Micron Echosounder

Product Manual

0650-SOM-00001, Issue: 02

Tritech

Outstanding Performance in Underwater Technology

A Moog Inc. Company

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Help & Support

First please read this manual thoroughly (particularly the Troubleshooting section, if present). If a warranty is applicable, further details can be found in a Warranty Statement at the end of the manual.

Tritech International Ltd can be contacted as follows:

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

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

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

2. Software or firmware revision numbers.

3. A clear fault description.

4. Details of any remedial action implemented.

⚠ Contamination

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

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

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

Warning Symbols

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

Note

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

Important

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

Caution

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

Warning

DANGER OF INJURY TO SELF OR OTHERS

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

1. Specification

1.1. Dimensions

Not to scale, dimensions in mm.

1.2. Physical

Weight in air	200g
Weight in water	60g
Depth rating	750m
Operating temperature	-10 to 35°C
Storage temperature	-20 to 50°C

1.3. Acoustic Properties

Operating frequency	500kHz
Beamwidth	6° conical
Maximum range	50m
Minimum range	0.5m
Digital resolution	1mm

1.4. Electrical & Communication

Analogue output	0-5V DC on AUX port
Communication protocol	RS485, RS232
Serial output format	ASCII, NMEA
Topside control	Computer with standard serial port SeaHub or USB-RS232/RS485 converter
Power requirements	12-48V, 1.72W

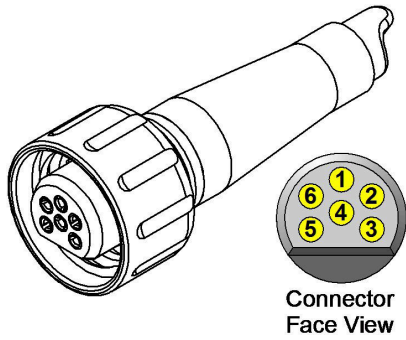## 1.5. Pin-out Diagram & Cable Specification

Caution

The Micron series connector is **not** wet mateable and direct exposure to water when the unit is powered will cause damage.

Caution

Echosounders with part number S06377 should not be connected to the `AUX` port of a Gemini 720im. The analogue voltage on the `MAIN` port of the Echosounder will damage the Gemini 720im.
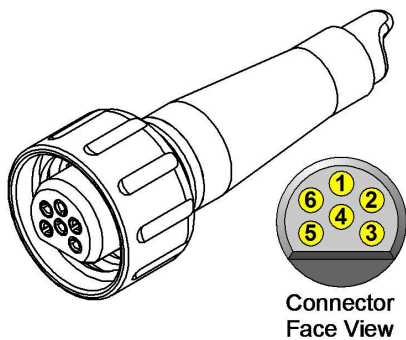
S11975 Pinouts (Standard Echosounder after September 2018)

Main Port		
Pin	**Wire Colour**	**Function**
1	Yellow	RS485 A RS232 TX
2	Blue	RS485 B RS232 RX
3	Red	DC +
4	Black	DC Ground
5	Green	RS232 Ground
6	Cable Sheath	Earth

Aux Port		
Pin	**Wire Colour**	**Function**
1		
2		
3	Red	DC +
4	Black	Analogue Ground DC Ground
5	Green	Analogue output
6	Cable Sheath	Earth

Connector Face View

S06377 Pinouts (Standard Echosounder before September 2018)

Main Port		
Pin	**Wire Colour**	**Function**
1	Yellow	RS485 A RS232 TX
2	Blue	RS485 B RS232 RX
3	Red	DC +
4	Black	DC Ground RS232 Ground Analogue Ground
5	Green	Analogue Output
6	Cable Sheath	Earth

Aux Port		
Pin	**Wire Colour**	**Function**
1		
2		
3	Red	DC +
4	Black	Analogue Ground DC Ground
5	Green	Analogue output
6	Cable Sheath	Earth

Connector Face View

2. Introduction

The Micron Echosounder is a sonar ranging device which, when mounted vertically gives the height above the seabed or in any other orientation will provide a method for measuring subsea distances. The Echosounder can be configured to operate as a single device or paired with other devices from the Micron range.

The altimeter data output from the Micron Echosounder can be transmitted as either an analogue signal or using an RS232/RS485 protocol.

This manual covers the setup and use of the Micron Echosounder as a stand-alone unit. There are a wide variety of different configurations available for the Micron Echosounder and it is important to use this manual alongside the original purchase documentation to ensure that the correct details are to hand.

3. Installation

3.1. Mounting

Optimal Orientation

Always mount the Micron Echosounder so that it is as close to the true vertical (or horizontal) as possible in relation to the trim position of the vehicle.

