

BII7079 Low Noise Hydrophone: Noise Level Below Sea State Zero

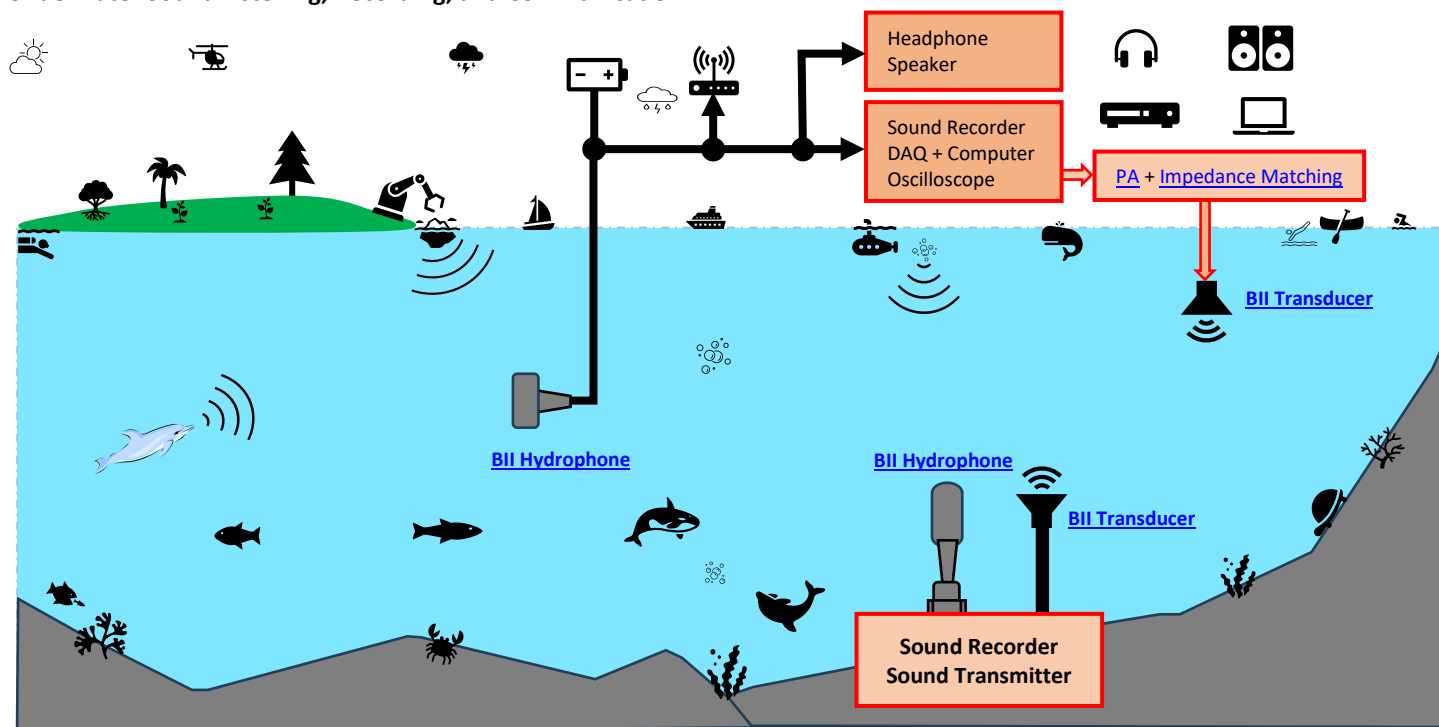
BII7079 Low noise directional hydrophones have conical beams for uses in detection of weak signals, broadband signals, pipeline leaks, and tracking of sound sources underwater. These acoustic sensors are also designed for applications in air to detect acoustic emission and stress waves. (Note: The couplant 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 f_c , 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 3Hz: Surface Waves (Wave-height Sensor), Turbulences, seismic, ocean traffics, industrial noises, precipitations, biologies, ... The preamplifier integrated in the hydrophone can drive cable up to 300m 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.

