Operator manual

KONGSBERG

MS1000

PC Based Sonar Processor

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Operator manual

Revision

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Document history

Issue 5.0 updated to include:

- Enthernet telemetry sonar heads configuration.
- SPD3003D compass sensor calibration procedure.

Kongsberg Mesotech Ltd.

1598 Kebet Way
Port Coquitlam, BC
V3C 5M5 Canada

Telephone: +1 604 464 8144
Telefax: +1 604 941 5423
www.kongsberg-mesotech.com
Email: km.sales.vancouver@kongsberg.com

KONGSBERG

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Introduction

The MS 1000 sonar system is one of the most powerful, feature-rich mechanically scanning sonar system in the word. It continues to be developed to meet the stringent requirements of the ever-changing offshore industry, including Harbour Defense, Police Search & Recovery, and Scientific Assessment & Survey.

The system uses a PC or MS 1000 processor as the control and display unit for one or more sonar heads and sensors. It works with several types of digital sonar heads and altimeters available from Kongsberg Mesotech Ltd. It displays a real-time sonar image and can record or export a data file for later viewing. In addition to sonar data, the system can receive information from external sensors, such as GPS, RTK(real time kinematic), MRU(motion reference unit) etc.

MS 1000 key features include:

- Simultaneous multiple scanning sonar head and altimeter operation, and sensors configurations
- Time-tagged recording of sonar data and playback recorded data file
- Advanced target measurement and annotation tools
- Trackplotter module allowing the user to pre-plot search and survey lines, and to geo-reference sonar targets
- Ping synchronization for multiple heads operation
- Fused data display for dual heads profiling
- Post-processing capability for profile data
- Pan Device used for rotating the sonar head in profiling applications
- BMP and GeoTIFF format support for imagery mosaics
- Single beam target tracking
- Remote Keypad support to substitute standard computer keyboard and mouse.

Computer System Requirements

Suggested Requirements

- 3 GHz Pentium 4 or faster recommended.
- 1 Gbyte RAM or more recommended.
- At least 30 Mbytes of free hard disk space.
- 32-bit color video with 1280 x 1024 or higher resolution.
- One or more available serial COM or USB ports.
- At least one parallel printer port or USB port.
- A CD ROM or DVD ROM drive for software installation.
- Windows XP Professional or Windows Vista Business edition operating system.

Minimum Requirements

- 1 GHz Pentium III or faster recommended.
- 512 Mbyte RAM or more recommended.
- 64K color video with 1024 x 768 or higher resolution.
- Windows 2000 operating system with Microsoft DirectX 8.0 or above.

Note: *Windows 2000 operating system doesn't support remote keypad (See "About the Remote Keypad" on page 91).*

Installing Software

It is recommended that you uninstall any previous version of MS1000 before installing the new version.

To uninstall MS1000

1. Close all active applications (including MS1000).
2. On your desktop, choose **Start > Control Panel**.
3. Double-click **Add/Remove Programs**.
4. In the **Currently installed programs** list, click **MS1000.**
5. Click **Remove** to remove the MS1000 application.
6. Click **Yes** for all subsequent questions.

To install MS1000 from the CD-ROM

1. Insert the disk in the drive.
2. On the CD-ROM drive, double-click **MS1000_V0XX_Setup.exe**.
3. Follow the instructions to install the program and accept the default settings for each choice by clicking **Next**.

To run MS1000 in Windows Vista

1. On your computer desktop, right-click the **MS1000** icon.
2. Click **Properties**, and then click the **Compatibility** tab.
3. Under **Compatibility mode**, select the **Run this program in compatibility mode for** check box.
4. In the list box, select **Windows XP (Service Pack2)**.
5. Under **Privilege Level**, select the **Run the program as an administrator** check box.

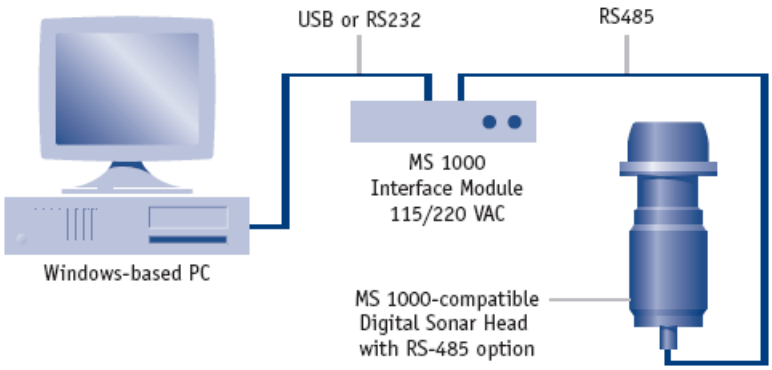
Installing Sonar Head

The sonar head can be connected to the MS1000 PC based Processor using either the Interface Unit supplied by KML, or in special cases, a user supplied telemetry system.

You can connect multiple heads to the system by using additional COM ports of the computer or connecting multiple heads in parallel on the RS-485 lines.

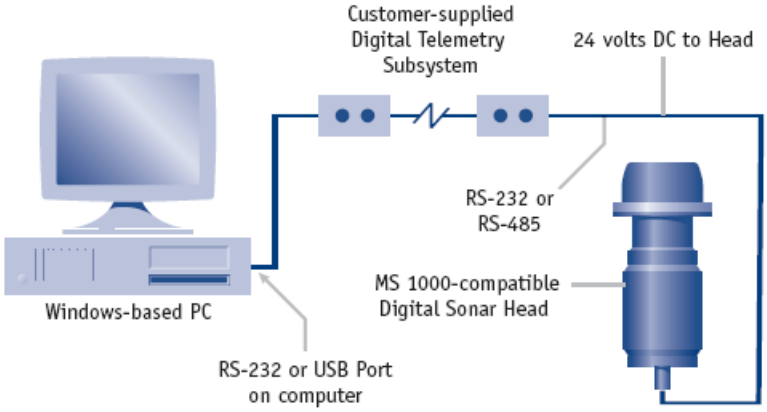
Option A - KML Interface

KML supplies MS1000 Interface units for scanning sonar. These units provide power for the sonar head and convert the USB or RS232 telemetry to RS485 to allow for extended cable length and multi-drop configurations. Please consult the hardware specification sheets for more information.

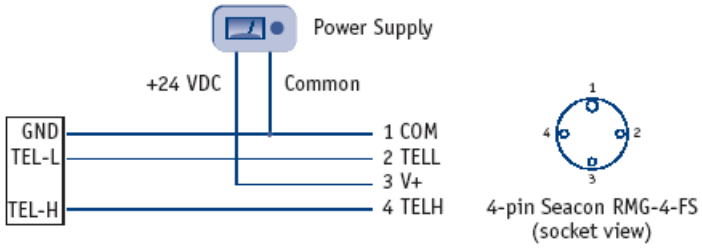


Option B - User Supplied Interface

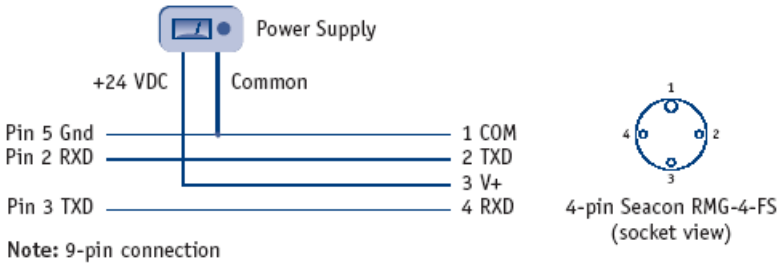
For special configurations or very long data links the user can employ a digital telemetry subsystem that accepts serial data at each end. These subsystems include Fiber Optic extension to serial telemetry links, user supplied RS232/RS485 converters or similar devices.



Note: *For operation using the USB port, a KML supplied USB/RS232 converter is required.*



RS 485 Configuration



RS 232 Configuration

Installing Hardware Key

To operate the sonar heads, the MS1000 System requires a hardware key (dongle) to be connected to your computer's parallel or USB port. If you only playback a data file, no key is required. You are free to make copies and distribute the software to others allowing them to view data that you have collected.

To install the key, simply plug it into the parallel or USB port. If a printer or other key is already connected to the port, simply remove it, and insert the MS1000 key, and then insert the removed connector into the hardware key pass-through socket.

Getting Help

You can get help from the accompanying operator manual or directly from the user interface. You can find topics in the online Help by using the table of contents and search tool. You can also print a Help topic and display Help topics relevant to the task you are performing.

Help is available through the following tools:

- Operator manual—provides commonly used procedures and information.
- Online help—lets you access Help directly from the user interface by pressing F1 and find topics using the contents topic, index, and word/phrase search tool.

  Click one of the following tabs:

  - Contents—lets you browse through topics in the Help

- Index—lets you use the index to find a topic
- Search—lets you search the full text of the Help for a particular word. For example, if you are looking for information about Range, you can type “Range” to display a list of relevant topics.

You can also:

- View Help for a dialog box by clicking the **Help** button.

• StatusBarTips—let you access tips for using the application’s icons and buttons. To view a StatusBarTip, point the cursor over an icon, button, or other application control.

Document Conventions

The following table describes conventions used in the operator manual and Help.

Convention	Description
Text in **Bold**	Represents names of interface elements such as buttons, check boxes, list boxes, list views, menu names, menu choices, options, tabs, and text boxes.
Text in *Italics*	Indicates a special term
Notes	Provide additonal information about the material being discussed
Select	Add a check to a check box or menu item
Clear	Remove a check from a check box or menu item
Use **Menu Panel > Command button**	Indicates using a **Command button** on certain **Menu Panel** to perform an operation.
Click **Menu > Menu command**	A menu item and menu command that you need to click in sequence.

Getting Started

This section includes the following:

- Running the System
- Getting Familiar with the MS1000 display
- About the Menu Panel
- Changing Menu Text Languages
- Setting Menu Appearance
- The Message Log Window
- The Status Bar
- Defining Users and Settings

Running the System

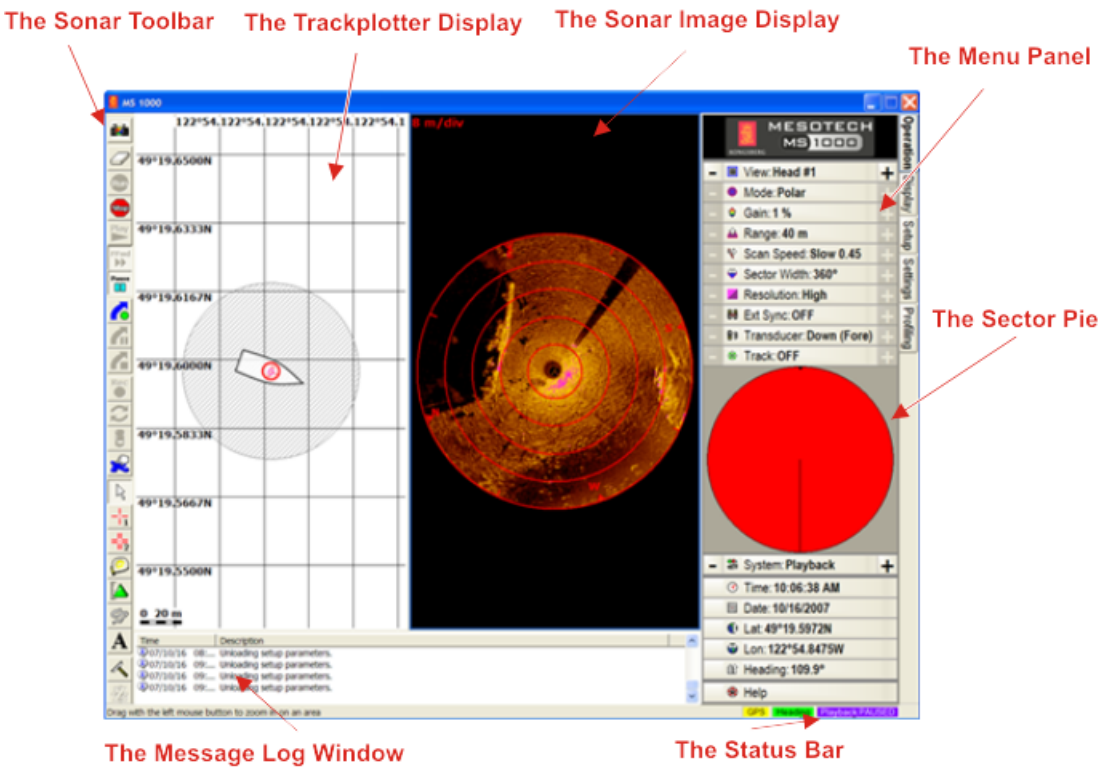
Make sure the hardware key (See “Installing Hardware Key” on page 4) is installed to your computer before you start the MS1000 system. All available serial ports are defined during the starting process.

To	Do this
Start MS1000	On your computer desktop, double-click the **MS1000** icon.
Configure sonar heads	See “Configuring Heads” on page 13.
Run sonar heads	Click **System > Run**.
Pause/resume the sonar head	Click **Operation** > **Pause/Resume**.
Stop running heads or playback a file	Click **System > Stop**.
Exit the system	Click **System > OFF**.

Getting Familiar with the MS1000 display

The MS1000 system contains several viewable display objects:

- The Sonar Image Display.
- The *Trackplotter Display*, See “Trackplotter” on page 57.
- The *Menu Panel*, See “About the Menu Panel” on page 9.
- The *Message Log* window, See “The Message Log Window” on page 11.
- The *Status Bar*, See “The Status Bar” on page 11.
- The *Sector Pie* shows sonar scan coverage. If more than one head attached, the sector pies are present in different color for different heads.



You can hide these objects except the sonar image display. You can drag the pointer to move the split lines between display windows to adjust the window size.

You can hide the menu panel to get a full-screen sonar image display. When the resolution of sonar image is higher than the image display window, you have the choice of showing image in its full resolution or fitting the image to the window size.

To show or hide the Sonar Toolbar

1. Click **Setup > Advanced Menu > View**.
2. Do one of the following:
   - To show, select **Sonar Toolbar**
   - To hide, clear **Sonar Toolbar**

To show or hide menu panel

- Use **Display > Menu AutoHide**.

To fit sonar image to window size

1. Right-click in the sonar image display.
2. Select **Fit Image to Screen**.

Changing the Brightness of Screen

You can change the brightness of the screen according to the environment you are working in.

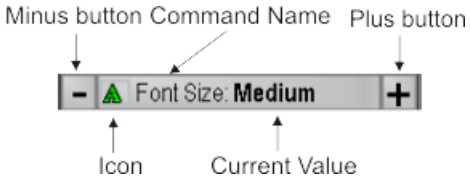
To change the display brightness

- Use **Display** > **Display**.

About the Menu Panel

Operation commands are accessible through the menu panel, shortcut menu, and the Sonar toolbar. The *Menu Panel* contains most of the operation commands. Some of the command buttons may be unavailable in playback mode.

A typical command button contains several components:



General command button operations include:

To	Do this
Increase the command value	Do one of the following: • Click +. • Click the command button.
Decrease the command value	Do one of the following: • Click -. • Right-click the command button.
Get the maximum value	Right-click +.
Get the minimum value	Right-click -.
Fast-forward the command value	Hold down + or -.

The current system time and date, as well as the vessel status are shown at the bottom of the menu panel.

Button	Description
Time	Current time according to the system clock
Date	Current date according to the system clock
Lat	Current boat latitude
Lon	Current boat longitude
Heading	Current boat heading

Changing Menu Text Languages

You can change the menu panel text language in this system.

To change languages

- Use **Setup** > **Language**.

At this time, the MS1000 system supports the following languages:

- English
- Danish
- Dutch
- Icelandic
- Norwegian
- Russian
- Spanish

Setting Menu Appearance

You can adjust the menu width and change the menu font size. You can show or hide the icons on the menu buttons. You can also show all the menu buttons (long) or only basic buttons (short).

To	Do this
Show/hide the menu icons	Use **Setup** > **Icon**.
show all/basic menu buttons	Use **Setup** > **Menu**.
Adjust the menu width	Use **Setup** > **Menu Width**.
Change the menu font size	Use **Setup** > **Font Size**.

The Message Log Window

The *Message Log* window shows the date, time and description of the events, both normal and abnormal, as logged by the system. The contents of the message log can be used in diagnosing and troubleshooting the system problems. The log files are saved in **KML\ MS1000\Logs**.

You can hide, show, or clear the Message Log window. Once the *Message Log* window is shown, clicking in it enables the **Message Log** menu panel.

To	Do this
Show the Message Log window	Right-click in the sonar image display window and select **Message Log**.
Hide the Message Log window	Right-click in the sonar image display window and clear **Message Log**.
Clear message log	Click **Message Log > Clear Log**.

The Status Bar

The *Status Bar* at the bottom of the display provides various information according to the position of the pointer.

The left side of the *Status Bar*:

- Describes a command button function when you point to it**.**
- Gives instructions on what to do next when you perform certain operation.

The right side of the *Status Bar* indicates the system status by color. For instance,

means you are playing back a file containing DGPS and MRU data.

	Status	Color
Head Operation	Head running	Yellow
	Playback	Blue
	Playback Pause	Purple
	Recording	Green
	Recording pause	Red
	Stop	Grey

	Status	Color
Sensors	Receiving data	Green
	Not receiving data	Yellow
	Receiving conflicting data from multiple sensors at the same time	Red
	No sensors are enable for this type of data	Grey

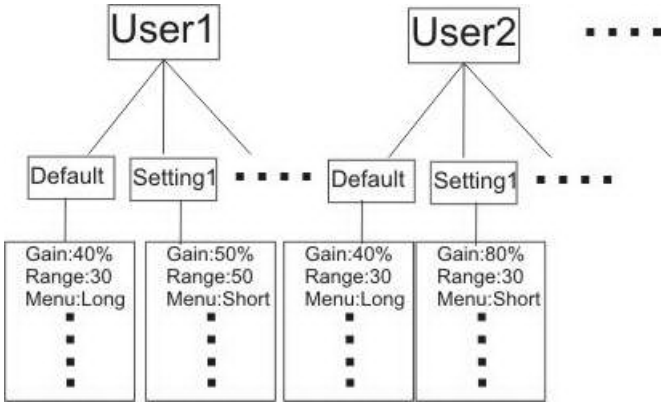
To show or hide the Status Bar

1. Click **Setup > Advanced Menu > View**.
2. Do one of the following:
   - To show, select **Status Bar**.
   - To hide, clear **Status Bar**.

Defining Users and Settings

You can create and save different settings and configurations for more than one user. Different users can easily restore their own settings.

The following diagram shows the relationship between users, settings, and configuration:

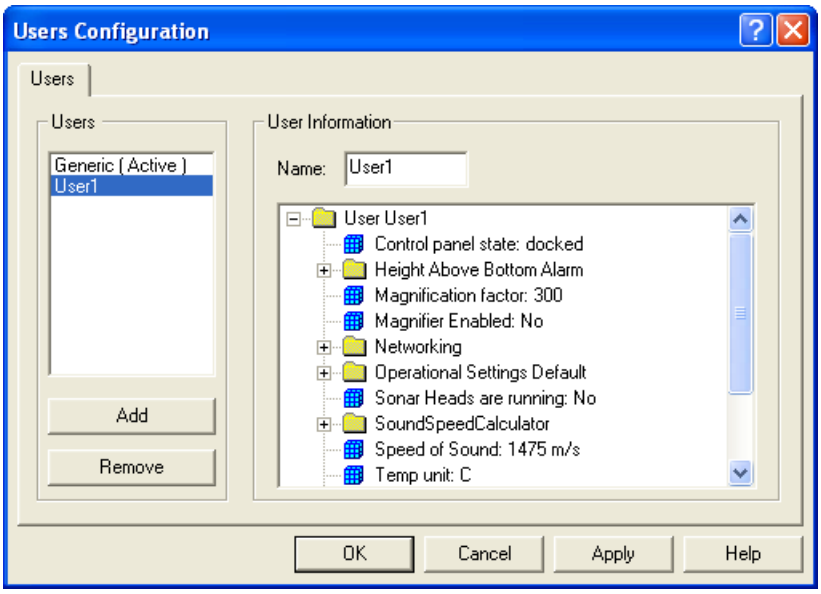


You can create, rename, or delete a user.

You can create, save, rename, or delete a setting. You also can reset the system to the standard factory setting. When you save settings, the system saves all the settings to a <username>.cfg file for the current user. You can load settings from this file when you need.

To create a new user

1. Click **Setup > Advanced Menu > Configuration > Users > Define**.



2. Click **Add**.
   A new user appears with the default name **UserN**. You can edit its name in the **Name** box.
3. Click **Apply.**
   The selected user becomes active. The **User Information** lists the current settings for the selected user.

To delete a user

1. Click **Setup > Advanced Menu > Configuration > Users > Define**.
2. In the **Users** list, click the user that you want to delete.
3. Click **Remove**.

To change user

1. Click **Setup > Advanced Menu > Configuration > Users**.
2. Select a desired user.

To Define settings

To	Do this
Save a setting	Click **Settings > Save Setting**.
Create a new setting	Click **Settings > Save Setting** and enter a new setting name.
Rename a setting	Click **Settings > Rename Setting** and enter a new setting name.

To	Do this
Delete a setting	Click **Settings > Delete Setting**.
Reset the system to the standard factory settings	Click **Settings > Factory Setting**.
Load settings from a file	Click **Setup > Advanced Menu > Configuration > Load Settings**.

Configuring Sonar Heads and Sensors

This section includes the following:

- Configuring Heads
- Adjusting Sonar Head Mounting Offsets
- Setting Sonar Head Mounting Orientation
- Programming Heads Downlink Baud Rate
- Checking Head Settings Information
- Configuring Altimeters
- Synchronizing Heads
- Configuring External Sensors
- Setting Sensor Mounting Offsets
- Accepting Integrated Compass Sensor Data
- Calibrating compass Sensors
- Overriding Playback Head Mounting Offsets

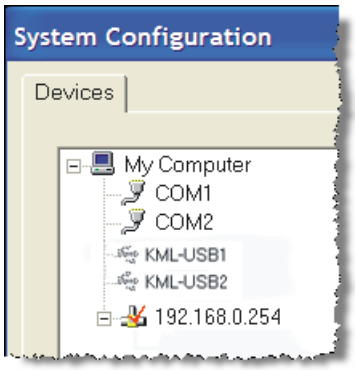
Configuring Heads

Before you configure heads, make sure the hardware key is installed in the USB port.

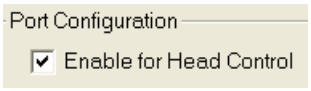
The 1071 Ethernet digital sonar head is required to connect to your computer's ethernet adapter (See "Setting up Your Computer to Communicate with Ethernet Head" on page 115).

To configure heads

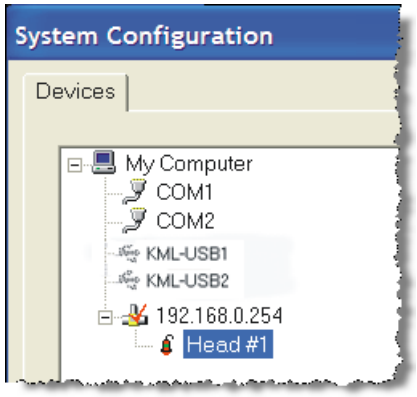
1. Click **Setup > Connect Sonar**.
   The **System Configuration** dialog box appears showing the follows:
   - Available COM ports
   - USB ports being used for USB interface
   - Ethernet adapters being connected to ethernet sonar heads



2. Click the port to which the sonar head is connected.
   The **Port Configuration** box appears showing the port hardware address.
3. Select the **Enable for Head Control** check box.



