



# OHMEX

INSTRUMENTATION

## SONARMITE MTX/BTX

### v4.0

PORTABLE BLUETOOTH ECHO SOUNDER



Ohmex is a company formed to manufacture and distribute products designed by Lymtech Ltd. a company established in 1982 w founded on technological innovation and design. The company prides itself on being the first to produce products in the field of instrumentation and software used within the Earth Science sectors. Achievements to date include DGM ,the first digital ground modelling software to run on a standard PC, SONARLITE, the first truly portable echo sounder, TIDALITE the first portable Tide Gauge, EDAS, Integrated tide and weather networked software for use by ports and harbours. SONARMITE the first portable Bluetooth echo sounder based on WinSTRUMENTATION - The integration of Instrumentation, Wireless networks and modern portable computer equipment.



## INTRODUCTION

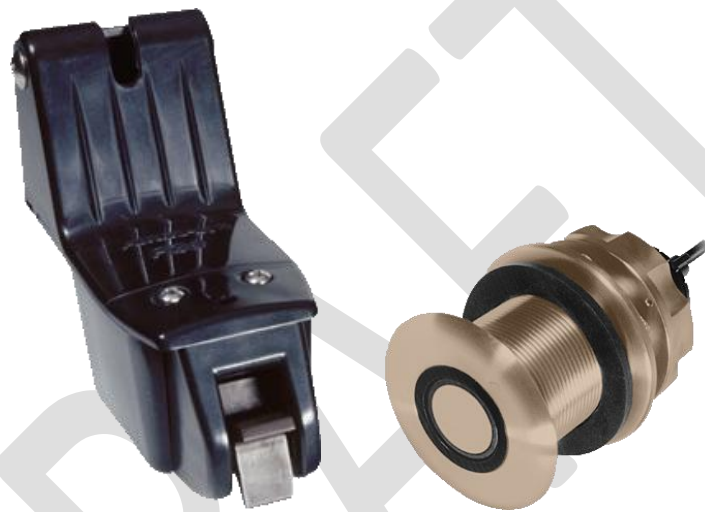
The SonarMite Echo Sounder was the result of nearly two years research and development to further extend the boundaries of shallow water hydrographic surveying equipment. The introduction by Ohmex of the SonarMite, the worlds first truly portable echo sounder system, has been a hard act to follow and it remains the portable instrument of choice in many survey companies around the world. The release of the SonarMite MTX instrument marks the next stage introducing a series of equipment designed around the WinSTRUMENT concept using the latest portable computers integrated with new measurement technologies.

Throughout the Hydrographic world the term 'Black Box' has become a euphemism for a device that has a minimal user interface and normally requires connection to a PC to be of any use ! In most cases these boxes are a cut down version of a more conventional instrument without all the features of the full system. The SonarMite extends this idea of a rugged design and minimalist interface to produce a 'Blue Box' system where the user interface is provided by integrated software running on a portable computer connected via a Bluetooth link. The use of wireless technology enables the instrument to be waterproof and used in a hostile environment while the more sensitive computer features can be located in a more user friendly environment up to 50m away from the instrument.

The SonarMite MTX instrument uses the same 'Smart' integrated transducer technology used in previous systems, in addition to highly reliable bottom tracking algorithms using DSP techniques the system also outputs a quality value associated with every depth measurement made. The popular SonarW7 software has been updated to the latest Windows versions. Software for the 'front end' of the SonarMite is available to run on a wide range of devices from Pocket PCs through to the full range of desktop systems running the Windows operating system.

## ***Typical Use of the Equipment***

The SonarMite Portable Echo Sounder has been designed to provide a portable instrument that provides the facilities of a 'professional' sounder at the cost and performance of a 'fish finder' device. It is important to recognize what the differences are between these two types of echo sounder. The 'fish finder' or leisure craft devices are primarily concerned with two functions, finding fish in the water column below the boat by sensing returns from their swim bladders and providing a bottom tracking/smoothing algorithm to detect average water depth below the boats hull. Survey sounders are designed to provide a large number of pings with as little processing of the raw data as possible to define the bottom in as fine detail as possible. Of major concern in a survey sounder is a narrow beam width to prevent averaging of the returned signal.



235KHz and 200/30KHz Transducers

The SonarMite uses Active Transducers, these are digital as opposed to analogue components and use microprocessors to synthesize transmitted frequencies and to interpret the return signals. The devices incorporate state of the art DSP and filtering techniques to reduce noise and improve depth tracking. These devices are supplied encapsulated in resin and have no serviceable parts. The connecting cable to the transducer carries only low DC voltage and digital I/O, none of the EMC problems associated with conventional analogue devices apply.

To improve weatherproofing and to avoid connection problems the SonarMite has two connectors that provide all the I/O required by the device. One of the connectors also includes a return pin to enable the system to switch on by cable connection rather than using a switch. Cables to the device can be connected simultaneously (e.g. Transducer on port 1 and Serial Data Cable on Port 2).

## ***Equipment Supplied***

The SonarMite BTX is supplied as standard with the following list of equipment ...

- ❑ SonarMite main processor unit c/w Bluetooth Antenna
- ❑ Universal EU/US/UK internal battery charger
- ❑ 'Smart' P66 depth transducer c/w 5m cable and embedded processor
- ❑ Serial data lead
- ❑ IP68 rugged plastic Transit case
- ❑ SonarW7 post process/import/export software



SonarMite BTX single beam echo sounder

The following is a short list of accessories for the SonarMite ...

