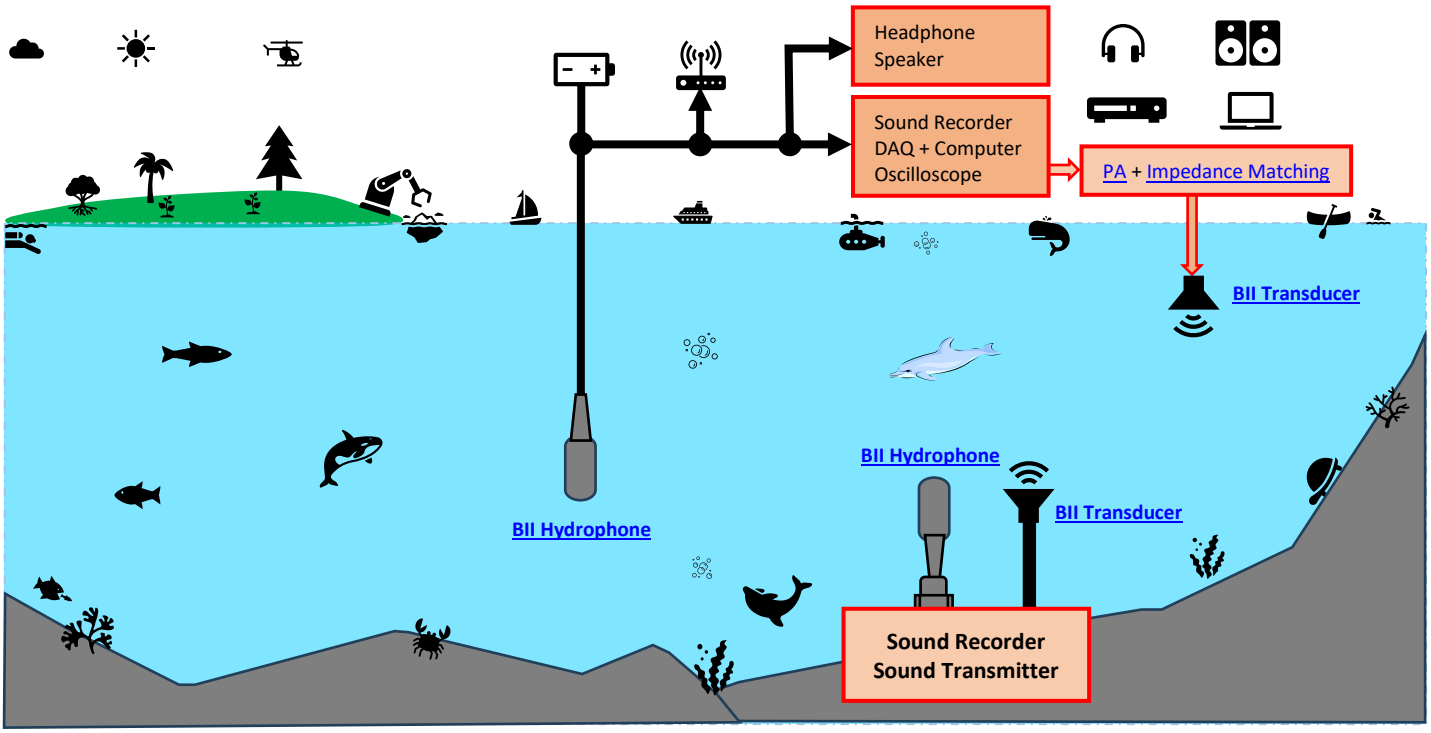
BII7120 Series Low Noise, Low Power, and Low Frequency Hydrophone: Noise Level Below Sea State Zero

BII's low noise hydrophones are optimized to possess self-noise levels below sea-state zero with omnidirectional response in low frequency range and toroidal response in high frequency range. Its streamlined hemispherical dome minimizes drag force and hydrodynamic noise. The power consumption can be customized to be 1 to 2 mA quiescent current at 9 VDC for battery powered underwater instrumentation. A spatial array of multiple hydrophones can be set up for directional measurement system. The hydrophones can measure underwater sounds and pressure fluctuations down to 0.1Hz infrasonic sounds: surface waves (Wave-height Sensor), turbulences, seismic, ocean traffics, industrial noises, precipitations, biologics, ...

