



BII7110 Series Flush-Mounting Hydrophone

BII7110 series hydrophones mount through a hole or counterbore hole cut in the housing of underwater instruments, apparatus, vehicles (or towed streamlined body) or the wall of swimming pools. The flush-mounting design of these transducers minimizes surface discontinuity between the transducer and the mounting wall (or hull), and allows for smooth water flow over the surfaces, resulting in much lower induced acoustic noise (hydrodynamic noise, flow noise), less drag/resistance, avoidance of accidental collision and better acoustic performance for the underwater devices in motion such as towed fish/bodies, ROV/AUV/UUV, robots, etc... Low-profile flush installation protrudes only 4.75mm outside the housing with streamlined flange.

The hydrophone can be mounted on different materials such as woods, plastics, fiber glass, ceramics and metals. Marine sealants shall be used for sealing, bedding and installation. The depth rating is limited by the sealing performance of the cured marine sealants.

Sound Excitation by Turbulence: $\frac{1}{c^2} \frac{\partial^2 p}{\partial t^2} - \Delta p = \rho \frac{\partial^2 v_i v_k}{\partial x_i \partial x_k}$; v-Velocity of Turbulence Flow; c-Sound Speed in Fluid. p-Pressure; ρ-Fluid Density; x-Position.

Typical Applications

Towed Sonar/Bodies, Vessels in Motion, Sonobuoy	LBL/SBL/USBL Positioning System
Studies of Ocean Turbulence and Flow, Marine Hydrodynamics	Communication/Remote Control/Telemetry
Monitoring Aquarium/Pool Safety/Alarm System/Underwater Security	Process Measurement and Control, Leaking Detection

Specification

Part Number:	BII7111	BII7111DF	BII7112	BII7112DF	BII7113	BII7114
Metric Thread:	M35x1.5		M35x1.5		M14x1.5	M10x1.5
Sensitivity:	-197 ±2dB	-191 ±2dB	-205 ±2dB	-200 ±2dB	-201 ±2dB	201 ±2dB
at 1 kHz (V/μPa)	Sensitivity Loss over Cable (dB)=20*log[C _h /(C _h +C _c)]; C _h : Hydrophone Capacitance; C _c : Capacitance of Cable. Cable is of 100 pF/meter roughly.					
FFVS:	Free-field Voltage Sensitivity, Refer to Graph of FFVS vs. Frequency .					
Frequency Range in Water:	1 Hz ~ 300 kHz, ±3 dB V/μPa.		1 Hz ~ 450 kHz, ±3 dB V/μPa.			
	-3dB high pass filter f _{-3dB} = 1/(2πR _i C _h). R _i : Input Resistance or Impedance of Preamp. C _h : Capacitance of hydrophone at 1 kHz.					
	(1) BII7111DF and preamp R, 200MΩ constitute high pass filter with -3dB frequency 3.46Hz. (2) BII7112DF and preamp R, 200MΩ constitute high pass filter with -3dB frequency 2.10Hz.					
Hydrophone is high impedance devices in low frequency range. Its simplified complex impedance = j/(2πfC _h), C _h is the capacitance of hydrophone, f is frequency in Hz. This impedance is in series with preamp R _i .						
Usable Frequency in Air:	1 Hz ~ 6.5 kHz at -3dB V/μPa			5 Hz ~ 11 kHz		10 Hz ~ 26 kHz
Built-in Preamp:	None. Order Preamp and filters separately.					
Capacitance C _h @1kHz:	0.83 nF	0.23 nF	1.4 nF	0.38 nF	0.32 nF	0.1 nF
Dissipation @1kHz:	0.026					
Noise Density at f << fs: dB μPa/√Hz	35.2 – 10*log f	35.7 – 10*log f	37.7 – 10*log f	37.9 – 10*log f	46.7 – 10*log f	52.4 – 10*log f
	1. f in kHz; fs: Resonance Frequency which is close to the frequency of maximum FFVS.					
	2. Noise densities in this datasheet are calculated values with transducer parameters being measured in water. 3. As hydrophones works with preamps or data acquisition modules, total noise density is determined by all noise sources. Generally, the total noise density is much higher than the ones stated in this datasheet.					
Receiving Face:	Circular Planar Face					
Acoustic Aperture:	Φ27 mm			Φ10 mm	Φ4 mm	
Directivity Pattern:	Conical Beam					
-3 dB Beam Width:	2350°/f(kHz)			6345°/f(kHz)		15862°/f(kHz)
Frequency f _{-3dBML} :	30 kHz			82 kHz		176 kHz
	f _{-3dBML} : Main Lobe drops -3dB at ±90° normal to acoustic axis.					
Critical Frequency f _c :	70 kHz.			180 kHz		450 kHz
	Side lobes exist with operating frequency f > f _c ; The hydrophone has no side lobe with f ≤ f _c .					
±90° Sidelobe Frequency f _n :	93 kHz.			240 kHz		600 kHz
	First Side Lobes exist at ±90° normal to acoustic axis with operating frequency f = f _n .					
Signal Type:	Single Ended	Differential	Single Ended	Differential	Single Ended	Single Ended
Acceleration Sensitivity:	148.7 dB along acoustic axis.			143.6 dB μPa/(m/s ²) along acoustic axis.		
	141.0 dB along other directions.			141.0 dB μPa/(m/s ²) along other directions.		
Underwater Projector:	Yes.	No	Yes.	No	No	No
Do NOT use the hydrophone as a sound projector in the air otherwise the hydrophone will be damaged.						
Resonance fs:	200 kHz	N/A	350 kHz	N/A	N/A	N/A
Maximum Drive Voltage:	600 Vpp	N/A	600 Vpp	N/A	N/A	N/A
Maximum Pulse Length:	For Projector ONLY: 100 mS at Maximum Drive Voltage					
Duty Cycle in Water:	For Projector ONLY: 10% at Maximum Drive Voltage. 100% at ≤ 30 Vpp or 10.6 Vrms.					

