Gemini 720is Imaging Sonar

Product Manual

Document: 0703-SOM-00002, Issue: 7

Tritech

Outstanding Performance in Underwater Technology

A Moog Inc. Company

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Help & Support

First please read this manual thoroughly (particularly the Troubleshooting section, if present). If a warranty is applicable, further details can be found in the Warranty Statement, 0080-STF-00139, available upon request.

Tritech International Ltd can be contacted as follows:

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		Westhill Business Park
		Westhill, Aberdeenshire
		AB32 6JL, UK
	Telephone	++44(0)1224 744 111
	Fax	++44(0)1224 741 771
	Email	support@tritech.co.uk
	Website	www.tritech.co.uk

Prior to contacting *Tritech International Ltd* please ensure that the following is available:

1. The Serial Numbers of the product and any *Tritech International Ltd* equipment connected directly or indirectly to it

2. Software or firmware revision numbers

3. A clear fault description

4. Details of any remedial action implemented

Contamination

If the product has been used in a contaminated or hazardous environment you *must* de-contaminate the product and report any hazards *prior* to returning the unit for repair. *Under no circumstances should a product be returned that is contaminated with radioactive material.*

The name of the organisation which purchased the system is held on record at *Tritech International Ltd* and details of new software or hardware packages will be announced at regular intervals. This manual may not detail every aspect of operation and for the latest revision of the manual please refer to www.tritech.co.uk

Tritech International Ltd can only undertake to provide software support of systems loaded with the software in accordance with the instructions given in this manual. It is the customer's responsibility to ensure the compatibility of any other package they choose to use.

Warning Symbols

Throughout this manual the following symbols may be used where applicable to denote any particular hazards or areas which should be given special attention:

Note

This symbol highlights anything which would be of particular interest to the reader or provides extra information outside of the current topic.

Important

When this is shown there is potential to cause harm to the device due to static discharge. The components should not be handled without appropriate protection to prevent such a discharge occurring.

Caution

This highlights areas where extra care is needed to ensure that certain delicate components are not damaged.

Warning

DANGER OF INJURY TO SELF OR OTHERS

Where this symbol is present there is a serious risk of injury or loss of life. Care should be taken to follow the instructions correctly and also conduct a separate Risk Assessment prior to commencing work.

Head Variations

The Gemini 720is comes in the following configurations:

1000m version	4000m version
• Aluminium Housing	• Titanium Housing

The Gemini 720is is available with a wide variety of connectors fitted:

- Single Seacon 5506-1508 (Standard option)
- Dual Seacon: 5506-1508 and 5506-1506
- Schilling Seanet connector (Gemini 720is Titanium units only)
- Single Seacon MCBH8M (Gemini 720is Aluminium units only)
- Single SubConn FCR1506M (Gemini 720is Aluminium units only)
- Single SubConn FCR1508M (Gemini 720is Titanium units only)
- Single SubConn BH10M
- Single Titan Impulse MKS-307-FCR (Gemini 720is Aluminium units only)
- Single Titan Impulse MKS-310-FCR (Gemini 720is Aluminium units only)

Pin outs for each specific model can be found in later sections of this manual.

1. Introduction

1.1. General Overview

The Gemini 720is is a 2D imaging sonar. It is a multibeam sonar, offering a 120° field of view with update rates of up to 30Hz giving rapid feedback to the user (hardware is capable of 30Hz, Seanet Pro is limited to 15Hz).

The system consists of the Gemini sonar head(s) and either Gemini or Seanet Pro control and display software. The software communicates with the sonar over Ethernet (100Mbit·s⁻¹), or Very high speed Digital Subscriber Line (VDSL) via a VDSL to Ethernet converter.

The software is Windows® based and will run best on a display of resolution 1280x1024 or greater with 32-bit colour resolution.

1.2. Communications

There are two connection options, 100Mbit·s⁻¹ Ethernet and VDSL. The sonar will automatically detect which connection is available and switch to that connection.

The VDSL option allows a single twisted pair to be used for communication to/from the sonar at high speeds dependent on the length and quality of the cable (see Chapter 2, *Technical Specification* for details). The *Tritech International Ltd* supplied VDSL Adapter Unit takes the two wire VDSL input and bridges it to Ethernet for simple connection to a PC.

VDSL maximises the data rate by testing the quality of the connection at start up and adapting the speed accordingly. With VDSL there is a trade off between link speed and noise immunity. There is a setting in the software that allows optimisation to cope with the level of noise introduced by other parts of the system.

Note

The red LED on the VDSL adapter box may light up to indicate that the link is experiencing higher levels of electrical noise. The sonar can cope with some electrical noise on the link but it may reduce the ping rate.

When using an Ethernet connection it should be noted that the Gemini Sonar can fully utilise a 100Mbit·s⁻¹ link while returning the sonar data. If the Gemini Sonar is to share an Ethernet link with other high bandwidth devices, such as video cameras, it is recommended that the 100Mbit·s⁻¹ devices share a gigabit (or faster) link to the surface to reduce possible network congestion.

1.3. Electrical Connection

Depending on the electrical connector fitted to the Gemini not all communication modes may be available for use. Please refer to Section 3.3, "Sonar Head Pin-Out Diagrams" for details on the range of connectors available and the appropriate communication modes support.

Caution

Power should only be applied to the MAIN port of the Gemini. The AUX port, if fitted, provides a regulated power supply - please refer to Section 2.1, "Gemini 720is" for more information.

1.4. Software Version

Note

The instructions within this manual apply to the following software versions:

• Gemini software - 1.20.18 onwards

• Seanet Pro - 2.23 build 540 onwards

Screenshots and images within the software may differ slightly from the ones used within this manual. The latest version of software can also be downloaded from www.tritech.co.uk.

2. Technical Specification

2.1. Gemini 720is

All dimensions are in mm, not to scale
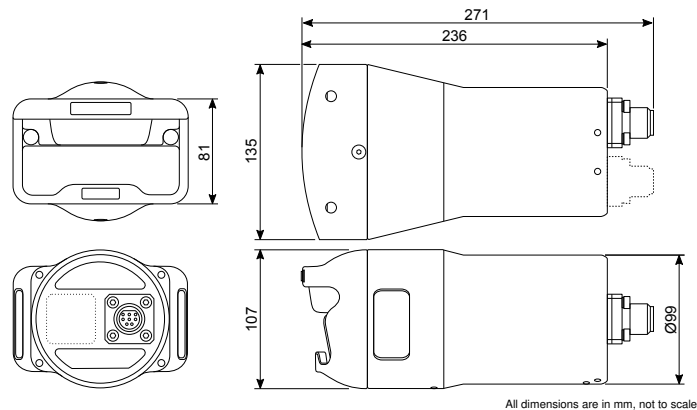
Acoustic	
Operating Frequency	720kHz, CHIRP selectable
Number of Channels	96
Angular Resolution	1.0° acoustic, 0.25° effective
Scanning Sector	120°
Number of Beams	512
Vertical Beamwidth	20° (tilted down 10°)
Range	0.2m to 120m
Scan Rate	5-30Hz (range dependent)
Range Resolution	8mm (range dependent)

Electrical and Communication	
Power Consumption	25W max
Supply Voltage	19 to 74V DC
Aux Port Voltage	24V DC (±0.6V) at 30W max
Data Communications	Ethernet or VDSL
Additional I/O	RS232, RS485 (half duplex), TTL in, Ethernet
Connector types	SeaCon 55 series, SubConn FCR 15 series or Schilling SeaNet (single port as standard)

3. Hardware Installation & Configuration

⚠️ **Caution**

Although the sonar head is rugged, it should be handled with care, particularly the connector and receiver/transmitter elements. The plastic guard fitted to the unit will not be able to protect the sonar against significant impacts.

3.1. Installing the Sonar Head

The sonar should be mounted with the transmitter element on the top. The transmit and receive elements are internally angled down at 10° which should be taken into account when mounting the Sonar.

Any metallic clamps should be electrically insulated from the sonar body by either rubber or plastic strips or mounting brackets of at least 3 mm thickness and extending at least 3 mm beyond the clamp boundary to reduce any galvanic corrosion effect. Non-metallic clamps are preferable; if metallic clamps are used (especially if they are different in composition to the material used by the sonar) they should be painted or lacquered with at least two or three coatings.

⚠️ **Caution**

When deploying the aluminium version of the Gemini 720is, alloys containing copper such as brasses or bronze should be avoided.
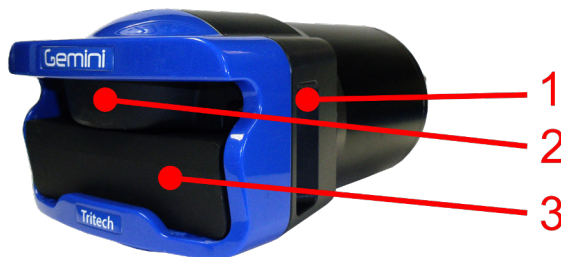
1. Sound Velocity Probe

2. Transmitter Elements

3. Receiver Elements

3.2. Electrical & Communication Notes

A cable whip supporting either Ethernet or VDSL communications can be supplied. The other end of this cable whip should be terminated with a suitable connector for the user application.

Connector Maintenance Guidelines

Mating surfaces should be lubricated with 3M Silicone Spray or equivalent, DO NOT GREASE. Connectors must be lubricated on a regular basis. Clean plugs and receptacles with soap and fresh water.

⚠ Caution

When attaching a connector make sure that both connector and socket are completely dry. Any water trapped in the connection could result in an electrical short.

If the Gemini has two ports then the unused connector must have a blanking cap fitted prior to immersing in water. Failure to do this will cause permanent damage.

If using alcohol or IPA to clean out the connector take care that it does not come into contact with any other part of the sonar. If an O-ring is present it should be first removed and discarded and the new O-ring only inserted after the IPA has evaporated.

⚠ Caution

For units fitted with the Titan Impulse MKS-310-FCR or MKS-307-FCR connector, ensure that o-rings have been fitted correctly to cables and blanking caps before use. O-rings should be inspected and replaced as part of a regular maintenance programme. Frequency will depend on usage. O-rings should be lubricated with Dow Corning #111 Valve lubricant or equivalent.

Ground Fault Monitoring

The power supply within the Gemini includes an electrically isolated DC-DC converter front-end. There is a small capacitive connection between the isolated ground and the sonar chassis which should not noticeably affect any impressed current ground fault indicator (GFI) equipment.

When used with either the Ethernet or VDSL Adaptor top box and the Gemini PSU please note that the Gemini 720is chassis will be directly connected to Earth.

Power

⚠ Caution

Never try to make the Gemini work down a long cable by increasing the PSU output voltage above 74V DC.

⚠ Caution

Power should only be supplied to the Gemini through the MAIN port. The AUX port power is supplied via an internal regulator.

⬣ Warning

The Gemini PSU that is supplied with the Gemini system is intended for INDOOR USE ONLY and should not be placed in a position where it could get wet.
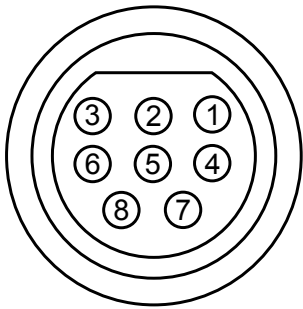
3.3. Sonar Head Pin-Out Diagrams

The following pin out diagrams details the appropriate connectors for each major variant of the Gemini 720is.

3.3.1. Single Seacon 5506-1508 connector
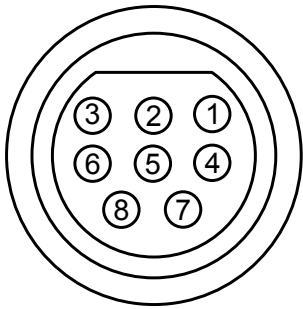
S11108 (1000m) or S11109 (4000m)

Gemini 720is fitted with a single Seacon 55 series connector using Ethernet communications only.

Bulkhead view	Pin	Function
	1	Ethernet RX+
	2	Ethernet RX-
	3	Ethernet Tx+
	4	DC +
	5	N/C
	6	Ethernet Tx-
	7	DC Ground
	8	N/C

S11110 (1000m) or S11111 (4000m)
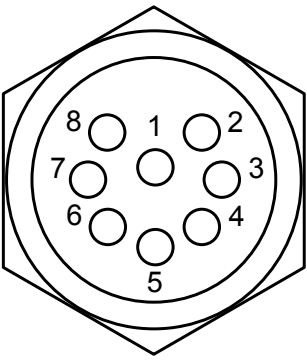
Gemini 720is fitted with a single Seacon 55 series connector using Ethernet and VDSL communications.

Bulkhead view	Pin	Function
	1	Ethernet Rx+
	2	Ethernet Rx-
	3	Ethernet Tx+
	4	DC +
	5	VDSL +
	6	Ethernet Tx-
	7	DC Ground
	8	VDSL -

3.3.2. Single Seacon MCBH8M connector

S11107 (1000m) only
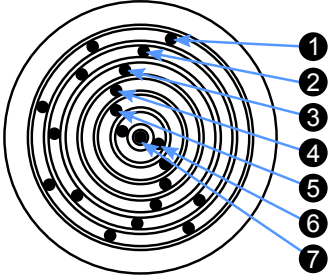
Gemini 720is fitted with a single Seacon MCBH8M connector using Ethernet communications only.

Bulkhead view	Pin	Function
	1	Ethernet RX+
	2	Ethernet RX-
	3	N/C
	4	DC +
	5	Ethernet Tx+
	6	Ethernet Tx-
	7	DC Ground
	8	Chassis

3.3.3. Single Schilling SeaNet connector

S11112 (4000m) only
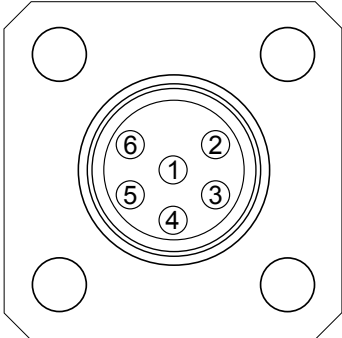
Gemini 720is fitted with a Schilling Seanet connector, using Ethernet communications.

Bulkhead view	Pin	Function
	1	DC +
	2	DC Ground
	3	Chassis
	4	Ethernet Rx+
	5	Ethernet Rx-
	6	Ethernet Tx-
	7	Ethernet Tx+

3.3.4. Single SubConn FCR1506M connector

S11538 (1000m) only
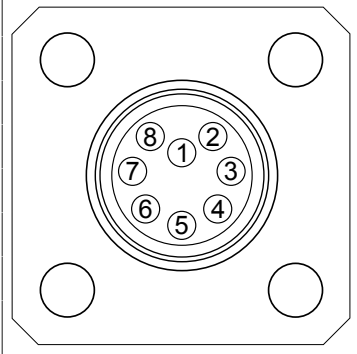
Gemini 720is fitted with a single SubConn FCR1506M connector, using VDSL communications.

Bulkhead view	Pin	Function
	1	VDSL+
	2	VDSL-
	3	N/C
	4	DC +
	5	DC Ground
	6	CHASSIS

3.3.5. Single SubConn FCR1508M connector

S11532 (4000m) only
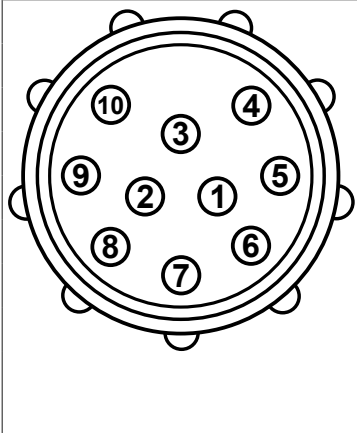
Gemini 720is fitted with a single SubConn FCR1508M connector, using Ethernet communications.

Bulkhead view	Pin	Function
	1	Ethernet RX+
	2	Ethernet RX-
	3	N/C
	4	DC +
	5	Ethernet TX+
	6	Ethernet TX-
	7	DC Ground
	8	CHASSIS

3.3.6. Single SubConn BH10M connector

S11494 (5° 4000m), S11495 (10° 4000m) or S11586 (20° 4000m)
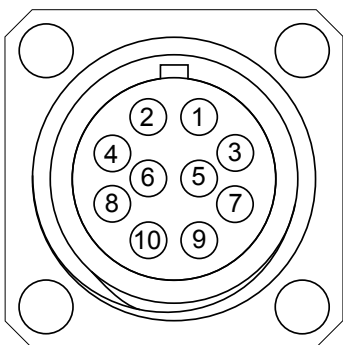
Gemini 720is fitted with a single SubConn BH10M connector, using Ethernet or VDSL communications.

Bulkhead view	Pin	Function
	1	Ethernet RX+
	2	Ethernet RX-
	3	Ethernet TX+
	4	DC +
	5	VDSL+
	6	Ethernet TX-
	7	DC Ground
	8	VDSL-
	9	CHASSIS
	10	N/C

3.3.7. Single Titan Impulse MKS-310-FCR connector

S11414 (1000m) only
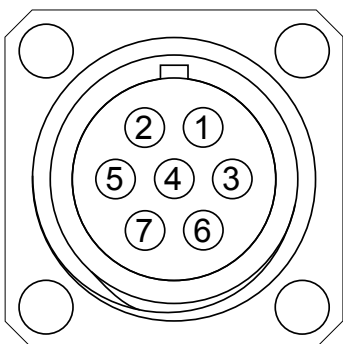
Gemini 720is fitted with a single Titan Impulse MKS-310-FCR connector using Ethernet communications only.

Bulkhead view	Pin	Function
	1	Ethernet Rx+
	2	Ethernet RX-
	3	Ethernet Tx+
	4	DC +
	5	DC +
	6	Ethernet Tx-
	7	DC Ground
	8	DC Ground
	9	TTL Ground
	10	TTL In

3.3.8. Single Titan Impulse MKS(W)-307-FCR connector

S11415 (1000m) only
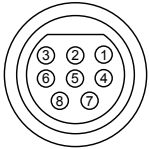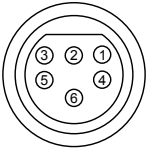
Gemini 720is fitted with a single Titan Impulse MKS(W)-307-FCR connector using VDSL communications. An auxiliary RS232 input can be fed into the sonar.

Bulkhead view	Pin	Function
	1	DC Ground
	2	DC +
	3	RS232 Rx
	4	RS232 Tx
	5	RS232 Ground
	6	VDSL +
	7	VDSL -

3.3.9. Seacon 5506-1508 and Seacon 5506-1506 connectors
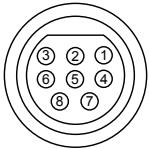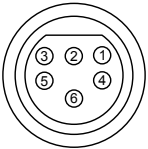
S11127 (1000m) or S11128 (4000m)

Gemini 720is fitted with two Seacon 55 series connectors. The main connector uses Ethernet communications with the auxiliary connector providing an additional Ethernet communication line and regulated 24V DC output.

MAIN Bulkhead view	MAIN		AUX		AUX Bulkhead view
	Pin	Function	Pin	Function	
	1	Ethernet Rx+	1	Ethernet Rx+	
	2	Ethernet Rx-	2	Ethernet Rx-	
	3	Ethernet Tx+	3	24V DC +	
	4	DC +	4	0V DC	
	5	N/C	5	Ethernet Tx+	
	6	Ethernet Tx-	6	Ethernet Tx-	
	7	DC Ground			
	8	N/C			

S11017 (1000m) or S11027 (4000m)

Gemini 720is fitted with two Seacon 55 series connectors. The main connector uses Ethernet or VDSL communications with the auxiliary connector allowing either RS232 or RS485 (software selectable) communications to an attached device. A regulated 24V DC output is also available.

MAIN Bulkhead view	MAIN		AUX		AUX Bulkhead view
	Pin	Function	Pin	Function	
	1	Ethernet Rx+	1	RS232 Rx / RS485 B	
	2	Ethernet Rx-	2	RS232 Tx / RS485 A	
	3	Ethernet Tx+	3	24V DC +	
	4	DC +	4	0V DC	
	5	VDSL +	5	RS232 / TTL Ground	
	6	Ethernet Tx-	6	TTL In	
	7	DC Ground			
	8	VDSL -			

3.4. Surface Adapter Pin-out Diagrams

Note

For all system types the connection to the surface computer or IT infrastructure from the Gemini Hub, Ethernet or VDSL adapter should be via a shielded Cat5e cable fitted with an RJ45 connector. The 72V VDSL Adapter Unit can also be used in applications where long length power and communications is desirable - for more information see the associated Product Manual: *0713-SOM-00003* available at www.tritech.co.uk

3.4.1. Ethernet Adapter
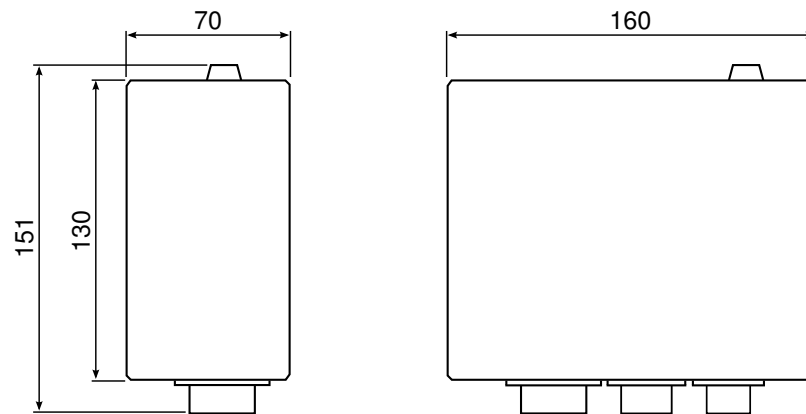
Not to scale, dimensions in mm.

Sonar Head Connector

Pin	Function	Diagram	Photograph
A	Ethernet RX+		
B	Ethernet RX -		
C	Ethernet TX+		
D	DC +		
E	DC +		
F	Ethernet TX -		
G	DC Ground		
H	DC Ground		
J	not connected		
K	not connected		
L	not connected		
M	cable screen	Souriau UTS71412S	

Ethernet DC Connector

Pin	Function	Diagram	Photograph
1	DC Ground		
2	DC +		
3	not connected		
4	Earth	Souriau UTS7124P	

3.4.2. VDSL Adapter

70   160   151   130
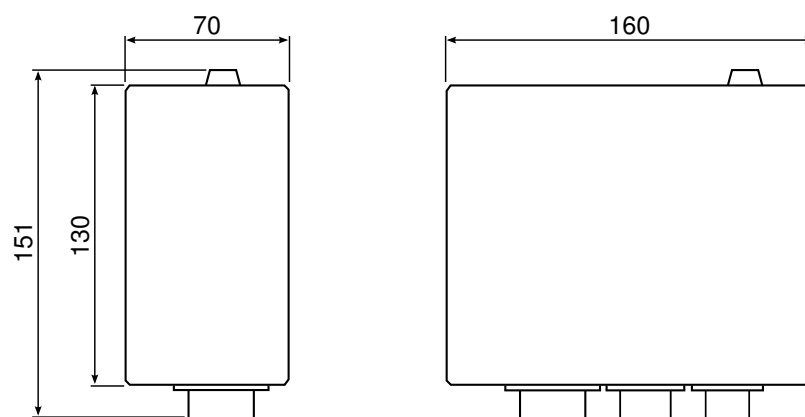
Not to scale, dimensions in mm.

Sonar Head Connector

Pin	Function	Diagram	Photograph
1	DC Ground		
2	DC +		
3	not connected		
4	VDSL +		
5	VDSL -		
6	not connected		
7	cable screen	Souriau UTS7147S	

VDSL DC Connector

Pin	Function	Diagram	Photograph
1	DC Ground		
2	DC +		
3	not connected		
4	Earth	Souriau UTS7124P	

3.5. An Example Ethernet Setup

Test or bench setup for the Gemini Sonar system using Ethernet communications via the Ethernet adapter unit (Gemini 720is shown).

