

Motion Reference Units

High performance, Affordable and Robust



 MRU Compact



 MRU Marine



 MRU Subsea



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Our advantages



High Accuracy

An MRU from Norwegian Subsea has robust and high-performance motion measurements even in irregular motions and during horizontal accelerations.

Other MRUs may perform well in regular motions, such as in single frequency sine wave motion in lab conditions, but a Norwegian Subsea MRU gives you the performance you need in real sea conditions.

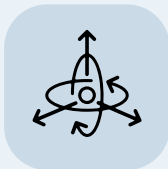
Affordable

High performance in all conditions at affordable prices set the Norwegian Subsea MRUs apart from the competition.

Easy to use

Our small and lightweight MRUs, with flexible cable options, are easy to install and come with free web browser configuration software for effortless integration into your system.

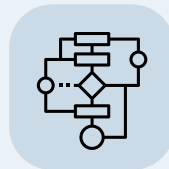
How do we achieve this?



MEMS sensors

Advances in MEMS technology gyroscopes and accelerometers enable new high accuracy sensors at low cost

+



Sensor Fusion Algorithms

Our unique advanced sensor fusion algorithms get the most out of the best available sensors to provide great results under realistic circumstances

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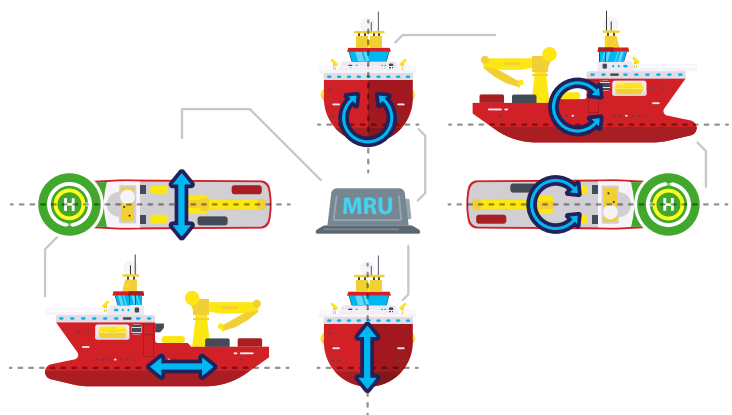
High Accuracy at low cost

High Accuracy in Real Sea Conditions

What is a Motion Reference Unit?

A Motion Reference Unit (MRU) is a self-contained sensor that measures motion in all 6 degrees of freedom (DoF): Roll, Pitch, Yaw, Surge, Sway, and Heave. The 6 DoF positions, velocities and accelerations are measured by the MRU using high-end gyroscopes and accelerometers together with advanced sensor fusion algorithms.

An MRU has high accuracy Roll & Pitch measurements, and measures oscillatory Heave, Surge and Sway motions for wave periods at sea. Linear motions with very long periods, or steps, cannot be measured by an MRU as it assumes a 0 mean heave position.



Product overview



The Norwegian Subsea range of MRUs covers most marine and subsea applications.

The Compact, Marine and Subsea models have different mechanical and electrical interfaces suitable for your environment, whether installation is in a cabinet, on deck or at the bottom of the ocean.

Each model is available in the 3000, 6000 and 9000 series, to accommodate different accuracy requirements. All MRU models are available in the inclinometer/VRU version if you only need attitude measurements (Roll & Pitch).

All Norwegian Subsea sensors can be mounted in any position.

MRU Compact



Usage area
IP 65

Heave accuracy
5.0 cm or 5.0 %

Roll & Pitch accuracy

↗ **3000** ± 0.05°
↗ **6000** ± 0.02°
↗ **9000** ± 0.01°

Connectors
RJ45 or RJ50

MRU Marine



Usage area
IP 68, 50 m depth

Heave accuracy
5.0 cm or 5.0 %

Roll & Pitch accuracy

↗ **3000** ± 0.05°
↗ **6000** ± 0.02°
↗ **9000** ± 0.01°

Connectors
Lemo or Subconn

MRU Subsea



Usage area
6000 m depth

Heave accuracy
5.0 cm or 5.0 %

Roll & Pitch accuracy

↗ **3000** ± 0.05°
↗ **6000** ± 0.02°
↗ **9000** ± 0.01°

Connectors
Subconn

MRU Ex



Usage area
Hazardous areas

Heave accuracy
5.0 cm or 5.0 %

Roll & Pitch accuracy

↗ **3000** ± 0.05°
↗ **6000** ± 0.02°
↗ **9000** ± 0.01°

Connectors
Pigtail cable

Which series should I choose?

This depends on your application, here are some general guidelines.

↗ 3000

The 3000 series, with 0.05° accuracy in Roll & Pitch, is ideal for most **monitoring applications** where the main purpose is to collect motion data for analysis or decision making. This model is also suitable for some control applications, such as AHC for smaller vessels with short lever arms to the remote monitoring points.

↗ 6000

The 6000 series, with 0.02° accuracy in Roll & Pitch, is our most versatile MRU due to its high accuracy and is suitable for most applications. This is the recommended MRU for most **control applications** such as AHC and winch control.

↗ 9000

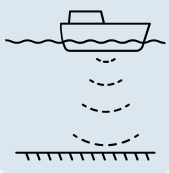
The 9000 series, with 0.01° accuracy in Roll & Pitch is our most accurate MRU. We recommend this MRU for the most demanding sonar motion compensation applications. This model is also recommended if high accuracy surge and sway measurements are important.

