StarFish Sidescan Sonar

453OEM System Manual

Contents

1. Introduction

Thank you for purchasing the StarFish453OEM Seabed Imaging System, a revolutionary high definition side-scan sonar system capable of producing near photographic quality sonar images of the seabed.

Whether surveying lakes, rivers or the open ocean for dive sites, submerged structures, shipwrecks or research purposes, StarFish gives you the capability to capture detailed images of the seabed for work or play, making hi-tech seabed imaging accessible to anyone.

The StarFish453OEM sonar is design for equipment manufacturers or those wishing to integrate a sidescan sonar onto their own platform (such as ROV or AUV). The system comprises of two hull-mounted transducers that should be mounted angled 30° down from the horizontal, and an electronics module with USB connection to a Microsoft® Windows® based embedded PC.

The simple intuitive StarFish “Scanline” software makes seabed imaging extremely easy for novices and experienced side scan sonar users alike, alternately an SDK is available that allows StarFish data to be captured directly into your own application.

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

We hope you get many years of trouble free use from your StarFish sonar. However, should you have any difficulties please refer to the “Product Support” section at the end of this manual for details on how to obtain technical support, upgrades and repairs.

Safety

Before installing and using this product, please read through the “Safety” section at the rear of this manual.

Throughout the documentation the following symbols are used to indicate special precautions or procedures:

WARNING!
This symbol indicates a warning you should follow to avoid bodily injury or 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 system.

2. Installation

2.1. Choosing A Mounting Location

Before you can start using the Starfish453OEM Sonar system in the field, you will need to mount the sonar transducers to your underwater platform. Correct mounting of the sonar is essential in order to achieve the best image results, and as each setup is different you should consider the following points when deciding on a suitable mounting location…

Avoid creating acoustic shadows

The StarFish transducers contain transmitter and receiver elements that should be mounted horizontally and angled 30° down from the horizontal-plane for optimal sea-bed coverage.

The transducers acoustically transmit sound in a “fan beam” of narrow width (refer to the specification of your StarFish product for the exact width), but wide vertically, with most of the acoustic energy confined to the centre 60° of the beam.

The arrangement allows the StarFish to perform well in shallow water at long ranges, and see almost directly below it, but incorrect placement on the hull/platform could cause “acoustic shadows” or “reflections” to be produced features around them, such an ROV thrusters, AUV fins/dive-planes, umbilical cables etc.

Acoustic shadows will create blind spots in the sonar’s field of vision and may reduce its maximum working range. Reflections from the hull may create a ‘ghost’ or mirror image of the opposite channel on the sonar display.

Reduce vulnerability to grounding

When mounting the sonar, ensure there is always a point on the hull/platform that is lower than the transducers location. This will reduce the risk of damage to the transducer should you run aground or collide with any submerged obstacle.

Position in relation to the platforms propulsion

Ideally the StarFish transducers should be mounted to the hull/platform in front of its means of propulsion (i.e. propeller or thrusters), as these introduce small air-bubbles into the water which in-turn act as reflectors of sound and degrade the range and quality of the sonar imagery.

If it is not possible to mount the transducers in front of the thrusters or propeller, efforts should instead be made to mount the transducers lower than it, such that its turbulence does not obstruct the acoustic beams.

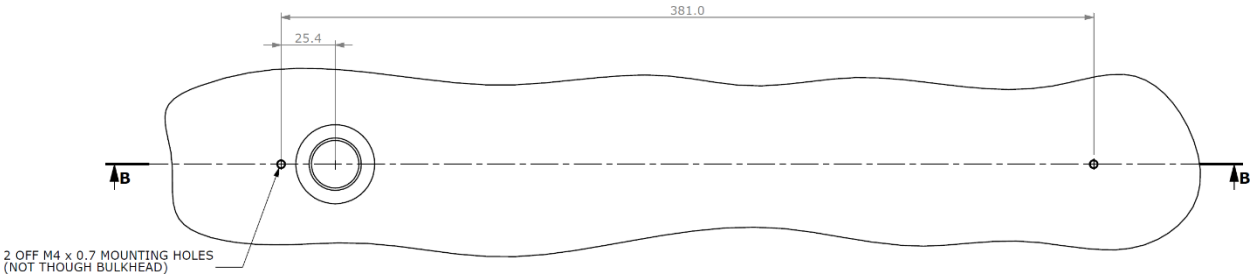
Avoid cavitation & turbulence

When mounting the transducers, it is important that a location is chosen that under normal conditions is known to be free from turbulence and aeration. You should also ensure the transducer is positioned such that cavitation and turbulence is minimised on the transmitter and receiver surfaces as this may distort or degrade the sonar imagery.

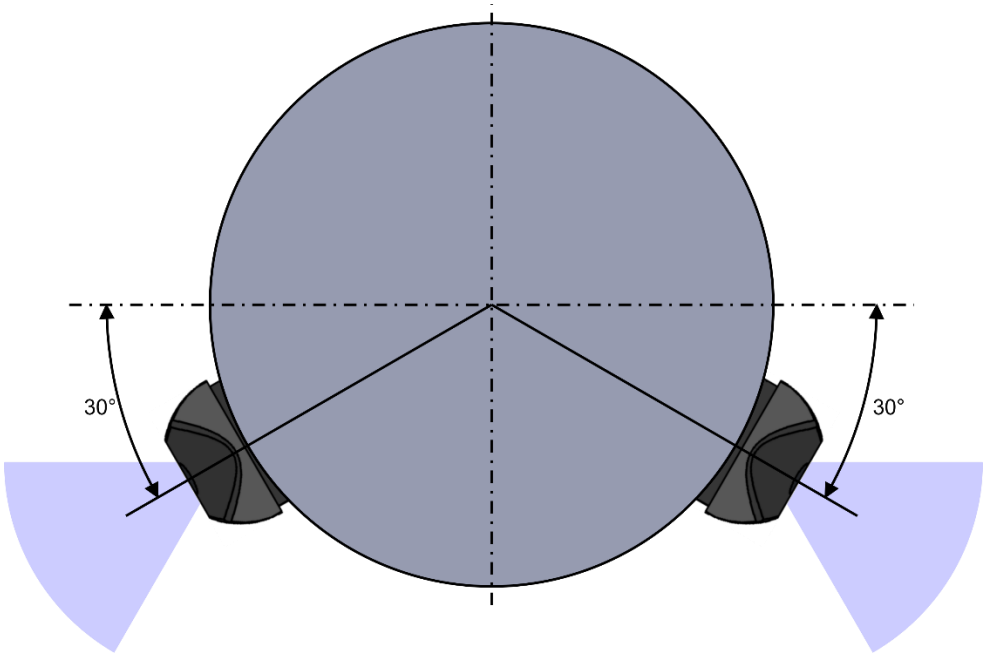
Avoid mounting the transducers behind features on the hull/platform, such as rivets, strakes or steps, that may introduce cavitation or turbulence into the water around them.

2.2. Transducer Mounting & Sealing

The StarFish transducers should be mounted onto the hull of the vehicle (or subsea platform) using 2 × M4 fixings, with centres 381mm apart as shown in the diagram below.

