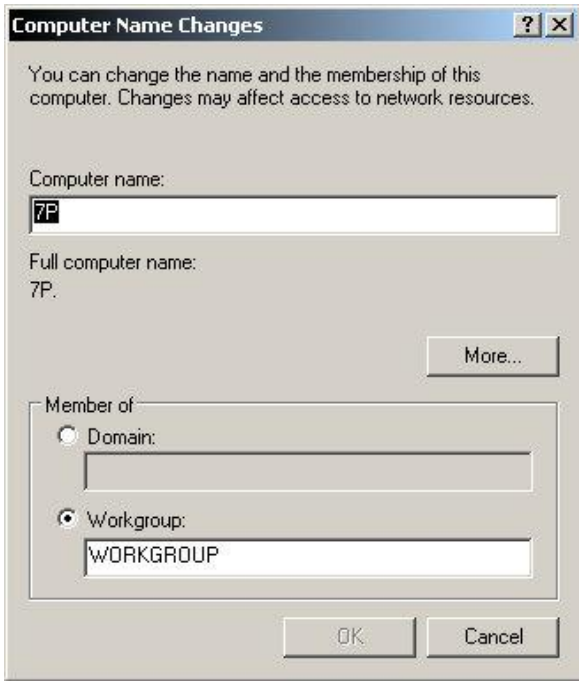
2. Double-click on System.



3. In the System Properties window, select the Computer Name tab to review the computer description, full computer name, and the workgroup name.
   - To change the computer description: Enter the new description in the Computer description field and click OK.

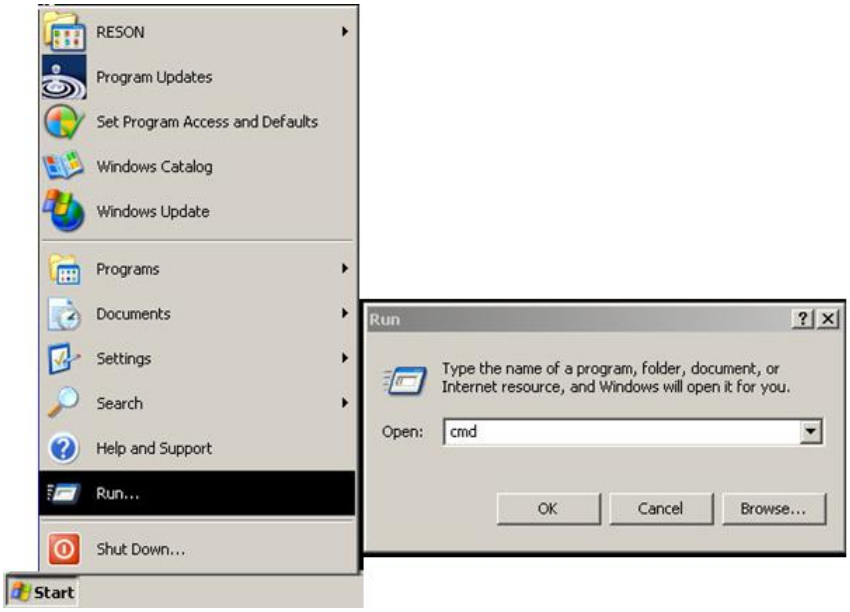


- To change the computer name[8] or workgroup: Click the Change button and enter a new computer name or workgroup name and click OK. Changing either of these names does not affect the IP address.

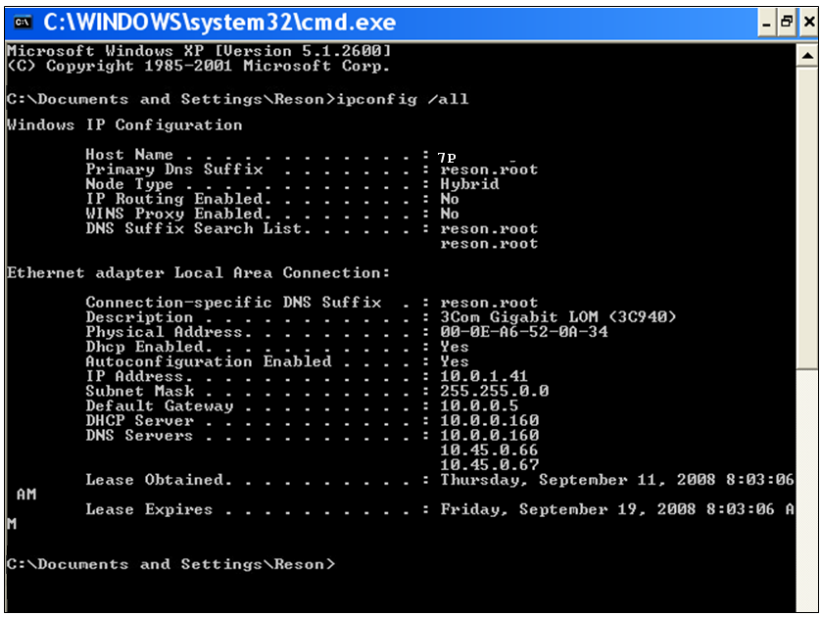


[8] Computer name is by default: SN xxxxxxx (7-digit serial number).

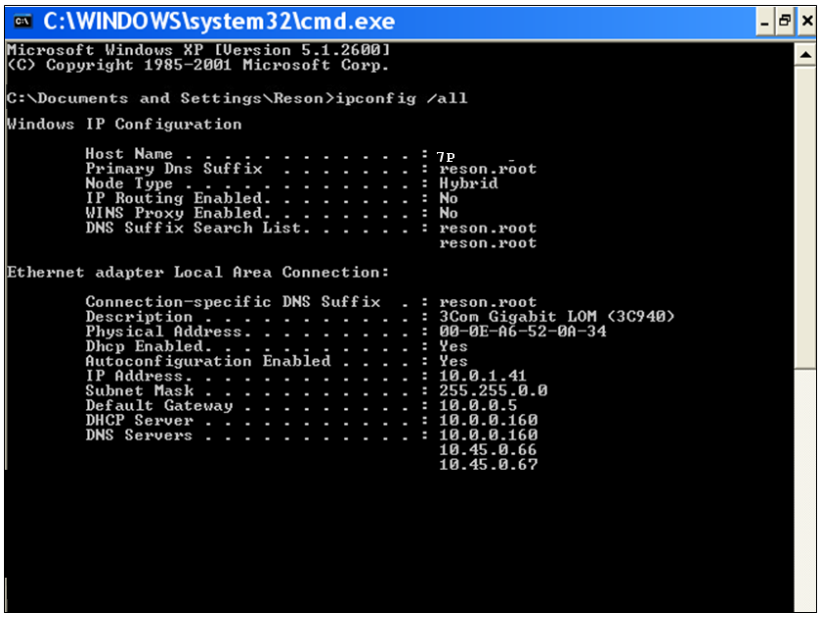
4. To view current IP address information, go to the Start Menu and select Run. Enter cmd in the Open field and click OK.



5. In the command screen, enter ipconfig /all (be sure to enter a single space before /all) and press Enter.
   - The screen displays the connection status of all the network connections, including IP Addresses as shown in the following example command screen.



   - If all connections are disconnected, only the Media State and MAC address for each connection display. The following example command screen shows a typical disconnected transceiver.


C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\Reson>ipconfig /all
Windows IP Configuration
Host Name . . . . . : 7P
Primary Dns Suffix . . . . . : reson.root
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : reson.root
reson.root
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . : reson.root
Description . . . . . : 3Com Gigabit LOM (3C940)
Physical Address. . . . . : 00-0E-A6-52-0A-34
Dhcp Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IP Address. . . . . : 10.0.1.41
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.0.0.5
DHCP Server . . . . . : 10.0.0.160
DNS Servers . . . . . : 10.0.0.160
10.45.0.66
10.45.0.67

5 SYSTEM OPERATION

5.1 Chapter Overview

This chapter covers the SeaBat 7k user interface in great detail and includes the following subjects (click the emphasized hyperlink to be taken to the section):

- ***User Interface*:** Consists of an overview of the various window elements.
- ***Primary Display Tab:*** Consists of a presentation of the different sonar image display formats and related indicators and controls.
- ***Motion Tab***: Consists of a presentation of the options available for viewing the roll data and motion format information.
- ***Snippets and Side Scan Tabs:*** Consists of a presentation of the options available for viewing the snippets and side-scan data.
- ***Built-In Test Environment (BITE):*** Consists of a presentation of the BITE displays.
- ***Sonar Control Tabs:*** Consists of a presentation of the settings available for controlling the sonar and viewing the sonar data.
- ***7k Center Console Window:*** Consists of a brief presentation of the function of this window.
- ***Software Release Information:*** Consists of system information needed for reference.

NOTE
For information on starting, stopping, and setting up the SeaBat sonar system, see *section 3 System Startup and Shutdown*.
For information on configuration of the system (including I/O module configuration, remote operation, and folder management), see *section 4 System Configuration*.
For information on the practical use of the sonar, see *section 6 Active Sonar Usage.*

5.2 User Interface

The initial view presented to the user is for the default device. It comprises sonar data displays and relevant information. There are two sets of tabbed window elements indicated by the two framed areas in *Figure 7*. The upper tabs are for data displays while the lower tabs are for sonar controls. A menu bar is located above the sonar data display area.

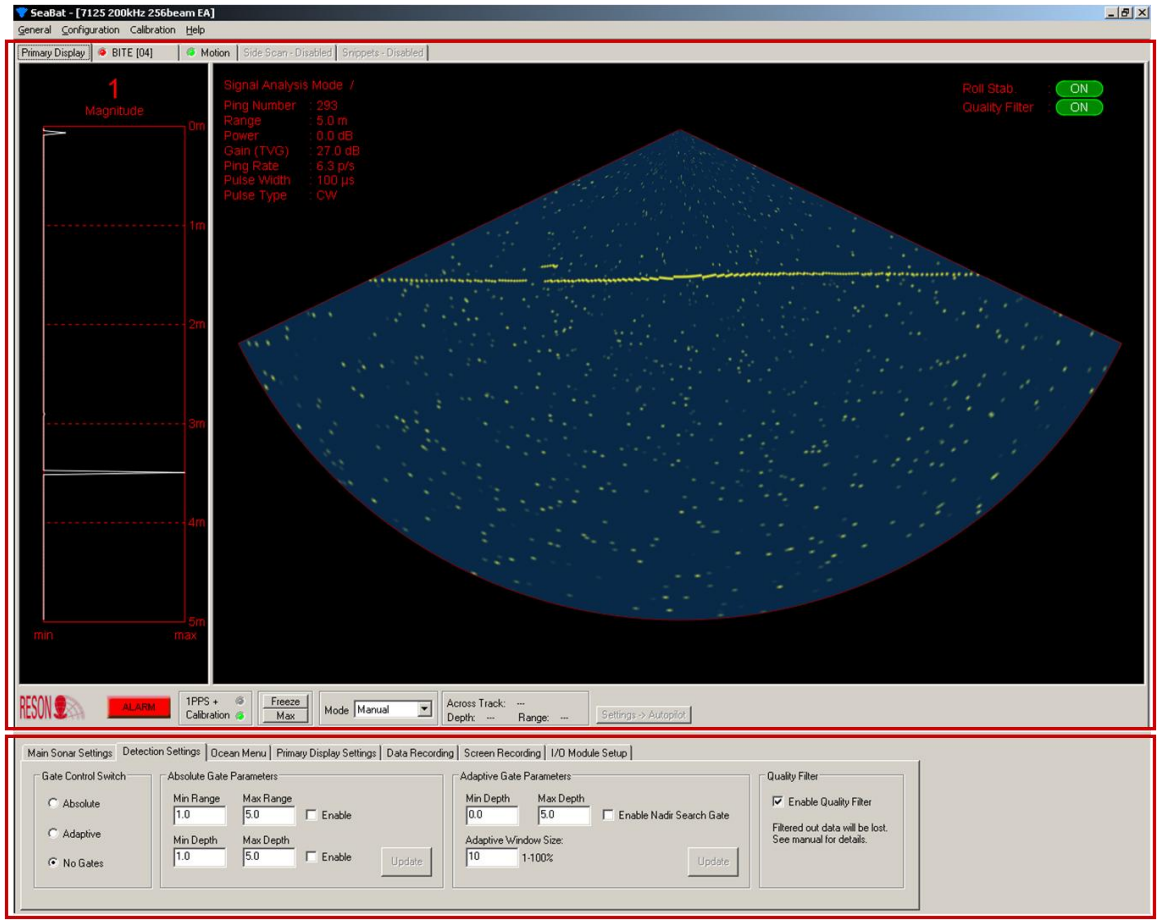


Figure 7: User Interface with Display and Control Areas

- **Upper display tabs** give access to different ways of displaying sonar data and system information. Some of the display tabs contain a separate set of tabs providing the operator with additional options for viewing the sonar data.
- **Lower sonar control tabs** give access to a number of menu settings for controlling the sonar and aiding the bottom detection process. Some of the control tabs provide recording options and I/O module settings.
- **Menu selections** include the Configuration menu with several options for system configuration (see *section 4 System Configuration)*.

5.3 Primary Display Tab

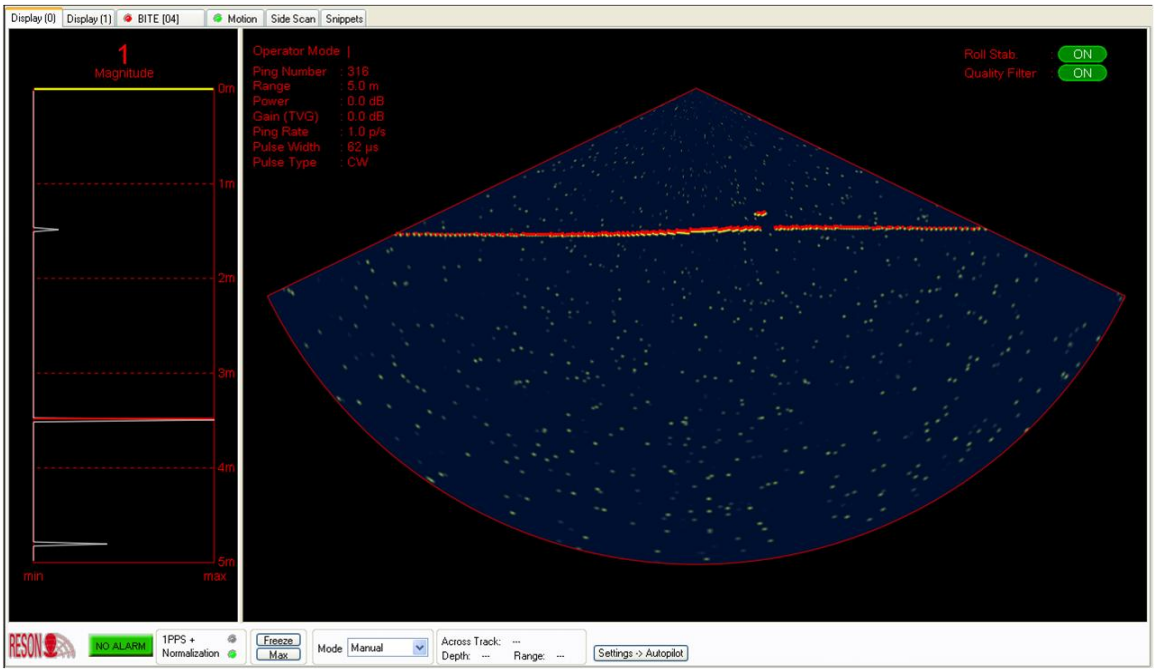


Figure 8: Primary Display Tab

The image on the right, in the center of the Primary Display tab is called the sonar image. The sonar image shows the complete swath illuminated by a single transmitted ping and can be represented in either Wedge format or Beam format (B-scan).

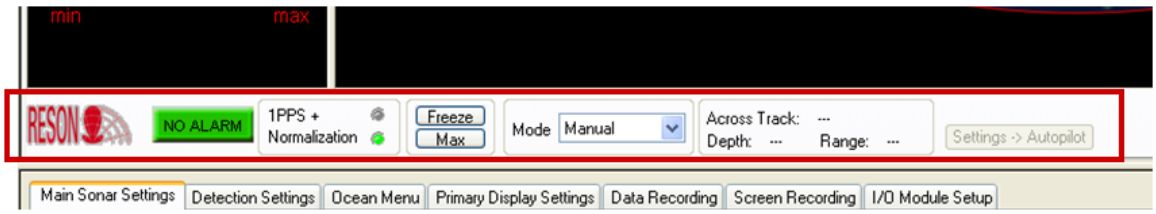
Current information is shown in the upper left corner of the sonar image frame and includes the following:

- Data Source
  - Signal Analysis Mode
  - Operator Mode
- Spinner (rotates 45° every time the sonar cycles)
- Ping Number (indicates the accumulated number of pings since the system was powered up)
- Range
- Power
- Gain
- Ping Rate
- Pulse Width
- Pulse Type

In the upper right corner of the sonar image frame, the status of Roll Stabilization and Quality Filter are shown.

- The Roll Stab indicator reports one of the following:
  - ON (indicates roll stabilization is active. Data output and wedge displays are roll stabilized to within ±0.025°)
  - OFF (indicates roll stabilization is inactive)
  - WARNING (indicates that roll values in excess of ±15° are being received)
  - ERROR (indicates that roll values in excess of ±35° are being received or that roll rates exceed 10°/sec)
- The Quality Filter indicator reports one of the following:
  - ON (indicates quality filter is active)
  - OFF (indicates quality filter is inactive)

The section of the Primary Display tab just below the sonar image and above the sonar control tabs is the sonar image control portion, which includes the following features:



- Alarm indicator (event messages)
- 1PPS input indicator
- Normalization indicator
- Button control for freezing the sonar image
- Button control for maximizing the sonar image
- Mode drop-down menu
- Track, depth, and range readings
- Button control for automatic update of autopilot settings

5.3.1 Sonar Image

5.3.1.1 Wedge Display

The sonar wedge is the default view for the SeaBat sonar systems.

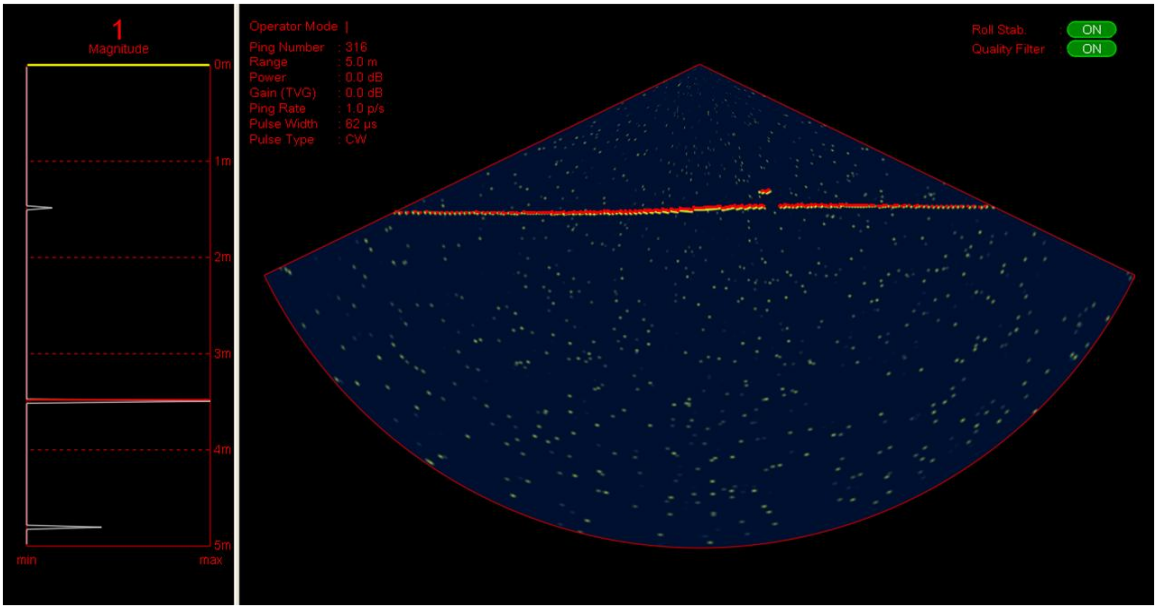
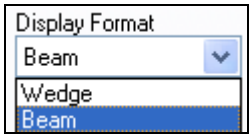


Figure 9: A-Scan and Sonar Wedge Display

5.3.1.2 B-Scan (Beam) Display

The sonar image can be changed from the traditional wedge display to a B-scan display by selecting Beam from the Display Format drop-down menu on the Primary Display Settings tab (see also *section 5.7.4 below).*



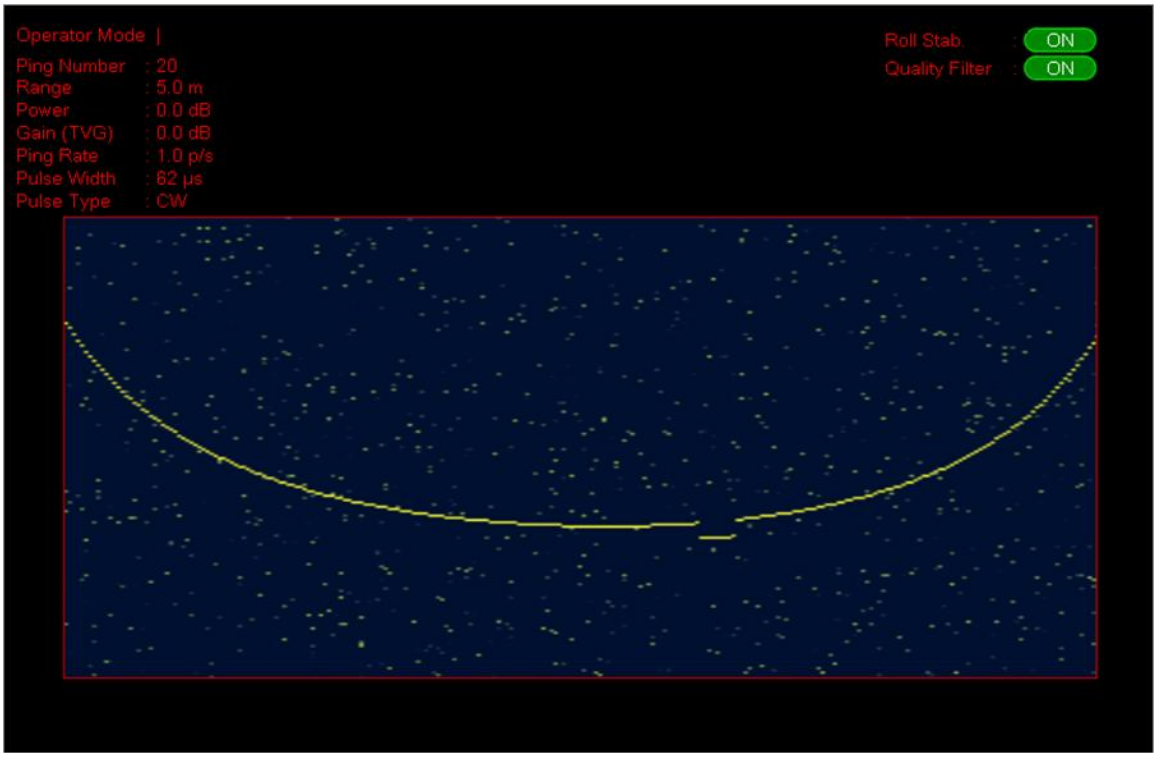


Figure 10: B-Scan Display

5.3.2 A-Scan Display

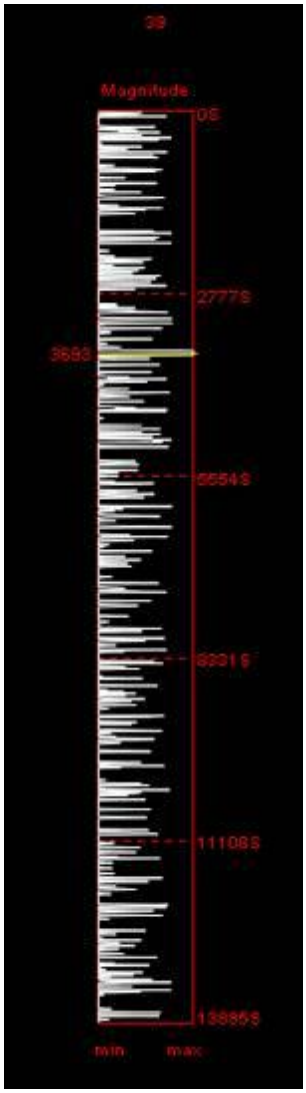
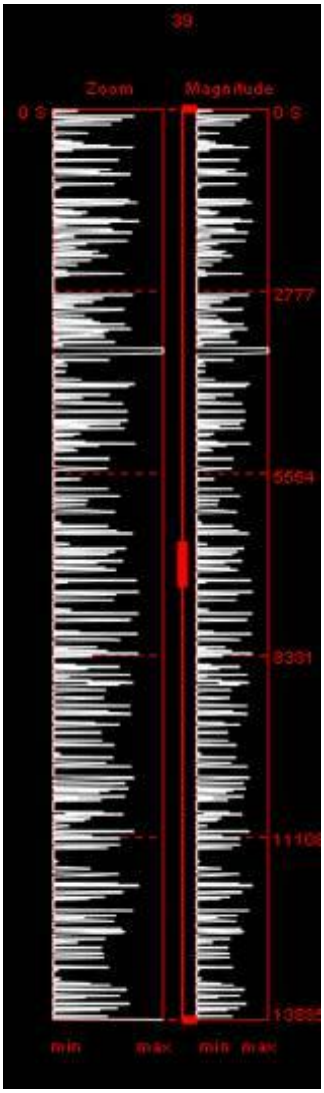
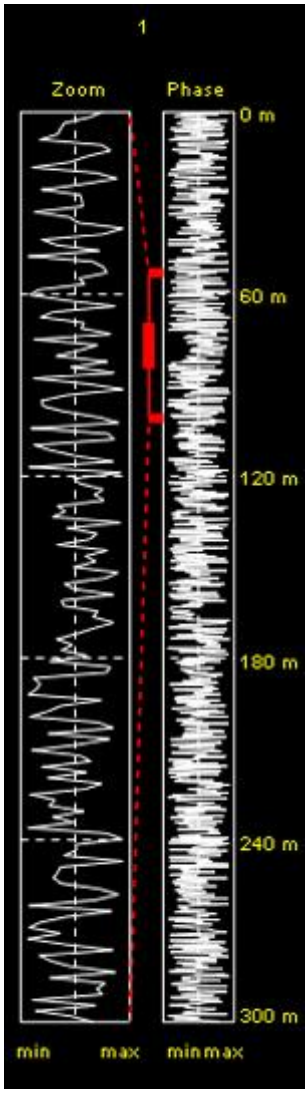
On the left side of the Primary Display (see *Figure 9*), next to the sonar wedge (or B-scan) display, is the A-scan display. This display allows the operator to view the details of a single beam or group of beams.

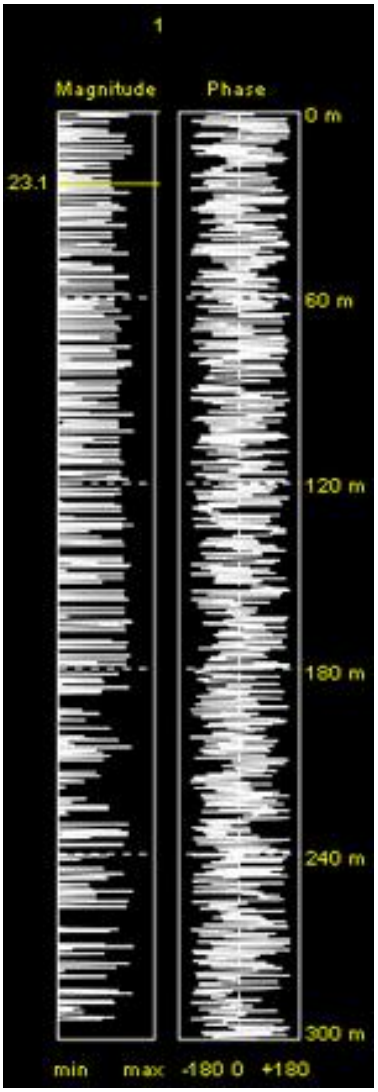
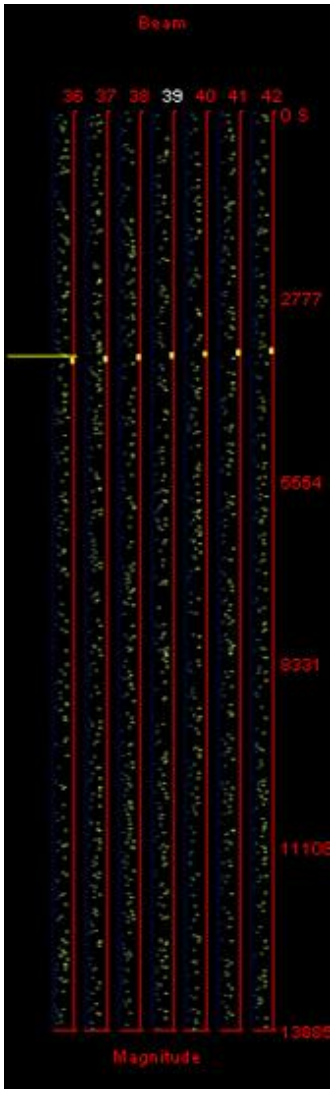
The default axis values are range vs. magnitude. Magnitude is scaled from minimum to maximum. Range labels can be changed to Time and Sample Number using the Label Format drop-down menu on the Primary Display Settings tab (see *section 5.7.4 below*).

5.3.2.1 Available Displays

Place the pointer over the A-scan display panel and right-click to switch between the available displays.

NOTE
All displays may not be available, depending on the type of data being received.

Single Beam Magnitude:	Single Beam Magnitude with Zoom:	Single Beam Phase with Zoom:
		
Shows the selected beam's range versus magnitude.	Shows the selected beam's range versus magnitude with a zoom control for detailed inspection.	Shows the selected beam's range versus phase with a zoom control for detailed inspection.

Single Beam Magnitude and Phase:	Multiple Beams:
	
Shows the selected beam's range versus magnitude and phase.	Shows the range versus magnitude of the selected beam and three beams on either side of the selected beam.

5.3.2.2 Using the Zoom Feature

Both the Magnitude with Zoom and the Phase with Zoom A-scan displays have a zoom feature. Three mouse controls located between the two plots are available to the user for controlling the zoom. They appear as three red rectangles and joining lines regardless of the user-defined color schemes.

- **Upper Window/Lower Window:** These control the zoom window for the plot. Clicking within the controls and sliding them up or down will shorten or lengthen the resulting zoom area to the left.

- **Window Slider:** Once a window size has been configured, the user can click and drag the center rectangular slider up or down the Y axis. This results in the zoom window being applied to different positions on the plot.

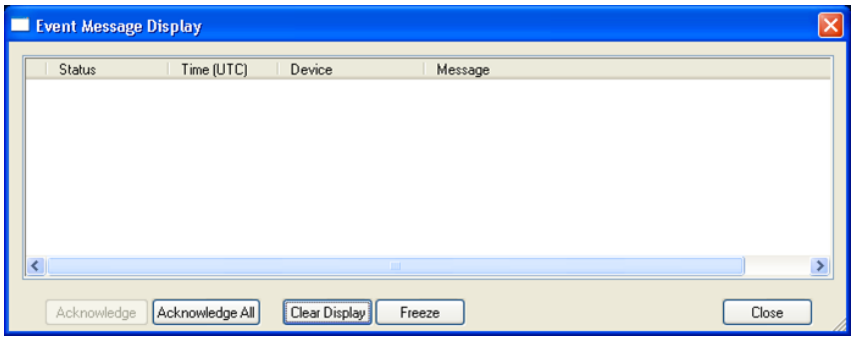
5.3.3 Event Messages

5.3.3.1 Event Message Display

The alarm indicator appears during normal operation as a green button on the Primary Display tab and is labeled NO ALARM. This button will change based on the status of the SeaBat system to one of three states, indicated by colors:

- **Green:** No alarm. The system is functioning normally, or all alarms have been acknowledged.
- **Yellow:** Warning. One or more features may need attention.
- **Red:** Alarm. The system requires attention or is no longer operational.

To view event messages, click the Alarm button.



- **Acknowledge:** This button allows the operator to select an alarm or warning and change the status to Acknowledged. This is an informational change only. It does not have any effect on the function of the sonar itself.
- **Acknowledge All:** This button allows the operator to change the status of all warnings and alarms to Acknowledged. This is an informational change only and does not have any effect on the function of the sonar itself.
- **Clear Display:** This button allows the operator to change the status of all warnings and alarms to Acknowledged and remove them from the Event Message Display. This is an informational change only and does not have any effect on the function of the sonar itself.
- **Freeze:** This button allows the operator to freeze the display to examine individual messages.

When the status of all Warning or Alarm messages have been changed to Acknowledged, the Alarm button on the Primary Display tab will return to green.

5.3.3.2 Recommended Actions

In most cases, information is provided to the operator to rectify the problem. For instance an alarm indicating missing sound velocity input to the processor will require the operator to check the instrument and the input.

If errors occur that result in a condition where the systems in not operable the following actions are recommended.

1. Exit any active applications.
2. Shut down the transceiver completely.
3. Restart the transceiver. (Use Shut Down from the menu rather than Restart.)
4. If the condition persists after a shutdown and restart, contact RESON Service (support@reson.com).

For a description of event messages and recommended actions, see *Appendix A Troubleshooting*.

5.3.4 1PPS Input Indicator

The 1PPS input indicator reveals the selection that has been made in the Trigger/PPS Configuration dialog (see *section 4.2.5.3 1PPS Polarity*).

- Plus sign (+) = Rising edge of the 1PPS signal will be used.
- Minus sign (-) = Falling edge of the 1PPS signal will be used.
- Green = 1PPS signal is being received.
- Yellow = 1PPS signal has been lost for at least 3 seconds.
- Red = 1PPS signal has been lost for at least 15 seconds.

5.3.5 Normalization Indicator

The Normalization indicator reveals the current channel normalization status of the system (see *section 4.3 Channel Normalization*).

- Green = System has been normalized.
- Yellow = Normalization is in progress.
- Red = System has not been normalized.

5.3.6 Freeze the Sonar Image

Clicking the Freeze button prevents the image on the Primary Display tab from being updated while all other sonar functions continue. This allows prolonged viewing of a particular item.

Click the Resume button to allow updates to continue.

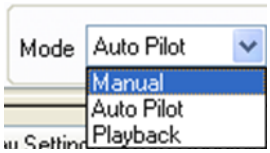
5.3.7 Maximize the Sonar Image

Clicking the Max button hides the lower set of tabs and enlarges the sonar image to fit the entire SeaBat window. This allows close inspection of data.

Click the Min button to return the image to normal size and display the lower set of tabs.

5.3.8 Change Modes

The Mode drop-down menu allows the operator to select between the following options.



- **Manual:** View data being collected now.
- **Auto Pilot:** Disables the operator selection of certain parameters (such as range, gain, power) and allows the SeaBat to automatically adjust sonar settings based on the bottom detection data. For details, see *section 4.2.9 Edit Auto Pilot Settings*.
- **Playback:** View a previously collected data file. Selecting Playback mode adds the Playback tab to the lower set of tabs (see *section 5.7.8 below*).

5.3.9 Identify Beam Track, Depth, and Range (or Channel and Sample)

To the right of the Mode drop-down menu the beam Across Track, Depth, and Range readings are displayed for a particular point on the sonar wedge display. Readings are in meters.