- ❑ SonarMite Windows Mobile PDA software
- ❑ SonarMite W7 software for Tablet/Portable PC
- ❑ USB serial lead
- ❑ Aluminium shoe to connect transducer to detail pole
- ❑ 'Smart' 200/30KHz depth transducer c/w 5m cable and embedded processor

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- ❑ Serial data lead
- ❑ IP68 rugged plastic Transit case
- ❑ SonarW7 post process/import/export software
- ❑ External battery connector leads



SonarMite MTX multiple beam echo sounder

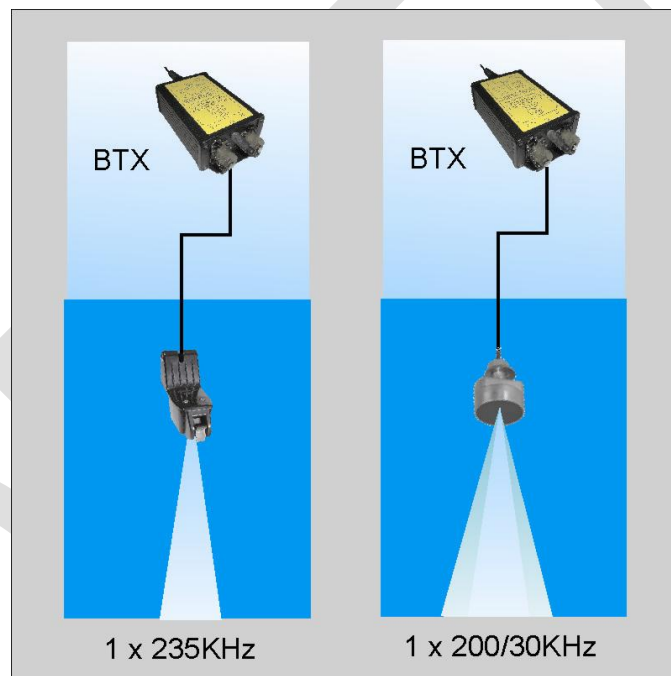
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- ❑ USB serial lead
- ❑ Aluminium shoe to connect transducer to detail pole
- ❑ 'Smart' 200/30KHz depth transducer c/w 5m cable and embedded processor
- ❑ 2 x 'Smart' P66 depth transducer c/w 5m cable and embedded processor

The SonarMite MTX is a compact, portable, low power system for use in shallow water hydrographic surveys, it's small size and low power requirements make the system easy to deploy and transport to remote or inaccessible sites. The SonarMite MTX is a development from the basic SonarMite single beam echo sounder providing a wider range of single beam solutions for surveyors working in shallow water hydrographic surveying. The MTX is available in two versions ...

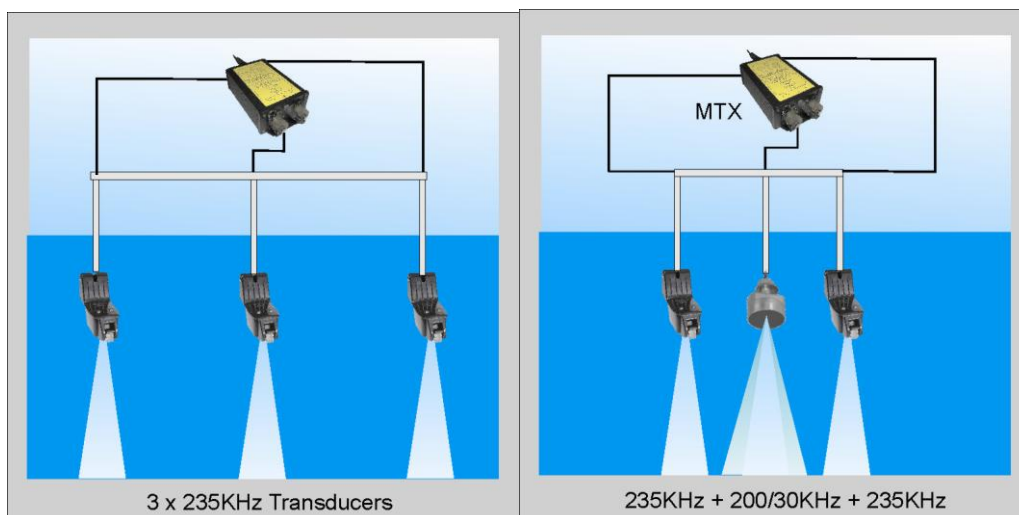
- BTX - a single transducer variant
- MTX - a three channel multiple transducer 'sweep' version

Both models make use of a range of interchangeable smart transducers. In its simplest form the SonarMite BTX is a 235KHz single beam system in the same format as the previous SonarMite BT system. This single channel system can interchange its transducer for a dual frequency unit operating simultaneously at 200KHz and 30KHz . As with the previous SonarMite versions every measured depth is accompanied by a QA value which can be used for post analysis of the survey data.



