SeaBat 7125 Operator's Manual

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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.

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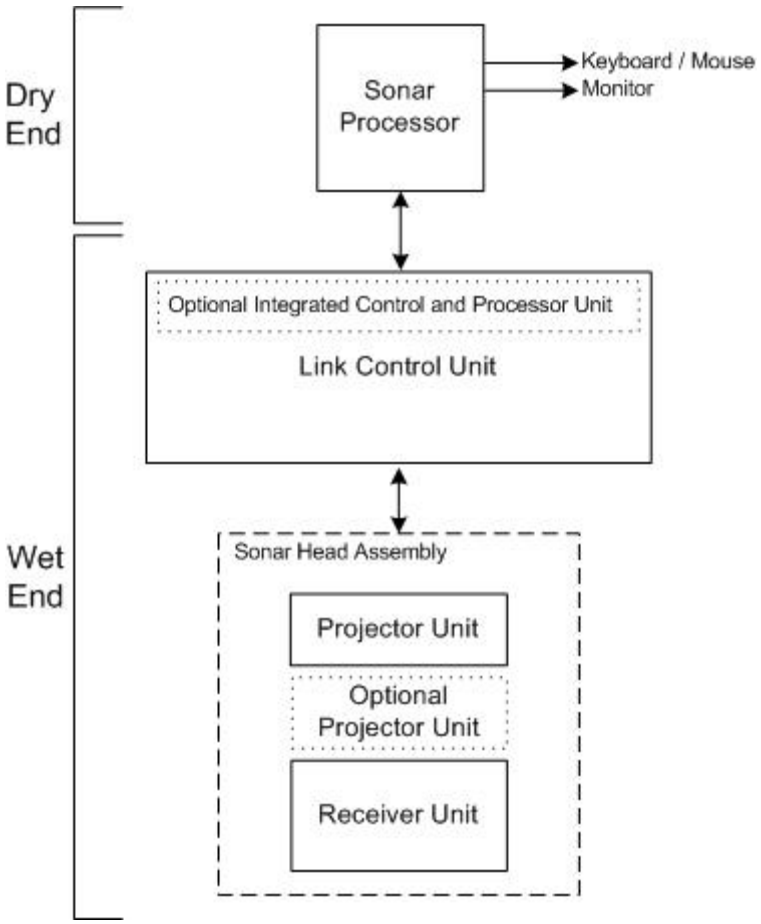
1 INTRODUCTION

1.01 Intro to the SeaBat Interactive Operator's Manual

1.01.01 System Overview

The SeaBat 7125 system is a multibeam sonar system that measures relative water depths over a wide swath perpendicular to the vehicle's track. The SeaBat 7125 ensonifies a 128° sector below the Sonar Head Assembly and is suitable for mounting on a surface vessel, ROV or AUV.



1.02 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 7125 system.

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

1.02.01 Standards of Measurement

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

1.02.02 Notes and Warnings

All notes and warnings will be shown in the following format:

NOTE: This is a note. A note represents explanatory information that may be useful to the operator.

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

WARNING: This is a Warning. It indicates important information about your SeaBat™ system. Disregarding information provided in a Warning box could result harm to personnel working with or near the system.

1.03 What's New in this Release?

The following major enhancements have been made to the SeaBat 7125 since the last release:

7kCenter:

- **Bottom Detection:** Improved bottom detect minimizes noise and improves performance on the outer beams. Also enhanced to allow for multiple depth/range/adaptive gate options.
- **Quality and Process flags:** The 7kCenter now calculates quality and bottom detect process flags and transmits them with the bathy data (record 7006).
- **Multithreading:** Enhanced multithreading allows for maximum efficiency on different types of hardware (G1 and G2 and beyond)

7k UI:

- **Time Stamp Alarm:** The UI will display an alarm when the 1 PPS pulse fails. The user will be notified that a software time stamp is being used instead and that the system requires attention

- **Adaptive Gates:** New type of gating scheme implemented (see manual). Allows for better bottom detection performance under certain conditions.
- **Data Recording and Playback:** Data recording controls are provided. They also include recording filters so the user can select which records are to be logged. Playback of data is now possible in real time through the User Interface. Data Recording and Playback can take place simultaneously, although system performance may be affected on G1 machines.
- **I/O Module Setup:** The user can now configure the I/O module to accept Time and SVP input. See manual for procedures.
- **Data Broadcasting:** The UI can be used to configure the 7kCenter to broadcast data on a UDP socket to a remote client. See Manual for procedures.
- **Quality Reporting:** The UI has a control for displaying quality/process flags now. It is located on the Primary Display Settings Page. See manual for description.

General:

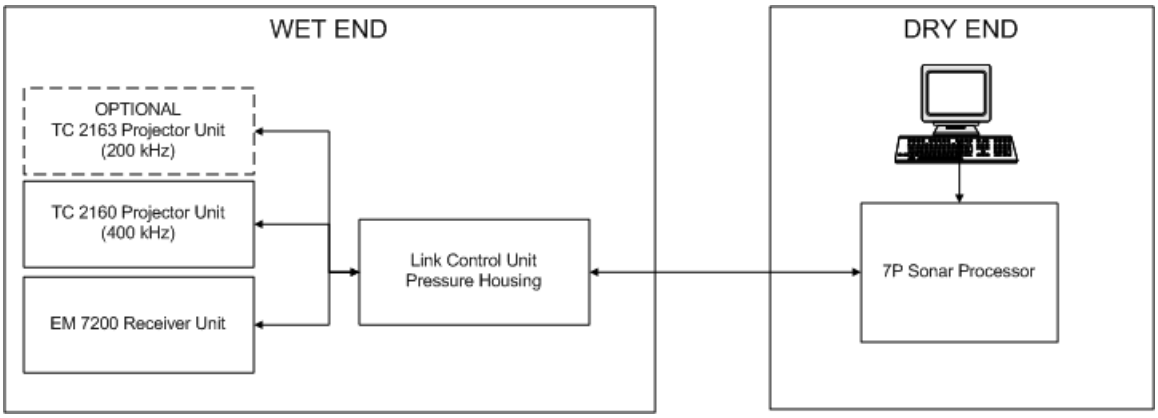
- Side-scan and Snippets are now output by the 7kCenter. There are waterfall type displays in the User Interface that are provided for simple QC purposes in this release. There are no slant range corrections or normalizations applied in this release.

2 SYSTEM COMPONENTS

2.01 System Component Summary

The SeaBat 7125 produces bathymetry data suitable for the generation of high-resolution hydrographic charts that exceed international standards.

A single transmission from the Projector Unit illuminates a 128º swath on the sea floor. The seabed return signal is received by the Receiver Unit,



2.02 Technical Specification Overview

Parameters	Baseline System	200 kHz Option
Sonar Operating Frequency	400 kHz	200 kHz
Across-Track Beam Width	Transmit: >128° Receive: 0.5° (center)	Transmit: >128° Receive: 1° (center)
Along-Track Beam Width	Transmit: 1° Receive: 27°	Transmit: 2° Receive: 27°
Number of Across-Track Beams	256 beams, spaced 0.4688° apart	128 beams, spaced 0.4688° apart
Swath Coverage	128°	128°
Depth (typical)	1 - 200 meters	1 - 500 meters

Parameters	Baseline System	200 kHz Option
Ping Rate	Up to 48 pings per second	Up to 48 pings per second
Pulse Length	10 to 300 µsec	10 to 300 µsec
Duty Cycle	5%	5%
Depth Resolution	5 mm	5 mm

2.03 7-P Sonar Processor Unit

The 7-P Sonar Processor is a high-performance sonar processing unit that manages data flow and signal processing using a state-of-the-art FPGA processing architecture. This highly integrated design offers reliability, maintainability, and high performance in a small size.

The 7-P Sonar Processor offers a highly flexible platform that supports a number of disparate functions, including highly accurate time stamping, storage of interfaced sensors, and optional beam data storage on a large, external RAID array, in addition to more standard functions such as user displays and control interface.

The 7-P is housed inside a 19", 5U high rack-mounted chassis and receives data from the Receiver Unit via the LCU. The Sonar Processor performs initial signal processing and beam forming before presenting data or exporting it to an external system.

By using a common data transfer protocol, the 7-P is capable of connecting to any combination of SeaBat series Projector Unit, Receiver Unit and LCU, and can easily be upgraded or modified.

The SeaBat 7-P Sonar Processor:

- Receives digitized sonar data from the LCU.
- Receives operational settings either directly through the user interface, or remotely from an external system.
- Provides beam forming and initial processing of acoustical data.
- Controls, formats and outputs data to external systems. This can include making beam formed data and pre-processed 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 beam forming can be conducted correctly.

CAUTION: The 7-P Sonar Processor was 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 7-P Sonar Processor is done at the customer's own risk. In the event that software is installed on the 7-P Sonar Processor Unit by a non-RESON authorized technician, RESON accepts no responsibility for any consequences that may arise in connection with the installation.

2.03.01 7-P Sonar Processor Technical Specifications

The following table provides information as to the technical specifications of the Sonar Processor:

Specification	Value
Power Requirements	115 to 230 VAC, 50 / 60 Hz, 200 W Maximum
Video Output	S-VGA, DVI, 1024x768 @ 72 Hz Refresh Rate
Data Communication	Gigabit Ethernet

Specification	Value
Graphics Colors	True Color (32 Bit)
Input Device(s)	Trackball, Mouse, Keyboard, Remote Commands
Mounting	19 Inch Rack
Dimensions	Height: 220.8 mm Width: 482.2 mm (with mounting ears) Depth: 629.9 mm (with handles)
Weight	30 kg
Temperature	Operating: 0° to +40° C Storage: -30° to +55° C

2.04 7-L Link Control Unit

The Link Control Unit (LCU) provides the bi-directional high-speed data link between the Projector / Receiver Units and the 7-P Sonar Processor Unit. Full bandwidth digital data from the Receiver Unit is formatted and transmitted to the Sonar Processor, while operator commands are received from the Sonar Processor and distributed for implementation. The LCU also manages power distribution, Built-In Test and monitoring functions.

The LCU is installed inside a cylindrical pressure housing that has electrical connectors mounted on one of the end caps. One connector is provided for each

of the Projector and Receiver Units, and one is provided for communications and power. The Projector Unit to LCU cable and the Receiver Unit to LCU Cable are each up to 3 meters in length.

The cable between the LCU and the Sonar Processor is 25 meters in length. Choice of cable type depends on the quantity of data required and the length of the link. Longer cable runs will require conversion to an optical signal running over a single-mode fiber.

In a standard installation, LCU receives 48 VDC power from the SPU, then provides the required DC voltages for the Projector and Receiver Units. In an ROV, towed body, or AUV installation, power will be supplied by the vehicle.

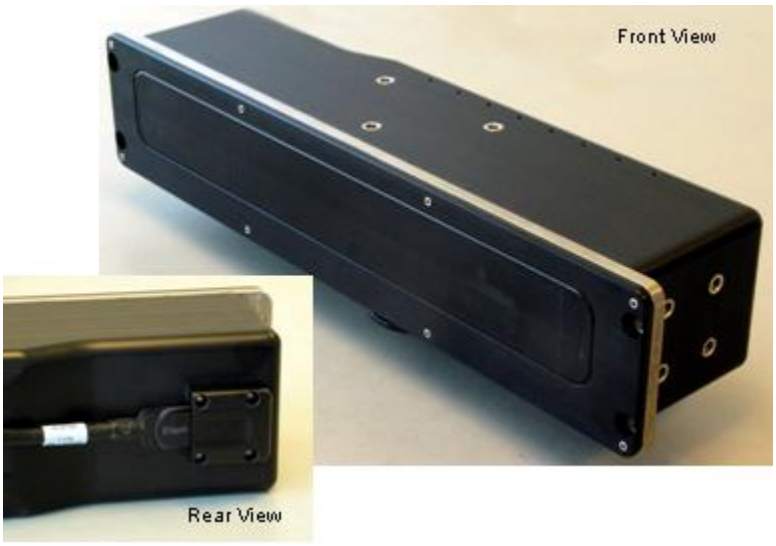
2.04.01 LCU Technical Specifications

CAUTION: The LCU Pressure Housing is nitrogen-filled and sealed. DO NOT OPEN the pressure housing unless specifically directed to do so by a RESON representative.

Specification	Value	
Material	Aluminum or Titanium	
Power	Average: 60 W Peak: 250 W, 50 ms typical duration each ping cycle	
Depth Rating	400 meters (Aluminum) or 6000 meters (Titanium)	
Housing Dimensions	Length: 530.9 mm Diameter: 174 mm	
Weight	<u>Aluminum</u> Air: 15.7 kg Water: 5.2 kg	<u>Titanium</u> Air 24.8 kg Water: 13.3 kg
Temperature	Operating: -5° to +40° C Storage: -30° to +70° C	

2.05 EM 7200 Receiver Unit

The Receiver Unit receives acoustic signals from the water, digitizes them, and sends the digitized signals to the LCU via a separate cable.



The unit is constructed using a Grade 2 Titanium lid on which the receive ceramics are mounted, protected by a Polyurethane acoustic window. The system is depth rated to 400 meters with an optional 6000 meter depth rating.

2.05.01 EM 7200 Technical Specifications

The following table provides information as to the technical specifications of the EM 7200 Receiver Unit:

Specification	Value
Material	Titanium (Grade 2) and Polyurethane
Dimensions	Height: 102 mm Width: 496 mm Depth: 131 mm
Weight	Air: 9.6 ±1.0 kg Seawater: 4.6 ±1.0 kg
Depth Rating	400 m (Optional 6000 m version available)

Specification	Value
Temperature	Operation: -2° to 35° C Storage: -30° to 70° C

2.06 TC 2160 Projector Unit

The TC 2160 Bathymetry Projector Unit produces a narrow beam that is 1° along-track by 128° across-track. The entire 128° sector is illuminated in one transmission, with the maximum ping rate of 48 Hz providing 100% bottom coverage even at high vessel speed.

The ping rate is set based on range selection, and can be modified by the operator through the user interface. The system is depth rated to 400 meters, with an optional 6000 meter depth rating.

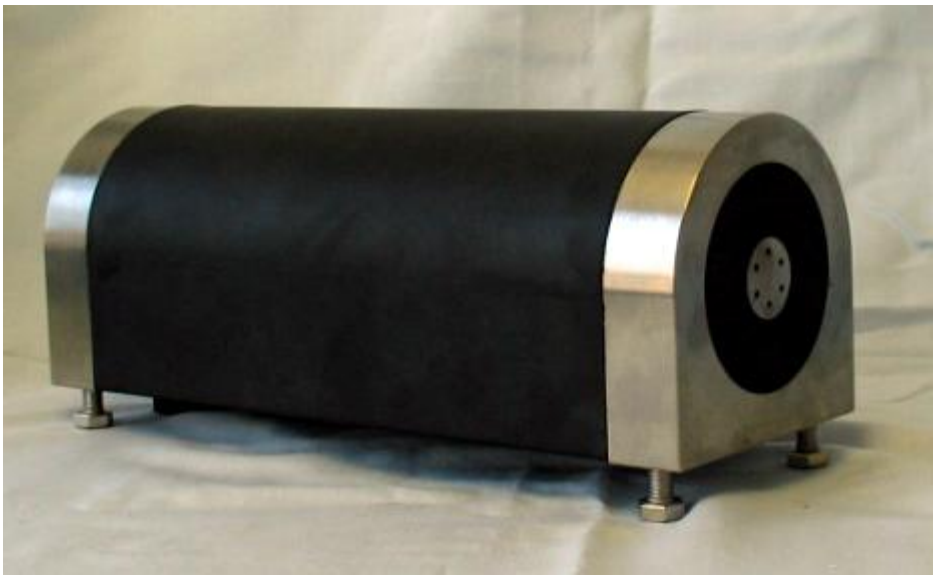
2.06.01 TC 2160 Technical Specifications

Specification	Value
Material	Titanium (Grade 2) and Polyurethane
Dimensions	Height: 77 mm Width: 62 mm Depth: 285 mm
Weight	Air: 2.75 kg Seawater: 1.75 kg
Depth Rating	400 m (Optional 6000 m version available)

Specification	Value
Temperature	Operation: -5° to 40° C Storage: -30° to 70° C

2.07 TC 2163 Projector Unit (Optional)

The TC 2163 Bathymetry Projector Unit produces a narrow beam that is 2° along-track by 128° across-track. The entire 128° sector is illuminated in one transmission, with the maximum ping rate of 48 Hz providing 100% bottom coverage even at high vessel speed.