With these low power hydrophones, battery and system lifetimes are extended, and lighter portable systems with lower-capacity batteries can be achieved. Its compact small size and hemispherical dome reduce interferences to acoustic field under test. Some preamplifier can drive cable up to 1000m without significant signal loss. Available cable terminals include audio connectors (TRS, DIN, 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, Noise Measurement, Marine Bioacoustics, Passive Acoustic Monitoring (PAM System).
Coastal/Offshore Processes, Engineering & Management, Wave-Structure Interaction, Wave-height Sensor, Wave and Tide Recorder/Logger.
Surface Waves, Ocean Turbulences, Hydrodynamics, Marine Geophysics, Battery-Powered Instruments: Sonobuoy, Recorder, Transponder, Acoustic Release...

Questions

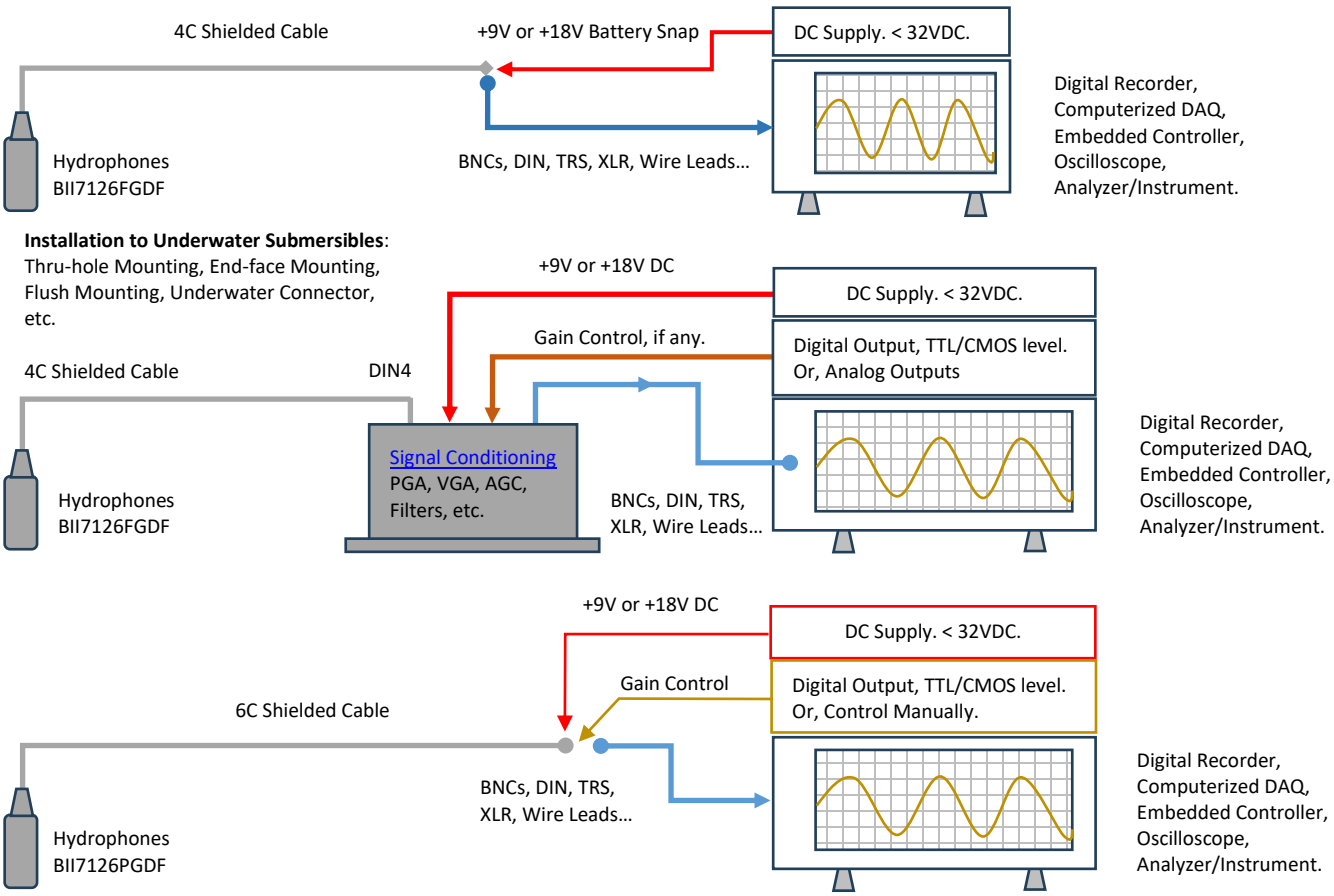
How do I set up my professional sound recorders to work with BII Hydrophones?

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).

System Configuration of Receiving Sounds and Waves.



