



Omnidirectional Spherical Hydrophone

BII7000 Series Omnidirectional Spherical Hydrophone

BII's spherical hydrophones provide omnidirectional responses up to 700kHz and offer excellent acoustic characteristics of low noise and durability, which make these hydrophones ideal for a wide range of oceanography applications. Bespoke built-in preamplifiers allow the hydrophones to be used with long extension cables with no loss in sensitivity. The customized built-in filters increase Signal-to-Noise Ratio, reject unwanted noise, and avoid saturation.

Typical Applications

Sonobuoy, Dipping Hydrophone. LBL, SBL, USBL Positioning, Communication. Parabolic Antennas Underwater. Reference Hydrophone, Noise Measurement.	Detection of Ultrasonic Cavitation Noise, Thermoacoustics in Gas. Passive Acoustic Monitoring (PAM System). Array Element, Vector Hydrophone Element. Marine Bioacoustics, Phantom-power Hydrophone, Sound Recording.
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Specification

Part Number:	BII7002	BII7002DF
Sensitivity @ 1kHz:	-194.5 dB V/μPa ± 2dB	-190.0 dB V/μPa ± 2dB
FFVS:	Sensitivity Loss over Extension Cable (dB) = 20*log[C _h /(C _h +C _c)]. C _h : Hydrophone Capacitance; C _c : Capacitance of Extension Cable. Cable is of 100 pF/meter roughly. Valid for hydrophone without preamplifier.	
Usable Frequency in Water:	Refer to Graph of FFVS vs. Frequency . Free-field Voltage Sensitivity.	
Usable Frequency in Air:	0.1 Hz ~ 80 kHz at ±3dB V/μPa	
Usable Frequency:	In Water: 0.1 Hz ~ 80 kHz at ±3 dB V/μPa.	
	In Air: 0.1 Hz ~ 3.2 kHz at -3 dB V/μPa.	
	Minimum Usable Frequency depends on -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 hydrophone at 1 kHz. when a BII7002 and a BII preamp of R _i = 200 MΩ are used to detect sounds, -3dB high pass frequency of detection = 0.1 Hz.	
Capacitance C _h @ 1kHz:	7.6 nF ± 10%	7.3 nF ± 10%
Dissipation @ 1kHz:	0.003	0.008
Noise Density at f << fs: dB μPa/VHz	13.5 – 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.	
	14.4 – 10*log f	
Directivity Pattern:	Omnidirectional, Refer to Graph of Beam Pattern .	
Signal Output Type:	Single Ended	Differential
Acceleration Sensitivity:	137.0 dB μPa/(m/s ²)	
Underwater Projector:	Yes.	No
Resonance fs:	65 kHz	N/A
Maximum Drive Voltage:	560 Vpp	N/A
Maximum Pulse Length:	100 mS at Maximum Drive Voltage	N/A
Duty Cycle in Water:	10% at Maximum Drive Voltage. 100% at ≤ 30 Vpp or 10.6 Vrms.	N/A
Operating Depth:	Maximum 400 m and limited by the cable length if the cable has wire leads or a non-waterproof connector.	
Mounting Options:	1. Default: Free Hanging (FH) 2. Free-hanging with Male Underwater Connector (FHUWC) 3. Thru-hole Mounting with Single O-ring (THSO) 4. Thru-hole Mounting with Double O-ring (THDO) 5. Bolt Fastening Mounting (Plastics) (BFMP) 6. Bolt Fastening Mounting (Stainless Steel) (BFMSS) Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and more details.	
Cable Options:	1. Default: Coax RG174/U (RG174) (for Single Ended Output ONLY) 2. Coax RG178/U (RG178) (for Single Ended Output ONLY), up to 200°C. 3. Coax RG58/U (RG58) (for Single Ended Output ONLY) 4. Shielded Cable with Polyurethane Jacket, ΦD=2.6 mm (SC26) 5. Shielded Cable with Twisted Pair and Teflon (PTFE) Jacket, ΦD=3.2 mm (SC32), up to 200°C. Not water-proof. 6. Shielded Cable with Twisted Pair and Polyurethane Jacket, ΦD=4.7 mm (SC47) 7. Default: Shielded Cable with Twisted Pair and PVC Jacket, ΦD=6.0 mm (SC60) (for Differential Output ONLY) 8. Shielded Cable with Rubber Jacket, ΦD=6.5 mm (SC65) Differential (balanced) output with shielded Twisted Pair Cable is recommended to reject Electromagnetic Interference (EMI) over long cable.	
Cable Length:	1. Default: 6 m. 2. Custom-fit Cable Length.	
Connector:	SE: Single ended Output, DF: Differential Output. 1. Default: Wire Leads (WL) 2. Male BNC (BNC), Max. Diameter Φ14.3 mm, for SE ONLY. BNC with RG178 Coax: Service Temperature up to 165°C or 329°F. 3. SMA (Plug, Male Pin) (SMA), Voltage Rating: 335 V _{RMS} Continuous. Max. Diameter Φ9.24 mm, for SE ONLY.	