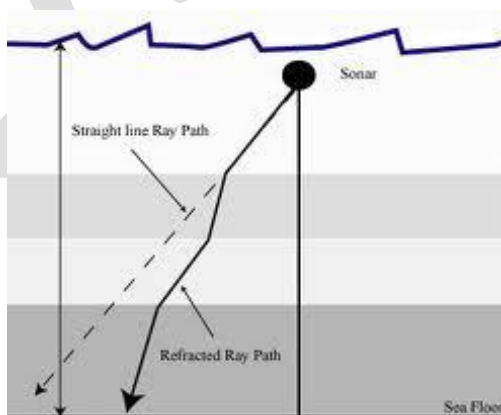
**BTX Single Beam SF and DF solution**

The multiple transducer 'sweep' configuration provides an intermediate stage between swath and a single beam systems. These configurations consist of an array of single beam echo sounders located around the vessel, normally as a boom frame mounted over the stern but could also be around the vessel at various offset positions from the positioning antenna, for convenience the transducers are referred to as the 'Port', 'Centre' and 'Starboard' locations. The multiple channel device can be configured in two basic formats, a 3 x 235 KHz or a 235+200+235KHz array, the mixed frequency array giving the option to use the transducers in closer proximity without the problem of crosstalk between transducers operating at the same frequency.



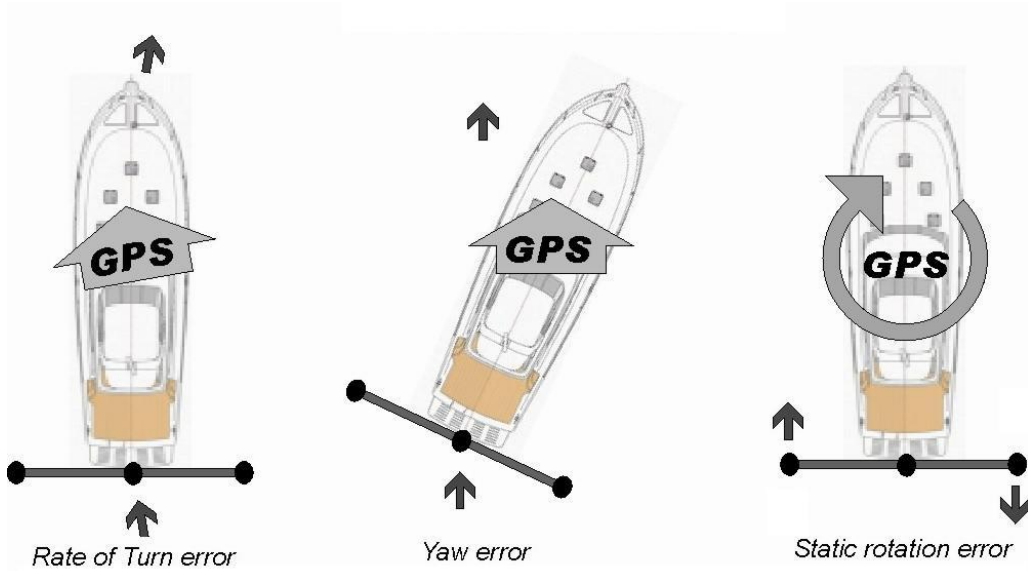
### MTX transducer array configurations

A typical acoustic sweep system consists of a linear array of evenly spaced transducers mounted vertically around the vessel. These systems are used in critical shallow water areas (harbours, channels, etc.). The coverage of the bottom is 100%, depending on transducer spacing and water depth. These systems are very accurate for IHO Special Order and Order 1 surveys where 100% coverage and high accuracy are required. By using multiple transducers the problems associated with swath systems such as stray side shots caused by incorrect motion adjustment or water refraction errors are greatly reduced or eliminated. The speed of sound in water is approximately 1500 meters/second, however, this speed can vary with changes in temperature, salinity and pressure. These variations can drastically change the path that sound travels through water, as changes in sound speed between layers of water cause the trajectory of sound waves to bend by refraction. With a multiple transducer system all measurements are made vertically through the water column avoiding refraction errors caused by non homogenous or stratified water layers of different densities/temperatures. With a single beam sounder the forward and reverse sonar paths pass through the same vertical column so any velocity error is an 'average' over the entire path not a complex reflected and refracted flight route.



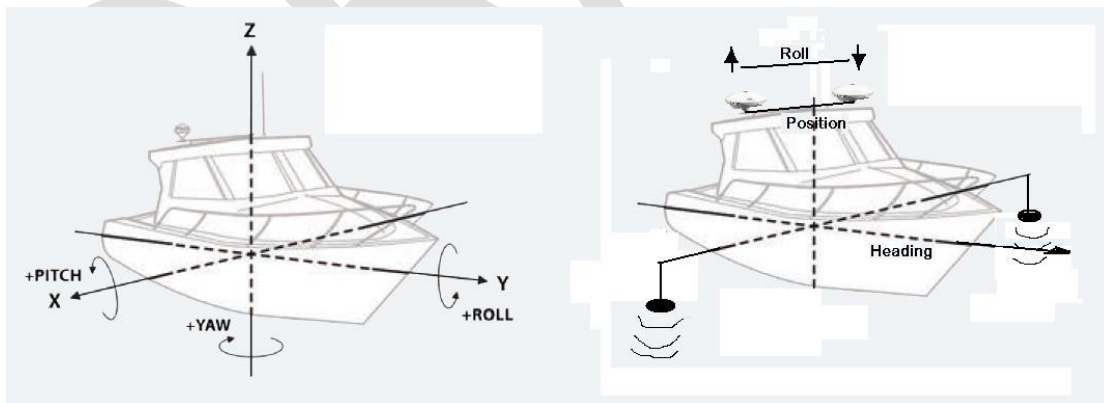
### Swath side shot refraction errors

As with a swath system true heading is important for the accuracy of the system, the dynamic GPS heading message is sufficient for systems that do not change direction rapidly, rotate on a static location or travel in a rotated position. For more accurate systems a dual antenna GPS that provides both position and heading from the true bearing between the antennas is required.