Specification

The hydrophone is tested in water unless stated otherwise.			
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:	**BII7126FGDF**	**BII7126PGDF**	**BII7126PGSE**
Sensitivity @ 1 kHz:	-192.0 + Preamp Gain, ± 2 dB V/µPa.		
	-160.0 dB V/µPa.	-182.0, -152.0, dB V/µPa.	-182.0, -152.0, dB V/µPa.
Sensitivity Matching: (at 1 kHz)	When hydrophones are used as array elements, it is necessary for array elements to possess uniform sensitivities. Available Options of Sensitivity Tolerance: a. ±2.0 (Default); b. ±1.0; c. ±0.5; d. ±0.3; e. ±0.1; in dB V/µPa. 1. Sensitivity is tested at 1 kHz in water. 2. Hydrophones whose sensitivity variations are out of specified tolerance are rejected.		
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/√Hz.		
	Graphs of Pressure Noise Density are for hydrophones with default preamps. Contact BII for noises of bespoke preamps.		
Built-in Filters: at -3dB V/µPa.	Bespoke HPF .	Bespoke HPF or BPF.	Bespoke HPF or BPF.
	Minimum high pass filter f_{-3dB} = 10 Hz.	Minimum high pass filter f_{-3dB} = 15 Hz.	Minimum high pass filter f_{-3dB} = 15 Hz.
	In Water: 10 Hz to 260 kHz.	**In Water**: 15 Hz to 260 kHz.	**In Water**: 15 Hz to 260 kHz.
	In Air: 10 Hz ~ 12 kHz.	**In Air**: 15 Hz ~ 12 kHz.	**In Air**: 15 Hz ~ 12 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):	32 dB.	10 and 40 dB.	10 and 40 dB.
Bespoke Preamp:	Low Power Fixed Gain Preamp.	Low Noise Programmable Gain Preamp.	
	Buyer may specify a specific preamp to be used in the hydrophone to fit the project better.		
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.	
Directivity Pattern:	Omnidirectional and Toroidal. Refer to Graph of Directivity Response Pattern.		
Side Lobe Level:	No side lobes.		
Signal Output Type:	Differential.	Differential.	Single-ended.
	Differential signal has better capability to reduce and reject EMI noise, especially over long cable.		
	How to use differential output as single-ended output?		

	Output+ and **COM** constitute a single-ended output. The terminal of unused **output-** must be insulated to avoid short circuit.		
Maximum Output V_{omax}:	Supply Voltage V_s – 4.0, in Vpp.	V_s – 3.4, in Vpp.	V_s – 3.4, in Vpp.
Overload Pressure Level:	20*log(V_{omax}/2.828) – Sensitivity, in dB µPa. Refer to the chart of Overload Pressure Level (**OPL**).		
Acceleration Sensitivity:	101.5 dB µPa/(m/s²) at Acoustic Axis.		
	≤ 101.5 dB µPa/(m/s²) 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 (**FH**). 2. Free-hanging with Male Underwater Connector (**FHUWC-4P**, **FHUWC-6P**). 3. Thru-hole Inch Mounting with Single O-ring Sealing (**THM-7/16"**). 4. Thru-hole Inch Mounting with Double O-ring Sealing (**THDO-7/16"**). 5. Bolt Fastening Mounting (Plastics) (**BFMP-NPT3/8"**). 6. Bolt Fastening Mounting (Stainless Steel) (**BFM-7/16"**, **BFM-5/8"**).		
	Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and more details.		
Cable Options:	Four Conductor Shielded Cable (**SC**)	Six Conductor Shielded Cable (**SC**)	Six Conductor Shielded Cable (**SC**)
	Wire/Cable Bundles (**WCB**). Available for hull-mounted Options.		
Cable Orientation:	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 Length:	1. Default: 20m (65.6ft) for Non-Underwater Connector; 0.6m (2ft) for Underwater Connectors.		
	2. Custom-fit Cable Length up to 305 m or 1000 ft, refer to Maximum Cable Length. The chart is based on 5Vpp Sinusoidal signals. Maximum cable length which a hydrophone can drive is proportional to output voltage level of the hydrophone.		
Connector:	1. Default: Wire Leads (**WL**) 2. Male BNC (**BNC**) (Max. Diameter Φ14.3 mm). **Differential Output**: Two BNCs for Output+ and Output- Signals and their Commons. **Single-ended Output**: One BNC for Output Signal and its Common. 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, Φ20mm 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.		
Supply Voltage $\mathbf{V_s}$:	+8.5 to +32 VDC.	+9 to +32 VDC	+9 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):	6.8 mA	18.0 mA	15.0 mA
Size:	Housing ΦD = Φ21 mm, Sensing Element: ΦD = Φ10.1 mm, Overall Length = 90 to 100 mm.		
	Other Mounting Types: actual length depends on Mounting Parts.		
Weight:	≥ 1.0 kg with 20 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.		
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.		
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; **SE**: Single-ended Output; **BPF**: Band Pass Filter; **HPF**: High Pass Filter; **LPF**: Low Pass Filter.					
Part Number	**-Preamp Gain**	**-HPF -3dB Frequency**	**-Mounting**	**-Cable Length**	**-Connectors for Signal/Gain Selection/DC Supply**
BII7126FGDF	32 dB.	10 Hz, 100 Hz.	**FH**: Free Hanging.	20 m (65.6 ft).	WL, XLR3, BNC, BS, BP; XLR4.
BII7126PGDF BII7126PGSE	10/40 dB.	15 Hz, 100 Hz.			WL, XLR3, BNC, BS, BP; XLR6.