Computer

Ethernet Adapter

CAT5 Patch Cable

Gemini 720is

Power lead
(UK/EU
to IEC)

Gemini PSU

Blanking cap

Ethernet / power test cable
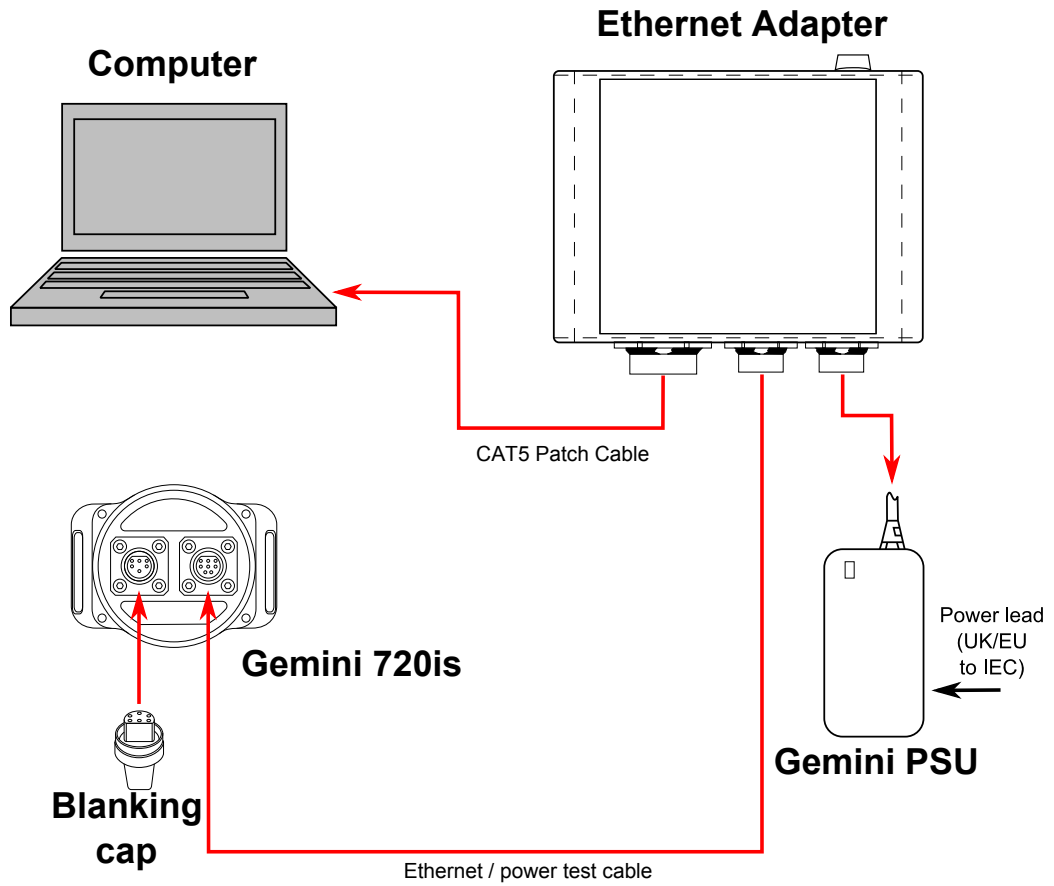
3.6. An Example VDSL Setup

Test or bench setup for the Gemini Sonar system using VDSL communications via the VDSL adapter unit (Gemini 720is shown).

Computer

VDSL Adapter

CAT5 Patch Cable

Gemini 720is

Power lead
(UK/EU
to IEC)

Gemini PSU

**Blanking
cap**

VDSL / power test cable
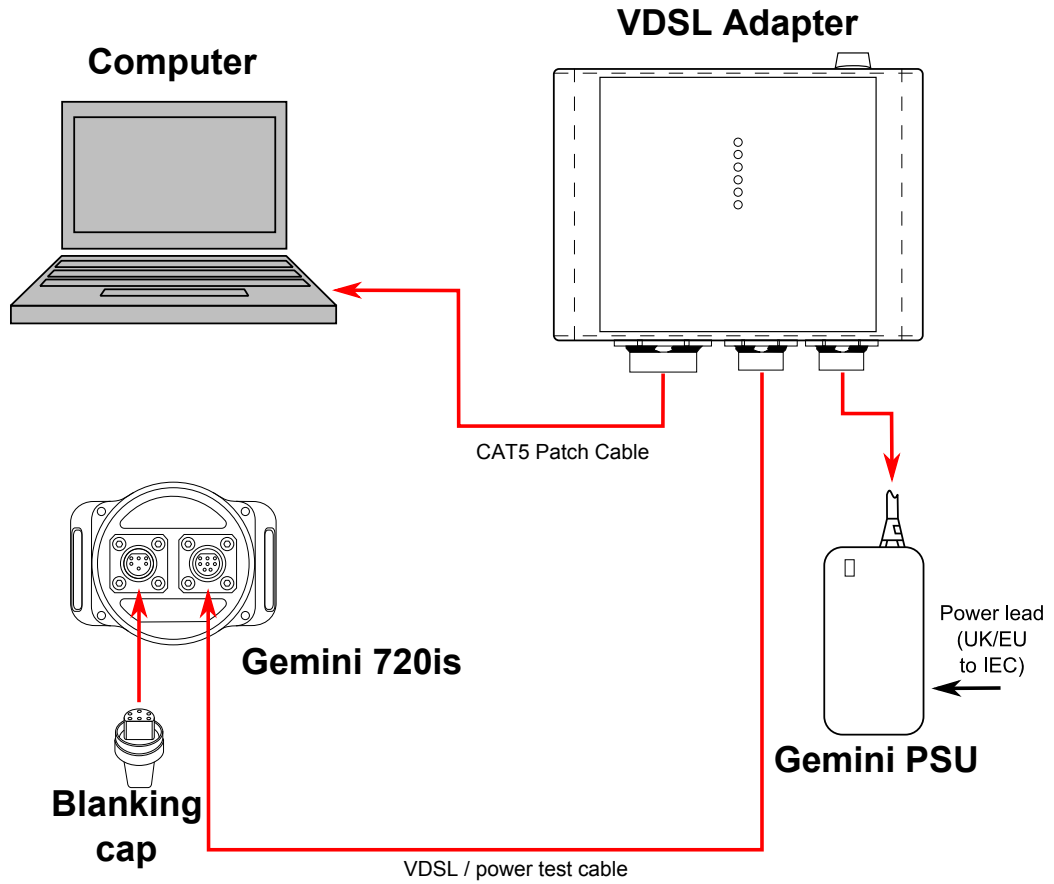
3.7. An Example ROV Setup

An example of connections for an ROV, with the Gemini Sonar system using VDSL communications via the VDSL adapter unit (Gemini 720is shown).

VDSL Adapter

Computer

IT infrastructure

Ethernet
communications

VDSL
communications

power supply
from vessel

Gemini 720is

Blanking cap

VDSL communications and power supply

ROV
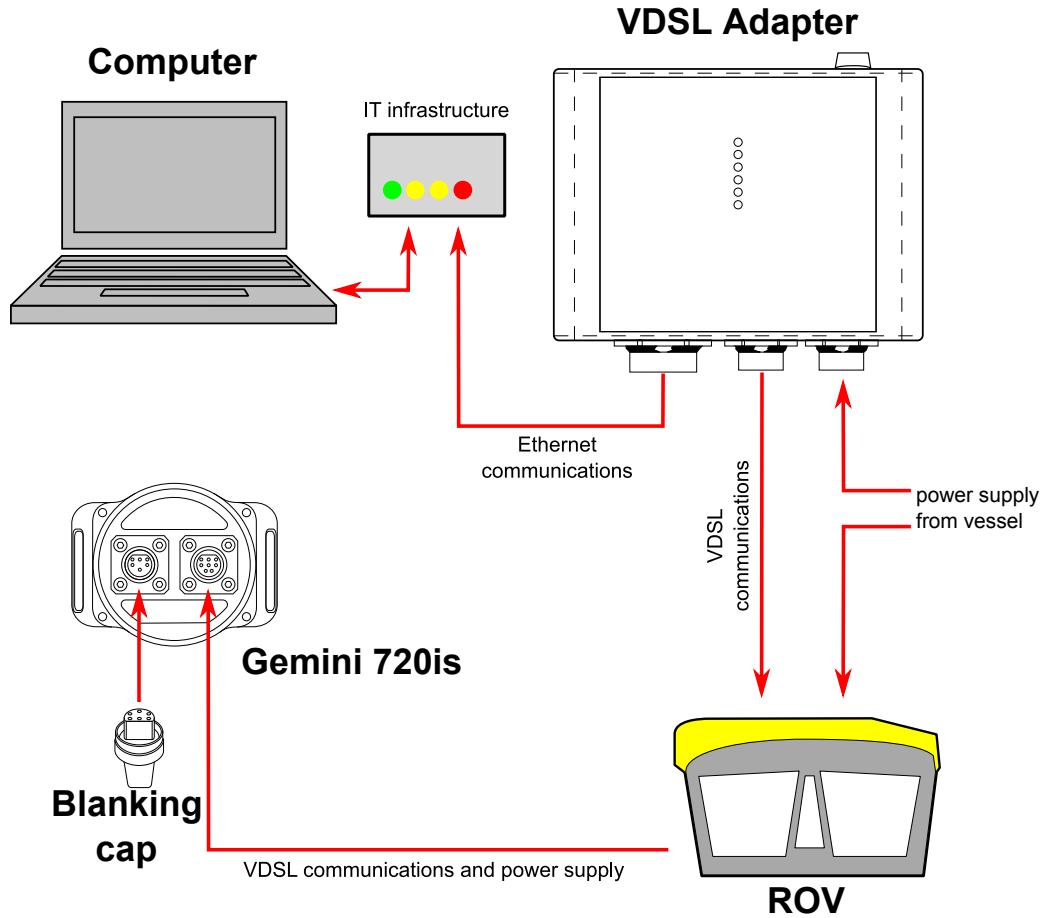
3.8. Multiple Head Installation

It is possible to control and display up to four Gemini heads from one computer using the Gemini software. In order to do this extra hardware will be required to connect the extra Gemini heads to the system as detailed:

Using the Gemini Ethernet Interface Box | The Ethernet Interface Box will output to a standard Ethernet connection so on a system with multiple heads it is possible to connect these to an Ethernet switch. The Gemini sonar is capable of utilising the full bandwidth of the 100Mbit·s^{-1} (fast Ethernet) connection so any switch or hub (and subsequent infrastructure) used should be rated to Gigabit speeds in order to be able to cope with the data.

Using the Gemini Hub | Available as a separate item from *Tritech International Ltd* is a Gemini Hub which is capable of powering and communicating with up to two Gemini sonars. The hub also provides RS232 ports for connecting additional sensors to the system (such as GPS or navigation sensors). For more details of the Gemini Hub please refer to the Gemini Hub manual or contact *Tritech International Ltd*.

It is also possible to link two Gemini 720is units together as long as at least one unit is fitted with dual Seacon connectors in the dual Ethernet configuration:

MAIN ETHERNET PORT:
CONNECTED TO ETHERNET
INFRASTRUCTURE (MUX POD ETC)

AUX ETHERNET PORT:
CONNECTED TO MAIN PORT
OF ADDITIONAL GEMINI 720is

GEMINI 720is

MAIN ETHERNET PORT:
CONNECTED TO AUX PORT
OF FIRST GEMINI 720is

GEMINI 720is
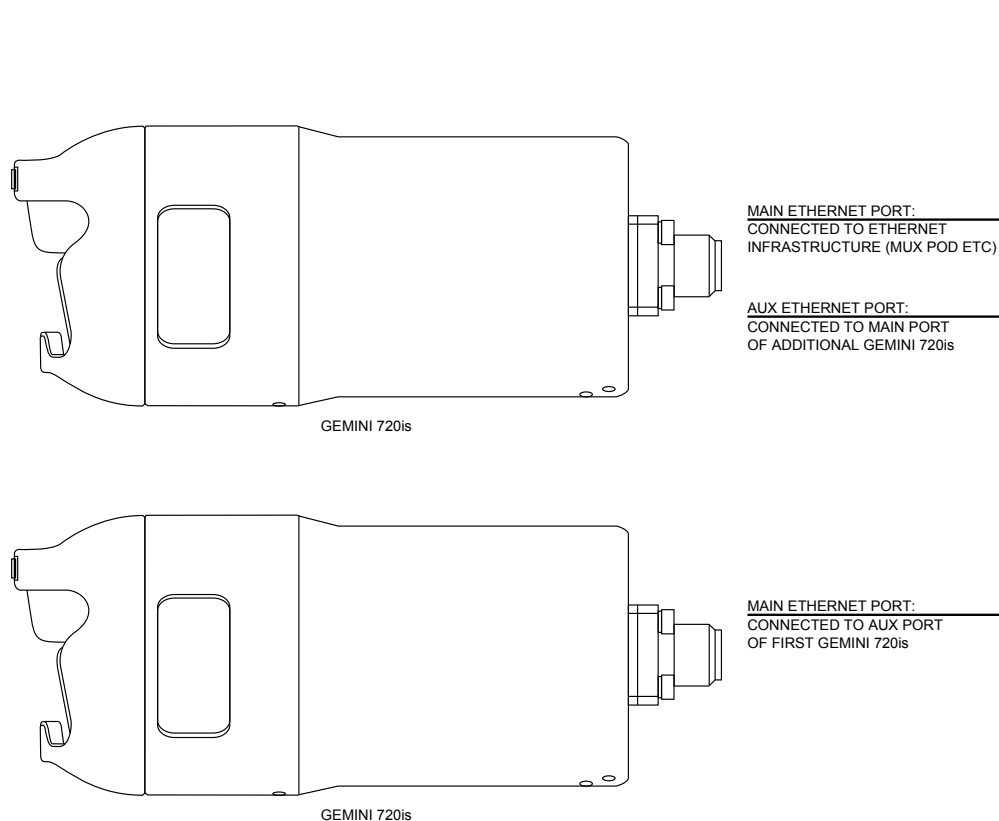
Both units would be controllable through the Gemini software as if they were connected through a standard hub.

4. Gemini Software Installation

The Gemini head is supplied with software to control the functions of the sonar and to display the captured images. The software is supplied as an installer package which installs the software and a number of supporting files and documentation.

Note

The software is also available for download from www.tritech.co.uk

4.1. System Requirements

	Minimum	Recommended
Processor	2GHz	2GHz dual core
RAM	1GB	2GB
Graphics	3D hardware accelerated graphics card.	
Display	1280x1024 (32bit colour)	1600x1200 (32bit colour)
Disk space	Install is 20MB, greater than 160GB recommended for log files	
Networking	100Mbit·s⁻¹ (fast Ethernet)	1000Mbit·s⁻¹ (Gigabit Ethernet)
Software	Windows® XP 32bit	Windows® 7 32 or 64bit

4.2. Installing the Gemini Software

The Gemini software is supplied on a CD-ROM which has been designed to auto-run upon disc insertion. The latest commercial release of software is always available from www.tritech.co.uk.

Once loaded, the main menu of the CD will be shown on screen.
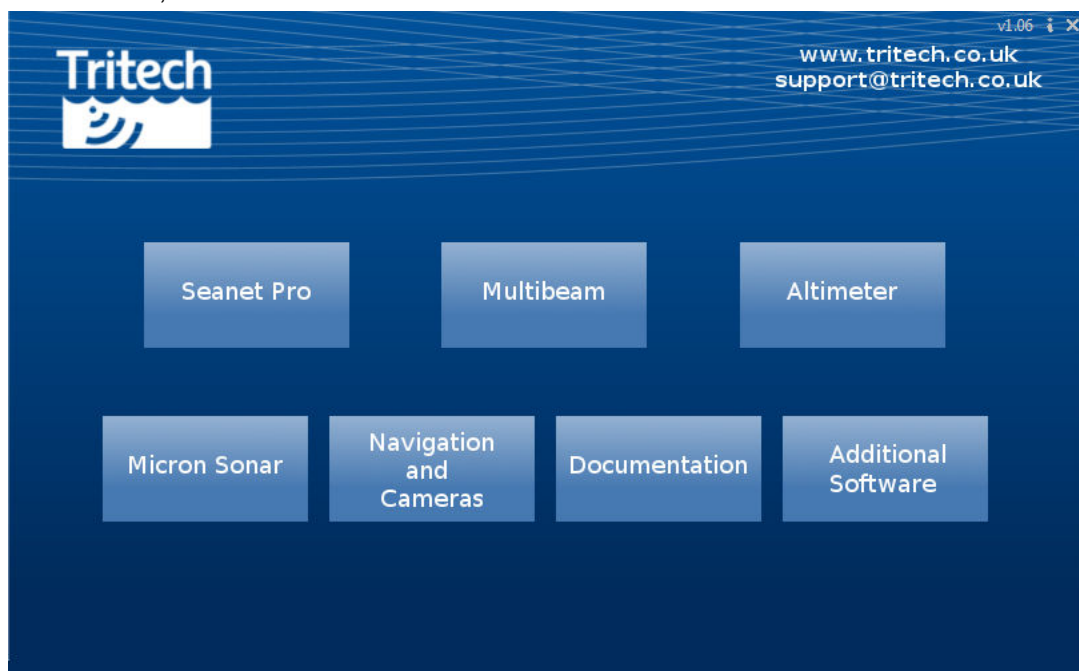
Click on the `Multibeam` button and the following screen will display all the appropriate software packages for installation.

Click on the appropriate installation option and then follow the onscreen prompts and instructions.

> ## Note
>
> Do not attempt to remove the CD-ROM from your computer during the installation process.

4.3. Configuring the Gemini

The Gemini head uses Ethernet to communicate with the computer running the Gemini software. Depending on the configuration of the system, this may be partly carried over a VDSL link. Before the head can be connected to 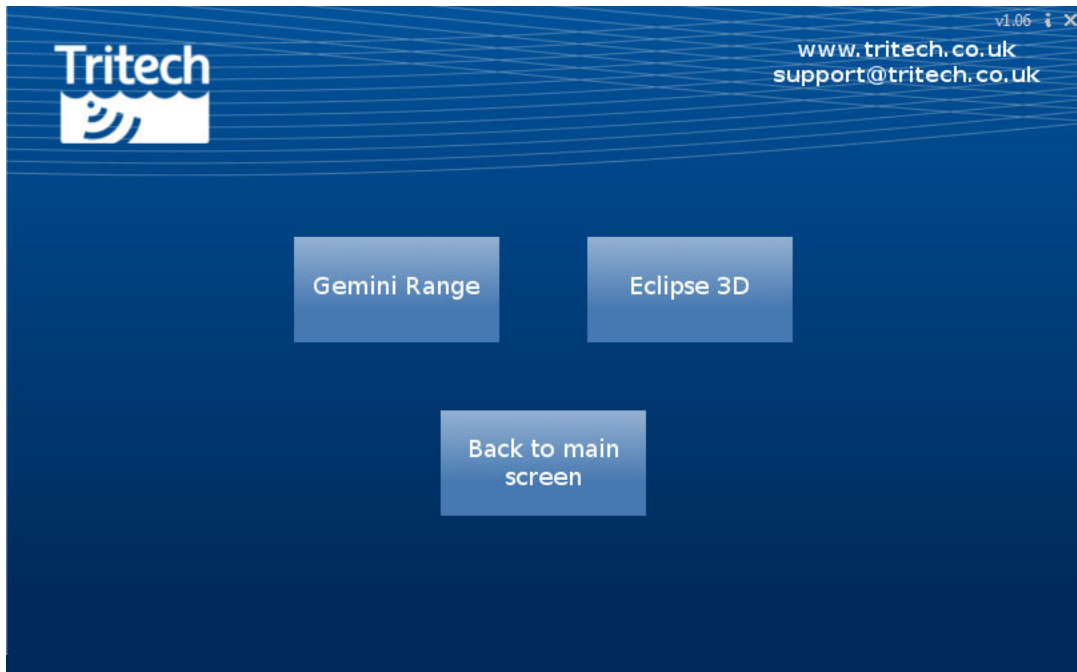the LAN, the IP address needs to be set to a suitable value for that network. Also the subnet mask needs to be appropriate for the network and the address chosen.

Configuring the IP address of the Gemini is a four stage process. Firstly the IP address of the computer is set to a value which will communicate with the head. The Gemini software is then used to change the IP address of the Gemini. The third stage is to reset the IP address of the computer. The final stage is to check the operation of the Gemini on the network (by running the Gemini software and verifying that the Gemini head is able to communicate).

The following instructions use addresses 192.168.2.201 for the Gemini and 192.168.2.100 for the computer. These addresses are only appropriate for a new Gemini which has just been delivered from the factory. If the IP address of Gemini has already been changed, an appropriate address for the computer will need to be selected first to allow communication with the Gemini before it can be configured.

The Gemini head should be given an IP address appropriate for the network it will be running on. The address at manufacture is 192.168.2.201 and the process of setting the sonar IP address involves talking to the unit via the 192.168.2.201 address to change the IP address to a value suitable for the network.

Note

For instructions on setting the computer and Gemini IP address please refer to Appendix A, *Setting the computer IP address in Windows® XP* or Appendix B, *Setting the computer IP address in Windows® 7 or Windows® 10* and Appendix C, *Setting the Gemini Device IP Address in Gemini Software*.

4.3.1. Check the operation of the Gemini

If the correct changes have been made to the Gemini it should now show as connected in the Gemini software. If nothing is displayed, check that all values entered were correct and it may be necessary to rerun the Gemini software to establish a link. The Gemini software retains its settings between runs, and so all the values which were used whilst the Gemini was programmed will be retained.

When the Gemini software is started, select the `Advanced` tab to show details of the connected Gemini and if it is able to communicate, it will be listed in the status window and automatically go online after five seconds.

5. Gemini Software Operation

Note

To access the online help hover the mouse pointer over a control and press the F1 key.

Note

In order to communicate with a Gemini Imaging Sonar, the Gemini software must be set to run in Imager mode. This is done by setting the Sonar Type to "Imager" in the Section 5.2.2, "Configuration Options".

When the Gemini software is running, it presents a choice of two screens, which are selected by clicking on the tabs at the top left hand of the screen. The two screens are the `User` screen and the `Advanced` screen. The `User` screen allows the maximum amount of screen to be used for data display and the `Advanced` screen enables adjustment of the sonar settings.

5.1. User Screen

5.1.1. Overview
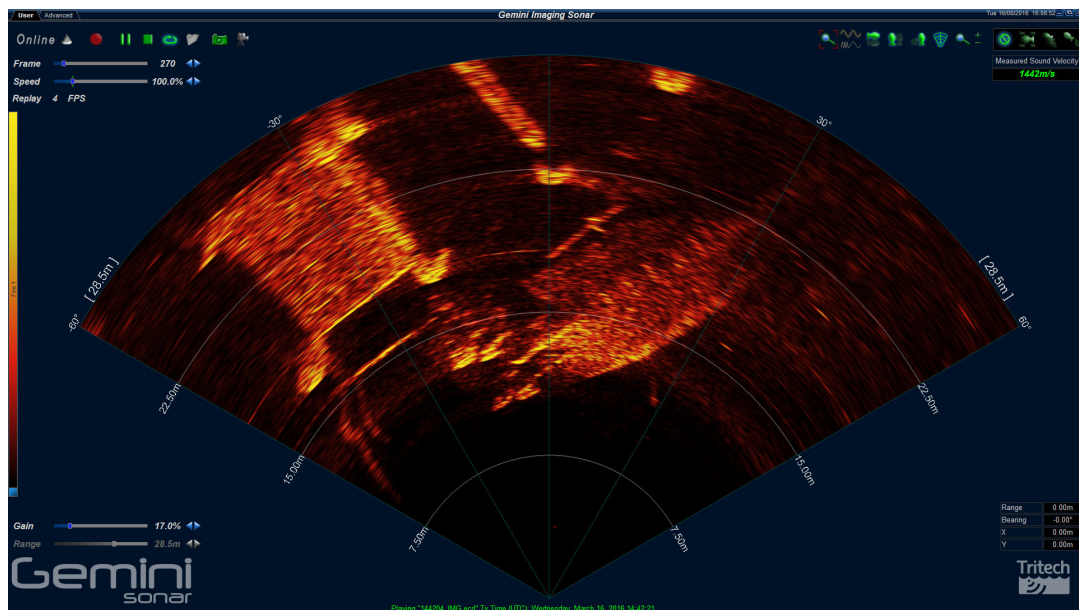
The 120° cone in the middle of the display shows the sonar image that the Gemini Sonar is producing. Around this display are the most commonly used controls.

On the upper left hand corner are the controls for starting the sonar imaging, starting the software logging of the images received from the sonar, replaying previously logged data, and capturing images.

On the upper right hand corner are the controls for orienting the displayed sonar image, controlling the zoom window, selecting the post processing filtering to be applied to the image, and the sound velocity indicator.

In the middle of the left hand side of the screen is the palette selector.

On the lower left hand side of the screen are the range and gain controls for the sonar.

On the lower right hand side of the screen are the indicators showing the pointer position within the display area.

Note

If serial sensor data is available and enabled from the `Advanced` tab, a subset of the data will be shown at the bottom of the `User` screen as well.
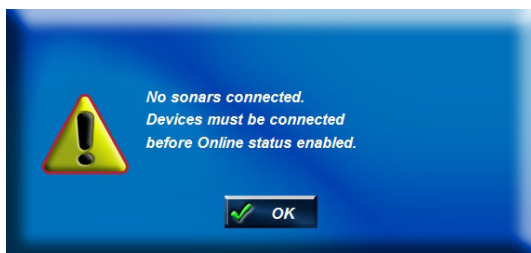
5.1.2. Online Button

The `Online` button starts communication with the Gemini head. When the software is started the head will not be running and the `Online` button will be grey.