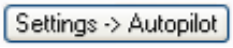
These numbers change as the pointer passes over the sonar image, indicating the pointer's current position on the image.

- Across Track:
  - Positive reading is distance from sonar head to starboard side.
  - Negative reading is distance from sonar head to port side.
- Depth: Vertical distance from sonar head.
- Range: Distance covered by beam to reach that point.

When Beam has been selected from the Display Format drop-down menu, the readings will indicate channel and sample as the pointer passes over the B-scan display (see also *section 5.3.1.2 above*).

5.3.10 Automatic Update of Auto Pilot Settings

The Settings –> Autopilot button appears to the right on the sonar image control portion of the Primary Display. The button updates the settings in the AutoPilot Parameters dialog (see *section 4.2.9 Edit Auto Pilot Settings*).



When operating in Auto Pilot mode the button cannot be selected.

5.4 Motion Tab

When the Roll Stabilization option has been enabled, the sonar wedge display (see *section 5.3.1 above*) will display motion compensated data with a precision of within ±0.025°. If the compensated data does not appear, select the Motion option from the Configuration menu to enable it (see *section 4.2.6 Motion*).

NOTE
Care should be taken to ensure that roll stabilization is correctly configured and operational prior to collecting survey data.

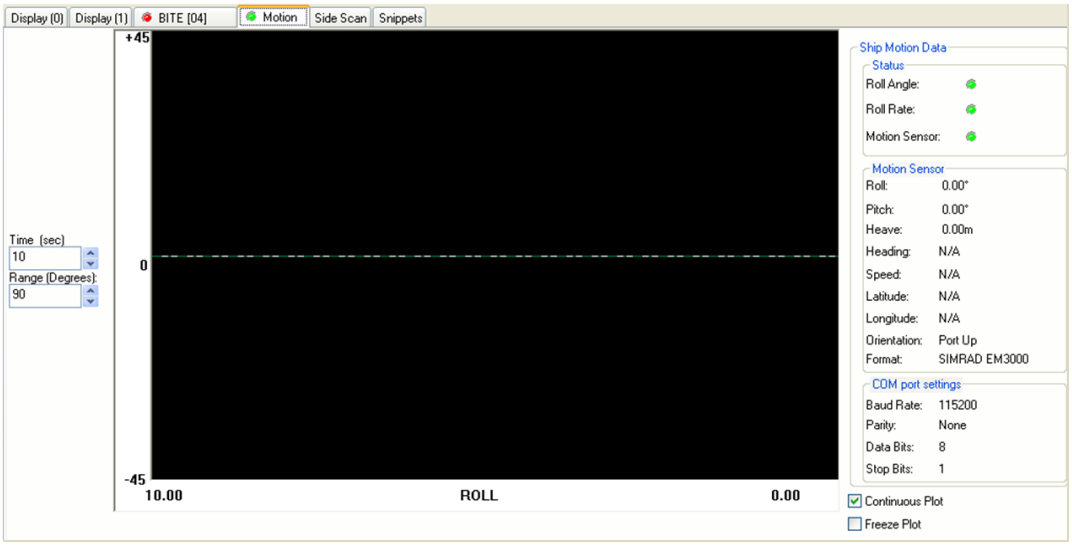


Figure 11: Motion Tab

The Motion tab has three different sections for displaying roll history, motion format information, and current data:

- **Time (sec):** If set to value T the display will show the last T seconds of roll data.
- **Range (Degrees):** Set to desired vertical scale of display. For example, if the roll varies between +/-5 degrees, set this value to 10.
- **Graphical display:** Displays roll value applied by the beamformer per sonar sample.
    - Continuous Plot:
        - When checked, connects the adjacent data sets.
        - When not checked, shows the time gap between adjacent data sets.
    - Freeze Plot: When checked, prevents the plot from updating.
- **Ship Motion Data:**
    - Status:
        - Roll Angle: Green if roll is less than 15 degrees; yellow if between 15 and 35 degrees; and red if above 35 degrees.
        - Roll Rate: Not currently available.
        - Motion Sensor: Green if good input from motion sensor; red if bad or no input.
    - Motion Sensor: Current values from motion sensor.
    - COM port settings: Current motion sensor configuration (see also *section 4.2.6 Motion*).

For examples on how to use this feature, see *section 6.3.2 Roll Stabilization*.

5.5 Snippets and Side Scan Tabs

The Snippets tab displays the snippets data and the Side Scan tab displays the side-scan data currently being collected or played back. If the Snippets and Side Scan tabs do not appear in the displayed tabs (are disabled), select the Data Display & Format option from the Configuration menu to unhide them (see *section 4.2.1 Data Display & Format*).

For information on the data types, see *section 7 System Performance and Data Types*.

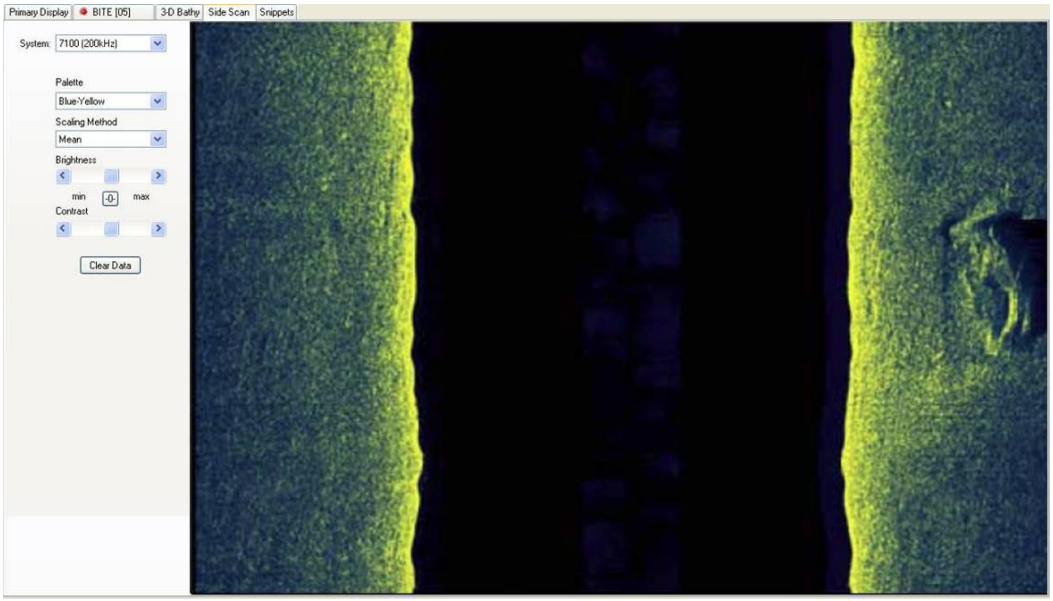


Figure 12: Typical Side-Scan Display

The Snippets and the Side Scan tabs have a separate and identical set of controls to the left of the displays.

- **System:** Select the system for which you would like to view the data.
- **Palette:** Change the color scheme applied to the display.
- **Scaling Method:** Select the scaling method for data.
    - Mean
    - Peak
    - RMS
- **Brightness:** Move the slider to change the brightness level of the display. The center position indicates no adjustment.
- **Contrast:** Move the slider to change the contrast level of the display. The center position indicates no adjustment.
- **-0-:** Click this button to return the Brightness and Contrast bars to the no adjustment position.
- **Clear Data:** Clear the data history from the screen.

5.6 Built-In Test Environment (BITE)

5.6.1 BITE

BITE is an integral part of the system and monitors several subassemblies within the system for firmware version, temperature, voltage, communications status, and other parameters.

Each subassembly is displayed on a separate tab on the BITE tab.

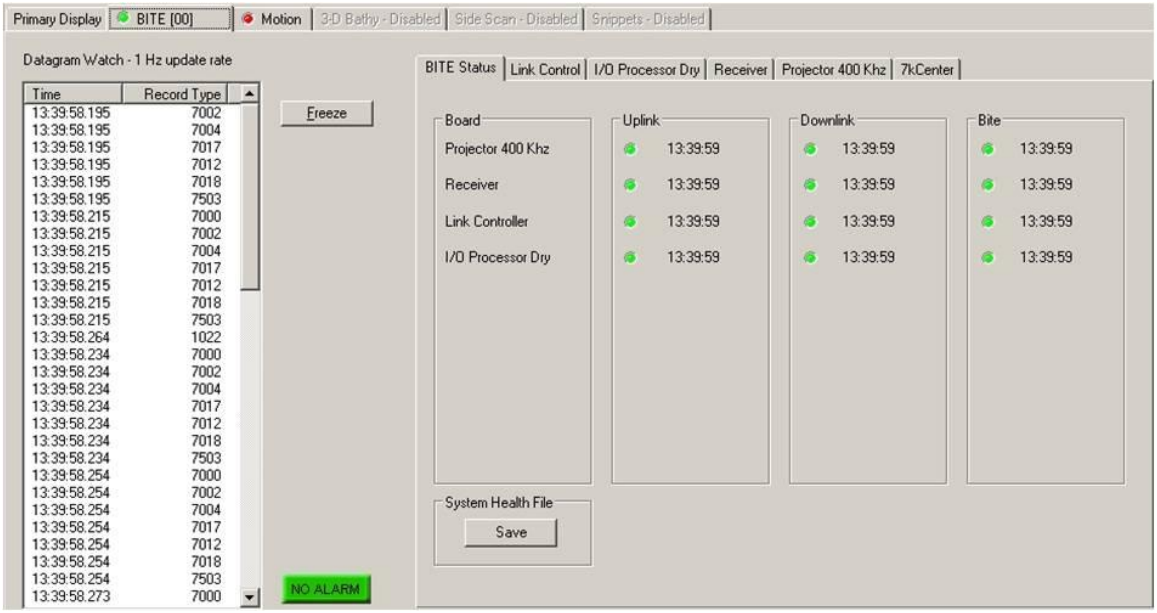


Figure 13: BITE Tab

An out-of-tolerance parameter turns the LED to red on the BITE Status tab and the individual board tabs to alert the operator.

The BITE tabs can also be used to verify an installation, firmware update, or to diagnose installation problems. For instance, if no wedge display is present after software startup, checking the BITE tabs can help localize the failure.

If a firmware update is done in the field, the BITE tabs are useful for verifying that the new version has been accepted.

5.6.2 BITE Tabs

5.6.2.1 BITE Status Tab

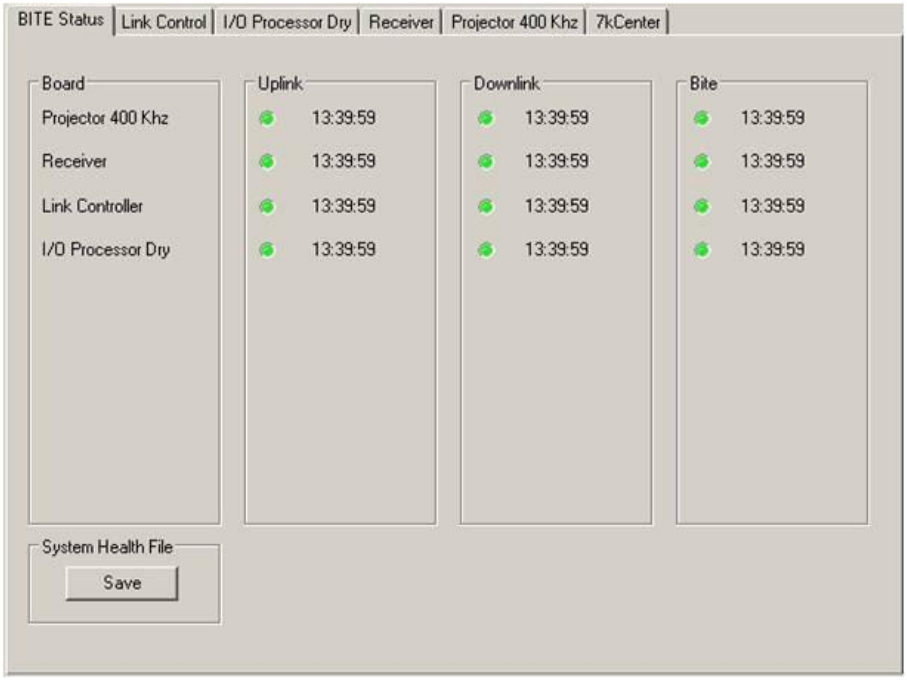


Figure 14: BITE Status Tab

The System Health File Save button produces a snapshot of various system versions, hardware configuration, registers, and other information. This file is saved in the 7k Center executable directory and named SystemHealth_date_time.txt. This file aids in troubleshooting and may be requested by service and support.

5.6.2.2 Link Control Tab

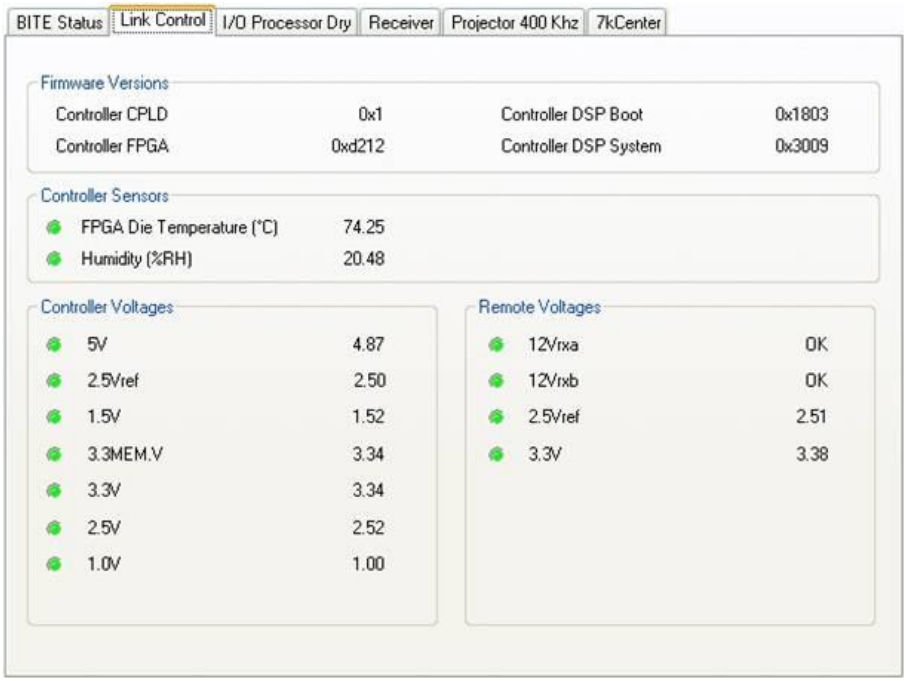


Figure 15: BITE – Link Control Tab

5.6.2.3 I/O Processor Dry Tab

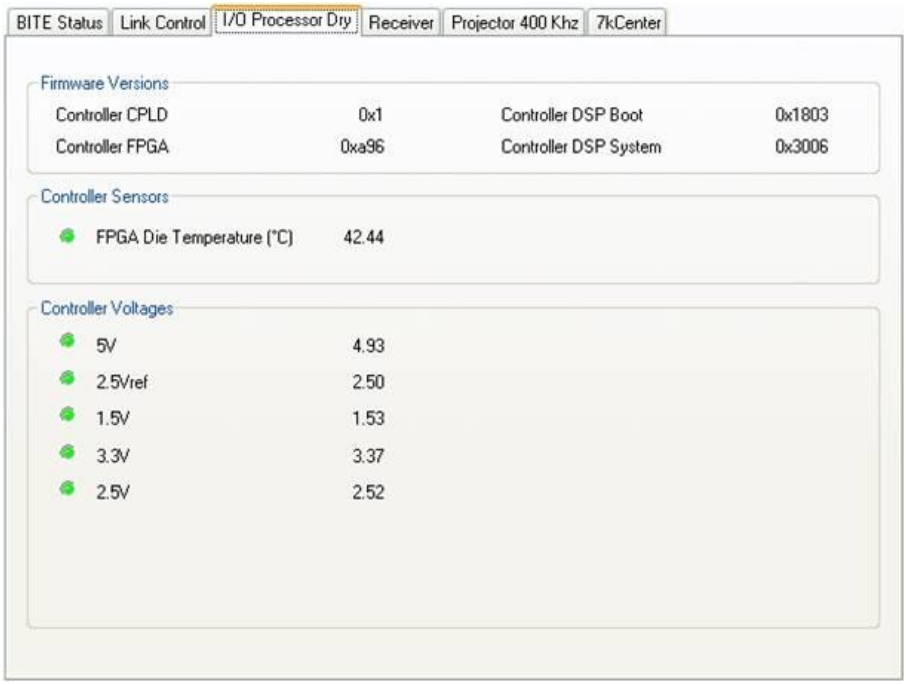


Figure 16: BITE – I/O Processor Dry Tab

5.6.2.4 Receiver Tab

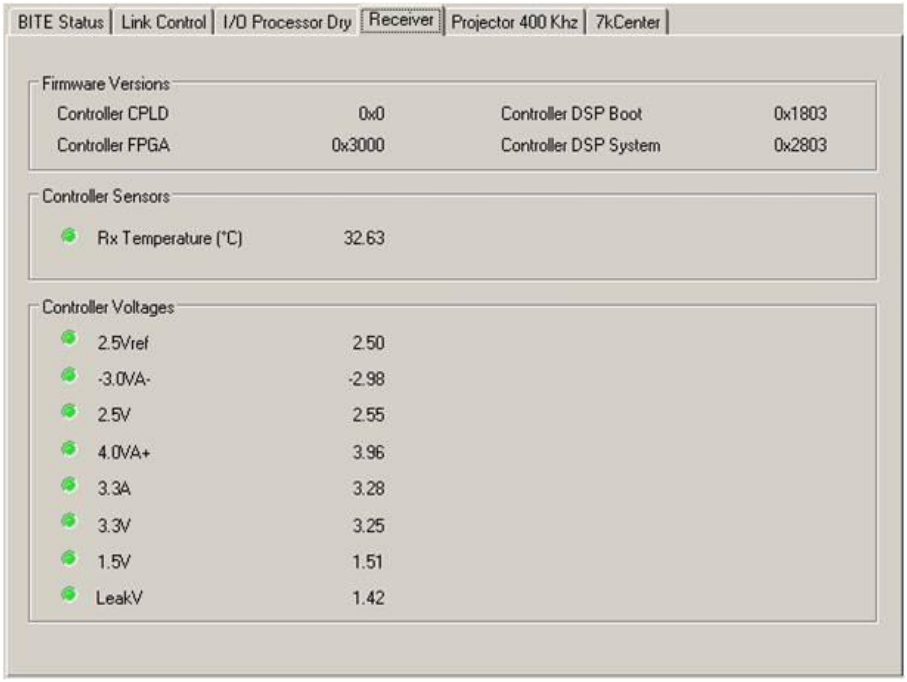


Figure 17: BITE – Receiver Tab

5.6.2.5 Projector Tab

Figure 18: BITE – Projector Tab

5.6.2.6 7kCenter Tab

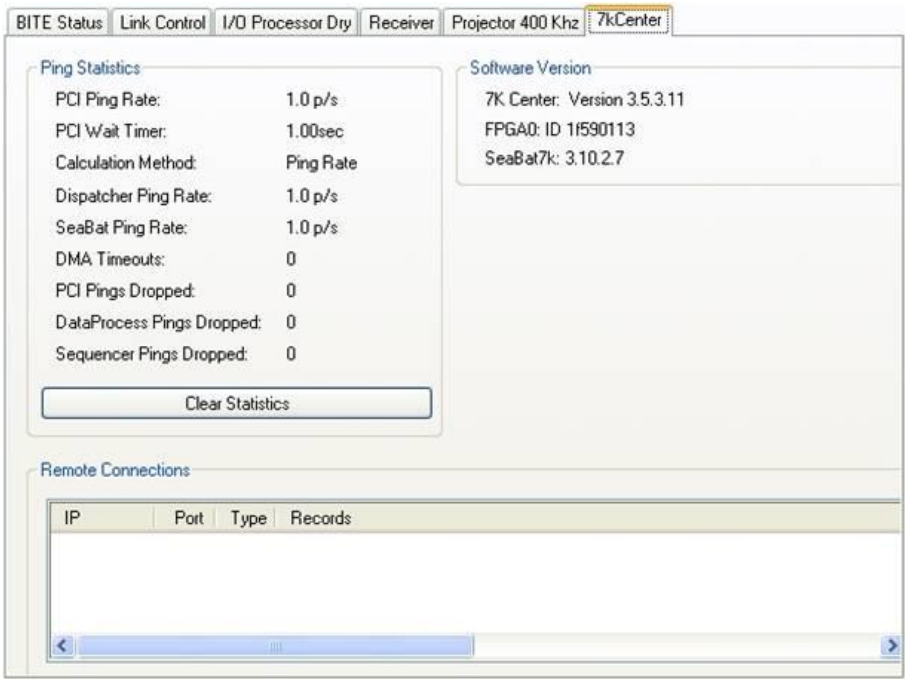


Figure 19: BITE – 7kCenter Tab

The 7kCenter tab shows:

- The ping rate averaged over a number of pings. Note that changing the range will not immediately result in a change to a new ping rate.
- The remote connections shows the Ethernet data connections currently running with the sonar.
- The software version shows the build numbers of the various software components in the system.

5.7 Sonar Control Tabs

5.7.1 Main Sonar Settings

The Main Sonar Settings tabs are the control point for the projector and receiver units.

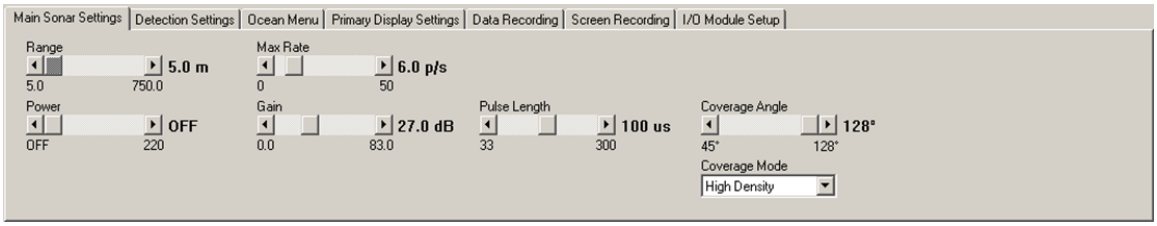


Figure 20: Sample of Main Sonar Settings Tab

NOTE
For all sliders on the Main Sonar Settings tab, except the Power control, the new settings will not be sent until the mouse has released control of the sliders.

5.7.1.1 Set the Range

The Range setting determines how far the SeaBat will “see”. The range settings are operator selected. There are multiple settings in discrete increments. For the SeaBat 7125 SV, these settings range from 5 to 300 meters (750 meters for 200kHz operation).

Select the appropriate range scale to keep the horizontal bottom image at or above the widest part of the sonar wedge:

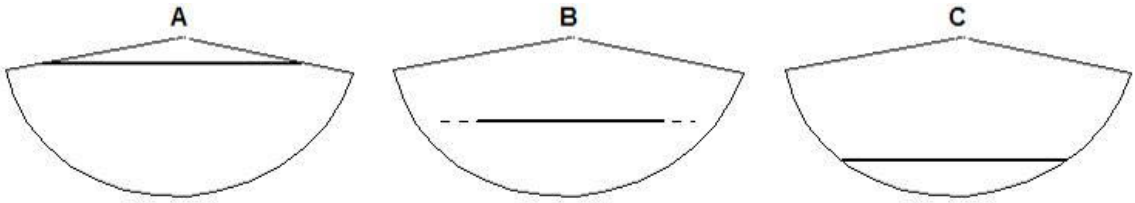


Figure 21: Range Setting Diagrams

Diagram A depicts a proper range setting. Diagram B depicts an acceptable range setting for a swath that is beginning to fade due to the effects of attenuation and spreading loss. Diagram C depicts an incorrect range setting. Notice that the still-useable ends of the swath are being cut off by the limits of the range setting.

For additional examples on incorrect range settings and possible solutions, see *section 6.2.6 Correct Range Setting*.

5.7.1.2 Set the Transmit Power (Power)

The Power setting allows the operator to increase or decrease the amount of power (acoustic energy) transmitted into the water. There are multiple increments (from OFF to 220dB), each accounting for an increase of approximately 1dB.

For examples on how to use this setting, see *section 6.2.2 Transmit Power OFF*.

5.7.1.3 Set the Maximum Ping Rate (Max Rate)

The Max Rate setting allows the operator to limit the number of pings per second (p/s), independent of the current range setting. For the SeaBat 7125 SV the ping range available is from 0 to 50p/s in increments of 1. The normal value for Max Rate is 50 to ensure unhindered operation of the sonar.

For examples on how to use this setting, see *6.2.3 Lower Ping Rate*.

NOTE
If Max Rate is set to 0, the system will not ping or receive data. If Max Rate is set to a value higher than the range-determined ping rate, the sonar will ping at the rate determined by the range setting. If Max Rate is set to a value lower than the range-determined ping rate, the sonar will ping at the rate specified by Max Rate.

5.7.1.4 Set the Gain

The Gain setting allows the operator to select the amount of receiver gain applied to the returned sonar signal (in addition to the calculated gain). The gain range available is from 0 to 83dB.

For examples on how to use this setting, see *6.2.4 Receiver Gain*.

5.7.1.5 Set the Pulse Length

The Pulse Length setting allows the operator to change the pulse length of the transmitted signal. For the SeaBat 7125 SV the pulse lengths available are from 33µs to 300µs in increments of approximately 10µs.

For examples on how to use this setting, see *6.2.1 Pulse Length and Image Resolution*.

5.7.1.6 Set Variable Swath[9]

Two settings allow the operator to control the swath coverage:

- **Coverage Angle:** This setting allows the operator to change the swath width from maximum 128° (or 140°) to 45° in increments of 5°.
- **Coverage Mode:** This setting allows the operator to switch between two coverage modes:
  - **High Density:** All beams are formed and compressed as needed into the given coverage sector providing increased sounding density.
  - **Reduced Beams:** Only the number of beams necessary to populate the given coverage sector are formed.

Variable swath is available in all beam modes (equidistant or equiangular) and may be used in conjunction with roll stabilization (see *section 4.2.6 Motion*).

For examples on how to use this setting, see *section 6.2.5 Variable Swath*.

[9] Available with the Efficiency feature package (see *Table 20*).

5.7.2 Detection Settings

The Detection Settings tab allows the operator to apply range and/or depth filters (depth gates) to the bottom detection process to aid in noise reduction and to correct for a tilted sonar head. Gate lines (filter lines) can be optionally displayed on the sonar image. For details, see *section 5.7.4 below*.

A yellow highlight of text fields and check boxes indicates that the data was changed since last update and has not yet been applied.

The color of the Update button indicates if data is stored locally by the UI or sent directly to the center:

- **Red:** Data is stored locally and gates are inactive
- **Green:** Data is sent to center and gates are active

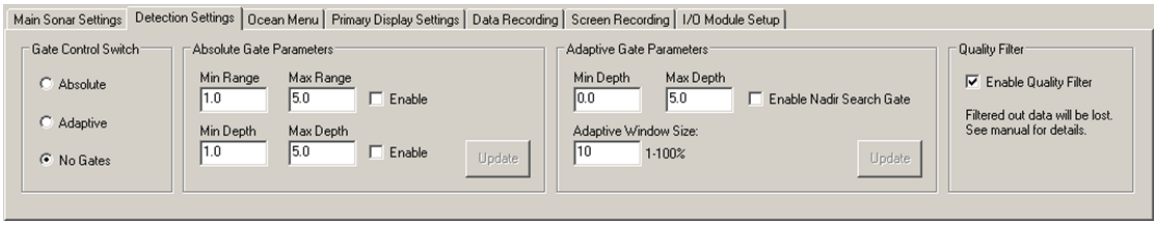


Figure 22: Sample of Detection Settings Tab

The last user settings are stored and will be recalled upon system startup.

For examples on how to use this setting, see *section 6.2.7 Use of Gates*.

5.7.2.1 Gate Control Switch

There are three gate modes:

- Absolute
- Adaptive
- No Gates (gate functionality is turned off)

If you switch gate mode, the data stored last time the Update button was clicked for that mode will automatically be sent to the center.

5.7.2.2 Absolute Gate Parameters

When Absolute gating is selected, either gate range or depth is entered in this section. Select the Enable check box for the type of gate desired.

- **Range:** Applies the minimum and maximum range values as entered in the MinRange and MaxRange fields. Only bottom returns within these range limits will be used in the bottom detection process.

- **Depth:** Applies the minimum and maximum depth values as entered in the MinDepth and MaxDepth fields. Only bottom returns within these depth limits will be used in the bottom detection process. Use of a motion sensor is required to rotate the depth gates with the rolling motion of the vessel to ensure soundings are not clipped as the seabed rotates with respect to the sonar (see *section 4.2.6 Motion*).

Click the Update button to finalize changes.

NOTE
The simultaneous use of both range and depth filters is not recommended.

5.7.2.3 Adaptive Gate Parameters

When Adaptive gating is selected, the bottom is tracked based on window size and search criteria from beam to beam within a ping.

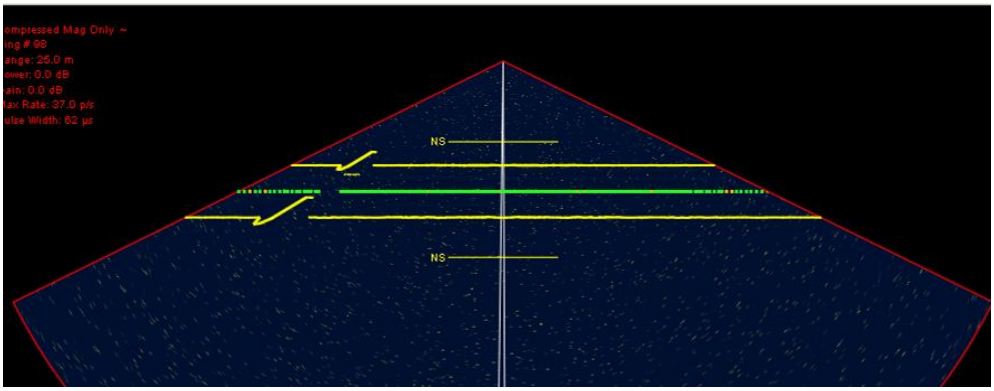
- **Enable Nadir Search Gate:** Applies the minimum and maximum nadir depth values as entered in the MinDepth and MaxDepth fields to refine the initial search for the strongest bottom return from the nadir beam. This initial search gate can be enabled or disabled. See also *section 5.7.2.4 below*.
- **Adaptive Window Size:** Applies the percentage value as entered in the Adaptive Window Size based on the total samples in the ping. Once the initial bottom detection point is located, the gates are propagated in each direction using this number. The bottom detection from beam to beam is therefore based on the results from the previous beams. Increasing this window size allows more samples to be included in the detection process, but may also introduce noise. Decreasing this window size too much may degrade performance, when the bottom is not flat.

Click the Update button to finalize changes.

5.7.2.4 Automated Nadir Search Gate

When Adaptive gating is selected and the Enable Nadir Search Gate box checked, a window appears on the Primary Display, delimited by yellow horizontal lines labeled NS. As the filter limits approach the nadir search limits, the NS gates are automatically updated to center the nadir search on the detected seafloor.

The NS gates can be moved manually with the mouse/trackball by right-clicking and selecting Move Nadir Gate.



5.7.2.5 Quality Filter[10]

- **Enable Quality Filter:** Allows the operator to prevent export and display of any data which does not exceed a predetermined quality threshold.

For details on the quality testing, see *section 7.3 Quality*.

5.7.3 Ocean Settings

The Ocean Menu tab allows the operator to enter various correction factors to compensate for changing environmental conditions.

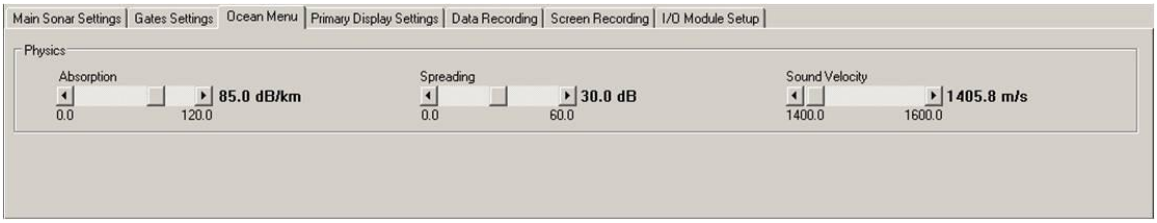


Figure 23: Sample of Ocean Menu Tab

NOTE
For all sliders on the Ocean Menu tab, the new settings will not be sent until the mouse has released control of the sliders.

5.7.3.1 Change the Absorption Loss Value (Absorption)

The Absorption slider allows the operator to enter the amount of loss expected through the ambient water medium. The range available is from 0 to 120dB/km. The last selected user setting is stored and will be recalled upon system startup.

This value is used in conjunction with the spreading loss coefficient to compute the TVG (time-varied gain) curve as described in *section 5.7.3.2 below*.

For examples on how to use this setting, see *section 6.5.1 Loss of Sound by Absorption*.

[10] Available with the Efficiency feature package (see *Table 20*).

5.7.3.2 Change the Spreading Loss Coefficient (Spreading)

The Spreading slider allows the operator to enter the amount of cylindrical and spherical spreading loss that is expected through the ambient water medium. The range available is from 0 to 60dB, with a recommended initial value of 30. The last selected user setting is stored and will be recalled upon system startup.

This coefficient value is used in conjunction with the absorption loss value (see *5.7.3.1 above*) to compute the TVG curve applied to the returned signal.

For examples on how to use this setting, see *section6.5.2 Loss of Sound by Spreading*.

5.7.3.3 Set the Sound Velocity

The Sound Velocity slider allows the operator to enter the externally measured speed of sound through the local water. This value is represented in meters per second, and is used in Range display and Receiver Beam Steering. The range allowed is from 1400 to 1600m/s.

The Override check box is only available, if an external sound velocity source is detected.

For examples on how to use this setting, see *section 6.5.3 Sound Velocity*.

CAUTION
An online sound velocity probe must be used for providing up-to-date velocities, if the sonar system is using ED beamforming. If the system is using EA beamforming, an online sound velocity is not required and an approximate value from the water column SV data can be entered manually.

5.7.4 Primary Display Settings

The Primary Display Settings tab allows the operator to customize some of the visual properties of the sonar image.

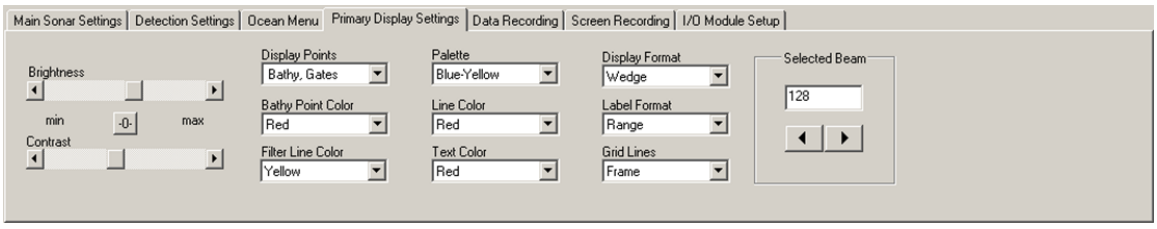
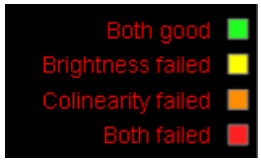


Figure 24: Sample of Primary Display Settings Tab

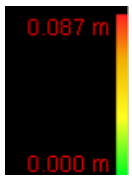
NOTE
For all sliders on the Primary Display Settings tab, the new settings will not be sent until the mouse has released control of the sliders.

