

#### BII7079 Low Noise Hydrophone: Noise Level Below Sea State Zero

BIJ7079 Low noise directional hydrophones have conical beams for uses in detection of weak signals, broadband signals, pipeline leaks, and tracking of sound sources underwater. These acoustic sensors are also designed for applications in air to detect acoustic emission and stress waves. (Note: The couplant such as water or gel is a necessary material to provide efficient acoustic coupling between the hydrophone face and the piece under test in air applications.)

Below the critical frequency fc, the hydrophones are of single beam without side lobes. This feature makes the hydrophone be an ideal candidate for target angle estimation systems or sound source tracking systems. A spatial array of multiple hydrophones can be set up for directional noise-measurement system.

The hydrophones can measure underwater sounds and pressure fluctuations down to 13Hz: Surface Waves (Wave-height Sensor), Turbulences, seismic, ocean traffics, industrial noises, precipitations, biologics, ...

The preamplifier integrated in the hydrophone can drive cable up to 200m without signal loss. Available cable terminals include audio connectors (TRS, XLR), BNC, and underwater mateable connectors. The housing and mounting part are corrosion resistant plastics and/or stainless steels.

#### Underwater Sound Listening, Recording, and Communication



## **Typical Applications**

Underwater Sounds Recording, Listening, and Communication, Marine	Coastal/Offshore Processes, Engineering & Management, Wave-Structure				
Bioacoustics, Passive Acoustic Monitoring (PAM System). Interaction, Wave-height Sensor, Wave and Tide Recorder/Logger.					
Oceanic Ambient Noise Measurement, Surface Waves, Ocean Turbulences,	Battery-Powered Instruments: Sonobuoy, Recorder, Transponder, Acoustic				
Hydrodynamics, Marine Geophysics.	Release				

#### Questions

How do I set up my professional sound recorders to work with BII Hydrophones?

- 1. Bll hydrophones have their own DC power supply to support **Line Input** of recorders, and **Do NOT** use phantom power 48V which may destroy the hydrophones. 2. **Maximum Input Level (Line Input)** of recorders should be large enough to avoid saturation or clipping during recording.
- Equivalent Input Noise of recorders should be low enough for the recorders to be sensitive to weak signal of the interest.

3. Sampling Rate of the recorder should be fast enough to avoid missing high frequency sound of the interest. Generally, the Sampling Rate should be at least two times greater than the maximum frequency of sound.

- 4. Calculate the memory size of data storage according to sampling rate, resolution, sampling channels, and recording time, and use suitable recording media.
- 5. Calculate battery service life according to battery power and consuming current.
- 6. When the cable is greater than 5m, balanced signal or differential signal is recommended to be in use over the cable.

#### How do I playback the recorded sounds in water?

System Setup: Recorder (Recorded Sounds) with Line or Phone Output -> Audio Power Amplifiers -> Impedance Matching Device -> Transducers (Projectors).



