SeaBat 7125

High-Resolution Multibeam Echosounder System

OPERATOR'S MANUAL

Serial Number: _____

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1 INTRODUCTION

1.01 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, or remotely operated vehicle (ROV), or for use on an autonomous underwater vehicle (AUV).

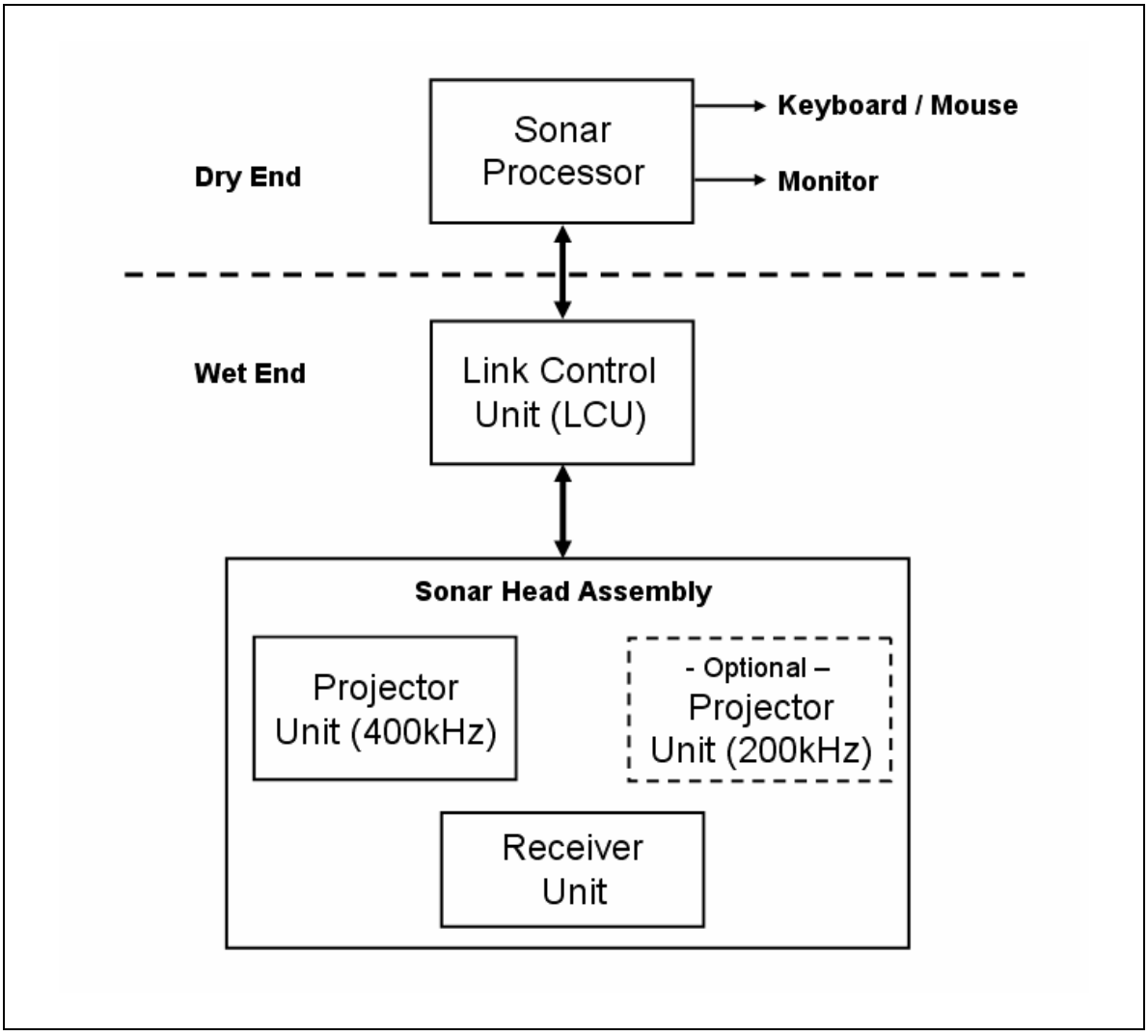

Figure 1: SeaBat 7125 System Configuration

1.02 System Options

The following options are available at additional cost:

- External RAID hard drive array for beam data recording.
- Fiber optic conversion.
- SVP-70 sound velocity probe with 25-meter cable.
- Mounting bracket with fairing.
- Additional SeaBat cable sets.
- Extended warranty, training, support, and maintenance contracts.

For more information regarding these options, please consult the SeaBat 7125 Product Description (RESON Document Number R032) or contact your local RESON sales office.

NOTE: Components associated with system options are mentioned in this document and clearly marked as "Optional."

1.03 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. This manual 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.

1.03.01 Standards of Measurement

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

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

NOTE: Notes represent explanatory information that is useful to the operator.

CAUTION: Cautions provide important information regarding your SeaBat system. Disregarding information provided in a Caution may result in damage to your SeaBat® system.

WARNING: Warnings indicate important information about your SeaBat™ system. Disregarding information provided in a Warning could result harm to personnel working with or near the system.

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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, digitized, and transmitted via the link control unit to the sonar processor unit, where it is formatted for display and data output. Bottom-detection bathymetry soundings and raw water column data are displayed locally or exported via Ethernet to an external data collection system.

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

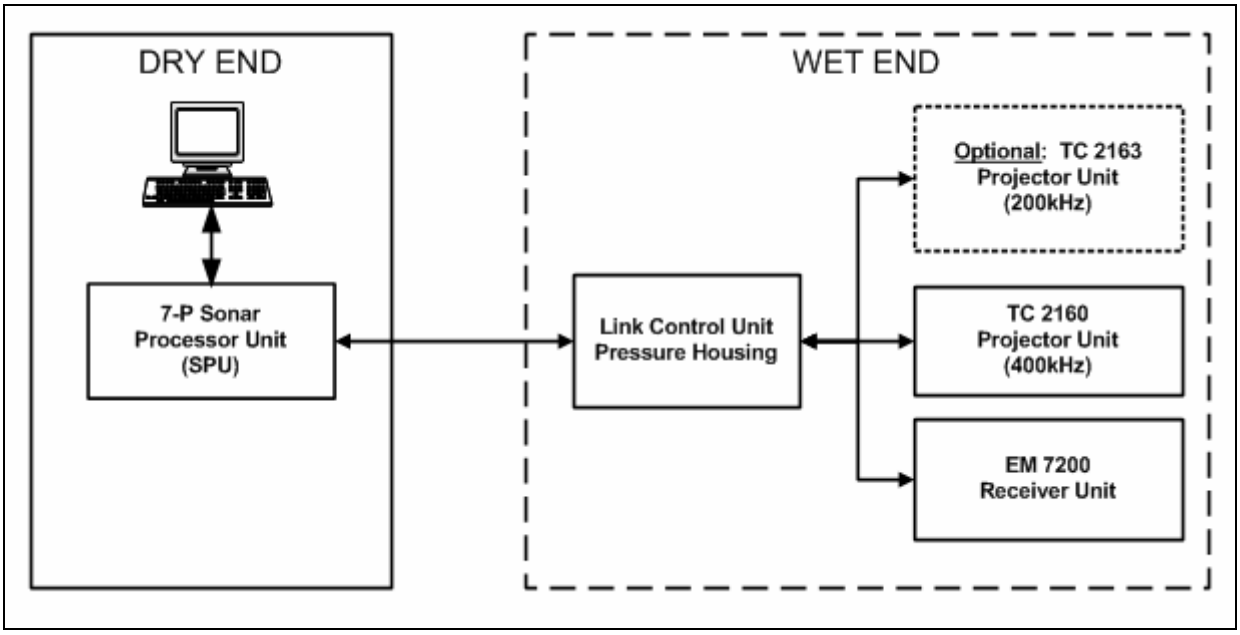

Figure 2: Wet-End and Dry-End Configuration

2.02 Technical Specification Overview

Parameters	Baseline System	
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°
Across-Track Beams	256 or 512 beams	256 beams
Swath Coverage	128°	128°
Depth (typical)	1 - 200 meters	1 - 500 meters
Ping Rate	Up to 50 Hz	Up to 50 Hz
Pulse Length	10 to 300 µsec	10 to 300 µsec
Duty Cycle	5%	5%
Depth Resolution	5 mm	5 mm

2.03 Available Configurations

2.03.01 Overview

The **SeaBat 7125** is available in different configurations based on depth rating:

System	Frequency (kHz)	Depth Rating (Meters)
7125-A	400	400
7125-B	200/400	400
7125-C	400	6000
7125-D	200/400	6000
7125-E	200	400
7125-F	200	6000

2.03.02 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 link control unit (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.

2.03.03 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.

2.04 7-P Sonar Processor Unit (SPU)

The 7-P SPU is a high-performance industrial PC that 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 3: 7-P Sonar Processing Unit

The 7-P SPU offers a flexible platform that supports a number of 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 SPU is housed inside a 19", 5U-high rack-mounted chassis and receives data from the receiver unit via the LCU. The SPU 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 SPU 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 SPU:

- 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.
- Provides an interface for a sound velocity sensor so that range measurements and receiver beam forming can be conducted correctly.

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

2.04.01 7-P SPU Technical Specifications

The following table provides information as to the technical specifications of the 7-P SPU:

Specification	Value
Power Requirements	115 to 230 VAC, 50 / 60 Hz, 350 W maximum
Video Output	S-VGA, DVI, 1024x768 @ 72 Hz refresh rate
Data Communication	Gigabit Ethernet
Graphics Colors	True color (32 bit)
Input Device(s)	Trackball, mouse, and keyboard.
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

2.05 Link Control Unit (LCU)

The LCU provides the bi-directional high-speed data link between the projector / receiver units and the 7-P SPU. Full-bandwidth digital data from the receiver unit is formatted and transmitted to the SPU, while operator commands are received from the SPU and distributed where appropriate. The LCU also manages power distribution, built-in test environment (BITE) and monitoring functions.

Figure 4: Link Control Unit (LCU)

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 standard projector-to-LCU and receiver-to-LCU cables are each three meters long.

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

In a standard installation, the 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 is supplied by the vehicle.

2.05.01 LCU Technical Specifications

CAUTION: The LCU pressure housing is nitrogen-filled and sealed. DO NOT OPEN the pressure housing.

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	

2.06 EM 7200 Receiver Unit

The receiver unit receives acoustic signals from the water, digitizes them, and sends the digitized signals to the LCU.

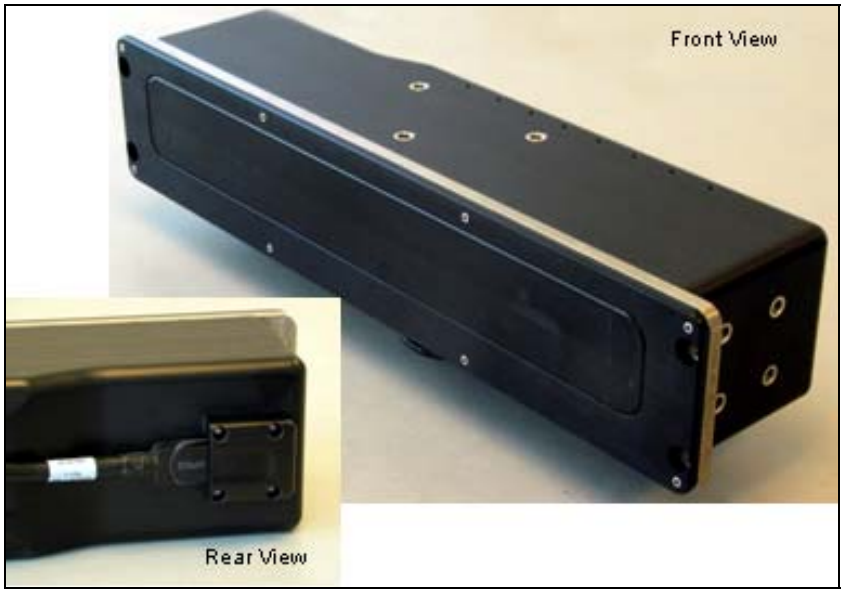

Figure 5: EM 7200 Receiver Unit

The receiver 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.

2.06.01 EM 7200 Technical Specifications

The following table lists the technical specifications for 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)
Temperature	Operation: -2° to 35° C Storage: -30° to 70° C

2.07 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 50 Hz, which provides 100 percent bottom coverage even at high vessel speed.

Figure 6: TC 2160 Projector Unit

The ping rate is set based on range selection, and can be modified by the operator through the user interface.

2.07.01 TC 2160 Technical Specifications

The following table lists the technical specifications for the TC 2160 projector unit.

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

2.08 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 50 Hz, which provides 100 percent bottom coverage even at high vessel speed.

Figure 7: TC 2163 Projector Unit

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.

2.08.01 TC 2163 Technical Specifications

The following table lists the technical specifications for the TC 2163 projector unit.

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

2.09 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 is used to convert the twisted pair from the link control unit to fiber optic cable. The fiber converter is housed within a customer-provided pressure housing.

Figure 8: TC3300 Media 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 the 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.

2.10 Sound Velocity Probe (Optional)

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

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

2.10.01 Technical Specifications

Specification	Value
Type	SVP-70
Sound Velocity	Range: 1350 - 1600 meters per second Resolution: 0.1 m/sec Accuracy: ±0.25 m/sec
Depth	Range: 2000 meters in one meter steps Accuracy: ±0.5 m/sec + 2% of measured depth Measurement: Pressure sensor
Barometric Adjustment	Self-adjusting zero point
Ultrasonic Transmitter	Power: 1 Watt Frequency: 2 MHz (nominal)
Cable Length	8 meters
Data Transmission	RS-232 at 9600 Baud, 7 data bits, odd parity, 2 stop bits
Operating Temperature	0 to +45° C
Power Consumption	50 mA at 24 V 100 mA at 12 V
Operating Power	12 - 24 VDC
Housing	Marine grade stainless steel
Connector	6-pin subcon
Weight	5.0 kg
Dimensions	Tube Diameter: 70 mm Max Diameter: 100 mm Length: 480 mm (including handle)
Scope of Delivery	SVP Unit, 8-meter cable, depth rated to 2000 meters

2.11 Cables

The following cables are provided to connect the **SeaBat 7125** system components.

- **LCU to Sonar Processor Unit:** Shown at position 1 on the diagram below. This cable allows power and data to be passed between the LCU and the SPU. This cable has a standard length of 25 meters and a minimum bend radius of 180 mm.
- **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 three meters and a minimum bend radius of 90 mm.
- **400kHz Projector to LCU:** Shown at position 3 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 three meters and a minimum bend radius of 90 mm.
- **200kHz Projector to LCU (Optional):** Shown at position 4 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 three meters and a minimum bend radius of 90 mm.

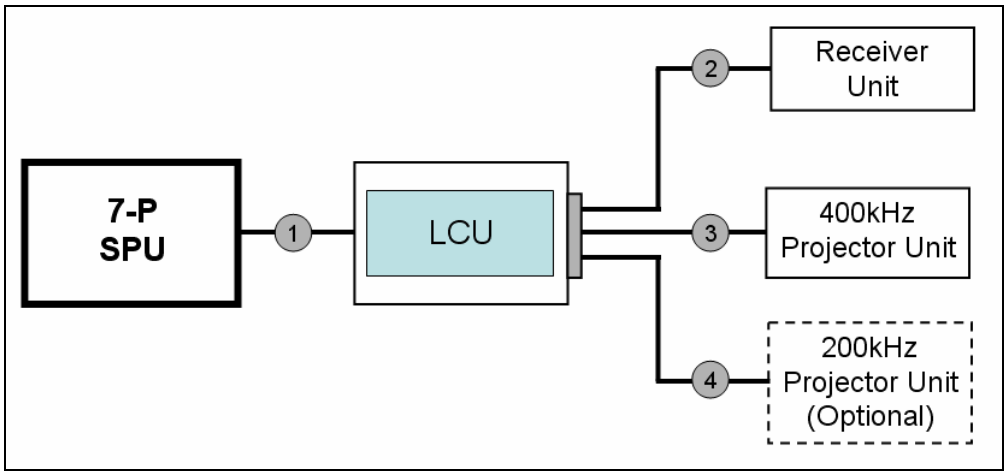

Figure 9: SeaBat 7125 System Cables

NOTE: Projector-to-LCU and receiver-to-LCU cables are available in an optional 10-meter length for an additional cost.