- **Brightness:** Move the slider to change the brightness level of the sonar wedge display. The center position indicates no adjustment.
- **Contrast:** Move the slider to change the contrast level of the sonar wedge display. The center position indicates no adjustment.
- **- 0 -:** Click this button to return the Brightness and Contrast bars to the no adjustment position.
- **Display Points / Filters:** Select the items to display in the wedge display.
    - Bathy: Display bathymetry points.
    - Gates: Display gates/filter lines.
    - Rejected Items[11]: Display points that do not pass the quality filtering.
- **Bathy Point Color:** Change the color of the bathymetry points in the wedge display or display the color-coded bottom detection method or quality or uncertainty reporting.
    - Red, Yellow, Green, Blue, or White: Dots will appear on the screen in the selected color.
    - Process: Each sounding is color-coded based on the weighting used in the magnitude/phase bottom detection process.
        - Blue: Magnitude
        - Green: Phase
        - Orange: Magnitude and Phase blend

    - Quality: Uses a two-part test for brightness and colinearity with color-coded results. For further details, see *section 7.3 Quality*.
        - Green: Good brightness, good colinearity
        - Yellow: Poor brightness, good colinearity
        - Orange: Good brightness, poor colinearity
        - Red: Poor brightness, poor colinearity



    - Uncertainty[12]: Uses a Green-Yellow-Orange-Red transition palette to display uncertainty. Green indicates the lowest uncertainty and red the highest. For further details, see *section 7.4 Uncertainty Estimation*.



- **Filter Line Color:** Change the color of the filter lines in the wedge display.
- **Palette:** Change the color scheme applied to the Primary Display.
- **Line Color:** Change the color of the frames and gridlines in both the sonar image and A-scan displays.
- **Text Color:** Change the color of the text in both the sonar image and A-scan displays.

[11] Right-clicking the wedge display and selecting Show Rejected from the menu will do the same.
[12] Available with the Efficiency feature package (see *Table 20*).

- **Display Format:** Switch the sonar image display between Wedge and Beam (B-scan) modes.
- **Label Format:** Change the labels in both the sonar image and A-scan displays to reflect units of range (in meters), time (in seconds), or samples.
- **Grid Lines:** Activate or deactivate grid lines on the Primary Display.
    - All: Show the frame around the sonar image, as well as the selected units of measure.
    - Frame: Hide the units of measure, leaving only the frame around the sonar image.
    - None: Hide all frames.
    - Beam Select: Hide the frame around the sonar image and the units of measure. Show the frame around the selected beam.
- **Selected Beam:** View the number of the currently selected beam in this field, or change the beam selection by either entering a beam number or clicking the arrow buttons to cycle through the beams.

5.7.5 Data Recording

The Data Recording tab is divided into three general sections:

- Recording Control
- Advanced
- Recording Status

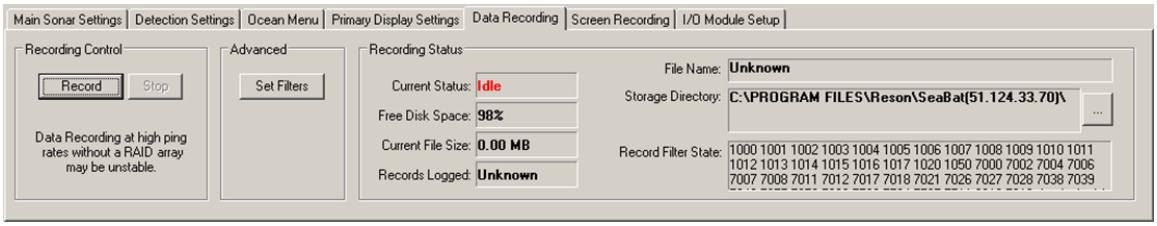


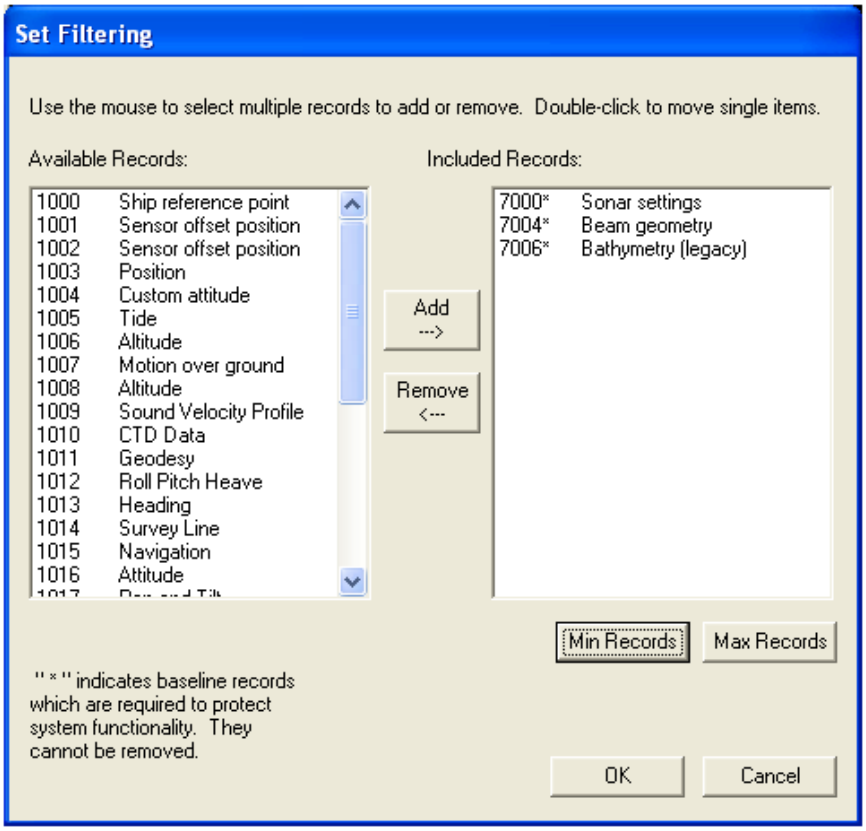
Figure 25: Sample of Data Recording Tab

5.7.5.1 Recording Control

The Recording Control section of the Data Recording tab allows you to start and stop the data recording process. Click the Record button to start recording and the Stop button to stop recording.

5.7.5.2 Advanced (Set Filters)

Click the Set Filters button to select particular records to be included in the recorded data. Use the Add and Remove buttons to move records between the Available Records and Included Records frames.



5.7.5.3 Recording Status

The Recording Status section of the Data Recording tab provides information on the current recording:

- **Current Status:** Shows whether the system is idle or recording.
- **Free Disk Space:** Amount of free space available for storage of recorded files.
- **Current File Size:** The size of the currently recording file.
- **Records Logged:** The number of records that have been added to the recorded file.
- **File Name:** The file name for the current file. The file name is automatically generated using the following naming convention: YYYYMMDD_<System ID>_SystemName.s7k. Refer to the Data Format Definition document for further description (see *Appendix C Reference Documentation*).
- **Storage Directory:** The storage location for the current file. To change this location, click the Browse button and select the folder where the recorded files should be saved.
- **Record Filter State:** The record types currently being included in the recording.

For instructions on playing back recorded sonar data, see *section 5.7.8 below*.

5.7.6 Screen Recording (Video Recording)

The Screen Recording tab is divided into two general sections:

- Recording Control
- Recording Status

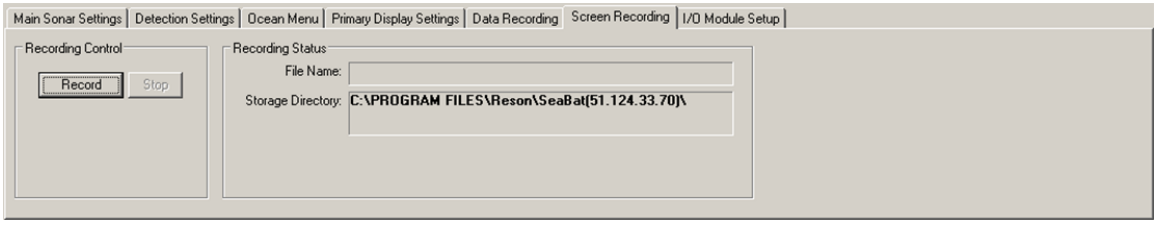


Figure 26 Sample of Screen Recording Tab

NOTE
Screen recording records the entire window and not just the sonar display area.

5.7.6.1 Recording Control

The Recording Control section of the Screen Recording tab allows you to start and stop the screen recording process. Click the Record button to start recording and the Stop button to stop recording.

5.7.6.2 Recording Status

The Recording Status section of the Screen Recording tab provides information on the current recording:

- **File Name:** The name of the current file. The file name is automatically generated using this naming convention: YYYYMMDD_HHMMSS.avi. The file name is shown only during recording.
- **Storage Directory:** The storage location of the current file. To change this location, go to the Data Recording tab and click the Browse button to select the folder where the recorded files should be saved.

5.7.6.3 Play Back Recorded Video Data

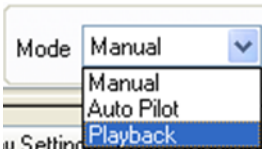
You can use any media player to play back .avi files.

5.7.7 I/O Module Setup

See *section 4.4 I/O Module Configuration*.

5.7.8 Data Playback

The Data Playback tab is hidden when the SeaBat is in Manual mode. To display the Data Playback tab, select Playback from the Mode drop-down menu (see *section 5.3.8 above*).



The Data Playback tab is divided into three general sections:

- Playback Control
- Advanced
- Playback Status

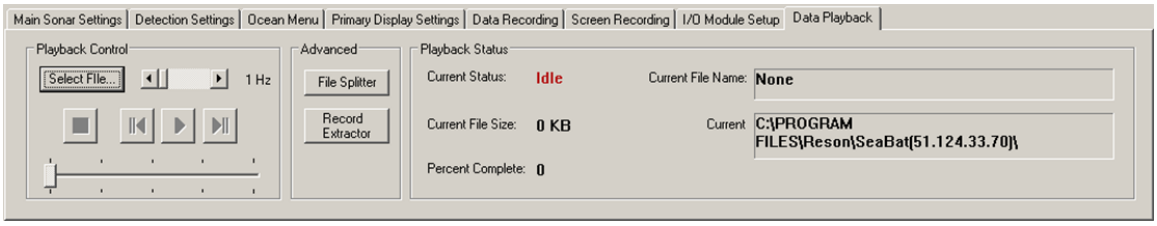


Figure 27: Sample of Data Playback Tab

5.7.8.1 Playback Control

The Playback Control section of the Data Playback tab allows you to start and stop the playback process. Click the Select File button to select the file to play back, and then click the Play button to start playback. The Stop button will stop the playback.

The Playback Rate option is not enabled for this system. Playback will always be at the system's maximum speed.

5.7.8.2 Advanced

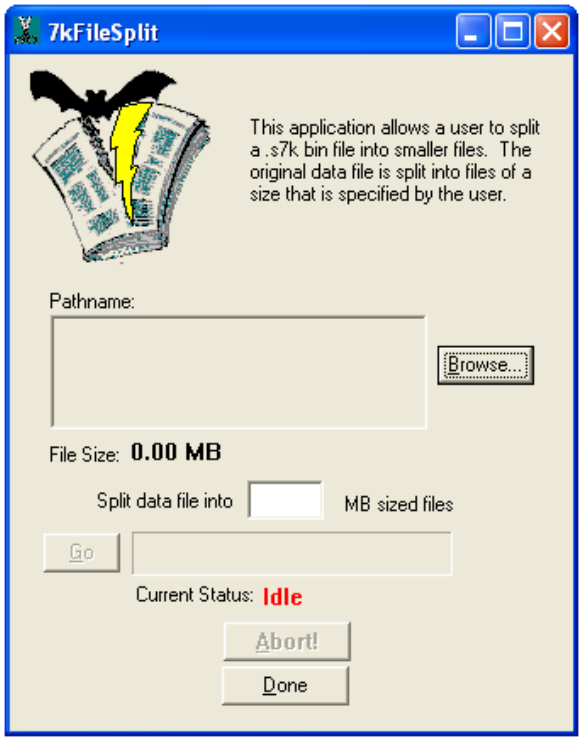
The Advanced section of the Data Playback tab has two utilities:

- **File Splitter:** This utility allows the operator to split recorded data files into smaller files.
- **Record Extractor:** This utility allows the operator to extract an individual record or groups of records in order to analyze sections of recorded data files.

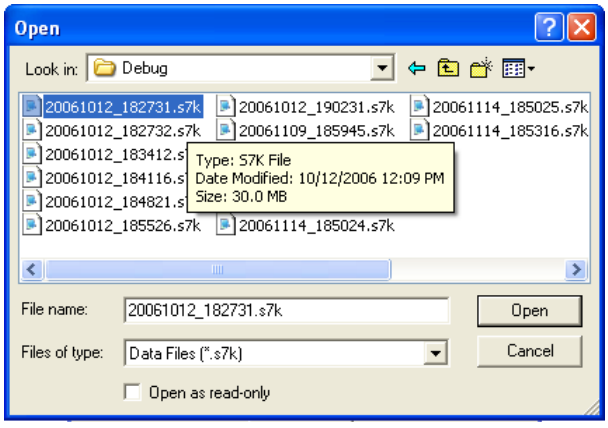
To use File Splitter:

1. Click the File Splitter button to launch the utility.

2. Click the Browse button to locate the desired file.

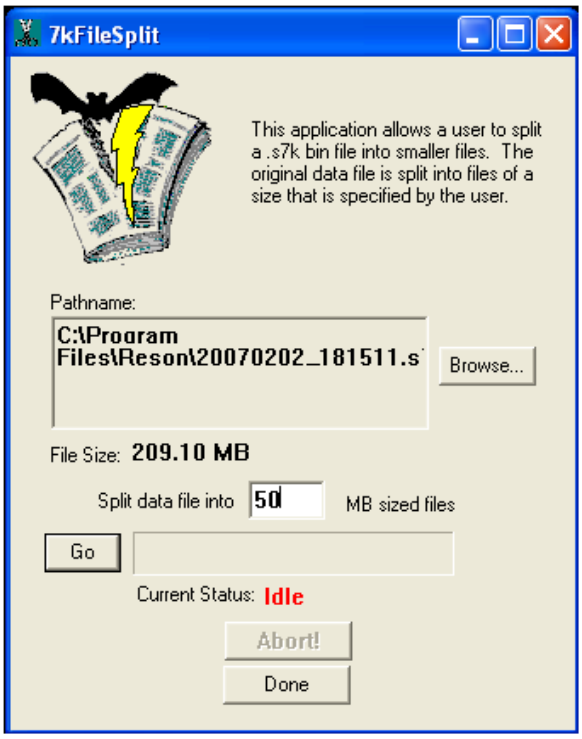


3. Select a file and click Open.



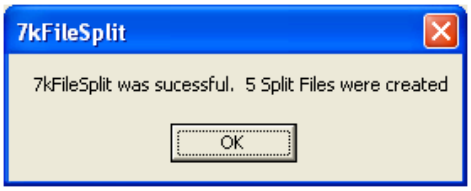
The 7kFileSplit utility window updates with the name and size of the selected file.

4. Enter a value in the field, Split data file into, and click the Go button.



The progress bar shows the status of the operation as new split files are created.

5. When complete, a message displays the number of split files generated. Click OK.

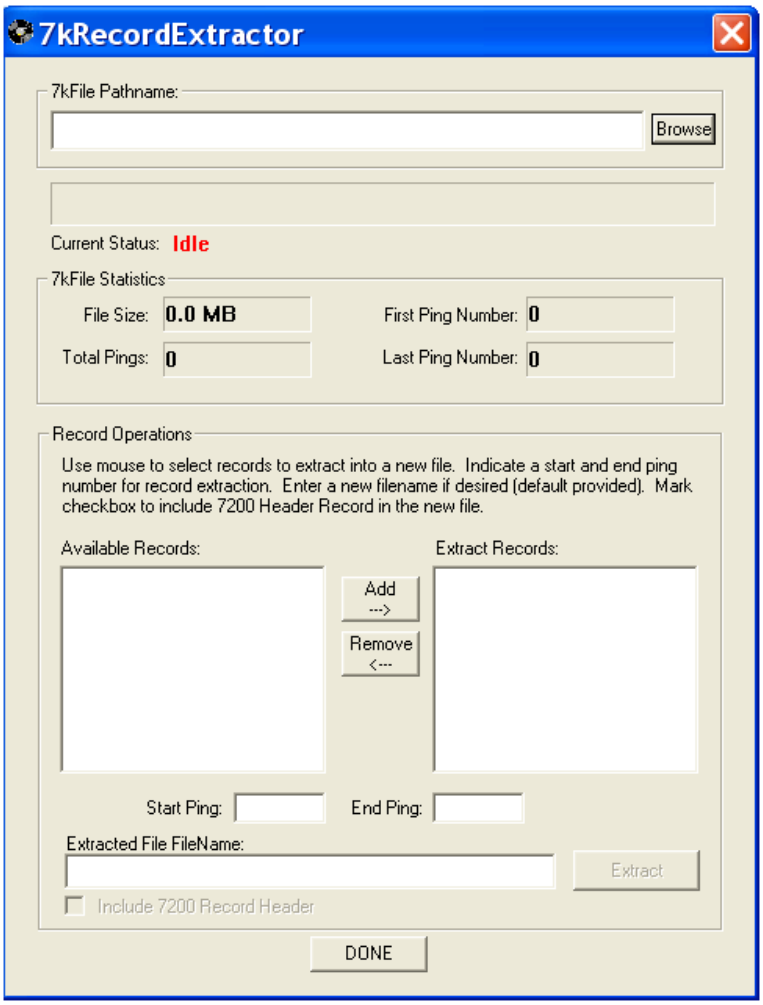


The new files are located in the same location as the original input file.

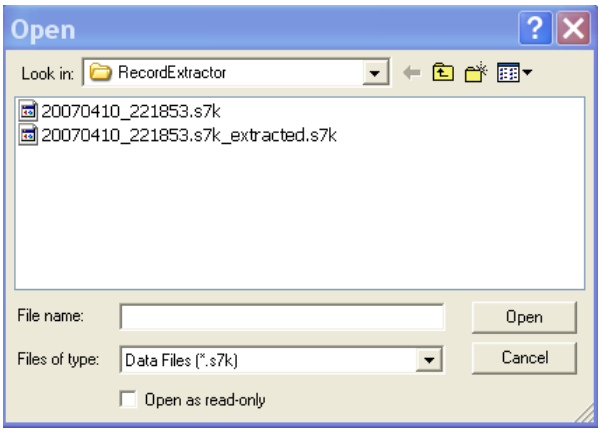
To use Record Extractor:

1. Click the Record Extractor button to launch the utility.

2. Click the Browse button to locate the desired file.

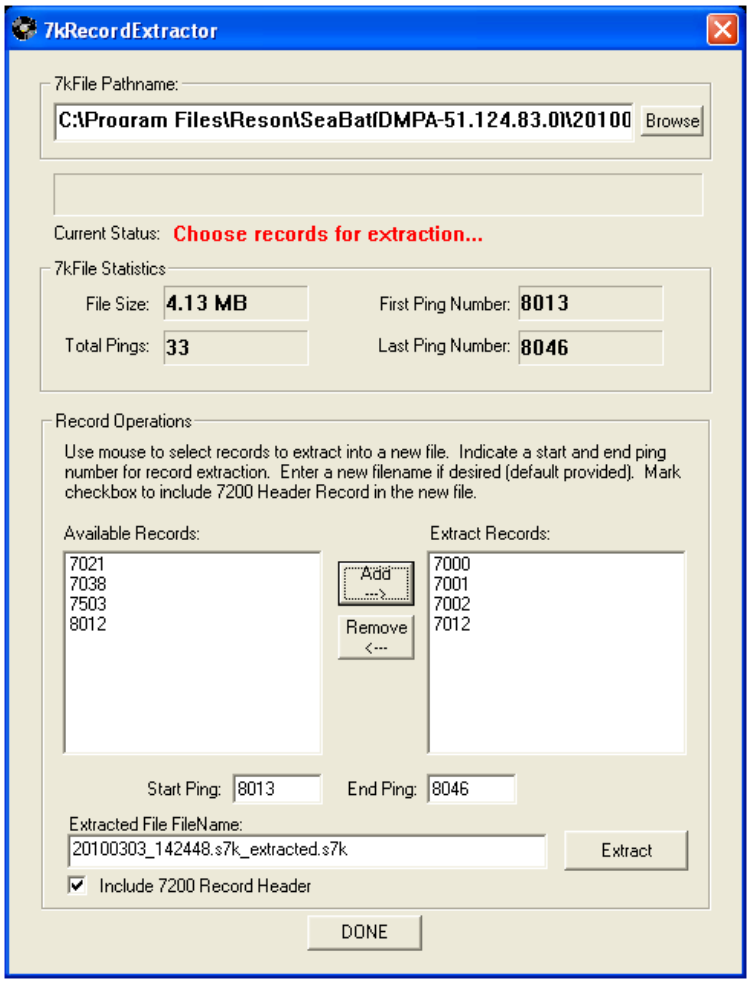


3. Select a file and click Open.



The 7kRecordExtractor utility window updates with the name of the selected file and available records.

4. Select a record from the Available Records list and click Add to move it to the Extract Records list. Repeat this for each desired record.



5. Click Extract to start the file extraction process.

   The “Extracted Record to new file” message briefly appears on the Current Status progress bar before returning to Idle status.

6. Click DONE.

   The extracted files are located in the same location as the original input file.

5.7.8.3 Playback Status

As the Playback progresses, the Playback Status section of the Data Playback tab will display information regarding the file being played.

- **Current Status:** Indicates the status of the system.
  - Playback: The system is playing a file.
  - Idle: Playback has stopped.
  - Loading: A file is loading.
  - Unknown: A playback file has not been selected.

- **Current File Size:** The size of the selected file.
- **Percent Complete:** The percent of the file that has played.
- **Current File Name:** The name of the selected file.
- **Current Directory:** The directory location of the selected file.

NOTE
Most communication with the sonar processor is disabled when in Playback mode. Alerts will continue to be received and displayed, however any alerts stored in the playback file will also be displayed. The time stamp on the alert will indicate whether it is a current or pre-recorded alert. In addition, recording and playback can be done simultaneously.

5.8 7k Center Console Window

The 7k Center runs in console mode only. The semi-resizable black console window is active while controlling the sonar. On startup and shutdown progress information is posted to this window. All other sonar information is obtained from the status display in the UI. However, if there is a problem with the system, errors may be reported in the console window as well.

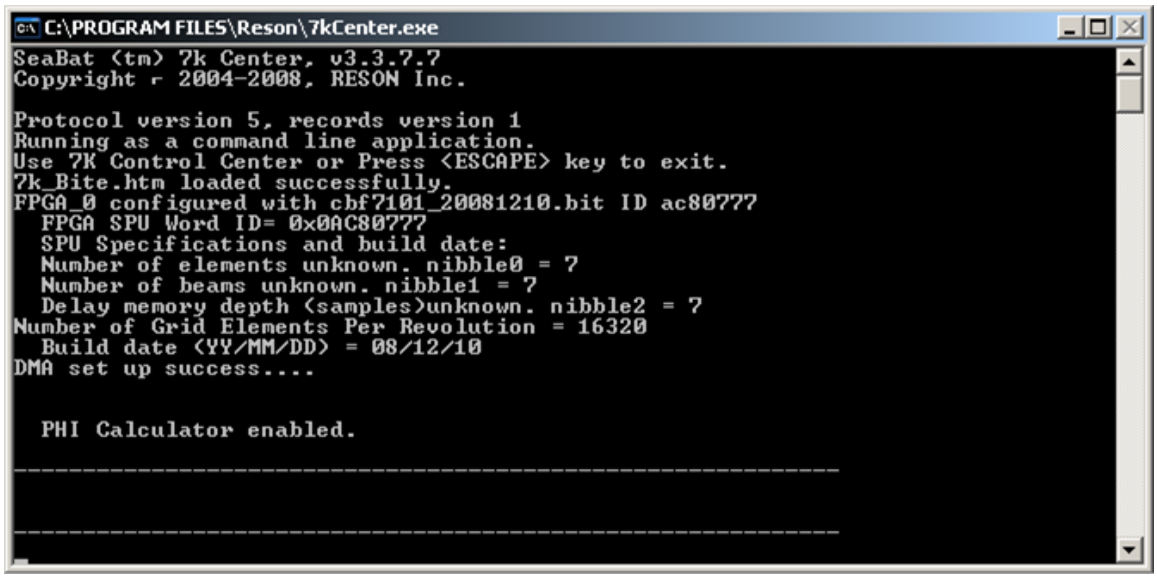


Figure 28: 7k Center Console Window

5.9 Software Release Information

The software release information box contains important information about your system that should be noted if you need to contact RESON. In addition, please note all firmware versions from the BITE tabs.

- Version: SeaBat version number
- 7k Center: Version number and Beamformer ID
- Data Format Protocol

NOTE
The file SystemHealth_date_time.txt, which is generated in the exe folder, may conveniently be sent to RESON. (See *section 5.6.2.1 above*.)

Figure 29: Software Release Information (Example Only)

6 ACTIVE SONAR USAGE

6.1 Chapter Overview

This chapter includes detailed instructions on the following subjects (click the emphasized hyperlink to be taken to the section):

- ***Enhancing the Sonar Image:*** Consists of examples on how to use the UI controls to enhance the sonar image.
- ***System Efficiency:*** Consists of examples on how to use the auto pilot, roll stabilization, and head tilt features.
- ***Use of Displays:*** Consists of descriptions on when to use the available displays.
- ***Compensation for Environmental Conditions:*** Consists of a thorough introduction into the environmental parameters that may affect sonar operation.
- ***Limitations:*** Consists of examples on the various physical limitations that may affect sonar operation.

NOTE
For information on starting, stopping, and setting up the SeaBat sonar system, see *section 3 System Startup and Shutdown*. For information on configuration of the system (including I/O module configuration, remote operation, and folder management), see *section 4 System Configuration*. For information on the user interface and operation of the system, see *section 5 System Operation.*

6.2 Enhancing the Sonar Image

6.2.1 Pulse Length and Image Resolution

For a given power setting, a narrower pulse length will provide a higher resolution at a shorter range. A wider pulse length will provide better range but a lower resolution image.

In certain conditions, for example in turbid waters, the narrower pulse length may not operate well. In such circumstances, the wider pulse length may give better short-range performance. This may also be achieved by changing from higher to lower frequency operation.

For instructions on how to adjust this setting, see *section 5.7.1.5 Set the Pulse Length*.

6.2.2 Transmit Power OFF

If the Power is set to OFF, the system will not ping, but it will continue to receive data provided that the max ping rate is not set to 0 (see also *section 5.7.1.3 Set the Maximum Ping Rate (Max Rate)*).

With the transmit power OFF, the sonar system will act as a passive sonar by only receiving data. This is a feature that is very useful for monitoring the ambient water in order to assess the level of background noise and interference from the vessel itself.

For instructions on how to adjust this setting, see *section 5.7.1.2 Set the Transmit Power (Power)*.

6.2.3 Lower Ping Rate

In some instances it may be beneficial to force a lower ping rate than the normal rate associated with a particular range.

Examples of this would be instances when the vessel is moving at a very slow rate, and the operator wants to reduce the quantity of data generated; or when the sonar is operating in a high-reverb environment where echoes of the previous ping are contaminating the current ping.

For instructions on how to adjust this setting, see *section 5.7.1.3 Set the Maximum Ping Rate (Max Rate)*.

6.2.4 Receiver Gain

The SeaBat system utilizes Time-Varied Gain (TVG) by applying a variable gain to the signal, based upon the formula in *Table 1*.

Table 1: TVG Formula

Receiver Gain = 2 α R_{km} + Sp log R_m + G
Where:
α = Absorption loss in dB/km
Sp = Spreading loss coefficient
$\mathbf{R}_{km}$ = Range in kilometers
$\mathbf{R}_m$ = Range in meters
G = Extra gain from RxGain menu item

For details on environmental conditions such as absorption and spreading, see section *6.5 below*

For instructions on how to adjust this setting, see *section 5.7.1.4 Set the Gain*.

6.2.5 Variable Swath

The benefits of the variable swath feature are twofold:

- Increased sounding density in a small sector may be used when tracking pipes or other linear features, where the operator is not interested in data outside a defined sector. The increased sounding density helps define small targets.
- A reduced swath width allows an increase in ping rate for any given depth.

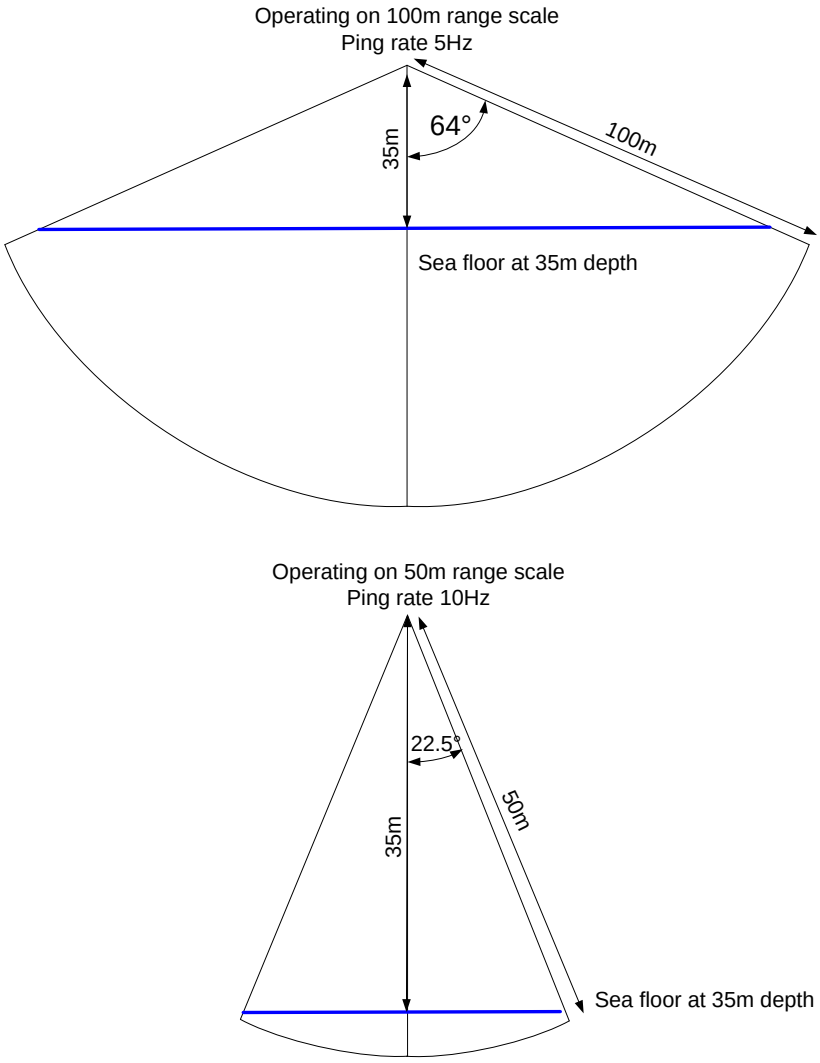


Figure 30: Example of Reduced Swath Width

For instructions on how to adjust this setting, see *section 5.7.1.6 Set Variable Swath*.

6.2.6 Correct Range Setting

Table 2: Incorrect Range Settings – Examples and Solutions

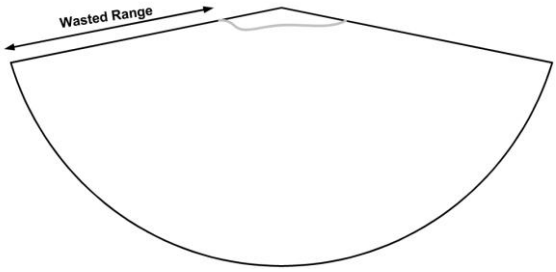


Figure 31: Range Setting – Too Long

With the range set too long, the receivers are “open” for too long and the system is recording long after the acoustic returns from the seabed have been received. Spurious background noise can be amplified, especially when TVG is used, and this can give noisier data. The ping rate is also reduced thereby reducing sounding density. This should not be used to artificially reduce the ping rate, rather the range should be set correctly and the ping rate should be capped using Max Rate (see *section 5.7.1.3 Set the Maximum Ping Rate (Max Rate)*).

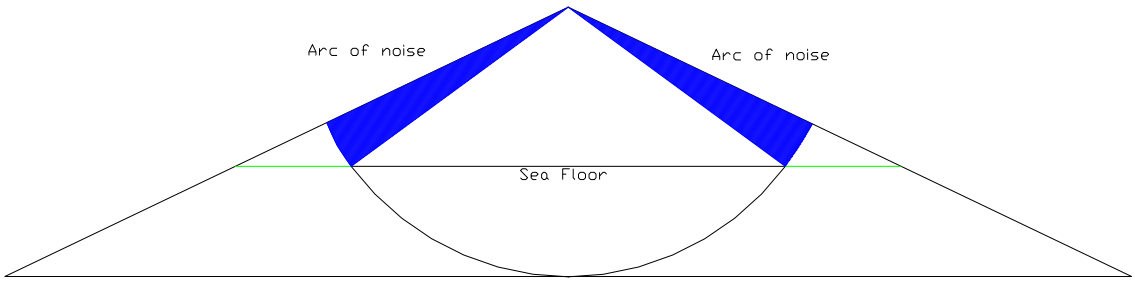


Figure 32: Range Setting – Too Short

With the range set too short, the outer beams formed are not long enough to reach the seabed. With no seabed in these beams the bottom detection process can only lock onto the noise in the water column. An exception to this is if the seafloor to the outer parts of the swath is of no interest and the user wishes to concentrate on a smaller seafloor coverage thereby increasing the ping rate and hence sounding density. In this case the user should reduce the swath coverage of the sonar (see *section 5.7.1.6 Set Variable Swath*).

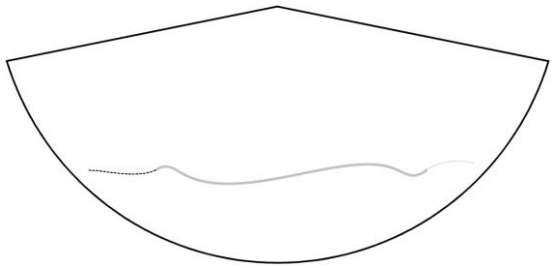


Figure 33: Range Setting – The Exception

If you are operating in relatively deep water to the limits of operation and the outer parts of the swath exceed the acoustic range of the sonar, the user should reduce the swath coverage (see *section 5.7.1.6 Set Variable Swath*) to cover the seabed that is visible only. This will increase the ping rate and reduce noise picked up for these visible beams.

6.2.7 Use of Gates

The depth gates, with no input from a motion sensor, will orient themselves parallel to the horizontal plane of the sonar head, as shown by the Min and MaxDepth lines in *Figure 34*. In this series of illustrations, the bottom detect dots are shown as a horizontal line (Line A or B) with dashed lines representing depth gates above and below the bottom and no vessel roll present. Visualize the bottom as being in the 'layer' formed by the depth gates.