Clicking the `Online` button will start the Gemini head; the button and the sonar cone image next to it will change to green. Clicking the button a second time will stop communication with the head, and the button and sonar cone will return to grey.

If the `Online` button is pressed while no heads are visible to the Gemini software, the following message will be displayed.

Clicking OK will acknowledge the message, and the software will not go online.

If the `Sonar ID` entered in the Sonar box of the configuration settings is not one of the heads visible to the Gemini software when the Online button is pressed, the software will present one of two messages.

If only one head is visible, the software will offer the chance to start imaging from that head.
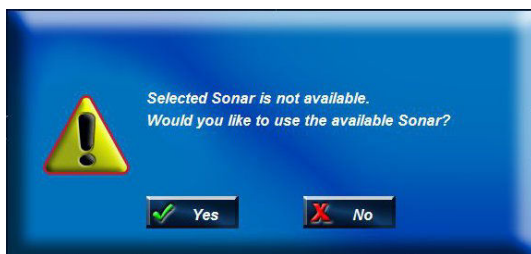
Clicking `Yes` will cause the software to select the head which is visible to it. Clicking `No` will acknowledge the message, and the software will not change the selected head and will not go online.

If there are multiple heads that are available, the software will display a message asking you to change the `Sonar ID` to one of the detected units.
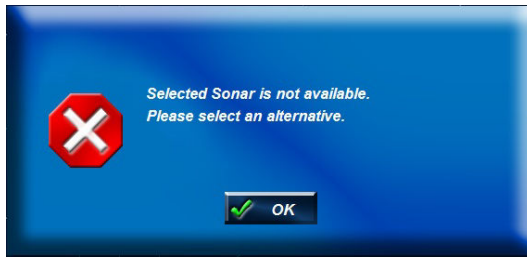
If the head is not able to connect due to being on a different network or having different network settings the following will be displayed:

Note

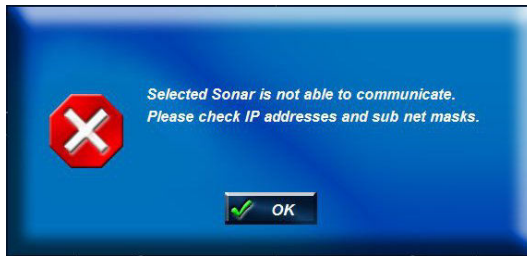To correctly set up the network refer to Appendix B, *Setting the computer IP address in Windows® 7 or Windows® 10* (or Appendix A, *Setting the computer IP address in Windows® XP*) and Appendix C, *Setting the Gemini Device IP Address in Gemini Software*.

5.1.3. Record Button

The `Record Button` controls the recording of the image being displayed by the software. When the button is clicked the software will start recording data and the button will be highlighted. Recording can be stopped by clicking on the button again.

The `Log Directory` selector controls which directory the data is recorded in. The directory displayed in the `Log Directory` selector is the root directory where all recorded data will be stored. Below that, a directory will be created using the current date, and each log data filename will include the time when recording started.

The software has a maximum file size for the logged data files. Once this size has been reached, the software will stop logging to the current file and open a new file to resume logging. The name of the new file will be based on the time the file was opened. If data is logged for a significant period of time, a number of files will be created, each with a different filename indicating when the data was first logged to that file.

For example, if the `Log Directory` selector is showing that the directory selected is `C:\GeminiData`, and recording was started at 4:30:02pm on 18th of October 2014, the data would be recorded in the file 163002_IMG.ECD in the directory `C:\GeminiData \LD20141018`.

The software will automatically create any directories needed for recording.

5.1.4. Player Controls

The player controls manage the replay of Gemini data previously recorded by the software.

From left to right they are Play, Stop, Repeat and Load. The controls that are enabled will depend on what the software is doing, for example, it is not possible to do anything with the player controls whilst the software is acquiring data from the Gemini head, nor is it possible to open a file whilst another file is already playing.

Play Button

The Play button is a play/pause control for the file player. When the data from a file is loaded but not playing, the image is a green triangle.

Clicking the image will start the file playing and the image will change to a Pause control (two vertical lines).

Clicking the image again will pause the file replay and the image will change back to the Play control (triangle).

Stop Button

The Stop button stops file replay and resets the play progress to the start.

Repeat Button

If the Repeat button is active and the player reaches the end of the file it is playing, it will return to the start of the file and continue. Clicking the Repeat button will alternate between the repeat being active and inactive.

Load Button

When the Load button is pressed, the software will open a file selector to allow the user to select a previously recorded data file to be replayed. To replay the data recorded at 4:30:02pm on 18th October 2014, file selector would look like this and the file 163002_IMG.ecd should be selected.

Multiple files may be selected in the file selection dialogue. The software will attempt to replay the log files in sequential order according to filename. Replay order is not guaranteed if the selected files are from different dates.
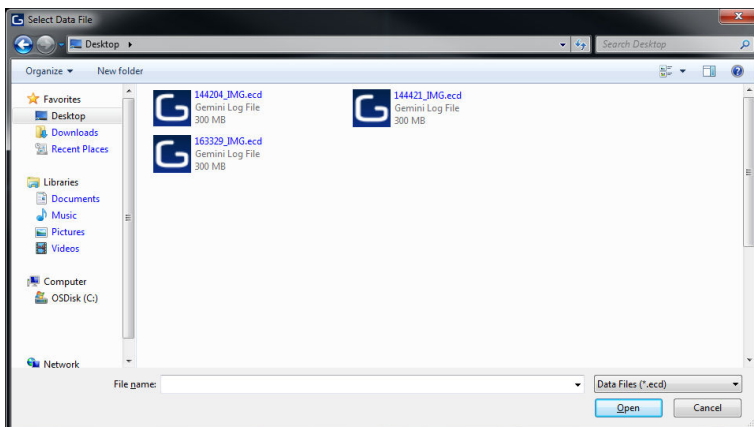
When replaying a log file, the filename, together with the date and time of recording, will be displayed at the bottom of the screen (below the Gemini data) in green text, for example:

Playing "025206_IMG.ecd"   Friday, April 16, 2010 10:52:07

Frame Number and Speed Control

| Frame | 1 ◀▶ |
| Speed | 100% ◀▶ |

The `Frame` control is a slider bar which allows the user to move quickly around the file that has been loaded. The number at the right hand end is the currently displayed frame number from the file. The slider can be grabbed to move quickly to any position in the file, whilst the two arrows at the end of the slider can be used to precisely position the frame being displayed in the file. The frame number can be used changed whilst the file is playing or paused. This control only appears when a file has been loaded.

The `Speed` control changes the replay speed of the data being replayed by the software. The maximum speed is 5 x (500% as indicated by the number at the right hand end of the slider bar). The slider can be grabbed to change the replay speed quickly, whilst the two arrows at the end of the slider can used to precisely control the replay speed. The replay speed can be changed whilst the file is playing or paused. This control only appears when a file has been loaded.

5.1.5. Capture Screen

When clicked, the `Capture Screen` button will take a screenshot of the Gemini data view and write it to an image file. This image is stored in the Images subdirectory of the log data directory, with a filename of `Gemini_YYYY-MM-DD-HHmmSS.xxx`, where:

- `YYYY`: Year

- `MM`: Month

- `DD`: Day

- `HH`: Hour

- `mm`: Minutes

- `SS`: Seconds

- `xxx`: Image file format. See Section 5.2.3, "Application Settings" for the capture format and resolution options.

For example, using a logging directory of `C:\GeminiData`, the first image captured would be stored in the file `C:\GeminiData\Images\Gemini_2016-05-12-111555.jpg`.

When the image has been captured, the Gemini software will display a message (as below) giving the name of the file. This message will be displayed for five seconds and then will close automatically.

Screen captured.
Dir: C:\GeminiData\Images
File: Gemini_2016-05-12-113415.jpg

✓ OK
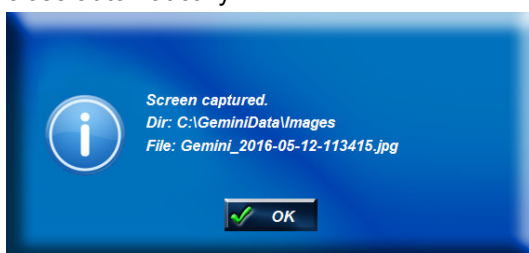
5.1.6. Record Video

The `Record Video` button is used to capture replayed Gemini data as a video file. Video capture is only available when a file is being replayed and cannot be performed on live Gemini data.

When a file has been loaded and the playback of the file has been paused or stopped, the Record Video button will be enabled. When the Record Video button is clicked, the video capture process will take over the replaying of the data. The video capture process is ended when the Record Video button is clicked for a second time.

The frame counter will be visible during recording as the user may select which part of the log file they would like to capture. The video file will be captured so that the replay will occur at approximately real time and it is not possible to change the speed of the playback during recording.

The generated file is stored in the Images sub-directory of the log data directory with a filename of `Gemini_YYYY-MM-DD-HHmmSS.xxx,` where:

- `YYYY`: Year

- `MM`: Month

- `DD`: Day

- `HH`: Hour

- `mm`: Minutes

- `SS`: Seconds

- `xxx`: Video file format. See Section 5.2.3, "Application Settings" for the video format and resolution options.

When the video file has been captured, the Gemini software will display a message (as below) giving the name of the file. This message will be displayed for five seconds and then will close automatically.
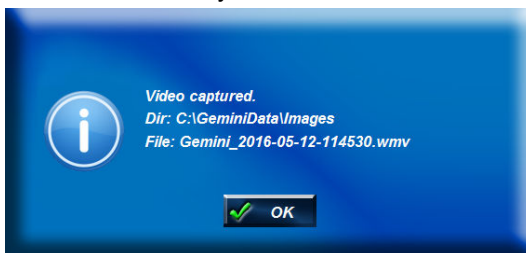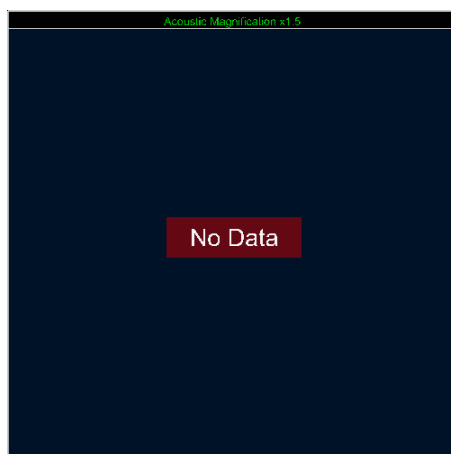

5.1.7. Acoustic Zoom button

The `Acoustic Zoom` button is only displayed during the replay of logged data and opens the Acoustic Zoom window. The Acoustic Zoom window will show any previously logged Acoustic Zoom data.

When enabled, the `Acoustic Zoom` button will be highlighted as shown.

If no Acoustic Zoom data is available the Acoustic Zoom Window will display the following message:

Acoustic Magnification x1.5

No Data

Zoom box example with Gemini Sonar data

In order for the Acoustic Zoom window to show data during replay, the `Zoom` button must have been enabled with a CHIRP enabled Gemini unit during the initial recording of the file.

5.1.8. CHIRP button

The CHIRP button toggles the CHIRP function of the Gemini Sonar. CHIRP transmissions use longer acoustic pulse lengths and advanced pattern recognition to achieve a higher Signal to Noise ratio and will improve image quality in acoustically noisy environments.

The default setting for the CHIRP function is `auto` mode. The Sonar will automatically enable and disable the CHIRP function based upon the range being used by the software. Below 4.8M (approximately) the Sonar will disable CHIRP.

To override the `auto` mode and de-activate the CHIRP function, press the CHIRP button until it looks similar to the graphic opposite.

To override the `auto` mode and activate the CHIRP function, press the CHIRP button until it looks similar to the graphic opposite.

Please note that at short ranges (approximately less than 4.8M) the sonar imagery may appear to be over saturated while the CHIRP function is active.

5.1.9. Invert Display (Up/Down)

The Invert Display (Up/Down) button is used to vertically invert the image displayed by the software.

5.1.10. Flip Image (Left/Right)

If the sonar is mounted upside down, the software has the ability to flip the image from left to right as viewed on the computer screen so that the image still appears correctly oriented to the user. The illustration above shows the button in the non-flipped state.

5.1.11. Rotate Image

The Rotate Image button turns the image from the sonar by 90°. The Invert Display and Flip Image controls will still affect the image displayed on screen.
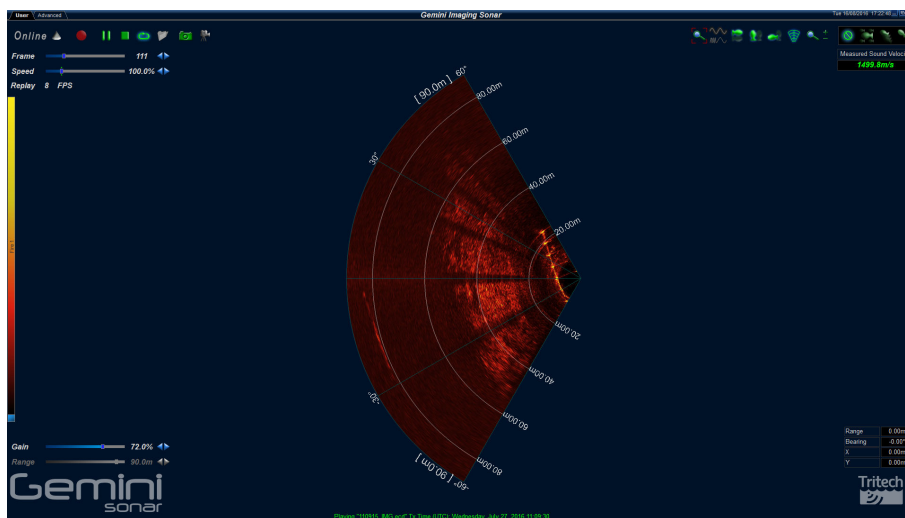
Rotate Image example with Gemini Sonar data

5.1.12. Draw Grid

The Draw Grid button, when clicked, draws the range and bearing grid on the displayed Gemini data. The illustration above shows the button in the on state.

5.1.13. Zoom Button

When the `Zoom button` is clicked, a zoom window opens which shows the data around the mouse pointer in more detail, as the following image shows.
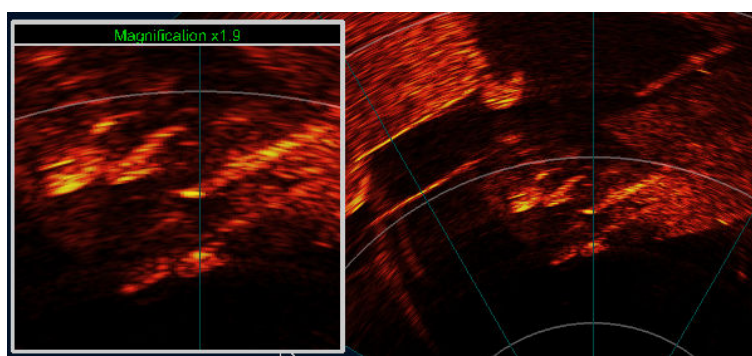
Zoom box example with Gemini Sonar data

If the Gemini unit has CHIRP enabled, the zoom window will show Acoustic Zoom data. Acoustic Zoom data is additional data collected by the Gemini unit for the highlighted area, allowing a more detailed view without loss of resolution. If data is being recorded when this button is enabled, the Acoustic Zoom data will also be recorded in addition to the normal view data.

If the Gemini unit does not have CHIRP enabled, the zoom window will show Digital Zoom data. This data is simply a magnified view of the data present on the normal view.

The zoom window positions itself to either the left hand side or the right hand side of the screen so that it does not obscure the Gemini data. The magnification level of the window is changed by using the mouse wheel, or by using the + and – buttons next to the zoom button. The magnification level can be changed between 1.5x (minimum magnification)and 40x (maximum magnification).

Clicking within the Gemini data arc will lock the zoom at that point. Clicking outside of the arc will release the lock and the zoomed area will follow the mouse pointer.

5.1.14. Filter Selector
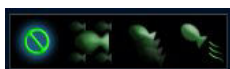
The Gemini software allows three filters to be applied to the image after it has been received from the Gemini Sonar and also to replayed data. From left to right, they are None, Average, Persistence, and Movement.

There are controls on the advanced screen to change the setting for each of the filters and they are described in more detail in Section 5.2.4, "Filter Settings".

5.1.15. Sound Velocity Indicator
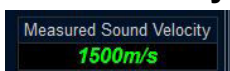
The sound velocity indicator at the upper right hand side of the display shows the sound velocity used by the Gemini Sonar whilst producing the sonar image. The Gemini Sonar can use a fixed value for the sound velocity or an automatically measured velocity.

5.1.16. Palette Selector

The Gemini software is supplied with a number of palettes which are used to show the different intensities in the sonar image in different colours. The palette bar on the left hand side of the screen shows the mapping currently being used.

Clicking on the palette bar opens a palette selector which allows the selection of the palette to use. As the mouse is hovered over the different palettes, the sonar image will preview that palette.

5.1.17. Gain Control

Gain ▫ 1.0% ◄▶
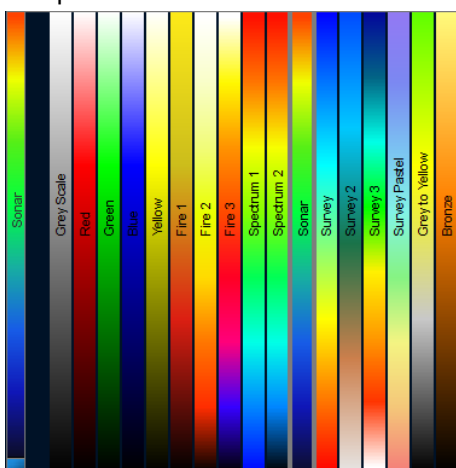
The Gain slider at the bottom left hand side of the display is used to change the gain level being used by the Gemini head, and is expressed as a percentage between 0 (no gain being applied) and 100 (full gain being applied).

The gain can be changed by either clicking on the dark blue indicator showing the current gain position in the slider and dragging it left or right, or by using the arrows at the end to change the gain one step at a time. The arrows are designed for fine control of the gain and operate one step per click and clicking on the arrows and holding them down will have no effect.

The gain can also be altered using keyboard shortcuts ('z' to decrease gain, 'a' to increase gain).

5.1.18. Range Control

Range ▬▬ 12.0m ◄▶

The Range slider at the bottom left hand side of the display is used to change to the range of the image being acquired by the Gemini head.

The range can be changed by either clicking on the dark blue indicator showing the current range position in the slider and dragging it left or right, or by using the arrows at the end to change the range one step at a time. The arrows are designed for fine control of the range and operate one step per click and clicking on the arrows and holding them down will have no effect. The range control has been implemented with a logarithmic scale so that the smaller values of range can be more precisely selected.

The range can also be altered using keyboard shortcuts ('c' to decrease range, 'd' to increase range).

5.1.19. Indicators

Range	12.90m
Bearing	51.00°
X	10.02m
Y	8.12m

When the mouse pointer is within the 'cone' on the sonar display (that is over the displayed sonar image), the indicators at the bottom right hand side of the screen will show the position of the mouse pointer relative to the origin of the display (that is relative to the Gemini Sonar). The pointer position is expressed as a range / bearing pair, and as a Cartesian co-ordinate (X, Y).

5.1.20. Sonar Swathe

Around the edge of the sonar cone there are three handles that allow the swathe size (also known as the aperture size) to be adjusted.

Click and hold the mouse over one of the handles. The clicked handle, and any other handles that will move when the mouse is dragged, will be highlighted. Square shaped handles adjust the edges of the swathe size. Diamond shaped handles adjust the centre of the swathe size.
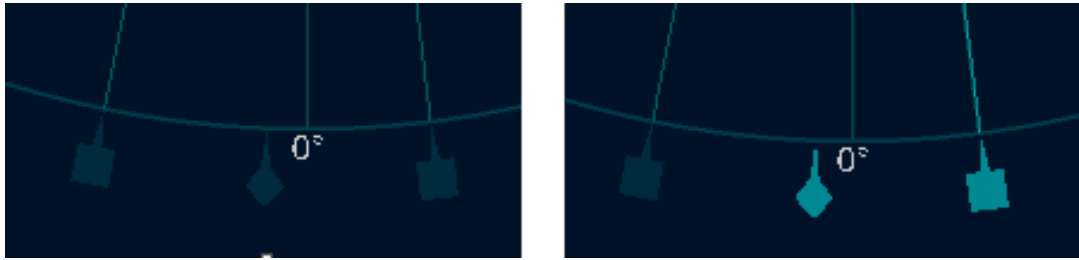
Drag the mouse to move the handle to the desired location and then release the mouse button. There will be a short delay (depending on network bandwidth) while the profiler is updated with the new swathe size. It is possible to adjust the swathe size using the keyboard by pressing the `b` or `g` keys.

5.1.21. Measurements

When the mouse pointer is within the cone on the Gemini data display measurements can be taken from the display. A single click on the cone will show the position of the click.
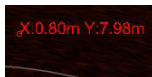
Clicking at one point on the cone and holding the left mouse button down whilst moving the mouse will give a measurement between the two points.
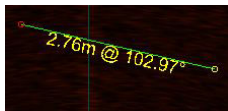
When any measurement has been taken, clicking outside the cone will turn the measurement off.

5.1.22. Warnings

### *Out of water*

If the Gemini detects that it is not immersed in water, the warning "Out of water" will be displayed in the centre of the scan image:

The sonar will continue to operate at full power during a 20 minute countdown period. During the countdown period, toggling the `Online` button will reset the timer back to the start or immersing the sonar back into water will clear the warning.
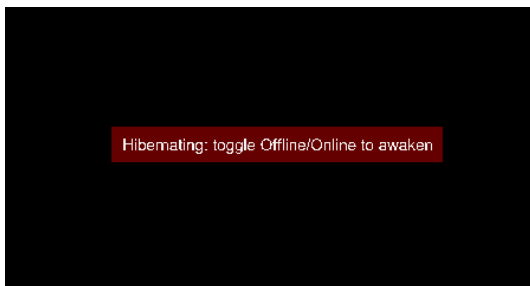
At the end of this period the sonar will enter a power saving mode to reduce the heat build up within the unit. The software will still display information about the sonar during this power saving mode, but the sonar will not re-enable it's ability to transmit until the `Online` button has been toggled off then on.

Over temperature

If the temperature sensors within the sonar detect that the internal temperature is too high an "Over temperature" warning will be displayed.
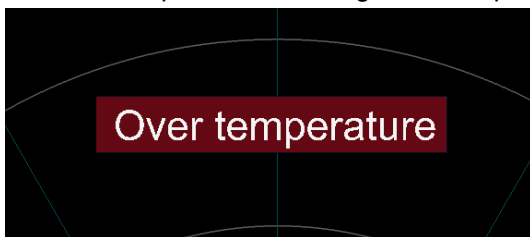
The sonar will enter a power saving mode and only basic communication with the unit will be possible. Cooling the unit and then toggling the `Online` button will clear the warning and resume the full capabilities of the sonar.

5.2. Advanced Screen

The `Advanced` screen is accessed by clicking the `Advanced` tab at the upper left hand corner of the screen.
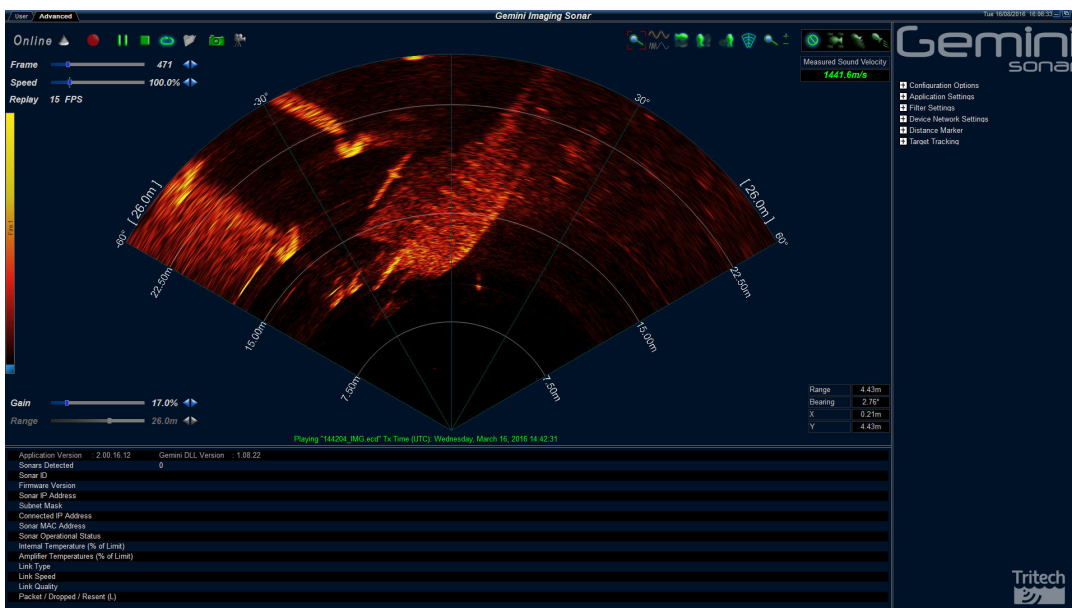
The `Advanced` screen shows more details about the Gemini system, and allows certain options in the software to be configured. The screen is split into three areas: the `User` area, which has been previously described in Section 5.1.1, "Overview"; the lower left area of the screen contains the `System Data` tabs; and the `Advanced Settings` panel, which contains the majority of the configurable settings for the software.