   The standard serial port baud rate is 115200 bps. To achieve a higher speed, use a faster telemetry serial port and multiply the baud rate. For instance, if your telemetry serial port speed is 230400 bps, select 2X from the **Baudrate Multiplier** box.
4. Click **Detect Heads**.
   The head is detected after twenty seconds or more (depending on the number of enabled ports and connected heads). The **Port Configuration** section changes to show the **Head Name, Part Number,** and **Serial Number.**

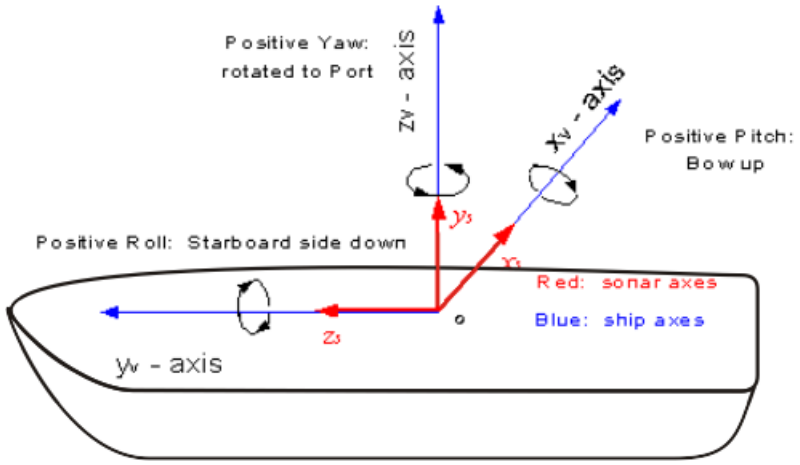


5. To use constant baud rate to all the connected heads, select the **Use constant baud rate** check box, and select a desired baud rate in the list box.
6. Click **OK** or **Apply**.

Adjusting Sonar Head Mounting Offsets

The sonar head coordinate system used in this system has a fixed time position relative to the vessel coordinate system. The actual sonar head position offsets are measured after the installation. By default, the coordinate systems of the sonar head and the vessel coordinate system are aligned.

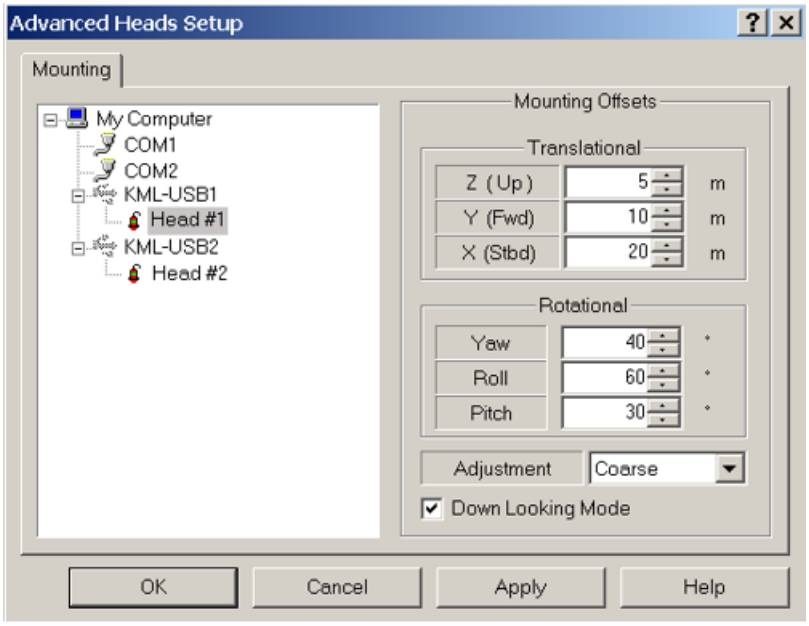
The following diagram shows the positions of the vessel and sonar head when they are aligned both in the directions of the axes and locations of the origins, where o-Xs-Ys-Zs is the sonar coordinate system and o-Xv-Yv-Zv is the vessel coordinate system.



This system allows you to adjust sonar heads offsets in real-time or during playback.

To adjust head mounting offsets

1. Right-click in the sonar image window.
2. Click **Offsets**.
3. In the **My Computer** list, select a head.



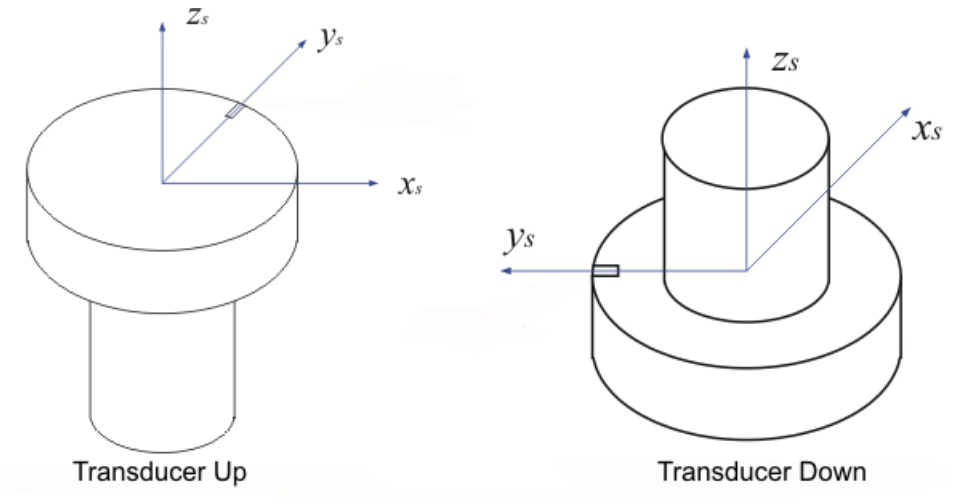
4. In the **Translational** area, enter the sonar head X, Y and Z offsets.
5. In the **Rotational** area, enter Yaw, Roll, and Pitch offsets.
6. If you use more than one head enter offsets for each by selecting another head in Step 3. .

You can also use the offsets and rotation buttons on the **Profiling** menu panel to adjust the sonar head mounting offsets.

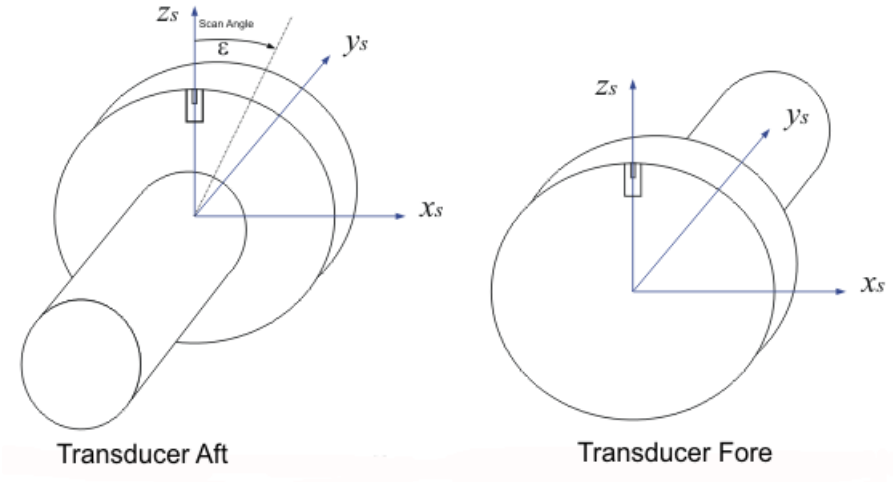
Setting Sonar Head Mounting Orientation

Sonar heads can be mounted on the vessel vertically or horizontally. A sonar head is mounted horizontally is call *Down Looking Mode*, which is used to gather sea bottom data.

When a sonar head is mounted vertically, the transducer can face up or down.



In the sonar head down looking mode, the transducer can toward the stern of the vessel (aft) or toward the bow of the vessel (fore).



The orientation setting determines how the image is plotted on the image display. If you set it incorrectly, the image is reversed right to left. By default, the orientation setting of the sonar head in this system is head mounted vertically with transducer facing up (aft). If the sonar head is mounted horizontally or transducer facing down, you need to configure the orientation settings.

To set sonar head to down looking mode

1. Right-click in the sonar image display.

2. Click Offsets.
3. In the **My Computer** list, select the head.
4. Select the **Down Looking Mode** check box.

To set transducer orientation

- Use **Operation** > **Transducer**.

Programming Heads Downlink Baud Rate

You can re-program the newer 1071 sonar heads to use a downlink baud rate different from the default value of 9600 bps.

To program Heads

1. Configure heads, See "Configuring Heads" on page 15.
2. Choose **Setup > Advanced Menu > Configuration > Program Heads.**
   The **Heads Startup Baud Rate** dialog box shows the current baud rate in the **Current** box.
3. Select a value from the **New** list.
4. Click **Program.**
   All enabled heads are programmed with the new startup baud rate. When running the head, the **Startup Information** dialog box shows the new baud rate.

Checking Head Settings Information

You can find the basic information about the connected head and its characteristics in the **Head Settings** dialog box **Info** page.

To check the Head Settings Info

1. Right-click in the sonar image display window.
2. Click **Control Head,** and then click the **Info** tab.

Parameter		Description
Identification	Type Number	The head type identification number
	Serial Number	The serial number of the connected head
	Software Version	The version number of the software in the head (not the MS1000 version number)
	Head - ID Array	The entire array of identification data from the head. These numbers are intended for internal use by Mesotech technicians.

Parameter		Description
Specifications	Max Sampling Frequency (Hz)	The maximum sampling frequency supported by this head
	Min Sampling Frequency (Hz)	The minimum sampling frequency supported by this head
	Maximum TX Pulse Length	The maximum transmit pulse length supported by this head
	Minimum TX Pulse Length	The minimum transmit pulse length supported by this head
	Maximum Data Buffer Size	The maximum size of the data buffer for this head
	Maximum Range Samples	The maximum number of range samples per ping for this head

Configuring Altimeters

The MS1000 system supports 1007 series altermeters which is designed to acoustically measure underwater altitude for both deep and shallow water. It shows altitude measurements as graph of proportional to range in the image display window.

To configure an altimeter

1. On the **Setup** menu panel, click **Connect Sonar**.
   The **System Configuration** dialog box appears showing every available COM port on the computer or a USB connection if the USB interface is being used.
2. Click the COM or the USB port to which the altimeter head is connected.
   The COM **Configuration** box appears showing the port hardware address for the COM port.
3. Select the **Enable for Head Control** check box.
4. Click **Detect Heads**.
   The altimeter is detected in a few seconds. The **COM Configuration** section changes to show the **Head Name, Part Number,** and **Serial Number**.
5. Click **OK** or **Apply**.

To show the altimeter data

1. Right-click in the sonar image window.
2. Click **Altimeter**.

Synchronizing Heads

When one sonar head is running near another head, you need to synchronize ping transmissions to avoid or minimize mutual interference.

The MS1000 system provides two synchronization methods:

- **Hardware synchronization:** used to synchronize heads attached to separate serial ports of one computer or different computers.
- **Software synchronization:** used to synchronize heads attached to the same serial port. You need to arrange these heads into groups. Each group has a minimum of two sonar heads and one head behaves as the **Master**. If you pause the **Master**, all the other heads within that group will pause scanning. A given head can only belong to one group at a given time.

To synchronize heads attached to separate serial ports

1. Connect these heads by a separate connection.
2. On the **Operation menu** panel, click **Ext Sync** to set:
   - One head as a **Master** head and the others as **Slave** heads.
   - All heads to **Select** mode. In this way, the system will automatically set up the heads.

To synchronize heads attached to the same serial port

1. Right-click in the sonar image window.
2. Click **Synchronize**.
3. Click the COM port that the sonar heads attached with.
4. Click **New group**.
   A new group appears in the **Groups** list. You can edit the group name.
5. Under this COM port, click the sonar head that you want to be the MASTER, and then click **Add head**.
   The sonar head name appears in the **Heads** list.
6. Under this COM port, add the other heads that need to be synchronized one by one to this group.
   - To delete a group, select the group from **Groups** list and click **Delete group**. The system pauses all the heads within that group.
   - To remove a head from a group, select the group from **Groups** list. The **Heads** box lists all the synchronized heads within that group. Select the head and click **Remove head**. If there is only two heads in a group and you remove one of them, the system deletes that group all together. If you remove the MASTER, the system automatically assigns a new MASTER for that group.

Configuring External Sensors

You can configure the MS1000 system to receive the NMEA sensory data from an external sensor, such as a GPS receiver or a compass, to indicate Latitude/Longitude,

heading, depth, speed, etc. You can also set up the system to receive a user defined sensory data.

To configure the system to accept heading data from a compass

1. Click **Setup** > **External Sensors.**
2. Click the **NMEA Data Selection** tab.
3. Select the **COM** port that you are using.
4. Select **HDG** in the **Standard** list and click **Connect**.You can also use **HDT** or **HDM** if your compass does not support the **HDG** sentence.
5. Click the **Ports Configuration** tab.
6. Select the **COM** port you are using.
7. Click **Use NMEA Settings**.
   The **Bits Per Second** (Baud rate) is set to 4800. If your compass uses a different rate, set the **Bits Per Second** accordingly.
8. Click **OK** or **Apply**.

It is recommended that you test the sensor after the configuration, See "To test sensors configuration" on page 25.

Note: *If you are using a magnetic or flux gate compass (not a true north seeking gyro compass), you should set the local magnetic variation, See "Setting Magnetic Variation" on page 29.*

To configure the system to accept position data from a GPS

1. Click **Setup** > **External Sensors.**
2. Click the **NMEA Data Selection** tab.
3. Select the **COM** port you are using.
4. Select **GGA** in the **Standard** list and click **Connect**. You can also use **GGL, RMA,** or **RMC**, if your GPS does not support the **GGA** sentence.
5. Click the **Ports Configuration** tab.
6. Select the **COM** port you are using.
7. Click **Use NMEA Settings**.
   The **Bits Per Second** (Baud rate) is set to 4800. If your GPS uses a different rate, set the **Bits Per Second** accordingly.
8. Click **OK** or **Apply**.

It is recommended that you test the sensor after the configuration, See "To test sensors configuration" on page 25.

To configure the system to accept data from other NMEA device

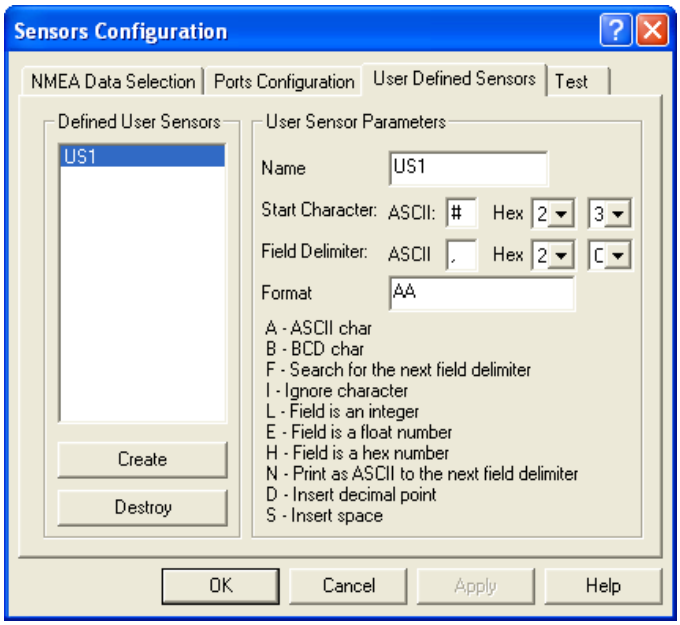
1. Click **Setup** > **External Sensors.**
2. Click the **NMEA Data Selection** tab.
3. Select the **COM** port you are using.
4. Select a sentence in the **Standard** list that is supported by your NMEA device and click **Connect**.
5. Add additional sentences by repeating Step 4.
6. Click the **Ports Configuration** tab.
7. Select the **COM** port you are using.

8. Click **Use NMEA Settings**.
   The **Bits Per Second** (Baud rate) is set to 4800. If your NMEA device uses a different rate, set the **Bits Per Second** accordingly.
9. Click **OK** or **Apply**.

It is recommended that you test the sensor after the configuration, See "To test sensors configuration" on page 25.

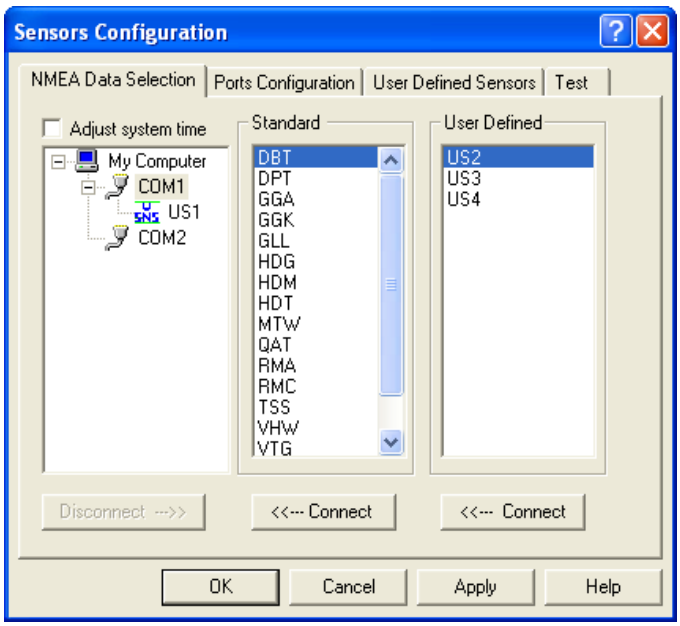
To configure the system to receive a user defined sensor data

1. Click **Setup** > **External Sensors.**
2. Click the **User Defined Sensors** tab.



3. Click **Create** to add a new user defined sensor. This automatically gives the name US1 for the first sensor, US2 for the second and so on.
4. Set up **User Sensors Parameters**:
   - Set the **Start Character** of the user serial string.
   - Set the **Field Delimiter**, typically it is a comma or space.
   - In the **Format** box, enter a string which is a sequence of letters A,B,F,I,N,D, or S defining the display format:
     - A: Print as ASCII character
     - B: Print as BCD character
     - F: Search for next Field Delimiter
     - I: Ignore character
     - N: Print as ASCII to next Field Delimiter
     - D: Insert Decimal Point
     - S: Insert Space

5. Click **OK** or **Apply**.
6. Click the **NMEA Data Selection** tab.
7. Click the **COM** port that you are using.



8. In the **User Defined** list, click the sensor name, and then click **Connect**.
9. Click the **Ports Configuration** tab.
10. Click the **COM** port that you are using.
11. Set the **Communications Settings** to match the user defined sensor.
12. Click **OK** or **Apply**.

It is recommended that you test the sensor after the configuration, See “To test sensors configuration” on page 25.

An example of a user defined sensor data:

If you have a device which provides distance traveled through the water using the NMEA defined VLW sentence:

$--VLW,x.x,N,x.x,N*hh<CR><LF>

where:

$--VLW identifies the start and type of sentence,

x.x is a variable length data field showing the cumulative distance traveled through the water.

N specifies the distance units to be in nautical miles,

x.x is a variable length data field showing the distance since reset,

N specifies the distance units to be in nautical miles,

*hh is a checksum,

<CR><LF> is a terminating carriage return and line feed pair.

This sentence always starts with $, so set the **Start Character** for this data to:

The data is separated into fields using commas, so set the **Field Delimiter** for this data to:

If you want to display only the cumulative distance and the distance since reset from this data string, set the display **Format** string to **FNFSSN**.

The first F ignores everything up to including the first comma

The first N displays the cumulative distance field

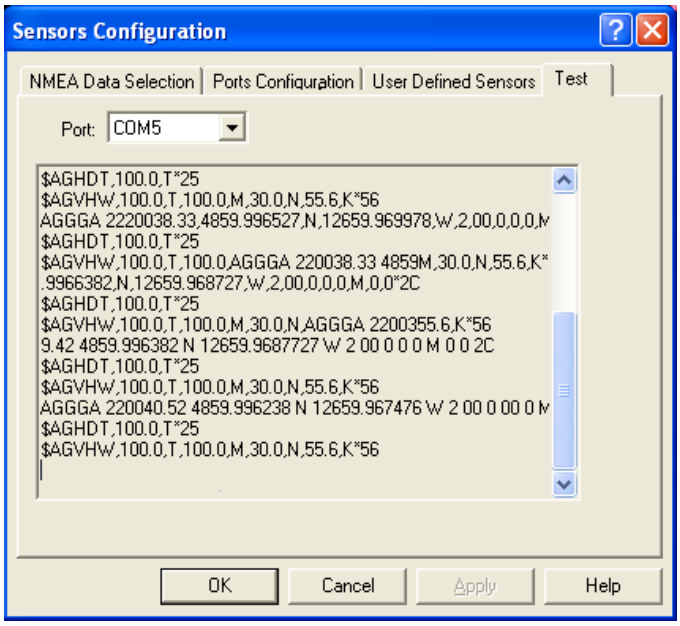
The next F skips the next field

The SS prints two spaces to separate the data

The final N displays the “distance since reset” field.

To test sensors configuration

1. Click **Setup** > **External Sensors.**
2. Click the **Test** tab.
3. Select the **COM** port that the sensor is connected.
   The data from the COM port appears in the box below.



To show sensors data

See “To show the NMEA Sensors Data gauge window” on page 86.

Setting Sensor Mounting Offsets

The sensors mounting coordinate system in this system is as the same as sonar head. See “Setting Head Mounting Orientation and Offsets” on page 14.

To set GPS mounting offsets

1. Right-click in the sonar image window.
2. Click **Offsets**.
3. In the **My Computer** list, select the GPS.
4. In the **Translational** area:
   - Enter the height of the GPS antenna above your reference point into **Z (Up)** as a positive number.
   - Enter the distance forward of your reference point into **Y (Fwd)** as a positive number. If the GPS is mounted to the left of your reference point, enter it as a negative number.
   - Enter the distance to the right of your reference point into **X (Stbd)** as a positive number. If the GPS is mounted to the left of your reference point, enter it as a negative number.

Note: *The* ***Rotational*** *offsets are not required for a GPS, leave them at zero. So does the* ***Down looking mode****, don’t select the check box.*

To set heading sensor mounting offsets

1. Right-click in the sonar image window.

2. Click **Offsets**.
3. In the **My Computer** list, select the heading sensor.
4. In the **Rotational** area, if the heading sensor is not aligned exactly fore and aft, enter a **Yaw** offset in degrees. The **Pitch** and **Roll** offsets are not required.

Note: *The* ***Translational*** *offsets are not required for a heading sensor, leave them at zero. So does the* ***Down looking mode****, don't select the check box.*

Accepting Integrated Compass Sensor Data

The MS1000 system accepts compass data from the build in compass sensor of the sonar head. The integrated sensor data will be displayed in the **Head Settings** gauge window automatically (See "Gauge Windows" on page 85). You can enable or disable the system to accept the integrated sensor data.

To enable/disable compass sensor reading

1. Right-click in the sonar image window.
2. Click **Control Head**, and then click the **XXXX Sensor** tab, where XXXX could be HMR3300 or SP3003D type digital compass
3. Do one of the following:
   • To enable the integrated sensor, select the **Enable sensor** check box.
   • To disable the integrated sensor, clear the **Enable sensor** check box.
4. For SP3003D compass, a "Data Filter" could be adjusted in a range from 1 to 65536. The higher value will make the compass provides more steady reading but less responsive.

Calibrating compass Sensors

In certain circumstance, you need to re-calibrate head sensor in order to correct the local magnetic distortions.