Example of Part Number:	**Description**
BII7126FGDF-32dB-10Hz-FH-20m-WL	BII7126FGDF Hydrophone, 32dB Gain, High Pass Filter: 10Hz, Free Hanging, 20m Shielded Cable, Connector: None, Wire leads.
BII7126FGDF-32dB-10Hz-FH-20m-BNC/BS	BII7126FGDF Hydrophone, 32dB Gain, High Pass Filter: 10Hz, Free Hanging, 20m Shielded Cable, Connector: Two BNC Male for Output+ and Output- Signals, 9V Battery Snaps for DC Supply.

BII7126FGDF-32dB-100Hz-FH-20m-XLR3/BS	BII7126FGDF Hydrophone, 32dB Gain, High Pass Filter: 100Hz, Free Hanging, 20m Shielded Cable, Connector: XLR3 for Signal, 9V Battery Snaps for DC Supply.
BII7126FGDF-32dB-10Hz-FH-20m-XLR4	BII7126FGDF Hydrophone, 32dB Gain, High Pass Filter: 10Hz, Free Hanging, 20m Shielded Cable, Connector: XLR4 for Signals and DC Power Supply.
BII7126PGDF-10/40dB-100Hz-FH-20m-WL	BII7126PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 100Hz, Free Hanging, 20m Shielded Cable, Connector: None, Wire leads.
BII7126PGDF-10/40dB-15Hz-FH-20m-XLR3/WL/BS	BII7126PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 15Hz, Free Hanging, 20m Shielded Cable, Connector: XLR3 for Signal, Wire Leads for Gain Selection, 9V Battery Snaps for DC Supply.
BII7126PGDF-10/40dB-15Hz-FH-20m-XLR6	BII7126PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 15Hz, Free Hanging, 20m Shielded Cable, Connector: XLR6 for Signals, Gain Selection, and DC Power Supply.
Non-stock Examples:	**Description**
BII7126FGDF-32dB-10Hz-FH-30m-WL	BII7126FGDF Hydrophone, 32dB Gain, High Pass Filter: 10Hz, Free Hanging, 30m Shielded Cable, Connector: none, Wire leads.
BII7126FGDF-32dB-10Hz-FH-30m-BNC/BS	BII7126FGDF Hydrophone, 32dB 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.
BII7126FGDF-32dB-10Hz-BFM-7/16”-100m-XLR3/BS	BII7126FGDF Hydrophone, 32dB 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.
BII7126FGDF-32dB-10Hz-FH-0.6m-UMC4P	BII7126FGDF Hydrophone, 32dB Gain, High Pass Filter: 10Hz, Free Hanging, 0.6m Shielded Cable, Connector: 4-pin Underwater Mateable Connector for Signals and DC Power Supply.
BII7126PGDF-10/40dB-15Hz-FH-30m-WL	BII7126PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 15Hz, Free Hanging, 30m Shielded Cable, Connector: none, Wire leads.
BII7126PGDF-10/40dB-15Hz/50kHz-BFM-7/16”-100m-XLR3/WL/BS	BII7126PGDF Hydrophone, 10/40dB Gain, Band Pass Filter: 15Hz to 50kHz, 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.
BII7126PGDF-10/40dB-15Hz-FH-0.6m-UMC6P	BII7126PGDF Hydrophone, 10/40dB Gain, High Pass Filter: 15Hz, Free Hanging, 0.6m Shielded Cable, Connector: 6-pin Underwater Mateable Connector for Signals, Gain Selection, and DC Power Supply.