The ping rate is set based on range selection, and can be modified by the operator through the user interface. The system is depth rated to 400 meters, with an optional 6000 meter depth rating.

2.07.01 TC 2163 Technical Specifications

Specification	Value
Material	Titanium (Grade 2) and Polyurethane
Dimensions	Height: 117 mm Width: 100 mm Depth: 259 mm

Specification	Value
Weight	Air: 7.5 kg Seawater: 6.4 kg
Depth Rating	400 m (Optional 6000 m version available)
Temperature	Operation: -5° to 40° C Storage: -30° to 70° C

2.08 Fiber Optic Link (Optional)

The LCU may communicate with the 7-P Sonar Processor Unit via a dedicated, customer-provided, single mode fiber. The TC3300 Media Converter will be used to convert the twisted pair from the Link Control Unit to fiber optic cable. The fiber converter will be housed within a customer-provided pressure housing.

TC3300S 10/100/1000Base-T Fiber Optic Converter (one-fiber version shown)

The TC3300 utilizes one dedicated, single-mode fiber to handle bidirectional network traffic over distances of up to 70 kilometers.

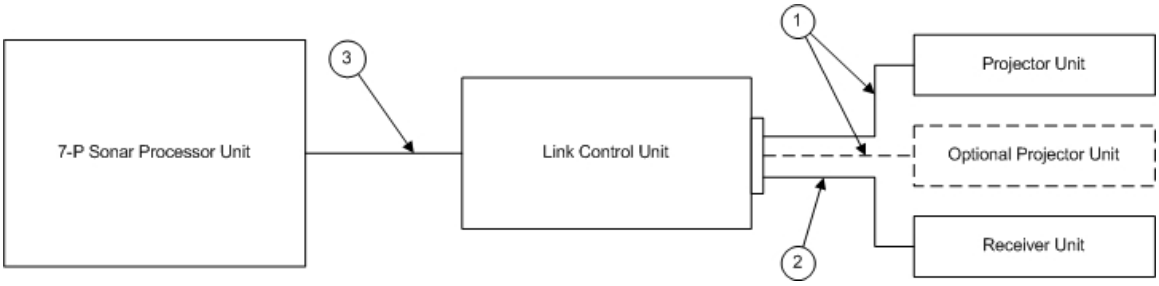
Specification	Value
Ethernet data rates supported	10, 100, 1000 megabits/second
Base-T Connector	RJ-45
Optical Fiber Connectors	SC
Power Requirements	Wet End: 48 V Dry End: 48 V (Supplied by SPU)
Measurements	Height: 3.53 cm Width: 18.14 cm Depth: 16.57 cm

A second TC3300 is installed topside to convert from Fiber to Twisted Pairs.

2.09 Cables

Three different types of cables are provided to connect the SeaBat 7125 system components.

- **Projector to LCU :** Shown at position 1 on the diagram below, this cable allows power and data to be passed between the Projector and LCU. This cable has a standard length of 3 meters and a minimum bend radius of 91 mm. (One cable of this type is provided for each Projector Unit.)
- **Receiver to LCU:** Shown at position 2 on the diagram below, this cable allows power and data to be passed between the Receiver and LCU. This cable has a standard length of 3 meters and a minimum bend radius of 91 mm.
- **LCU to Sonar Processor Unit:** Shown at position 3 on the diagram below, this cable allows power and data to be passed between the LCU and the Sonar Processor Unit. This cable has a minimum bend radius of 182 mm.



2.10 Available Configurations

2.10.01 Overview

The SeaBat 7125 is available in different configurations – a combination of single frequency or dual frequency, depth rating, and receiver setup. These configurations are summarized below:

System	Frequency	Depth Rating	ReceiverSetup
7125-A	400 kHz	400 m	Single Head
7125-B	200 / 400 kHz	400 m	Single Head
7125-C	400 kHz	6000 m	Single Head
7125-D	200 / 400 kHz	6000 m	Single Head

System	Frequency	Depth Rating	ReceiverSetup
7125-E	200 kHz	400 m	Single Head
7125-F	200 kHz	6000 m	Single Head
7125-G	400 kHz	400 m	Dual Head
7125-H	400 kHz	6000 m	Dual Head
7125-I	200 / 400 kHz	400 m	Dual Head
7125-J	200 / 400 kHz	6000 m	Dual Head
7125-K	200 kHz	400 m	Dual Head
7125-L	200 kHz	6000 m	Dual Head

2.10.02 Dual Frequency Operation Configuration

The EM 7200 Receiver Unit is capable of operating at either 400 kHz (standard) or 200 kHz. The addition of a second projector, operating at 200 kHz, allows the system to operate as a dual-frequency system, providing optimum functionality of long range (up to 500 m) with the 200 kHz element and high resolution with the 400 kHz element.

2.10.03 Increased Depth Rating Configuration

The standard depth rating for the SeaBat 7125 is 400 meters, however customers who required a deeper rating can order the system rated to 6000 meters. A Titanium LCU Pressure Housing, rated to 6000 m (630 bar), is used instead of the aluminum version. The dimensions of the two Pressure Housings are identical.

2.10.04 Maximum Swath or Maximum Resolution Configuration

The SeaBat 7125 can be set up in one of three ways: Standard (Single Head), Maximum Swath (Dual Head), or Maximum Resolution (Dual Head). This allows for the option to add a second Sonar Head Assembly either to increase overall swath coverage or to increase the overall maximum resolution.

3 SAFETY PRECAUTIONS

3.01 Operator Safety

The **SeaBat 7125** 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 power on.
- **DO NOT** attempt to open and service the Projector or Receiver Units.
- **DO NOT** attempt to open and service the LCU or Sonar Processor Unit unless you have been specially trained and certified by RESON.
- **DO NOT** operate the system while divers are in the water and closer than 2 meters from the Projector and Receiver Units. High powered ultrasonic energy can be hazardous to human physiology.
- **DO NOT** touch or handle any internal printed circuit boards without specific instructions from RESON.

3.02 Equipment Safety

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

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 adequate packaging and shock-absorbing materials to ship or store any equipment outside the supplied transit cases.
- Do not drop the equipment.
- Do not place the Sonar Head in an area where the face may be scratched or damaged.
- 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.

- While operating in air, set your SeaBat™ system to the lowest possible setting. A higher setting may damage the transmit array ceramics.
- To prevent overheating, do not operate the SeaBat™ system with the Link Control Unit or Sonar Head Assembly out of water for more than 30 minutes at LOW power.

3.03 Electrical Isolation

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

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

3.04 Exposure to Sunlight

Do not allow the Sonar Head to sit in direct sunlight when not in use. In addition to furthering corrosive effects, continued exposure to UV rays will damage the polyurethane array face.

4 INSTALLATION INSTRUCTIONS

4.01 Installation Checklist

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

- Install the Dry End Components
  - 7-P Sonar Processor
  - Monitor, Keyboard, Mouse
- Install the Wet End Components
  - Transducer Arrays
  - Link Control Unit
- Install and Connect Cables
  - Projector to LCU Cable(s)
  - Receiver to LCU Cable(s)
  - LCU to Sonar Processor Cable
  - Auxiliary Sensor Cables
  - Monitor, Keyboard, and Mouse Connections
  - Sonar Processor Power Cable
- Power Up the System
- Test the System
- Configure the SeaBat Software

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

4.02 Dry End Installation

4.02.01 Installing the Sonar Processor

The Sonar Processor may be either rack- or table-mounted. It must be in an area that is not exposed to the weather, but is within easy reach of both the operator workstation connections, the optional topside TC3300 unit, and the Sonar Processor to LCU Interconnect Cable. Allow clearance around the unit to provide adequate air circulation and easy access to the power switch.

Once the Sonar Processor is installed, the only interaction required should be to depress the power switch and energize the system.

NOTE: Although RESON does not provide slides or rails for rack mount arrangements, mounting holes have been provided on the chassis for this purpose. For rack installation, follow the instructions provided by the manufacturer of your particular rack.

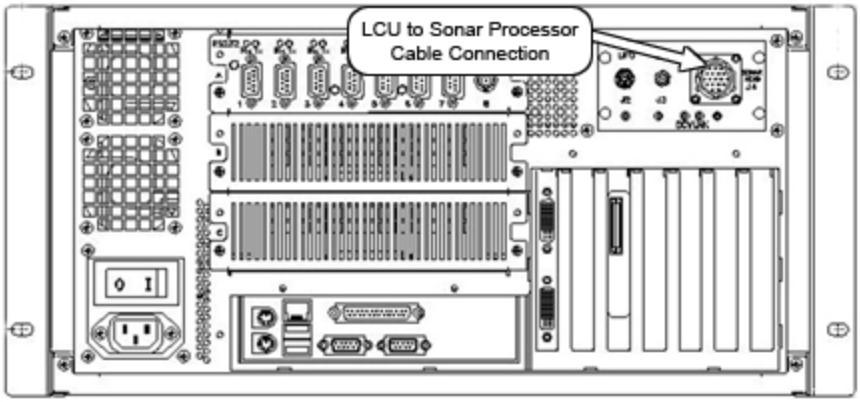
4.02.02 Dry End Cable Connections

Most of the cable connections on the dry end are made directly into the rear panel of the 7-P Sonar Processor Unit.

4.02.02.01 Sonar Connections

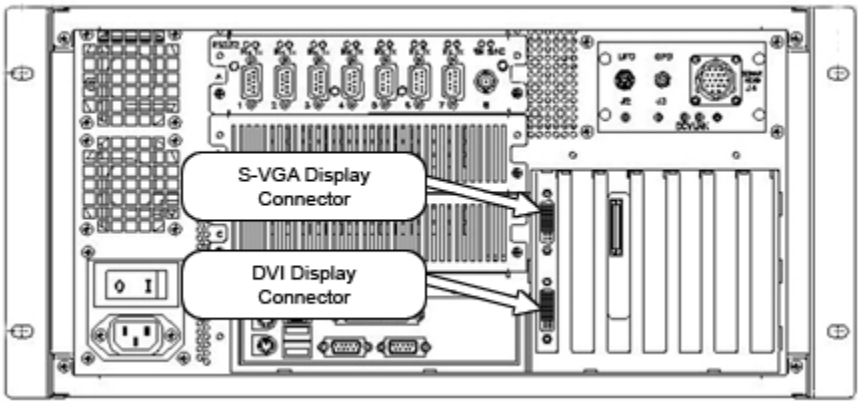
The Wet End portion of the system connects to the SPU via the LCU to Sonar Processor Unit Cable. This cable is usually 25 meters in length and must be routed from the LCU to the rear of the Sonar Processor. Make sure not to exceed the minimum bend radius, as this cable will cease to function if it is damaged.

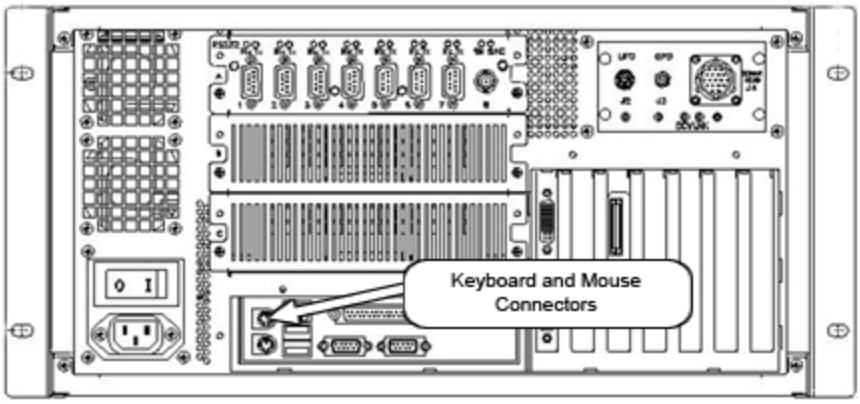
The LCU to Sonar Processor Unit Cable should be attached to the connector in the upper right hand corner of the rear panel, as shown below.



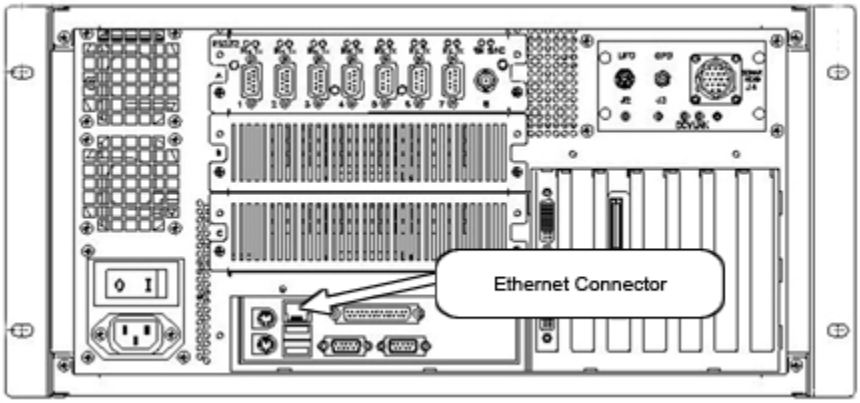
4.02.02.02 Monitor, Keyboard and Mouse

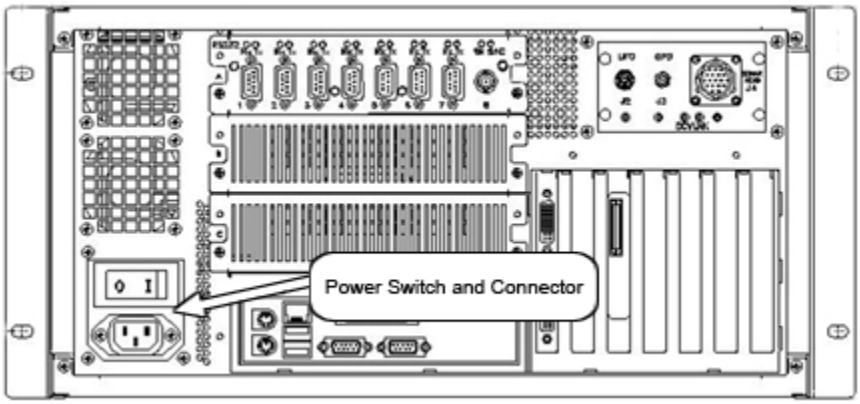
The monitor, keyboard, and mouse are installed at the appropriate ports on the rear panel of the 7-P Sonar Processor Unit.





4.02.02.03 Power and Network Connections





4.03 Wet End Installation

4.03.01 Wet End Mounting

Mounting may be over the side, over the bow, or through a moon pool. The Sonar Head Assembly should be immersed in water to a depth of at least 0.8 m to ensure that noise from the surface (waves) and turbulence generated by the mounting structure do not degrade performance. The depth should also be sufficient to avoid shadows from the keel, hull, or other obstacles.

Take care that the Sonar Head Assembly is electrically isolated from the structure to avoid corrosion problems.

NOTE: The Sonar Head is not designed to be hydrodynamic, and at speeds in excess of two knots, vibration and oscillation will become evident if the mounting pole is not strong enough. To minimize the unsupported length, place a support as close to the waterline as possible. Fairings can also be used to improve hydrodynamic performance.

4.03.02 Link Control Unit Installation

The LCU should be mounted in a convenient location within easy reach of the Projector to LCU and Receiver to LCU cables. The Pressure Housing may be secured using straps.

4.03.03 EM 7200 Receiver Unit Installation

The mounting flange on the front of the EM 7200 Receiver Unit is designed to accommodate four M8 machine screws in a rectangular hole pattern.

4.03.04 TC 2160 Projector Unit Installation

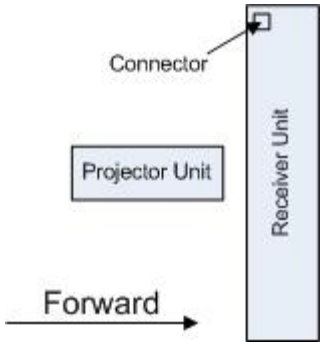
The TC 2160 Projector Unit mounts to the vehicle or mounting plate using four M10 machine screws of appropriate length, arranged in a rectangular hole pattern.

4.03.05 TC 2163 Projector Unit Installation

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

4.03.06 SeaBat 7125 Transducer Orientation

The Sonar Head Assembly should be mounted with the faces of the arrays oriented vertically downwards. In the ideal configuration, the Receive Array will be mounted across-track, while the Transmit Array will be mounted along track and aft of the Receive Array.



