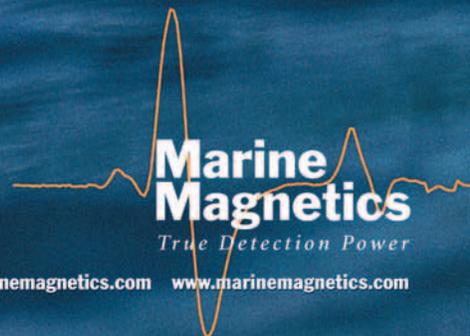


SeaSPY

Marine Magnetometer



52 W Beaver Creek Rd #16, Richmond Hill, ON, L4B 1L9 Canada t:+1905 709.3135 f:+1905 709.0805 e: info@marinemagnetics.com www.marinemagnetics.com

SeaSPY

Overhauser Sensor

Marine Magnetics takes pride in designing and manufacturing magnetic exploration equipment that meets scientific observatory specifications. The SeaSPY magnetometer product eliminates many of the inherent problems associated with other marine magnetometers such as orientation restrictions, sensor realignment, time and temperature drift and poor absolute accuracy.

The Overhauser Effect

Marine Magnetics is the only marine magnetometer company in the world that can produce stable Overhauser sensors that do not degrade with time.

Marine Magnetics' SeaSPY magnetometer measures the ambient magnetic field using a specialized branch of nuclear Magnetic Resonance technology, applied specifically to hydrogen nuclei.

Worldwide Operation With No Restrictions

The SeaSPY sensor is unique in that it is entirely omnidirectional. The amount of signal produced by the sensor is completely independent of magnetic field direction. You never have to orient your sensor, because it is already optimized to work around the World.

As a result, regardless of where you are in the World and no matter what the magnetic field strength is, your SeaSPY sensor will continue to provide a strong signal and accurate data.

Highest Absolute Accuracy

SeaSPY Overhauser sensors have the highest absolute accuracy of any magnetometer: 0.2nT

The repeatability between SeaSPY sensors is also unmatched at better than 0.01nT. This makes them ideal for gradiometer configurations, where the output of two independent sensors is compared to measure the value of magnetic gradient between them.

High Sensitivity

SeaSPY Overhauser sensors deliver high-resolution output with a noise level of $0.01\text{nT}/\sqrt{\text{Hz}}$; counter sensitivity is 0.001nT

Maintenance Free Sensors, No Realignment and No Consumable Parts

SeaSPY Overhauser sensors are entirely maintenance free and most importantly, SeaSPY's specifications do not degrade over time. As a result, the SeaSPY sensor never has to be realigned, or recalibrated in order to meet the manufacturer's specifications at the time of shipping.

In addition, the SeaSPY sensor does not contain any parts that wear out and need to be replaced.

Ultra Low Power Consumption

A SeaSPY system only requires 1W standby and 3W maximum. SeaSPY can run for days directly from a 24V vehicle battery.

Digital System

SeaSPY is entirely digital. The magnetometer signal is measured inside the towfish where the signal is strongest and most immune to outside noise.

No Sensor Warm-Up Time

SeaSPY Overhauser sensors do not require temperature stabilization. Therefore, unlike competing technologies, SeaSPY will work equally as well in cold, deep water as in warm, tropical water, instantly on power-up.

Scientific Quality Instruments

Stable time: The clock used in the SeaSPY electronics module is accurate to 1ppm throughout the entire temperature range, as opposed to 100ppm found in competing magnetometer systems. As a result, no matter how much the temperature changes during a survey, the data will always be accurately time stamped, ensuring that it will always match up perfectly with diurnal correction (base station) information.

No temperature effect on accuracy: Data collected at -40°C will be identical to data recorded at $+60^{\circ}\text{C}$

No heading error: Heading error is a detectable offset in the magnetometer output caused by changing the heading of the magnetometer within the Earth's magnetic field.

Marine Magnetics' SeaSPY magnetometer is constructed of the most nonmagnetic materials possible. As a result, the SeaSPY Overhauser sensor does not display heading error.

Therefore, no matter how the SeaSPY sensor is oriented in the Earth's magnetic field, successive survey lines taken in opposite directions will match up perfectly.