To calibrate HMR3300 compass sensor

1. Start MS1000 software.
2. Click "System" button, select "Run".
3. Right-click on the sonar image window.
4. Click **Control Head**, and then click the **HMR3300 Sensor** tab.
5. Click **Calibrate**.

During the calibration procedure, the compass and the platform to which the compass is attached is rotated at a reasonably steady speed through 360 degree. This process should at least take one minute for best accuracy. The rotation should includes as much pitch and roll orientations possible. Click "Stop" at the completion of the rotations.

To calibrate SP3003D compass sensor

1. Mount sonar head vertically, leave transducer side down.
1. Start MS1000 software.
2. Click "System" button, select "Run".

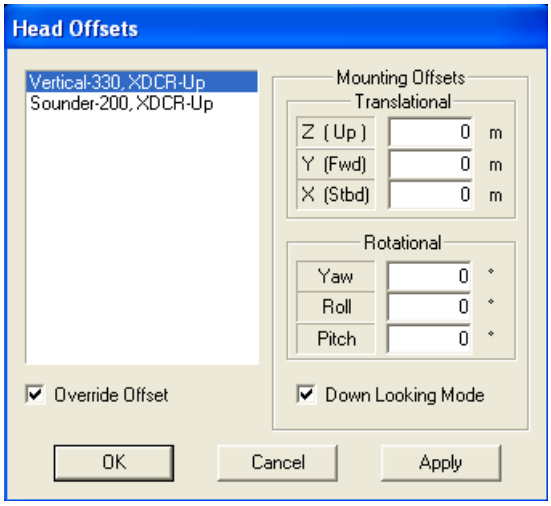
3. Right-click on the sonar image window.
4. Click **Control Head**, and then click the **SP3003D Sensor** tab.
5. Click “Start Calibration” button.
6. Set magnetic adation to “OFF”.
7. Click “RESET” button.
8. Point the “Zero” mark of the sonar head North, and then set magnetic adaption to “MANUAL”.
9. Rotate sonar head vertically through 360 degrees for at least 10 seconds.
10. Point the “Zero” mark of the sonar head East or West and then rotate sonar head vertically through 360 degrees for at least 10 seconds.
11. Set magnetic adaption to “AUTO”.
12. Repeat step (8) and step (9) untill the “Magnetic error” drops to less than 25.
13. Set magnetic adaption to “OFF”.
14. Click “Finish Calibration” button.
15. Click “OK” or “Apply” to accept result.

Overriding Playback Head Mounting Offsets

You can override the playback file head offsets if the initial offsets aren’t correct.

To override a playback data file head mounting offsets

1. Choose **Setup > Advanced Menu> Configuration > Playback Head Offsets**.



2. Select a head that you want to override its offsets.
3. Select the **Override Offset** check box.
4. Enter the correct **Translational** and **Rotational**.
5. Select the **Down Looking Mode** check box if you want to override the sonar head scanning mode to down looking.

Setting System Parameters and Coordinate

This section includes the following:

- Setting Magnetic Variation
- Setting Measurements Units
- Setting Sound Speed
- Setting Coordinate System
- Calibrating Head Coordinate

Setting Magnetic Variation

Magnetic variation, also called magnetic declination, is the angle between magnetic north and true north. Magnetic variation is considered positive east of true north and negative when west.The local magnetic variation information is available on marine charts of the area.

You can set the magnetic variations in this system to correct the heading of compass if you are using a magnetic or flux gate compass.

To set the magnetic variation

- Use **Setup** > **Mag Var**.

Note: *You can't change the magnetic variation in playback mode. However, if you want to override the initial magnetic variation, you need to set a value before you start playback*

Setting Measurements Units

You can set *Rang* and *Temperature* measurements to desired units.

Range units choice are:

- Meters
- Feet
- Yard
- Fathoms

Temperature units choice are:

- Celsius
- Fahrenheit

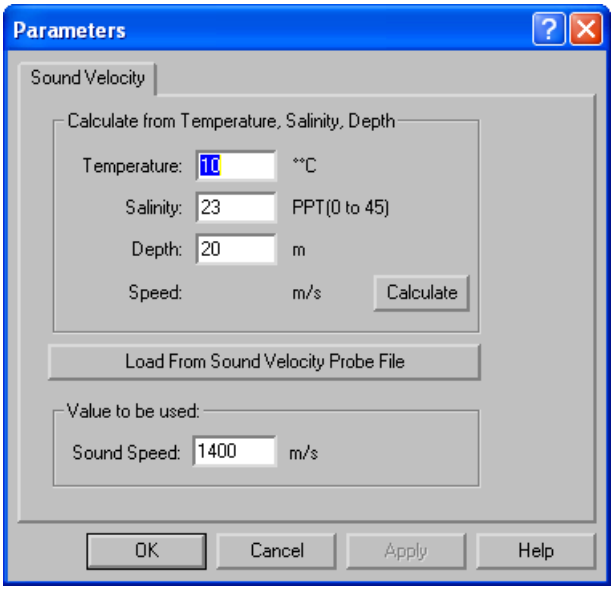
To set	Do this
Range units	Use **Setup** > **Range**.
Temperature units	Use **Setup** > **Temp**.

Setting Sound Speed

You might want to set the sound velocity value to match local conditions because of maximum accuracy and performance.You can use the **Parameters Sound Velocity** dialog box to calculate or directly enter a known value for the velocity of sound in water. You can also load a sound velocity probe file that includes sound velocity value. In the playback mode, you can override the original recorded sound speed.

To apply a known or measured sound speed

1. Click **Setup > Advanced Menu > Configuration > Sound Speed**.



2. Enter **Sound Speed**.
3. Click **Apply** or **OK**.

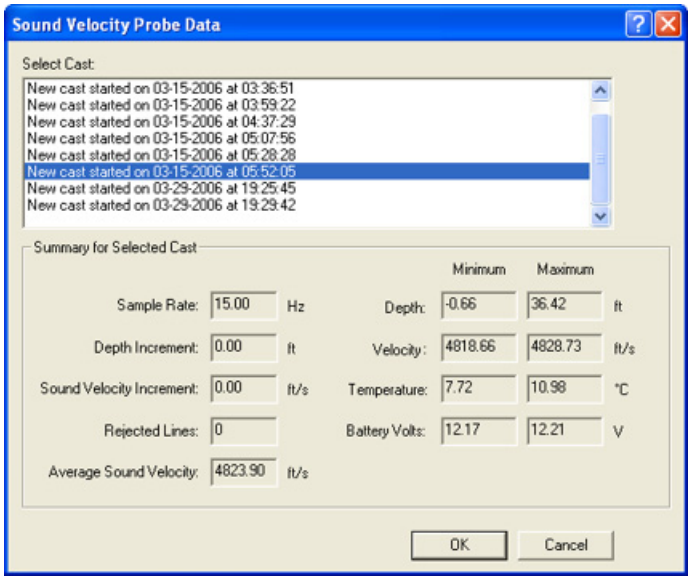
To calculate a sound speed based on temperature, depth, and salinity

1. Click **Setup > Advanced Menu > Configuration > Sound Speed**.
2. Enter **Temperature, Salinity** and **Depth**.
3. Click **Calculate**.
4. Click **Apply** or **OK**.

Note: *Salinity of pure fresh water is near 0 ppm, salinity of sea water is typically between 30 and 40 ppm. Brackish or mixed fresh and salt water is somewhere in between.*

To load a sound velocity probe file

1. Click **Setup > Advanced Menu > Configuration > Sound Speed**.
2. Click **Load From Sound Velocity Probe File**.
3. Select the file containing the data you want.
4. Click **Open**.



5. In the **Select Cast** list, select the sound velocity cast (data set).
   The **Summary for Selected Cast** area shows the summary of the data in the selected cast.
6. Click **OK**.

Note: *The term cast refers to the set of data collected every time the sound velocity probe is cast into the water.*

Setting Coordinate System

If you has a GPS connected and configured (See “Programming Heads Downlink Baud Rate” on page 19), you can get the Latitude/Longitude information of objects in the scanning area.

You can set the Latitude/Longitude format to D, DM, or DMS. You can also convert between geographic coordinates and UTM or SPCS coordinates using this system and show Northing/Easting in sonar image display and Trackplotter chart.

To set Latitude/Longitude format

1. Do one of the following:
   • Click **Setup > Advanced Menu** > **Configuration > Calibrate Head Position**.
   • Click **Trackplotter > Chart Setup**.
2. Click the **Projection** tab.
3. In the Latitude/Longitude Format list box:
   • To show Latitude/Longitude in degree, select **D**
   • To show Latitude/Longitude in degree-minutes, select **DM**
   • To show Latitude/Longitude in degree-minutes-second, select **DMS**

To set Northing/Easting coordinate

1. Do one of the following:
   • Click **Setup > Advanced Menu** > **Configuration > Calibrate Head Position**.
   • Click **Trackplotter > Chart Setup**.
2. Click the **Projection** tab.
3. In the **Display Coords In** list, select **Northing/Easting**.
4. In the **Northing/Easting** list, select a desired option.

To convert between Lat/Lon and Northing/Easting coordinate

1. Do one of the following:
   • Click **Setup > Advanced Menu** > **Configuration > Calibrate Head Position**.
   • Click **Trackplotter > Chart Setup**.
2. Click the **Projection** tab.
3. In the **Projection** area, select a **Latitude/Longitude** option.
4. In the **Projection** area, select a **Northing/Easting** option.
5. Click **Apply**.
   The **Latitude/Longitude** to **Northing/Easting** calculate boxes appears.
6. Enter **Latitude/Longitude** or **Northing/Easting** and click **Convert**.

Calibrating Head Coordinate

If the sonar head is mounted in a fixed location and you know the sonar head's coordinates and true heading, this system enables you to caculate the coordinate of the scanned area.

If you don't know the sonar head's postion, but you know the postions of two reference points in the image display, you can caculate the head coordinate.

During the calibrating process, if the **Display North Up** check box is selected, true north is always up on the screen.

To caculate coordinate using sonar head position and heading

1. Click **Setup** > **Advanced Menu** > **Configuration > Calibrate Head Position**.
2. Select the **Sonar on Tripod** check box.
3. If you want the sonar image to be shown with north towarding up, select the **Display North Up** check box.
4. If you want to change the projection and format, click the **Projection** tab and set up desired projection settings.
5. Enter sonar coordinates to **Known Sonar Pos** boxes and sonar heading to **Known Sonar Heading** box.
6. Click **Caculate**.
   The **Calculated Sonar Position and Heading** appears. It sometimes includes an **Error** value which indicates how well the known target positions fit the

measurements made by the sonar. It is also an indication of the accuracy you can expect when measuring the positions of other nearby targets.

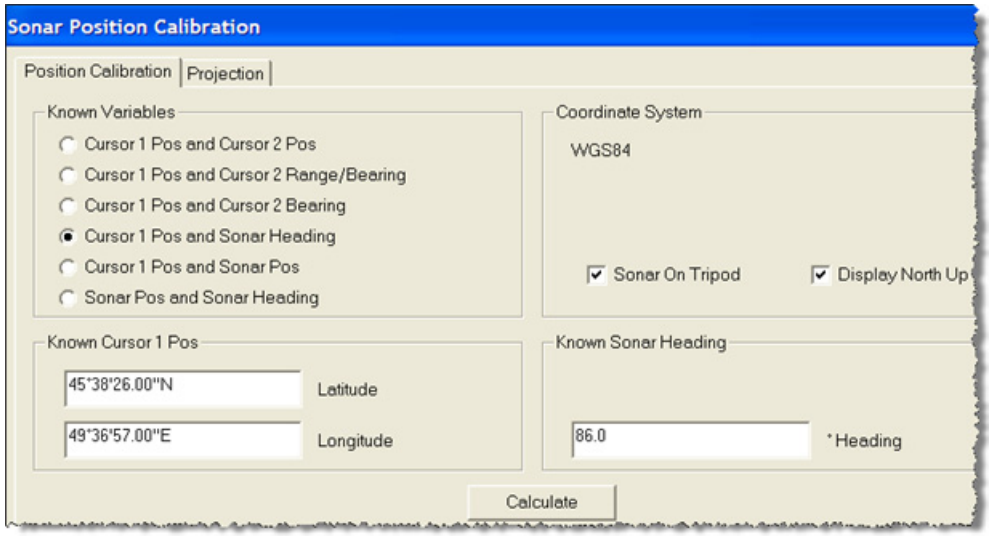
Note: *If you move the sonar, you must repeat the process to recalibrate.*

To caculate the head position

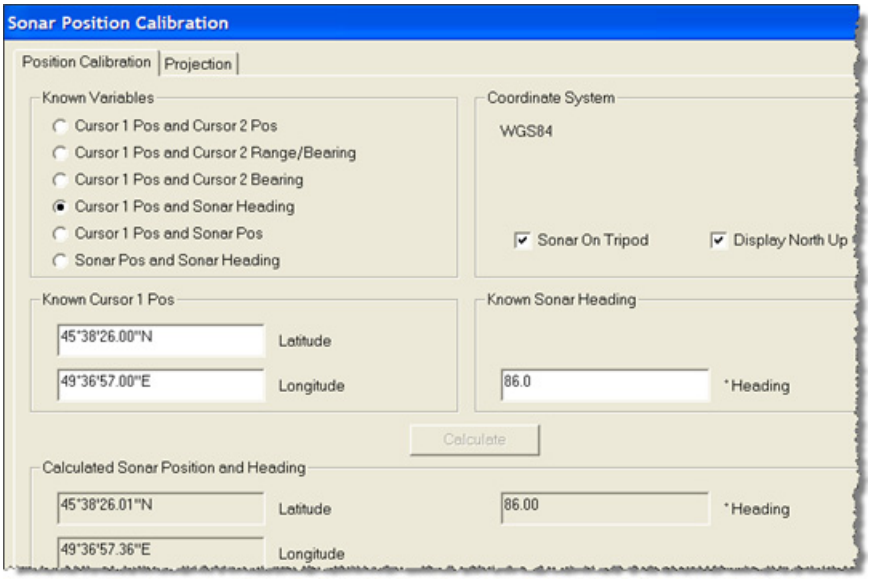
1. On the sonar image, place the **Cursor 1** to a point where you know the geographical coordinates.
2. Place the **Cursor 2** to a second point where you can identify on your drawing. You do not need the geographical coordinates of the second point, but you need to know in what direction it lies relative to the first point.
3. Click **Setup** > **Advanced Menu** > **Configuration > Calibrate Head Position**.
4. In the **Known Variables** field, select one of the following:

If you know	Select
• Coordinates of **Cursor1** • Coordinates of **Cursor2**	**Ref1 Position and Ref2 Position**
• Coordinates of **Cursor1** • The Range and Bearing from **Cursor1** to **Cursor2**	**Ref1 Position and Ref2 Range-Bearing**
• Coordinates of **Cursor1** • The Bearing from **Cursor1** to **Cursor2**	**Ref1 Position and Ref2 Bearing**
• Coordinates of **Cursor1** • The true heading of the sonar head	**Ref1 Position and Sonar Heading**
• Coordinates of **Cursor1** • Coordinates of the sonar head	**Ref1 Position and Sonar Position**

5. Select the **Sonar on Tripod** check box.
6. If you want the sonar image to be shown with north towarding up, select the **Display North Up** check box.
7. If you want to change the projection and format, click the **Projection** tab and set up desired projection settings.
8. Enter the **Known Ref1 Position.**
9. Enter the **Known Ref2 Position** according to your choice of **Known Variables**.



10. Click **Caculate**.



The **Calculated Sonar Position and Heading** appears. It sometimes includes an **Error** value which indicates how well the known target positions fit the measurements made by the sonar. It is also an indication of the accuracy you can expect when measuring the positions of other nearby targets.

Note: *If you move the sonar, you must repeat the process to recalibrate.*

Sonar Image

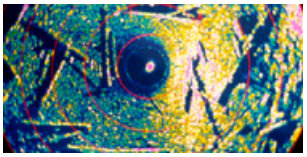
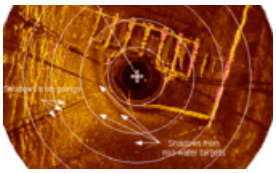
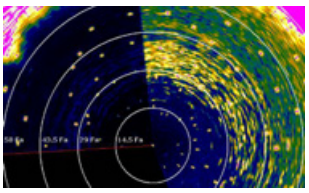
This section includes the following:

- Interpreting Sonar Image
- Changing Color Palettes
- Customizing Color Palettes
- Filtering out Weak Targets by Using Threshold
- Smoothing Image
- Filtering out the Acoustic Interference
- Setting Image Overlays
- Processing Sonar Image by Receiver Gain

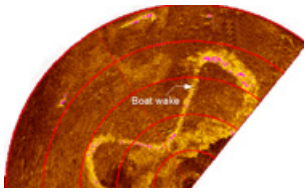
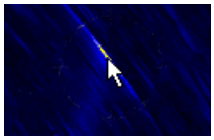
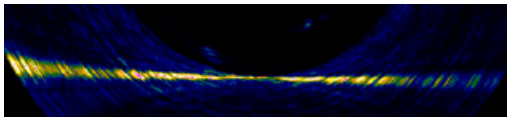
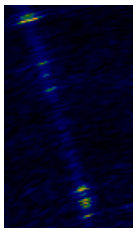
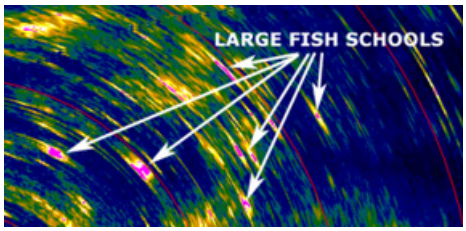
Interpreting Sonar Image

The sonar image is a map of the echo returns over the scanned area.

The following table describes some special sonar image effects:

Sonar Image Effects	Description
 Bright and dark return	Bright return indicates a strong sonar target, such as a hard or highly reflective surface. Dark return indicates a low reflectivity area (soft area).
 Shadow	Shadow is the dark zone behind a target. It reveals the shape of the target. The shape is usually distorted by the slope of the bottom.
 Interference	Interference from other acoustic sources, such as echo sounders, pingers, and other sonars, produces symmetrical pattern of blips on the screen.

The following table describes some special sonar image effects:

Sonar Image Effects	Description
 Masking Effect	Masking effect happens when sonar signals are blocked by air or gas bubbles. For example, the aeration in the wake of a vessel often last ten to twenty minutes and mask out most sonar returns on the far side. Gas bubbles can be found when a sea bottom contains decomposing organic matter that is disturbed by dredging or plowing.
 SCUBA Diver	A SCUBA diver *is* a small, dot-like target followed by a long bubble trail. A radial line may be seen from time to time created by the noise from the regulator.
Closed-Circuit Diver	A closed-circuit diver is a small dot-like target.
 Sidelobes	Sidelobes are artifact generated from the beamforming process that makes strong targets smear or bleed into adjacent beams at the same range.
 Mechanical Noise	Mechanical noise, such as propellers, hydraulic pumps, and thrusters, are usually directional and only show up when the sonar is pointed directly at them. They appear as radial lines displayed from the origin of the sonar to maximum range.
 Marine Life	Marine Life are often seen in schools. Fish appear as large areas or blobs that are slow moving; and change shape and intensity over time. Marine mammals appear similar in target size to divers. The main difference between human and marine mammal targets are erratic movement and speed.

Changing Color Palettes

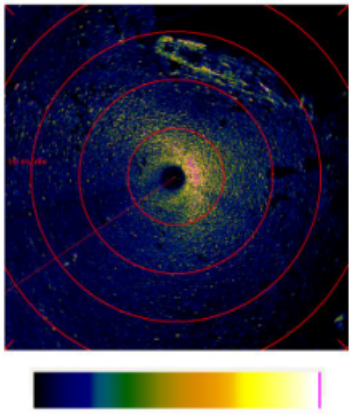
This system provides a variety of color palettes to help you define the relative strengths of the returns.Most of them use darker colors to indicate weak returns and brighter colors to indicate the stronger returns.The copper palette is the best at resolving target shadows.

The following table describes each palette scheme:

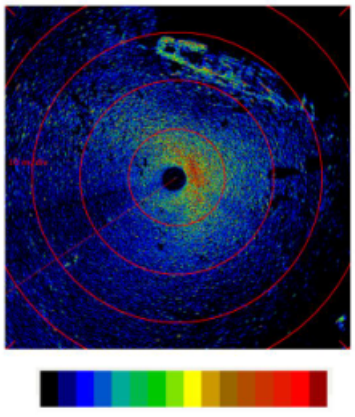
Palette Name	Palette Scheme
Simrad 1	
Simrad 2	
Simrad 3	
Simrad 4	
Copper	
Grey	
Reversed Grey	
Profile	

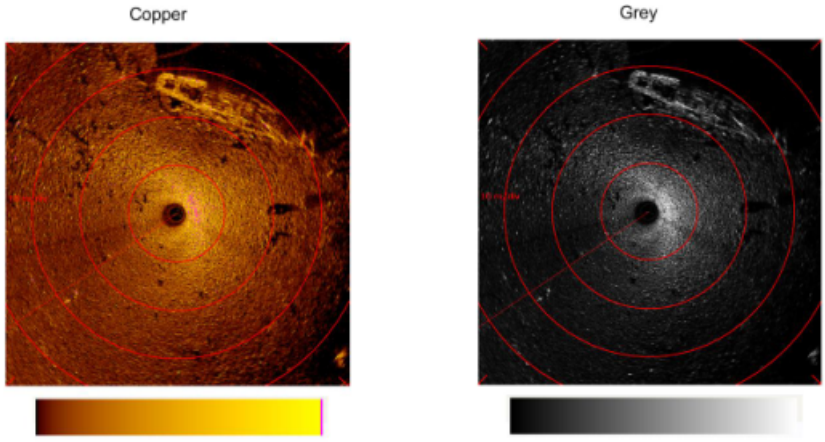
The following are some color palette image examples:

Simrad1



Simrad2 (16 shades)



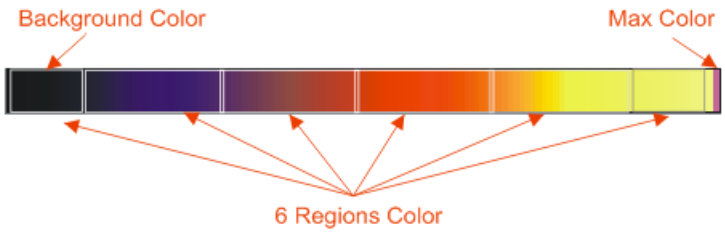


To change the color palette

- Use **Display** > **Palette**.

Customizing Color Palettes

In addition to the predefined palettes, you can define and use a customized color palette.



The customized **Color Palette** consists of 6 color regions and a **Max Color** from left to right, which indicates from the weak to strong sonar signal level. The first left region represents the background color. The **Max Color** at rightmost end represents the maximum signal level or saturation.

To define a color palette

1. Click **Display > Palette > User Defined**.
   The value of the **Palette** button changes to **User Defined** and the **Color Palette** is available for you to change colors.
2. Do the following:
   - To change the color of a region, click in the region.
   - To change the max color, right-click anywhere in the **Color Palette**.
3. Select the desired color.

To save the defined color palette

1. Define a color palette.
2. Right-click in the sonar image window.
3. Click **Display Settings** and then click the **Color** tab.
4. Click **Save As**.
5. Select a location and enter a name.

The extension of the palette filename is SOP.

To load a defined color palette

1. Right-click in the sonar image window.
2. Click **Display Settings** and then click the **Color** tab.
3. Click **Load**.
4. Select the SOP file.

