Motion Reference Units

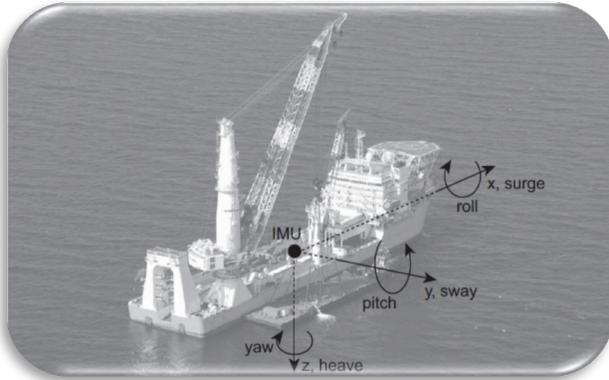**Inertial Labs**
Attitude is Everything

- IP-67 sealed
- 5% / 5 cm Heave accuracy
- 0.03 m/sec Velocity accuracy
- 0.03 deg Pitch and Roll accuracy
- 0.005 m/sec^2 Acceleration accuracy
- 0.0002 deg/sec Angular rate accuracy
- NMEA 0183 and TSS1 output data format
- DGPS / RTK horizontal & vertical position
- Kongsberg/Seatex, SMC & Teledyne data formats*

Datasheet
Revision 1.6

Inertial Labs has developed **Motion Reference Units (MRU)** to meet requirements from marine and hydrographic applications. **MRU** is enhanced, high-performance strapdown Motion Sensor, that determines Pitch & Roll, Heave, Sway, Surge, Accelerations, Angular rates, Heading, Velocity and Positions for any device on which it is mounted.

The Inertial Labs **Motion Reference Units** utilizes solid state 3-axes each of precision accelerometers, magnetometers, gyroscopes and barometric sensors to provide accurate Heave, Sway, Surge, Pitch and Roll of the device under measure.

Integration of very low noise gyroscopes output provides high frequency, real-time measurement of the Vessel, Ships, Helidecs, ROV, Marine antennas, Cranes rotation about all three rotational axes.

Through a combination of proven sector expertise and a continued investment in technological innovation, Inertial Labs delivers the optimum balance of price and performance ratio solutions for its customers.

KEY FEATURES AND FUNCTIONALITY

➢ Kongsberg/Seatex, Teledyne and SMC data formats
➢ State-of-the-art algorithms for Survey, Vessels, Ships, Active Heave Compensators, Cranes, Helideck, ROV, AUV, DPS, Buoys, Echo Sounders, Offshore Platforms
➢ 0.03 deg RMS Pitch & Roll dynamic accuracy
➢ 5% or 5 cm RMS (whichever is greater) Heave accuracy
➢ 0.005 m/sec^2 linear acceleration accuracy
➢ NMEA 0183, TSS1 output data formats
➢ HYPACK software compatibility
➢ Environmentally sealed (IP67), compact design
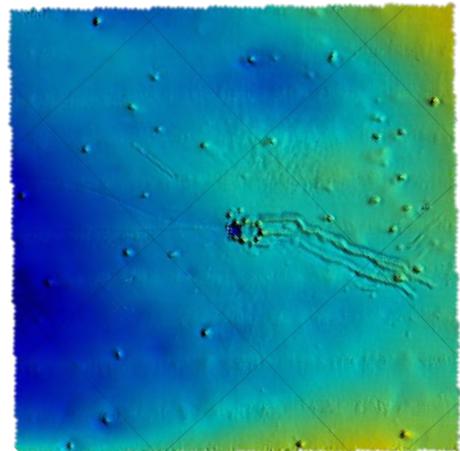
Our **MRU**s featuring developed few micro g Bias in-run stability Micro Electro Mechanical System (MEMS)-based accelerometers. New generation of Inertial Labs 1 deg/hr Bias in-run stability MEMS-based gyroscopes are an ideal solution for demanding marine applications, with their electronic nature negating the problems associated with expensive mechanical gyro solutions, as well as those based on fiber optic (FOG) technology.

Inertial Labs MEMS gyroscopes set the standard for the industry, with our high-end **MRU**s featuring gyros that enable sector-leading accuracy and reliability standards.

