WAVE Sensors

- 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 or Subsea Enclosure
- Optional Internal Data Logger
- Compatible with Buoy's Controllers

WS - Enhanced WS - Professional Dual







WS-E

WS-PD



Wave Sensor Datasheet Revision 1.10

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.



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.

Directional Spectra for 01-16-2012 05:20 - 05:40 x 10 330 0 0.5 30	Measured Parameters	WS-E	WS-PD
Al 25 60 10	Weasured Parameters	Enhanced	Professional Dual
90	Wave Height (meters)	~	✓
240	Wave Period (sec)	✓	✓
210 150	Wave Direction (deg)	✓	✓
m ² s / deg Spectral intensity vs frequency	Heave, Surge, Sway (% / meters)	 Image: A set of the set of the	✓
Co 0.2 0.6 0.4 0.4	Pitch & Roll (deg)	×	✓
D Spectral Intensity vs source direction x 10	Gyro-magnetic Heading (deg)	✓	✓
12) 200 Log 100 100 100	High Precision GNSS Heading (HDT) (deg)		✓
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Attitude is Everything

Wave Sensor Datasheet Revision 1.10

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Velocity accuracy, RMSmeters/secExternal Source<.0.3Initialization timesecondsExternal Source<.50 (cold start), <.30 (hot start)		-			GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5,		
EnvironmentImage: Constraint of the sector of	Velocity accuracy, RMS	meters/sec	Externa	I Source	<0	0.03	
$ \begin{array}{c c c c c c } \hline Operating temperature & deg C & -40 to +70 & -40 to +70 \\ \hline Storage temperature & deg C & -50 to +85 & -50 to +85 \\ \hline Storage temperature & deg C & -50 to +85 & -50 to +85 \\ \hline MTBF & hours & 250,00 & -0 & 250,00 \\ \hline MTBF & hours & 250,00 & -0 & 250,00 \\ \hline IEC 60945/K 60945 & 0.250,00 & -0 & -0 & -0 & -0 \\ \hline IEC 60945/K 60945 & -0 & -0 & -0 & -0 & -0 \\ \hline IEC 60945/K 60945 & -0 & -0 & -0 & -0 & -0 & -0 \\ \hline Supply voltage & V DC & 9 to 3 & -0 & -0 & -0 & -0 & -0 & -0 \\ \hline Output Data Formats & -0 & -0 & -0 & -0 & -0 & -0 & -0 & -$	Initialization time	seconds	Externa	I Source	<50 (cold start)), <30 (hot start)	
Storage temperaturedeg C $-50 t + 85$ $-50 t + 85$ MTBFhours $250 \cdot 0$ $250 \cdot 0$ $250 \cdot 0$ International Control $ 1EC 60945 \cdot K 60945$ $1EC 60945 \cdot K 60945$ Electrical $ -$ Supply voltageV DC $0 + 0 = 0$ $0 + 0 = 0$ $0 = 0 = 0$ Power consumptionWatts $1.4 (2.4 with data logger)$ $2.6 (3.6 with data logger)$ Compliance to EMCD, immunity/emission $ 1EC 60945 \cdot K 60945$ Compliance to EMCD, immunity/emission $ -$ Output Data Formats $ -$ Number of the face $ -$ Physical $ -$ Physical $ -$ Sizemm $120 \times 50 \times 53$ $245 \times 140 \times 115$ $120 \times 50 \times 53$ 245 $\times 140 \times 115$ $ -$ Sizemm $ -$ Sizemm $ -$ <td>Environment</td> <td></td> <td></td> <td></td> <td></td> <td></td>	Environment						
$\begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Operating temperature	deg C	-40 t	o +70	-40 t	o +70	
Vibration - IEC 60945/EN 60945 IEC 60945/EN 60945 Electrical V V - IEC 60945/EN 60945 Supply voltage V DC 9 to 36 9 to 36 Power consumption Watts 1.4 (2.4 with data logger) 2.6 (3.6 with data logger) Compliance to EMCD, immunity/emission - IEC 60945/EN 60945 IEC 60945/EN 60945 Output Data Formats - Binary; TSS-1; NMEA 0183 XSCI; Kongsberg/Seatex; SMC; Televent TSS* Interface RS-232; RS-22; Ethernet RS-232; RS-22; Ethernet Physical IP-67 Subsea Size mm 120 x 50 x 53 245 x 140 x 115	Storage temperature	deg C	-50 t	o +85	-50 t	o +85	
Electrical VDC 9 to 3 9 to 3 Supply voltage VDC 9 to 3 9 to 3 Power consumption Watts 1.4 (2.4 with data logger) 2.6 (3.6 with data logger) 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; Tely were TSS* Physical IP-67 Subsea IP-67 Size mm 120 x 50 x 53 245 x 140 x 115 120 x 50 x 53		hours	250	,000	250	,000	
$\begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Vibration	-	IEC 60945	/EN 60945	IEC 60945	/EN 60945	
Power consumption Watts 1.4 (2.4 with data logger) 2.6 (3.6 with data logger) Compliance to EMCD, immunity/emission - IEC 60945/EN 60945 IEC 60945/EN 60945 Output Data Formats - - IEC 60945/EN 60945 IEC 60945/EN 60945 Interface - <t< td=""><td>Electrical</td><td></td><td></td><td></td><td></td><td></td></t<>	Electrical						
Compliance to EMCD, immunity/emission - IEC 60945/K 60945 IEC 60945/K 60945 Output Data Formats - <t< td=""><td>Supply voltage</td><td>V DC</td><td></td><td></td><td></td><td></td></t<>	Supply voltage	V DC					
Output Data Formats	Power consumption	Watts					
Interface RS-232; RS-422; Ethernet RS-232; RS-422; Ethernet Physical IP-67 Subsea IP-67 Subsea Size mm 120 x 50 x 53 245 x 140 x 115 120 x 50 x 53 245 x 140 x 115				,			
Physical IP-67 Subsea IP-67 Subsea Size mm 120 x 50 x 53 245 x 140 x 115 120 x 50 x 53 245 x 140 x 115		-					
Size mm 120 x 50 x 53 245 x 140 x 115 120 x 50 x 53 245 x 140 x 115						· · · · · · · · · · · · · · · · · · ·	
	Physical						
Weight kg 0.320 6.5 0.320 6.5		mm					
	Weight	kg	0.320	6.5	0.320	6.5	