Filtering out Weak Targets by Using Threshold

You can use Palette Threshold to set the minimum displayed target level for echo returns. By default, the Threshold value is 0, all signals are displayed. When you increase the threshold value, weaker signals are removed from the display.

To filter out the weak targets

1. Click to active the sonar image display window.
2. On the **Display** menu panel:
   - Hold on the **Plus** button of **Threshold** to increase the threshold
   - Hold on the **Minus** button of **Threshold** to decrease the threshold

Signals below the threshold are shown in black.

Note: *You may filter out real target by increasing the threshold.*

Setting Image Overlays

You can set the image display window gird to *polar* or *rectangular* mode.

The *Scan Marker* on the sonar image shows the current angle of the transducer. You can show or hide the marker.

You can show or hide compass rose. You can also change the color of the overlay.

To set image grid

1. Right-click in the image display window.
2. Click **Display Settings**, and then click the **Control** tab.
3. In the **Grid** area:

- To hide grid, clear the **Enable** and **Rectangular** check boxes.
- To show polar gird, select the **Enable** check box.
- To show rectangular grid, select the **Enable** and **Rectangular** check boxes.

To show or hide the scan marker

1. Right-click in the sonar image window.
2. Click **Display Settings**, and then click the **Controls** tab.
3. Do the following:
   - To show the scan marker, in the **Scan Marker** box, click **Show.**
   - To hide the scan marker, in the **Scan Marker** box, click **Hide.**

To show or hide the compass rose

- Use **Display** > **Compass Rose**.

To change a overlay color

1. Right-click in the sonar image display window that you want to change a overlay color.
2. In the shortcut menu, click **Display Settings**, and then click the **Color** tab.
3. Select one of the following:
   - Sector Limit
   - Grid
   - Cursor1
   - Cursor2
   - Annotation
4. Select the desired color.

Smoothing Image

You can smooth sonar image for fast (large step) scanning speeds.

To smooth image

1. Right-click in the sonar image window.
2. Click **Post Processing**.
3. Select the **Enable Image Smooth** check box, and then move the **Minimum Step** slider to adjust for the best result.

Note: *Moving the slider to right makes the image less smoother.*

Filtering out the Acoustic Interference

About sonar image noise and interference, See “Interpreting Sonar Image” on page 35.

To filter out the acoustic interference

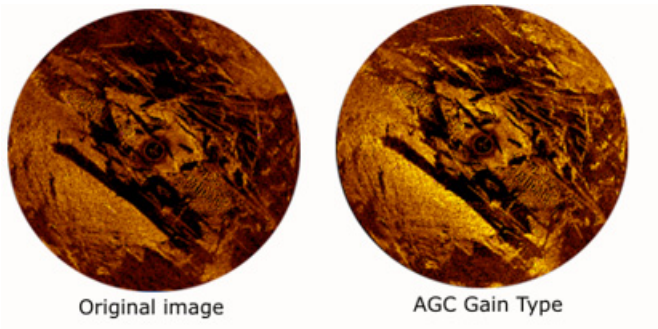
- Use **Display** > **Interference Filter.**
- To hide grid, clear the **Enable** and **Rectangular** check boxes.
- To show polar gird, select the **Enable** check box.
- To show rectangular grid, select the **Enable** and **Rectangular** check boxes.

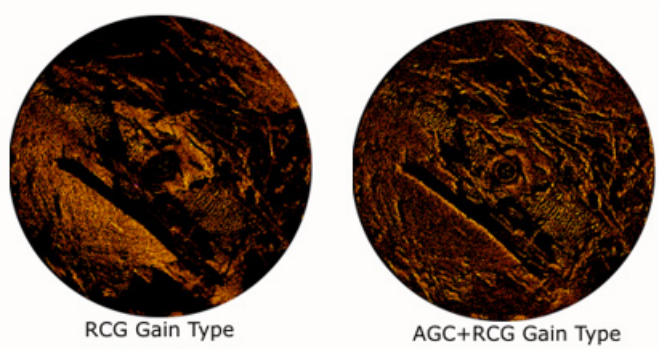
Processing Sonar Image by Receiver Gain

This system provides three Receiver (Rx) Gain types to process sonar image:

Receiver Gain types	Description
Automatic **G**ain **C**ontrol (**AGC**)	AGC adjusts the gain applied to each sample of a ping to maintain nominal signal level. The leading edge of targets are therefore most visible with the trailing edges fading away.
Reverberation **C**ontrolled **G**ain (**RCG**)	RCG uses the average signal level through a number of ping to maintain overall background signal. This has the effect of increased gain in low noise environment and small gain for highly noisy environment.
RCG+AGC	a combination of the two

The following images show the three gain type effects:





To set Rx Gain Type

1. Right-click in the sonar image.
2. Click **Display Settings**, and then click the **Control** tab.
3. In the **Rx Gain Type** list box, select one of the following:
   - AGC
   - RCG
   - AGC/RCG
4. In the **Rx Gain Response** list box, select a speed.

Sonar Operation

This section includes the following:

- Changing Scan Modes
- Controlling Sonar Scan
- Adjusting Range and Gain
- Adjusting the Bandwidth
- Changing Image Resolution
- Setting Head Transmit
- Setting TVG
- Tracking Targets

Changing Scan Modes

The MS1000 system operation is based on transmitting sound waves into the water and receiving their reflections from obstacles such as the sea bottom. The portion of energy reflected from an interface is proportional to the angle of incidence and the characteristic acoustic impedance ratio in the layer interface.

This system supports to display sonar images in multiple scan modes:

Scan Mode	Description
Polar scan mode	*Polar* mode provides a full 360 degree scan image
Sector scan mode	*Sector* mode provides a scan angles less than 180 degrees image with doubled number of samples. It allows a larger scale image to be plotted.
Sidescan and Echosounder scan modes	*Sidescan* mode and *Echosounder* mode provide an even more detailed view of what is around and beneath your boat. When you select the **Sidescan** or **Echosounder** mode, the system locks the transducer to look sideways or sea bottom.
True Ratio Echosounder scan mode	*True Ratio Echosounder* mode keeps a constant ping to ping ratio in the **Echosounder** view.
Altimeter scan mode	*Altimeter* mode shows altitude measurements as graph of proportional to range.

To change scan mode

• Use **Operation > Mode**.

Controlling Sonar Scan

The *Sector Pie* in the menu panel shows the scan coverage. You can adjust the scan coverage by adjusting the **Sector Width** and **Head Heading**.

In the *Polar* and *Sector* mode, you can adjust the scanning speed. The slower scan speed generates nicer looking image.You can also reverse the scan direction.

In the *Sidescan* and *Echosounder* mode, you can adjust the scroll speed to **slow**, **normal**, or **fast**.

In *Sector* scan mode, you can change the orientation of the sonar image display to up, down, left, or right. Generally, you should choose the view that match the orientation of the sonar head. For instance, choose **Sector Up** if the head is looking ahead; choose **Sector Down** if the head is looking down as profiling.

To adjust Sector Width

• Use **Operation** > **Sector Width**.

To adjust Head Heading

• Use **Operation** > **H Heading**.

Note: *In the* ***Polar*** *scan mode,* ***H Heading*** *button is unavailable if the sector width is 360 degree.*

To adjust scan speed

• Use **Operation** > **Scan Sp**.

To reserve scan direction

• Use **Operation** > **Reserve Scan**.

To adjust scroll speed

• Use **Display > Scroll Speed**.

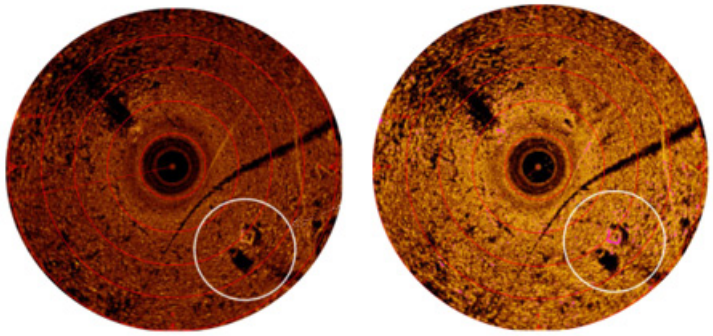
To change the Sector view orientation

1. Right-click in the sonar image window.
2. Click **Display Settings**, and then click the **Controls** tab.
3. In the **Sector View** area, click to select one of the following:
   • Up
   • Down
   • Left
   • Right

Adjusting Range and Gain

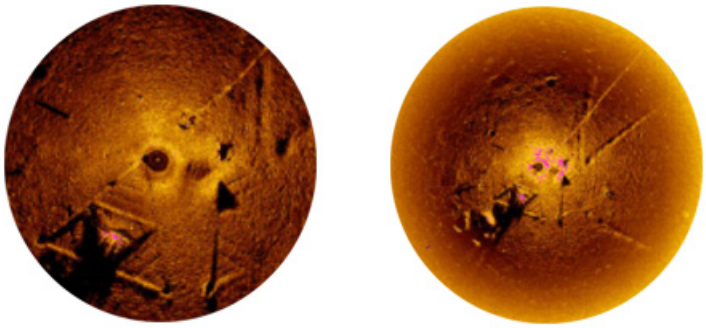
To get a clear target image, you need to adjust the Range and Gain to an appropriate level.

At the same Range level, applying a too high Gain level causes a loss in target definition, over saturating the receiver, and clipping the signal. You can estimate this by seeing targets turn pink in the sonar image display. For instance, a crab trap and tire are shown in the following two images: the gain level is set correctly on the left image and too high on the right one.



Normal Gain level Too high Gain level

At the same Gain level, longer Range shows more noise than shorter Range in the image display.



Gain level correctly set Longer Range shows noise

To adjust Range

- Use **Operation** > **Range**.

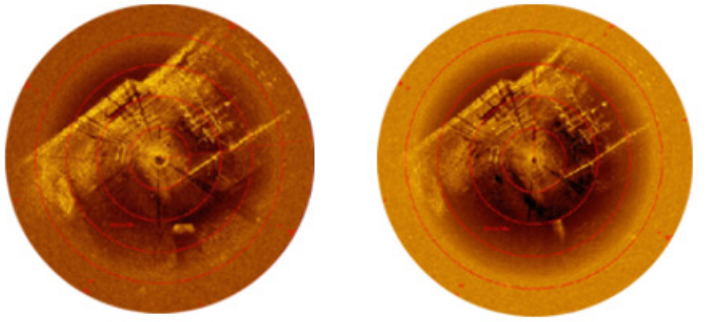
To adjust Gain

- Use **Operation** > **Gain**.

Adjusting the Bandwidth

Adjusting the bandwidth of the received signal is available for analog telemetry sonar heads and some digital sonar heads with dual bandwidth capability.

The options are **Narrow, Medium, Wide, Maximum** and **Automatic**. If you use the **Automatic** option, the system selects the optimal bandwidth depending on the pulse length. The narrower the bandwidth, the less signal is fed through which results in a less noisy image.Therefore, at a longer range, you can choose a narrow bandwidth to reduce noise.



12kHz Bandwidth/150m Range 100kHz Bandwidth/150m Range

To adjust bandwidth

- Use **Operation** > **Bandwidth**.

Changing Image Resolution

You can get a high resolution image by applying the **High Acquisition**. The **High Acquisition** changes the number of samples collected from the sonar head twice as its normal value. This is equivalent to a ZOOM x 2 operation.

To change the resolution of the sonar image

- Use **Operation** > **Resolution**.

Setting Head Transmit

In active mode, to optimize sonar image, you can adjust the **Pulse Length**, **Uplink Band Rate**, **Transmitter Power**, and **Peak Detection** settings other than the system default. To do this, right-click in the sonar image window, and click **Control Head**, and then click the **Transmit** tab.

The following table describes each transmit setting:

Transmit Settings	Description
Pulse Length	*Pulse Length* sets the desired transmit pulse length. Generally, a shorter pulse length gives a sharper image but with reduced range. For more information, See "Pulse Length and Range Resolution" on page 104.
Uplink Baud Rate	*Uplink Baud Rate* is the transmit data rate from sonar head to your computer. You should set the uplink baud rate to as high as your system supports to prevent from generating too many errors.
Transmitter Power	*Transmitter Power* sets the current transmit power output. The sonar signal is very strong at the high power and weaker at the low power. ***Note:*** *You can also turn the power off to determine the background noise or other interference.*
Peak Detection	*Peak Detection* improves the resolution and prevent losing of the image detail. When you set the Peak Detection to Low, Medium, or High, the system increase the peak detection domain to 2, 4, 8 times of the normal value and thus increases the accuracy of the sample peak processing. ***Note:*** *Using Peak Detection may slow the ping rate due to additional computational overhead.*

Setting TVG

Time Varying Gain (TVG) is a system that automatically increases the sonar receiver gain with time after each transmitted ping to compensate for predictable transmission losses.

The default TVG setting, 20Log, is suitable for most conditions. 30Log and 40Log TVG can be used under conditions requiring more gain to compensate for high spreading and absorption losses.

To set TVG, right-click in the sonar image window, and click **Control Head**, and then click the **TVG** tab.

The following table describes each TVG characteristics:

TVG Setting	Characteristics
Gain	• **Default** is the standard default TVG • **High** is slightly higher than default • **Low** is slightly lower than default
Gain Limit	• **Default** is the default upper gain limit • **High** is higher than default. • **Low** is lower than default
TVG Type	• *20Log is the default TVG setting suitable for most conditions*. • 30Log and 40Log TVG can be used under conditions requiring more gain to compensate for high spreading and absorption losses. • Select **Test** for a simple ramped TVG curve. • Select **User** to allow a custom TVG curve to be defined.
TVG Curve	The TVG curve uses three different colored lines to show the current settings graphically. • The solid green line shows the current TVG curve. • The dashed red line shows the upper limit for the TVG curve. • The position of the yellow line can be adjusted up or down with the slider control to the left of the graph. The range and gain at the intersection of the yellow and green lines is shown in the Range-Gain box.

The following table describes each TVG characteristics:

TVG Setting	Characteristics
A customized TVG curve	The general formula for the **TVG** is: **Gain = A log (R) + 2BR + C** • **R** is proportional to time since start Range. • **A** factor represents spreading loss, • **B** factor represents one way absorption loss, • **C** factor represents a base or starting gain level. • **L** factor limits the maximum gain to reasonable levels

Tracking Targets

The Target Tracking feature allows you to detect and track one stationary or slowly moving (1-2 knots) target. This feature is available with all digital head.

You can see the target and sonar tracks in the sonar image display during the tacking process. You can record the target tracking data along with sonar data to a file for later viewing in Playback mode. You can also export the target geographic position (latitude, longitude) to an ASCII file or/and a serial port as a standard TLL NMEA sentence.

A successful target tracking process need to meet the following requirements:

- The target must be well defined and isolated from other targets, bottom,and the background noise.
- The speed of a target relative to sonar must not exceed 2 knots.
- A smaller target needs a slower **Scan Speed**.

To track a target

1. On the **Operation** menu panel, click to set **Target Tracking** to **Search** mode and let the system scan the desired target at least once.
2. Once the desired target has been scanned, click **Target Tracking** once more to set it to **Select** mode.

   The pointer changes to a red-cross shap which indicates the target is available for tracking.

3. Point to the desired target. When the pointer becomes green  , you click the target to start tracking.

   The **Target Tracking** changes to **Lock** mode and the system plots sonar tracks in the image display. In the **Lock** mode, the system takes control over the sonar head and keeps the target in the view. The sonar scans over the target by alternating the scan

direction and the system automatically changes **Range** if the target gets closer than 20% or futher than 80% of the current **Range**.

4. To track another target, you need to repeat the whole tracking process starting from Step 1. on page 49
5. To end the target tracking process, click **Target Tracking** to set it to **OFF**.

Recording, Playback, and Exporting

This section includes the following:

- Recording Sonar Data Files
- Playback Sonar Data Files
- Playback Files from Event Viewer
- Exporting Sonar Data
- Exporting Imagery

Recording Sonar Data Files

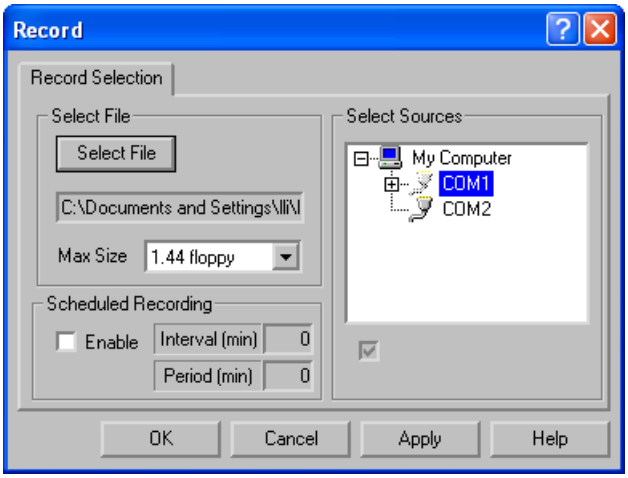
With MS1000 program, you can record the sonar image view and head settings information to a .smb data file.

You need to run the sonar head before recording.

To record a sonar data file

1. On the **Sonar Toolbar**, click 

.
The **Record** dialog box appears.



2. Set up the recording options:
   - **File name and location**: the system creates a unique name for each file based on the date and time and saves it to **\KML\MS1000\Record**. If you do not want to use the default directory and name, you can change the file location and name.
   - **Max Size:** you can set a maximum size for each recorded file, when this size is reached, a new file will be started using the same name and a different extension as follows:
     - The first file has the extension SMB.
     - The next file has the extension 001.
     - The next file has the extension 002.

- Etc.

- **Scheduled Recording:** The scheduled recording feature allows you to automatically record data for a selected interval then pause for another interval. This cycle will repeat continuously. In the **Interval (min.)** box, enter the number of minutes to be recorded. In the **Period (min.)** box, enter the number of minutes between recording sessions.
- **Data Sources**: By default, all available sonar heads and sensors are selected as data sources for recording. You can disable recording from some heads or sensors.To change the default data sources, in the **Select Sources** box, click the sonar head or a serial port with sensors attached that you DO NOT WANT to record from and clear the **Select** check box.

3. Click **OK** to start recording.
4. To pause or resume recording, on the **Sonar Toolbar**, click 

5. To stop recording, on the **Sonar Toolbar**, click 

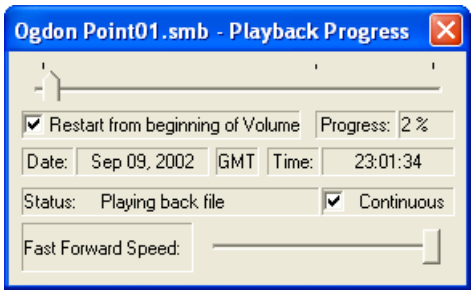
.

Playback Sonar Data Files

You can playback a recorded.smb sonar data file and control the playback progress.

The **Playback Progress** dialog box appears when you playback a recorded file:

- The **Progress** shows the playback progress as a percentage of the total file group size.
- The slider on the top shows the relative progress of the playback.
- The markers above the slider correspond to the beginning of each volume or file in the selected file group.
- The **Date** and **Time** boxes show the date and time of the recorded data.



To playback a recorded file

1. Do one of the following:
   - On the **Sonar Toolbar**, click 

.
   - Click **System > Playback**.
2. In the **Playback Data** dialog box, select the file you want to playback (only.**smb** file can be selected).

3. To pause or resume playback, on the **Sonar Toolbar**, click 

.
4. To stop playback, on the **Sonar Toolbar**, click 

.

To show or hide the Playback Progress dialog box

1. Right-click in the sonar image display window.
2. Do one of the following:
   - To show, select **Playback Progress**.
   - To hide, clear **Playback Progress**.

To control playback progress

Do the following:

- To see any part of the data, in the **Playback Progress** dialog box, move the slider on the top.
- To continuously replay the same file group over and over again, in the **Playback Progress** dialog box, select the **Continuous** check box.

To fast-forward the playback process

1. On the **Sonar Toolbar**, click 

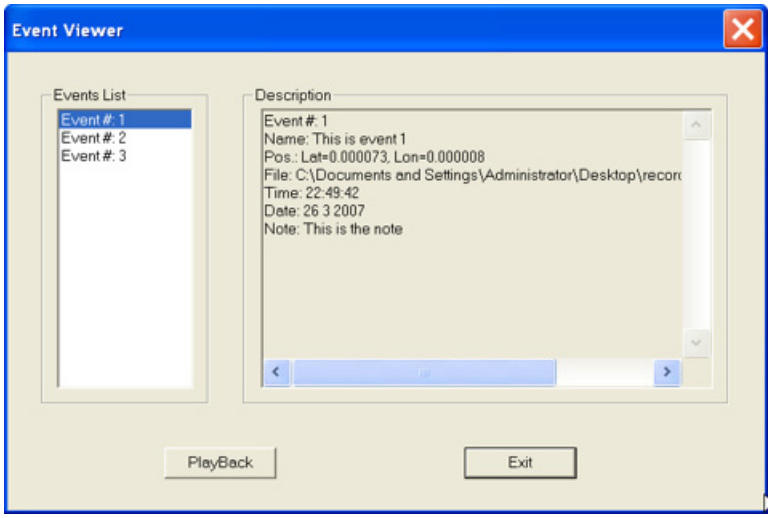
.
2. To adjust fast forward speed, in the **Playback Progress** dialog box, drag the **Fast Forward Speed** slider.

Playback Files from Event Viewer

If you put event markers in the sonar image display during recording process, the system automatically generates an event log file (.evl). You can preview the event information in the **Event Viewer** and playback the data file from the volume that includes the selected event marker.

To playback a file from Event Viewer

1. Click **Setup > Advanced Menu > View > Events log file**.



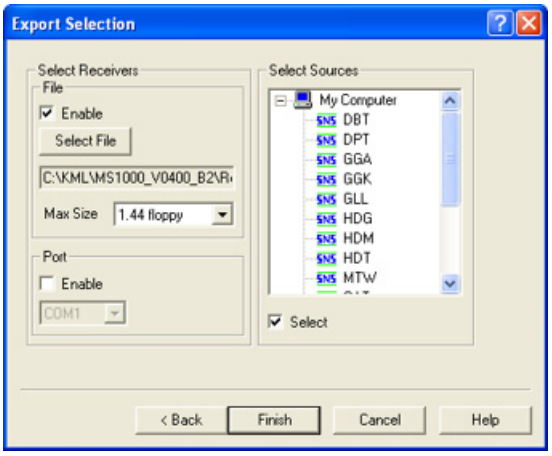
2. In the **Event List**, select a event that you want to see.
3. Click **PlayBack**.

Exporting Sonar Data

You can export the sonar image view and head settings information to an .exp file or a serial port of your computer. The exported EXP file is a ASCII file that can be opened by any text editor such as Windows Notepad. You can export when you are running a head or playing back a recorded data file.

To export sonar data

1. On the **Sonar Toolbar**, click  .
2. In the **Start Export** dialog box, click **Next**.
3. In the **Export Format** dialog box, select one of the following:
   • MS1000: to export data in the MS1000 format.
   • NMEA: to output depth in NMEA format.
4. Click **Next**.
   The **Export Selection** dialog box appears.



In the **Export Selection** dialog box:

- The source has already been selected by default. You can change to different heads or sensors.
- You need to select either **File** or **Port** or both of them as export receiver.

5. Click **Finish** to start exporting.
6. To pause or resume exporting, on the **Sonar Toolbar**, click  .
7. To stop exporting, on the **Sonar Toolbar**, click  .