Low Frequency Sounds in the Ocean at 1 Hz to 1 kHz. Low Frequency Sounds between 1Hz to 1kHz undergo little attenuation in ocean and lakes: 1.2×10^{-7} at 1Hz, 0.0002 at 10Hz, 0.0015 at 100Hz, 0.07 at 1kHz, in dB/km, proximately. The major propagation losses are Spreading Loss, Absorption and Scattering at boundaries such as seafloor sediments. The sounds being trapped in deep sound channel or SOFAR channel avoiding losses from both top and bottom boundaries can propagate very big area with very low loss. These low frequency sounds contain valuable information on their sources and propagation areas such as Weathers (Winds, Rains, Surface Waves, Ice, Storms, ...), Geological Process (Earthquakes, Tsunamis, Moving of Tectonic Plates and Crusts,...), Marine Animals (Whales, Dolphins, Fish, Invertebrates, ...), Anthropogenic Activities (Shipping, Harbor, Oil and Wind Energy Extraction, Air Guns, ...). Besides sounds detection or monitoring with deployment at 1000m depth, the distributed hydrophone network in shallow water (at a specific depth) can also be used to detect and monitor upward sounds being refracted from SOFAR channel.

Underwater Sound Listening, Recording, and Communication



Typical Applications

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

Questions

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

1. BII 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 \(Projectors\)](#).

Specification

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:	BII7079FGDF	BII7079PGDF
Sensitivity FFVS @ 1 kHz:	-184 + Preamp Gain, dB V/μPa, ± 2 dB. -158.0 dB V/μPa.	-174.0 and -144.0 dB V/μPa.
FFVS:	Refer to Graph of FFVS vs. Frequency . Free-field Voltage Sensitivity.	
Pressure Noise Density:	Refer to Graph of Pressure Noise Density , Referred to Input (RTI), in μPa/VHz.	
Built-in Filter:	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 Hz ~ 5 kHz	in Air: 13 Hz ~ 5 kHz
	1. Reduce Noise. 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 1 kHz, 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. 2. Avoid Saturation. When there are strong low frequency noises, disturbances, and/or vibrations, resulting from rough surface waves and/or mechanical movements of the platform, it is recommended to specify a high pass filter to avoid hydrophone saturation in these low frequency ranges.	
Preamp Gain (dB):	26 dB.	10 and 40 dB.
Bespoke Preamp:	Low Power Fixed Gain Preamp.	Low Noise Programmable Gain Preamp.
Gain Selection Voltage:	N/A	CMOS/TTL Compatible Logic Low 0: Gain Selection Wire to COM or 0 to +0.8 VDC. Logic High 1: Gain Selection Wire Open or +2.4 VDC to V _s .
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 axis.	
Critical Frequency f _c :	36 kHz, f _c : Side lobes exist in the case of operating frequency f > f _c ; The hydrophone has no side lobe in the case of f ≤ f _c .	
±90° Sidelobe Frequency f _n :	49 kHz, f _n : First Side Lobes exist at ±90° normal to acoustic axis in the case of operating frequency f = f _n .	
Sidelobe Level:	< -17.8 dB when f > f _c ; No side lobe when f ≤ f _c .	
Output Type:	Differential	Differential
	Differential signal has better capability to reduce and reject EMI noise, especially over long cable.	
Maximum Output V _{omax} :	Supply Voltage V _s – 3.4, Vpp.	Supply Voltage V _s – 3.4, Vpp.
Overload Pressure Level:	20*log(V _{omax} /2.828) – Sensitivity, in dB μPa.	
Acceleration Sensitivity:	152.7 dB μPa/(m/s ²) along acoustic axis. Other direction: 142.5 dB μPa/(m/s ²).	
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 (FH) 2. Thru-hole Mounting with Single O-ring (THM-7/16", or THM-5/8".) 3. Thru-hole Mounting with Double O-ring (THDO-7/16".) 4. Bolt Fastening Mounting (Stainless Steel) (BFM-7/16", or BFM-5/8".) 5. Bolt-Fastening Mounting with Free Hanging (BFM-FH-1/4", BFM-FH-3/8".) 6. Free-hanging with Male Underwater Connector (FHUWC-4P, FHUWC-6P.) Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and more details.	
	1. Default: Perpendicular to end face of hydrophone. 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 Length:	Default: 20m (65.6ft) for Non-Underwater Connector; 0.6m (2ft) for Underwater Connectors.	
	Custom-fit Cable Length up to 305 m or 1000 ft, refer to Maximum Cable Length . The chart is based on 2Vpp Sinusoidal signals. Maximum cable length which a hydrophone can drive is inversely proportional to output voltage level of the hydrophone.	
Connector:	1. Default: Wire Leads (WL) 2. Two Male BNCs (BNC) (Max. Diameter Φ14.3 mm) for Output+ and Output- Signals. 3. DIN Receptacle with 3 Male Pins (DIN3), (Max. Diameter Φ17 mm). DIN Receptacle with 4 Male Pins (DIN4), (Max. Diameter Φ17 mm). DIN Receptacle with 6 Male Pins (DIN6), (Max. Diameter Φ17 mm). 4. 1/8" (3.5mm) TRS Plug (TRS) (Max. Diameter Φ10.5 mm). 5. XLR Receptacle with 3 Male Pins (XLR3), (Max. Diameter Φ20.2 mm). XLR Receptacle with 4 Male Pins (XLR4), (Max. Diameter Φ20.2 mm). XLR Receptacle with 6 Male Pins (XLR6), (Max. Diameter Φ20.2 mm). 6. Underwater Mateable Connector UMC4P and UMC6P, made by global manufacturers, buyer may search online to get detailed specs of these connectors from their manufacturers. Available in-stock options (the customized is available upon request): 4 pins (UMC4P = MCIL4M + MCDLS-F, or MCOM4M + OMBMC + MCDLS-F.), Maximum Diameter Φ21.5 to Φ35 mm. 6 pins (UMC6P = MCIL6M + MCDLS-F, or MCOM6M + OMBMC + MCDLS-F.), Maximum Diameter Φ21.5 to Φ35 mm.	
	7. +9VDC Battery Snap (BS), for +9VDC or +18VDC power supply. 8. 4mm Banana Plug Pair (Red and Black Color) (BP), for DC power supply ONLY.	
	Underwater Mateable Connectors are for underwater uses. Other connectors/wire leads are for dry aerial uses and are not waterproofed.	
	1. BNC: "Bayonet Neill–Concelman" is a miniature quick connect/disconnect radio/audio frequency connector used for coaxial cable. Fastening Type: Bayonet Lock. 2. 3.5mm TRS stand for Tip, Ring, and Sleeve, miniature, quick connect/disconnect, audio frequency connector used for shielded cable. Fastening Type: None.	