# Benthowave Instrument Inc.

Underwater Sound Solutions

benthowave.com

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## Specification

FG: Fixed Gain; PG: Programm	nable Gain; <b>DF:</b> Differential Output; <b>SE:</b> Single Ended Output; <b>BPF</b> :	Band Pass Filter; HPF: High Pass Filter; LPF: Low Pass Filter.					
Part Number:	BII7079FGDF	BII7079PGDF					
Sensitivity FEVS @ 1 kHz:	-184 + Preamp Gain, dB V/μPa, ± 2 dB.						
	-160.0 dB V/μPa174.0 and -144.0 dB V/μPa.						
FFVS:	Refer to Graph of FFVS vs. Frequency. Free-field Voltage Sensit	ivity.					
Pressure Noise Density:	Refer to Graph of <u>Pressure Noise Density</u> , Referred to Input (RT	ΓΙ), in μPa/VHz.					
	Bespoke HPF.	Bespoke HPF, or BPF.					
	Minimum HPF: 3 Hz.	Minimum HPF: 13 Hz.					
	in Water: 3 Hz ~ 100 kHz	in Water: 13 Hz ~ 100 kHz					
	in Air: $3 \text{ Hz} \sim 5 \text{ kHz}$	in Air: $13 \text{ Hz} \sim 5 \text{ kHz}$					
	1. Reduce Noise. Both ocean ambient noises and the self-nois	ses of electronic devices decrease when frequency increases. It is					
Built-in Filter:	recommended to choose a built-in high pass filter to reject nois	es in low frequency range. For example, if you are interested in the					
	signals greater than 1 kHz, you may specify a high pass filter with	th -3dB cut-off frequency at 100 Hz to improve signal to noise ratio					
	of the signals of the interest.	cos disturbances and/or vibrations, resulting from rough surface					
	2. Avoid Saturation, when there are strong low frequency hoises, disturbances, and/or vibrations, resulting from rough surface						
	saturation in these low frequency ranges	recommended to specify a high pass lifter to avoid hydrophone					
Preamp Gain (dB):	34 dB	10 and 40 dB					
	Low Power Fixed Gain Preamp.	Low Noise Programmable Gain Preamp.					
Bespoke Preamp:	Buyer may specify a specific preamp to be used in the hydrophy	one to fit the projector better.					
		CMOS/TTL Compatible					
Gain Selection Voltage:	N/A	<b>Logic Low 0</b> : Gain Selection Wire to COM or 0 to +0.8 VDC.					
5		<b>Logic High 1</b> : Gain Selection Wire Open or +2.4 VDC to V <sub>s</sub> .					
Receiving Face:	Circular Planar Face						
Directivity Pattern:	Conical Beam, Refer to Graph of Directivity Pattern.						
-3dB Beam Width:	1700°/f(kHz)						
Frequency f-3dBML:	15 kHz, f-3dBML: Main Lobe drops -3dB at ±90° normal to acoustic	caxis.					
Critical Frequency f <sub>c</sub> :	36 kHz, f <sub>c</sub> : Side lobes exist in the case of operating frequency f >	> fc; The hydrophone has no side lobe in the case of $f ≤ fc$ .					
±90° Sidelobe Frequency fn:	49 kHz, fn: First Side Lobes exist at ±90° normal to acoustic axis	in the case of operating frequency f = fn.					
Sidelobe Level:	< -17.8 dB when f > fc; No side lobe when f $\leq$ fc.						
Output Type:	Differential	Differential					
Output Type.	Differential signal has better capability to reduce and reject EM	I noise, especially over long cable.					
Maximum Output V <sub>omax</sub> :	Supply Voltage Vs – 3.4, Vpp.	Supply Voltage Vs – 3.4, Vpp.					
Overload Pressure Level:	20*log(V <sub>omax</sub> /2.828) – Sensitivity, in dB μPa.						
Acceleration Sensitivity:	152.7 dB $\mu$ Pa/(m/s <sup>2</sup> ) along acoustic axis.						
	Other direction: 142.5 dB $\mu$ Pa/(m/s <sup>2</sup> ).						
Operating Depth:	Maximum 300 m or 3 MPa pressure and limited by the cable le	ngth if the cable has wire leads or a non-waterproof connector.					
	1. Default: Free Hanging (FH)						
	2. Thru-hole Mounting with Single O-ring (THM-M10, THM-7/16", or THM-5/8".)						
Mounting Ontions	Inru-noie iviounting with Double O-ring (IHDO-//16")     Bolt Eastening Mounting (Stainless Steel) (BEM-7/16" or BEM-5/8")						