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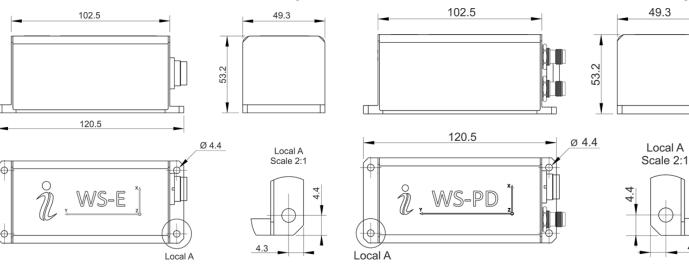


Wave Sensor Datasheet Revision 1.10

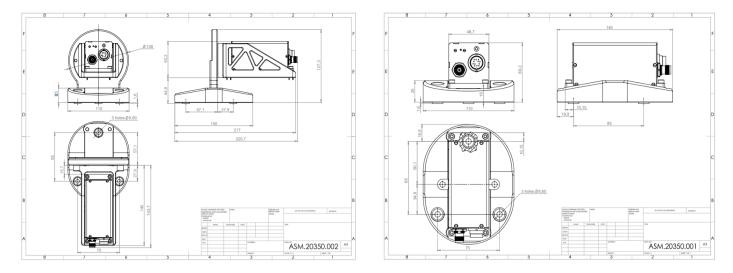
4.3

Wave Sensor (WS-PD) Mechanical Interface Drawings

Wave Sensor (WS-E) Mechanical Interface Drawings



Inertial Labs IP67 sealed Wave Sensors (WS-E, WS-PD) can be easily integrated into existing systems using the following bracket.