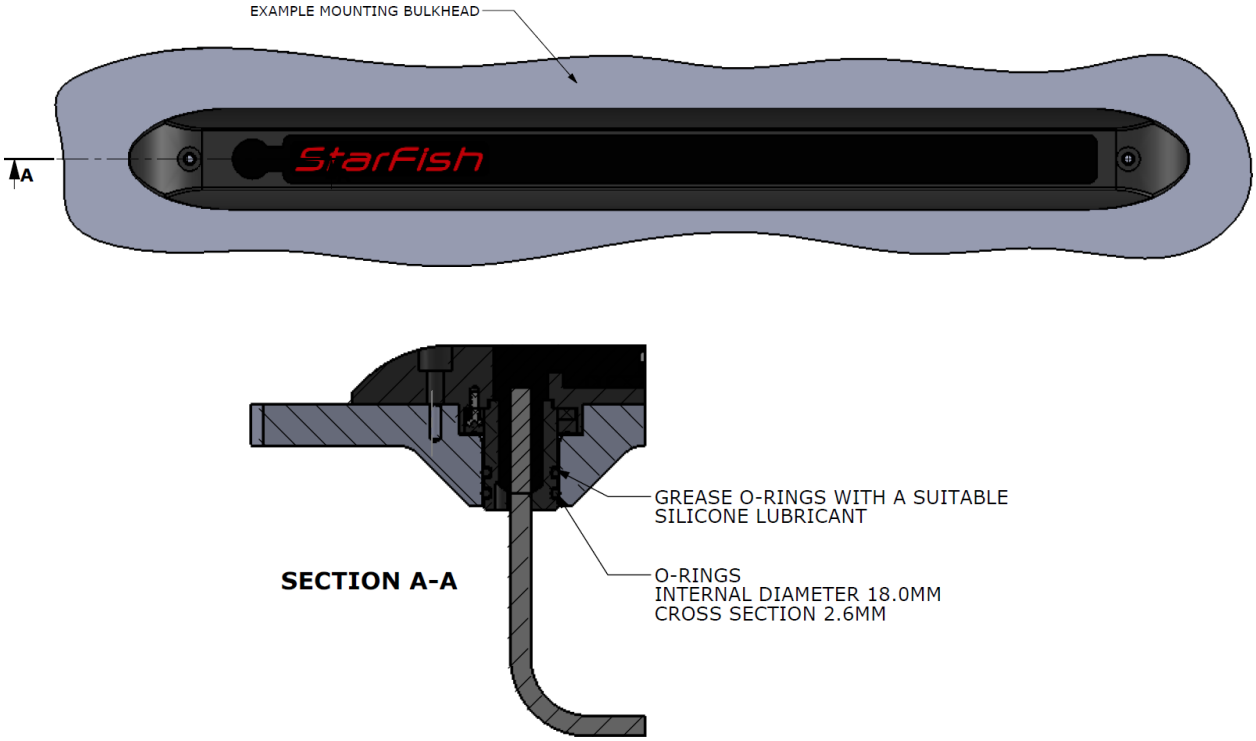


For best acoustic performance, the transducers should be mounted such that they are angled 30° down from the horizontal plane, as shown:



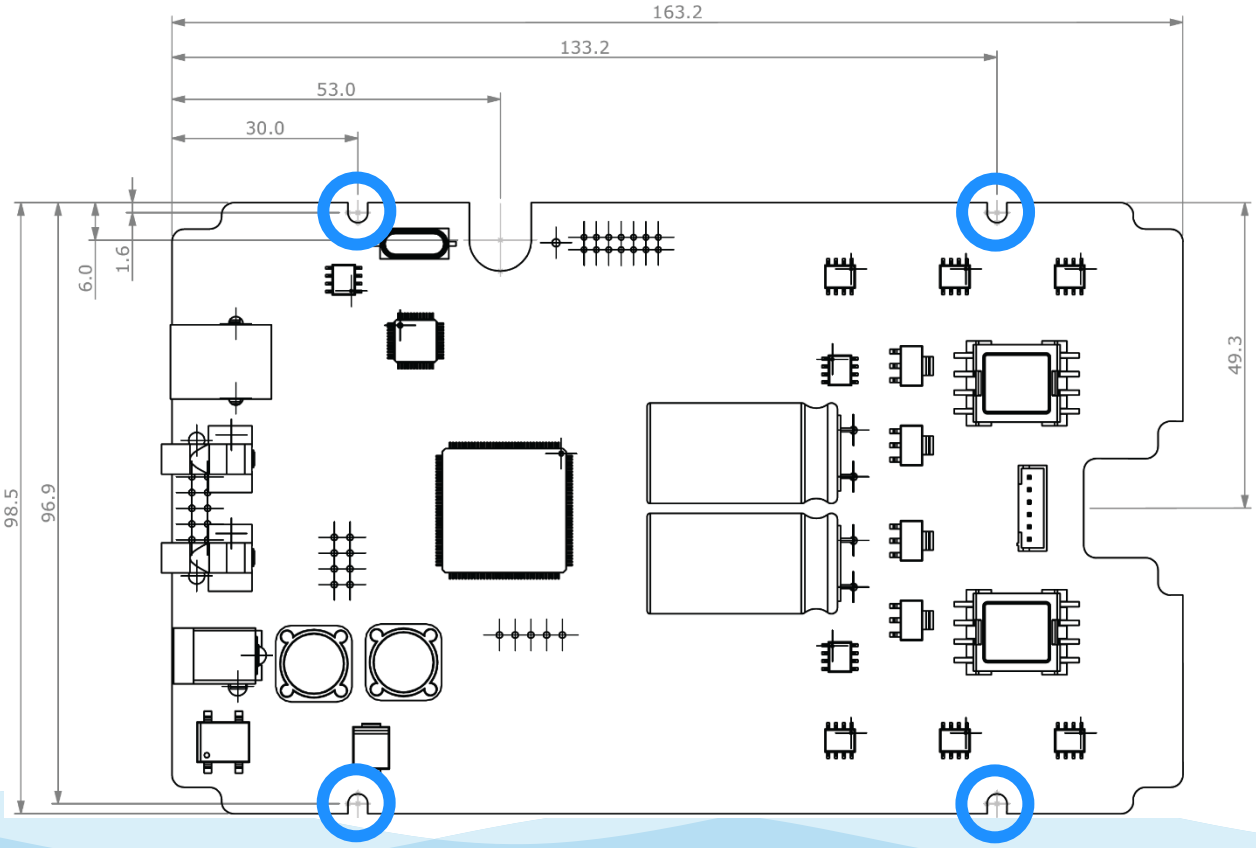
To ensure a waterproof connection, the cable boss protruding from the rear of the transducer is fitted with two 18.0mm × 2.6mm∅ O-rings. These should be greased with a small amount of suitable silicone lubricant and inserted into a suitable machined hole on the mounting housing that ensures a waterproof piston-seal.

Alternately, a waterproof glad may be used to seal onto the cables that are potted into the rear of the transducer housings.



2.3. Circuit Board Mounting

The StarFish electronics can be mounted onto a base plate using 4 × M3 fixings that locate into the notches on the edge of the board (circled in blue below).