3. DIN: Electrical cylindrical connectors, 3 to 14 contacts, Ø20mm diameter, used for audio, RF, digital, and DC or AC power signals. Fastening Type: Threaded.		
4. XLR: Employed for balanced audio and DC or AC power signal interconnections, 3 to 7 contacts. Fastening Type: Latch Lock.		
5. MIL: MIL-5015 Style Connectors, interconnection solution for high power signals. -55°C to +125°C, Fastening Type: Threaded. Dry Uses.		
6. UMC: Underwater Mateable Connectors, interconnection solution for high power or weak signals. Fastening Type: Threaded. Underwater Uses.		
Supply Voltage Vs:	+4.5 to +32 V	+9 to +32 V
Suggested DC Supply:	+9 VDC 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):	1.05 mA	18 mA
Size:	Free Hanging: ØDxL = Ø60 x 70 to 80 mm	Free Hanging: ØDxL = Ø60 x 70 to 80 mm
	Other Mounting Types: actual length depends on Mounting Parts.	
Weight:	1.04 kg with 20 m cable.	0.78 kg with 20 m cable.
	Actual weight depends on Mounting Parts, Cable Types and Length.	
	Warning: Do not move or lift transducers or hydrophones by the cable in air for protecting the cable from damage by the weight.	
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.	
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.	
AE (Acoustic Emission) Applications: These hydrophones are tested and calibrated in water. It is buyer's responsibility and liability to calibrate and maintain the AE sensors according to the acoustic emission national standards of buyer's country.		
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 Standard Hydrophones. BII Keeps Standard Products in Stock.