Mounting Options.	4. boil Lastening Woulding (Stalliess Steel) ( <b>Drivi-7/10, Of Drivi-7/0</b> ,) 5. Free-hanging with Male Underwater Connector ( <b>FHUWC-6P.</b> )						
	6. Flush Mounting ( <b>FSM-M55</b> )	1					
	Please refer to online document AcousticSystem.pdf for a comp	plete list of Mounting Options and more details.					
	1. Default: Perpendicular to end face of hydrophone.						
Cable Orientation:	2. Customization: Perpendicular to side wall of hydrophone (Generally, this is used to reduce the overall length of hydrophone),						
	Appending SW to the part number.						
Cable Options:	Four Conductor Shielded Cable (SC)	Six Conductor Shielded Cable (SC)					
Cable Lawrite	Default: 20m (65.6ft) for Non-Underwater Connector; 0.6m (2ft	t) for Underwater Connectors.					
Cable Length:	Custom-fit up to 200 m or 656 ft.						
	1. Default: Wire Leads (WL)						
	2. Two Male BNCs (BNC) (Max. Diameter Ф14.3 mm) for Output+ and Output- Signals.						
	3. DIN Receptacle with 3 Male Pins ( <b>DIN3</b> ), (Max. Diameter Φ17 mm).						
	DIN Receptacle with 4 Male Pins ( <b>DIN4</b> ), (Max. Diameter $\Phi$ 17 mm).						
	DIN Receptacle with 6 Male Pins ( <b>DIN6</b> ), (Max. Diameter $\Phi$ 17 mm).						
	4. 1/8" (3.5mm) TRS Plug ( <b>TRS</b> ) (Max. Diameter Φ10.5 mm).						
_	5. XLR Receptacle with 3 Male Pins ( <b>XLR3</b> ), (Max. Diameter Φ20.2 mm).						
Connector:	XLR Receptacle with 4 Male Pins ( <b>XLR4</b> ), (Max. Diameter Φ20.2 mm).						
	XLR Receptacle with 6 Male Pins ( <b>XLR6</b> ), (Max. Diameter $\Phi$ 20.2 mm).						
	6. Underwater Mateable Connector (4 pins) ( <b>UMC4P</b> ) (Max. Diameter Ф21.5 to Ф35 mm).						
	Underwater Mateable Connector (6 pins) ( <b>UMC6P</b> ) (Max. Diameter <b>0</b> 21.5 to <b>0</b> 35 mm).						
	$7 \pm 9$ /DC Battery Span ( <b>BS</b> ) for $\pm 9$ /DC or $\pm 18$ /DC power supply	UNIC IS FROM GIODAL MANUTACTURERS OF UNDERWATER CONNECTORS. Its part number is listed in quote in detail.					
	8 Amm Banana Plug Pair (Bed and Black Color) (BP) for DC now	y. ver supply ONLY.					
	8. 4mm Banana Plug Pair (Red and Black Color) (BP), for DC power supply ONLY.						
	Underwater Mateable Connectors are for underwater uses. Other	er connectors/wire leads are for dry uses and are not waterproofed					
Supply Voltage Vs.	Underwater Mateable Connectors are for underwater uses. Other +4.5 to +32 V	er connectors/wire leads are for dry uses and are not waterproofed. +9 to +32 V					
Supply Voltage Vs:	Underwater Mateable Connectors are for underwater uses. Oth +4.5 to +32 V +9 VDC Battery, Marine Battery, Automobile Battery, Fixed DC	er connectors/wire leads are for dry uses and are not waterproofed. +9 to +32 V Linear Power Supply. Not Included					
Supply Voltage Vs: Suggested DC Supply:	Underwater Mateable Connectors are for underwater uses. Oth +4.5 to +32 V +9 VDC Battery, Marine Battery, Automobile Battery, Fixed DC DO NOT use variable power supply whose maximum supply vol	er connectors/wire leads are for dry uses and are not waterproofed. +9 to +32 V Linear Power Supply, Not Included. tage is higher than the rated voltage.					
Supply Voltage Vs: Suggested DC Supply:	<ul> <li>Underwater Mateable Connectors are for underwater uses. Other +4.5 to +32 V</li> <li>+9 VDC Battery, Marine Battery, Automobile Battery, Fixed DC I DO NOT use variable power supply whose maximum supply vol DO NOT use switching mode DC power supply.</li> </ul>	er connectors/wire leads are for dry uses and are not waterproofed. +9 to +32 V Linear Power Supply, Not Included. tage is higher than the rated voltage.					