Applications

Norwegian Subsea Motion Reference Units (MRUs) can be used in a variety of Marine, Subsea and Wind Energy applications.

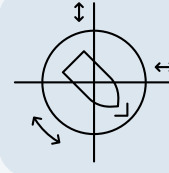


Marine Operations



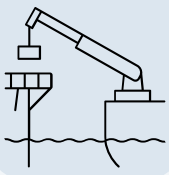
Hydrography

Compact and cost-effective MRU for accurate motion compensation of Sonars, ensuring high-quality seafloor maps.



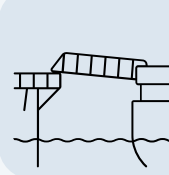
Dynamic Positioning

Easy to retrofit MRU with no recalibration for motion compensation of GNSS antenna and other position reference systems.



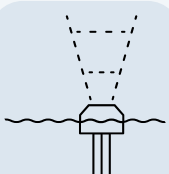
Active Heave Compensation

Heave compensation of cranes, LARS and winches requires accurate heave measurements in Real sea conditions.



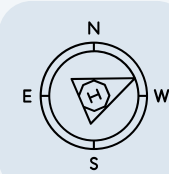
Gangway

3D motion compensated gangways require accurate 6DoF motion measurements at all times in Real sea conditions.



Wind Lidar Buoys

High quality wind data requires accurate heave, roll and pitch measurements in Real sea conditions.



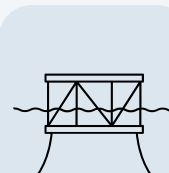
Helideck Monitoring

Accurate heave velocity and roll and pitch measurements in real sea conditions. No recalibration needed and flawless operation in any temperature.



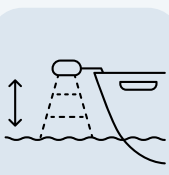
Ship Motion Monitoring

Prevent Cargo damage and Container loss. Add accurate ship motion measurements for safe and optimal vessel operations.



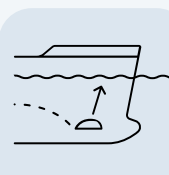
Offshore Fish Farms

Condition monitoring of Offshore fish farms. Reduce risk with Accurate motion measurements.



Wave Radar

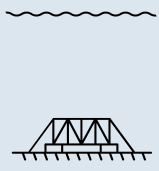
Accurate heave measurements to compensate downward looking wave radars. Compact and no recalibration required.



Stabilizing Fins

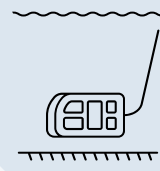
Roll damping systems and Stabilizing fins need accurate and affordable roll measurements in Real sea conditions.

Subsea



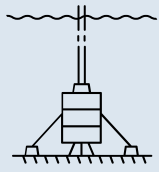
Subsea Surveys

Precise subsea tilt (roll & pitch) measurements at affordable prices.



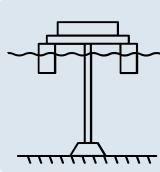
ROV/AUV

Reliable and accurate motion measurements for navigation and payload sensor compensation.



BOP Monitoring

Accurate 6DoF motion and vibration measurements to monitor BOP and other subsea structures.



Riser Monitoring

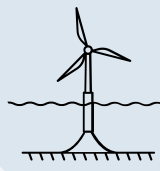
Topside motion sensors as input to the riser digital twin or subsea sensors attached to the riser.

Wind Energy



Bottom Fixed Offshore Wind

Turbine tower roll & pitch measurements as input to a wind tower digital twin model. Ultra-low-noise accelerometer for structural monitoring.



Floating Wind Turbine Control

Accurate MRU measurements used in active pitch control to limit wave induced motions.



Floating Wind Base Motion Monitoring

Structural monitoring of the floating wind base and mooring system using MRUs and Ultra-low-noise accelerometers.



The Future of Sonar Motion Compensation: High-Precision. Always Reliable. Low Cost.

The Game-Changer for Sonar Accuracy in Challenging Environments

Motion Reference Units (MRUs) are crucial in bathymetric survey technology, providing precise motion compensation data to ensure reliable and accurate seafloor mapping. The Norwegian Subsea MRU has redefined what is possible, delivering exceptional performance even in incredibly challenging conditions. Our technology provides **high-accuracy roll, pitch, and heave compensation** without dependency on RTK or GNSS signals, eliminating common vulnerabilities in sonar mapping.

Why you need Motion Compensation for Sonar Systems?

- **Accurate Seafloor Mapping** – Without proper motion compensation, vessel movement can distort sonar readings, leading to incorrect depth measurements and unreliable bathymetric data.
- **Elimination of Data Gaps** – Uncompensated motion causes inconsistencies in sonar returns, resulting in gaps or misaligned sonar images, making it harder to detect underwater features.
- **Improved Target Detection** – Whether for shipwreck hunting, fish-finding, or subsea infrastructure monitoring, stable motion data ensures clear, high-resolution sonar images.
- **Avoid repeated surveys and extensive post processing** – High-quality motion compensation ensures high-precision sonar results in real-time

Captain Sid Hynes struggled with traditional motion sensors when mapping shipwrecks in Newfoundland's Grand Banks—a region notorious for unpredictable, three-directional 6 feet swells.

