



### 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

<b>Part Number:</b>	BII7004FGDF	BII7004FGSE	BII7004PGDF	BII7004PGSE	BII7004PGSELP
Sensitivity FFVS at 1 kHz:	(-198.5 + Preamp Gain) ± 2 dB V/μPa.				
Free-field Voltage Sensitivity:	Refer to Graph of <b>FFVS vs. Frequency</b> .				
FFVS:	Refer to Graph of <b>FFVS vs. Frequency</b> . Free-field Voltage Sensitivity.				
Pressure Noise Density:	Refer to Graph of <b>Pressure Noise Density</b> , Referred to Input (RTI), in μPa/√Hz.				
Usable Frequency:	<b>In Water:</b> 1 Hz ~ 200 kHz at -3dB V/μPa.				1 ~ 200 kHz
	<b>In Air:</b> 1 Hz ~ 9 kHz at -3dB V/μPa.				1 ~ 9 kHz
Built-in Filters:	Bespoke High Pass Filter or Band Pass filter. Specify -3dB cut-off frequencies when ordering.				
	<b>If buyer does NOT specify -3dB cut-off frequencies, BII will use default -3dB cut-off frequencies suitable to the hydrophone.</b> Both ocean ambient noises and the self-noises of electronic devices decrease when frequency increases. It is recommended to choose a built-in high pass filter to reject noises in low frequency range. For example, if you are interested in the signals greater than 200 Hz, you may specify a high pass filter with -3dB cut-off frequency at 100 Hz to improve signal to noise ratio of the signals of the interest.				
Preamp Gain (dB):	Bespoke <b>Fixed Gain Preamp</b> . Default: 40 dB. Bespoke: -40 to +60 dB.		<b>Programmable Gain Preamp</b> 0/20/40/60 dB.		30, 60 dB.
	<b>If buyer does NOT specify a preamp, BII will use a low noise preamp in the hydrophone.</b> <b>Note: If Digital Outputs or switches are used to select gains, Voltage Protection Rating or Absolute Maximum Voltage Ratings of these devices must be greater than V<sub>s</sub> Supply Voltage.</b>				
Gain Selection Voltage: (Programmable Gain Preamp)	N/A		CMOS/TTL Compatible Logic Low 0: Gain Selection Wire to COM, or 0 to +0.8VDC. Logic High 1: Gain Selection Wire Open, or +2.4 to V <sub>s</sub> .		
Directivity Pattern:	Omnidirectional Beam. Refer to Graph of <b>Directivity Pattern</b> .				
Side Lobe Level:	No side lobes.				
Signal Output Type:	Differential	Single Ended	Differential	Single Ended	Single Ended
	To reject Electromagnetic Interference (EMI) over long cable, the differential (balanced) output is recommended. <b>Differential output is NOT suitable for hydrophones whose usable frequencies are greater than 1 MHz when 50/75Ω impedance matching is necessary over long cable.</b>				
Maximum Output V <sub>omax</sub> :	Supply Voltage V <sub>s</sub> - 4, in V <sub>pp</sub> .				Supply Voltage V <sub>s</sub> - 1.
Overload Pressure Level:	198.5 or [20*log(V <sub>omax</sub> /2.828) - Sensitivity], whichever is less. in dB μPa.				
Acceleration Sensitivity:	135.0 dBμPa/(m/s <sup>2</sup> ) at Acoustic Axis; ≤ 133.0 dBμPa/(m/s <sup>2</sup> ) at other directions.				
Operating Depth:	Maximum 300 m or 3 MPa pressure and limited by the cable length if the cable has wire leads or a non-waterproof connector.				
Mounting Options:	1. Default: Free Hanging ( <b>FH</b> ) 2. Free-hanging with Male Underwater Connector ( <b>FHUWC</b> ) 3. Thru-hole Mounting with Single O-ring ( <b>THSO</b> ) 4. Thru-hole Mounting with Double O-ring ( <b>THDO</b> ) 5. Bolt Fastening Mounting (Plastics) ( <b>BFMP</b> ) 6. Bolt Fastening Mounting (Stainless Steel) ( <b>BFMSS</b> ) Please refer to online document <a href="#">AcousticSystem.pdf</a> for a complete list of Mounting Options and more details.				
	Cable:	Four Conductor Shielded Cable (SC)		Six Conductor Shielded Cable (SC)	
Cable Length:	1. Default: 10 m. 2. Custom-fit Cable Length up to 305 m.				up to 150 m
Connector:	<b>SE:</b> Single ended Output, <b>DF:</b> Differential Output. 1. Default: Wire Leads ( <b>WL</b> ) 2. Male BNC ( <b>BNC</b> ) (Max. Diameter Φ14.3 mm), for SE ONLY. 3. SMA (Plug, Male Pin) ( <b>SMA</b> ), Voltage Rating: 335 V <sub>RMS</sub> Continuous. (Max. Diameter Φ9.24 mm), for SE ONLY. 4. SMC (Plug, Female Socket) ( <b>SMC</b> ), Voltage Rating: 335 V <sub>RMS</sub> Continuous. (SMC) (Max. Diameter Φ6.4 mm), for SE ONLY. 5. 1/8" (3.5mm) TRS Plug ( <b>TRS</b> ) (Max. Diameter Φ10.5 mm), for SE or DF. 6. XLR Plug (pin) ( <b>XLR</b> ) (Max. Diameter Φ20.2 mm), for SE or DF. 7. MIL-5015 Style (pin) ( <b>MIL</b> ) (Max. Diameter Φ30 mm with 3 contacts), for SE or DF. 8. Underwater Matable Connector (pin) ( <b>UMC</b> ) (Max. Diameter Φ21.5 to Φ35 mm), for SE or DF. 9. +9VDC Battery Snap ( <b>BS</b> ), for +9VDC or +18VDC power supply. 10. 4mm Banana Plug Pair ( <b>Red</b> and Black Color) ( <b>BP</b> ), for DC power supply ONLY.				