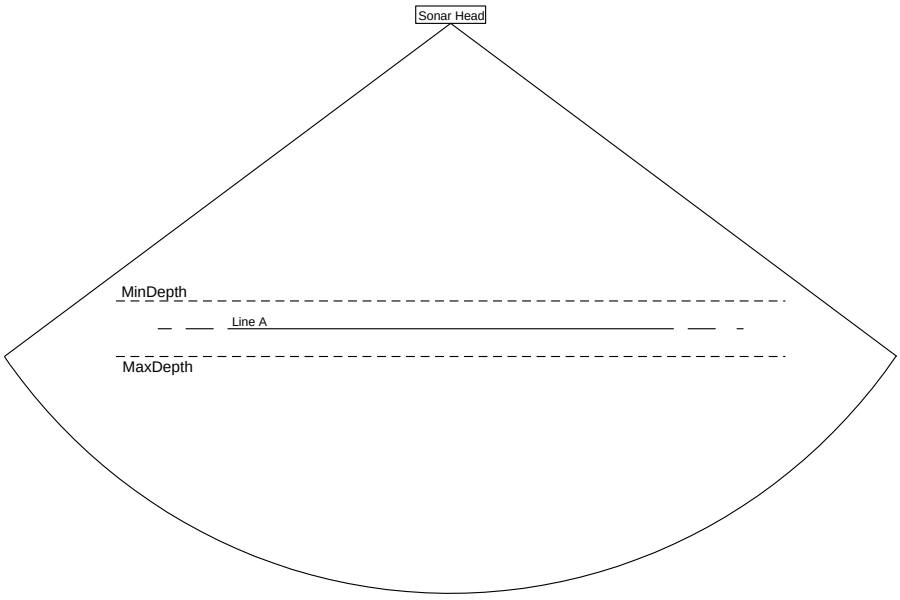


Figure 34: Depth Gates, With No Roll

Figure 35 shows the same bottom image with a small roll value to port. Notice that the ends of the swath have been cut off due to the action of the static depth gates (no motion sensor applied). In this figure, and all remaining figures in this discussion, the bottom is flat.

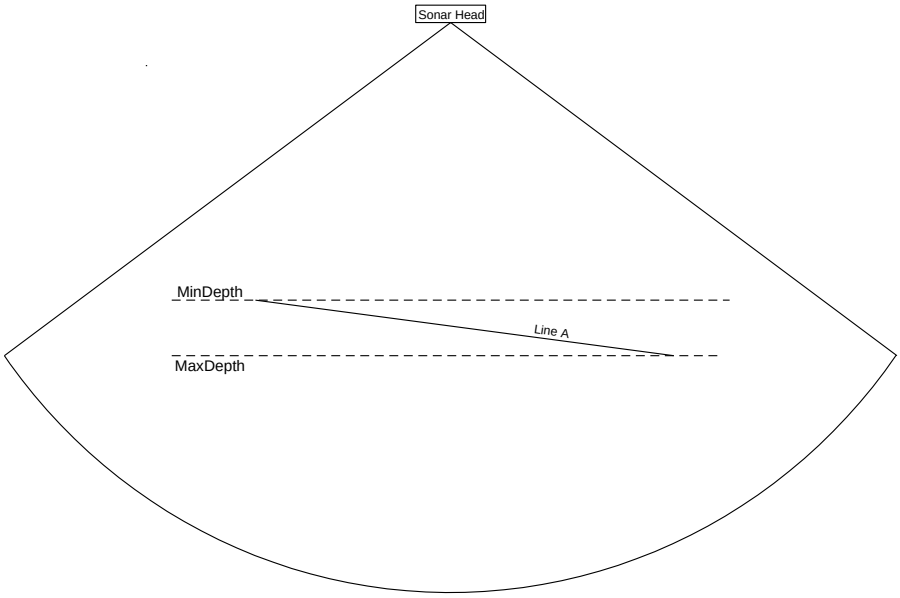


Figure 35: Depth Gates, With Roll

When controlled by a motion sensor, the depth gates will be parallel to the local horizontal plane of the earth even as the vessel rolls. *Figure 36* shows the same bottom image with dynamic depth gates applied.

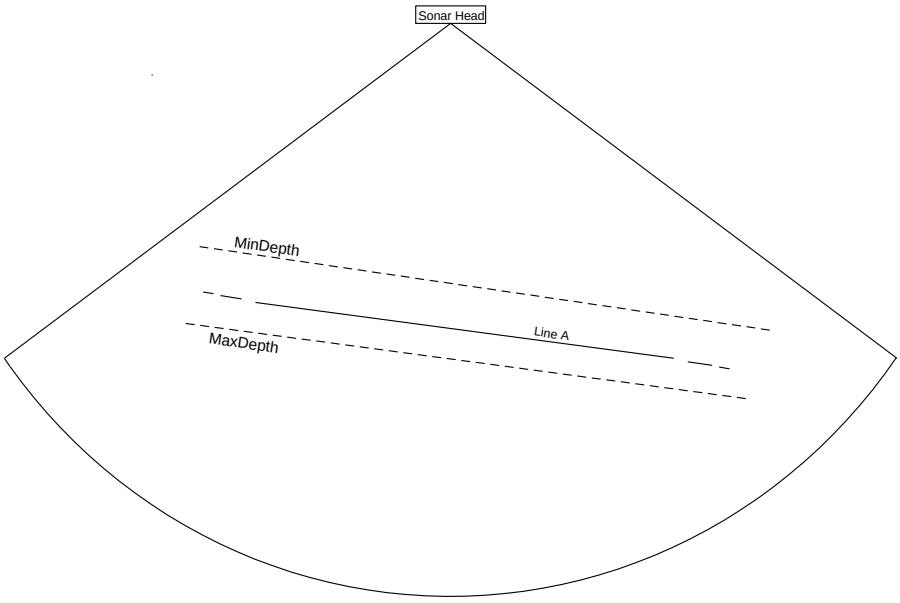


Figure 36: Depth Gates, With Roll and Motion Sensor Input

For instructions on how to adjust this setting, see *section 5.7.2 Detection Settings*.

6.3 System Efficiency

6.3.1 Auto Pilot

The sonar can be switched to Auto Pilot mode by selecting this option from the Mode drop-down menu. This disables operator selection of certain parameters such as range, gain, and power until the Manual mode is reselected (see *section 5.3.8 Change Modes*).

Once Auto Pilot mode is initiated, the 7k Center analyzes bottom detection data from a series of pings. If a certain amount of those pings are judged to have good bottom detection quality, the average bottom depth and maximum usable swath angle are determined. Then an appropriate range setting is determined and commanded to the sonar.

The process then repeats for the next series of pings. If too few of the analyzed pings are judged to be good (for example, if the water depth exceeds the current range), the Auto Pilot will command the next greater range setting to the sonar before analyzing the next series of pings. This way Auto Pilot mode can be reset to the minimum range and it will incrementally try greater ranges until the bottom is found.

Auto Pilot mode also automatically adjusts sonar parameters (power, gain, pulse length, and maximum ping rate) according to a user editable table (see *section 4.2.9 Edit Auto Pilot Settings*). This is made up of rows corresponding to each range setting of the sonar. Depending on the automatically selected range, the corresponding parameters from the table will be copied to the sonar settings. This way, critical sonar settings as well as range are all automatically adjusted when in Auto Pilot mode.

NOTE
The user always has full control of what the Auto Pilot settings will be.

The following routine is suggested for populating the Auto Pilot table in cases when the default values are not optimal:

1. In the AutoPilot Parameters dialog select the Easy-fill ON check box and click OK.

   When the Easy-fill ON check box is selected, the Settings -> Autopilot button on the Primary Display will be enabled.

2. Continue operating in Manual mode and click the Settings -> Autopilot button to transfer the current sonar settings to the row in the AutoPilot table that corresponds to the current range setting.

   This procedure allows the operator to quickly and easily build an AutoPilot table while running the sonar over the range of water depths the table needs to cover.

3. Once the desired number of range scale values are populated, open the AutoPilot Parameters dialog and save the settings to a file.

For further instructions, see *section 4.2.9 Edit Auto Pilot Settings*.

6.3.1.1 Auto Pilot Sensitivity

In general, the greater the sensitivity setting is, the greater the range. While this lowers the risk of losing part of the swath due to range, it also lowers the maximum ping rate.

- Lower sensitivity settings would be appropriate for roll-stabilized systems or very calm conditions without roll stabilization.
- Higher sensitivity settings (>20%) would be safer for non-roll-stabilized systems and/or highly featured bottoms.

6.3.1.2 Auto Pilot Limitations

The Auto Pilot functionality is difficult to optimize for all imaginable conditions and it should be expected that occasionally, the functionality will fail when subjected to marginal conditions. Occurrences such as rapidly changing seafloor topography, poor signal-to-noise ratio (possibly when operating at extreme ranges) and environmental conditions such as flow noise, bubbles around the array, and bio activity could all cause intermittent failure of Auto Pilot. See also *section 6.6 below.*

6.3.2 Roll Stabilization

Roll stabilization is an important feature related directly to system efficiency which allows the swath width on the seafloor to be maximized, thus increasing line spacing and reducing vessel time.

Under zero roll conditions, the swath is vertical and the center of the swath is directly below the vessel.

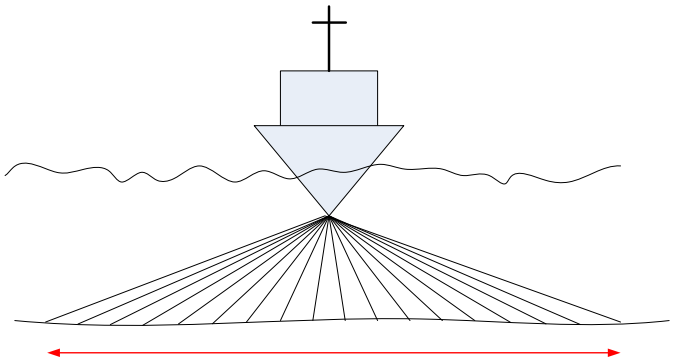


Figure 37: Swath under Zero Roll Conditions

When the vessel rolls the swath is rotated and the projected swath on the seafloor is laterally displaced.

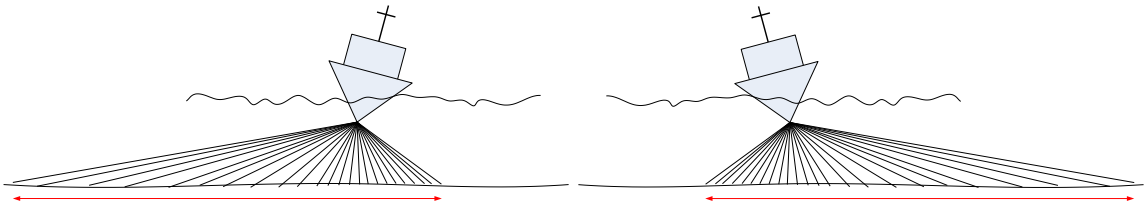
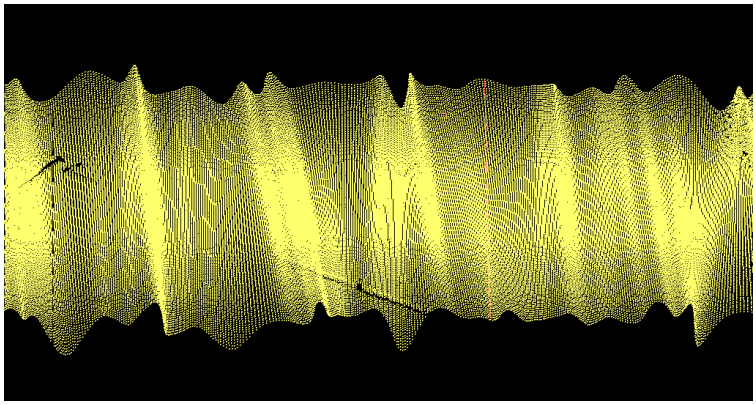


Figure 38: Laterally Displaced Swaths under Roll Conditions

This has the effect of reducing the usable swath width due to the distortions on the edge.



With the input from a motion sensor (and roll stabilization enabled) to steer each receive beam dynamically for every sample, the swath stays vertical irrespective of vessel motion thereby maximizing swath.

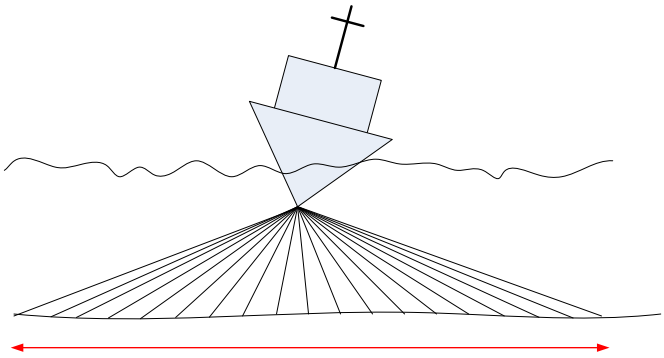


Figure 39: Swath under Roll Stabilization

It is recommended that the motion sensor data update rate is at least 50Hz and preferably 100Hz. Baud rate and protocol details may be set in the Configure Motion Sensor dialog (see *section 4.2.6 Motion*), but it should be ensured that the baud rate is sufficient to allow the desired update rate.

6.4 Use of Displays

6.4.1 Equidistant versus Equiangular Beam Mode

RESON offer both equiangular (EA) and equidistant (ED) beam modes in the SeaBat range of multibeam echosounders. In EA mode the beam center-center angular spacing is constant across the swath and in ED mode the spacing is modified to maintain an equal horizontal distance between soundings on the seafloor assuming a flat bottom. It is recommended that this mode be used for general survey applications where the requirement to achieve a specific number of sounding per cell in the across-track is critical, or where the seafloor is generally flat.

In areas of significant relief and in particular when surveying features such as wrecks and vertical structures such as harbor walls, EA mode should be used in preference to ED mode. In extreme conditions, using ED mode over complex structures can cause magnified artifacts due to the large overlap between beams towards the edge of the sector.

For instructions on how to switch between the beam modes, see *section 3.3 Starting the 7k Control Center and Sonar*.

6.4.2 Wedge versus B-Scan Display

The sonar wedge is the default view of the SeaBat sonar system. Change to B-scan view when operating long distance. For further details on wedge and B-scan displays, see *section 5.3 Primary Display Tab*.

6.4.3 A-Scan, Phase and Magnitude Displays

With the A-scan displays it is possible to analyze the signal in a single beam (or group of beams) to determine whether the bottom detection point is trustworthy.

The magnitude display is suitable to use for analysis of the middle beams and the phase display is suitable to use for analysis of the outer beams of the swath. Signal Operator Mode must be selected to make the phase display available (see *section 4.2.1 Data Display & Format*).

For instructions on how to switch between the available A-scan displays, see *section 5.3.2.1 Available Displays*.

6.5 Compensation for Environmental Conditions

As sound propagates through the underwater environment, the energy is absorbed by the liquid caused by molecular interactions that convert acoustic energy into heat. A propagating sound field also spreads geometrically, which means that the sound pressure decreases with increasing distance from the sonar. Other mechanisms such as bubbles, plankton, tidal currents, currents from rivers etc. may influence sound propagation, but these mechanisms are difficult to measure and model, as they vary with time and only appear in a limited number of areas. However, as absorption and

geometrical spreading exist everywhere in the underwater environment, they are considered to be the most important loss mechanisms.

In the SeaBat system it is possible to compensate for loss caused by absorption and geometrical spreading. In addition, the SeaBat system allows for changes in the speed of sound, a parameter which is important in the beamforming process.

For instructions on how to adjust these settings, see *section 5.7.3 Ocean Settings*.

6.5.1 Loss of Sound by Absorption

The amount of loss of sound through absorption in water depends on the water conditions and the sound frequency. As sound moves through the water, the water absorbs it by converting some of the acoustic energy to heat. The absorption loss is proportional with the salinity of the water and the sound frequency: the higher the salinity or frequency, the greater the loss (see *Figure 40*). The figure also shows that an increased temperature will increase the absorption loss.

The absorption loss value is part of the formula that the SeaBat system uses to calculate the amount of gain to apply to the sonar return signal (see *section 6.2.4 above*).

If the exact absorption loss value is not known, a value of 110dB/km for salt water and 70dB/km for fresh water is recommended for 400kHz operation, and a value of 50dB/km for salt water and 20dB/km for fresh water is recommended for 200kHz operation. For instructions on how to adjust this setting, see *section 5.7.3.1 Change the Absorption Loss Value (Absorption)*.

Figure 40 provides a general reference for acoustic absorption at different frequencies and salinity in three different temperature environments.

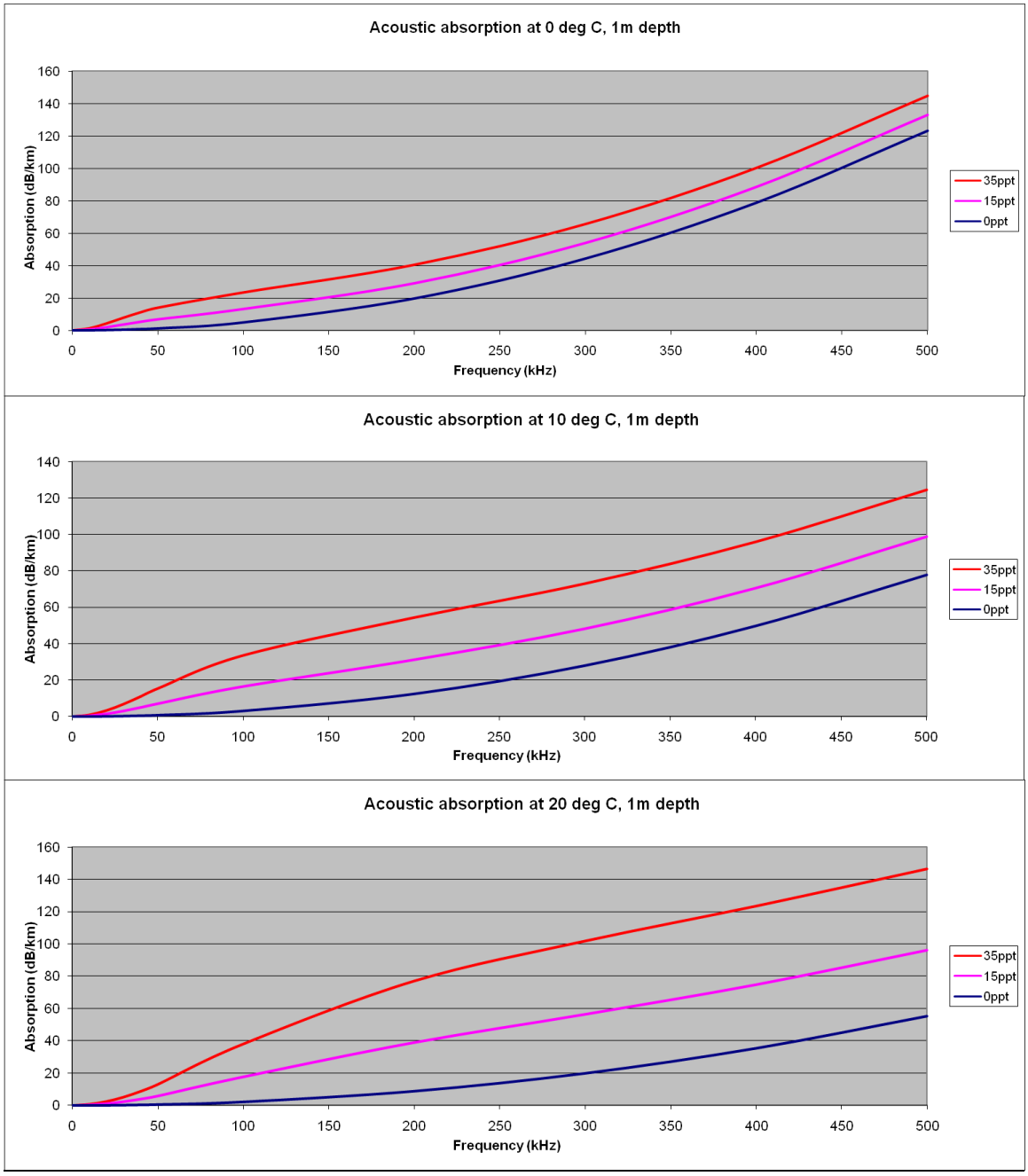


Figure 40: Acoustic Absorption Reference

6.5.2 Loss of Sound by Spreading

Spreading of sound through water may be the greatest contributor to the loss of sound. As sound moves away from its source in all directions, the acoustic pressures will decrease with range.

In deep water, where the acoustic propagation is not bounded by the sea surface or the seafloor, the spreading loss is spherical. In this case the pressure decrease is proportional to 1 divided by the range R from the sonar to a given object or surface.

Thus, the acoustic pressure decays as 1/R. As the sound is scattered back to the sonar the backscattered field also decreases as 1/R. Consequently, for a two-travel path the acoustic pressure in a free field decays as $1/R^2$.

In shallow waters, on the other hand, the sound propagation is bounded by the sea surface and the seafloor, and the spreading loss is cylindrical. In cylindrical spreading the sound pressure only decreases as $1/R^{½}$, and the two-way travel path decays as 1/R.

In practical situations the transmission loss will lie between 20 and 40dB; in other words, the spreading loss will neither be perfectly spherical nor perfectly cylindrical. Finally, if the sonar operates very close to the seabed or very close to objects in general, near-field effects may yield a transmission loss less than 20dB.

The spreading loss value is part of the formula that the SeaBat system uses to calculate the amount of gain to apply to the sonar return signal (see *section 6.2.4 above*).

If the exact spreading loss value is not known, an initial value of 30dB is recommended. For instructions on how to adjust this setting, see *section 5.7.3.2 Change the Spreading Loss Coefficient (Spreading)*.

6.5.3 Sound Velocity

Sound velocity varies with pressure, temperature, and salinity. An increase in these three levels increases the sound velocity. The sonar data presented in the SeaBat system is dependent on the sound velocity profile provided.

If the local sound velocity is not known, RESON recommends a value of 1480 to 1500m/s for open sea areas and 1425m/s for fresh water. For instructions on how to adjust this setting, see *section 5.7.3.3 Set the Sound Velocity*.

Figure 41 provides a general reference for typical surface sound velocity at different temperatures and salinity.

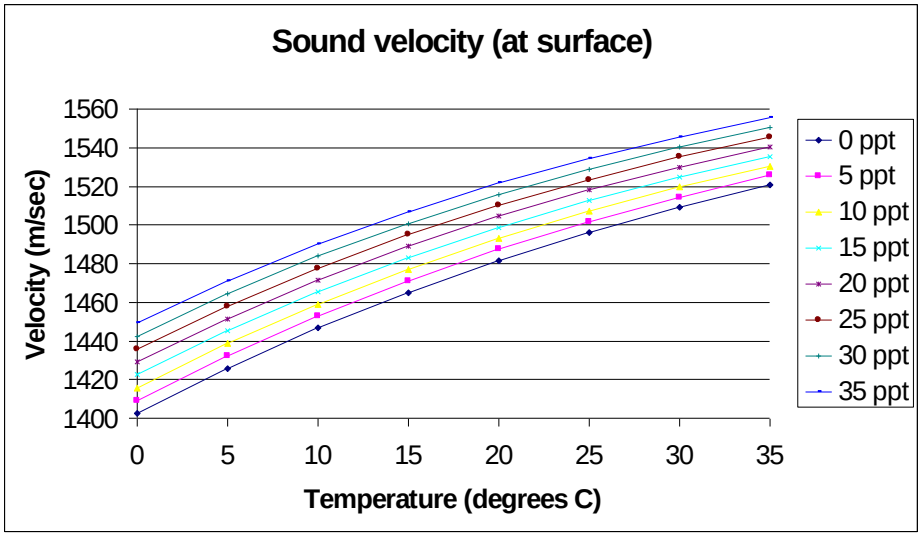


Figure 41: Typical Sound Velocity Values

6.6 Limitations

Physical limitations in the functionality of the system have to be taken into consideration when operating the SeaBat system. Some of the limitations are absolutes; others can to some degree be overcome.

The following subsections provide examples of different kinds of limitations.

6.6.1 Cavitation

Some reduction in the transmitted source level is expected to be caused by cavitation. For means of compensating for this, see subsections in *6.2 above*.

6.6.1.1 Propeller Cavitation

Propeller cavitation can be a significant concern for two reasons. First, the frequency of propeller cavitation noise is in the operating frequency band of most sonar equipment. Second, the source levels of the propellers installed are expected to be high unless special quieting techniques have been implemented.

Propeller energy typically propagates to the forward area sonar systems via a direct or hull-grazing path. The other arrival path of propeller energy is by the bottom bounce path. This path will be more significant in shallow water depths (less than 500 meters). The potential impact can be further quantified for particular bottom depths of proposed operational test sites.

6.6.1.2 Appendage Cavitation

Appendage cavitation can result from rough or unfaired edges on the hull and can even be present at lower speeds. If the source is located near the sonar installation area, it can be a significant noise deficiency. It is difficult to predict the occurrence of appendage cavitation without under-hull drawings, pictures, or visual inspection of the ship when in dry-dock.

6.6.2 Machinery Noise

Machinery noise should not be a major factor for sonars that operate at frequencies above 5kHz. Mechanical machinery noise is usually prevalent at 2kHz and below, though it is occasionally detected at higher frequencies when fluid flow through pipes or cavitating pumps are involved.

Typically, the most important consideration for machinery noise is the proximity of the acoustic sensor to the machinery source. There has been one observed case where diesel engine piston frequency harmonics have been the controlling noise source at 12kHz, but in this situation, the engine room and the sonar compartment shared a common bulkhead. Normally, acoustic devices are sufficiently distanced from major machinery noise sources that machinery noise does not interfere.

A concern remains that there may be some auxiliary machinery (or other unusual equipment) located near the sonar that could produce noise interference. An inspection of the installation site and ship drawings to verify the position and proximity of all

shipboard equipment should be conducted to determine if there is a potential for machinery interference prior to conducting at-sea testing. For means of compensating for this, see subsections in *6.2 above*.

6.6.3 Speed

Hydrodynamic flow noise can be a concern when operating at higher speeds. Externally mounted acoustic sensors should have fairings that are as flush (or near-flush) mounted to the ship hull as is practically possible. This way the hydrodynamic flow-induced vibration noise should be minimal. For means of compensating for this, see subsections in *6.2 above*.

NOTE
A poorly designed sonar fairing can degrade the system performance by a factor of 4 for speeds above 8-10 knots. Typically, this noise source is the most common problem on all sonar installations.

6.6.4 Air Bubbles

Bubble sweep-down can be another potential noise problem. The significance of this problem is associated with the noise generated as the bubbles cascade along the hull after being ingested in the bow wave of the ship and, more importantly, with the baffling produced by the entrained air layer between the face of the sonar sensor and the water environment.

If air bubbles are present between the sonar and the water, the system will not function properly. This phenomenon is transient in nature occurring only for a few seconds per wave period. It is typically most prevalent on shallow draft ships and increases in intensity at higher sea states and ship speeds.

Modeling of this problem only indicates that air bubble noise may be present by determining the transmission vehicle of potential bubbles. Actual at-sea measurements are usually required to fully determine the presence and severity of bubble sweep-down. At-sea diver viewing has been very successful in the past to capture the bubble sweep-down characteristics of a particular ship hull on film.

Air bubbles mask some or all of the view of the sonar where the affected area will completely blank out. Common causes for bubble masking include:

- The vessel props when thrusting into reverse and pours a stream of bubbles over the sonar.
- The sonar has not been deployed deeply enough and there is bubble wash from the sea surface.
- Bubble ingestion as the vessel pitches into the sea.

6.6.5 Environment

A high-reverb environment where echoes of the previous ping are contaminating the current ping may prove to be difficult. For means of compensating for this, see *section 6.2.3 above*.

7 SYSTEM PERFORMANCE AND DATA TYPES

The SeaBat 7125 SV sonar system produces three types of data, bathymetry, side-scan, and snippets, suitable for the generation of high-resolution hydrographic charts that exceed international standards.

A single transmission from the projector unit illuminates a 128° (or 140°) swath on the seafloor. The seabed return signal is received by the receiver unit, digitized, and transmitted to the transceiver, where it is formatted for display and data output. Bottom detection bathymetry soundings, side-scan, and snippets are displayed locally or exported via gigabit Ethernet using TCP I/P protocol[13] to an external data collection system.

A Windows®-based user interface controls the system, allowing the operator to select system configuration, data output, and storage options. This also provides built-in test environment (BITE) displays to assist the operator.

Table 3: SeaBat 7125 SV System Performance

Parameters	400kHz	200kHz option
Sonar operating frequency	400kHz	200kHz
Across-track beam width (nominal values[14])	Transmit: >145° Receive: 0.54° ±0.03° (center)	Transmit: >142° Receive: 1.1 ±0.05° (center)
Along-track beam width (nominal values[14])	Transmit: 1.0° ±0.2° Receive: 31° ±3.5°	Transmit: 2.2° ±0.5° Receive: 28.5° ±3.8°
Across-track beams	256 or 512	256
Swath coverage[15]	128° or 140°	128° or 140°
Range (typical)	0.5-300 meters	0.5-750 meters
Ping rate (range dependent)	Up to 50 pings/s	Up to 50 pings/s
Pulse length	33-300µs (CW)	33-300µs (CW)
Depth resolution	6mm	6mm
Depth rating	50	50

For available configurations, see *Appendix E Available SeaBat 7125 Configurations*.

[13] UDP is also available.
[14] All beam width measurements are performed at -3dB, unsteered with a sound velocity of 1480m/s.
[15] The swath coverage of 140° is available with the Efficiency feature package (see *Table 20*).

7.1 Data Types

7.1.1 Bathymetry Data

At 400kHz, the SeaBat 7125 SV generates 256 (or 512[16]) equiangular or equidistant soundings per ping. At 200kHz, the system generates 256 equiangular (or equidistant) bathymetry soundings per ping. The system broadcasts from the transceiver to the data acquisition software, where they are corrected for mechanical offsets, motion, heading, refraction, tide or depth, and position. To perform these corrections, the appropriate sensors must be interfaced to the data acquisition software (see *section 4.4 I/O Module Configuration*).

Depending on the beam angle, bottom type, and signal characteristics, the bottom detection method employed may be magnitude center-of-energy, phase slope zero-crossing, or a blend of the two methods. The bottom detection method can vary from ping to ping and beam to beam.

7.1.2 Side-Scan Data

Side-scan swath is measured and displayed without degrading any of the traditional survey capabilities of the SeaBat.

7.1.2.1 Side-Scan Imagery Data

Side-scan forms an image of the seafloor which can be used to locate and identify features and bottom conditions. Each sonar ping is used to generate a line of data. Each line contains a series of amplitudes representing the signal return versus time or range. When a series of these lines is combined and displayed as the vessel moves along the track, a two-dimensional image is formed, providing a detailed picture of the bottom along either side of the vessel.

The side-scan data can be viewed on a waterfall display representing the results of a peak-detect search through the left and right beams of the swath.

NOTE
Side-scan cannot be used to accurately measure true depths, but it can provide a more detailed picture of the seafloor. This image can be used together with bathymetry to identify features and to help ensure that the survey does not miss any small but significant targets.

7.1.2.2 Side-Scan Process

The side-scan process averages adjacent pairs of beams to eliminate noise and then carries out a peak detection over beams from the left and right sides of the swath. The peak detection is done at the sample rate of the sonar.

The bathymetry and side-scan data are independent in the beamforming process and in how the output data is generated.

[16] Available with the Efficiency feature package (see *Table 20*).

7.1.2.3 Side-Scan Data Output

The array of intensity values is a series of amplitudes, one for each sample interface for each side-scan beam. A sampling rate of 34482 samples per second provides approximately one measurement for every 2.5 centimeters of range.

The number of intensity values reported in a side-scan packet is a function of range. The number of values per packet can be calculated using the following formula:

$$\left(\frac{Range}{1/2SoundVelocity}\right) * SampleRate = SamplesPerBeam$$

Side-scan is one of the many records available for subscription from the 7k Center software. Refer to the 7k Data Format Definition for further information regarding side-scan data output (see also *Appendix C Reference Documentation*).

7.1.3 Snippets Data

Snippets data is available from the SeaBat 7125 SV. Each snippet consists of a windowed selection of amplitudes taken from the bottom detection point of each beam.

A snippets data sample contains corrected backscatter data from the ‘footprint’ on the seabed illuminated by a single sonar ping. The number of snippets in a swath is a function of the number of sonar beams. The length of each snippet depends on the operating mode, beam number, and depth. All of these settings may be selected by the operator.

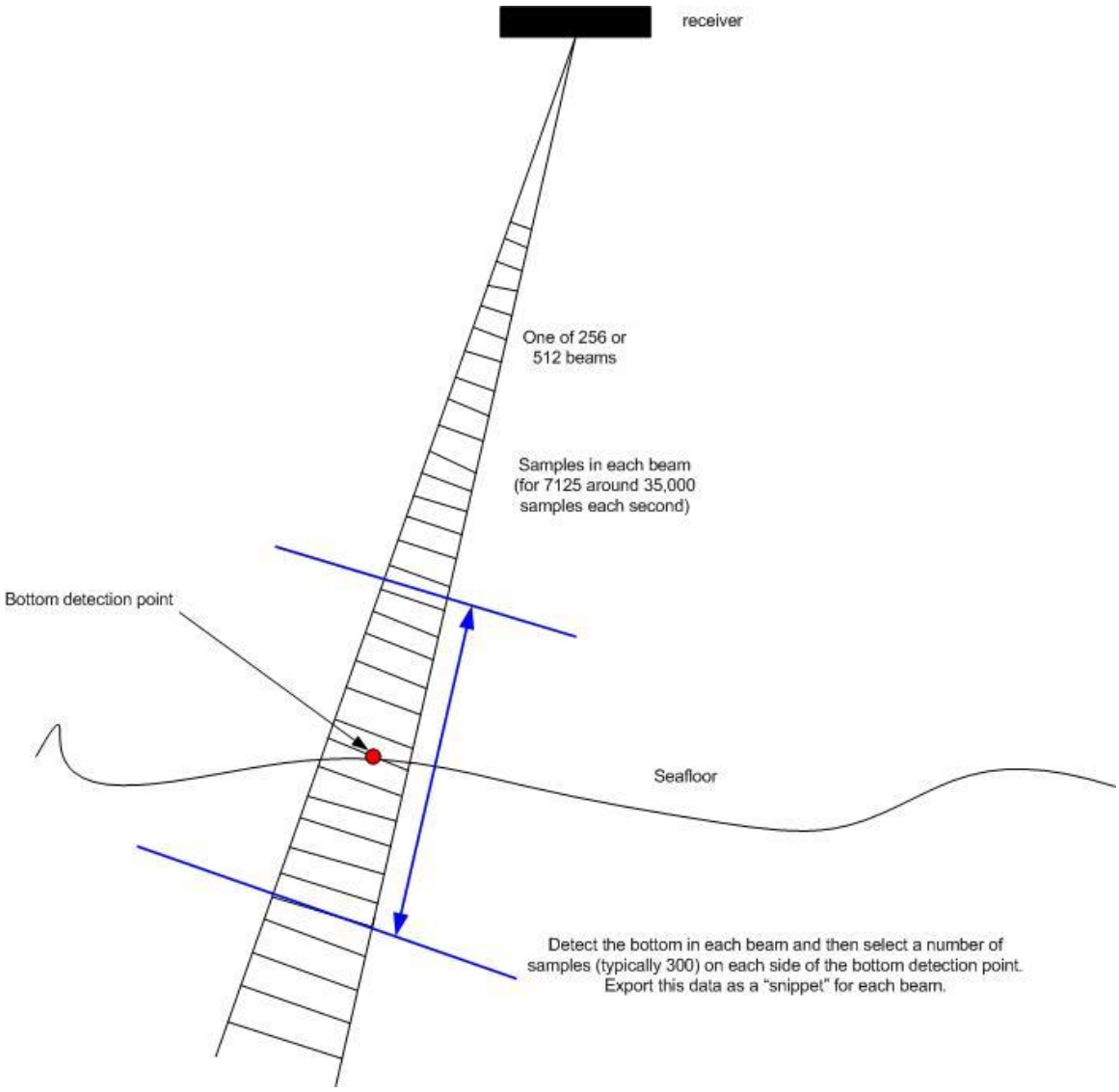


Figure 42: Graphic Illustration of Snippets Data

Each snippets data packet contains pertinent information such as time stamp, sequential ping number, sample rate, sound velocity, and operator settings such as power, gain, absorption, and range scale.