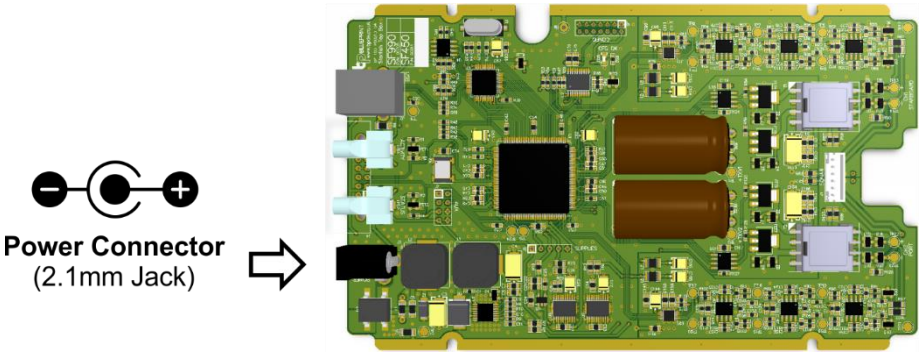
The should be stood off a base plate using spacers with a minimum height of 3mm.

For best electrical performance, the electronic should be placed into an enclosed metal housing that is electrically connected to the same Ground reference as the power supply input – this will reduce electrical noise and interference that may appear on the sonar display.

2.4. Power Supply Connection

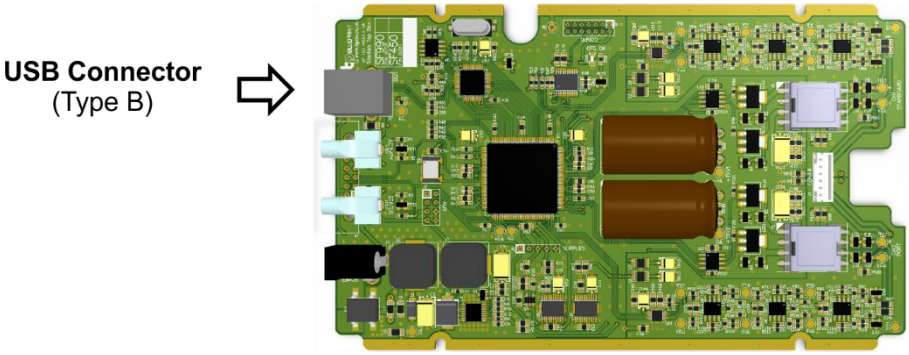
The StarFish electronics module has a 2.1mm DC input socket (labelled “J3”) that will accept voltages between 9V and 28V, and will require a supply capable of delivering 5W.
Typically, this means the StarFish will require just under 500mA at 12V, or just under 250mA at 24V.

The centre pin (tip) of the power connector is **Positive**, and the outside of the connector (ring) is **Ground**.



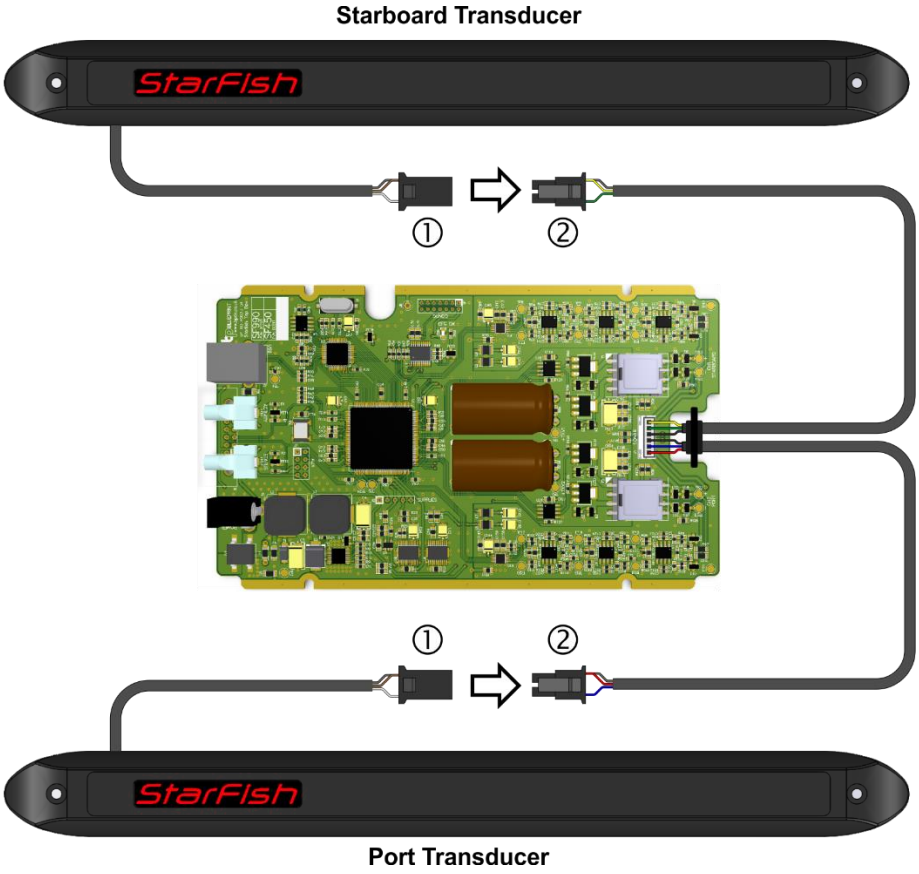
2.5. USB Data Connection

The PC running the Scanline software should be connected to the electronics module using “J2”, a Type-B USB 2.1 connector (bandwidth used is less than 12Mbps).

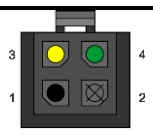


2.6. Transducer Connections

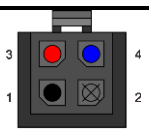
The StarFish electronic circuit board is pre-fitted with the transducer cable loom connected to “J1”. Once the transducers have been mounted and sealed into the housing, they should be connected as shown in the diagram below to the electronics module:



The grey cables from the circuit board are labelled with “Port” and “Starboard” to indicate which transducer they should be connected to. However, in case the labels are missing, the Starboard transducer should be connected to the Yellow & Green wiring pair, while the Port transducer should be connected to the Red & Blue wires.



Front (Pin) View



Front (Pin) View

Wire Function	Wire Colour	Starboard Connector Pin	Port Connector Pin	J1 Connector Pin
Ground	**Black**	1	-	4
	Not Used	2	-	-
Starboard Signal+	**Yellow**	3	-	6
Starboard Signal-	**Green**	4	-	5
Ground	**Black**	-	1	3
	Not Used	-	2	-
Port Signal+	**Red**	-	3	1
Port Signal-	**Blue**	-	4	2

3. Using The Sonar

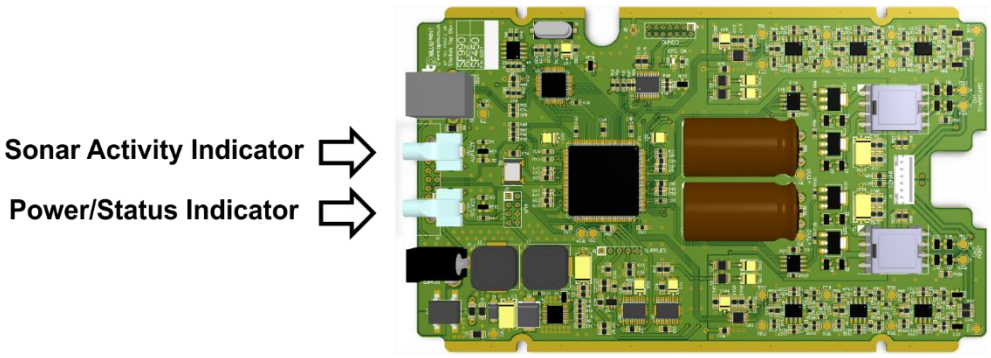
3.1. Operation

Once the StarFish453 transducers and electronics module have been installed onto your platform, the system is ready for use.