If necessary, the projector may be oriented forward or the head rotated away from vertical, however allowances must be made in the processor setup. In addition, an alternate mounting makes the head more susceptible to impact damage and collection of trailing debris.

The Receiver Unit and Projector Unit(s) should be within ±250 mm of each other in all three planes. The Projector Unit should be aligned perpendicular to the Receiver Unit (within ±0.5º).

CAUTION: To ensure proper beam forming, the Receiver Unit must be mounted with the connector oriented to the Port (left) side of the vessel or vehicle on which it has been installed.

4.03.07 Wet End Cable Connections

The cable connections from the Receiver Unit and Projector Unit(s) to the LCU should be made prior to immersing the unit in water. A light coating of grease on the connector face will ensure sealing.

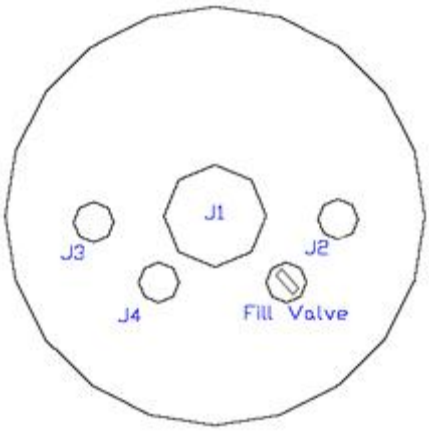
Ensure that cables are securely fastened and that strain relief is provided to prevent cable damage. Maximum cable length between the Sonar Head Assembly and the LCU bottle is 3m.

Take care to avoid impact to the Projector Unit and Receiver Unit faces, as damage could degrade system performance.

4.03.07.01 Link Control Unit Connections

The Projector to LCU, Receiver to LCU, and LCU to Sonar Processor Unit cables all have connection points on a single end cap of the Link Control Unit. Connections MUST be made as follows:

- **Connector J1:** LCU to Sonar Processor Unit Cable
- **Connector J2:** Receiver Unit to LCU Cable
- **Connector J3:** Projector Unit to LCU Cable (Standard Projector)
- **Connector J4:** Projector Unit to LCU Cable (Optional Projector)



WARNING: Use a minimum bend radius of 91 mm or a minimum bend diameter of 182 mm when positioning the cables. These cables are very stiff, and a smaller bend radius will result in damage to the cable.

4.04 Setting Up the System

4.04.01 System Checkout Procedure

Once the SeaBat 7125 has been installed, follow these steps to ensure that the system is working properly.

- Ensure that all system cable connections are mated properly.
- Verify that mains power is available.
- Energize the monitor.
- Ensure that the power switch at the rear of the Sonar Processor is in the "On" position.
- Energize the system.
    - Open the Sonar Processor front panel.
    - Press the "On / Reset" switch **UP** towards the "On" position.
- Start the sonar by clicking the "SeaBat" icon on the 7-P operator desktop.
- Verify that the "Power" setting on the "Settings" tab is "Off".
- Once the system has been energized, perform the following checks to verify that the system is operating correctly:
    - Set the Range to 150.
    - Set Gain to 20.
    - Select "Blue-Yellow" from the Palette drop-down menu on the Primary Display Settings tab.
    - 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.
    - Gradually increase the Power setting on the "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. DO NOT exceed the 187 dB Power setting.
    - While listening to the clicks, slowly decrease the Range setting one step at a time. The tick rate should increase as the scale decreases.

5 DATA PRODUCTS

5.01 Bathymetry Data

The SeaBat 7125 generates up to 256 equally spaced bathymetry soundings per ping (at 400 kHz) and broadcasts from the 7-P Sonar Processor 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.)

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.

5.02 Snippets Data

Snippets data is available from the SeaBat 7125 which consists of a range windowed number of samples containing both amplitude and phase information (if selected). 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, the beam number, and depth.

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

5.03 Side-Scan Data

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

5.03.01 Side-scan Imagery Data

Side-scan forms an image of the sea floor 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 are 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.

Side-scan data is output as an array of amplitude values which represent the amplitudes for each sample cell in the beam from a single ping.

Side-scan cannot be used to accurately measure true depths, but it can provide a more detailed picture of the sea floor. 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.

5.03.02 Technical Specifications

Specification	Value
Swath Width	128º
Range Resolution	2.5 cm
Along-Track Beam Width	1.0º
Output Format	7k Center Record

5.03.03 Technical Details

The Bathymetry and Side-scan data are independent both in the beam forming process and in how the output data is used.

5.03.04 Side-Scan Beam Forming

The beam forming process combines one half of the bathymetry beams into two Side-scan beams. The process combines adjacent pairs of beams by averaging, then combining the averages by selecting the brightest points from the averaged beams. The combination process uses peak detect determination and yields a less “noisy” output.

5.03.05 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. At a 100 meter setting, using a 1,500 meter per second sound velocity, the packet will have approximately 4600 values per Side-scan beam.

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.

6 SYSTEM STARTUP AND SHUTDOWN

6.01 System Startup Instructions

Once the SeaBat 7125 hardware has been installed, the system may be started. To do this, press the power buttons on both the Sonar Processor and Color Monitor.

CAUTION: When using the power switch at the front of the 7-P Sonar Processor, it is important to note that the switch is a "toggle." Pressing the top portion of the switch will cause the Sonar Processor to begin its power-up sequence. Pressing the bottom portion of the switch will cause the Sonar Processor to begin its reset process.

DO NOT press the RESET portion of the switch during the start-up or shut-down process, as this will damage the Sonar Processor.

The 7-P Sonar Processor will power up and boot directly into Windows. No user name or password is required for standard systems.

To start the sonar, double-click the appropriate icon. This will be represented by the name of the sonar and the frequency.

NOTE: The above instructions pertain to standard systems released after January 1, 2006. Your system may have different requirements.

6.02 I/O Module Configuration

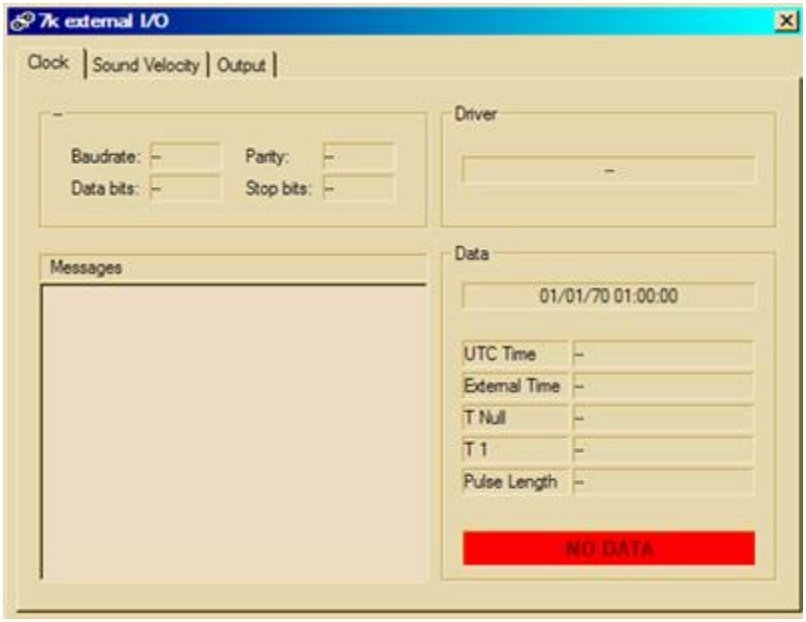
The I/O Module icon appears in the Windows System Tray as an icon.

When you right-click the icon, a menu will appear.

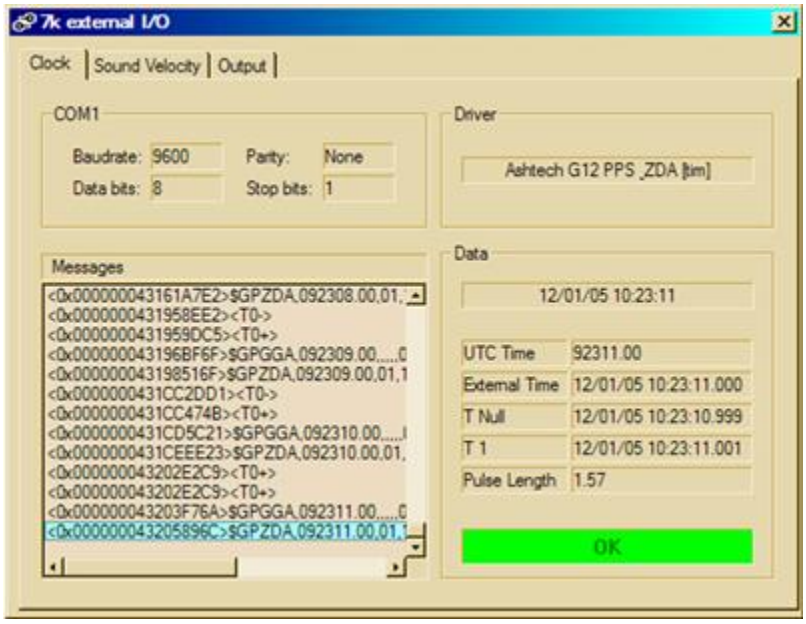
- **Show:** Displays the main window.
- **Hide:** Hides the main window.
- **About:** Displays a dialog with version info.

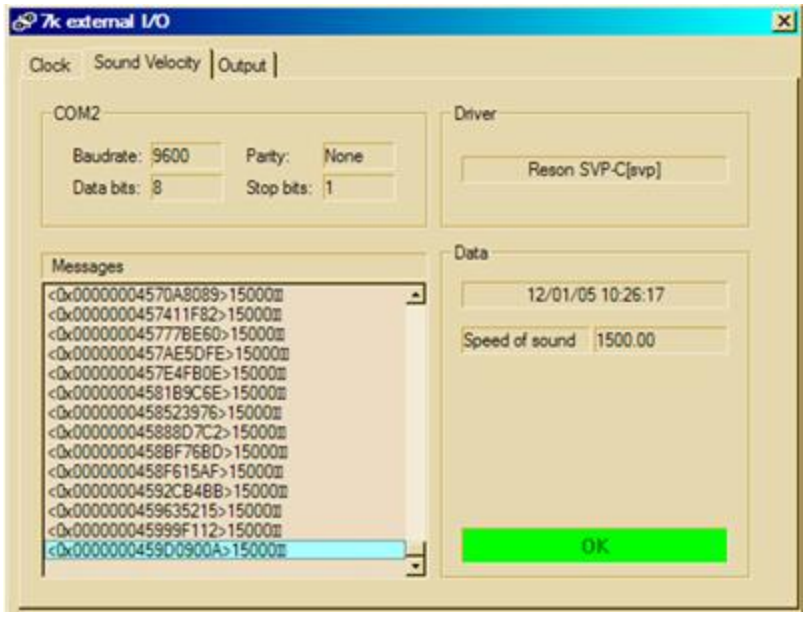
- **Exit:** Stops the I/O Module.

The I/O Module can be monitored on the main window (shown below). This window is a property sheet with one page for each sensor (external clock and sound velocity) and an output page.

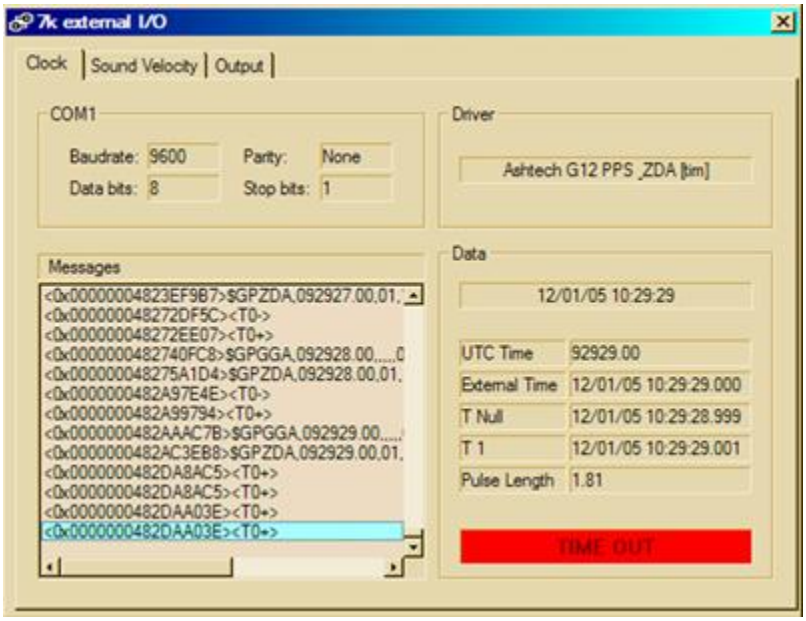


The Clock page and the Sound Velocity page show the port settings, names of the selected driver, raw data messages and decoded values of the incoming data and a status indicator. Once configured by the 7k User Interface and running and receiving data, messages will begin to appear in the "Messages" window.

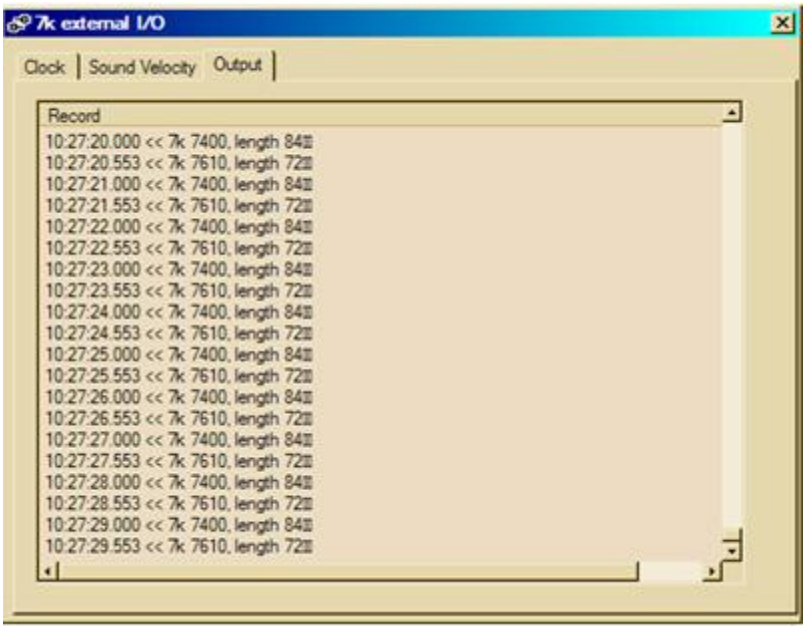




The status indicator shows "OK" in green when the data flow is normal. When a problem occurs in the data flow (for example, when serial cable is disconnected), the status indicator will change to red and will show the new status. When the data flow has been recovered, the status will return to OK again.



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



NOTE: The I/O module pages only monitors its operation. All user input (creating or changing the configuration) is done using the 7k user interface (on the 'I/O Module Setup' page).

The I/O Module automatically saves configuration information and loads the last settings upon restart.

6.03 Dual Frequency Operation

If the dual-frequency configuration option was purchased, the SeaBat 7125 will be capable of operation at a frequency of either 200 kHz or a 400 kHz. This is accomplished by allowing the operator to select from two different icons on the Windows® XP desktop, each icon labeled according to frequency. Double-click the appropriate icon to start the sonar.

To switch between frequencies, close all open screens and the Main Sonar Display window for the current frequency, then double-click the icon for the desired frequency.

NOTE: The SeaBat 7125 is designed to be a true dual-frequency system. Future system updates will include the introduction of a single-point, multiple-frequency interface that will allow selection of operating frequency without the need for system shutdown.

6.04 System Shutdown Instructions

Improper shut down of the 7-P Sonar Processor can result in software issues. To assure that all systems are shut down properly, follow these steps to stop the sonar and power down the 7-P.

