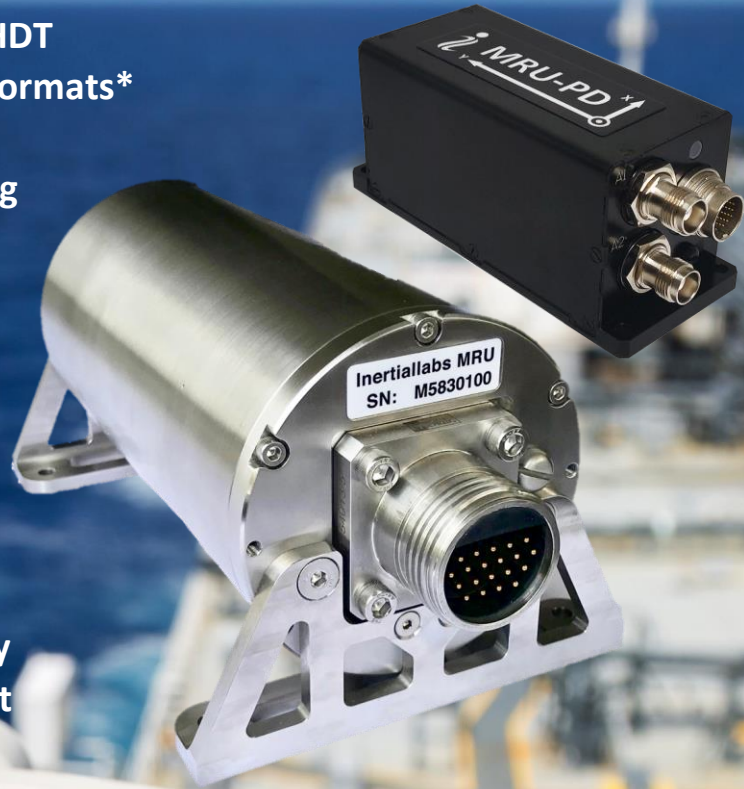# Motion Reference Unit
MRU-PD

- **3-in-1 solution: MRU + DGPS/RTK + HDT**
- **Kongsberg/Seatex, SMC & TSS data formats***
- **Compatible with SBES/MBES**
- **Input from DVL - Doppler Velocity Log**
- **IHO SP44 standard compliant**
- **DGPS/RTK Position accuracy**
- **IP-67 or Subsea Enclosure**
- **5 cm Heave accuracy**
- **5 cm Surge & Sway accuracy**
- **0.05 deg Heading accuracy**
- **0.02 deg Pitch and Roll accuracy**
- **0.005 m/sec^2 Acceleration accuracy**
- **0.0002 deg/sec Angular rate accuracy**
- **NMEA 0183, TSS1 output data format**

InertialLabs
Attitude is Everything

Inertial Labs has developed a professional version of **Motion Reference Units (MRU-PD)** to meet the requirements from marine and hydrographic applications. The **MRU-PD** is an enhanced, high-performance strapdown Motion Sensor – affordable solution for survey, that determines Pitch & Roll, Heave, Sway, Surge, Accelerations, Angular rates, Heading, Velocity and Positions for any device on which it is mounted.
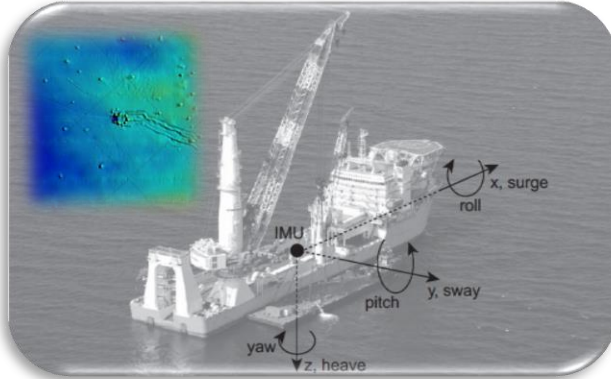
The Inertial Labs **MRU-PD Motion Reference Units** utilizes high precision, dual antenna GNSS receiver with DGPS and RTK positions accuracy, solid state 3-axes each of precision accelerometers, magnetometers, gyroscopes and barometric sensors to provide accurate Positions, Heading, Heave, Sway, Surge, 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
- ABS Design Assessed
- Kongsberg/Seatex, Teledyne and SMC data formats*
- State-of-the-art algorithms for Vessels, Ships, Active Heave Compensators, Cranes, Helideck, ROV, AUV, DP-1, DP-2, DP-3 Buoys, Echo Sounders, Offshore Platforms
- 3 cm Oceanix Nearshore Horizontal Position Accuracy, 1-0.05 m VERIPOS Horizontal Position Accuracy
- 0.02 deg RMS Pitch & Roll accuracy
- 5% or 5 cm RMS Heave accuracy
- NMEA 0183, TSS1 output data formats
- ROS, LabVIEW, HYPACK, QINSY & Inertial Explorer support
- 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.

