WAVE Sensors

WS-E
WS-PD

- 0.5 cm Wave Height Accuracy
- 0.1 sec Wave Period Accuracy
- 0.05° Wave Direction Accuracy
- 0.02° Pitch & Roll accuracy
- 5 cm / 5% Heave accuracy
- IP67 Environmentally Sealed
- Optional Internal Data Logger
- Compatible with Buoy's Controllers

WS - Enhanced
WS - Professional Dual

Datasheet
Revision 1.4

ABS DESIGN ASSESSED
CERTIFIED ISO 9001:2015 COMPANY
MADE IN THE USA

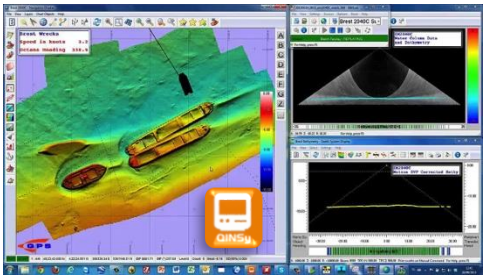
InertialLabs
Attitude is Everything

Wave Sensor Datasheet
Revision 1.4

Inertial Labs has developed **Wave Sensors (WS)** to meet industry wave statistics requirements and also generates the spectral data as a complete set of Fourier coefficients and energies. **Wave Sensors (WS)** are an enhanced, high-performance strapdown Wave, Direction & Motion Sensors, that determines Significant Wave Height, Max Wave Height, Wave Period, Wave Direction, Wave Energy, Directional Width, Fourier Coefficients, Mean Spread Angle, Heading, Pitch, Angular Rates, Accelerations, Magnetometer Data, Temperature, Heave, Heave Velocity and Position for any device on which it is mounted.

The Inertial Labs **Wave Sensors (WS)** Units utilizes solid state 3-axes each of precision accelerometers, magnetometers, gyroscopes and barometric sensors to provide accurate Wave Characteristics as well as Heave, Sway, Surge, Pitch and Roll of the device under measure.
The **Wave Sensors (WS)** can easily be integrated with a buoy or floating platform controller to transmit data in real time.

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.



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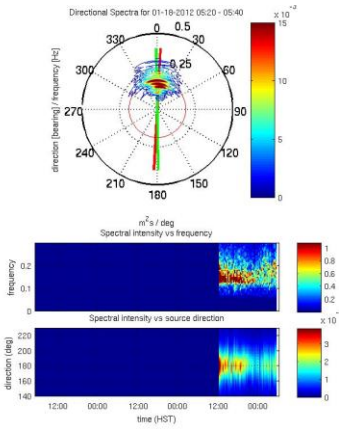
LabVIEW

Our **Wave Sensors** featuring developed few micro g Bias in-run stability Advanced Micro Electro Mechanical System (AMEMS)-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 **Wave Sensors** featuring gyros that enable sector-leading accuracy and reliability standards.



Measured Parameters	WS-E	WS-PD
	Enhanced	Professional Dual
Wave Height (meters)	✔	✔
Wave Period (sec)	✔	✔
Wave Direction (deg)	✔	✔
Heave, Surge, Sway (% / meters)	✔	✔
Pitch & Roll (deg)	✔	✔
Gyro-magnetic Heading (deg)	✔	✔
High Precision GNSS Heading (HDT) (deg)		✔
DGPS/RTK Position (meters)		✔

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Tel: +1 (703) 880-4222, Fax: +1 (703) 935-8377 Website: www.inertiallabs.com