“The standard sensor was jumping all over, creating gaps in the data. But the Norwegian Subsea MRU was like a needle—smooth and precise. You could barely tell the boat was moving. It is incredibly sensitive compared to the others”

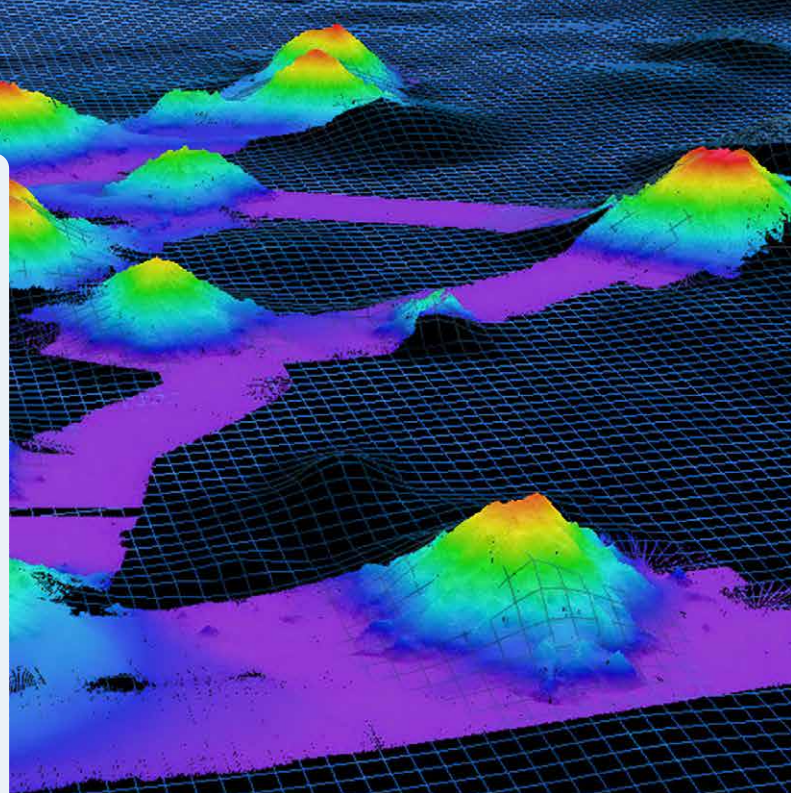
– Sid Hynes, Master Mariner



Courtesy Olex AS

Why Choose Norwegian Subsea MRUs for Sonar Motion Compensation?

- **Industry-Leading Motion Accuracy in Real Sea Conditions** – Handles irregular and multi-directional waves with no loss in precision.
- **Works Anywhere - Independent of GNSS & RTK** – Works outside of RTK coverage, in off-shore and deep-sea applications. Avoid RTK base station or subscription cost and hassle.
- **High End MRUs at a fraction of the price** – Premium grade motion compensation also for entry level Sonar systems.
- **Real-Time Heave, Roll, and Pitch Correction** – Delivers survey-grade data accuracy in all conditions in real-time.
- **Ready-Calibrated and Maintenance-Free** – Reducing downtime and providing long-term reliability for users.
- **Compact Form Factor** – Can be mounted on vessels, near sonar heads, or integrated within sonar equipment.
- **Plug-and-Play Integration** – Compatible with leading sonar systems for seamless operation.
- **OEM Solutions Available** – Can be integrated directly into sonar systems for optimized performance.



“With the Norwegian Subsea MRU, our customers get a system that is easy to use, highly accurate, and doesn’t require a massive learning curve. The results speak for themselves.”

– Nick Fogarty, Senior Product Manager, WASSP

“The accuracy, weight, and form factor of Norwegian Subsea MRUs are unmatched.”

– Gabriel Walton, Technical Director, Ultrabeam Hydrographics

Optimized for all types of Sonar Systems

Norwegian Subsea MRUs seamlessly integrate with **Multibeam Echo Sounders (MBES)**, **Side-Scan Sonars (SSS)**, **Single Beam Echo Sounders (SBES)**, **Forward-Looking Sonars (FLS)**, and **Sub-bottom Profilers**, ensuring superior motion compensation across all sonar applications.

Norwegian Subsea MRUs redefine sonar motion compensation by delivering **high-performance accuracy at an affordable price**.

Upgrade your sonar system today. All sonar systems can benefit greatly from using Norwegian Subsea high-precision motion compensation.

MRU Compact



Compact

The eMRU is compact, dust and splash proof (IP 65).

Plug & Play

The eMRU is plug & play due to the standard RJ 45 ethernet connector with passive power over ethernet (PoE). This makes cabling very fast & easy. The MRU comes with a wide range of standard and customized data protocols. Integration is never an issue.

Heave accuracy

5.0 cm or 5.0 %

Available models

3000	6000	9000
± 0.05°	± 0.02°	± 0.01°
Roll & Pitch accuracy		

	RJ45	RJ50
Environment	IP65	
Connector	RJ45 with POE	10-pin RJ50 with POE
Ports	Ethernet	Ethernet & RS-232 / Ethernet & RS-485 / Ethernet & PPS
Communication	Ethernet: UDP, Modbus TCP, Ethernet/IP	
Weight	0.55 kg	
Footprint (L x B x H)	12.0 cm x 5.7 cm x 5.3 cm	
Enclosure material	Anodized aluminum 6061-T6	
Temperature range	Operating: -40 to +85 degrees Celsius Storage: -40 to +85 degrees Celsius	

What is passive Power over Ethernet?