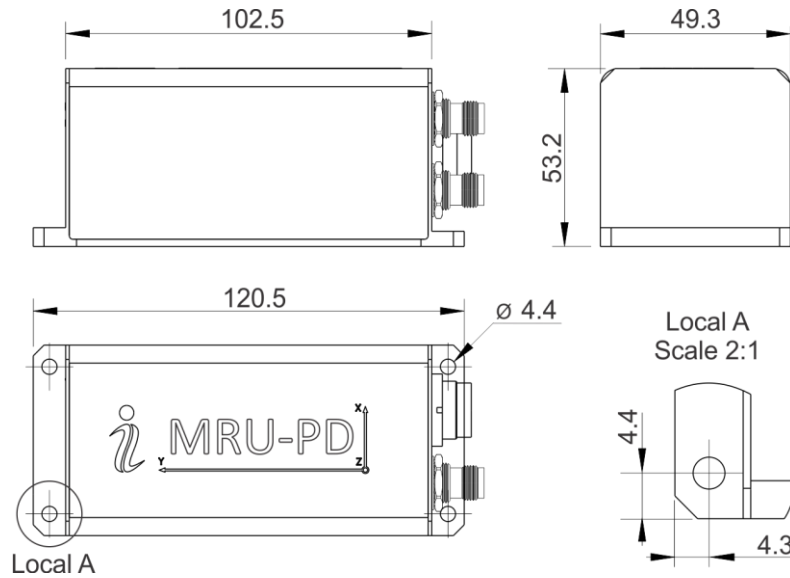| Measured Parameters	
Heave, Surge, Sway (% / cm)	✔
Pitch & Roll (deg)	✔
Precision Heading (HDT) (deg)	✔
Velocity (meters/sec)	✔
DGPS / RTK Positions (cm)	✔
ROS, LabVIEW, HYPACK, QINSy, Novatel IE support	✔