Measured Parameters	MRU-B * Basic	MRU-E Enhanced	MRU-P Professional
Heave, Surge, Sway (% / cm)	+	+	+
Pitch & Roll (deg)	+	+	+
Heading/Yaw (deg)		+	+
Velocity (meters/sec)			+
DGPS/RTK Positions (meters)			+

* MRU-B1 (Heave or Pitch & Roll measurement) and MRU-B2 (Heave, Pitch & Roll measurements) are available

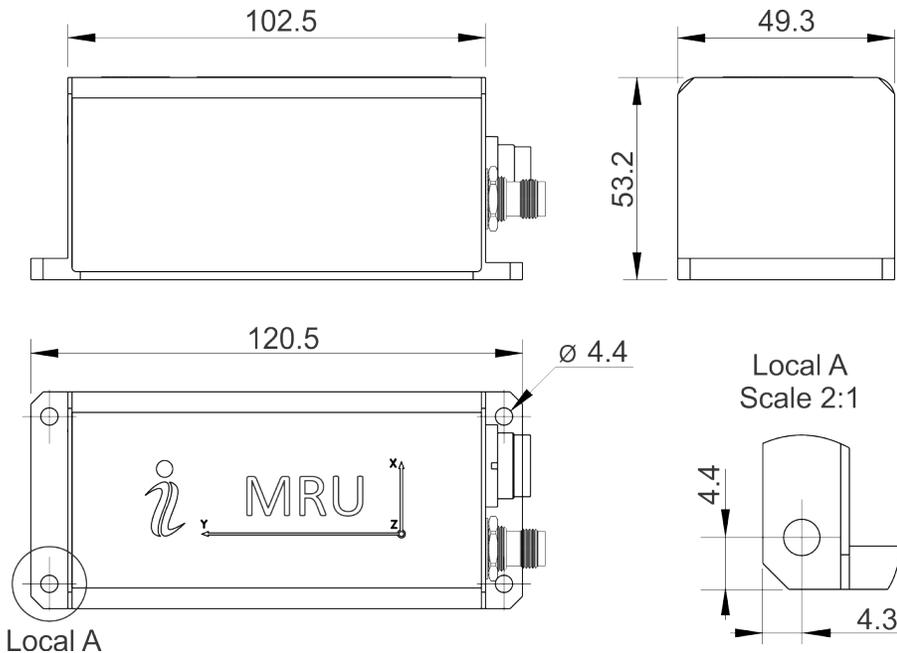**Inertial Labs:** Address: 39959 Catoctin Ridge Street, Paeonian Springs, VA 20129 U.S.A.
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MRU Specifications

Parameter	Units	MRU-B (Basic)	MRU-E (Enhanced)	MRU-P (Professional)
Basic Output signals		Heave, Heave Velocity, Heave Acceleration, Surge, Sway, Pitch & Roll, Pitch & Roll Rate, Pitch & Roll Velocity, Accelerations, Angular rates, Significant Wave Height, Temperature, Barometric data, Pulse Per Second (PPS)		
Output data formats		Kongsberg/Seatex, Ship Motion Control SMC, Teledyne TSS*		
Additional output signals			Heading/ Yaw	Heading/Yaw GPS/GLONASS/GALIELO/ BeiDou/SBAS/DGPS/RTK Positions, Velocity
Compatibility		SBES/MBES: Teledyne; R2Sonic; WAASP; Kongsberg; EdgeTech; NORBIT; IMAGENEX HYPACK, QINSY and Novatel Inertial Explorer software*		
Update rate	Hz	1 … 200 (user settable)	1 … 200 (user settable)	1 … 200 (user settable)
Start-up time	sec	<1	<1	<1
Heave	**Units**	MRU-B	MRU-E	MRU-P
Measurement range	meters	±300	±300	±300
Resolution	meters	0.01	0.01	0.01
Accuracy, RMS	% (meters)	5 (0.05)	5 (0.05)	5 (0.05)
Pitch and Roll	**Units**	MRU-B	MRU-E	MRU-P
Range: Pitch, Roll	deg	±90, ±180	±90, ±180	±90, ±180
Angular Resolution	deg	0.01	0.01	0.01
Static Accuracy in whole Temperature Range	deg	0.02	0.02	0.02
Dynamic Accuracy	deg RMS	0.03	0.03	0.03
Heading	**Units**	MRU-B	MRU-E	MRU-P
Range	deg	-	0 to 360	0 to 360
Angular Resolution	deg	-	0.01	0.01
Static Accuracy in whole Temperature Range	deg	-	0.3	0.2
Dynamic Accuracy	deg RMS	-	0.6	0.4
Post processing accuracy [1]	deg RMS	-	0.1	0.1
Positions, Velocity and Timestamps	**Units**	MRU-B	MRU-E	MRU-P
Horizontal position accuracy (GPS L1), RMS	meters	-	-	1.5
Horizontal position accuracy (SBAS), RMS	meters	-	-	0.6
Horizontal position accuracy (DGPS), RMS	meters	-	-	0.4
Horizontal position accuracy (RTK), RMS	meters			0.01 + 1 ppm
Horizontal position accuracy (post processing) [1]	meters	-	-	0.005
Velocity accuracy, RMS	meters/sec	-	-	0.03
GNSS raw data rate	Hz	-	-	20
Timestamps accuracy	nano seconds	20	20	20
Gyroscopes	**Units**	MRU-B	MRU-E	MRU-P
Measurement range	deg/sec	±450	±450	±450
Bias in-run stability (RMS, Allan Variance)	deg/hr	1	1	1
Noise density	deg/sec√Hz	0.004	0.004	0.004
Accelerometers	**Units**	MRU-B	MRU-E	MRU-P
Measurement range	g	±8	±8	±8
Bias in-run stability (RMS, Allan Variance)	mg	0.005	0.005	0.005
Noise density	mg√Hz	0.025	0.025	0.025
Magnetometers	**Units**	MRU-B	MRU-E	MRU-P
Measurement range	Gauss	-	±1.6	±1.6
Bias in-run stability, RMS	nT	-	0.2	0.2
Noise density, PSD	nT√Hz	-	0.3	0.3
Pressure	**Units**	MRU-B	MRU-E	MRU-P
Measurement range	hPa	300 – 1100	300 – 1100	300 – 1100
Bias in-run stability (RMS, Allan Variance)	Pa	2	2	2
Noise density	Pa/√Hz	0.8	0.8	0.8
Environment	**Units**	MRU-B	MRU-E	MRU-P
Operating temperature	deg C	-40 to +70	-40 to +70	-40 to +70
Storage temperature	deg C	-50 to +85	-50 to +85	-50 to +85
MTBF	hours	100,000	100,000	100,000
Vibration		IEC 60945/EN 60945	IEC 60945/EN 60945	IEC 60945/EN 60945
Electrical	**Units**	MRU-B	MRU-E	MRU-P
Supply voltage	V DC	9 to 36	9 to 36	9 to 36
Power consumption	Watts	1	1.4	2.6
Output Interface	-	Ethernet, RS-232, RS-422	Ethernet, RS-232, RS-422	Ethernet, RS-232, RS-422
Output data format	-	Binary, TSS-1, NMEA 0183 ASCII, Kongsberg /Seatex, SMC, Teledyne*		
Compliance to EMCD, immunity/emission		IEC 60945/EN 60945	IEC 60945/EN 60945	IEC 60945/EN 60945
Connector [2]		Binder Series 723	Binder Series 723	Binder Series 723 & TNC
Physical	**Units**			
Size	mm	120 x 50 x 53	120 x 50 x 53	120 x 50 x 53
Weight	gram	220	280	320
Enclosure material		Anodized Aluminum	Anodized Aluminum	Anodized Aluminum