	4. SMC (Plug, Female Socket) (SMC), Voltage Rating: 250 V _{RMS} Continuous. Max. Diameter $\Phi 6.4$ mm, for SE ONLY. 5. 1/8" (3.5mm) TRS Plug (TRS), Max. Diameter $\Phi 10.5$ mm, for SE or DF. 6. XLR (pin) (XLR), Max. Diameter $\Phi 20.2$ mm, for SE or DF. 7. MIL-5015 Style (pin) (MIL), Max. Diameter $\Phi 30$ mm with 3 contacts, for SE or DF. 8. Underwater Mateable Connector (pin) (UMC), Max. Diameter $\Phi 21.5$ to $\Phi 35$ mm, for SE or DF. Underwater Mateable Connector is for uses underwater. Other connectors and wire leads are for dry uses and are not waterproofed.
Size:	$\Phi D = \Phi 34$ mm, Length ≥ 40 mm and actual length depends on Mounting Parts.
Weight:	≥ 0.55 kg with 10m cable. Actual weight depends on Mounting Parts, Cable Types and Length.
Operation Temperature:	1. Default: -10°C to +60°C or 14°F to 140°F. 2. Bespoke High Temperature Transducer: -10°C to 120°C, or 14°F to 248°F. Append HT to part number. Maximum Operating Depth at 120°C or 248°F: 50 m.
Storage Temperature:	-20°C to +60°C or -4°F to 140°F.
Array Design Service:	Line (Linear) Array, Rectangular Planar Array, and Circular Planar Array design: Side Lobe Level SLL , -3dB Beam Angle θ_{-3dB} ; Array Element Spacing d ; Array Element Number N ; Beam Steering, FFVS loss, and mutual effects among these parameters.
Underwater Projector Application: for 50Ω BNC Male connector, it is buyer's sole responsibility to make sure that the (female) BNC shield of the signal source is firmly grounded for operating safety before hooking up transducer/hydrophone to the signal source. Coax with BNC is not intended for hand-held use at voltages above 30Vac/60Vdc.	
Do NOT use the hydrophone as a sound projector in the air otherwise the hydrophone will be damaged.	
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.	

How to Order Hydrophones

Part Number	-Mounting Part	-Cable Length in Meter	-Cable Type	-Connector Type
Example:	Description			
BII7002-FH-6m-RG174-BNC	BII7002 Hydrophone, Free Hanging, 6m RG174 Coax, Male BNC.			
BII7002-HT-FH-6m-RG178-BNC	BII7002 Hydrophone, Service Temperature: -10 °C to 120 °C, or 14 °F to 248 °F. Free Hanging, 6m RG178 Coax, Male BNC.			
BII7002DF-FH-10m-SC60-XLR	BII7002DF Hydrophone, Free Hanging, 10m Shielded Cable with Twisted Pair SC60 , 3-pin XLR Plug.			
BII7002DF-FH-3m-SC60-UMC	BII7002DF Hydrophone, Free Hanging, 3m Shielded Cable with Twisted Pair SC60 , 3-pin Underwater Mateable Connector.			

Question:

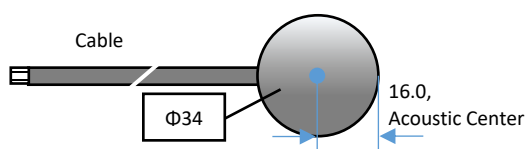
What if the mating connector of my DAQ module or recording device is NOT available from BII?

1. Buyer may order BII products with wire leads, and buyer assembles the mating connector to the cable end.
2. A connector adaptor might be assembled by BII by customization, and BII ships the adaptor to buyer as accessory of the device. Please contact BII for customizations.
3. Many adaptors for standard connectors are available in worldwide electronic suppliers such as BNC to SMA, BNC to SMC, XLR to TRS, etc. Check out your local suppliers.

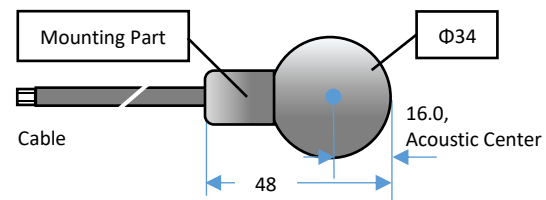
Wirings

Differential Output:	Wire Leads	Underwater Connector	TRS Plug (Balanced Mono)		XLR Plug (Balanced Audio)
Signal +	White or Red	Pin 2	Tip, Positive/Hot		Pin 2, Positive/Hot.
Signal -	Black	Pin 1	Ring, Negative/Cold		Pin 3, Negative/Cold.
Common & Shielding	Shield	Pin 3	Sleeve, Ground/Common		Pin 1, Shield/Ground.
Single Ended Output:	Wire Leads	Underwater Connector	BNC/SMA/SMC	Coax with Wire Leads	TRS Unbalanced mono
Signal	White or Red	Pin 2	Center Contact	Coax Center Contact	Tip
Signal Common	Black	Pin 1	Shield	Coax Shield	Ring & Sleeve
Shielding	Shield	Pin 3	Shield	Coax Shield	Ring & Sleeve