MRU-PD Specifications

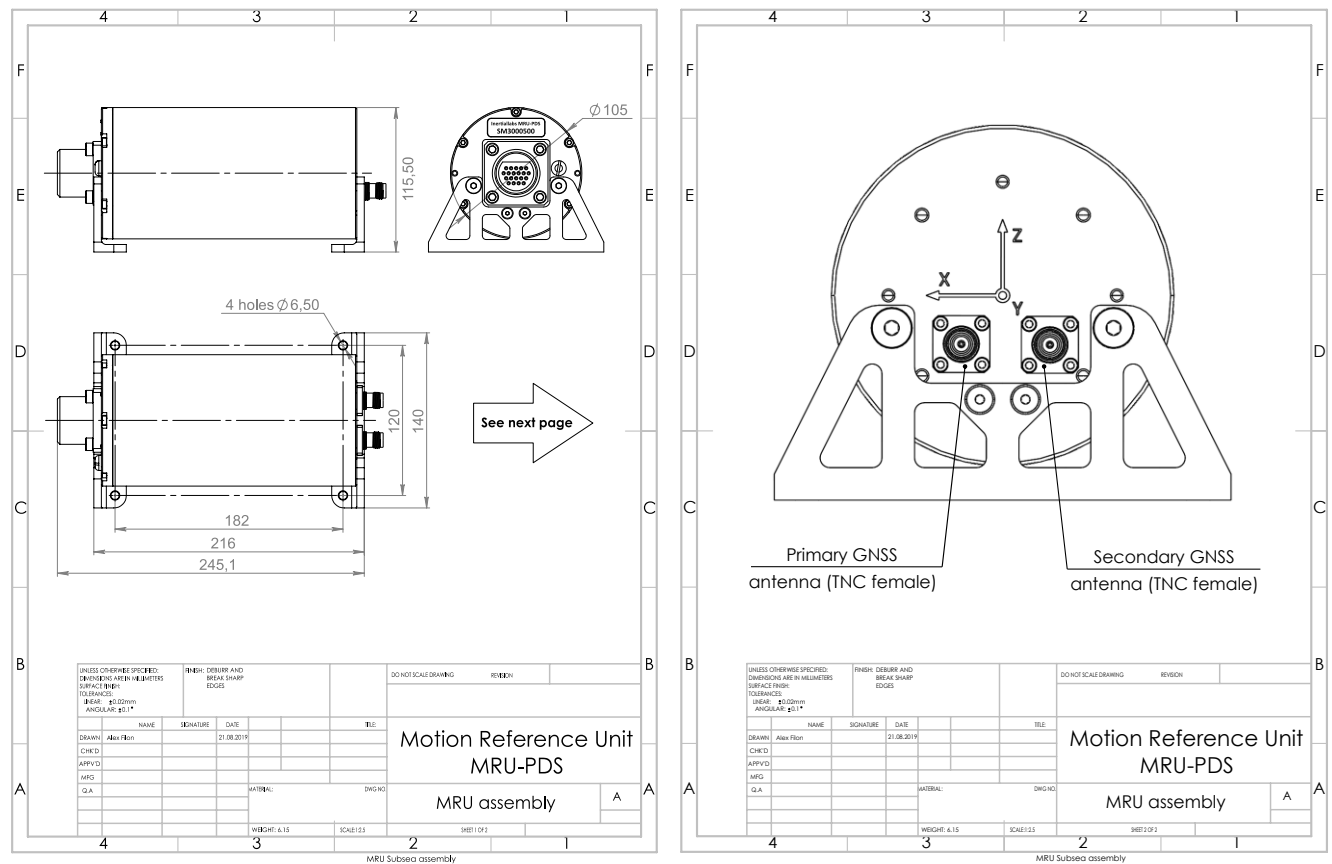| Parameter	Units	MRU-PD	
Output signals		• Heave, Surge, Sway, Heading/Yaw, Pitch, Roll, Positions, Velocities, Accelerations, Angular rates, Barometric data, PPS time	
Output data formats		• Kongsberg/Seatex, Ship Motion Control SMC, Teledyne TSS*	
Input Signal		• DVL (Doppler Velocity Log), External Stand Alone Magnetic Compass	
Compatibility		• SBES/MBES: Teledyne; R2Sonic; WAASP; Kongsberg; EdgeTech; NORBIT; IMAGENEX* • HYPACK, QINSY, Novatel Inertial Explorer software* • DP-1, DP-2, DP-3, AHC, HMS, Survey systems	
Update rate	Hz	1 … 200 (user settable)	
Internal Data Logger		64 GB (optional)	
Heave, Surge, Sway	**Units**	**MRU-PD**	
Measurement range	meters	±300	
Resolution	meters	0.01	
Real time accuracy, RMS	% (meters)	5 (0.05)	
Post Processing accuracy, RMS	% (meters)	2 (0.02)	
Pitch and Roll	**Units**	**MRU-PD**	
Range: Pitch, Roll	deg	±90, ±180	
Angular Resolution	deg	0.005	
Static Accuracy	deg	0.01	
Dynamic Accuracy	deg RMS	0.02	
Post processing accuracy	deg RMS	0.006	
Heading	**Units**	**MRU-PD**	
Range	deg	0 to 360	
Angular Resolution	deg	0.001	
Real time Static and Dynamic Accuracy	deg	0.08 (2 meters baseline)	
Real time Static and Dynamic Accuracy	deg	0.05 (4 meters baseline)	
Post processing accuracy	deg RMS	<0.03	
Positions, Velocity and Timestamps	**Units**	**MRU-PD**	
Horizontal position accuracy (SBAS), RMS	meters	0.6	
Horizontal position accuracy (DGPS), RMS	meters	0.4	
Horizontal position accuracy (RTK), RMS	meters	0.01	
Horizontal position accuracy (Oceanix Nearshore) [1], RMS	meters	0.03	
Horizontal position accuracy (VERIPOS) [1], RMS	meters	1-0.05	
Horizontal position accuracy (PPK), RMS	meters	0.005	
GNSS Velocity accuracy, RMS	meters/sec	<0.03	
IMU Velocity accuracy, RMS	meters/sec*√hr	<0.009	
PPS accuracy	nano seconds	20	
Gyroscopes	**Units**	**MRU-PD**	
Measurement range	deg/sec	±450	
Bias in-run stability (RMS, Allan Variance)	deg/hr	1	
Noise density	deg/sec√Hz	0.004	
Accelerometers	**Units**	**MRU-PD**	
Measurement range	g	±8	
Bias in-run stability (RMS, Allan Variance)	mg	0.005	
Noise density	mg√Hz	0.015	
Pressure	**Units**	**MRU-PD**	
Measurement range	hPa	300 – 1100	
Bias in-run stability (RMS, Allan Variance)	Pa	2	
Noise density	Pa/√Hz	0.8	
Environment	**Units**	**MRU-PD**	
Operating temperature	deg C	-40 to +70	
Storage temperature	deg C	-50 to +85	
MTBF	hours	100,000	
Compliance to EMCD, immunity/emission		IEC 60945/EN 60945	
Electrical	**Units**	**MRU-PD**	
Supply voltage	V DC	9 to 36	
Power consumption	Watts	5 (6 with data logger)	
Output Interface	-	RS-232 / RS-422 / Ethernet / CAN	
Output data format	-	NMEA 0183, TSS-1, Binary ASCII characters	
Physical	**Units**	**MRU-PD (IP-67)**	**MRU-PDS (Subsea)**
Size	mm	120 x 50 x 53	245 x 140 x 115
Weight	kg	0.320	6.5

