



NORSUB sMRU

MRU Subsea User Manual



English

Intro

The purpose of the user manual is to provide information about the Norwegian Subsea (NORSUB) Subsea Motion Reference Units (MRU Subsea 3000, MRU Subsea 6000, and MRU Subsea 9000 models).

Restrictions in Warranty

The Seller's liability for defects is stated in the Norwegian Subsea general terms and conditions of sale. For the warranty to be valid the MRU:

- ◆ must not be subjected to extreme shock, rough handling or extensive vibrations.
- ◆ must only be opened by Norwegian Subsea.
- ◆ must not be stored or used in temperatures outside the range -40 to +85 deg. C.
- ◆ must be handled with care.
- ◆ must only be used with the correct power supply (10 – 36 V DC power).

Any breach of the points above will void the warranty.

Disposal

All electrical and electronic components have to be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or local authorities. The correct disposal and separate collection of your old appliance will help prevent potential negative consequences for the environment and human health. It is a precondition for reuse and recycling of used electrical and electronic equipment. For more detailed information about disposal of your old appliance, please contact your local authorities or waste disposal service.

In support of the global requirements to dispose of electrical waste within environmentally acceptable specifications, Norwegian Subsea offers customers the take-back and recycle process to properly dispose of surplus and end-of-life products.

Equipment that is returned to Norwegian Subsea through this program is disposed of in an environmentally safe manner using processes that comply with the WEEE (EU Directive on Waste Electrical and Electronic Equipment) regulations. All Norwegian Subsea-branded products are accepted under the program.



Support Information

Please contact Norwegian Subsea for technical support at support@norwegian-subsea.no. Technical support is available Monday - Friday between 09.00 – 17.00 CET.

Product Returns

In case of product returns, the buyer shall arrange for return shipment to Norwegian Subsea. Please note that a return merchandise authorization (RMA) from Norwegian Subsea is required in advance.

The return address is:

Norwegian Subsea
Hovfaret 8
0275 Oslo
Norway

Export Restrictions

The MRU must not be exported or re-exported to countries listed on the Norwegian Ministry of Foreign Affairs' prohibition list. Please contact Norwegian Subsea for further details.

Disclaimer

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MRU SUBSEA USER MANUAL (NORSUB-MSUM-x.x.x)			
REVISION HYSTORY			
	VERSION	CODE	NOTES
LEGACY	1.2.0	NORSUB-MSUM-1.2.0	First digital release.
	1.3.0	NORSUB-MSUM-1.3.0	First print release. The manual is completely redesigned to add all the important mechanical, electrical, and technical sensor information.
	1.3.1	NORSUB-MSUM-1.3.1	Minor correction of typos.
CURRENT	1.3.5	NORSUB-MSUM-1.3.5	Modified section "Restrictions in warranty". Added "Maintenance" section.

**NOTE**

Please read this user manual to ensure proper use of the MRU and the configuration software.

NORSUB MRU SUBSEA

High performance 6 DoF motion sensor

NORSUB Motion Reference Units (MRU) are high performance, compact and affordable. NORSUB MRUs use state-of-the-art MEMS technology and advanced sensor fusion algorithms. This results in accurate and reliable roll, pitch, yaw, surge, sway and heave position and velocity measurements. The performance is great also during horizontal accelerations and coupled motions.



Tailormade for subsea use

NORSUB MRU SUBSEA is ideal for use in subsea applications such as riser motion monitoring, ROV/AUV or subsea surveys. The MRU Subsea is a very compact motion sensor that is depth rated to 6000 m. The small size and footprint make it easy to install almost anywhere. The high performance in irregular motions makes it ideal for use in real sea conditions.



Easy interfacing

The NORSUB MRU SUBSEA comes in a water-proof titanium housing with ethernet and serial ports. Software upgrades are free of charge. A wide range of industry standard and custom protocols are included for easy interfacing to other systems. The MRU can be delivered with custom length cables and desired connector at your end.



An MRU for your needs

A high-end magnetometer can be included in the MRU to provide accurate magnetic heading. The MRU Subsea comes in three different versions: 3000, 6000 and 9000 models to accommodate for different accuracy requirements and budgets.

NORSUB MRU SUBSEA

General information

The NORSUB MRU Subsea outputs roll, pitch, yaw, heave, surge and sway measurements at configurable output rates up to 100 Hz.