If this is the first time you're using the StarFish system, it is recommended you install the "Scanline" software and USB hardware drivers on your embedded PC before connecting the electronics module to it. Refer to the accompanying "Scanline User Guide" for details on how to do this.
When using the StarFish453OEM system with "Scanline", follow the connection and configuration instructions for a StarFish 450 family device.

- Switch the DC power on to the StarFish electronics module
- When powered up, the "Power/Status Indicator" will illuminate and start to flash – indicating that the Topside box has correctly initialised.

  The "Activity Indicator" will not illuminate until the USB connection is made, Scanline is running and configured correctly.



- Start the Scanline software or your application. When the software opens the data connection to the StarFish electronics and starts the sonar "pinging", the "Activity Indicator" will start to flash.

3.2. Software Development Kit

The StarFish Software Development Kit (SDK) can be downloaded from the Blueprint product website (see the "Technical Support" section for details). The SDK contains the software libraries, drivers, utilities and documentation to help you :

- Integrate the StarFish interface into your own application using the Windows API DLL.
- Diagnose USB connection issues within the Windows operating system.
- Diagnose operational issues with the StarFish hardware using the "StarFishTools" utility, including an FFT spectral analyser mode to resolve electrical noise and interference issues.

4. Understanding Sidescan Imagery

Interpreting side-scan imagery may seem difficult 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 seafloor is doing below the sonar, and if there are any targets on it.

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 several example images, and see how information can be obtained from them.

4.1. What Is A Side-Scan Sonar?

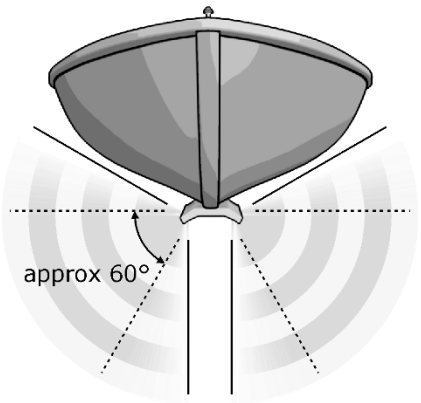
Sonar (**SO**und **N**avigation **A**nd **R**anging) and echo-sounding technology dates back to the 1920's, but it was only in the early 1960's that Dr. Harold Edgerton (an electrical engineering professor at the Massachusetts Institute of Technology) started to adapt his techniques on high-speed flash photography to acoustics, having concluded that photography was not best suited to the murky conditions underwater.

By sending "flashes" of acoustic energy into the water and recording the echoes, Edgerton (who later worked with underwater explorer Jacques Cousteau), developed a towed side-looking sonar that could create a continuous image of the seafloor.

By transmitting a narrow fan-shaped acoustic pulse (ping) perpendicular to its direction of travel, the side-scan sonar sends acoustic pulses outwards. The seabed and other objects reflect some of the sound energy back in the direction of the sonar (known as backscatter), and the travel time of the returned pulse is recorded together with its intensity.

As sounds travels at a known velocity (of approximately 1500 metres per second) through water, we can directly relate the time we received an echo, to the range of the target that reflected it.

This scan-line of information is sent to a topside computer for interpretation and display, and by stitching together data from successive pulses, a long continuous image of the seafloor is created, as the sonar is towed from the survey vessel.



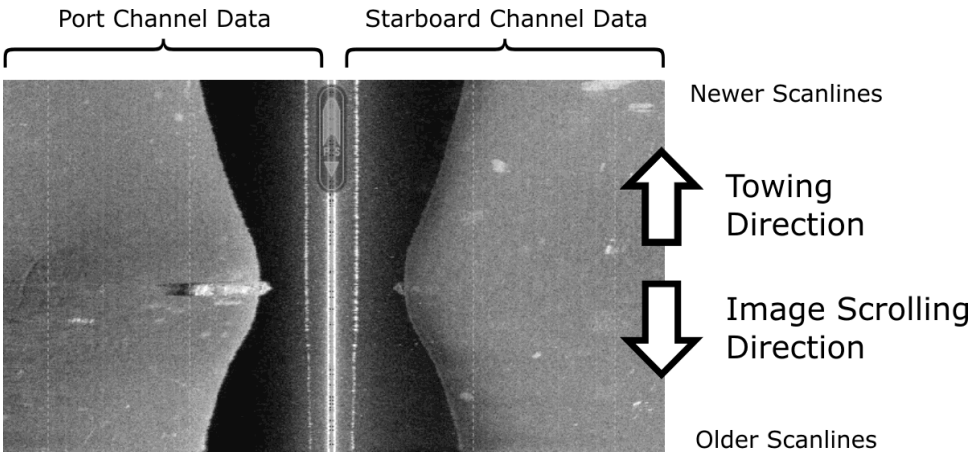
As mentioned previously, your StarFish has two transducers (transmitter and receiver elements) that are angled 30° down from the horizontal, and acoustically transmit sound in a "fan beam" of narrow width (refer to the specification of your StarFish product for the exact width), but wide vertically with most of the acoustic energy confined to the centre 60° of the beam.
This gives the StarFish the ability to see almost directly below it, to just above the horizontal.

However, despite this field of vision, the StarFish cannot determine where a target lies vertically in its beam (i.e. above or below it), as everything is translated to a planar 2D display.
For example, if there are two targets both 10 metres from the sonar (one horizontally level with it, and one directly below it, and are received on the same channel) they would both appear at the same point on the sonar display, as the display scale is based around time, and both echoes would arrive simultaneously.

With some experience though, image artefacts like "acoustic shadows" can help the operator make an educated guess to the size of targets and sea-bed features.

4.2. What Does A Side-Scan Sonar Image Look Like?

The figure below is a real image captured by a StarFish sonar, where each horizontal line is a representation of time versus the intensity of the reflected echoes. The further something is away from the centre line of the display, means the longer it took for the echo to be received.



In this figure, both the port (left) and starboard (right) channels are operating at the same time. The sonar is positioned in the middle of the topmost line, and as the sonar is moved through the water the image will scroll away from it as more data is added.

4.3. Calculating Depth Below The Sonar (Altitude)

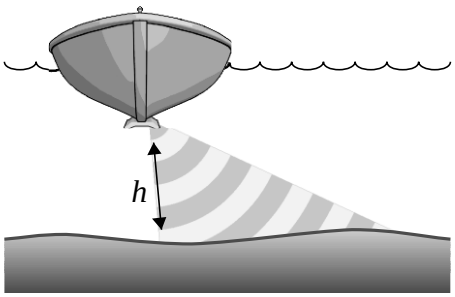
A useful measure to know when using a side-scan sonar is the height above the seafloor, so a safe distance can be maintained and hazards avoided.

Looking at the previous image, we can see a large black “hour-glass” shaped area in the middle of the display, where no echoes have been received.

