ARTEMIS

Diver Sonar & Navigator

USER GUIDE

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1 INTRODUCTION

Artemis is a modular handheld console that can be configured as a diver target detection sonar and GPS underwater navigation aid.

Primarily designed to assist divers in localizing and relocating objects on the seabed, Artemis is specifically optimized for use by Naval Mine Clearance and EOD Divers to relocate items of ordnance as an alternative to conducting a tactile or circular search around a known datum.

Typical uses are search & relocation of…

- Unexploded ordnance by navy mine clearance divers, commercial EOD divers, etc.
- Seabed infrastructure within the offshore oil & gas environment (e.g. pipelines, well heads, structures).
- Missing persons, lost property, vehicles, aircraft, wrecks by police or search & rescue divers.
- Seabed/lakebed antiquities by marine biologists, archaeologists, sports divers, etc.

Artemis is intuitive and straightforward to use. The interface has been designed by divers for divers. The user can quickly interpret information presented via the simple menu interface and graphical display. Sonar, Navigation and other apps are selected and controlled via a simple 5-button interface.

Using the 'plug-and-play' USB connection, data can be transferred between the internal Flash storage on Artemis and a Microsoft® Windows® based PC or laptop. The "Artemis Manager" PC software allows pre-dive creation of "Mission" files (to assist with search and navigation tasks), and post-dive analysis of "Dive Log" files containing sonar imagery, area covered, dive-placed markers-of-interest etc.

Before proceeding, we recommend that you read the safety, deployment and operation guidelines in this user guide, in order to get full benefit from the features of the Artemis system.

Throughout this document the following symbols are used to indicate special precautions or procedures you should note…

WARNING!
This symbol indicates a warning you should follow of to avoid bodily injury and damage to your equipment.

CAUTION
This symbol denotes precautions and procedures you should follow to avoid damage to your equipment.

NOTE
This symbol denotes special instructions or tips that should help you get the best performance from your Artemis system.

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2 SYSTEM CONTENTS

Before proceeding, please check that your system contains the following items…

Part Number

- Artemis console, with…
  - o Artemis display unit
  - o Artemis battery holder
  - o Swim-board frame with compass module
  - o Scanning sonar and cable
  - o Analogue compass module

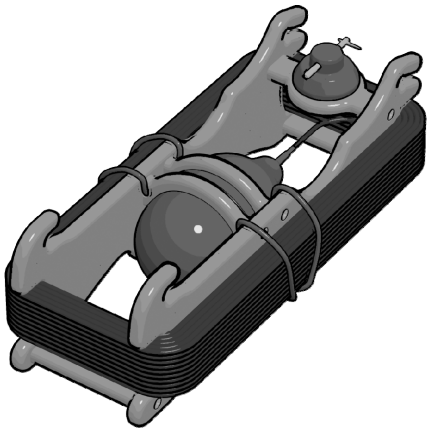
BP00707

  - o Serial Port Blanking Plugs
  - o USB Port Blanking Plug

BP00946
BP00947

- Artemis GPS Float and cable management skid with securing pin.

BP00845

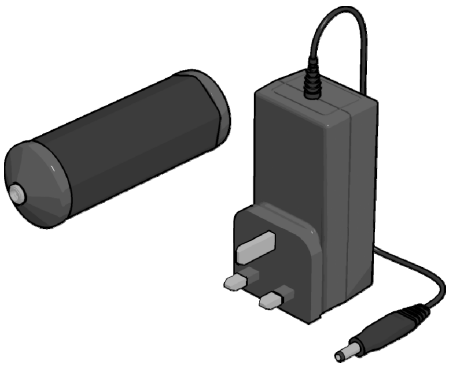


- 16.8V, 2.2Ah rechargeable NiMH battery pack.

BP00642

- Universal AC supply, smart 3-stage battery charger (with international power adapters).

BP00648



- USB adapter lead.

BP00949

- Artemis PC software CD.

BP00696

- User Guide.

BP00697

- Transit Case

BP00700

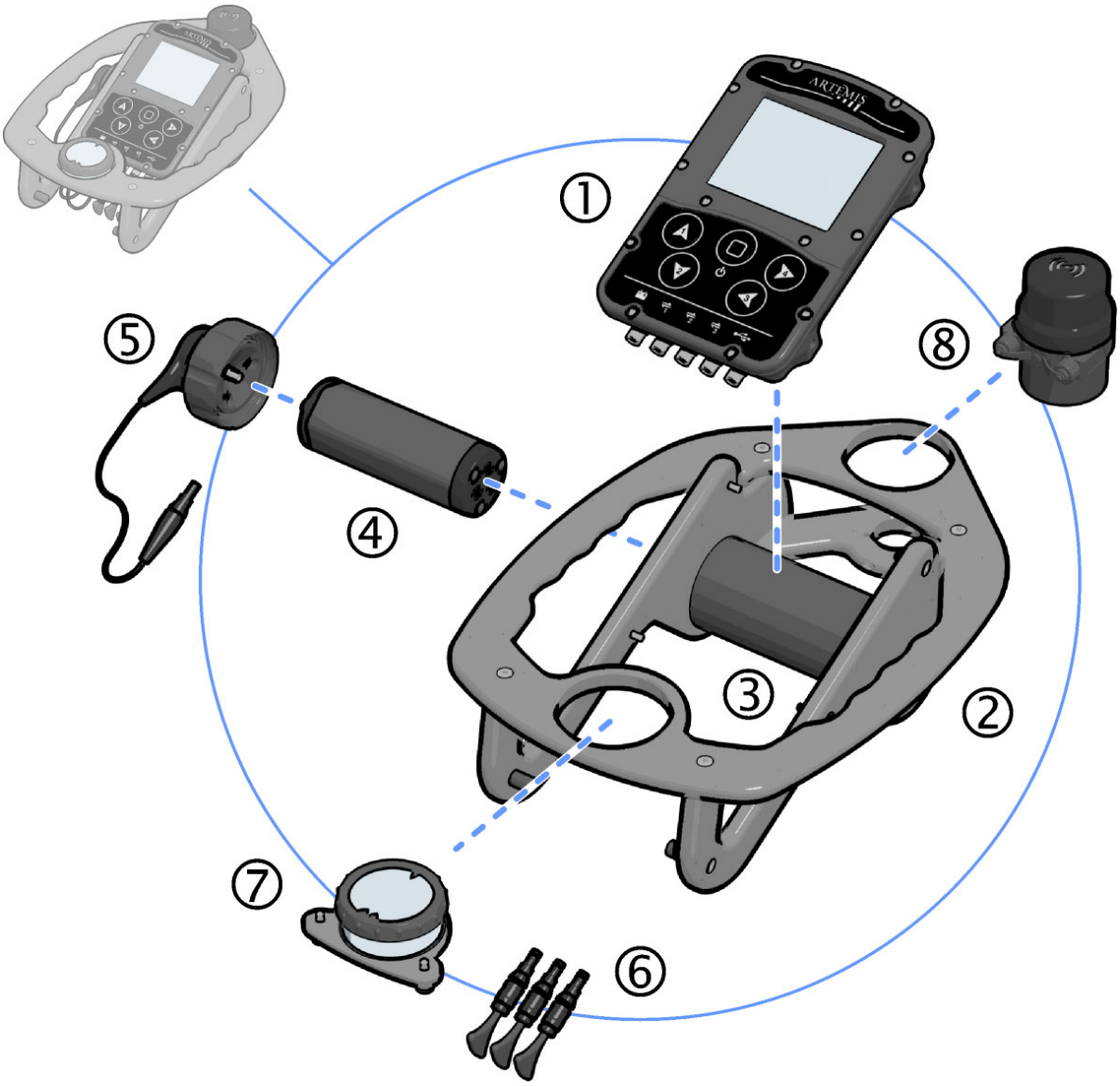
You will also need…

- Microsoft “Windows XP / Vista / 7 / 8” compatible computer, with…
  - o 1 free USB port (for connection to Artemis)
  - o CD-ROM drive (or internet connection) for software installation.

3 PREPARING ARTEMIS

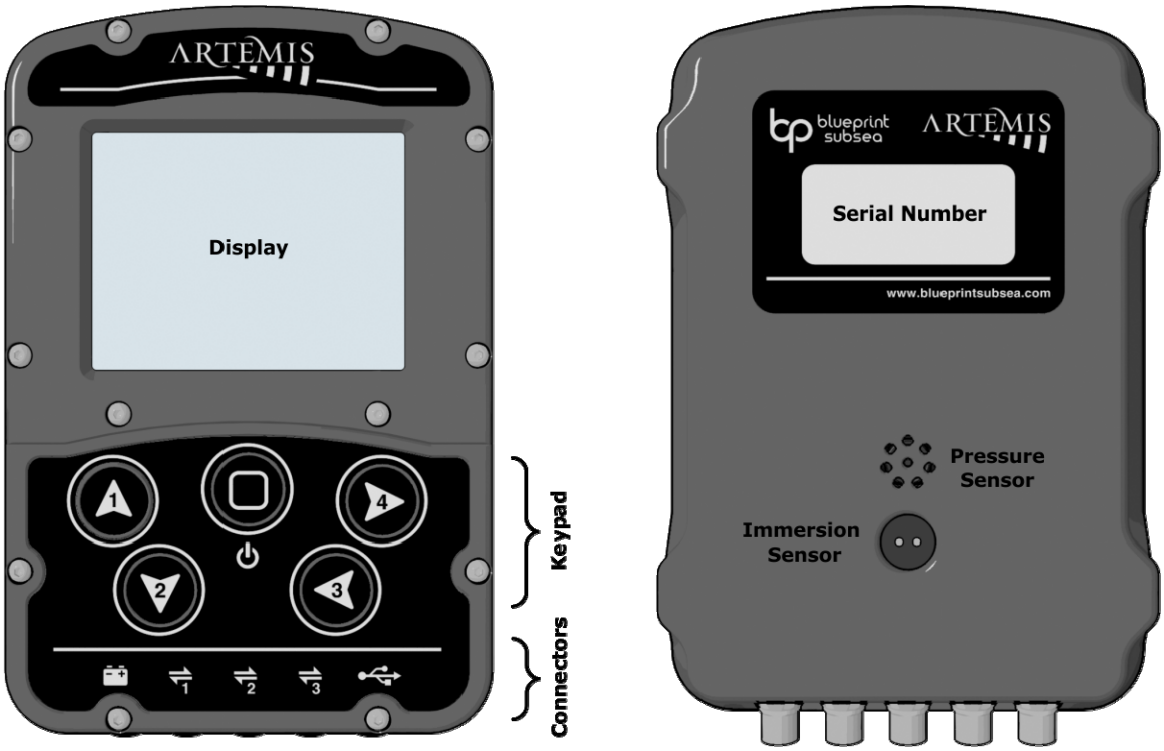
3.1 Identifying Component Parts

The diagram below shows the main component parts of the Artemis Console…



①	**Display & Keypad**	⑤	**Battery Housing Cap**
②	**Frame**	⑥	**Blanking Plugs (Serial & USB)** (for unused connectors)
③	**Battery Housing**	⑦	**Analogue Compass Module**
④	**Battery Pack**	⑧	**Sonar Module**

The following sections discuss the operation of these components in greater detail…



3.1.1 Keypad

The 5-button keypad is located on the front of the Artemis display. For durability, the buttons use a 'piezo' pressure sensing technology and require a firm push to operate.

The button functions and labelled and defined as…

F1 / Up
Selects Function 1, or moves the selection/cursor up.

F2 / Down
Selects Function 2, or moves the selection/cursor down.

Power / App
Used to power up the unit, and cycle through displays.

F3 / Left
Selects Function 3, or moves the selection/cursor left.

F4 / Right
Selects Function 4, or moves the selection/cursor right.

3.1.2 Connectors

Connectors are located along the bottom edge of the Artemis Console, and labelled for the following functions…

Battery / DC Power
Connects to the battery housing cap)

USB Connector
Connects to PC for transferring 'mission' and 'dive' files.

Serial Port 1
Connects to the Sonar.

Serial Port 2
Connects to the GPS Float.

Serial Port 3
Connects to additional sensors.

Blanking plugs <u>MUST ALWAYS</u> be fitted in external connectors that are not in use otherwise water ingress may erode or damage the connector contacts.

3.2 Important Considerations

Before using your Artemis System, please read and follow these safety considerations… If you have any other safety or operational queries, please contact Artemis technical support (see page 64).

3.2.1 Operation

- Do not rely on this product or its sensors as a primary means of life-support during or after a dive. Artemis is designed as a survey tool, and not as an alternative or replacement for dive-computers or similar apparatus.
- Do not use this product if any of the cabling, or housings of its component parts appear to be damaged or compromised for the ingress of water (where required to be watertight).
- Do not attempt to disassemble or service this product yourself (outside the scope described in this manual). Contact Artemis technical support for any maintenance, spares or repair work required.
- **Do not submerge the console, unless all blanking plugs are fitted in unused electrical connector sockets, and the battery housing cap is secured.**

3.2.2 Maintenance & Cleaning

When you have finished using your Artemis system, you should…

- Wash the system in fresh water, if it has been used in salt-water, to prevent corrosion and damage to rubber mouldings.
- Remove any weed, or other detritus, that may have been collected during its operation.

Additionally please observe the following precautions for cleaning and maintenance…

- Do not clean with solvents, and only use a damp cloth on the exterior of the unit.
- Do not undertake maintenance of the unit, outside the scope of that defined within this manual, unless instructed to do so by technical support.
- Do not attempt to modify any of the system cables, power cords or plugs.
- Do not insert extraneous objects (metal or other) into the unit or any of its connector apertures.

3.2.3 Storage

When storing or shipping the Artemis system, please observe the following…

- Do not store the unit in direct or strong sunlight, as this may cause surfaces or transparent windows to discolour, perish cable insulation and other rubber mouldings.
- To prevent corrosion, remove any salt or other residues from the product before storage.
- Store in the recommended temperature range (see page 67), and avoid excessive and large fluctuations in temperature.
- Store in a well ventilated enclosure after use, to allow any moisture on system components to evaporate naturally.
- Do not store battery packs in a discharged state, as this may reduce operational life or cause premature ageing of the cell. When storing batteries for more than one year, charge at least once a year to prevent leakage and deterioration of performance due to self-discharging.
- **Do not leave battery packs in the battery housing for long periods of storage, and cells may leak and damage the seals and interior of the housing.**

3.3 Charging the Battery Pack

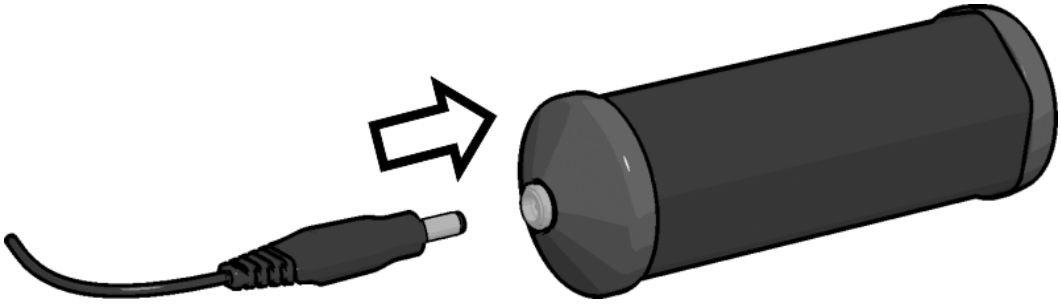
Artemis is supplied with a fast Nickel Metal-Hydride (NiMH) battery charger, for use with Artemis Battery Packs.

Safety Notices…

- Do not use any charger, other than the supplied Artemis charger with the Artemis NiMH battery packs.
- Batteries should be disconnected from the charger when not in use (to prevent slow discharge).
- The charger is designed for indoor use only and should **not be exposed to water** or dust. The charger housing is double insulated (insulation class II).
- Do not cover up the charger when in use
- The charger is turned on by connecting it to the mains socket. Disconnecting it from the mains socket turns it off
- The mains socket should be easily accessible. If an operational error occurs, the plug should be immediately removed from the socket.
- If the charger cord or housing is damaged, the charger must not be used
- The charger contains dangerous voltages and the cover should not be removed. All service or maintenance work should be carried out by qualified personnel. For further assistance please refer to the " Product Support" section (on page 64) of this manual.
- Avoid exposing the chargers housing to oils, grease, etc., as these chemicals and solvents may break down the plastic.

To charge the battery pack…

- Remove the battery back from the Artemis Battery Housing (by unscrewing the Battery Cap) before charging.
- Plug the charging lead into the socket at the end of the battery pack…



- The charger is started by connecting the battery pack to the charger, and switching the charger on at the mains socket.
- The charger indicator will be yellow before the fast charge starts, and turns to orange when charging commences.
- When the batteries are approaching fully charged, the charger will enter its 'top-off' charge mode (where the indicator will be green with an intermittent yellow flash), and finally enter 'trickle' charge mode (where the indicator is permanently green).
- Charging is complete when the charge is in 'trickle' mode (permanent green indicator), and the batteries can be left connected for long periods (up to 24-hours max recommended) without suffering any damage.
- If new batteries are to be connected, the charger must be idle for at least 15 seconds to make sure its charge cycle resets correctly. When the indicator turns yellow this shows a new charge cycle can begin.

	Indicator Colour	Mode
	Yellow	Battery not connected, or initialisation and analysis.
	Orange	Bulk charge
	Green with intermittent fast yellow flash	Top-off charge
	Green	Trickle charge (complete)
	Alternating slow orange/green flash	Error

When connected to a flat battery pack, a full charge should take approximately 7 hours to complete – batteries that are not completely flat should take less time to charge.

The charger features a safety timer that prevents excessive amounts of charge being delivered. If the battery is not holding charge, or being charged from a very discharged state, the safety timer might expire (after 7 hours). In this case the indicator will alternate between orange and green, and turning the charger off at the mains will clear the error.

You may attempt to continue charging the battery, and for 'good' batteries the error should not occur again until charging is complete on the second attempt. However, if the error keeps occurring, the battery has most likely reached the end of its life, and do not attempt further charges.

3.4 Connecting the Battery

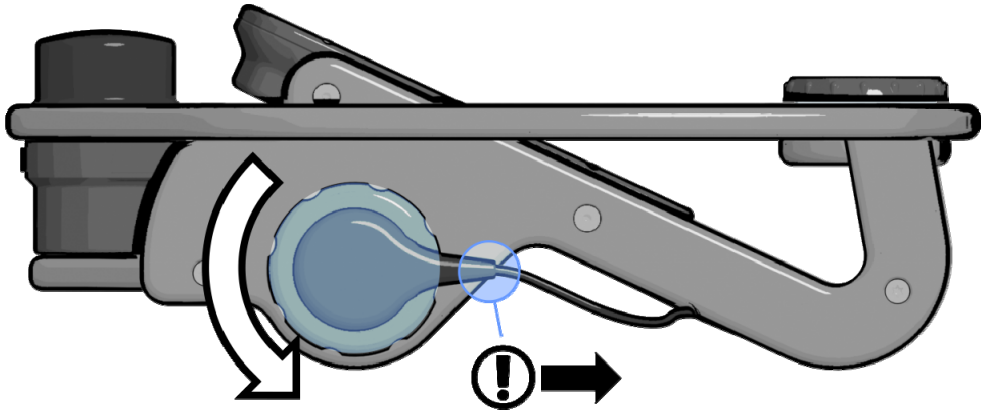
Safety Notices…

- **Do not allow the battery to be exposed to water**, or any other substance that may cause an electrical short between battery terminals.
- If the battery housing or protective wrapping is damaged, avoid using the battery
- Always charge the battery in a well ventilated area. Never charge the battery in a sealed container.
- Avoid repeatedly re-charging the battery without allowing for a minimum 30 minute cooling period between charge cycles.
- During charging the battery pack will get warm, but typically this should be no more than 25-30°C above the ambient temperature. Disconnect the charger and allow to cool if the batteries exceed this.
- As charging nears completion, the battery temperature will rise by approx 5°C.
- Avoid charging the batteries at excessively high or low ambient temperatures, as this may affect the charge rate and charge-termination methods. If possible charge between 10°C and 30°C.
- The battery pack contains a thermal fuse and current fuse. Temperatures in excess of 85°C, and discharge currents over 5A will cause these fuses to blow.
- Do not place any metal (or electrically conductive) objects in the battery connector, other than those specified in this manual (i.e. the charge plug).
- Use only the supplied Artemis Battery Charger with the battery pack. Do not use any other type of NiMH battery charger, as this may damage the battery pack, or lead to excessive heating.
- Batteries should be disconnected from the charger when not in use (to prevent slow discharge).

