

Acoustic Transducers and Measurement Systems

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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; p-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	BII7113DF	BII7114
Metric Thread:	M35x1.5	M35x1.5	M35x1.5	M35x1.5	M14x1.5	M14x1.5	M10x1.5
Sensitivity:	-201 ±2dB	-195 ±2dB	-208 ±2dB	-203 ±2dB	-208 ±2dB	-202 ±2dB	205 ±2dB
at 1 kHz (V/μPa)	$\textbf{Sensitivity Loss over Cable } (dB) = 20*log[C_h/(C_h + C_c)]; C_h: Hydrophone Capacitance; C_c: Capacitance of Cable.$						•
,	Cable is of 100 pF/meter roughly. Free-field Voltage Sensitivity, Refer to Graph of FFVS vs. Frequency.						
FFVS:	Free-field Volta	ge Sensitivity, Ref	er to Graph of FFV	S vs. Frequency.	_	_	
	1Hz~300kHz	5Hz~300kHz	1Hz~450kHz	5Hz~450kHz	5Hz~450kHz	20Hz~450kHz	10Hz~450kl
	-3dB high pass filter $f_{-3dB} = 1/(2\pi R_i C_h)$. R _i : Input Resistance or Impedance of Preamp. C _h : Capacitance of hydrophology						ohone at 1 kHz.
Frequency Range in Water:	1 1	•		pass filter with -3dl			
				pass filter with -3dl			2 (0) 0 :
				equency range. Its simpedance is in se			$2\pi t C_h$), C_h is the
Usable Frequency in Air:	1Hz ~ 6.5kHz	5Hz ~ 6.5kHz	1Hz ~ 6.5kHz	5Hz ~ 6.5kHz	5Hz ~ 11kHz	20Hz ~ 11kHz	10Hz ~ 26kH
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	0.08 nF	0.1 nF
Dissipation @1kHz:	0.026						0.1
	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	47.0–10*log f	52.4–10*log
				o the frequency of m		47.0 10 log l	32.4 10 108
Noise Density at f << fs:		•	•	alues with transduce		moscured in water	r
dB μPa/√Hz							
		•		quisition modules, t		s determined by a	all noise source
			is much higher tha	n the ones stated in	this datasheet.		
Receiving Face:	Circular Planar I	ace	T .		T .		1 .
Acoustic Aperture:	Ф27 mm		Ф27 mm		Ф10 mm		Ф4 mm
Directivity Pattern:	Conical Beam		1		T .		1 .
-3 dB Beam Width:	1	2350°/f(kHz) 2350°/f(kHz)			6345°/f(kHz)		15862°/f(kH
Frequency f _{-3dBML} :	30 kHz		30 kHz		82 kHz		176 kHz
. requertey 1-subME.	f _{-3dBML} : Main Lob	e drops -3dB at ±	90° normal to acoι	ıstic axis.	_		
Critical Frequency f _c :	70 kHz		70 kHz		180 kHz		450 kHz
Critical Frequency Ic.	Side lobes exist with operating frequency $f > f_c$; The hydrophone has no side lobe with $f \le f_c$.						
100° Cidalaha Faansaasi f	93 kHz		93 kHz 240 kHz			600 kHz	
±90° Sidelobe Frequency f _n :	First Side Lobes exist at $\pm 90^{\circ}$ normal to acoustic axis with operating frequency $f = f_n$.						
Signal Type:	Single Ended	Differential	Single Ended	Differential	Single Ended	Differential	Single Ende
	148.7 dB along	acoustic axis.		143.6 dB μl	Pa/(m/s²) along aco	ustic axis.	•
Acceleration Sensitivity:	141.0 dB along	other directions.		141.0 dB μPa/(m/s²) along other directions.			
Underwater Projector:	Yes.	No	Yes.	No	No	No	No
Do NOT use the hydrophone	as a sound project	or in the air other	wise the hydropho	one will be damaged		•	1
Resonance fs:	200 kHz	N/A	350 kHz	N/A	N/A	N/A	N/A
Maximum Drive Voltage:	600 Vpp	N/A	600 Vpp	N/A	N/A	N/A	N/A
Maximum Pulse Length:		· ·	aximum Drive Volt	age	1 -	1 .	<u>, , , , , , , , , , , , , , , , , , , </u>
	For Projector ONLY: 10% at Maximum Drive Voltage. 100% at ≤ 30 Vpp or 10.6 Vrms.						
Duty Cycle in Water:	For Projector O	NLY: 10% at Maxir	num Drive Voltage	100% at < 30 Vnn (or 10 6 Vrms		



