

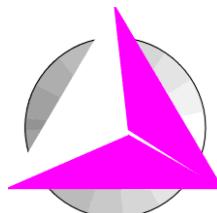


SONARMITE v3.0

PORATABLE BLUETOOTH ECHO SOUNDER



Ohmex is a company formed to manufacture and distribute products designed by Lymtech LLC, a company 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 a standard PC, SONARMITE, 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. WinSTRUMENTATION - The integration of Instrumentation, Wireless networks and modern portable computer equipment.



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INTRODUCTION

The SonarMite Echo Sounder is the result of nearly two years research and development to further extend the boundaries of shallow water hydrographic surveying equipment. The introduction by Ohmex in 1997 of the SonarLite, 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 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 instrument uses the same 'Smart' integrated transducer technology used in the SonarLite system, 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 SonarVista software has been updated to SonarVista, in addition to the standard post-processing and editing features found in the SonarMite software the program now includes extended features to implement the additional measurements produced by the SonarMite. 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. In the event the user already has data acquisition software the SonarMite can be used as a simple 'dumb' echo sounder that can be configured in wide variety of formats.

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.



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 stream data, 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 ‘TXR’ port and Serial Data Cable on ‘PC’ Port).

Equipment Supplied

The SonarMite 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' depth transducer c/w 5m cable and embedded processor
- Serial data lead
- IP68 Transit case with DuPont Velco internal case
- ** The Trimble GeoXT is shown for illustration only ...



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

- SonarMite WinCE software c/w SonarVista software for PC
- SonarMite WinXP software c/w SonarVista software for PC
- GPS power/data lead adaptor
- Aluminium shoe to connect transducer to detail pole

INSTALLATION & USE

This chapter describes how the SonarMite Portable Echo Sounder would normally be installed and used. There are three typical ways in which the device can be used for hydrographic surveying applications, either as a ‘Dumb’ sounder connected via a serial cable/Bluetooth Link to a PC running data logging and display software, or as a ‘Logging’ sounder in which all depths are internally time tagged and stored. The third option is to use both modes and use the serial output data for real time processing and the stored data for post-processing applications.

Switching the System On

To turn the system on the user ensures the system is fully charged then connects the transducer to the ‘TXR’ connector on the front panel, the Red LED alongside the connector will flash indicating connection and battery charge status.

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 SonarVista 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).

Barchecking

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

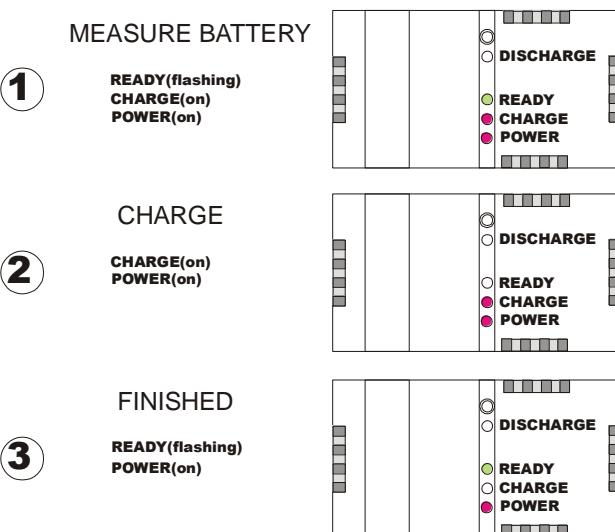
All of the above factors vary the density of the water in some way and effect the ‘time of flight’ of a pulse of ultrasound in water and hence the depth calculated from this time by the SonarMite. The user can either measure the speed of sound in water by taking velocity profiles using a dedicated velocity measuring device or can use the SonarMite static in a known depth over a flat, firm base and the 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.**

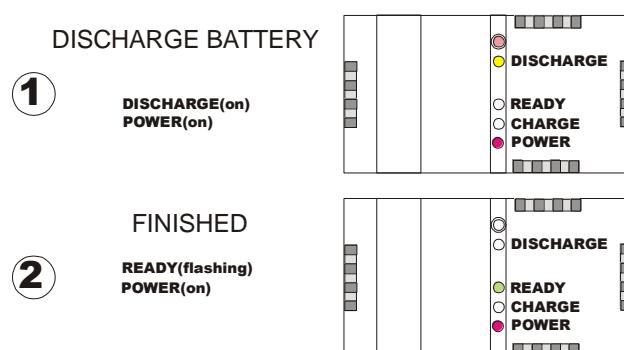
Internal Battery Charging

The SonarMite is fitted with an internal sealed Nickel Metal Hydride battery which provides 1.5Ahr @ 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 1.0Amp 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 IP67 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.