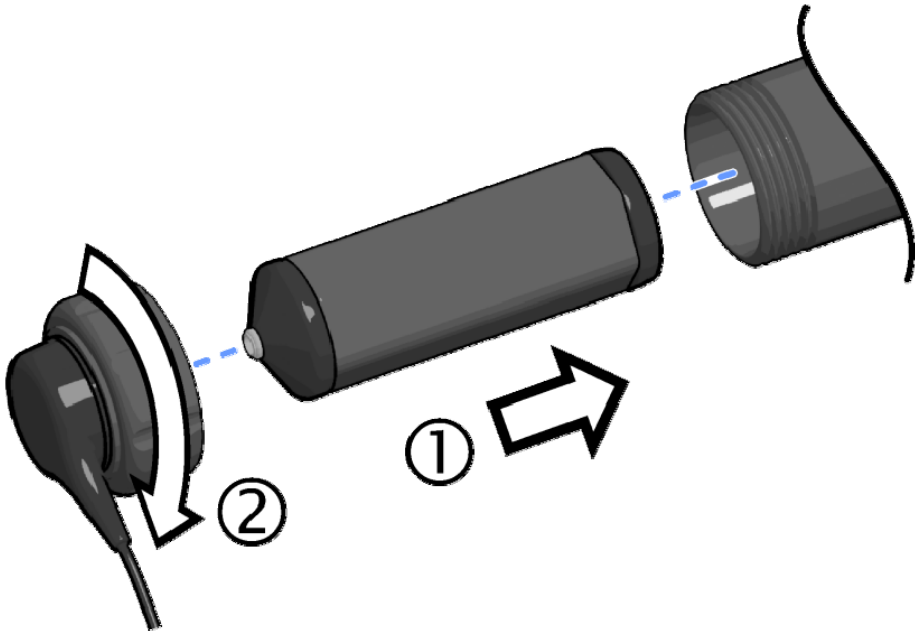
Once the battery has been charged successfully, it can be connected to the Artemis console with the following steps…

- If the Artemis console already contains a battery, first check the console is turned off (see the “Turning Power On & Off” section from page 18).
- Dry any excess moisture from around the battery housing to prevent ingress and contact with the battery pack.
- Unscrew the battery housing cap in the anti-clockwise direction…
  As the battery housing is sealed, you may hear the internal pressure equalising with atmospheric pressure as the seals release. Wait until any pressure equalisation finishes before completely removing the cap.

When opening or closing the battery cap, hold the bend restrictor in the orientation shown below to prevent excess strain from being placed on the cable.



- Check there is not dirt on the o-ring seals inside the battery cap, or around the inside of the mouth of the battery holder. If necessary, use a lint-free cotton-bud to wipe clean and apply a small amount of silicone grease.
- Insert the battery pack, feet first, into the battery holder.
- Align the plug on the inside of the battery cap, with the socket on the battery pack and push together.
- Screw the battery cap in a clockwise direction to secure and seal the battery holder.



3.5 Care & Storage of Batteries

When not in use, batteries should be stored in a fully charged state. The chemistry of the nickel metal hydride battery pack will self-discharge approximately 1% of its charged capacity per day (up to 30% per month).

The self-discharge rate varies greatly with temperature, where lower storage temperature leads to slower discharge rate and longer battery life. The self-discharge is 5% – 20% on the first day, and stabilizes around 1% per day at room temperature (at 45°C it's approximately 3 times as high).

During long term storage, it is recommended that the battery pack be re-charged at least once every six month period. Storage for long periods in a discharged state may permanently reduce the capacity of the battery pack or lead to the pack leaking.

Do not store the Artemis console for extended periods of time with the battery inserted. If the battery pack leaks it may damage the interior and seals of the battery housing.

When charging for the first time after long term storage, internal chemical changes within the battery cells may lead to increased voltage, and decreased capacity. Restore such batteries to original performance by repeating several cycles of charging and discharging.

Batteries should be disconnected from the charger when not in use (to prevent slow discharge through the charger circuitry).

Avoid repeatedly re-charging the battery without allowing for a minimum 30 minute cooling period between charge cycles.

For best performance, it is recommended to store batteries in a dry location with low humidity, no corrosive gasses, and at temperature range of -10°C to +35°C.

3.6 External Sensors Connections

Several external sensors, such as the Sonar and GPS Float, can be connected to the Artemis console.

The sensors care connected to the “Serial Sensor” ports located on the bottom edge of the Artemis housing, and identified by the following symbols…

- Serial Port 1
- Serial Port 2
- Serial Port 3

Power is controlled to each port by Artemis as the sensor is required for use.

Only sensors supported by the Artemis software should be connected to the console.

3.6.1 Sonar

If the sonar was specified at the time the system was ordered, it will be fitted and configured prior to delivery.
By default the sonar is connected to Serial Port 1. However, firmware settings on Artemis allow this to be changed.
For further details on using the Sonar, please refer to the “Sonar Application” section on page 25, and “Understanding Sonar Imagery” on page 60.

3.6.2 GPS Float

If being used with the system, by default the GPS Float should be connected to Serial Port 2 (although this may be changed under the Artemis software settings).
For further details on navigating with the GPS Float, please refer to the “Navigation Application” section on page 26.

3.6.3 Sensor Power

To save battery life during a mission, power to the two sensor serial ports can be switched on or off from the “Power Application” as required by the diver. By default, power to both sensors is switched on when Artemis is powered up. See section 4.1.3 for further details.

3.7 Compass Modules

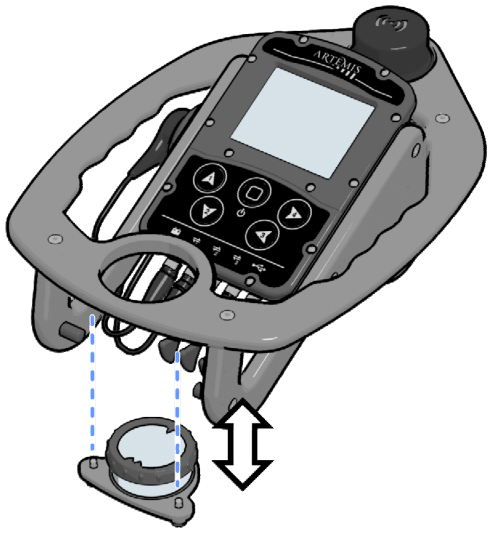
When configuring Artemis prior to a dive, the user can choose between the two compass options depending on the type of operation required…

3.7.1 Analogue (Magnetic) Compass

For situations that do not require the use of the in-built navigation system, the Analogue Compass module can be used to provide a simple and robust magnetic heading for the diver.

Unlike the inbuilt Digital Compass, the Analogue Compass is not as sensitive to the external magnetic environment and cannot be calibrated before use.

The Analogue Compass can be quickly installed and removed on the Artemis frame, and secured using the two thumb-screws on either side of the module.



As the Analogue Compass is mechanical and contains a magnet, using the Analogue Compass module at the same time as the Digital Compass will introduce a directional error onto the digital reading.

When using the Digital Compass for navigation, the Analogue Compass module should be removed from the Artemis frame.

3.7.2 Digital (Magnetometer) Compass

The Digital Compass is located within the Artemis Console and is used by the navigation system to determine the diver's current heading and bearing to swim values that are displayed on the screen.

The compass is extremely sensitive to surrounding magnetic fields and may need calibrating before use depending on the background magnetic signature at differing geographic locations.

For further information on calibrating the digital compass see section 4.8 on page 30.

Based around a magneto-resistive magnetometer sensor, the Digital Compass exhibits no magnetic signature (unlike the Analogue Compass) making it ideal for use in environments that are magnetically sensitive or where a fast update rate and high-accuracy are required.

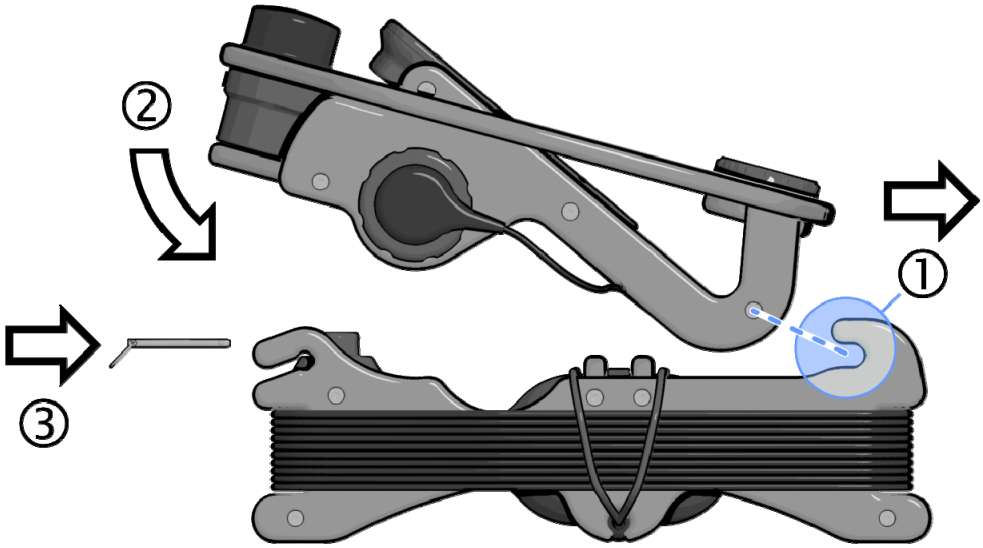
When using the Digital Compass for navigation, the Analogue Compass module should be removed from the Artemis frame.

3.8 Attaching the GPS Skid

For navigation, Artemis is supplied with a GPS float, 40m tether and cable management skid.

To attach the skid to the main frame…

- First slide the locating lugs at the rear of the Artemis frame into the hook recesses at the rear of the skid
- Lower the front of the Artemis frame down onto the GPS skid so the attachment boss engages with the frame.
- Secure the skid by inserting the Locking Pin into the small hole at the front of the frame (beneath the sonar).



- Once the skid is secure, remove the blanking plug from Serial Port 2 on the Artemis console (see section 3.6 on page 14).
- Firmly push the GPS Skid's electrical plug into Serial Port 2 (see note below) on the Artemis console and ensure that the connector pins are not exposed to water.
- On power up, the GPS status icon (➶) should turn yellow while a fix is being acquired, then green when a position is obtained. If this does not occur, ensure the GPS power is enabled in the "Power Application" (see section 4.1.3), and check the GPS diagnostics display (see section 4.4.3).

By default Serial Port 2 is configured as the GPS port, although settings are available in the "Settings Application" (see section 4.4.4) to allow this to be swapped to Serial Ports 1 or 3.

When removing the GPS skid, reverse the above procedure and ensure the blanking plug has been replaced in Serial Port 2 to prevent damage to the electrical contacts by salt-water.

3.9 Attaching the GPS Training Float

If using the large orange 'training float' (supplied as an optional extra), then the float should be secured to the Artemis frame by means of the plastic boss and locking pin that are attached to the float's cable.

Do not rely on the GPS Float connector plug as the only means of securing the Training Float to Artemis.

3.10 Connecting the USB Lead

To upload new “Mission” files onto Artemis, or download recorded “Dive Log” data, use the USB lead connect the Artemis display to a PC…

- Power down Artemis, and plug the USB lead into the USB connector at the base of the console.
- Connect the other end of the lead into a free USB socket on a PC / Laptop that has the “Artemis Manager” software installed.
- Turn Artemis on and after a short time the Windows™ operating system should detect Artemis, and appear as a “Mass Storage Device” (similar to a USB pen-drive).
- Use the Windows File Explorer (or other file manager) to copy any Mission files onto the internal flash storage of the Artemis Display, or download and remove any Dive Log files.

Please note that on some systems, the USB detection time can take up to several minutes if the computer needs to find and download the appropriate Mass Storage Device drivers from Microsoft.

To prevent corruption to any of the files, always follow the “Safely Remove Hardware & Eject Media” procedure required for the Windows operating system being used, before disconnecting the USB cable or powering-down Artemis.

For further details on working with Artemis Mission and Dive Log files, please refer to section “Mission & Dive Log Files” on page 32.

4 USING ARTEMIS

4.1 Turning Power On & Off

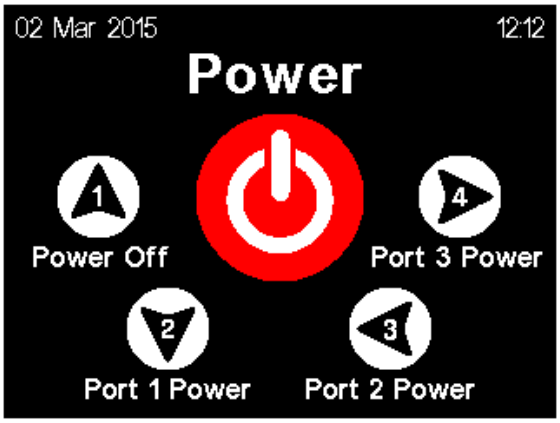
Before powering up, ensure that a charged battery has been properly connected to the display unit as described in the previous sections.

4.1.1 Powering Up

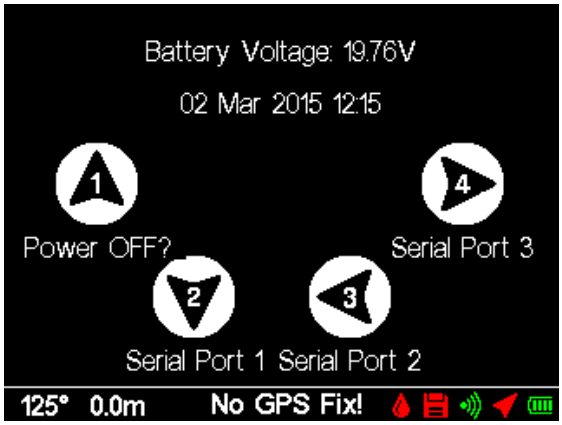
- When Artemis is powered down, the unit may be turned on by a single press to the central "**Power / App**" button.
- After a few seconds, the Artemis welcome screen will appear and the unit is ready for use.

4.1.2 Powering Down

- When the unit is turned on, repeatedly press the "**Power / App**" button to cycle through the applications until the "Power Application" appears…



- Press any button to enter the application…



- Press "**F1 / Up**" to choose "Power OFF"

The use of Artemis "Applications" is discussed further in subsequent sections.

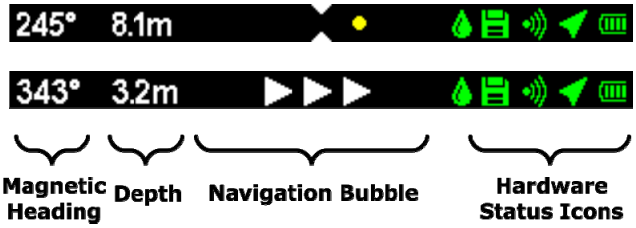
4.1.3 Sensor Power (GPS & Sonar)

To save battery life during a mission, power to the two sensor serial ports can be switched on or off from the "Power Application".
By default, when Artemis powers up, power to both Serial Ports is also turned on. To switch off an external sensor, enter the Power Application (as described above), then select **F3 / LEFT** or **F4 / RIGHT** to toggle power to Serial Ports 1 and 2 respectively.

4.2 Display Status Bar

When Artemis is power up, regardless of the current application display, the bottom strip of the screen will always show the Status Bar.

The Status Bar is split into 4 parts…



- **Hardware Status Icons** – These icons show the current status of the battery, sonar, GPS, dive-log and immersion sensor. The icons change colour to indicate state where green indicates OK, yellow is a warning condition and red indicates error or disabled. Generally during a dive all the status icons should be green.
- **Navigation Bubble** – The Navigation Bubble part of the display is only used when the diver has selected a Mission file in the Settings Application (see section 4.4.2). In the Navigation Application a Mission marker can then be selected, and the display will show a graphical representation of the course the diver should swim to reach their destination.
- **Magnetic Heading** & Depth – The magnetic heading shows the current reading for the onboard digital compass, while depth is displayed from the pressure sensor reading.

4.2.1 Battery Status

The battery status icon will show one of the following states…


- Battery capacity greater than 80%.


- Battery capacity greater than 60%.


- Battery capacity greater than 40%.


- Battery capacity greater than 20%.


- Battery capacity greater less than 20%.

(Further detailed battery information is available from the Power Application)

4.2.2 Sonar Status

The sonar status icon will show one of the following states…
(See the Settings Application section 4.4 for details of enabling the sonar.)


- Sonar is powered up and scanning correctly.


- Sonar is powered up and initialising.


- Sonar is not powered up.

4.2.3 GPS Status

The GPS status icon will show one of the following states…
(See the Settings Application section 4.4 for details of enabling the GPS.)

- GPS is powered up and producing position fixes.

- GPS is powered up, but waiting to acquire its first fix.

- GPS is not powered up.

4.2.4 Dive Logging Status

The Dive Logging icon will show one of the following states…
(See the Settings Application section 4.4 for details of manually starting dive logging, if the immersion sensor is not enabled.)

- The Dive-Log is recording Sonar, GPS, Depth, Attitude and Heading information.

- The Dive Log is not recording.

4.2.5 Immersion Sensor Status

The Immersion Sensor icon will show one of the following states…

- The immersion sensor is wet.

- The immersion sensor is dry.

- If the icon is not shown, the immersion sensor has been disabled in the Settings Application.

4.2.6 Magnetic Heading & Depth

The magnetic heading will display the current measurement taken from the onboard digital compass, while depth is calculated from the pressure sensor reading.

The compass sensor may be affected by the presence of ferrous materials (or magnetic fields) around Artemis and a calibration may need to be performed – see section 4.8 for further details on this procedure.

4.2.7 Navigation Bubble

The Navigation Bubble (or Navigation Aid) is only used when a Mission file has been selected for use in the Settings Application (see section 4.4.2), and a target selected in the Navigation Application (see section 4.6).

Depending on the course the diver needs to swim to reach the target marker, the display will show one of the following symbol combinations…

- Target is more than 90° to left or right

- Target is more than 60° to left or right

- Target is more than 30° to left or right

Target within ±30°. Turn to align the dot in centre of display for the correct course. The colour of the dot will match that of the selected navigation marker.

4.3 Choosing a Display (Application)

Once Artemis is powered on, it can perform several tasks to aid the diver, including showing sonar information, navigational position, distance and bearing to a selected target and data logging.

To achieve this, Artmeis runs several software applications, or “Apps” (similar to modern smart-phones). Each application has its own visual display, and different functions for the four navigation/function buttons on the keypad.

The applications currently installed on Artemis are…

Power
Allows control of power to the attached peripherals (Sonar and GPS), and shuts down Artemis.

Settings
Provides a menu interface to allow system settings to be adjusted, including screen brightness, date and time and hardware setup.
Additional GPS diagnostic information and system information can be displayed.

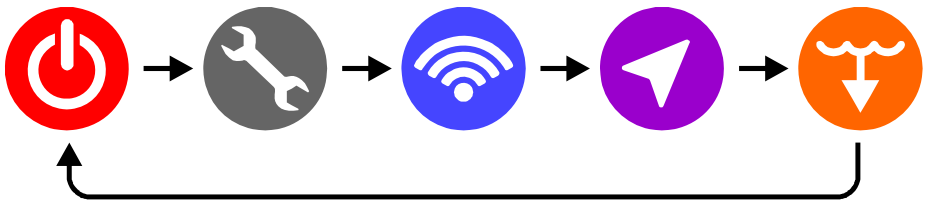
Sonar
Shows the imagery collected by the sonar, and allows the range and gain settings to be controlled by the function keys.

Navigation
Shows a chart containing pre-defined ‘mission’ targets and waypoints, the diver’s position and previous route. The functions keys allow selection of navigation destinations, chart zoom levels and further targets to be marked.

Dive Profile
Shows a recent history of the depth sensor plus additional information on the dive duration and current diver depth.

To choose an application…

- First press the “**Power/App**” button to show the application switcher display.
- Repeated presses of the “**Power/App**” button will cycle through the list of available Apps, in the order shown below…

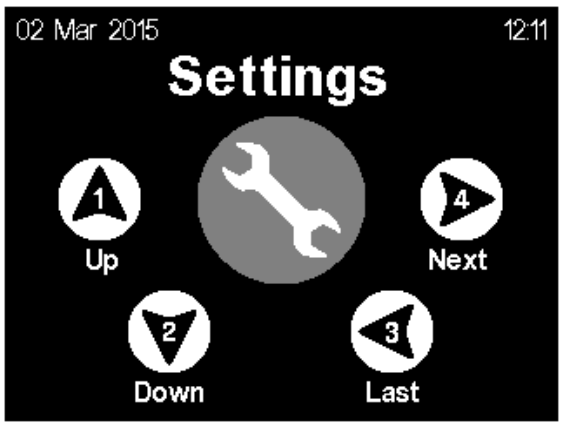


- When the icon for the desired application is shown, press any of the other four function buttons to select and switch to its display.

In addition to the title, the Application switcher display shows the actions performed by the four function buttons within the application, along the bottom of the screen.

4.4 Settings Application

The Settings Application allows the diver to control the Artemis operational parameters.



When the Settings Application is active, the console buttons have the following functions…

1	**Move Selection Up**	3	**Previous Value / Execute**
2	**Move Selection Down**	4	**Next Value / Execute**

By moving the Selection cursor Up and Down the list, the Diver may choose a parameter to alter (or sub-menu to enter).
Pressing the Left or Right keys will then cycle through a list of values for the current parameter, or execute the function selected (such as Start Logging or enter a sub-menu).