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Sidelobe Level:	< -20 dB when f > fc. No side lobe when f ≤ fc.				
	100 m to 300 m, limited by the	performance of the sealing	materials.		
Depth Rating:				are cut on the mounting wall and O-	
Depart Ruting.	_	_	. The surface finish of the flan	ige 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.			phones.		
	Please refer to <u>lable 1. Flush Mounting (Marine Sealant or Gasket) (FSM)</u> .				
Marine Sealants or Gaskets: Bil does NOT provide sealing materials such as marine sealants and gaskets. Buyer may buy these materials from				y these materials from buyer's local	
	stores of adhesives, boats, automobiles, and industry suppliers.				
	Single Ended Signal:				
	1. Coax RG174/U (RG174)				
	2. Coax RG178/U (RG178), up to 200°C.				
Cable Options:	3. Coax RG58/U (RG58)				
•	Differential Signal:				
	 Shielded Cable with Twisted Pair and PVC Jacket, ΦD=3.6 mm (SC36) Shielded Cable with Twisted Pair and PVC Jacket, ΦD=6 mm (SC60) 				
	6. Shielded Cable with Twisted	•	'	0°C Non Waterproof	
	0.15 m (6")	Pall allu Telloll (PTFE) Jacke	ι, ΨD=3.2 mm (3C32), up to 20	C. Non-waterproof.	
Cable Length:	ble Length:				
	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 (ΦDxH):	Refer to Table 1.				
Weight:	300 grams	295 grams	90 grams	60 grams	
Operation Temperature:	1. Default: -10°C to to 60°C, or 14°F to 140°F.				
Operation remperature.	2. Bespoke High Temperature:	-10°C to 120°C, or 14°F to 24	8°F. Append HT to part numbe	er.	
Storage Temperature:	-20 to 60 °C, or -4 to 140 °F.				
Underwater Projector Applic	ation: for 50Ω BNC/SMC/SMA cor	nector, it is buyer's sole resp	onsibility to make sure that the	e BNC/SMC/SMA shield of the signal	

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
≤ Φ5 mm	Stainless Steel	M10x1.5	24.75	Ф18	≤ (L − 14)	≤ 10 Nm
≤ Ф10 mm	Anodized Aluminum	M14x1.5	26.75	Ф22	≤ (L – 16)	≤ 10 Nm
≤ Φ27 mm	Anodized Aluminum	M35x1.5	29.75	Ф59	≤ (L – 13)	≤ 14 Nm
<u>≤ Φ27 mm</u>	Anodized Aluminum	M36x4	29.75	Ф59	≤ (L − 13)	<u>≤ 14 Nm</u>

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. BIJ Keeps Standard Products in Stock.

The to the transfer of the tra				
Hydrophone Part Number	-Cable Length in Meter	-Cable Type	-Connector Type	
BII7111DF	0.15 (6")	Shielded Cable with Twisted Pair SC60	WL: Wire Leads.	
BII7112DF	0.15m (6")	Shielded Cable with Twisted Pair 3C60	WL: Wire Leads.	
Example:	Description			
BII7111DF-0.15m-SC60-WL	BII7111DF Hydrophone, 0.15m Shielded Cable with Twisted Pair SC60 , Wire Leads.			
BII7112DF-0.15m-SC60-WL	2DF-0.15m-SC60-WL BII7112DF Hydrophone, 0.15m Shielded Cable with Twisted Pair SC60 , Wire Leads.			

How to Order Bespoke Hydrophones. Non-stock.

now 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 <u>Sensitivity Loss</u> .	Refer to <u>Cable Options</u> .	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.			

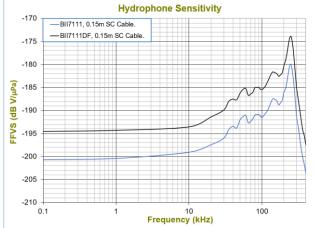
Wirings

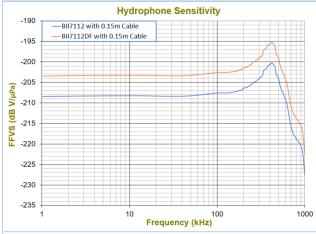
Differential Output:	Wire Leads		
Signal +	White or Red	Red	
Signal -	Black	White	
Common & Shielding	Shield	Shield	
Single Ended Output:	Coax with Wire Leads		
Signal	Coax Center Contact		
Signal Common	Coax Shield		
Shielding	Coax Shield		

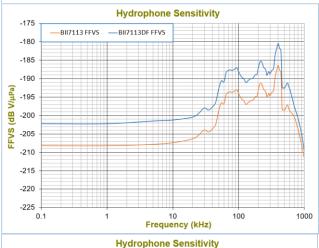
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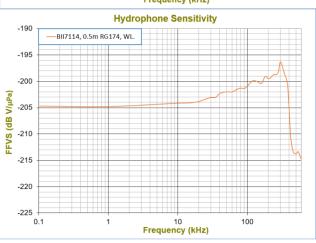
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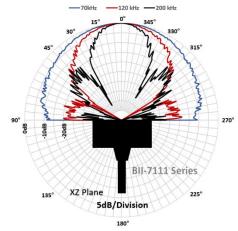


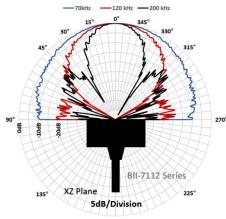


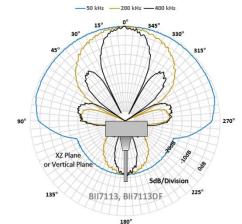


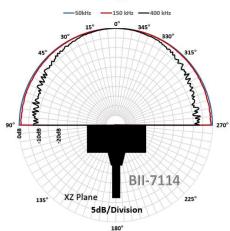


Directivity Pattern







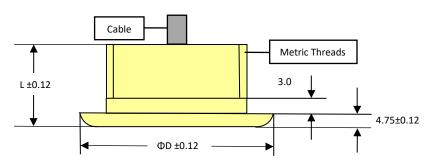




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Physical Size (Dimensional Unit: mm): Nut is included with shipment.





Installation/Mounting