To select a file as the export receiver

1. Select the **Enable** check box. The system automatically creates a unique name for each file based on the date and time and will save to the default directory **\KML\MS1000\Record**.
2. Click **Select File** if you want to change the file name and save to a different location.
3. In the **Max Size** box, select one of the following as the maximum size for each exported file:
   - 1.44 floppy
   - 2.88 floppy
   - 5 MB
   - 10 MB
   - 20 MB

To select a COM port as the export receiver

1. Select the **Enable** check box.
2. In **COM** box list, select the port that you want to be the export receiver.
3. Click **Next**.
4. In **Communication Settings** field, enter or select the desired **Bits Per Second, Data Bits, Parity,** and **Stop Bits** value.

Exporting Imagery

Besides recording and exporting sonar image data, you can also export imagery in order to form mosaics by using some geographic information system (GIS) programs.

This system support export two types of image format:

- BMP format along with a world File (.bpw) that contains position and scale information
- GeoTIFF format that contains projection Lat/Lon with datum WGS84

When you generate these image files, you can also get a text file including sonar settings and sensor data at the time the image saved.

To save image to files

1. On the **Sonar Toolbar**, do one of the following:
   - To save the image with overlays, click  .
   - To save the sonar image only, click  .
2. In the **Save as type** box, select a desired image file format type.
3. In the **File name** box, enter a file name.

Trackplotter

This section includes the following:

- Trackplotter Chart
- Setting Chart Coordinate System
- Centering View
- Zooming and Panning
- Establishing and Applying Default Scale
- Measuring Distances by Using the Tape Tool
- Locking the Sonar on the Tripod
- Working with Survey Lines
- Showing Vessel Position in Helmsman Display
- Marking Targets by Event Marker

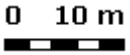
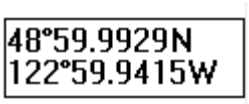
Trackplotter Chart

The **Trackplotter** chart shows the location of the vessel and the area being scanned by the sonar. It provides co-ordinates in Latitude/Longitude, UTM, or State Plane grids, and scaling in both imperial and metric units. It uses different symbols to represent different objects.

The following table describes symbols used in the **Trackplotter** chart:

Symbol	Description
	The sonar is mounted on the vessel and can move.
	The sonar is located at a fixed position. For example, it is mounted on a tripod.
	The normal symbol for the vessel, it shows the same size regardless of the **Trackplotter** scale.
	If the **Trackplotter** is set to draw the vessel to scale, the vessel can change size as you change the **Trackplotter** scale

The following table describes symbols used in the **Trackplotter** chart:

Symbol	Description
	GPS antenna
	Scale Legend
	The position of the pointer

To open or close the Trackplotter chart

1. Click **Setup** > **Trackplotter**.
2. Select one of the Trackplotter position options:
   - OFF
   - Left
   - Top
   - Right
   - Bottom

To skew the Trackplotter chart

Do one of the following:

- To skew clockwise, click **Trackplotter** > **Skew**.
- To skew counter-clockwise, right-click **Trackplotter** > **Skew**.

To show contents in the Trackplotter chart

1. On the **Trackplotter** menu panel, click **Chart Setup**, and then click the **Contents** tab.
2. Do the following:

To show	Select
Grid lines as solid lines	**Solid Lines**
Grid lines as small tick marks	**Tick Marks**
vessel position and heading	**vessel Position**
Sonar position and heading	**Sonar Position**
GPS antenna position	**GPS Antenna**

To show	Select
Track of the vessel	**Track History**
General purpose markers	**Markers**
A legend showing the scale	**Scale Legend**
Grid lines	**Grid Lines**
Any planned survey lines	**Planned Lines**
Coordinates of the pointer	**Pointer Position**
Grids to be labeled	**Grid Labels**

To change the vessel size

1. Click **Trackplotter** > **Chart Setup.**
2. Click the **Contents** tab.
3. Select the **Plot to Scale** check box.
4. Enter the **Length** and **Width** of the vessel.

To plot the head scan covered area

1. Click **Trackplotter** > **Chart Setup.**
2. Click the **Contents** tab.
3. Do one of the following:
   - To plot the head scan covered area with history, select the **Plot** check box and clear the **Timer Update** check box.
   - To plot the head scan covered area without history, select the **Plot** and the **Timer Update** check boxes.

Note:

- *The covered area is not updated if the sonar head is paused.*
- *The covered area is not plotted when the head is set to down looking mode.*

To mark vessel events

1. Click **Trackplotter** > **Chart Setup.**
2. Click the **Event** tab.
3. Do the following:
   - To mark vessel event manually, click **Manual** and press **Ctrl+F11** to mark.
   - To mark by distance, click **Automatic By Distance** and enter a distance into the **Every** box.
   - To mark by time, click **Automatic By Time** and enter a time into the **Every** box.
   - To send the events to another device through COM port, select the **Generate External Event** check box.

Setting Chart Coordinate System

See “Setting Coordinate System” on page 31.

Centering View

You can set the view center of the **Trackplotter** chart to the vessel, sonar head, or the survey area. The survey area can be survey lines or certain latitude/longitude coordinates.You can also let the system adjust the chart center automatically to follow the view center that you have selected.

To set the Trackplotter view center

1. Click **Trackplotter** > **Centering.**
2. Do one of the following:
   - To set the view center to vessel, select **vessel**
   - To set the view center to sonar, select **Sonar**
   - To set the view center to survey, select **Survey**

To set the chart follow the view center

- Use **Trackplotter** > **Auto Center**.

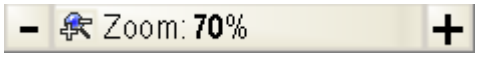
To set the survey area center

1. Click **Trackplotter** > **Chart Setup.**
2. Click the **Survey** tab.
3. Do the following:
   - To set the survey area center to survey lines, click **Center Around Survey Lines**.
   - To set the survey area center to latitude/longitude coordinates, click C**enter Around These Coordinates**, and then enter **Lat** and **Lon**.

Zooming and Panning

You can change the view of an object in the **Trackplotter** chart by zooming in to get a closer look or by zooming out to see more in the chart. You can also zoom to see the position of the object in the earth by zooming to Word View.

The **Zoom** button in the **Trackplotter** menu panel shows the current zoom percentage.

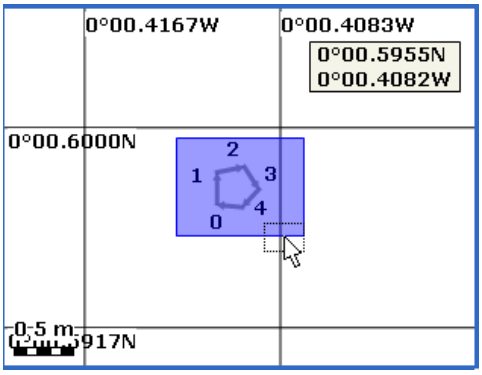


When you work at high magnification levels, you may not be able to see the whole view. Panning lets you view areas that aren’t displayed by moving the page around in the **Trackplotter** chart. You can pan the **Trackplotter** chart by **Pan** tool or pointer. You need to turn off **Auto Center** before you pan.

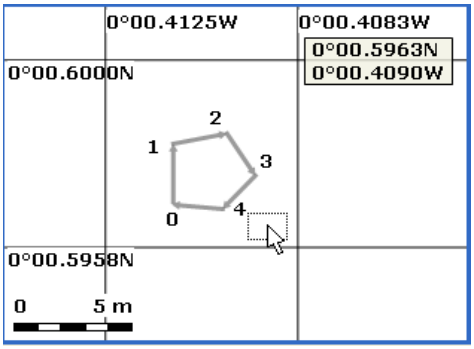
To zoom in a specific area

1. In the Trackplotter chart, point to the area that you want to zoom.

2. Click and hold down the left mouse button to draw a blue rectangle of the area.



3. Release the mouse button.
   The selected area is enlarged.



To zoom

1. Right-click in the Trackplotter chart.
2. Do one of the following:
   - To zoom in, select **Zoom In**
   - To zoom out, select **Zoom Out**
   - To see the object in the earth, select **Word View**

To Pan by the Pan tool

Note: *In order to pan the chart, you need to turn off Centering by click it on the Trackplotter menu panel.*

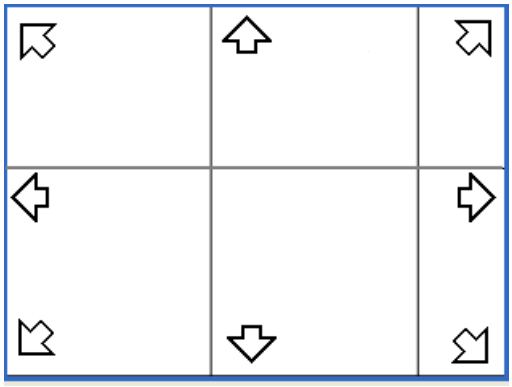
1. Click **Trackplotter** > **Tools > Pan**.

   The pointer changes to a hand shape .
2. Drag in the Trackplotter window until the area you want to view displays.

To pan by the Pointer

Note: *In order to pan the chart, you need to turn off Centering by click it on the Trackplotter menu panel.*

1. Click **Trackplotter** > **Tools > OFF**.
2. Put the pointer at the top, bottom, side, or the corner of the Trackplotter window. When the pointer becomes a big arrow, you click to pan the Trackplotter chart toward the opposite direction.



Establishing and Applying Default Scale

You can define a desired area and scale as default. When you have changed the scale and area, you can return to the default scale immediately.

To establish a default scale

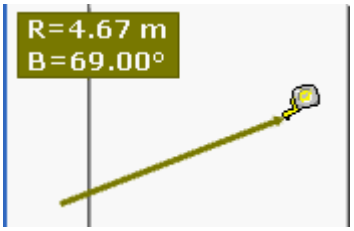
1. Select the area and scale that you want to use as the default.
2. Right-click in the **Trackplotter** chart.
3. Select **Set Current Scale as Default**.
   The current Zoom setting becomes to 100%.

To apply the default scale

1. Right-click in the **Trackplotter** chart.
2. Do the following:
   - To return to the default scale from any other scale, select **Use Default Scale**.
   - To return to the previous scale and area from the default scale, clear **Use Default Scale**.

Measuring Distances by Using the Tape Tool

You can use the **Tape Measure** tool to measure distances on the **Trackplotter** chart.



To measure the distance by using the Tape Measure

1. Click **Trackplotter** > **Tools > Tape**.
2. Click the start point and drag to the end point that you want to measure.

Locking the Sonar on the Tripod

If the sonar head is mounted at a fixed position, such as a tripod, you should lock the sonar head on the tripod.

To lock the sonar on the tripod

Do one of the following:

- Press **F5**.
- Click **Setup > Advanced Menu > Configuration > Mark Sonar Tripod Position**.

In the Trackplotter chart, the **Sonar** symbol changes to **Sonar on Tripod** symbol and a reference marker appears in the sonar image display.

To unlock the sonar on tripod

1. Click **Setup > Advanced Menu > Configuration> Calibrate head position**
2. Clear the **Sonar on tripod** check box.

Working with Survey Lines

Survey Lines are straight line segments that you can place anywhere in the **Trackplotter** window.

You can use the survey lines to lay out a course that you want the vessel to follow through a scanned or surveyed area.

You can add and delete survey lines.You can lock a survey line to prevent it from being accidentally deleted. You can also label a survey line by a name or description which can be shown or hidden in the Trackplotter chart.

To add survey lines

1. Click **Trackplotter** > **Tools > Survey Line**.

   The pointer changes to a cross shape .
2. Click in the chart where you want the survey line to start.
3. Move the pointer to where you want the line to end, then click again.

4. To add another survey line, move the cursor to the next end point and click.
5. Right-click to end drawing the survey line.

To add parallel survey lines

1. Right-click the survey line, and then click **Add Parallel Lines**.
2. Do the following:
   - Enter the **Line Spacing**
   - Enter the **No. of Lines to Right**
   - Enter the **No. of Lines to Left**

To label or lock a survey line

1. Right-click the survey line.
2. Click **Line Properties**.
3. Do the following:
   - Enter a **Name** if you want to label the survey line with a name.
   - Select the **Show Name** check box if you want to show the name.
   - Select the **Show Description** check box if you want to show the description.
   - To lock, select the **Lock Position** check box.
   - Click the **Description** tab and enter **Description** if you want to label the survey line with description.

To delete survey lines

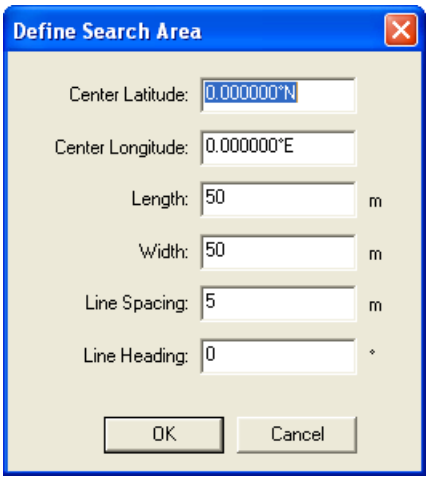
Do one of the following:

- To delete a survey line, right-click the survey line, and then click **Delete Survey Line**.
- To delete all survey lines at one time, on the **Trackplotter** menu panel, click **Survey Menu**, and then click **Delete All Survey Lines**.

Note: *You can't delete a locked survey line. Thus make sure the survey line is unlocked before you delete it.*

To define a search area

1. Right-click in the Trackplotter chart.
2. Click **Survey Lines > Define Search Area**.



3. Do the following:
   - Enter the **Center Latitude**.
   - Enter the **Center Longitude**.
   - Enter the **Length**.
   - Enter the **Width**.
   - Enter the **Line Spacing**.
   - Enter the **Line Heading**.

To save or load survey lines

1. Right-click in the Trackplotter chart.
2. Do one of the following:
   - To save survey line to a file, click **Survey Lines > Save to file**, and then enter a file name.
   - To load survey lines from a file, click **Survey Lines > Load from file**, and then select the file.

To reverse the survey line direction

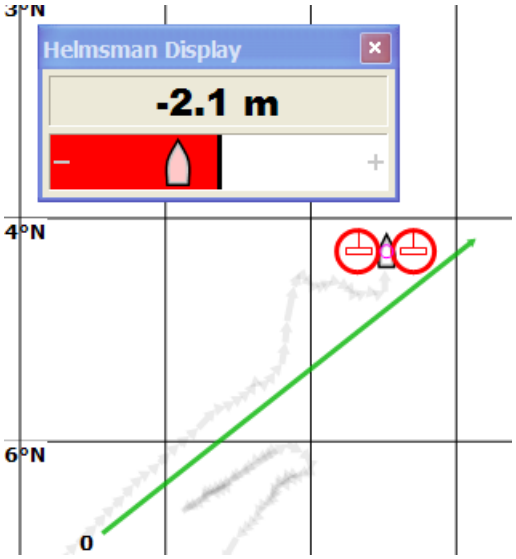
1. Right-click the survey.
2. Click **Reverse Survey Line Direction**.

Showing Vessel Position in Helmsman Display

If you want the vessel to follow a survey line and its direction, you can use the **Helmsman Display** to show the position of the vessel in terms of left or right of the survey line. If you select a survey line and set it as current survey line, the selected survey line changes to green and the **Helmsman Display** indicates the vessel position and direction:

- If the vessel is on the right side of the survey line, the **Helmsman Display** shows a positive number and a green right bar.

- If the vessel is on the left side of the survey line, the **Helmsman Display** shows a negative number and a red left bar.
- If the vessel is exactly on the survey line, the number is 0 and the bar remains white.



To show the vessel position in the Helmsman Display

1. Click **Trackplotter > Helmsman**.
2. Right-click the survey that you want the vessel to follow, and then click **Select As Current Survey Line**.

Marking Targets by Event Marker

See “Event Markers” on page 87.

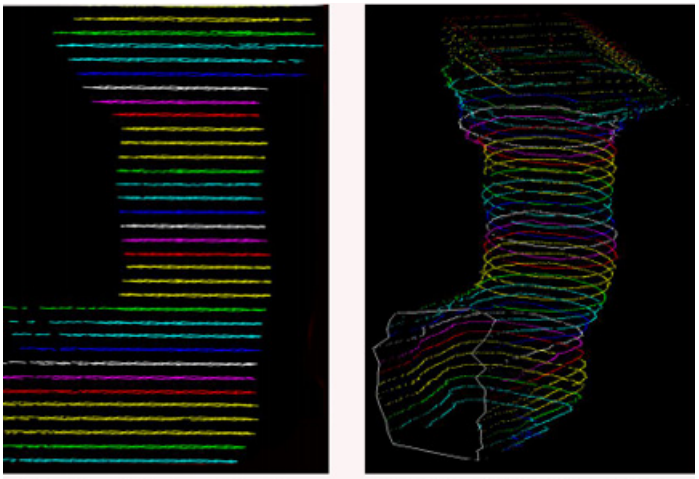
Profiling

This section includes the following:

- About the Profiling
- Showing Profile Points
- Fusing Profiling Data
- Compressing Sonar Image
- Configuring Extraction Algorithm
- Exporting Profile Data
- Monitoring Bathymetric Sensory Data
- Rotating the Head with Pan Device

About the Profiling

The MS1000 system profiling application generates profiling points data that can be recorded with time-tagged sensor data and entered offsets, and then be processed into X,Y,Z values using Kongsberg Mesotech's BathyXYZ conversion program. These XYZ files can be used to generate a 3D image of the scanned field by using 3-D terrain mapping program.



Side view of horizontal profiles 3-D view of horizontal profiles

The profiling system consists:

- **Sonar profiling heads**
  - Single beam
  - Mechanical scanning
  - Performs raw sonar imaging data acquisition of seafloor
  - Two heads are required for pipeline applications.
- **Sonar Altimeter**

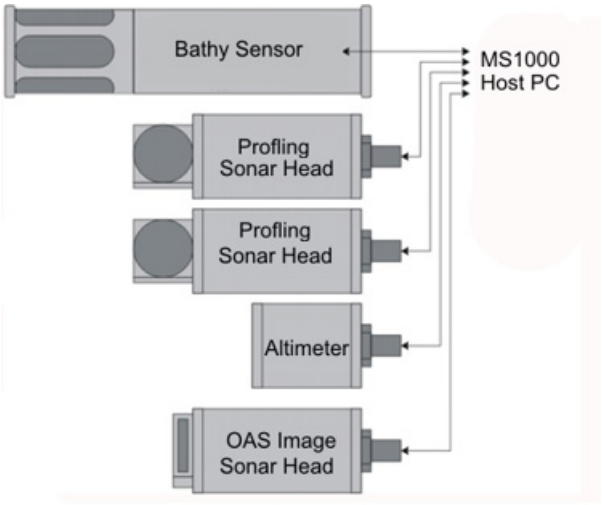
- Single beam
- Fixed direction
- Aid in vehicle navigation

• **Obstacle Avoidance Sonar (OAS) head**

- Single beam
- Mechanically scanning imaging sonar
- Aid in vehicle navigation.

• **Bathy Sensor**

- Monitor under water depth, temperature, salinity, and sounder velocity



The profiling system

Showing Profile Points

The MS1000 provides two profiling display modes:

• Image and Profile: show both image and profile points

• Profile Only: only shows profile points

To show profile points

1. Click **Profiling** > **Profiling Property**.
2. In the **Display Mode** area, select one of the following:
   • Image and Profile
   • Profile
3. To change algorithm, in the **Algorithm** list, select one of the following:
   • 1st Return
   • Peak Return
4. To configure algorithm, See “Configuring Extraction Algorithm” on page 70.

To change the profile points size

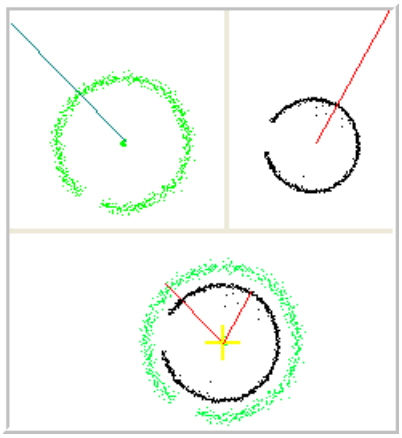
1. Click to active the profiling image window.
2. Click **Profiling** > **Profile Points**.
3. Select one of the following:
   - Small
   - Medium
   - Large

To change the profile points color

1. Right-click in the profiling image window.
2. Click **Display Settings**, and then click the **Color** tab.
3. Click **Profile Points**.
4. Select the desired color.

Fusing Profiling Data

In Polar scan mode, you can fuse the profiling data from two heads, which must be scanning in the same Range, to one image display.



You can change the palette settings (See "To change the color palette" on page 38), show or hide the scan markers (See "To show or hide the scan marker" on page 40), and show or hide Grid of the fused data window (See "To set image grid" on page 39).

You can also use Tape tool measure distance between targets in the fused head window (See "Tape" on page 81).

When you adjust the translational or rotational offsets of the heads (See "To adjust head mounting offsets" on page 17), the sonar images in the fused head window will move and rotate dynamically.

To fuse data with another head

1. Right-click in the profiling image window.
2. Click **Fuse Data with**.
3. Select the head that you want to fuse data with and click **OK**.

A new image display window appears showing the fused profile points.

To close fused data display

1. Right-click in the fused data image window.
2. Click **Close Fused Display**.

Compressing Sonar Image

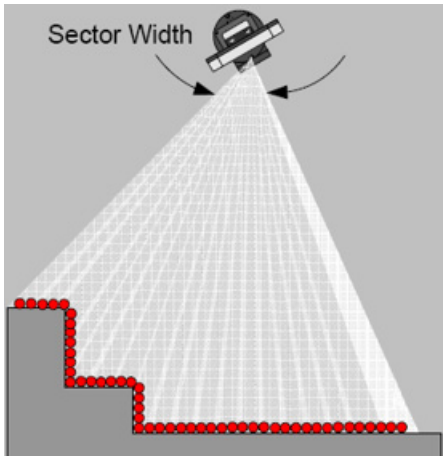
You can compress the sonar image to get profile points quickly. Compressing the sonar image causes the loss in color depth, thereby increases uplink speed of the sonar data and system performance.

To compress sonar image

1. Right-click in the sonar image display window.
2. Click **Control Head**, and then click the **Transmit** tab.
3. In the **Compression** box, select **On**.

Configuring Extraction Algorithm

Profile points are generated by an algorithm that detects the echoed return and assigns a range and bearing relative to the sonar transducer and its “0”-degree reference. The number of profile points on a specific scan is set by the selected “Step Size” - typically this is every 0.45 or 0.9 degrees. Sector Width and Heading are used to orient the head scan angle and arc of acoustic coverage.



To configure profile points extraction algorithm

1. Click **Profiling** > **Profiling Property**.
2. In the **Algorithm** list, select one of the following algorithms:
   - 1st Return: Giving first point above set threshold.
   - Peak Return: Giving peak point above set threshold
3. You can adjust the following parameters to meet your needs:

- **Minimum Range:** the range that the system starts looking for profile returns.
- **Maximum Range:** the range that the system stops looking for profile returns.
- **Minimum Gap:** the minimum gap between successive returns.
- **Minimum Width:** the minimum width of a target.
- **Number Of Returns:** the maximum number of returns to be detected for each ping.
- To compensate for weaker returns, adjust the **Threshold Curve** to set the detection thresholds to different levels at different angles.