	Underwater Mateable Connector is for uses underwater. Other connectors and wire leads are for dry uses and are not waterproofed.				
Supply Voltage V <sub>s</sub> :	+7.5 to +32 VDC	+7.5 to +32 VDC	+8.2 to +32 V	+8.2 to +32 V	+4.5 to +32 VDC
Suggested DC Supply:	+9VDC Battery, Marine Battery, Automobile Battery, Fixed DC Linear Power Supply, Not Included. DO NOT use variable power supply whose maximum supply voltage is higher than the rated voltage. DO NOT use switching mode DC power supply.				
Current (Quiescent):	16 mA	13 mA	13 mA	9 mA	2.1 mA
Size:	ΦD = Φ21 mm and Φ15.8 mm, Length ≥ 70 mm and actual length depends on Mounting Parts.				
Weight:	≥ 0.55 kg with 10 m cable. Actual weight depends on Mounting Parts, Cable Types and Length.				
Operation Temperature:	-10 °C to +60 °C or 14 °F to 140 °F.				
Storage Temperature:	-20 °C to +60 °C or -4 °F to 140 °F.				
<b>Sound Measurement in Air:</b> 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.**

**FG:** Fixed Gain; **PG:** Programmable Gain; **DF:** Differential Output; **SE:** Single Ended Output; **LP:** Low Power; **LN:** Low Noise; **HPF:** High Pass Filter; **LPF:** Low Pass Filter.