In fact this area is showing us the height the sonar is above the sea bed.

As the figure opposite shows, the nearest object to the sonar will always be the seabed below it (assuming a relatively flat seabed).

However, it will take some time for the “bottom echo” to be returned, and as the display shows the received echoes from when the transmission started, this area appears black.



Therefore, the narrower the band of black is, the closer the sonar is to the seabed – and as the image is built up over time, if the sonar’s altitude changes we actually start to see the profile of the seabed that the sonar has passed over.

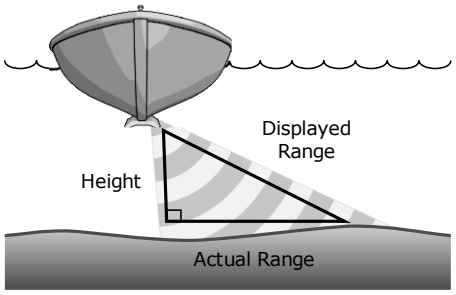
This means in the figure above, the seabed gets shallower in the middle of the display, and then gets deeper again at the bottom.

4.4. Calculating The Distance To A Target

As mentioned earlier, the sonar display shows the recorded echoes over a period of time, and we have seen how we can work out the depth below the sonar from this.

However, this also means that the range a target appears to be on the display is not the distance it lies at from the sonar horizontally across the seabed.

To understand why this is the case, consider the triangle shown in the figure opposite.
As the sound waves travel from the sonar, they start to hit the seabed, and each point of contact returns an echo along the shortest path to the sonar.



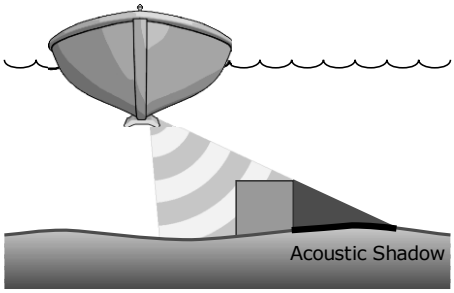
To work out the actual distance at which a target lies, you need to use the mathematical formula (based on Pythagoras's theorem) …

$$\text{Actual Range} = \sqrt{\text{Displayed Range}^2 - \text{Height}^2}$$

4.5. Acoustic Shadows

When sound from the sonar hits a submerged target with any height above the seabed, an acoustic shadow will be cast away from the sonar.

An experienced sonar operator can use the lengths of these shadows, along with knowledge of the sonar altitude to get an idea of the size and height of the object.



To help understand this, imagine you are in a darkened room, with a flashlight, standing above a ball. If you shine the flashlight down on the ball, a small shadow is cast around it, while if you lie down level with the ball and shine the light at it, a much longer shadow is produced stretching away from it.

This principle applies to side-scan sonar in a similar way; objects directly beneath the sonar will appear to have very small shadows, while objects at greater distances will have longer shadows because they are being illuminated (acoustically) on their side.
The shadows of targets can be elongated further if the towing altitude of the sonar is decreased or if in shallow water.

4.6. Reflected Target Intensity

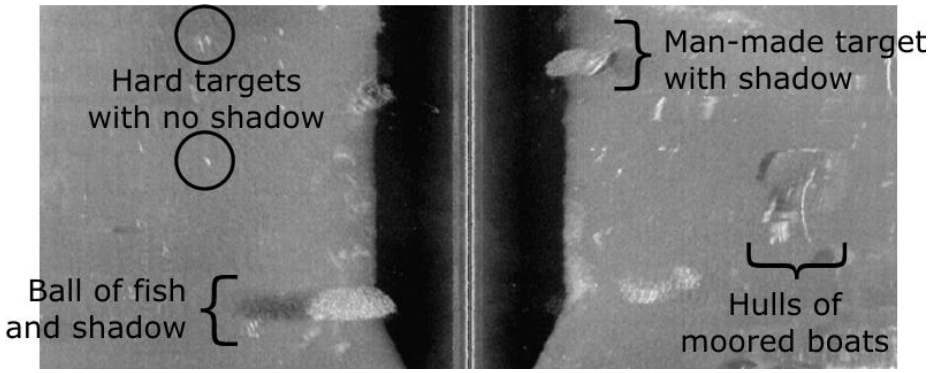
To complete our understanding of the basics of sonar imagery, we need to consider the brightness information (intensity of echo) shown on the sonar display.

As with a surface reflecting light, different surface textures and materials of targets have different acoustic reflective properties.

Typically, the more the density of the target differs from that of water, or the more rigid its material is, the more sound is reflected back:

- Any target with a gas in (such as air) will act as an almost perfect reflector for sound, and will show as the brightest colour in the palette.
- Muddy or silted lake and sea beds will generally show up as a low-intensity background colour, as mud is a good sound absorber and contains water.

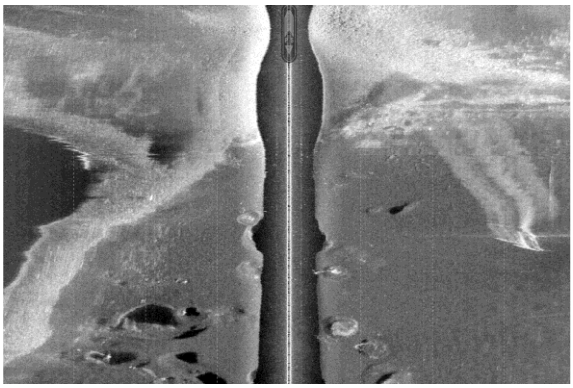
The example image below shows several bright targets of interest…



Taking what we already know about sonar imagery into account we can interpret the following…

- White ‘dots’, without any form of shadow are most likely either flat hard targets on the bottom or large mid-water fish (with their air-filled swim-bladder showing up on the sonar).
- At the bottom of the image we can see a bait-ball of fish – identifiable as large spherical structure that protrudes above the seabed profile (there is a faint and fragmented shadow extending away from it, implying it is not a single solid target).
- On the right of the image, we can see several vertical curved white lines. These are most likely the hulls of moored boats, and close to them we can see the square outlines of the concrete mooring blocks.
- At the top of the image, there is a large target. As it appears on both channels, and we can see its profile, we know the sonar has passed directly over it. The bright geometric echoes on it indicate it is probably man-made, and there is an acoustic shadow visible on the right portion of it, showing it has height. It is most likely this is the wreck of a sunken vessel.

4.7. Example Side-Scan Sonar Images



Lake Bed

Scan showing boat moorings at the bottom (concrete blocks in craters of silt).

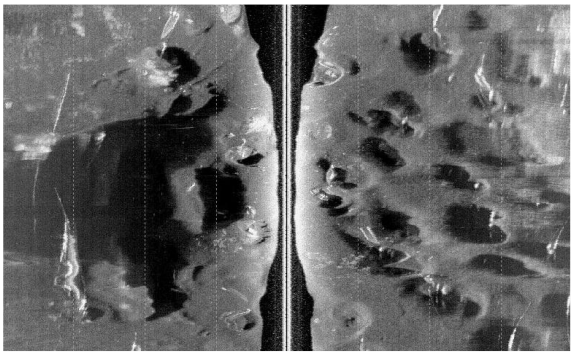
The dark area on the left channel is the shoreline.
A boat with wake is visible on the right.