5.2.1. System Data

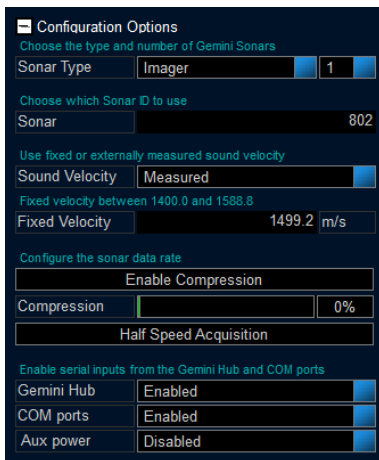|	
Application Version : 2.00.00.41	Gemini DLL Version : 1.08.13
Sonars Detected	1
Sonar ID	802
Firmware Version	720is: BF:02.02, DA:02.02
Sonar IP Address	127.0.0.2
Subnet Mask	255.255.255.0
Connected IP Address	10.104.34.57
Sonar MAC Address	00:50:c2:b9:43:22
Sonar Operational Status	Online
Internal Temperature (% of Limit)	FPGA[50/40],HSC[41],TX[42],PSU[44]
Amplifier Temperatures (% of Limit)	FPGA[50],AFE[51/52],[53/54],[55/56],[57/58]
Link Type	Ethernet
Link Speed	100 Mbps
Link Quality	100%
Packet / Dropped / Resent (L)	86167 / 0 / 0 (0)

The first line on the screen gives the versions of the elements which make up the Gemini software and the other lines show status information from the Gemini Sonar (or Sonars) connected to the system. More than one Gemini Sonar can be communicating at any one time and the Gemini software will display the images from up to a maximum of four of the sonars.

If more than one Gemini Sonar is connected and powered, its details will appear on the System Data screen. The currently active sonar will have green text and the dormant sonar(s) will be in yellow.

For a multiple sonar setup the arrows allow the list of sonars to be scrolled.

5.2.2. Configuration Options

The `Configuration Options` allow the user to select which Gemini Sonar to use, select the Sound Velocity to be used during image processing, modify sonar data rates, and finally to change the network settings.

Configuration Options

Choose the type and number of Gemini Sonars

Sonar Type	Imager	1

Choose which Sonar ID to use

Sonar	802

Use fixed or externally measured sound velocity

Sound Velocity	Measured

Fixed velocity between 1400.0 and 1588.8

Fixed Velocity	1499.2 m/s

Configure the sonar data rate

Enable Compression

Compression	0%

Half Speed Acquisition

Enable serial inputs from the Gemini Hub and COM ports

|	
Gemini Hub	Enabled
COM ports	Enabled
Aux power	Disabled

Note

In order to communicate with a Gemini Imaging sonar the software must be set to run in Imager mode. This is done by setting the Sonar Type to "Imager".

When changing this setting, the user will be prompted to allow the software to restart. Once the software restarts, all Imager settings and relevant options will be available.

Sonar Selection

The Sonar ID of the Gemini Sonar is used to determine which sonar will be used as the source of images displayed by the software. The Sonar ID is available on the system data area of the Advanced screen, and should be entered in the Sonar box. The number of sonars can also be selected (up to 4) and each can have an ID. If multiple sonars are present the ID selection field will change to allow the sonar to be positioned on the display with an offset and rotation.
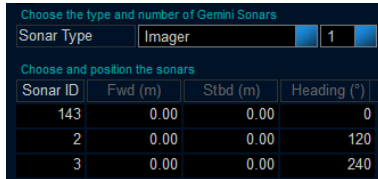
When the Gemini software is loaded it will, by default, attempt to connect to all valid Gemini devices that it discovers on the same network. This is indicated by the `AUTO` option in the drop down selection for the number of sonar heads. This can be overridden by placing the software offline then altering the number of sonars and their IDs.

The Gemini software will retrieve the IP address and Subnet Mask for the chosen Gemini Sonar (if the sonar is visible to it) and use them to communicate with the Sonar.

Note

If the sonar is operating and `Online` has been selected then it will not be possible to change the ID until the sonar is taken off-line.

Sound Velocity

The `Sound Velocity` controls are used to set how the Gemini obtains the sound velocity which is used in producing the sonar image. The Gemini can either use a fixed sound velocity (in which case the sound velocity to be used is entered in the `Fixed Velocity` box below the sound velocity selector), or use a measured sound velocity.
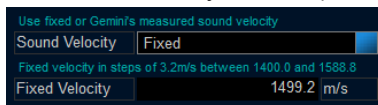

The above example shows the fixed sound velocity selected with a value of 1499.2m·s⁻¹.

When entering a fixed sound velocity, the software will verify the value is within the range 1400m·s⁻¹ to 1588m·s⁻¹. If not, a warning is displayed to the user and a default value of 1499.2m·s⁻¹ is used.

Compression

Run Length Encoding (RLE) is a technique that is used to compress the image data as it is transferred between the Gemini head and the software, thus reducing the required bandwidth. RLE in Gemini is a lossy compression technique where all sonar data below a determined level is set to zero before compression is applied. Increasing the compression level will increase the efficiency of the compression and effectively reduce the bandwidth required to transmit the image data. The consequence is that weaker returns are filtered out of the sonar image. This will initially reduce potential noise but will start to remove smaller/weaker targets from the image.
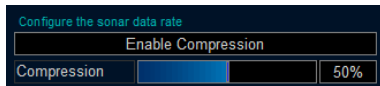
The `Enable  Compression` button toggles the compression when clicked (black background to the button means compression is off, blue background means compression is on). The `Compression` control sets the level applied by the run length encoding; returns below this intensity percentage will be set to zero. The live image displayed by the Gemini software immediately shows the effect of the compression.

The live image displayed by the Gemini software shows the effect of the compression immediately.
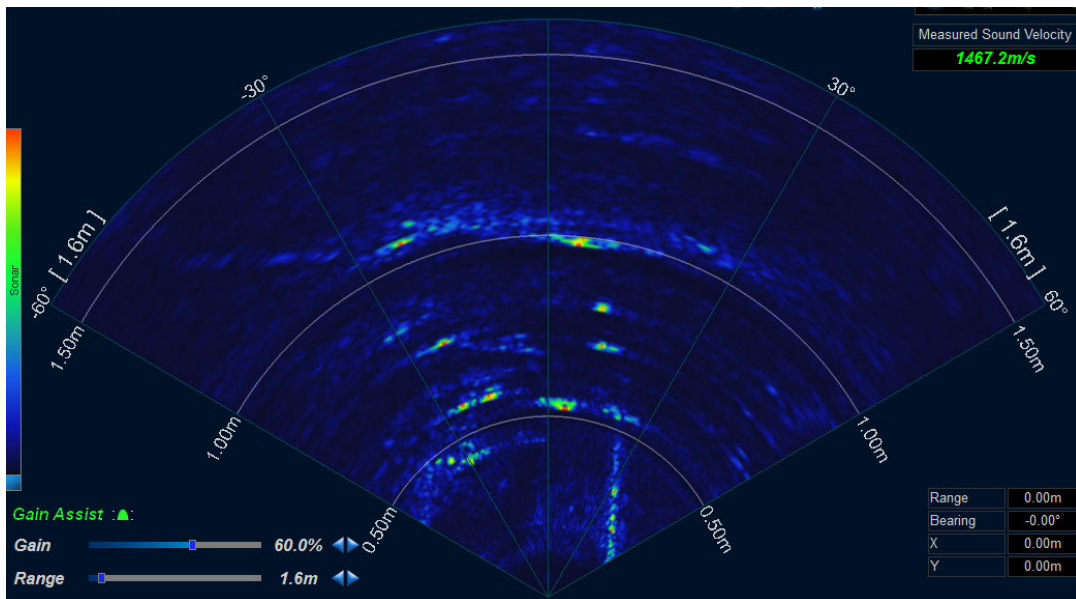
Example screenshot of sonar imagery with no compression.
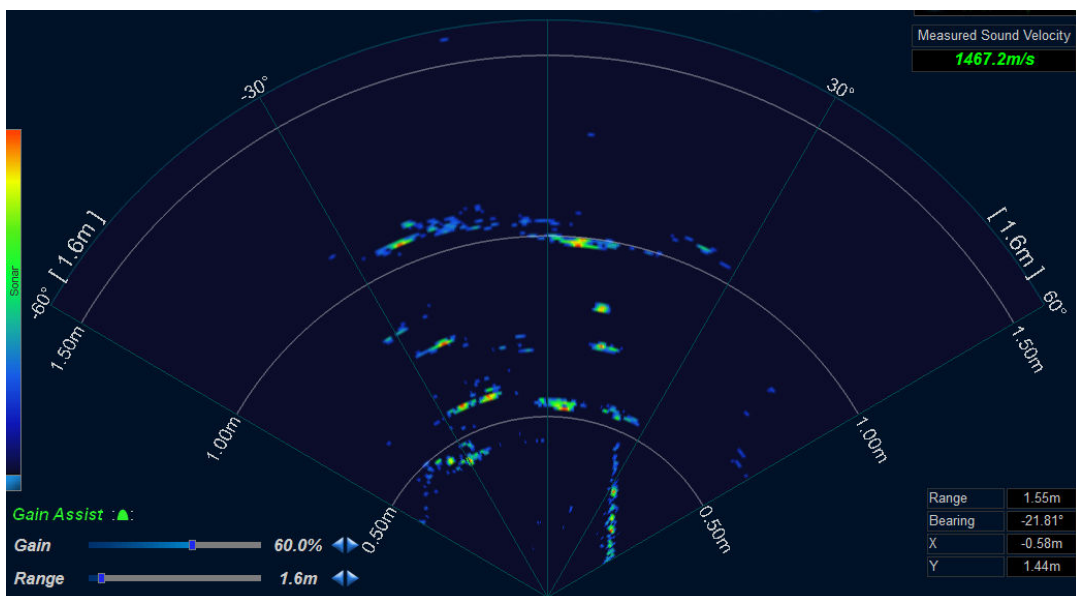
Example screenshot of sonar imagery with a 25% compression level.

Note

Compression is applied before the software receives the sonar data and therefore compression cannot be applied to data that has already been recorded. Conversely, recorded data that has been compressed cannot be uncompressed.

Acquisition Speed

Acquisition speed is another mechanism available for reducing the sonar data rate and required bandwidth. When the `Half Speed 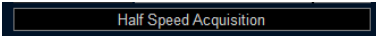Acquisition` button is enabled (blue background) the software will reduce the sonar image acquisition speed to approximately half the maximum rate.

Note

Reducing the acquisition speed can also be useful if acoustic multipath is causing false moving/transient targets to be observed in the sonar image.

Serial Inputs

Data from external serial sensors can input to the software via a Gemini Hub, the computer COM Ports or via the additional serial ports on the Gemini unit itself. These options can be enabled/disabled using the provided drop-down menus. See Section 5.3, "Serial Data Input" for a detailed description of the related settings and options.
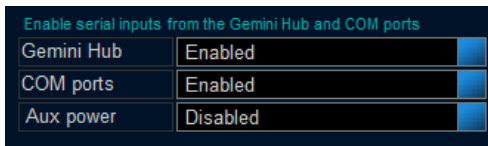
The `Gemini Hub` and `COM Ports` options can only be altered when the software is offline.

5.2.3. Application Settings
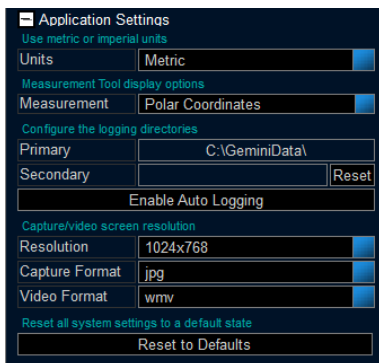
Units

The `Units` control selects between Metric and Imperial units. The selected unit type is then used throughout the program to display measured values. For example, a Sound Velocity displays as 1499.2m·s^{-1} using Metric and 4918.64 ft·s^{-1} with Imperial.

Measurement

The `Measurement` control selects between Measurement Tool annotation options that display distance in the Gemini data view. The user may select the measurement to be shown in polar coordinates, Cartesian coordinates, or no annotation displayed. For more information on the Measurement Tool see Section 5.1.21, "Measurements".

Logging Directories

The `Primary` logging directory selector indicates the write location for all data logging, including screenshot captures and video (see Section 5.1.5, "Capture Screen" and Section 5.1.6, "Record Video" for capture examples).

The `Secondary` logging directory selector allows the user to specify a second directory in which Gemini log data will be written to. For example, this may be used to write to a backup location. If both `Primary` and `Secondary` directories are specified a recorded log file will be written to both directories.

Click the directory control (i.e. the box containing `C:\GeminiData`) in order to open the Browse for Folder dialogue. Use the navigation tree to select the desired directory and then press `OK`. The `Cancel` button closes the dialogue and does not change the logging directory.
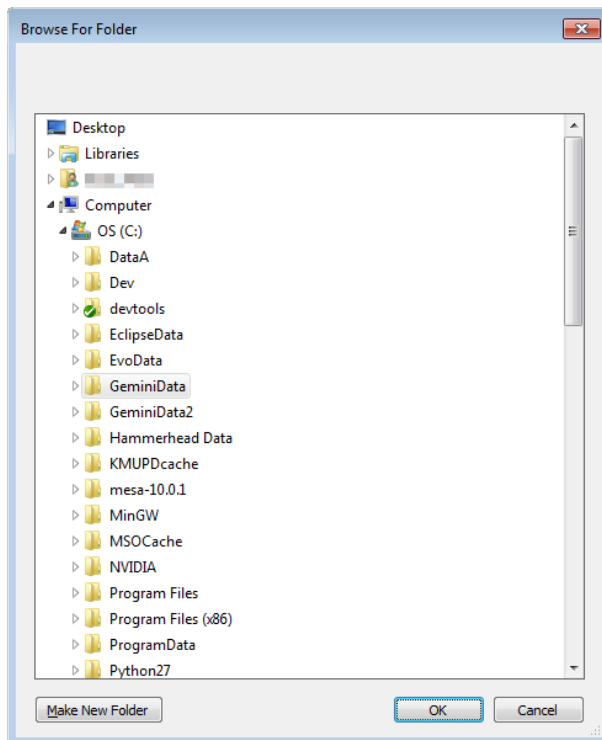
Enable Auto Logging

This option will enable the Gemini software to start logging data immediately upon start up and when the software goes online, without any additional user intervention. It will use the `Primary` and `Secondary` locations for storage and use the `ECD` file format for storage.

Resolution

The `Resolution` dropdown menu provides options for screenshot and video capture resolution. This can be used to increase or decrease the image/video size (width x height) as well as the quality.

The list contains the following options: commonly used screen resolutions (i.e. 1920x1080) and a Screen (x) option, which is the current monitor resolution.

Note

Recording large videos may fail on systems with insufficient memory. If videos are not written correctly or have no frames then decrease the resolution before recording. Additionally, AVI videos are less memory intensive and may work better for larger resolutions.

Capture Format

The user may specify a standard image file format which is used when saving a captured screenshot. Options provided include: `BMP`, `GIF`, `JPG`, and `PNG`.

Video Format

The user may specify a standard video file format which is used when saving a recorded video. Options provided include: `AVI` and `WMV`.

Reset to Defaults

Pressing the Reset to Defaults button returns the software settings to the default values. Caution should be taken as this will overwrite all user settings changes.

5.2.4. Filter Settings

The `Filter Selector` on the `User` screen selects one of three filters to be applied to the image before it is displayed. The Filter Setting section of the Configuration Options screen allows the settings of these three filters to be changed. The `Filter Settings` panel provide three different data filters that may be applied to the sonar image before it is displayed. The filters are only active if enabled in the sonar view (See Section 5.1.14, "Filter Selector").
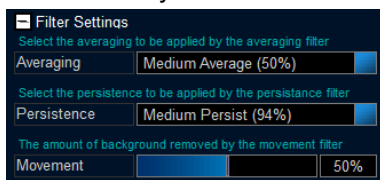
The `Averaging` filter applies an average over a number of images received from the sonar. It has the effect of removing random noise and rapidly moving targets from the image.
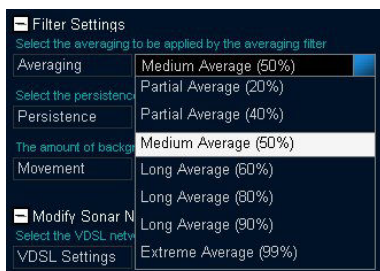
The `Persistence` filter retains decreasing amounts of earlier images as well as the current image. It has the effect of highlighting movement in the images, which appears as a decaying "snail trail" behind the moving object.
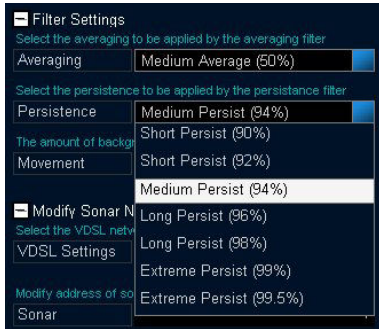
The `Movement` filter highlights the changes between images and filters out static returns. The Movement control sets how much background (i.e. non-moving data) is removed from the image. With the Movement control set at maximum, the movement filter removes all of the background and so the display only shows targets that are moving between images. With the Movement control set at minimum, the movement filter retains almost all the background (and becomes almost indistinguishable from the `Persistence` filter).

5.2.5. Device Network Settings
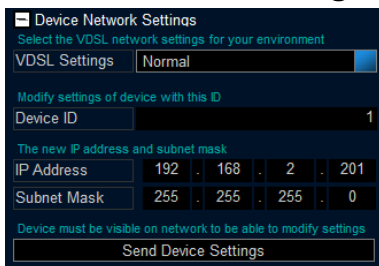
VDSL Settings

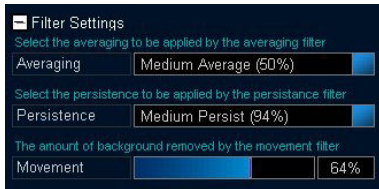The `VDSL Settings` drop-down allows three different settings to be applied to the VDSL link in order to cope with different levels of electrical noise experienced by the sonar cable.
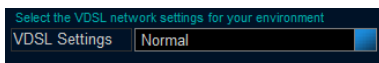
 Note

Only if difficulties are being experienced communicating with the Gemini head should the VDSL settings be changed from `Normal` to one of the other values.

Appendix C, *Setting the Gemini Device IP Address in Gemini Software* describes how the Gemini network settings can be altered to allow it to work with a desired network. Once the head has been successfully configured it should not be necessary to change the settings again unless moving to a different infrastructure.

5.2.6. Distance Marker

The `Distance Marker` provides a mechanism for measuring the distance between two points in the Gemini data view. This is similar to the `Measurement Tool` but provides additional options that allow it to be used as a more permanent measurement.
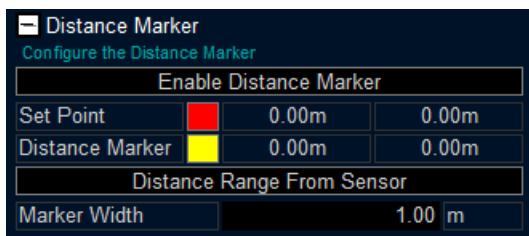
Enable the feature by clicking the `Enable Distance Marker` button. This will draw the `Distance Marker` as a horizontal line and the `Set Point` as a small circle in the Gemini data view.

For both the `Distance Marker and Set Point,` the corresponding colour selector may be used to distinguish the markers from the head image. Click on each colour box to open a colour selection dialogue. Additionally, for each marker, the Cartesian coordinate is displayed in the `Distance Marker` panel. The Distance Marker line width can be set by entering a value into the `Marker Width` field.

In the Gemini data view, each marker can be clicked and dragged to a new position. The distance measurement will continuously update and reflect the distance between the two markers.

Note

In order to click and drag the markers the click must be within the head image. For example, if a marker is at location (0, 0) the clickable area is fairly small and care must be taken to click the correct area. In this case, the `Distance Marker` line may reach past the head image boundary and would only be clickable where it overlaps the head image.

The distance between the `Distance Marker and Set Point` is displayed in the bottom right of the Gemini data view (see image below). The displayed values are calculated as:

Distance (X, Y) = (Distance Marker - Set Point)
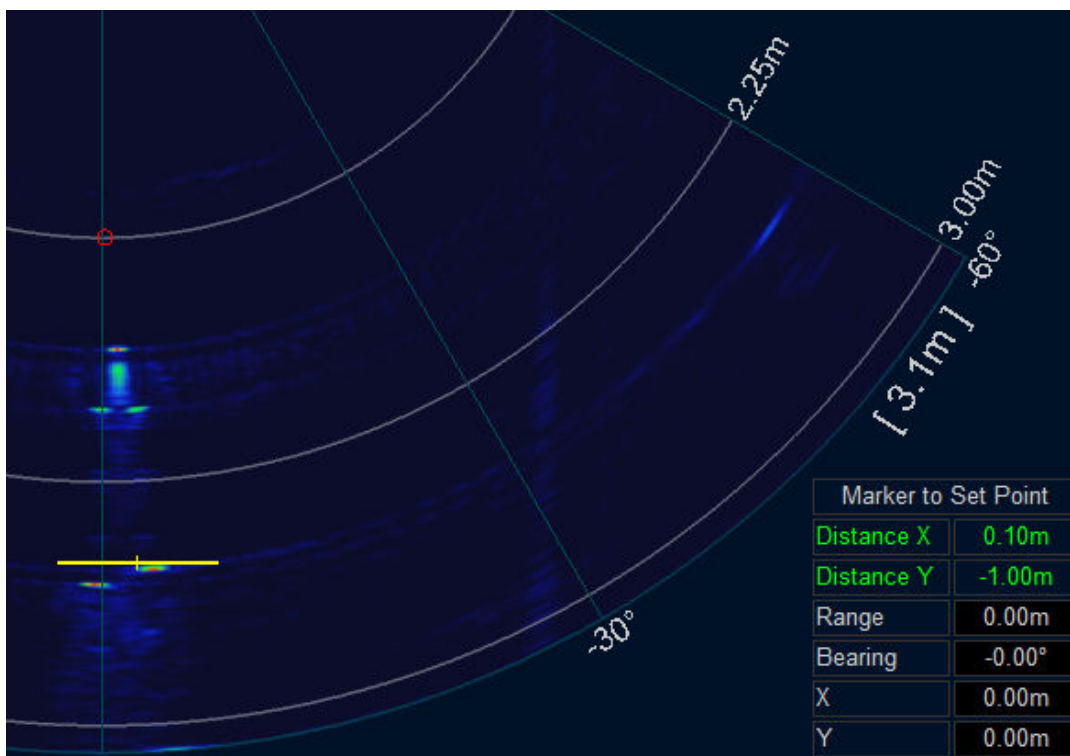
The Distance Marker range/ Y coordinate may be updated from an external sensor. Enabling the `Distance Range from Sensor` button will update the value whenever a configured sensor message is received. See Appendix E, *Gemini Software String Decode* for the appropriate `Marker Range` decode options.

5.2.7. Target Tracking

`Target Tracking` provides a mechanism of highlighting objects and following their movement over subsequent sonar frames. Once enabled, targets will be automatically determined and tracked when selected. There are two main methods of target tracking available within the Gemini software:

1. Click + Track

2. Detect + Track

Note

Although both options will only be displayed, the `Detect + Track` option will only be available for selection if a Gemini 720is has been detected.
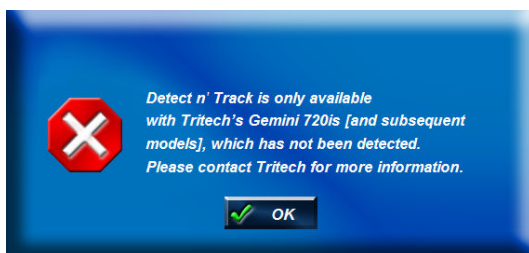
The `Target Tracking` method can be selected using the drop down selection on the `Tracking Mode` box.
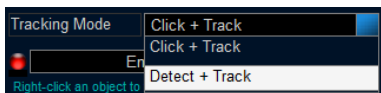
Click + Track
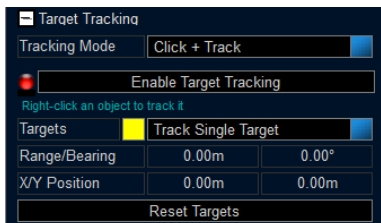
In order to track a single target, the `Track Single Target` option can be selected from the Targets menu. This restricts the user to select one target at a time and has the benefit of displaying the target position. As the target is tracked the Range/Bearing and X/Y Position will be updated from each sonar frame.