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 or BPF	-Mounting	-Cable Length	-Connector Options
BII7079FGDF	26dB or Bespoke	3 Hz.	FH: Free Hanging.	20 m (65.6 ft).	Connectors for Signal/DC Supply
BII7079PGDF	10/40dB or 20/50dB	13 Hz.	BFM-5/8" : Bolt-fastening.	0.6 m (2 ft).	Connectors for Signal/Gain Selection/DC Supply
In-Stock Examples:			Description		
BII7079FGDF-26-3Hz-FHUMC-4P			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 3Hz, Free-hanging with Male Underwater Connector FHUMC-4P (MCBH4MSS).		
BII7079FGDF-26dB-3Hz-FH-20m-WL			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Connector: None, Wire leads.		
BII7079FGDF-26dB-3Hz-FH-20m-BNC/BS			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Connector: Two BNC Male for Output+ and Output- Signals, 9V Battery Snaps for DC Supply.		
BII7079FGDF-26dB-3Hz-FH-20m-XLR3/BS			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Connector: XLR3 for Signal, 9V Battery Snaps for DC Supply.		
BII7079FGDF-26dB-3Hz-FH-20m-XLR4			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 3Hz, Free Hanging, 20m Shielded Cable, Connector: XLR4 for Signals and DC Power Supply.		
BII7079PGDF-10/40dB-13Hz-FHUMC-6P			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Connector FHUMC-6P (MCBH6MSS).		
BII7079PGDF-10/40dB-13Hz-FH-20m-WL			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Free Hanging, 20m Shielded Cable, Connector: None, Wire leads.		
BII7079PGDF-10/40dB-13Hz-FH-20m-XLR3/WL/BS			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Free Hanging, 20m Shielded Cable, Connector: XLR3 for Signal, Wire Leads for Gain Selection, 9V Battery Snaps for DC Supply.		
BII7079PGDF-10/40dB-13Hz-FH-20m-XLR6			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 13Hz, Free Hanging, 20m Shielded Cable, Connector: XLR6 for Signals, Gain Selection, and DC Power Supply.		
Example of Part Number:			Description		
BII7079FGDF-26dB-10Hz-FH-30m-WL			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 10Hz, Free Hanging, 30m Shielded Cable, Connector: none, Wire leads.		
BII7079FGDF-26dB-10Hz-FH-30m-BNC/BS			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 10Hz, Free Hanging, 30m Shielded Cable, Connector: Two BNC Male for Output+ and Output- Signals, 9V Battery Snaps for DC Supply.		
BII7079FGDF-26dB-10Hz-BFM-7/16"-100m-XLR3/BS			BII7079FGDF Hydrophone, 26dB 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-26dB-10Hz-FH-0.6m-UMC4P			BII7079FGDF Hydrophone, 26dB Gain, High Pass Filter: 10Hz, Free Hanging, 0.6m Shielded Cable, Connector: 4-pin Underwater Mateable Connector for Signals and DC Power Supply.		
BII7079PGDF-10/40dB-20Hz-FH-30m-WL			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 20Hz, Free Hanging, 30m Shielded Cable, Connector: none, Wire leads.		
BII7079PGDF-10/40dB-20Hz/20kHz-BFM-7/16"-100m-XLR3/WL/BS			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 Snap for +9VDC Batteries.		
BII7079PGDF-10/40dB-20Hz-FH-0.6m-UMC6P			BII7079PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 20Hz, Free Hanging, 0.6m Shielded Cable, 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 Female 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	TRS Tip
Signal-	Blue, Green, or Yellow	Pin 4	Pin 2	DIN3 Pin 1	TRS Ring	TRS Ring
Signal Common	Black	Pin 1	Pin 1	DIN3 Pin 2	TRS Sleeve	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 Female Snap	Battery Female Snap
Common	Black	Pin 1	Pin 1	Battery Male Snap, BNC Shield.	Battery Male Snap, DIN Pin 2 or XLR Pin 1.	Battery Male Snap, TRS Sleeve.
Output Signal+	White	Pin 2	Pin 3	"1" BNC Center Pin	DIN Pin 3	TRS Tip
Output Signal -	Green	Pin 4	Pin 2	"2" BNC Center Pin	DIN Pin 1	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 Brown	Yellow or Brown
Shielding	Shield	Metal Shell	Metal Shell	BNC Shield	Metal Shell	N/A
Selecting Sensitivity of One-bit Digitally Programmable						
FFVS Selection Wire A0		Hydrophone Sensitivity FFVS at 1kHz.				
0 (Logic Low)		-184 + 10 dB V/μPa.				
1 (Logic High)		-184 + 40 dB V/μPa.				

Question:

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 differential-input 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 = $j/(2\pi f C_h)$, C_h is the capacitance of hydrophone/transducer, f is frequency in Hz. This impedance is in series with preamp R_i and can reach several MΩ to hundreds MΩ depending on C_h and f . (2). Most high-performance operational amplifiers (IC chips) can use input resistors R_i up to 1 to 200 MΩ 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.

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 + [PGA](#) amplifier with gain of 0/20/40/60 dB.

A low noise hydrophone + [VGA](#) amplifier with gain of 0 ~ 70 dB.