4.4.1 Settings

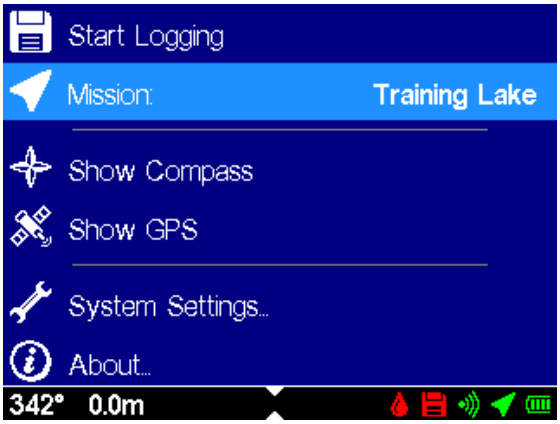
The top level of the settings list contains the following items…

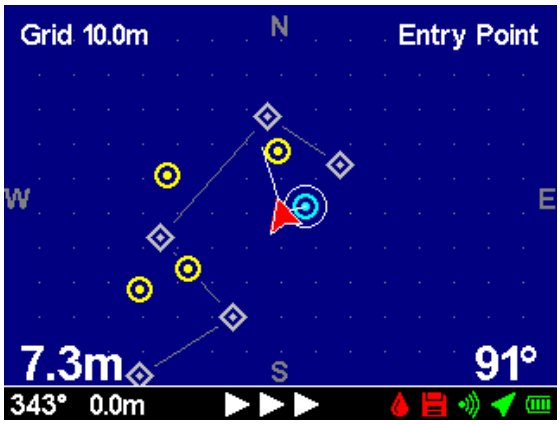
- **Start / Stop Logging** – Manually starts or stops a dive (normally the Immersion sensor would do this if enabled). When a Dive is started, the depth sensor is zeroed, and recording of a dive log starts.
- **Mission** – Chooses the current mission file the Navigation Application should use, see section 4.4.2 below for further details.
- **Show Compass** – Displays a screen just showing compass information.
- **Show GPS** – Displays a screen showing the current state of the GPS receiver, and the satellite availability currently being used to compute its fix. See section 4.4.3 below for further details.
- **System Settings** – contains controls to allow the real-time-clock to be set, and hardware configuration selected. See section 4.4.4 below.
- **About** – Displays a list of system settings, including the serial number of the unit and the version numbers for its hardware and firmware. See section 4.4.5 below.

4.4.2 Mission Selection

The Mission setting allows the diver to cycle through a list of available ".mission" files on the Artemis storage. These files are created using the "Artemis Manager" software (see section 5.5) and copied onto Artemis' internal storage via the USB lead (see section 3.10).

When a mission file has been selected in the Settings Application, cycling to the Navigation application will show the markers and waypoints contained in the file…



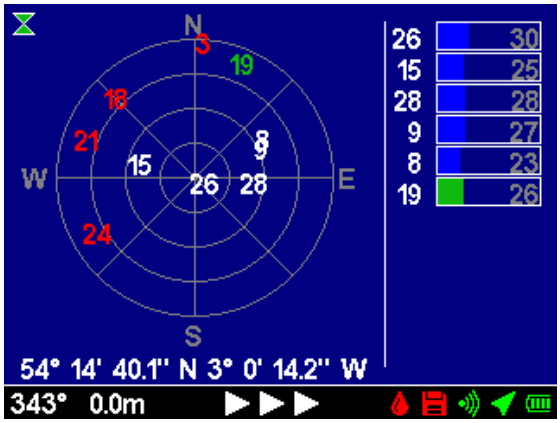


If no mission file is required, the "No Mission" option can be selected in the settings.

4.4.3 GPS Diagnostics

When the GPS is connected (and enabled in the System Settings menu), the "Show GPS" settings option will show the GPS diagnostic display.

This shows the current state of the GPS, including the availability of satellites, their signal strengths and the current GPS position fix.



After connecting and powering up the GPS, it can take several minutes for the GPS receiver to get it first fix. During this time, the GPS status icon ( ) will be yellow, and once a fix has been acquired the icon will change to green.

The connection status indicator ( ) at the top left of the display will rotate through 90° every time Artemis receives a GPS data message, regardless of a fix being available. This can be used to verify the receiver is connected and powered up.

The main part of the display shows a polar graph representing the overhead hemisphere of the sky with the numbers of available GPS satellites in their current positions. To the right of the display a series of bar-graphs shows the signal strength available form each satellite.

Satellites whose signal is too weak to receive are shown in red, while satellites whose information is not being used in the current fix are shown in green. Satellites that are being used in the fix solution are shown in white.

4.4.4 System Settings

The "System Settings" menu allows the user to adjust the hardware setup of Artemis.

- **Language** – Allows the user interface language to be changed.

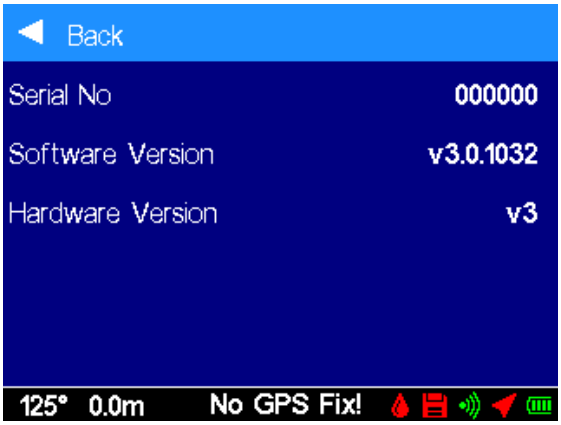
Brightness Shortcut

- **Brightness** - The display brightness can be adjusted through 3 settings : Low, Medium and High.
  Simultaneously pressing the **F1 / Up** and **F4 / Right** keys will toggle between the current brightness and Low brightness.
- **Date and Time** – The clock is used for dive logging, and will be stored in the internal battery backed up clock.
- **Serial Port** - The device attached to each serial port can be selected from a list of available hardware (None, Sonar or GPS). If these settings are incorrect for the attached hardware peripherals, they will not detect correctly and the corresponding status bar icon will remain red.

Data Scuttle Shortcut

- **Data Scuttle** – Setting this option "On" enables the Data Scuttle feature, which will erase all mission and dive-log data from Artemis' internal storage when the Diver presses the **F3 / Left** and **F4 / Right** keys simultaneously.

4.4.5 System Information

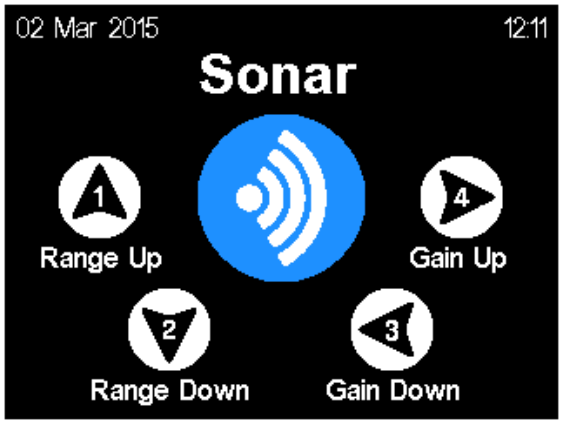


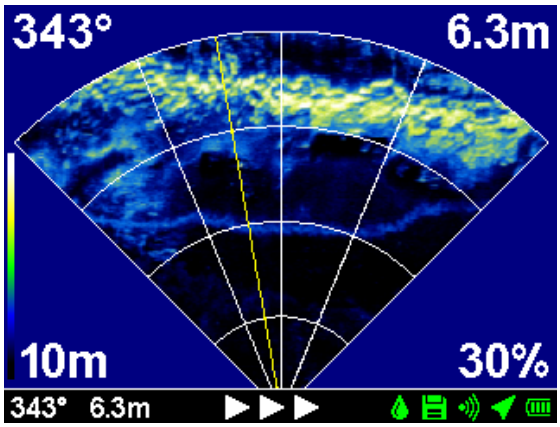
The "About" settings option will show information about Artemis' current configuration.

Please have this information to hand if contacting Artemis Technical Support.

4.5 Sonar Application

The Sonar Application shows a polar (top-down) image of acoustic echoes transmitted and received by the sonar and varying angles as its scans across its 90° field of vision in front of the diver.





See the section 7 “Understanding Sonar Imagery” on page 60 for further details of how to interpret the sonar display and get the best performance from the range and gain controls.

When the Sonar Application is active, the console buttons have the following functions…

Range Up
Increases the range scale on the sonar display.

Range Down
Decreases the range scale on the sonar display.

Gain Down
Decreases the sonar gain – image intensity will be reduced and finer detail seen on closer targets.

Gain Up
Increases the sonar gain – fainter targets will appear brighter.

4.5.1 Gain

The current sonar gain is shown at the bottom right of the display as a percentage. Increasing the gain will amplify fainter echoes making the entire display appear brighter (and possibly saturate some target detail), while decreasing the gain will dim the display (possibly hiding fainter targets, but making it possible to detect texture and detail on others).

4.5.2 Range

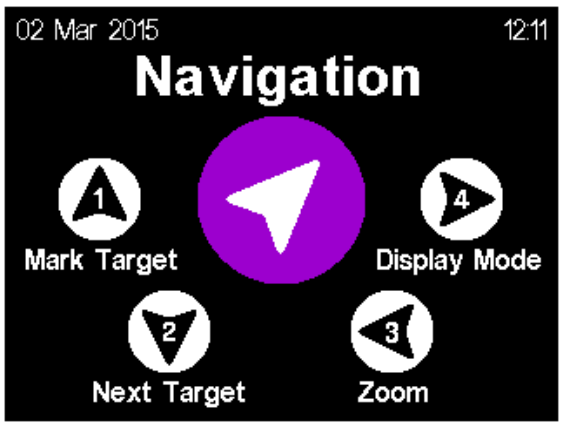
The sonar range is shown at the bottom left of the display, and represents the maximum range the display is showing.
At larger ranges, the sonar scan rate will slow, as it must to wait longer to collect the received echoes from targets, while lower ranges will increase scanning speed.

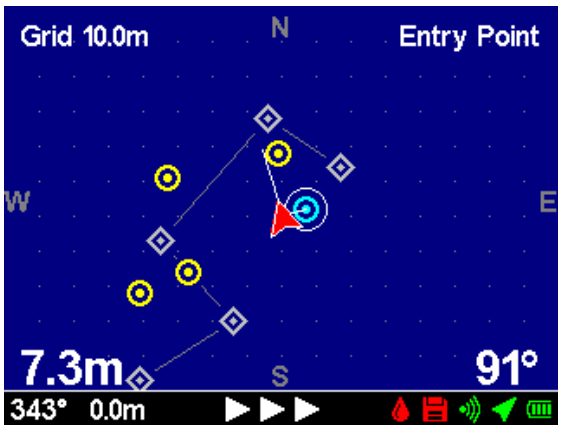
4.5.3 Heading and Depth

To assist in location, search and rescue tasks, the current magnetic heading and depth sensor readings are shown at the top of the display.

4.6 Navigation Application

The Navigation Application uses data from the external GPS Float, and the internal compass to provide navigation information to the diver.





Before a dive commences, the Artemis Manager PC software should be used to create a Mission File that is uploaded onto Artemis via the USB cable, and then selected as the current mission file to use from the Settings Application.

The Mission File defines a series of “Markers” that have their geographical locations shown on the display. Marker locations may be entered in the Artemis Manager software or imported from third-party software (such as Google Earth TM™ KML data). For flexibility, the Diver and Supervisor may pre-agree on the styles and colours of markers to be used and what they represent.

The Navigation display shows a scalable chart of the diver’s position and mission markers. The charts grid spacing is shown at the top left of the display, and currently selected marker name at the top right.

The two large numbers at the bottom of the display are calculated from the current GPS position and show the divers distance and course-to-swim to the selected marker.

The magnetic compass heading and Navigation Bubble are shown in the Status Bar at the bottom of the display (see section 4.2.7 for more information).

For further information on creating Mission Files, please refer to the Artemis Manager “Mission File Editor” section on page 35.

When the Navigation Application is active, the console buttons have the following functions…

Mark Target
Pressing this key will add a “Diver Marker” to the mission file at the divers’ current location.
In total the Mission File can support 20 markers, but must contain spare capacity to allow the marker to be added.

Next Target
Pressing this key will sequentially cycle through the list of defined markers, selecting each one in turn as the current navigation destination.

Zoom
This key cycles through a list of chart scales, from “Show All”, progressively zooming into the display.

Display Mode
This key selects whether the display is shown in Cartesian “North Up” or Polar “Diver Heading Up” modes.

With a mission file selected, the display may show the following symbols…

Diver
This symbol represents the position of the diver, and rotates to show his heading (relative to North at the top of the display).

Waypoint Marker
A style of marker that defines a navigational path the diver may take if doing area search work.

Target Marker
A marker indicating a target or point of interest to visit or investigate.

Diver Placed Marker
A marker that has been placed by the diver during a dive.

Once a Mission File has been selected, pressing the **F2 / Down** ( ) key will cycle through the missions list of Markers, selecting each on in turn as the Destination, and showing its name in the top right corner of the display.

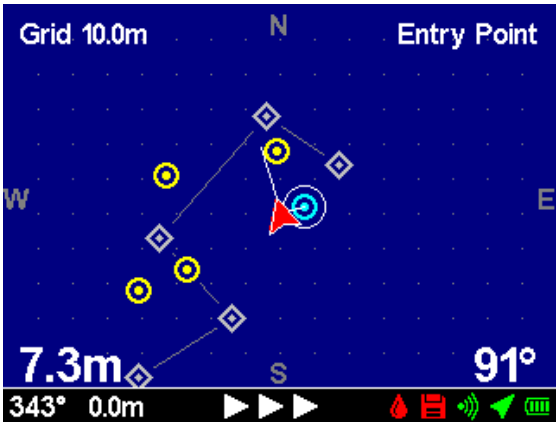
The destination marker will be highlighted with a white outline on the display, and an interconnecting line. In addition, the 'range to marker' is shown at the bottom left of the display, and 'bearing to marker' at the bottom right.

4.6.1 Using the Navigation Application

The first stage when using the Artemis Navigation function is to create a '.mission' file using Artemis Manager. This should contain markers for any waypoints or targets of interest the diver wishes to locate.

The '.mission' file should be copied onto Artemis' internal storage via the USB lead.

In the Settings Application, select the name of the mission file for the Navigation display to use.



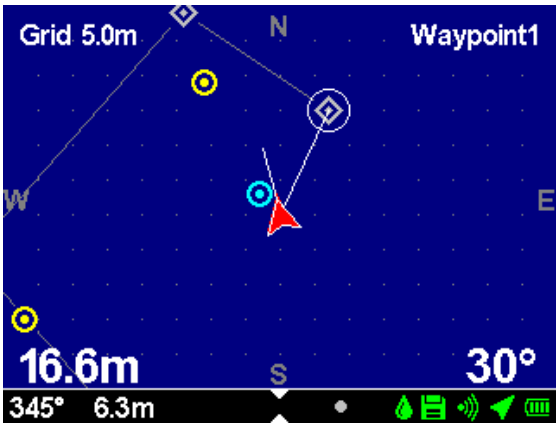
Ensure the GPS is connected, enabled in hardware settings and receiving a fix (use the GPS diagnostics display if necessary).

Switching to the Navigation display shows the mission markers relative to the diver (at the centre of the display).

Press **F4 / Right** to toggle the display mode between a Cartesian grid and Polar rings with either North Up or Diver-Heading Up.

At this point the diver is not in the water, so the Immersion sensor has not activated logging and the "disk" status icon is red.

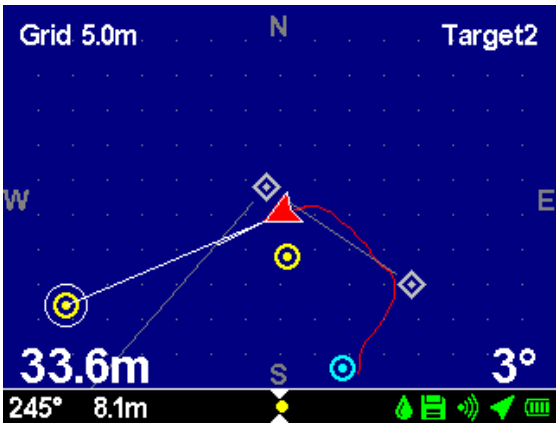
When the diver submerges the dive logging will begin and the "disk icon becomes green. If the Immersion sensor has been disabled (in the hardware settings), then "Start Logging" must be manually selected in the Settings.



The figure to the left shows the diver has used pressed **F2 / Down** to cycle through the markers until “Waypoint1” is selected, and has pressed **F3 / Left** to increase the chart scale to 5m per grid division.

Their current magnetic heading is 345°, shown in the status bar).
The two large numbers at the bottom of the display indicate they area 16.6m from the marker, and it lies 30° to their right.

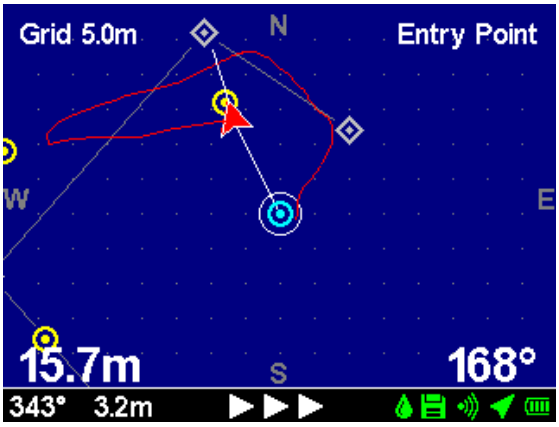
In the status bar, the “bubble” display shows graphically the heading they should swim. As the diver rotates towards the marker, the “bubble” will move left across the status bar until it aligns with the datum markers in the centre.



As the dive progresses, a “snail trail” (limited to approximately 1 hour) will be displayed behind the diver showing the course they have covered.

The figure to the left shows the diver navigated towards “Waypoint1”, then “Waypoint2” before selecting “Target2”.

The large numbers at the bottom of the display show that it lies 33.6m in front of them and 3° to their right – this is also confirmed by the yellow “bubble” (matching the marker colour) being almost central on the status bar.



Finally in this dive, the diver has inspected “Target2” and is currently by “Target3”.

As the mission was created with an “Entry Point” marker, they have selected this and navigation information is displayed at the bottom of the screen showing the course they must take to return to their point of entry.

The destination is more than ±30° away from their current heading, so the status bar “bubble” has been replaced with a serial of arrows showing they must turn through at least 90° to their right (where each arrow represents a 30° increment).

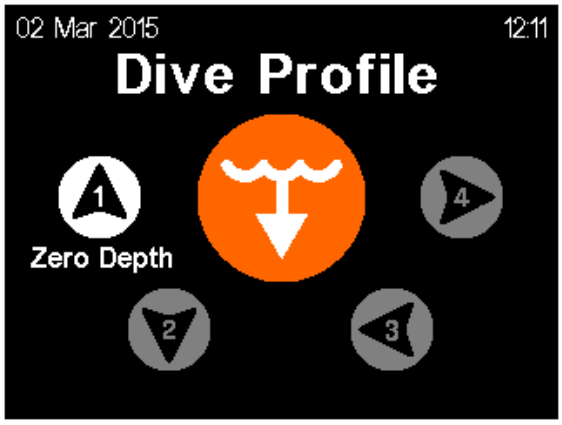
4.6.2 Marking Targets

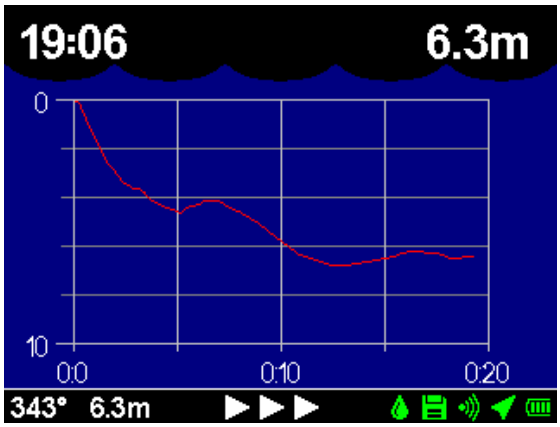
During a dive, the pressing **F1 / Up** will add a marker to the mission file at the divers current location. The marker is entered as a “diver marker” (▣) so its graphical symbol differs from that of a “waypoint” (◈) or “target marker” (⦿) simplifying post-mission dive-log analysis when using the Artemis Manager software.

In total, a mission file can up to 20 markers and this includes diver placed markers. Once the mission file marker list is full, no further diver placed markers can be added.

4.7 Dive Profile Application

The Dive Profile application shows the recent history of the depth sensor, along with the current depth reading and the duration of the dive (since the dive was started by the immersion sensor, or manually selecting “Start Dive” from the settings screen).





When the Dive Profile Application is active, the console buttons have the following functions…

1 **Zero Depth**

2 *Not used*

3 *Not used*

4 *Not used*

4.7.1 Resetting the Depth Sensor

Pressing F1/Up on the Depth display will reset the depth sensor reading to zero for the divers current depth. Consequently, this function should only be performed at the surface by the diver if the depth sensor isn’t reading zero.

However, if the Immersion Sensor is enabled (see Settings application), then the depth sensor will be automatically set to zero when an immersion is detected and a new dive-log is started.
Manually starting logging (from the Settings application) will not reset the depth sensor automatically.

4.8 Calibrating the Compass

The Artemis digital compass uses three magnetic sensor elements (one on each axis) to measure the surrounding magnetic field and determine the direction or Magnetic North.
However, the presence of ferrous material or changes in the magnetic environment around Artemis may cause an error to be present in the compass heading displayed, indicating that the sensors should be recalibrated.