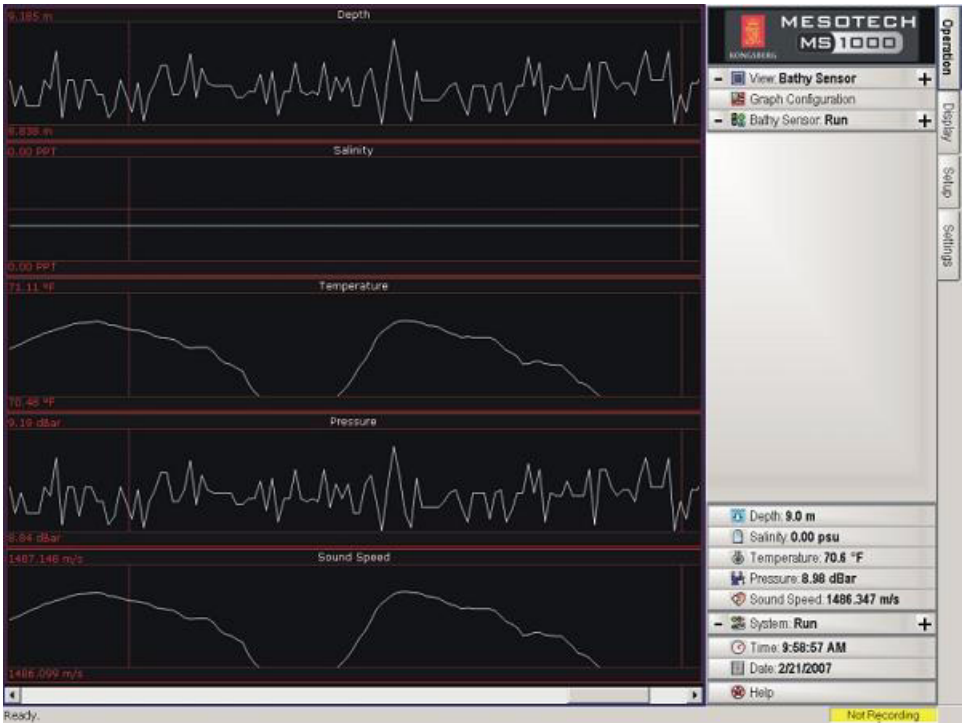
Exporting Profile Data

See “Exporting Sonar Data” on page 54.

Monitoring Bathymetric Sensory Data

Bathymetric Sensor is a conductivity temperature depth (CTD) sensor package and used for monitoring underwater depth, temperature, salinity, and sound velocity. It's a part of an overall profiling system.

The Bathy Sensor display plots Depth, Salinity, Temperature, Pressure and Sound Speed graph by time in 5 different windows. The current sensory data are shown in the **Operation** menu panel.



You can show or hide any of the graph windows. You can also show lines or points of the graph. You can show or hide the frame or gird.

When you put the mouse pointer in the window, the sensory data at that moment appear on the right-bottom of each window.

You can record or export these sensory data to a file, See “Recording, Playback, and Exporting” on page 47.

To configure bathy Sensor

The operation of configuring bathy sensor is as the same as sonar head, See “Configuring Heads” on page 13.

To show or hide the graph window

1. Click **Operation** > **Graph Configuration**.
2. Click one of the sensory data tab that you want to configure.
3. Do the following:
   - To show that window, select the **Enable** check box.
   - To hide that window, clear the **Enable** check box.

To plot the graphs in line or points

1. Right-click in the Bathy Sensor graph window.
2. Do the following:
   - To plot graph in lines, select **Plot Lines**.
   - To plot graph in points, clear **Plot Lines**.
   - To show frames, select **Plot Frames**.
   - To show grid, select **Plot Grid**.

To zoom the graph by using the mouse

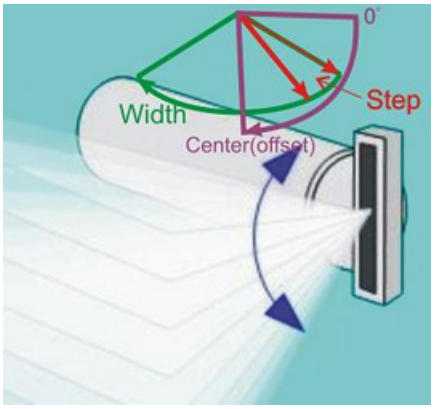
- To zoom in, scroll up the mouse wheel.
- To zoom out, scroll down the mouse wheel.

Rotating the Head with Pan Device

The Pan Device is a motor used for rotating the sonar head in profiling applications such as pier walls and bridge legs. The Pan Device is a separated hardware and it has its own controller. It is synchronized with the sonar head through software.

You can set the system to run an automatically pan and scan period with a rotation angle defined in advance.

The following diagram describes the pan and scan process. The head scans in a vertical pan (see blue arrow). The rotator moves the head in a horizontal pan (see the green arrow), starting from one end of the horizontal sector and incrementing by one step to the other end of the sector.

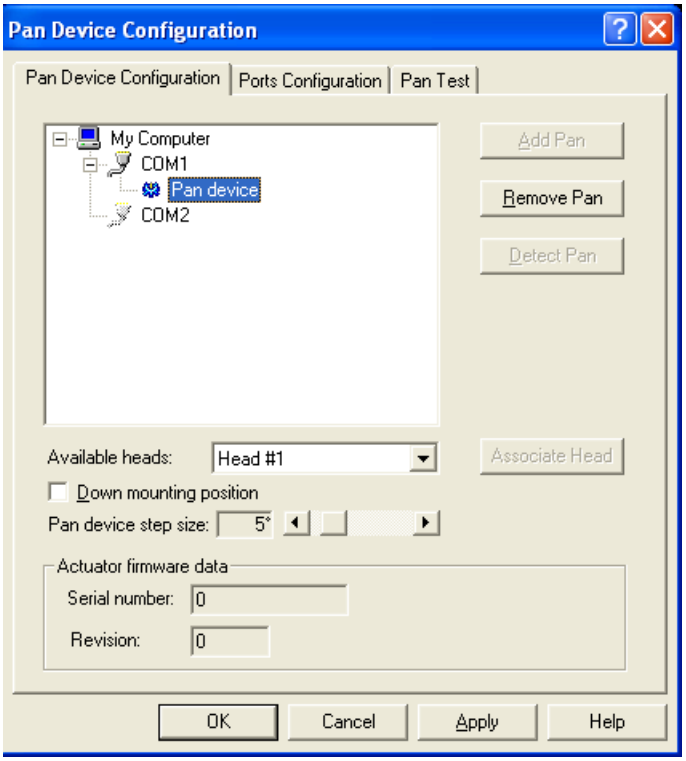


You can also use the Pan Device manually rotate the head to a certain position and set the head scan that area.

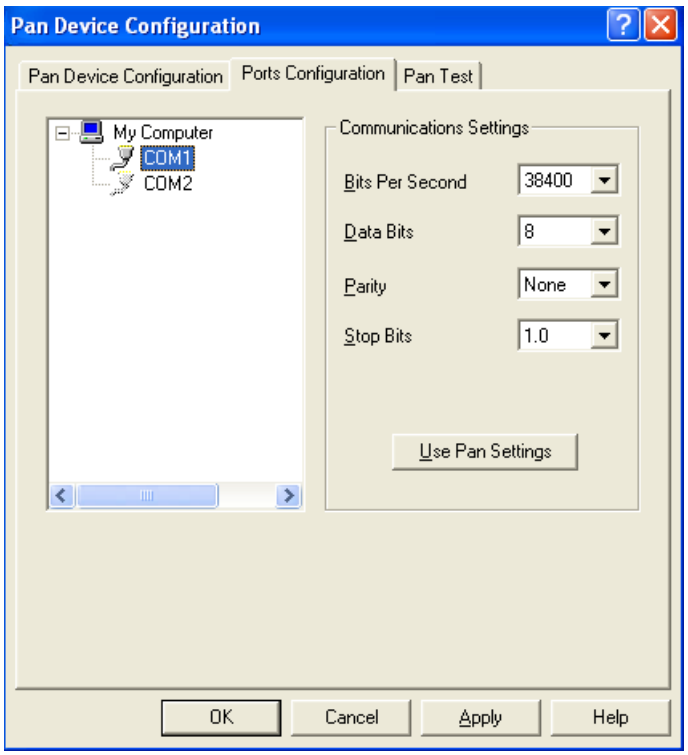
You need to configure the Pan Device before you run the sonar head. After the configuration, you can test it without running a head. You can set the speed, width, and the center (offset) of the Pan Device. You can also monitor its position while the Pan Device is moving.

To configure a Pan Device

1. Click **Setup** > **Pan Device**.
2. Select the **COM** port that you want to use for the Pan Device and click **Add Pan**.



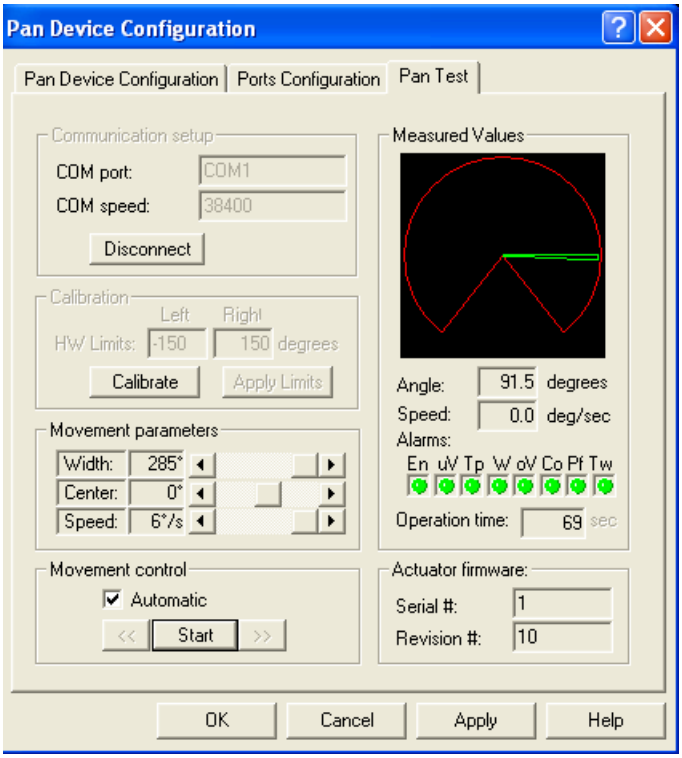
3. In the **Available Heads** list, select the head that the Pan Device associate with, and then click **Associate Head**.
4. If the Pan Device is mounted as down looking mode, select the **Down mounting position** check box.
5. Adjust the **Pan Device Step Size** between 1º to 30º. The smaller the step size the slower the Pan Device scanning speed is, the more profiling pointers you can get from sonar image. You might want to choose a suitable step size for your application.
6. Click **Apply**.
7. Click the **Ports Configuration** tab.
8. Select the **COM** port that connect the pan and click **Use Pan Settings**.
   The default Baud Rate is 38400bps. If your Pan Device uses a different rate, set the Baud Rate accordingly.



9. Click **Apply** or **OK**.
   It is recommend that you test the Pan Device after your configuration, See “To test a Pan Device” on page 74.

To test a Pan Device

1. Click **Setup > Pan Device**.
2. Click the **Pan Test** tab.



3. Click **Connect** to start pan testing.
4. To get the maximum sector width, click **Calibrate**.
   After calibration, the Pan Device is positioned in the middle of the sector.
5. Adjust the **Width**, **Center,** and **Speed** of the **Movement Parameters**.
6. In the **Movement control** box, do the following:
   - To move the Pan Device automatically, select the **Automatic** check box and click **Start**.
   - To move the Pan Device manually to the right edge of the sector, clear the **Automatic** check box and click the two “greater than” sign **(>>)** button.
   - To move the Pan Device manually to the left edge of the sector, clear the **Automatic** check box and click the two “less than” sign (<<) button.
7. Check the testing status in **Measured Values**:
   - **Angle** and **Speed** values.
   - Eight alarms lights. It turns from green to red if alarm occurred.

Note: *If the uV, Pf, and Tw occur, the En will occur.*

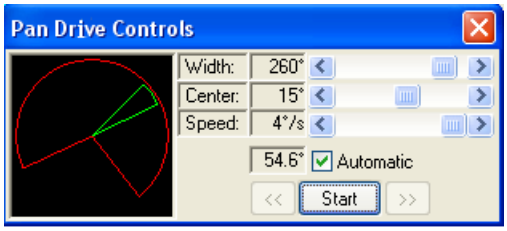
The following table describes each alarm status:

Name	Meaning	Response
En	Enable Flag	This indicates whether current is flowing in the motor oil. The Pan Device reset this flag if the motor exceeds a limit condition
uV	Under Voltage Alarm	Disable the motor until voltage is in range
Tp	Temperature Alarm	Not available in current version
W	Water Detect Alarm	Not available in current version
oV	Over Voltage Alarm	Disable the motor until the voltage is in range
Co	Communication Alarm	Ignore packet and return NAK
Pf	Power Fail Alarm	Disable motor, set power on default
Tw	Watchdog Alarm	Disable motor until a clear error command is received

8. To stop testing, click **Disconnect**.

To set up the Pan Device rotation

1. Click **Display** > **Pan Control**.



2. Use the slide to adjust **Width**, **Center**, and **Speed**.
3. Do the following:
   - To automatically pan and scan, select the **Automatic** check box.
   - To move the Pan Device manually to the right end of the sector, clear the **Automatic** check box and click the two “greater than” sign **(>>)** button.
   - To move the Pan Device manually to the left end of the sector, clear the **Automatic** check box and click the two “less than” sign (<<) button.

To pan and scan

1. Configure Pan Device.(See “To configure a Pan Device” on page 73)
2. Run the head.

Note: *In the pan and scan mode, the maximum head width is less than 360 degrees.*

3. If you want to set up Pan Device rotation, See “To set up the Pan Device rotation” on page 76.
4. Do the following:
   • In the **Pan Drive Controls** dialog box, click **Start**.
   • Click **Operation** > **Pan and Scan**.

Once the system automatically pan and scan, the system records a data file, as well as export a file to the previous recording data location.

When the Pan Device rotate to the end the sector, it will stop while the head is keeping on scanning.

Tools

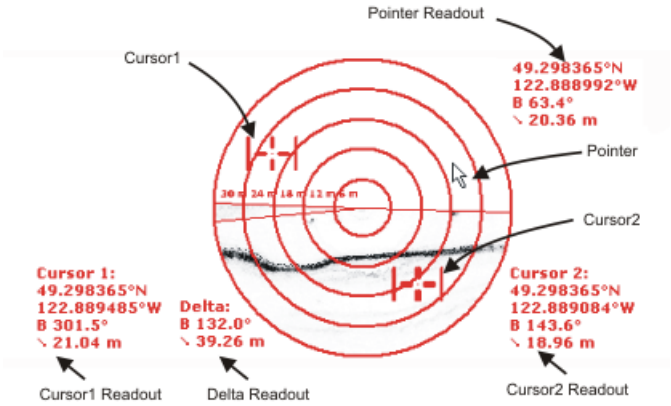
This section includes the following:

- Reference Cursors
- Magnifier Window
- Tsquare
- Protractor
- String
- Height
- Pencil
- Wiper
- Zoom
- Gauge Windows
- Event Markers

Reference Cursors

The *Reference Cursors* can be placed anywhere on the sonar image to mark a point of interest. When you put Cursors on the target, the overlay readouts appears showing their position relative to each other and to the sonar transducer or vessel in terms of *Bearing* and *Range*. This gives you a general purpose measuring tool that can be used to estimate the size and orientation of the sonar targets, or to mark a spot at a given Bearing and Range from a known target.

You can also use the **Reference Cursors** to determine the geograohic location of the sonar head when you know the coordinates and orientation of a visible target ((See “Calibrating Head Coordinate” on page 32)).



To use Cursors

1. Click to active the sonar image window.

2. Click **Display** > **Cursors**.
3. In the sonar image display, click to place the cursor.

You can also enable **Cursor1** by Pressing **F7**.

To remove Cursors

1. Click to active the sonar image window.
2. On the **Display** menu panel, click **Cursors** to set it to **OFF**.

To set the Cursors and Pointer readout options

1. Right-click in the sonar image window.
2. Click **Display Settings**, and then click the **Readout Options** tab.
3. Set **Origin** option:

Select	If
Sonar	you want readout value relative to sonar transducer.
Vessel	you want readout value relative to Vessel which include head mounting offsets.

4. Set **Bearing relative to** option:

Select	If
Heading 0	you don't want readout value to be corrected for compass heading.
True North	you want readout value to be corrected for compass heading.

To set projection

1. Choose **Setup > Advanced Menu > Configuration > Calibrate Head Position**.
2. Click the **Projection** tab.
3. In the **Display Coords In** list, select one of the following:
   - **Latitude/Longitude**
   - **Northing/Easting**
4. Do one of the following:
   - Select a **Latitude/Longitude** option if you have chosen to display coordinate in **Latitude/Longitude**.
   - Select a **Northing/Easting** option if you have chosen to display coordinate in **Northing/Easting**.

To set Latitude/Longitude format

1. Choose **Setup > Advanced Menu > Configuration > Calibrate Head Position**.
2. Click the **Projection** tab.
3. Do one of the following:
   - To show Latitude/Longitude in degrees, select **D**.
   - To show Latitude/Longitude in degrees-minutes, select **DM**.

Magnifier Window

The *Magnifier* window shows a magnified view of the area surrounding the mouse pointer.

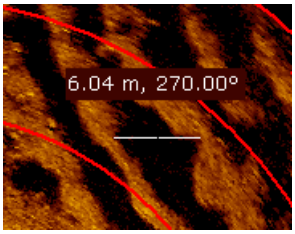
You can move the slider from left to right to increase the magnification from 100% to 1000%.

To open or close the Magnifier window

- Use **Display > Magnifier**.

Tape

Tape measures the length of a target.

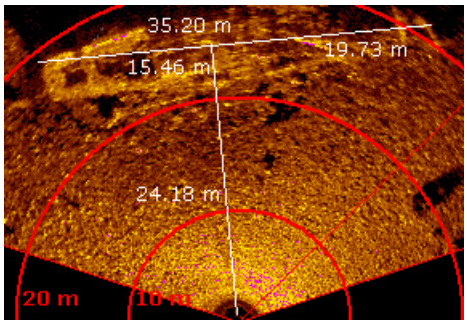


To use Tape

1. On the **Sonar Toolbar**, click  .
2. Right-click at the beginning of the target, drag to the end of the target.
3. Release the right mouse button and move up and down to your desired position.
4. Click to lock it in place.

Tsquare

Tsquare is similar to the T-squares instrument used in drafting.

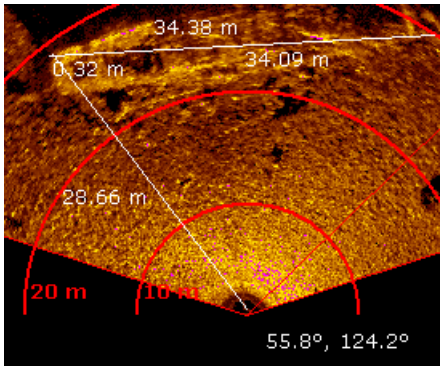


To use Tsquare

1. On the **Sonar Toolbar**, click .
2. Click the first point where you want to set the left top part of the T.
3. Click the second point where you want to set the right top part of the T.
4. Move to adjust the length and position of the arm.
5. Click to lock it in place.

Protractor

Protractor is similar to the Tsquare but the angle of the arm is adjustable rather than only 90 degrees.



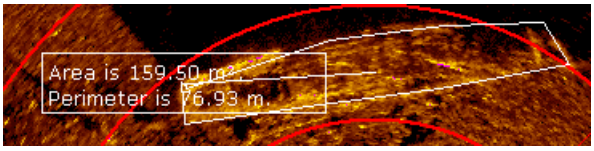
To use Protractor

1. On the **Sonar Toolbar**, click .
2. Click the first point where you want to set the left top part of the T.
3. Click the second point where you want to set the right top part of the T.
4. Click the third point where you want to set one end of the arm.
5. Move up and down, or left and right to adjust the length and angle of the arm.

6. Click to lock it in place.

String

String measures the area and perimeter of the target.

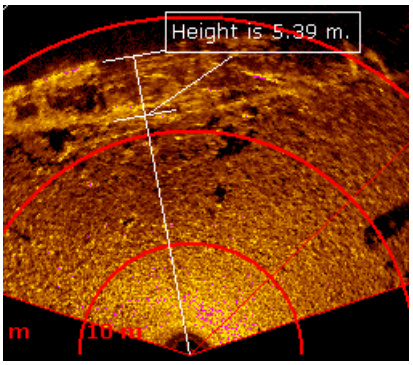


To use String

1. On the **Sonar Toolbar**, click  .
2. Click around the outer edge of the target.
3. Double-click when you reach the start point.

Height

Height measures the height of the target.

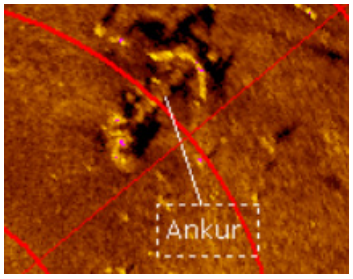


To use Height

1. On the **Sonar Toolbar**, click  .
2. Click the far side of the target's shadow.
3. Click the far side of the target itself.
4. Click the estimated first bottom return.

Pencil

Pencil adds annotation for a target.



To add annotation for a target

1. On the **Sonar Toolbar**, click  .
2. Double-click the point where you want to put annotation.
3. Enter the annotation.

To edit the annotation

1. Double-click the existing annotation.
2. Enter the new annotation.

Wiper

Wiper removes existing measurement overlays, event markers, and **Cursors**.

To use Wiper

1. On the **Sonar Toolbar**, click  .
2. Click the item that you want to remove.

Zoom

This system has two zoom tools--**True Zoom** tool and **Digital Zoom** tool. The True Zoom tool magnifies part of the sonar image without losing any image quality. It is available in the **Polar**, **Sector**, **Sidescan**, and **Echosounder** scan mode. The Digital Zoom tool also enlarges images, but loses some of the image quality. It is available in the **True Ratio Echosounder** scan mode.

To use the True Zoom tool

1. On the **Sonar toolbar**, click  .
2. Do the following:
   - Click to zoom in.
   - Right-click to zoom out.

- Control-click to zoom in/out completely.
- Shift-click to pan.

To use the Digital Zoom tool

1. On the **Sonar toolbar**, click  .
2. Do the following:
   - Click to zoom in.
   - Right-click to zoom out.
   - Control-click to zoom in/out completely.

Gauge Windows

A **Gauge Window** is a small window containing data and appearing inside the sonar display window. It shows information pertaining to the associated head.

You can open a system pre-defined gauge window. You can also customize a gauge window to show the desired system information.

Pre-defined gauge windows in this system:

- **Head Settings**: shows the main settings of the sonar head.
- **NMEA Sensor Data**: shows the sensors data received by external sensors.

You can't change the pre-defined gauge windows, but you can duplicate it and then modify its parameters.

To show the Head Settings gauge window

1. Right-click in the sonar image window.
2. Click **Head Settings**.

Parameter	Description
Bits Per Sample	Numbers of bits per sample
Compass Heading	Integrated compass unit heading
Gain Shift Factor	The fact level to reduce the gain
Head Sensor Pitch	Pitch angle in degree
Head Sensor Roll	Roll angle in degree
Oversampling Frequency	Numbers of sample per second
Panel Gain	Number of Gain per second
Ping Rate	Numbers of ping per second
Pulse Length	Time of energy is applied to transducer

Parameter	Description
Range	Radius measurement
Sample Count	Numbers of samples per ping
Sample Delay	Skipped numbers of samples per ping
Sample Interval	Number of available pixels decided by Range
Scan Speed	Azimuth change of stepper motor at each ping

To show the NMEA Sensors Data gauge window

1. Right-click in the sonar image window.
2. Click **NMEA Sensor Data**.

To create a customized Gauge Window

1. Right-click in the sonar image display window to open the option menu.
2. Click **Customize Gauge Windows**.
3. Click **New** and enter a name.
4. To add parameters, in the **Unused Parameters** list, double-click the desired parameters.