At the top of the right channel, it can be seen that the bottom has a rockier texture, and appears brighter than the silt in the rest of the image.

Cable Car Ferry

Lake bed beneath a cable-hauled car ferry.
The two cables are visible above the bottom, crossing beneath the sonar.

The movement of the cables has exposed the bedrock of the lake, causing a brighter reflection.
The grooves are visible on the centre profile on the lakebed, and the shore and slip-way are visible in the top left.



Marina

Shallow water with moored boats. The bright white targets of the hulls are visible, above “craters” in the silt, caused by the movement of the mooring cables.

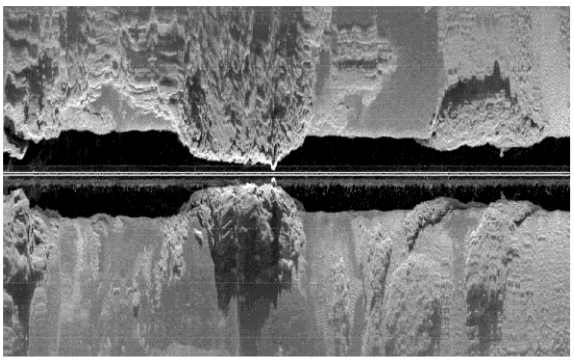
Note the large acoustic shadow on the left channel, caused by a raised area of the seabed being almost level with the sonar in the shallow water.

Coral Reef

Horizontal image orientation showing a scan over coral reefs.

At the extreme right of this image, ripples in the sand are visible, while each coral outcrop has clearly visible shadows.

Note how close the sonar came to a small outcrop at the centre of the image!



4.8. Gain & Contrast Settings

When operating your sonar, the adjustments you will make to the gain and contrast controls are critical in achieving good side-scan imagery. This section examines the function and purpose of these controls…

Gain

The software gain control is similar to the volume control on a home hi-fi system, or the brightness control on a television.
The gain control sets how the incoming scan-lines of data (from the sonar hardware) map onto the display's colour palette.

- Increasing the gain value will make all areas of the display image appear brighter, while decreasing it will make the whole image appear darker.
- For general operation, a gain value of 30% (-28dB) is recommended.

Contrast

The function of the contrast control is slightly more complex to understand than that of the gain control.
The contrast value sets the palette range that the incoming signal will be stretched or shrunk to fit.

- A lower contrast value means that the image will transition from dark to bright colours more quickly than a higher contrast value.
- For general operation, a contrast value of 30% (38dB) is recommended, but can be reduced to 25% to enhance shadows and submerged targets.

The best way to understand the operation of the Gain and Contrast controls is to experiment with these values while scanning the sonar over a known area of seabed.

Generally, having set the operational range of the sonar, you should then set the gain to a level where the background noise is just visible. This should ensure that quiet signals are visible at the extremities of the display, whilst the central mid-water areas and seabed profile have good definition.

Then, when scanning, adjust the contrast to give the desired sharpness of targets – lowering the contrast will make echoes appear brighter, while keeping shadows dark.

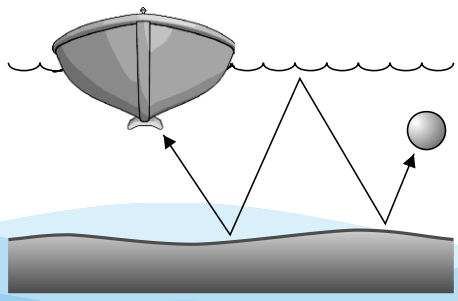
4.9. Shallow Water & Channels

When operating in shallow water and channels, you may experience a "ghosting" effect caused by acoustic returns from previous sonar "pings" still bouncing between targets and the sonar receivers.

To reduce these effects, use a larger "range" on the sonar display, which should have the effect of slowing the "ping rate" and allowing time for these echoes to dissipate.

In shallow water, you may also see distortion on long range targets, caused by "multi-path" phenomenon – where sound is reflected between the seabed and surface before hitting the target.

Due to surface waves and chop, the effect can manifest its self as ripples on distant targets.



4.10. Tips For Good Imagery

Vessel Speed

When operating the StarFish, remember that it is “pinging” at a fixed rate (depending on range). The faster you move the sonar transducers over the seabed, the more compressed images will appear on the display.

For long ranges, try to operate at speeds between 1 and 3 knots, while shorter ranges can be used with speeds of 3 to 6 knots.

Water Depth

The depth of water beneath the sonar is an important factor to consider when interpreting heights of submerged objects from their acoustic shadows.
In shallow water, acoustic shadows from targets appear very elongated (like shadows cast from objects at sunset), while in deep water the seabed will appear more as a “birds-eye” type view with minimal shadows.

Mounting Position

The position and method of mounting the transducers on the hull/platform is probably one of the biggest factors in determining overall image quality. As discussed in previous sections, the transmitter and receiver faces on the transducer should…

- Have no obstructions in their acoustic beams that may cause shadows or reflections.
- Be clear of any turbulence or cavitation from the hull in front of them.
- Be clear of turbulence or aeration caused by the platforms thrusters/propeller.

Boat Navigation

When surveying an area, think about the course you will steer your platform/vessel. Try to divide the area into a grid of long straight runs, with 180° turns at the end.

Remember that as the sonar turns, the acoustic beams from the inside of the turn will overlap, while the outside ones will be covering more seabed – consequently the imagery produced will appear distorted and hard to interpret in these areas.

Try and avoid the aerated water left in the wake of other boats, as this will be acoustically visible for some time should you cross through it with your sonar.

Waves, Wake and Surface Chop

As some of the acoustic energy transmitted from the StarFish transducers is beyond its 60° vertical beam-width, it is possible that it may be reflected off the underside of the surface of the water if you are operating close to the surface. This may cause the sonar imagery to appear be distorted due to waves and surface chop on the water.

Remember that when operating the StarFish sonar your own safety is paramount and should not be compromised trying to achieve good sonar imagery.

6. Safety

6.1. Electrical Safety

- The AC power adaptor and electronics modules are **NOT** protected against the ingress of water, so take care to avoid exposing the unit to sources of conductive liquids. Dry wet hands before handling the AC power adaptor or surface control box.
- Do not attempt to disassemble or service this product yourself (outside the scope described in this manual). Contact StarFish technical support for any maintenance, spares or repair work required.
- Do not overload a mains supply outlet, extension cord or adapter as this may result in electric fire or shock.
- Do not modify the power cord or plug.
- Do not place the AC adaptor or power cord near any heat sources that may melt the protective insulation.
- 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.
- Do not use (and ensure the product is unplugged) in situations where a power-line surge may occur (such as a lightning storm), or if the product is not used for a prolonged period of time.
- Ensure that the power supply has suitable earthing and electrical shock risk is minimised through the use of fusing and/or residual-current-detection (RCD) devices where appropriate.

6.2. Operational Safety

- Do not rely on the product to necessarily represent the immediate sub-surface conditions below the mounting platform, and as such this product should not be used as a direct means of avoiding submerged objects, shallow water & grounding, collisions with other vessels, boat damage or personal injury. If you are in doubt about any of these hazards, always operate at reduced speeds, and proceed with caution.
- Do not rely on this product as a navigational aid.
- Do not allow the sonar transducer cable to obstruct or present a hazard to other personnel on the deck area or passage-ways of the boat. Use the provided cable-tie to coil and secure any surplus cable.
- Do not rely on the connection between the electronics box and the transducer cable, as a means of securing the sonar to the boat. The sonar transducer head should be fixed directly to the boat hull.