DEPTH TRANSDUCER

The SonarMite system uses a ‘boat’ shaped 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.

- ❑ 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 cable length: 7.6 m (25’)



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

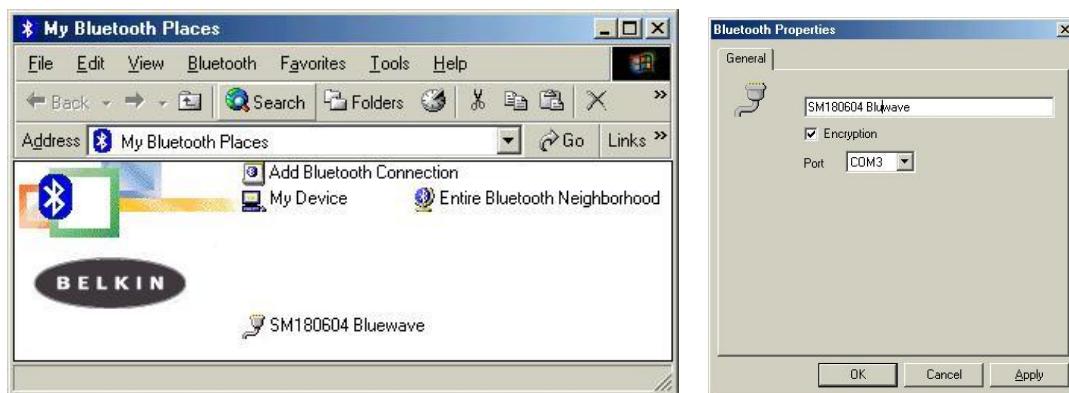
The Active Transducers include piezoelectric elements which are embedded within a resin compound. If the user has to fabricate a custom mounting for the transducer (a very common requirement given the vast permutations of boats in which surveys are performed) avoid using a fixing technique that causes physical stress in the transducer body as this will change the resonant properties of the device and effect its depth measuring accuracy.

BLUETOOTH INTERFACE

The Ohmex BluWAVE PCB provides a fully compliant wireless Bluetooth™ Class 1 Master and Slave function via a simple UART or RS232 interface. The BluWAVE PCB will provide wireless connectivity to any device supporting either a UART or RS232 interface. The BluWAVE PCB Serial is compatible with all other device supporting Bluetooth™ SPP such as iPAQ™, Palm™, Laptops with integrated Bluetooth™, USB adaptors and cell phones etc.

BluWave ID/Password code

In some instances the local Bluetooth interface may request a password/ID to set up pairing with the device, for version 3 devices the pin number is always set to ‘1234’ (numeric one two three four).



Typical PC Bluetooth software

Bluetooth™ Serial Port Profile

BluWAVE 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 up to 100m (330ft)
- ❑ Integrates with RS232 or UART systems.
- ❑ Small footprint
- ❑ Platform independent
- ❑ Supports baud rates from 2400 – 115200 baud
- ❑ Configurable Digital I/O
- ❑ Various low power sleep modes
- ❑ (R)SMA Antenna connection for direct antenna connection or coax

The BluWAVE PCB 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.

Autoconnect to remote slave device with optional PIN code. If PIN code not specified then no authentication is used. The unit will retry connections when the connection is dropped and at power up. (WC master mode). AT+BWAL[=nn] Autolisten. Listen for an incoming connection. The unit will resume listening when the connection is dropped and at power up. (WC slave mode). The optional value indicates the timeout for the listen.

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 BluWave 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.

1. The remote device will “discover” other Bluetooth devices. The BluWave device will appear as “BluWave”.
2. The remote device will need to pair with the BluWave. The pin number is then entered.
3. The remote device will connect to the serial port service of the BluWave Serial Terminal.
4. A virtual communications port will then generally be created and the application can then talk over this port to the BluWave Serial Terminal.