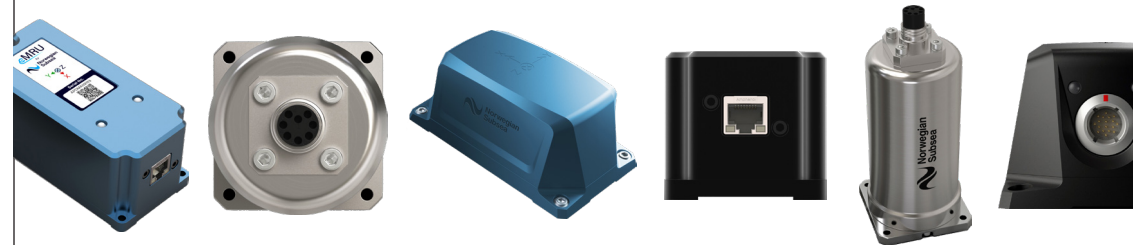
The MRU Subsea consists of a high-end MEMS 6 DOF IMU (3 x gyroscopes and 3 x accelerometers) and a processing unit where the motions states are calculated using an advanced sensor fusion algorithm. The MRU Subsea comes with a 8 pin SubConn connector.







This manual describes the mechanical and electrical interfaces needed to integrate the MRU Subsea in a system, and the technical specifications of all the available models.

A solution for every application




Norwegian Subsea AS offers a portfolio of sensors, cables, connectors, and software tools which covers a variety of applications, environmental, and operational requirements. Visit the [company website](#) to choose the Norwegian MRU Subsea that fits your needs!







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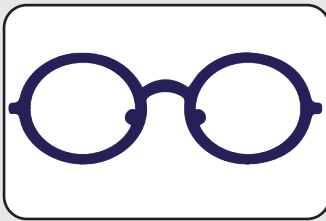
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1. GENERAL INFORMATION

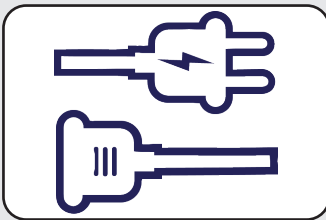


Quick Start Guide



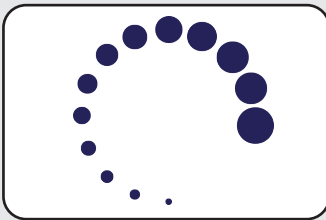
1. CHECK ITEMS

Verify that all the items are in the shipment (see MRU Subsea User Manual for details).



2. CONNECT THE MRU

Connect the MRU Subsea to a PC through an Ethernet port with or to a system with the SubConn connector (see MRU Subsea User Manual for details).



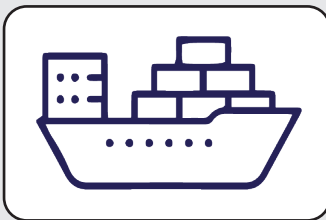
3. INSTALL THE SOFTWARE

Install the NORSUB MRU Configuration Software by double clicking on the installer file (setup.exe) on the USB memory stick (see MRU Configuration Software User Manual for details).



4. CONFIGURE THE MRU

Run the NORSUB MRU Configuration Software to configure the MRU Subsea (see MRU Configuration Software User Manual for details).



5. INSTALL THE MRU

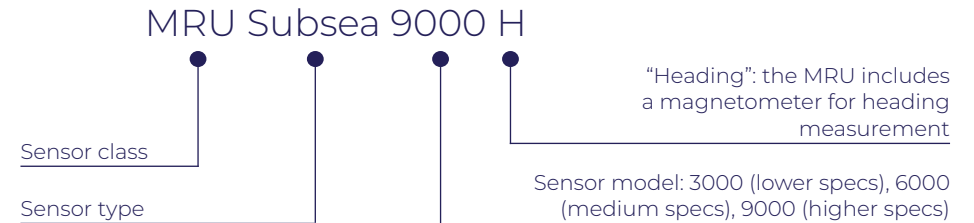
Install the configured MRU Subsea at the desired location.

MRU Subsea Models

The MRU Subsea comes in 6 different models which cover a variety of performance levels and features. The MRU Subsea models are:



The model name is explained here:



Variations between models will be explicitly described in this manual.

In the following the MRU Subsea 3000/6000/9000 will be referred to as “Basic”, the MRU Subsea 3000/6000/9000 H will be referred to as “H”.

GENERAL INFORMATION

Product List

The MRU Subsea, subsea cables, and other accessories that are available for purchase at Norwegian Subsea are listed in the following:

NORWEGIAN MRU Subsea SUBSEA-RELATED PRODUCT LIST	
PRODUCT NAME	PRODUCT CODE
NORSUB MRU 9000 Subsea	10013
NORSUB MRU 6000 Subsea	10014
NORSUB MRU 3000 Subsea	10015
NORSUB MRU 9000 Subsea H	10016
NORSUB MRU 6000 Subsea H	10017
NORSUB MRU 3000 Subsea H	10018
NORSUB MRU 9000 Subsea (Ethernet & RS-232)	10101
NORSUB MRU 6000 Subsea (Ethernet & RS-232)	10102
NORSUB MRU 3000 Subsea (Ethernet & RS-232)	10103
NORSUB MRU 9000 Subsea H (Ethernet & RS-232)	10104
NORSUB MRU 6000 Subsea H (Ethernet & RS-232)	10105
NORSUB MRU 3000 Subsea H (Ethernet & RS-232)	10106
NORSUB MRU 9000 Subsea (RS-232 & RS-485)	10113
NORSUB MRU 6000 Subsea (RS-232 & RS-485)	10114
NORSUB MRU 3000 Subsea (RS-232 & RS-485)	10115
NORSUB MRU 9000 Subsea H (RS-232 & RS-485)	10116
NORSUB MRU 6000 Subsea H (RS-232 & RS-485)	10117
NORSUB MRU 3000 Subsea H (RS-232 & RS-485)	10118
NORSUB MRU 9000 Subsea (Ethernet & 2 wire RS-485)	10125
NORSUB MRU 6000 Subsea (Ethernet & 2 wire RS-485)	10126
NORSUB MRU 3000 Subsea (Ethernet & 2 wire RS-485)	10127
NORSUB MRU 9000 Subsea H (Ethernet & 2 wire RS-485)	10128
NORSUB MRU 6000 Subsea H (Ethernet & 2 wire RS-485)	10129
NORSUB MRU 3000 Subsea H (Ethernet & 2 wire RS-485)	10130

MRU SUBSEA

Table 1: Norwegian Subsea MRU Subsea-related product list (part 1).

GENERAL INFORMATION

Product List

NORWEGIAN MRU Subsea SUBSEA-RELATED PRODUCT LIST	
PRODUCT NAME	PRODUCT CODE
Subsea SW Cable 2 m	30011
Subsea SW Cable 5 m	30012
Subsea SW Cable 10 m	30013
Subsea SW Cable 20 m	30014
Subsea SW Cable xx m	30015
Subsea Cable 2 m	30021
Subsea Cable 5 m	30022
Subsea Cable 10 m	30023
Subsea Cable 20 m	30024
Subsea Cable xx m	30025
Subsea Pigtail SW Cable 2 m	30016
Subsea Pigtail SW Cable 5 m	30017
Subsea Pigtail SW Cable 10 m	30018
Subsea Pigtail SW Cable 20 m	30019
Subsea Pigtail SW Cable xx m	30020
Subsea Pigtail Cable 2 m	30026
Subsea Pigtail Cable 5 m	30027
Subsea Pigtail Cable 10 m	30028
Subsea Pigtail Cable 20 m	30029
Subsea Pigtail Cable xx m	30030
Subsea SW Test Cable 10 m	30031
Subsea Custom Cable	30032
Transport Case M	40001
Power Supply 24 V DC	40002
Subsea Dummy Plug F	40003
Subsea Dummy Plug M	40004
USB stick with MRU configuration software	40005

SUBSEA CABLES

SUBSEA PIGTAILS

ACCESSORIES

Table 2: Norwegian Subsea MRU Subsea-related product list (part 2).

GENERAL INFORMATION

Items List

A standard shipment of the MRU Subsea 3000 / MRU Subsea 3000 H, MRU Subsea 6000 / MRU Subsea 6000 H, MRU Subsea 9000 / MRU Subsea 9000 H contains the following items (*):

1. 1 x NORSUB MRU Subsea;
2. 1 x Subsea cable (10 m);
3. 1 x Power supply;
4. 1 x USB flash drive containing the NORSUB MRU Configuration Software;
5. 1 x Configuration Software user manual and 1 x MRU Subsea user manual.



1. MRU
NORSUB MRU Subsea



2. CABLE
Subsea cable, 10m



5. USB FLASH DRIVE
USB drive with the NORSUB
MRU Configuration
Software



6. USER MANUALS
Configuration Software user
manual and MRU Subsea
user manual

(*) The shipment content (such as cable length and cable connectors) may vary from the above item list depending on items in your order (see "Product List" on page 4).

GENERAL INFORMATION

System Set-Up

- ◆ Connect the male connector of the subsea cable to the MRU SubConn connector, and the other end to your system (*). In the following figure, a subsea cable with an RJ45 plug and a power barrel jack is shown.
- ◆ Connect the RJ45 plug (ethernet) or DB-9 connector (serial) to your system.
- ◆ Connect the power cable to the power supply. It is recommended to plug the power supply to the power socket last, because this operation will start-up the MRU Subsea.