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3 SAFETY PRECAUTIONS

3.01 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 LCU or SPU.
- **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.
- **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, which include handles and tie-down rings. 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 connect or disconnect cables at the rear of the 7-P SPU while the processor is running. This can damage the internal workings of the processor.
- 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 plastic 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.

- While operating in air, set your SeaBat™ system to the lowest possible setting. A higher setting may damage the transmit array ceramics. **The system should only be operated in air for very short periods of time.**

CAUTION: Do not operate transmitters in air with a power equivalent to 180 dB or more.

3.03 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 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 transducer arrays to sit in direct sunlight when not in use. In addition to furthering corrosive effects, continued exposure to ultraviolet (UV) rays will damage the polyurethane array face.

3.05 Sonar Array Protection

The acoustic window molded over the front of the projector and receiver arrays is made of high-density polyurethane. The following recommendations are made to protect the arrays whilst in use and in storage.

- Do not allow the transducer arrays to sit in direct sunlight when not in use. In addition to furthering corrosive effects, continued exposure to ultraviolet (UV) rays will damage the polyurethane array face.
- 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.
- For cleaning use a mild soap and fresh lukewarm water and a soft brush.
- Rinse the sonar with fresh water after every use.
- 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.
- Do not exceed operating and storage temperature limits.

4 INSTALLATION INSTRUCTIONS

4.01 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:
  - 7-P SPU
  - Monitor, keyboard, mouse
- Install the wet-end components:
  - Transducer arrays
  - LCU
- 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
  - SPU power cable
- Power up the system
- Test the system
- Configure the SeaBat software

4.02 Dry-End Installation

4.02.01 Installing the Sonar Processor

The SPU 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, the optional topside TC3300 unit, and the SPU-to-LCU interconnect cable. Allow clearance around the unit to provide adequate air circulation and easy access to the power switch.

After the SPU is installed, the only interaction required should be to press 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.

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 SPU.

WARNING: Do not disconnect any cables from the rear of the 7-P SPU while the unit is running. This can damage the internal workings of the processor.

4.02.02.01 Sonar Connections

There are several cable connections to be made at the dry end of the installation. These connections are between the SPU and its peripheral equipment, between the SPU and the operator workstations, and between the SPU and the LCU.

The critical connections are shown in the following illustration. All dry-end cables come with factory-installed connectors and just need to be attached at the appropriate port(s).

- **(1)** On/Off Power Switch
- **(2)** AC Power Input
- **(3)** Mouse
- **(4)** Keyboard
- **(5)** Trigger Input (Optional)
- **(6)** Hardware Sync Pulse Output
- **(7)** 1 PPS Input
- **(8)** Ethernet
- **(9)** S-VGA Display
- **(10)** DVI Display
- **(11)** Host Cable

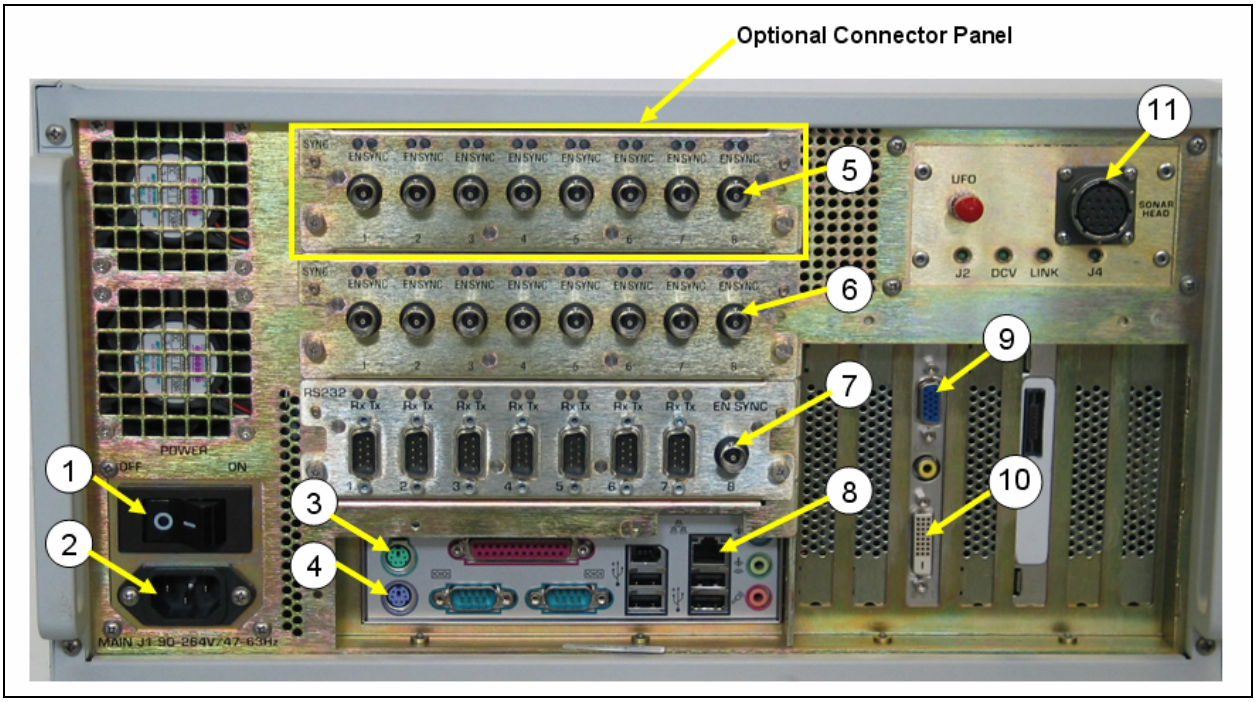

Figure 10: Dry-End Cable Connections

4.03 Wet-End Installation

4.03.01 Wet-End Mounting

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 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.

4.03.02 Link Control Unit (LCU) 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 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 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 pattern.

4.03.06 Sonar Head Assembly Orientation

The sonar head assembly should be mounted with the faces of the arrays oriented vertically downwards. Ideally, the receive array is mounted across-track, while the transmit array is 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 projector more susceptible to impact damage and collection of trailing debris.

4.03.06.01 Critical Orientation Notes

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

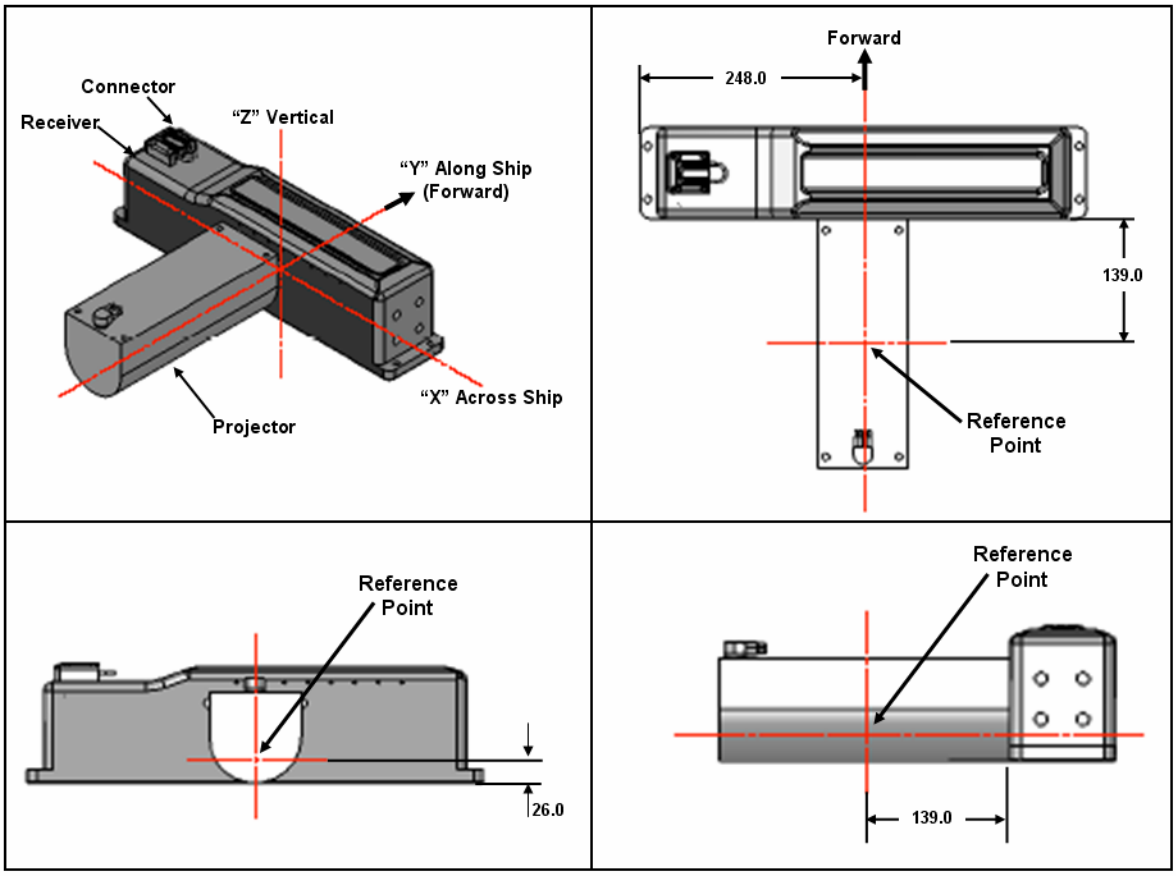

Figure 11: Sonar Head Assembly Orientation

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. Standard cable length between the sonar head assembly and the LCU bottle is three meters.

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

4.03.07.01 LCU Connections

The LCU connections **must** be made as follows:

- **Connector J1:** LCU-to-SPU cable
- **Connector J2:** Receiver-to-LCU cable
- **Connector J3:** 400 kHz Projector-to-LCU cable
- **Connector J4:** 200 kHz Projector-to-LCU cable (optional)

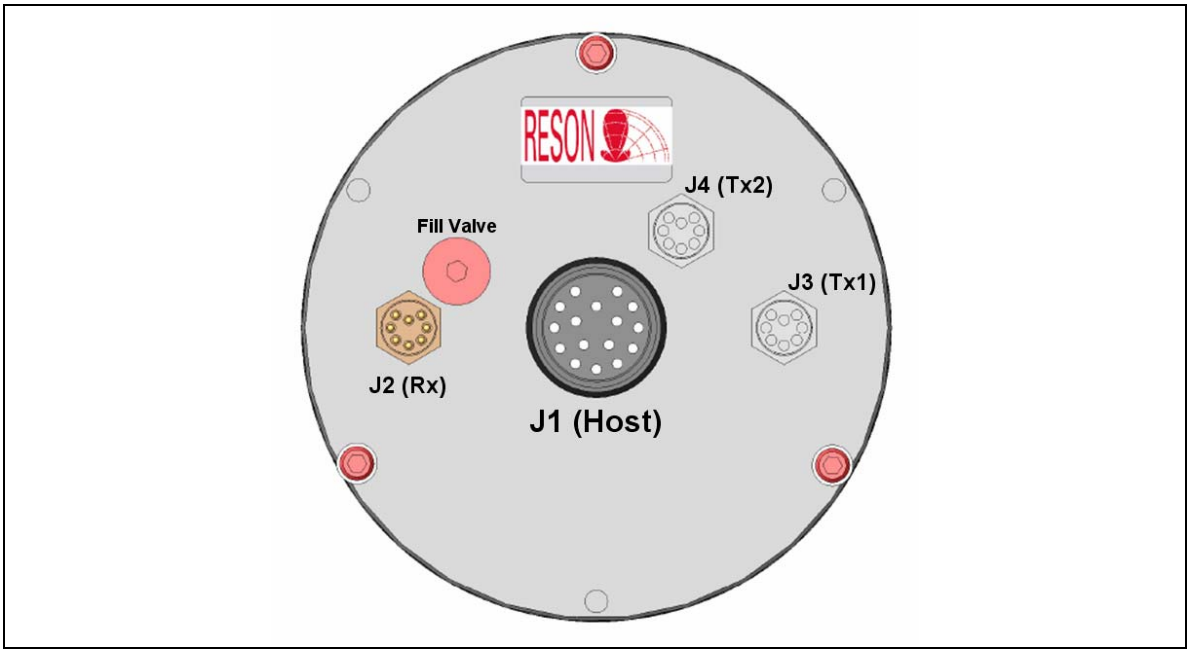

Figure 12: LCU Cable Connections

WARNING: Use a minimum bend radius of 90 mm or a minimum bend diameter of 180 mm when positioning the cables. These cables are very stiff, and a smaller bend radius will damage the cable.

4.04 System Setup

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 the main power is available.
- Energize the monitor.
- Ensure the power switch on the rear of the SPU is in the “On” position.
- Energize the system.
  - Open the SPU front panel.
  - Press the "On / Reset" switch UP towards the "On" position.
- Start the sonar by clicking the "7K Control Center" 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 Max Rate to highest setting.
  - Set the 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 180 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.

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5 DATA PRODUCTS

5.01 Bathymetry Data

At 200kHz, the **SeaBat 7125** generates 256 equi-angle (or 256 equidistant) bathymetry soundings per ping. At 400kHz, the system generates 256 or 512 equi-angle (or 512 equidistant) bathymetry soundings per ping at 400kHz. The system broadcasts from the 7-P SPU 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 amplitude information. 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.

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 traditional survey capabilities of the SeaBat.

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 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.

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

NOTE: 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 Details

The bathymetry and side-scan data are independent in the beam forming process and in how the output data is used.

5.03.03 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.

5.03.04 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.

6 SYSTEM STARTUP AND SHUTDOWN

6.01 System Startup Instructions

After the SeaBat hardware has been installed, the system may be started. To do this, press the power buttons on both the SPU and the color monitor.

CAUTION: When using the power switch at the front of the 7-P SPU, it is important to note that the switch is a "toggle." Pressing the top portion of the switch causes the sonar processor to begin its power-up sequence. Pressing the bottom portion of the switch causes 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. Doing so damages the SPU.

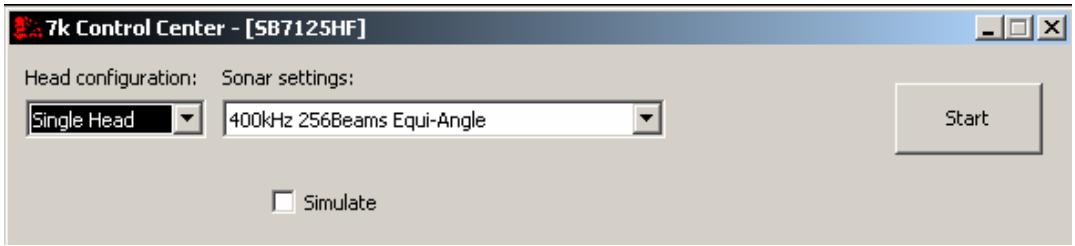
The 7-P SPU will power up and boot directly into Windows. No user name or password is required for standard systems.

6.01.01 Starting the 7K Control Center and Sonar

Note: It is possible to manually start and shutdown the components and user interface without using the 7K Control Center.

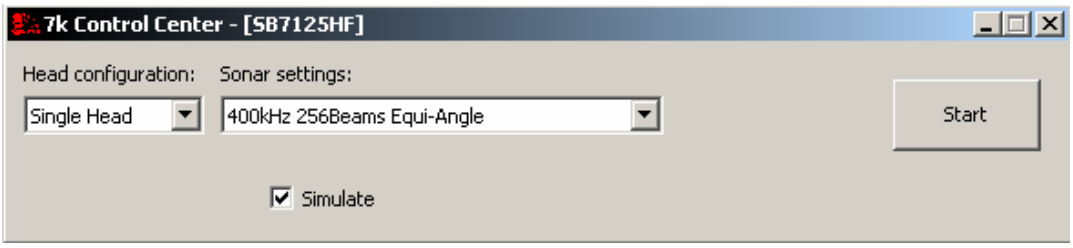
1. Double-click the 7KControlCenter icon located on the left side of the desktop.

2. The system reads the necessary files within the C:\Program Files\Reson\ directory and then the 7KControlCenter window appears.