To remove a customized Gauge Window

1. Right-click in the sonar image display window to open the option menu.
2. Click **Customize Gauge Windows**.
3. In the **Gauge Windows** box, click the icon of the gauge window, and then click **Remove**.

To duplicate a Gauge Window

1. Right-click in the sonar image display window to open the option menu.
2. Click **Customize Gauge Windows**.
3. In the **Gauge Windows** box, click the icon of the gauge window, and then click **Deuplicate**.

To show a closed Gauge Window

1. Right-click in the sonar image display window to open the option menu.
2. Click **Customize Gauge Windows**.
3. In the **Gauge Windows** box, click the icon of the gauge window, and then click **Show**.

To remove parameters from a customized Gauge Window

1. Right-click in the sonar image display window to open the option menu.
2. Click **Customize Gauge Windows**.

3. In the **Gauge Windows** box, click the icon of the gauge window.
4. In the **Label** box, click a parameter that you want to remove, and then click **Remove**.

To change the font size of Gauge Window

1. Right-click in the gauge window.
2. Select one of the following:
   - Small
   - Medium
   - Large
   - Larger
   - Largest
   - Autosize

   Autosize adjusts the width and height to fit the font size.

Event Markers

Event Markers are small symbols that you can place anywhere on the Sonar image or Trackplotter display for any purpose.

Typically, you can used a marker to mark the location of a sonar target or an object at a known position. You can also label a marker with a name and description.

Marker Icon	Description	Marker Icon	Description
	Marker 1		Foul Ground
	Marker 2		Underwater Obstruction
	Marker 3		Pipeline Crossing
	Marker 4		Offshore Platform
	Marker 5		Lighted Beacon
	Marker 6		Rock

Marker Icon	Description	Marker Icon	Description
	Marker 7		Red Buoy
	Marker 8		Green Buoy
	Piling		Pos Reference
	Wreck		

To show or hide the Markers Toolbar

1. Choose **Setup > Advanced Menu > View**.
2. Do one of the following:
   - To show, select **Markers Toolbar**.
   - To hide, clear **Markers Toolbar**.

To add a marker

1. On the **Markers Toolbar**, click the desired marker.
2. Place the marker in the display.

To label a marker

1. Do the following:
   - To label a marker in the sonar image window, double-click the marker.
   - To label a marker in the Trackplotter window, right-click the marker, and then click **Marker Properties**.
2. In the **Marker Properties** dialog box:
   - To label a marker with name, click the **General** tab and enter a name.
   - To label a marker with description, click the **Description** tab and enter a description.

To prevent a marker being erased by locking it

1. Do the following:
   - To label a marker in the sonar image window, double-click the marker.
   - To label a marker in the **Trackplotter** window, right-click the marker, and then click **Marker Properties**.
2. In the **Marker Properties** dialog box, click the **General** tab, and then select the **Lock Position** check box.

To remove markers

Note: *You can't remove a marker that is locked. To unlock a marker, clear the* ***Lock Position*** *check box in the* ***Marker Properties*** *dialog box.*

To remove	Do this
All markers	Right-click in the display window, and then click **Delete All Markers**.
A single marker in the Trackplotter window	Right-click the marker that you want to remove, and click **Delete Marker**.
A single marker in the Sonar window	On the **Display** menu panel, click **Tools**, and click **Wiper**, and then click the marker that you want to remove.

To show a marker label in the Trackplotter display

1. Right-click the marker.
2. Click **Marker Properties**.
3. Do the following:
   • To show the marker name, select the **Show Name** check box.

To show the marker description, select the **Show Description** check box.

Remote Keypad

This section includes the following:

- About the Remote Keypad
- Operating by Using Remote Keypad

About the Remote Keypad

The remote *Keypad* is an USB plug and play device used to operate the MS1000 software application substituting a standard computer mouse and keyboard.

A remote Keypad consists of:

- A joystick with two buttons that emulates mouse control
- Softly backlighted and labeled keys suitable for dark environment
- A removable rubber bracket provides mechanical protection

Specifications

Materials/Finish	Keypad - Aluminium 6061-T6 / GLS dynaflex G2711 TPE Bracket - Santoprene TPE
Finish (Al)	Hard Anodize, Black MIL-A-8625 Type III
Dimensions	Length 6.3" / 160 mm Width 3.17" / 88 mm Depth 1.57" / 40 mm
Weight	1.3 lbs / 0.58 kg (without bracket) 1.4 lbs / 0.66 kg (with bracket)

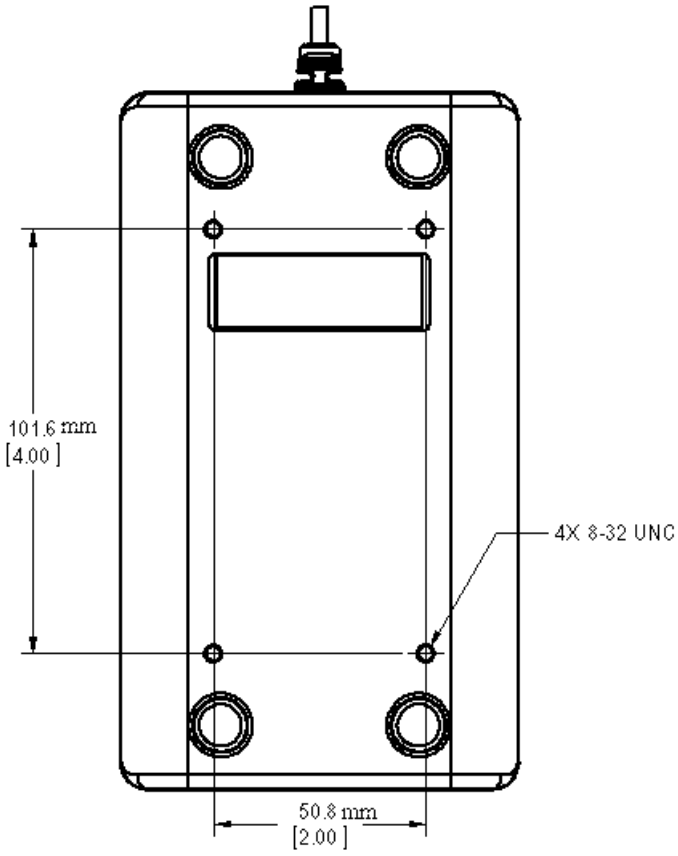
Installation

The remote *Keypad* is a plug-and-play device. You need to connect it to one of the host PC's USB 1.1/2.0 ports.

You can use the remote *Keypad* as a handheld or desktop device.

You can also affix it to a flat surface with its four #8-32 mounting holes on the back.

The following diagram shows remote Keypad back-view with dimensions of mounting holes:



Operating by Using Remote Keypad

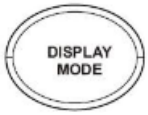
A remote *Keypad* has a joystick with two buttons and 19 keys.

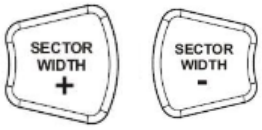
The joystick is a pressure-sensitive pointing device that positions the pointer; the left-button emulates the mouse left-button action; the right-button emulates the mouse right-button action.You can use the joystick to operate Windows applications.

The labeled keys manipulates the operation of the MS1000 software.

Note: *These keys are designed only for operating the MS1000 software, and therefore can't be used for other applications.*

To operate MS1000 by using keys

To	Press
Run all heads connected to the system	
Stop all heads connected to the system	
Select the next active head/display window	
Pause/resume the currently selected head	
Reverse scan direction for the currently selected head	
Change the scan mode for the currently selected head	
Adjust Range for the currently selected head	
Adjust Scan Speed for the currently selected head	
Adjust Gain for the currently selected head	

To	Press
Adjust Sector Heading for the currently selected head	
Adjust Sector Width for the currently selected head	
Change image color palette for the currently selected head	
Starts recording a data file of operations of all heads connected to the system	
Playback a recorded data file	

Networking

This section includes the following:

- About Networking
- Setting up Networking

About Networking

The Networking feature allows you to control and view data from your local computer to a remote computer through LAN, WAN, or Internet.

This system includes four networking modes used for different purpose:

Networking Mode	Description
Stand alone mode	Stand alone mode is default operating mode that can operate sonar heads or playback recorded data.
Server mode	Server mode, which is required to connected with sonar heads, passes all its operational settings and sonar data to the client. ***Note:*** *Only one server is allowed in a network.*
Passive client mode	Passive client mode views sonar data generated by a server. It can not operate sonar heads locally, but can change Display settings, such as Palette and Font Size. ***Note:*** *More than one passive client can be connected to a server.*
Active client mode	Active client mode can view sonar data generated by a server. It can also change some settings of the server, such as Gain, Range, Scan Speed, and TVG, but can not perform Run, Stop, Record, Playback, and Connect Heads. ***Note:*** *Only one active client is allowed in a network.*

Setting up Networking

This system use DCOM technology to communicate with each others.You need to set up your computer DCOM for MS1000 (See “Setting up Your Computer DCOM for MS1000” on page 111) before you set up networking.

By default, your system is in stand-alone mode unless it has been configured to other modes.

To set up your system as a server/ passive client

1. Set up your computer DCOM for MS1000 (See “Setting up Your Computer DCOM for MS1000” on page 111).
2. Click **Setup > Advanced Menu > Network > Initialize**.
3. Do the following:
   • To set up your system as a server, click **Connect to Client**.
   • To set up your system as a passive or active client, click **Connect to Server.**
4. In the **Remote Machine Name** box, enter or select the remote and local computer name.

To set up your system as an active client

1. Set up your system as a passive client (See “To set up your system as a server/ passive client” on page 96).
2. Click **Request Control.**
   If there is another active client in the network, the system shows a dialog box in the active client asking permission to take control away. If the active client agrees to relinquish control, then the requesting machine becomes the active controller. Both clients are informed of the change in the active client.

To set up your system as stand-alone

1. Set up your computer DCOM for MS1000 (See “Setting up Your Computer DCOM for MS1000” on page 111).
2. Click **Setup > Advanced Menu > Network**.
3. Do one of the following:
   • If your system is a client, select **Disconnect from Server**.
   • If your system is a server, select **Disconnect from Client**, and then select all of the clients.

To change an active client to a passive client

1. Set up your computer DCOM for MS1000 (See “Setting up Your Computer DCOM for MS1000” on page 111).
2. Click **Setup > Advanced Menu > Network**.
3. Do one of the following:
   • If your system is an active client, click **Relinquish control**.
   • If your system is a server and you want to take control privilege away from an active client, click **Remove control Privilege From Clients.**

To test network connection

- Click **Setup > Advanced Menu > Network** > **Beep Remote**.

Note: *You must make sure that the sound is enabled on the remote machine. If you can not hear a beep on the remote machine, there might be a problem with the connection. You should re-connect and try again.*

To display network connection

- Click **Setup > Advanced Menu > Network** > **Display Network Connections**.

Reference

Factory Reset Settings

The following table describes factory settings:

Parameter	Default Value	Parameter	Default Value
Range	10 meters	Peak Detect	High
Gain	10%	Orientation	Down
Scan Speed	0.45º	Sector Width	360º
Scan Mode	Polar	Sector Heading	0º
Tx Power	High	Palette	Simrad 1
Pulse Length	25 us	Uplink Baud Rate	115200
TVG	20Log	All Overlay Colors	Red
Profiling	Disabled	Grids	Enable

File Types Used by This System

This system creates and uses several file types, each with a special extension.

The following table describes each file type and its description:

File Type	**Description**
SMB	Binary file, created by recording data, contains sonar image view and head settings information for playback. The extension of the first recorded file is .smb and the subsequent are .001, .002, and so on.
EXP	Export file, generated by exporting sonar data, is a ASCII text file that contains profile and sensor data. The extension of the first file in a series is .EXP and subsequent are .e001, .e002 and so on.
TXT	Text file, created by exporting imagery, contains the system settings information.
BMP	Bitmap file, created by exporting imagery, contains sonar image.

The following table describes each file type and its description:

File Type	Description
SVL	Survey line file stores survey line information.
CFG	Configuration file stores system configurations for multiple users.
LOG	Log file is a ASCII text file.
BPW	World file, created by exporting imagery, contains position and scaling information.
SOP	Sonar palette file contains the customized color palettes for the sonar image.
TIF	GeoTIFF file, created by exporting imagery, contains projection Lat/Lon and datum WGS84.

Export Data Formats

Following is a list of MS1000 generated sentences for exporting sensor and profile data to an ASCII file. Each sentence starts with a mnemonic describing the type of information in that sentence. There are standard fields such as the device number and time following each mnemonic. Device numbers are allocated as new types of data are setup to be sent to the file. These may include TSS sensors, GPS, MS1000 raw profile and processed profile data. Time is in UTC which is either obtained from the source (NMEA data from serial port) or calculated from the local time by the MS1000. A mechanism of synchronizing the local time with that received from the serial port is available in the **Export** dialog box.

Each sentence has the following general format:

Mnemonic Device Number Time Date Other device specific information

Information fields are separated by space

Mnemonics assigned to different data sources (devices) are defined bellow.

Device number is an arbitrary number assigned to a particular data source and used subsequently to identify that source.

Time is in milliseconds since midnight

Date is in dd mm yyyy:

- dd is two digit day of the month
- mm is two digit month of the year
- yyyy is four digit year

The following table describes each Device specific information with the associated mnemonic and its description:

Name	Mnemonics	Description
Device Information	**DEV**	Device number. is used in the subsequent sentences to identify the source of data. Assignment of device numbers are arbitrary.
Offset	**OFS**	Source specific mounting offsets: X (starboard) Y (Forward) Z (Up) all in meters Pitch Roll Yaw all in degrees Sonar head mounting 1=down, 0=forward Transducer number, used for dual transducer heads.
Position	**GPS**	Latitude Longitude quality indicator (as defined by NMEA standard)
Motion Sensor	**HRP**	Heave Roll Pitch quality indicator
True Heading	**HDT**	True heading in degrees.
Altimeter Reading	**ALT**	Depth below transducer in samples Sampling rate in Hertz Depth in samples
Water temperature	**MTW**	Water temperature in degrees Celsius
User Defined	**UDF**	User defined sensor input as defined by the user format string.
Raw Profile Data	**PRO**	Profile data in range and bearing with respect to the sonar head. Start angle in 0.225 º Step size in 0.225 º Number of acoustic pings Number of profile points per ping Start time offset in milliseconds Stop time offset in milliseconds Sampling rate in Hertz Samples to skip Profile points in each ping sequentially arranged for all pings Transducer number, used for dual transducer heads.

The following table describes each Device specific information with the associated mnemonic and its description:

Name	Mnemonics	Description
Processed Profile Data	**PPR**	Profile data in Cartesian coordinate system Number of acoustic pings Number of profile points per ping Start time offset in milliseconds Stop time offset in milliseconds Profile points in each ping sequentially arranged for all pings given in X Y Z (all in meters) Transducer number, used for dual transducer heads.
Pan Device Info	**PDI**	Rotator's position

Following is an example of the export file for dual head profiling operation with TSS, GPS and user defined sensor input for heading.

DEV 8 68206600 21 5 1999 TSS

Device 8 is a TSS attached at 18:56:46.6 on May 21, 1999

OFS 8 68206600 21 5 1999 2.030000 -5.730000 0.000000 0.000000 0.000000 0.000000

Device 8 has an offset of X=2.03 and Y=-5.73 meters

HRP 8 68206600 21 5 1999 0.00 0.85 -3.46 U

Data from device 8 indicates: Heave=0 m, Roll=0.85º and pitch=-3.46º

DEV 9 68206820 21 5 1999 GGA

Device 9 is a GGA attached at 18:56:46.82 on May 21, 1999

OFS 9 68206820 21 5 1999 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000

Device 9 has no offsets

GPS 9 68128.000000 21 5 1999 4917.5835 -12252.3933 2

Data from device 9 indicates:

Latitude= 49 º 17.5835 minute North

Longitude= 122 º 52.3933 minute West

DEV 13 68206880 21 5 1999 MS1000

device 13 is an MS1000 sonar head attached at 18:56:46.88 on May 21, 1999

OFS 13 68207480 21 5 1999 -1.919800 0.000000 -3.400000 1.200000 2.700000 0.000000 1 0

Device 13 has an offset of:

X=-1.9198 meters and Z=-3.4 meters

pitch = 1.2º and Roll=2.7 º

and is mounted in the Down looking mode.

The transducer number is 0, corresponding to primary.

PRO 13 68206668 21 5 1999 478 -4 4 2 0 405 5850 0 0 233 0 218 0 215 0 0

Raw Profile Data from device 13:

Start angle = 478 x 0.225 = 107.55 º

step size = -4 x 0.225 = -0.9 º

number of acoustic pings = 4

number of profile points per ping = 2

start time offset = 0 milliseconds

stop time offset = 405 milliseconds

sampling rate = 5850 Hz

samples to skip = 0

profile point [n] = (value + samples to skip) x speed of sound / (2 x sampling rate)

profile point[1] = 0 at angle 107.55

profile point[2] = 0 at angle 107.55

profile point[3] = (233 + 0) x 1475 / (2 x 5850) = 29.37m at angle (107.55 + step size)

angle = 106.65 º

profile point[4] = 0 at angle 106.65

profile point[5] = 27.48m at angle 105.75

profile point[6] = 0 at angle 105.75

profile point[7] = 27.1 at angle 104.85

profile point[8] = 0 at angle 104.85

The transducer number is 0, corresponding to primary.

PPR 13 68206668 21 5 1999 8 1 0 405 -1.9198 0.0000 -3.4000 -1.9198 0.0000 -3.4000 -1.9198 0.0000 -3.4000 -1.9198 0.0000 -3.4000 -1.9198 0.0000 -3.4000 25.1090 0.0000 -14.9009 23.1968 0.0000 -14.5564 22.6753 0.0000 -14.7906 0

Processed Profile Data from device 13:

number of acoustic pings = 8

number of profile points per ping = 1

start time offset = 0 milliseconds

stop time offset = 405 milliseconds

profile point[1] = -1.9198, 0, -3.4 (x,y,z) in meters

profile point[2] = -1.9198, 0, -3.4 (x,y,z) in meters

profile point[3] = -1.9198, 0, -3.4 (x,y,z) in meters

profile point[4] = -1.9198, 0, -3.4 (x,y,z) in meters

profile point[5] = -1.9198, 0, -3.4 (x,y,z) in meters

profile point[6] = 25.10, 0, -14.90 (x,y,z) in meters

profile point[7] = 23.19, 0, -14.55 (x,y,z) in meters

profile point[8] = 22.67, 0, -14.79 (x,y,z) in meters

The transducer number is 0, corresponding to primary.

HRP 8 68207040 21 5 1999 0.01 0.89 -3.44 U

DEV 12 68207040 21 5 1999 MS1000

PPR 12 68206888 21 5 1999 8 1 0 405 17.2603 0.0000 -14.7192 17.9494 0.0000 -14.8552 18.2384 0.0000 -14.6761 18.5258 0.0000 -14.4908 19.2284 0.0000 -14.5828 19.8325 0.0000 -14.5863 20.1216 0.0000 -14.3711 21.2682 0.0000 -14.6766 0

PRO 12 68206888 21 5 1999 568 -4 8 1 0 405 5850 0 154 159 160 161 166 170 171 180

HRP 8 68207480 21 5 1999 0.01 0.95 -3.43 U

DEV 7 68207480 21 5 1999 UDF HDM FEA

Device 7 is a user defined sensor called HDM and has a user defined display format of FEA as described by user defined sensor format

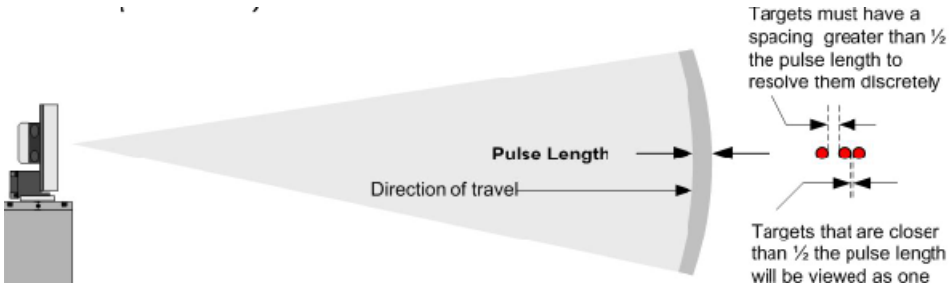
OFS 7 68207480 21 5 1999 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000

UDF 7 68207480 21 5 1999 326.8 M

The user defined sensor indicates a magnetic heading of 326.8 º

Pulse Length and Range Resolution

In underwater acoustics, the word *resolution* is the ability of the instrument to distinguish (resolve) discrete targets. Pulse length refers to the time electrical energy is applied to the transducer, and subsequently the size (width) of the longitudinal pressure wave moving through the water column.

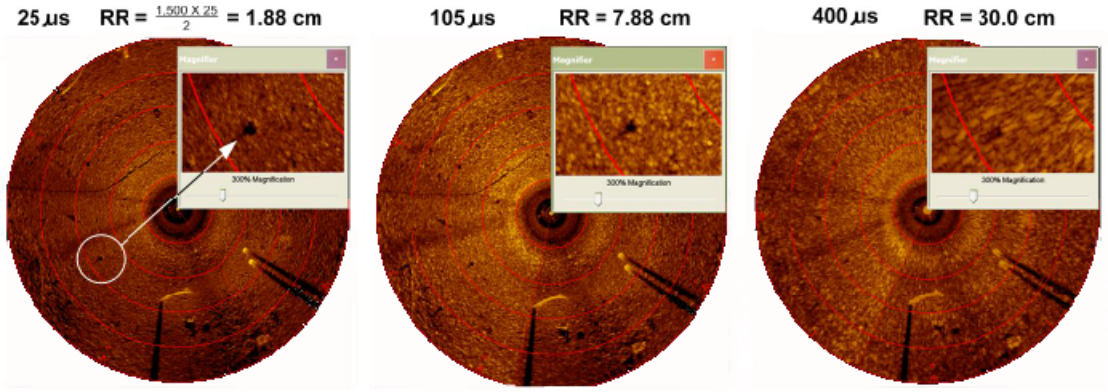


The formula that defines **Range Resolution (RR)** is:

$$RR = \frac{\text{Speed of Sound} \times \text{Pulse Length}}{2}$$

Note: *The smallest pulse length that affects range resolution is limited by 1/receiver bandwidth.*

The following image shows the narrowest pulse length provides the best range resolution; use of a longer pulse length delivers more energy and results in longer detection ranges of large targets, but at the expense of losing small target detail.



Coordinate System

To obtain the real-time 3D visual representation of underwater objects, such as the landscape of the sea bottom, we need to relate the sonar coordinate data with the current UTM (Universal Transverse Mercator) coordinate data. Depending on how the sonar is installed on the vehicle, a series of transforms may be needed to convert the sonar coordinates to the coordinates under the UTM system.

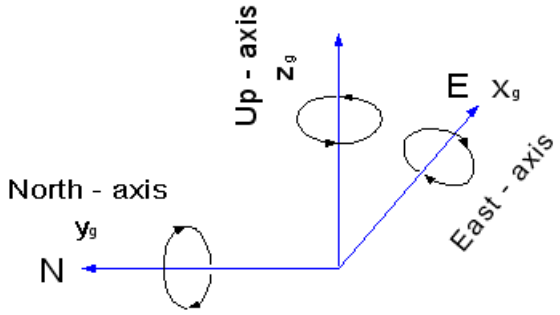
The following information serves as a guide on how the coordinate systems are specified, their relative relationships and introduces a uniform solution for the various transforms.