7.2 Equidistant Beamforming

As the beam steering angle increases from nadir, the number of beams per degree of swath stays constant for equiangular spacing while it increases for equidistant spacing. *Figure 43* presents the number of beams as a function of steering angle for a 1° nadir beam spacing.

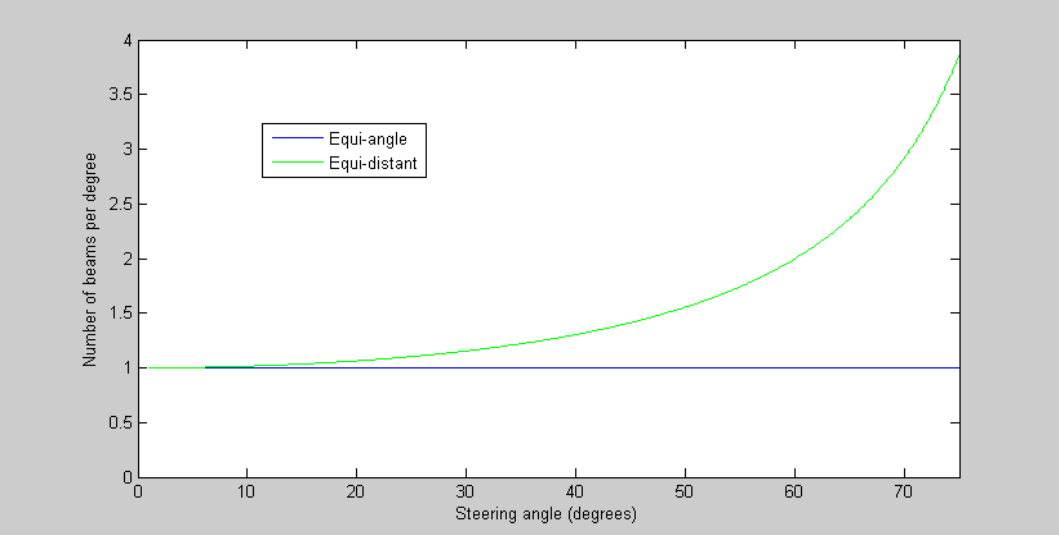


Figure 43: Beam Density

Assuming a flat bottom and using the beam footprint generated by the nadir beam, it may be seen that the center-to-center spacing for each beam successively reduces as the departure from nadir increases until at ±65° the beam density is approximately 2.5 times greater than at nadir.

Assuming one sounding is generated from the intersection of the beam center with the seafloor, in equidistant mode, the appropriate number of beams is formed to maintain this nadir sounding spacing across the entire swath. See also *Figure 44*.

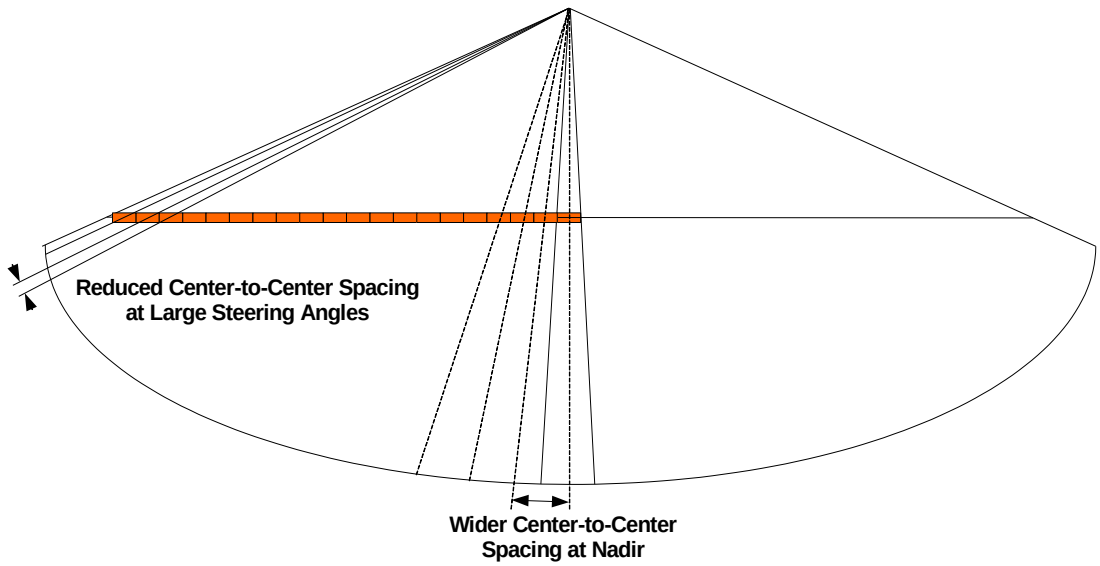


Figure 44: Beam Spacing

In order to achieve this uniform sounding spacing, it is necessary to decrease the beam center-to-center spacing which requires a significant increase in the number of beams formed. As an example, in the SeaBat 7125 SV 400kHz system 256 or 512 beams are formed in equiangular or equidistant mode over the same 128° (or 140°) swath. For

instructions on how to change the mode, see *section 3.3 Starting the 7k Control Center and Sonar*.

The beamformer is able to generate a receive beam centered on any angle within the available swath and in equidistant mode a set of coefficients is selected that form a set of receive beams that are centered on the midpoints of the footprints.

Figure 45 shows the difference in distribution between equiangular and equidistant modes.

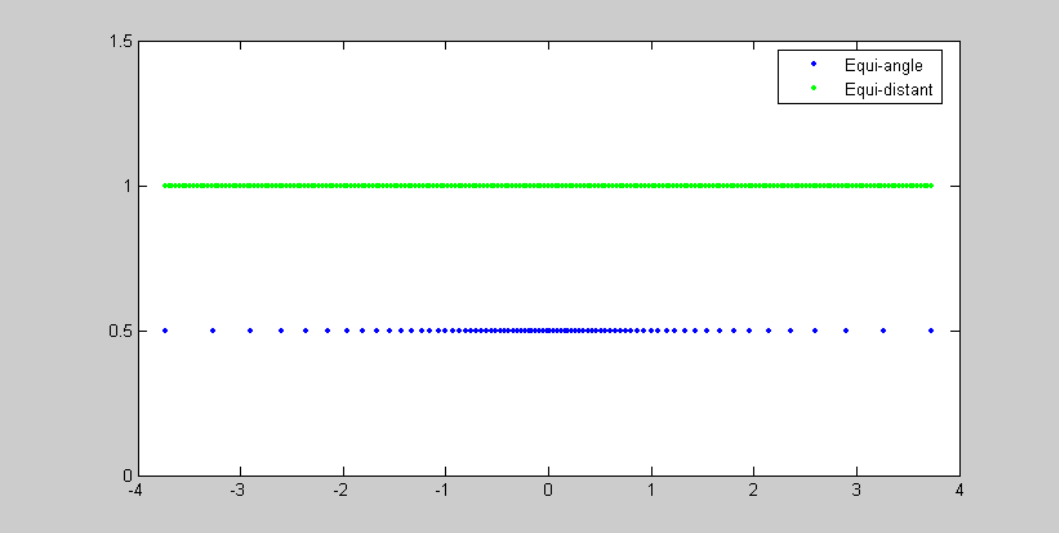


Figure 45: Across-Track Sounding Location on a Flat Bottom

7.3 Quality

The quality of each bathymetric bottom detection point is evaluated by the 7k Center (see Bathy Point Color in *section 5.7.4 Primary Display Settings*).

7.3.1 Brightness Test

The brightness test measures the signal-to-noise ratio (SNR) of the signal strength (magnitude) near the bottom detection point (as determined by the bottom detection algorithm) versus the background noise in the rest of the beam.

The signal strength is the mean of the square of the sample intensity around the bottom detection point. The number of samples used is marked ‘A’ in *Figure 46* and is a small percentage of the total number of samples. The noise is based on a mean of the square of the samples in the second half of the “tail” of the detection window (marked ‘B’ in *Figure 46*) and the square of the samples in the “head” of the water column (before the first return – marked ‘C’ in *Figure 46*).

Beams, whose SNR is greater than a predetermined threshold, will be flagged as passing the brightness test.

For instructions on how to display the test results, see Quality in *section 5.7.4 Primary Display Settings*.

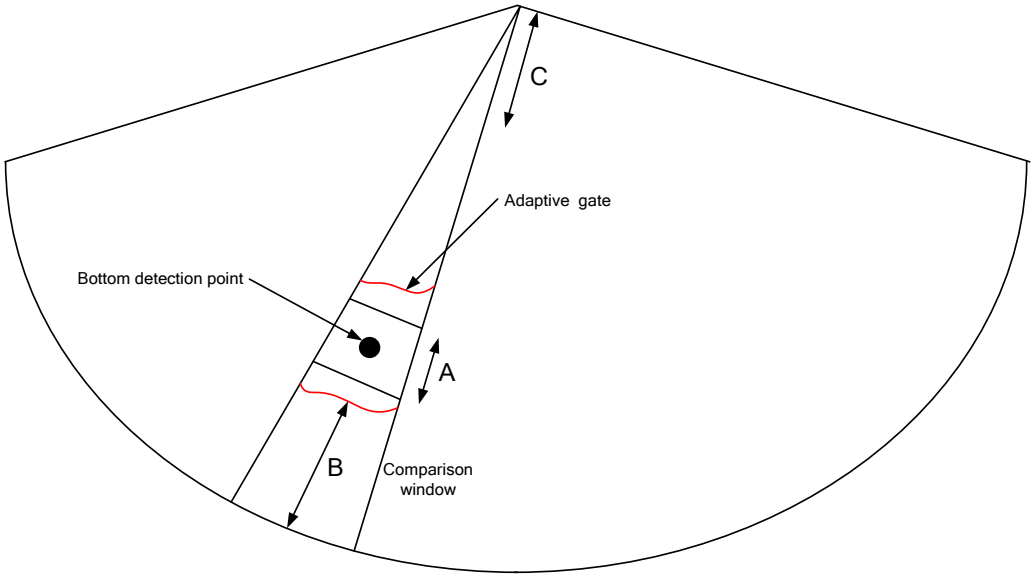


Figure 46: Brightness Test

7.3.2 Colinearity Test

In general terms, this test will pass if a bottom detection point sample number for a given beam falls on or near a line drawn through its neighboring beams' bottom detection points. This is achieved using a moving polynomial fit of the points on either side of each point. If a given point is within the window of the line fit, it is marked colinear.

This process is done in stages that begin with the central beams and moving outward on each side of the wedge in turn.

For instructions on how to display the test results, see Quality in *section 5.7.4 Primary Display Settings*.

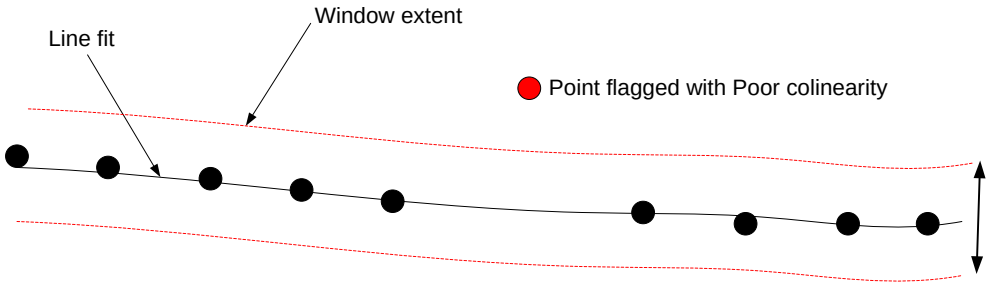


Figure 47: Colinearity Flags

7.3.3 Quality Filter

A quality filter makes it possible to not display or export bottom detection points which do not pass the quality criteria. Enabling the quality filter (see *section 5.7.2.5 Quality Filter*) has the following effects:

- The corrected bathymetric data record will only contain the detection points that pass the quality filtering. A flag will be set in the record to indicate that the quality filter was applied.
- The dedicated snippets record will only contain the detection points that pass the quality filtering. A flag will be set in the records to indicate that the quality filter was applied.
- The Primary Display wedge and Snippets displays will only show points that pass the quality filtering.
- The options Show Rejected (selected by right-clicking the wedge display) and Rejected Items (in the drop-down menu on the Primary Display Settings tab) will be disabled (see Display Points / Filters in *section 5.7.4 Primary Display Settings*).

For details on settings for the quality filter, see *section 5.7.2 Detection Settings*.

7.4 Uncertainty Estimation

The calculation of Total Propagated Error (TPE) is used to aid the surveyor determine the sounding quality of the bottom detection point. The calculation is done by statistical methods, typically in the data acquisition software. One of the inputs into the TPE calculation is the sounding measurement error as computed in the sonar system. Other error sources include position, draft, squat, load, tide geodetic calculations, lever arms calculations, timing offsets, speed, heading, attitude, and sound velocity.

In the sonar processor, the error associated with bottom detection is computed separately for amplitude, phase, and blended detection methods. This value is exported as a field in both raw and corrected bathymetry records.

The uncertainty value is normalized to the detection point by dividing the absolute range error (number of samples) by the detection point (fractional sample number). For example:

- Absolute range error: 0.8 samples
- Fractional sample number of detection point: 120.2
- Uncertainty = 0.8/120.2 = 0.006655574

When the Uncertainty option is active, a color legend is shown on the wedge display.

For instructions on how to display the uncertainty, see Bathy Point Color in *section 5.7.4 Primary Display Settings*.

7.5 Ping Rate Table

Table 4: Ping Rate Table

Range setting (m)	Theoretical max ping rate (1500m/s)	Realized ping rate [Hz]	
		200kHz, 256 EA beams	400kHz, 512 ED beams
5	150	51.1	49.0
8	93.7	49.7	50.2
10	75.0	50.0	45.6
15	50.0	36.5	33.0
20	37.5	28.7	25.9
25	30.0	23.7	21.1
30	25.0	20.0	18.0
35	21.4	17.5	15.4
40	18.8	15.4	13.6
50	15.0	12.4	11.0
75	10.0	8.5	7.3
100	7.5	6.4	5.5
125	6.0	5.0	4.4
150	5.0	4.4	3.7
175	4.3	3.7	3.1
200	3.8	3.3	2.6
250	3.0	2.5	2.1
300	2.5	2.1	1.8
350	2.1	1.8	n/a
400	1.9	1.7	n/a
500	1.5	1.3	n/a
750	1.0	0.9	n/a

NOTE

The table reflects the ping rate performance on a processor only running the 7kCenter. If PDS2000 is running on the same processor, the ping rate performance may be marginally lower.

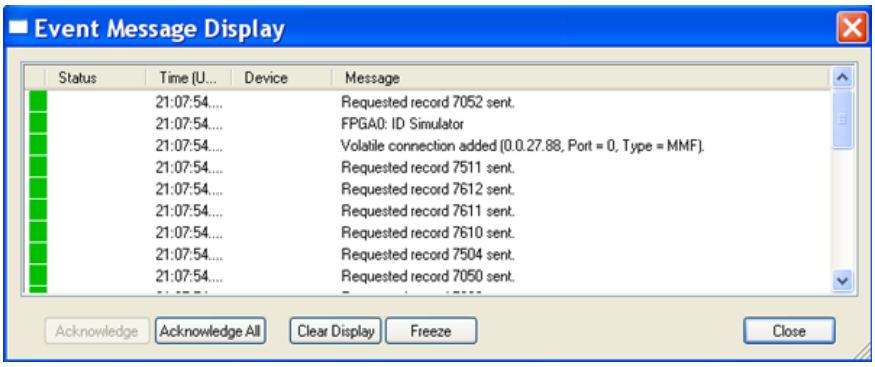
APPENDIX A TROUBLESHOOTING

A.1 System Warnings and Alarm Messages

NOTE
Most alarms and warnings do not result in a system failure. In the case of repeated alarms or warnings, contact RESON Customer Support (support@reson.com).

This chapter contains a global list of warning and alarm event messages generated by the 7k Center software. The event messages appear in the Event Message Display window.

To launch the Event Message Display window, click the alarm button on the Primary Display tab.



A.2 Responding to Errors and Alarms

When an error occurs:

1. Examine the lists of errors in *section A.3 below* to decide course of action.

   or, if that fails,

1. Shut down the software.

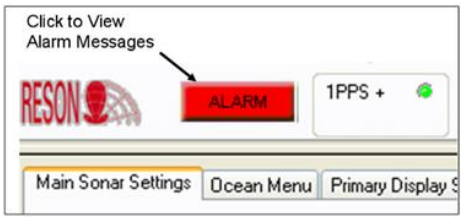
2. Double-click the Reset Factory Defaults icon on the desktop.

3. Restart the software.
4. If the problem continues after restarting the software, reboot the transceiver.
5. If the condition still persists, contact RESON Customer Support (support@reson.com).

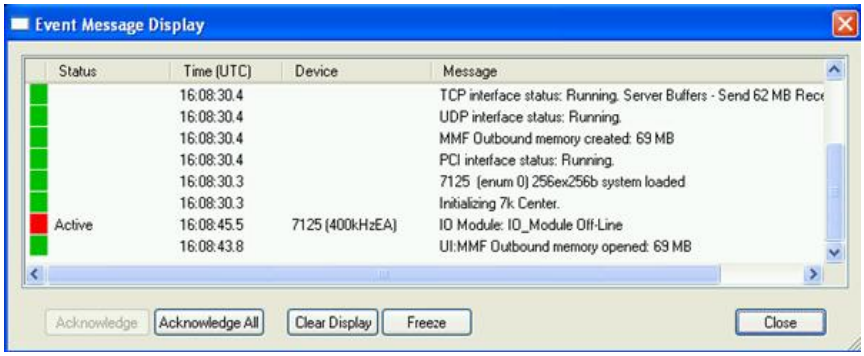
A.3 Alarm Messages

NOTE
The alarm messages listed in this section are accurate up to the document release date. For a complete list of up-to-date alarm messages, contact RESON Customer Support (support@reson.com).

Click the alarm button to view alarm messages in the Event Message Display window.



Alarms are marked as red as shown in the following sample window.



A.3.1 General System Startup Alarms

Message	Description	Action
ADMXRC configuration failed	The software failed to detect or configure the primary processing card.	Check PCI bus drivers for ADMXRC card.

Message	Description	Action
Could not create UDP server Could not create TCP server	Indicates a network resource was unavailable to the software from the operating system.	Check user permissions, network drivers.
Could not create PCI server Error creating PCI Reader thread Error creating PCI Copier thread	Software detected a failure to configure the main data acquisition and distribution module (PCI). This can be caused by errors in the configuration files, or corrupted installation.	Reboot the PC, call RESON support.
Create TCP socket failed, code…	Operating system did not allow creating of network resources.	Check Windows installation, user settings, and network resources.
Error creating non-sonar data reader thread	BITE module has failed to initialize.	Check Windows installation and resources.
Failed to allocate memory for ADMXRC read Failed to allocate memory for ADMXRC transfer	The software could not allocate enough system memory to perform the operation.	Make sure no other software is running on the transceiver. Reboot the system.
Failed to set up DMA Card 0 Failed to set up DMA Card 1	The software could not access the processing card device.	Check ADMXRC drivers.
Internal 7k Center error Internal error, 7kCenter NOT fully operational	One or more startup conditions have failed.	Check previous alarms or warnings and verify software installation.
Inbound memory initialization failed MMF Outbound memory creation …	PC resources are inadequate.	Check RAM or virtual memory resources
Required file: "7k_0.xml" or "7k.xml" Not found. Required file: "7k_Bite.htm" Not found. SET UP: NO TOP BIT FILE MATCH for Device <x>, Enumerator <x> SET UP: TOO MANY BIT FILES (Max = x) SET UP: FAILED TO LOAD BIT FILE "<x>" for Device <x>, Enumerator <x>	A critical startup configuration file was missing or too many were found.	Reinstall the software.

Message	Description	Action
SET UP: TOO MANY BIT FILES (Max = x)		
SET UP: FAILED TO LOAD BIT FILE "XXX" for Device <x>, Enumerator <x>		
Socket initialization failed, error code <x>	Windows has failed to allocate a network resource.	Check network permissions and resources or Reinstall operating system.

A.3.2 PCI Card Related (ADMXRC) Alarms

The ADMXRC refers to the drivers that control the main processing unit within the transceiver. This processing card sits on the motherboards PCI bus and acts as a signal processing layer between the hardware and software.

Message	Description	Action
2nd ADMXRC card not found	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.
ADMXRC card not found, ERROR =		
ADMXRC.dll not found.		
Configure FPGA failed.		
Incorrect ADMXRC board found, card_1		
Failed to set up DMA Card 0, ERROR =		
Failed to allocate memory for ADMXRC transfer.		
Failed to set ADMXRC clock, Card_1, ERROR =		
Failed to get ADMXRC space info, Card_1, ERROR =		
Failed to configure 1st FPGA with <x>, ERROR =		
Failed to find ADMXRC info, card_0, ERROR =		
Failed to set ADMXRC clock, Card_0, ERROR =		
Failed to get ADMXRC space info, Card_0, ERROR =		
Failed to configure 1st FPGA with <x>, ERROR =		

Message	Description	Action
Failed to find ADMXRC info, card_1, ERROR =		

A.3.3 Data Reading Alarms

Message	Description	Action
DMA Transfer Timeout. <x> of <x> bytes received	This error generally indicates that the uplink from the receiver is interrupted at some point.	Check the BITE tab for receiver BITE values. Restore factory defaults. Reboot the PC.
FATAL: DMA Read size limitation reached.	A general error occurred while transferring data to the software.	Reboot the system.
Lost sync with DMA read		

A.3.4 System Resource Alarms

Message	Description	Action
Error starting I&Q Reader thread.	A module has failed to start correctly.	Reboot the system.
Error starting IQ thread.		
Error starting PCI Copier thread.		
Error starting PCI Reader thread		
Error creating IQ thread		
Error starting I&Q threads		

A.3.5 Input Signal (Timing and Triggers) Alarms

Message	Description	Action
Failed to register external trigger, ERROR =	The pulse is not being detected. Time stamping will be done using system time only. 1 millisecond accuracy not possible.	Check input signal cabling.
Failed to unregister external trigger, ERROR =		
FIRMWARE does not support External Trigger. Pinging is OFF		
External triggering has failed. Check/update software installation.		
FATAL ERROR: PPS Timestamp error Check 1 PPS input		

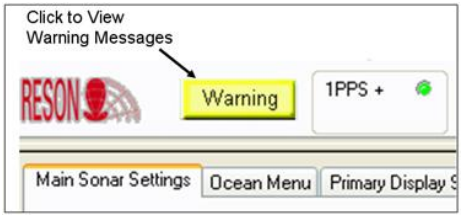
A.3.6 Calibration Alarms

Message	Description	Action
Calibration Failed: Too much noise	Calibration has failed. Check BITE page and hardware and cable installation to the receiver.	Check environmental noise. Contact RESON Customer Support.
Calibration Failed: Over 10% dead Rx channels.		
Calibration Failed: Magnitude Error		
Calibration Failed: Phase Error		
Calibration Error: Calibration might be invalid. Repeat the calibration.		

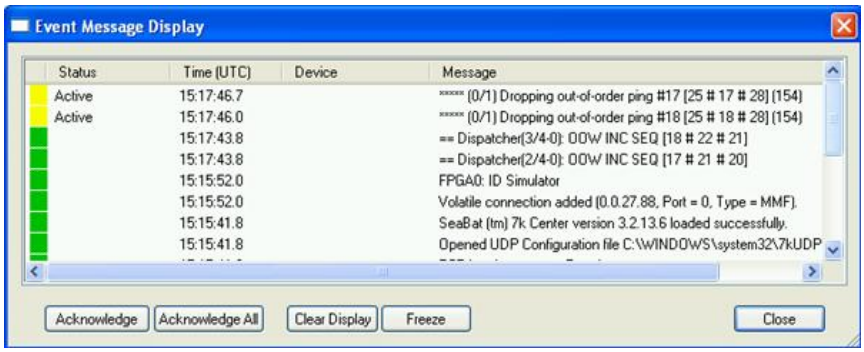
A.4 Warning Messages

NOTE
The warning messages listed in this section are accurate up to the document release date. For a complete list of up-to-date alarm messages, contact RESON Customer Support (support@reson.com).

Click the warning button to view warning messages in the Event Message Display window.



Warnings are marked as yellow as shown in the following sample window.



A.4.1 Configuration Warnings

Message	Description	Action
7K Bite File cannot be Read	Software installation is corrupt.	Restore factory defaults. Reinstall software.
Cannot Read UDP Configuration file <x> Error		
Cannot Open or Create UDP Configuration file		
UDP Configuration file not available		

A.4.2 Startup Warnings

Message	Description	Action
Failed to start PCI Reader thread	One or more PCI bus or network resources has failed to initialize.	Check user permissions and transceiver network hardware.
Failed to start PCI Copier thread		
PCI interface status: Down		
TCP interface status: Down		
UDP interface status: Down		

A.4.3 Data Processing Warnings

Message	Description	Action
***** (xxx) Dropping out-of-order ping #<x>	The data processing chain has been delayed and stale data has been discarded.	Check transceiver hardware and resources.
PING <x> :(Lost FPGA sync...sample	One or more pings have been lost due to an error on the uplink between the receiver and the software. The system is becoming unstable and data transfer is corrupted on the PCI bus.	Reboot. Check transceiver hardware.
PING <x> :(Lost FPGA sync...sample		
DMA Transfer Timeout. <x> of <x> bytes received		

A.4.4 Data Recording Warnings

Message	Description	Action
WARNING: Critical Disk Level: RDR - Data recording stopped	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories, as well as permissions on target files/directories.
RDR - Already in Playback/Record mode.		
RDR Record failed - No Filename		
RDR Record failed - Set file name failed: <x>		
RDR - Data recording failed to start. filename:		
RDR - Data <x> failed to stop.		
RDR - <x> already in progress.		
RDR Playback failed - No Filename		
RDR Playback failed - Set file name failed:		
RDR - Data playback failed, filename =		
RDR - Data delete failed: in Record/Playback mode.		
RDR Data delete failed - Filename not available		
RDR - Set new file name failed		
RDR - Set Data path Failed		
Disk Level Threshold: X%.		

A.4.5 BITE Data Warnings

Message	Description	Action
ERROR : NSD	An error has occurred in reading of BITE data. The data buffer has overflowed.	No action needed.
Non Sonar Data FIFO overflow (x packet)		

A.4.6 Input Signal Warnings

Message	Description	Action
Roll Compensation is not available.	The input data for motion is not available or the feature is not enabled.	Check device inputs and cabling.
Pitch Compensation is not available.		

A.4.7 System Stability Warnings

Message	Description	Action
WARNING: PPS Time-stamp error	The internal clock may not be disciplined properly resulting in incorrect time stamp of data.	Check 1PPS connections and GPS output. If uncorrected sonar data cannot be time stamped to 1 millisecond.
WARNING: Reduce Ping Rate or Range - DROPPING ping	The system is overloaded processing data. A ping has been lost because the processing queue is full.	Restart the software. Reboot PC.

A.4.8 Data Subscription Warnings

Message	Description	Action
Subscriber UDP sendto() failed	The software was unable to send data to a connected client.	Check network resources and user permissions.
Subscriber send() failed		
Subscribers outbound MMF buffer memory overwrite error!	The link to the user interface running on the transceiver has detected a non-critical error.	Check system resources, shutdown all non-critical software applications. Reboot processor.
Subscribers outbound MMF buffer read error!		
Subscribers outbound MMF buffer memory overwrite error!		

A.4.9 Network Components Warnings

Message	Description	Action
TCP Server - Unknown packet type	A connected client has sent an unrecognized command to the software.	Review client software source code or definitions for correct implementation of RESON 7k Data Format.
UDP Server - Unknown packet type		
TCP Server - Warning max connections reached	The network module has become saturated with client connections and will refuse any further connections.	Close some of the connected clients.
UDP Server - Warning max connection reached		

A.4.10 External Trigger Warnings

Message	Description	Action
Trigger out length (x) is invalid	An unsupported value was received for trigger setup.	Check settings in user interface.
Trigger out offset (x) is invalid		
Trigger out offset + length (x) exceed limit of 20ms		

A.5 Alarm Messages – Master List in Alphabetical Order

Message	Description	Action	Alarm Type
2nd ADMXRC card not found	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
ADMXRC card not found, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
ADMXRC configuration failed	The software failed to detect or configure the primary processing card.	Check PCI bus drivers for ADMXRC card.	General System Startup
ADMXRC.dll not found.	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Calibration Error: Calibration might be invalid. Repeat the calibration.	Calibration has failed. Check BITE page and hardware and cable installation to the receiver.	Check environmental noise. Contact RESON Customer Support.	Calibration
Calibration Failed: Magnitude Error	Calibration has failed. Check BITE page and hardware and cable installation to the receiver.	Check environmental noise. Contact RESON Customer Support.	Calibration
Calibration Failed: Over 10% dead Rx channels.	Calibration has failed. Check BITE page and hardware and cable installation to the receiver.	Check environmental noise. Contact RESON Customer Support.	Calibration
Calibration Failed: Phase Error	Calibration has failed. Check BITE page and hardware and cable installation to the receiver.	Check environmental noise. Contact RESON Customer Support.	Calibration
Calibration Failed: Too much noise	Calibration has failed. Check BITE page and hardware and cable installation to the receiver.	Check environmental noise. Contact RESON Customer Support.	Calibration

Message	Description	Action	Alarm Type
Configure FPGA failed.	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Could not create PCI server	Software detected a failure to configure the main data acquisition and distribution module (PCI). This can be caused by errors in the configuration files, or corrupted installation.	Reboot the PC, call RESON support.	General System Startup
Could not create TCP server	Indicates a network resource was unavailable to the software from the operating system.	Check user permissions, network drivers.	General System Startup
Could not create UDP server	Indicates a network resource was unavailable to the software from the operating system.	Check user permissions, network drivers.	General System Startup
Create TCP socket failed, code…	Operating system did not allow creating of network resources.	Check Windows installation, user settings, and network resources.	General System Startup
DMA Transfer Timeout. <x> of <x> bytes received	This error generally indicates that the uplink from the receiver is interrupted at some point.	Check the BITE page for receiver BITE values. Restore factory defaults. Reboot the PC.	Data Reading
Error creating IQ thread	A module has failed to start correctly.	Reboot the system.	System Resource
Error creating non-sonar data reader thread	BITE module has failed to initialize.	Check Windows installation and resources.	General System Startup
Error creating PCI Copier thread	Software detected a failure to configure the main data acquisition and distribution module (PCI). This can be caused by errors in the configuration files, or corrupted installation.	Reboot the PC, call RESON support.	General System Startup

Message	Description	Action	Alarm Type
Error creating PCI Reader thread	Software detected a failure to configure the main data acquisition and distribution module (PCI). This can be caused by errors in the configuration files, or corrupted installation.	Reboot the PC, call RESON support.	General System Startup
Error starting I&Q Reader thread.	A module has failed to start correctly.	Reboot the system.	System Resource
Error starting I&Q threads	A module has failed to start correctly.	Reboot the system.	System Resource
Error starting IQ thread.	A module has failed to start correctly.	Reboot the system.	System Resource
Error starting PCI Copier thread.	A module has failed to start correctly.	Reboot the system.	System Resource
Error starting PCI Reader thread	A module has failed to start correctly.	Reboot the system.	System Resource
External triggering has failed. Check/update software installation.	The pulse is not being detected. Time stamping will be done using system time only. 1 millisecond accuracy not possible.	Check input signal cabling.	Input Signal (Timing and Triggers)
Failed to allocate memory for ADMXRC read.	The software could not allocate enough system memory to perform the operation.	Make sure no other software is running on the transceiver. Reboot the system.	General System Startup
Failed to allocate memory for ADMXRC transfer.	The software could not allocate enough system memory to perform the operation.	Make sure no other software is running on the transceiver. Reboot the system.	General System Startup
Failed to allocate memory for ADMXRC transfer.	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to configure 1st FPGA with <x>, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card

Message	Description	Action	Alarm Type
Failed to configure 1st FPGA with <x>, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to find ADMXRC info, card_0, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to find ADMXRC info, card_1, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to get ADMXRC space info, Card_0, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to get ADMXRC space info, Card_1, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to register external trigger, ERROR =	The pulse is not being detected. Time stamping will be done using system time only. 1 millisecond accuracy not possible.	Check input signal cabling.	Input Signal (Timing and Triggers)
Failed to set ADMXRC clock, Card_0, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to set ADMXRC clock, Card_1, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to set up DMA Card 0	The software could not access the processing card device.	Check ADMXRC drivers.	General System Startup

Message	Description	Action	Alarm Type
Failed to set up DMA Card 0, ERROR =	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Failed to set up DMA Card 1	The software could not access the processing card device.	Check ADMXRC drivers.	General System Startup
Failed to unregister external trigger, ERROR =	The pulse is not being detected. Time stamping will be done using system time only. 1 millisecond accuracy not possible.	Check input signal cabling.	Input Signal (Timing and Triggers)
FATAL ERROR: PPS Timestamp error Check 1 PPS input	The pulse is not being detected. Time stamping will be done using system time only. 1 millisecond accuracy not possible.	Check input signal cabling.	Input Signal (Timing and Triggers)
FATAL: DMA Read size limitation reached.	A general error occurred while transferring data to the software.	Reboot the system.	Data Reading
FIRMWARE does not support External Trigger. Pinging is OFF	The pulse is not being detected. Time stamping will be done using system time only. 1 millisecond accuracy not possible.	Check input signal cabling.	Input Signal (Timing and Triggers)
Inbound memory initialization failed.	PC resources are inadequate.	Check RAM or virtual memory resources	General System Startup
Incorrect ADMXRC board found, card_1	One or more of the processing cards has failed to initialize or is non-functional within the transceiver.	Reboot transceiver and try again.	PCI Card
Internal 7k Center error	One or more startup conditions have failed.	Check previous alarms or warnings and verify software installation.	General System Startup
Internal error, 7kCenter NOT fully operational.	One or more startup conditions have failed.	Check previous alarms or warnings and verify software installation.	General System Startup

Message	Description	Action	Alarm Type
Lost sync with DMA read	A general error occurred while transferring data to the software.	Reboot the system.	Data Reading
MMF Outbound memory creation …	PC resources are inadequate.	Check RAM or virtual memory resources	General System Startup
Required file: "7k_0.xml" or "7k.xml" Not found.	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
Required file: "7k_Bite.htm" Not found.	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
SET UP: FAILED TO LOAD BIT FILE "<x>" for Device <x>, Enumerator <x>	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
SET UP: FAILED TO LOAD BIT FILE "XXX" for Device <x>, Enumerator <x>	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
SET UP: NO TOP BIT FILE MATCH for Device <x>, Enumerator <x>	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
SET UP: TOO MANY BIT FILES (Max = x)	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
SET UP: TOO MANY BIT FILES (Max = x)	A critical startup configuration file was missing or too many were found.	Reinstall the software.	General System Startup
Socket initialization failed, error code <x>	Windows has failed to allocate a network resource.	Check network permissions and resources or Reinstall operating system.	General System Startup