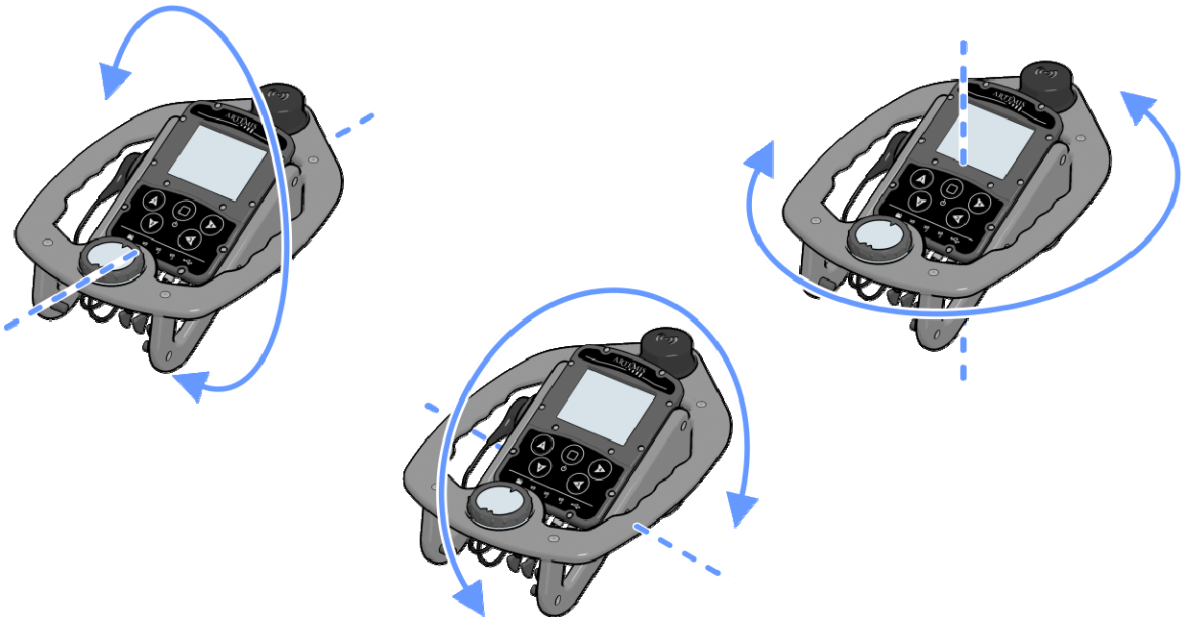
To calibrate the compass…

- Switch to the Settings Application.
- Choose the “Show Compass” option to bring up the Compass Display.
- Press the **F1 / Up** button to start the calibration procedure.
- Follow the instructions on the display to work through the calibration procedure and calibrate the compass.

During calibration, you will be required to rotate Artemis around its three axis (pitch, roll and yaw). It helps if you imagine Artemis being inside a sphere, and during rotation the front of Artemis is painting the inside of the sphere as you move it around.

The aim is to rotate and roll Artemis through as many orientations as possible in three-dimensional space, and as you do so the compass is attempting to measure the magnetic field for each orientation.

The figures below give an indication as to the types of movements you should make around the axis, and this should be done in a variety if different orientations (i.e. holding Artemis horizontally, vertically, upside down etc)…



4.9 Updating Firmware

Occasionally a new version of the Artemis firmware (software that is run on the Artemis Console) will be released, to fix bugs or add new functionality. The firmware can be updated in the field, without needing to return the unit to the factory.

The current firmware version can be obtained by switching to the “Settings Application”, and selection the “About” option in the list.

To update the firmware…

- Ensure you have the new “firmware.bin” file accessible on your computer.

- With Artemis turned off, connect the console to the PC via the USB cable.

- Turn Artemis on by pressing the power button.
- Artemis should connect to the PC and appear as a USB “Mass Storage Device” in Windows File Explorer.
- When Artemis is detected by Windows, open a File Explorer and copy the new “firmware.bin” file into the root of Artemis’ storage (do not change the filename).
- When the file has copied, to prevent corruption to any of the files follow the “Safely Remove Hardware & Eject Media” procedure required for the Windows operating system being used, to disconnect the Artemis Mass Storage Device.
- When Windows shows the “It is now safe to disconnect your hardware” notification change to the “Power Application” and power down Artemis.
- Disconnect the USB lead from the Artemis console.
- Press the power button again to turn Artemis back on. After a few seconds the screen should display “Updating Firmware”.
- Please wait for approximately 10 to 20 seconds for this process to complete.
- When done, Artemis should continue to its main display using the new firmware (the new firmware version number can be checked by changing to the “Settings Application” and selecting “About”).
- If the firmware update has been successfully, Artemis will remove the “firmware.bin” file from its storage.

<u>DO NOT FORMAT</u> the Flash storage as this will delete factory entered hardware-specific calibration data stored in hidden system files, and lead to erroneous sensor readings until new calibration data can be entered.

5 USING ARTEMIS MANAGER

5.1 Mission & Dive Log Files

"Artemis Manager" is a PC Windows software application that is used pre-dive to configure the Artemis console with geographical locations (navigational waypoints and targets of interest), and post-dive to review data collected by the sonar, and review the route taken by the diver along with additional targets marked during the dive.

Artemis Manager provides the user with two distinct functions…

Mission Files
Mission files are created prior to diving with Artemis, and copied onto its internal memory via the supplied USB cable.

The "Navigation Application" on the Artemis console reads the mission file, and displays a geographical chart showing the marked navigational waypoints and targets of interest for the dive.

During the dive, the diver can select a marker from the mission file and the Artemis Navigation System will then use position data (from the GPS float) to provide real-time distance and bearing information, helping to navigate them to the target.

The Artemis Manager application provides several methods for importing (and exporting) position information for the markers, including CSV (Comma Separated Variable) files and KML files (used by applications like Google Earth™).

Dive Log Files
During the dive, Artemis will collect and record all the sensor information received from the Sonar, GPS float, internal compass and depth sensor, into a 'dive log' file.

Once the dive is complete, the log file can be copied onto a PC running the Artemis Manager software application, and played back to allow the sonar data to be reviewed along side the diver position and heading when it was recorded.

Artemis Manager provides several data export functions, allowing the sensor data to be processed by other third-party applications (such as Tritech SeaNet, Google Earth™ and spreadsheet applications), as well as creating new mission files from the dive including any additional diver-placed position markers.

5.2 Installing Artemis Manager

From CD

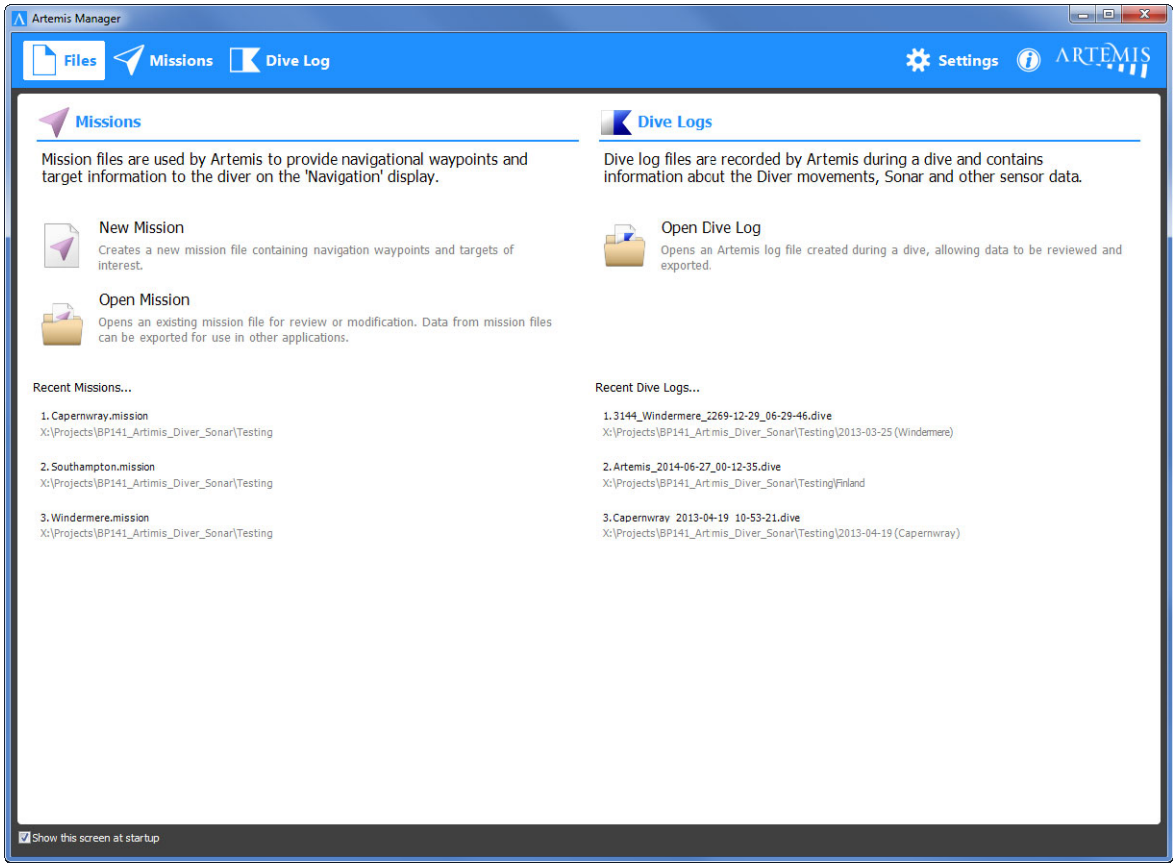
- Insert the CD supplied with the Artemis system into the CD-ROM drive of PC running Microsoft Windows.
- If the CD does not auto-run, run the "ArtemisSetup.exe" file found on it.
- When the Install Wizard starts, follow the on-screen instructions to complete the install, and place shortcuts to it on the Desktop and in the Start Menu.

From the Internet

- Visit the www.blueprintsubsea.com/artemis/support.php software support web page to download the latest version of "Artemis Manager"; then run it when complete.
- When the Install Wizard starts, follow the on-screen instructions to complete the install, and place shortcuts to it on the Desktop and in the Start Menu.

5.3 Getting Started

When “Artemis Manager” application starts, it will show the “Files” screen…



As discussed in the previous section, Artemis Manager has two distinct roles; Mission Editor and Dive Log Viewer.

The options available allow the operator to quickly perform the most commonly used tasks…

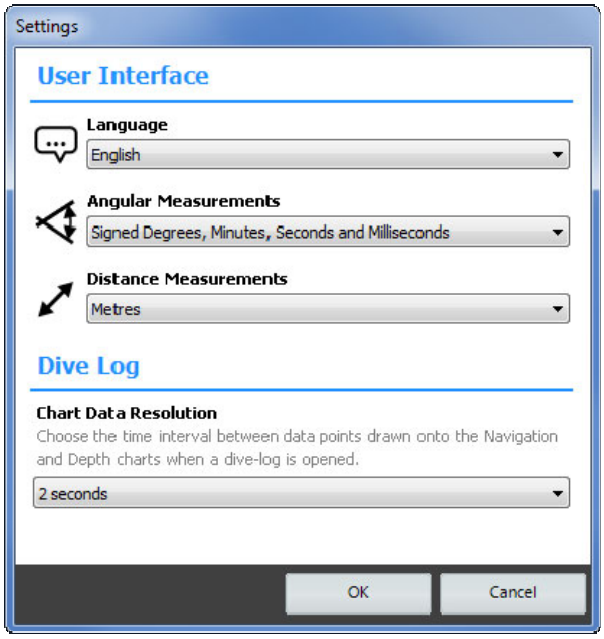
New Mission
Click this button to quickly jump to the “Mission Editor” and start working on a new mission file. See the “Mission Files” section below for further details.

Open Mission
This button opens an existing Mission File in the “Mission Editor”. See the “Mission Files” section below for further details.

Open Dive Log
This button opens a recorded log file in the “Dive Log Viewer” to allow data to be reviewed and exported. See the “Dive Log Files” section below for further details.

5.4 Settings & Options

From the “Files” page, click the “Settings” button to show a window where program settings and preferences can be adjusted



Angular Measurements

The angular measurements drop-down list allows you to select the style that latitude and longitude values will be shown as. Available formats include…

- Signed Degrees
- Signed Degrees & Minutes
- Signed Degrees, Minutes & Seconds
- Signed Degrees, Minutes, Seconds and Milliseconds

Examples…
-54.241819° N
-54° 14.509' N
-54° 14' 30" N
-54° 14' 30.547" N

- Unsigned Degrees
- Unsigned Degrees & Minutes
- Unsigned Degrees, Minutes & Seconds
- Unsigned Degrees, Minutes, Seconds and Milliseconds

Examples…
54.241819° S
54° 14.509' S
54° 14' 30" S
54° 14' 30.547" S

Distance Measurements

The distance measurements drop-down list allows you to select the units that distance values will be shown in. A variety of metric and imperial units are available, including…

- Meters (m)
- Feet (ft)
- Inches (in)
- Fathoms (ftm)

Chart Data Resolution

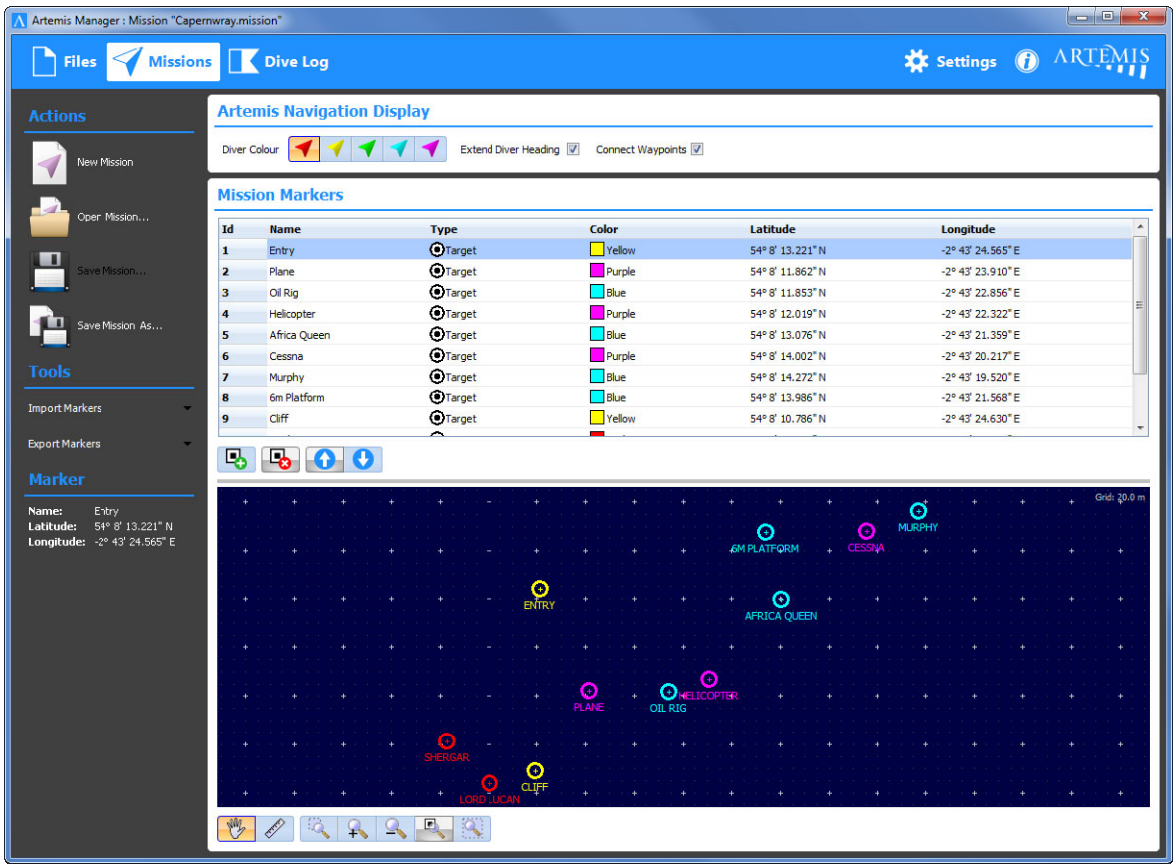
When Dive-Log data is loaded into Artemis Manager this settings determine the time interval at which data points on the display are created (for the Navigation Path and Dive Profile displays).

Selecting a smaller time interval will create higher resolution paths and allow the mouse point to show data to a finer time resolution at the expense of memory and possibly slowing the PC’s performance on larger Dive-Log files.

5.5 Mission File Editor

Show the “Mission File Editor” by clicking the Missions tab at the top of the Artemis Manager screen.

When a Mission File is open, then screen will look similar to the example below…



5.5.1 Mission File Actions

Use the actions listed down the left side of the screen to open, close and save Mission files…

New Mission
Closes any currently open mission file, and creates a new blank mission.

Open Mission
Loads a previously created (or exported from a Dive Log) mission file for review or editing.

Save Mission
Save any changes made to a Mission file back to disk.

Close Mission
Closes the currently open Mission file, prompting to save any changes in necessary.

5.5.2 Adding & Removing Navigation Markers

Navigation markers (up to a maximum of 20) can be added to the mission by clicking the “Add Marker” button. Once added, click on grid row to edit marker values.

To remove a marker, click its grid row then click the “Remove Marker” button.

Artemis can handle up to 20 mission markers in total, and this includes any placed by the diver during the dive. If the mission file has all 20 markers defined, there will be no spare capacity for the diver to add any additional markers.

Name

Each marker can have a name (up to 12 characters). This will be shown for the selected target on the Artemis navigation display.

Type & Colour

Each marker can be one of 3 types…

- **Waypoint** – waypoints are used to specify a search path/pattern and can be either dark or light gray in colour. Optionally, connecting lines can be shown on the Artemis display to assist the diver navigating the path.
- **Target** – targets should be used to specify points of interest that the diver may wish to navigate to or be aware of. A choice of Red, Yellow, Green, Blue and Purple colours are available for target markers.
- **Diver** - any markers placed during the dive are specified as “Diver” type to distinguish them from the pre-dive “Targets”.

Latitude, Longitude & Depth

Enter the position and depth of the marker in these fields. When the marker is selected as the destination on the Artemis navigation display, heading and distance will be given based on the divers current position (from the GPS float).

The format of the “latitude”, “longitude” and units of the “depth” values can be selected in the “Options” window – see the “Settings & Options” section on page 34 for further details.

5.5.3 Organising Navigation Markers

The order of the mission markers in the on-screen table is the order they will be presented to the diver on the Artemis console, and the order they are cycled through.

To re-order the list, click the row the required marker to move is on, then use the “Move Up” and “Move Down” buttons to reposition appropriately.

5.5.4 Navigation Display Options

The navigation display options control the appearance of information on the Artemis console during the dive.

Diver Colour
Use these buttons to choose the colour the diver (and trail) is represented as. Depending on the marker colours chosen, you may wish to choose a contrasting colour. By default red is selected.

Extend Diver Heading
Tick this option to show a “heading line” extending out from the diver icon. The heading line can assist the diver in determining if they are on the correct course.

Connect Waypoints
Tick this option to draw interconnecting gray lines between the defined Waypoint markers in the mission file. This is useful if waypoints have been entered to define a search pattern or path that should be followed.

5.5.5 Importing & Exporting Mission Data

Import KML Markers
As an alternative to entering mission navigational markers manually in the Mission Editor, third-party programs (such as Google Earth™) allow them to be graphically placed and saved to a KML file.
Choose this option to import any place-marks defined in a KML file as mission markers.

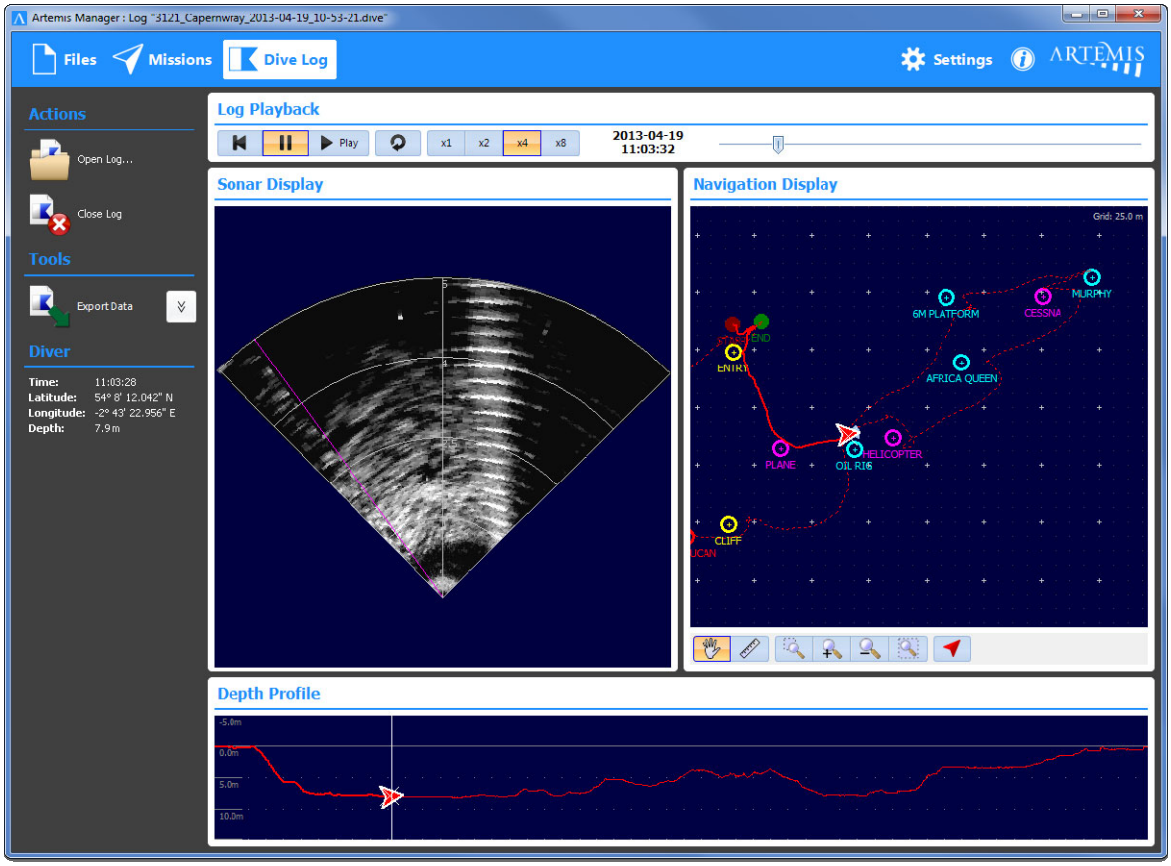
Export KML Markers
Exporting the mission markers to a KML file allows them to be opened and graphically edited in third-party programs (such as Google Earth™).