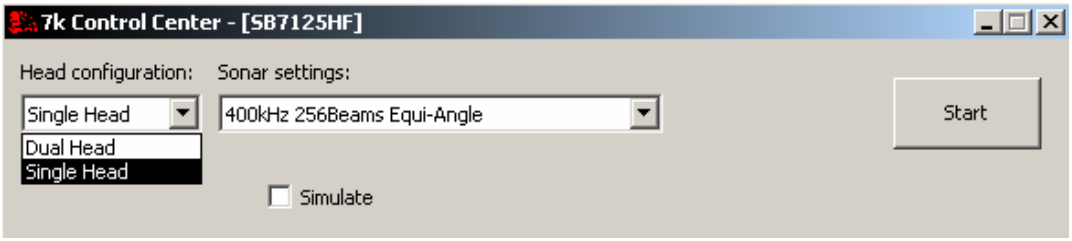


3. Select the operating mode. The 7KControlCenter can operate the 7KCenter and SeaBat display in real sonar operating mode or in a simulator mode.

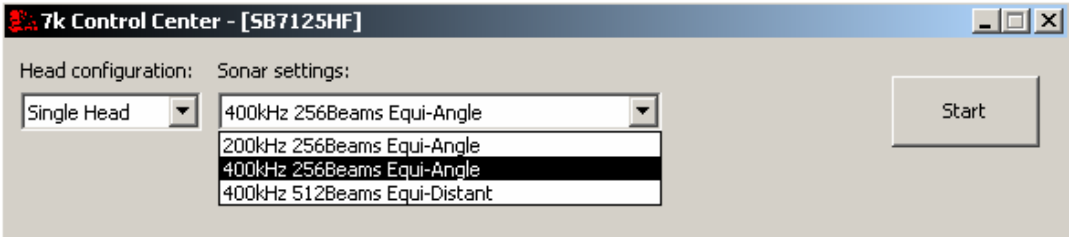
   - Simulator Mode: Select the “Simulate” checkbox.
   - Real Sonar Mode: If the Simulate checkbox is unchecked, the system operates in real sonar mode.



4. Select the sonar head configuration. If the sonar has dual-head capability, the menu selections are Single Head and Dual Head. Otherwise, Single Head is the only selection.



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

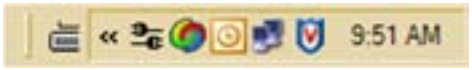


6. Click the Start button one time to the start the sonar.

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

6.02 I/O Module Configuration

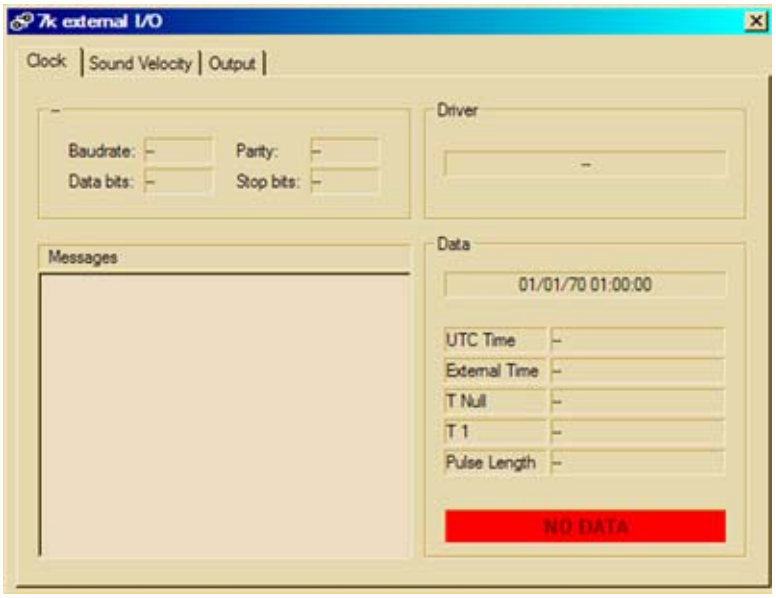
The I/O Module icon appears in the Windows System Tray as an icon.



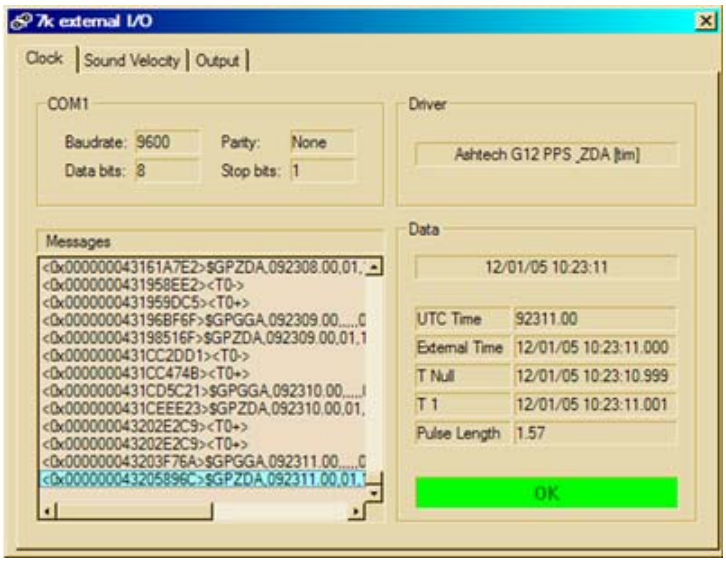
Right-click the icon and a menu appears with the following selections:

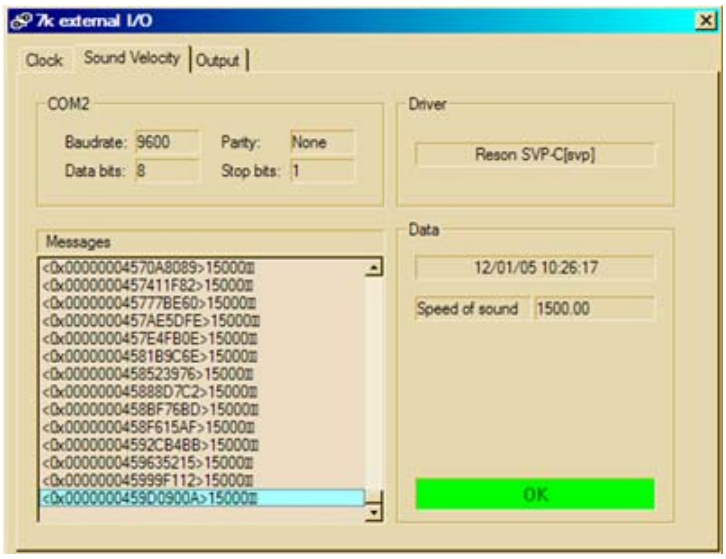
- **Show:** Displays the main window.
- **Hide:** Hides the main window.
- **About:** Displays a dialog with version information.
- **Exit:** Stops the I/O Module.

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.

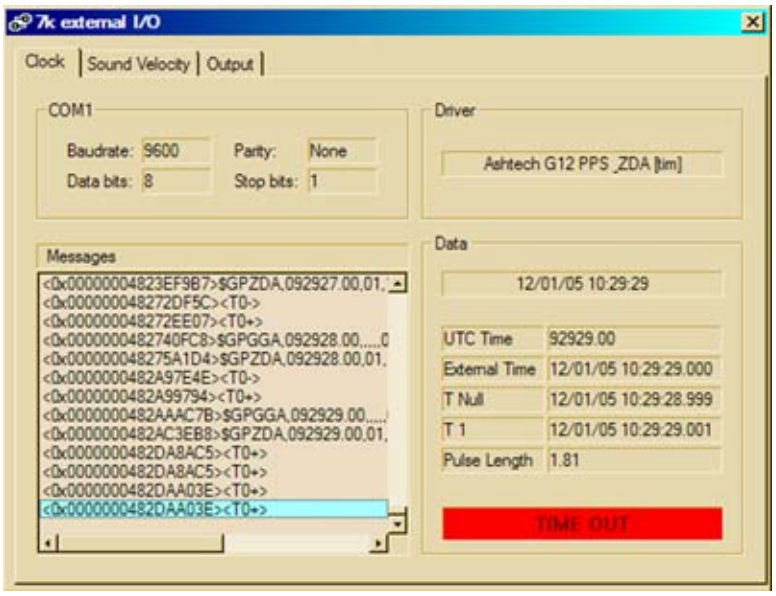


The Clock page and the Sound Velocity page show the port settings, names of the selected driver, raw data messages and decoded values of the incoming data and a status indicator. Once configured by the 7k user interface and running and receiving data, messages will begin to appear in the "Messages" window.

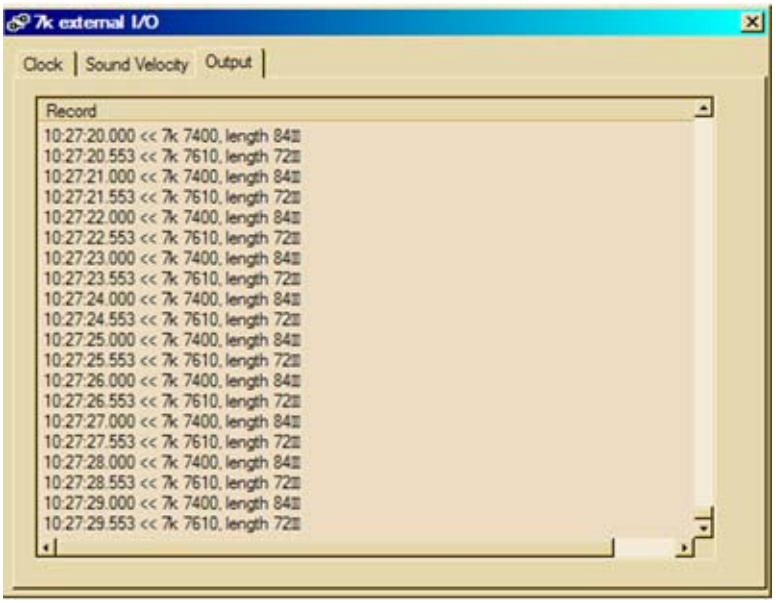




The status indicator shows "OK" in green when the data flow is normal. When a problem occurs in the data flow (for example, when serial cable is disconnected), the status indicator changes to red and shows the new status. When the data flow has been recovered, the status returns to OK again.



The output page shows the 7k messages that are being sent 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 page 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.

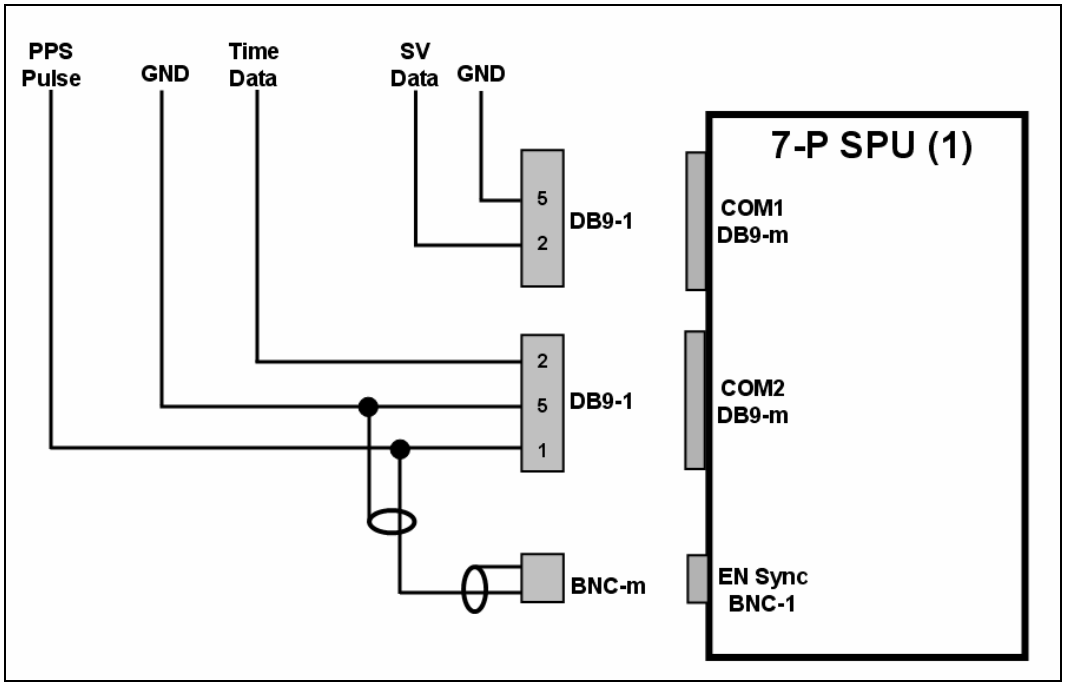
6.03 Sound Velocity and Time

6.03.01 Sound Velocity Input

To achieve correct beam steering, the sonar needs to have an up-to-date sound velocity measurement from the water in the area of the sonar head. If PDS2000 is used as an acquisition system, the sound velocity probe can be interfaced to this and the sound velocity value sent by network to the sonar. If a different acquisition system is used, then the sound velocity must be entered using the I/O Module loaded on the 7-P SPU.

To connect a sound velocity probe to the 7-P SPU:

- Using a DB9 female connector, connect the SV data to pin 2 and ground to pin 5. Connect this to Com1 or Com2 on the rear panel of the 7-P SPU.
- Start the 7k user interface and select the I/O Module tab.
  - Add a new sound velocity sensor from the list of drivers to the required port configuration and press OK.
  - Clicking on the QC button brings up a “7K External I/O” window, which shows the raw data and the associated decoded data.
  - The status should be green. If the status is not green, the incorrect driver may have been chosen, an error in the port parameters or no data coming in.



6.03.02 Time Input

To achieve correct time stamping of transmitted pulses it is necessary to send time to the sonar. 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). On a female DB9, connect:

- The time data to pin 2 and its ground to pin 5.
- The 1PPS pulse to pin 1 and its ground to pin 5.
- Additionally, the 1PPS pulse should be connected to a BNC male connector and applied to the “EN sync” BNC connector. This is used to reset the internal clocks of the sonar.

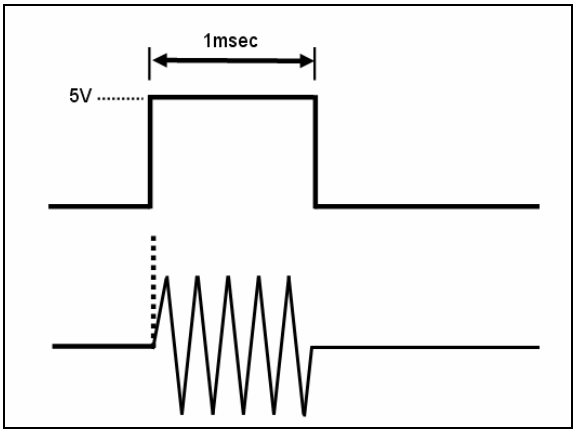
Connect the DB9 to the remaining unused comport on the rear panel of the 7-P SPU. Start the sonar and select the I/O Module tab.

- Add a new external clock from the list of drivers to the required port configuration and press OK.
- Clicking on the QC button brings up a “7K External I/O” window showing the raw data and the associated decoded data.
- The status should be green. If not, then there could be an incorrect driver chosen, an error in the port parameters or no data or 1PPS pulse coming in.

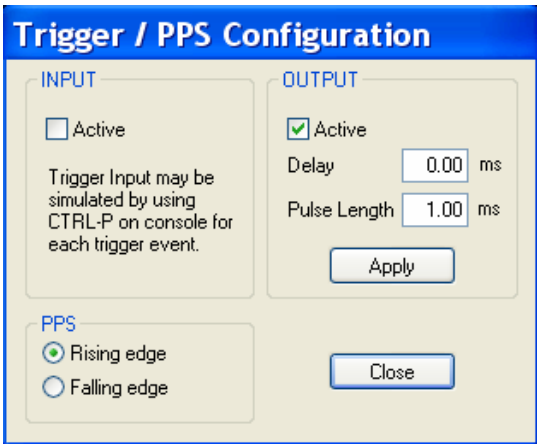
If the PPS pulse is not detected during sonar operation, a warning appears and an alarm generated in the SeaBat.

6.04 Hardware Sync Pulse Out

A TTL pulse, approximately synchronous with the transmit pulse, is available from the BNC connector on the I/O module located at the rear of the SPU. The following illustration shows a pulse example.



The user can control of the pulse length and delay characteristics using the Trigger/PPS Configuration dialog, which is accessed though the Configuration drop-down menu.



Trigger Input

Active: The Active checkbox 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. Disabling will return to ping rate control based on the Max Ping Rate slider.