Part Number	-Preamp Gain, dB	-HPF/LPF	-Mounting	-Cable Length	-Connectors for Signal/Gain/DC Supply
BII7004FGDF	Preamp Gain in dB. Default: 40 dB.	-3dB Filter Frequencies, in kHz. Default: 0.5Hz to 300kHz.	Refer to Options. Default: Free Hanging.	in meter. Default: 10m.	Refer to Options. Default: Wire Leads.
BII7004FGSE					
BII7004PGDF BII7004PGSE	0, 20, 40, 60 dB.				
BII7004PGSELP	30, 60 dB.				
Example of Part Number:		Description			
BII7004FGSE-26dB-0.3kHz-FH-10m-SC-BNC/BS		BII7004FGSE Hydrophone, 26dB Gain Preamplifier, 0.3kHz High Pass Filter, Free Hanging, 10m Shielded Cable, Connector: Male BNC for Signals, Battery Snap for +9VDC Batteries.			
BII7004FGDF-26dB-0.3kHz-FH-10m-SC-XLR		BII7004FGDF Hydrophone, 26dB Gain Preamplifier, 0.3kHz High Pass Filter, Free Hanging, 10m Shielded Cable, Connector: 4-pin XLR for Signals and DC Supply.			
BII7004FGDF-26dB-0.3kHz-FH-3m-SC-UMC		BII7004FGDF Hydrophone, 26dB Gain Preamplifier, 0.3kHz High Pass Filter, Free Hanging, 3m Shielded Cable, Connector: 4-pin Underwater Mateable Connector for Signals and DC Supply.			
BII7004PGDF-0/20/40/60dB-10Hz/100kHz-FH-100m-SC-XLR/WL/BS		BII7004PGDF Hydrophone, 0/20/40/60dB Programmable Preamplifier, 10Hz to 100kHz Band Pass Filter, Free Hanging, 100m Shielded Cable, Connector: 3-pin XLR Plug for Signals, Wire leads for Gain Selection, Battery Snap for +9VDC Batteries.			
BII7004PGDF-20/40/60/80dB-10Hz/100kHz-FH-100m-SC-XLR		BII7004PGDF Hydrophone, 20/40/60/80dB Programmable Preamplifier, 10Hz to 100kHz Band Pass Filter, Free Hanging, 100m Shielded Cable, Connector: 6-pin XLR Plug for Signals, Gain Selections, and DC Supplies.			

**Wiring Information of Hydrophones with Fixed-gain Preamps:**

Single Ended Output:	Wire Leads	BNC Male/SMA/SMC, 9V Battery Snap	Underwater/XLR Connector	XLR Plug and 9V Battery Snap	TRS Plug and 9V Battery Snap
+VDC	Red	Female Snap	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Male Snap	Pin 1	Battery Male Snap	Battery Male Snap
Signal	White	Center Pin or Contact	Pin 2	XLR Pin 2	TRS Tip
Signal Common	Blue, Green, or Yellow	BNC/SMA/SMC Shield	Pin 4	XLR Pin 1 and Pin 3	TRS Ring and Sleeve
Shielding	Shield	N/A	N/A	XLR Metal Shell	N/A
<b>Differential Output:</b>	<b>Wire Leads</b>	<b>Underwater/XLR Connector</b>		<b>XLR + 9V Battery Snap</b>	<b>TRS + 9V Battery Snap</b>
+VDC	Red	Pin 3		Battery Female Snap	Battery Female Snap
Common	Black	Pin 1		Battery Male Snap	Battery Male Snap
Signal+	White	Pin 2		XLR Pin 2	TRS Tip
Signal-	Blue, Green or Yellow	Pin 4		XLR Pin 3	TRS Ring
Signal Common	N/A	N/A		XLR Pin 1	TRS Sleeve
Shielding	Shield	N/A		XLR Metal Shell	N/A
<b>4mm Banana Plug Pair:</b> Red Plug for +VDC, Black Plug for Common of the DC power supply.					