Export CSV Markers
The option exports the markers defined in the mission file, as a list of Comma Separated Variables (CSV), which can be opened and manipulated in spreadsheet applications.

5.6 Dive Log Viewer

Show the “Dive Log Viewer” by clicking the Dive Logs tab at the top of the Artemis Manager screen.

When a Dive Log is open, then screen may look similar to the example below…



The screen is split into several sections; file actions and tools are listed down the left side, displays for sensor data occupy the main central area, and log replay controls are shown along the bottom.

5.6.1 Dive Log Actions

Use the actions listed down the left side of the screen to open, close and save Mission files…

Open Log
Loads a log file recorded during a dive. In addition to depth, heading, and other integrated sensor data, the sonar data and GPS position are also recorded if those sensors are connected. Once opened, the Dive Log viewer can review or export the data to another application.

Close Log
Closes the currently open Dive Log file.

5.6.2 Exporting Data

Once the dive log has been opened, you can export its data to a variety of third party programs.

Click the expander button to the right of the “Export Data” tool, to show a popup list of file types that can be exported.

To export an individual file, click the file heading. Alternately, each file type has a tick-box next to it – select files to export in a batch operation, then click the “Export Data” button to export all files at the same time.

For convenience, your selections are remembered when Artemis Manager is opened, so once configured log files can be quickly exported to other programs.

Available export types are…

Tritech Seanet Sonar File
Exports a Seanet logfile (“.v4log” extension) which can be opened in Tritech’s Seanet application to review the sonar data, take measurements etc.

Artemis Mission File
Exports a new mission file that combines the mission file used to create the Dive Log, along with any additional markers placed by the diver during the dive.

KML Data
Exports the mission markers, diver markers and the path the diver took to a KML places file that can be loaded into graphical viewer applications such as Google Earth™.

CSV Data
Exports the mission markers, diver markers, path data, depth profile, battery voltage etc., into a series of Comma Separated Variable (CSV) files that can then be loaded into external applications and spreadsheets.

5.6.3 Log Playback

When a Dive Log has been opened, its can be played back in the Dive Log viewer using the following controls, location along the bottom of the display…

Position Slider
In the bottom right corner of the display, the position slider shows and sets the current position in the log file. Drag the slider to reposition the playback location.

Play
Click the play button to start log file playback.

Pause
Click the pause button to stop log file playback.

Restart
Move the playback position back to the start of the logfile.

Repeat
Toggles whether the log file stops playing when the end is reached, or automatically restarts from the beginning again.

Playback Speed
The “x1”, “x2”, “x4” and “x8” buttons controls the speed of the log file playback. For real-time playback (i.e. the speed the data was recorded at), select “x1”.

5.6.4 Navigation Display

The navigation display shows the route the diver took (as recorded by the GPS float), along with defined mission markers and diver placed markers.

Moving the log position slider will move the diver along the track, and show the route covered as a solid line.
The diver arrow graphic shows the divers heading as recorded by the Artemis compass.

The following controls and tools are available for the Navigation Display…

Pan
Choose this option, then drag the display with the left-mouse-button, to move the viewable area around.

Measure
Chose this option, then drag from one point to another on the navigation display, to measure distance and heading. Cursor information is shown on the left side of the screen.

Zoom To Area
Choose this option, then drag a rectangular area on the navigation display to zoom in to it.

Zoom In
Zooms the navigation display in one scale level.

Zoom Out
Zooms the navigation display out one scale level.

Zoom All
Sets the display zoom level to show all mission markers, and the entire route taken by the diver.

5.6.5 Depth Display

The depth display shows the depth profile recorded for the entire dive. Moving the log position slider will move the cursor along the display so the depth data can be related to the sonar and navigation displays.

Markers placed by the diver during the dive are shown as vertical dotted lines at the time index they were placed.

5.6.6 Sonar Display

The sonar display shows imagery recorded by the forward looking sonar. For further details on using the sonar and its imagery, refer to the section “Understanding Sonar Imagery” on page 60.

5.7 Entering Mission Marker Coordinates

In addition to importing markers from external sources (such as Google Earth), Mission File markers can be entered manually from geographic positions. However, there are several formats that positions can be expressed in and this section looks at how Artemis Manager handles these…

5.7.1 Definitions

The terms "Latitude" and "Longitude" define values of a geographic coordinate system for positions on the surface of a sphere such as the Earth.

- **Latitude** is the north/south angle between a point on the surface of the Earth and the equatorial plane, where a straight line that passes through the point and is normal to the surface of the Earth. Latitudes can lie between -90° (or 90° South) to +90° (or 90° North), where 0° lies on the equator.
- **Longitude** is the east/west angle between a point on the surface of the Earth and the reference meridian that goes from the North Pole to the South Pole. Longitudes can lie between -180° (or 180° West) to +180° (or 180° East)[1].

Latitude and Longitude geographic coordinate values represent the value of an arc, and depending on the convention being used can typically be expressed in one of three ways…

Degrees

Sometimes referred to as "Decimal Degrees", the value is written as a single number with fractional part that describes the coordinate.
Values in degrees are written with a circular dot symbol (°) after the value.

This is the simplest form of expressing a coordinate but requires a significant number of decimal places to describe a location[2].
At the equator (worst case), typically 5 decimal places are required to have a precision of approximately 1 metre, while 8 are required for approximately 1 millimetre.

Degrees and Minutes

The coordinate is expressed as two fields…

- The first field contains the whole (integer) number of degrees, and is indicated by the circular dot symbol (°).
- The second field contains the number of minutes with an optional decimal fractional component, and is indicated by the single quote symbol (').

Each minute value represents one sixtieth of a degree ($^1/_{60}$), and so the decimal minutes value can be obtained by multiplying the fraction part of a decimal degrees value by 60. For example…

32.76125° ≡ 32° 45.675' *(as 0.76125 × 60 = 45.675)*

This notation is sometimes called Degrees and Decimal Minutes, or DM for short.

Degrees, Minutes and Seconds

Expanding on the previous form, the coordinate is expressed as three fields…

- The first field contains the whole (integer) number of degrees, indicated by the circular dot symbol (°).

[1] Values of -180° and +180° describe the same antipodal meridian relative to the 0° "Greenwich" meridian.

[2] For further information on precision visit http://en.wikipedia.org/wiki/Decimal_degrees.

- The second field contains the whole number of minutes, indicated by the single quote symbol (').
- The third field contains the number of seconds with an optional decimal fractional component, and is indicated by the double quote symbol (").

As with the DM notation above, each minute represents one sixtieth of a degree, but additionally each second represents on sixtieth of a minute (or $^{1}/_{3600}$ of a degree).

Values can be converted from decimal degrees by first multiplying the fractional part of the degrees value by 60 to obtain the minutes, then multiplying the fractional part of the minutes again by 60 to obtain the seconds, For example…

32.76125° ≡ 32° 45.675’ ≡ 32° 45’ 40.5” *(as 0.675 × 60 = 40.5)*

This notation is sometimes called Degrees, Minutes and Decimal Seconds, or DMS for short.

5.7.2 Signed versus Unsigned

As discussed above, Latitudes and Longitudes both fundamentally express an angular value in degrees, so a ‘sign’ value is used to indicate which hemisphere the coordinate lies in.

Convention defines these to be…

- For Latitudes…
  - Positive values lie in the Northern hemisphere (from 0° to +90°)
  - Negative values lie in the Southern hemisphere (from 0° to -90°)
- For Longitudes…
  - Positive values lies in the Eastern hemisphere (from 0° to +180°)
  - Negative values lies in the Western hemisphere (from 0° to -180°)

The hemispheres are often abbreviated to the four characters “N”, “S”, “E” and “W” and these are written at the end of the coordinate value.

So, for example (ignoring the latitude or longitude context)…

- 32.76125° would be interpreted as either 32.76125° N or 32.76125° E
- -32.76125° would be interpreted as either 32.76125° S or 32.76125° W

However, this means we can choose to either…

- Express all values with a positive or negative ‘sign’ and use a North or East reference ONLY.

  Artemis Manager refers to this system as SIGNED COORDINATES

  i.e. 32.76125° N and (minus) -32.76125° N
- Express all values without any sign, and use the appropriate North/South or East/West notation

  Artemis Manager refers to this system as UNSIGNED COORDINATES

  i.e. 32.76125° N and 32.76125° S

5.7.3 Choosing the Display Format

You can choose how you want Artemis Manager to display Latitude and Longitude coordinate values using the “Settings” button from the toolbar.

When the Settings window appears, the angular measurements drop-down list allows you to select the style that latitude and longitude values will be shown in.

Regardless of how values are to be displayed, Artemis Manager will accept values in ANY of previously discussed formats when creating mission files.

Examples of how the different formats are displayed are…		**Signed** Values are always shown in terms of the Northern or Eastern hemispheres with an optional minus sign to indicate Southern or Western values.	**Unsigned** Values are always shown without a minus sign. Instead a “N/S” or “E/W” character is used to indicate the hemisphere.
Degrees	Values are expressed as Decimal Degrees (DD) to 6 decimal places.	***54.241819° N*** *for the northern hemisphere or* **(minus)** **-54.241819° N** for the southern hemisphere.	***54.241819° N*** *for the northern hemisphere or* **54.241819° S** for the southern hemisphere.
Degrees & Minutes	Values are expressed as a whole number of degrees and a number of minutes with a decimal fractional part.	***54° 14.509' N*** *for the northern hemisphere or* ***(minus)*** ***-54° 14.509' N*** *for the southern hemisphere.*	***54° 14.509' N*** *for the northern hemisphere or* ***54° 14.509' S*** *for the southern hemisphere.*
Degrees, Minutes & Seconds	Values are expressed as a whole number of degrees, minutes and seconds (with no fractional part).	***54° 14' 30" N*** *for the northern hemisphere or* ***(minus)*** ***-54° 14' 30" N*** *for the southern hemisphere.*	***54° 14' 30" N*** *for the northern hemisphere or* ***54° 14' 30" S*** *for the southern hemisphere.*
Degrees, Minutes, Seconds & Milliseconds	Values are expressed as a whole number of degrees and minutes, and a number of seconds with a decimal fraction part (to 3 decimal places – milliseconds).	***54° 14' 30.547" N*** *for the northern hemisphere or* ***(minus)*** ***-54° 14' 30.547" N*** *for the southern hemisphere.*	***54° 14' 30.547" N*** *for the northern hemisphere or* ***54° 14' 30.547" S*** *for the southern hemisphere.*

5.7.4 Entering Coordinate Values

This section covers how to enter Latitude and Longitude coordinates into Artemis Manager when creating Mission files. Typically this is required when coordinates have been obtained by a third-party or provided by a GPS system.

The common source of confusion when trying to enter coordinates is interpreting their format and value compared to that Artemis Manager is currently using to display coordinates.

However, it should be noted that regardless of how values are set to be displayed, Artemis Manager will accept values in ANY of previously discussed formats when creating mission files.
When the value has been entered, Artemis will then convert it and display it in the currently required settings.

This means you can enter values as either just Degrees or Degrees & Minutes, while the display setting is Degrees, Minutes and Seconds. Once the value has been entered and accepted as valid it will be shown in the DMS format.

When entering coordinates as either Latitude or Longitudes, Artemis Manager expects up-to three separate numbers to be entered for the value, separated by spaces.
The last of these numbers may have a decimal point and fractional part.

Any minus sign entered before the sets of numbers will make the value negative and specify either the Southern or Western hemispheres.
Alternately, you may enter a “N”, “S”, “E” or “W” character after the values to specify the hemisphere.

For example, all the following values represent the same location and may be entered as Latitudes regardless of the current display format Artemis Manager is set to…

- `-54.241819` or `54.241819 S` *Degrees*
- `-54 14.509` or `54 14.509 S` *Degrees & Minutes*
- `-54 14 30` or `54 14 30 S` *Degrees, Minutes & Seconds*
- `-54 14 30.547` or `54 14 30.547 S` *Degrees, Minutes, Seconds & Milliseconds*

Any other letters, punctuation characters or number fields that you may enter will either be ignored or result in a value of zero (0) if they corrupt the meaning of the value.

This means that symbols for Degrees (°), Minutes (‘) and Seconds (“) can be optionally used if values are being pasted in from another source, but are not critical as it is the order of the fields (separated by spaces) that is important.

5.7.5 Troubleshooting Coordinates

Sometimes coordinate values can be provided in ambiguous forms that hides their format. In such cases think about the rules and range limits for Latitudes and Longitude to help interpret them, for example…

- **54 13 875**

  Artemis manager would not accept this as the third field is seconds and so can only accept values up to 60.
  It is more likely that a decimal place is missing and the value should read "54 13.875" indicating a Degrees and decimal minutes format.

  If entered as a Latitude the value will be in the Northern hemisphere, while a Longitude will specify the Eastern hemisphere.

- **093 42 23.5**

  This would have to be entered as a Longitude, as Latitude values cannot exceed ±90°.
  Artemis manager will ignore any leading zeroes on any of the numeric fields.

- **4916.45N**
- **12311.12W**

  Values in this type of format often come directly from GPS NMEA serial strings.
  Depending on the value type either the first two of three characters should be interpreted as degrees, followed by two characters and the decimals as the minutes…

  4916.45N represents 49° 16.45' N and should be entered as "49 16.45 N".

  12311.12W represents -123° 11.12' E and could be entered as either "123 11.12 W" or "-123 11.12 E".

5.7.6 Useful Formula

A value expressed in Degrees, Minutes and Seconds component form can be converted to Decimal Degrees using the following…

$$DD = D + \frac{M}{60} + \frac{S}{3600}$$

A value expressed as Decimal Degrees (DD) can be converted into its component Degrees (D), Minutes (M) and Seconds (S) using the following equations…

$$D = trunc(DD)$$
$$M = trunc(|DD| \times 60) \mod 60$$
$$S = trunc(|DD| \times 3600) \mod 60$$

Additionally the Decimal Minutes (DM) and Decimal Seconds values can be found by…

$$DM = (|DD| \times 60) \mod 60$$
$$DS = (|DD| \times 3600) \mod 60$$

Where…

- $|DD|$ represents the absolute value of Decimal Degrees.
- $trunc(x)$ is the truncation function (that removes the fraction part of a value).
- $\mod$ is the modulo operator, that finds the remainder of a division.

5.8 Creating Mission Files using Google Earth

As an alternative to manually entering Mission file marker coordinates as values, a Mission file can be created by importing KML markers graphically positioned using the Google Earth™ application.

In its basic form, Google Earth is a freely downloadable Windows application that displays a graphical virtual 3D globe overlaid with high resolution aerial imagery of the Earths terrain.

By using mouse and on-screen controls, the user can position and zoom the virtual observation "camera" above the site where they wish to create a mission file, and use Google Earths tools to graphically position and name markers ready for import into Artemis Manager.

5.8.1 Installing Google Earth

To create KML files, Google Earth needs to be installed on your computer if not already.

- To download the latest version of Google Earth, open an internet browser and visit www.google.com/earth.
- Follow the links and on-screen instructions to download and install Google Earth onto your computer.

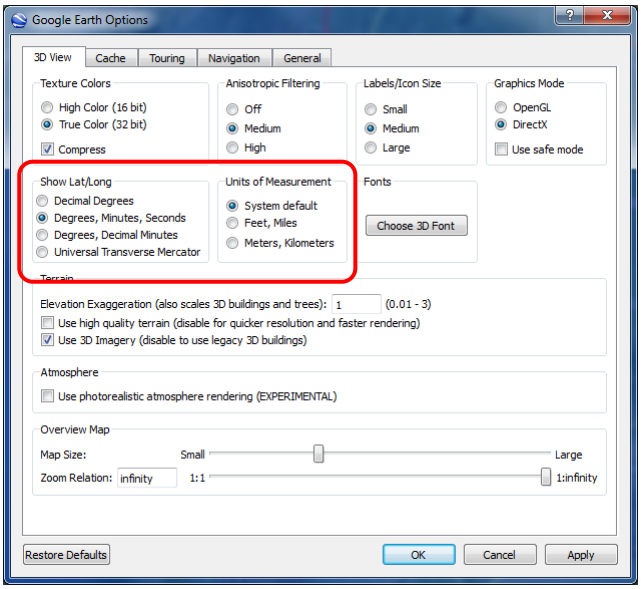
At the time of writing, the current version of Google Earth was v7.1.2 (found by choosing "Help » About Google Earth" from the menu).
Subsequent software releases may mean some of the screen-shots will differ but the basic concepts presented here should remain valid.
For further details on the use of third-party software applications with Artemis please refer to the "Notices" section on page 66 of this manual.

Further information on how to use Google Earth, including a comprehensive set of tutorials is available on the Google Earth website at the link given above.

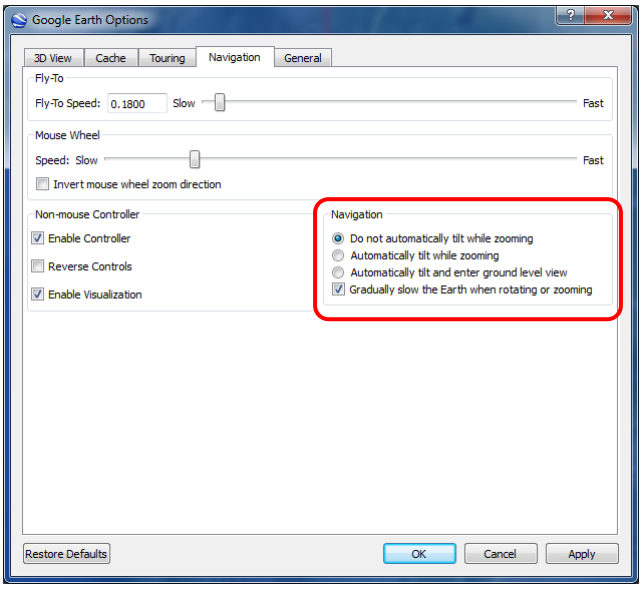
5.8.2 Preparing Google Earth for use

Once Google Earth has been successfully installed, it is recommended that several configuration changes are made to its default settings.

- From the menu, choose "Tools » Options", to show the "Google Earth Options" window.
- In the Options window under the "3D View" tab, first choose how you want latitude and longitude values to appear and distance units to be displayed in the "Show Lat/Long" and "Units of Measurement" group boxes respectively.

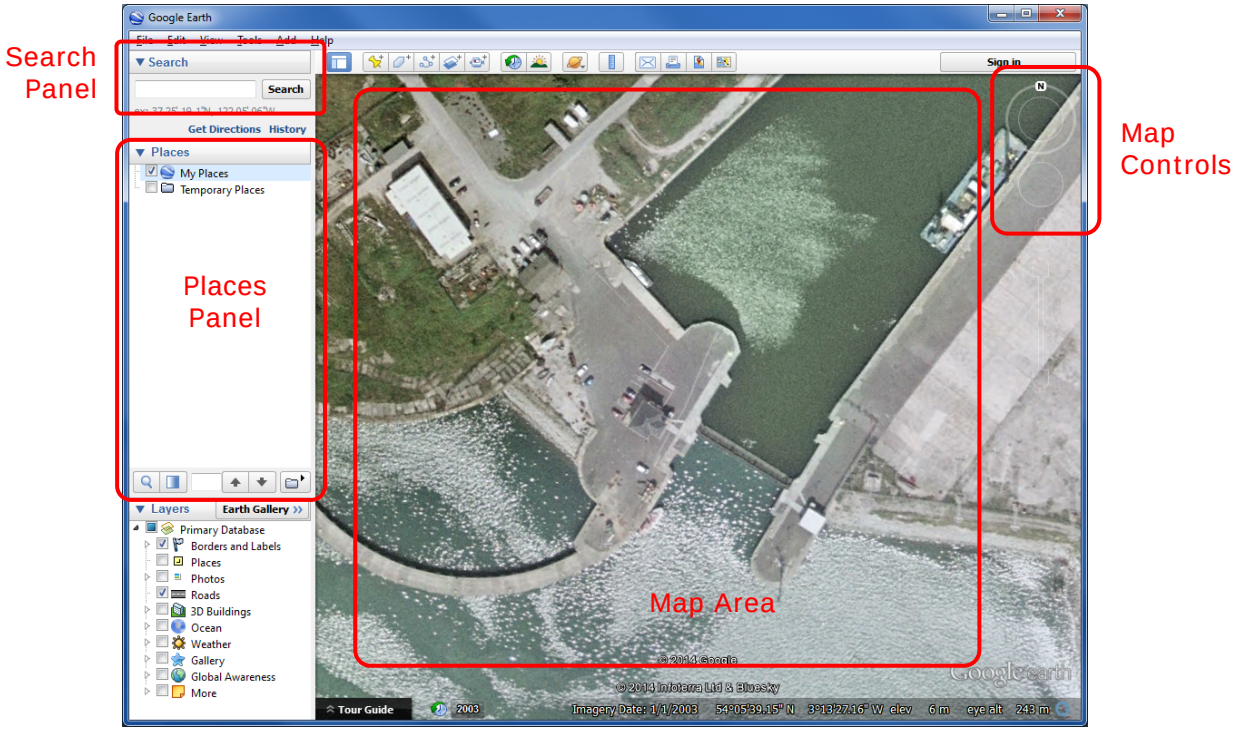


- For ease of use, it is recommended that the auto-tilt while zooming feature is disabled.
- To achieve this, in the Options window select the “Navigation” tab, and in the “Navigation” group box click the “Do not automatically tilt while zooming” option.