**Version 3 - WHEN CONNECTED THE GREEN/BLUE LED WILL
ILLUMINATE CONTINUOUSLY**

CONNECTIONS

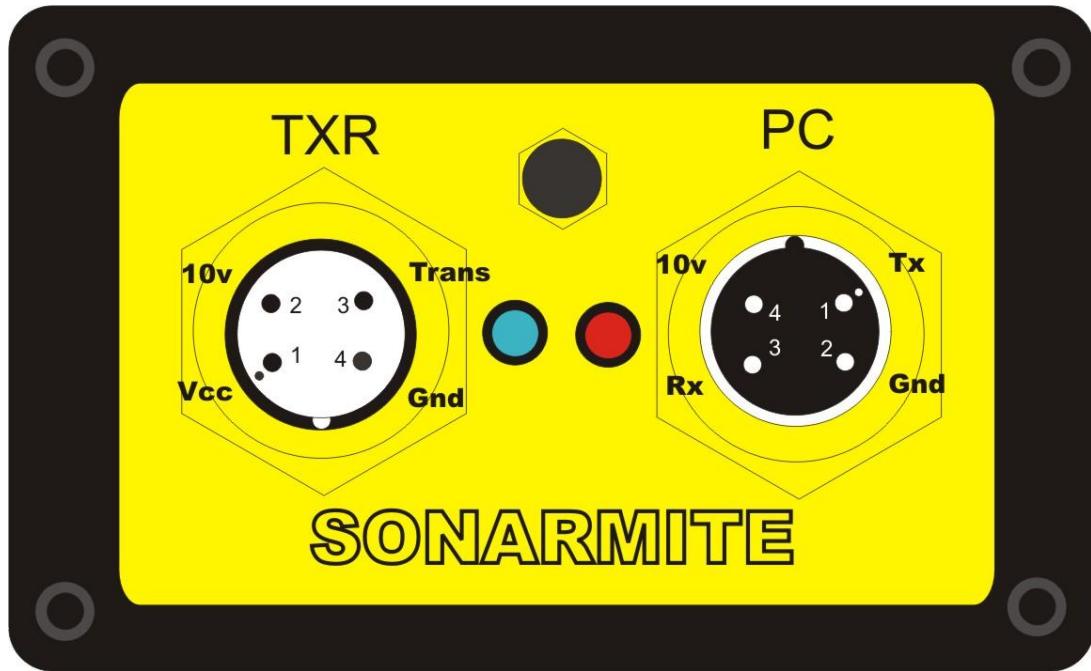
The only accessible connectors on the SonarMite are those on the front of the machine referred to as the ‘Transducer’ and ‘Computer’ connections. **There are no user connections or serviceable parts within the SonarMite body itself.**

‘Computer’ connection

This 4 way female connector is used to connect to either a PC serial connection or for an incoming ASCII data stream such as GPS in a ‘Polled’ connection.

‘Transducer/Charger’ 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. **CONNECTING EXTERNAL POWER OTHER THAN THE CHARGER PROVIDED TO THE INTERNAL BATTERIES IS NOT RECOMMENDED AND MAY CAUSE SERIOUS DAMAGE !**



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 ‘control’ 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 RAM 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. Some of the more dangerous settings have been purposely moved to a system menu to prevent their accidental use.

SonarMite Serial Commands

☺ (^H)elp

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

^Help,Format,Version,Id,Save,[Reset,Load,U/Dsos]

Commands shown in parenthesis [] are only available in the **SYS>** format.

Memory Operations

☺ (^R)eset

Pressing ^R (Contol R) will reset the SonarMite to its default values, these values are saved in Flash memory and set in current working RAM memory (**only available in the SYS> output mode**).

☺ (^L)oad

Pressing ^L (Contol L) will reload the Flash memory into the current working memory. (**only available in the SYS> output mode**).

☺ (^S)ave

Pressing ^S (Contol S) will save the current working memory area to Flash memory to become the system settings on reboot.

General Operations

☺ (?) Query format

Pressing ? will reply with current output formats as below ...

*Old SonarMite
Simple ASCII
DBT NMEA
DPT NMEA
Odom SBT
DESO 25
Polled
System
New SonarMite*

☺ (^F)format

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

Format 0 Old SonarMite format with null HPR (e.g. 1 1.88 0 0 0.0 12.7 128 20)

1 0.48 0 0 0 8.9 115 0
1 0.48 0 0 0 8.9 115 0
1 0.48 0 0 0 17.8 116 0
1 0.48 0 0 0 8.9 115 0
1 0.48 0 0 0 8.9 115 0

Example Standard Sonarmite Output

Output Parameters

Output message is eight numeric ASCII parameters, floating format, space delimited as ...

id depth roll pitch heave battery qa flags<cr><lf>

where ...

id = The id number of the instrument (0..7)

depth = current measured depth (m)

roll = current roll lateral atitude (+/-deg)

pitch = current pitch axial atitude (+/-deg)

heave = current heave depth correction (m)

battery = current battery condition (v)

qa = current depth relative qa value (0=null, 70=poor, 128=best)

flags = binary toggle flags 1=^X, 2=^Y, 4=^A, 16=^Z, 32=^G

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 8 nulls at 1 second timeouts, in normal operation the eight numbers are reported at 0.5 second intervals.