**Wiring Information of Hydrophones with Two-bit Programmable Gain Preamps:**

Single Ended Output:	Wire Leads	9V Battery Snap and BNC Male/SMA/SMC	Underwater/XLR Connector	XLR Plug + 9V Battery Snap	TRS Plug + 9V Battery Snap
+VDC	Red	Battery Female Snap	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Battery Male Snap	Pin 1	Battery Male Snap	Battery Male Snap
Digital Common		Black		Black	
Digital A1 (Gain Selection)	Yellow or Brown	Yellow or Brown	Pin 5	Yellow or Brown	Yellow or Brown
Digital A0 (Gain Selection)	Blue	Blue	Pin 6	Blue	Blue
Output Signal	White	BNC/SMA/SMC Center	Pin 2	XLR Pin 2	TRS Tip
Output Signal Common	Green	BNC/SMA/SMC Shield	Pin 4	XLR Pin 1 and Pin 3	TRS Ring and Sleeve
Shielding	Shield	Shield	N/A	XLR Metal Shell	N/A
<b>Differential Output:</b>	<b>Wire Leads</b>	<b>Underwater/XLR Connector</b>		<b>XLR Plug + 9V Battery Snap</b>	<b>TRS Plug + 9V Battery Snap</b>
+VDC	Red	Pin 3		Battery Female Snap	Battery Female Snap
Common	Black	Pin 1		Battery Male Snap, XLR Pin 1.	Battery Male Snap, TRS Sleeve.
Digital Common			Black	Black	
Digital A1 (Gain Selection)	Yellow or Brown	Pin 5		Yellow or Brown	Yellow or Brown
Digital A0 (Gain Selection)	Blue	Pin 6		Blue	Blue
Output Signal +	White	Pin 2		XLR Pin 2	TRS Tip
Output Signal -	Green	Pin 4		XLR Pin 3	TRS Ring

Shielding	Shield	N/A	XLR Metal Shell	N/A
<b>4mm Banana Plug Pair: Red Plug for +VDC, Black Plug for Common of the DC power supply.</b>				
<b>Selecting Sensitivity FFVS of Two-bit Digitally Programmable</b>				
<b>FFVS Selection Wire A1</b>	<b>FFVS Selection Wire A0</b>	<b>Hydrophone Sensitivity at 1kHz</b>		
0 (Logic Low)	0 (Logic Low)	-198.5 + 0dB V/μPa		
0 (Logic Low)	1 (Logic High)	-198.5 + 20dB V/μPa		
1 (Logic High)	0 (Logic Low)	-198.5 + 40dB V/μPa		
1 (Logic High)	1 (Logic High)	-198.5 + 60dB V/μPa		

**Wiring Information of Hydrophones with One-Bit-Word Programmable Gain Preamps:**

Single-Ended Output:	Wire Leads	Underwater/XLR Connector	9V Battery Snap and BNC Male/SMA/SMC	XLR + 9V Battery Snap	TRS + 9V Battery Snap
+VDC	Red	Pin 3	Battery Female Snap	Battery Female Snap	Battery Female Snap
Common	Black	Pin 1	Battery Male Snap	Battery Male Snap, XLR Pin 1.	Battery Male Snap, TRS Sleeve.
Digital Common	Yellow or Brown	Pin 5	Yellow or Brown	Yellow or Brown	Yellow or Brown
Digital A0 (FFVS Selection)	Blue	Pin 6	Blue	Blue	Blue
Output Signal	White	Pin 2	BNC/SMA/SMC Center	XLR Pin 2	TRS Tip
Output Signal Common	Green	Pin 4	BNC/SMA/SMC Shield	XLR Pin 3	TRS Ring
Shielding	Shield	N/A	Shield	XLR Metal Shell	N/A
<b>4mm Banana Plug Pair: Red Plug for +VDC, Black Plug for Common of the DC power supply.</b>					
<b>Selecting Sensitivity of One-Bit-Word Digitally Programmable</b>					
<b>FFVS Selection Wire A0</b>	<b>Sensitivity FFVS at 1kHz.</b>				
0 (Logic Low)	-198.5 + 30 dB V/μPa				
1 (Logic High)	-198.5 + 60 dB V/μPa				

**Question:**

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

- Buyer may order BII products with wire leads, and buyer assembles the mating connector to the cable end.
- 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.
- 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.

**How do I use Gain Selection wires in field?**

**1. Manual Gain Selection.**

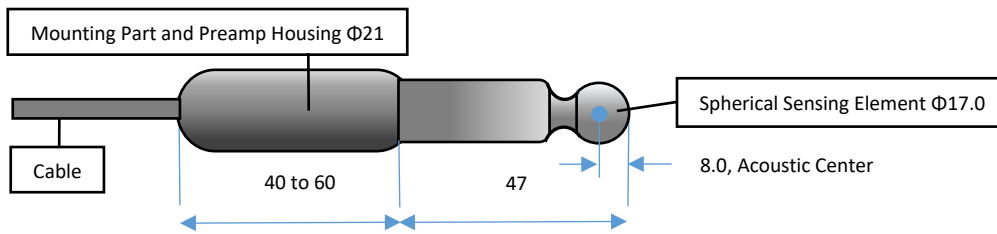
When a **Gain Selection wire** is floating or open, its digital logic is High or "1".

When a **Gain Selection wire** is short to **Digital Common**, its digital logic is Low or "0".

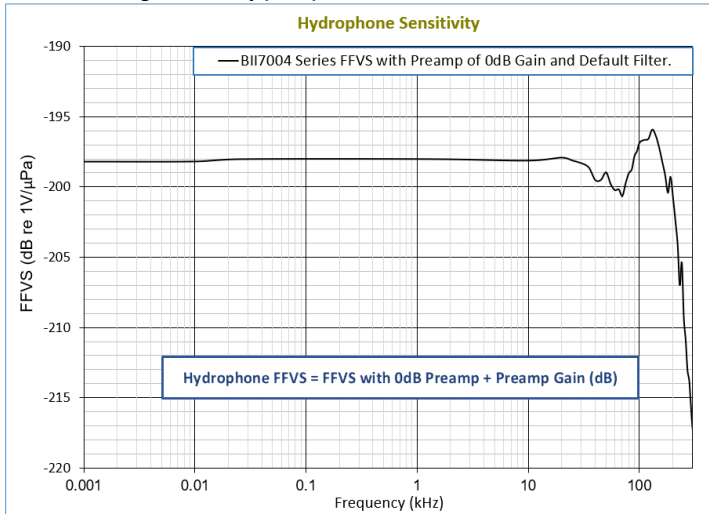
Sensitivity of a Hydrophone is fixed when its Gain Selection wires are fixed to **Digital Common** or open (floating) during operation.

**2. Gain Selection with Digital Outputs.** Digital Outputs of a DAQ (data acquisition device) select gains with TTL/CMOS logic levels.

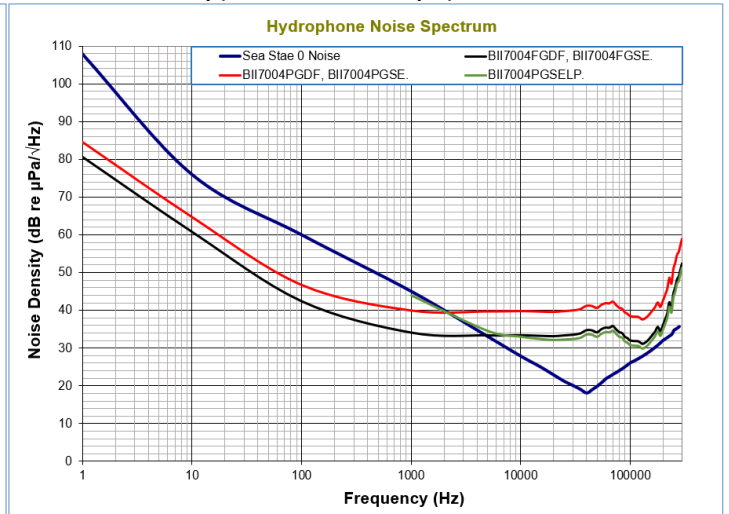
**Physical Size (Dimensional Unit: mm):** The overall length varies with the length of the built-in preamplifier.



**Free-field Voltage Sensitivity (FFVS):**



**Pressure Noise Density (RTI, referred to the input):**



**Directional Response Pattern:**