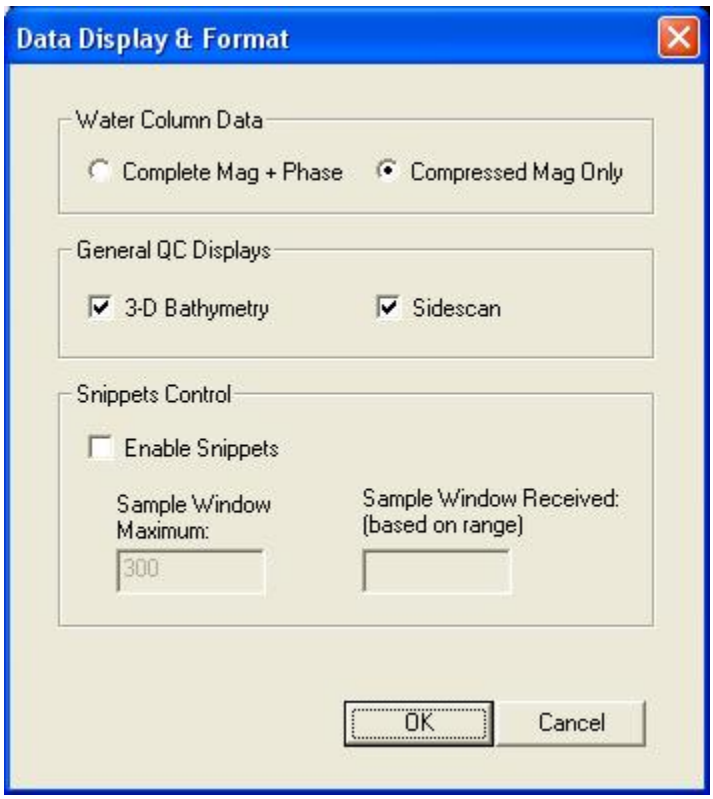
- Close all open screens and the Main Sonar Display window.
- Click the “Start” button and select “Shut Down.”

7 SYSTEM OPERATION

7.01 System Configuration Options

7.01.01 Data Display and Format

This dialog controls the type of 7k records that are generated and displayed. If was purchased, these selections will also determine what data is recorded.



- **Water Column Data:** Use the radio buttons to select either Beamformed or Compressed Image data to be displayed in the Sonar Image.
    - **Complete Mag + Phase:** Magnitude and Phase data are both transmitted to the user interface. This allows for phase data to be analyzed in the A-Scan displays. Because this option increases the CPU usage for the SeaBat, RESON recommends only only using this option when inspecting Phase data. This option is not currently available when Snippets functionality is activated.
    - **Compressed Mag Only:** When this option is enabled, 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

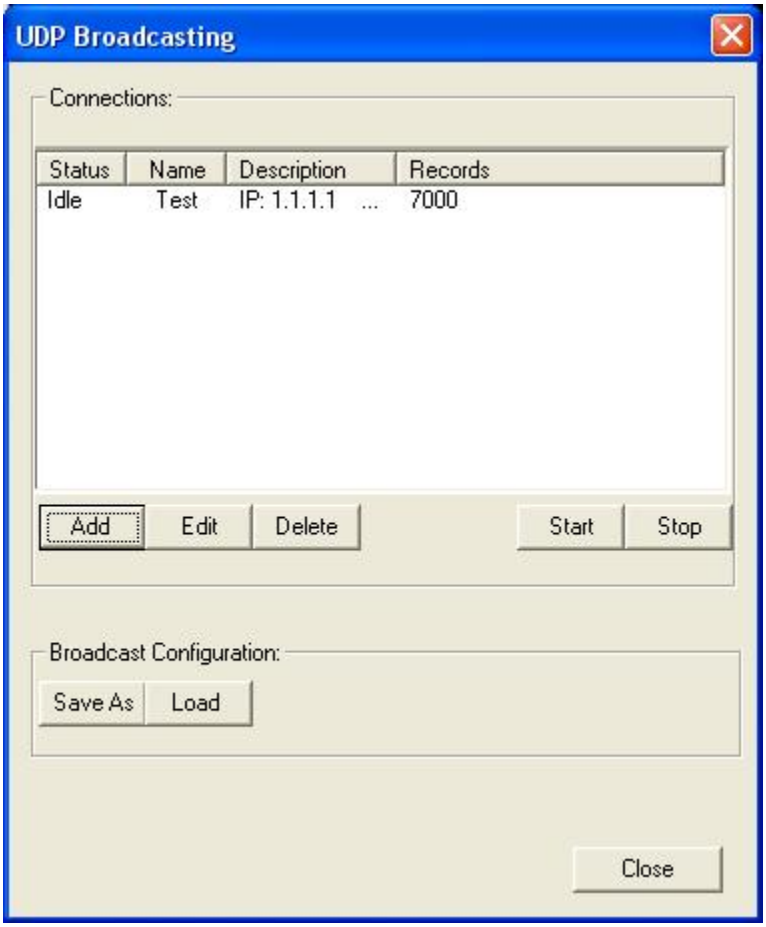
samples are received in the ping, no compression occurs. This feature improves performance of the system, but eliminates the ability to inspect the phase data. When Snippets functionality is activated, this option will automatically be selecte.

- **General QC Displays:** Select additional displays:
  - **Bathymetry Data:** Display the 3-D Bathy tab.
  - **Side-scan:** Display the Side-scan tab.
- **Snippets Control:** When this option is selected, a fixed length snippet is generated. This option will change the Sonar Image to Compressed Image mode.
  - **Sample Window Size:** Determines the size of the Snippet window per beam. For instance, if a value of 300 is selected, a window of 300 samples will be extracted from each beam.
  - **Sample Window Received:** This display informs the user of the actual window sized being used by the SeaBat to generate snippets. Under some circumstances, the number of samples in a ping may be less than the snippet window size. In this case the Snippet window size is automatically adjusted to reflect this.

7.01.02 UDP Broadcasting

The UDP Broadcasting dialog allows the operator to broadcast selected records to a remote IP address and port. From this dialog, you can:

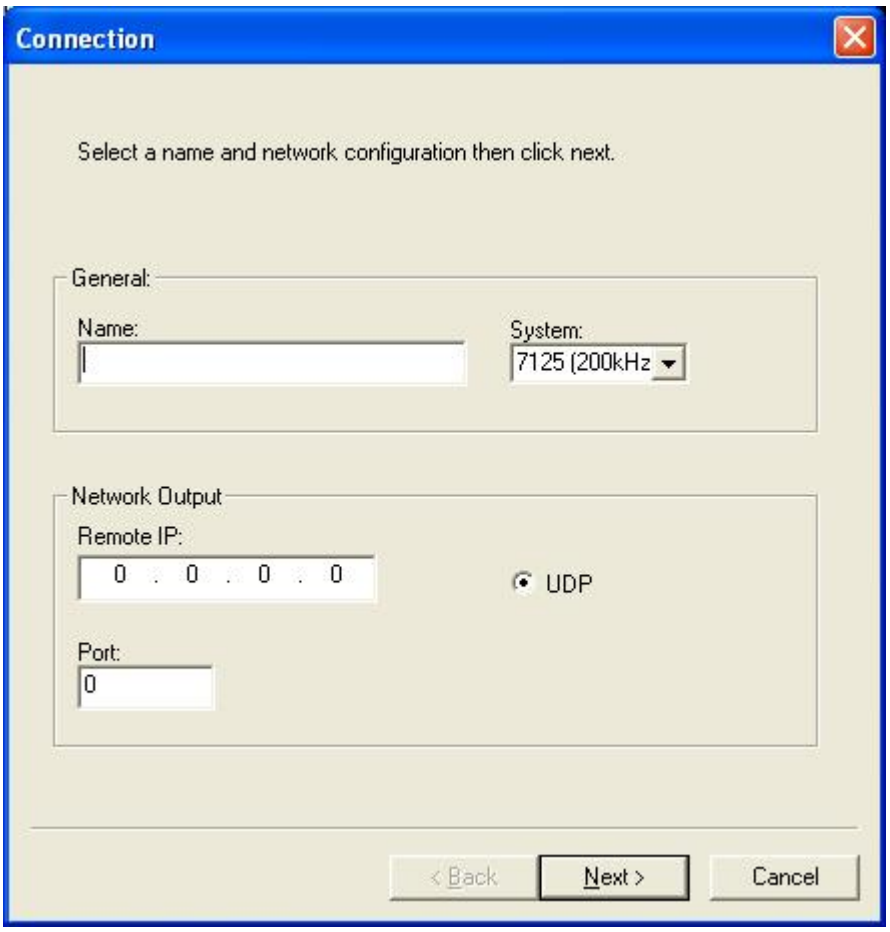
- *Add*, *edit*, or *delete* broadcast addresses.
- *Start or stop* the broadcast process.
- *Save or load* an existing broadcast configuration.



7.01.02.01 Add a New Broadcast

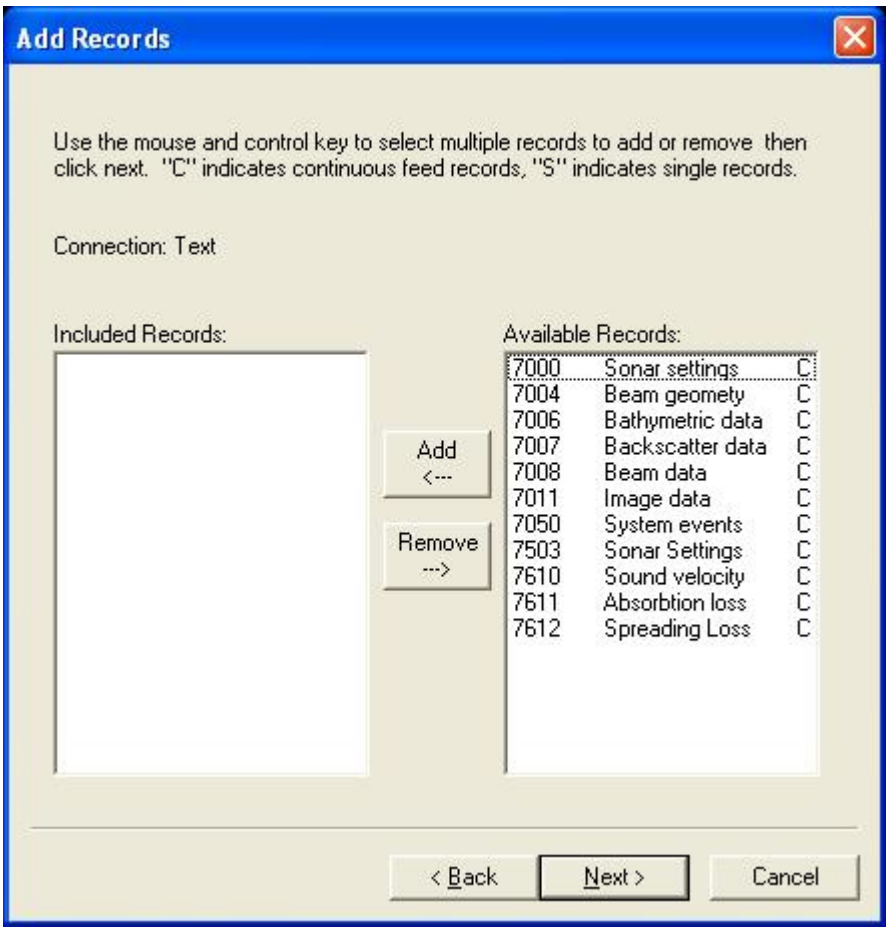
The “Add” button allows the creation of a new broadcast. To create a new broadcast, follow these instructions:

- Click the “Add” button. The Connection dialog will appear.
- In the Connection Dialog:
  - Enter a name for the broadcast in the “Name” field.
  - Enter the IP address of the target computer in the “Remote IP” field.
  - Enter the port number for the target computer (a valid port number is required).
  - Click “Next”.

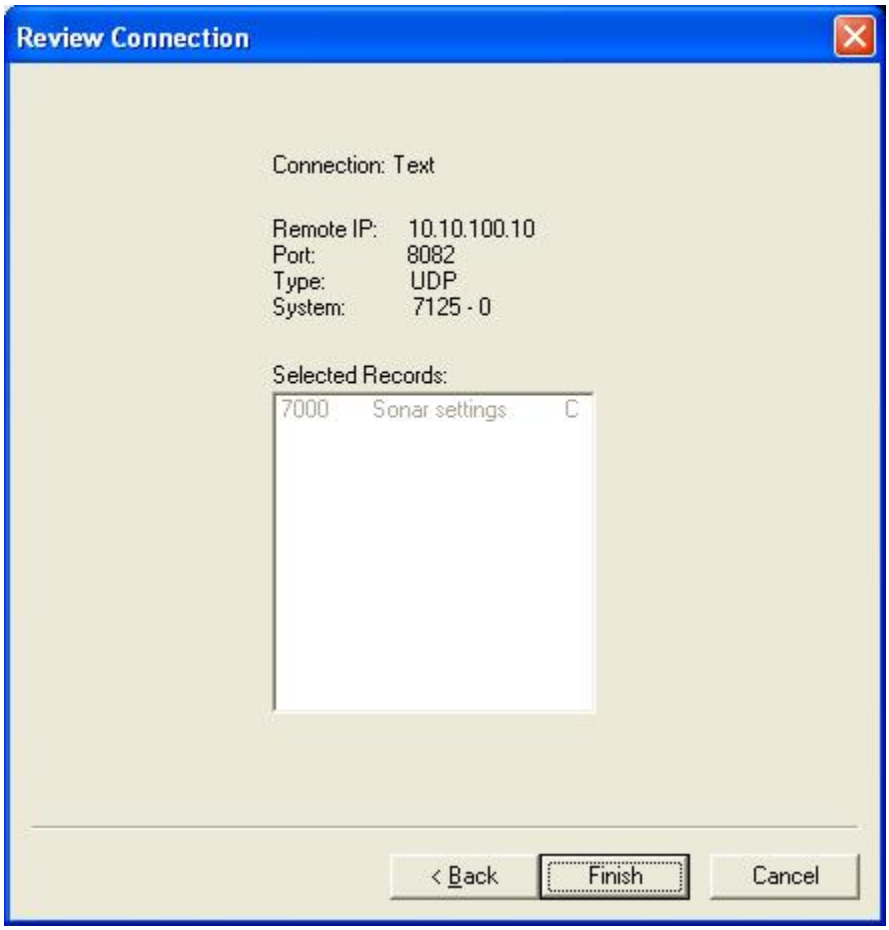


- In the Add Records dialog:
  - Select the records you want included in the broadcast by clicking on the record in the “Available Records” window. Hold down the “Ctrl” key when selecting records if you wish to select more than one record at a time.
  - Click the “Add” button to add the selected record(s) to the broadcast. Successfully added records will appear in the “Included Records” window.
  - Once you have selected all the records required for your broadcast, click “Next.”

NOTE: Refer to the 7k Data Format Definition for information regarding the records you require.



- When the Review Connection dialog appears, review the information you entered to make sure it is correct.
    - If you wish to make changes, click the “Back” button to move back through the previous windows.
    - If you are satisfied that this is the connection you wish to create, click “Finish” to complete the process.
    - If you decide not to create a broadcast at this time, click “Cancel” to terminate the process without creating the new broadcast.



7.01.02.02 Edit an Existing Broadcast

To edit an existing broadcast, select the broadcast you wish to edit (in the Connection window) and click the “Edit” button, then follow the same instructions shown above.

7.01.02.03 Delete a Broadcast

To delete an existing broadcast, select the broadcast you wish to delete 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.

7.01.02.04 Start or Stop the Broadcast Process

To start a broadcast or stop an active broadcast, select the broadcast you would like to start or stop and click the button that corresponds with the action you wish to take. The status will change to “Active” if the system is broadcasting messages to that address, or “Idle” if the system is not broadcasting messages to that address.

NOTE: If the sonar has been stopped and restarted, it is necessary to restart all broadcast connections.

7.01.02.05 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 wish to save a particular configuration for later use or load a different (previously saved) configuration instead of setting it up manually.