A low noise hydrophone + [AGC](#) amplifier with gain of -20 ~ 80dB.

How do I use Gain Selection wires of a Programmable Sensitivity Hydrophone in field?

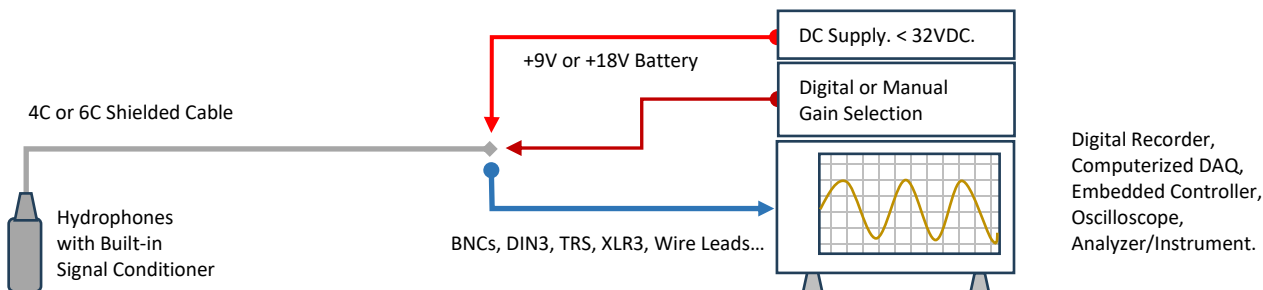
(1). **Manual Gain Selection.**

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.



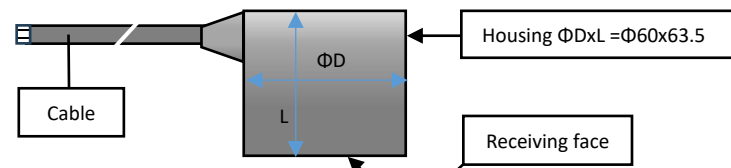
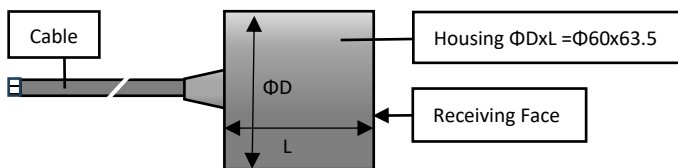
Physical Size (Dimensional Unit: mm): The overall length varies with the length of the built-in preamplifier and mounting parts.

1. Free Hanging. Cylindrical surface of the housing can be clamped to position the hydrophone.

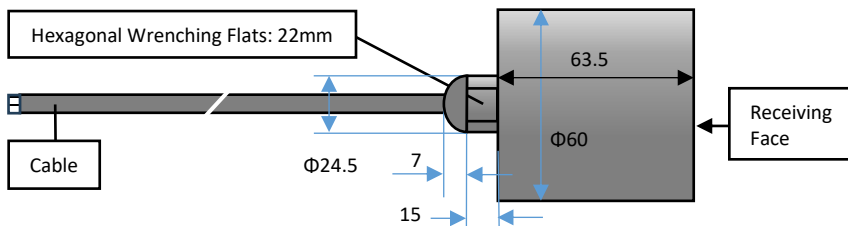
Warning: Metal clamp plus rubber cushion, Plastic/Rubber cable tie and/or jigs/fixture should be used for positioning hydrophones and avoiding damage the surface. Sharp and spiky clamps will damage hydrophone surfaces.

a. General Size information.

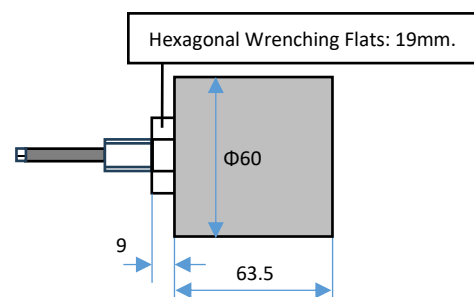
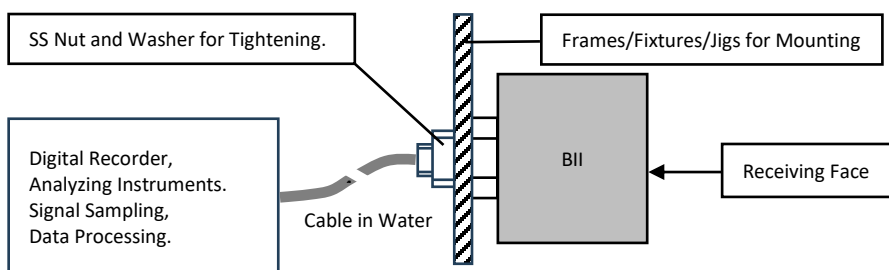
b. Size information of Customized Cable Orientation: Side Wall (-SW).