[1] Post-processing results using third party software. [2] Cable with pigtail wires or with Souriau 851-36RG 16-26s50 connector are the options

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MRU-B and MRU-E mechanical interface drawing
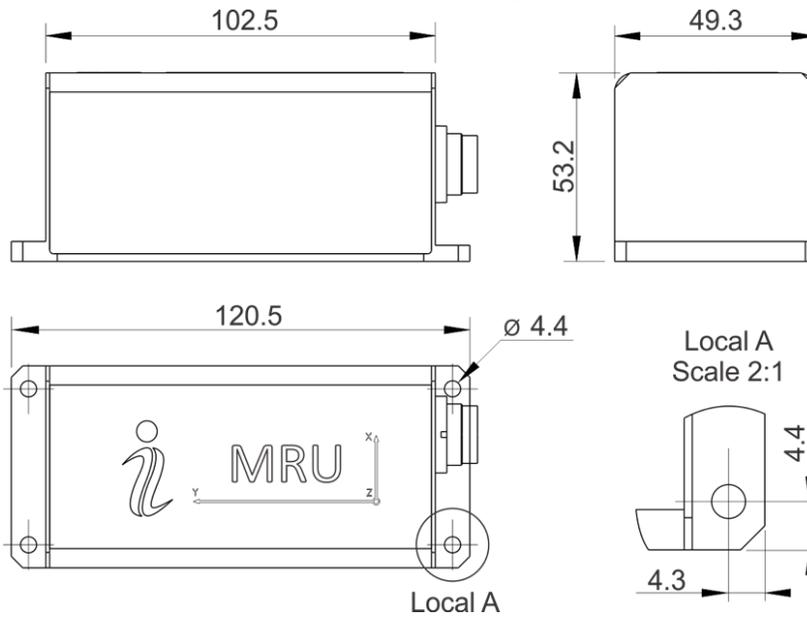
MRU-P mechanical interface drawing

Notes:

1. All dimensions are in millimeters.
2. All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.
3. Data connector type: Binder Series 723. Male receptacle, shielded, rear-mounting
4. GNSS connector type (MRU-P): TNC-Female

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