5.8.3 Using Google Earth

In addition to its toolbar and menu bar, the Google Earth display has four main areas that the user should be familiar with…



Map Area

The map area shows the 3D view of the earth as if looking through a camera. When the mouse pointer is over this area…

- Holding down the left mouse button and dragging will pan the map around.
- Rolling the mouse wheel will zoom the map in and out.
- Holding down the middle mouse button and dragging will tilt the map (NB: This function may be sometimes overridden by the Windows mouse settings, and not work).

Map Controls

The map controls allow the map to be panned, tilted and zoomed, by holding down the left mouse button over the relevant control and then dragging the mouse pointer.

A useful feature is to click the “N” icon on the compass to re-align the map view to geographic north.

Places Panel
The places panel will be used extensively in this tutorial to manipulate the place markers over the targets of interest before being exported to Artemis Manager.

The places panel will show a hierarchical list (or 'Tree View') of folders containing place markers.
Right clicking with the mouse will show a pop-up menu that provides actions that can be performed on the item in the list, including…

- **Add** – This sub menu allows additional place marks and folders to be created.
- **Rename** – This option allows place marks to be renamed; the names will be exported into Artemis Manager.
- **Save Place As** – This option will start the export process, saving the currently selected folder/place to a KML file.
- **Properties** – This option shows the properties window, and when visible place mark positions can be changed by dragging the place mark.

Search Panel
The search panel is useful to quickly find a place of move the map to a specific geographic coordinate.

To search for latitudes and longitudes, enter the coordinate in the form "<latitude>, <longitude>".
Use of the symbols for degrees, minutes and seconds is optional if each coordinate is appended with a "N/S" or "E/W" character.

For example, entering…

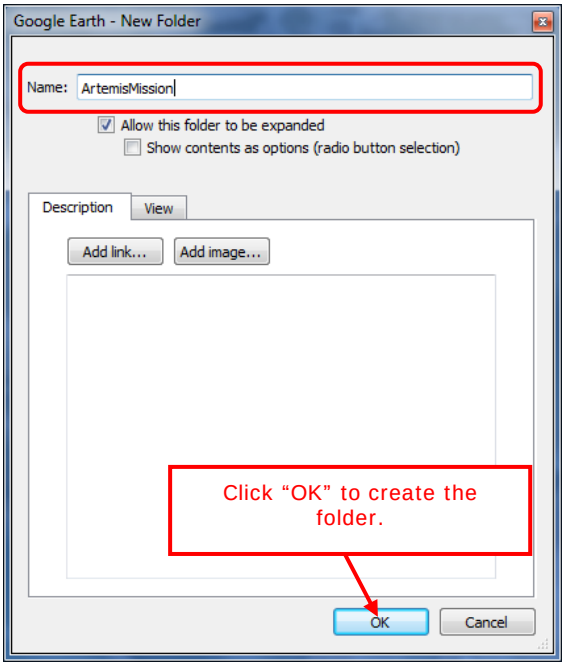
- `51 31 54N, 0 7 23W` or
- `51 31′ 54N″, 0 7′ 23W″` or
- `Kings Cross Station London`

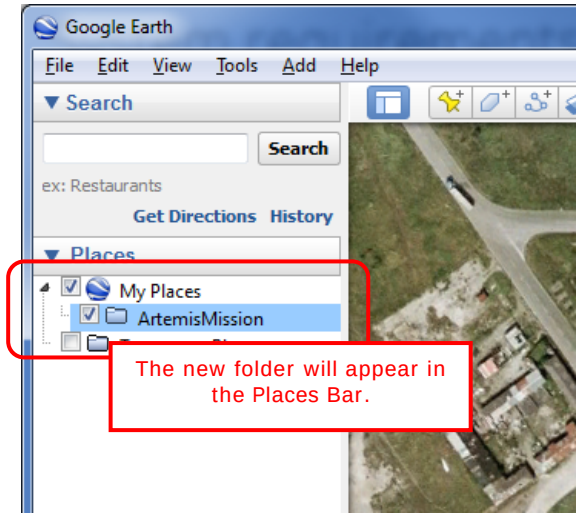
will jump the map view to Kings Cross railway station in London.

5.8.4 Creating Mission Markers

Creating the Mission Marker folder
The first step to creating an Artemis Mission file in Google Earth is to create the places "folder" to organise the markers within.

- To create a folder, either…
    - o Left click on the "My Places" entry in the Places Bar to select it, then choose from the main menu "Add » Folder", or
    - o Right click on the "My Places" entry in the Places Bar, and choose "Add » Folder" from the pop-up menu.
- A "New Folder" window will appear. In the text box next to the "Name" heading, enter the name Mission File as the folder name.
- Press Enter, or click "OK" to create the folder.
- In the places bar, a new folder entry will appear under "My Places"





When exporting the markers, the name of this folder will be the default filename, although you may then change it to whatever you wish.

If you have other entries under "My Places" in the Places Bar, and accidentally create the new folder in the wrong place (or level of the hierarchy), drag the new folder (with the left mouse button) over the top "My Places" heading to move it.

If you wish to change the name of the folder, right click on it in the Places Bar, then select "Rename" (or "Properties") from the pop-up menu.

Placing Markers
Having created the Mission Marker folder, the next step is to create and position the required mission markers. There are several ways of doing this, first we will place the markers visually on the map.

- Use the mouse and map controls to pan and zoom the map area to the location that the mission markers will be placed in.

If you are creating mission markers from a list of coordinates, enter the first coordinates into the Search Panel as described previously.

- To create a new marker (that will initially appear at the centre of the current map view), either…
    - o Left click on the newly created Mission Folder (see above) in the Places

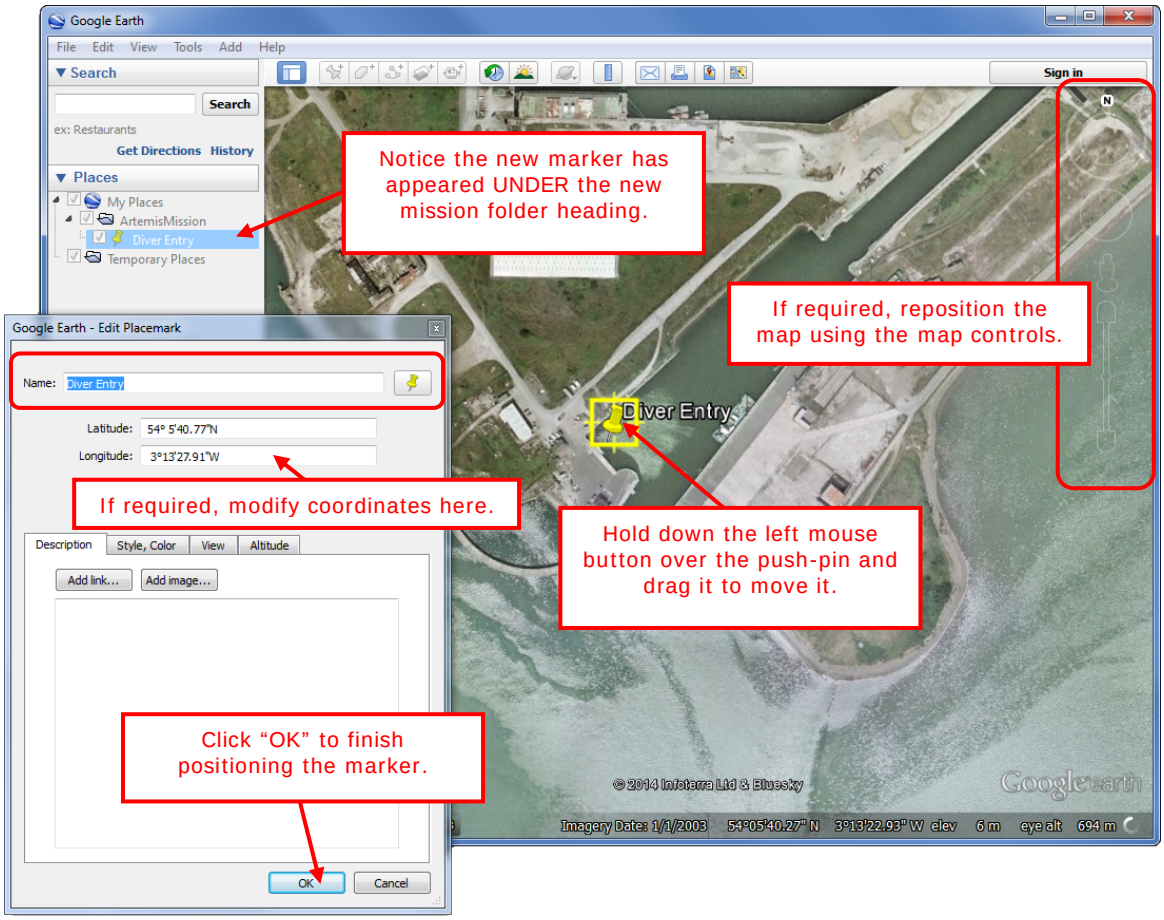
Bar to select it, then choose from the main menu “Add » Placemark”, or

- Right click on the newly created Mission Folder in the Places Bar, and choose “Add » Placemark” from the pop-up menu.

- The “New Placemark” window will appear. If this is over the work area of the map, drag the window title to move it out of the way.
- Enter the name of the marker into the text box at the top of the Placemark window. This is not mandatory, but when imported the name will appear on the Divers display of the Artemis console (truncated to 12 characters if the one you enter here is longer).
- On the map area, a push-pin icon will be shown (with flashing yellow box highlighting it – drag the push-pin icon to the desired marker location by holding down the left mouse button.

While positioning the push-pin, you may use the map controls on the right side of the display to zoom or reposition the map, or use the left mouse button or mouse wheel over the map area.

- If you have a known location for the marker, you may manually enter this in the “Latitude” and “Longitude” text boxes in the Placemark window.
- Once you have positioned the push-pin, press Enter or click “OK” to confirm its position and stop editing.
- Repeat the above steps for each marker you wish to add to the mission. Artemis can support up to 20 markers in a mission, but filling all 20 will prevent the diver from adding additional markers during the dive as there will be no space to store them in.



If you have other entries under “My Places” in the Places Bar, and accidentally create the new Placemark in the wrong place (or level of the hierarchy), drag the new Placemark (with the left mouse button) over the top mission folder to move it into it.

If you wish to change the name or reposition the Placemark, right click on it in the Places Bar, then select “Properties” from the pop-up menu. The “Edit Placemark” window will then appear, and the push-pin can be dragged or repositioned as described above.

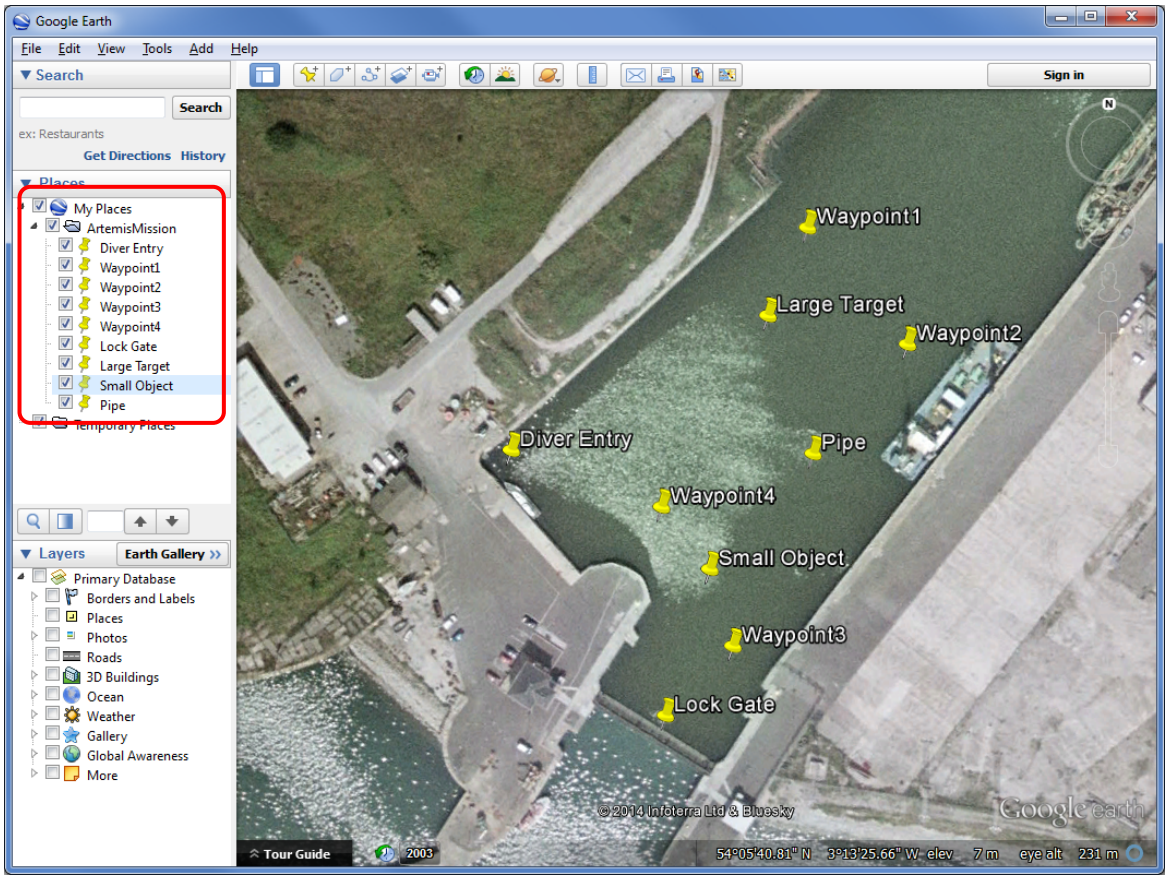
5.8.5 Exporting KML markers from Google Earth

Once you have followed the previous procedures to create the mission marker folder, then add placemarks to it representing the mission targets and waypoints, you can export these markers into Artemis Manager via a KML file.

The image below shows a fairly typical set of mission markers. Marker names have been chosen to be brief but descriptive to the diver (when shown on the Artemis Display).

Notice how the markers have all been added to the “ArtemisMission” folder in the places bar, and the hierarchy shows them to be indented to the right from the folder name.

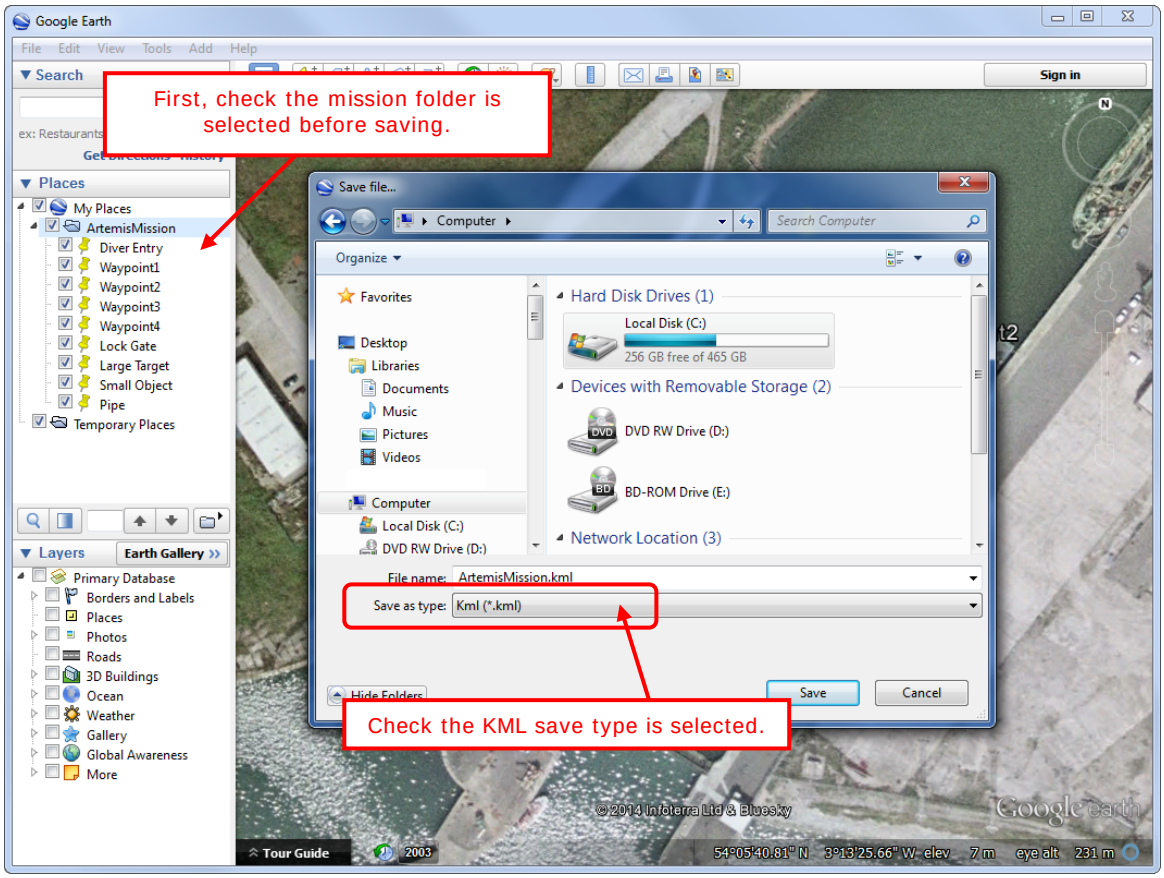
If all the markers aren’t in the mission folder, at this stage drag them over the mission folder name to reposition them. Additionally, drag the markers names over each other within the mission folder to organise the sequence they will appear to the diver in (this can also be done later in Artemis Manager).



Once the markers are entered and have been organised correctly, export them to a KML file…

- Start the export for just the required mission markers by either…
    - Selecting the mission folder to export in the Places Bar by left clicking on it, then choose from the main menu “File » Save » Save Place As”.
    - Right click on the mission folder to export in the Places Bar, then form the pop-up menu choose “Save Place As”.
- The “Save File” window will appear. By default the mission folder name created previously will be used as the file name – if required, change this here.

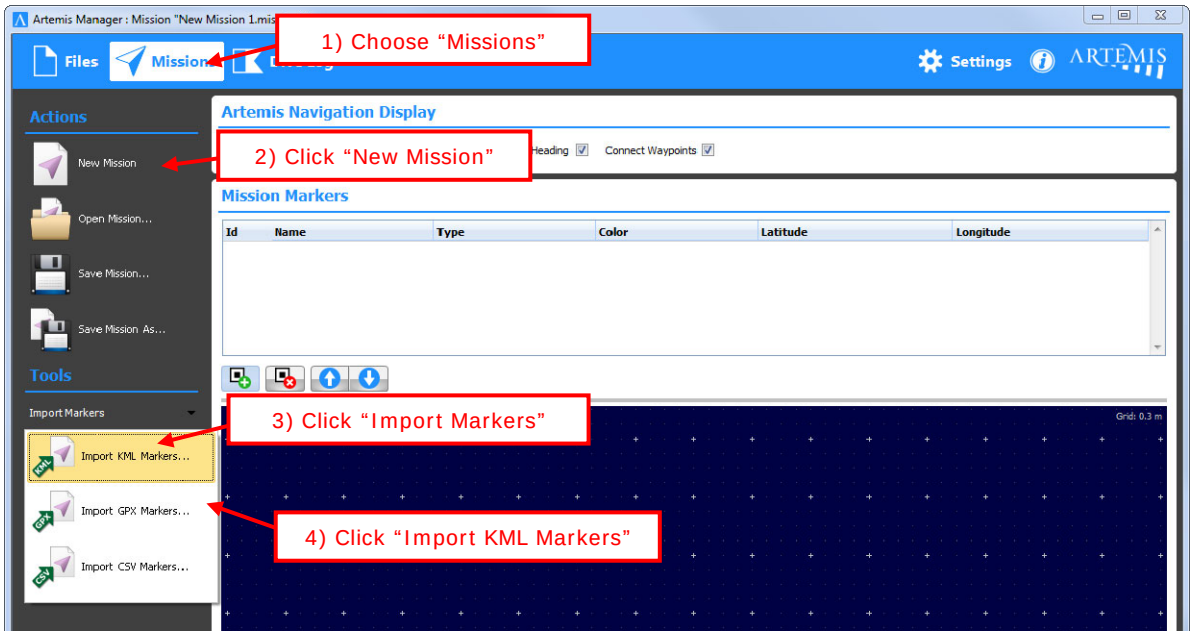
- By default, Google Earth will try to export the markers in a KMZ format. As Artemis Manager requires a KML format, click the “Save as type” drop down list and choose the KML option.
- Choose the file location you want to export the data to, then click “Save”.