**Heading errors using 'NMEA' HDG message**

The effects of pitch and roll do not so greatly affect a sweep system as they do a wide beam swath system. If a dual GPS antenna system is used then the roll of the mounting boom can also be calculated from the difference in height of the two antennas if they are mounted along the same axis as that of the boom.



**Dual GPS Antenna Heading/Roll adjustment**



## **INSTALLATION & USE**

This chapter describes how the SonarMite Portable Echo Sounder would normally be installed and used. The typical way in which the device can be used for hydrographic surveying applications, is as a 'Dumb' sounder connected via a serial cable/Bluetooth Link to a PC or PDA running data logging and display software. Another option is to use both data streams with the serial output data for real time processing and the parallel Bluetooth output for graphic depth display.

### ***Switching the System On***

To turn the system on the user ensures the system is fully charged then connect the transducer to the 'Txr' connector on the front panel, the LED alongside the Bluetooth antenna will then turn on.

### ***Data Collection Techniques***

When not used as a 'Dumb' echo sounder in conjunction with a data logging package the SonarMite can be used in conjunction with the following data types to create full XYZ hydrographic data using the SonarW7 software package....

- ❑ Total Station XYZ data plus Time
- ❑ XYZ data from RTKGPS plus Time
- ❑ XY data from DGPS plus Tide plus Time
- ❑ Range and Bearing from hand held laser plus Tide plus Time
- ❑ Simple event marking past known position markers

The basis on which all data correlation is achieved is internal time base, so particularly when using the SonarMite with GPS data the clocks should be synchronised to GPS time (UTC).

### ***Sound Velocity Settings***

The SonarMite default Speed of Sound in Water(SoS) setting is 1500m/second, facilities to vary this have been provided in the calibration or in post processing. In practice this velocity value can vary due to several factors ...

- ❑ Water Temperature
- ❑ Water Salinity
- ❑ Water Turbidity

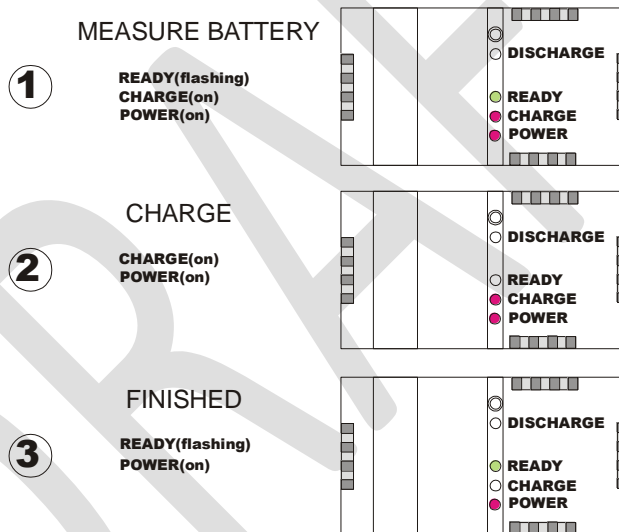
All of the above factors vary the density of the water in some way and effect the 'time of flight' of a pulse of ultrasound in water and hence the depth calculated from this time by the SonarMite. The user can either measure the speed of sound in water by taking velocity profiles using a dedicated velocity measuring device or can use the

SonarMite static over a known depth to a flat, firm base and then compare the measured value with the known depth. The difference in Sound Velocity between warm fresh water and cold salt water is about +/-30m/Second which represents a change of depth of +/-2%, this must be viewed in context with typical depths of the survey, if a typical depth is 10m then the error could be about 20cm. **The Sound Velocity setting is the largest source of measurement error when care is not taken in setting it correctly.**

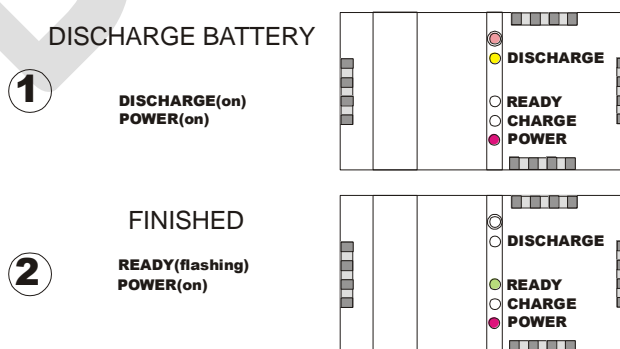
### Internal Battery Charging

The SonarMite BTX is fitted with an internal sealed Nickel Metal Hydride battery which provides 2.8Ahr @ 10vDC and a mains powered battery charger capable of bulk and float charging to give the most efficient battery cycle. The user should avoid running the SonarMite until the batteries are completely flat as there will be a high risk of both data loss and permanent damage to the batteries. The charger will illuminate CONSTANT RED when bulk charging and FLASHING YELLOW when charged, the charger illustrated may change if a local mains variant is required.