Errors in the head alignment can give rise to unreliable results.

Mounting Material and Suitable Brackets

Caution

Avoid mounts that contain any metal alloys of copper such as brass or bronze.

Caution

Under no circumstances should the body tube be rotated within the clamp. If torque is applied to the transducer or upper body tube they may unscrew resulting in a unit that is no-longer water tight.
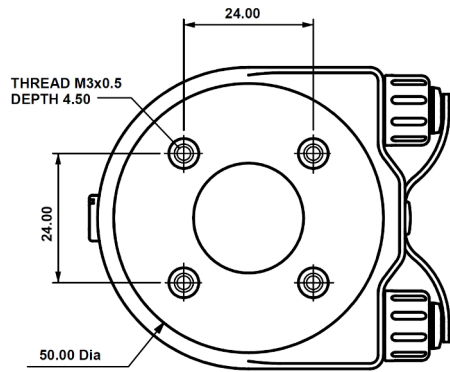
Non-metallic clamps should always be used where possible to prolong the life of the unit and prevent any galvanic corrosion effects. If metallic clamps are used they should be electrically insulated from the Echosounder body by means of rubber or plastic strips or mount brackets of at least 3mm thickness and extending at least 3mm beyond the clamp boundary. It is advised that metallic mounts should also be painted or lacquered with at least three coatings.

The Micron Echosounder can be mounted with a clamp around the body (the bottom half of the Echosounder) or can be mounted using the holes on the base as detailed in Figure 3.1, "Mounting Holes on Micron Range".

Caution

Under no circumstance should a clamp be used on the transducer section (top half) of the Micron.

All dimensions are in millimetres.

Figure 3.1. Mounting Holes on Micron Range

3.2. Power

> ### Caution
>
> Unused connector sockets should be sealed against water ingress using the provided blanking cap.

> ### Caution
>
> When mating the connectors ensure that both plug and socket are completely dry.

The Micron Echosounder head is protected against voltage surges on the power and communication lines using internal supressers. Sustained over voltage will damage the unit.

Power can be applied from a rectified transformer PSU and the output of the PSU must have a filter capacitor of not less than 470µF, for each head being powered. If an unregulated PSU is used, then make sure that the voltage value measured at the head is in the range specified in Chapter 1, *Specification*, in power on/off and running conditions.

> ### Note
>
> To reduce the risk of damage due to over-voltage it is recommended that 100mA fuses are used in the communication lines and appropriate fuse is used in the power supply (e.g., 1A at 12V or 500mA at 24V).

> ### Note
>
> The Aux port provides pass through voltage from the Main port.

If using, or testing, with a SeaHub it is possible to power the Micron Echosounder from the SeaHub using a combined power and data cable (port C or D). Please refer to the SeaHub manual for details of the port pin-out diagram or contact *Tritech International Ltd* who can provide a ready made cable.

If using an RS232 connection from a computer, or if the Echosounder is mounted to an ROV it will be necessary to construct a cable with an appropriate Micron connector on one end and power/data on the other end. Contact *Tritech International Ltd* for an appropriate cable whip.

Caution

Never attempt to operate the Micron Echosounder at the end of a long cable by increasing the PSU output voltage above the maximum rated voltage of the unit.

3.3. Communications

Caution

The power should be turned off before making a connection between the sonar head and surface controller (SCU or SeaHub).

3.3.1. Port Layout

Note

For pin-out diagrams and cable specification refer to Chapter 1, *Specification*.

The Micron Echosounder is supplied with two communications ports labelled `MAIN` and `AUX`. All serial communication to the control computer on the surface or to another micron device should be via the `MAIN` port.

The `AUX` port of the micron sonar is used only for analogue voltage output. If only analogue voltage is required then the `MAIN` port can be left blanked off and the power supplied via the `AUX` port.

The communication configuration of the ports are factory set (although they can be changed in software) . The factory setting is written on the label attached to the Micron, and can also be obtained from the original build record.

Any combination of protocols RS232 and RS485 on the main and aux port are possible.

Note

If the settings are changed through software it is important to keep a record of the changes, otherwise it can become very difficult to re-connect to the Echosounder.

3.3.2. RS232 Characteristics

The RS232 telemetry is bi-directional, 3-wire (TX, RX and ground) with a maximum speed of 115.2kbps.

This may form the connection between the Echosounder and the control computer RS232 COM port. Typically this is a DE-9 port or via a DE-9 to USB converter if the computer has no native RS232 ports (such as in modern laptops). It is also possible to connect via an RS232 modem or multiplexer.