A.6 Warning Messages – Master List in Alphabetical Order

Message	Description	Action	Type
***** (xxx) Dropping out-of-order ping #<x>	The data processing chain has been delayed and stale data has been discarded.	Check transceiver hardware and resources.	Data Processing
7K Bite File cannot be Read	Software installation is corrupt.	Restore factory defaults. Reinstall software.	Configuration
Cannot Open or Create UDP Configuration file	Software installation is corrupt.	Restore factory defaults. Reinstall software.	Configuration
Cannot Read UDP Configuration file <x> Error	Software installation is corrupt.	Restore factory defaults. Reinstall software.	Configuration
Disk Level Threshold: X%.	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
DMA Transfer Timeout. <x> of <x> bytes received	One or more pings have been lost due to an error on the uplink between the receiver and the software. The system is becoming unstable and data transfer is corrupted on the PCI bus.	Reboot. Check transceiver hardware.	Data Processing
ERROR : NSD	An error has occurred in reading of BITE data. The data buffer has overflowed.	No action needed.	BITE Data
Failed to start PCI Copier thread	One or more PCI bus or network resources have failed to initialize.	Check user permissions and transceiver network hardware.	Startup
Failed to start PCI Reader thread	One or more PCI bus or network resources have failed to initialize.	Check user permissions and transceiver network hardware.	Startup

Message	Description	Action	Type
Non Sonar Data FIFO overflow (x packet)	An error has occurred in reading of BITE data. The data buffer has overflowed.	No action needed.	BITE Data
PCI interface status: Down	One or more PCI bus or network resources have failed to initialize.	Check user permissions and transceiver network hardware.	Startup
PING <x> :(Lost FPGA sync...sample	One or more pings have been lost due to an error on the uplink between the receiver and the software. The system is becoming unstable and data transfer is corrupted on the PCI bus.	Reboot. Check transceiver hardware.	Data Processing
PING <x> :(Lost FPGA sync...sample	One or more pings have been lost due to an error on the uplink between the receiver and the software. The system is becoming unstable and data transfer is corrupted on the PCI bus.	Reboot. Check transceiver hardware.	Data Processing
Pitch Compensation is not available.	The input data for motion is not available or the feature is not enabled.	Check device inputs and cabling.	Input Signal
Pitch Compensation is not available.	The input data for motion is not available or the feature is not enabled.	Check device inputs and cabling.	Input Signal
RDR - <x> already in progress.	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR - Already in Playback/Record mode.	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR - Data <x> failed to stop.	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording

Message	Description	Action	Type
RDR - Data delete failed: in Record/Playback mode.	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR - Data playback failed, filename =	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR - Data recording failed to start. filename:	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR - Set Data path Failed	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR - Set new file name failed	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR Data delete failed - Filename not available	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR Playback failed - No Filename	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR Playback failed - Set file name failed:	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
RDR Record failed - No Filename	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording

Message	Description	Action	Type
RDR Record failed - Set file name failed: <x>	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
Roll Compensation is not available.	The input data for motion is not available or the feature is not enabled.	Check device inputs and cabling.	Input Signal
Roll Compensation is not available.	The input data for motion is not available or the feature is not enabled.	Check device inputs and cabling.	Input Signal
Subscriber send() failed	The software was unable to send data to a connected client.	Check network resources and user permissions.	Data Subscription
Subscriber UDP sendto() failed	The software was unable to send data to a connected client.	Check network resources and user permissions.	Data Subscription
Subscribers outbound MMF buffer memory overwrite error!	The link to the user interface running on the transceiver has detected a non-critical error.	Check system resources, shutdown all non-critical software applications. Reboot processor.	Data Subscription
Subscribers outbound MMF buffer memory overwrite error!	The link to the user interface running on the transceiver has detected a non-critical error.	Check system resources, shutdown all non-critical software applications. Reboot processor.	Data Subscription
Subscribers outbound MMF buffer read error!	The link to the user interface running on the transceiver has detected a non-critical error.	Check system resources, shutdown all non-critical software applications. Reboot processor.	Data Subscription
TCP interface status: Down	One or more PCI bus or network resources has failed to initialize.	Check user permissions and transceiver network hardware.	Startup
TCP Server - Unknown packet type	A connected client has sent an unrecognized command to the software.	Review client software source code or definitions for correct implementation of RESON 7k Data Format.	Network Components

Message	Description	Action	Type
TCP Server - Warning max connections reached	The network module has become saturated with client connections and will refuse any further connections.	Close some of the connected clients.	Network Components
Trigger out length (x) is invalid	An unsupported value was received for trigger setup.	Check settings in user interface.	External Trigger
Trigger out offset (x) is invalid	An unsupported value was received for trigger setup.	Check settings in user interface.	External Trigger
Trigger out offset + length (x) exceed limit of 20ms	An unsupported value was received for trigger setup.	Check settings in user interface.	External Trigger
UDP Configuration file not available	Software installation is corrupt.	Restore factory defaults. Reinstall software.	Configuration
UDP interface status: Down	One or more PCI bus or network resources have failed to initialize.	Check user permissions and transceiver network hardware.	Startup
UDP Server - Unknown packet type	A connected client has sent an unrecognized command to the software.	Review client software source code or definitions for correct implementation of RESON 7k Data Format.	Network Components
UDP Server - Warning max connection reached	The network module has become saturated with client connections and will refuse any further connections.	Close some of the connected clients.	Network Components
WARNING: Critical Disk Level: RDR - Data recording stopped	The hard drive is getting full. One or more errors have occurred in conjunction with data recording.	Check user permissions and available disk space. Check file names and recording directories	Data Recording
WARNING: PPS Time-stamp error	The internal clock may not be disciplined properly resulting in incorrect time stamp of data.	Check 1PPS connections and GPS output. If uncorrected sonar data cannot be time stamped to 1 millisecond	System Stability

Message	Description	Action	Type
WARNING: Reduce Ping Rate or Range - DROPPING ping	The system is overloaded processing data. A ping has been lost because the processing queue is full.	Restart the software. Reboot PC.	System Stability

APPENDIX B INSTALLATION INSTRUCTIONS

B.1 Components Checklist

Table 5: SeaBat 7125 SV Components

Part Number	Description
85000327	Projector, TC2163, 7125, 200kHz , 2 Deg
85000328	Projector, TC2160, 7125, 400kHz, 1 Deg
85002184[17]	Receiver, EM7216, 7125/8, 200/400kHz
85101817[18]	ASSY, TXCVR G3, SIU/SPU, SV, 7K
85002234	CABLE ASSY, TXCVR to Rx, SV, 25m, 7K
85002233	CABLE ASSY, TXCVR to Tx, SV, 25m, 7K
88100752	Keyboard, PC, USB, Illuminated keys
88100753	Mouse, Wheel, Optical, PS2/USB, Black
85002300	Mouse mat, Reson logo
88100736	Monitor, 19in, TFT, 1280x1024, Flexscan
89100052	SHIP CASE, STENCILED, TXCVR, SV,DRY END
89100053	SHIP CASE, STENCILED, 7125-SV WET END
86000149	MANUAL, OPERATION, SeaBat 7125-SV
86000151	Quick Reference Guide, 7125-SV
60000002	Cord, PWR 3-Cond, NEMA5-15P TO IEC
88100610	230 volt UK - power cable 2,5 m, Black
SB9999/00057	230 volt EU - power cable
85002297	KIT, TABLE MOUNTING, TXCVR OR SPU
85002281	ADAPTER, HP DisplayPort to DVI-D
85002294	CABLE ASSY, RJ45 to DSUB9, RS232, 0.5m
85002309	ADAPTER, DVI TO VGA

NOTE
This component checklist constitutes the standard SeaBat 7125 SV delivery. For precise information, refer to the packing list you received with your delivery.

[17] Receiver unit EM 7216 has replaced EM 7200.
[18] or 85101816 ASSY, TXCVR G2, SIU/SPU, SV, 7K
or 85101812 ASSY, TXCVR, SIU/SPU, SV, 7K

B.2 Installation Checklist

NOTE
This checklist only covers the most basic, standard system installation. Depending on the system configuration or specific customer requirements, this list may or may not apply.

Follow these basic steps to install and configure your new SeaBat sonar system:

- Install the dry-end components:
  - Transceiver
  - Monitor, keyboard, mouse
- Install the wet-end components:
  - Receiver unit
  - Projector unit
- Install and connect cables:
  - Transceiver to receiver cable
  - Transceiver to projector cable(s)
  - Auxiliary sensor cables
  - Monitor, keyboard, and mouse connections
  - Transceiver power cable
- Power up the system
- Test the system

For information on configuration of the system (including I/O module configuration, remote operation, and folder management), see *section 4 System Configuration*.

CAUTION
Before turning the system on, make sure that there is no significant difference between the temperatures of the equipment and environment in order to prevent condensation.

B.3 Dry-End Installation

B.3.1 Transceiver Installation

The transceiver is a high-performance industrial unit that combines sonar processing and interface functions. The unit manages data flow and signal processing using a state-of-the-art processing architecture. This highly integrated design offers reliability, maintainability, and high performance.

Figure 48: Transceiver Unit

Table 6: Transceiver Technical Specifications

Specification	Value
Power requirements	100-230VAC, 50/60Hz, 1000W max.
Fuse	10A/250V T
Video output, 4x	Up to 1920x1600
Data communication, 2x	Gigabit Ethernet
Graphics colors	True color (32 bit)
Input device(s)	Mouse and keyboard
Mounting	19-inch rack
Dimensions	Height: 221.5mm Width: 478.0mm Depth: 556.8mm
Weight	20.5kg (excl. wet-end cables)
Temperature	Operating: -15° to +45°C Storage: -30° to +70°C
Humidity	Max. 95% RH noncondensing
Vibration	±1mm at $7m/s^2$

The transceiver offers a flexible platform for a number of functions:

- Receives digitized sonar data from the receiver unit.
- Receives operational settings directly through the user interface or remotely from an external system.
- Provides beamforming and initial processing of acoustical data.
- Controls, formats, and generates data to external systems. This can include making beamformed data and preprocessed image data available to external systems over a fast Ethernet connection.
- Performs built-in test routines and alerts the operator to any abnormal conditions.
- Provides an interface for a sound velocity sensor, so that range measurements and receiver beamforming can be conducted correctly.
- Provides an interface for a PPS timing interface so that accurate time stamping of data can be made.
- Displays the sonar image and the detected seabed as well as the sonar control user interface.
- Generates the various data telegrams to be recorded by Data Acquisition Systems.
- Supports optional beam data storage on a large, external RAID array.

CAUTION
The transceiver is designed and assembled specifically to accommodate the RESON-provided software packages installed at the factory. Installing additional software on this machine can result in decreased performance and/or system malfunction. Installation of additional software on the transceiver is done at the customer's own risk. In the event that software is installed on the transceiver by a non-RESON authorized technician, RESON accepts no responsibility for any consequences that may arise in connection with the installation.

The transceiver may be either rack mounted or table mounted. It must be in an area that is not exposed to the weather, but is within easy reach of the operator workstation connections and the interconnect cables. Allow clearance around the unit to provide adequate air circulation and easy access to the power switch.

After the transceiver is installed, the only interaction required should be to press the power switch and energize the system.

B.3.2 Transceiver Mounting

Angle brackets are provided for mounting the transceiver on a table.

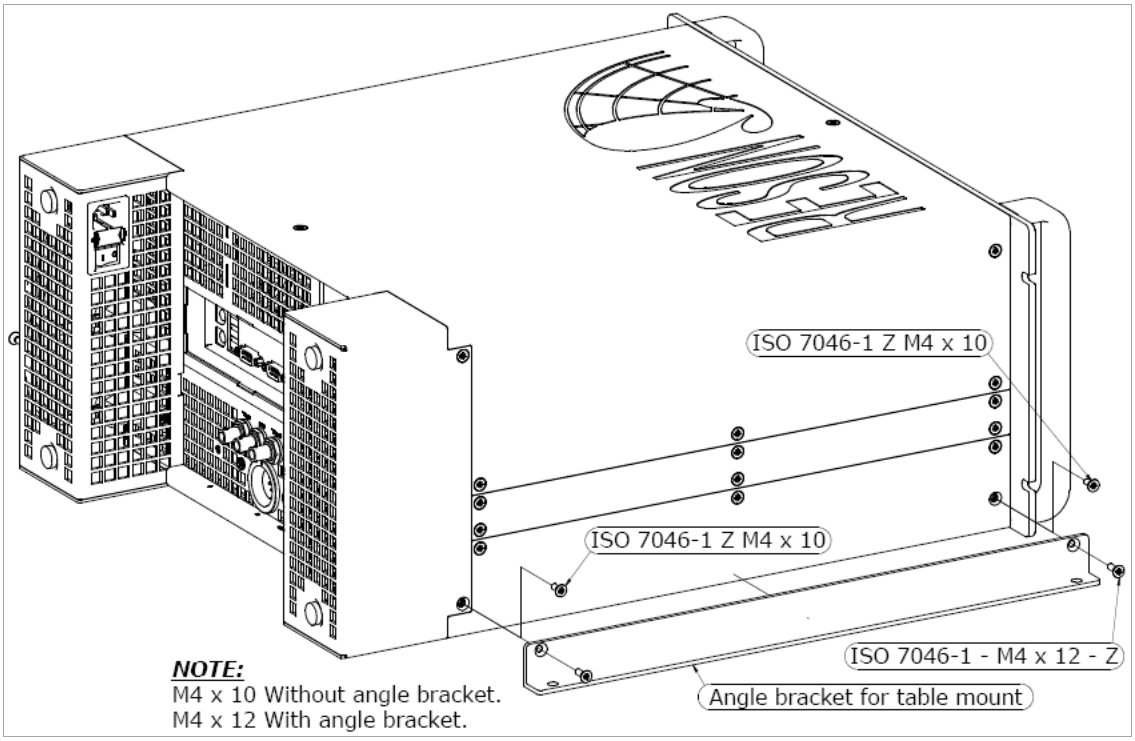


Figure 49: Transceiver Mounting

B.3.3 Transceiver Cable Connections

There are several cable connections to be made at the dry end of the installation. All dry-end cables provided by RESON come with factory-installed connectors and just need to be attached at the appropriate port(s) on the rear panel of the transceiver.

Figure 50: Transceiver Rear View

CAUTION
Do not disconnect any cables from the rear of the transceiver while the unit is running. This can damage the internal workings of the unit.

The critical connections are clearly marked on the transceiver and shown in *Figure 51*.

(1) Power input and switch
(2) Monitor output (4x display)
(3) Monitor output (2x DVI)
(4) Mouse
(5) Keyboard
(6) USB (x4)
(7) Ethernet (x2)
(8) Trigger in
(9) 1PPS input
(10) Trigger out
(11) Time marker serial port UTC/ZDA
(12) Serial ports with LED indication (x5)
(13) Motion sensor serial port
(14) Alternate SVP serial port
(15) Receiver connection
(16) Projector connections
(17) Main SVP serial port with power
(18) Diagnostic LEDs (see *Figure 52*)
(19) Protective earth screw for equipotential connection

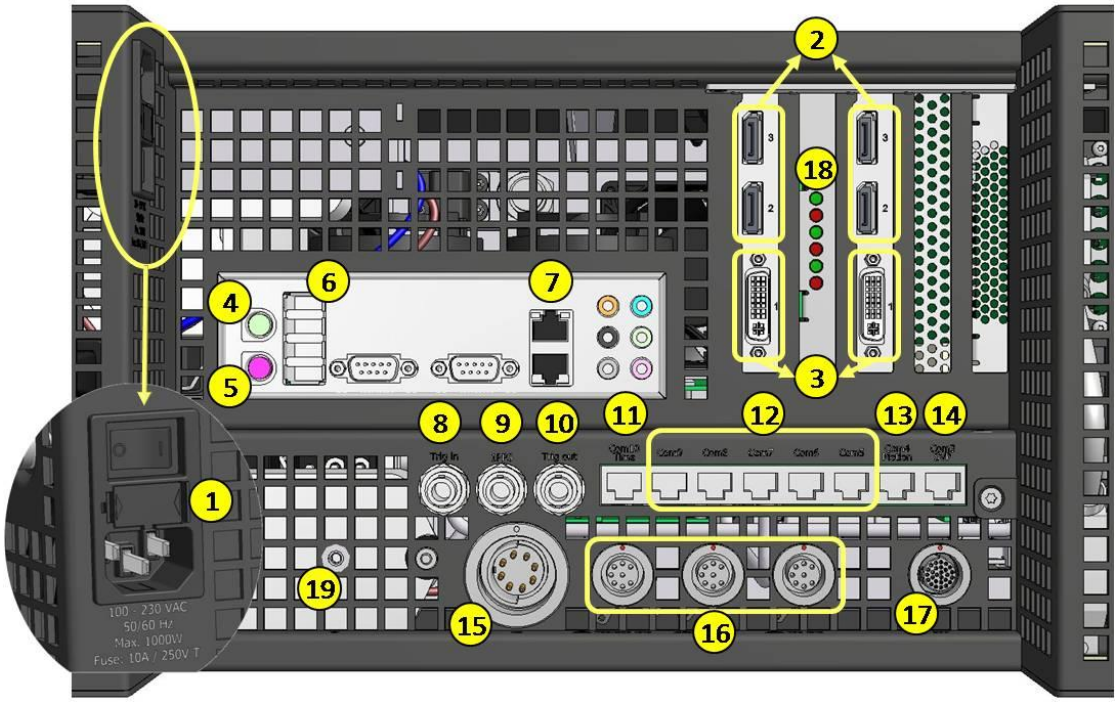


Figure 51: Transceiver Cable Connections

WARNING!
For safety reasons the SeaBat™ must be connected to protective earth. The protective earth pin in the mains appliance inlet is the protective conductor terminal of SeaBat™.

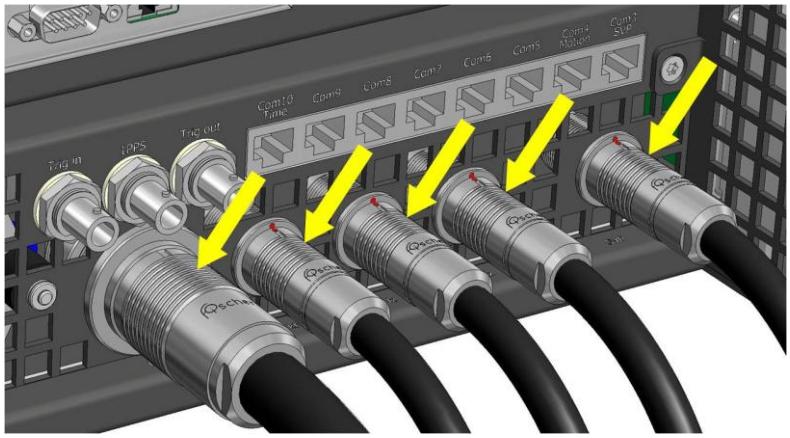
CA	= Card alive
PN	= Ping now
1PPS	= 1PPS
PRG	= Programmed
ULN	= Uplink
MDR	= Motion data received

Figure 52: Transceiver Diagnostic LEDs

CAUTION

To disconnect the receiver/projector/SVP cable from the transceiver, hold on the groove part of the connector (at the arrows) and pull gently outwards.

Do **not** pull directly on the cord, as this will damage both cable and transceiver.



WARNING!

The projector connections must be handled with great care as the output power voltage is hazardous to human safety.

Do **not** pull out the cables with power on.

B.3.4 Monitor Connections

The monitor connections[19] to the transceiver MUST be done as described in *Table 7* and *Table 8*. Connections are achieved using DVI-I or display port connectors. Monitors can be cloned from within Windows®, although it is possible to clone a display port output by first converting to DVI-D and then using a DVI-D splitter (see *section B.3.6 below*).

Table 7: DVI and Analog Monitor Connections

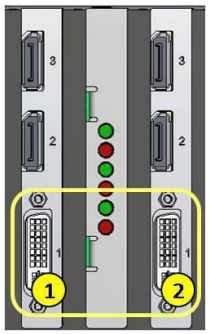
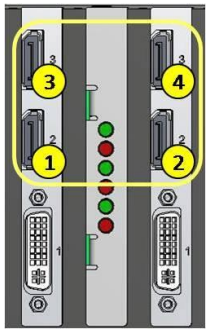
Connections to DVI and analog monitor:	**DVI Ports**[20]
One monitor: Use port 1. Two monitors: Use ports 1 and 2. **Note!** For analog monitors, first add a DVI to analog adaptor to the DVI-I connector.	

Table 8: Display Port Connections

Connections to display port monitor:	**Display Ports**[20]
One monitor: Use port 1. Two monitors: Use ports 1 and 2. Three monitors: Use ports 1, 2, and 3. Four monitors: Use all 4 ports. **Note!** The display ports cannot be converted to analog monitors; however, adaptors are supplied to convert to DVI-D signals. (Note that DVI-D and DVI-I connectors are slightly different.)	

CAUTION

When removing the display port cable from the transceiver, press the button (at the arrow) on the connector to disconnect.

Do **not** pull directly on the cord, as this will damage both cable and transceiver.

[19] The DVI and display ports can be combined to maximum two monitors per video card.
[20] The ports are numbered according to the numbers in the Windows® Display Properties dialog.

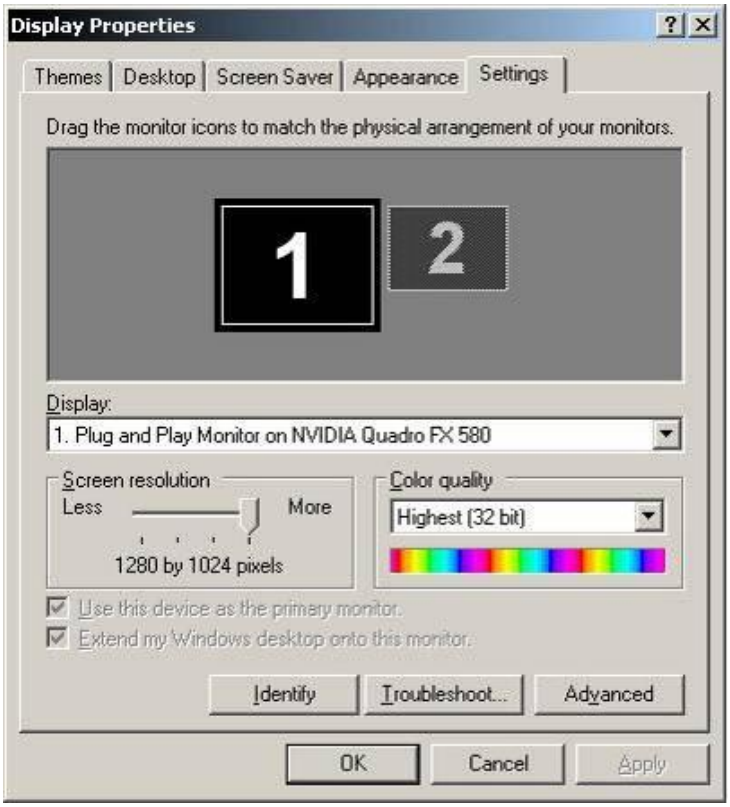
B.3.5 Simple Monitor Setup

To set up the monitor or multiple monitors you must use Windows setup for standard setup and not the NVIDIA Control Panel.

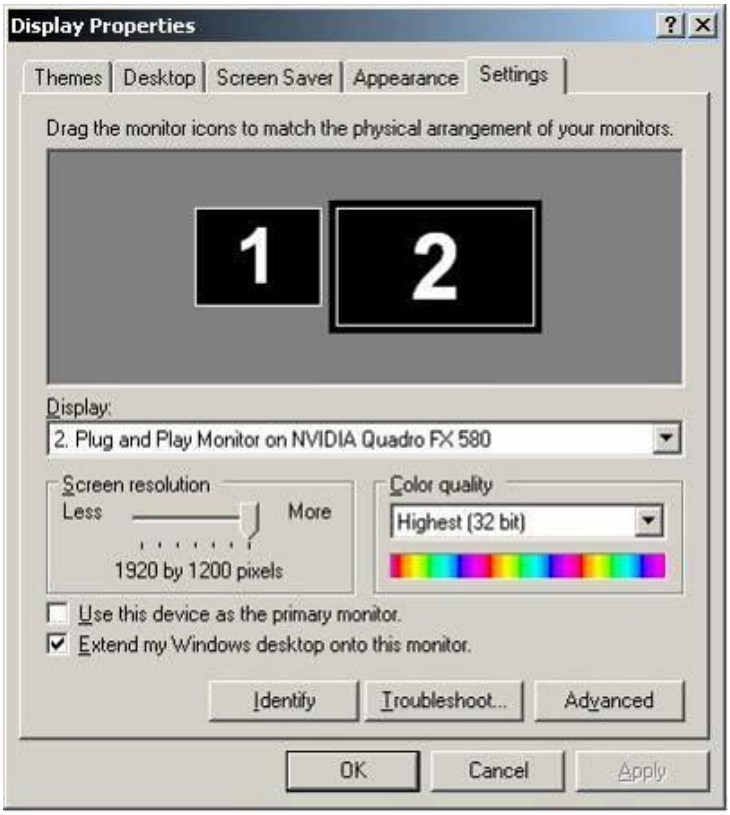
For information on possible monitor connections, see *Table 7: DVI and Analog Monitor Connections* and *Table 8: Display Port Connections*.

1. Connect the required number of monitors to the transceiver.
2. Turn on the transceiver.
3. Right click on the Desktop and select Properties from the menu.

4. In the Display Properties dialog, select the Settings tab.
5. Select the Screen resolution that match the attached monitor no. 1.



6. To make monitor no. 2 active, click the check box Extend my Windows desktop onto this monitor.



7. Select the Screen resolution that match the attached monitor.
8. Repeat procedure from step 3 until all attached monitors have been set up.

B.3.6 Advanced Monitor Setup (Cloning Monitors)

Cloning monitors on the SeaBat 7125 SV is a bit tricky, as the four monitors you are able to attach are driven by two video cards. These two video cards are not capable of communication with each other and therefore you can only clone the monitors two by two. You will not be able to clone three or four monitors.

For information on possible monitor connections, see *Table 7: DVI and Analog Monitor Connections* and *Table 8: Display Port Connections*.

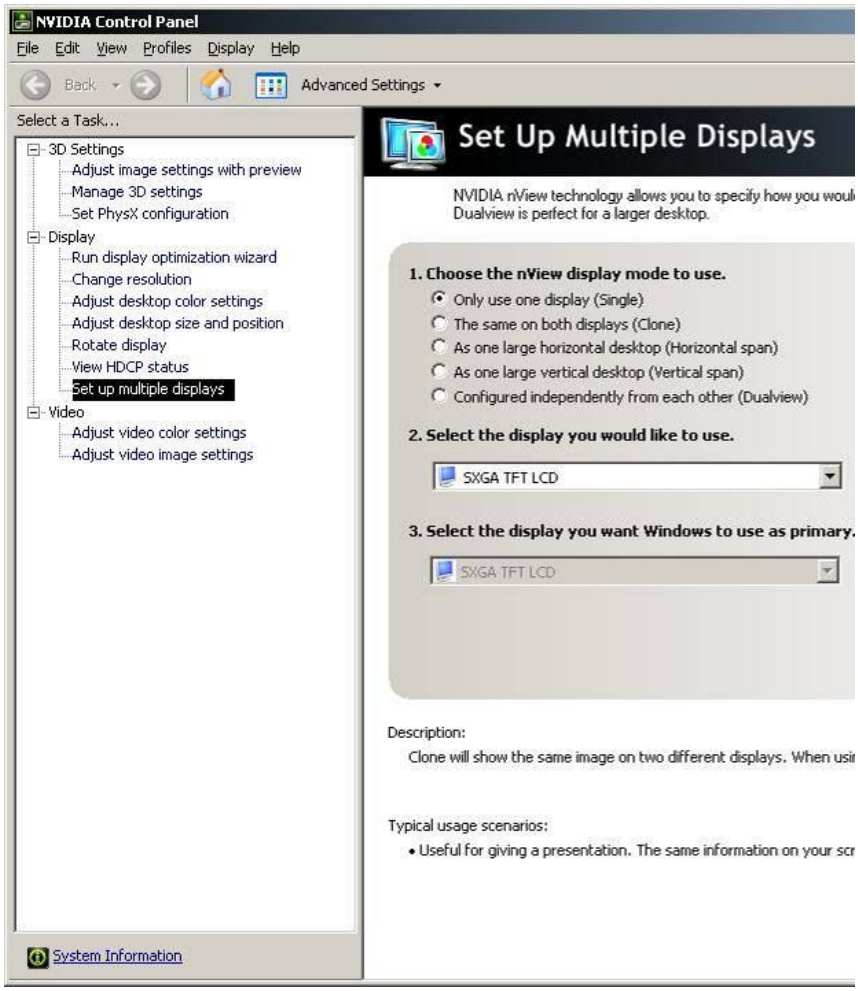
NOTE
Two monitors about to be cloned should be set to the same Screen resolution.

To clone two monitors:

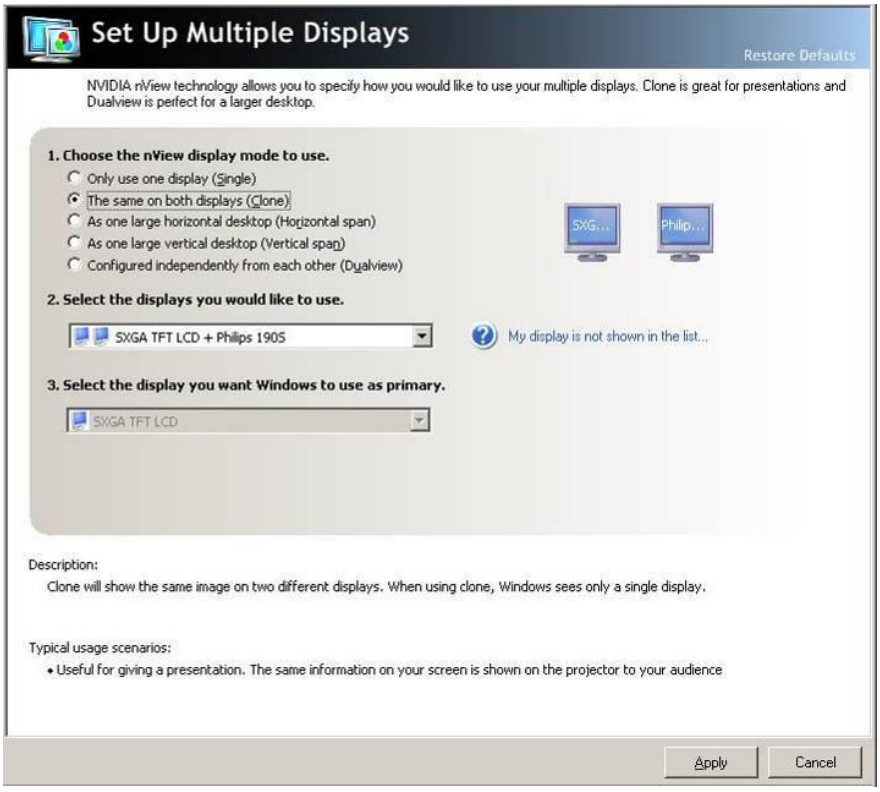
1. Connect the two monitors you want to clone to the first video card (it is not important whether it is DVI or display ports).
2. Turn on the transceiver.

3. Right-click on the Windows Desktop and select NVIDIA Control Panel from the menu.

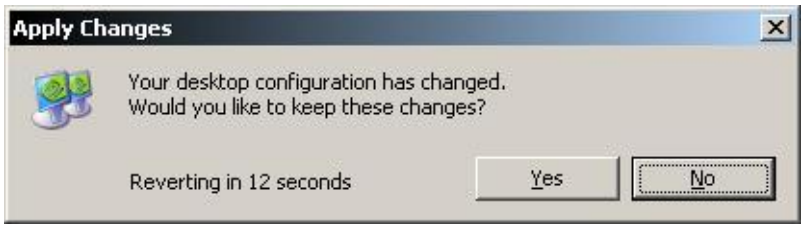
4. In the NVIDIA Control Panel, select Set up multiple displays in the left hand navigation pane.



5. Click the radio button The same on both displays (Clone), and then Apply.



6. Click Yes in the Apply Changes prompt.



The two monitors connected to the first video card are now cloned.

To add a third monitor:

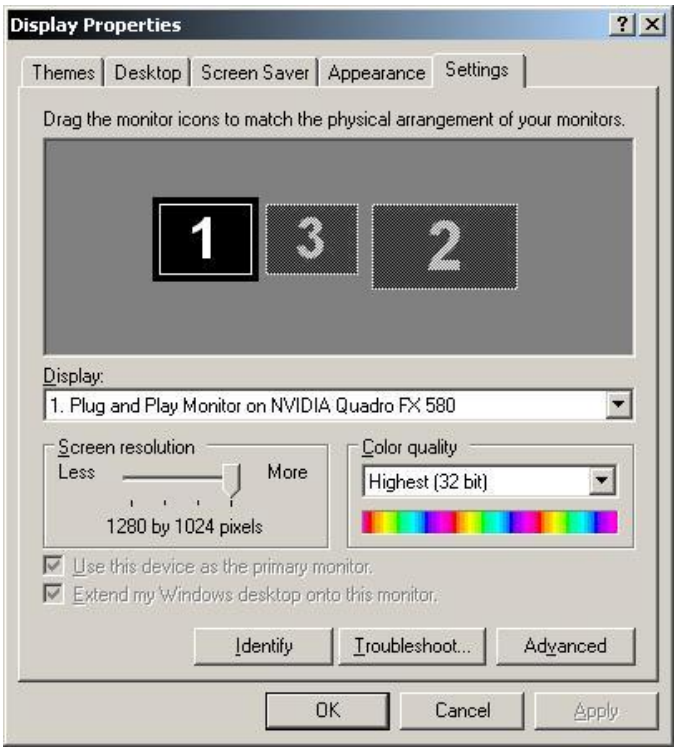
You can now add other monitors, e.g. extend your Windows Desktop to a third monitor in the survey room.

1. Right click on the Desktop and select Properties from the menu.

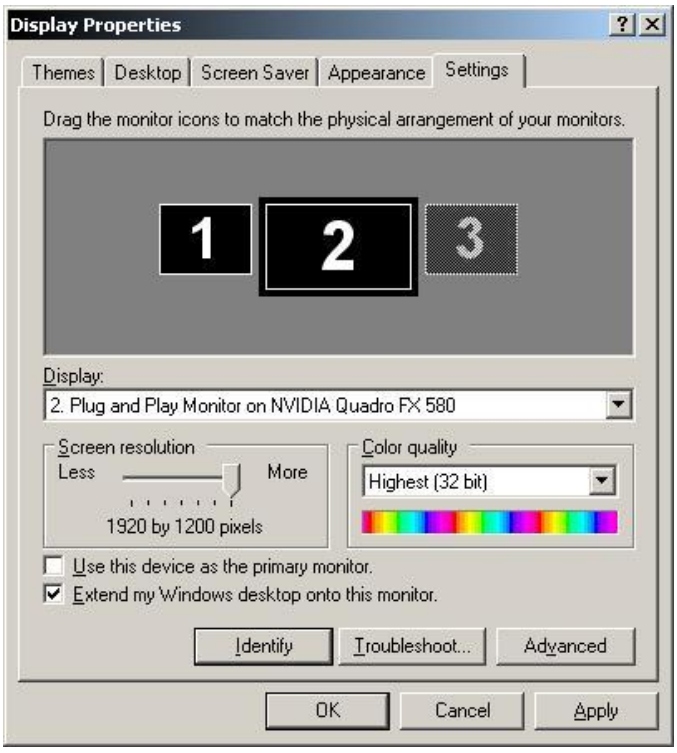
2. In the Display Properties dialog, select the Settings tab.

3. Click Identify to recognize your cloned monitors as no. 1.

   Do NOT change any settings for the cloned monitors.



4. Select the monitor you have connected and make it active by clicking the check box Extend my Windows desktop onto this monitor.