Passive Power over Ethernet means that the MRU Compact is powered through the Ethernet cable with 9 – 36 V DC.

We recommend using a PoE splitter / injector to power the MRU Compact.

Versions and Options

1. Inclinator / VRU version without Heave/Surge/Sway output, which gives the same Roll & Pitch performance as the MRU, also in irregular coupled motions.
2. Magnetic Heading



Versatile placement

The MRU Marine can be used on deck or under water in up to 50 m water depth (MRU Marine SW), a compact and cost effective solution for mounting the MRU close to the sonar head. The MRU Marine comes with ethernet, RS232, RS485 and PPS time synchronization ports for easy communication with your system.

Heave accuracy

5.0 cm or 5.0 %

Available models



$\pm 0.05^\circ$ $\pm 0.02^\circ$ $\pm 0.01^\circ$

Roll & Pitch accuracy

Marine		Marine SW	
Environment	IP68	50 m water depth	
Connector	Marine 16 pin male connector	8 pin SubConn MCBH8M	16 pin SubConn MCBH16M
Ports	Ethernet, RS-232, RS-485, PPS	Ethernet & RS-232 / Ethernet & 2-wire RS-485	Ethernet, RS-232, RS-485, PPS
Communication	Ethernet: UDP, Modbus TCP, Ethernet/IP. RS-485: Modbus RTU		
Weight	1.2 kg		
Footprint (L x B x H)	15.4 cm x 8.6 cm x 6.7 cm		
Enclosure material	Anodized aluminum 6061-T6		
Temperature range	Operating: -40 to +85 degrees Celsius Storage: -40 to +85 degrees Celsius		

Analog outputs

Analog outputs are available using the analog output junction box. Configurable +/-10 V and 4-20 mA output signals are available.

Retrofit

Norwegian Subsea MRUs are often used as a drop-in replacement of older MRUs (retrofit) on Dynamic Positioning, Helideck Monitoring and Active Heave Compensation systems. For these applications, normally no recalibration is required.

Versions and Options

1. Inclinometer / VRU version without Heave/Surge/Sway output, which gives the same Roll & Pitch performance as the MRU, also in irregular coupled motions.
2. Magnetic Heading



6000 m water depth rating

The MRU Subsea is ideal for subsea applications such as riser motion monitoring, ROV/AUV operations, and subsea surveys. Housed in a compact titanium casing and depth-rated to 6000 m, the unit has a small footprint that allows for easy installation almost anywhere. It also features a Subconn wet-mateable connector.

The Subsea Inclinometer version is popular due to its small size, high accuracy, and affordability.

All Norwegian Subsea sensors can be mounted in any position.

Heave accuracy

5.0 cm or 5.0 %

Available models



± 0.05° ± 0.02° ± 0.01°

Roll & Pitch accuracy

Subsea

Environment	6000 m water depth
Connector	8-pin SubConn FCR1508M
Ports	Ethernet & RS-232 Ethernet & 2-wire RS-485
Communication	Ethernet: UDP, Modbus TCP, Ethernet/IP
Weight	1.6 kg
Footprint (L × B × H)	7.6 cm × 7.6 cm × 16.5 cm
Enclosure material	Titanium housing
Temperature range	Operating: -40 to +70 degrees Celsius Storage: -40 to +85 degrees Celsius

Easy interfacing

The MRU Subsea comes in a 6000 m rated titanium housing with ethernet and serial ports for easy communication with your system. Industrial communication protocols can be used for PLC interfacing. The MRU comes with a wide range of standard and customized ASCII or binary data protocols. The MRU can be delivered with custom length cables with Subconn 8 pin connectors.

Versions and Options

1. Inclinometer / VRU version without Heave/Surge/Sway output, which gives the same Roll & Pitch performance as the MRU, also in irregular coupled motions.
2. Magnetic Heading



For Hazardous Areas

The Ex MRU is a cost-effective solution for hazardous areas. Easy to install with pigtail cable and including all certificates and documentation.

- Ex certificate II 2 G Ex d IIC Gb
- Compact and cost effective unit
- Stainless steel unit
- Ethernet & serial line

Versions and options

- Including pigtail cable in custom lengths

Heave accuracy

5.0 cm or 5.0 %

Available models



± 0.05° ± 0.02° ± 0.01°

Roll & Pitch accuracy






MRU Ex


Environment	II 2 G Ex d IIC Gb
Connector	Pigtail cable – 8 wires 10 m / 25 m / custom length
Ports	Ethernet & RS-232 Ethernet & 2-wire RS-485
Communication	Ethernet: UDP, Modbus TCP, Ethernet/IP. RS-485: Modbus RTU
Weight	15 kg (excluding cable)
Footprint (L × B × H)	19 cm × 19 cm × 20.5 cm
Enclosure material	AISI 316L
Temperature range	Operating: -20 to +40 degrees Celsius Storage: -40 to +85 degrees Celsius

Versions and Options

1. Inclinator / VRU version without Heave/Surge/Sway output, which gives the same Roll & Pitch performance as the MRU, also in irregular coupled motions.