Trigger Output

- **Active:** The Active checkbox is selected by default. When selected, a pulse will be output in conjunction with the sonar ping.
- **Delay:** The default setting is 0msec. This setting allows the operator to specify how many milliseconds after the sonar ping that the output pulse will be sent.
- **Pulse Length:** The default setting is 1msec. This setting allows the operator to change the pulse length of the transmitted output signal. For the **SeaBat 7125**, the pulse length plus the delay must be slightly less than 20ms.

Click the "Update" button to finalize changes.

NOTE: Each time the 7KParameters.dat file is deleted, the default parameters are reset. Also note that when changing configurations (from 256 to 512 beams for instance), the 7KParameters.DAT file is not deleted automatically.

1PPS Polarity

By default, the **SeaBat 7125** accepts positively polarized (Rising edge) 1PPS pulses to perform accurate time stamping. If a negatively polarized (falling edge) 1PPS is used, the Falling Edge polarity button on the Trigger/PPS Configuration dialog must be selected to ensure accurate timing.

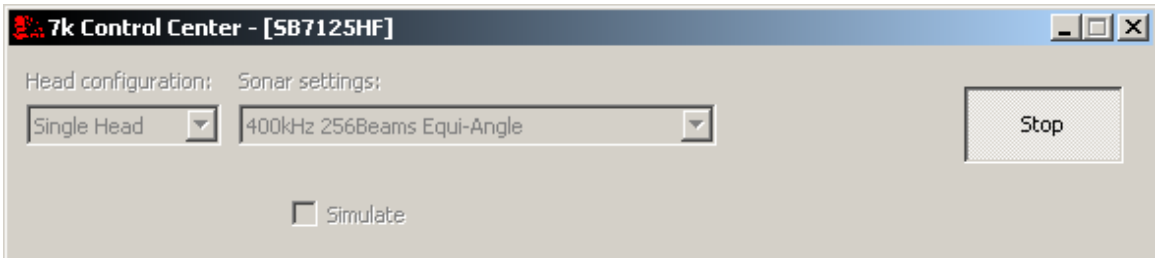
The 1PPS input indicator appears on the wedge control portion of the Main Sonar display. A plus sign (+) indicates that the rising edge of the PPS signal will be used. A minus sign (-) indicates that the falling edge of the PPS signal will be used.

- Green = Signal is being received.
- Red = Signal is not being received.

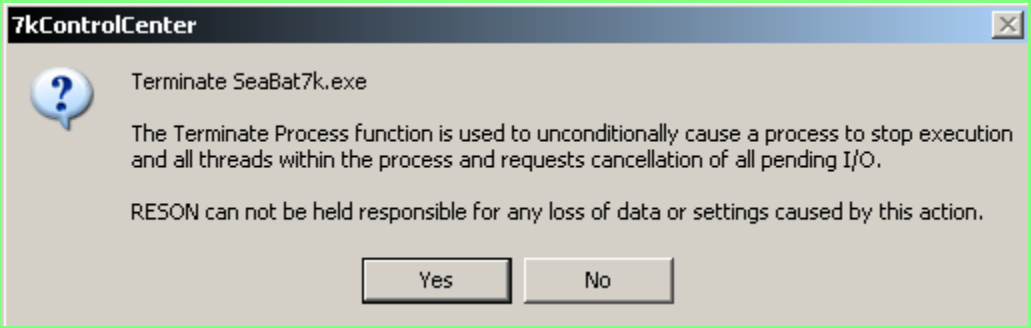
6.05 System Shutdown Instructions

CAUTION: Improper shut down of the 7-P SPU can result in software issues.

After the system starts, the 7KControlCenter Start button displays as “Stop.” Click on the Stop button to shut down both the 7kCenter and the SeaBat display. This does not terminate the 7KControlCenter. The 7KControlCenter remains active, ready to start the 7kCenter and SeaBat Display again, with the same or different selection of a Sonar configuration.



NOTE: On rare occasion an error occurs while the 7KControlCenter is attempting to shut down the SeaBat display.



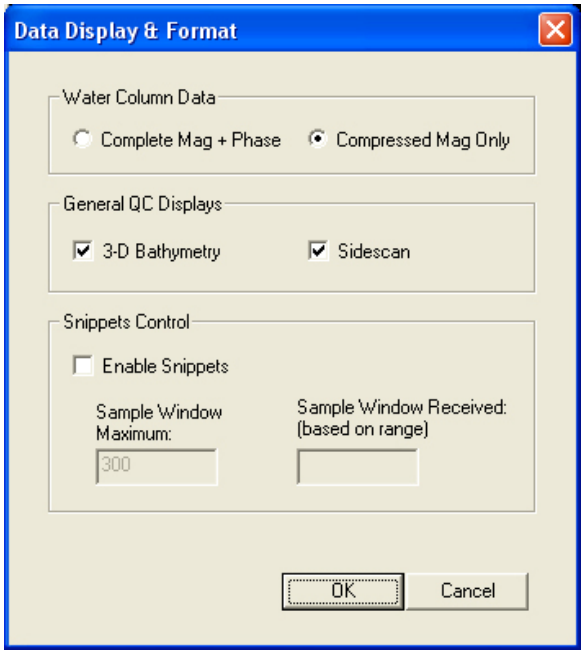
If there is any unprocessed data when the error occurs, it is possible that portion may be lost. It is also possible that the current sonar settings (Depth, Range, etc.) might not be saved the next time the sonar is started.

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. These selections also determine what data is recorded and displayed.



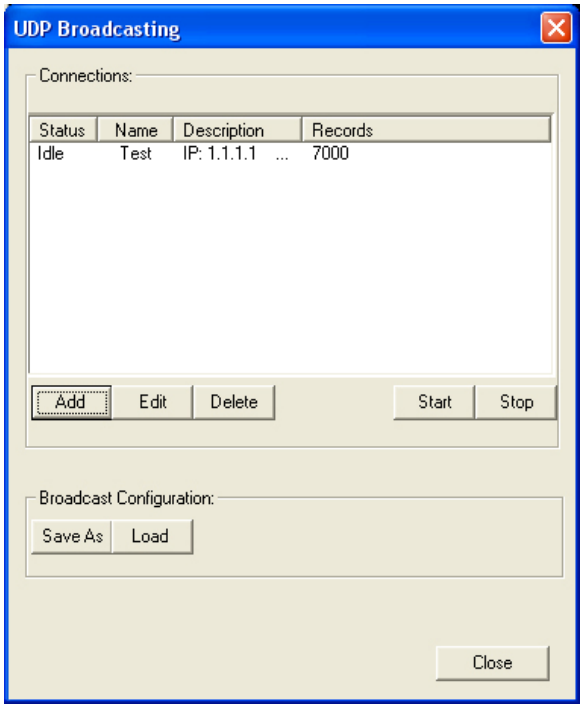
- **Water Column Data:** Use the radio buttons to select either Beamformed or Compressed Image data to be displayed in the sonar image.
  - o Complete Mag + Phase: Magnitude and phase data are both transmitted to the user interface. This allows for phase data to be analyzed in the A-Scan displays. Because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

- **General QC Displays:** Select additional displays:
  - Bathymetry Data: Display the 3-D Bathy tab.
  - Side-Scan: Display the Side-scan tab.
- **Snippets Control:** When 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: Informs the user of the actual window size 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:

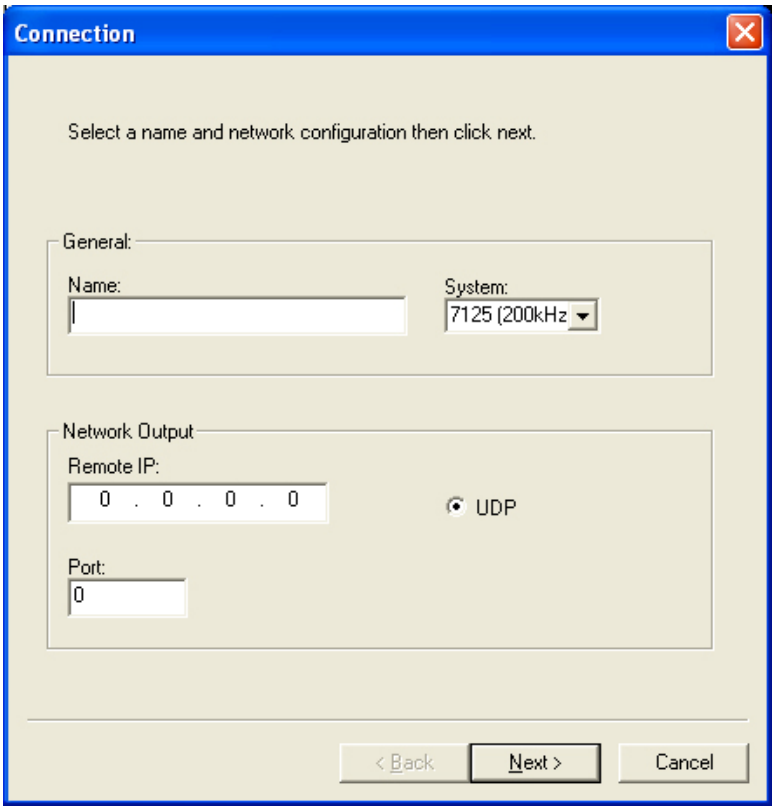
- Add, edit, or delete broadcast addresses.
- Start or stop the broadcast process.
- Save or load an existing broadcast configuration.



7.01.02.01 Add a New Broadcast

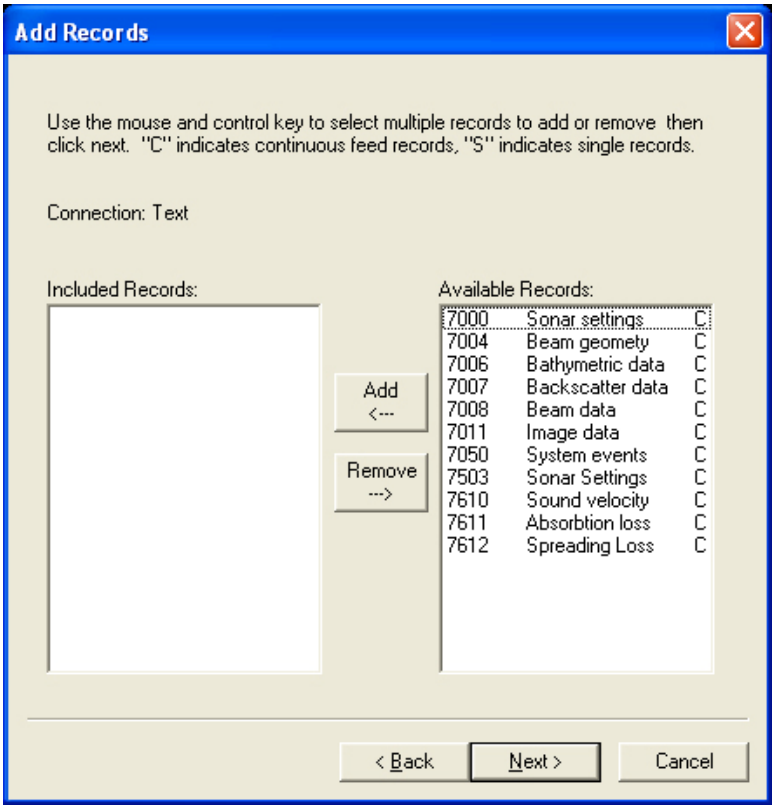
The “Add” button allows the creation of a new broadcast. To create a new broadcast:

- Click the “Add” button and the Connection dialog appears.
- 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”.

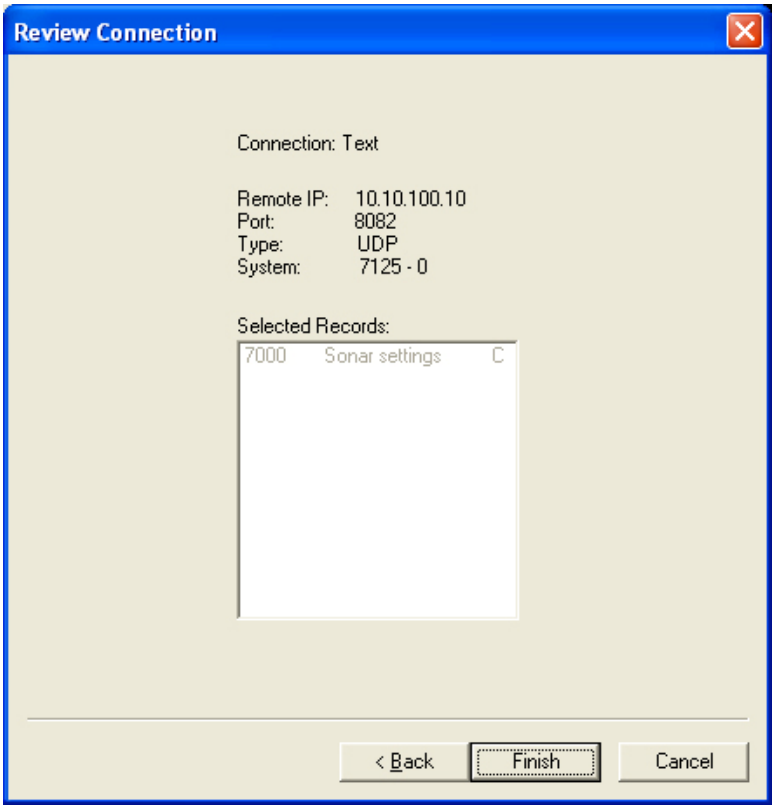


- In the Add Records dialog:
  - Select the records you want included in the broadcast by clicking on the record in the “Available Records” window. Hold down the “Ctrl” key when selecting records if you wish to select more than one record at a time.
  - Click the “Add” button to add the selected record(s) 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 entered to make sure it is correct.
  - If you want 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, and 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 want to start or stop and click the button that corresponds with the action you want to take. The status changes to “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 7KCenter software when it is stopped. On startup, these broadcasts are resumed.

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 want 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:

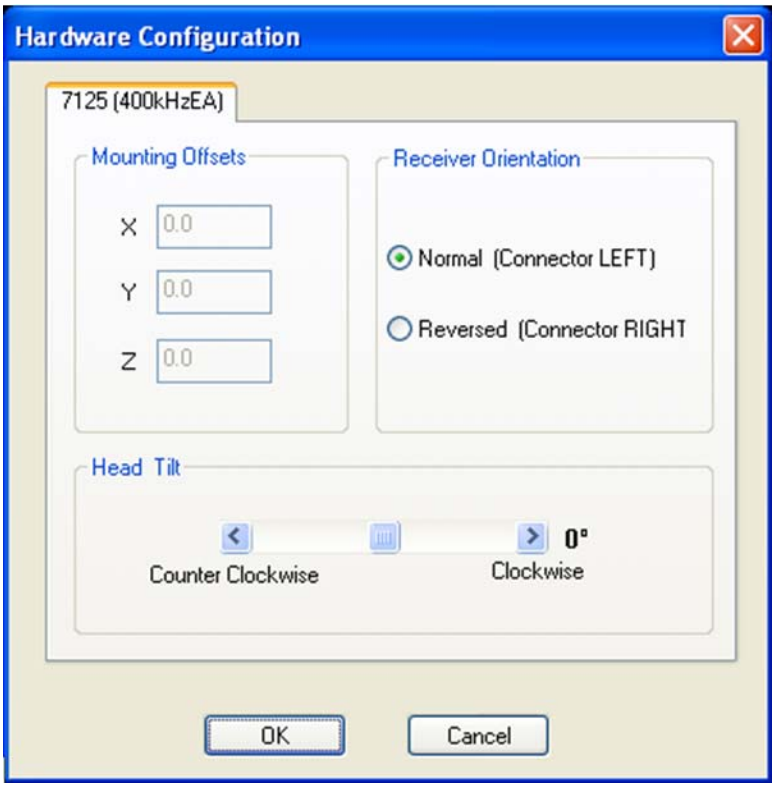
- Make sure the configuration is set up correctly.
- Verify that the Mode is set to Manual and that the MaxPingRate slider is not OFF.
- Click the “Save” button.
- Enter a file name and choose the location to which you want this file saved. The file extension is automatically set to (*.bcg).
- Click the “Save” button.

To load an existing configuration:

- Verify that the mode is set to Manual and that the MaxPingRate slider is not OFF.
- Click the “Load” button.
- A warning box appears indicating that the new configuration file will completely overwrite the current configuration. Click “OK” if you want to continue.
- Browse to the correct location and select the .bcg file you want to load.
- Click “Open.”