(1)   Requires a subscription to a Oceanix data service, contact Inertial Labs for more information.

Inertial Labs: Address: 39959 Catoctin Ridge Street, Paeonian Springs, VA 20129 U.S.A.
Tel: +1 (703) 880-4222, Fax: +1 (703) 935-8377 Website: www.inertiallabs.com

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MRU-PD (IP-67) mechanical interface drawing

MRU-PDS (Subsea) mechanical interface drawing

See next page

Primary GNSS antenna (TNC female)

Secondary GNSS antenna (TNC female)

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<u>Notes:</u>
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
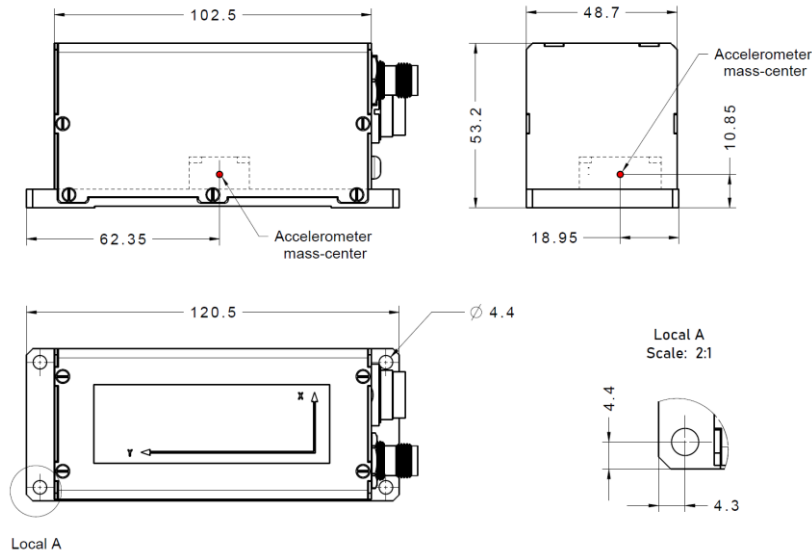4. GNSS connector type: TNC-Female