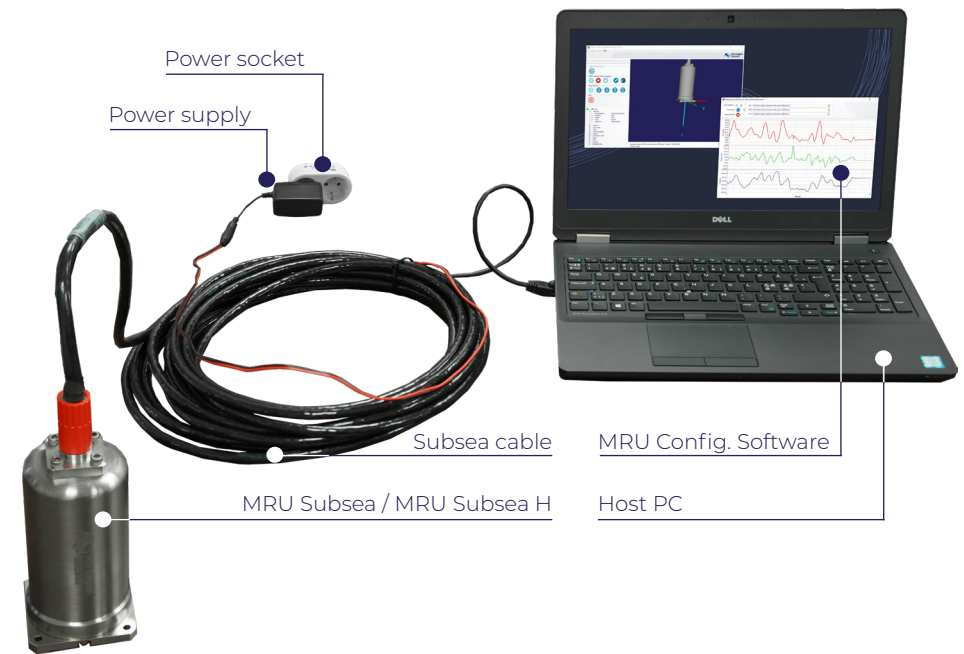


Figure 1: System set-up for the MRU Subsea / MRU Subsea H, Ethernet connection.

2. MECHANICAL INTERFACE



Design

The dimensions of the MRU Subsea / MRU Subsea H are:

- ◆ Length: 76 mm;
- ◆ Breadth: 76 mm;
- ◆ Height: 180 mm.

The footprint of the MRU Subsea is seen in Figure 5, dimensions are in millimeters. This shows the 4 mounting holes and the 2 alignment holes / slots on the center line. The MRU is mounted to a solid surface using 4 x M5 screws. 4 mm diameter alignment dowels are recommended for best alignment during installation.

The MRU Subsea 3000, MRU Subsea 3000 H, MRU Subsea 6000, MRU Subsea 6000 H, MRU Subsea 9000, and MRU Subsea 9000 H are identical when considering geometry, construction and materials.

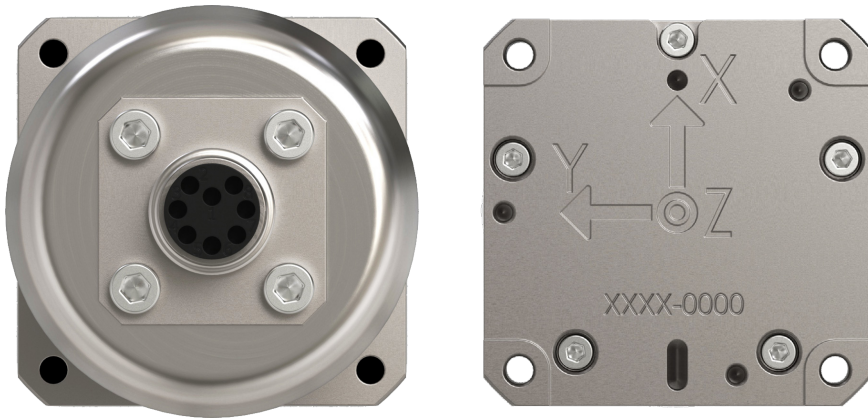


Figure 2: MRU Subsea / MRU Subsea H: front and bottom views.

Design



Figure 3: MRU Subsea / MRU Subsea H: isometric, and front views.

Technical Drawings

MRU Subsea / MRU Subsea H top and bottom technical drawings. All dimensions are in millimeters:

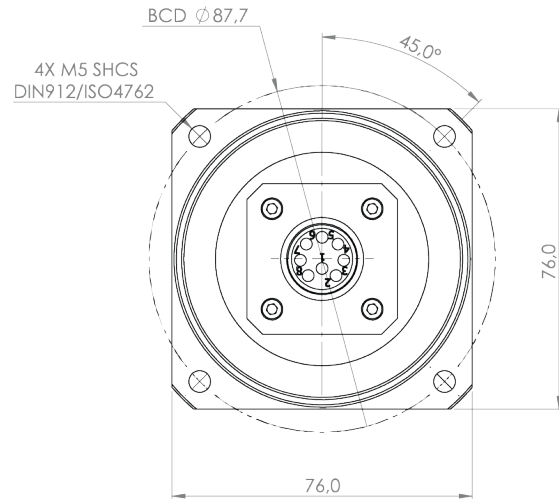


Figure 4: MRU Subsea / MRU Subsea H technical drawings: top view.