Notes:

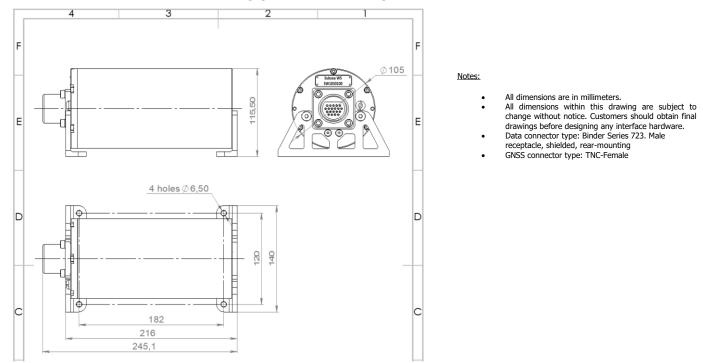
- 1. All dimensions are in millimeters.
- 2. All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.
- 3. Data connector type: Binder Series 723. Male receptacle, shielded, rear-mounting
- 4. GNSS connector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

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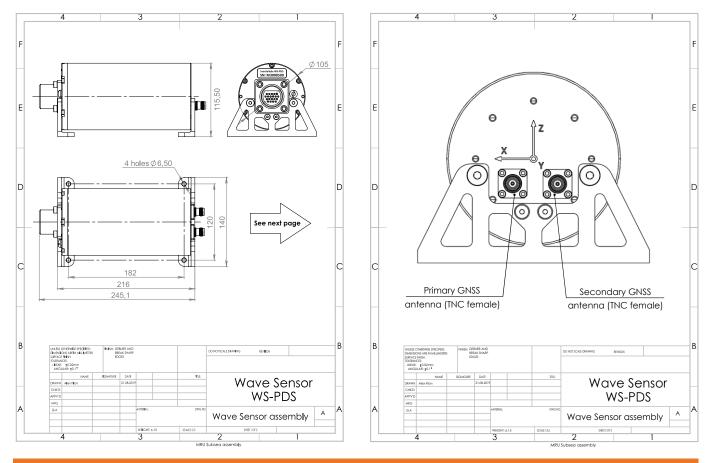


Wave Sensor Datasheet Revision 1.10

WS-ES mechanical interface drawing (Subsea enclosure)



WS-PDS mechanical interface drawing (Subsea enclosure)



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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	S64	V0	1245			

WS-ES Part numbers structure (Subsea)

	WS-ES (Subsea) part numbers description										
Model	Gyro	Accel	Calibration	Connector	Color	Storage	Version	Interface			
WS-ES	G450	A8	TMGA	C13	S	S64	V0	1245			

WS-PD Part numbers structure (IP-67)

	WS-PD part numbers description									
Model WS-PD	Gyro G450	Accel A8	Calibration TGA TMGA (optional)	Connector C3	Color B	Storage S64 (optional)	GNSS Receiver 07720	Version VD4 VD42 VD43 VD49 VD9	Interface 1245	

WS-PDS Part numbers structure (Subsea)

	WS-PDS (Subsea) part numbers description										
Model WS-PDS	Gyro G450	Accel A8	Calibration TGA TMGA (optional)	Connector C13	Color S	Storage S64 (optional)	GNSS Receiver 07720	Version VD4 VD42 VD43 VD49 VD9	Interface 1245		

Example: WS-PD-G450-A8-TGA-C3-B-S64-O7720-VD4.1245

Description:

- WS-E/WS-ES: Heading, Heave, Surge, Sway, Pitch and Roll + Wave Direction, Fourier Coefficients, Wave Spectrum (IP-67)
- WS-PD/WS-PDS: Heave, Surge, Sway, Pitch, Roll, Heading, Position, Velocity + Wave Direction, Wave Position, Fourier Coefficients, Wave Spectrum
- G450: Gyroscopes measurment range = ±450 deg/sec
- A8: Accelerometers measurement range = ±8 g
- TGA: Gyroscopes and Accelerometers
- TMGA: Magnetometers (optional), Gyroscopes and Accelerometers
- C3: 24 pins connector (IP67)
- C13: 20 pins connector (subsea)
- B: Black color of enclosure (IP67)
- S: Silver color of enclosure (Subsea)
- S64: 64GB of internal storage (optional)
- ------WS-PD/WS-PDS------
- OEM7720: Novatel OEM 07720: 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
- ------WS-E/WS-ES/WS-PD/WS-PDS- .1245: RS-232, RS-422, CAN, Ethernet