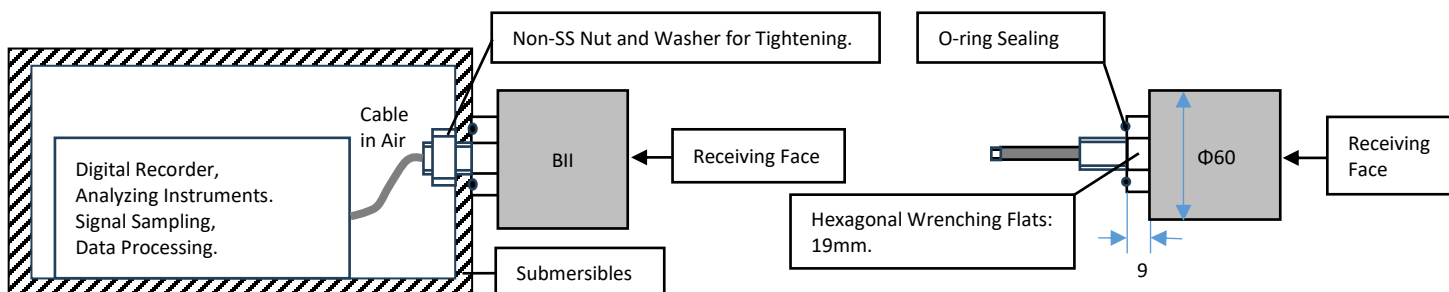
c. Size information of Free Hanging.



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

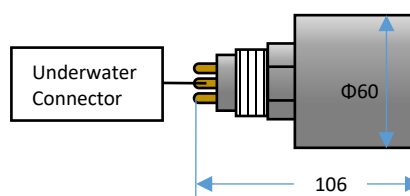
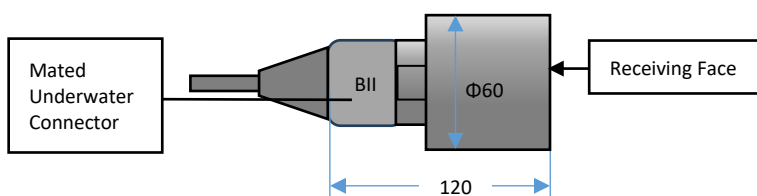


3. Thru-hole Mounting (Inch Thread) with Single O-ring Sealing THM-7/16" (7/16"-20x22 UNF-2A), or BFM-5/8" (5/8"-18x22 UNF).



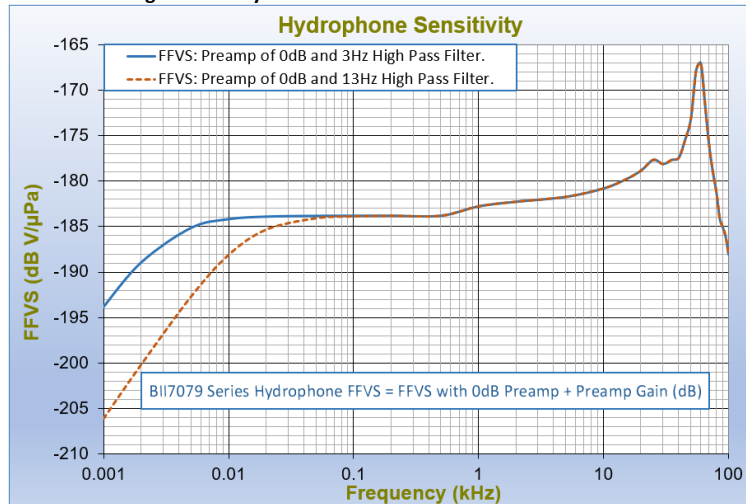
4. Free-hanging with Underwater Connector FHUWC-6P, 6 Pins.