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SE=SL-TL+AG-NL	Underwater Sound Solutions	d Solutions benthowave.com Revised on 2025/01/1			
Size:	Free Hanging: ΦDxL = Φ60 x 63.5 mm, Other N	lounting Types: actual length d	epends on Mounting Parts.		
Weight:	$\ge$ 1.2 kg with 20m 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.				
Sound Measurement in Air: Th	e hydrophones can be used to detect sounds in a	ir. The sensitivity in air is same	to the one in water in low frequency range.		

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

FG: Fixed Gain;	FG: Fixed Gain; PG: Programmable Gain; DF: Differential Output; BPF: Band Pass Filter; HPF: High Pass Filter; LPF: Low Pass Filter.						
Part Number	-Preamp Gain	-HPF Filter	-Mounting	-Cable Length	-Connectors for Signal/Gain Selection	/DC Supply	
BII7079FGDF	34 dB.	3 Hz.	FH: Free Hanging. Connector Options for Signals, Gain Selection				
BII7079PGDF	10/40 dB.	13 Hz.	BFM-5/8": Bolt-fastening.	20111 (05.011)	Supply.		
Example of Part Number: Description							
BII7079FGDF-34	BII7079FGDF-34dB-3Hz-FH-20m-WL BII7079FGDF Hydrophone, 34dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Connecter None, Wire leads.					ble, Connector:	
BII7079FGDF-34dB-3Hz-FH-20m-BNC/BS BII7079FGDF Hydrophone, 34dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Conne Two BNC Male for Output+ and Output- Signals, 9V Battery Snaps for DC Supply.				ble, Connector:			
BII7079FGDF-34dB-3Hz-FH-20m-XLR3/BS BII7079FGDF Hydrophone, 34dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Conne XLR3 for Signal, 9V Battery Snaps for DC Supply.					ble, Connector:		
BII7079FGDF-34dB-3Hz-FH-20m-XLR4 BII7079FGDF Hydrophone, 34dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Connec XLR4 for Signals and DC Power Supply.					ble, Connector:		
BII7079PGDF-10/40dB-13Hz-FH-20m-WL BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Free Hanging, 20m Shielded Ca Connector: None, Wire leads.					Shielded Cable,		
BII7079PGDF-1	BII7079PGDF-10/40dB-13Hz-FH-20m-XLR3/WL/BS BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Free Hanging, 20m Shielded Cabl Connector: XLR3 for Signal, Wire Leads for Gain Selection, 9V Battery Snaps for DC Supply.					Shielded Cable,	
BII7079PGDF-1	BII7079PGDF-10/40dB-13Hz-FH-20m-XLR6 BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Free Hanging, 20m Shielded Cabi Connector: XLR6 for Signals, Gain Selection, and DC Power Supply.						

## How to Order Bespoke Hydrophones. Non-stock.

FG: Fixed Gain; PG: Programmable Gain; DF: Differential Output; SE: Single Ended Output; BPF: Band Pass Filter; HPF: High Pass Filter; LPF: Low Pass Filter.							
Part Number	-Preamp Gain	- <u>HPF or BPF</u>	-Mounting	-Cable Length	-Connectors for Signal/Gain Selection	/DC Supply	
BII7079FGDF	34 dB.	Filter.	Mounting	in meter.	Connector Options for Signals, Gain Selection,	and DC	
BII7079PGDF	10/40 dB.	in Hz, kHz.	Options.	Up to 200m (656 ft).	Supply.		
Example of Part	t Number:		Description				
BII7079EGDE-34	4dB-10Hz-FH-30m-V	MI	BII7079FGDF Hyd	drophone, 34dB Gain, Hi	igh Pass Filter: 10Hz, Free Hanging, 30m Sh	ielded Cable,	
			Connector: none,	Wire leads.			
	1dB_10H7_EH_30m_B		BII7079FGDF Hyd	drophone, 34dB Gain, Hi	igh Pass Filter: 10Hz, Free Hanging, 30m Sh	ielded Cable,	
BI170791 GD1-34	+0.0-10112-111-30111-0	511C/ 05	Connector: Two B	NC Male for Output+ and	Output- Signals, 9V Battery Snaps for DC Supply.		
			BII7079FGDF Hydrophone, 34dB Gain, High Pass Filter: 10Hz, Bolt Fastening Mounting BFM-7/16", 100m				
Shielded Cable, Connector: 3-pin XLR for Signals and Battery Snap for +9VDC Batteries.							
			BII7079FGDF Hydrophone, 34dB Gain, High Pass Filter: 10Hz, Free Hanging, 0.6m Shielded Cable,				
BI1/0/9FGDF-54	+ub-1062-F6-0.000-0	UIVIC4P	Connector: 4-pin	Underwater Mateable Con	nector for Signals and DC Power Supply.		
		ma \4/I	BII7079PGDF Hyd	drophone, 10/40dB Gain,	High Pass Filter: 20Hz, Free Hanging, 30m Sł	nielded Cable,	
BII/0/9PGDF-10	J/400B-20H2-FH-30	III-VVL	Connector: none,	Wire leads.			
BII7079PGDF-10/40dB-20Hz/20kHz-BFM-7/16"-			BII7079PGDF Hydrophone, 10/40dB Gain, Band Pass Filter: 20Hz to 20kHz, Bolt Fastening Mounting BFM-				
			7/16", 100m Shielded Cable, Connector: 3-pin XLR for Signals, Wire Leads for Gain Selection, and Battery				
100m-ALR3/WL	./ 55		Snap for +9VDC B	atteries.			
			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 20Hz, Free Hanging, 0.6m Shielded Cable,				
BII/0/9PGDF-10	BII/0/9PGDF-10/40dB-20Hz-FH-0.6m-UMC6P Connector: 6-pin Underwater Mateable Connector for Signals, Gain Selection, and DC Power Supply.						