Maximum cable length

Depending on the type of conductors used, the RS232 may only drive up to 20m of copper cable. For longer cable lengths it is necessary to run through a repeater or converter, or switch to optical fibre with an RS232 telemetry option.

It is possible to connect over a longer cable using a pair of RS232 to RS485 (or RS422) converters and only using the RS232 connection over short ranges near the Echosounder head and control computer.

3.3.3. RS485 Characteristics

The RS485 telemetry is half-duplex, 2-wire (RS485 A (or -) and RS485 B (or +)) with a maximum speed of 115.2kbps.

The surface RS485 connection is typically through an RS485 serial COM port installed in the computer (usually desktop computers) or an RS485 to RS232 signal converter. This protocol is also used when connecting a Micron Echosounder to the AUX port of a Micron Sonar.

Note

The RS485 circuit inside the Micron has a factory supplied 150Ω termination resistor fitted. A matching resistor may be fitted to the surface side if the twisted pair length requires it.

Maximum cable length

The RS485 protocol is capable of a maximum of 2000m using high quality twisted pair cable.

3.3.4. Analogue Characteristics

Pin 5 of the `AUX` connector on the Micron Echosounder is able to output an analogue signal which relates to the depth measured by the Echosounder.

This output will be calibrated from 0.03 to 5V to represent 0.5 to 50m depth.

4. Operation

Note

The output from the Echosounder can be in serial or analogue format. This section only covers applications which use the data in serial format.

4.1. Output Strings

The serial output is either interrogated (i.e., the software asks for a response) or free-running and will continuously send out acoustic pulses and supply the output from the Echosounder to the connected computer even if the software is not running.

The output is an ASCII data string terminated with a carriage return and line feed (`<CR><LF>`) and will be in one of three formats depending on the hardware settings. These formats are as follows:

3P2

```
xxx.xxm<CR><LF>
```

`xxx.xx` = range in metres to 2 decimal places

`m` = units label for metres

`<CR><LF>` = carriage return and line feed terminators.

3P3

```
xxx.xxxm<CR><LF>
```

`xxx.xxx` = range in metres to 3 decimal places

`m` = units label for metres

`<CR><LF>` = carriage return and line feed terminators.

NMEA $DBT

```
$PADBT,xxx.xx,f,yyy,yy,M,zzz.zz,F*hh<CR><LF>
```

`xxx.xx` is the range in feet

`yyy.yy` is the range in metres

`zzz.zz` is the range in fathoms

`hh` is an 8-bit checksum

`<CR><LF>` = carriage return and line feed terminators.

In free running mode the unit will start to output data immediately upon power up. If the Echosounder has been set to interrogate mode it will not output data until the interrogate command (`Z`) is received, at which point a single data string is transmitted to the surface computer.

To confirm which mode the Echosounder is in a simple test is to power on the unit and listen for any audible clicks or pings. In free running mode the Echosounder will start pinging as soon as it receives power but in interrogated mode it should remain silent.

Warning

NEVER place the transducer close to the ear to listen for the clicks. Doing so could result in permanent damage to the eardrum. Always remain at least 15cm away from the transducer.

4.2. Data Stream Characteristics

The default Echosounder output communication characteristics are as follows:

• 8 data bits

• 1 stop bit

• No parity

• No flow control

Depending on the hardware setup the unit will either output a 0 result or the maximum possible result whenever a valid signal is not detected (i.e., fail low or fail high). These settings are, respectively, `Zero No Echo` (`ZNE`) or `Max No Echo` (`MNE`).

5. Configuration

The Micron Echosounder is configured at the factory and it is not normally possible to re-configure it in the field.

5.1. Connecting the Echosounder to other Micron products

Note

When daisy chained, the Micron Echosounder should be placed at the end of the chain. In the example of a Micron Sonar and Responder setup, the Echosounder should be placed on the AUX port of the Responder.

In this situation you will need to make sure that the AUX port of the responder is set to a communication protocol and baud rate that matches your Echosounder.

Compatible products are the MicronNav Responder (AUX port), and MK2 or MK3 Micron Sonar (AUX port). It is recommended that the Echosounder is set as below:

• RS485

• 3P2 string (xxx.xxm<CR><LF>) or 2P3 string (xx.xxxm<CR><LF>)

• Free running mode

• Zero No Return

• No analogue output (unless using a custom cable).

5.2. MAIN Port Communication Protocol

The MAIN port of the Micron Echosounder can be configured for either RS485 or RS232.

5.3. AUX Port Communication Protocol

The AUX port of the Micron Echosounder is for analogue output only.