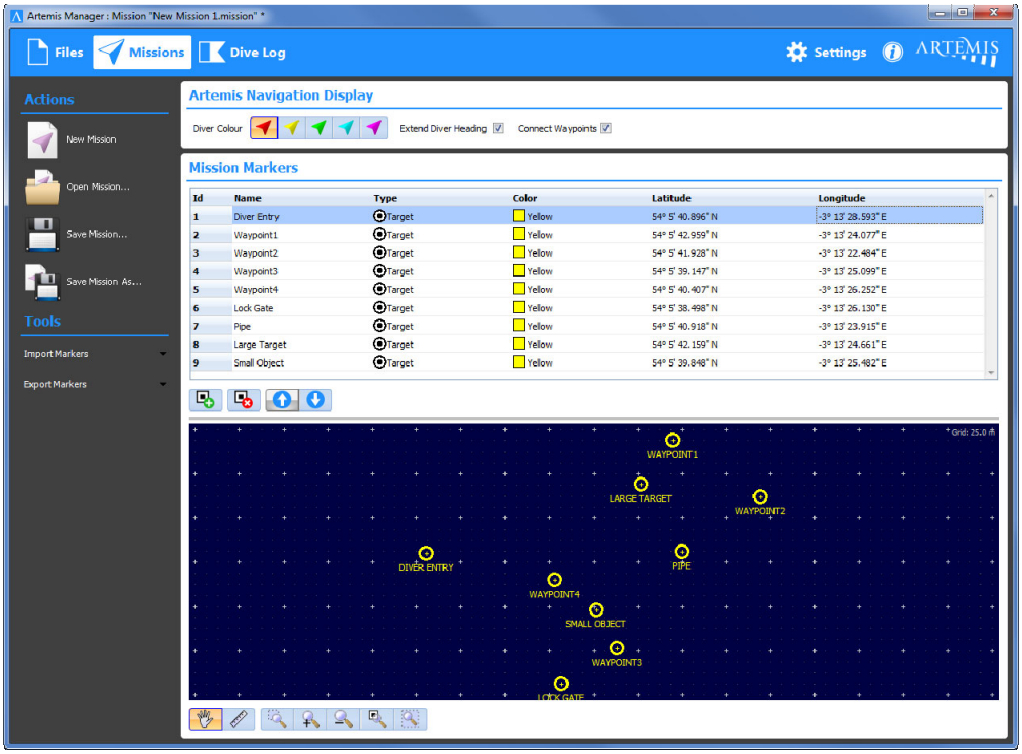
5.8.6 Importing KML markers into Artemis Manager

Once the markers have been exported from Google Earth, the can be imported into Artemis by the following steps…

- First, start the Artemis Manager application
- Click the “Missions” tab at the top of the screen.
- Click on the “New Mission” button under the “Actions” heading – this will create a new empty mission file.
- Click on the “Import Markers” button under the “Tools” heading.
- From the pop-up menu choose “Import KML Markers”



- When the “Import Mission Markers” window appears, find the file KML that was exported previously from Google Earth, and click “Open”.
- The markers should be imported and the display should show something similar to…

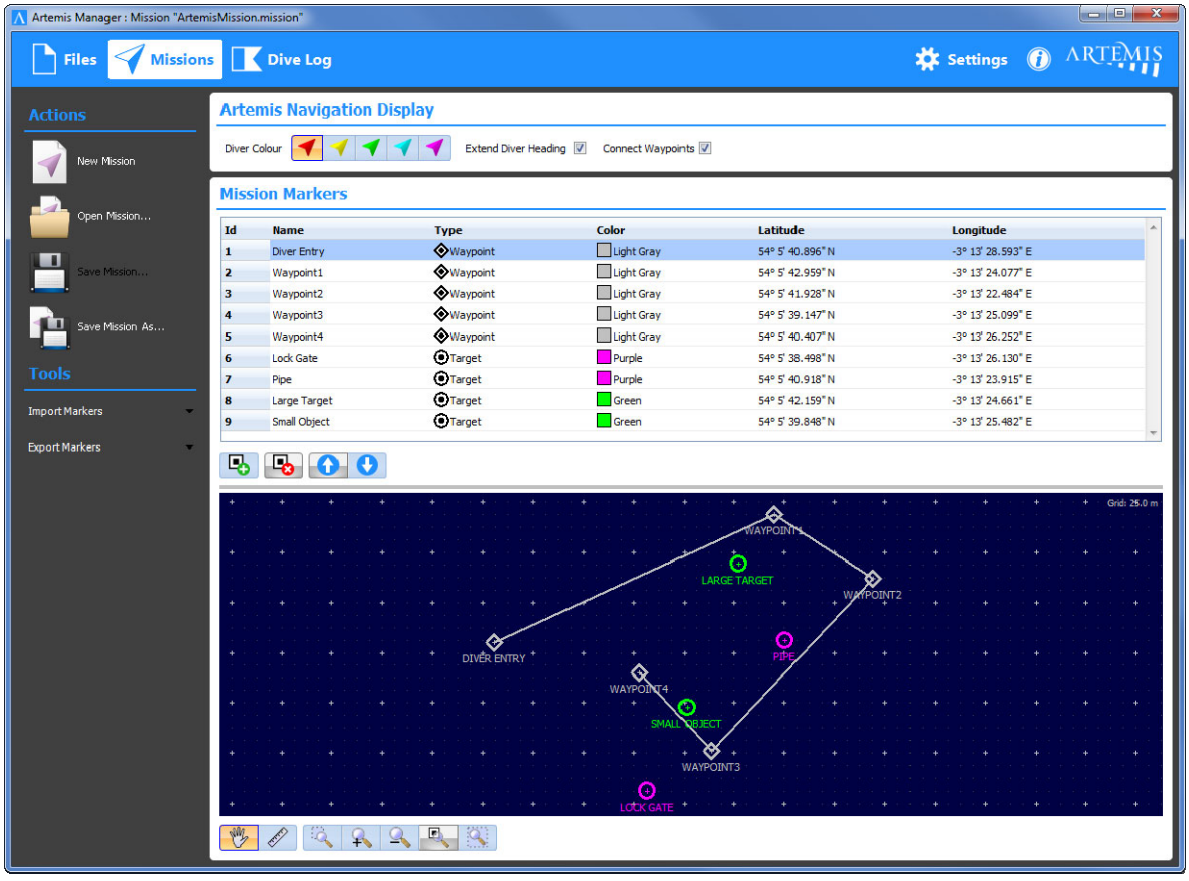


- At this stage the mission file may now be saved ready for use with Artemis by clicking on “Save Mission As”. However, we may now wish to customise some of the marker properties…
- For each marker shown in the “Navigation Markers” list, click on the “Type” and “Colour” entries to customise how the markers will appear to the diver.

Markers can be chosen to be one of three types…

- Target — Targets should be used to specify points of interest that the diver may wish to navigate to or be aware of. A choice of Red, Yellow, Green, Blue and Purple colours are available for target markers.
- Waypoint — Waypoints are used to specify a search path/pattern and can be either dark or light gray in colour. Optionally, connecting lines can be shown on the Artemis display to assist the diver navigating the path.
- Diver — Diver markers are normally placed during the dive are specified as “Diver” type to distinguish them from the pre-dive “Targets”. However, you may wish to use the different symbol graphic to identify certain types of targets.

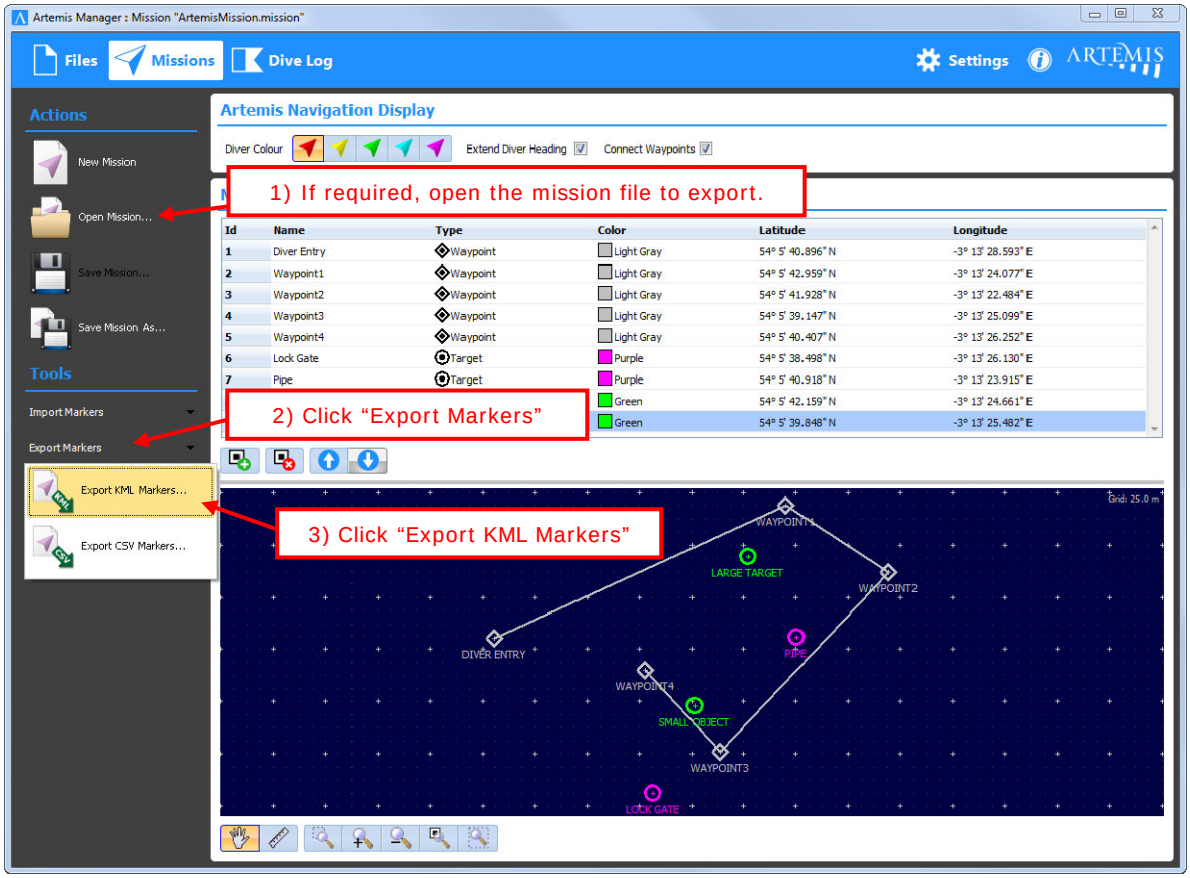
- If required, reorganise the marker order by clicking on a marker entry and using the “Move Up” and “Move Down” buttons.
- In the example below, the marker types and colours have been customised to show a navigation path for the diver made up from Waypoints, with known fixed objects shown in purple, while targets to investigate are highlighted in green – these colour conventions are arbitrary and up to the diver and dive supervisor to agree upon.
- When done, click “Save Mission As” to save the mission file, then transfer it to Artemis using the USB cable and method discussed in the Artemis User Manual.



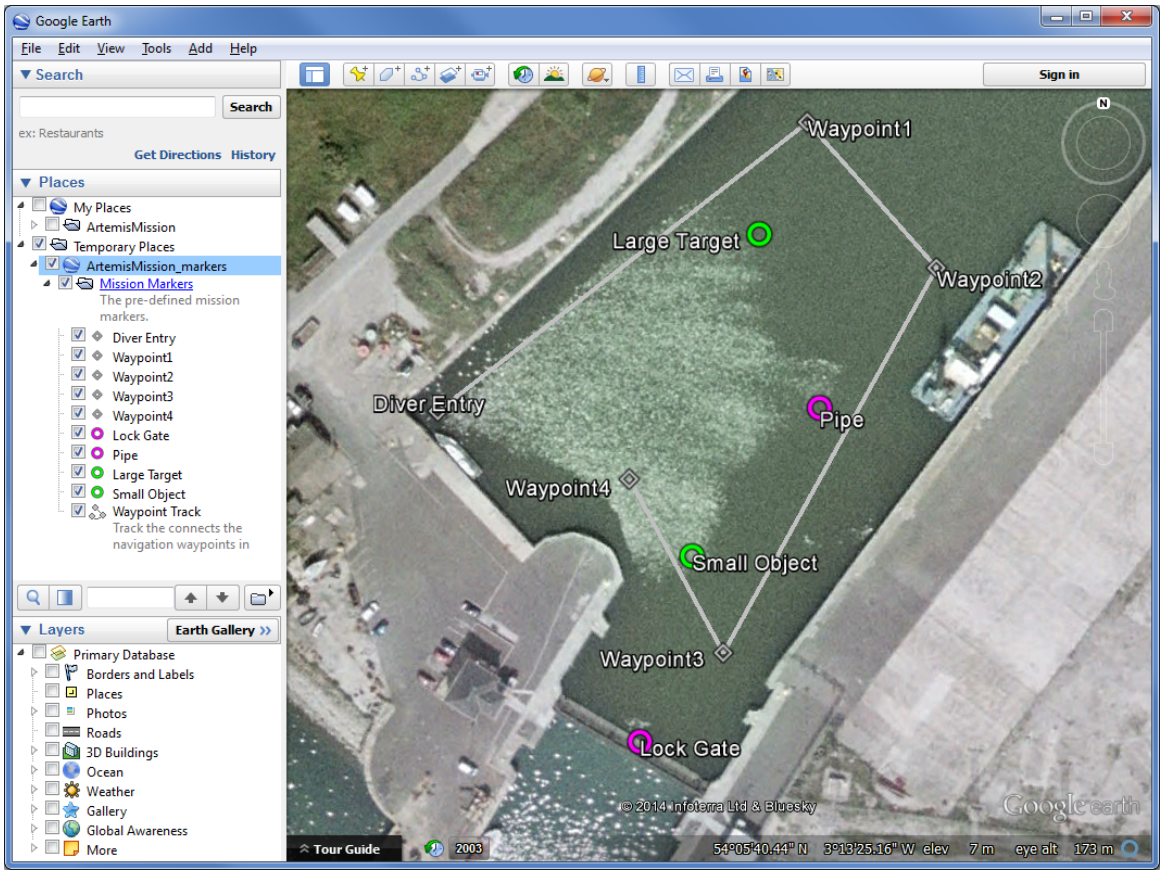
5.8.7 Exporting Mission Markers to Google Earth

For convenience or to allow further editing, Artemis Mission markers can be exported as a KML file and imported back into Google Earth.

- Start with an open mission file in Artemis Manager.
- Click on “Export Markers” under the “Tools” heading.
- Click on “Export KML Markers” in the pop-up menu.
- In the “Export Mission Markers” window, choose the location to save the KML file to, then click “Save”.



- Switch back to Google Earth, and from the main menu choose “File » Open”.
- From the “Open” window, find the location where the KML markers where exported to, select the file and click “Open” to load them into Google Earth. The display may then look like the following image…



Notice that the marker colour and symbol have also been imported across, and the waypoint connecting lines added where required.

Also notice that a new folder with the name of the file (in this case "ArtemisMission_markers") has been created in the places bar under the "Temporary Places" heading.
This means that these markers will not be saved by Google Earth when it is closed, unless they are dragged into the "My Places" category.

Use the check-boxes to the left of the marker or folder names in the Places Bar, to toggle their visibility on the display if it becomes cluttered.

Double click on a marker or folder name in the Places Bar to move the map view to show it.

6 DIVING ARTEMIS

Before diving with the Artemis console, please familiarise yourself will all aspects of the systems operation, as described in this manual.

6.1 Pre-Dive Checklist

Prior to a dive with the Artemis Console, please check all of the following actions have been completed...

- There is enough free space on the internal storage for the Dive-Log file – allow approximately 2Mb of storage space per minute of the dive.
- Any Mission file to be used has enough free “marker” slots to allow the diver to define any in-mission markers if required.
- Battery pack is fully charged ( )
- Battery housing cap is tight and sealed.
- Blanking plugs have been fitted to all unused connectors (Serial and USB) to prevent water ingress.
- If the Sonar is to be used, check the Sonar status icon ( ) on the Artemis Display status bar is visible and white (red indicates no Sonar connected, yellow indicated invalid data).
- If the GPS Float is to be used, check the GPS status icon ( ) on the Artemis Display status bar is visible and white (red indicates no GPS connected, yellow indicates data, but not GPS fix determined).

6.2 Summary of Sonar Operation

The following points summarise the operation of the sonar (for further details, see page 60) ...

- Hold the sonar horizontally and stationary for a few seconds while a full scan completes. Moving the sonar during a scan will smear or distort the imagery.
- Only targets illuminated by the sonar beam can be seen – 35° in the vertical plane, 3° in the horizontal plane, scanning through a 90° arc.
  With the sonar angled horizontally, this means targets above and below the operator by approximately 17° degrees may not be seen.
- The polar sonar display shows “top-down” type display of the echoes received from the targets leading edges.
- Targets cast acoustic shadows, which may obscure all or parts of targets behind them.
- Dense or gaseous targets appear brightest on the display, while mud and silt will appear very dull.
- As no vertical information is available, vertically aligned or overlapping targets in the sonar beam will merge into a single echo.
- Use the gain control to reduce the background noise reflections in a high clutter (rocky/boulder) environment.
  When scrutinizing a target at close range (within 3m range) in turbid or nil visibility, the gain is particularly useful in establishing the shape, constitution and dimensions of the target being prosecuted.

6.3 Recommended Operational Procedures

6.3.1 Searching Within 30 Metres of a Known Target Position

The following operational procedure is recommended when searching within 30 metres of a known seabed target position…

- Check that Artemis has been prepared in accordance with the instructions in this manual, and the pre-dive checklist above, and the Sonar is fitted.
- Cycle through the Artemis displays to the Sonar Application, then set the sonar to a 40m range scale, 50% gain.
- Diver leaves surface and descends to seabed.
- When the Artemis console is submerged, the Dive Log file start recording (if the immersion sensor is enabled) – alternately, start logging using the “Start Dive” option from the Settings display.
- When ready to proceed, diver holds Artemis approximately 0.5m above seabed at chest height and holds the unit on a steady bearing. If possible, the diver should kneel on the seabed with Artemis horizontal and at chest height.
- The Diver should let Artemis scan for at least 3 sweeps on each bearing. The centre bearing can be changed by the diver at any time but 45 degree changes are recommended.
- When the diver believes the target has been acquired, he closes the range. The target should be kept in the centre of the Sonar Display.
  As a rule of thumb;
  - If the target is presenting on the left hand side of the Sonar display, the Artemis console should be trained left which will bring the target to the centre of the Sonar Display.
  - If the target is presenting on the right hand side of the Sonar display, the Artemis console should be trained right which will bring the target to the centre of the Sonar Display.
  - The Navigation Application, Status Bar digital readout or Magnetic Compass can be used to assist bearing guidance.
- With the target in the centre of the display, the diver continues to close the range until either the target becomes visual (visibility permitting) and/or the target can be seen on the minimum range scale (1m) of the Sonar Display.
- In bad visibility care should be taken to ensure that a safe distance is observed from the target where interaction with the same could compromise the safety of the diver.

For further information on using the Sonar, please refer to sections 4.5 (Sonar Application) and 7 (Understanding Sonar Imagery).

6.3.2 Navigation Using the GPS Float

The following operational procedure is recommended when underwater navigation using the GPS Float is required.

- If required, use the Artemis Manager PC software to prepare a Mission File containing the positions (latitude and longitudes) of search-pattern waypoints or targets of interest to navigate to. Use the USB cable to download the mission file onto the Artemis console.
  For more information on Mission Files, see page 35.
- Check that Artemis has been prepared in accordance with the instructions in this manual, and the pre-dive checklist above, and is fitted with the GPS Float.
- Once the unit is switched on, the GPS signal will obtain a fix after a few minutes providing that a satisfactory GPS signal can be obtained.
  The quality of the GPS Position displayed on the screen should be compared where possible to another GPS source (from the RhiB or operating platform to confirm correlation).
- Cycle through the Artemis displays to the Navigation Application, then (if defined) select the required destination marker (waypoint or target) from the Mission file. The Range and Bearing to the destination marker will also be displayed. The diver can use the Navigation system for guidance to the datum as indicated.
- When the Artemis console is submerged, the Dive Log file start recording (if the immersion sensor is enabled) – alternately, start logging using the “Start Dive” option from the Settings display.
- Should the diver chance upon an unknown target during his sortie, the position of the target can be marked by pressing the “Mark Target” button on the console. This will record the geodetic position of the target.
  The accuracy can be improved by the diver drawing the surface float above him to reduce the lay-back offset described by the position of the float at the point at which the position is recorded.
- In total, Artemis can hold 20 markers in a Mission. When specifying pre-dive targets, ensure the mission file has sufficient space for any additional targets to be marked during the dive.
- Upon return to the surface, connect Artemis to a PC through the USB cable, and download the relevant “Dive Log” files. These can be opened in the Artemis Manager PC application, and data analysed or exported to third-party applications.

For further details on navigation, refer to the Navigation Application in section 4.6

7 UNDERSTANDING SONAR IMAGERY

Interpreting sonar imagery may seem challenging at first, but with practice and some knowledge of how the sonar works, it doesn't take very long for an operator to understand what the sonar image represents.

Many people try to look at the pictures and understand them as you would a photograph, but this however is not strictly the case. In the following sections, we will look at how the sonar produces its images, and see how information can be obtained from them.

Basic Operation

The Sonar used by Artemis is a "forward looking, scanning sonar". In simple terms the acoustic beam produced by the sonar is much like that of a torch beam having a vertical and horizontal beam width.

The sonar will build up an image of echoes it receives from targets in front of it by mechanically scanning a narrow (approx 3° horizontal width) wide acoustic sound beam horizontally through a 90° arc, performing "pings" at set intervals.

When an object is 'illuminated" within the sonar beam, the sound energy reflects off the target and is presented on the Artemis sonar display. The size of the object on the display is a function of the size of the target itself and the range at which it is observed.

The operator should hold the Artemis console (and sonar) horizontally, and stationary for a few seconds while a full scan completes. If the sonar is moved or rotated during a scan, the resulting image will appear smeared and distorted.

For relocation of large objects, wrecks, jetties, underwater swimmer delivery vehicles and the like, it is possible to use the maximum range of 100m.
Once the object has been detected, the diver can close the range, changing the Range Scales as the target range is closed.