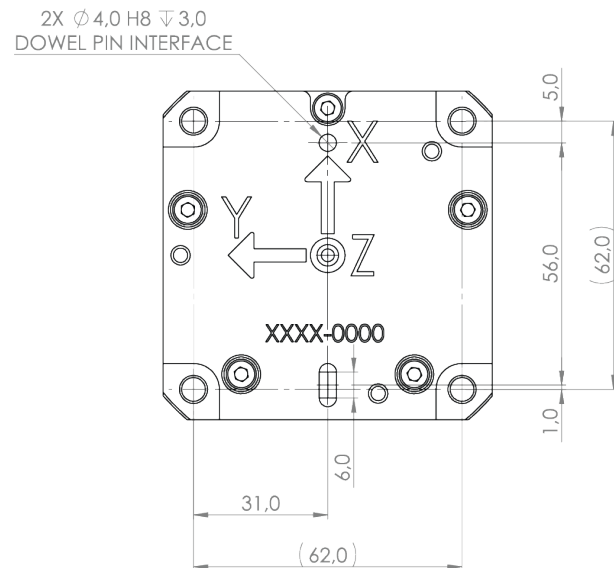


Figure 5: MRU Subsea / MRU Subsea H technical drawings: bottom view.

Technical Drawings

MRU Subsea / MRU Subsea H side technical drawing. All dimensions are in millimeters:

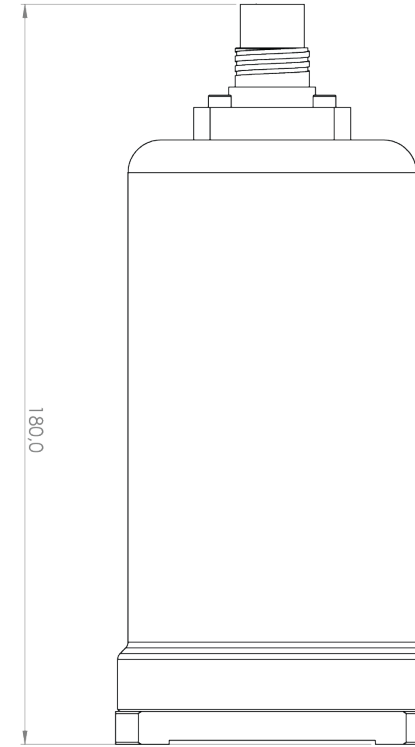


Figure 6: MRU Subsea / MRU Subsea H technical drawings: side view.

3. ELECTRICAL INTERFACE



Subsea Cable / Connectors

The MRU Subsea and MRU Subsea H models are connected to a system with the subsea cable plugged to a SubConn connector. The 8 pin SubConn connector has not enough pins for power, Ethernet, RS-232 and RS-485 ports. The 5 available power and communication configurations for the SubConn connector are given below. Note that all signals are w.r.t to the MRU connector.

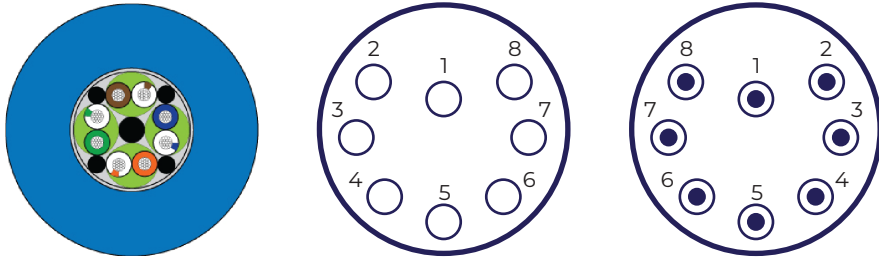


Figure 7: Subsea cable cross section and SubConn connectors (female and male).

SUBSEA CABLE AND SUBCONN CONNECTOR CONFIGURATION 1		
WIRE COLOR	PIN N.	SIGNAL
TP 4 (Brown)	1	GND
TP 4 (White /Brown)	2	24V
TP 1 (Blue)	3	GND
TP 1 (White/Blue)	4	24V
TP 2 (White/Orange)	5	Tx_D1+
TP 2 (Orange)	6	Tx_D1-
TP 3 (White/Green)	7	Rx_D2+
TP 3 (Green)	8	Rx_D2-

SUBSEA CABLE AND SUBCONN CONNECTOR CONFIGURATION 2		
WIRE COLOR	PIN N.	SIGNAL
TP 4 (Brown)	1	GND
TP 4 (White /Brown)	2	24V
TP 1 (Blue)	3	Tx
TP 1 (White/Blue)	4	Rx
TP 2 (White/Orange)	5	Tx_D1+
TP 2 (Orange)	6	Tx_D1-
TP 3 (White/Green)	7	Rx_D2+
TP 3 (Green)	8	Rx_D2-

Table 3: Subsea cable and connector configurations 1 and 2.