The `Track Multiple Targets` option can be used to select and follow multiple targets. Each right-click will attempt to find a target and track it separately. No position information is displayed when tracking multiple targets. If the user changes from Multiple to Single tracking, the target closest to the sonar will be used.
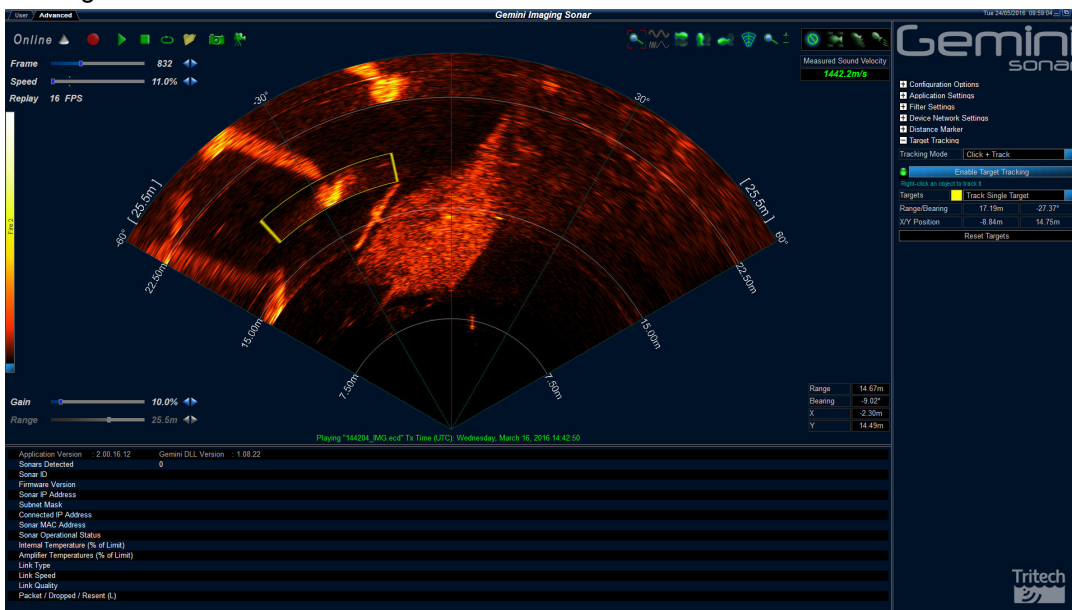
The `Reset Targets` button will clear all selected targets. This is useful when an incorrect target has been selected or the user wants to track a new target.

Note

Noisy conditions may lead to inconsistent target recognition and tracking. Targets that overlap with other objects or sections of visible seabed may result in large targets that encompass more than the desired target. Ideally, a target will have a high contrast to its surroundings.

Detect + Track
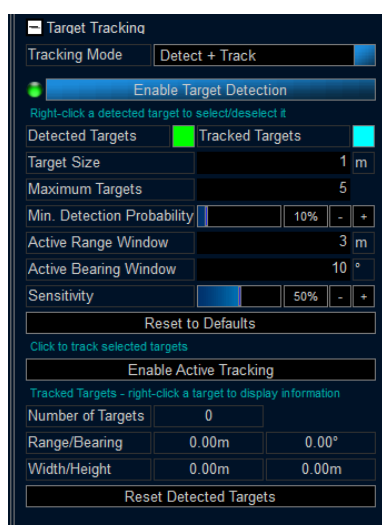
In order to track objects effectively, the various settings need to be optimised.

Target Size

This is the estimated size of target that is to be tracked.

Maximum Targets

This sets an upper limit of the number of targets that will be considered for tracking. Setting this to a large number will increase the load on the computer CPU and may cause the Gemini software to slow down.

Min. Detection Probability

This controls the ability of the software to retain, or drop targets based upon the intensity of their acoustic return. A low value will cause the software to try and track an identified target even when the target is very faint.

Active Range Window and Active Bearing Window

These settings set up a mask around a tracked target. As long as the target moves within the mask from one instance to the next the target will remain tracked. If the target moves too quickly tracking will cease.

Sensitivity

Increasing the sensitivity will allow the tracking to detect more potential objects, but can result in a greater number of false positives.

The `Reset to Defaults` button will reset the above settings back to default values. It will also automatically stop any active tracking.

To track a target, click on the `Enable Target Detection` button and setup the settings to suit the current environment.

Once enabled, potential targets will be highlighted in the appropriate colour, green in this instance.
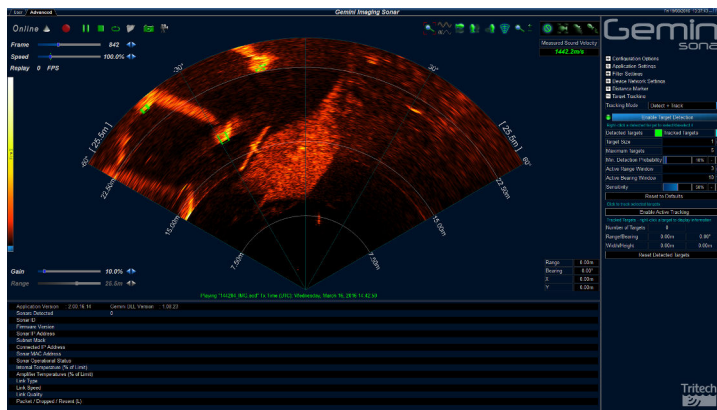
To track one or more targets, place the mouse cursor over it and *right click* on it. A small cross will appear in each target selected.

To begin tracking either: click the `Enable Active Tracking` button; or double *right click* the last target. The highlight boxes will change colour and the other potential targets will no longer be highlighted.
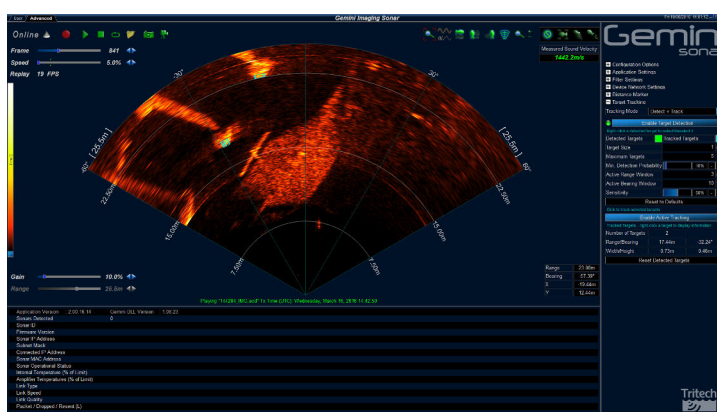
The `Tracked Targets` information will now update with details of the primary target to be tracked. The primary target is denoted by a small cross within the highlight box.

To change the primary target, *right click* another highlighted target. The cross will then move to the new primary target.

The `Reset Targets` button will stop any tracking that is currently taking place.

5.3. Serial Data Input

Data from external serial sensors can be input into the Gemini software and logged as part of the sonar image record.

To enable data input to the system select `Enabled` for the `COM Ports` or `Gemini Hub`. The `COM Ports` drop-down list is for serial ports that are connected to the computer (either natively or through an RS232 to USB converter) and is also for configuration of the RS232 functionality of the Gemini Sonar head. The `Gemini Hub` drop-down list is only for configuration of connected Gemini Hubs.
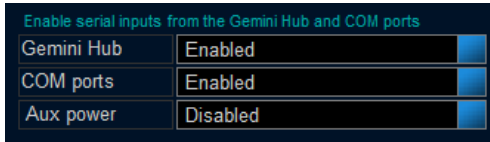
Selecting `Enabled` for either `Gemini Hub` or `COM Ports` will alter the tab options in the bottom left of the screen. If both are disabled there will be no tabs visible and the status area will only display information about connected Gemini heads.

 With `Gemini Hub` selected.

 With `COM Ports` selected.

 With `Gemini Hub` and `COM Ports` selected.

5.3.1. Sonars & Sensors

The `Sonars` tab is for displaying information and is the same display when no tabs are present (for a full description see Section 5.2.1, "System Data").
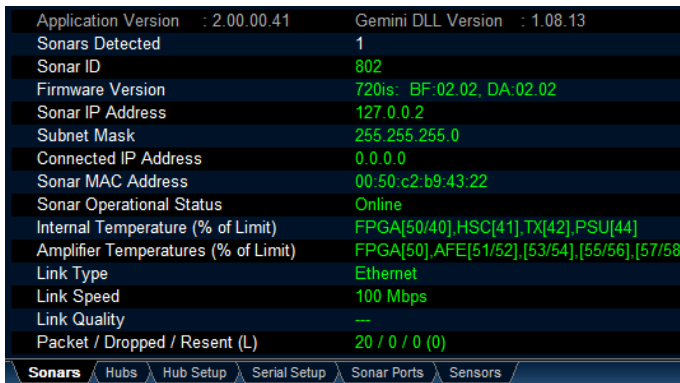
The `Sensors` tab is for displaying extra information from connected RS232 sensors.

Note

If serial sensor data is shown here, a subset of the data will also be shown at the bottom of the `User` screen.

5.3.2. Gemini Hub

Hubs Tab

The `Hubs` tab shows the status information from any connected Gemini Hubs.

Application Version : 1.17.00	Gemini DLL Version : 1.07.94
Hubs Detected	1
Hub ID	137
Firmware Version	01.0c
Hub IP Address	192.168.2.101
Subnet Mask	255.255.255.0
Connected IP Address	192.168.2.210
Hub MAC Address	00:50:c2:b9:40:e8
Hub Operational Status	Online
PSU/FPGA Temperature (% of Limit)	55 / 46
Port J (Master)	1000 Mbps
Port K	---
Port L	---
Packets	2495

Sonars \ **Hubs** \ Hub Setup \ Sensors
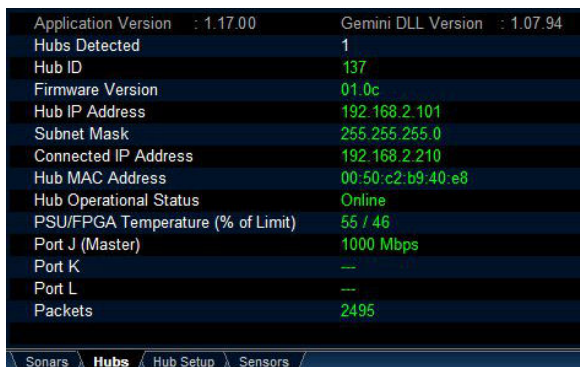
Hub Setup Tab

The `Hub Setup` tab allows configuration of the serial ports on the rear of the Gemini Hub to allow RS232 data to pass through to the Gemini software from external sensors.

Enable Comms	Hub ID		137						
Port	Mode	Sync	Baud	Decode	Max	Age		Hz	String
A	ASCII	<CR>	9600	TSS Std 1	2			2.4	:000000 0000H 0063 0244
B	ASCII	<CR>	9600	GPGGA	2			5.8	$GPGGA,100928,3322.69162,N,07013.95610,E,2,07,1.4,0.0,M,0.0,M,2.2,0362*5C
C	ASCII	<CR>	9600	HEHDT	2			7.0	$HEHDT,173.0,T*2A
D	ASCII	<CR>	9600	GPGGA ZDA	2			1.0	$GPGGA,102137,2759.27933,N,08655.51255,E,2,07,1.4,0.0,M,0.0,M,2.2,0362*51
E	ASCII	<CR>	9600	SonDepth	2			9.0	$SONDEP,509.6,1.1,M*68
F	ASCII	<CR>	19200	Speed of Sound	2			5.2	1499.23
G	ASCII	<CR>	38400	GPGGA	2			1.3	$SONDEP,506.4,1.1,M*65
H	ASCII	<CR>	9600	<none>	2			0.0	

Sonars \ Hubs \ **Hub Setup** \ Sensors

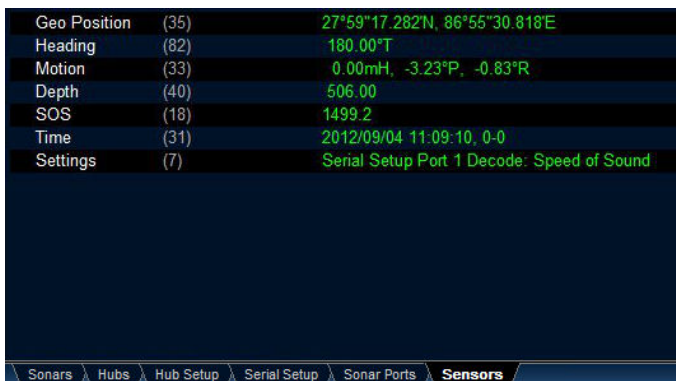|	
Port	The port letter, corresponding to the label on the back of the Gemini Hub.
Mode	Can change between an ASCII decode, binary decode or can echo the data on one of the other ports (ASCII is the default input, only the Simrad EM3000 uses a binary input). Echo is used as an alternative to a serial splitter cable in systems where the sensor data is also used by another application or device.
Sync	The sync character used to frame the ASCII string.
Baud	The baud rate of the sensor connected to the port.
Decode	The decode definition to apply for the expected receive data on the port.
Max	Set the time in seconds to generate an alarm if no data is received.
Age	The age of the data, shows when the last good data was received (see note below).
Hz	The incoming data rate

String   The incoming data string, check this against the chosen `Decode` if the data indicator is red.

Note

The data age status indicator will show the status of each port. A grey indicator means no data is present, red is for an incorrect data string, yellow indicates an incomplete data string and green is for normal operation.

5.3.3. COM Ports

The `COM Ports` enables two extra tabs called `Serial Setup` and `Sonar Ports` from where all the serial communication (both connected to the PC and ports on the Gemini head) are configured.

Serial setup

The `Serial Setup` tab controls the serial communication being inputted and exported by the Gemini software.

COM Port   The COM port to use.

...   Open the settings dialog for configuring the port baud rate, data bits, parity and flow control.

Mode   Can change between an ASCII or binary decode (ASCII is the default and binary is only used for the Simrad EM3000).

Sync   The sync character used to frame the ASCII string.

Decode   The decode definition to apply for the expected receive data on the port.

Max   Set the time in seconds to generate an alarm if no data is received.

Age   The age of the data, shows when the last good data was received (see note below).

Hz   The incoming data rate

String   The incoming data string, check this against the chosen `Decode` if the data indicator is red.

The `Output COM Port` section allows the user to export data from the Gemini software to third party applications. Changing the `Encode` option will alter the output. For more details on the data formats for each string, please refer to Appendix F, *Gemini Software String Encode*.

Note

The data age status indicator will show the status of each port. A grey indicator means no data is present, red is for an incorrect data string, yellow indicates an incomplete data string and green is for normal operation.

Sonar Ports

The `Sonar Ports` tab controls the two serial channels available on each Gemini 720is unit that is connected.

Sonar ID	The Gemini 720is ID number
Port	The port, or serial channel, on the Gemini.
Function	Changes the intended use for the data being put into the Gemini. **Decode** will enable the selection boxes from Mode onwards and will attempt to parse the data. **Route to...** will pass the data from the Gemini onto a selected COM Port that the software has been able to detect on the computer. This option will hide the Mode, Sync, Decode, Max, Age, Hz and String information.
Protocol	RS232 or RS485 can be used on Port 0. Only RS232 can be used on Port 1.
Baud Rate	The baud rate selection for the Port. Selectable between 9600 to 115200 Baud.
Mode	Can change between an ASCII or binary decode (ASCII is the default and binary is only used for the Simrad EM3000).
Sync	The sync character used to frame the ASCII string.
Decode	The decode definition to apply for the expected receive data on the port.
Max	Set the time in seconds to generate an alarm if no data is received.
Age	The age of the data, shows when the last good data was received (see note below).
Hz	The incoming data rate
String	The incoming data string, check this against the chosen `Decode` if the data indicator is red.

5.3.4. Aux Power

The `Aux Power` will enable, or disable power to the Aux port of the Gemini 720is.

Caution

As the Aux port is powered by an internal regulator, the maximum power limit should never be exceeded. Doing so will damage the Gemini 720is.

Note

The Aux Power control will only affect Gemini 720is units that have serial based Aux ports. The dual ethernet version of the Gemini 720is is unaffected by this setting.

5.4. Gemini Firmware updates

Each release of the Gemini Software automatically contains the latest revision of firmware suitable for the Gemini Sonar. The software will automatically check the existing firmware and will advise if an update is available. Updating the firmware of the Gemini Sonar will improve the capabilities of the unit as well as allow access to new features and enhancements as they are developed.

Warning

During the update process, power to the Gemini Sonar should not be interrupted. Power loss during this process may cause the Gemini Sonar to become unstable and require immediate servicing.

In the `Advanced` screen, the `Sonar` tab contains details of all the Gemini Sonars detected by the software. Should an update be available, the affected sonar will have its firmware details highlighted with orange text - regardless of if the unit is `Online` or `Offline`.
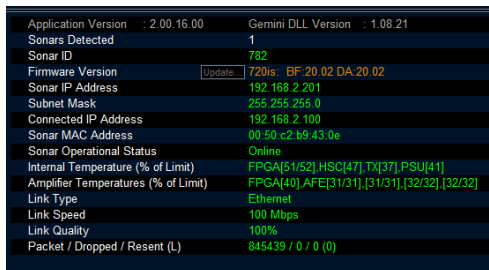
To update the firmware of the unit, ensure that the unit is `Offline` and click on the `Update` button.
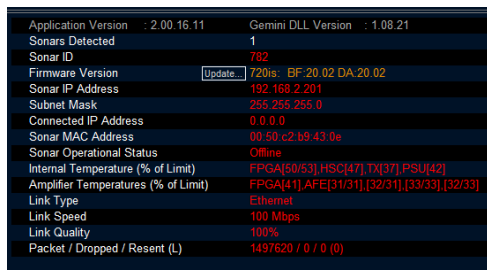
The software will then ask you to confirm the update process, giving details of the existing firmware and its replacement. Click `Ok` to proceed.
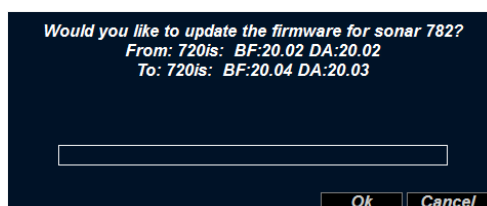
The firmware update process will start. It is a two step process and both must be completed in order for the firmware to be completely upgraded.

> Updating firmware for sonar 782.
> To: 720is: BF:20.04 DA:20.03
> Step 1 of 2
>
> Block 0 of 1, Packet 127, Retry 0
> Programming Succeeded
>
> Ok   Cancel

It is important that power to the Gemini is not disconnected at any point during the upgrade process

> Updating firmware for sonar 782.
> To: 720is: BF:20.04 DA:20.03
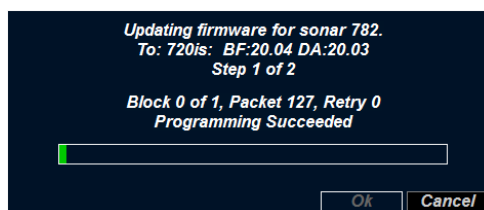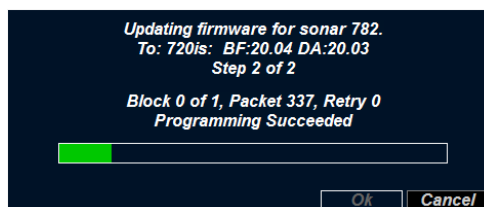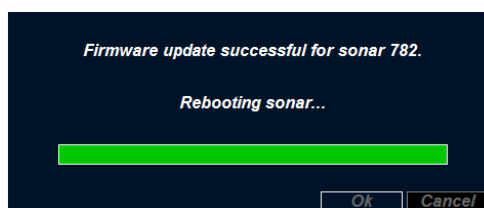> Step 2 of 2
>
> Block 0 of 1, Packet 337, Retry 0
> Programming Succeeded
>
> Ok   Cancel

Once both steps are fully completed the Sonar will reboot in order to finalise the upgrade process

> Firmware update successful for sonar 782.
>
> Rebooting sonar...
>
> Ok   Cancel

Once rebooted, the update progress window will remain visible until the `Ok` button is clicked.

> Firmware update successful for sonar 782.
>
> Ok   Cancel
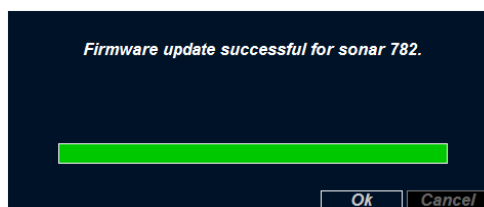
Once fully updated the `Update` button will no longer be visible and when connected `Online` all the Sonar details will be in green text.

Application Version	: 2.00.16.11	Gemini DLL Version	: 1.08.22
Sonars Detected		1	
Sonar ID		782	
Firmware Version		720is: BF:20.04 DA:20.03	
Sonar IP Address		192.168.2.201	
Subnet Mask		255.255.255.0	
Connected IP Address		192.168.2.100	
Sonar MAC Address		00:50:c2:b9:43:0e	
Sonar Operational Status		Online	
Internal Temperature (% of Limit)		FPGA[56/56],HSC[50],TX[40],PSU[45]	
Amplifier Temperatures (% of Limit)		FPGA[42],AFE[31/31],[31/31],[32/33],[32/32]	
Link Type		Ethernet	
Link Speed		100 Mbps	
Link Quality		100%	
Packet / Dropped / Resent (L)		1657754 / 0 / 0 (0)	

If your Gemini Sonar fails to update correctly please contact *Tritech International Ltd* for assistance.

5.5. Multiple Head Operation

Note

The following instructions refer to a Gemini Sonar with a 120° swathe. Other products within the Gemini range may have differing swathes, but the same basic principles described apply.

The number of heads connected to a system can be selected using the drop-down list on the right-hand pane of the `Advanced` screen.

> Choose the type and number of Gemini Sonars
> Sonar Type   Imager   3
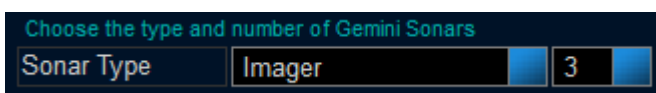
The first time the number of heads is altered the sonar display will place the sonars side-by-side in a line. Any subsequent alterations to the position or rotation of each sonar image is stored and recalled when the Gemini software is restarted.
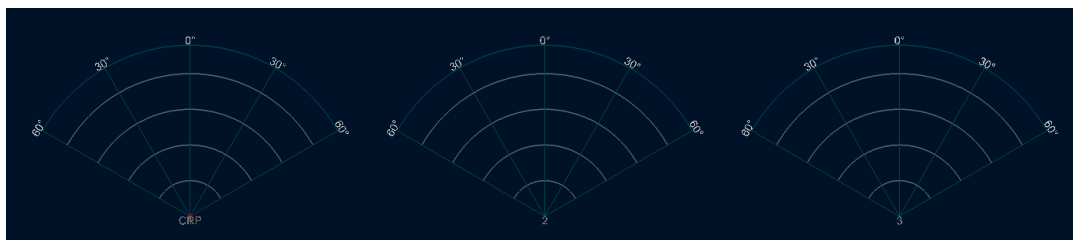
The position of the sonar images can be altered using the text fields listed under `Choose and position the sonars`. Each text field is editable and allows the sonar scans to be moved around in relation to a central reference point. The default is as follows:

Sonar ID	Fwd (m)	Stbd (m)	Heading (°)
1	0.00	0.00	0
2	0.00	25.00	0
3	0.00	50.00	0

Example Layout

Changing the position values as follows:

Sonar ID	Fwd (m)	Stbd (m)	Heading (°)
1	0.00	0.00	0
2	0.00	0.00	-120
3	0.00	0.00	120

Will arrange the sonar images in a circle:
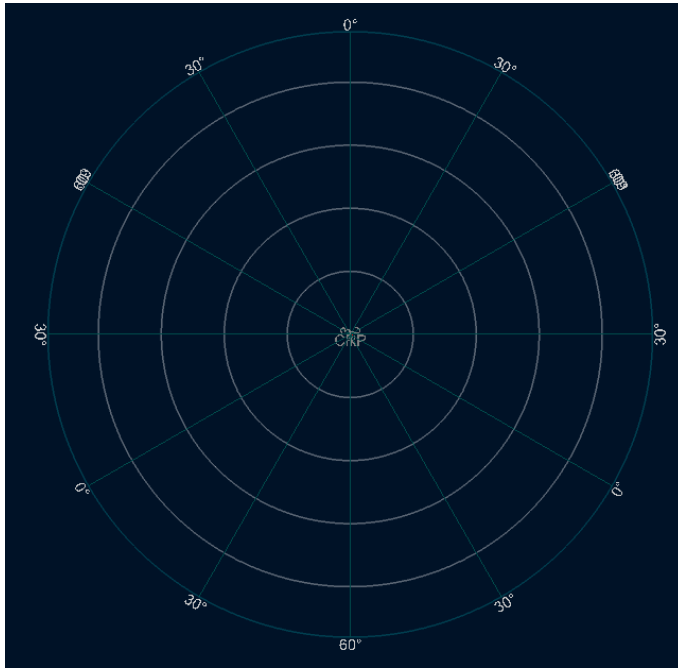
Note

Turning off the range lines and text can improve the display.