To save a configuration:

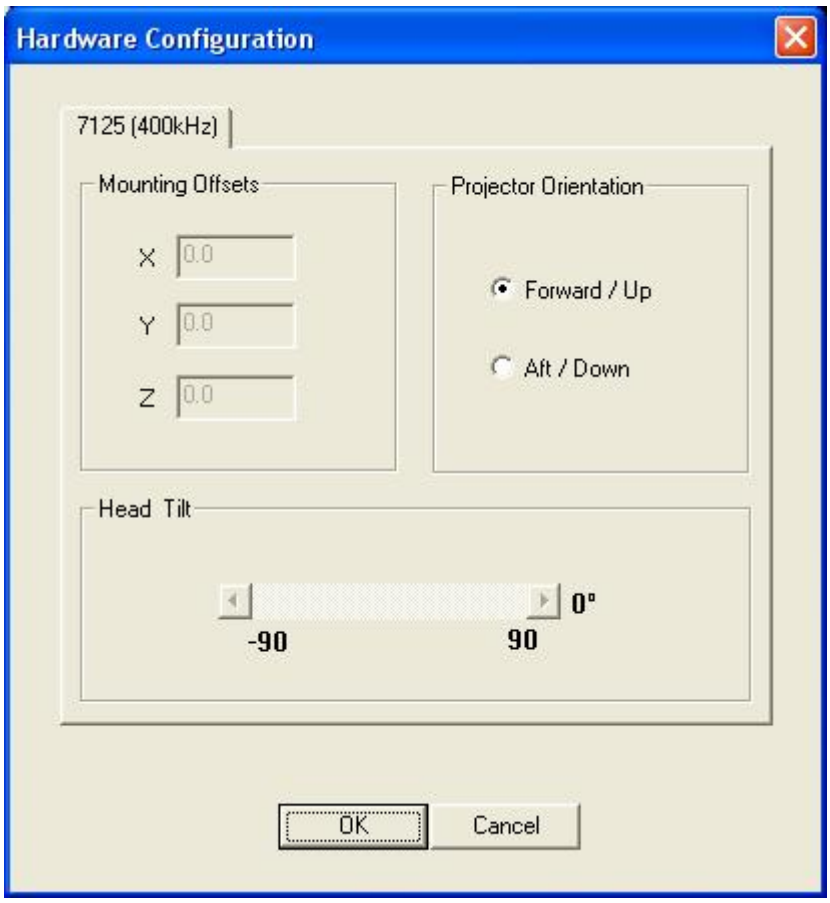
- Make sure the configuration is set up correctly.
- Click the “Save” button.
- Enter a file name and choose the location to which you want this file saved. The file extension is automatically set to (*.bcg)
- Click the “Save” button.

To load an existing configuration:

- Click the “Load” button.
- A warning box will appear, reminding you that the new configuration file will completely overwrite the current configuration. Click “OK” if you wish to continue.
- Browse to the correct location and select the .bcg file you wish to load.
- Click “Open.”

7.01.03 Hardware Configuration

This 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 need to be modified unless the physical installation changes.



- **Head Tilt:** This feature is not currently enabled.
- **Offset:** This feature is not currently enabled.
- **Projector Orientation:** Allows the user to reverse the sonar image in the user interface if necessary.

7.01.04 Dual Head Configuration

When set up in a maximum swath or maximum resolution configuration (configuration options G through L), two complete sonar systems are used, with one Sonar Processor acting as a “slave” to the other.

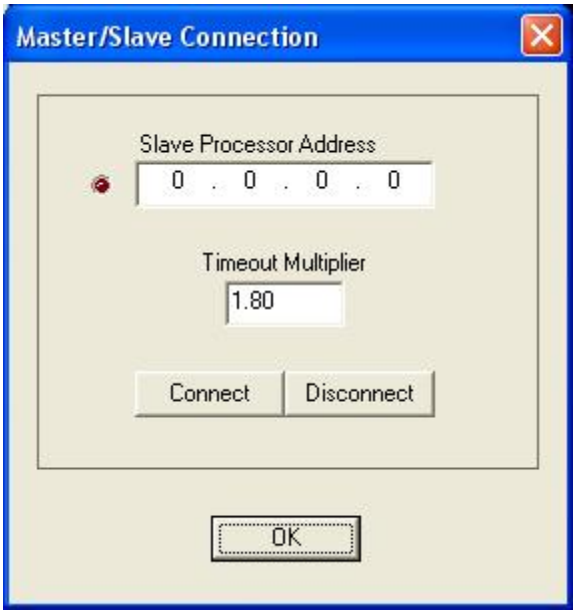
The “master” processor is the sole interface for the operator, with all entered settings being instantly relayed to the secondary (or “slave”) processor. The “Master” processor also dictates the ping sequence between the two sonar head assemblies in order to minimize feedback between the two systems.

- **Slave Processor Address:** To configure a slave processor, first access the SeaBat User Interface on the master processor and select “Dual Head” from

the “Configuration” menu. In the “Master/Slave Connection” dialog, enter the IP address of the slave processor and click the “Connect” button.

If the entered IP address is valid, and the processor is able to establish a connection, the indicator beside the IP address field will turn green. If the connection is not valid, the indicator will turn red.

- **Timeout Multiplier:** To increase the delay between pings, increase this number.



7.01.05 Save Current

This dialog allows you to save the current sonar settings to a file, to be loaded later in matching environments. Configuration files of this type are saved with the file extension *.cfg.

7.01.06 Load

This dialog allows you 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.

7.02 Understanding the Sonar Image

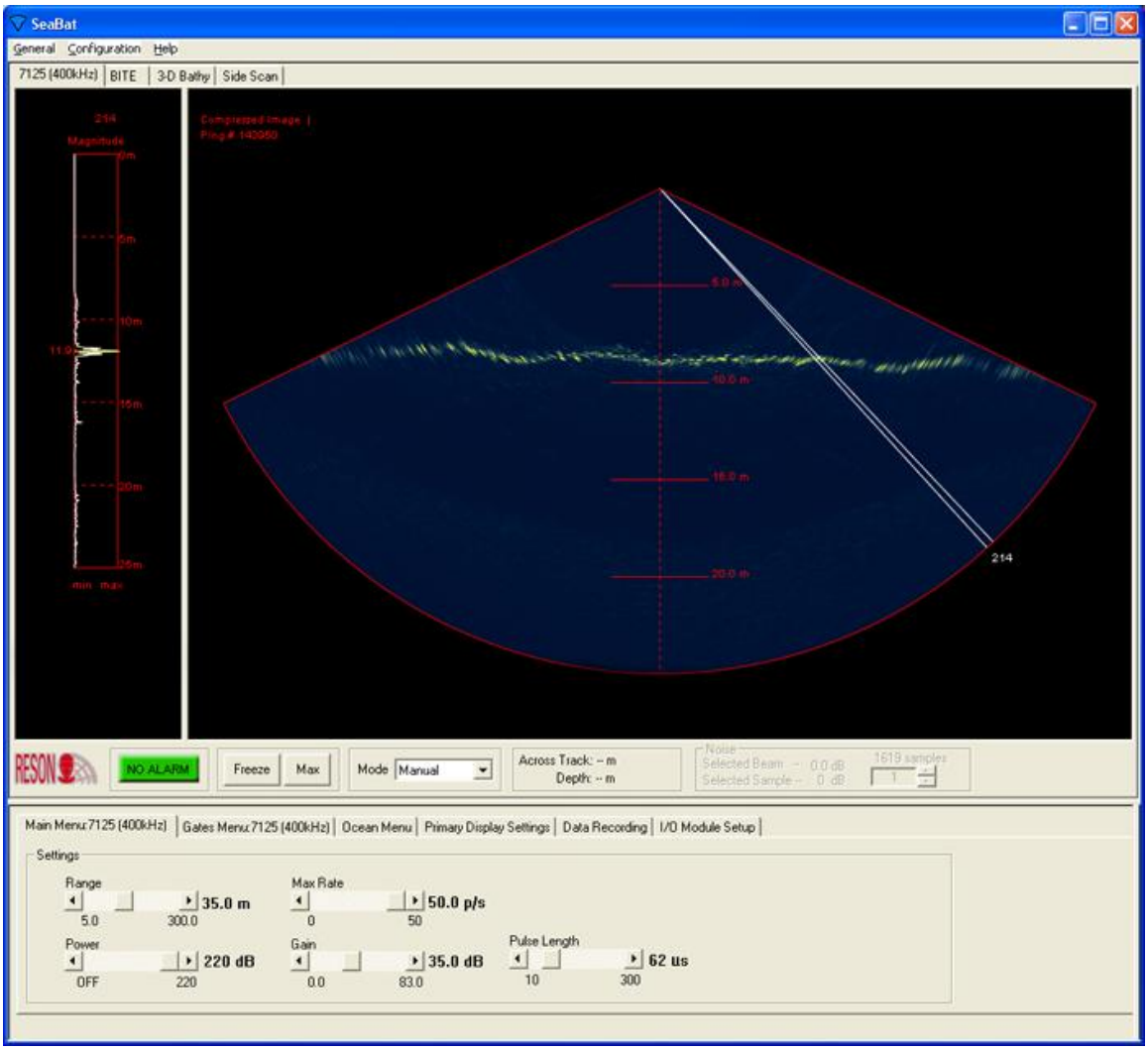
7.02.01 View the Main Sonar Page

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 displays available to the user - The uppermost tabs are for data display while the lower tabs are for sonar controls.

The image in the center of the main display screen is called the Sonar Image. This image shows the complete sector illuminated by a single transmitted ping and can be represented in either “Sonar Wedge” mode or in B-Scan mode.

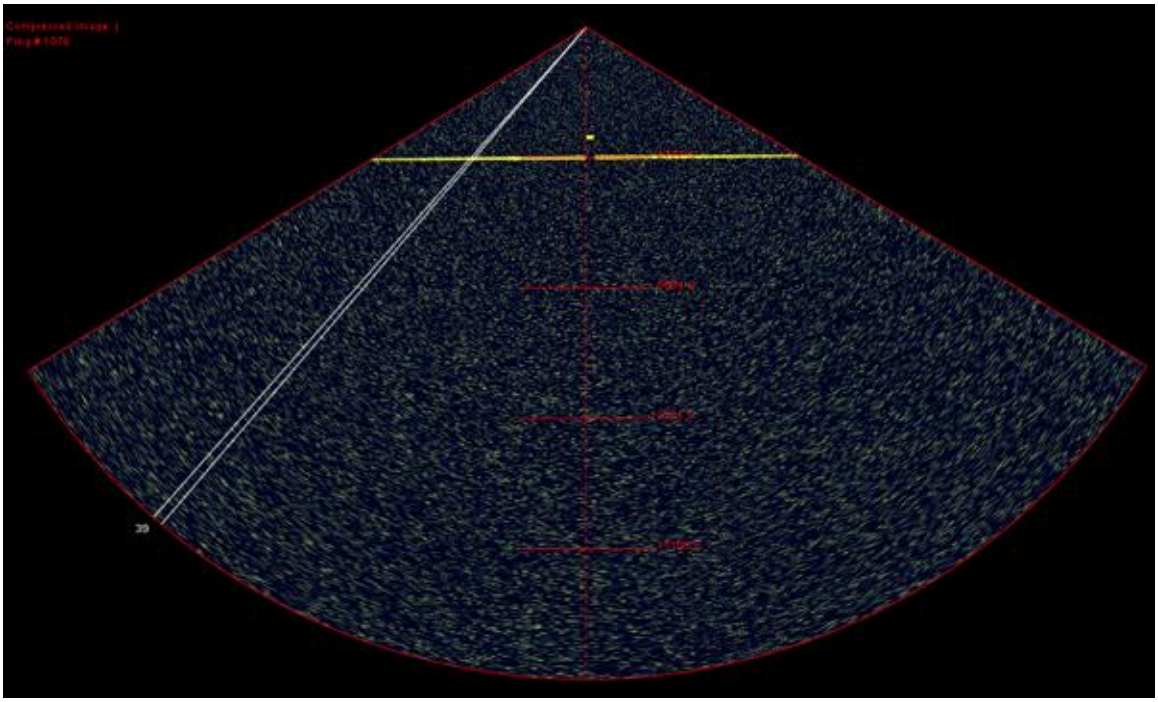
Current information is shown in upper left corner of the Sonar Image frame. The following information is displayed:

- **Data Source:** Whether the display is a Beamformed or Compressed Image.
- **Spinner:** Rotates one quarter turn per ping.
- **Ping Number:** The accumulated number of pings since the system was powered up.



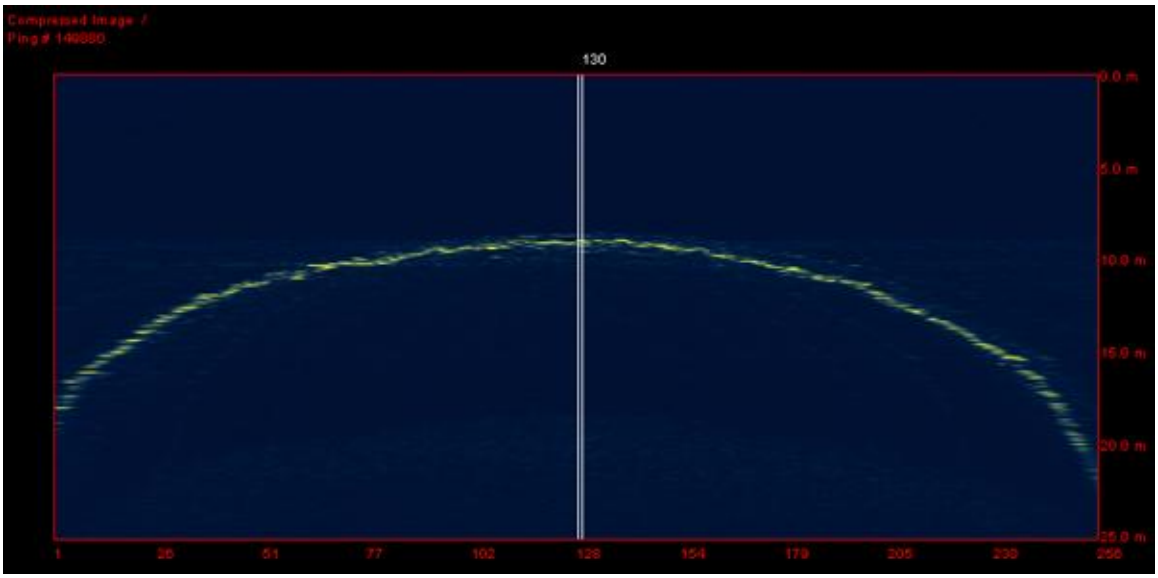
7.02.02 Wedge Display

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



7.02.03 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 section of the Primary Display Settings tab.



7.02.04 A-Scan Display

On the left side of the Main Sonar Display, beside the 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 menu on the Primary Display Settings tab.

- ***Single Beam Magnitude:*** Shows the selected beam's range versus magnitude.
- **Single Beam Magnitude and Phase:** Shows the selected beam's range versus magnitude and phase.
- ***Multiple Beam:*** Shows the range versus magnitude of the selected beam and three beams on either side of the selected beam.
- ***Single Beam Magnitude with Zoom:*** Shows the selected beam's range versus magnitude with a zoom control for detailed inspection.
- **Single Beam Phase with Zoom:** Shows the selected beam's range versus phase with a zoom control for detailed inspection.

Place the pointer over the A-Scan display panel and press the right mouse button to switch between the available displays.

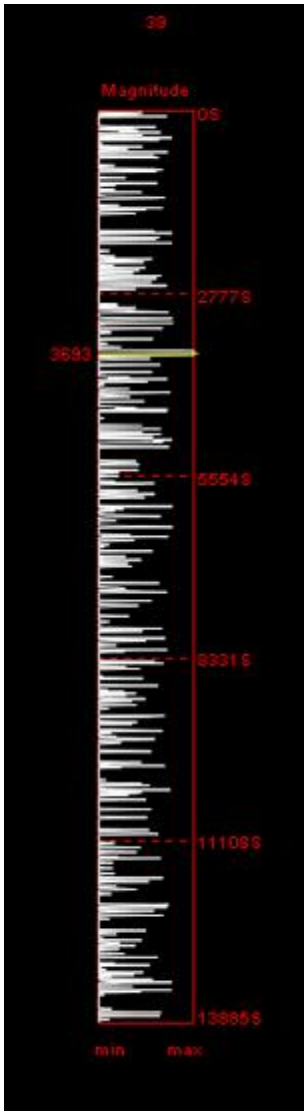
NOTE: Not all displays may be available, depending on the type of data being received.