7. Care Of Your Starfish

7.1. Operational Care

In addition to the points highlighted in the "Safety" section, please observe the additional precautions…

- Do not operate the product near a source of heat that may cause the operational temperature parameters to be, or stack other heat generating equipment on top of the unit.
- If not rigidly mounted in your system, always use the electronics module on a stable, non-slip, rigid, flat and lint-free surface.
- Make sure the product is more than 10cm away from any other appliance that may be susceptible to electromagnetic interference.

7.2. Maintenance & Cleaning

When you have finished using your StarFish sonar, you should…

- Disconnect the product from the power supply before attempting any maintenance or cleaning.
- Remove any weed, or other detritus, from the sonar transducers and cables, 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 insert extraneous object (metal or other alien substance) into the unit or any of its connector apertures.

7.3. Storage

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

- Avoid excessively bending or kinking the transducer cables (below a radius of 30mm), as this could reduce its operational life.
- Avoid excessive and large fluctuations in temperature.
- To prevent corrosion, remove any salt or other residues from the product before storage out of the water.
- Store in a well-ventilated enclosure after use, to allow any moisture on system components to evaporate naturally.
- Ensure no point-load is exerted on the acoustic transducers.

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 StarFish technical support.

Note: For software issues and problems, please refer to the "Scanline User Guide".

Problem…	*Solution(s)…*
Electrical interference	This is most commonly seen as bright small snow-like dots over the image – usually with some form of regular repeating pattern. The most common cause is interference from other high-current switching electrical devices (such as mains inverters, or motors) connected to the same power source as the top box electronics module. Try methodically turning off other electrical devices to find the cause, or running the StarFish from its own dedicated supply (or battery).
Acoustic noise	This is most commonly seen as large stripes or pulses of varying brightness over the image, usually with some form of regular repeating pattern. Try to identify and, where possible, remove the source of the acoustic noise. Most commonly, your platform, or other vessels, may have an echo-sounder that is running at a frequency close to the operating band of the StarFish.
Image ghosting or mirroring	This problem may occur if the StarFish transducers are receiving echoes from features on the hull/platform it is mounted on. Try repositioning the transducers so the acoustic beams are not obstructed from the transmitter faces. This problem can also occur in shallow water, where the high-intensity transmission from one transducer is being received by the other. If possible, use the software to display only a single channel (and prevent transmissions from the other); this will reduce the inter-channel cross-talk.

9. Product Support

Website

For the latest software and firmware updates, as well as production information, manuals and datasheets, visit

www.blueprintsubsea.com/starfish

We welcome any feedback you may have about the StarFish 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.

Technical Support

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

However, if you need further support, you can contact us via your distributor or directly at…

- Web — www.blueprintsubsea.com/starfish (for access to on-line resources and technical support)
- Email — enquiries@blueprintsubsea.com
- Telephone — +44 (0)1539 531536 (9:00am to 5:00pm, Monday to Friday, UK Time)

For all the above please provide the following information 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 Scanline 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 need to return your StarFish system for servicing, please…

- Contact us (using the details above) for returns information and shipping details.
- Pack your StarFish system back in the original packaging (or other suitable container), and include written documentation including your contact details (including contact phone number), 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 Subsea, using an insured courier and delivery confirmation.

10. Limited Warranty Policy

The manufacturer, Blueprint Design Engineering Limited (hereafter 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.

Conditions

Unless other terms are specifically requested and mutually agreed in writing prior to dispatch, the conditions of the warranty include, but are not limited to:

- The warranty is only deemed to be valid if the equipment was sold through Blueprint or one of its approved distributors.
- The 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.
- 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.
- The warranty is not transferable.
- 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.
- 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.)
- The warranty does not cover the transportation of personnel and per diem allowances relating to any repair or replacement.
- 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.
- Any equipment or parts returned under warranty provisions will be returned to the customer freight prepaid by Blueprint
- The warranty shall become invalid if the customer attempts to repair or modify the equipment without appropriate written authority being first received from Blueprint.
- Blueprint retains the sole right to accept or reject any warranty claim.
- 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.
- 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.

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.

11. Notices

Copyright

Disclaimer

Neither Blueprint Design Engineering Limited, 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

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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 are subject to change without notice, and does not represent a commitment on the part of Blueprint Design Engineering Ltd.

Handling Recommendations

The StarFish system contains sensitive electronic components that may be damaged by an Electrostatic Discharge (ESD) if handled incorrectly. To minimise risk of damage, users should 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

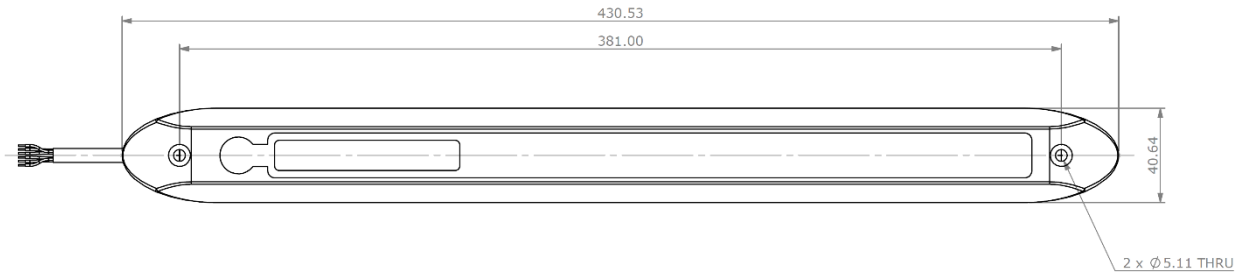
Under the European Union (EU) directive on 'Waste Electrical & Electronic Equipment' (Directive 2002/96/EC), from August 13, 2005, products categorised as electrical or electronic equipment cannot be discarded as municipal waste by placing in landfill, dumping in the sea or incineration. SEPARATE collection 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.

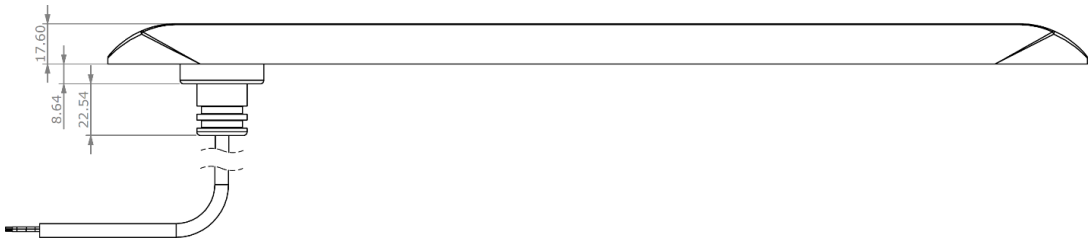
Restriction of Hazardous Substances Statement