MRU Specifications

	 3000	 6000	 9000	Remarks
Performance				
Roll & Pitch	$\pm 0.05^\circ$	$\pm 0.02^\circ$	$\pm 0.01^\circ$	RMS (dynamic)
Heave (real-time)	5.0 cm or 5.0 %	5.0 cm or 5.0 %	5.0 cm or 5.0 %	Whichever is greater for 0 to 25 s periods
Heading (optional)	$\pm 0.5^\circ$	$\pm 0.5^\circ$	$\pm 0.5^\circ$	Magnetic heading
Range				
Rotation speed	$\pm 150^\circ/\text{s}$	$\pm 450^\circ/\text{s}$	$\pm 450^\circ/\text{s}$	-
Acceleration	$\pm 3 \text{ g}$	$\pm 4 \text{ g}$	$\pm 10 \text{ g}$	-
Heave	$\pm 50 \text{ m}$	$\pm 50 \text{ m}$	$\pm 50 \text{ m}$	-
Roll/Pitch/Yaw	$\pm 180^\circ / \pm 90^\circ / \pm 360^\circ$			-
Output frequency	0-100 Hz	0-100 Hz	0-100 Hz	Adjustable output frequencies
Gyro output				
Scale factor error	0.2% max/min	0.2% max/min	0.2% max/min	-
Angular rate noise	$0.05^\circ/\text{s}$ RMS	$0.025^\circ/\text{s}$ RMS	$0.015^\circ/\text{s}$ RMS	-
Acceleration output				
Acceleration noise	0.0025 m/s^2 RMS	0.002 m/s^2 RMS	0.0015 m/s^2 RMS	-
Acceleration accuracy	0.01 m/s^2 RMS	0.01 m/s^2 RMS	0.01 m/s^2 RMS	-
Power & Interface				
Power consumption	6 W			-
Supply voltage	9-36 V DC (24 V nominal)			-
Internal storage	32 GB			-
Data protocols	Custom NMEA, ASCII and Binary, Atlas, Gyrocompas 1, Ifremer Victor, MDL, NORSUB 1-8, Simrad EM 3000, SMCA, SMCC, Tokimek PTVG, RDI ADCP, TSS1 and many more. Please refer to user manual.			-
Configuration protocols	GET/SET through telnet or serial port and web server based configuration SW			-
Time synchronization	Sync to host PC, Sync to NTP server, Sync to PPS			-

	 3000	 6000	 9000	Remarks
Features				
PPS	PPS time synchronization			On request
Aiding	Heading and Velocity aiding			On request
Environmental specifications				
Electromagnetic compatibility	IEC 60945/EN 60945 (immunity/emission)			-
Vibration	IEC 60945/EN 60945			-
Max shock	2000 m/s2 (half-sine 0.5 msec) non-operational (10 ms peak)			-
MTBF (computed)	100000 h			-



Ultra-Low-Noise Accelerometer

The ACC is high performance, ultra-low noise, and affordable. The ACC use state-of-the-art MEMS technology 3-axis accelerometers. The exceptional low noise density, velocity random walk (VRW) and bias instability make this accelerometer ideal for high demanding vibration monitoring applications.

The ACC can be mounted in a dry area (ACC Compact & ACC Marine), on a floating substructure in up to 50 m water depth (ACC Marine SW) and subsea up to 6000m (ACC Subsea) and offers a very cost-effective solution for demanding vibration monitoring applications.

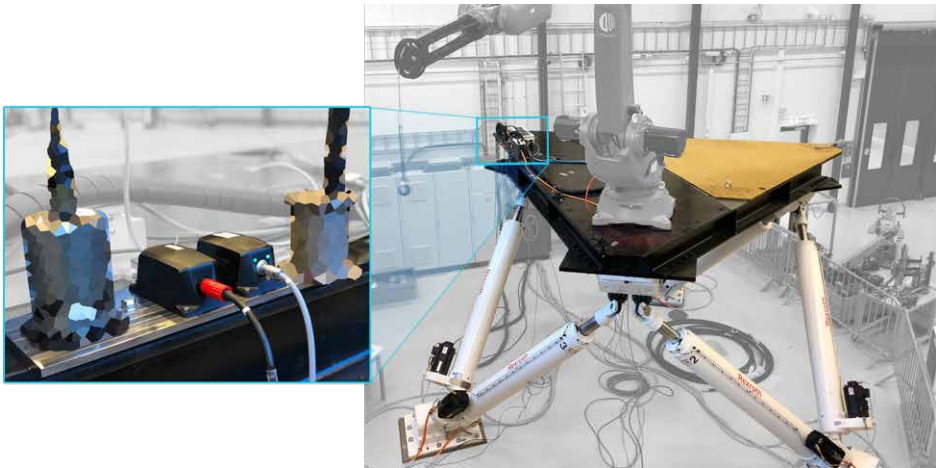
Developed for monitoring of floating offshore wind platforms, offshore structures and subsea templates or any other structure with demanding vibration monitoring requirements. The accelerometer can be used in real time applications to monitor the integrity of the installation, as an input to a digital twin model of the structure or as an input for fatigue life analysis.