7.01.03 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.



- **Mounting Offsets:** This feature is not currently enabled.
- **Receiver Orientation:** The receiver should be mounted with the connector to the left (refer to the Installation section). When mounted like this, the receiver orientation should be selected to Normal. If the receiver is installed with the connector on the right, select Reversed. Note that this normalizes the image only and does not affect data output.
- **Head Tilt:** Allows the user to enter a tilt angle to compensate when the sonar arrays are installed at an angle. The maximum head tilt is +/- 45 degrees.

7.01.04 Dual-Head Configuration

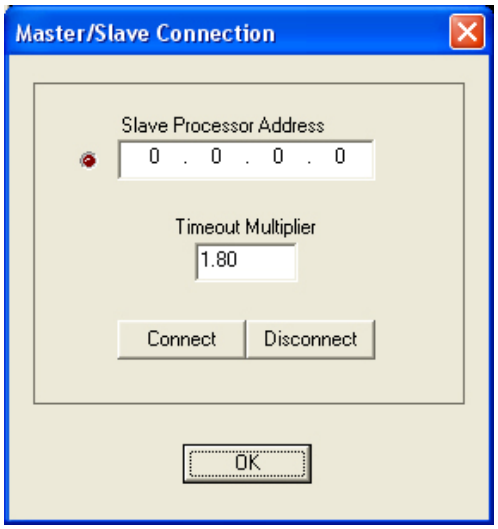
When set up in a maximum swath or maximum resolution configuration, two complete sonar systems are used, with one sonar processor acting as a “slave” to the other.

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

The Save Current 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

The Load 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. The sonar must be pinging to load a configuration.

7.01.07 Edit Autopilot Settings

See section 7.02.09 Autopilot for details.

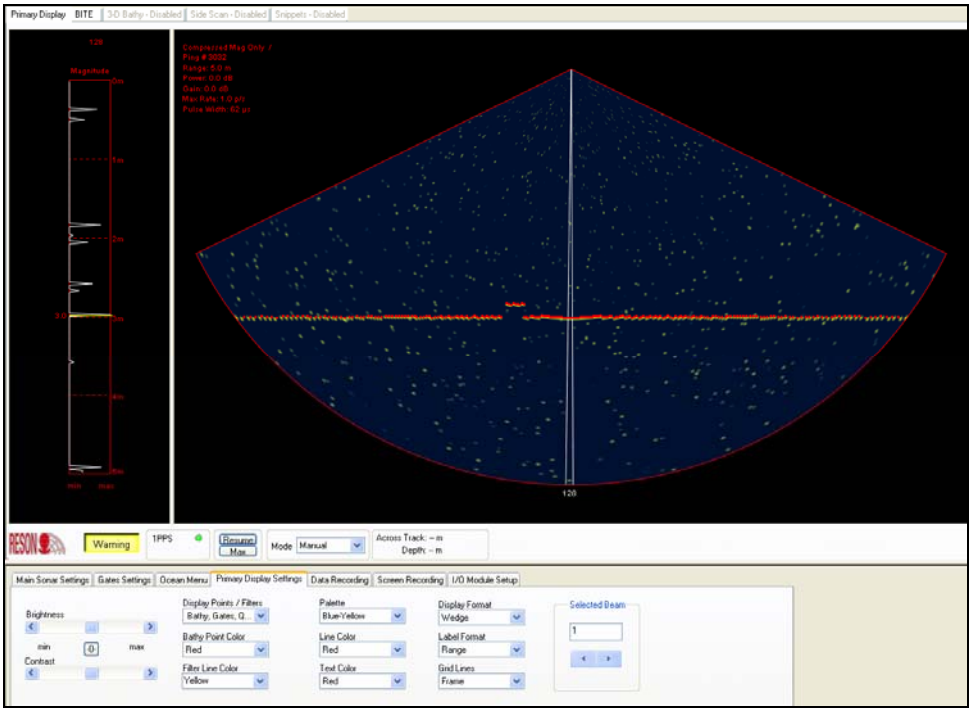
7.02 Understanding the Sonar Image

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.

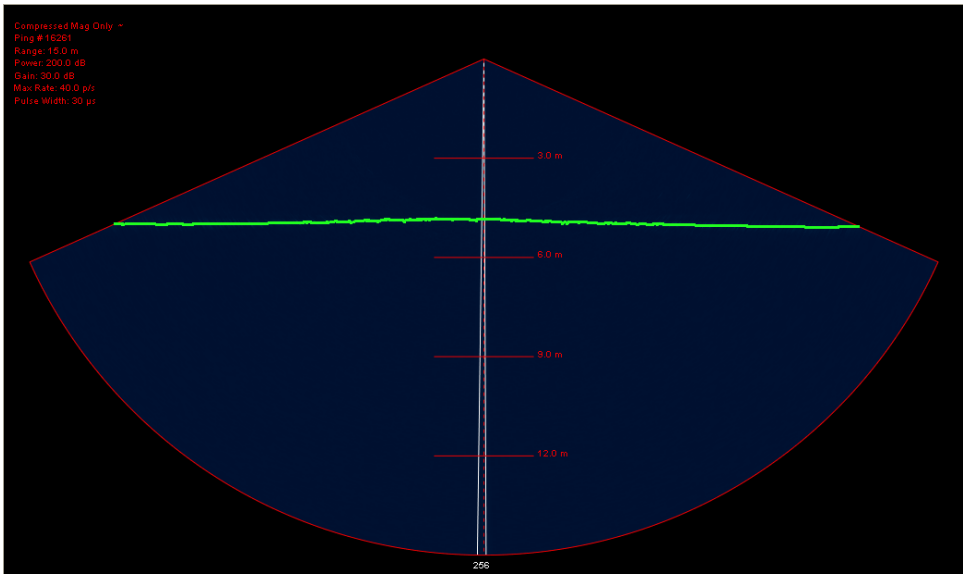
The image in the center of the main display screen is called the sonar image. The sonar image shows the complete sector illuminated by a single transmitted ping and can be represented in either “Sonar Wedge” mode or in B-Scan mode. Current information is shown in upper left corner of the sonar image frame. The following information is displayed:

- **Data Source:** Whether the display is a Beamformed or Compressed Image.
- **Spinner:** Rotates while the system is pinging.
- **Ping Number:** The accumulated number of pings since the system was powered up.
- **Range**
- **Power**
- **Gain**
- **Maximum Ping Rate**
- **Pulse Width**



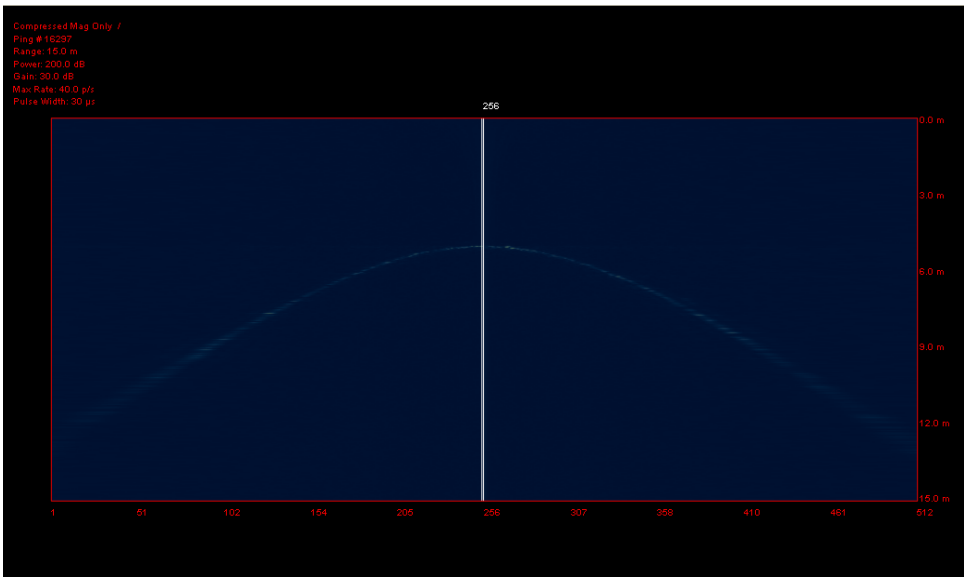
7.02.02 Wedge Display

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, next to 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.

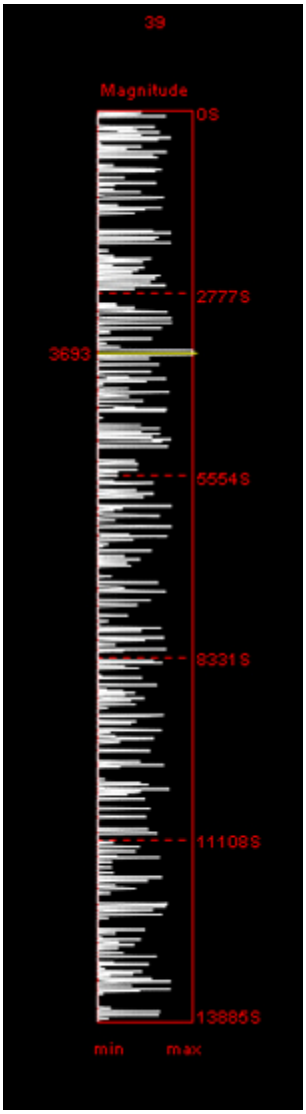
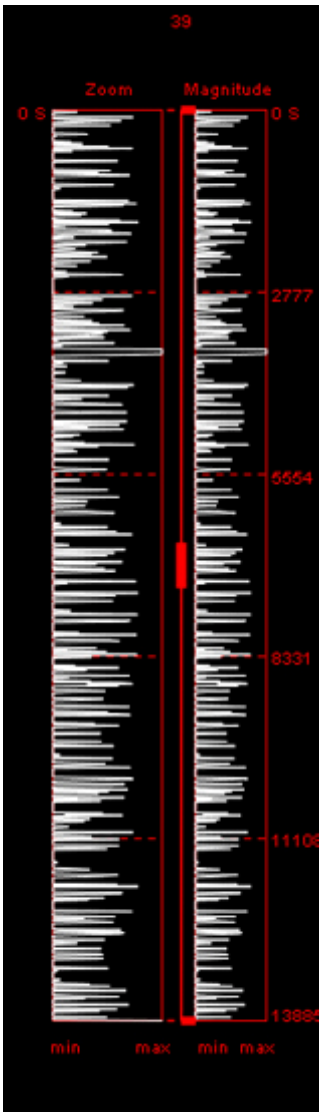
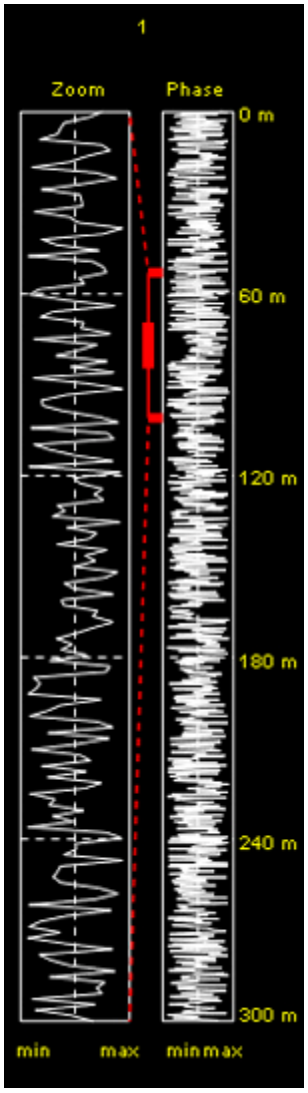
Place the pointer over the A-Scan display panel and press the right mouse button to switch between the available displays.

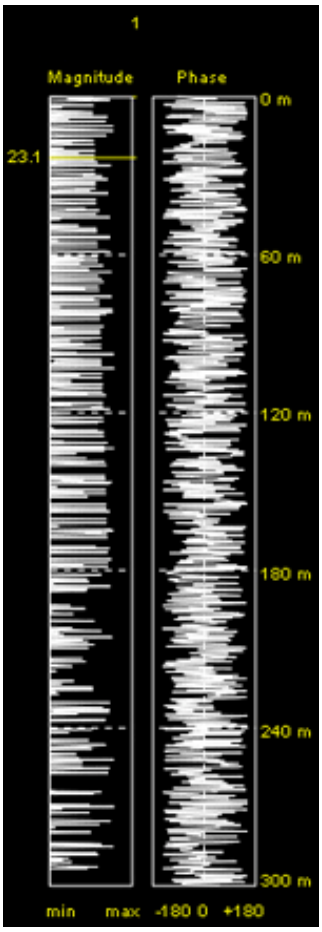
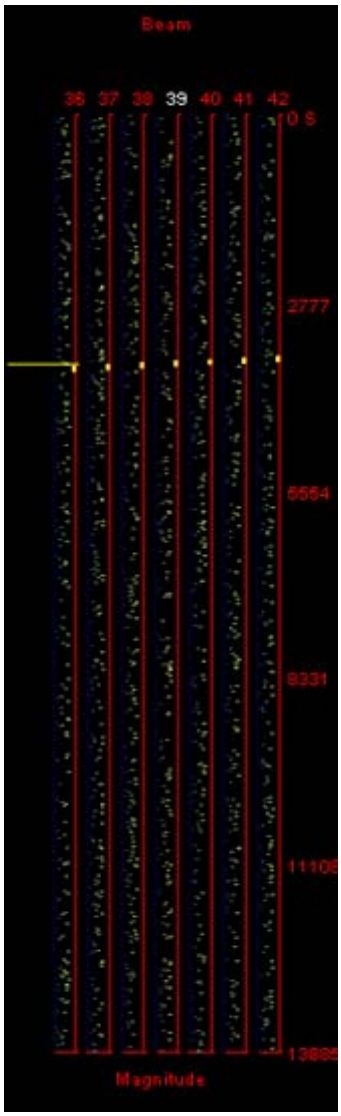
NOTE: Not all displays may be available, depending on the type of data being received.

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*
	

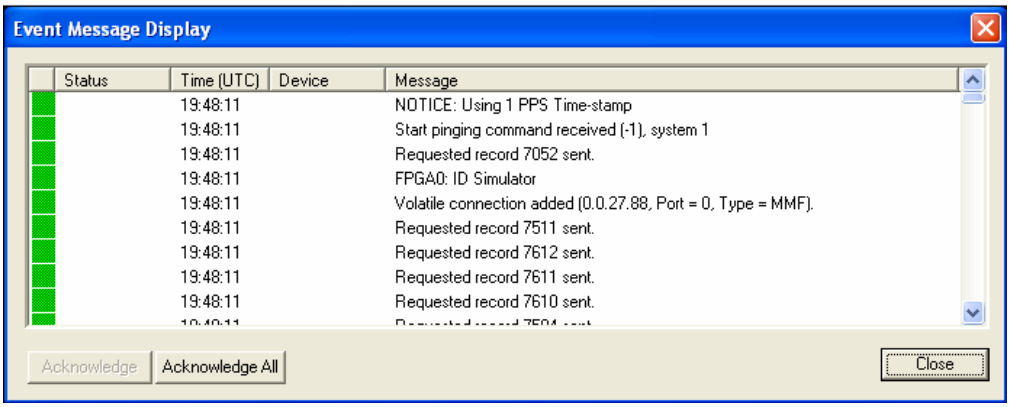
7.02.05 Event Messages

The Alarm indicator appears during normal operation as a green button on the Main Sonar Page and 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 or caution 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.

The “Acknowledge All” button allows the operator to change the status of all caution and alarms to "Acknowledged." This is an informational change only and 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

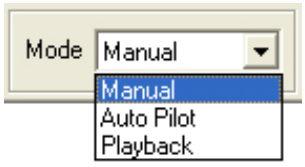
Selecting “Freeze” prevents the image on the Main Sonar Page from being updated while all other sonar functions continue. This allows prolonged viewing of a particular item when the display is frozen. Select “Resume” to allow updates to continue.

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 drop-down menu allows the operator to select to view the current data being collected or to view a playback of a previously collected file.



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

- **Manual:** View data being collected now.
- **Autopilot:** 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 detect data. See section 7.02.09 Autopilot for details.
- **Playback:** View a previously collected data file. Selecting “Playback” mode adds the “Playback” tab to the settings portion of the interface.