#### CHARGE SEQUENCE



#### DISCHARGE SEQUENCE



**WARNING - Only the correct charger should be used with the SonarMite**

### ***Reverse Voltage Protection***

The SonarMite is protected from reverse connection or direct short circuit by an internal diode and 1 Amp thermal fuse. If the fuse is tripped then the system will need to be disconnected for 1 minute for the fuse to cool down and reset itself.

### ***Weatherproofing***

The SonarMite has been designed to conform to the IP65 waterproofing standard, this benchmark describes equipment which can withstand a light spray of water from a hose for a short period of time, it does not imply the device is suitable for immersion in any depth of water or exposed to prolonged harsh weather conditions. The weatherproofing also assumes the connectors or cover caps are fully screwed on to their rubber sealing rings. The weatherproofing does not apply to certain components which are by definition not designed for outdoor use such as the mains battery charger and D9 serial cable connectors.

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## DEPTH TRANSDUCER

The SonarMite system uses a ‘boat’ shaped P66 transducer in a ‘knock off’ fitting for fixing to the transom of a light boat or more commonly in a temporary mounting using a survey detail pole. **The transducer includes a unique processor and is not the same device as the commercially available transducer from Airmar.**

- ❑ Hydrodynamic shape provides vertical sound beam orientation on hull deadrise angles up to 30°
- ❑ Reversible wedge allows mounting to transom angles from 2° to 22°
- ❑ Integral release bracket protects against impact damage, mounts with 3 screws, and provides 12 mm of vertical adjustment
- ❑ Chemical and impact resistant plastic housing
- ❑ Designed to meet CE requirements
- ❑ Shielded piezoceramic element for noise free echo sounder display
- ❑ Standard minimum cable length: 5.0 m (16 feet)



Transom Mounting Transducer

### ***Transducer Mounting***

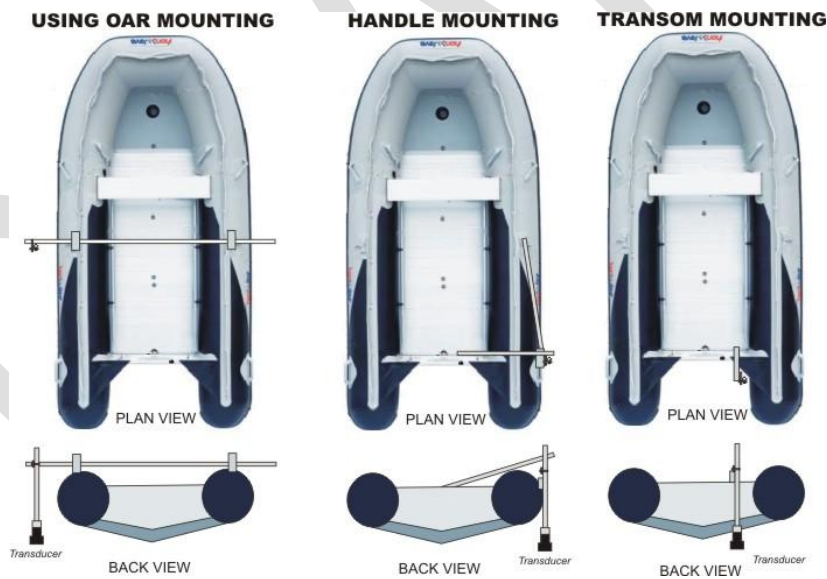
When mounting the transducers the following points should be taken into consideration ...

- ❑ How near to the Metacentre of the boat is the transducer
- ❑ Is any turbulence generated around or in front of the transducer when moving
- ❑ Is the turbulence from the propellers in the field of view of the transducer

The only important consideration in mounting is that the transducer is always in the water and that the transducer does not represent an obstacle when the boat is used at higher speeds (i.e getting to the survey location). If at all possible mounting the transducer directly below the positioning antenna reduces the calculation of X/Y offset to zero.



Example Transducer Mountings



Typical rubber boat mounting

### ***Avoid Stressing Transducers***

The Active Transducers include piezoelectric elements which are embedded within a resin compound. If the user has to fabricate a custom mounting for the transducer (a very common requirement given the vast permutations of boats in which surveys are performed) avoid using a fixing technique that causes physical stress in the transducer

body as this will change the resonant properties of the device and effect its depth measuring accuracy.

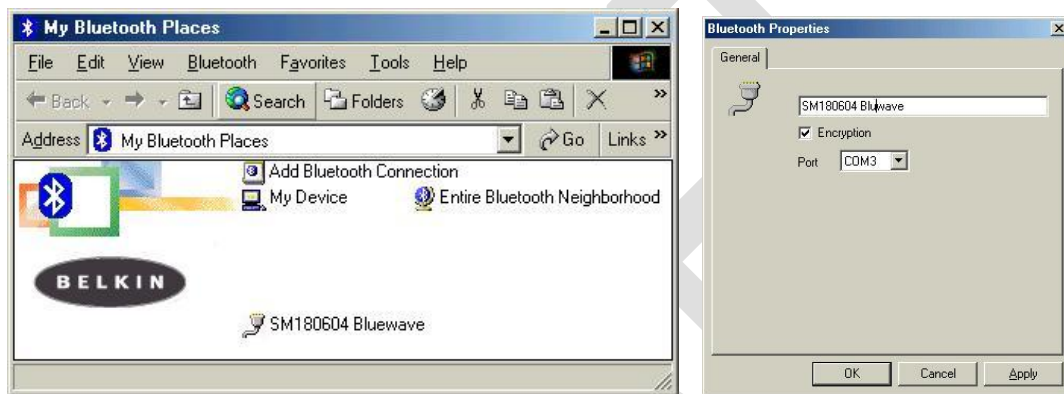
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## BLUETOOTH INTERFACE