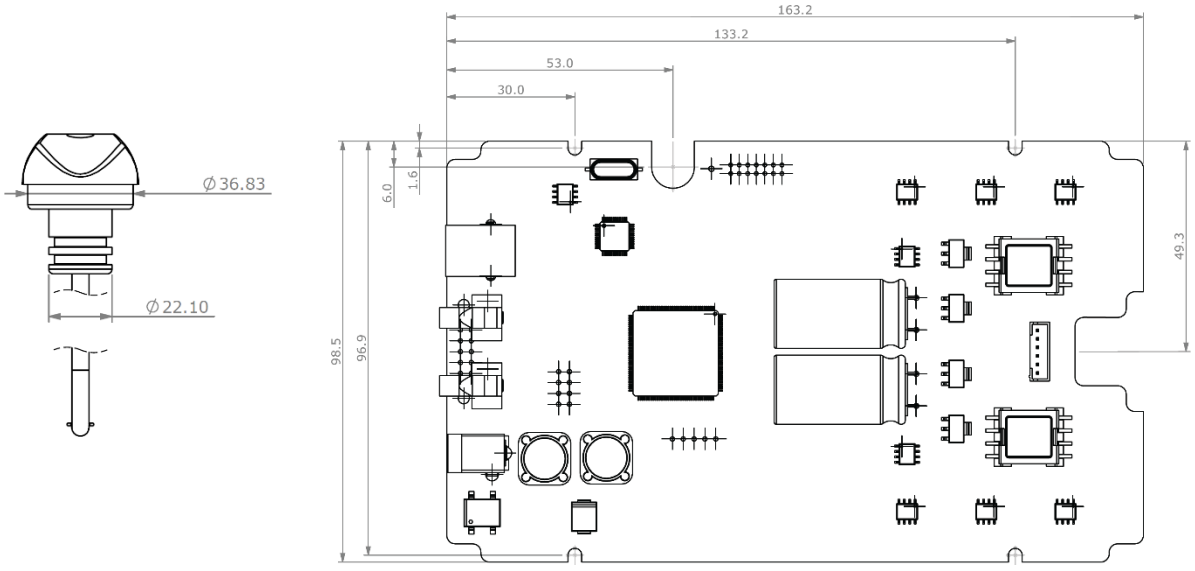
Under the European Union (EU) directive on the 'Restriction of Hazardous Substances' (Directive 2002/95/EC), from July 1, 2006, electrical and electronic equipment cannot contain lead ("lead free"), mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers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

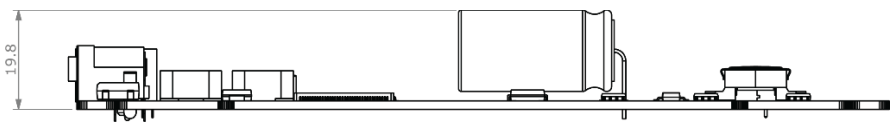
12. Specifications

12.1. Mechanical Drawings









12.2. Technical

Transducer

Frequency	450kHz CHIRP
Operating Range	100m per channel
Horizontal Beam Width	0.5° (@ -3dB signal level)
Vertical Beam Width	60° (@ -3dB signal level)
Transducer Mounting Angle	Tilted Down 30° from Horizontal recommended
Length	432mm each transducer
Width	41mm each transducer
Height	18mm each transducer
Weight (in Air)	0.35kg each transducer
Construction	ABS & Reinforced polyurethane rubber
Colour	Black
Depth Rating	300m

Electronics Module

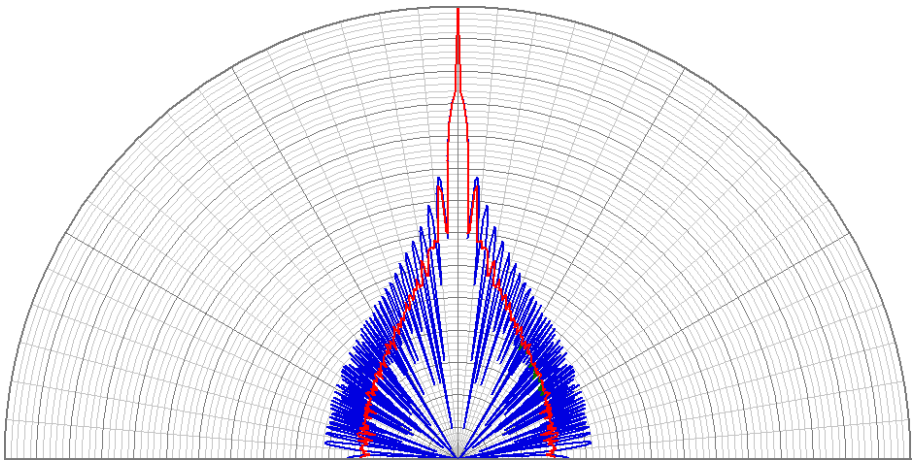
Supply Voltage	9V to 28V DC
Power Consumption	6W (500mA @ 12VDC)
Power Interface	2.1mm DC jack socket
PC Interface	USB 2.1 B-Type connector
Sonar Interface	2 x Molex 43025-0400 4-way (2x2) polarised latching crimp housings (using Molex 43030-0010 crimps) for Port and Starboard transducer connection.
Length	163.2mm
Width	98.5mm
Height	15mm
Weight (in Air)	0.1kg
Operating Temp Range	-5°C to +40°C

12.3. Acoustic Beam Patterns

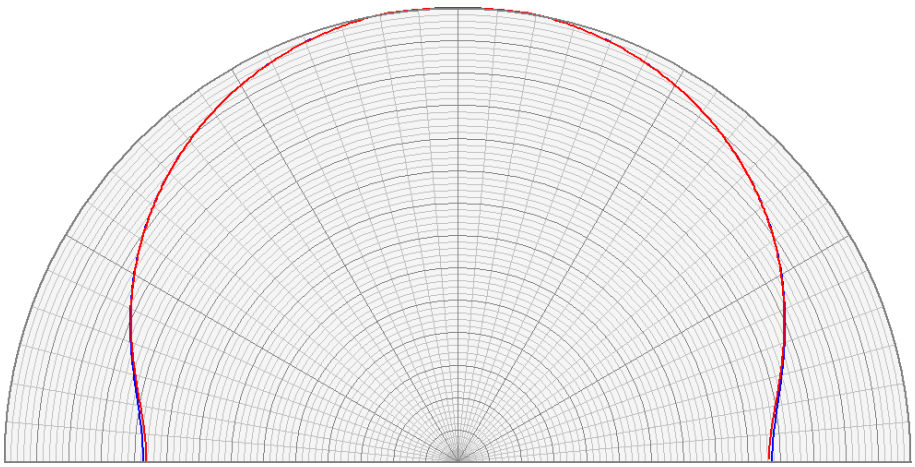
The StarFish453OEM uses a 430kHz to 470kHz, 400µs swept frequency transmission (CHIRP).

- Blue trace represents single 450kHz centre frequency
- Red trace represents average swept 430kHz to 470kHz frequency chirp (BW 40kHz, Q 11.25)
- Plot radial range is 70dB, with 5dB graticule markings. VOS taken as 1475ms^{-1}.
- Transducers are mechanically angled 30° down from the horizontal.
- At centre frequencies, the horizontal beam (at the -3dB level) is 0.54°, and vertical beam is 58.2°.
- The near-field range varies between 27.19 and 29.72m during the sweep, and is 28.45m at the centre frequency.

Horizontal Beam Pattern



Vertical Beam Pattern



Distributor…