Format 1 Simple ASCII mode (e.g. 1.92)

0.48
0.48
0.48
0.48
0.48
0.48
0.48
0.48

Example Simple ASCII Output

Format 2 DBT NMEA mode (e.g. \$SMDBT,5.94,f,1.81,M,,*67)

\$SMDBT,1.6,f,0.48,M,,*5C
\$SMDBT,1.6,f,0.48,M,,*5C
\$SMDBT,1.6,f,0.48,M,,*5C
\$SMDBT,1.6,f,0.48,M,,*5C
\$SMDBT,1.6,f,0.48,M,,*5C
\$SMDBT,1.6,f,0.48,M,,*5C

Example NMEA DBT Output

Format 3 DPT NMEA mode (e.g. \$SMDPT,1.81,0.0*66)

\$SMDPT,0.48,0.0*62
\$SMDPT,0.48,0.0*62
\$SMDPT,0.48,0.0*62
\$SMDPT,0.48,0.0*62
\$SMDPT,0.48,0.0*62
\$SMDPT,0.48,0.0*62

Example NMEA DPT Output

Format 4 Odom SBT mode (e.g. et 47)

et 47
et 47
et 47
et 47
et 47
et 47
et 47

Example Odom Output

Format 5 Deso 25 mode (e.g. DA 0.48 m)

DA 0.48 m
DA 0.48 m

Example Deso Output

Format 6 Polled mode (e.g. any text line in here 0.48 116)

```
any text line in here 0.48 116
Auto0163,1001.850,999.890,102.771,23.01.2009,15:49:32.9 0.48 115
$GPGGA,155147.9000,1000.2431,N,1001.7700,E,1,05,1.0,102.7566,M,0.0,M,0.0,0001*99
0.48 115
0.48 115
0.48 116
```

Example Polled Output

Format 7 mode used for system settings

```
SYS> 54 0.48 109 109 0 116 1500 0.2 0
SYS> 15 0.48 109 109 0 116 1500 8.9 0
SYS> 13 0.48 109 109 0 115 1500 8.9 0
SYS> 14 0.48 109 109 0 116 1500 8.9 0
SYS> 14 0.48 109 109 0 116 1500 8.9 0
SYS> 14 0.48 109 109 0 116 1500 8.9 0
```

Example System Output

Format 8 New SonarMite format (e.g. 1 1.88 12.7 128 20)

```
1 0.48 8.9 115 0
1 0.48 8.9 115 0
1 0.48 8.9 115 0
1 0.48 8.9 115 0
1 0.48 8.9 115 0
1 0.48 8.9 115 0
1 0.48 8.9 115 0
```

Example New SonarMite Output

☺ (^V)ersion

Display the current firmware version number

nSonarMite v3.01 (c) 2009 LYMTECH

☺ (^I)d

Toggle the ID number of the instrument. This function is intended for use in multiple transducer systems running in polled mode.