The SonarMite deck box provides a fully compliant wireless Bluetooth™ Class 1 Master and Slave function via a simple UART or RS232 interface. The Bluetooth Wireless will provide connectivity to any device supporting either a UART or RS232 interface. The SonarMite Bluetooth Serial is compatible with all other device supporting Bluetooth™ SPP (Serial Port Protocol).

### BlueTooth ID/Password code

In some instances the local Bluetooth interface may request a password/ID to set up pairing with the device, for MTX version devices the pin number is always set to '1234' (numeric one two three four).



Typical PC Bluetooth software

### Bluetooth™ Serial Port Profile

Bluetooth Serial provides either a Bluetooth™ slave or master connection fully supporting the (SPP) Serial Port Profile ...

#### Features

- ❑ Fully Bluetooth™ Class 1 v1.1 SPP compatible
- ❑ Wireless range of over 100m (330ft)
- ❑ Integrates with RS232 or UART systems.
- ❑ Small footprint
- ❑ Platform independent
- ❑ Various low power sleep modes
- ❑ SMA Antenna connection for direct antenna connection or coax

The SonarMite Bluetooth Serial Terminal encapsulates all of the Bluetooth™ protocols on a single chip, providing a simple serial interface to the host, therefore

removing any need for software drivers or experience in developing wireless technology

### ***Bluetooth - actual range of the device.***

The device uses Bluetooth class 1. The range will depend on the other Bluetooth™ device that it is connected to. It will also depend on the physical environment (ie) obstructive walls and the type of walls the signal will need to go through and on the antenna that is fitted. Assuming it is connected to a class 1 device then the maximum range should be between 50 and 150 meters.

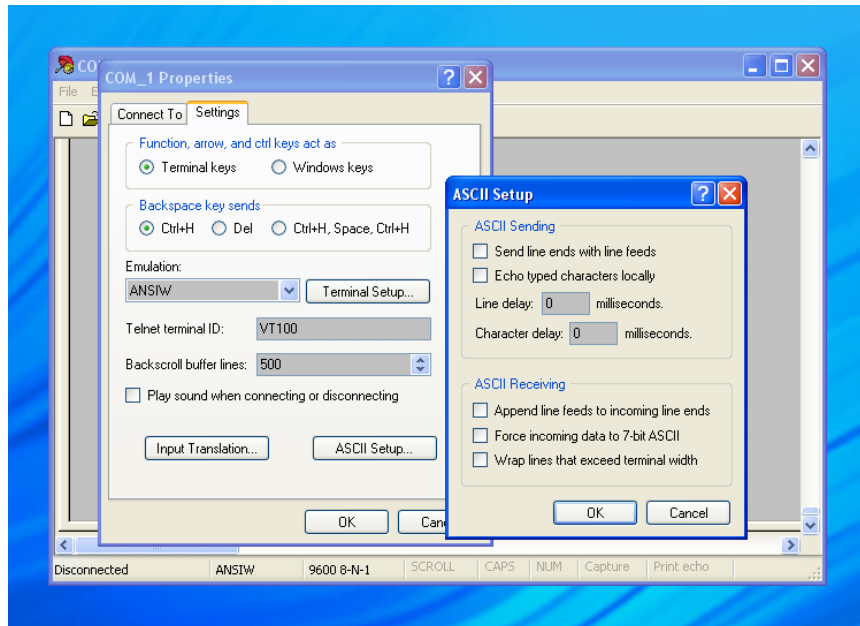
### ***Connecting to another Bluetooth™ PC/PDA***

The Bluetooth Serial Terminal will connect to any Bluetooth™ enabled device supporting SPP. This can be in MASTER mode, where the terminal initiates the connection, or SLAVE mode, where the remote device initiates the connection. The method of connection will vary depending on the remote device. However, generally the other device will perform a four stage process.

