

# MRU 5



KONGSBERG

## The Ideal Marine Motion Sensor

**This fifth generation MRU 5 is specially designed for high precision motion measurements in marine application and for users requiring high accuracy roll, pitch and heave measurements.**

### Typical applications

The MRU 5 is the ideal sensor for motion compensation of multi-beam echo sounders, offshore cranes, hydroacoustic positioning systems and dynamic motion monitoring of roll, pitch and linear accelerations on offshore structures. The MRU 5 provides documented roll and pitch accuracy of  $0.02^\circ$  RMS at a  $\pm 5^\circ$  amplitude. The unit maintains its specified accuracy aboard any surface vessel or subsea vehicle.

### Function

The MRU 5 incorporates three highly accurate accelerometers and three high-end Kongsberg Seatex developed Micro-Electro-Mechanical-Structures (MEMS) gyros of type MRG (MRU Rate Gyro). The MRG gyro combines low noise, excellent bias stability and gain accuracy. Very high reliability is achieved by using solid state sensors with no rotational or mechanical wear-out parts.

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

### Output variables

The MRU 5 outputs roll, pitch and yaw angles and corresponding angular rate vectors. The unit outputs



relative (dynamic) heave, surge and sway positions, velocities and accelerations in adjustable frames.

### External inputs

The MRU 5 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

- 0.02° roll and pitch accuracy
- 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
- Small size, light weight and low power consumption
- No limitation to mounting orientation
- 2-years warranty
- Each MRU delivered with Calibration Certificate
- Selectable communication protocols in the Windows based MRU configuration software



## Technical specifications

### Roll and pitch output

Angular orientation range	±180°
Angular rate range	±150°/s
Resolution roll, pitch	0.001°
Angular rate noise	0.025°/s RMS
Static <sup>2</sup> accuracy	0.02° RMS
Dynamic <sup>1</sup> accuracy (for a ±5° amplitude)	0.02° RMS
Scale factor error	0.08% RMS

### Heave output

Output range	±50m
Periods (real-time)	0 to 25 s
Periods (delayed)	0 to 50 s
Heave accuracy (real-time)	5 cm or 5%, whichever is highest
Heave accuracy (delayed)	2 cm or 2%, whichever is highest

### Acceleration output

Acceleration range	±30m/s <sup>2</sup>
Acceleration noise <sup>2</sup>	0.002 m/s <sup>2</sup> RMS
Acceleration accuracy	0.01 m/s <sup>2</sup> RMS

### Electrical

Power requirements	10-36V DC, Max. 12 W
Output serial line (from MRU)	One RS-232 and one 422
Output serial lines (junction box)	Two RS 422
Analog channels (junction box)	# 4, ±10V, 14 bit resolution
Input serial line	Two RS-232/422
Ethernet ports	Three output and one input
Ethernet UDP/IP	10/100 Mbps
Digital output variables	24 (max), serial or Ethernet
Output data rate (max)	200 Hz
Timing	<1 ms

### Environment

Temperature range	-5 to +55°C
Humidity range, electronics	sealed, no limit
Enclosure protection	IP-66
Max vibration (operational)	0.5m/s <sup>2</sup> (10-2000 Hz continuous)
Max vibration (non operational)	20m/s <sup>2</sup> (0-2000 Hz continuous)
Max shock (non operational)	1000m/s <sup>2</sup> (10ms peak)

### Other data

MTBF (computed)	50000 h
Housing dimensions	Ø105x140 mm (4.134"x5.525")
Material	Anodised Aluminium
Weight	2.4 kg
Connector	Souriau 851-36RG 16-26S50

### Data output protocols

-- MRU normal	- Atlas Fansweep
-- NMEA proprietary	- TSS1
-- Sounder	- Seapath binary 23
-- EM3000	- PFreeHeave

- 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 minutes period.

*Specification subject to change without further notice.*



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