MRU-PD and MRU-PDS part numbers description									
Model	**Gyro**	**Accel**	**Calibration**	**Connector**	**Color**	**Data Logger**	**GNSS Receiver**	**Version**	**Interface**
MRU-PD	G450	A8	TGA	C3	B	S64 (optional)	O7720	VD4	1245
MRU-PDS			TMGA (optional)	C13	S			VD42	
								VD43	
								VD49	
								VD9	

Example: MRU-PD-G450-A8-TGA-C3-B-S64-07720-VD9.1245

<u>Description:</u>

- MRU-PD/MRU-PDS: Dual Antenna, Professional version of Motion Reference Unit (Heave, Surge, Sway, Pitch, Roll, High precision Heading, Position and Velocity Sensor)
- G450: Gyroscopes measurment range = ±450 deg/sec
- A8: Accelerometers measurement range = ±8 g
- TGA: Gyroscopes and Accelerometers
- TMGA: Gyroscopes, Accelerometers, Embedded Fluxgate Magnetic Compass (optional)
- C3: 24 pins connector (IP-67)
- C13: 20 pin subsea connector
- B: Black color of enclosure (IP-67)
- S: Silver color (subsea version)
- S64: 64GB embedded Data Logger (optional)
- O7720: Dual Antenna GNSS receiver
- VD4: GPS L1/L2, SBAS, Dual antenna Heading, DGPS, (40 cm position accuracy)
- VD42: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, Dual antenna Heading RTK (1 cm position accuracy)
- VD43: GPS L1/L2, GLONASS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions
- VD49: GPS L1/L2, GLONASS L1/L2, NavIC (IRNSS), Dual antenna Heading, SBAS, DGPS, 20 Hz positions; 20 Hz GNSS measurements
- VD9: GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, DGPS, RTK, Dual antenna Heading, 20 Hz measurements, 20 Hz positions
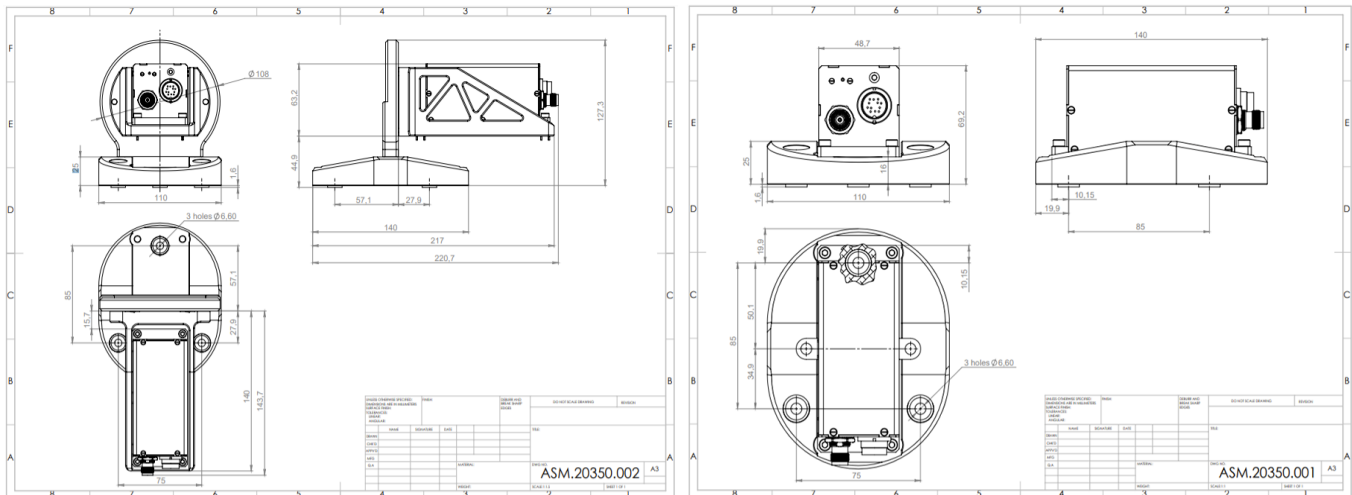- .1245: RS-232, RS-422, CAN, Ethernet

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IMU Center Diagram

DIMENSIONS ARE IN MILLIMETERS

All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.

Inertial Labs Motion Reference Units (MRU) can be easily integrated into existing systems using the following bracket.

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