In this case, sonar 1 is looking forward while 2 and 3 are looking aft. There is no overlap and each sonar is displaying a full 120° arc.

Overlapping sonars is also possible and any images generated will be a combination of echoes from both heads:

5.6. Offline Mode

If for some reason when the software is started it cannot initialise communications with the Sonar (for example if another instance of the software already running) the following warning will be displayed:

The software will then open with a cut down user interface which will allow the replay of data which have already been recorded, but all the controls associated with the Gemini Sonar will be removed.
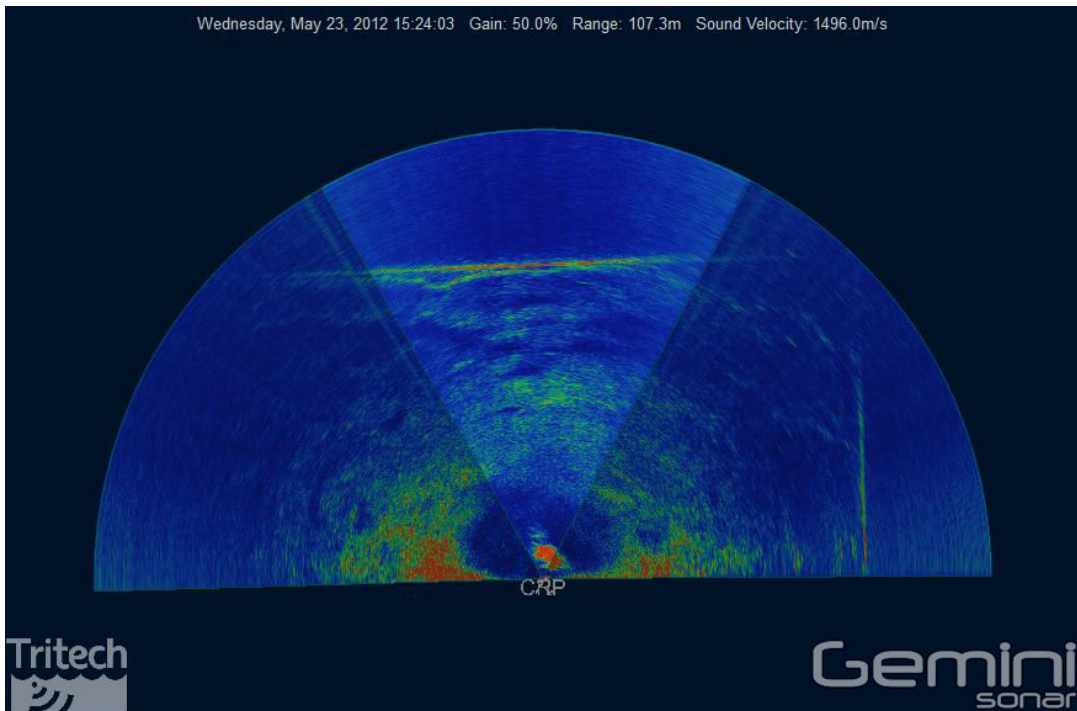
Those controls which are present work in exactly the same way as if communications with the Gemini Sonar was possible, and as described earlier in this manual.

5.7. Automatic Online

Once the Gemini Sonar and the Gemini software have been configured so that they can communicate successfully, when the Gemini software is started it will automatically start imaging as soon as it detects the presence of that Sonar. This allows unattended start up of the Gemini software and system.

This functionality can be disabled by adding the command line switch `/noautoonline` to the command which starts the Gemini software.

5.8. Settings Files

The Gemini software stores all the settings in the file `C:\GeminiData\Settings\Gemini.xml`. A backup of this file can be kept as a record of all the Gemini settings. When contacting *Tritech International Ltd* Technical Support it may be necessary to supply a copy of this file.

The Gemini software keeps a historical log of settings files in the folder `C:\GeminiData\Settings`, with folder and file names automatically generated from the date and time. This can be useful for restoration of previously known good settings. To use a previous settings file:

1. Shut down the Gemini software.

2. Delete (or rename) the `C:\GeminiData\Settings\Gemini.xml` file.

3. Copy the historical settings (*.xml) file into the location `C:\GeminiData\Settings` and rename it to `Gemini.xml`

4. Start the Gemini software.

A factory settings file is stored in the install folder (normally `C:\Program Files\Tritech\Gemini\Factory.xml`). To revert completely to the factory settings file:

1. Shut down the Gemini software.

2. Delete (or rename) the `C:\GeminiData\Settings\Gemini.xml` file.

3. Start the Gemini software.

5.9. Keyboard Shortcuts

A number of keyboard shortcuts are available for commonly used activities.

F7   Toggle Logging of data

Ctrl F   Capture the screen to file

A   Increase gain

Z   Decrease gain

D   Increase range

C   Decrease range

B   Decrease sonar swathe

G   Increase sonar swathe

6. Seanet Pro Installation

6.1. System requirements

	Minimum	Recommended
Processor	2GHz	2GHz dual core
RAM	1GB	2GB
Graphics	3D hardware accelerated graphics card.	
Display	1280x1024 (32bit colour)	1600x1200 (32bit colour)
Disk space	Install is 20MB, greater than 160GB recommended for log files	
Networking	100Mbit·s⁻¹ (fast Ethernet)	1000Mbit·s⁻¹ (Gigabit Ethernet)
Software	Windows XP® 32bit	Windows® 7 32 or 64bit

## 6.2. Installing Seanet Pro

Seanet Pro is supplied on a CD-ROM which has been designed to auto-run upon disc insertion. The latest commercial release of software is always available from www.tritech.co.uk.

Once loaded, the main menu of the CD will be shown on screen.
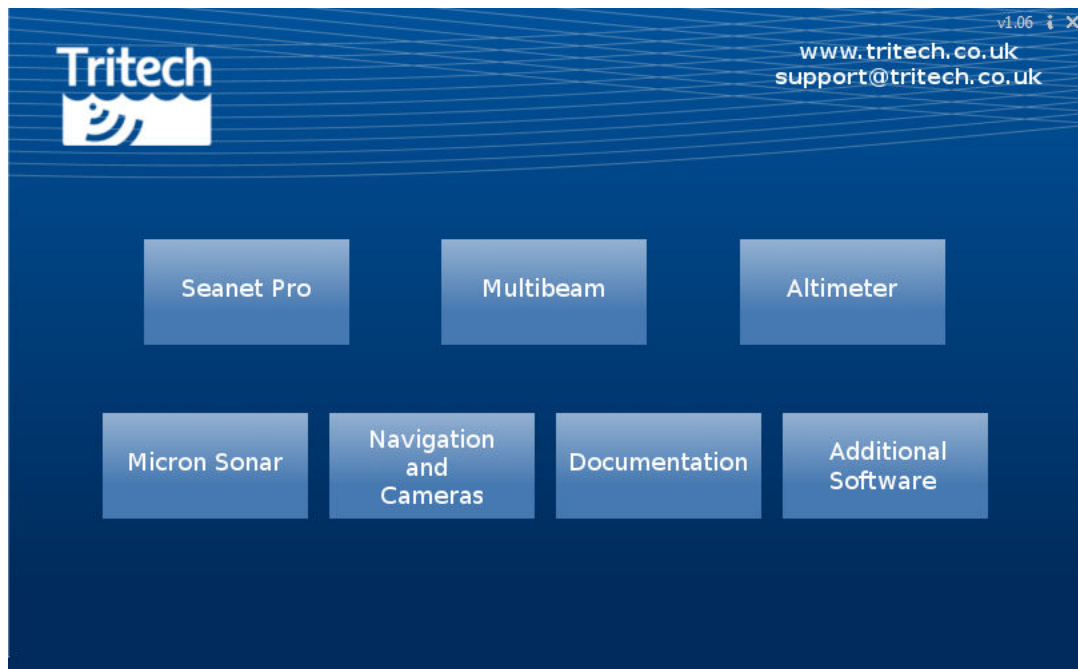
Click on the `Seanet Pro` button and the following screen will display all the appropriate software packages for installation.
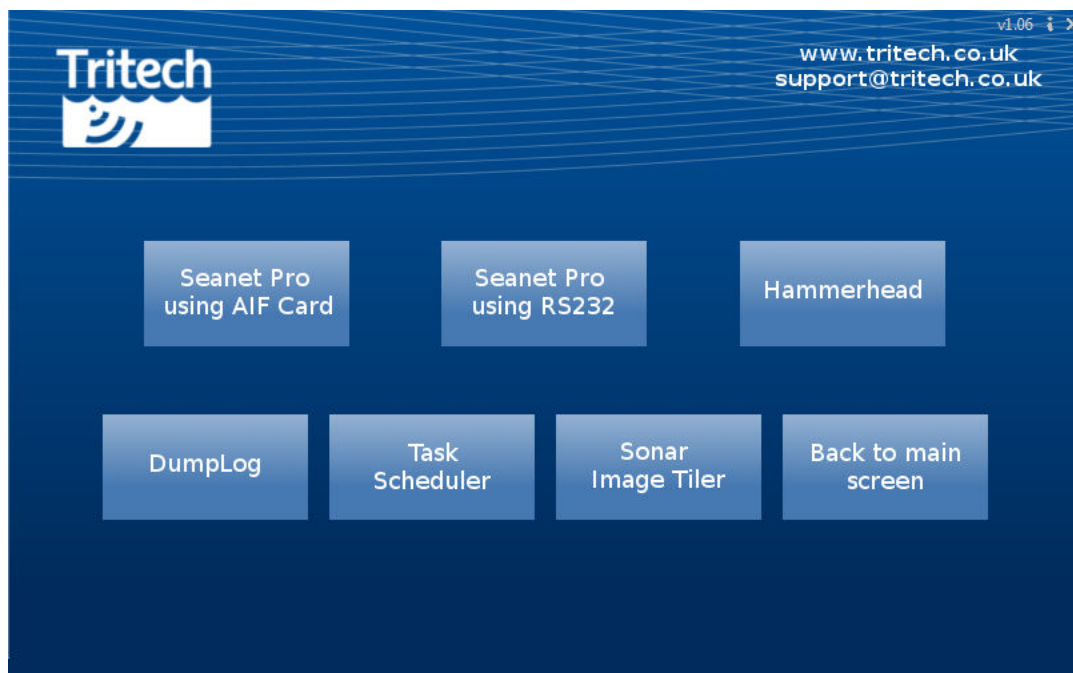
Click on the appropriate installation option and then follow the onscreen prompts and instructions.

- `Seanet Pro using AIF Card` - select this option if you are using a SCUv4, or PC equiped with a PCI AIF card.

- `Seanet Pro using RS232` - select this option if you are using a SeaHub, MicronNav Hub, PC or Laptop with either hardware COM Ports or USB converters.

- `Hammerhead` - this option installs a modified version for use with the Super SeaKing Hammerhead sonar.

- `Dumplog` - this option installs an additional software package for post-processing data files.

- `Task Scheduler` - this option installs an additional software package to automate the recording of logfiles with Seanet Pro.

- `Sonar Image Tiler` - this option installs an additional software package that can mosaic sonar imagery from Seanet Pro onto background images.

Note

Do not attempt to remove the CD-ROM from your computer during the installation process.

After installation of the appropriate software package, ensure that connection to the sonar is possible by changing the sonar and computer IP addresses so that the Ethernet link can work (since VDSL connections are bridged to Ethernet this also applies if using the sonar in VDSL mode).

Note

For instructions on setting the computer and sonar head IP address please refer to Appendix A, *Setting the computer IP address in Windows® XP* and Appendix D, *Setting the Gemini Head IP Address in Seanet Pro*

The final check to see if the correct changes have been made to the Gemini Sonar is to run `Seanet Setup` from the desktop icon to display the Node table. If the change of the sonar's IP address has been successful, the sonar should be listed in the node window.

Note

In order to correctly run the Gemini head on a SCU the SCUv5, or later, is required. Contact *Tritech International Ltd* for more details of the SCUv5.

7. Seanet Pro Operation

Note

This section details the aspects of Seanet Pro that are specific to the Gemini Sonar. For more general information (particularly if integrating with other devices) please see the Seanet Pro Software Manual which is available online at www.tritech.co.uk
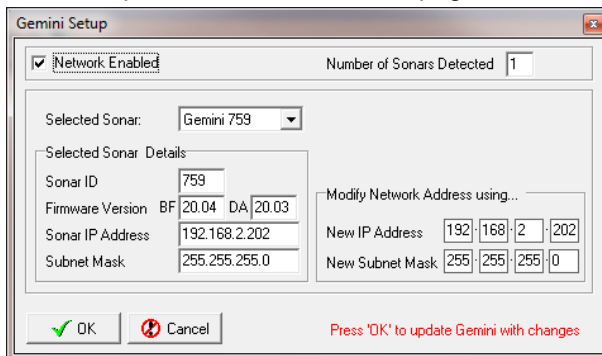
Before starting operations, run Seanet Setup to verify that the Gemini LAN is enabled and any connected devices, including the Gemini sonar, are detected. In Seanet Pro, the Gemini Sonar has been allocated the node range from 100 to 103.

7.1. Seanet Setup for Gemini

Click on `Gemini LAN` from the `Setup` menu.
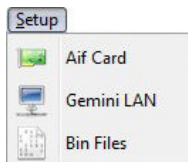
This will open the `Gemini Setup` page.

Gemini Setup

Network Enabled	Ensure this box is ticked to load the Gemini Connection DLL and start the Gemini Network. The box can remain permanently ticked thereafter.
Number of Sonars Detected	When the network is enabled, this will display the number of Gemini Sonars that are currently detected and broadcasting on the network.
Selected Sonar	The drop-down list will display the ID Numbers of all the Gemini Sonars currently connected. Select the Gemini Sonar that you wish to configure.
Selected Sonar Details	When the selected item in the 'Selected Sonar' drop-down list is changed, the details of that particular Gemini Sonar will be displayed here. These details include; unique Sonar ID, Firmware Versions, broadcasting Sonar IP Address and Subnet Mask.

Modify Network Address	The Sonar IP Address and Subnet Mask should be in the same range as the Computer IP Address and Subnet settings. To program a different Sonar IP Address and/or Subnet Mask into the selected Gemini Sonar, change the values in this panel and then click 'OK' on the main form to upload these changes into the Sonar.

Once the Gemini LAN is enabled and a Gemini Sonar connected ensure that Seanet Pro is using its Setup Application.
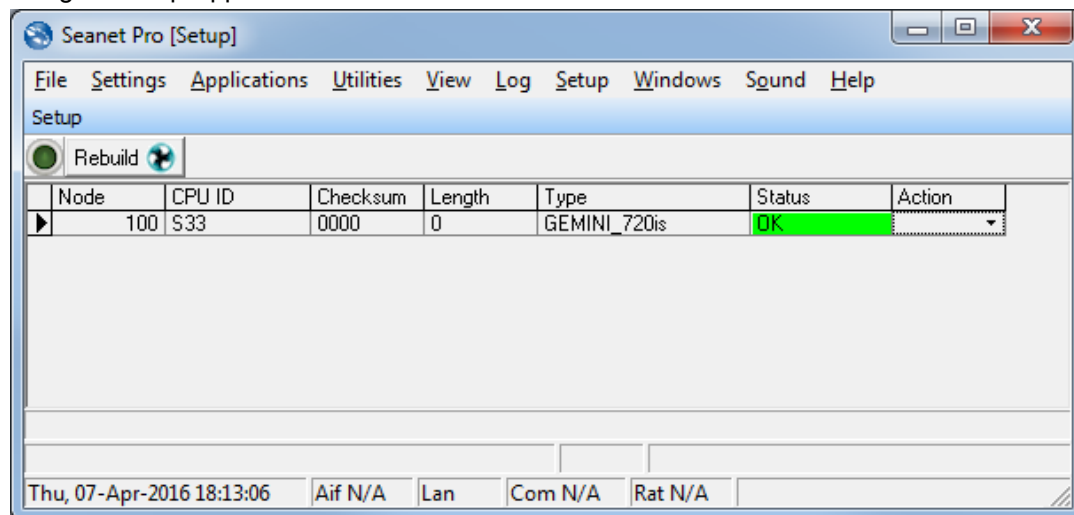
The Gemini will be displayed in the Seanet Setup Node Table.

The `Status` column will indicate the current state of the Gemini unit that has been detected.

A Status of `OK` means that the unit has the latest firmware and is immediately available for use.

A Status of `Change IP Addr` means that although Seanet Pro can detect the Gemini unit, it may not be usable as the IP addresses are not in the same subdomain. In order to establish full communication the IP address of either the computer or Gemini will need to be changed.

A Status of `Update Fpga` means that the firmware installed in the detected Gemini may be out of date. The firmware can be updated by Clicking on the `Action` column and selecting `Program FPGA`. Follow the onscreen instructions to complete the process.
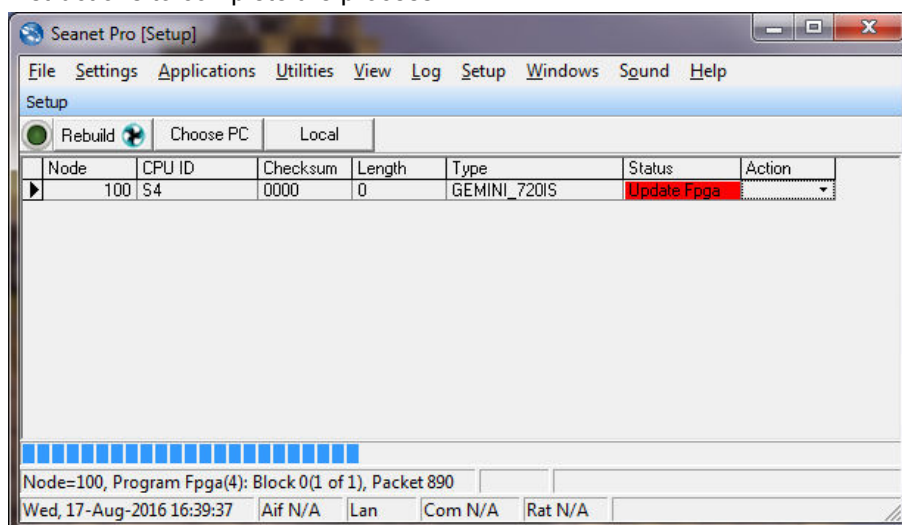
Do not interrupt power to the Gemini while updating the firmware.

Click on `Setup` in the `Action` column to open the `Gemini Cfg Setup` dialog.

Gemini Cfg Setup

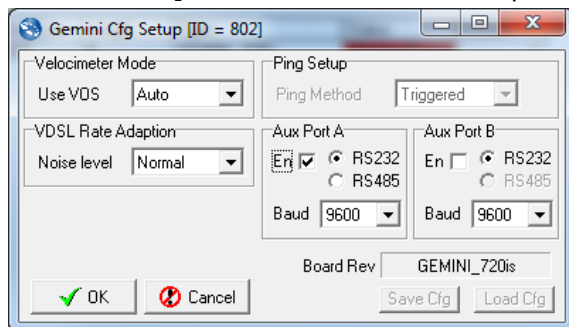Velocimeter Mode   Set to 'Auto' to apply the in-built velocimeter speed of sound calculation to the sonar data. Set to 'Manual' to revert to a fixed speed of sound. This fixed speed of sound is the manual V.O.S. (Velocity Of Sound) setting configured in the Environment dialog from within Seanet Pro.

Ping Setup   The two modes of operation are `Triggered` and `Continuous`. In `Triggered` mode the Gemini will be sent continual triggers where one trigger will instruct the Gemini to ping once. Each time Seanet receives data for the current scan, it will respond and send the next trigger to the Gemini to instruct it to perform the next ping. This turnaround is half duplex in nature. In `Continuous` mode, Seanet Pro sends one command at start-up which instructs the Gemini Sonar to ping continuously. For both modes an inter-ping time delay is also sent to the Sonar to control the scan update rate. This `InterPing Period` is set in the `Setup` dialog accessed through the `Tools` menu in Seanet Pro.
Note that for the Gemini 720is only the `Triggered` mode is supported.

VDSL Rate Adaption   The Seanet Pro software allows three different settings to be applied to the VDSL link, to cope with different levels of electrical noise experienced by the cable to the Sonar. The dropdown menu allows selection of 'Normal', 'Medium Noise' and 'High Noise'.

Aux Port A / B   The Gemini 720is contains two additional data ports capable of bi-directional communication. At present Seanet Pro is only able to process one of the ports, so the `En` checkbox determines which Port is actively being used.
Port A is capable of support RS232 or RS485 data communications. Port B can only support RS232. Both ports are able to support baud rates between 9600 and 115200, which the drop down selection being used to confirm the required data rate. Data being passed through the Gemini will be automatically decoded by Seanet Pro and displayed in the Gemini application window to the right of the sonar controls. The data can also be outputted via the REMV4 program.

Note

Only change `VDSL Rate Adaption` if difficulties are being experienced communicating with the Gemini Sonar. Whenever a `Medium Noise` or `High Noise` setting is selected, on initial startup of the Gemini, the VDSL communications will take several seconds to find it's optimum rate. During this

---

period of rate adaption, the top-left of the Sonar screen will indicate the status text `Acquiring…` (in red text).
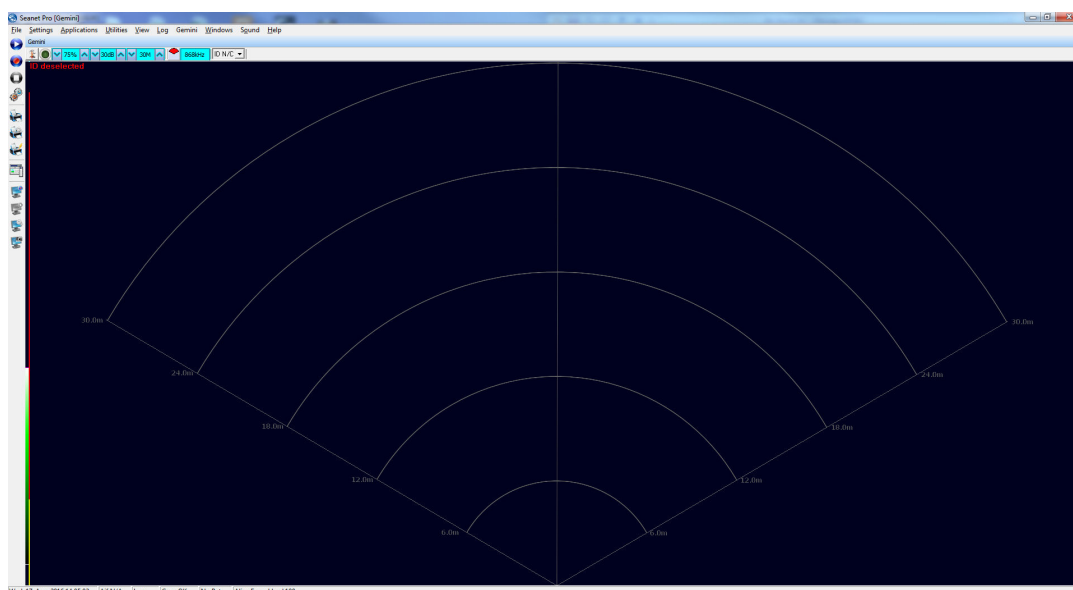
Once all changes have been made, click on `OK` to update the Gemini.

7.2. Gemini Sonar Application

> ### Note
>
> Refer to the Seanet Pro Software Manual manual for a comprehensive description of the menu bar, buttons, status bar and general features. This section shows only those specific to the Gemini Sonar Application.

The Gemini Sonar display is very similar to the standard Sonar display used for *Tritech International Ltd* mechanical sonar heads such as SeaKing and SeaPrince. However, the Gemini Sonar has a sector width of up to 120° and, like the SeaKing range of sonar heads, has the ability to alter the scan sector size and position adjustments.

