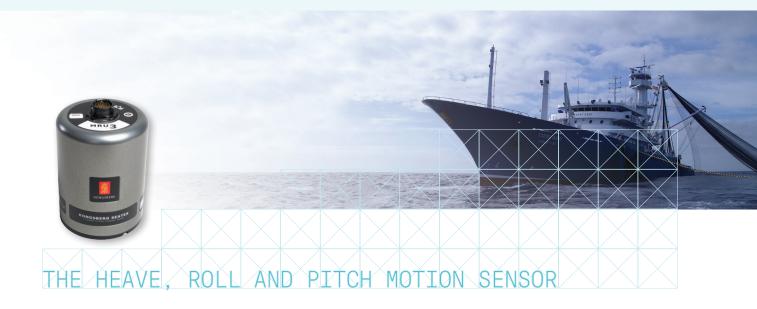# MRU 3

THE HEAVE, ROLL AND PITCH MOTION SENSOR

This fifth generation roll, pitch and heave motion sensor is specially designed for heave compensation applications.

Typical applications

The MRU 3 model is typically used for real-time roll, pitch and heave compensation of echosounders, fishing sonars and offshore cranes. The unit provides heave measurements to meet IHO standards. This unit has to be mounted in a fixed mounting direction with the connector pointing up or down.

Function

This cost-effective MRU 3 model incorporates 3-axis Micro-Electro-Mechanical-Structures (MEMS) sensors for both linear acceleration and angular rate. This unit achieves high reliability by using solid state sensors with no rotational or mechanical wear-out parts.

The unit is delivered with a Windows based configuration and data presentation software. In this software vector arms from where the MRU is mounted to centre of gravity (CG) and two individually configurable monitoring points (MPs) can be defined. The heave measurement can be output in four different locations (the MRU itself, CG, MP1 and MP2) simultanously on the same serial line or Ethernet port. Typical monitoring point is the transducer head or the crane tip.

Output variables

The MRU 3 outputs roll, pitch and heave together with linear acceleration in 3-axes. The MRU 3 outputs heave position and velocity. In addition roll and pitch angles and corresponding angular rate vectors are output.

PFreeHeave® Algorithm

The PFreeHeave algorithm uses past measurements to output a correct and phase-free heave from the MRU. PFreeHeave has an advantage in long swell conditions and for applications that can utilize a heave signal that is delayed some minutes, typical seabed mapping applications.

External inputs

The MRU 3 accepts input of external speed and heading information on separate serial lines or Ethernet for improved accuracy in heave, roll and pitch during turns and accelerations. For time synchronization the MRU accepts 1-second time pulse (1PPS) input on a TTL line (XIN) or as RS-232/422 signal.

Digital I/O protocols

For this fifth generation MRU data is available through both Ethernet interface and serial lines enabling easy distribution of MRU data to multiple users on board the vessel. Output protocols for commonly used survey equipment are available on two individually configurable serial lines and Ethernet/UDP.

FEATURES

- Outputs real-time roll, pitch and heave measurements
- Outputs on RS-232, RS-422 and Ethernet
- High output data rate (200 Hz)
- Precise heave at long wave periods by use of PFreeHeave® algorithms
- Lever arm compensation to two individually configurable monitoring points
- Meets IHO special order requirements
- Small size, light weight and low power consumption
- Each MRU delivered with Calibration Certificate
- Selectable communication protocols in the Windows based MRU configuration software
- Export license not required
- 2-year warranty

TECHNICAL SPECIFICATIONS

MRU 3

ORIENTATION OUTPUT

Angular orientation range	±45°
Resolution in all axes	0.001°
Accuracy [1], [2] roll, pitch (for a ±5° amplitude)	0.08° RMS

GYRO OUTPUT

Angular rate range	±100°/s
Angular rate noise	0.1°/s RMS
Scale factor error	0.5 % RMS

ACCELERATION OUTPUT

Acceleration range (all axes)	±50 m/s2
Acceleration noise	0.005 m/s2 RMS
Acceleration accuracy	0.02 m/s2 RMS
Scale factor error	0.5% RMS

HEAVE OUTPUT

Output range	±50 m, adjustable
Heave accuracy for 0 to 18 s motion periods (real-time)	5 cm or 5% whichever is highest (RMS)
Heave accuracy for 10 s motion period (real-time)	3 cm or 5% whichever is highest (RMS)
Heave accuracy for 0 to 50 s motion periods (delayed)	2 cm or 2% whichever is highest (RMS)
Heave velocity accuracy	0,01 m/s RMS

ELECTRICAL

Voltage input	10 to 36 V DC
Power consumption	Max 5,5 W
Serial ports:	
Com1	Bidirectional RS-422
Com2	Bidirectional RS-422 from junction box, user configurable RS-232, RS-422
Com3 & Com4	Input only, user configurable RS-232, RS-422

Analog channels (junction box)	# 4, ±10 V, 14 bit resolution
Ethernet output ports	5
Ethernet UPD/IP	10/100 Mbps
Data output rate (max)	200 Hz
Timing	< 1 ms

INPUT FORMATS

NMEA 0183, incl. HDT, HDM, ZDA, GGA, VTG, VHW, VBW or MRU Normal format

DATA OUTPUT PROTOCOLS

- MRU normal	- Sounder
- NMEA 0183 proprietary	- EM3000
- Atlas Fansweep	- TSS1
- Seapath binary 23, 25, 26	- PFreeHeave®
- PRDID	- KM binary

OTHER DATA

MTBF (computed)	50000 h
MTBF (service history based)	100000 h
Material	Anodised aluminium
Connector (MIL. spec.)	Souriau 851-36RG 16-26S50

WEIGHTS AND DIMENSIONS

Weight	2.0 kg
Dimensions	Ø 105 x 140 mm (4.134" x 5.525")

ENVIRONMENTAL SPECIFICATIONS

Operational temperature range	-5 °C to +55 °C
Storage temperature range	-25 °C to +70 °C
Enclosure protection	IP66
Vibration	IEC 60945/EN 60945

ELECTROMAGNETIC COMPATIBILITY

Compliance to EMCD, immunity/emission	IEC 60945/EN 60945

[1] When the MRU is exposed to a combined two-axes sinusoidal angular motion with 10 minutes duration.

[2] When the MRU is stationary over a 30-minute period.

Specifications subject to change without any further notice.