7.02.09 Autopilot

7.02.09.01 Bottom Detection with the Autopilot Feature

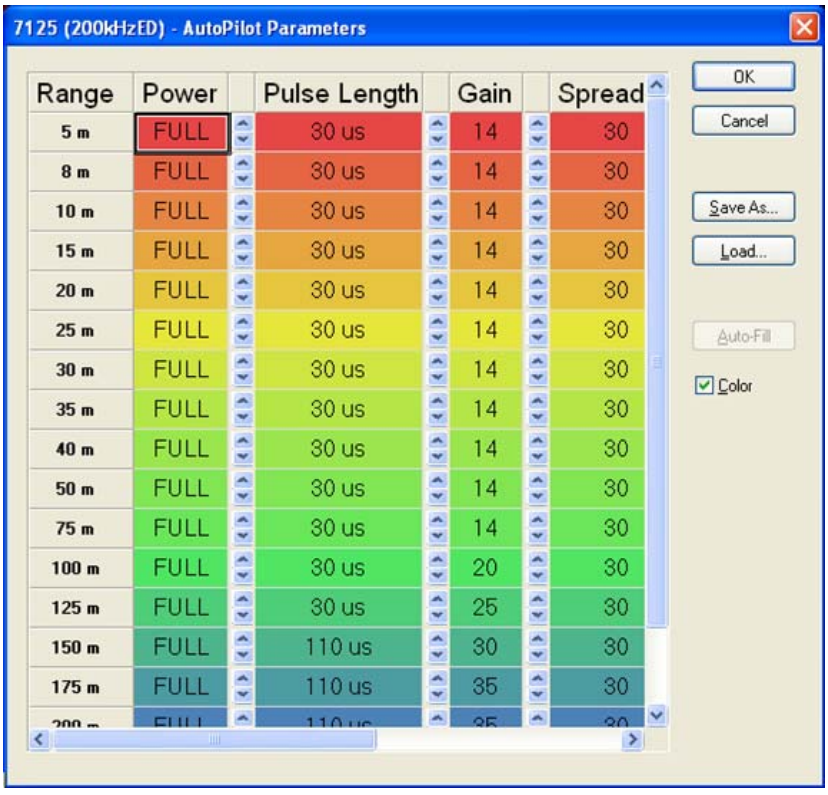
Once Autopilot is initiated, the 7kCenter analyzes bottom detect data from a specified number of pings. If a significant number of those pings are determined to have good quality, the average bottom depth and maximum usable swath angle are determined. Based on this information, an appropriate range setting is automatically set. The process then repeats, constantly updating the range to keep the bottom visible in the display.

If not enough bottom detect soundings have good quality, Autopilot will set the sonar to the next greatest range increment and analyze another set of pings, thus incrementally trying greater ranges until the bottom is found.

7.02.09.02 Sonar Parameter Adjustment

In addition to controlling the range, Autopilot mode automatically adjusts the following sonar parameters:

- Transmit Power
- Gain
- Maximum Ping Rate
- Transmit Pulse Length
- Spreading Loss
- Absorption



Range	Power	Pulse Length	Gain	Spread
5 m	FULL	30 us	14	30
8 m	FULL	30 us	14	30
10 m	FULL	30 us	14	30
15 m	FULL	30 us	14	30
20 m	FULL	30 us	14	30
25 m	FULL	30 us	14	30
30 m	FULL	30 us	14	30
35 m	FULL	30 us	14	30
40 m	FULL	30 us	14	30
50 m	FULL	30 us	14	30
75 m	FULL	30 us	14	30
100 m	FULL	30 us	20	30
125 m	FULL	30 us	25	30
150 m	FULL	110 us	30	30
175 m	FULL	110 us	35	30

These settings are specified by the operator prior to initiating Autopilot mode. To modify the default parameters, select **Edit Autopilot Settings** from the **Configuration** menu and make change by clicking the arrow buttons next to the desired setting.

Adaptive or No Gates should be specified by the operator from the Gates menu prior to initiating Autopilot mode. Absolute gates cannot be used in Autopilot mode. Gate control will select Adaptive gates if absolute gates have been specified.

7.02.09.03 Limitations

A feature such as Autopilot is difficult to optimize for all imaginable conditions. As such, it should be expected that the routine will occasionally fail when subjected to marginal conditions. Occurrences such as rapidly changing sea floor 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 Autopilot.

7.02.10 Identify Beam Track and Depth

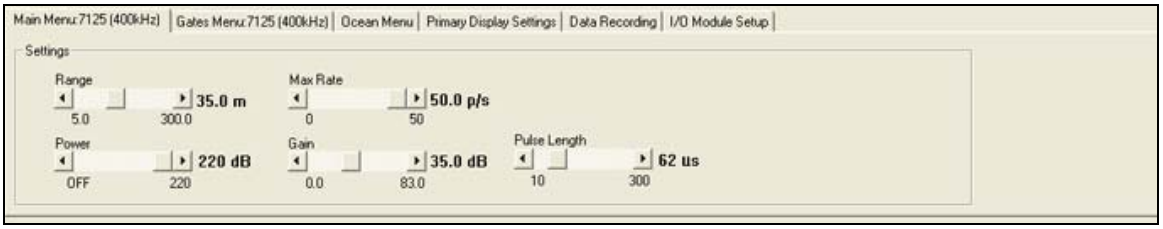
Next to the Modes menu the Beam Track and Depth readings display for a particular point on the sonar image. Readings are in meters.

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

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 will “see.” The range settings are operator selected. There are multiple settings in discrete increments. For the SeaBat 7125, these settings range from 5 to 300 meters (500 meters for 200 kHz operation).

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

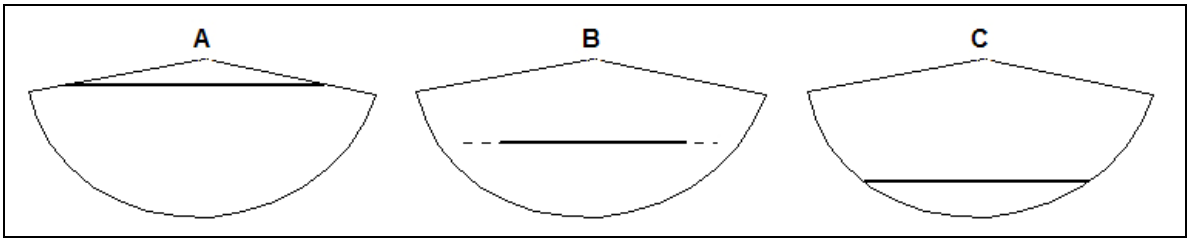


Diagram A depicts a proper range setting. Diagram B depicts an acceptable range setting for a swath that is beginning to fade due to the effects of Attenuation and Spreading Loss. Diagram C depicts an incorrect range setting. Notice that the still-useable ends of the swath are being cut off by the limits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

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 wants 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. For the **SeaBat 7125**, 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 its *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).

NOTE: The SeaBat 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

R_{km} = Range in kilometers

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. For the SeaBat 7125, 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 provides a higher resolution at a shorter range. A wider pulse length provides 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.

NOTE: For all slider bars except the power control, the new settings will not be sent until the mouse has released control of the slider bar.

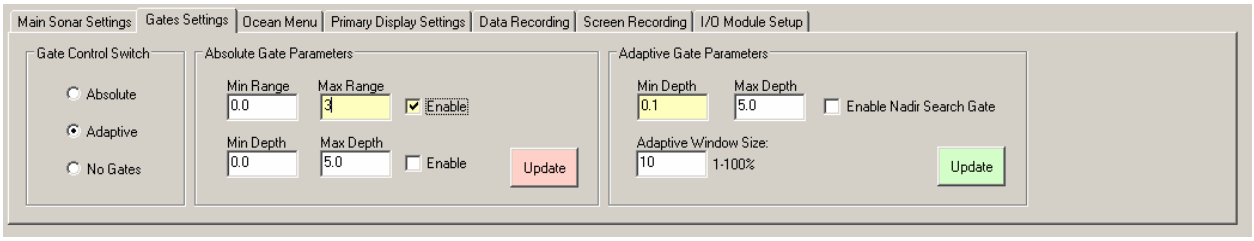
7.03.02 Applying Gates

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. Gate lines can be optionally displayed on the sonar image. See section 7.03.04 Primary Display Settings (Filter Lines) for details.

A yellow highlight on edit fields and checkboxes indicate the data was changed since last update and is not applied yet. The color of the Update button color indicates if data is stored locally by the UI or sent directly to the center (i.e., if gates are active or not):

- Red – Data is stored locally and gates are inactive.
- Green – Data is sent to center and gates are active

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



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.

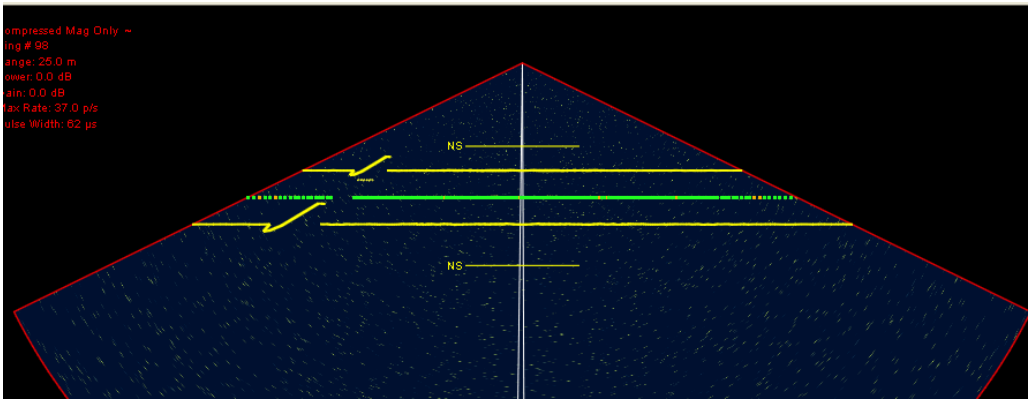
- **Enable Nadir Search Gate:** The minimum and maximum nadir depth gates are used to refine the initial search for the strongest bottom return from the nadir beam. This initial search gate can be enabled or disabled.
- **Adaptive Window Size:** This is a percentage based on the total samples in the 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.

7.03.02.04 Automated Nadir Search Gate

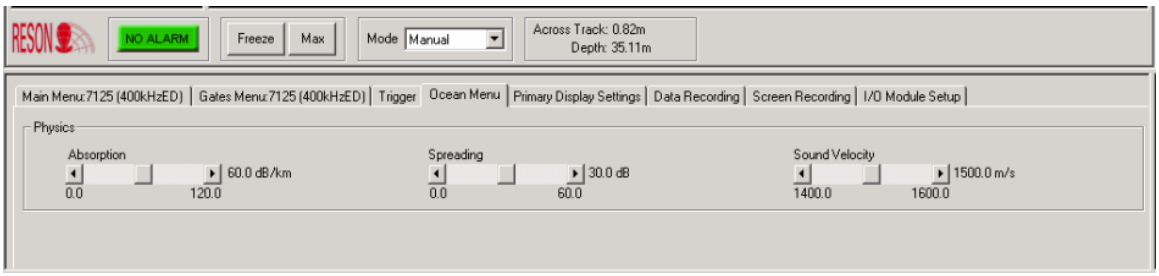
When adaptive gates are selected, a window appears on the main display, delimited by yellow horizontal lines labeled NS. As the filter limits approach the nadir search limits, the NS gates are automatically updated to center the nadir search on the detected sea floor.

The NS gates may be moved using the mouse/trackball and may be centered manually by right-clicking and selecting CENTRE NADIR GATE.



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

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 section 7.03.03.02 Change the Spreading Loss Coefficient (Spreading).

7.03.03.02 Change the Spreading Loss Coefficient (Spreading)

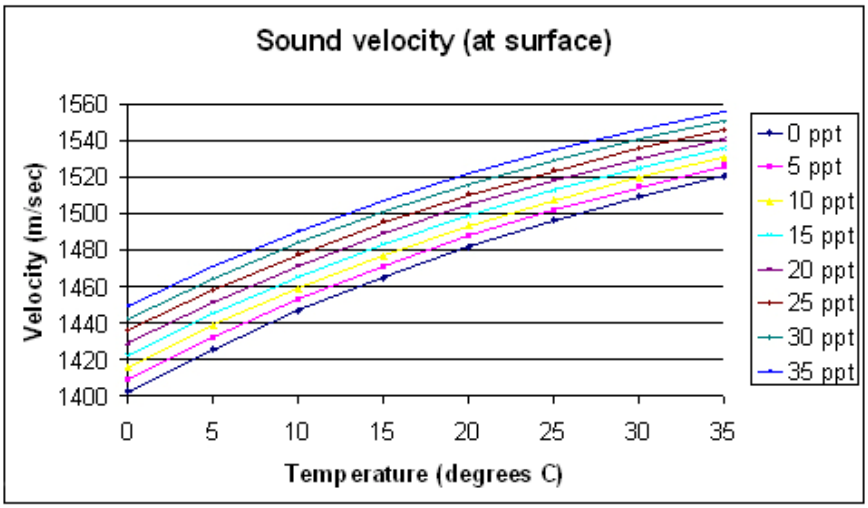
This selection allows the operator to enter the amount of cylindrical and spherical spreading loss that is expected through the ambient water medium. The range available is from 0 to 60, with a recommended initial value of 30.

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” selection 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. The following figure provides general reference for typical surface sound velocity at different temperatures and salinity.

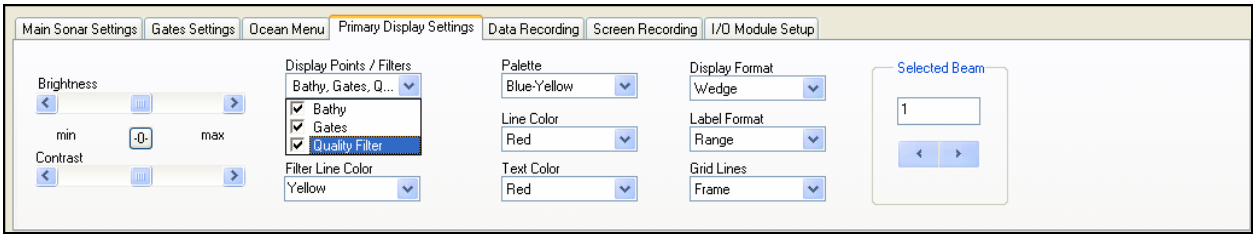


NOTE: If a sound velocity probe is interfaced to the sonar processor, the “Velocity” value is controlled by the probe and cannot be changed by the operator.

NOTE: For all slider bars on this page, the new settings will not be sent until the mouse has released control of the slider bar.

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.



Use this tab to 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. 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 deactivate 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 SPU. 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*.

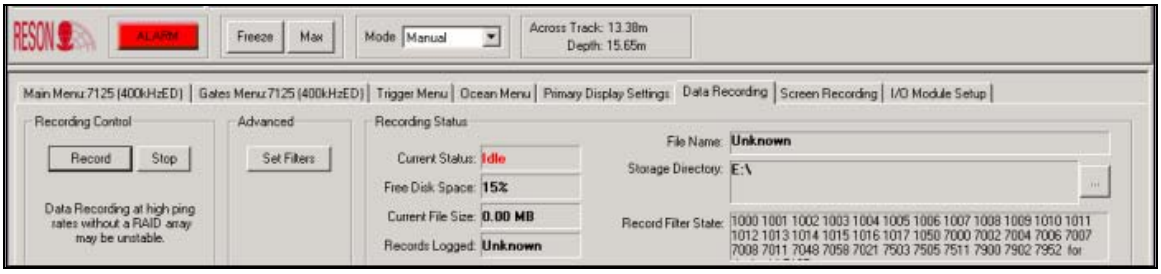
NOTE: Accuracy of the bathymetric data depends entirely on valid time sync and SVP input from this module, unless another solution such as PDS2000 is being used to perform this function. In the absence of time sync, a software time stamp is employed. However, this usually results in poor data quality 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

The Data Recording tab is divided into three general sections:

- Recording Control
- Advanced
- Recording Status



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.

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:** 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.