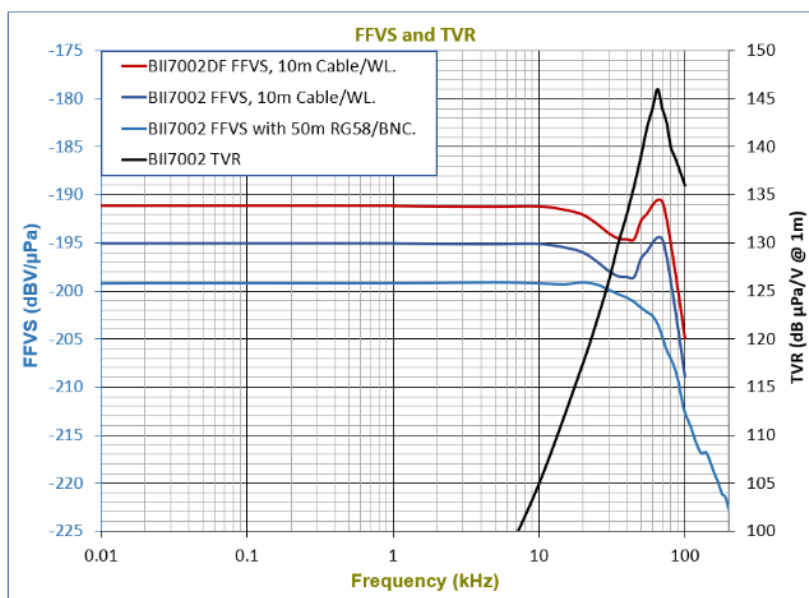
Physical Size (Dimensional Unit: mm) of Free Hanging:



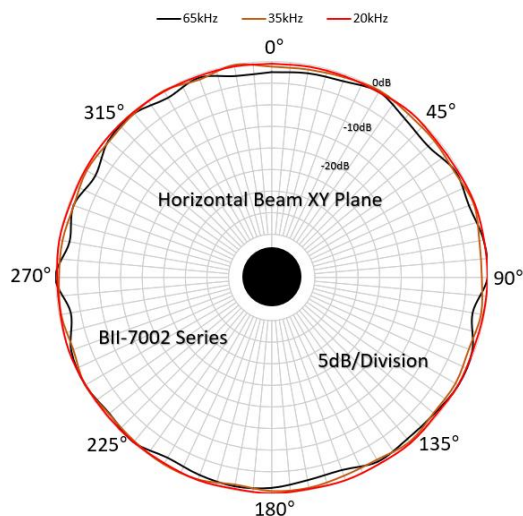
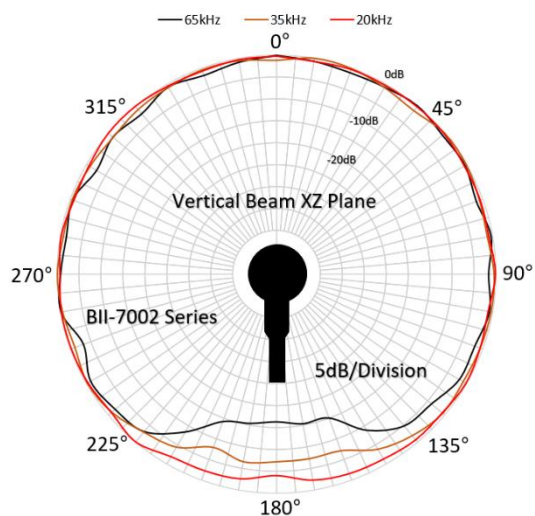
Physical Size (Dimensional Unit: mm) with Mounting Part:



Free-field Voltage Sensitivity (FFVS) and Transmitting Voltage Response (TVR):

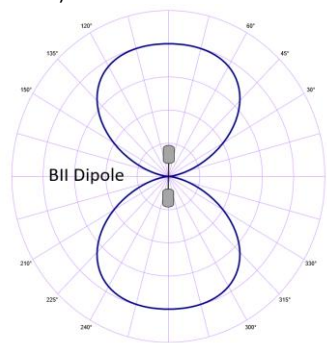
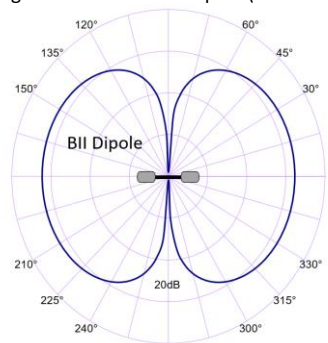


Beam Pattern:

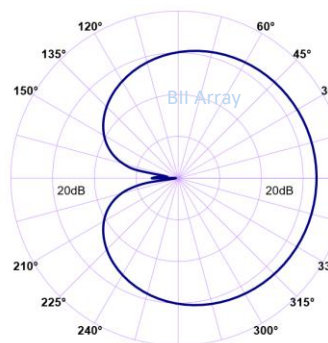


Simple Array Consisting of Hydrophones.

“Figure 8” Pattern of a Dipole (Pressure-Gradient).



Cardioid Pattern



Linear Array with BII Discrete Hydrophones