5.4. Baud Rate

The baud rate can be configured to be one of the following:

• 115.2kbps

• 57.6kbps

• 38.4kbps

• 19.2kbps

- 9.6kbps

- 4.8kbps

- 2.4kbps

5.5. Serial Output String

The output string can be configured for one of three options:

- 3P2

- 3P3

- NMEA

For more details of the string format please refer to Chapter 4, *Operation*.

5.6. Other Options

The Echosounder can be set to be free-running or interrogated. In free running mode it will output constantly as soon as power is applied, while in interrogated mode it will only output when it is sent a 'Z' character from the surface control computer.

The "no return echo" can be set to either 0m or 50m. This means that if an echo comes back which is beyond the acceptable range the Echosounder will return either a reading of 0m or 50m to the surface computer.

6. Maintenance

6.1. After each use of the equipment

Make sure that after using the Echosounder it is washed down with fresh water and check the unit for any signs of obvious damage.

Once the unit is clean; dry thoroughly and place in the storage container.

Note

If the unit is fitted to an ROV it is advisable to remove from its fitting and wash both with fresh water and dry both thoroughly prior to re-assembly. This will prevent the build up of corrosive salts in any crevices between the sonar and mounting bracket.

6.2. Regular maintenance

There are no user serviceable parts inside the Echosounder and should not be taken apart for routine maintenance tasks.

It is recommended that a regular inspection routine be established. Particular attention should be payed to the transducer and stress points, such as the connectors.

If the system is in regular use, or submerged routinely for extended periods, it is advisable to arrange for an annual service to be carried out by *Tritech International Ltd*. This service will enable the equipment to be checked thoroughly and any worn parts to be replaced enabling long-term trouble free operation. For details of the servicing options available contact *Tritech International Ltd*.

6.3. Storage of Equipment

If storing the equipment for extended periods make sure that it is completely dry (if necessary leave to air-dry before stowing).
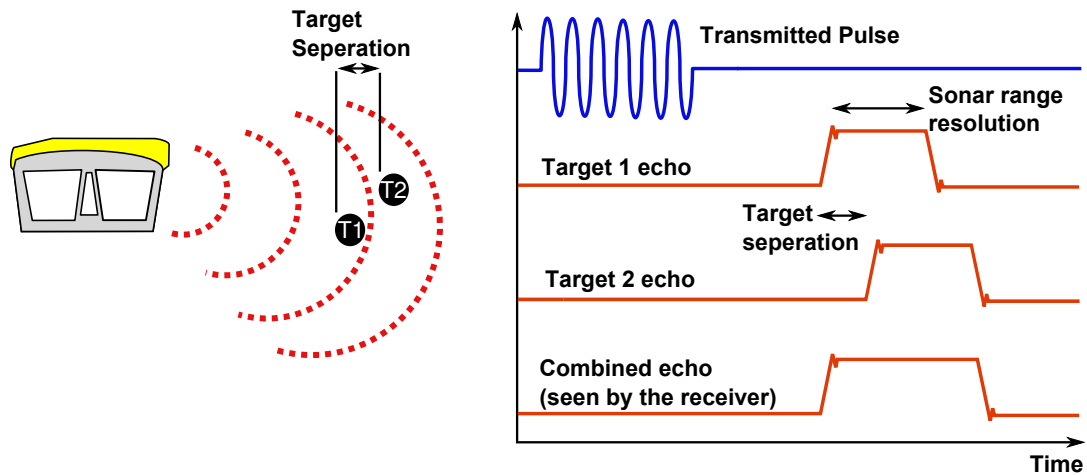
Pack into storage containers along with several pouches of silica gel. The original packing containers contain specific foam cut-outs for the storage of the equipment and wherever possible should be re-used. The foam will absorb moisture so if the cases are allowed to get wet they should be dried thoroughly prior to stowing equipment in them.

Any supplied cabling is jacketed with polyurethane which is resistant to corrosion but if it is intended to store the reel for an extended period without use then it is advisable to un-reel the cable and dry its entire length. This will also give the opportunity to inspect the cable for any damage which may have occurred during use.
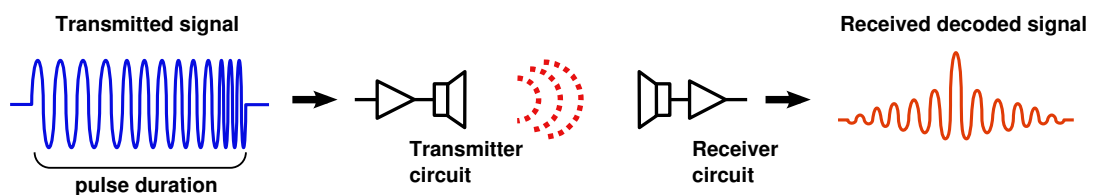
Appendix A. CHIRP Signal Processing

There are several advantages of *Tritech International Ltd* Digital Sonar Technology (DST) which allows the use of CHIRP signal processing technology to improve the images generated by the sonar.