☺ (^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

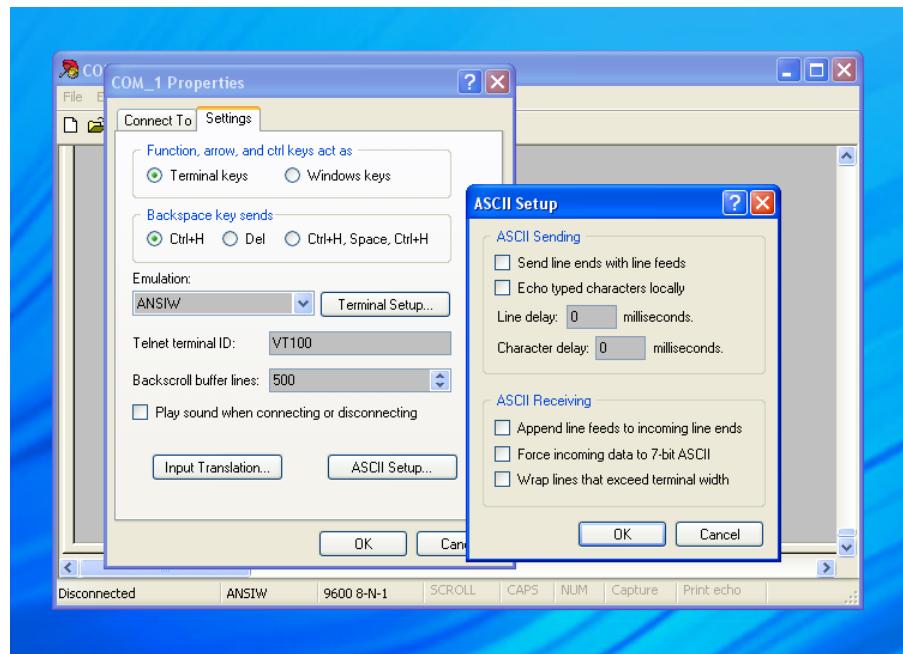
☺ (^C)lear

Reset output to format 0. (**used by external programs**).

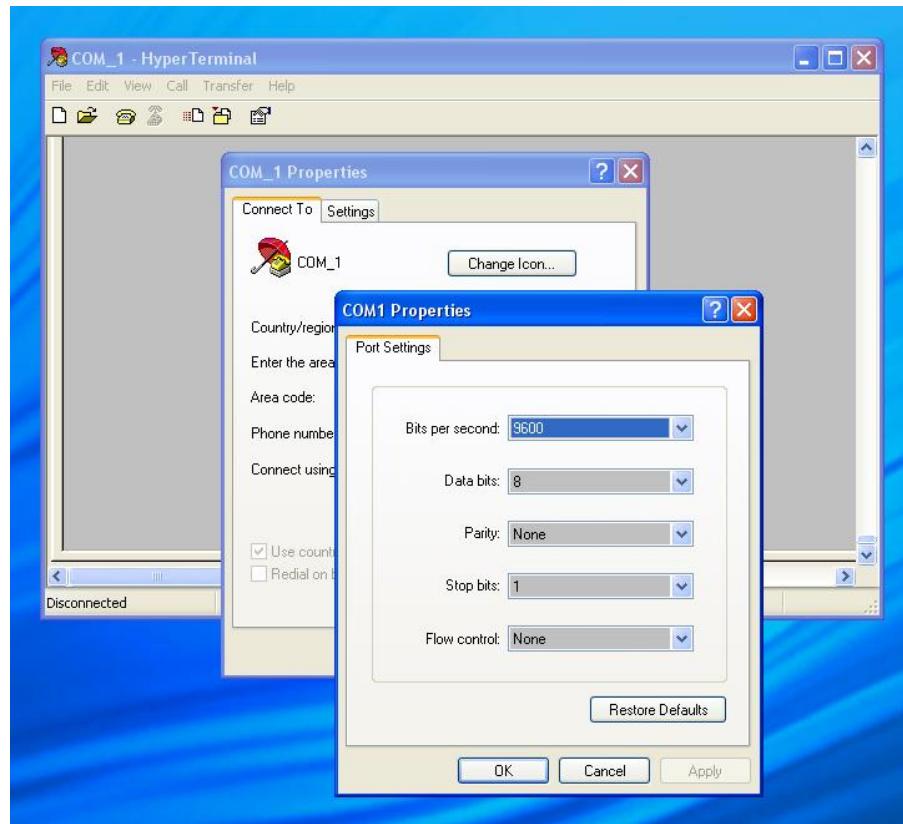
☺ (^B)

Set output to new format 8. (**used by external programs**).

Typical Windows HyperTerminal settings



Hyperterminal ASCII settings



Hyperterminal Connection settings

Version 3 modifications

June 2009 saw the release of version three of the SonarMite ...

The front panel LED functions have changed, now a Green/Blue LED that illuminates when a Bluetooth device is connected. Alongside this is a Red LED which illuminates and flashes when power is available and the device is switched on.

Internal batteries have been changed to new NiMh giving greater duration (12Hrs) and faster charge time. External power cannot be used with these batteries.

The HPR function is now discontinued as most precision positioning systems now use RTK output greater than typical wave motion frequency.

A new Bluetooth module is now used giving the same range >100m using less power. The module has a more rugged antenna to avoid physical damage.

Output formats have been added to increase connection to a wide range of third party software including the generic ‘polled’ format.

The physical case size has been reduced.