Sidelobe Level:	< -20 dB when $f > f_c$. No side lobe when $f \leq f_c$.		
Depth Rating:	100 m to 300 m, limited by the performance of the sealing materials. For deeper underwater deployment (maximum 300m), one option is that O-ring grooves are cut on the mounting wall and O-rings are used besides marine sealants or casting sealants. The surface finish of the flange against the mounting wall: 50.8 microns Ra, Linear tolerance +/-0.12mm.		
Flush Mounting (FSM):	Counterbore hole or through-hole shall be drilled or cut on the wall or hull to install hydrophones. Please refer to Table 1. Flush Mounting (Marine Sealant or Gasket) (FSM) .		
Marine Sealants or Gaskets:	BII does NOT provide sealing materials such as marine sealants and gaskets. Buyer may buy these materials from buyer's local stores of adhesives, boats, automobiles, and industry suppliers.		
Cable Options:	Single Ended Signal: 1. Coax RG174/U (RG174) 2. Coax RG178/U (RG178), up to 200°C. 3. Coax RG58/U (RG58)		
	Differential Signal: 4. Shielded Cable with Twisted Pair and PVC Jacket, $\Phi D=3.6$ mm (SC36) 5. Shielded Cable with Twisted Pair and PVC Jacket, $\Phi D=6$ mm (SC60) 6. Shielded Cable with Twisted Pair and Teflon (PTFE) Jacket, $\Phi D=3.2$ mm (SC32), up to 200°C. Non-Waterproof.		
Cable Length:	0.3 m (1 ft)		
	Preamps, DAQ, and/or Signal Conditioning Devices should be close to hydrophones to avoid signal loss over cable.		
Connector:	Wire Leads (WL), No Connector.		
Size ($\Phi D \times H$):	Refer to Table 1.		
Weight:	300 grams	295 grams	90 grams 60 grams
Operation Temperature:	1. Default: -10°C to 60°C, or 14°F to 140°F. 2. Bespoke High Temperature: -10°C to 120°C, or 14°F to 248°F. Append HT to part number.		
Storage Temperature:	-20 to 60 °C, or -4 to 140 °F.		
Underwater Projector Application: for 50Ω BNC/SMC/SMA connector, it is buyer's sole responsibility to make sure that the BNC/SMC/SMA shield of the signal source is firmly grounded for operating safety before hooking up transducer/hydrophone to the signal source. Coax with BNC/SMC/SMA is not intended for hand-held use at voltages above 30Vac/60Vdc.			
Sound Measurement in Air: The hydrophones can be used to detect sounds in air. The sensitivity in air is same to the one in water in low frequency range.			