Subsea Cable / Connectors

SUBSEA CABLE AND SUBCONN CONNECTOR CONFIGURATION 3		
WIRE COLOR	PIN N.	SIGNAL
TP 4 (Brown)	1	GND
TP 4 (White /Brown)	2	24V
TP 1 (Blue)	3	Tx
TP 1 (White/Blue)	4	Rx
TP 2 (White/Orange)	5	Tx+
TP 2 (Orange)	6	Tx-
TP 3 (White/Green)	7	Rx+
TP 3 (Green)	8	Rx-

SUBSEA CABLE AND SUBCONN CONNECTOR CONFIGURATION 4		
WIRE COLOR	PIN N.	SIGNAL
TP 4 (Brown)	1	GND
TP 4 (White /Brown)	2	24V
TP 1 (Blue)	3	GND
TP 1 (White/Blue)	4	24V
TP 2 (White/Orange)	5	Tx+
TP 2 (Orange)	6	Tx-
TP 3 (White/Green)	7	Rx+
TP 3 (Green)	8	Rx-

SUBSEA CABLE AND SUBCONN CONNECTOR CONFIGURATION 5		
WIRE COLOR	PIN N.	SIGNAL
TP 4 (Brown)	1	GND
TP 4 (White /Brown)	2	24V
TP 1 (Blue)	3	(B)+
TP 1 (White/Blue)	4	(A)-
TP 2 (White/Orange)	5	Tx_D1+
TP 2 (Orange)	6	Tx_D1-
TP 3 (White/Green)	7	Rx_D2+
TP 3 (Green)	8	Rx_D2-

Table 4: Subsea cable and connector configurations 3,4, and 5.

Subsea Cable

SUBSEA CABLE COMPONENTS	
ITEM	DESCRIPTION
Power conductor	0.20 mm ² (24 AWG) two silver-plated copper conductors insulated with teflon and twisted together (4 ea.). Each pair has a different twist-rate for crosstalk performance and each pair has a TPE belt-to-round jacket for performance at pressure
Shield	Aluminium/polyester tape and tinned copper braiding (85% coverage) with an overall polyester tape
Filler	The cable is filled with cable filling compound
Outer jacket	Polyurethane jacket. Colour blue
Color code	1. TP = White/Blue + Blue 2. TP = White/Orange + Orange 3. TP = White/Green + Green 4. TP = White/Brown + Brown

Table 6: Subsea cable components descriptions.

SUBSEA CABLE TECHNICAL DETAILS	
PARAMETER	VALUE
Diameter	10,4 mm nom. (0,410 ± 0,010 inch)
Weight in air	140 kg/km nom. (95 lbs/1,000 feet nom.)
Weight in seawater	53 kg/km nom. (36 lbs/1,000 feet nom.)
Minimum bending radius	100 mm (4 inch)
Depth rating	6000 metres (8700 psi)

Table 7: Subsea cable technical details.

SUBSEA CABLE ELECTRICAL CHARACTERISTICS	
PARAMETER	VALUE
Depth rating	250V max. 1 amp
Conductor resistance	≤ 85 ohm/km (26 ohm/1,000-FT)
Capacitance	42 pF/m to for 55 pF/m (13 pF/FT to for 17 pF/FT)
Impedance	85 ohm to 125 ohm

Table 5: Subsea cable electrical characteristics.

4. TECHNICAL SPECIFICATIONS



Output Protocols

The industry standard and custom NMEA/ASCII and binary protocols available on the MRU are:

NAME	TYPE	DATA
Custom NMEA	NMEA	See next page
Custom Binary	Binary	See next page
ATLAS	Binary	Roll, pitch, heave
GYROCOMPAS1	NMEA	Roll, pitch, heading, status
IFREMER VICTOR	Binary	Roll, pitch, heading, roll rate, pitch rate, yaw rate, acc x, acc y, acc z
MDL	ASCII	Roll, pitch, heading
NORSUB	NMEA	Roll, pitch, yaw, heave
NORSUB2	NMEA	Roll, pitch, yaw, heave, heave vel
NORSUB6	NMEA	Roll, pitch, yaw, surge, sway, heave, roll rate, pitch rate, yaw rate, surge vel, sway vel, heave vel, acc x, acc y, acc z
NORSUB7	NMEA	Roll, pitch, yaw, surge (body frame), sway (body frame), heave, roll rate, pitch rate, yaw rate, surge vel (body frame), sway vel (body frame), heave vel, acc x (body frame), acc y (body frame) acc z, period x, period y, period z, amplitude x, amplitude y, amplitude z, STATUS
NORSUB7b	NMEA	Roll, pitch, yaw, surge (body frame), sway (body frame), heave, roll rate, pitch rate, yaw rate, surge vel (body frame), sway vel (body frame), heave vel, acc x (body frame), acc y (body frame) acc z, period x, period y, period z, amplitude x, amplitude y, amplitude z, STATUS_A, STATUS_B
NORSUB8	NMEA	Roll, pitch, yaw, surge (NED frame), sway (NED frame), heave, roll rate, pitch rate, yaw rate, surge vel (NED frame), sway vel (NED frame), heave vel, acc x (NED frame), acc y (NED frame), acc z, period x, period y, period z, amplitude x, amplitude y, amplitude z, STATUS
NORSUB PRDID	NMEA	Pitch, roll
Tokimek PTVG	NMEA	Roll, pitch, yaw
RDI ADCP	NMEA	Roll, pitch, yaw
SMCA	NMEA	Roll, pitch, surge, sway, heave
SMCC	NMEA	Roll, pitch, yaw, surge, sway, heave, surge vel, sway vel, heave vel, acc x, acc y, acc z
Simrad EM 3000	Binary	Roll, pitch, yaw, heave
TSS1	ASCII	Roll, pitch, heave, status

Table 8: List of output protocols.

Output Protocols

Custom NMEA: custom output protocol in NMEA format. See the MRU Configuration Software User Manual for the full list of available output variables.

Custom Binary: custom output protocol in binary format. See the MRU Configuration Software User Manual for the full list of available output variables.

Output Variables

The following table shows the available variables for every protocol.

NAME	TYPE	DATA																									
		Roll	Pitch	Yaw	Roll rate	Pitch rate	Yaw rate	Surge	Sway	Heave	Surge velocity	Sway velocity	Heave velocity	Surge acc.	Sway acc.	Heave acc.	Surge period	Sway period	Heave period	Surge amplitude	Sway amplitude	Heave amplitude	STATUS	STATUS_A	STATUS_B		
Atlas	bin.	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Cyrocompas1	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Ifremer Victor	bin.	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
MDL	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
NORSUB	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
NORSUB2	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
NORSUB6	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
NORSUB7	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
NORSUB7b	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
NORSUB8	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

Table 9: Output protocol variables (part 1).

Output Variables

NAME	TYPE	DATA																									
		Roll	Pitch	Yaw	Roll rate	Pitch rate	Yaw rate	Surge	Sway	Heave	Surge velocity	Sway velocity	Heave velocity	Surge acc.	Sway acc.	Heave acc.	Surge period	Sway period	Heave period	Surge amplitude	Sway amplitude	Heave amplitude	STATUS	STATUS_A	STATUS_B		
NORSUB PRDID	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Tokimek PTVG	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
RDI ADCP	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
SMCA	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
SMCC	ASCII	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Simrad EM 3000	bin.	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
TSSI	bin.	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

Table 10: Output protocol variables (part 2).

Technical Specifications

MRU SUBSEA 3000/6000/9000 PHYSICAL CHARACTERISTICS	
PARAMETER	BASIC & H
Weight	1600 g
L x B x H	760 x 760 x 180 mm
Depth rating	6000 m

Table 11: MRU Subsea physical characteristics.

MRU SUBSEA PERFORMANCE						
PARAMETER	3000	3000 H	6000	6000 H	9000	9000 H
Roll & pitch	+/- 0.05 degs	+/- 0.05 degs	+/- 0.02 degs	+/- 0.02 degs	+/- 0.01 degs	+/- 0.01 degs
Real-time heave	5.0 cm or 5.0 %	5.0 cm or 5.0 %	5.0 cm or 5.0 %	5.0 cm or 5.0 %	5.0 cm or 5.0 %	5.0 cm or 5.0 %
Heading	N/A	+/- 0.5 degs	N/A	+/- 0.5 degs	N/A	+/- 0.5 degs

Table 12: MRU Subsea performance.

MRU SUBSEA RANGE						
PARAMETER	3000	3000 H	6000	6000 H	9000	9000 H
Acceleration range	+/- 3 g	+/- 3 g	+/- 4 g	+/- 4 g	+/- 10 g	+/- 10 g
Gyroscopes	+/- 150 degs/s	+/- 150 degs/s	+/- 450 degs/s	+/- 450 degs/s	+/- 450 degs/s	+/- 450 degs/s
Heave	+/- 50 m	+/- 50 m	+/- 50 m	+/- 50 m	+/- 50 m	+/- 50 m
Yaw	N/A	360 degs	N/A	360 degs	N/A	360 degs
Pitch	+/- 90 degs	+/- 90 degs	+/- 90 degs	+/- 90 degs	+/- 90 degs	+/- 90 degs
Roll	+/- 180 degs	+/- 180 degs	+/- 180 degs	+/- 180 degs	+/- 180 degs	+/- 180 degs
Output frequency	0 - 100 Hz	0 - 100 Hz	0 - 100 Hz	0 - 100 Hz	0 - 100 Hz	0 - 100 Hz

Table 13: MRU Subsea range.