Parameter	Units	WS-E (Enhanced)	WS-PD (Professional Dual)
Certification	-	ABS	
Basic Output Signals	-	• Significant Wave Height; Max Wave Height; Wave Period; Wave Direction; Wave Energy; Fourier Coefficient; Directional Width; Mean Spread Angle; Heading; Pitch; Angular Rates (X,Y,Z), Accelerations (X,Y,Z); Magnetometer Data; Temperature; Heave; Heave Velocity	
Input Signals	-	• Doppler Velocity Log; Gyro Compass; External Heading; External Position; External GNSS	
Output Data Formats	-	• Binary; TSS-1, NMEA 0183 ASCII; Kongsberg /Seatex; SMC; Teledyne TSS*	
Compatibility	-	• Buoy; SBES/MBES; Doppler Velocity Logger (DVL); Helideck Monitoring System (HMS) • HYPACK; QINSY; Novatel Inertial Explorer software* • DP-1; DP-2; DP-3; AHC; Survey systems	
Internal Data Logger	-	Optional (64 GB)	Optional (64 GB)
Update Rate	Hz	1-200 (User Settable)	1-200 (User Settable)
IP Grade	-	IP67	IP67
Wave Period			
Range	seconds	1 to 30	1 to 30
Resolution	seconds	0.001	0.001
Accuracy	% (seconds)	1 (0.1)	1 (0.1)
Wave Mean Period	seconds	Yes	Yes
Wave Peak Period	seconds	Yes	Yes
Wave Height			
Range	meters	±300	±300
Resolution	meters	0.001	0.001
Accuracy	meters	0.05	0.005
Wave Direction			
Range	deg	0 to 360	0 to 360
Resolution	deg	0.01	0.001
Accuracy	deg	0.5	0.05
Wave Mean Direction	deg	Yes	Yes
Wave Peak Direction	deg	Yes	Yes
Wave Characteristics			
	-	Fourier Coefficient Spectrum; Mean Spreading Angle; Directional Width; Long Crestedness Parameter; Mean Wave Direction Spectrum; Principal Wave Direction Spectrum; Average Wave Power; Number of Zero Crossings	
Pitch and Roll			
Range	deg	±90, ±180	±90, ±180
Angular Resolution	deg	0.01	0.005
Accuracy	deg	0.02	0.02
Heading			
Range	deg	0 to 360	0 to 360
Angular Resolution	deg	0.01	0.001
Accuracy	deg	0.6	0.05
Heave, Surge and Sway			
Measurement Range	meters	±300	±300
Resolution	meters	0.01	0.01
Real Time Accuracy, RMS	% / (meters)	5 / (0.05)	5 (0.05)
Positions and Velocity			
Horizontal position accuracy (DGPS), RMS	meters	External Source	0.4
Horizontal position accuracy (RTK), RMS	meters	External Source	0.01 + 1 ppm
Horizontal position accuracy (Oceanix Nearshore), RMS (1)	meters	External Source	0.03
Horizontal position accuracy (VERIPOS), RMS (1)	meters	External Source	1-0.05
Velocity Accuracy, RMS	meters/sec	External Source	0.03
GNSS Receiver			
Number of GNSS Antennas	-	External Source	Dual
Supported navigation signal	-	External Source	GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, SBAS, DGPS, RTK
Velocity accuracy, RMS	meters/sec	External Source	<0.03
Initialization time	seconds	External Source	<50 (cold start), <30 (hot start)
Environment			
Operating temperature	deg C	-40 to +70	-40 to +70
Storage temperature	deg C	-50 to +85	-50 to +85
MTBF	hours	250,000	250,000
Vibration	-	IEC 60945/EN 60945	IEC 60945/EN 60945
Electrical			
Supply voltage	V DC	9 to 36	9 to 36
Power consumption	Watts	1.4	2.6
Compliance to EMCD, immunity/emission	-	IEC 60945/EN 60945	IEC 60945/EN 60945
Output Data Formats	-	Binary; TSS-1; NMEA 0183 ASCII; Kongsberg/Seatex; SMC; Teledyne TSS*	
Interface		RS-232; RS-422; Ethernet	RS-232; RS-422; Ethernet
Physical			
Size	mm	120 x 50 x 53	120 x 50 x 53
Weight	gram	320	320