The benefits to the user are four-fold:

1. Targets will not be missed because they fall between mismatched survey lines.
2. Eliminates post processing. Competing technologies require the user to collect tie lines in order to level the data set (match-up inaccurate survey lines). This is not necessary with an accurate magnetometer like SeaSPY.
3. There will be no variation introduced in the data by slight course changes during a survey line.
4. A magnetic map of an area will look the same, regardless of in which direction the survey lines were conducted.



SeaSPY towfish with altimeter and 200m of cable on a metal reel

SeaSPY Options

Pressure Sensor

Provides distance from the surface in metres with every mag reading.

Available in 100psi, 500psi, 2,500psi, 5,000psi and 10,000psi.

Altimeter

An integrated, nonmagnetic 200kHz altimeter is available for all depth options. The altimeter provides an accurate and precise (to 0.1m) towfish altitude measurement with every magnetometer reading.

Deep Tow Options

Marine Magnetics offers three deep tow options:

1000m SeaSPY towfish tested to 1,500psi

3000m SeaSPY towfish tested to 4,500psi

6000m SeaSPY towfish tested to 9,000psi

Side Scan Sonar Integrations

Marine Magnetics has designed an integration cable that contains all of the power conditioning and interface electronics in a stainless steel housing that is terminated onto a 10m long tow cable. The cable has detachable tow connectors to the magnetometer and side scan. The SeaSPY towfish does not have to be altered in any way; the integration cable does it all.

The integration also maintains the basic system integrity of the SeaSPY and Side Scan Sonar towfish. Each system can be run independently as well as together. For more information please see our *SeaSPY Side Scan Sonar Integration brochure*.

Drive up to 10,000m of cable with the SeaSPY Smart Transceiver

An enhanced version of the communication transceiver, the Smart Transceiver's adaptive design adjusts to suit a broad range of cable parameters, enabling it to drive up to 10,000m of cable.

Additional advantages include:

- Boosts and regulates the towfish supply voltage, to minimize voltage drop over long cables.
- Digital auto-tuning of transmission/reception frequencies.
- Diagnostic features include digital voltage and current monitoring.
- Keeps time after power off, and automatically sets the towfish time when needed.

No additional hardware has to be purchased. The Smart Transceiver is compatible with the 24V AC power supply provided with all SeaSPY Marine Magnetometer Systems.

Dimensions: 12 x 6.5 x 8 cm (4.7 x 2.5 x 3 inches)

Weight: 300g (0.66 lbs)

Deck Leader / On Board Cable

The deck leader cable connects the tow cable to the communication transceiver. The deck leader cable is required if the tow cable is on a winch. If not, it may be requested, but is not required. Standard lengths available 10m/30m, custom lengths are available.

Standard SeaSPY Hardware

SeaSPY Towfish Includes:

- High sensitivity omnidirectional Overhauser sensor
- Electronics module containing all of the driving electronics, including the Larmour counter
- Leak detector
- 4 lead weights
- SeaLINK data acquisition and GPS logging software for Windows. See our SeaLINK brochure for more information.

Tow Cable

The SeaSPY tow cable is incredibly tough yet light in weight. The cable consists of one twisted pair of conductors, a Vectran strength member that is specifically woven to prevent rotational preference, water blocking and a yellow polyurethane jacket. Length to be determined by customer.

Communication Transceiver

The Communication Transceiver provides the complete interface between the customer's PC and the SeaSPY towfish. One side connects to a PC serial port using an RS-232 cable, and the other plugs into the tow cable and towfish. In addition to conditioning the towfish power supply, the transceiver functions like a modem, providing two-way communication along the same conductors that provide power to the SeaSPY towfish.

Dimensions: 11 x 6 x 3 cm (4 x 2 x 1 inches)

Weight: 130g (0.28 lbs)

RS-232 Cable

The 3 connector RS-232 cable connects the communication transceiver, P.C. and power supply or battery clip cables.

Weight: 165g (0.36 lbs)

Power Supply

This unit will accept any AC line power, from 100-240VAC at 50/60 Hz, to provide conditioned and clean 24V DC power to the SeaSPY magnetometer system.