> ### Note
>
> If a Gemini Narrow Beam Imager is connected then the scan size will automatically update to 130°.

7.2.1. Sonar Settings

The Gain, Contrast and Range controls relate to C1 – C3 respectively on a Remote Access Terminal (RAT). Function buttons F1 & F2 will become active whenever a multi-device or multi-window application is selected from the `Applications` menu. These controls will cycle through and maximise the device windows.
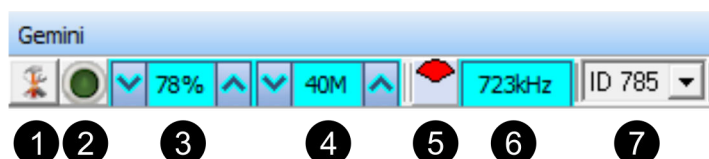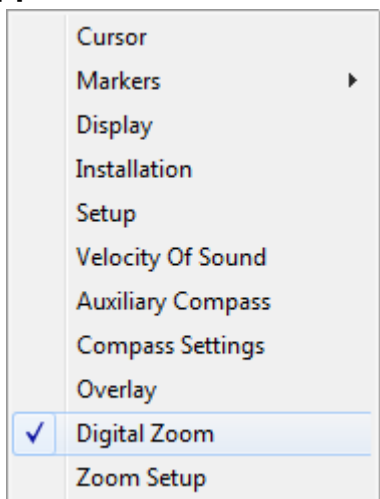
1. `Application Tools` Clicking on the tools icon on the left of the Sonar Settings Bar will open the Application Tools menu

2. `Application On, Off, Pause` This doubles as a pause button and a status indicator. Clicking on the button will pause the signals from sonar to Seanet Pro and pause the screen from refreshing. Green indicates normal operation, red indicates the sonar is paused and yellow shows sonar data from a log replay.

3. `Sonar Gain` (RAT: C1) sets the sonar receive gain as required – typically this is around 20% - 50% but is varied according to water and target conditions and user preference.

4. `Range` (C3) sets the maximum range the sonar will scan. Long ranges are scanned more slowly than short ranges due to the limit imposed by the velocity of sound in water.

5. `Scanned Area Indicator` indicates, in the colour red, the size and position of the scan sector. This control will update according to the settings of the `Sector Width` and `Sector Center` controls.

6. `Sonar Tx Frequency` This is acoustic Transmit Frequency of the currently connected Gemini Sonar.

7. `Selected Sonar` Use this option to select the sonar ID to display on the main screen, the drop-down list will display the ID of all the Gemini sonars currently connected.
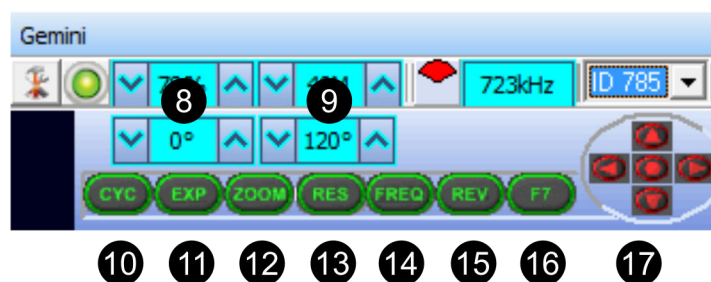
8. `Sector Center` (RAT: C4) sets the center point around which the `Sector Width` is based.

9. `Sector Width` (RAT: C5) sets the width of the area to be esonified.

10. `Cycle Window` (RAT: F1) can be used to switch between active devices within the Seanet Pro Application, when the display is maximised (using the `Expand` (F2) button).

11. `Expand Window` (RAT: F2) will toggle between maximising the current device to fill the available screen space, or show all devices in a multi-device Seanet Pro Application.

12. `Zoom` (RAT: F3) activates the relevant zoom function of the sonar. If CHIRP is enabled on the Gemini, this will be an acoustic zoom (performing extra data sampling in the zoomed area), otherwise it will be a digital zoom.

13. `Sonar Resolution` (RAT: F4) this control is disabled for the Gemini range.

14. `Sonar Frequency` (RAT: F5) this control is disabled for the Gemini range.

15. `Reverse Scan` (RAT: F6) this control is disabled for the Gemini range.

16. `Start Log` (RAT: F7) this can be set to begin recording a log file. This function is normally disabled, but can be enabled through the `Log-Log Setup` drop down menu.

17. `Sector Quick Select` this can be used to reset the `Sector Center` and `Sector Width` back to the default settings by pressing either the middle or top red icon.

7.2.2. Application Tools

Click on the Tools icon on the left of the Sonar Settings Bar to open the popup menu which includes all the Application Tools for the Gemini Sonar.

> **i** **Note**
>
> The popup menu can also be accessed by a right mouse button click on the Sonar display.

Cursor

Adds the cursor position panel to the sonar display.

Figure 7.1.

The `Polar` check box changes the output display co-ordinates from Polar (Range & Bearing) format if enabled to Cartesian (X, Y) format if unchecked.
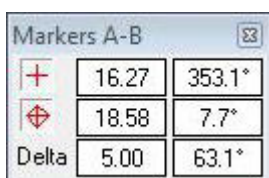
Markers

Figure 7.2.

Adds A and B markers onto the sonar display, the range and bearing to each marker & separation and relative bearing are shown.

Click on the symbol to deploy on the `Marker` panel and that marker symbol will be dropped at the Origin (0, 0) on the Sonar display. Then, pick up the Marker using the left mouse button and drag it to the position required.
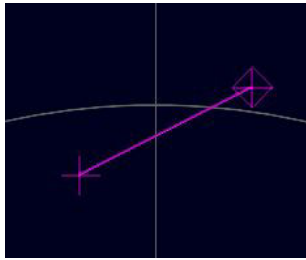
Figure 7.3.

When both markers are dropped on the display, a line will be drawn which connects them. The 'Delta' Range and Bearing at the bottom of the panel indicates separation and angle between both Markers.

There are 4 sets of Markers that can be implemented; A-B, C-D, E-F, G-H. The operation of each set is the same as A-B described above.

Display
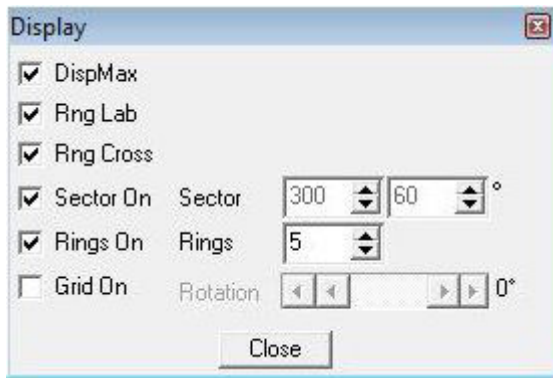
Figure 7.4.

Sets up sonar display options.

DispMax – Tick to expand sonar display vertically to fit window. If un-ticked will expand horizontally.

RngLab – Switch the Range Labels On / Off.

Rng Cross, Rings On, Rings, Grid On - Display Grid line options.

Sector On, Sector – Display a Sector overlay with left and right angular limit adjustment (in degrees).

Rotation – Rotational offset to correct Sonar heading – (Disabled for Gemini Sonar).

Installation

Figure 7.5.

This configures the location of the Sonar in the real world and enables the Geo-referencing of sonar targets on the sonar display.
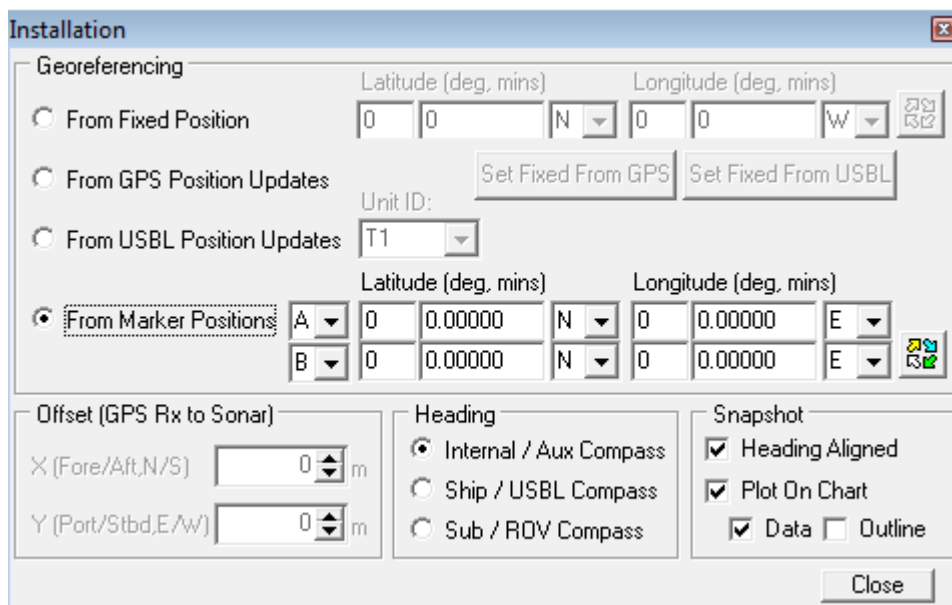
From Fixed Position	If there is no GPS input, select this option and input the Sonar position in Latitude and Longitude co-ordinates (DegMin or DegMinSec format). A Heading input will also be applied, else a zero degree heading is applied. If present it is also possible to set the fixed position from the USBL or GPS input so that they can be disconnected and the position will remain persistent – simply click the appropriate button "Set Fixed from GPS" or "Set Fixed From USBL"
From GPS Position Updates	If a GPS input is active, select this option. A Heading input will also need to be active for the Geo-referencing to be functional.
From USBL Position Updates	If a USBL input is active, select this option. A Heading input will also need to be active for the Geo-referencing to be functional.
From Marker Positions	This function requires an application with `Sonar` and `Nav` displays loaded (e.g., by selecting `Settings→Applications→Sonar Nav`). The chart of the `Nav` display is used to obtain the Marker position references to be used in this function. If a `Nav` chart is not used then the Marker positions must be manually entered in the `Sonar` display.
Offset (GPS RX to Sonar)	X and Y position offsets should be entered if there is any offset between GPS receiver and Sonar (e.g. for a ship hull mounted system). Or, for an ROV mounted sonar, if the GPS position updates are the position of a sub/vehicle then this offset may apply for the separation between a beacon/transponder and the sonar.
Heading	Use this option to select the source of the heading data. If using a sonar which contains an internal heading and compass device or if the compass is connected to the Aux port of the sonar select Internal/Aux Compass. If the compass device has been

connected through a COM port on the SCU or PC, or if a USBL system is in use then select Ship/USBL Compass. If the sonar is mounted to an ROV and both the ROV and support vessel have a compass it is possible to switch to the ROV compass by selecting Sub/ROV Compass.

Once position and heading data are present, the Cursor display will be extended to provide position co-ordinates when the mouse cursor is moved around the sonar plotter.

Note

There must be active sonar data, as well as position and heading data, for the position co-ordinates to be reported.

Aux Compass

Selecting `Aux Compass` will place a compass and pitch/roll display on the sonar screen. The data which is displayed is taken from the device selected in the `Installation` dialog.
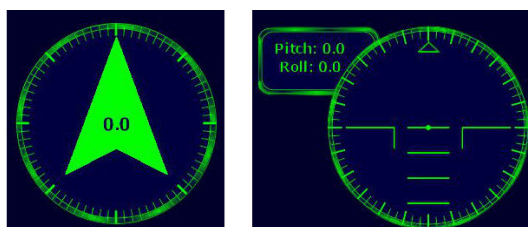
Figure 7.6.

Note

The compass and pitch/roll display are never displayed side-by-side as shown here, their position is at the top/bottom right of the screen by default but can be changed using the `Compass Settings` dialog.

Compass Settings
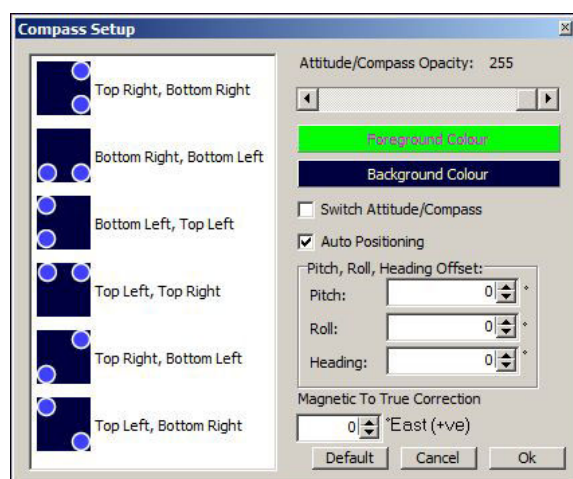
Figure 7.7.

The `Compass Settings` dialog allows configuration of the compass and pitch/roll sensor display on the main screen. The position can be selected only if `Auto Positioning` is first de-selected. Also colour and opacity can be controlled through this dialog.

If more than one sensor is available for selection this should be performed in the `Installation` dialog.

If an offset is required it can be entered here and the compass can be corrected for displacement of magnetic against True North.

Setup

Sets various Gemini Sonar head options for the currently selected Sonar ID.

```
Gemini Setup [ID = 759]                                    ☒
InterPing Period  Max Rate  ▼    Link Type  Ethernet
   Range Units  Metres      ▼    Link Speed  100Mbps
             Packet/Dropped/Resent  122847 / 0 / 0
    Chirp  Auto  ▼   No. Sample Bins  569
Flipped Head ☐   Inverted Head ☐   Auto Dynamic Range ☐
```
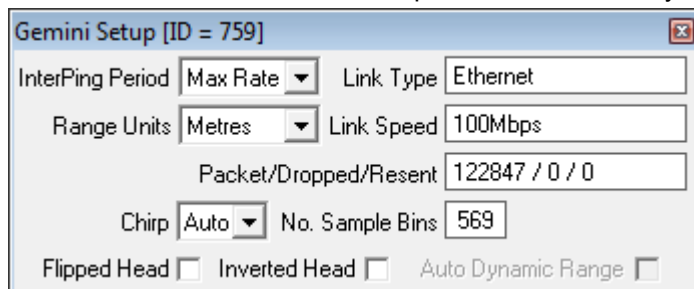
InterPing Period	This sets the time delay between successive Sonar pings. The 'Max Rate' will set the Sonar update rate to fastest achievable (up to 15Hz). Range, plot size and PC CPU specification will limit the maximum achievable rate.
Range Units	Select the display range units. Options are Metres, Feet, Fathoms, and Yards.
Link Type	This indicates the current type of communications link between the Gemini and surface. This can be either direct Ethernet or VDSL.
Link Speed	This is the Uplink transmission speed for the active Link Type. For Ethernet this will be either 10Mbit·s^{-1} or 100Mbit·s^{-1}. For VDSL this will be a rate that may be adapted according to the VDSL Rate Adaption setting – for the 'Normal' setting, the optimal Link Speed will be applied.
Packet/Dropped/Resent	This indicates, respectively, the Number of Packets transmitted from the Gemini, the Number of Dropped/lost Packets and the Number of Packet Resends attempted.
No. Sample Bins	This is the Number of Samples over the current Range scale.
Flipped Head	If the Gemini Sonar is mounted upside down (that is the sonar is positioned with the transmitter on the top rather than the design orientation with the transmitter at the bottom), ticking this box will flip the image from left to right, as viewed on the computer screen, so that the image still appears correctly oriented to the user.
Inverted Head	This is used when the Gemini sonar is mounted with the transducer pointing aft instead of forward
Chirp	This is used to select the CHIRP capabilities of the Gemini 720is unit. Note that the unit must have CHIRP capable firmware in order for this option to be selectable.

- `Off` - This setting will disable the CHIRP function

- `On` - This setting will enable the CHIRP function across all ranges

- `Auto` - This setting will allow the Gemini Sonar to control the CHIRP function based upon the range setting within Seanet Pro. Typically CHIRP will be switched On for ranges greater than 3M

Velocity of Sound

This panel displays the Velocity of Sound value being used by the Gemini Sonar. The Gemini is fitted with a Velocimeter which can be enabled/disabled in the `Gemini Cfg Setup` dialog.

The current displayed Velocity of Sound used value is what was applied to the current sonar scan. If Auto VOS is "OFF" then the Velocity of Sound used is based on the Manual VOS applied in the 'Environment' (e.g. click on 'Settings' – 'Environment' in Seanet Toolbar).

Note

The Gemini Sonar will apply Manual VOS in steps of 3.2m·s⁻¹, starting from the minimum limit of 1400m·s⁻¹. For example, if 1402.1m·s⁻¹ was set in the 'Environment' page then Gemini will round to nearest 3.2m·s⁻¹ step and consequently the 'Velocity of Sound used' will be returned as 1403.2m·s⁻¹

Overlay
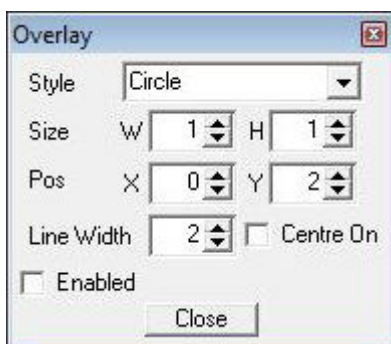
Figure 7.8.

When enabled, this option can be used to place and size an overlay shape or outline onto the Sonar display canvas.

Style	Select the type of shape from; Circle, Rectangle. Triangle.
Size	Set the Width and Height of the shape.
Pos	Move the Shape with X, Y position offset from display origin.
Line Width	Line width.
Centre On	Enable centre marker (+) for the shape.

Digital Zoom

The `Digital Zoom` will be selectable if Seanet Pro detects a Gemini 720is.

When selected, a Zoom box will appear on screen and is movable by pressing and holding the left mouse button and then dragging to the desired location.
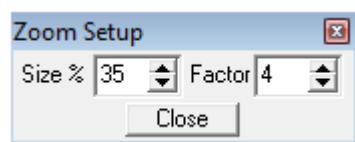
The area chosen by the Zoom box will be over sampled by the Gemini (for the Digital zoom option) in order to provide a higher resolution picture at that point. If Seanet Pro is recording a logfile, this additional data will be recorded alongside the normal imagery data.

### *Zoom Setup*


- `Size` - This sets the size of the highlighted zoomed area (red outline) as a percentage of the pop up Zoom window. For example a `Size` of 10% means that the highlighted zoom area will be 10% of the size of the pop up Zoom window. This control has a maximum value of 40%

- `Factor` - This sets the oversampling rate used for the zoom area. This control has a maximum value of 4.

7.3. Outputting data via REMV4

With the Gemini 720is setup to process an incoming serial data stream (see Section 7.1, "Seanet Setup for Gemini" for details) the incoming data can be set to output to external software packages using the REMV4 software.
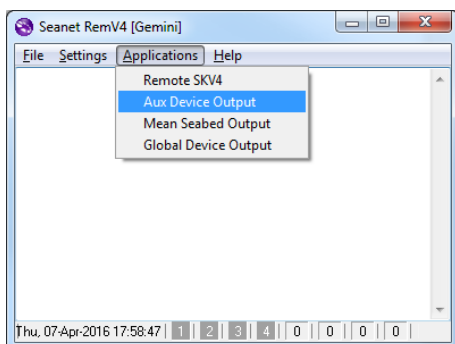
Locate the REMV4 icon on the system tray and double click it to show the main window. From the `Applications` drop down menu, select `Aux Device Output`.
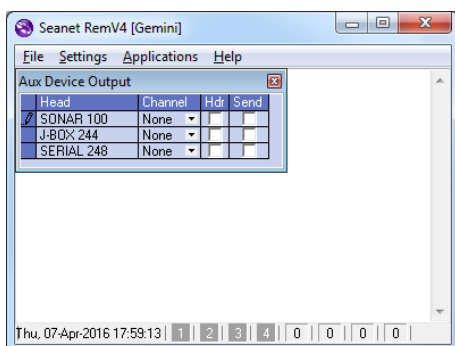
The Aux Device Output window will now be visible. The Port A or Port B data stream will be available on the `SONAR XXX` head, where `XXX` is the node number given to the Gemini unit by Seanet Pro.
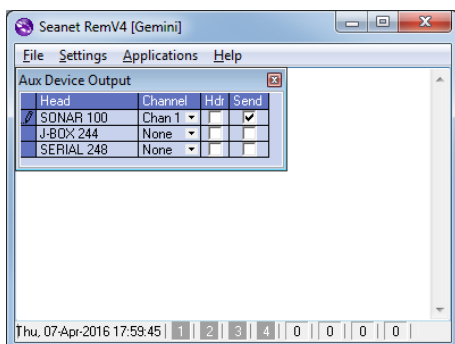
For the appropriate head, select the `Channel` to output the data on and, once configured, enable the `Send` box. Data will now be transmitted by REMV4.

For more details on the operation of REMV4, please see its associated Product Manual: *0706-SOM-00004*.

8. Maintenance

8.1. After using Sonar

Make sure that after using the sonar head that it is washed down with fresh water and check the unit for any signs of obvious damage. Pay particular attention to the transducer head and free any organic matter which has become trapped. Once the unit is clean; dry thoroughly and place in storage container.

8.2. If storing the sonar for extended periods

Make sure that the sonar is completely dry (if necessary leave to dry in air before stowing). Pack into storage container along with several pouches of silica gel.

8.3. Regular maintenance

Caution

It is essential to have a regular maintenance schedule so that any defects arising from corrosion or erosion can be spotted early and corrected before they cause severe damage to the unit. It is recommended that the unit is annually serviced and can be returned to Tritech International Ltd for this purpose.

Although the Gemini range is not field serviceable regular care and maintenance of the unit should be carried out. Ensuring that the electrical connectors are clean and free of corrosion will aid in preserving the working lifespan of the unit. Particular care should be taken for units that use an o-ring seal on the connectors and blanking caps to ensure that these o-rings are seated properly.

Regular visual inspection of the unit around the areas where salt build up can occur will help highlight any potential issues of corrosion and allow for corrective action to be undertaken before any integrity failure of the unit. The areas around the Transmitter and Receiver array should be inspected, as well as the VOS sensor. The mechanical interface between the bulkhead connectors and housing elements should also be inspected.

As part of a regular visual inspection cycle it is recommended that the front panel of the Gemini be removed in order to clean around the front elements of the sonar.
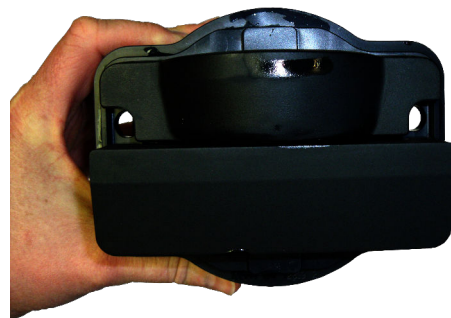
Using a M3 Allen key, unscrew the top and bottom retention screws from the cover.

Once both screws have been removed, gently pull the cover away from the main body of the sonar.

The area surrounding the transmitter and receiver can now be visually inspected for any salt deposits and cleaned as appropriate.

Note

To reattach the cover, simply reverse these steps.

Caution

Do not deploy the Gemini without the cover being attached to the unit.

It is recommended that Gemini units be returned to Tritech as part of a regular maintenance schedule. An annual return is highly recommended, but this can be lengthened, or shortened, by various factors:

• Frequency of use

• The operating environment (i.e. salinity, temperature)

• The presence of any galvanic action from dissimilar metals, or case voltages

9. Troubleshooting

The software reports that no sonars are detected

VDSL System – Check the VDSL link light on the Gemini Hub (note that it may take up to 1 minute to establish a stable VDSL link). If there is no VDSL link light then check all cabling between Gemini Hub and the sonar and verify that the sonar is powered correctly with appropriate voltage at the sonar. If there is a VDSL link light then the sonar is operational and the problem will be either the network connection between Gemini Hub and the PC or the network configuration on the PC.

Ethernet System – Check all cabling to the sonar and verify that it is powered correctly with appropriate voltage at the sonar. Also check that the correct cable is in use - for Ethernet systems this needs to be a cable of at least Cat5e standard. If the sonar has successfully established a link then the problem will be with the network settings on the PC.

Note

Ethernet connection requires Cat5e cable for the entire cable run (max 80m) – lengths of untwisted cable must be kept to an absolute minimum.

All Systems – Some firewalls have been known to cause this issue. Contact the network administrator for advice if the sonar is connected to a network where disabling the firewall would present a security risk.

Sonar goes offline while operating on deck

The sonar head outputs heat to the body casing (using it as a heatsink) which is dissipated to the surrounding water during normal operation.

In order to protect the internal electronics from damage due to overheating a thermal cut-off will shut down the sonar if it gets too warm. It will be necessary to allow the unit to cool down before it will operate again.

The unit should not be operated out of water for extended periods.