7.02.04.01 Using the Zoom Feature

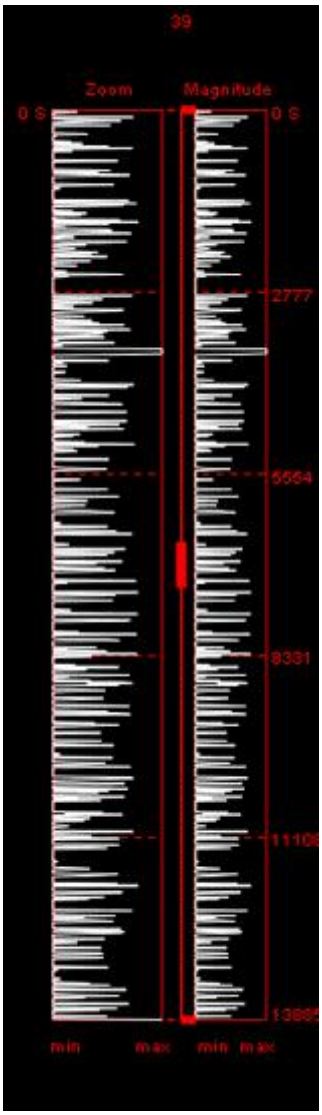
Both the "Magnitude with Zoom" and the "Phase with Zoom" A-Scan displays have a zoom feature. Three mouse controls are available to the user for controlling the zoom: Upper Window, Lower Window, and Window Slider. The mouse controls are located in between the two plots. They appear as three red rectangles 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.

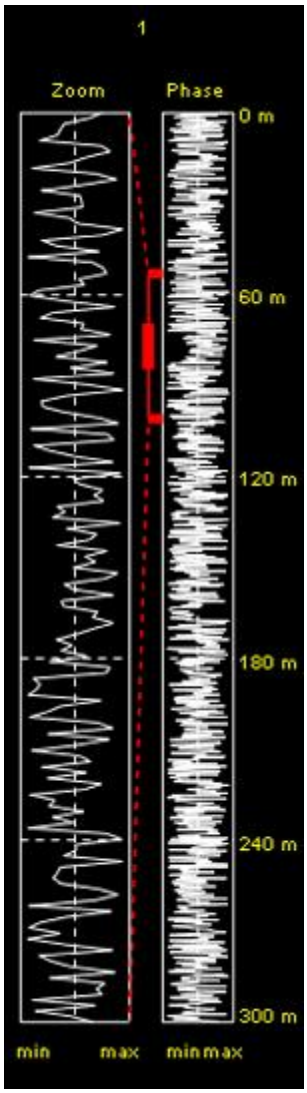
Single Beam Magnitude



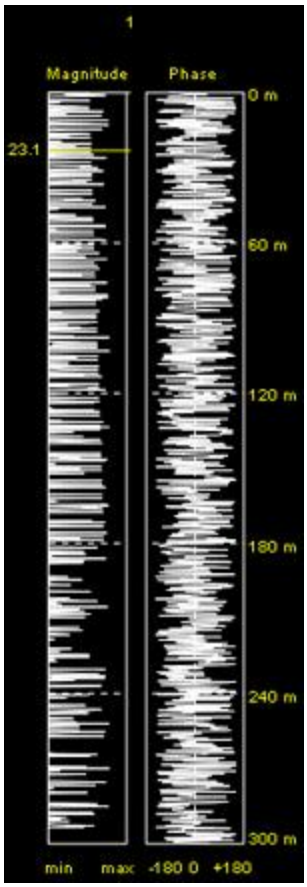
Single Beam Magnitude with Zoom



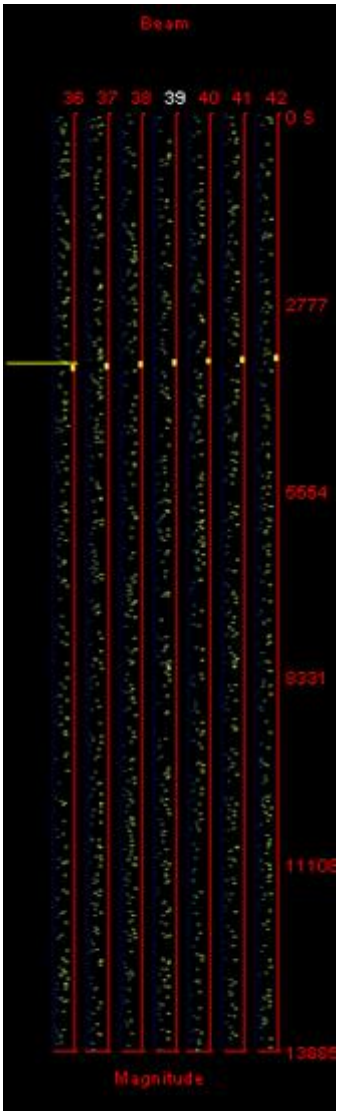
Single Beam Phase with Zoom



Single Beam Magnitude with Phase



Multiple Beam Display



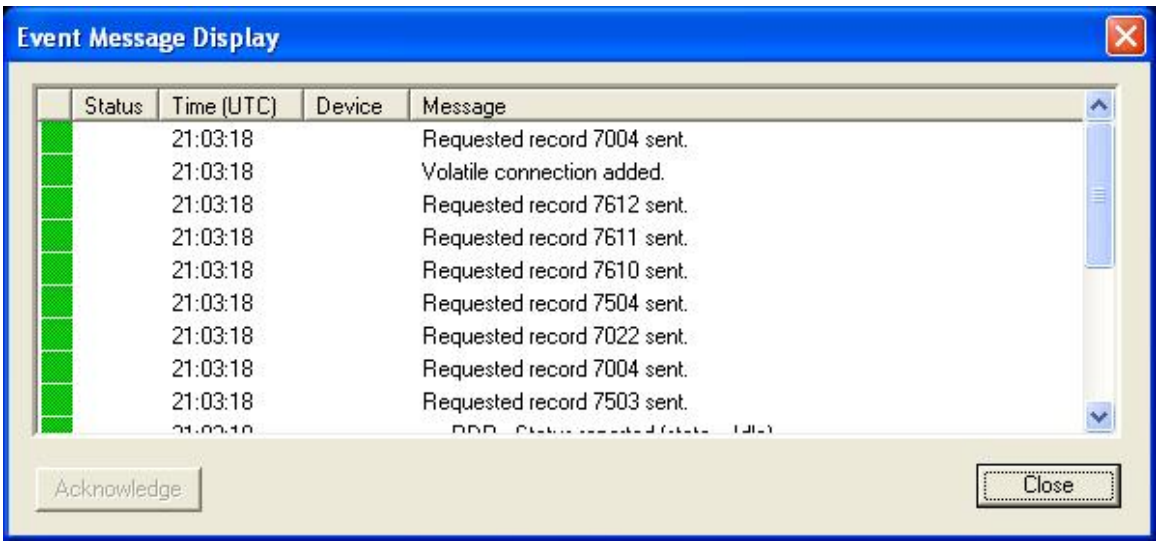
7.02.05 Event Messages

The Alarm indicator appears during normal operation as a green button on the Main Sonar Page that is labeled "No Alarm." This button will change based on the status of the SeaBat system.

The Alarm indicator will be one of three levels - indicated by colors:

- **Green:** Normal Operation. The system is functioning normally, or all alarms have been acknowledged.
- **Yellow:** Caution. 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.

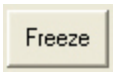


The "Acknowledge" button in the lower left corner of the dialog allows the operator to select an alarm and change the status to "Acknowledged." This is an informational change only. It does not have any effect on the function of the sonar itself.

When the status of all Caution or Alarm messages have been changed to "Acknowledged," the Alarm button on the main sonar page will return to green.

7.02.06 Freeze the Sonar Image

Selecting “Freeze” prevents the image on the Main Sonar Page from being updated while all other sonar functions continue. This allows prolonged viewing of a particular item when the display is frozen. Select “Resume” to allow updates to continue.



7.02.07 Maximize the Sonar Image

Selecting “Max” hides the settings tabs and enlarges the Sonar Image to fit the entire SeaBat window. This allows close inspection of data. Select “Min” to return the image to normal size and display the settings tabs.

7.02.08 Change Modes

The Mode pull-down allows the operator to select whether to view the current data being collected or to view a playback of a previously collected file.

To select the desired mode, click the pull-down menu with the mouse and select one of the following options:

- **Manual:** View data being collected now.
- **Playback:** View a previously collected data file.

Selecting “Playback” mode will add the “Playback” tab to the settings portion of the interface.

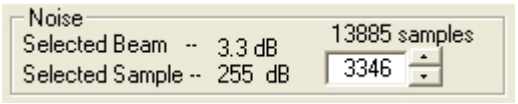
7.02.09 Identify Beam Track and Depth

Beside the Modes menu are displayed the Beam Track and Depth readings for a particular point on the Sonar Image. Readings are in meters and degrees.

These numbers will change as the mouse pointer passes over the Sonar Data Image, indicating the pointer’s current position on the image.

7.02.10 Noise

The Noise display allows the operator to determine the amount of ambient noise present in a particular beam or sample.



To identify the amount of ambient noise in a beam or sample, first turn the Power setting to the “Off” position. This will cause the sonar to stop transmitting sound into the water, but it will continue to receive information.

Once the power is off, select the beam you wish to evaluate by clicking anywhere on the Sonar Image or by entering a particular beam number in the Primary Display Settings tab. The “Selected Beam” information will immediately be updated with the average ambient noise for all samples in that beam.

To evaluate a particular sample within the selected beam, enter the sample number in the “Samples” box on the Noise display, or click the “Up” or “Down” arrows to cycle through the samples in order. When a sample is selected, the “Selected Sample” information will immediately be updated with the actual ambient noise present in that sample.

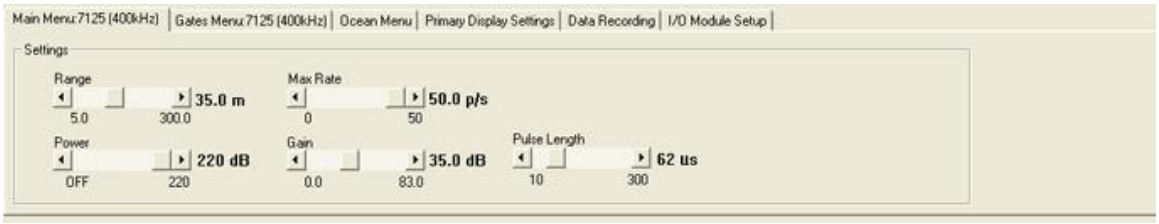
All ambient noise level readings are provided in dB.

NOTE: The Noise display ONLY functions when the sonar is operating in “Beamformed Data” mode. To change the mode, see 8.1.1 Data Display and Format.

7.03 Changing the Sonar Settings

7.03.01 Sonar Settings (Main Menu)

The "Main Menu " tab is the control point for the Projector and Receiver Units.



7.03.01.01 Set the Range (Range)

The “Range” setting determines how far the SeaBat 7125 will “see”. The range settings are operator selected. There are multiple settings, from 5 to 200 meters (500 meters for 200 kHz operation) in discrete increments.

7.03.01.02 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 220, each accounting for an increase of approximately 1dB.

7.03.01.03 Set the Maximum Ping Rate (Max 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 wishes to eliminate redundant data; or when the vessel is in a high-reverb environment where echoes of the previous ping are contaminating the current ping.

The "Max Rate" setting allows the operator to limit the number of pings per second (p/s), making it lower than the standard ping rate for that range setting. The ping range available is from OFF to 50 p/s, in increments of 1.

NOTE: If Max Rate is set to "Off", the system will not ping or receive data. If Max Rate is set higher than the sonar's *actual* maximum ping rate, the sonar will ping at it's *actual* maximum ping rate.

7.03.01.04 Set the Gain (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 settings available for "Gain" are 0 dB to 83 dB in 1 dB increments.

NOTE: The SeaBat 7125 system utilizes Time Varied Gain (TVG) by applying a variable gain to the signal, based upon the following formula:

$$\textbf{Receiver Gain} = 2\,\alpha\, R_{km} + Sp \log R_m + G$$

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

7.03.01.05 Set the Pulse Length (Pulse Length)

The "Pulse Length" setting allows the operator to change the Pulse Length of the transmitted signal. The Pulse Lengths available are from 10 µs to 300 µs in increments of approximately 10 µs.

NOTE: For a given power setting, a narrower Pulse Length will provide a higher resolution at a shorter range. A wider Pulse Length will provide maximum range with lower resolution image results. For most applications 50 to 60 µs is an adequate setting for 400 kHz operation, while 80 µs is adequate for 200 kHz operation.

7.03.02 Applying Gates

The "Gates Menu" allows the operator to apply range and/or depth filters (Depth Gates) to the bottom-detect process to aid in noise reduction and to correct for a tilted Sonar Head.

7.03.02.01 Gate Control Switch

There are three choices for Gate functions:

- **Absolute**
- **Adaptive**
- **No Gates:** Gate functionality is turned off.

7.03.02.02 Absolute Gate Parameters

When Absolute gating is selected, the gate ranges or depths are entered in this section. Either Range or Depth gates may be entered. Select the "Enable" checkbox for the type of gate desired.

- **Range:** Applies 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 (Depth Gates) will be used in the bottom detection process. Use of a motion sensor is required to maintain constant depths during the ship’s normal pitch and roll action.

Click the “Update” button to finalize changes.

7.03.02.03 Adaptive Gate Parameters

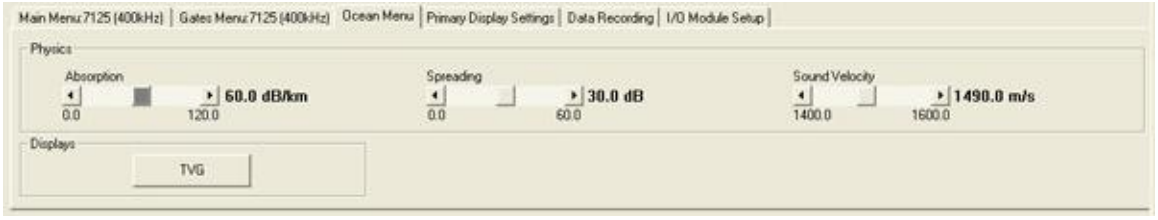
The Adaptive gating option "tracks" the bottom based on a window size and search criteria from beam to beam within a ping.

- **Min Depth / Max Depth:** The upper and lower gate values will never these stated minimums and maximums.
- **Enable Nadir Search Gate:** The minimum and maximum nadir depth gates are used to refine the initial search for the strongest bottom return, usually from the nadir beam. This initial search gate can be enabled or disabled.
- **Adaptive Window Size:** This is a percentage 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 also can introduce noise. Decreasing this window size too much will degrade performance when the bottom is not flat.

Click the “Update” button to finalize changes.

7.03.03 Ocean Settings

The Ocean menu allows for the entry of various correction factors to compensate for changing environmental conditions.



7.03.03.01 Change the Absorption Loss Value (Absorb)

This selection allows the operator to enter the amount of loss expected through the ambient water medium. The range available is from 0 to 120 dB/km. If the exact value is not known, a value of 110 dB/km for salt water and 70 dB/km for fresh water is recommended for 400 kHz operation, and a value of 50 dB/km for salt water and 20 dB/km for fresh water is recommended for 200 kHz operation.

This value is used in conjunction with the Spreading Loss Coefficient to compute the TVG curve as described in 8.12.2 Change the Spreading Loss Coefficient (Spread).

7.03.03.02 Change the Spreading Loss Coefficient (Spread)

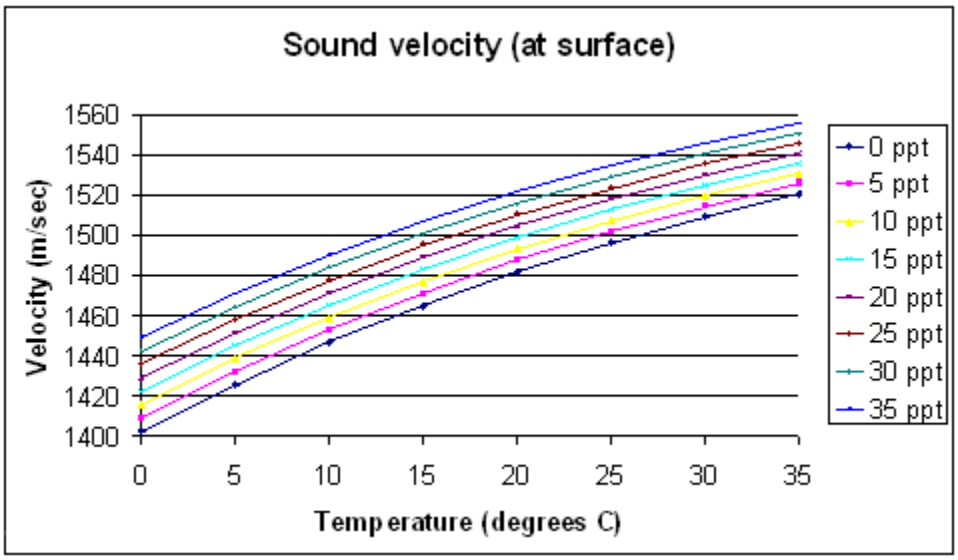
This selection allows the operator to enter the amount of cylindrical and spherical Spreading Loss that is expected through the ambient water medium. The range available is from 0 to 60, with a recommended initial value of 30.