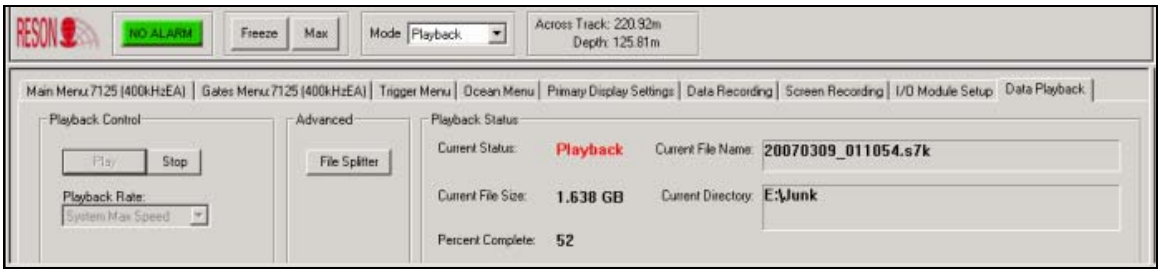
- **Current File Name:** The filename for the current file. The filename is automatically generated using the following naming convention: YYYYMMDD_<*System ID*>_SystemName.s7k. See the RESON Data Format Definition document for further description.
- **Current Directory:** The location where the current file is being stored. To change this location, click the Browse button and select the folder where the recorded files should be saved.
- **Record Filter State:** Lists the record types that are currently being included in the recording.

7.04.02 Play Back Recorded Sonar Data

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 7.02.08 Change Modes).

The Data Playback tab is divided into three general sections:

- Playback Control
- Playback Status
- Advanced



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”), loading a file (“Loading”) 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 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**.

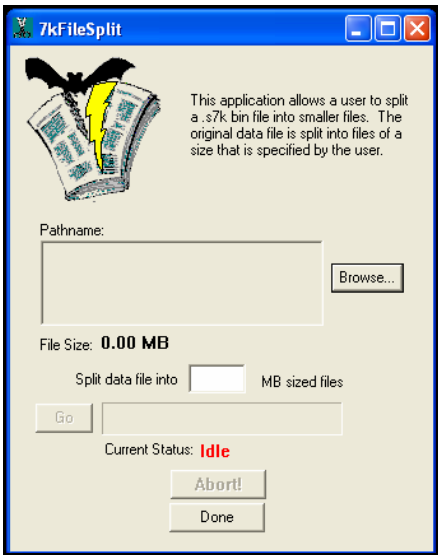
7.04.02.03 Advanced (File Splitter Utility)

The Advanced section of the Data Playback tab provides the File Splitter tool, which allows the manipulation of recorded data files. This is utility allows the user to split recorded data files into smaller files.

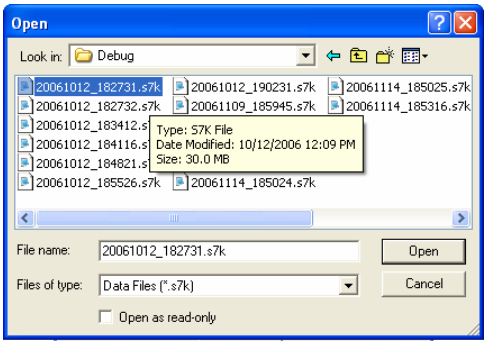
To use File Splitter:

1. Click the “File Splitter” button to launch the application.

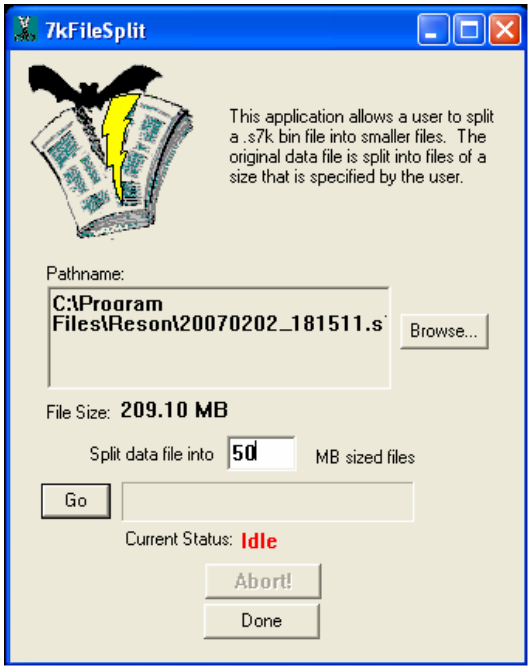
2. Click the “Browse” button to locate the desired file.



3. Select a file and click Open.

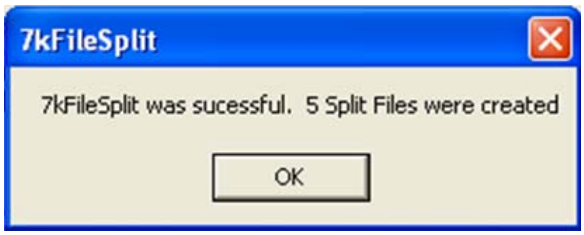


4. The screen updates with the name and size of the selected file. Enter a value in the split size field. Click the “Go” button.



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.

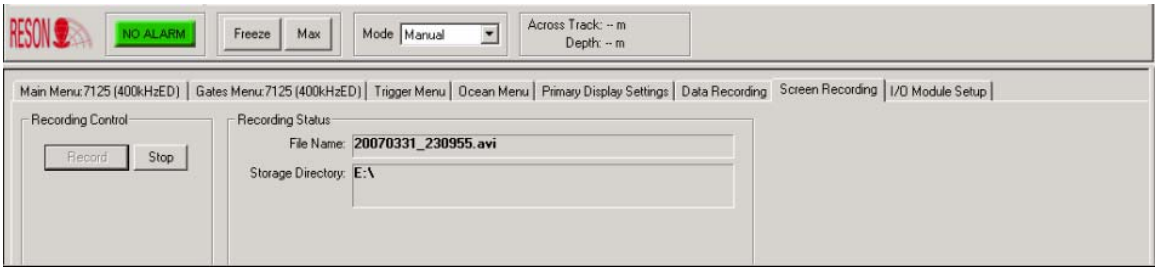


The new files are located in the same location as the original input file.

7.05 Screen Recording

7.05.01 Record Video Data

The Screen Recording tab is divided into two general sections: Recording Control and Recording Status.



7.05.01.01 Recording Control

The Recording Control portion 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.

7.05.01.02 Recording Status

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

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

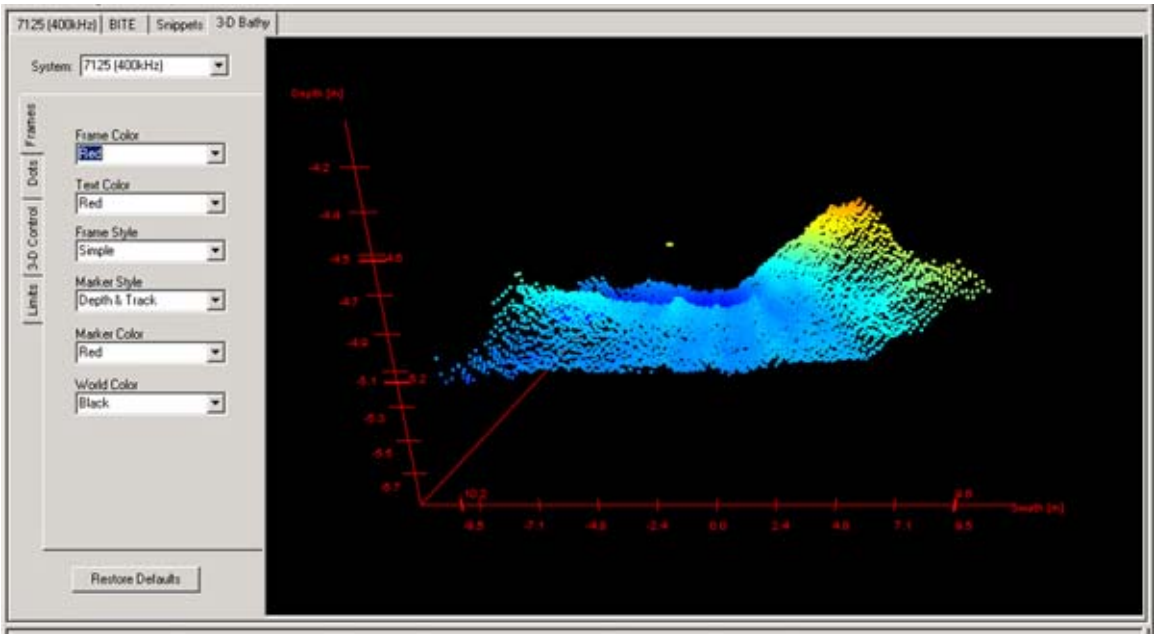
7.05.02 Play Back Recorded Video Data

Use any media player to play back .avi files.

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.



The 3-D Bathymetry 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 bathymetry 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 display.

7.06.01.01 Frames Tab

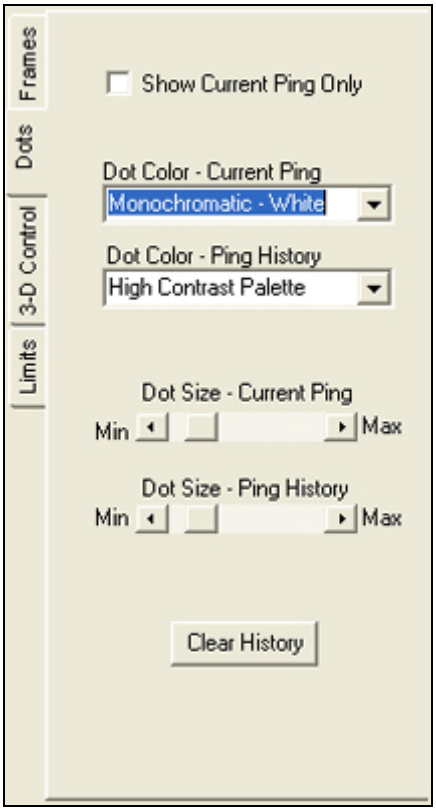
The Frames tab allows the operator to change the appearance of lines, text elements, markers, and background for the 3-D Bathymetry display. Each of these is changed by selecting the desired appearance from a pull-down menu.

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.
  - o All: Show all frames.
  - o Dynamic: Automatically adjust frames to best display, based image rotation.
  - o Simple: Show only the X and Y axes.
  - o 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 Tab

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.

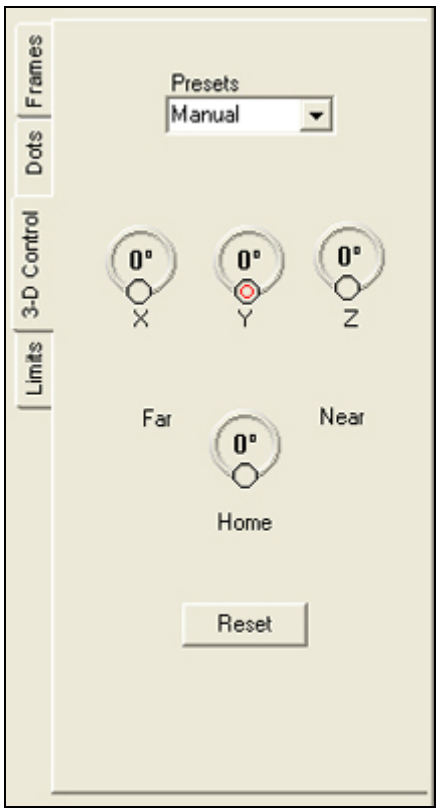


The following settings may be customized:

- **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 Tab

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

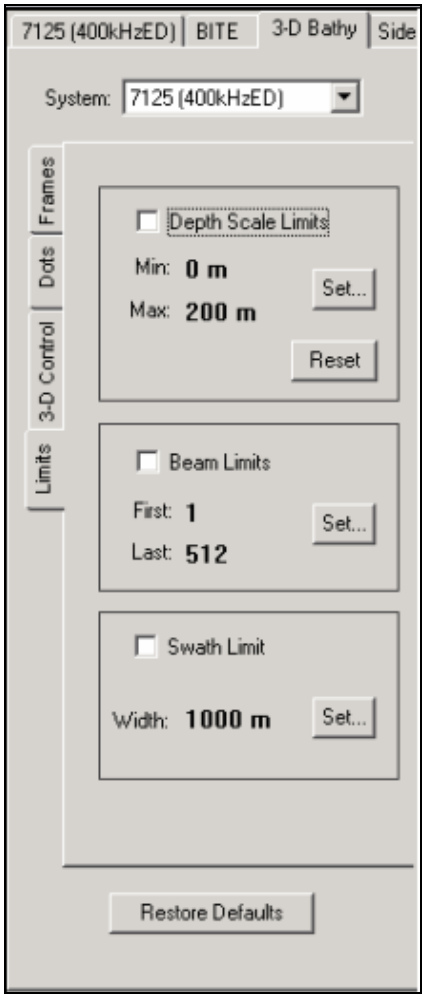


The following settings can be changed:

- **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 Tab

The Limits 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.

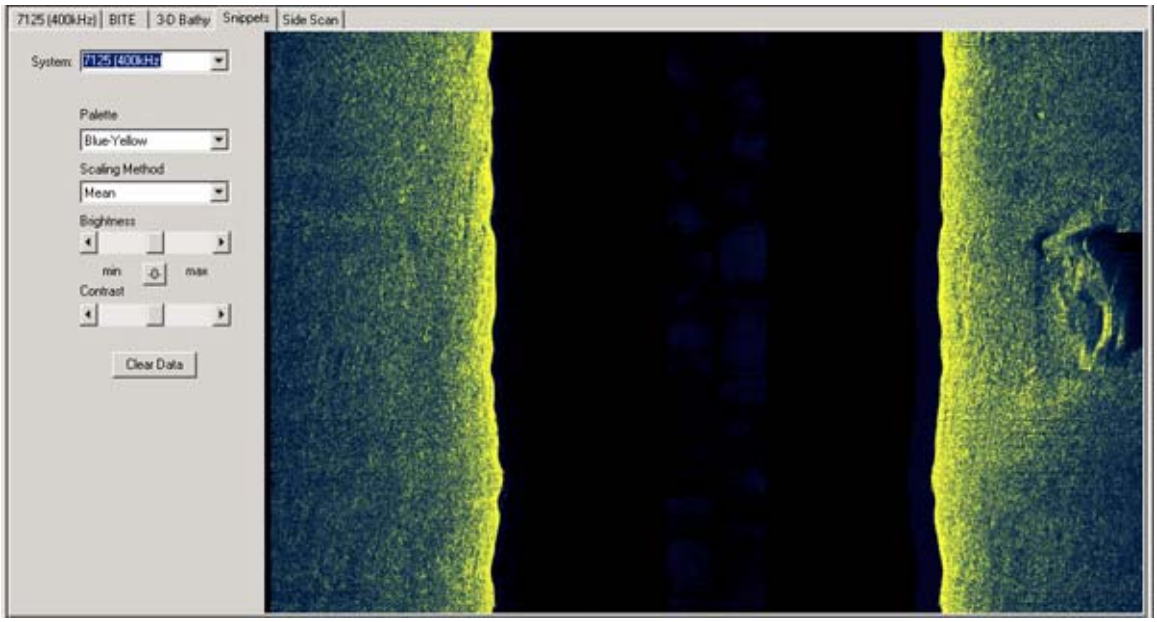


The following options can be changed:

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

7.07 Snippets and Side-Scan Displays

The Snippets tab displays the snippets data and 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 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.

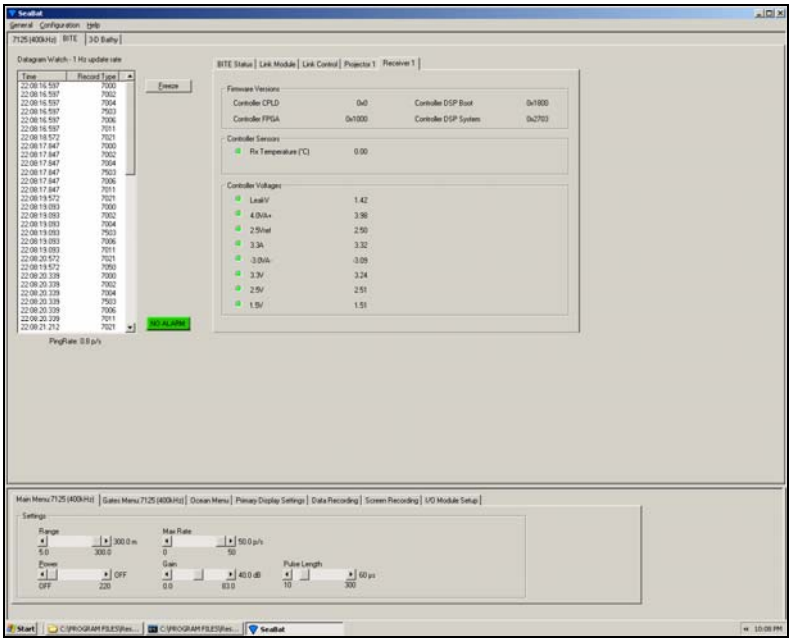
7.08 Built-In Test Environment (BITE)

7.08.01 BITE

BITE is an integral part of the **SeaBat 7125** system and provides the operator with continuous monitoring of critical temperatures, voltages and communications status. BITE is implemented on several PC boards within the system, typically:

- Link Module (in the 7-P)
- Link controller (in the LCU)
- Receiver digital controller (in the receiver)
- Transmitter (in the LCU)
- I/O Module (in the 7-P)

Depending on the particular system, a number of parameters are monitored and presented to the operator through the BITE tab on the user Interface.