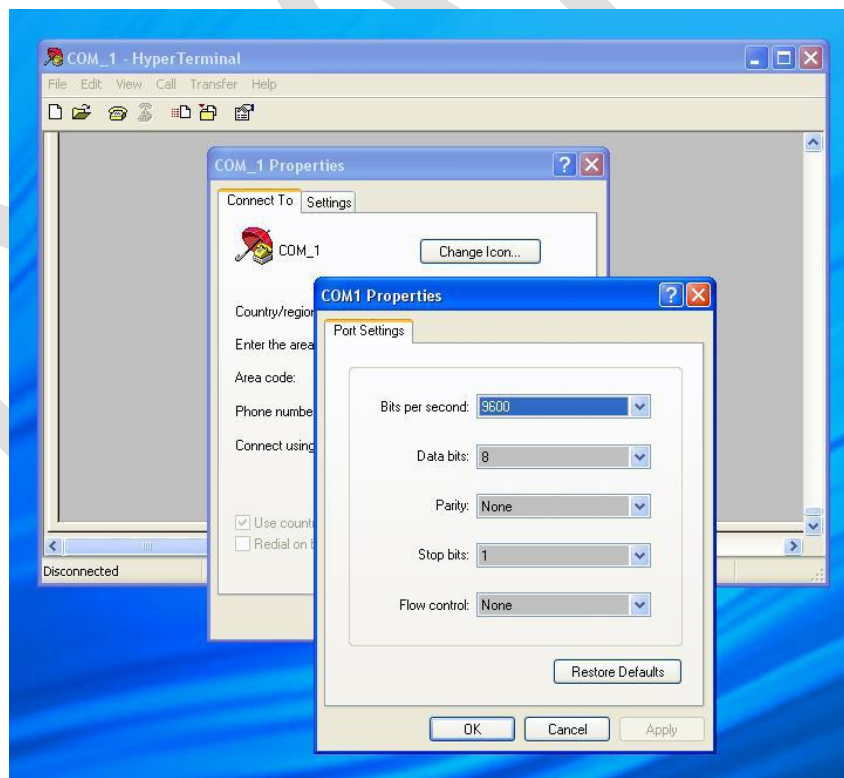
- ❑ The remote device will “discover” other Bluetooth devices. The Bluetooth device will appear as “SMnnnnnn” (where nnnnnn is serial number).
- ❑ The remote device will need to “Pair” with the SonarMite Bluetooth. The pin number is then entered.
- ❑ The remote device will connect to the serial port service of the SonarMite Bluetooth Serial Terminal.
- ❑ A virtual “Outgoing” communications Comm port will then generally be created and the application can then talk over this port to any connection to the SonarMite Bluetooth Serial Terminal.
- ❑ **WHEN CONNECTED THE RED LED WILL ILLUMINATE AND FLASH CONTINUOUSLY**



## Typical Windows HyperTerminal settings



Hyperterminal ASCII settings



Hyperterminal Connection settings

## CONNECTIONS

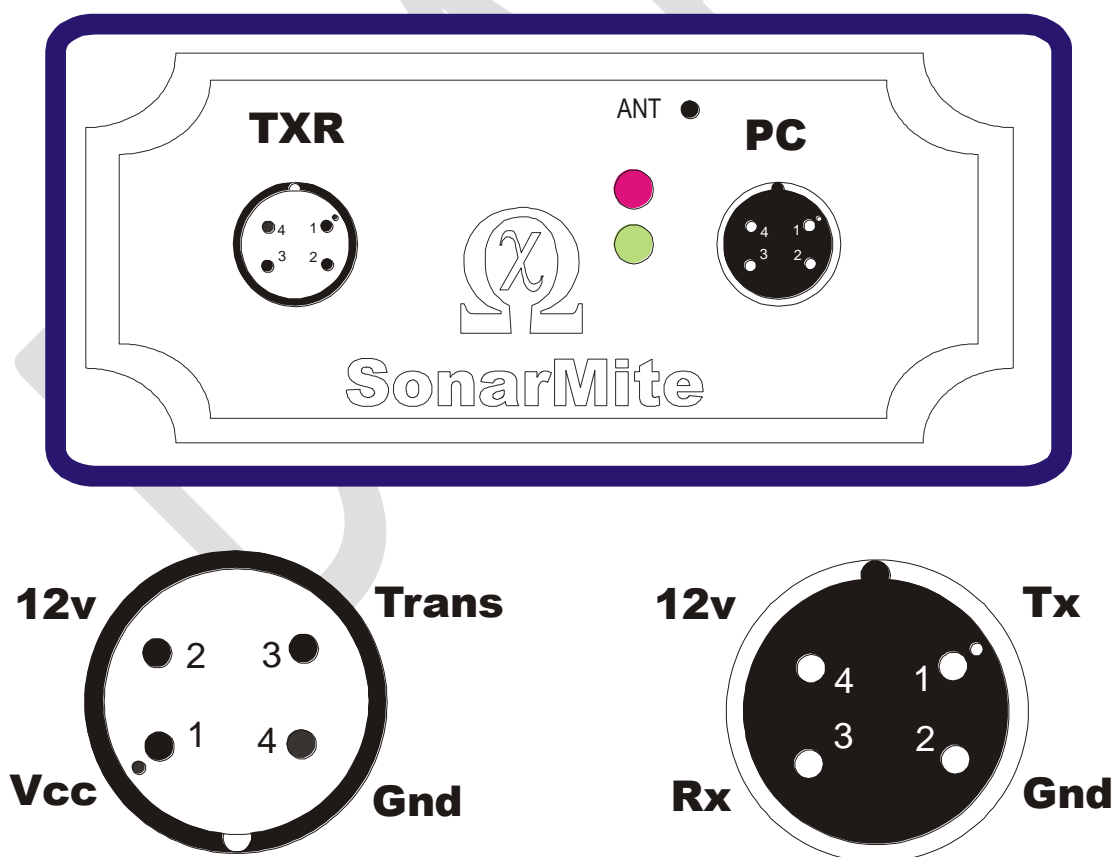
The only accessible connectors on the SonarMite are those on the front of the machine referred to as the 'Transducer' and 'Computer' connections. **There are no user connections or serviceable parts within the SonarMite body itself.**

### 'Computer' connection

This 4 way female connector is used to connect to either a PC serial connection or for an incoming GPS connection.