	ACC Ultra-Low-Noise Accelerometer
Range	± 15 g
Scale factor	6.00E-05 mg/LSB
Misalignment axis to axis	0.1 degs
Nonlinearity	0.03 %FS
Initial error	2 mg
Bias repeatability	3 mg
In run bias instability	0.2 µg
Velocity random walk (VRW)	0.00012 m/s/sqrt(h)
Noise density	0.7 µg/sqrt(Hz) RMS
Frequency bandwidth 3dB	400 Hz

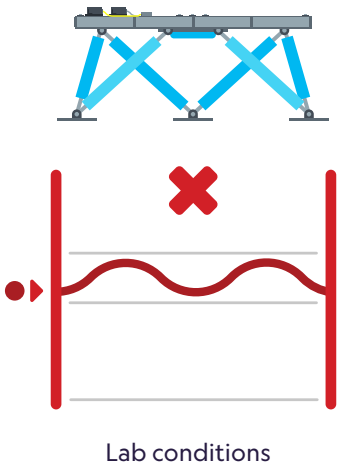
Validated in real sea conditions

Tested in real sea conditions

Many suppliers tend to present test data solely for simple regular motions observed in laboratory conditions. Unfortunately, vessels experience irregular and coupled motions at sea. While most sensors perform well in sine wave motion, only a select few excel in irregular sea conditions. Our MRUs stand out as they consistently deliver exceptional performance across all conditions.



3rd party test facility	Motion Lab, University of Agder Grimstad (Norway)
Motion reference platform	Bosch Rexroth eMotion-8000 hexapod with laser position measurements
Tested MRU	MRU Marine 6000
Tested scenarios	Regular and irregular sea-state conditions Based on real sea conditions Single and multi-axis coupled motions Motion periods from 3 to 25 seconds



This test verifies that the Norwegian Subsea MRUs meet the specifications and demonstrates typical MRU performance in realistic sea conditions.

Two Norwegian Subsea MRUs were mounted on top of a hexapod and the MRU output was compared to the reference measurements from the hexapod (truth).

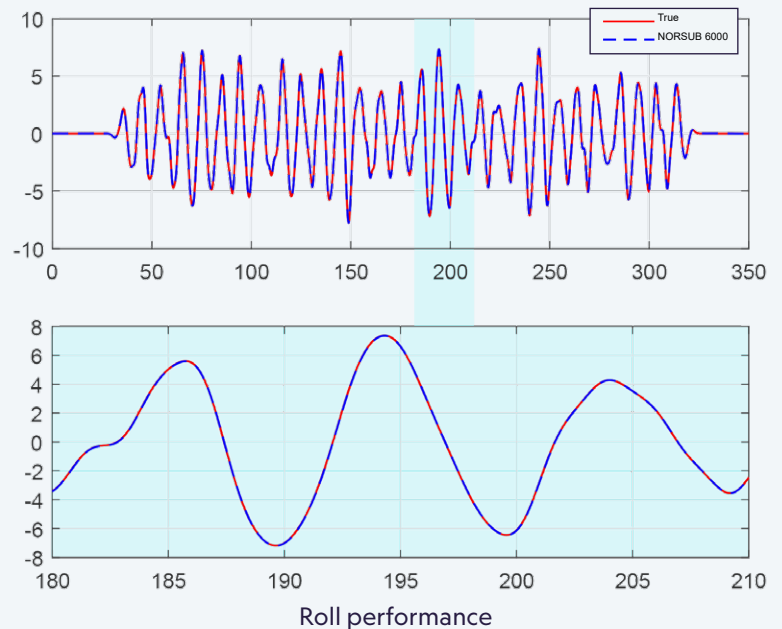
Both regular and irregular motion patterns were tested, with periods from 3 to 25 s and amplitudes from 0.1 to 0.8 m / 0 to 10 degrees. All degrees of freedom (DOFs) were tested individually and combined (coupled motions)

Combined roll and pitch test

Irregular motion profile with significant amplitude of 5 degrees and peak period of 10 s.

The test starts and stops with the MRU in the horizontal position (0 degrees).

The roll and pitch RMS error is calculated over the entire test duration of 350 s.



 6000

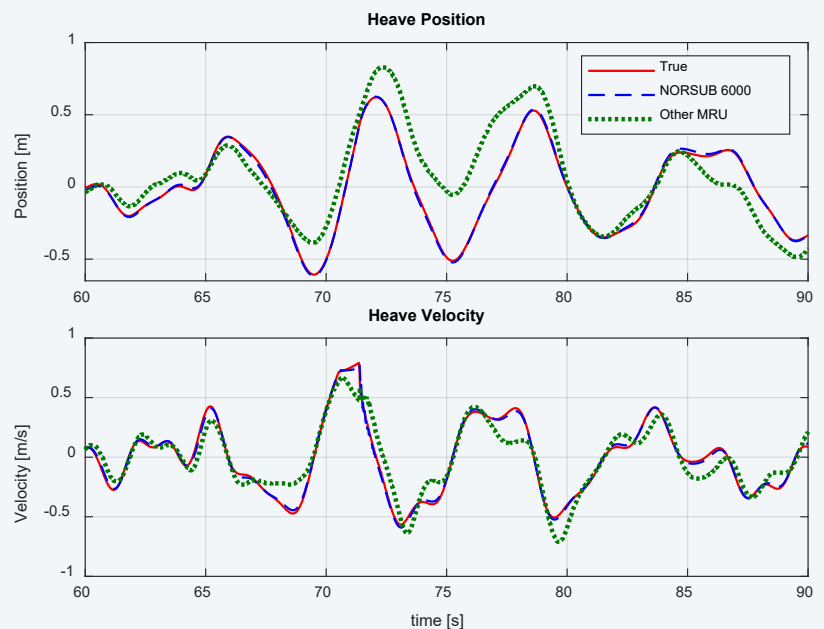
	Datasheet Specs	Test Results	Approved
Roll	0.02°	0.016°	✓
Pitch	0.02°	0.014°	✓

Heave Test

The heave test has an irregular motion profile with a significant amplitude of 0.5 m and peak period of 7 s. The heave filter uses automatic estimation of significant amplitude and peak period to optimize the performance.