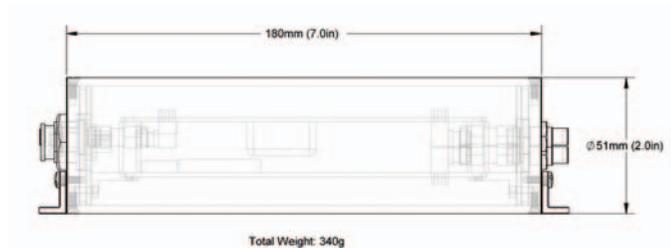
Dimensions: 11 x 6 x 3.5 cm (4 x 2 x 1 inches)

Weight: 370g (0.8 lbs)

OEM SeaSPY Electronics Module

SeaSPY electronics modules contain all of the driving electronics, including the Larmour counter. The module is a completely sealed, self-contained unit that is safe to handle even in dirty, or wet conditions.

All SeaSPY electronics modules are completely interchangeable, enabling a customer to swap between modules on demand. This makes them ideal for applications where multiple electronics modules are required as gradiometers or simply as spares.



SeaSPY electronics module

OEM SeaSPY Overhauser Sensor

All SeaSPY sensors are omnidirectional, maintenance free, and do not require realignment, or recalibration, and they do not contain any consumable parts, or toxic chemicals.

In addition, all SeaSPY sensors are interchangeable, and with a repeatability of 0.01nT between the sensors, they are ideal for multi-sensor applications.

Floatation Cable

SeaSPY floatation cable consists of one twisted pair of conductors, a Vectran strength member, water blocking and the addition of an extra layer of syntactic foam, coated with an orange polyurethane jacket.

Extension Cables

Marine Magnetics provides extension cables for both our standard Vectran and floatation cables. Each extension consists of a male and female brass connector. Both connectors have the capability of bearing the full working load of the cable.

This configuration allows multiple extension cables to be connected together in series up to 1000m

Connector –Tow Cable Termination Kit

Marine Magnetics' proprietary screw-on underwater connector, for interface to the SeaSPY towfish, is made of a brass alloy that is entirely non-magnetic. The connector is extremely tough and can support more than one tonne of towing force.

This connector is used with all of the SeaSPY options, allowing the customer to swap between cables at will.

Best of all, the connector is field-serviceable with a Marine Magnetics termination kit.

Winches

Hand cranked reels and winches are available. Please contact Marine Magnetics.

Battery Clip Cable

The battery clip cable can be connected in place of the AC power supply if the system is to be powered from batteries. With a power consumption of only 3W, a complete SeaSPY system can operate for days from two standard 12V car batteries connected in series.

Lead Weights

The towfish can be made buoyant in the field by removing two of the internal stabilizing lead weights. For added versatility, the towfish can also be made heavier in the field by adding up to 4 more stabilizing lead weights inside the towfish.

Tow Cable Weights

Marine Magnetics brass cable weights are an effective, yet inexpensive way of getting our SeaSPY towfish to deep depths. Placing the cable weights periodically along the length of the cable effectively counters the lift produced by tow cable drag, it also produces a very sharp drop rate that can be sustained for long cable lengths. In recent trials it has proved to be more effective than depressor wings that are costly, awkward, and large.

Each weight weighs about 6lbs in water and can be installed or removed with a screwdriver, enabling the user to remove or add weights at will.



Brass tow cable weight attached to MMC's cable

Gradiometer Configurations

Overview

The simplest gradiometer measures magnetic gradient in one dimension by subtracting the difference between two independent magnetic sensors. Since the Earth's magnetic field is three dimensional, up to three independent gradient directions can be measured – vertical, horizontal (across-track) and longitudinal (along-track). Marine Magnetics offers each of these gradiometer configurations with its SeaSPY magnetometer product. In addition, all SeaSPY magnetometers are compatible, enabling existing SeaSPY customers to upgrade their magnetometer to the gradiometer configuration of their choice, as they need to.

Marine Magnetics' SeaSPY sensors are highly accurate and repeatable making them ideal for gradiometers. To learn more about how gradiometers work and why accuracy and repeatability are key elements in the way they perform, please see our *Gradiometer Application Guide*.

For collection of gradient data in all three dimensions simultaneously please see our *SeaQuest Multi-Sensor Gradiometer Platform brochure and Using SeaQuest To Track Cables and Pipelines*.