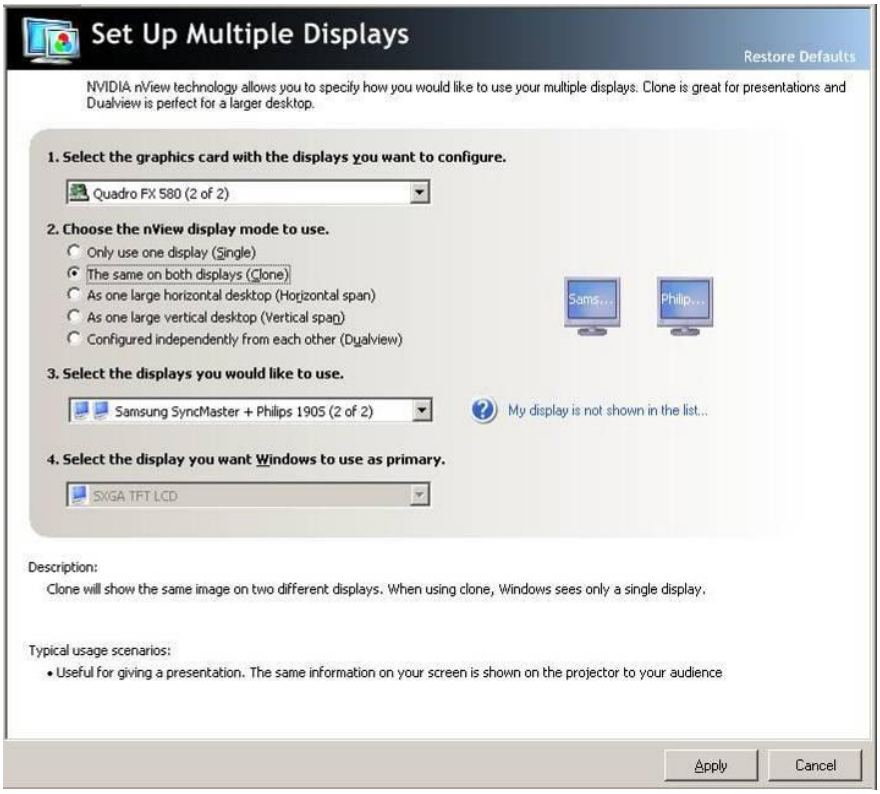


5. Click Apply and then OK.

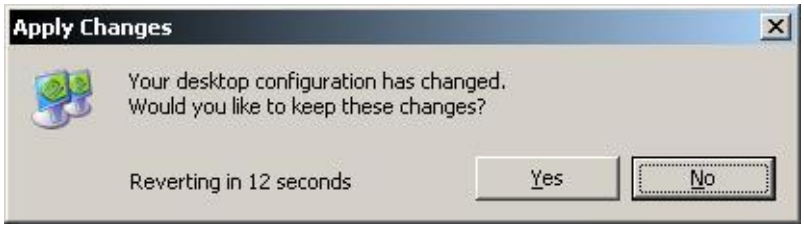
To clone a fourth monitor:

The two extended monitors to be cloned must be connected to the ***second*** video card.

1. Right-click on the Windows Desktop and select NVIDIA Control Panel from the menu (see also *section B.3.6 above*).
2. In the NVIDIA Control Panel, select Set up multiple displays in the left hand navigation pane.
3. Select Quadro FX580 (2 of 2) from the drop-down menu to match your video card.
4. Click the radio button The same on both displays (Clone), and then Apply.



5. Click Yes in the Apply Changes prompt.



B.4 Auxiliary Sensors

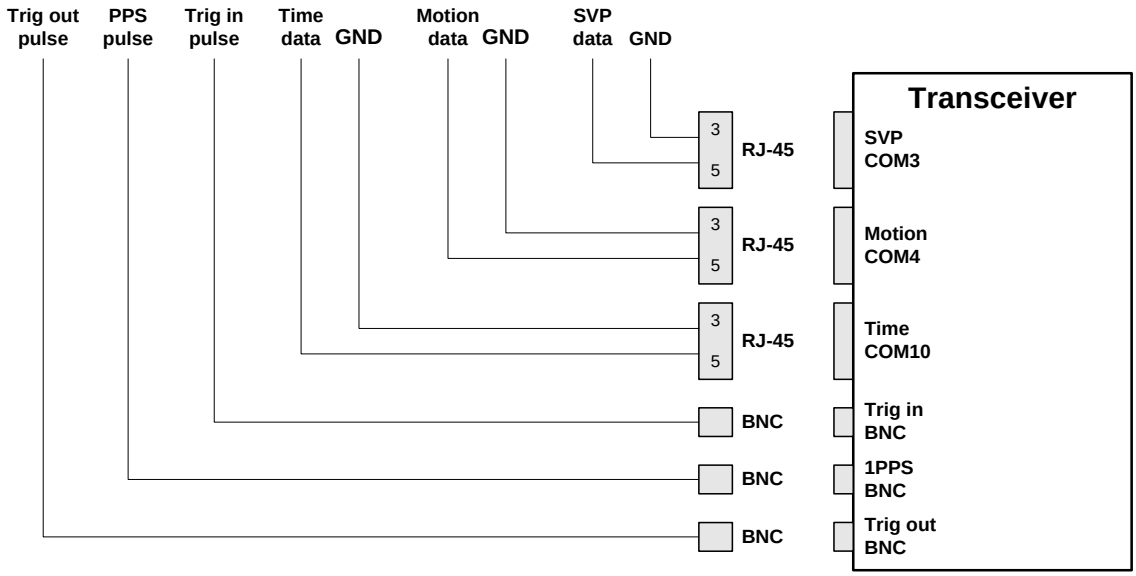


Figure 53: SVP, Motion, and Time Standard Connections

B.4.1 Sound Velocity Input

To connect a sound velocity probe to the transceiver, follow these steps:

1. Using a RJ-45 male connector, connect the SVP data to pin 5 and ground to pin 3.
2. Connect the RJ-45 to the port marked Com3 SVP on the rear panel of the transceiver (see item 14 in *Figure 51*).

   or

1. Connect a RESON standard SVP cable with a Fischer connector to the port marked SVP (see item 17 in *Figure 51*).

Table 9: Transceiver Port “SVP/Com3”

RJ-45 Pin	RS-232
1	DSR
2	RTS
3	GND
4	TxD
5	RxD
6	DCD
7	CTS
8	DTR

B.4.2 Motion Sensor Input

To connect a motion sensor to the transceiver, follow these steps:

1. Using a RJ-45 male connector, connect the motion data to pin 5 and ground to pin 3.
2. Connect the RJ-45 to the port marked Com4 Motion on the rear panel of the transceiver (see item 13 in *Figure 51*).

Table 10: Transceiver Port “Motion/Com4”

RJ-45 Pin	RS-232
1	DSR
2	RTS
3	GND
4	TxD
5	RxD
6	DCD
7	CTS
8	DTR

B.4.3 Time Input

To connect an external clock to the transceiver, follow these steps:

1. Using a RJ-45 male connector, connect the time data to pin 5 and ground to pin 3.
2. Connect the RJ-45 to the port marked Com10 Time on the rear panel of the transceiver (see item 11 in *Figure 51*).
3. Using a BNC male connector, connect the 1PPS pulse to the port marked 1PPS on the rear panel of the transceiver for setting the internal clocks of the sonar.

Table 11: Transceiver Port “Time/Com10”

RJ-45 Pin	RS-232
1	N-A
2	N-A
3	GND
4	TxD
5	RxD
6	N-A
7	N-A
8	N-A

B.4.4 Standard Serial Ports

Table 12: Transceiver Ports “Com5”, “Com6”, “Com7”, “Com8”, “Com9”

RJ-45 Pin	RS-232
1	DSR
2	RTS
3	GND
4	TxD
5	RxD
6	DCD
7	CTS
8	DTR

B.4.5 RJ-45 to D-SUB9 Adaptor

To allow the connection of standard DB9-f connectors to the serial ports of the processor, RJ-45 to DB9 adaptors are supplied with the system.

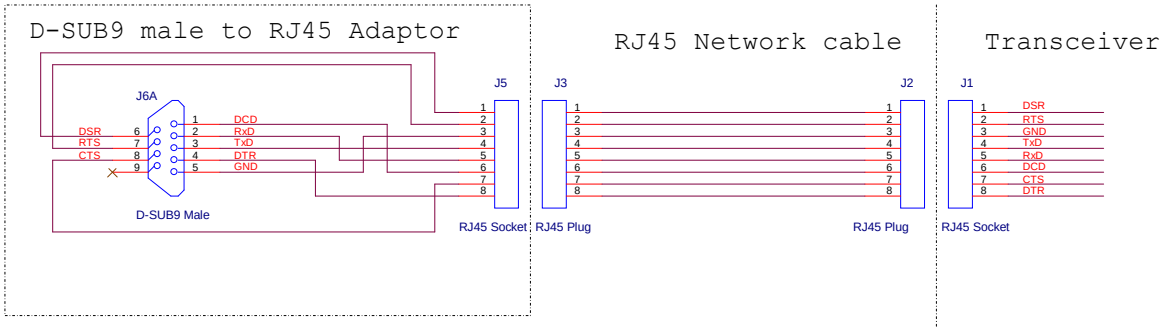


Figure 54: RJ-45 to D-SUB9 Adaptor

Table 13: RJ-45 to DB9 Adaptor

Wire Color	RJ-45 Pin	DB9-m Pin
Brown	6	1
Green	5	2
Red	4	3
Blue	8	4
Orange	3	5
Black	1	6
Yellow	2	7
Grey	7	8
Black (without pin)	Shield	To be soldered on the house

B.5 SeaBat 7125 SV Cables

A standard cable set is provided to connect the SeaBat 7125 SV system components.

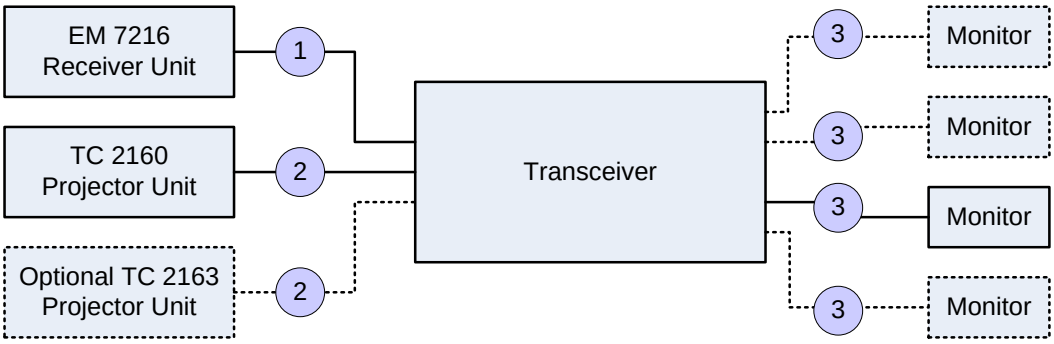


Figure 55: SeaBat 7125 SV System Cables

- **Receiver to transceiver (1):** This cable allows power and data to be passed between the receiver and transceiver. This cable has a standard length of 25 meters and a minimum bend radius of 127mm.
- **Projector to transceiver (2):** This cable allows power and data to be passed between the projector and transceiver. This cable has a standard length of 25 meters and a minimum bend radius of 73mm.
- **Monitor to transceiver (3):** This cable allows data to be passed between transceiver and monitor(s). If analog monitors are used a DVI to analog converter is necessary (see also *section B.3.4 above*).

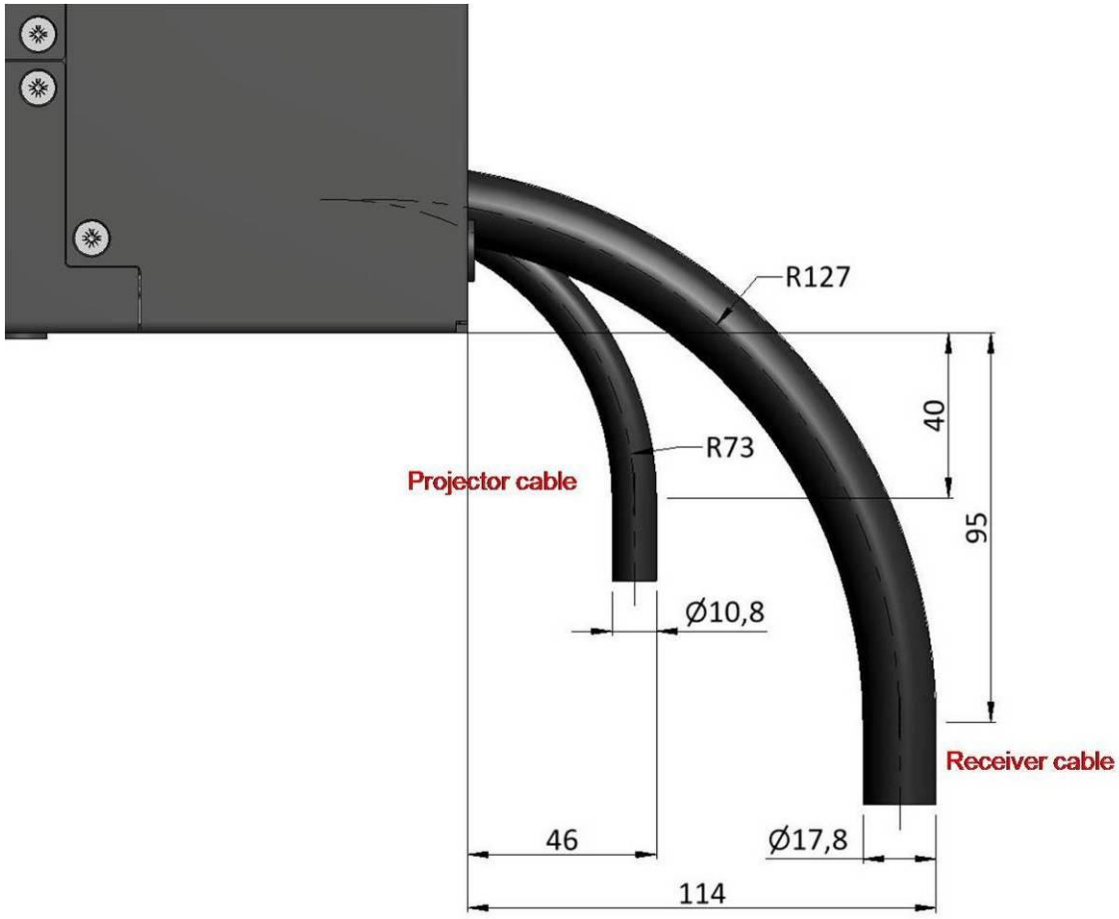


Figure 56: Bend Radius

CAUTION
The units must not be suspended from own outside plugs. Ensure that strain relief on the cable (cable grip) is used. If the cable is very long, use an external wire or cable covered with steel flex.

For cable options, see *appendix D.5 SeaBat Cables*.

B.6 Wet-End Installation

B.6.1 EM 7216 Receiver Unit

The EM 7216[21] receiver unit is capable of operating at either 400kHz (standard) or 200kHz (optional) with the dual-frequency system configuration (see *Appendix E Available SeaBat 7125 Configurations*).

Figure 57: EM 7216 Receiver Unit

Table 14: EM 7216 Receiver Unit Technical Specifications

Specification	Value
Material	Titanium (grade 2) lid Polyurethane acoustic window
Dimensions	Height 102.0mm ±0.15mm Width: 496.0mm ±0.30mm Depth: 137.5mm ±0.50mm
Weight	Air: 10.7kg ±1.0kg Water: 5.7kg ±1.0kg
Temperature	Operating: -2° to +35°C Storage: -30° to +70°C

The mounting flange on the front of the EM 7216 receiver unit is designed to accommodate four M8 machine screws in a rectangular pattern.

[21] Receiver unit EM 7216 has replaced EM 7200.

B.6.2 TC 2160 Projector Unit

The TC 2160 bathymetry projector unit operates at the frequency of 400kHz and produces a narrow beam that is approximately 1° along-track by 145° across-track. The entire 128° swath is illuminated in one transmission, with the maximum ping rate of 50Hz, providing 100% bottom coverage even at high vessel speed.

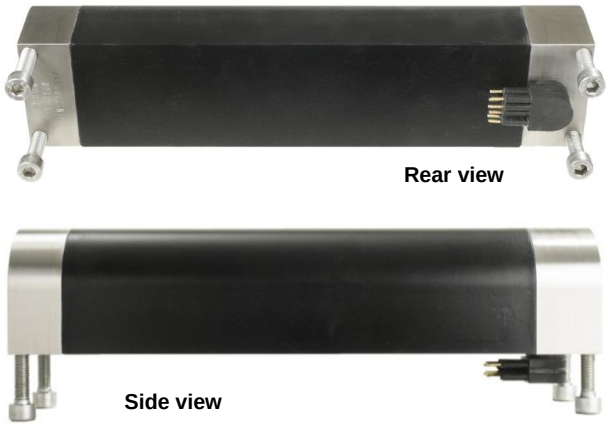


Figure 58: TC 2160 Projector Unit

Table 15: TC 2160 Projector Unit Technical Specifications

Specification	Value
Material	Titanium (grade 2) lid Polyurethane acoustic window
Dimensions	Height: 77mm ±0.7mm Width: 62mm ±0.2mm Depth: 285mm ±0.3mm
Weight	Air: 2.75kg ±0.5kg Water:1.75kg ±0.5kg
Temperature	Operating: -5° to +40°C Storage: -30° to +70°C

The TC 2160 projector unit mounts to the vehicle or mounting plate using four M10 machine screws of appropriate length, arranged in a rectangular pattern.

B.6.3 TC 2163 Projector Unit (Optional)

The TC 2163 bathymetry projector unit operates at the frequency of 200kHz and produces a narrow beam that is approximately 2° along-track by 142° across-track. The entire 128° swath is illuminated in one transmission, with the maximum ping rate of 50Hz providing 100% bottom coverage even at high vessel speed.

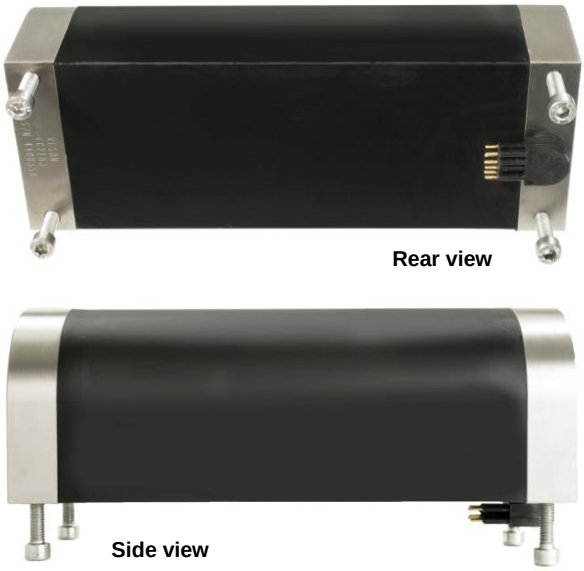


Figure 59: TC 2163 Projector Unit

Table 16: TC 2163 Projector Unit Technical Specifications

Specification	Value
Material	Titanium (grade 2) lid Polyurethane acoustic window
Dimensions	Height: 115mm ±0.1mm Width: 100mm ±0.2mm Depth: 280mm ±0.4mm
Weight	Air: 7.5kg ±0.5kg Water: 5.0kg ±0.5kg
Temperature	Operating: -5° to +40°C Storage: -30° to +70°C

The TC 2163 projector unit mounts to the vehicle or mounting plate using four M10 machine screws of appropriate length, arranged in a rectangular pattern.

B.6.4 Wet-End Mounting

- Take care that the sonar head assembly is electrically isolated from the structure to avoid corrosion problems. RESON provides an optional mounting bracket, which is described in *appendix D.3 7125 Mounting Bracket*.
- The head should be immersed in water to a depth of at least 0.8m. This ensures that noise from surface waves and turbulence generated by the mounting structure does not degrade performance.
- Mounting may be over the side, over the bow, or through a moon pool.
- Ensure that submersion depth is sufficient to avoid shadows from the keel, hull, or other obstacles.

NOTE
The sonar head is not designed to be hydrodynamic at speeds in excess of two knots. Vibration and oscillation will become evident, if the projector and receiver are not rigidly mounted. To minimize the unsupported length, place a support as close to the waterline as possible. Fairings can also be used to improve hydrodynamic performance.

B.6.5 Sonar Head Assembly Orientation

The sonar head assembly should be mounted with the faces of the arrays oriented vertically downwards. Ideally, the receiver is mounted across track, while the projector (or projectors) is mounted along track and aft of the receiver. If necessary, the projector may be oriented forward or the head rotated away from vertical with allowances made in the processor setup and data acquisition software.

CAUTION
An alternate mounting makes the projector more susceptible to impact damage and collection of trailing debris.

- The faces of the projector and receiver must be aligned in the vertical (“Z”) plane within +/-2.0mm.
- The alignment along-ship (“Y”) plane and across-ship (“X”) plane should be within +/-250.0mm.

The actual sonar head assembly installation must be reflected in the user interface settings (see *section 4.2.3 Hardware Configuration*).

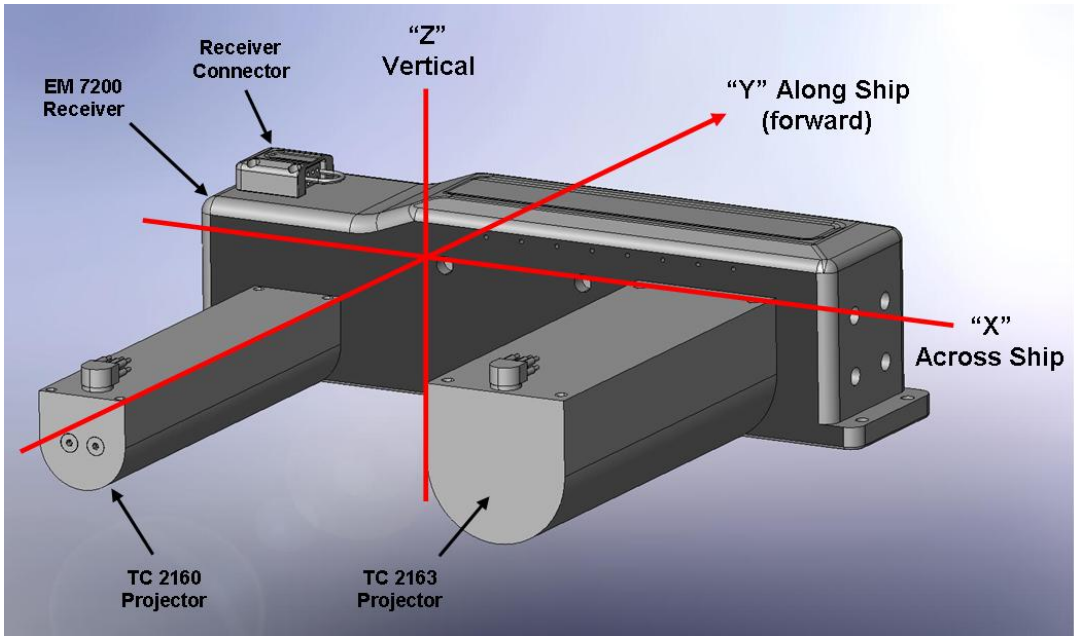


Figure 60: Sonar Head Assembly Orientation

B.6.6 Sonar Reference Point

Figure 61 illustrates the sonar reference point: The SeaBat 7125 SV dual-frequency sonar head is shown for general definition of the sonar reference point concept[22].

- X = across ship
- Y = along ship
- Z = vertical (up-down)

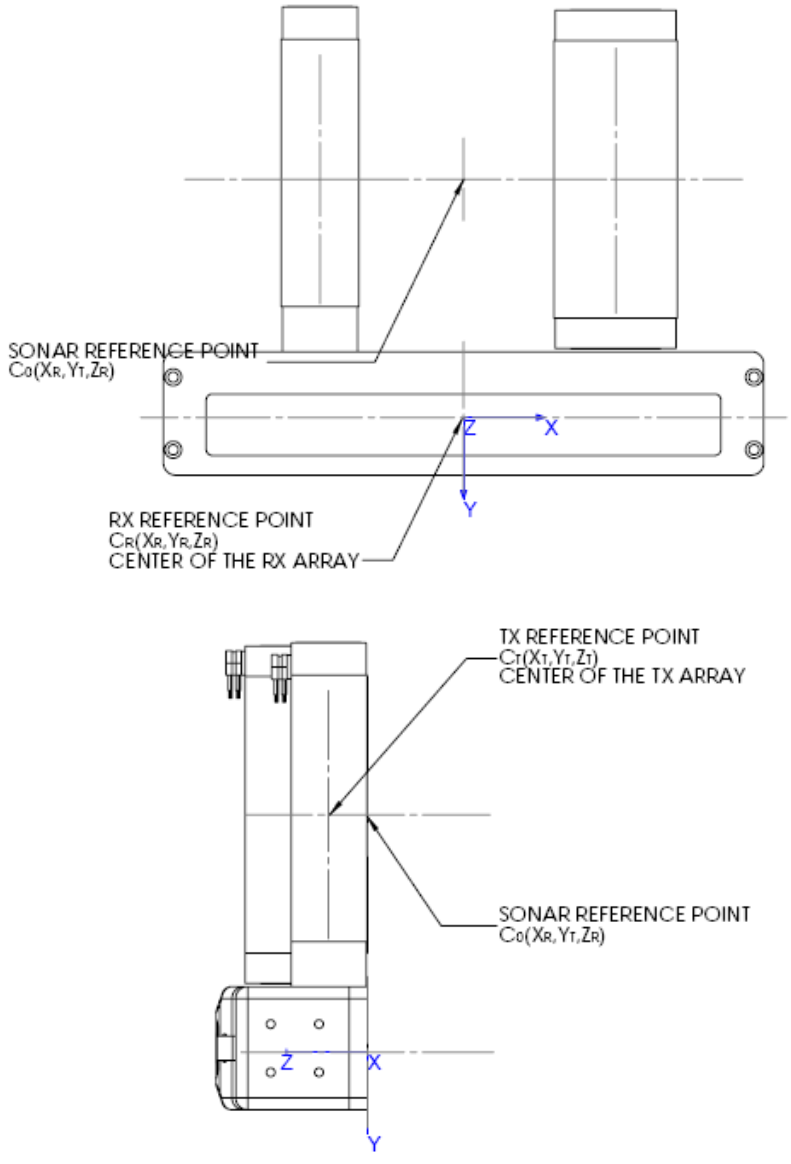


Figure 61: Sonar Reference Point

[22] For exact data on reference points, see the individual unit installation drawings.

B.6.7 Wet-End Cable Connections

- The cable connections to the receiver and projector units should be made prior to immersing the units in water.

WARNING!
The projector connections must be handled with great care as the output power voltage is hazardous to human safety. Do **not** pull out the cables with power on. Output voltage: $280V_{rms} \approx 800V_{p-p}$

- A light coating of grease on the connector face will ensure sealing.
- Unused connectors should be sealed with dummy plugs.
- Verify that all cables are securely fastened and that strain relief is provided to prevent cable damage.

CAUTION
Take care to avoid impact to the faces of projector and receiver units, as damage could degrade system performance.

CAUTION
To reduce the amount of radiated emission, the cables for receiver, projector(s), and SVP must be bundled tightly together onboard the vessel.

B.7 System Check

Once the SeaBat 7125 SV has been installed, follow these steps to ensure that the system is working properly. For information on the settings, see *section 5.7 Sonar Control Tabs*.

1. Ensure that all system cable connections are mated properly.
2. Verify the main power is available.
3. Energize the monitor.
4. Ensure the power switch on the rear of the transceiver is in the ON position.
5. Energize the system.
6. Start the sonar by double-clicking the 7kControlCenter icon on the operator desktop and first selecting the desired system settings (see also *section 3.3 Starting the 7k Control Center and Sonar*).
7. Verify that the Power setting on the Main Sonar Settings tab is set to OFF.
8. Once the system has been energized, follow these steps to verify that the system is operating correctly:
    a. Set the Range to 150.
    b. Set Max Rate to 4.
    c. Set the Gain to 30.
    d. Select Blue-Yellow from the Palette drop-down menu on the Primary Display Settings tab.
    e. Perform a receiver check by vigorously rubbing the face of the receiver unit with fingertips while monitoring the display. A noise pattern should be barely visible on the display.
    f. Gradually increase the Power setting on the Main Sonar Settings tab while an assistant presses an ear against the projector face. Continue to increase the power until the assistant can hear pings (ticking sounds) emitting from the front of the projector to just below FULL for a very short period.
    g. Turn transmit Power to OFF as soon as possible.

CAUTION
Transmitting into air for any period of time may result in the damage of the ceramics of the projector and will result in degraded performance.

APPENDIX C REFERENCE DOCUMENTATION

C.1 SeaBat 7125 SV Documentation

In addition to this document, the following SeaBat documentation is available in Adobe Portable Document Format (.pdf) for printing.

Document Title	Document Number	Document Description
SeaBat 7125 SV Operator's Manual	OM12604	Printed version of this document
SeaBat 7125 SV Quick Reference Guide	QG12656	Printed version 4 or higher
Data Format Definition Document	11542	Version 1.0 or higher
Data Format Definition Document, Addendum	DFD12893-1	Addendum to 11542

Each system contains a link in the Start menu to system documentation.

To access these documents click Start | Reson Documentation and a list of documents appears.

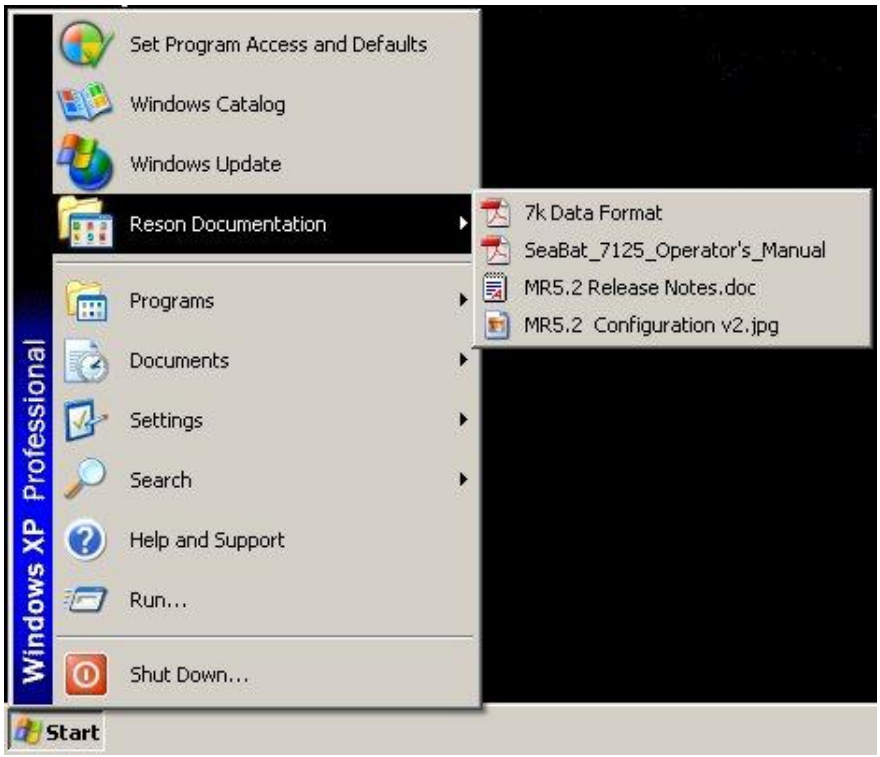


Figure 62: System Documentation Link (Example Only)

C.2 SeaBat 7125 SV Design Documents

The following design documents and drawings are provided for reference purposes.