For relocation of smaller objects such as mines, depth charges, etc it is recommended that the diver is placed as close as possible to the datum position (within 50m preferably).

Range & Gain Controls

The sonar has two main controls the help optimise the image; **Range** and **Gain**.

The range control allows the operator to choose the maximum range targets will be shown at on the display. As sound travels at a fixed speed through water, increasing the range means the sonar must wait longer to collect echoes from more distant targets and so the scan rate will slow down, while shorter ranges will cause the sonar to scan faster.

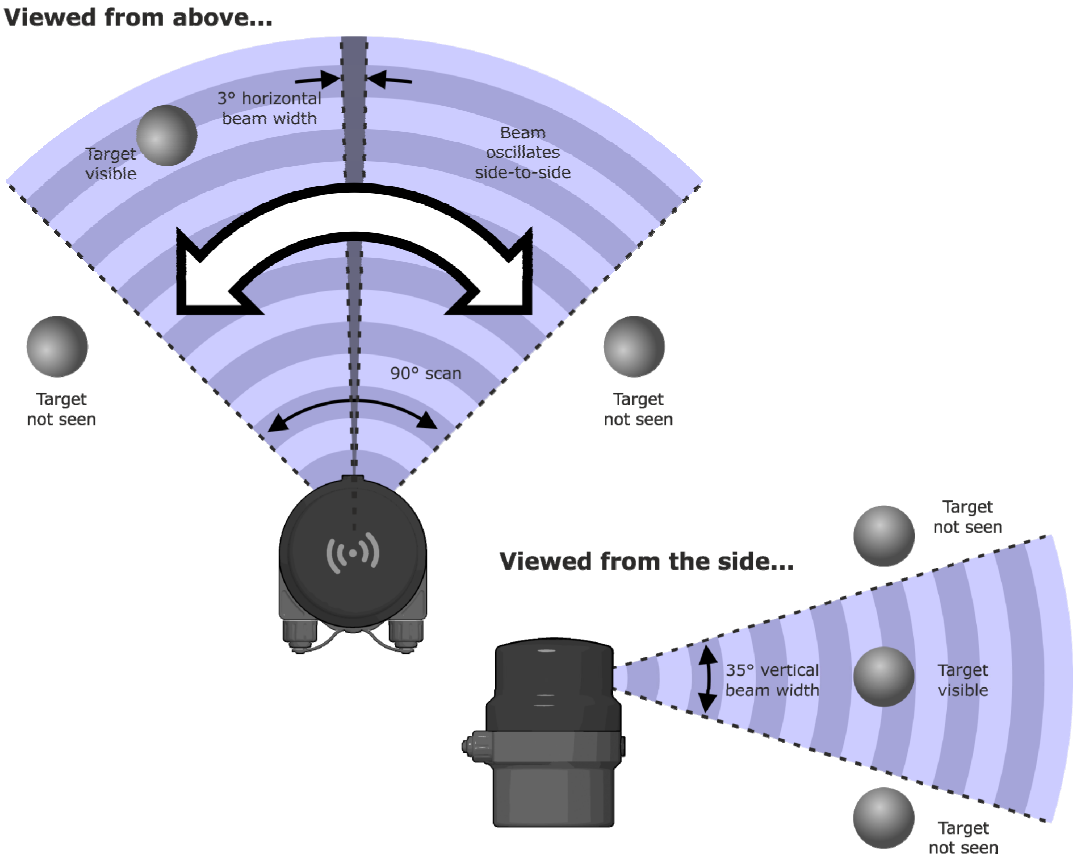
The gain control can be thought of like a "volume" control – increasing the gain will amplify fainter echoes making the entire display appear brighter (and possibly saturate some target detail), while decreasing the gain will dim the display (possibly hiding fainter targets, but making it possible to detect texture and detail on others).

Gain is mainly used to reduce the background clutter reflections in a high clutter (rocky/boulder) environment. By reducing the gain, the clutter and seabed reverberations can be reduced on the Sonar display making the initial detection of the target easier to see.

When scrutinizing a target at close range (within 3m range) in turbid or nil visibility, the gain is particularly useful in establishing the shape, constitution and dimensions of the target being prosecuted.

Target Visibility
Targets that lie within the 90° sector (and the range of the sonar) will be shown on the display, while <u>targets that lie outside this area can't be shown</u>.

In the vertical plane, the sonar beam is 35° wide (regardless of scan angle), and again targets within this beam will be visible, while <u>targets above or below won't be seen</u>…



For each mechanical scan position, the sonar display shows the received echo strength (as colour brightness) against distance from the sonar. This means the display could be thought of as being very similar to an overhead "satellite" image, but with a few key differences, discussed below…

Target (& Echo) Intensity
As the acoustic beam scans across the 90° field of vision, the sound travels from the sonar (at approximately 1500 metres per second in water) until it hits the first target in its path.

Depending on its composition, the target then reflects some proportion of this acoustic energy back towards the sonar, which is received and displayed (with a colour corresponding to the sound level received).

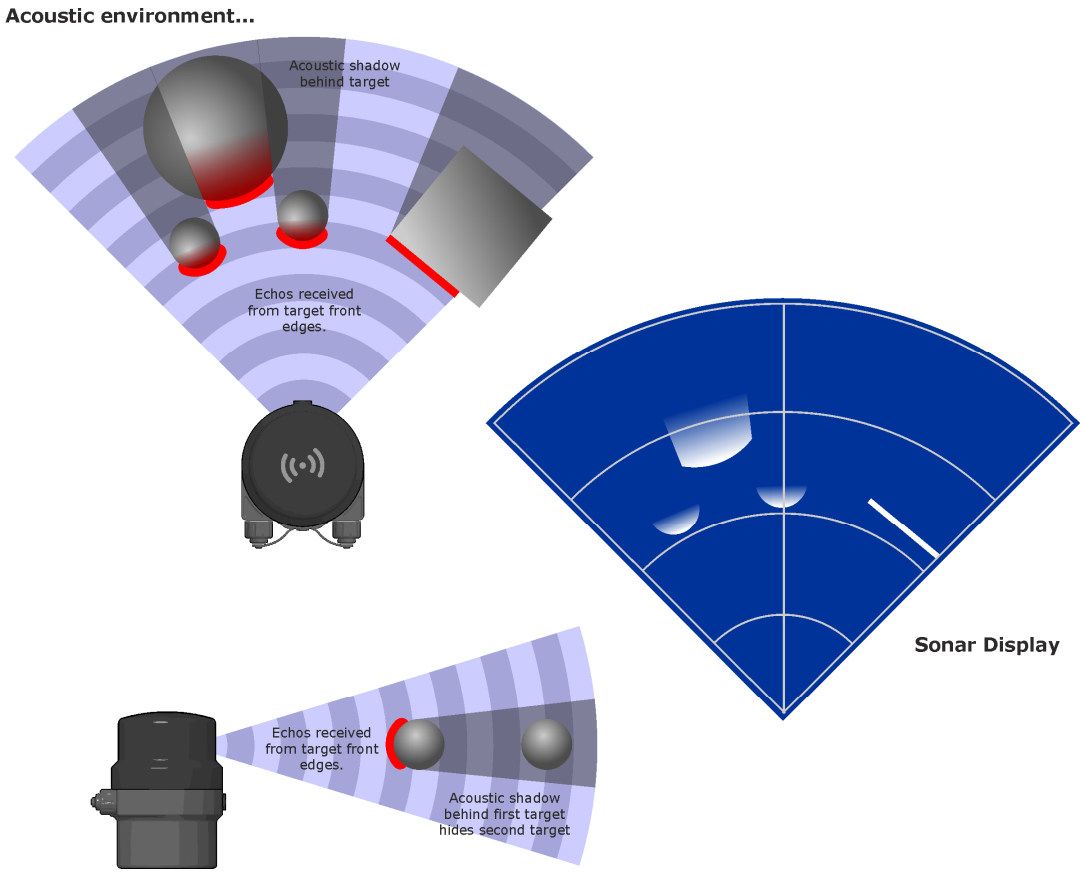
<u>The greater the density difference of the target is to water, the more acoustic energy is reflected</u>.

- Gas bubbles, photo-synthesising aquatic plants, rocks, or any gas filled thin walled targets will appear very brightly along with very solid metal or concrete structures.
- Thin walled, water-filled or water-logged targets (i.e. barrels, canisters, wooden crates etc) will reflect some, but not as much sound as a solid target.
- Mud, silt or other particles in suspension are good absorbers and will return very little acoustic energy.

Acoustic Shadows

Similar to an object casting a shadow when illuminated with a narrow torch beam, underwater targets can cast “acoustic shadows” in the sound beam, meaning any further targets behind them will not be visible if they lie fully within the shadow.

The figure below show a selection of spherical and rectangular targets in the sonar’s field of vision. As well as the shadows they create, the leading edges of the targets have been highlighted to surfaces the sound is reflected from, and ultimately this is what is shown on the display…

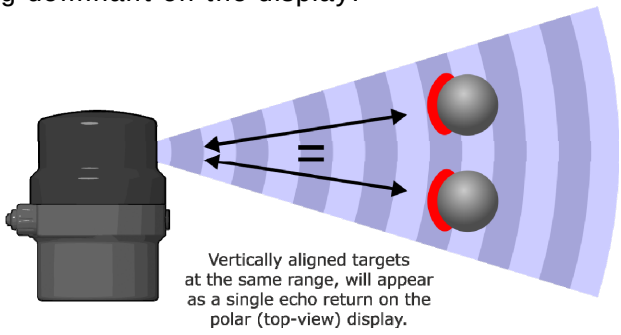


If a target is partly obscured by another target in front of it, the returns echo will be a combination of the horizontal profile of both targets, and this can be seen in the “Sonar Display” in the figure above.

Vertical Targets

As the sonar only scans horizontally, is cannot determine if a target lies above or below it, and this means no vertical information is available to the operator.

If two targets are positioned along the same scan angle with one vertically above the other at the same range from the sonar, then the sonar will not be able to tell the two apart, and their echoes will merge into one result on the image, with the more reflective target being dominant on the display.



However, by moving location, the echoes will separate and both targets will become visible.

8 TROUBLESHOOTING

Below is a table of common problems and solutions, but if you have a problem that cannot be solved from the table below, or an issue that is not covered, please contact technical support - see page 64 for further details.

Problem…	*Solution(s)…*
On power up, a white screen is observed and the unit shuts down after 10 seconds.	This has occasionally been observed when a very flat battery is used to power the system. Fully charge the battery and try powering the system on again.
The digital compass direction is erratic.	The compass direction can be thrown off by the presence of magnetic fields from ferrous materials. On vessels, engines and the hull can be a large contributing factor to this. Try using Artemis in a large clear area away from any metals, and if this fails to stabilise the compass, try performing a compass calibration. The presence of the analogue compass module will affect the digital compass reading (as it contains a magnet itself). If present, remove the analogue compass module.
The Sonar / GPS do not connect.	Check the devices are plugged into the correct serial-port connectors on Artemis. By default the Sonar is configured for port 1, and the GPS for port 2. From connection, the GPS status bar indicator should be yellow when connection is established by waiting for first fix, this process can take 2 or 3 minutes to complete – if the period is longer, move the GPS antenna to an area that allows improved visibility of the satellites, and does not attenuate their signals.
The depth sensor reading is offset.	At atmospheric pressure changes, it may have a small effect on the reading of the depth sensor. Before every dive, zero the depth sensor at the surface using the “zero depth sensor” function from the “Dive Profile” application.

9 PRODUCT SUPPORT

9.1 Artemis Website

For the latest software and firmware updates, as well as production information, manuals and datasheets, visit www.blueprintsubsea.com/artemis.

We welcome any feedback you may have about the Artemis system, from bug reports to ideas for new features or hardware to support – please use the contact details on the website (or shown below) to get in touch.

9.2 Technical Support

If your Artemis system is not operating properly, please consult the 'Troubleshooting' section of this manual and further information on the Artemis website to see if the problem can be easily remedied.

However, if you need further support, you can contact us at…

- **Web** www.blueprintsubsea.com/artemis
  (for access to on-line resources and technical support)

- **Email** enquiries@blueprintsubsea.com

- **Call us** +44 (0)1539 531536
  (9:00am to 5:00pm, Monday to Friday, GMT)

For all of the above please provide the following information, where appropriate and if possible, to help us with your technical support request…

- Part and Serial Numbers of the system components. These are located on the labels of each item, and are in the form "BPxxxxx.xxxxxx".
- Version number of the 'Artemis' software and firmware you are using.
- The operating system name, version, type (32 bit or 64 bit) and service pack upgrade your computer is using.
- Brand and model of your computer (processor type and memory configuration is also useful if known).
- Name of the distributor where the system was purchased from.

If you have to return your Artemis system for servicing, please…

- Contact us (using the details above) for a "Returned Materials Authorisation" (RMA) number, and shipping details.
- Pack your Artemis system back in the original packaging (or other suitable container), and include written documentation including your contact details (including contact phone number), the RMA number and a description of the problem and any symptoms occurring.
- If your product is still under warranty, please include a copy of your receipt (showing proof and date of purchase).
- Please return the product back to Blueprint Design Engineering Ltd, using an insured courier and delivery confirmation.

10 LIMITED WARRANTY POLICY

The manufacturer, Blueprint Design Engineering Ltd (herein after referred to as Blueprint), warrants that at the time of shipment all products shall be free from defects in material and workmanship and suitable for the purpose specified in the product literature.

The system warranty commences immediately from the date of customer acceptance and runs for a period of 365 days. Customer acceptance will always be deemed to have occurred within 72 hours of delivery.

Conditions

These include, but are not limited to, the following:

1. The warranty is only deemed to be valid if the equipment was sold through Blueprint or one of its approved distributors.
2. The equipment must have been installed and commissioned in strict accordance with approved technical standards and specifications and for the purpose that the system was designed.
3. The warranty is not transferable.
4. Blueprint must be notified immediately (in writing) of any suspected defect and if advised by Blueprint, the equipment subject to the defect shall be returned by the customer to Blueprint, via a suitable mode of transportation and shall be freight paid.
5. The warranty does not apply to defects that have been caused by failure to follow the recommended installation or maintenance procedures, or defects resulting from normal wear & tear, incorrect operation, fire, water ingress, lightning damage or fluctuations in vehicles supply voltages, or from any other circumstances that may arise after delivery that is out with the control of Blueprint. (Note: The warranty does not apply in the event where a defect has been caused by isolation incompatibilities.)
6. The warranty does not cover the transportation of personnel and per diem allowances relating to any repair or replacement.
7. The warranty does not cover any direct, indirect, punitive, special consequential damages or any damages whatsoever arising out of or connected with misuse of this product.
8. Any equipment or parts returned under warranty provisions will be returned to the customer freight prepaid by Blueprint
9. The warranty shall become invalid if the customer attempts to repair or modify the equipment without appropriate written authority being first received from Blueprint.
10. Blueprint retains the sole right to accept or reject any warranty claim.
11. Each product is carefully examined and checked before it is shipped. It should therefore be visually and operationally checked as soon as it is received. If it is damaged in anyway, a claim should be filed with the courier and Blueprint notified of the damage.

Blueprint reserve the right to change specifications at any time without notice and without any obligation to incorporate new features in instruments previously sold.

If the system is not covered by warranty, or if it is determined that the fault is caused by misuse, repair will be billed to the customer, and an estimate submitted for customer approval before the commencement of repairs.

Any customer acceptance testing (if applicable) must be performed at either Blueprint premises or at one of their approved distributors unless mutually agreed in writing prior to despatch.

11 NOTICES

Copyright Notice

Disclaimer

Neither Blueprint Design Engineering Ltd., or their affiliates shall be liable to the purchaser of this product, or third parties, for losses, costs, damages or expenses incurred by the purchaser or third parties as a result of accident, misuse, abuse, modification of this product or a failure to strictly comply with the operating and maintenance instructions.

Trademarks

The Windows™ operating system is a trademark of the Microsoft Corporation. The Google Earth™ mapping service is a trademark of Google Inc. Other product and brand names used within this document are for identification purposes only. Blueprint Design Engineering Ltd. disclaims any and all rights in those marks.

Third-Party Software Applications

Third-party applications referred to in this document (such as Google Earth and Microsoft Windows) are not affiliated with Blueprint Design Engineering Ltd. in any way, and the content provided here is on an “as is” basis for information only. Blueprint Design Engineering Ltd. can offer no technical support for these applications (unless stated otherwise in the text), or accept responsibility whatsoever for any damages arising out of the use of information contained in the documentation by other parties, and makes no guarantees, expressed or implied, about its availability, quality, reliability, functionality or any other characteristic.

Specifications & Content

All information in this document is believed to be correct at the time of going to press, Blueprint Design Engineering Ltd cannot be held responsible for any inaccuracies or omissions. If you find an error or feel we have missed important or useful information, please contact us. The latest version of the manual is always available to download from the website.
Specifications and information contained in this document is subject to change without notice, and does not represent a commitment on the part of Blueprint Design Engineering Ltd.

Handling Recommendations

The Artemis system contains sensitive electronic components that may be damaged by an Electrostatic Discharge (ESD) if handled incorrectly. To minimise risk, avoid dismantling the unit, touching any exposed electrical contacts on external connector, or inserting anything other than the recommended cabling into the connectors.

Waste Electrical & Electronic Equipment Statement

Under the European Union (EU) directive on 'Waste Electrical & Electronic Equipment' (Directive 2002/96/EC), from August 13, 2005, products categorised as electrical or electronic equipment cannot be discarded as municipal waste by placing in landfill, dumping in the sea or incineration. SEPARATE collection is mandatory.
At the end of its life, you should either return this system and its associated leads & accessories (if appropriate) to Blueprint Design Engineering Ltd with a certificate of decontamination (we reserve the right to protect our staff from the effects of any contamination) or it should be sent to an appropriate treatment or recycling agency.

Restriction of Hazardous Substances Statement

Under the European Union (EU) directive on the 'Restriction of Hazardous Substances' (Directive 2002/95/EC), from July 1, 2006, electrical and electronic equipment cannot contain lead ("lead free"), mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).
All components of the Artemis system, sold by Blueprint Design Engineering Ltd, fully comply with this legislation where applicable.

12 SPECIFICATIONS

12.1 Console

Dimensions	340mm long × 240mm wide × 125 mm high	
Weight	Artemis and Battery only… 2.6kg (in air) 0.8kg (in water)	Artemis with GPS Skid option… 4.3kg (in air) 0.6kg (in water)
Construction	Black acetal plastic	
Temperature Range	-10°C to +35°C operating and storage	
Operating Depth	100msw (11 BAbs)	

12.2 Display Unit

Power Supply	16.8V DC nominal from supplied battery pack (or 7V to 28V DC input range from external source)
Processor	150MHz low-power consumption ARM processor
Display	Tilted 3.5”, 320 × 240 pixel, 16-bit colour Liquid Crystal Display
Data Storage & Logging	Internal 16Gb non volatile ‘Flash’ memory (other capacities available on request). Data Logging capacity (assuming approx 2Mb per minute) > 100hrs on internal storage.
Integrated Sensors	Pressure sensor for depth calculation Attitude and Heading reference system (comprising pitch and roll, digitally gimballed electronic magnetic compass and rotational rate gyros) Battery voltage level indicator
User Interface	5 × solid-state piezo button interface for menu navigation and parameter control
Communications Interface	3 × switched power RS-232 serial ports (for connection to Sonar and GPS modules) USB port for connection to a PC (appears as a ‘pen-drive’ style mass storage device, for downloading logged data files)
Connectors	Fischer UltiMate series connectors… 1 × 2 pin DC power 3 × 4 pin Peripheral connector (switched output power and serial communications) 1 × 7 pin USB connector (to standard USB ‘A’ type plug)

12.3 Battery Pack

Battery Type	16.8V, 2.2Ah capacity, rechargeable Nickel Metal Hydride (NiMH) interchangeable pack.
Operating Time (from charged battery pack)	Approx 5-6 hours (with Sonar and GPS connected). (actual operating time depends on battery age, environmental temperature and charge state at the start of the dive)
Charging Time	No more than 7 hours, from a fully discharged state.
Safety	Integrated thermal fuse (94°C) and electrical fuse (5A)
Temperature Range	-10°C to +35°C operating and storage (NB: Elevated temperatures lead to greater self discharge rates) +10°C to +30°C charging

12.4 Battery Charger

Mains input	90-264V AC, 50-60Hz
Housing	90mm × 45mm × 32mm. Black ABS Plastic.
Additional Features	Smart multi-stage charge regime (with over charge protection, top-off timer and trickle charge) 3-colour charge state indication LED
Environmental Rating	IP41
Temperature Range	-20°C to +40°C operating (NB: See also Battery Pack charging temperature range)

12.5 Sonar

Operating Frequency	Chirped 650kHz to 750kHz
Beam Geometry	35° vertical, 3° horizontal
Dimensions	56mm diameter, 78.5mm high
Weight	320g (in air), 180g (in water)
Range Settings	From 1m to 100m in preset steps (1m, 2m, 5m, 10m, 20m, 30m, 50m, 100m)

12.6 GPS Skid & Float

Dimensions	360mm(L) x 110mm(W) x 120mm(H) (excluding wound cable)
Weight	1.7kg in air 0.2kg positively buoyant in water (float attached to skid)
Cable length	40m (consult factory for other lengths)
GPS Receiver	GPS L1 C/A-code, SPS. 66 acquisition and 22 tracking channels
Data Output	1Hz output interval, standard NMEA RMC, GGA, GSV and GSA strings based around WGS84 datum. 9600 baud RS232 serial data communications
Sensitivity	-148dBm (Cold Start Acquisition) -165dBm (Navigation)
Datum	WGS84

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