Horizontal or Vertical Transverse Gradiometer

Marine Magnetics' transverse gradiometers provide a rigid 2m structure linking the sensors, and are well suited for close-in precision surveys for small ferrous targets where short sensor separation is needed.

Applications:

Cable and Pipeline Survey – A horizontal transverse gradiometer can be used to track cables, or pipelines in real time from relatively high towing altitudes. Adding a vertical gradiometer enables the user to track the cable, and it also provides accurate measurement of cable/pipeline burial depth.

Detection of Small Ferrous Targets – Short baseline gradient measurement in any direction (longitudinal, horizontal, or vertical) is useful for eliminating geological interference and diurnal variation.



Longitudinal Gradiometer

Longitudinal gradiometers provide the largest variation in available baselines, from 1.5m to 500m+. Again, Marine Magnetics' communication transceiver technology is unmatched in its ability to support extremely long distances between the two towfish. Long baselines provide superior gradient measurement sensitivity and increased detection range. Longitudinal gradiometers are also extremely hydrodynamically stable when deployed.

Applications:

Shipwreck, Search and Salvage – Medium baseline longitudinal gradient measurement can eliminate interference by geological bodies, while highlighting massive magnetic sources like steel hulls, boilers or engines. Smaller sources such as anchors or cannons will require a shorter baseline, and lower towing altitude.

Environmental Survey – Medium baseline measurement with a longitudinal gradiometer can highlight shallow magnetic sediments, while eliminating deeper geological influences. The baseline should be on the order of magnitude of the expected towing altitude.

Exploration Geophysics – Long-baseline measurement with a longitudinal gradiometer is ideal since the bodies of interest are often far from the sensor, and produce very small gradients. The baseline should be on the order of magnitude of expected depth-to-source.



Specifications

Performance

Operating Zones	NO RESTRICTIONS. SeaSPY will perform exactly according to spec throughout the entire range.
Absolute Accuracy	0.2nT
Sensor Sensitivity	0.01nT
Counter Sensitivity	0.001nT
Resolution	0.001nT
Dead Zone	NONE
Heading Error	NONE
Temperature Drift	NONE
Power Consumption	1W standby, 3W maximum
Timebase stability	1ppm, -45°C to +60°C
Range	18,000nT to 120,000nT
Gradient Tolerance	Over 10,000nT/m
Sampling Range	4Hz - 0.1Hz
External Trigger	By RS-232
Communications	RS-232, 9600bps
Power Supply	15VDC-35VDC or 100-240VAC
Operating Temperature	-45°C to +60°C
Temperature Sensor	-45°C to +60°C, 0.1 step

Towfish Dimensions

Towfish Length	124 cm (49 inches)
Towfish Diameter	12.7 cm (5 inches)
Towfish Weight in Air	16 kg (35 lbs)
Towfish Weight in Water	2 kg (4.4 lbs)

Tow Cable Dimensions

Conductors	Twisted pair
Strength Member	Vectran
Breaking Strength	2,500 kg (5,500 lbs)
Outer Diameter	1 cm (0.4 inches)
Bending Diameter	16.5 cm (6.5 inches)
Weight in Air	125 g/m (84 lb/1000 ft)
Weight in Water	44 g/m (29.5 lb/1000 ft)
Outer Jacket	Yellow Polyurethane
Cable Termination	Field Replaceable

Floatation Cable

Conductors	Twisted pair
Strength Member	Vectran
Max Working Load	2,500 kg (5,500 lbs)
Outer Diameter	1.9 cm (0.74 inches)
Bending Diameter	25 cm (10 inches)
Weight in Air	272 g/m 183 lbs/1000 ft)
Weight in Water	-20 g/m (-13.5 lbs/1000 ft)
Outer Jacket	Orange Polyurethane
Cable Termination	Field Replaceable

Other Sensors

Pressure/depth sensor:

Available in 100psi, 500psi, 2,500psi, and 10,000psi.

Altimeter:

200kHz altimeter 0-100m range, 0.1 resolution integrated into the nose of the SeaSPY towfish. Altitude is available with every mag reading.

Transponder:

The transponder acoustically provides the accurate position of the SeaSPY towfish.