Document Title	Document Number
Outline Receiver, EM7216 7125/28	7216M011
TC 2163 Outline Dimension	2163M011
TC 2160 Outline Dimension	2160M011
Cable Assembly, Transceiver to Receiver, 7k	85002188B011
Cable Assembly, Transceiver to Transmitter, 7k	85002187B011
Cable Assembly, SVP70 to Transceiver	85002222B011
Cable Assembly, SVP71 to Transceiver	85002225B011

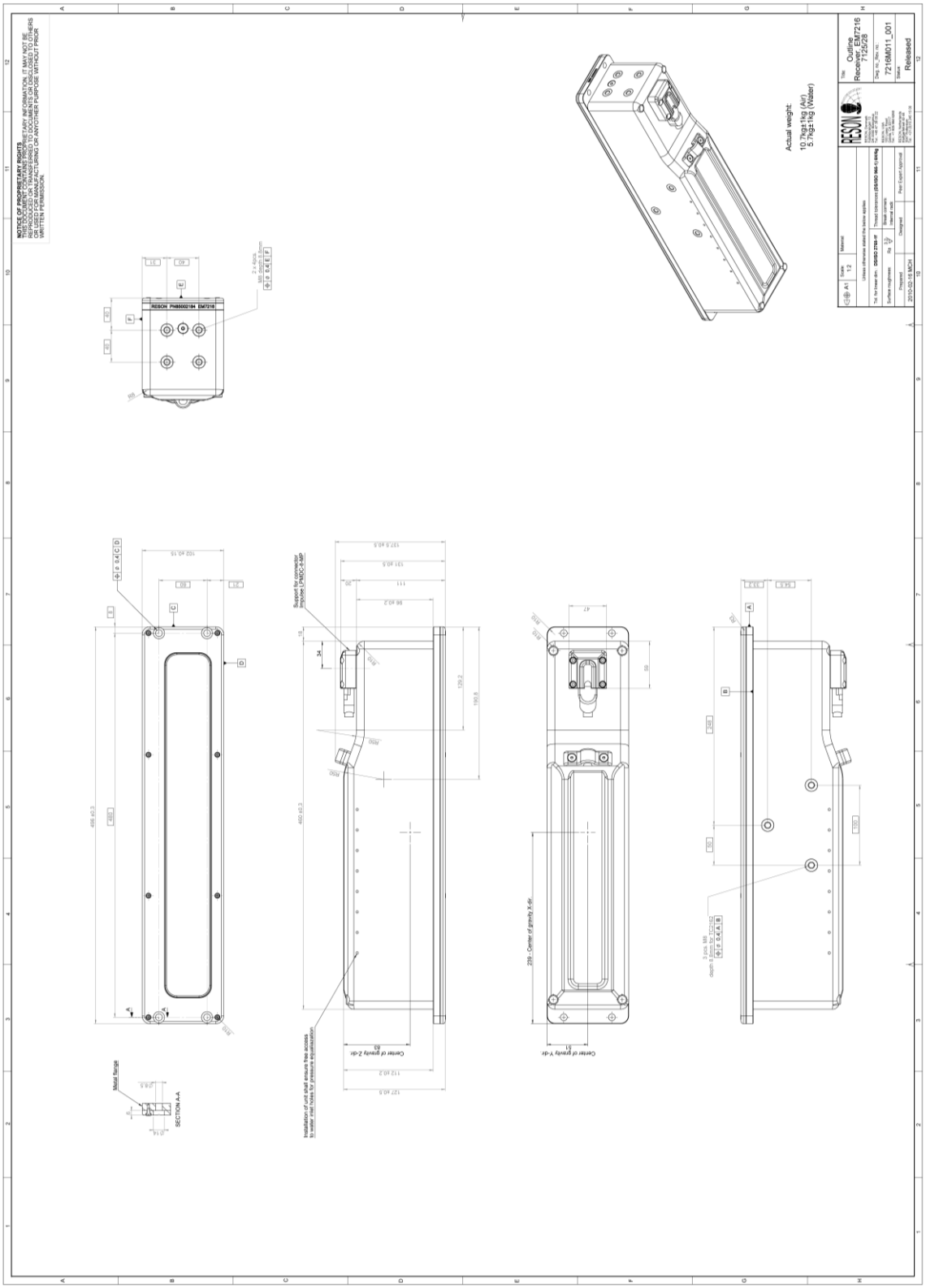


Figure 63: Receiver, EM 7216 Outline Dimension

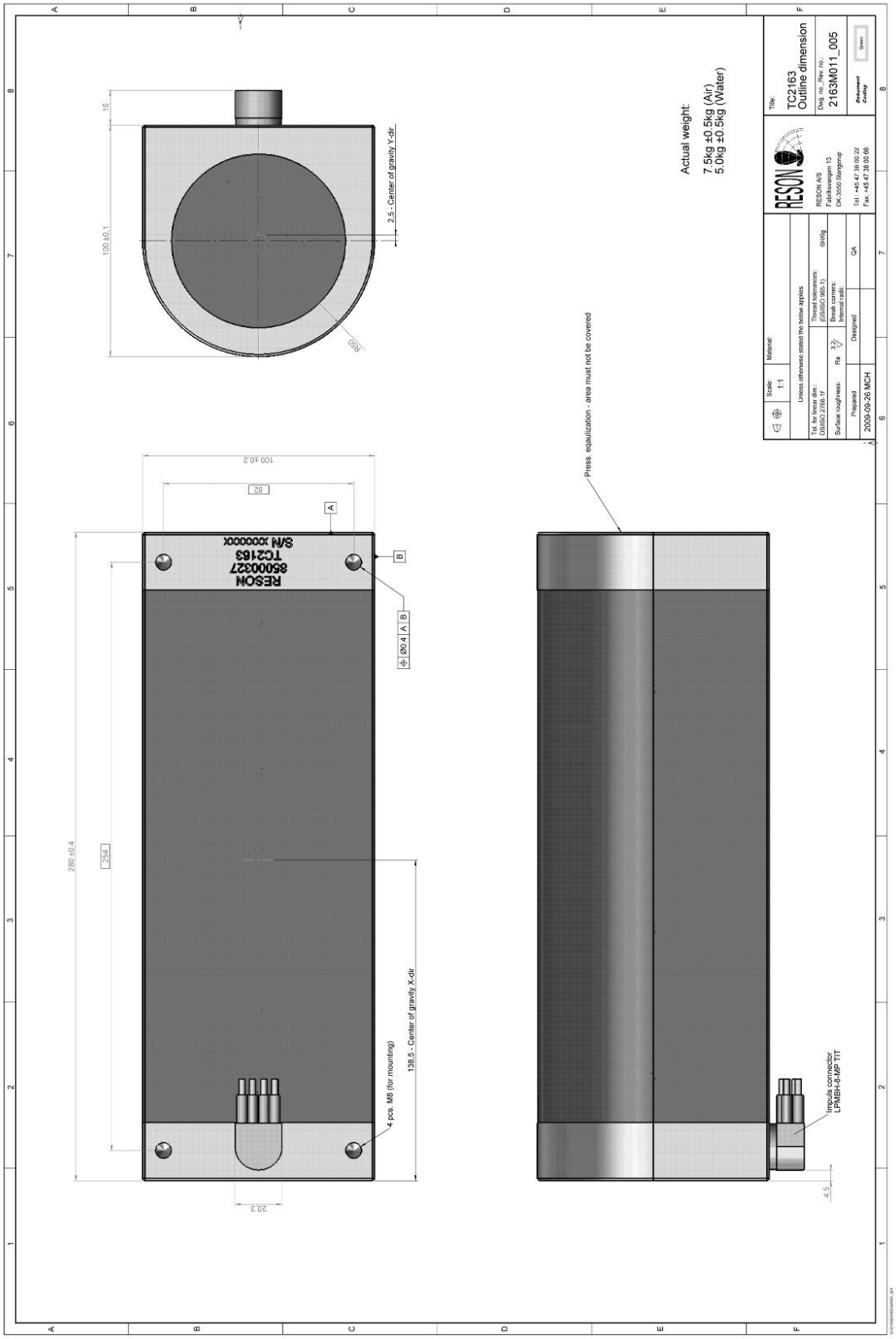


Figure 64: Projector, TC 2163 Outline Dimension

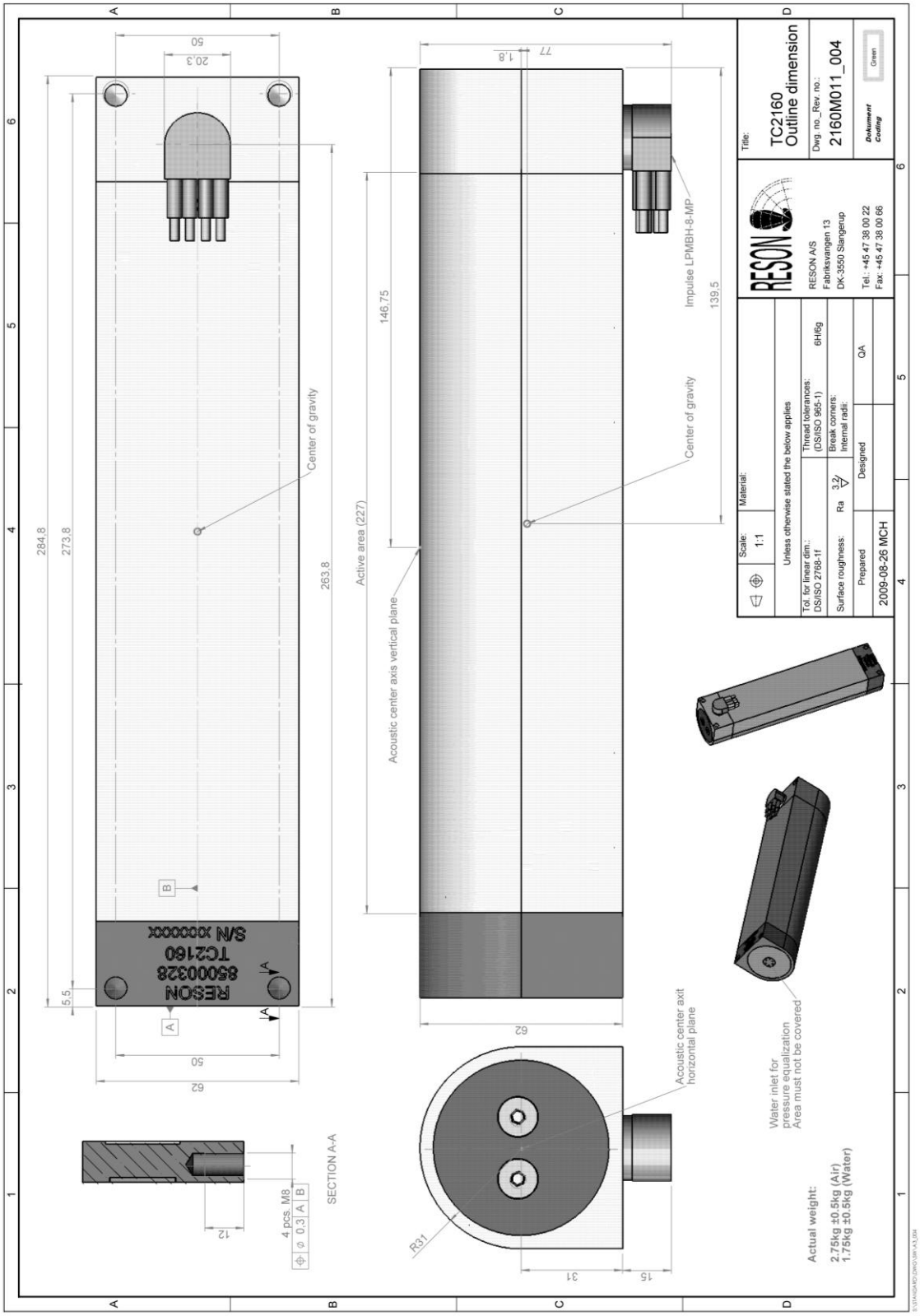


Figure 65: Projector, TC 2160 Outline Dimension

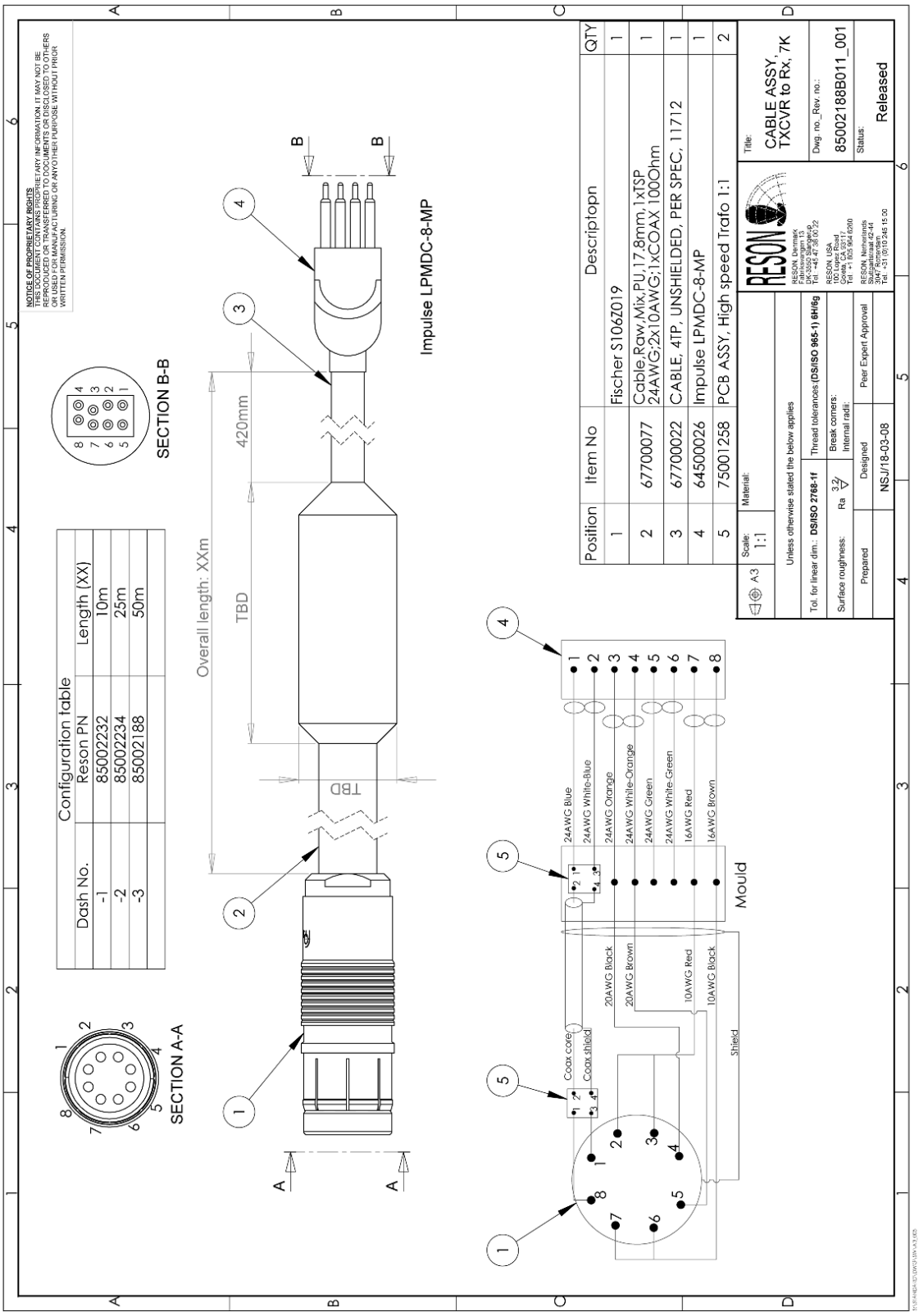


Figure 66: Cable Assembly, Transceiver to Receiver, Unshielded

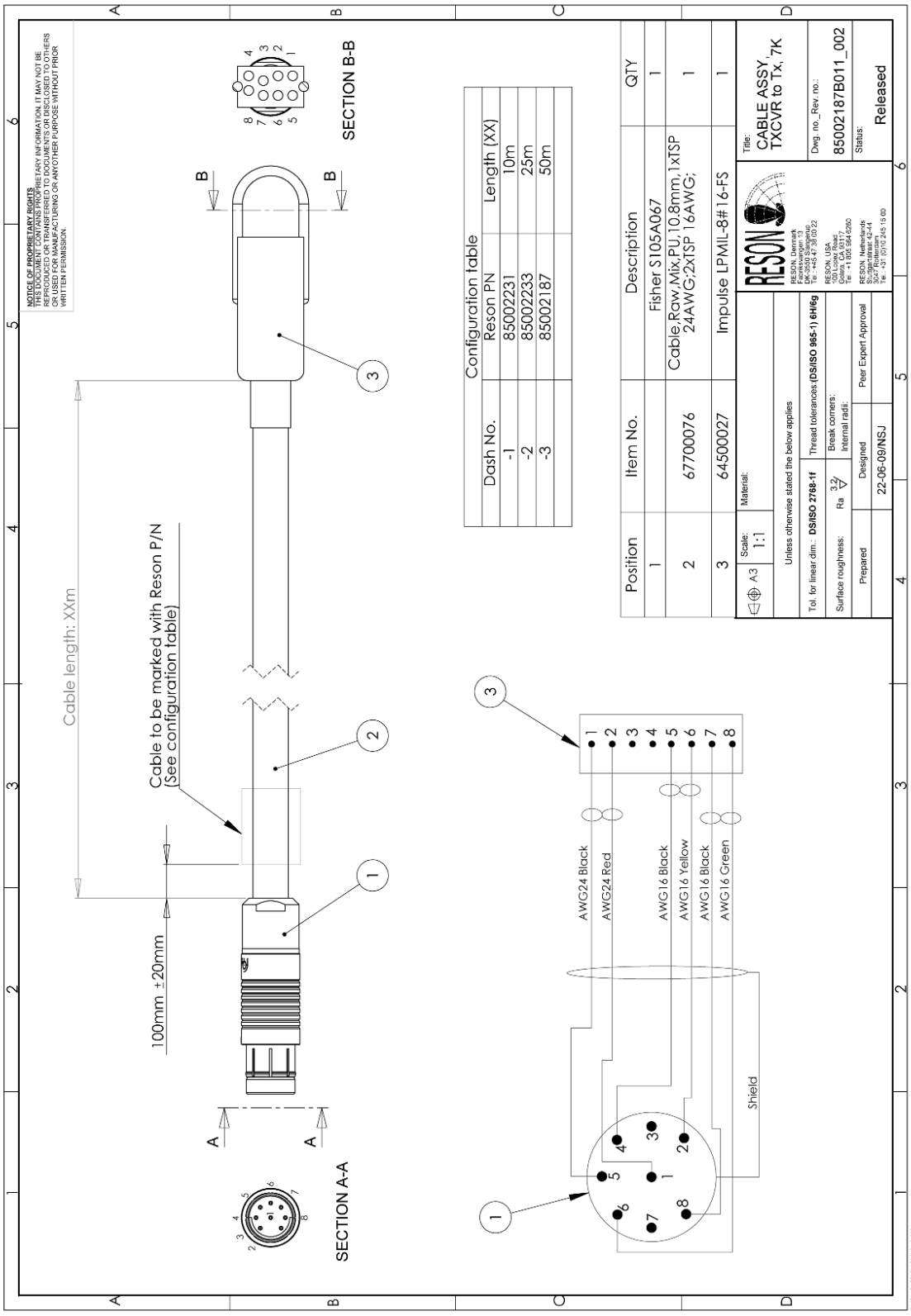


Figure 67: Cable Assembly, Transceiver to Transmitter

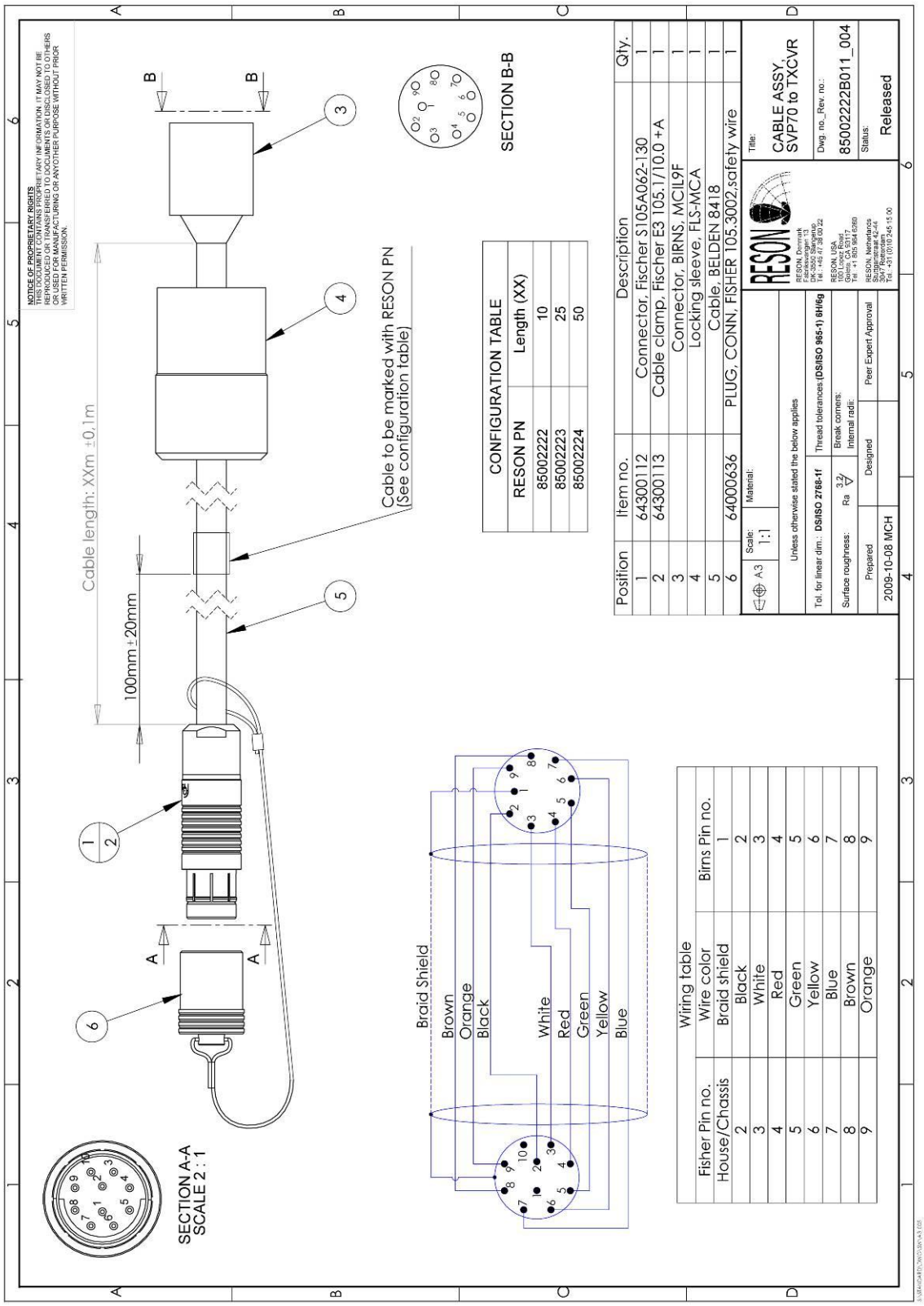


Figure 68: Cable Assembly, Transceiver to SVP 70 (optional)

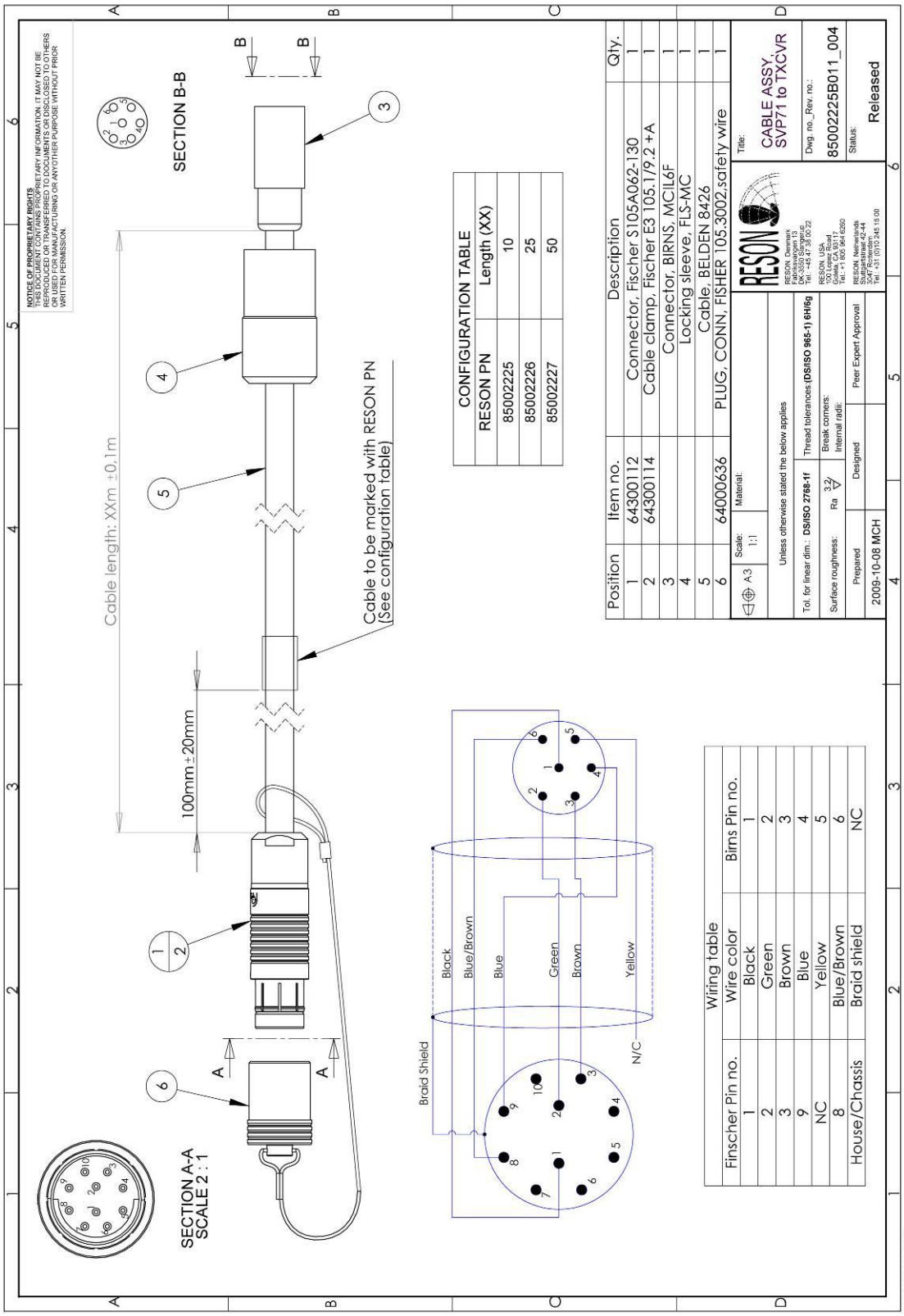


Figure 69: Cable Assembly, Transceiver to SVP 71 (optional)

APPENDIX D SEABAT 7125 SV SYSTEM OPTIONS

The following options are available with the SeaBat 7125 SV system. If you require more detailed information about any of these options, please contact RESON Sales for assistance.

- Extended Warranty Contract
- External RAID Drive
- Mounting Bracket
- PDS2000 Data Acquisition Software
- SeaBat Cables
- Sound Velocity Probe
- System Integration and Training
- Yearly Inspection and Servicing
- Yearly Upgrades for SeaBat Firmware

D.1 Extended Warranty Contract

All SeaBat™ systems are provided with a standard twelve-month warranty (see *Appendix F Warranty Information*). This option provides the user with the possibility of purchasing additional annual support.

D.2 External RAID Drive

A one Terabyte (TB) external RAID hard disk array may be purchased to offer additional storage space for the data recording function.

Figure 70: RAID Hard Disk Array

Table 17: RAID Hard Disk Array Technical Specifications

Specification	Value
Form factor	1U, 19-inch rack mount with rails
Base capacity	1.0 Terabyte
Protocol support	CIFS, NFS, NCP, HTTP, and FTP

Specification	Value
Max RAID capacity	1.0 Terabyte
Operating system	Windows® Storage Server 2003
Processor	Intel Pentium 4 2.8GHz at 800MHz 1MB
Memory	512MB Dual Channel DDR400 SDRAM
RAID environment	Integrated Marvell 4 port RAID controller
Hot swap	4 bays
Included drives	4 x 250GB SATA 8MB Cache
Ethernet	Dual Intel Gigabit controller 2x 10/100/1000
Load balancing	Load balancing, teaming and failover
Power supply	350W

D.3 7125 Mounting Bracket – PN 85160019

A 7125 Mounting Bracket is available to hold the EM 7216 receiver, TC 2160 projector, TC 2163 projector (optional), and an SVP 70 (optional). The mounting bracket is intended for mounting flat or via a pole on the ship's hull, or on a pole over the side. For complete installation information, see the 7125 Mounting Bracket Installation Manual (RESON Document IM11412).

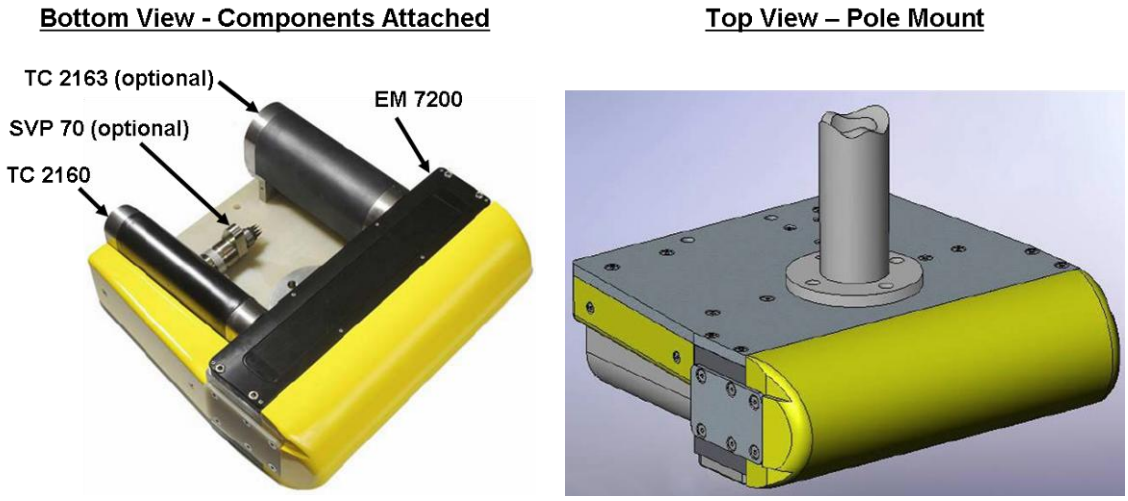


Figure 71: 7125 Mounting Bracket – PN 85160019

NOTE
The obsolete SeaBat 7125 Mounting Kit and Fairing (PN 85001559) is equally intended for mounting flat or via a pole on the ship's hull, or on a pole over the side.

D.4 PDS2000 Data Acquisition Software

RESON PDS2000 software provides a wealth of displays and data processing options. The SeaBat 7125 SV transceiver is available with the PDS2000 software preinstalled. The software can also be configured to run on a separate computer with a TCP I/P or UDP interface. PDS2000 also handles all commonly interfaced sensors.

For further information, please refer to the appropriate manual.

D.5 SeaBat Cables

Additional standard- (25m) or non-standard-length cables (10m or 50m) between receiver/projector and transceiver are available for purchase.

D.6 Sound Velocity Probe

To ensure proper beam steering, the sonar requires the input of the local sound velocity in the area of the transmitter and receiver arrays. The sound velocity probe (SVP) is used to continuously report this value to the transceiver.

The unit described below may be purchased from RESON as an option, or a SVP of similar specifications may be supplied by the customer.

Table 18: SVP Technical Specifications

Specification	Value
Type	SVP 70
Sound velocity	Range: 1350-1800m/s Resolution: 0.01m/s Accuracy: ±0.05m/s (0-50m) Accuracy: ±0.25m/s (0-6000m)
Sampling rate	20Hz and lower, programmable
Depth	6000m
Baud rate	2400-115200
Supply	9-55VDC
Power	2W
Housing	Titanium
Dimensions	Diameter: 44mm (max) Length: 165mm (excl. connector) End cap height: 69mm (max)

Specification	Value
Weight	1.0kg (excl. cable)
Temperature	-20° to +55°C

For further information, please refer to the appropriate manual.

D.7 System Integration and Training

Onsite installation, integration with a bathymetric data acquisition system, calibration, and training of operating personnel are available from RESON.

D.8 Yearly Inspection and Servicing

Although the SeaBat should not require recalibration or general servicing during its lifetime, some industries may require factory verification of performance and an annual equipment service. The following tasks are performed as a part of this option:

- Visual inspection of all system components.
- Installation of new sacrificial anodes.
- Opening of both the sonar head and sonar processor to:
    - Remove, test and retune receiver boards.
- Bench test of complete system.
- Tank/water test of system and verification of source level.

Prior to taking any action, RESON will provide the customer with an Estimate of Cost to Repair for any parts that require replacement.

D.9 Yearly Upgrades for SeaBat Firmware

This option provides all firmware upgrades that are released over the period of one year. This would normally be purchased at the time of the initial order for the second and third year period.

APPENDIX E AVAILABLE SEABAT 7125 CONFIGURATIONS

E.1 Configurations

The SeaBat 7125 is available in various single- or dual-frequency configurations:

Table 19: Available Configurations

System	Frequency (kHz)	Depth rating (meters)
7125 SV – single frequency	400	50
7125 SV – dual frequency	200/400	50
7125 ROV – single frequency	400	6000
7125 ROV – dual frequency	200/400	6000
7125 AUV – single frequency	400	Optional 6000
7125 AUV – dual frequency	200/400	Optional 6000

NOTE
The single-frequency systems are 400kHz only and dual frequency are 200/400khz. There is no 200kHz only configuration.

E.1.1 7125 SV Configuration

The SeaBat 7125 SV configuration is for mounting on a surface vessel and designed with ease of installation and operation as a high priority.

E.1.2 7125 ROV Configuration

The SeaBat 7125 ROV configuration is for deep-water use on a remotely operated vehicle. The link control unit is housed within a titanium bottle providing the system with a depth rating of 6000 meters.

E.1.3 7125 AUV Configuration

The SeaBat 7125 AUV configuration is for mounting on an autonomous underwater vehicle with its Integrated Control and Processor Unit of a standard depth rating of 400 meters (optional 6000m depth-rated pressure housing available). The system provides onboard data processing and logging.

E.2 Feature Packages

Each SeaBat 7125 configuration is available with 2 different feature packages, the license to each of which will be installed on the system you have purchased.

Table 20: SeaBat 7125 Feature Packages

Feature	Standard	Efficiency
256 EA beams	✓	✓
256 ED beams	✓	✓
512 EA beams	×	✓
512 ED beams	×	✓
140° receiver coverage	×	✓
Auto pilot	×	✓
Roll stabilization	×	✓
Channel normalization	✓	✓
Variable swath width	×	✓
Quality filter	×	✓
Uncertainty output	×	✓
Integrated PDS2000 (option)	✓	✓

NOTE
The Standard feature package can be upgraded after installation (see also *section 3.5 Installing a License*.

APPENDIX F WARRANTY INFORMATION

F.1 One Year Limited Warranty

RESON warrants the SeaBat system against defects in materials and workmanship for a period of one year from acceptance of the system. During the warranty period, RESON will, at its option, either repair or replace components which prove to be defective.

The warranty period begins on the day the system is accepted by the customer. The SeaBat system must be serviced by the RESON office that sold it. The customer shall prepay shipping charges (and shall pay all duty and taxes) for products returned for service. RESON shall pay for the return of the products to the customer, not including any duty and taxes.

F.2 Exclusions

The warranty on the SeaBat system shall not apply to defects resulting from:

- Improper or inadequate maintenance by the customer.
- Unauthorized modification or misuse.
- Opening of any parts of the equipment by anyone other than an authorized RESON representative.
- Operation outside the environmental specifications for the product.
- Improper site preparation and maintenance.
- Service provided by anyone but authorized service facilities (see *section F.6 below*).

F.3 Warranty Limitations

The warranty set forth above is exclusive and no other warranty, whether written or oral, is expressed or implied. RESON specifically disclaims the implied warranties of merchantability and fitness for a purpose.

F.4 Servicing During Warranty Period

If your system should fail during the warranty period, please contact your nearest RESON representative immediately (see *section F.6 below*) to protect your warranty rights.

F.5 Equipment Return Procedure

Before returning any equipment for service, you must follow the RESON equipment return procedure stated below:

1. Contact a RESON office to obtain an approved Return Material Authorization (RMA) number.
2. Follow the instructions in the supplied document and pack the equipment in the original shipping containers.
3. Ship the equipment to your RESON representative to the applicable address.
4. Ensure that the RMA number is included on all shipping documents and, most importantly, marked on the shipping container's address label.
5. Include a note with a brief, but thorough, description of the problem.

F.6 Service

If you are experiencing difficulty with your SeaBat system, please contact RESON Service Department at one of the following addresses for further instructions:

DENMARK
RESON A/S
Fabriksvangen 13
3550 Slangerup
Denmark
Tel: +45 47 38 00 22
e-mail: support@reson.com

UNITED STATES
RESON, Inc.
100 Lopez Road
Goleta, CA 93117
USA
Tel: +1 805 964 6260
e-mail: support@reson.com

APPENDIX G GLOSSARY OF TERMS

Entry	Definition
1PPS	1PPS (transceiver diagnostic LED)
7k	SeaBat 7000 series of multibeam sonars
AUV	Autonomous Underwater Vehicle
BITE	Built-In Test Environment
CA	Card alive (transceiver diagnostic LED)
CAD	Computer-Aided Detection
CE	Conformité Européenne
CRP	Central Reference Point
Cylindrical loss	The loss of sound by spreading in the form of a cylinder
DAC	Data Acquisition System
DWG	Drawing
EA	Equi-angle (UI)
ED	Equi-distant (UI)
GUI	Graphical User Interface
ICPU	Integrated Control and Processor Unit
KVM	Keyboard/video/mouse
LCU	Link Control Unit
LED	light-emitting diode
MDR	Motion data received (transceiver diagnostic LED)
N/A	not available or not applicable
PN	Part Number
PN	Ping now (transceiver diagnostic LED)
ppt	parts per thousand
PRG	Programmed (transceiver diagnostic LED)
PSU	Power Supply Unit
RDC	Receiver Digital Controller
RH	relative humidity
RMA	Return Material Authorization

Entry	Definition
ROV	Remotely Operated Vehicle
Rx	receiver
SB	SeaBat
SNR	signal-to-noise ratio
Spherical loss	The loss of sound by spreading in the form of a sphere
SPU	Sonar Processing (or Processor) Unit
SV	sound velocity (or surface vessel as in SB 7125 SV)
SVP	Sound Velocity Probe
TBD	To Be Defined
TPE	Total Propagated Error
TVG	Time-Varied Gain is a control intended to vary the gain of an amplifier over a predetermined time period (usually from a low to a high gain state)
Tx	transmitter
UI	user interface
ULN	Uplink (transceiver diagnostic LED)
WEEE	Waste Electrical and Electronic Equipment
ZDA	Time and date identifier

SeaBat 7125 SV Operator's Manual

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