Sonar is present but will not ping

VDSL System – Check the reported link speed – it must be greater than 10Mbit·s^{-1} downstream to function correctly. If it is less than this then the cable run is either too long or the VDSL twisted pair is of poor quality.

All Systems – Check your network settings on the PC. Typing "route print" from the command line will show the PC routing table. The sonar and PC must be on the same subnet and the PC's routing table needs to be set up so that packets are routed correctly to the sonar. If the sonar is receiving ping requests then the IP address of the PC will appear in the "Connected IP Address" field in the advanced settings page of the software.

If the sonar is connected to the PC then the most likely cause is particularly bad packet loss on the network between sonar and PC.

i

Note

The sonar will only respond to ping requests from IP addresses on the same subnet as the sonar. Some firewalls have been known to cause this issue. To view the computers routing table type "route print" from the command line.

Update rate is slow and there are sometimes large gaps between pings

VDSL System - The VDSL link is susceptible to electrical noise induced by turning other devices on and off such as thrusters on an ROV. If the link keeps going down try using the "Medium Noise" or "High Noise" VDSL setting in the advanced option. Higher Noise settings trade off speed for reliability of the network link. This may reduce the ping rate slightly but the link will be more reliable in the presence of noise. Check all connectors on the VDSL twisted pair, poor contacts have been known to cause this issue.

Ethernet System – There may be noise induced onto the Ethernet cables, be sure to route these as far away as practicable from noise sources.

All Systems – Some poor quality PC network cards have problems with the large data rate from the Gemini sonar and drop a significant amount of packets. If you have large packet loss, try updated network card drivers and a different brand of network card. Also check that the PC and graphics chipset meet the minimum spec.

Velocimeter reports unrealistic speed of sound

This is often caused by bubbles forming on the metal faces at the front of the sonar, particularly if the sonar has been stationary for an extended period of time in a tank. Wiping the surface to remove bubbles should resolve the issue.

Appendix A. Setting the computer IP address in Windows® XP

The following instructions apply to a computer running Windows® XP, though the sequence for other operating systems will be similar.

If the computer is connected to a network already, disconnect it from that network.

From the Start Menu select Control Panel. From the Control Panel Explorer window that opens, double click on Network Connections. From the list of available network connections that opens, double click on the Ethernet connection which will be used to connect to the Gemini head.

Click the Properties button on the dialog which opens. This will open a dialog which looks like this:

Scrolling the "This connection uses the following items" box will reveal an item titled "Internet Protocol (TCP/IP)". Click this item to select it, and then press the Properties button. The following dialog should open:
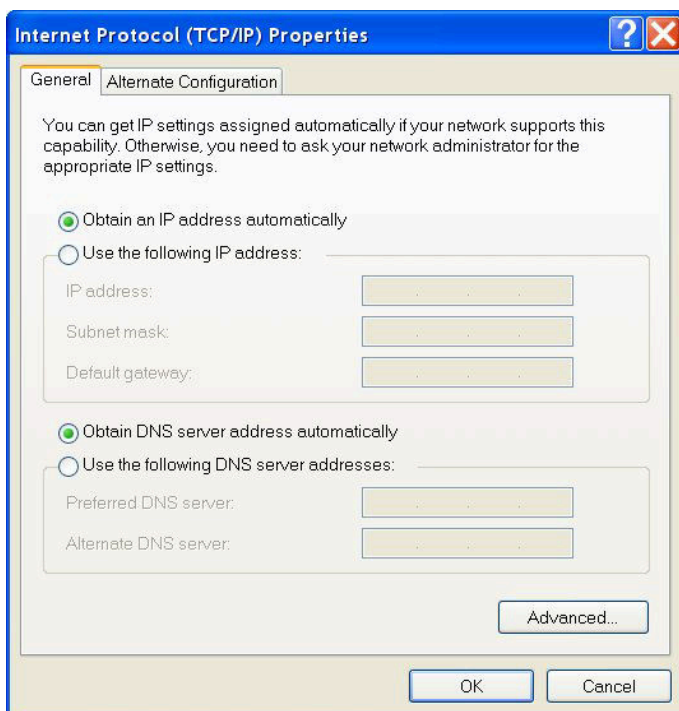
Make a note of the settings as currently used by the computer; these will be needed to restore the computer to any existing network. Refer to the appropriate section of this manual for the correct IP address to use.

The following screenshot shows the dialog after those changes have been made:
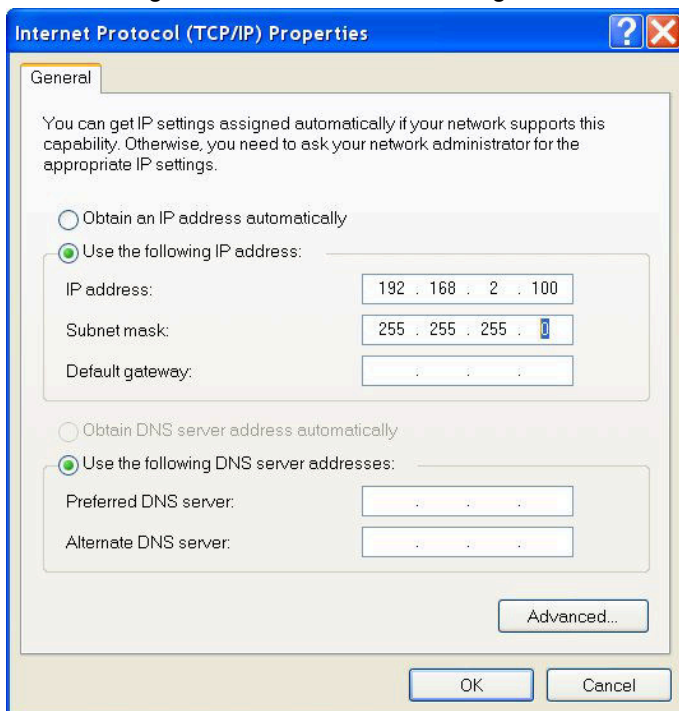
Appendix B. Setting the computer IP address in Windows® 7 or Windows® 10

The following instructions apply to a computer running Windows® 7 or Windows® 10, though the sequence for other operating systems will be similar. All screenshots are from a Windows® 7 installation.

Disconnect the computer from any existing network.

First click on the Start Menu and select `Control Panel`.
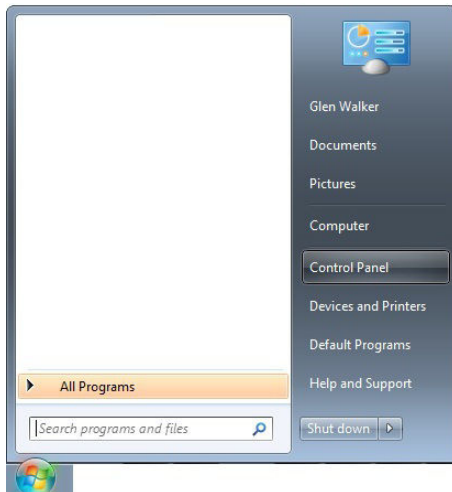
Under `Network and Internet` click on `View network status and tasks.`
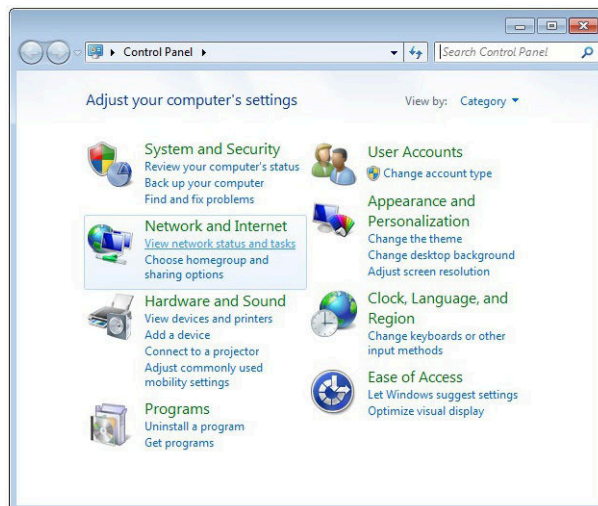
This will bring up the `Network and Sharing Center` which allows configuration of any networks on the computer. Click on `Change adapter settings` on the left-hand pane.

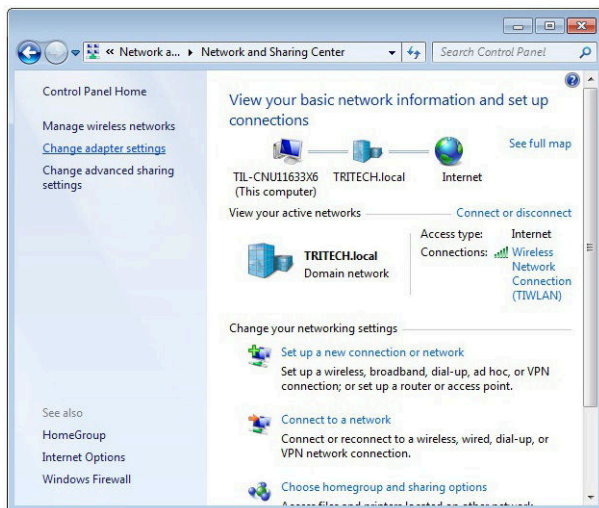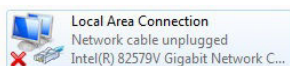A list of attached network devices should now present itself. Find the one which the Gemini head is to be connected to and double-click on it.

The `Local Area Connection Properties` dialog should be displayed. Find the entry labelled `Internet Protocol Version 4 (TCP/IPv4)`, select it and then click on the `Properties` button.
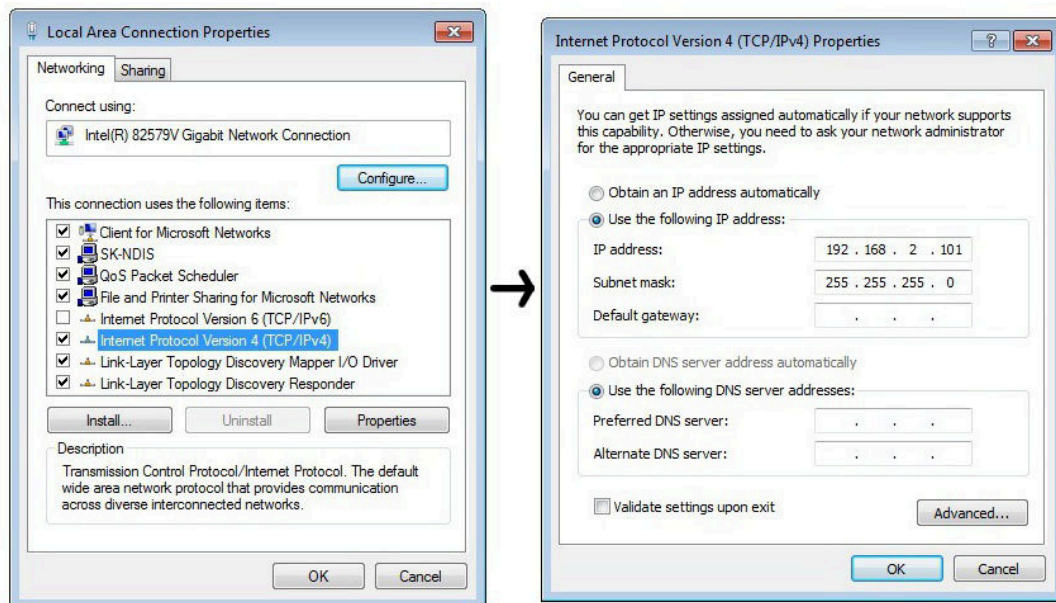
In the properties dialog which opens there will either be `Obtain an IP address automatically` or `Use the following IP address` selected. If an IP address is already present, make a note of it before changing any values since it will be needed if the computer is ever restored to the previous network. Refer to appropriate section of this manual for the correct IP addresses to use.

Appendix C. Setting the Gemini Device IP Address in Gemini Software

These instructions are applicable to any Gemini device.

For a Sonar or Profiler
Enter the ID into the `Sonar` box of the Advanced Configuration options (upper right hand side of the screen).

For a Hub
Enter the ID into the `Hub ID` box on the `Hub Setup` tab.

After starting the Gemini software and connecting a Gemini device click the `Advanced` tab at the upper left hand side of the screen to show the advanced settings screen, and expand the `Device Network Details` area by clicking the + button next to it.
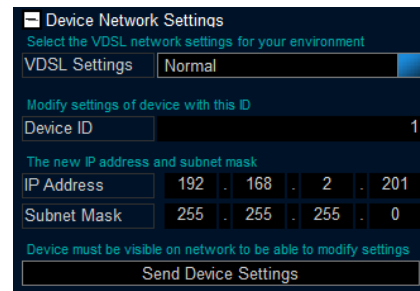
Note

The Gemini device should be connected directly to the computer and any other Gemini devices should be disconnected.

Once the ID of the Gemini has been entered at the top of the screen, the details for the new IP address can be entered. Three items need to be entered, the `Device ID` (to ensure that the correct Gemini is being altered), the new `IP Address` and the new `Subnet Mask`. Once these details have been entered, pressing the `Send Device Details` button will start the process of changing the IP address. A dialog box will open, requesting confirmation of the change.

Note

If the Gemini is online then it will not be possible to alter the IP address details. Make sure that the Gemini is offline before trying to change it.

Clicking the `Yes` button will program the new IP address details into the Gemini. The new IP address followed by a reboot command will be sent. When the device reboots it will be using the new IP address, and therefore will not show up on the status display. Once the IP address of the computer has been changed back to its original settings the Gemini should once again appear on the status display.

Appendix D. Setting the Gemini Head IP Address in Seanet Pro

Run `Seanet Setup` and click on `Gemini LAN` in the `Setup` menu.

This will open the `Gemini LAN Setup` dialog.
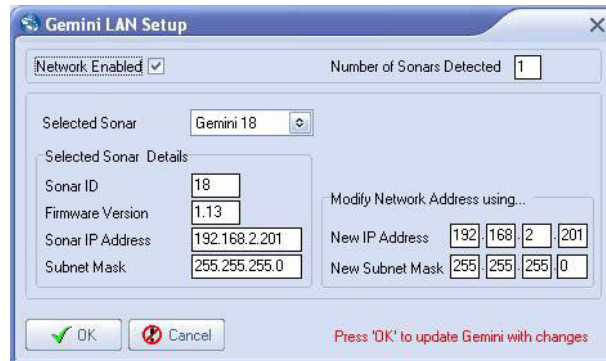
Ensure that the Gemini is connected directly to the computer.

In the `Selected Sonar` drop-down control, ensure that the correct Gemini is selected. The current `Sonar IP Address` and `Subnet Mask` are displayed on the left hand side of the form. These are the settings the selected Gemini is currently programmed with.

In the `Modify Network Address using…` panel on the right hand side, update `New IP Address` and/or `New Subnet Mask`. The text box background colour will change from white to red to indicate a change has been made, as shown below.
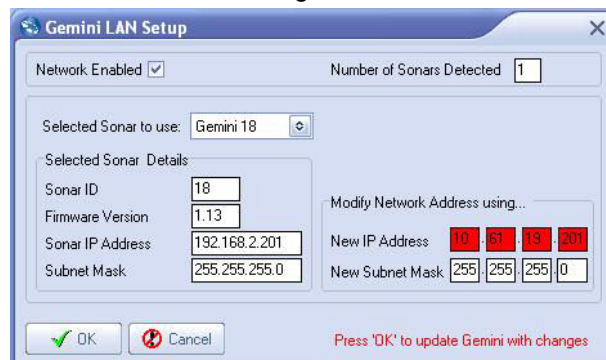
Once these details have been entered, pressing the `OK` button will start the process of changing the IP address. A dialog box will open, requesting confirmation from the user, the box looks like this.
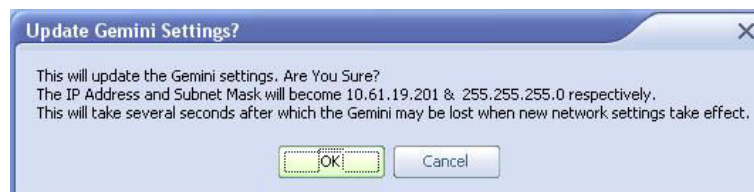
Check that the change details have been entered correctly and click on the `OK` button to accept.

The Gemini node `Status` will change to `Unknown` whilst the new details are being programmed into the Sonar. This will take a few seconds.

When the programming is finished the it may be necessary to reset the computer IP address to enable communication to resume with the Gemini (see the section *Setting the Computer*

IP Address for details of how to do this). Once communication has been re-established the following screen shows the sonar is connected:
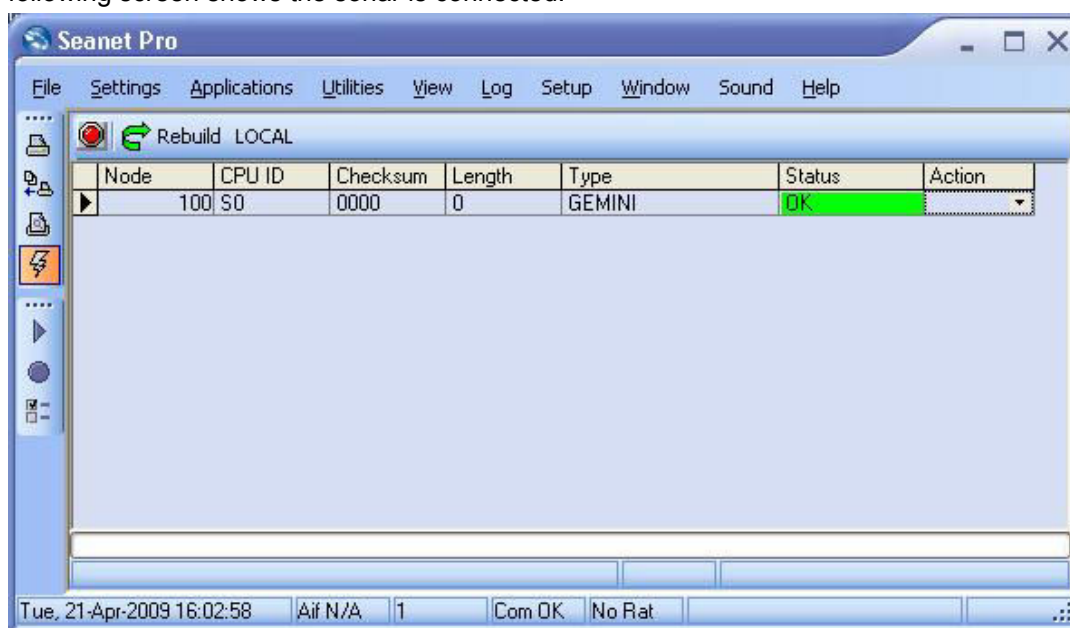
Returning to `Gemini LAN` from the `Setup` menu should confirm that the changes have been made successfully.

Appendix E. Gemini Software String Decode

The Gemini Software is capable of handling input from various different types of sensors using the following standard strings:

Depth strings

Name	Description	Format/Examples
Digi	Parascientific Digiquartz (depth sensor)	`000.0`
SonDepth	Depth	`$SONDEP...`

Distance Marker strings

Name	Description	Format/Examples
TSS Altimeter 1	Marker Range	`Rxx.xx`
Ulvertech Bathy	Marker Range	`00000,xxxx`

Heading, Position and Time strings

Name	Description	Format/Examples
CDL1	Heading, Pitch, Roll	`Haaa.aP+ccc.ccR+eee.eeT...`
GPGGA	GPS position	`$GPGGA...`
GPGGA ZDA	GPS position and UTC time	`$GPGGA...` `$GPZDA...`
$GPZDA	UTC Time	`$GPZDA...`
HEHDT	Heading	`$HEHDT...`
Navi-Pack	Position, Heading, Pitch, Roll	`$G...`

OctansAll	Heading, Heave, Pitch, Roll, Surge, Sway	`$HEHDT...`
		`$PHTRH...`
		`$PHLIN...`

OctansGHPR	Heading, Heave, Pitch, Roll	`$HEHDT...` `$PHTRH...`
OctansHead	Heading	`$HEHDT...`
OctansLinear	Heading, Heave, Surge, Sway	`$HEHDT...` `$PHLIN...`
Octans Std 2	Heading, Heave, Pitch, Roll	`:00000 -0000H-0000 -0000F`
Simard EM3000	Heading, Heave, Pitch, Roll	n/a
TSS Std 1 with HEHDT	Heave, Pitch, Roll and Heading	`:000000 -0000H-0000 -0000` `$HEHDT...`
TSS 1 (No Heave) with HEHDT	Pitch, Roll and Heading	`:000000 -0000 -0000` `$HEHDT...`

Velocity of Sound strings

Name	Description	Format/Examples
AML Smart SVP	Speed of Sound	`0 1500.0`
Speed of Sound	Speed of Sound	`1500.0`

Note

With the exception of `Simrad EM3000` (which is in binary format) all of the above strings are in ASCII format and use <CR> as the synchronisation character.

Appendix F. Gemini Software String Encode

The Gemini Software is capable of outputting different data strings depending on the requirement of the user:

Target tracking strings

Name	Description	Format/Examples
PTRITAR	Basic target tracking output string (Gemini 720i / 720id / NBI)	`$PTRITAR, DDMMYYYY, HHMMSS, 1, 0.0, 0.0, CS`
PTRITR1	Advance target tracking output string (Gemini 720is)	`$PTRITR1, DDMMYYYY, HHMMSS, 1, 1, 0.0, 0.0, CS`

Glossary

2D	2 Dimensional
ASCII	American Standard Code for Information Interchange - a character encoding scheme originally based on the English alphabet.
AVI	Audio Video Interleave - a video format introduced by Microsoft
BMP	A raster graphics image file format used to store bitmap digital images.
CAT5e	Category 5 enhanced - a standard specification for Ethernet cables.
CD-ROM	Compact Disc - Read Only Memory
CPU	Central Processing Unit, the processor of a computer.
DC	Direct Current
DLL	Dynamic Link Library - Microsoft's implemenation of the shared library, implemented in Microsoft Windows® and OS/2 operating systems, filenames have `.dll` extension.
Ethernet	A family of computer networking technologies for local area networks (LANs).
GB	Gigabyte = 1000MB
Gemini	Unless specified this can refer to any of the multibeam sonars in the Gemini range by *Tritech International Ltd* such as the Gemini Imager (720id), Narrow Beam Imager or Gemini Profiler (620pd).
Gemini Hub	A rack mountable device capable of driving 2 Gemini sonars and multiple serial sensors and outputting the data to a PC network.
GIF	Graphics Interchange Format - a bitmap image format developed by CompuServe.
Gigabit	Measure of transfer speed through Ethernet, usually considered to be 1000Mbit·s^{-1}
GPS	Global Positioning System.
IP	Internet Protocol - generally used as a means of addressing individual computers.
IPA	Isopropyl Alcohol (also known as 2-propanol, isopropanol, rubbing alcohol and iPrOH).
IT	Information Technology
kB	Kilobyte = 1000 bytes
LAN	Local Area Network
LED	Light Emitting Diode
MB	Megabyte = 1000kB
Mbit·s^{-1}	Megabit per second - data transfer rate equal to 1000 kilobits per second.

Multibeam	A sonar which forms multiple "beams" of sound so it can update in real time and does not have to perform a full scan like a traditional sonar.
PC	Personal Computer
PNG	The standard filename extension for Portable Network Graphics - a bitmapped image format employing lossless compression.
PSU	Power Supply Unit
RAM	Random Access Memory
RAT	Remote Access Terminal - the detachable front part of the Tritech Surface Control Unit (SCU) computer. Provides an alternative to using a keyboard and mouse.
RJ45	Registered Jack wiring scheme commonly used to refer to the 8 position 8 contact (8P8C) connector wired for Ethernet communications.
RLE	Run-length Encoding - a form of data compression in which sequences of data that have the same value are stored as a single datum point and count.
ROV	Remotely Operated Vehicle
RS232	Traditional name for a series of standards for serial binary data control signals.
RX	Receive (data)
SCU	Surface Control Unit - a specially manufactured computer which is rack mountable and capable of processing the data from the sonar equipment running either Windows® XP Embedded or Windows® 7 and Seanet Pro or Gemini software.
Seanet Pro	The software supplied by *Tritech International Ltd* which is capable of running all the sonar devices.
TX	Transmit (data)
USBL	Ultra Short Base Line (positioning system)
UTC	Coordinated Universal Time (time data closely related to Greenwich Mean Time (GMT)).
VDSL	Very-high-bitrate Digital Subscriber Line - a method of communicating down un-twisted copper cable at uplink speeds of 18Mbit·s^{-1} and downlink speeds of 50Mbit·s^{-1}.
VOS	Velocity of Sound
WMV	Windows® Media Video - a compression format for several proprietary codecs developed by Microsoft® for storing video files.