Wiring Information of BII7126FGDF:

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	XLR Pin 2	#1 BNC Center	TRS Tip
Signal-	Blue, Green, or Yellow	Pin 4	Pin 2	DIN3 Pin 1	XLR Pin 3	#2 BNC Center	TRS Ring
Signal Common	Black	Pin 1	Pin 1	DIN3 Pin 2	XLR Pin 1	BNC Shell	TRS Sleeve
Shielding	Shield	Metal Shell	Metal Shell	DIN3 and XLR3 Metal Shell		N/A	N/A

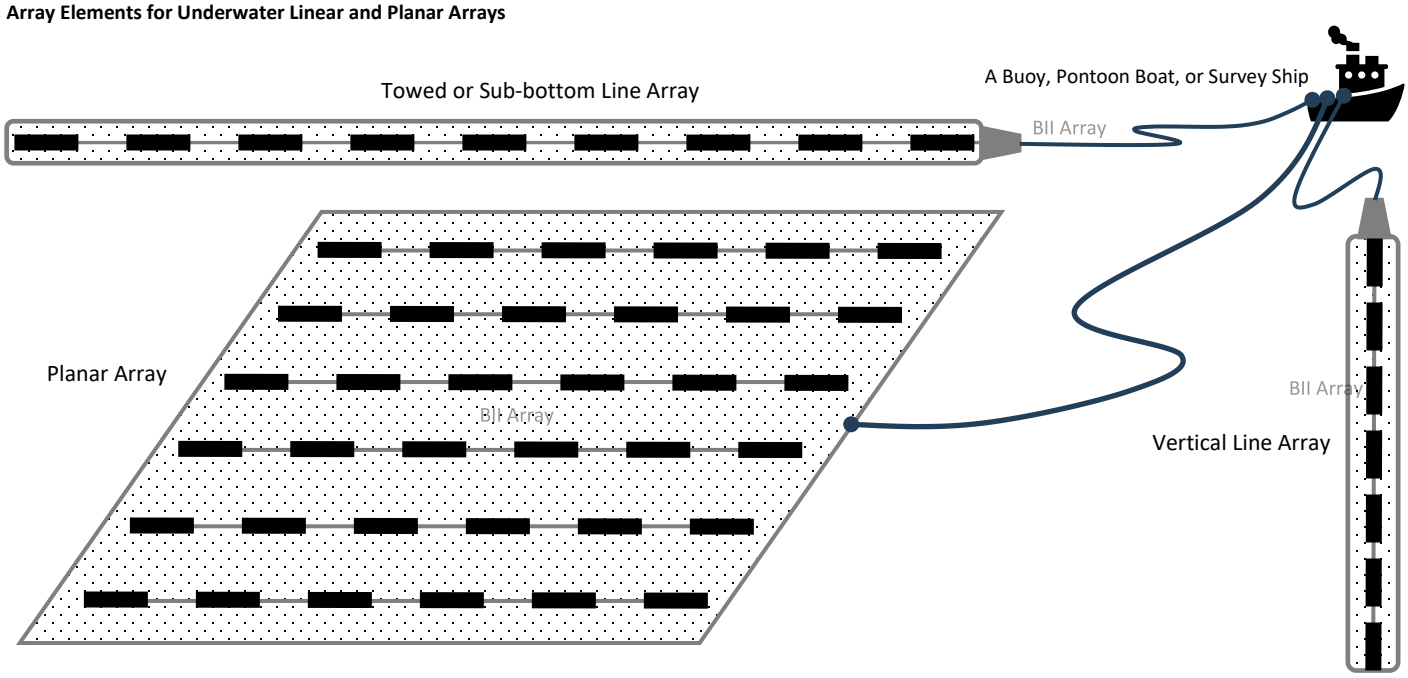
Wiring Information of BII7126PGDF:

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	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 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)		-192.0 + 10 dB V/µPa.					
1 (Logic High)		-192.0 + 40 dB V/µPa.					