An out-of-tolerance parameter turns the LED to red on the BITE Status tab and the individual board tab 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 page is useful for verifying that the new version has been accepted.

7.09 Equi-Distant Beamforming

As the beam steering angle increases from nadir, the number of beams per degree of swath stays constant for equi-angle spacing while it increases for equi-distant spacing. The following illustration presents the number of beams as a function of steering angle for a 1° nadir beam spacing.

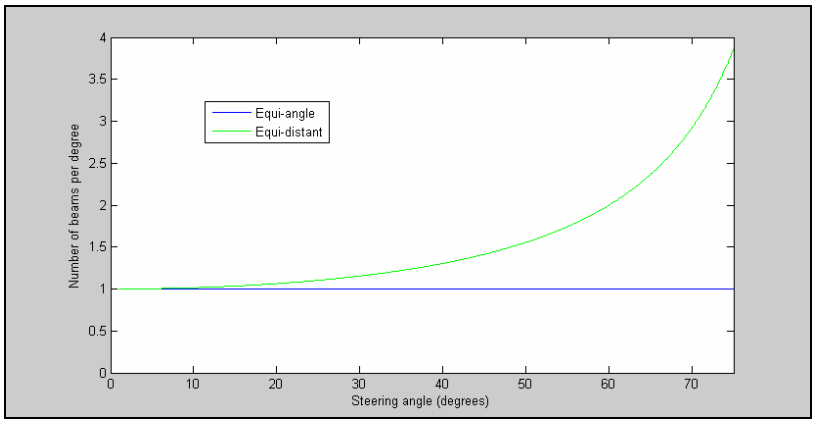


Figure 13: Beam Density

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 equi-distant mode, the appropriate number of beams are formed to maintain this nadir sounding spacing across the entire swath. Refer to the following figure.

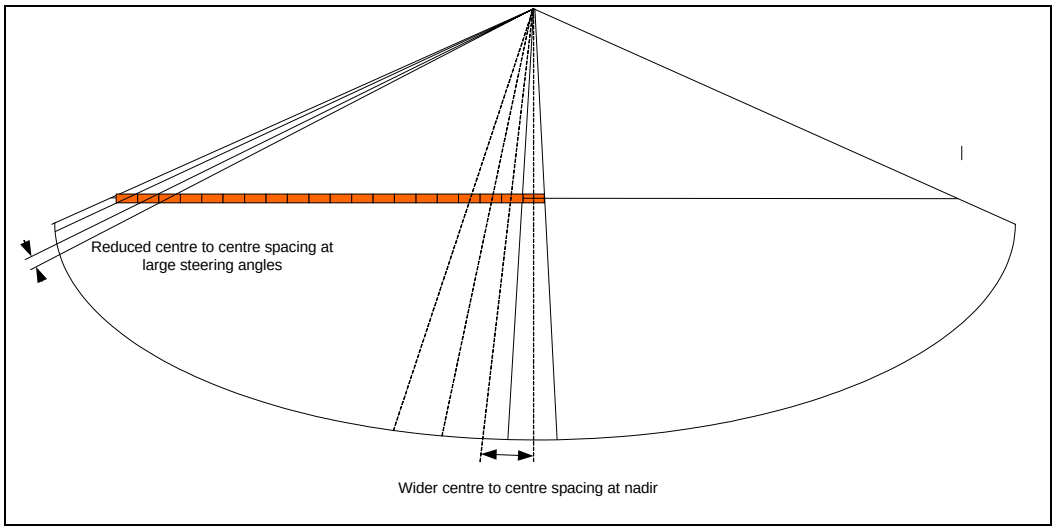


Figure 14: Beam Spacing

In order to achieve this uniform sounding spacing, it is necessary to decrease the beam center-to-center spacing requiring a significant increase in the number of beams formed. As an example, in the 7125-400 kHz system there are 256 or 512 beams formed in equi-angle mode and 512 beams formed in equi-distant mode over the same 150° swath.

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

The following figure shows the difference in distribution between equi-angle and equi-distant modes.

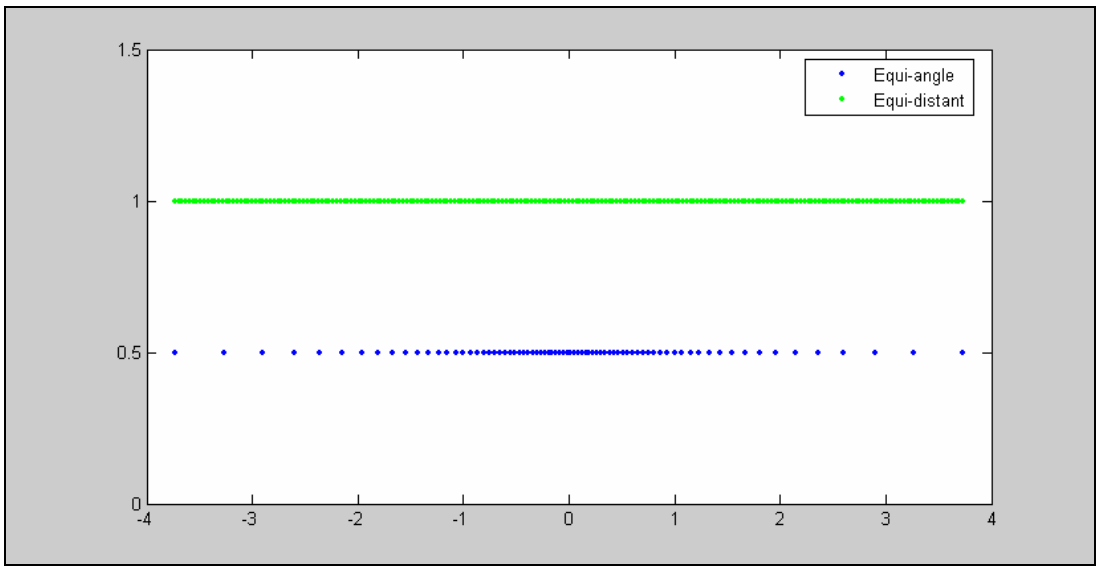


Figure 15: Across-Track Sounding Location on a Flat Bottom

7.10 Quality Flags

As part of the 7K 7006 record, a one-byte quality flag is exported indicating the quality of the bottom-detect point. Two bits are used with the following parameters:

- **Bit 0:** Brightness: 1 = pass, 0 = fail
- **Bit 1:** Colinearity: 1 = pass, 0 = fail
- **Bit 2:** Reserved quality bit
- **Bits 3-5:** Process bits
- **Bits 6-7:** Reserved

There are therefore four quality levels:

- **0:** Brightness and colinearity fail
- **1:** Brightness pass, colinearity fail
- **2:** Brightness fail, colinearity pass
- **3:** Brightness and colinearity pass

7.10.01 Display in the SeaBat7k UI

The wedge display in the SeaBat UI can display the bathy points color-coded to indicate which quality flags have passed:

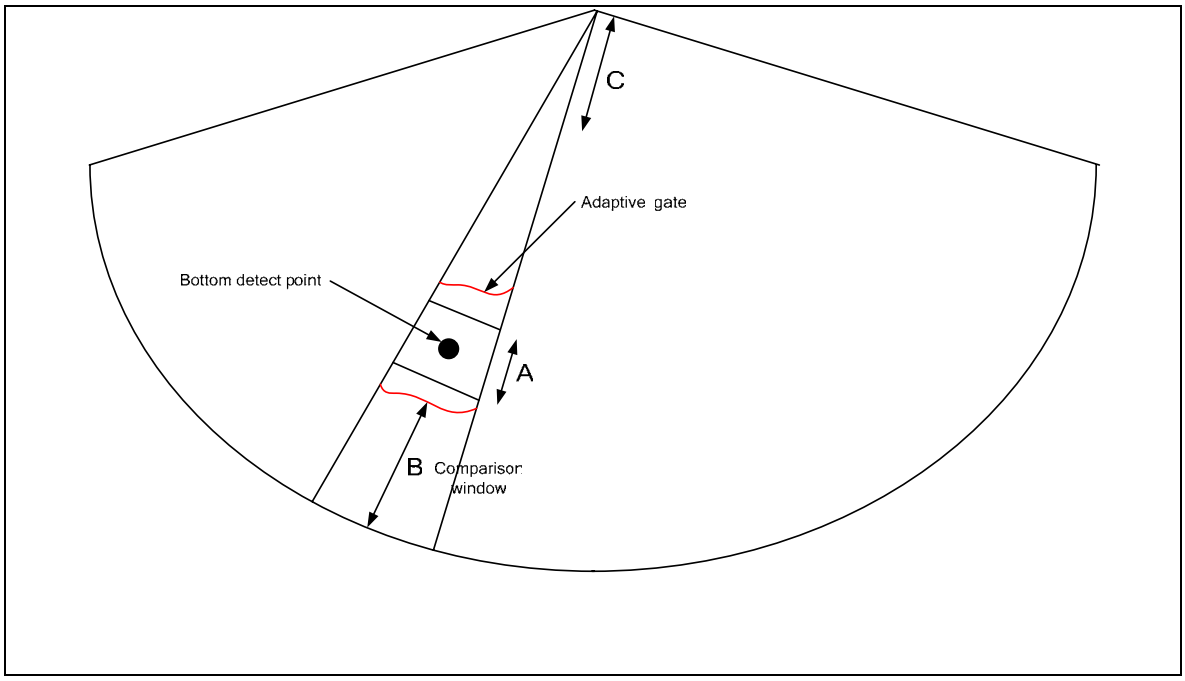
- **Green:** Both brightness and colinearity tests passed.
- **Orange:** Brightness test only passed.
- **Yellow:** Colinearity test only passed.
- **Red:** Neither test passed.

7.10.02 Brightness Test

The brightness test measures the signal-to-noise (S/N) ratio 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 square of the sample intensity around the bottom detection point. The number of samples used is marked ‘A’ on the diagram below, 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 the diagram) and the square of the samples in the “head” of the water column (before the first return – marked ‘C’ in the diagram).

Beams whose S/N ratio is greater than a predetermined threshold will be flagged as passing the brightness test.



7.10.03 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 point N is within a 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.

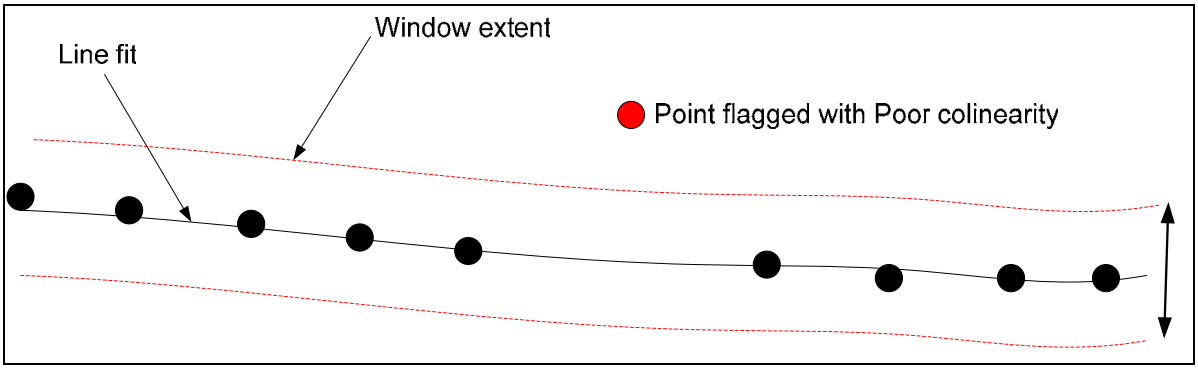


Figure 16: Colinearity Flags

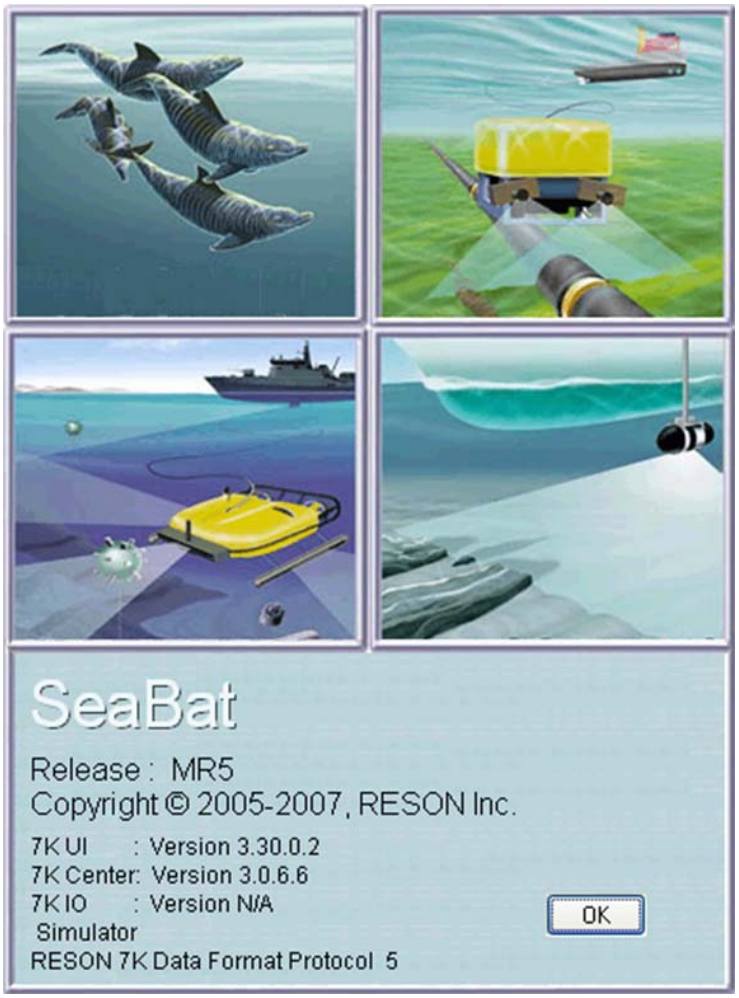
7.11 7kCenter Console Window

The 7kCenter runs in console mode only. The non-resizeable black console window is active while controlling the sonar. On startup and shutdown various progress information is posted to this window. All other sonar information that was previously reported in the console window is now obtained from the display.

7.12 Software Release Information Box

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



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8 REFERENCE DOCUMENTATION

8.01 SeaBat 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 Operator's Manual	12408	Printed version of this Web-based documentation set.
Data Format Definition	11542	Version 1.0 or higher

8.02 SeaBat 7125 Design Documents

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

Drawing Title	Drawing Number
Cable Assembly, TP, Wet to Dry (LCU to SPU)	*11679*
Cable Assembly, Rx HD - Link Controller Bottle	*11392*
Cable Assembly, Tx, HD - Link Controller Bottle	*11393*
SeaBat 7125 Reference Point	*12851*
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*

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9 WARRANTY INFORMATION

9.01 Warranty Information

9.01.01 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.

9.01.02 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 9.01.06 Service).

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 section 9.01.06 Service) 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 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.

9.01.06 Service

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

UNITED STATES

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

UNITED KINGDOM

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

GERMANY

RESON GmbH
Wischhofstrasse 1-3,
Geb.11, 24148 Kiel,
Germany
Tel: +49-431-720-7180
Fax: +49-431-720-7181
e-mail: reson@reson-gmbh.de

NETHERLANDS

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SeaBat 7125 Operator's Manual

Produced by:

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