In monotonic (single frequency burst) sonar, the range resolution is determined by the length of the transmitted pulse. The smaller the pulse, the greater the resolution achievable and vice-versa. The smallest pulse length is typically 50 micro seconds and velocity of sound in water is approximately 1500 metres/second which gives a range resolution of 37.5mm. This result determines the ability to resolve separate targets.

Using the example above, if two targets are less than 37.5mm apart then they cannot be distinguished from each other. The net effect is that the system displays a single large target, rather than multiple smaller targets.

CHIRP signal processing overcomes these limitations by sweeping the frequency within the burst over a broad range of frequencies throughout the duration of transmission pulse. This creates a signature acoustic pulse - the sonar knows what was transmitted and when. Using pattern matching technology, it can now look for its own unique signature being echoed back from targets.
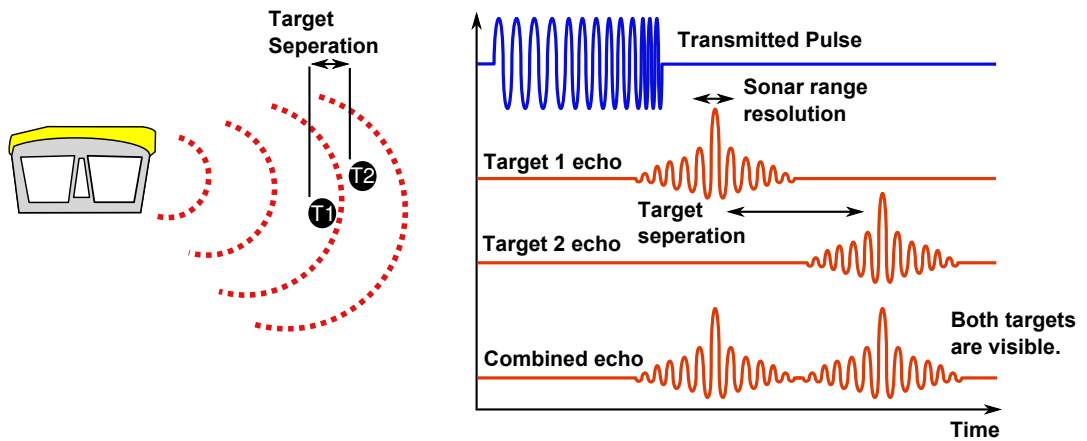

In a CHIRP system, the critical factor determining range resolution is the bandwidth of the CHIRP pulse which means the range resolution is given by:

$$\text{Range resolution} = \frac{\text{velocity of sound}}{2 \times \text{bandwidth}}$$

The bandwidth of a typical *Tritech International Ltd* CHIRP system is 50kHz.

With velocity of sound in water of 1500m/s this gives a new range resolution of 15mm.

This time, when two acoustic echoes overlap, the signature CHIRP pulses do not merge into a single return. The frequency at each point of the pulse is different, and the sonar is able to resolve the two targets independently.

The response from the pattern-matching algorithms in the sonar means that the length of the acoustic pulse no longer affects the amplitude of the echo on the sonar display. Longer transmissions (and operating ranges) can be achieved without a loss in range resolution.

CHIRP gives additional improvements in background noise rejection, as the sonar is only looking for a swept frequency echo and can remove random noise or out-of-band noise.

Glossary

ASCII
American Standard Code for Information Interchange - a character encoding scheme originally based on the English alphabet.

DC
Direct Current

DE-9
A 9 pin D shaped connector commonly used for serial communications on computers.

PSU
Power Supply Unit

ROV
Remotely Operated Vehicle

RS232
Traditional name for a series of standards for serial binary data control signals.

RS485
A standard for defining the electrical characteristics of drivers and receivers for use in a balanced digital multipoint system (also known as EIA-485).

RX
Receive (data)

SCU
Surface Control Unit - a specially manufactured computer which is rack mountable and capable of processing the data from the sonar equipment running either Windows® XP Embedded or Windows® 7 and Seanet Pro or Gemini software.

SeaHub
An alternative to using a Seanet SCU, this device connects to a laptop or PC via USB interface, essentially this takes the signal from the sonar (in RS232, RS485 or ARCNET) and converts it into a signal suitable for the USB port of the computer.

TX
Transmit (data)

USB
Universal Serial Bus.