Wiring Information of BII7126PGSE:

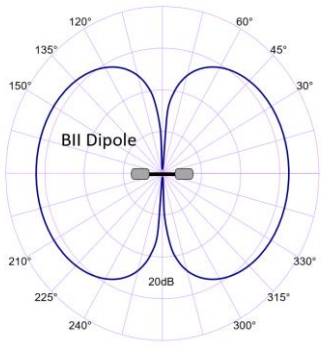
Differential Output:	**Wire Leads**	**UMC6P/XLR6**	**DIN6**	**BNC + 9V BS**	**DIN3/XLR3 + 9V BS**		**TRS + 9V BS**
+VDC	Red	Pin 3	Pin 4	Battery Female Snap	Battery Female Snap		Battery Female Snap
Common	Black	Pin 1	Pin 1	Battery Male Snap, BNC Shield.	Battery Male Snap, DIN Pin 2 or XLR Pin 1.		Battery Male Snap, TRS Sleeve.
Output Signal	White	Pin 2	Pin 3	“1” BNC Center Pin	DIN Pin 3	XLR Pin 2	TRS Tip
Signal Common	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 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)		-192.0 + 10 dB V/µPa.					
1 (Logic High)		-192.0 + 40 dB V/µPa.					

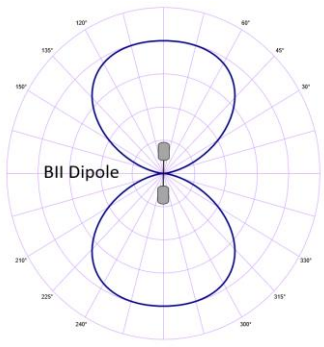
Array Elements for Underwater Linear and Planar Arrays



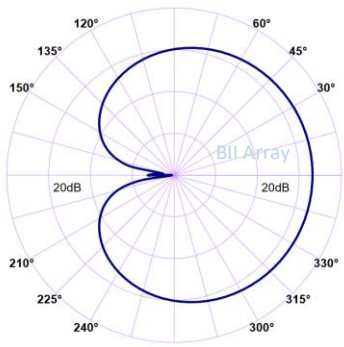
Simple Array Consisting of Hydrophones.

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

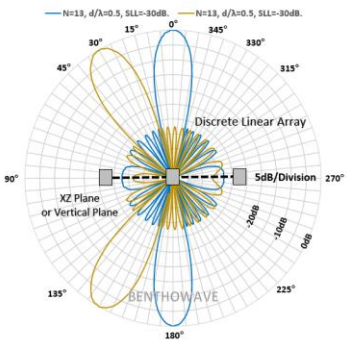




Cardioid Pattern



Linear Array with BII Discrete Hydrophones



Question:

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_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 such as 10dB.

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 such as 50dB.

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".

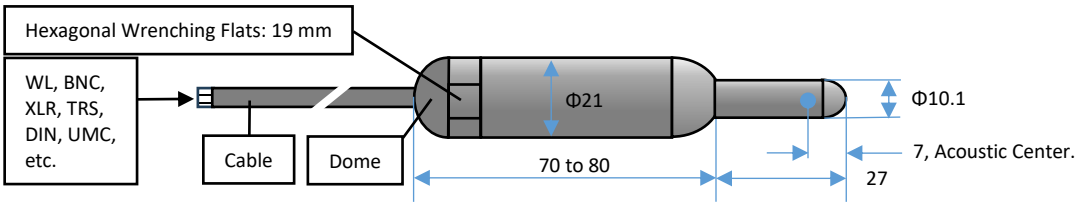
When a Gain Selection wire is short to Digital Common, its digital logic is Low or "0".

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.

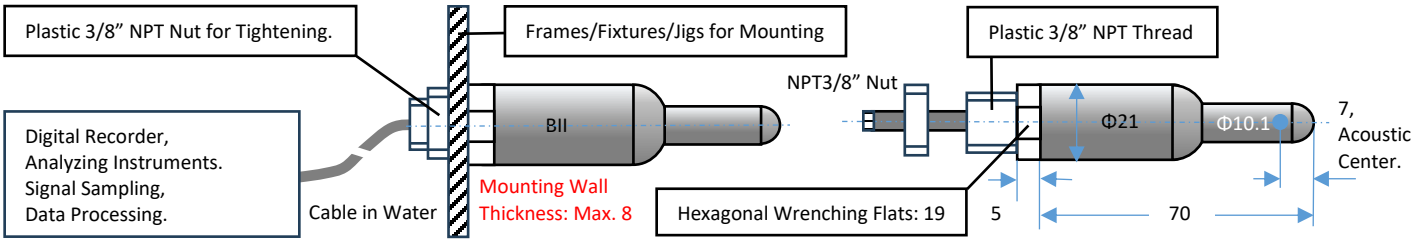
Physical Size (Dimensional Unit: mm): The overall length varies with the length of the built-in preamplifier and mounting parts.