The heave RMS error is calculated over the entire test duration of 250s. As you can see, the results are very accurate.

For reference, an MRU from another brand, having the same Heave accuracy specifications, was included in the tests. This MRU performed well in sine waves, but in real sea conditions, this MRU was not able to provide useful results.



 6000

	Datasheet Specs	Test Results	Approved
Heave	0.05 m or 5.0%	0.017 m	✓
Heave Velocity	0.02 m/s or 3.0%	0.011 m/s	✓



Case study

Enhancing Hydrographic Surveys with Norwegian Subsea MRUs

Courtesy Ultrabeam Hydrographics

Ultrabeam Hydrographic specializes in high-resolution 3D underwater surveys for marine asset inspections, including ports, bridges, and offshore wind farms. To ensure precise motion compensation, Ultrabeam integrated Norwegian Subsea's MRU 6000 Marine SW with their pole mounted Norbit Winghead, significantly improving survey accuracy and operational efficiency.



The Challenge: Size and Weight Constraints in Inland Surveys

Ultrabeam's Black Swan, a modular survey platform, conducts highly detailed 3D mapping, requiring precise motion data for roll, pitch, and heave compensation. However, conventional MRUs were bulky and cumbersome, making integration difficult—especially for inland and remote surveys where equipment weight is a critical factor.

“Every kilogram matters, and traditional MRUs were simply too heavy...”

– Gabriel Walton, Technical Director, Ultrabeam

The Solution: Norwegian Subsea's Compact MRUs

By adopting Norwegian Subsea's MRUs, Ultrabeam achieved seamless integration without compromising performance. The MRUs' compact size and calibration-free design reduced downtime, making surveys more efficient.

“We perform an initial calibration just once after installation. After that, there's no need for recalibration, significantly reducing our downtime.”

– Gabriel Walton, Ultrabeam

The Impact: High-Quality Data and Increased Efficiency

Norwegian Subsea MRUs enabled Ultrabeam to collect accurate 3D survey data in challenging environments. The lightweight, cost-effective design improved logistics and **reduced reliance on external RTK infrastructure**, expanding Ultrabeam's operational scope.

“While being the ideal companion in form and fit, the Norwegian Subsea MRU gives us motion compensation performance without needing external corrections”

– Gabriel Walton, Ultrabeam

With these enhancements, Ultrabeam continues to set new standards in hydrographic surveying, increasing efficiency and reliability in marine asset inspections.

Case study

Enhancing Multibeam Accuracy for Offshore Surveying and Fisheries

Courtesy Wassp Ltd

WASSP is a global provider of **multibeam sonar technology**, delivering high-resolution seabed mapping solutions for **commercial fishing, hydrographic surveying, and offshore industries**.



The Challenge: **Overcoming RTK Limitations**

WASSP sought an affordable yet precise solution for heave compensation without relying on expensive RTK (Real-Time Kinematic) positioning. RTK is widely used for high-precision surveying but is costly and unsuitable for deep-water environments. High-end Motion Reference Units (MRUs) offer an alternative, but their high price puts them out of reach for many users.

The Solution: **Norwegian Subsea MRU**

WASSP identified *Norwegian Subsea's MRU* as a highly accurate yet affordable option for motion compensation. After testing, it proved capable of delivering performance comparable to premium systems, making it an ideal solution for users operating beyond RTK coverage.

Testing & Validation

Extensive trials in *New Zealand's challenging offshore conditions* confirmed its reliability.

"In performance tests, we're getting incredibly close to RTK-level heave accuracy without the subscription costs or the burden of owning and maintaining a base station."

"For those who really want high-accuracy mapping that overlaps nicely and needs minimal cleaning, the better the sensor you use, the better the results you get. For us, the Norwegian Subsea MRU is now our premium offering. The price tag is much less than premium, however."

– Nick Fogarty, Senior Product Manager at WASSP

WASSP now offers the *Norwegian Subsea MRU* as a **high-performance yet affordable motion compensation option** for its customers.

High accuracy, easy to use and no maintenance

User friendly configuration

All MRUs and ACCs can be easily configured using the web based configurator. Here you can configure the communication ports, customize the output data protocol, configure the sensor installation parameters, or check the internal status. The software can also update the MRU firmware, log the sensor data to file, and plot output data. The configuration SW runs straight from the sensor, no downloads required.

Every sensor is calibrated, tested and validated

Every MRU is delivered with Configuration, Calibration, and Validation Certificates. All MEMS sensors are temperature calibrated so the sensor temperature does not influence the results. Every unit is calibrated and validated independently through a systematic sequence of rigorous tests in our labs.