### 'Transducer' connection

This 4 way male connector is used to connect to the SonarMite transducer, the same connection is also used for the battery charger connector.



Transducer and Computer connections

## **APPENDIX**

### ***SonarMite Settings***

The SonarMite when connected via Bluetooth to a serial communications program such as Hyperterminal has a basic set of simple single character commands used to set the basic parameters of the instrument.

### ***Flash Memory***

The instrument contains an area of configuration data held within its semi-permanent FLASH memory area. On running the instrument this data is copied into the current working RAM area of the processor. Pressing any of the configuration command characters will only change the current active states enabling the user to sample output until the 'Save' command is used to store the current settings and make them the new defaults when the system is rebooted.

## Commands

### (^H)elp

Pressing ^H (Contol H) will display the following help information as an aid memoir to the available commands...

*^Help, ^Version, ^Format, ^Clear, ^Up, ^Down*

### (^V)ersion

Display the current firmware version number

### (^C)lear

Pressing ^C (Contol C) will reset the SonarMite to its default values, these values are saved in Flash memory and set in current working RAM memory.

## General Operations

Please note that if no transducer is seen or the qa is below 5 (out of water) then the output will appear as a string of nulls at 1 second timeouts, in normal operation the eight numbers are reported at 0.5 second intervals.

### (^F)ormat

Pressing ^F (Contol F) will toggle the output formats as below ...

= SYS: mode (used for system settings)

0) Format = SonarMite MTX

*Flag PortTx PortQA CenterTX CenterQA StarBoardTx StarboardQA Battery*

Where ...

*Flag = Bit Flag 0x10=Port 0x20=Center 0x40=Starboard  
 PortTx = Depth in meters measured by Port Transducer  
 PortQA = QA value measured by Port Transducer  
 CenterTx = Depth in meters measured by Center Transducer  
 CenterQA = QA value measured by Center Transducer  
 StarboardTx = Depth in meters measured by StarBoard Transducer  
 StarboardQA = QA value measured by Starboard Transducer  
 Battery = Battery/Supply voltage*

Example ...

```
< 50  0.00  0  0.33 138  0.46 116 12.8
< 50  0.00  0  0.33 138  0.46 116 12.8
```

```
< 50  0.00  0  0.33 138  0.46 116 12.8
< 50  0.00  0  0.33 138  0.46 116 12.9
< 50  0.00  0  0.33 138  0.46 116 12.8
< 50  0.00  0  0.33 138  0.46 116 12.8
< 50  0.00  0  0.33 138  0.46 116 12.8
```

1) Format = SonarMite MTX stream

**Flag Depth QA**

Where ...

Flag = Bit Flag 0x10=Port 0x20=Center 0x40=Starboard

Depth = Depth in meters measured by Transducer

QA = QA value measured by Transducer

Example ...

```
10  0.33 138
40  0.46 116
10  0.33 138
40  0.46 116
10  0.33 138
40  0.46 116
10  0.33 138
40  0.46 116
```

2) Format = Odom MBT

**Flag Depth**

Where ...

Flag = Bit Flag 0x10=Port 0x20=Center 0x40=Starboard

Depth = Depth in meters measured by Port Transducer

Example ...

```
et H  33
et H  33
et H  34
et H  34
et H  33
```

3) Format = DESO 25 DF

**Flag Depth**

Where ...

Flag = Bit Flag 0x10=Port 0x20=Center 0x40=Starboard

Depth = Depth in meters measured by Center Transducer

Example ...

```
DA  0.33 m
DA  0.33 m
DA  0.34 m
DA  0.34 m
DA  0.33 m
```

4) Format = HYPACK

*Flag PortTx PortQA CenterTX CenterQA StarBoardTx StarboardQA*

Where ...

*Flag = Bit Flag 0x01=Port 0x02=Center 0x04=Starboard  
PortTx = Depth in meters measured by Port Transducer  
PortQA = QA value measured by Port Transducer  
CenterTx = Depth in meters measured by Center Transducer  
CenterQA = QA value measured by Center Transducer  
StarboardTx = Depth in meters measured by StarBoard Transducer  
StarboardQA = QA value measured by Starboard Transducer  
Battery = Battery/Supply voltage*

Example ...

```
6 0.00 0 0.33 138 0.46 116
6 0.00 0 0.33 138 0.46 116
6 0.00 0 0.33 138 0.46 116
6 0.00 0 0.34 138 0.46 116
6 0.00 0 0.34 138 0.46 116
6 0.00 0 0.33 138 0.46 116
6 0.00 0 0.33 138 0.46 116
```

5) Format = System

*SYS> Depth n.nn SoS ssss ff v.vv*

Where ...

*n.nn = Depth in meters measured by Transducer  
ssss = Current Speed of Sound setting  
ff = Transducer ID flag  
v.v.v = Battery/Supply voltage*

Example ...

```
SYS> Depth 0.00 SoS 1500 50 12.8V
```

**(^U)p**

Increase the sound velocity setting for dense cold water (only available in the SYS: output mode).

**This is a dangerous function and will change calibration values if saved**

**(^D)own**

Decrease the sound velocity setting for lighter fresh/warm water (only available in the SYS: output mode).

**This is a dangerous function and will change calibration values if saved**