Technical Specifications

MRU SUBSEA 3000/6000/9000 POWER AND INTERFACES	
PARAMETER	BASIC & H
Power consumption	6.0 W
Supply voltage	10-36 V DC (24 V nominal)
Internal storage	32 GB
Communication	One of the following: <ul style="list-style-type: none"> ◆ Ethernet ◆ Ethernet and RS-232 ◆ RS-232 and RS-485 ◆ RS-485 ◆ Ethernet and 2 wire RS-485
Protocols	See "Output Protocols" on page 22 for the complete list

Table 15: MRU Subsea power and interfaces.

MRU SUBSEA 3000/6000/9000 ENVIRONMENTAL SPECIFICATION	
PARAMETER	BASIC & H
Enclosure material	Titanium grade 5
Enclosure protection	6000 m
Operating temperature range	-20 to +70 degrees Celsius
Operating humidity (max)	No limit (sealed)
Storage temperature range	-40 to +80 degrees Celsius
Storage humidity	No limit (sealed)
Electromagnetic compatibility (immunity/emission)	IEC 60945/EN 60945
Vibration	IEC 60945/EN 60945
Max shock non-operational (10 ms peak)	2000 m/s ² (half-sine 0.5 msec)
MTBF (computed)	100000 h

Table 14: MRU Subsea environmental specification.

5. MAINTENANCE



MAINTENANCE

Maintenance General Information

The Norwegian Subsea MRUs are designed to be maintenance free, and no field maintenance is expected.

Repair or modification to the MRU must be done by Norwegian Subsea personnel. Attempts of opening the MRU will void the warranty.

No periodic maintenance is expected except for firmware upgrades. Any other maintenance shall be carried out by Norwegian Subsea.

Firmware Upgrades

Norwegian Subsea releases free firmware upgrades for the MRUs. The latest version of the firmware can be downloaded from the download pages of the company home page after registration of an MRU. Please contact Norwegian Subsea support for legacy versions of the MRU firmware.

Please see the MRU Configuration Software manual for how to save and apply configuration settings of the MRU.

Re-calibration

The NORSUB MRU requires re-calibration every 3rd year to guarantee the specified performance in roll & pitch. The specified heave accuracy of 5 cm / 5% whichever is greater, is maintained without re-calibration.

The MRU will perform well after 3 years without re-calibration for most applications. Longer re-calibration intervals than 3 years may be used if the application does not require the specified accuracy in roll & pitch. Without re-calibration, a roll & pitch accuracy as given by Table 1 is assumed to be maintained for the lifetime of the MRU under normal use.

The computed MTBF (mean time between failure) for the NORSUB MRU Marine is 100000 hours, but actual lifetime depends on use, vibrations, and temperature. However, lifetime of 10 years or more in normal continuous operation can be expected.

See Table 16 for details.

MAINTENANCE

Re-calibration

PARAMETER	SUBSEA 3000	SUBSEA 6000	SUBSEA 9000
Spec: Roll & pitch	0.05 degs	0.02 degs	0.01 degs
Spec: Heave	0.05 cm / 5%	0.05 cm / 5%	0.05 cm / 5%
Re-calibration interval	3 years	3 years	3 years
No recalibration: Roll & pitch	0.1 degs	0.05 degs	0.03 degs
No re-calibration: Heave	0.05 cm / 5%	0.05 cm / 5%	0.05 cm / 5%

Table 16: MRU performance and re-calibration.

Repairs

All repairs except for cable replacement must be performed by Norwegian Subsea.

Please contact Norwegian Subsea support if an MRU is assumed faulty. If troubleshooting with Norwegian Subsea support does not solve the issue, an RMA must be issued by Norwegian Subsea before the MRU can be sent for repair.

Troubleshooting

Please see the MRU Configuration Software manual for how to troubleshoot the MRU.

Norwegian Subsea was founded in 2014. Today, we are a fast-growing supplier of motion sensors to customers worldwide. We deliver motion sensors to satisfied customers in industries as diverse as ship motion monitoring, hydrography, green energy and subsea oil production.

Our mission is to create better and more affordable motion sensors for users in marine, land and subsea industries. We do this by combining advanced sensor fusion algorithms with high quality hardware and the latest MEMS sensors. Our sensors are thoroughly put to test in state-of-the-art labs as well as in the field.



Hovfaret 8, 0275 Oslo, Norway



support@norwegian-subsea.no



www.norwegian-subsea.no