No recalibration

The calibration certificate is valid for 4 years and full product specifications are maintained in this period under normal operating conditions. A slightly lower specification for Roll & Pitch is maintained during the lifetime of the sensor. For most applications, therefore no recalibration is required during the lifetime of the sensor.

Roll / pitch accuracy

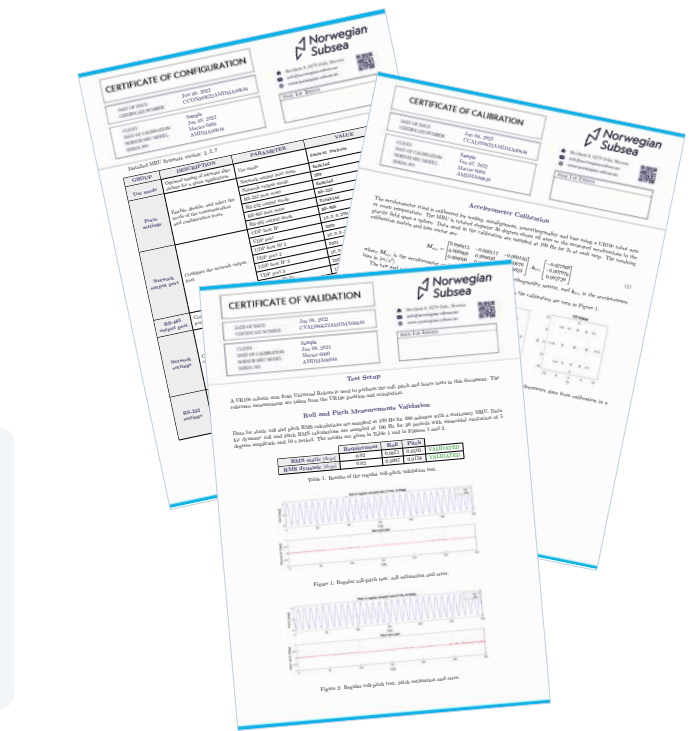
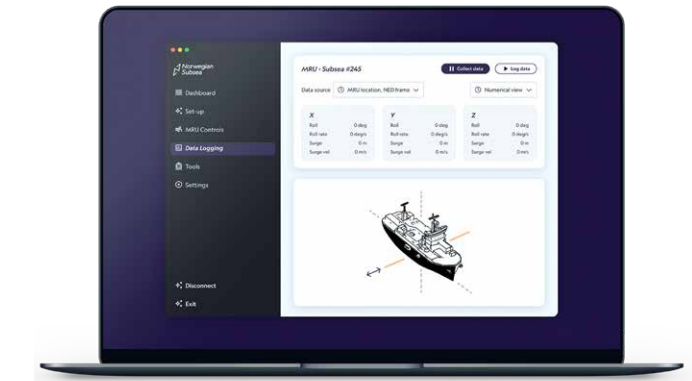
	With recalibration	Without recalibration
↗ 3000	0.05°	0.1°
↗ 6000	0.02°	0.05°
↗ 9000	0.01°	0.035°

Retrofit of existing MRU

Many vessels have MRUs installed that need frequent recalibration and repair or are end-of-life since support and recalibration services are no longer available. For most applications, our MRUs do not require recalibration during its lifetime. This is because our MRUs use the latest generation high-end MEMS sensors for extreme stability.

Typical applications for retrofit solution

Any application that uses a motion reference unit should consider our retrofit solution. However, applications such as AHC, dynamic positioning and helideck motion



monitoring can especially benefit as you can switch to an affordable MRU that does not require recalibration.

Export license

Our MRUs do not require an export license as they are not on the list of dual use items as per EU regulations.

About us



Norwegian Subsea is a leading provider of high-performance Motion Reference Units (MRU) and motion sensors for marine, subsea and offshore wind applications. Our products provide accurate and reliable measurements for control and monitoring purposes.

Since its establishment in 2014, Norwegian Subsea has rapidly emerged as a trusted global supplier of motion sensors. Serving diverse industries such as ship motion monitoring, hydrography, green energy, and subsea oil production, our satisfied customers testify to the reliability and quality of our solutions.

Our mission is to develop exceptional and cost-effective motion sensors tailored for the marine, land, and subsea

sectors. Through the fusion of advanced sensor algorithms, state-of-the-art MEMS sensors, and top-notch hardware, we create superior products. Rigorous testing in cutting-edge laboratories and real-world environments ensures the performance and dependability of our sensors.

With our headquarters situated in Oslo, Norway, Norwegian Subsea remains dedicated to providing innovative solutions that address the evolving needs of our customers in motion monitoring and beyond.

Contact information

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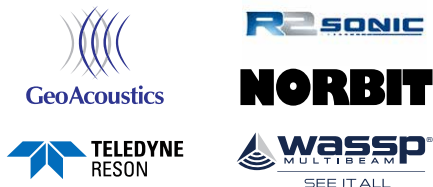
Harbitzalléen 2A, 0275 Oslo
Norway
Company registration 913 278 402

Selected customer references

Over 1000 Norwegian Subsea MRUs are in operation world-wide on over 500 vessels, floating and subsea structures.

Hydrography

– Our MRUs are used with the following sonar systems



Dynamic positioning

– Our MRUs are used with the following DP systems



Wave radar



Helideck Monitoring Systems



Floating wind lidar buoys



Motion Compensation of cranes, gangways, LARS & winches



Other references





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