This coefficient value is used in conjunction with the Absorption Loss value to compute the TVG curve applied to the returned signal.

7.03.03.03 Set the Sound Velocity (Sound Velocity)

The “Sound Velocity” item allows for entry of 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 1600 m/sec. If the local sound velocity is not known, RESON recommends a value of 1480 to 1500 m/sec for open sea areas and 1425 m/sec for fresh water. See Figure 35 as a general reference for typical surface sound velocity at different temperatures and salinity.



NOTE:

If a Sound Velocity Probe is interfaced to the Sonar Processor, the “Velocity” value will be controlled by the probe and may not be changed by the operator.

7.03.03.04 TVG Button

Click this button to see a visual representation of the TVG curve for the current settings.

7.03.04 Primary Display Settings

The Primary Display Settings tab allows the operator to customize some of the visual attributes of the Sonar Image.

In this tab, you can change the following settings:

- **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:** Show the Bathymetry points or Filter lines in the wedge display.
- **Bathy Point Color:** Change the color of the bathymetry points in the Wedge Display or display the color-coded bottom detection method or quality 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
        - **Yellow:** AUX
        - **Red:** Phase and AUX blend
    - **Quality:** Uses a two part test for Brightness and Colinearity as in the 8K systems. The dots are color coded as follows:
        - **Red:** Poor Brightness and Poor Colinearity
        - **Orange:** Good Brightness and Poor Colinearity
        - **Yellow:** Poor Brightness and Good Colinearity
        - **Green:** Good Brightness and Good Colinearity
- **Filter Line Color:** Change the color of the filter lines in the Wedge Display.
- **Palette:** Change the color scheme applied to the Main Sonar Display.

- **Line Color:** Change the color of the frames and gridlines in the Main Sonar Display and the A-Scan Display.
- **Text Color:** Change the color of the text in the Main Sonar Display and the A-Scan Display.
- **Display Format:** Switch the Main Sonar Display between Wedge and B-Scan (Beam) modes.
- **Label Format:** Change the labels in both displays to reflect units of range (in meters), time (in seconds) or samples.
- **Grid Lines:** Activate or de-activate grid lines on the Main Sonar Display. The choices are:
    - **All:** Shows the frame around the sonar image, as well as units of measure down the center of the image.
    - **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 down the center of the image. Show the frame around the selected beam.
- **Selected Beam:** Shows the number of the currently selected beam. The beam selection can be changed either by entering a beam number or by clicking the arrow buttons to cycle through the beams.

7.03.05 I/O Module Settings

The I/O Module Setup is the primary means of configuring data flow into the SeaBat from RS-232 devices attached to the system (such as SVP and GPS). Configuration is done through this interface which sets up the I/O Module installed on the 7-P. The data acquired by the I/O module is routed to the SeaBat in real time to allow for accurate time stamping and beam forming.

- **Device List:** This window displays the current list of devices.
- **New:** Create a new I/O device.
- **Edit:** Edit an existing I/O device.

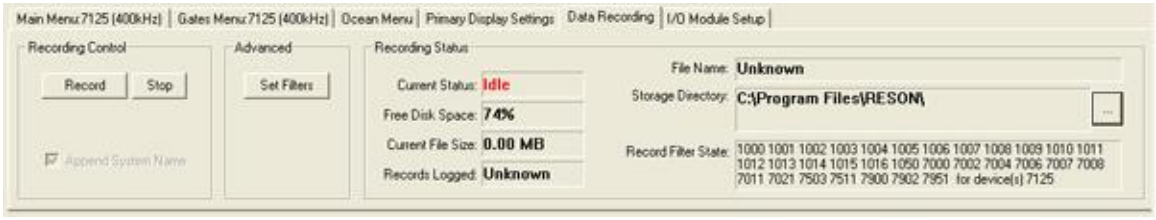
- **Remove:** Delete an I/O device from the list.
- **Device Status Display:** Shows the status of the corresponding device in the Device List window.
- **QC:** Launch the *I/O Module Monitor*.

NOTE: Accuracy of the bathymetric data depends entirely on a 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 will usually result in poor data quality since the time stamp is applied AFTER the last sample is received. In the absence of SVP input, the input from the SeaBat7k Ocean Settings Page is used instead.

7.04 Data Recording and Playback

7.04.01 Record Sonar Data

If the Beam Data Recording option was purchased, the Data Recording tab will be available.



The Data Recording tab is divided into three general sections – the Recording Control section, the Advanced section, and the Recording Status section.

7.04.01.01 Recording Control

The Recording Control portion 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.

The “Append System Name” option is not enabled for this system. The System Name will always be appended to the recording filename.

7.04.01.02 Advanced

Click the “Set Filters” button to select particular records to be included in the recorded data.

7.04.01.03 Recording Status

The Recording Status portion of the Data Recording tab provides information on the current recording. The following information is provided:

- **Current Status:** Shows whether the system is Idle or Recording.
- **Free Disk Space:** The 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.
- **Current File Name:** The filename for the current file. The filename is automatically generated using the following naming convention: YYYYMMDD_????_SystemName.s7k
- **Current Directory:** The location where the current file is being stored. To change this location, click the "Browse" and select the folder in which recorded files should be saved.
- **Currently Logging:** Lists the record types that are currently being included in the recording.

7.04.02 Play Back Recorded Sonar Data

If the Beam Data Recording option was purchased, the Data Playback tab will be available. The Data Playback tab will be hidden when the SeaBat is in "Manual" mode. To display the Data Playback tab, select "Playback" from the Mode drop-down box (see 8.7 Change Modes).

The following additional information is included on the Sonar Image for file playback:

- Image Type
- Ping Spinner
- Ping Number
- Selected Range
- Power Setting
- Gain Setting
- Max Rate Setting
- Selected Pulse Width

The Data Playback tab is divided into two general sections – the Playback Control section and the Playback Status section.

7.04.02.01 Playback Control

The Playback Control portion of the Data Playback tab allows you to start and stop the Playback process. Click the "Play" button to select the file to play back. The playback will begin immediately upon selecting the file. 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.

7.04.02.02 Playback Status

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

- **Current Status:** The current status indicates whether the system is playing a file ("Playback"), stopped ("Idle"), or does not have a playback file selected ("Unknown").
- **Current File Size:** The size of the selected file.
- **Percent Complete:** The percent of the file that has been played.
- **Current File Name:** The name of the selected file.
- **Current Directory:** The location of the selected file.

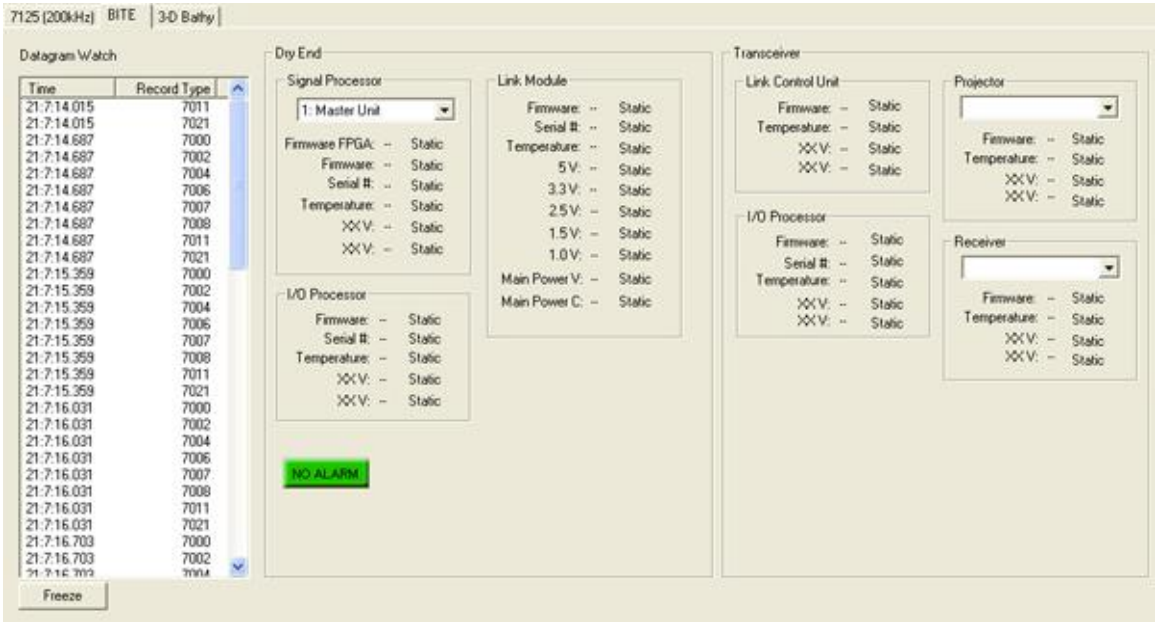
NOTE: Most communication with the Sonar Processor is disabled when in Playback mode. Alerts will continue to be received and displayed, however any alerts stored in the playback file will also be displayed. The time stamp on the alert will indicate whether it is a current or pre-recorded alert.

In addition, recording and playback **can be done simultaneously**.

7.05 Built-In Test Environment

7.05.01 Built-In Test Environment

The Built-In Test Environment (BITE) display is enabled for this version of the SeaBat 7125 User Interface but not all fields are populated.



Current functionality of the BITE Display includes:

- **Datagram Watch:** A time stamped display of real time ping records.
- **Alarm Indicator**

Future functionality of the BITE Display will include:

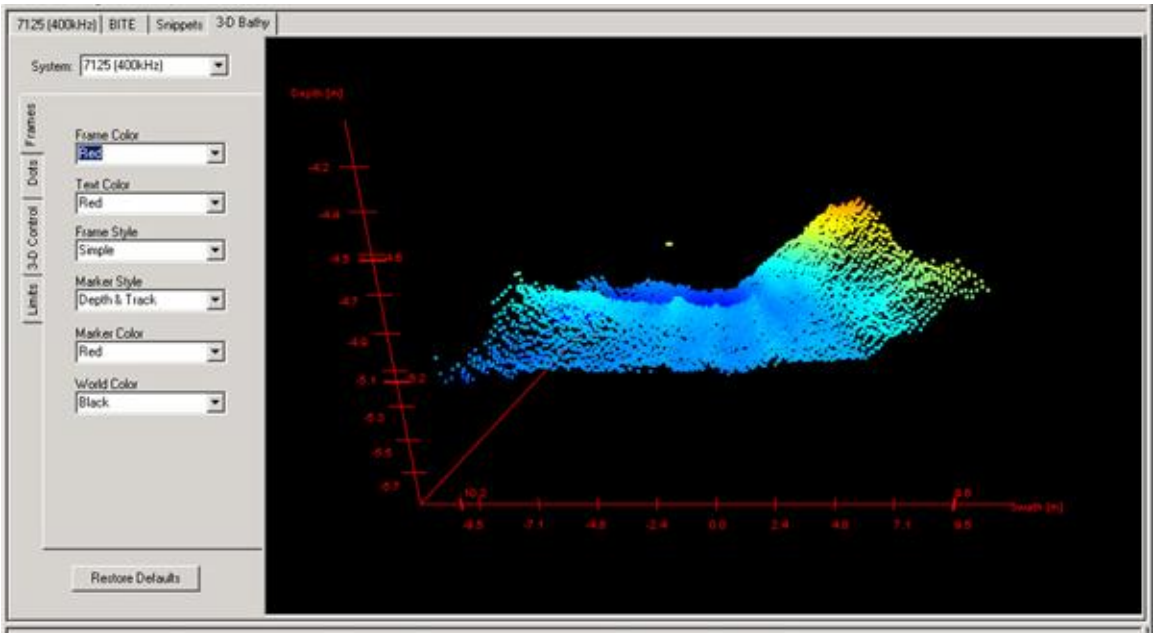
- Signal Processor Status
- Link Module Status
- I/O Processor Status
- Link Control Unit Status
- I/O Processor Status
- Projector Status
- Receiver Status

These items are not activated in the current version of the software.

7.06 3-D Bathymetry

7.06.01 3-D Bathymetry Display

The 3-D Bathymetry display is available for all Bathymetric systems. If the tab does not appear in the available display tabs, access the Data Display and Format menu option to unhide it (see 8.1.1 Data Display and Format).



The 3-D Bathy display has a separate set of controls that appear on vertically arranged tabs to the left of the display panel. Using these tabs, the operator can customize settings in the following general areas:

- ***Frames:*** Change the appearance of the lines, text elements, markers, and background for the 3-D Bathy display.
- ***Dots:*** Change the appearance of the dot display.
- ***3-D Control:*** Change the orientation of the three dimensional display.
- ***Limits:*** Change the parameters for which three dimensional data will be displayed.

7.06.01.01 Frames

The Frames tab allows the operator to change the appearance of lines, text elements, markers, and background for the 3-D Bathy display. Each of these is changed by selecting the desired appearance from a pull-down menu.

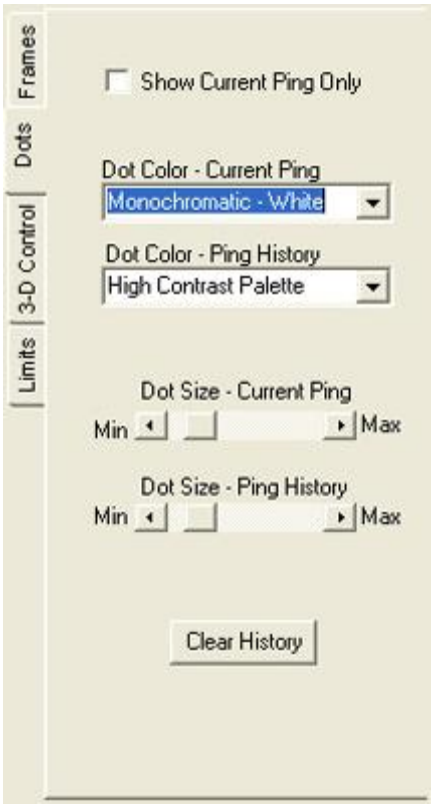
The available items that can be customized are:

- Frame Color: Change the color of the frames that enclose the 3-D image on the screen.
- Text Color: Change the color of text labels.
- Frame Style: Change the configuration of the frame.
  - All: Show all frames.
  - Dynamic: Automatically adjust frames to best display, based image rotation.
  - Simple: Show only the X and Y axes.
  - None: Removes frames altogether.
- Marker Style: Change the combination of markers that appear on the display.
- Marker Color: Change the color of markers.

- World Color: Change the background color.

7.06.01.02 Dots

The Dots tab allows the operator to customize the appearance of the bathymetry dots that make up the 3-D image displayed on the screen.

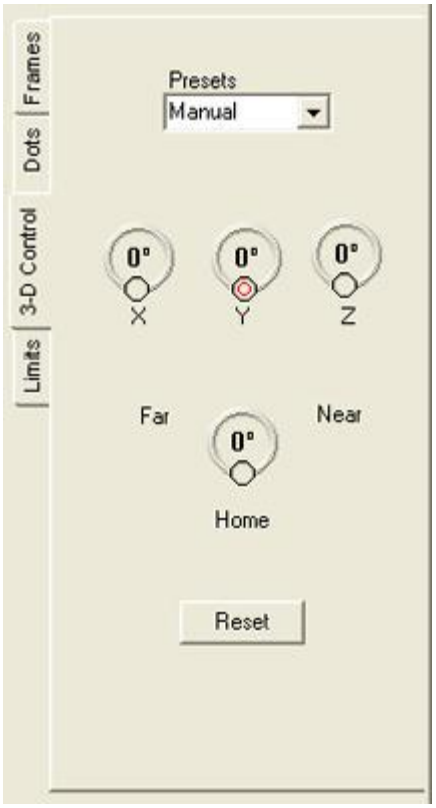


The following settings may be customized:

- **Show Current Ping Only:** Select this box to hide the dot display for previous pings.
- **Dot Color – Current Ping:** Change the dot color for the current ping.
- **Dot Color – Ping History:** Change the dot color for all previous pings.
- **Dot Size – Current Ping:** Change the size of the dots for the current ping.
- **Dot Size – Current History:** Change the size of the dots for all previous pings.
- **Clear History:** Clear the screen and build a fresh image beginning with the next ping.