#### Wiring Information of BII7079FGDF Hydrophones with Fixed-gain Preamps:

Differential Output:	Wire Leads	UMC4P/XLR4P	DIN4P	DIN3/XLR3 + 9V BS		BNC + 9V BS	TRS + 9V BS
+VDC	Red	Pin 3	Pin 4	Battery Fema	ile Snap	Battery Female Snap	Battery Female Snap
Common	Black	Pin 1	Pin 1	Battery Male	Snap	Battery Male Snap	Battery Male Snap
Signal+	White	Pin 2	Pin 3	DIN3 Pin 3	TRS Tip	#1 BNC Center	TRS Tip
Signal-	Blue, Green, or Yellow	Pin 4	Pin 2	DIN3 Pin 1	TRS Ring	#2 BNC Center	TRS Ring
Signal Common	Black	Pin 1	Pin 1	DIN3 Pin 2	TRS Sleeve	BNC Shell	TRS Sleeve
Shielding	Shield	Metal Shell	Metal Shell	DIN3 and XLR3 Metal Shell		N/A	N/A

## Wiring Information of BII7079PGDF Hydrophones with One-Bit-Word Programmable Gain Preamps:

Differential Output:	Wire Leads	UMC6P/XLR6	DIN6	BNC + 9V BS	DIN3/XLR3 + 9V BS		TRS + 9V BS
+VDC	Red	Pin 3	Pin 4	Battery Female Snap	Battery Fema	ile Snap	Battery Female Snap
Common	Black	Din 1	Din 1	Battery Male Snap,	Battery Male	Snap,	Battery Male Snap,
Common	DIACK	FIIII	FIILT	BNC Shield.	DIN Pin 2 or XLR Pin 1.		TRS Sleeve.
Output Signal+	White	Pin 2	Pin 3	"1" BNC Center Pin	DIN Pin 3	XLR Pin 2	TRS Tip
Output Signal -	Green	Pin 4	Pin 2	"2" BNC Center Pin	DIN Pin 1	XLR Pin 3	TRS Ring
Digital A0	Blue	Pin 6	Pin 5	Blue	Blue		Blue
Digital Common	Yellow or Brown	Pin 5	Pin 6	Yellow or Brown	Yellow or Bro	wn	Yellow or Brown
Shielding	Shield	Metal Shell	Metal Shell	BNC Shield	Metal Shell		N/A
Selecting Sensitivity of	of One-bit Digitally Pro	ogrammable					

#### **Question:**

0 (Logic Low)

1 (Logic High)

What if the mating connector of my DAQ module or recording device is NOT available from BII? A bespoke connector adaptor might be assembled by BII 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.

Is impedance matching necessary between hydrophones/sensors and preamplifiers/Recorders/Analyzers? it is NOT necessary to do impedance matching in low frequency range applications in which electromagnetic wave lengths are much greater than the cable length. High frequency transducers such as NDT pulsing transducers need 50Ω impedance matching among transducers, cables, and analyzers/digitizers.

My acoustic sensors generate differential signals in MHz range, are TRS connectors suitable for my applications? BII's test shows TRS connectors (Plug and Jack) of BII preamps can be used up to 20 MHz. Test Conditions: TRS Jack with 0.2m cable and TRS plug with 1m cable. Oscilloscope: 1MΩ||20pF, Signal Source: DDS Signal Generator.

Can 3.5mm (1/8") TRS be configured for single-ended signal of a hydrophone/transducer which does not have built-in preamplifier? Yes, the preamp with differentialinput TRS can accept single-ended signals from hydrophones/transducers whose TRS wiring should be like followings: TRS Tip: Signal. TRS Ring and Sleeve: Both terminals are soldered together for Signal Common and Shielding. Common and shielding should be "one-point" contact.

Can BII explain why the capacitance of my hydrophone/transducer affect high pass filtering? (1). Hydrophone/transducer is high impedance devices in low frequency range. Its simplified complex impedance =  $j/(2\pi fC_h)$ ,  $C_h$  is the capacitance of hydrophone/transducer, f is frequency in Hz. This impedance is in series with preamp R<sub>i</sub> and can reach several M $\Omega$  to hundreds M $\Omega$  depending on  $C_h$  and f. (2). Most high-performance operational amplifiers (IC chips) can use input resistors R<sub>i</sub> up to 1 to 200 M $\Omega$  to avoid bumping into saturation issue.