1. Free Hanging with Smooth Domes.

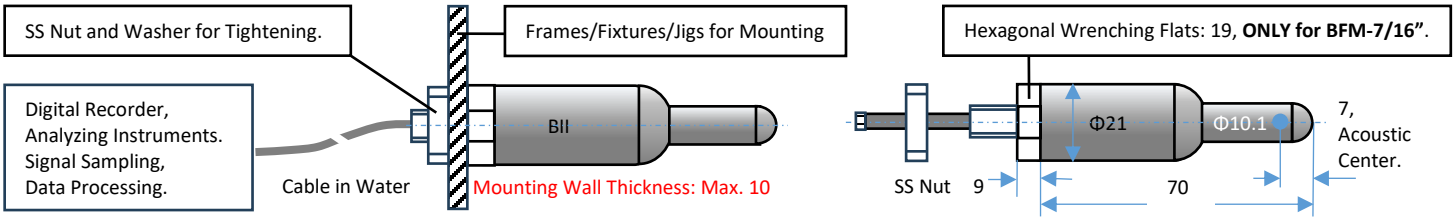


The hydrophone body has streamlined hemispherical domes which minimize the drag forces and the hydrodynamic noise caused by the hydrophone in motion or the flow past the hydrophone.

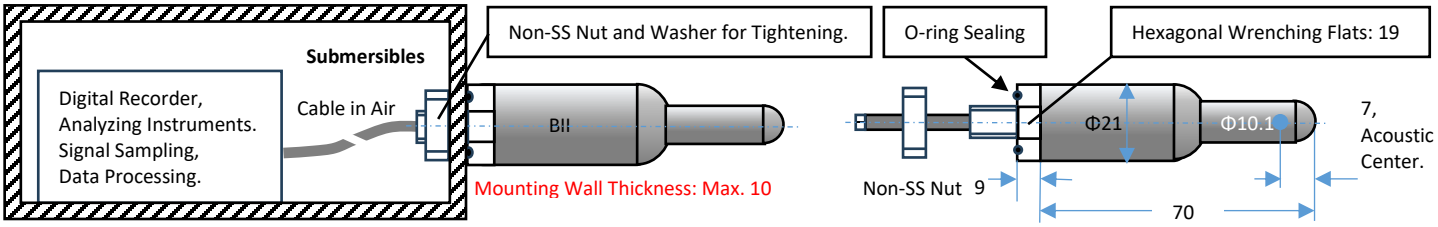
2. Bolt-Fastening Mounting BFM-NPT3/8", 3/8" NPT Thread Length: 15mm. Nut Height: 5mm. Tips: Plastic material has less sound reflection.



3. Bolt-Fastening Mounting BFM-7/16" (7/16"-20x22 UNF-2A), and BFM-5/8" (5/8"-18x22 UNF-2A, BFM-5/8" does NOT possess Hexagonal Wrenching Flats.).

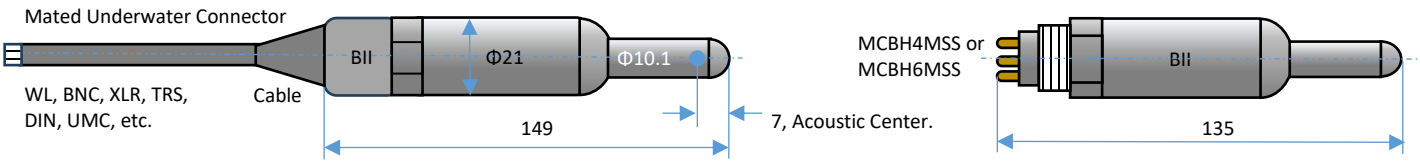


4. Thru-hole Mounting (Inch Thread) with Single O-ring Sealing THM-7/16" (7/16"-20x22 UNF-2A).



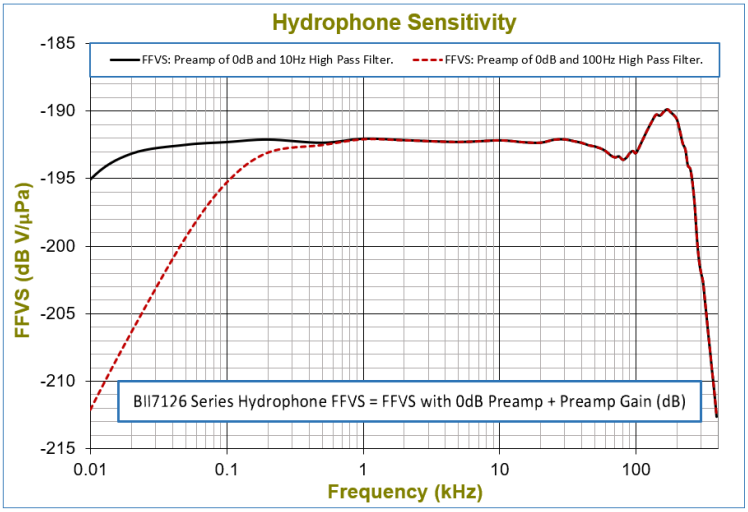
5. Free-hanging with Underwater Connector FHUWC-4P, 4 Pins (Fixed Sensitivity); FHUWC-6P, 6 Pins (Programmable Sensitivity).