Table 1. Flush Mount (Marine Sealant or Gasket) (FSM) (Dimension Unit: mm)

Acoustic Aperture	Material	Thread	Housing Length L	Flange Diameter ΦD	Mounting Wall Thickness	Fastening Torque
$\leq \Phi 5$ mm	Stainless Steel	M10x1.5	24.75	$\Phi 18$	$\leq (L - 14)$	≤ 20 Nm
$\leq \Phi 10$ mm	Anodized Aluminum	M14x1.5	26.75	$\Phi 22$	$\leq (L - 16)$	≤ 10 Nm
$\leq \Phi 27$ mm	Anodized Aluminum	M35x1.5	29.75	$\Phi 59$	$\leq (L - 13)$	≤ 20 Nm

Hex Nut: Included, for dry use ONLY. Material: Steel. **Moisture-Resistant Grease is recommended to resist moisture to prevent corrosion if necessary.**

BII does NOT provide sealing materials such as marine sealants and gaskets. Buyer may buy these materials from buyer's local stores of adhesives, boats, automobiles, and industry suppliers.

Threadlockers are recommended to prevent threaded fasteners from loosening due to shock and vibration. NOT provided by BII.

How to Order Standard Hydrophones. BII Keeps Standard Products in Stock.

Hydrophone Part Number	-Cable Length in Meter	-Cable Type	-Connector Type
BII7111DF BII7112DF	0.3m (1ft)	Shielded Cable with Twisted Pair SC60	WL: Wire Leads.
Example:	Description		
BII7111DF-0.3m-SC60-WL	BII7111DF Hydrophone, 0.3m Shielded Cable with Twisted Pair SC60 , Wire Leads.		
BII7112DF-0.3m-SC60-WL	BII7112DF Hydrophone, 0.3m Shielded Cable with Twisted Pair SC60 , Wire Leads.		

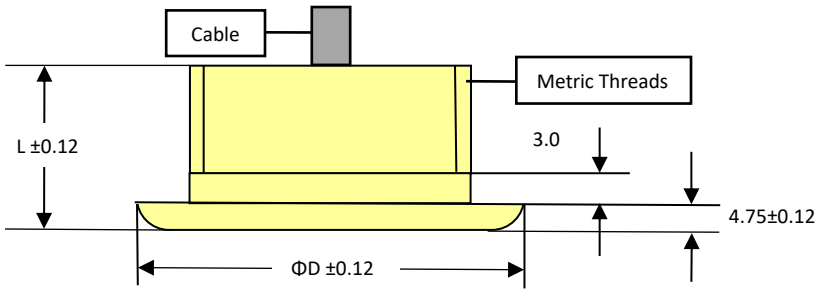
How to Order Bespoke Hydrophones. Non-stock.

Hydrophone Part Number	-Cable Length in meter	-Cable Type	-Connector Type
BII7111, BII7111DF, BII7112, BII7112DF, BII7113, BII7114.	Refer to Sensitivity Loss .	Refer to Cable Options .	WL: Wire Leads
Example:	Description		
BII7111DF-3m-SC36-WL	BII7111DF Hydrophone, 3m Shielded Cable with Twisted Pair SC36 , Wire Leads.		
BII7111-3m-RG58-WL	BII7111 Hydrophone, 3m Coax RG58/U (RG58), Wire Leads.		

Wirings

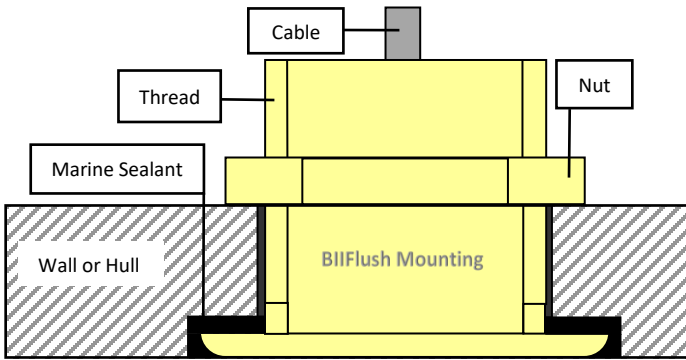
Wiring of Differential Output:	Wire Leads	
Signal +	White or Red	Red
Signal -	Black	White
Common & Shielding	Shield	Shield
Wiring of Single Ended Output:	Coax with Wire Leads	
Signal	Coax Center Contact	
Signal Common	Coax Shield	
Shielding	Coax Shield	

Physical Size (Dimensional Unit: mm): Nut is included with shipment.

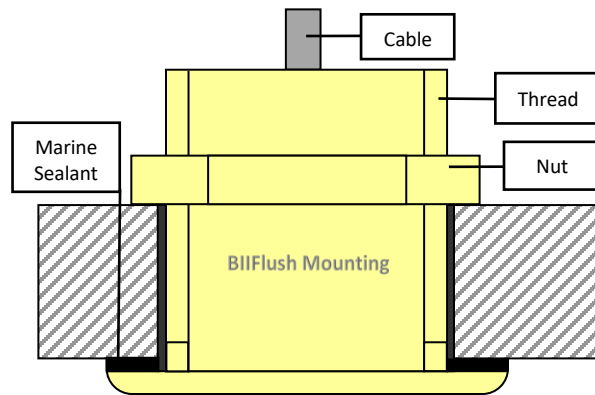


Installation/Mounting

Flush Mounting with Counterbore Hole.

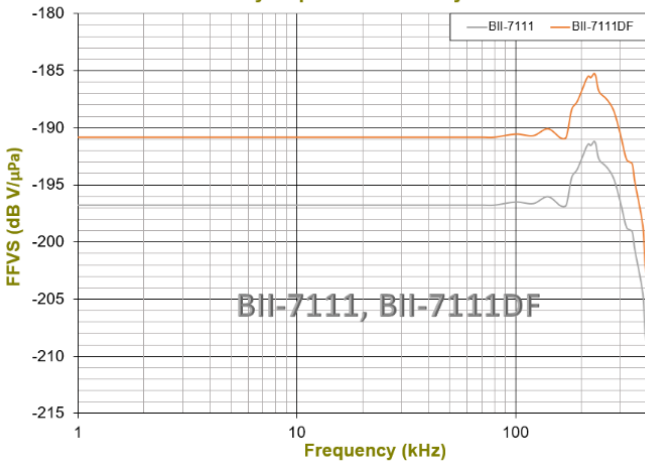


Low-profile Flush Mounting

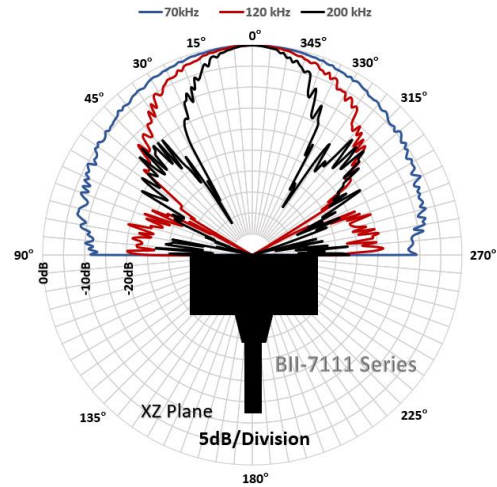


FFVS (Free-field Voltage Sensitivity)