Can the hydrophone with differential outputs be wired to single-ended inputs of a DAQ device (Data Acquisition Equipment) such as an Oscilloscope? Yes, output+ and Common of a BII hydrophone can be used a single-ended signal, or Output- and Common of the hydrophone can be used a single-ended signal. (1) The terminal of unused output MUST be insulated to avoid short circuit.

(2) Neither output+ nor output – of the hydrophone can be wired to common which is going to destroy the hydrophone by short circuit.

-184 + 10 dB V/μPa.

-184 + 40 dB V/μPa.

## How do I use a programmable sensitivity hydrophone as a fixed sensitivity hydrophone?

When a **Gain Selection wire** is short to **Digital Common**, its digital logic is Low or "0. The gain of the built-in preamp is set to low gain. When a **Gain Selection wire** is floating or open, its digital logic is High or "1". The gain of the built-in preamp is set to high gain. The unused terminals and bare splice wire leads MUST be insulated to avoid short circuit.

What if the connector of my analyzer (instrument) is SMA or SMC Connector? Buyer may order a SMA (or SMC) to BNC (Male) adaptor from local electronic distributors in buyer's country. BII may ship the adaptor as accessory of the device if buyer requests when ordering. By default, BII does NOT supply the adaptor as accessories.

How to increase hydrophone sensitivity for extremely weak sounds? BII low noise hydrophone with built-in preamp (Differential Output) -> Long Cable -> Standalone Preamp -> Analyzing Instrument or Recorder.

What components are necessary to compensate the propagation and spreading loss?

A low noise hydrophone +  $\underline{PGA}$  amplifier with gain of 0/20/40/60 dB.

A low noise hydrophone +  $\overline{VGA}$  amplifier with gain of 0 ~ 70 dB.

A low noise hydrophone +  $\overline{AGC}$  amplifier with gain of -20 ~ 80dB.

#### How do I use Gain Selection wires of a Programmable Sensitivity Hydrophone 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.

#### System Configuration of Receiving Sounds and Waves.





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

## 1. Free Hanging.



## 2. Bolt-Fastening Mounting BFM-7/16" (7/16"-20x22 UNF-2A), or BFM-5/8" (5/8"-18x22 UNF).

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### 3. Thru-hole Mounting (Inch Thread) with Single O-ring Sealing THM-7/16" (7/16"-20x22 UNF-2A), or BFM-5/8" (5/8"-18x22 UNF).



#### 4. Free-hanging with Underwater Connector FHUWC-6P, 6 Pins.

	UWC-Cable Length-Connector: Underwater Connector with Socket insert and Internal-Thread Mating Parts, customized-length shielded cable, a
Mating	Connector (WL, XLR, TRS, DIN, MIL, UMC, etc.) to DAQ devices or Digital Recorders.
Connector	How to order cable with mating underwater connector? for example:
connector	UMC4S-20m-WL: 20 m cable with Underwater Mateable Connector 4 Sockets (UMC4S) on one end and wire leads (WL) on other end.
and Cable	UMC4S-20m-XLR3/BS: 20 m cable with and Underwater Mateable Connector 4 Sockets (UMC4S) on one end and XLR Receptacle with 3 Male Pins
	(XLR3) and Two +9V Battery Snaps on other end.



6. More Mounting/Installation Options: Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and details.



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Underwater Sound Solutions

Free-field Voltage Sensitivity: Noise Density (Referred to Input): **Hydrophone Sensitivity** Hydrophone Noise Spectrum -165 110 FFVS: Preamp of 0dB and 3Hz High Pass Filter. —Sea State 0 Noise —BII7079FGDF —BII7079PGDF 100 -170 ---- FFVS: Preamp of 0dB and 13Hz High Pass Filter 90 -175 80 Noise Density (dB re µPa/√Hz) -180 FFVS (dB V/µPa) 70 -185 60 50 -190 40 -195 30 -200 20 -205 10 -210 0.1 Frequency (kHz) 0.001 0.01 10 100 0.001 100 0.1 0.01 10 Frequency (kHz)

#### **Directivity Pattern:**



Linear Array with BII7070 Series Elements