7.06.01.03 3-D Control

The 3-D Control tab allows the operator to rotate or zoom the 3-D image.

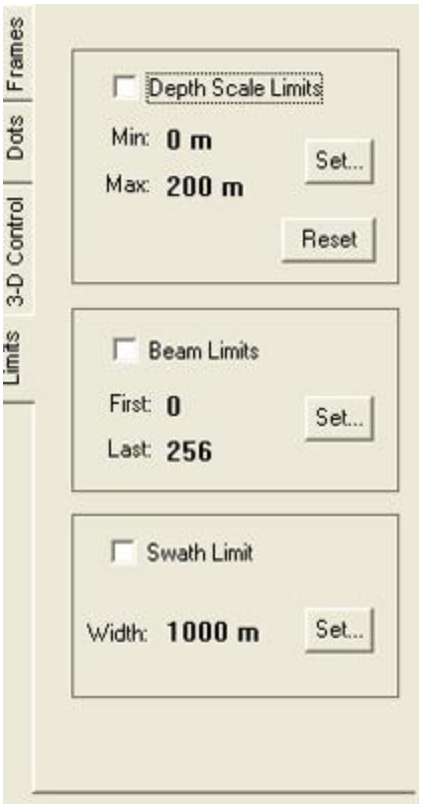


The following settings can be changed:

- **Presets:** Select a preset orientation from the pull-down menu.
- **X:** Rotate the 3-D image on its X axis.
- **Y:** Rotate the 3-D image on its Y axis.
- **Z:** Rotate the 3-D image on its Z axis.
- **Zoom:** Move the indicator towards “Far” to make the image smaller or “Near” to make the image larger.
- **Reset:** Reset all indicators to zero.

7.06.01.04 Limits

This tab allows the operator to select a subsection of the 3-D image for viewing. This can be based on depth, beam number, or swath width.



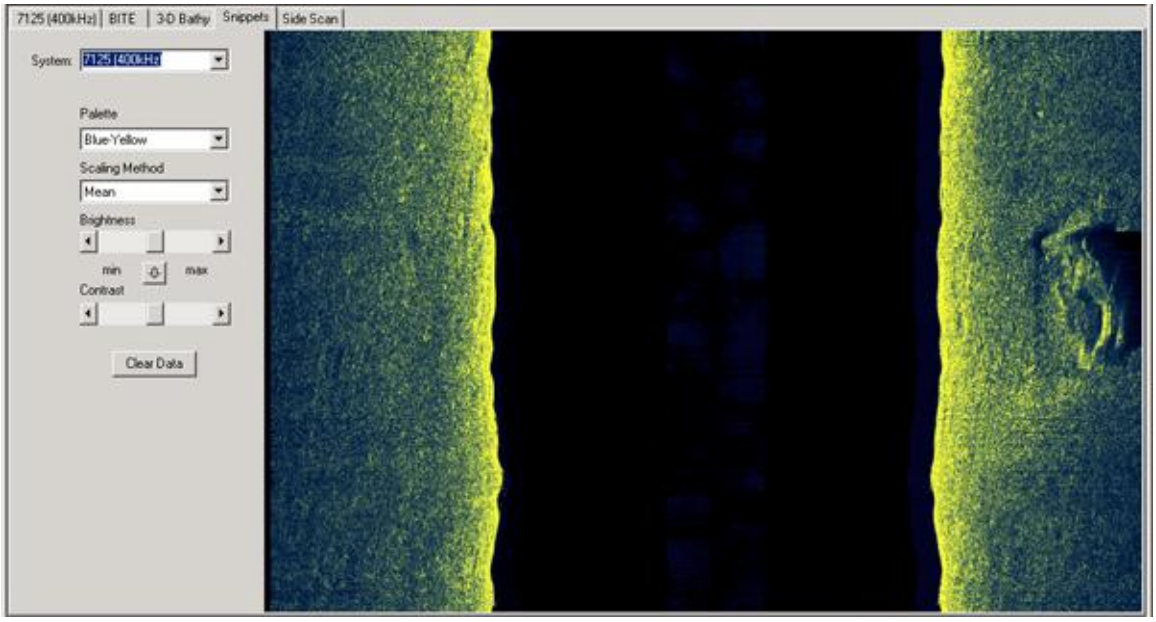
The following options can be changed:

- **Depth Scale Limits:** Select this box to set the minimum and maximum depths that will be displayed on the 3-D Bathymetry display.
- **Beam Limits:** Select this box to indicate a specific subset of beams to be displayed on the 30D Bathymetry display.
- **Swath Limit:** Select this box to indicate a specific subset of the swath width to display. This selection will limit the swath displayed to the specified measurement, with the nadir beam in the center of the display.

7.07 Snippets

7.07.01 Snippets Display

The Snippets tab displays the Snippets data that is currently being recorded or played back.



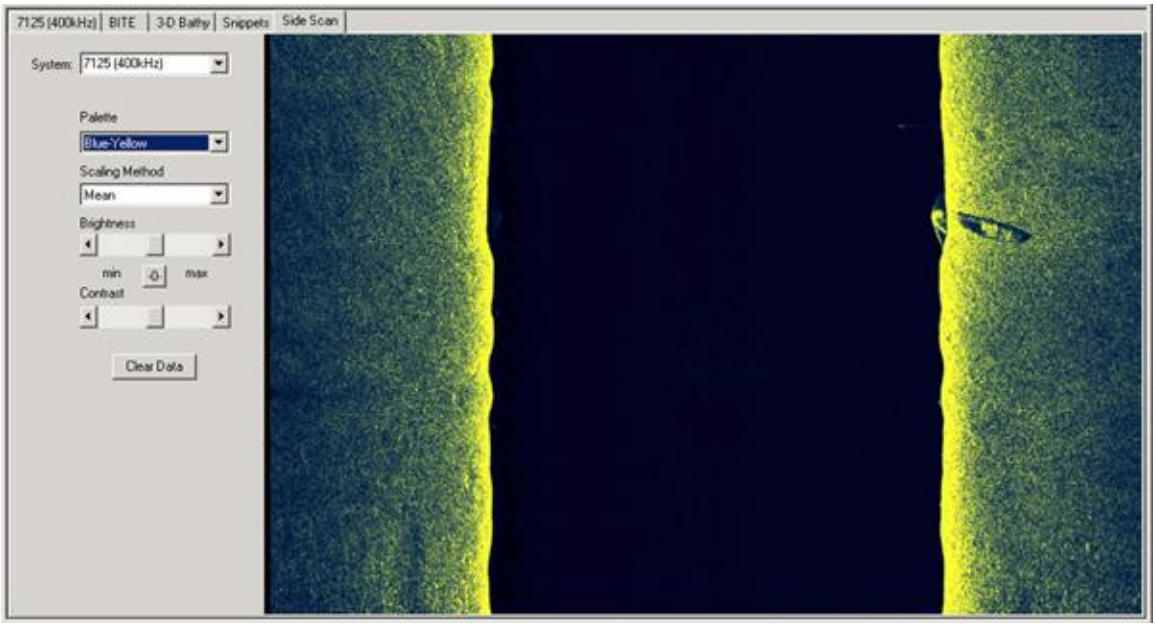
The following options are available to the left of the Snippets display:

- **System:** Select the system for which you would like to view Snippets data.
- **Palette:** Change the color scheme applied to the Snippets Display.
- **Scaling Method:** Select the scaling method for Snippets data. The choices are Mean, Peak, and RMS.
- **Brightness:** Move the slider to change the brightness level of the Snippets display. The center position indicates no adjustment.
- **Contrast:** Move the slider to change the contrast level of the Snippets 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.

7.08 Side-scan

7.08.01 Side-scan Display

The Side-Scan tab displays the Side-scan data currently being collected or played back.



The following options are available to the left of the Side-Scan display:

- **System:** Select the system for which you would like to view Side-scan data.
- **Palette:** Change the color scheme applied to the Side-scan Display.
- **Scaling Method:** Select the scaling method for Side-scan data. The choices are Mean, Peak, and RMS.
- **Brightness:** Move the slider to change the brightness level of the Side-scan display. The center position indicates no adjustment.
- **Contrast:** Move the slider to change the contrast level of the Side-scan 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.

8 REFERENCE DOCUMENTATION

8.01 SeaBat Design Documents

8.01.01 SeaBat 7125 Design Document List

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

Drawing Title	Drawing Number
Cable Assembly, Coax, Wet to Dry (LCU to SPU)	*11679*
Cable Assembly, Rx HD - Link Controller Bottle	*11392*
Cable Assembly, Tx, HD - Link Controller Bottle	*11393*
EM 7200 Outline Dimensions	*7200M011*
EM 7200 Installation Drawing	*7200M021*
TC 2160 Outline Dimensions	*2160M011*
TC 2160 Installation Drawing	*2160M021*
TC 2163 Outline Dimensions	*2163M011*
TC 2163 Installation Drawing	*2163M021*

8.02 Options and Upgrades

8.02.01 Intro to Options and Upgrades

The following options are available with the SeaBat 7125 system. If you require more detailed information with regards to any of these options, please contact RESON Sales for assistance. Options for the SeaBat 7125 system include:

- *Yearly Upgrades for SeaBat Firmware.*
- *Extended Warranty Contract.*
- *SeaBat Cables.*
- *System Integration and Training.*
- *Yearly Inspection and Servicing.*
- *Beam Data Recording*
- *Equidistant Footprint Selection.*
- *Full Array Calibration.*
- *Fiber Optic Conversion.*
- *Absorption Profile*
- *Automatic Operation*

8.02.02 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 initial order for the second and third year period.

8.02.03 Extended Warranty Contract

All SeaBat™ systems are provided with a standard twelve month warranty (see Appendix C Warranty Information). This option provides the ability to purchase additional annual support.

8.02.04 SeaBat Cables

You may purchase additional standard- or non-standard-length cables.

8.02.05 System Integration and Training

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

8.02.06 Yearly Inspection and Servicing

Although the SeaBat 7125 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.
- Open both the Sonar Head and Sonar Processor.
- Remove, test and re-tune receiver boards.
- Bench test complete system.
- Tank/water test system and verify source level.
- Burn-in system for a minimum of twenty four hours.

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

8.02.07 Beam Data Recording

The SeaBat 7125 is capable of producing digital data, either pre-beam formed (hydrophone channel) or beam data. This data stream is operator configurable and is written to an external RAID hard disk array. Data logging software controls recording, playback and data storage functions.

In addition to format selection, data limits may be set by defining the start and stop beam number and the start and stop sample number. The rate at which data is produced by the SeaBat and logged depends on the operating mode and the kind of data being produced.

A one terabyte (TB) external RAID hard disk array is supplied with the following specifications:

Specification	Value
Form Factor	1U, 19" Rack Mount
Base Capacity	1.0 Terabyte
Protocol Support	CIFS, NFS, NCP, HTTP, and FTP
Max RAID 0 Capacity	1.0 Terabyte
Max RAID 1 Capacity	1/2 Terabyte
Max RAID 5 Capacity	2/3 Terabyte
Max Single Array Size	1.0 Terabyte
Operating System	Windows® Storage Server 2003
Processor	Intel Pentium 4 2.8 GHz at 800 MHz 1MB Cache
Memory	512 MB Dual Channel DDR400 SDRAM (Low Latency)
RAID Environment	Integrated Marvell 4 port RAID controller
Hot Swap	4 bays
Included Drivers	4 x 250 GB SATA 8MB Cache: • 8 GB OS partition per drive • 242 GB data partition per drive
Ethernet	Dual Intel Gigabit controller 2x 10/100/1000 ports
Ethernet Load Balancing	Load Balancing, Teaming and Failover
Power Supply	350 W
Rails	Included

NOTE: If the Full Array Calibration (see B.9 Full Array Calibration) option has been purchased, this option will automatically be included at no additional charge.

8.02.08 Equidistant Footprint Selection

This option allows the operator to select between equiangular beam spacing or equidistant footprints. The equidistant footprint selection increases the number of beams to 256 for 200 kHz operation and 512 for 400 kHz operation, and defines the distance between footprints on the sea floor as a percentage of the depth or altitude. This option provides more uniform bottom coverage.

8.02.09 Full Array Calibration

To ensure that backscatter data accurately represents the absolute reflectivity of the sea floor, it is necessary to perform calibration tests on all receiver and projector channels in the arrays. Once complete, all backscatter data is corrected in the 7-P Sonar Processor prior to export. This includes Side Scan and Snippets data.

Data is corrected for:

- Source Level (SL).
- Receiver Gain (G).
- Analogue to Digital Converter Scale Coefficient (k).
- Array Weighting (w).
- Range (TVG application).
- Absorption Coefficient.
- Spreading Loss.
- Footprint Area.
- Receiver Sensitivity (from calibration coefficients).

  This processing is applied in the 7-P to produce a backscatter strength data output. To summarize the process, the signal is compensated for the internal parameters of the sonar:

- Gain steps, ADC scale coefficients and array weighting are known parameters of the sonar system.
- Transmitter sensitivity for each transmit stave is known and stored in a calibration file. This allows the entire array SL to be calculated.

- Receiver sensitivity for each receive stave is known and stored in a calibration file. This allows the entire array sensitivity to be calculated.
- TVG curves are designed into the system. They will be selected to minimize the risk of saturation or loss of too weak signals. The actual parameters are stored in the output data.
- The absorption coefficient varies with the depth. The Francois and Garrison model is implemented in the 7-P.
- The scattering area computed in the 7-P assumes a flat bottom.

The data is then formatted into 7k packets that contain the imagery in dB along with the parameters used in the processing. The end user is thus in a position to modify processing components to achieve specific goals.

Additional steps must to be applied to get to the actual bottom reflectivity. These steps are the responsibility of the end-user. Sound refraction correction will provide the actual incidence angle. A model of incidence angle dependence of the bottom reflectivity (like a Lambert's law) should be applied accordingly.

NOTE: If this option is been purchased, the Beam Data Recording (see B.7 Beam Data Recording) option will automatically be included at no additional charge.

8.02.10 Fiber Optic Conversion

For LCU to SPU cable lengths in excess of 100 meters, a fiber-optic link is required. This bidirectional link can run over a single mode fiber (where cable lengths in excess of 40 km are possible). The performance of a fiber optic link is highly dependent on the quality of the link, the number of connections and the end-to-end optical loss.

RESON offers a converter which resides in a customer pressure housing and converts the electrical output from the LCU to an optical signal. At the surface, the optical signal may either be converted back to optical or plugged directly into the 7-P Sonar Processor.

8.02.11 Absorption Profile

Real-time absorption profile used in gain calculations to improve performance.

8.02.12 Automatic Operation

In automated mode, certain system parameters are monitored and controlled by the sonar processor, including range setting, filters (depth gate), pulse length, and receiver gain (TVG).

9 WARRANTY INFORMATION

9.01 Warranty Information

9.01.01 One-Year Limited Warranty

RESON warrants the SeaBat 7125 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 7125 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.

9.01.02 Exclusions

The warranty on the SeaBat 7125 system shall not apply to defects resulting from:

1. Improper or inadequate maintenance by customer.
2. Unauthorized modification or misuse.
3. Opening of any parts of the equipment by anyone other than an authorized RESON representative.
4. Operation outside the environmental specifications for the product.
5. Improper site preparation and maintenance.
6. Service provided by anyone but Authorized Service Facilities (see “Service” below)

9.01.03 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.

9.01.04 Servicing During Warranty Period

If your system should fail during the warranty period, please contact your nearest RESON representative immediately (see “Service” below) to protect your warranty rights.

9.01.05 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. Pack the equipment in the original shipping containers.

3. Ship the equipment to your RESON representative, at 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.

9.01.06 Service

If you are experiencing difficulty with your SeaBat 7125 system, please contact the SeaBat Service Department at one of the following addresses for further instructions:

USA
RESON, Inc.
100 Lopez Road
Goleta, CA 93117
U.S.A.
Tel: 1-805-964-6260
Fax: 1-805-964-7537
e-mail:
support@reson.com

DENMARK
RESON A/S
Fabriksvangen 13
3550 Slangerup
Denmark
Tel: +45-47-38-00-22
Fax: +45-47-38-00-66
e-mail:
support@reson.dk

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RESON Offshore Ltd.
1 Tern Place
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Aberdeen, AB23 8JX
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Tel: +44-1224-709-900
Fax: +44-1224-709-910
e-mail:
sales@reson.co.uk

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