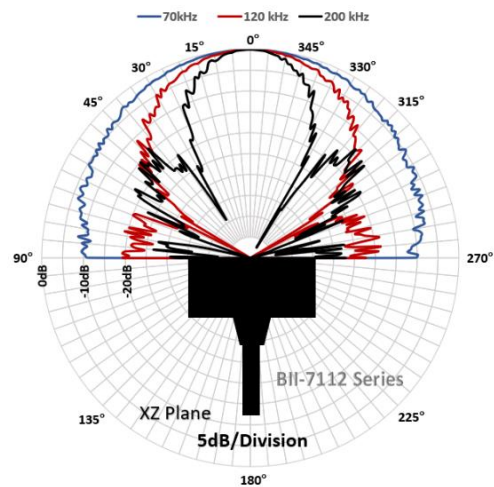
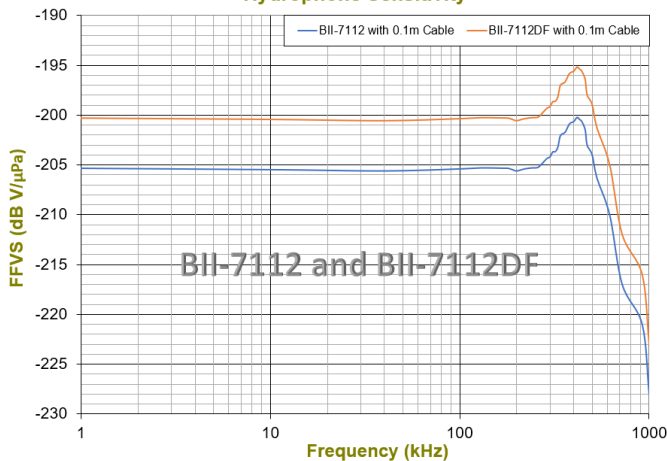
Hydrophone Sensitivity



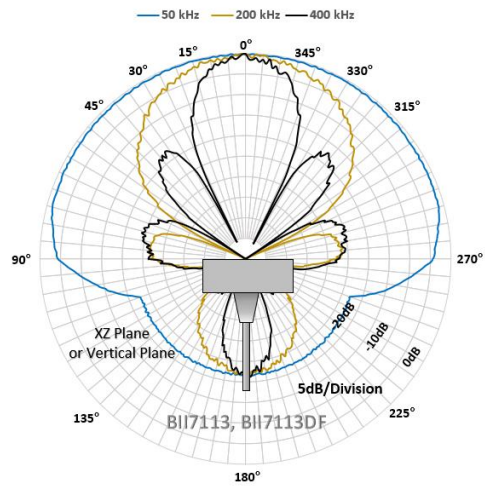
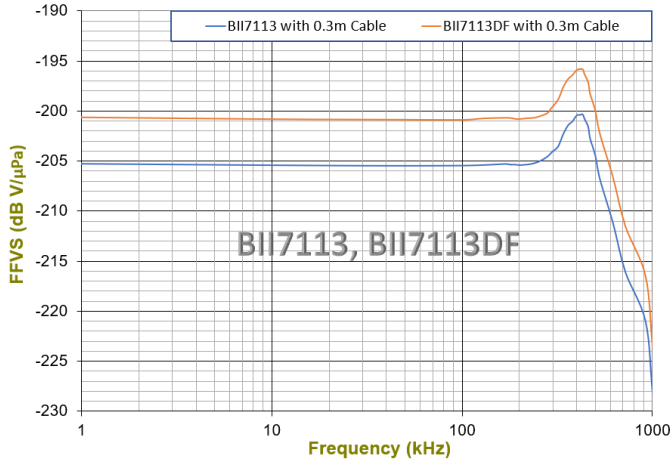
Directivity Pattern



Hydrophone Sensitivity



Hydrophone Sensitivity



Hydrophone Sensitivity