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

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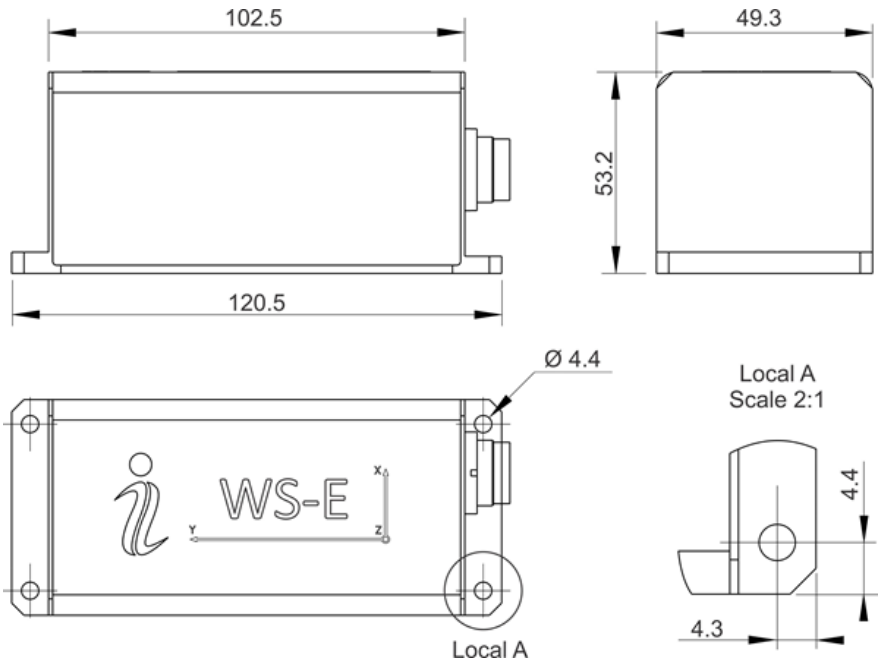
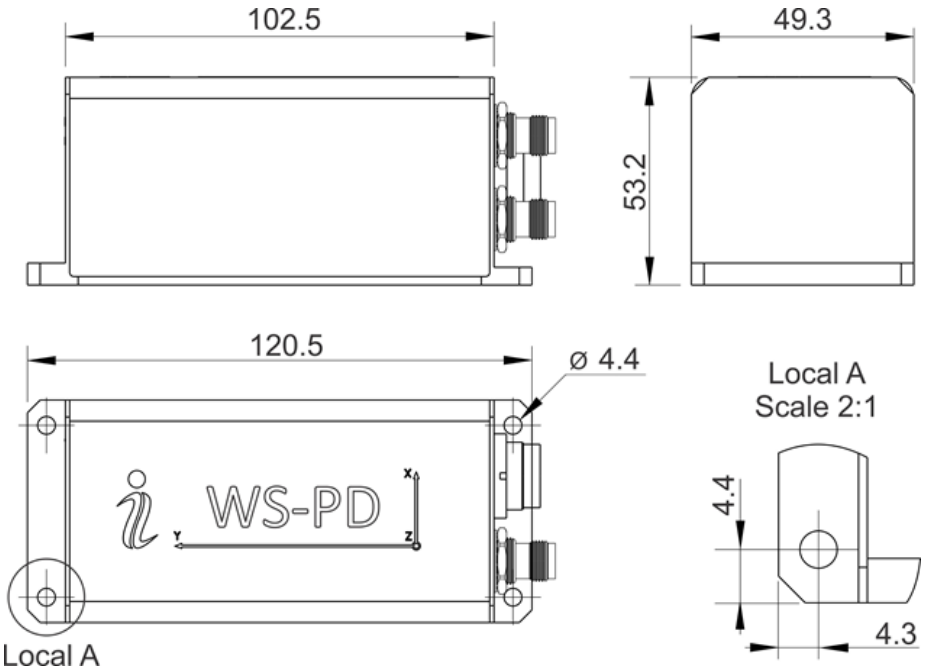
Wave Sensor (WS-E) Mechanical Interface Drawings



Wave Sensor (WS-PD) Mechanical Interface Drawings



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 (WSU-PD): TNC-Female

WS-E Part numbers structure (IP-67)

WS-E part numbers description								
Model	**Gyro**	**Accel**	**Calibration**	**Connector**	**Color**	**Storage**	**Version**	**Interface**
WS-E	G450	A8	TMGA	C3	B	S8	V0	12
						S64		15

Example: WS-E-G450-A8-TMGA-C3-B-S8-V1.12

WS-ES Part numbers structure (Subsea)

WS-ES part numbers description								
Model	**Gyro**	**Accel**	**Calibration**	**Connector**	**Color**	**Storage**	**Version**	**Interface**
WS-ES	G450	A8	TMGA	C3	B	S8	V0	12
						S64		15

Example: WS-ES-G450-A8-TMGA-C3-B-S8-V1.12

WS-PD Part numbers structure (IP-67)

WS-PD part numbers description									
Model	**Gyro**	**Accel**	**Calibration**	**Connector**	**Color**	**Storage**	**GNSS Receiver**	**Version**	**Interface**
WS-PD	G450	A8	TGA	C3	B	S8	O7720	VD4	12
						S64		VD42	15

Example: WS-PD-G450-A8-TGA-C3-B-S8-O7720-VD4.12

Description:

- WS-E: Heading, Heave, Surge, Sway, Pitch and Roll Sensor + Wave Direction, Fourier Coefficients, Wave Spectrum (IP-67)
- WS-ES: Heading, Heave, Surge, Sway, Pitch and Roll Sensor + Wave Direction, Fourier Coefficients, Wave Spectrum (Subsea)
- WS-PD: Heave, Surge, Sway, Pitch, Roll, Heading, Position and Velocity Sensor + Wave Direction, Wave Position, Fourier Coefficients, Wave Spectrum (IP-67)
- G450: Gyroscopes measurment range = ±450 deg/sec
- A8: Accelerometers measurement range = ±8 g
- TGA: Gyroscopes and Accelerometers
- TMGA: Magnetometers, Gyroscopes and Accelerometers (WS-E/WS-ES only)
- C3: 24 pins connector
- B: Black color of enclosure
- S8: 8GB of internal storage
- S64: 64GB of internal storage
- O7720: GNSS receiver
- V0.X: Standard – no receiver
- VD4.X: DGPS (40 cm position accuracy) – (WS-PD only)
- VD42.X: RTK (1 cm position accuracy)
- X.1Y: RS-232 + (Y: (2) RS-422; (5) Ethernet)