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.

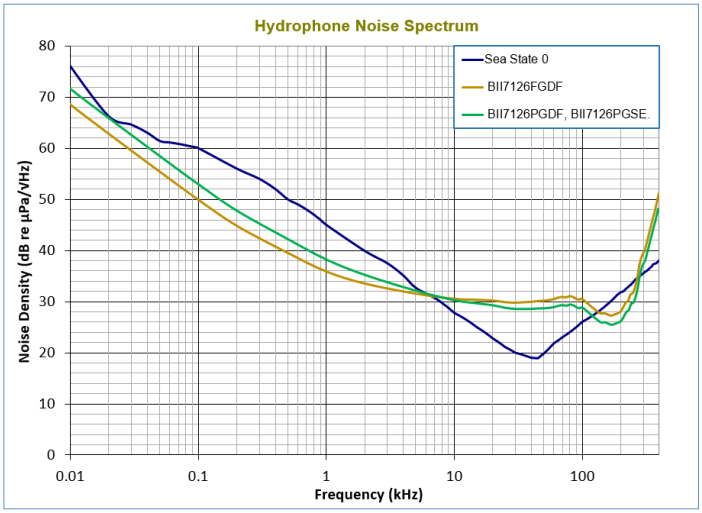


6. More Mounting/Installation Options: Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and details.

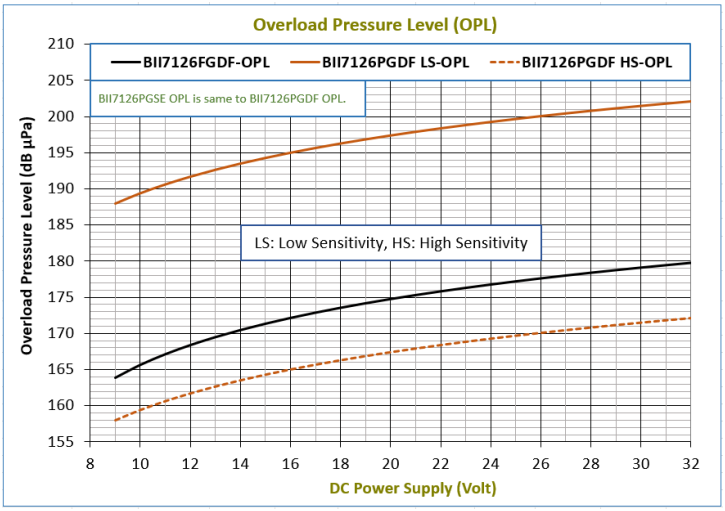
Free-field Voltage Response (FFVS):



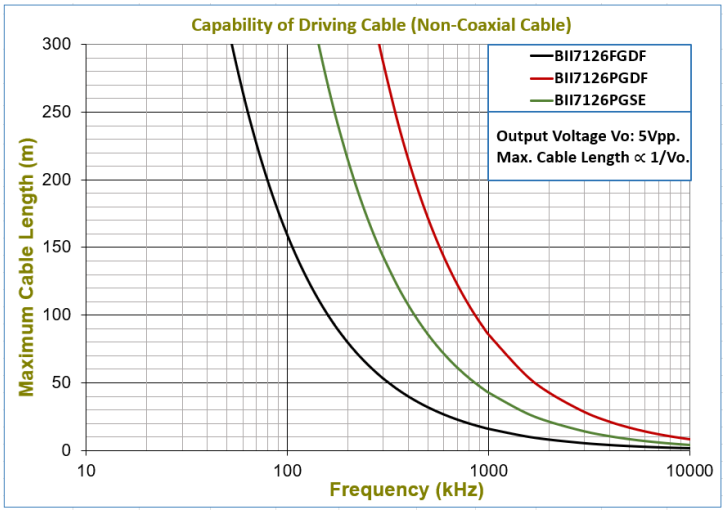
Pressure Noise Density (RTI, referred to the input):



Overload Pressure Level (OPL), LS: Low Sensitivity, HS: High Sensitivity.



Hydrophone Cable Length



Directivity Response Pattern: