MRU 5

The ultimate marine motion sensor

The MRU 5 represents the pinnacle of marine motion sensing technology – embodying a specially designed fifth-generation device that excels in delivering high precision motion measurements within marine applications. It stands out in its ability to offer highly accurate roll, pitch, and heave measurements for the most demanding users.

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
- Meets IHO special order requirements
- No limitation to mounting orientation
- Small size, light weight and low power consumption
- Each MRU delivered with Calibration Certificate
- 2-year warranty
- Selectable communication protocols in the Windows based MRU configuration software

Specifications

Product	MRU 5
Country of origin	Norge
Manufacturer	Kongsberg Discovery

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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° RMS at a ±5° 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 MicroElectro-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.

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.

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.

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.

External communication

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.

Specifications

Product	MRU 5
Country of origin	Norge
Manufacturer	Kongsberg Discovery
Weight	2.2 kg
Dimensions	Ø 105 x 140 mm
Material	Anodised aluminium

Gyro output

Angular rate range	±149°/s
Angular rate noise	0.025°/s RMS
Scale factor error	0.08 % RMS

Acceleration output

Acceleration range (all axes)	±30 m/s2
Velocity random Walk	3.3 µg/√Hz
Acceleration noise	0.01 m/s2 RMS
Scale factor error	0.02% RMS

Heave output

Output range	±50 m, adjustable
Heave accuracy for 0 to 25 s motion periods (real-time)	5 cm or 5% whichever is highest (RMS)
Heave accuracy for 10 s motion period (real-time)	1 cm or 3% 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
Bandwidth	0.04 to 10 Hz

Data output protocols

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

Electrical

Voltage input	10 to 36 V DC
Power consumption	Max 8 W (typical 7.2 Watts)
Ethernet output ports	5
Ethernet UPD/IP	10/100 Mbps
Data output rate	200 Hz
Timing	< 1 ms
Analog channels (junction box)	# 4, ±10 V, 14 bit resolution
Com1	Bidirectional RS-422
Com2	Bidirectional RS-422 from junction box, user configurable RS 232, RS-422
Com3 & Com4	Input only, user con figurable RS-232, RS-422

Other data

MTBF (computed)	50000 h
MTBF (service history based)	100000 h
Input formats	NMEA 0183, incl. HDT, HDM, ZDA, GGA, VTG, VHW, VBW or MRU Normal format
Connector (MIL. spec.)	Souriau 851-36RG 16-26S50

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

Orientation output

Angular orientation range	±180°
Resolution in all axes	0.001°
Angle noise roll, pitch	0.002° RMS
Accuracy roll, pitch	0.008° RMS