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

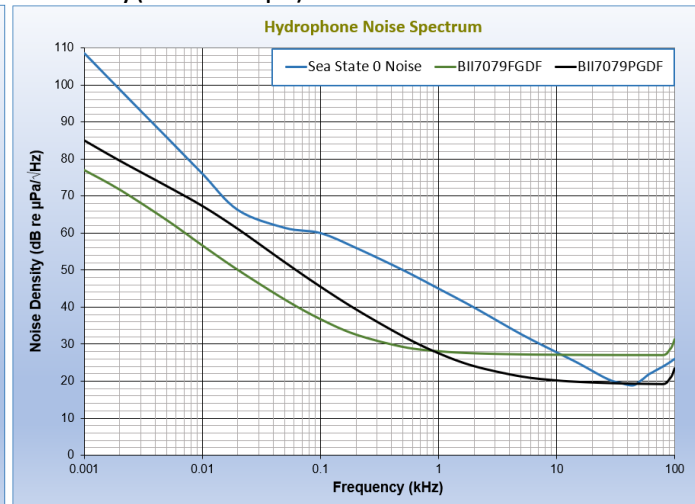


6. More Mounting/Installation Options: Please refer to online document [AcousticSystem.pdf](#) for a complete list of Mounting Options and details.

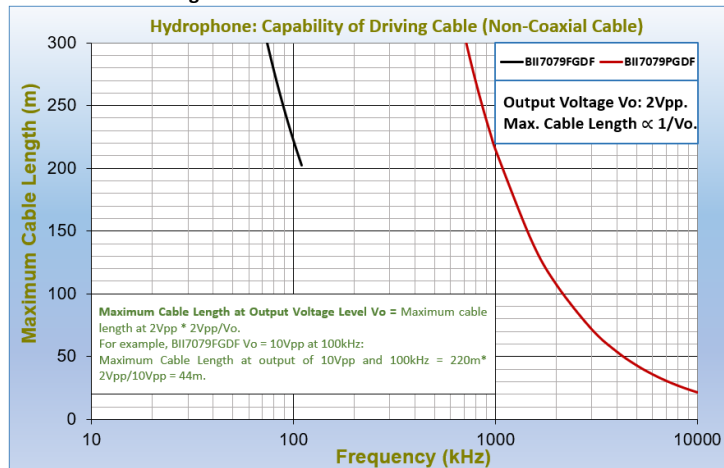
Free-field Voltage Sensitivity:



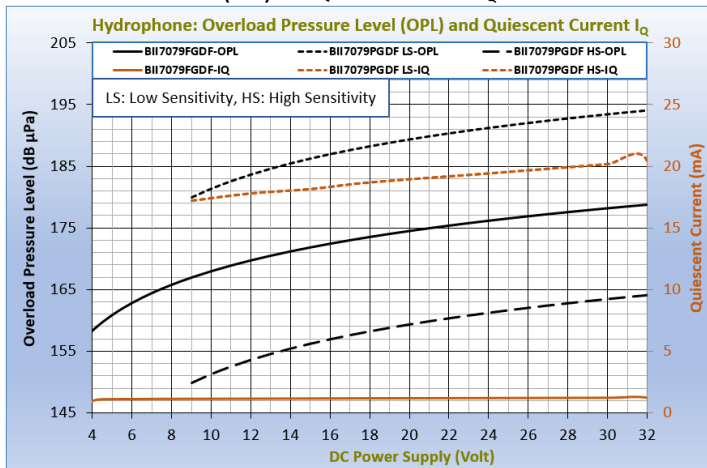
Noise Density (Referred to Input):



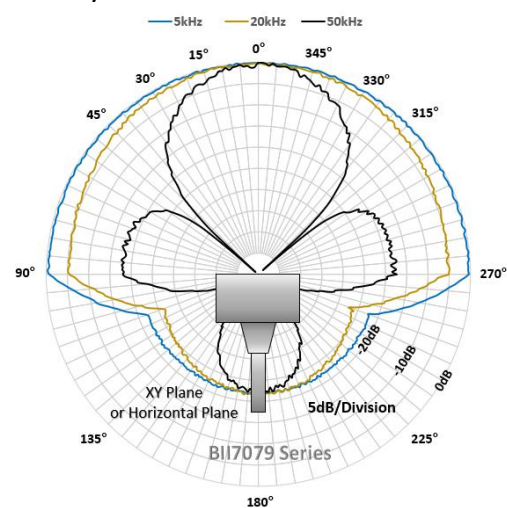
Maximum Cable Length



Overload Pressure Level (OPL) and Quiescent Current I_Q



Directivity Pattern:



Linear Array with BII7070 Series Elements