Getting familiar with the coordinate systems will also help in setting up the software provided by Kongsberg Mesotech Ltd.

Geographic Coordinate System

The geographic coordinate system has the geographic North as its N-axis, the geographic East as its E-axis, and the direction of the local gravity which is normal to the ideal earth geoid as its U-axis (U stands for Up). The origin of the geographic coordinate system is at N = 0 (equator), E = 0 (primary meridian) and U = 0 (sea level) in the latitude/ longitude system or is dependent on the local zone in the UTM system.

A graphical representation of this system is depicted as following:

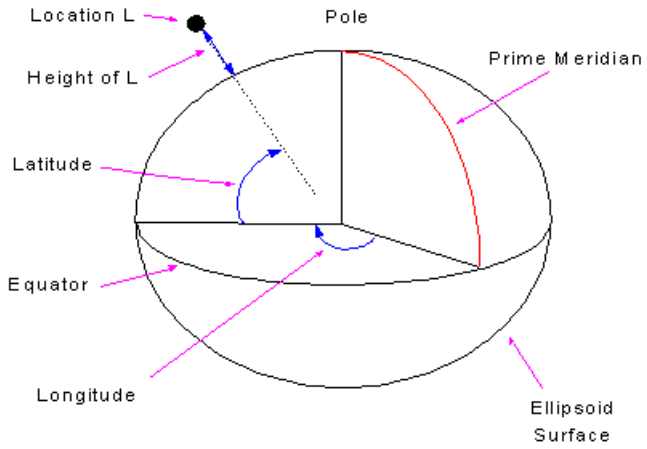


Geographic coordinate system

The geographic coordinate system is the reference system for positioning the vehicle. There are two different types of coordinates used in the geographic system: the longitude/ latitude coordinates and the UTM coordinates.

Latitude/ Longitude and Height Coordinate System

Latitude, longitude and height form one of the geographical coordinate systems as shown in the following diagram:



Latitude, Longitude, and Height coordinate system

Latitude and longitude can be used for locating places on the surface of the earth.

Latitude

The latitude is the angular measurement of a location expressed in degrees north or south of the equator. The latitude at the equator is 0°. At the north pole, the latitude is 90°N. At the south pole, the latitude is 90°S. The latitude lines are all in parallel to each other and run in the east-west direction.

Longitude

The longitude is the angular measurement of a location also expressed in degrees, but measured from the prime meridian. The longitude lines (meridians) run in the south-north direction from pole to pole and meet at theses poles (the compass needle also points to either of these poles). The prime meridian has a longitude of 0°. Then the longitude increases both east and west of the prime meridian to the 180° meridian which forms the international date line.

Height

The height of a location is the distance from the reference ellipsoid (approximately identical as the sea level) to this location, but it should be in the direction normal to the ellipsoid (this is also approximately the same direction as that of the gravity). We use sea level as zero in our system.

Latitude and Longitude measurement

The latitude and longitude are measured in degrees, minutes and seconds.

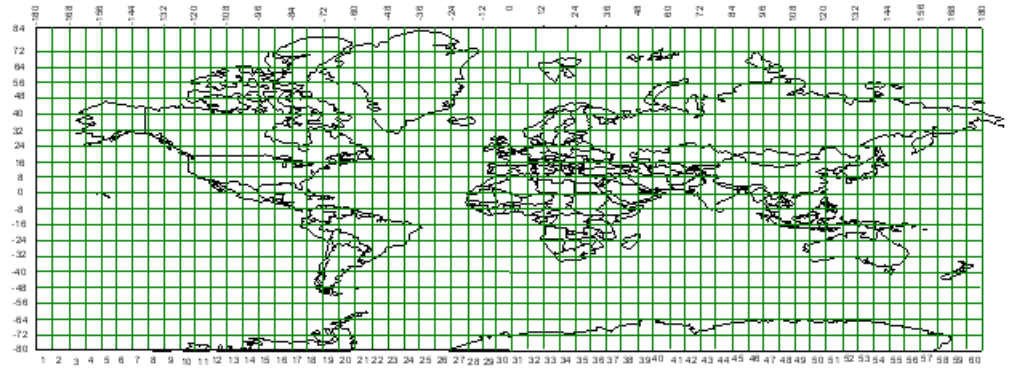
A degree (°) can be divided into 60 minutes ('), then one minute can be further divided into 60 seconds (“). One degree of latitude is approximately equal to 69 miles (111 km). One minute of latitude is a little more than a mile, and one second of latitude is around 100 feet. The distance of one degree of longitude is not constant. At the equator, a degree of longitude is about 69 miles, but at the poles, it becomes zero.

An example of latitude and longitude is 49°11' N 123°10' W which is Vancouver, British Columbia, Canada.

Universal Transverse Mercator (UTM) System

The Universal Transverse Mercator (UTM) coordinate system is a two dimensional rectangular definition of surfaces positions of the entire earth. UTM zones are defined within an imaginary rectangle with longitude as its horizontal axis and latitude as its vertical axis.

The UTM grid is shown in the following diagram:



The Universal Transverse Mercator system

The vertical axis of the UTM grid ranges from 80° South latitude to 84° North latitude with an interval of 8°. Each interval is designated by an English letter (starting with letter C and ending with letter X, but letters I and O are not used).

The horizontal axis scales of the grid are 6° apart and ranges from -180° to 180°. These horizontal scales are labeled using numbers from 0 to 60. However, there are zones which are special. They are located between 0° and 36° longitude and above 72° latitude. Another special zone can be found between 0° and 12° longitude and 56° to 64° latitude.

Each UTM zone has a central meridian. For example, Zone 10 extends from 120°W to 126°W. Therefore, its central meridian locates at 123°W. For a particular point inside each UTM zone, its Easting coordinate is measured from the zone's central meridian. The central meridian has a given imaginary Easting coordinate of 500,000 meters. The Northing coordinate of the same point is measured from the equator. If this point is located on the northern hemisphere, the equator's coordinate is 0. If this point is located on the southern hemisphere, the equator's coordinate is 10,000,000 meters.

The State Plane Coordinate System (SPCS)

The State Plane Coordinate System (SPCS) is a coordinate system designed for mapping the United States. It was developed in the 1930s by the U.S. Coast and Geodetic Survey to provide a common reference system to surveyors and mappers. The goal was to design

a conformal mapping system for the country with a maximum scale distortion of 1 part in 10,000, then considered the limit of surveying accuracy. Three conformal projections were chosen: the Lambert Conformal Conic for states that are longer in the east-west direction, such as Tennessee and Kentucky, the Transverse Mercator projection for states that are longer in the north-south direction, such as Illinois and Vermont, and the Oblique Mercator projection for the panhandle of Alaska, because it is neither predominantly north nor south, but at an angle. To maintain an accuracy of 1 part in 10,000, it was necessary to divide many states into zones. Each zone has its own central meridian or standard parallels to maintain the desired level of accuracy. The boundaries of these zones follow county boundaries.

North American datums

There are two horizontal datums used almost exclusively in North America. These are the North American Datum of 1927 NAD27 and the North American Datum of 1983 NAD83. The US. National Geodetic Survey (NGS) uses a transformation program known as NADCOM, the Canadian method for transformation between the two datums is known as the Canadian National Transformation.

NAD27: The North American Datum of 1927 uses the Clarke spheroid of 1866 to represent the shape of the Earth. The origin of this datum is a point on the Earth referred to as Meades Ranch in Kansas. Many NAD27 control points were calculated from observations taken in the 1800s. These calculations were done manually and in sections over many years. Therefore, errors varied from station to station.

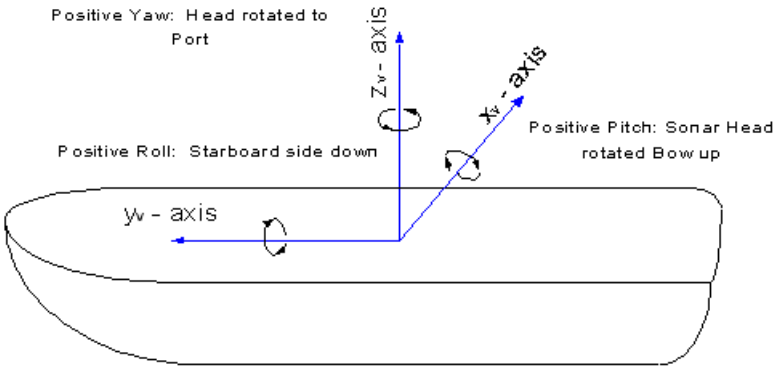
NAD83: Many technological advances in surveying and geodesy since the establishment of NAD27 - electronic theodolites, GPS satellites, Very Long Baseline Interferometry, and Doppler systems revealed weaknesses in the existing network of control points. Differences became particularly noticeable when linking existing control with newly established surveys. The establishment of a new datum would allow for a single datum to cover consistently North America and surrounding areas. The North American Datum of 1983 is based upon both Earth and satellite observations, using the GRS80 spheroid. The origin for this datum is the Earths center of mass. This affects the surface location of all latitude-longitude values enough to cause locations of previous control points in North America to shift, sometimes as much as 500 feet. A ten-year multinational effort tied together a network of control points for the United States, Canada, Mexico, Greenland, Central America, and the Caribbean.

Vehicle Coordinate System

This is the coordinate system which describes the vehicle such as a ship.

The coordinate system has three axes xv, yv and zv which are defined by assuming the ship is stationary. The yv - axis is horizontal and points in the bow (heading) direction of the vehicle. The xv - axis and the zv - axis point in the starboard direction of the vehicle and in the up direction respectively.

The vehicle coordinate system is shown in the following diagram:



Vehicle Coordinate system

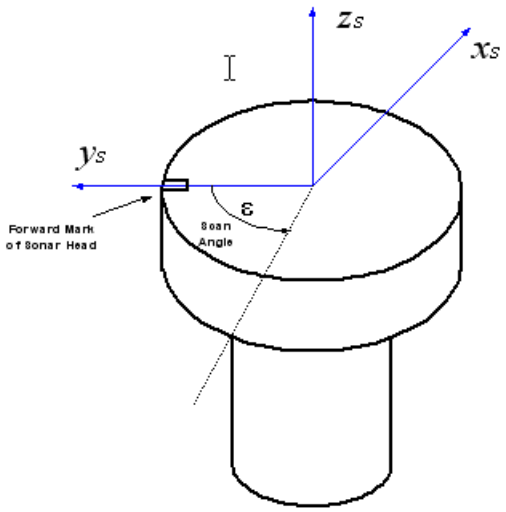
The vehicle coordinate system and the sonar head coordinate system have a fixed relationship in terms of position and orientation. This relationship can always be described clearly by a coordinate transformation and does not change with time. By default the xs-axis of the sonar head is aligned with the xv-axis of the vehicle. Then the ys-axis of the sonar head is aligned with the yv-axis of the vehicle, and finally the zs-axis of the sonar head is aligned with the zv-axis of the vehicle.

There is also a clearly defined relationship between the vehicle coordinate system and the geographic coordinate system. The only difference is that this relationship varies with time. At a specific moment of time, the relationship is certain. The default definition sets the yv-axis of the vehicle to the North-axis of the geographic system, then the xv-axis to East-axis, and the zv-axis to the U-axis of the geographic system.

Sonar Coordinate System

There are different designs for the sonar heads. Depending on the scanning direction in the applications, the orientation of a sonar head relative to the vehicle body varies.

In general, a coordinate system can be established for a sonar head as in the following diagram:

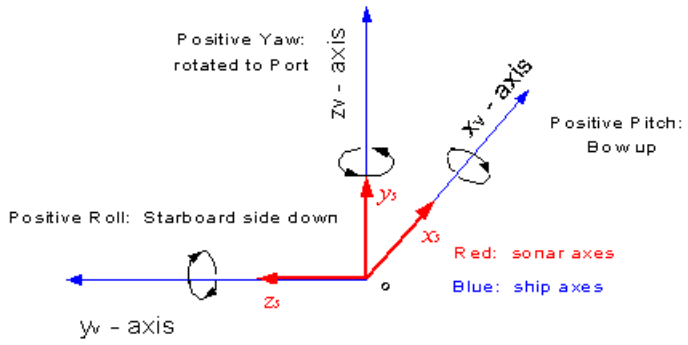


Sonar coordinate system

where the y - axis of the sonar head is normally aligned to the roll axis of the vehicle when a forward looking scan is conducted. The Roll-axis is also the heading (bow) direction of the vehicle. If we adopt the right-handed coordinate system, with the above arrangement, the x - axis of the sonar head will be pointing to the Pitch-axis (starboard direction) of the vehicle, and the z - axis of the sonar head will be in the Yaw axis direction (in the ideal case this is also the vertical (up) direction) of the vehicle. The y - axis is also the primary (0 degree) direction of the sonar head.

The sonar head coordinate system will have a fixed time invariant position relative to the vehicle coordinate system. The actual position offset will be measured after the installation. By default, the coordinate systems of the sonar head and the vehicle coordinate system will be aligned, i.e. zero for the x, y and z offsets and zero for row/ pitch/yaw errors. If a different installation is implemented, the user should change the settings in the software selection menu accordingly. The software will automatically apply transformations to suit the new relative positions/orientations.

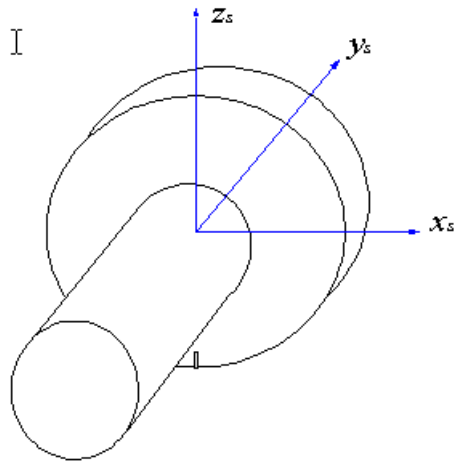
The following diagram shows the position of the ship and the position of the sonar when they are aligned both in the directions of the axes and locations of the origins, where o-xs-ys-zs is the sonar coordinate system and O-xv-yv-zv is the coordinate system for the ship.



Sonar and vehicle Coordinate system

Sonar Coordinates: Down Looking Mode

An alternative installation of a scanning sonar head is as shown in the following figure:



Sonar head down looking mode

where the orientation of the sonar head is such that the zero angle beam direction is downwards. This installation is to be used when the system is used to gather sea bottom data and present the same in the xs, zs frame.

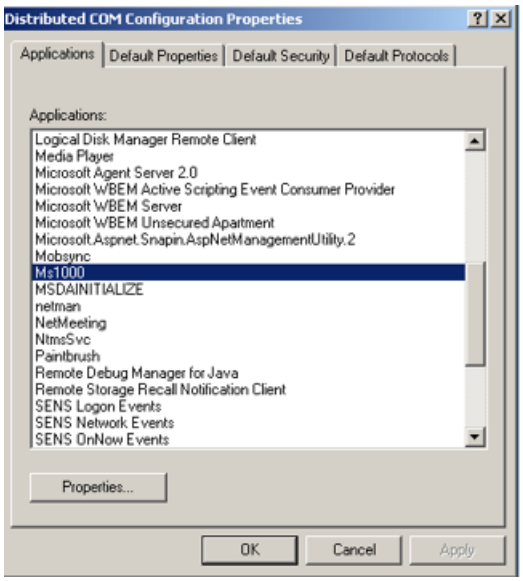
Setting up Your Computer DCOM for MS1000

DCOM stands for Distributed COM (Component Object Model). It is a network version of COM, which is basically an independent, distributed, object oriented system of the client/server type specified by Microsoft for creating binary SW components (objects), and their mutual communication.

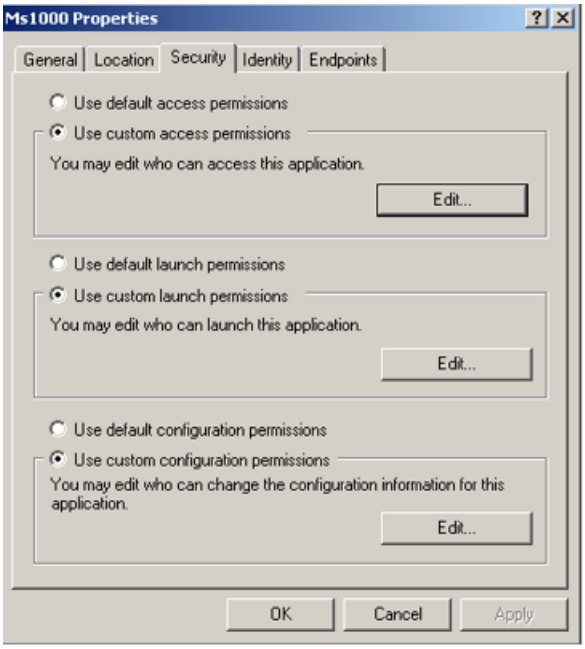
The DCOM setup is required for correct communication of MS1000 system with local and remote computers.

To set up DCOM for MS1000 under Windows 2000

1. In your computer desktop, click **Start >Run**.
2. Enter **dcomcnfg** and click **OK**.
3. Click the **Default Properties** tab.
4. Select the **Enable Distributed COM on this computer** check box and set the **Default Authentication Level** to **Connect**, and set the **Default Impersonation Level** to **Identify**.
5. Click the **Applications** tab and select **MS1000** from the list of installed applications.



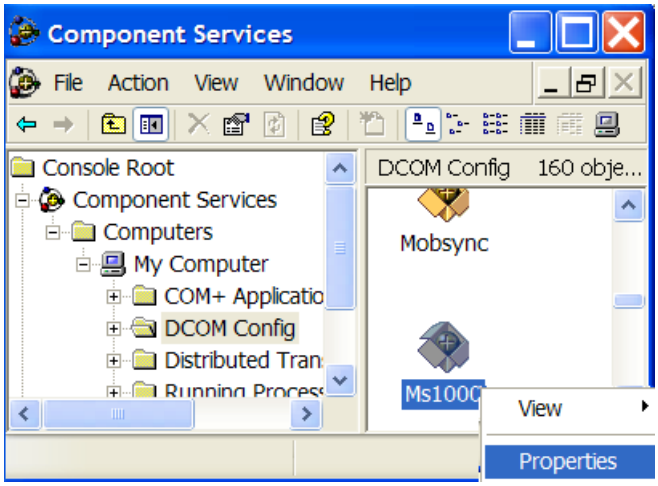
6. Click **Properties**.
7. Click the **Location** tab and select the **Run application on this computer** check box.
8. Click the **Security** tab and select **Use custom access permissions**, **Use custom launch permissions** and **Use custom configuration permissions**.



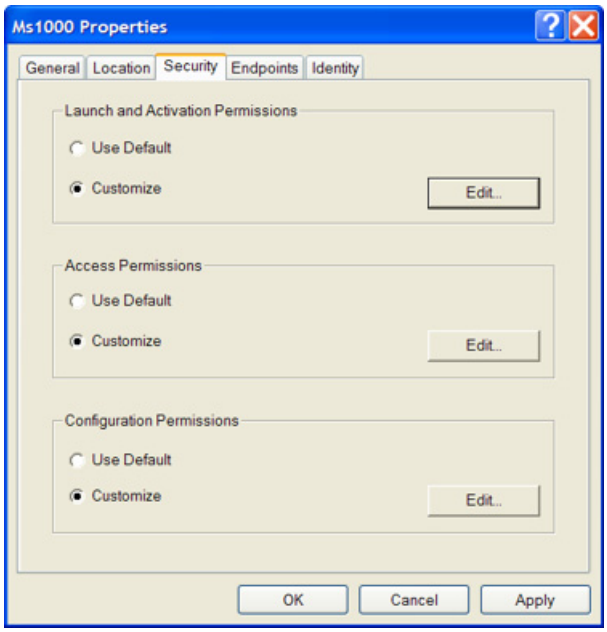
9. Click **Edit**.
10. Add **Everyone** in the **Name** list if it isn't there.
11. Repeat from step 9 for each of the three permission groups (access, launch, and configuration).
12. Click the **Identity** tab and select **The interactive user**.
13. Click **OK** to accept the changes.
14. Reboot the computer to make the changes take effect.

To set up DCOM for MS1000 under Windows XP and Vista

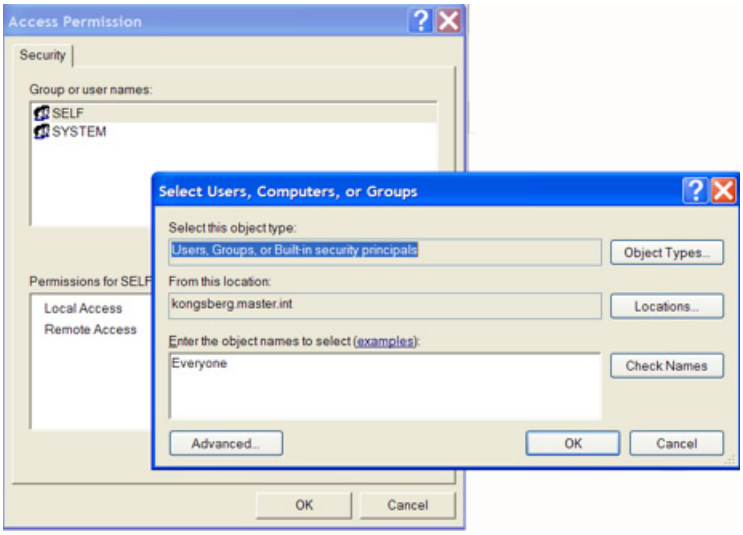
1. In your computer desktop, click **Start >Run**.
2. Enter **dcomcnfg** and click **OK**.
3. Click the **Component Services** folder and unpack its tree structure.
4. In the **DCOM Config** folder select the **MS1000** and Right-click it.



5. Click the **Properties** and click **NO** for any warning screens that appear.
6. Select the **Enable Distributed COM on this computer** check box and set the **Default Authentication Level** to **Connect**, and set the **Default Impersonation Level** to **Identify**.
7. Click the **Applications** tab and select **MS1000** from the list of installed applications.
8. Click **Properties**.
9. Click the **Location** tab and select the **Run application on this computer** check box.
10. Click the **Security** tab and select **Use custom access permissions**, **Use custom launch permissions** and **Use custom configuration permissions**.



11. Click **Edit**.
12. Add **Everyone** in the **Name** list if it isn't there.



13. Repeat from step 9 for each of the three permission groups (access, launch, and configuration).
14. Click the **Identity** tab and select **The interactive user**.
15. Click **OK** to accept the changes.
16. Reboot the computer to make the changes take effect.

Setting up Your Computer to Communicate with Ethernet Head

Static IP addresses are used for the 1071 Ethernet digital sonar. The following addresses are recommended to use as default for the Ethernet head and the surface Windows PC processor:

- IP Address 192.168.0.X
- Subnet Mask 255.255.255.0

Where “X” is a decimal number between 1 and 254, the number “0” and “255” are reserved numbers. To set up the static IP addresses,

To set up your computer Ethernet adapter IP address

1. On your computer desktop, click **Start > All Program > Control Panel**.
2. Click **Network Connections**.
3. Right-click the Ethernet interface (Local Area Connection X) that is connected to the Ethernet sonar head and **click Properties**.
4. Double-click **Internet Protocol**.
5. Click Use the following IP address.
6. Enter **IP Address**, **Subnet Mask**, and leave the rest field empty.
7. Click **OK**.

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1598 Kebet Way, Port Coquitlam, BC, V3C 5M5 Canada

Telephone +1 604 464 8144

Telefax +1 604 941 5423

www.kongsberg-mesotech.com