SE=SL-TL+AG-NL

Benthowave Instrument Inc.

Acoustical Solutions: SONAR, NDT/AE, HIFU. benthowave.com Revised on 2026-4-13

Omnidirectional Spherical Hydrophone

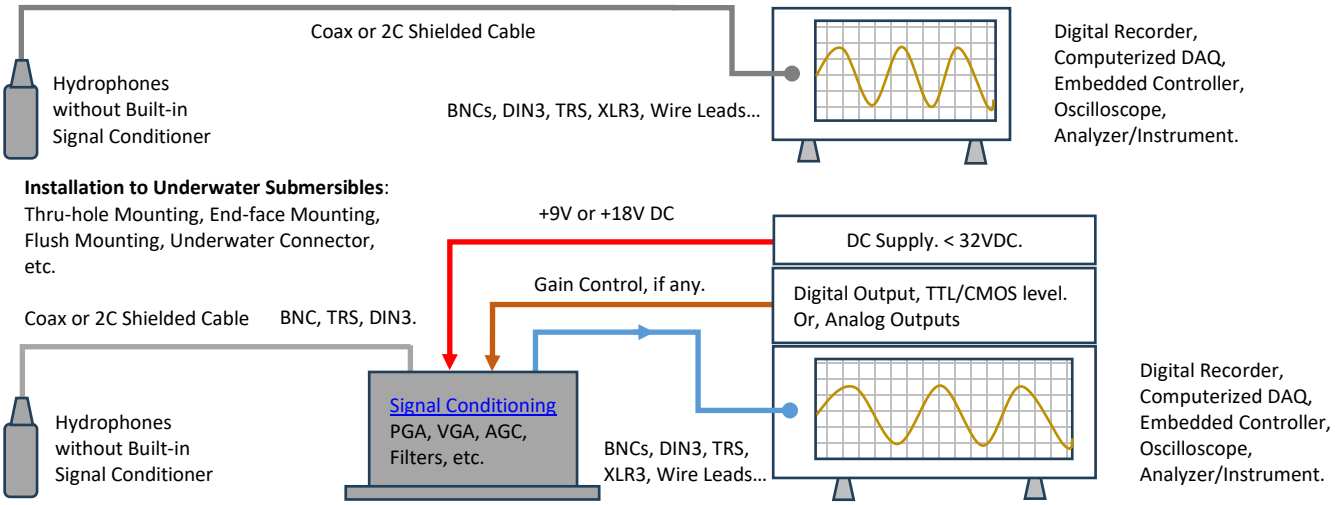
BII7000 Series Omnidirectional Spherical Hydrophone

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. 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.

System Configuration of Receiving Sounds and Waves.



Specification

The hydrophone is tested in water unless stated otherwise.				
Part Number:	**BII7001**	**BII7001DF**	**BII7001DW**	**BII7001MD**
Sensitivity @ 1kHz:	-202.0 dB V/µPa ± 2dB	-196.5 dB V/µPa ± 2dB	-199.0 dB V/µPa ± 2dB	-198.3 dB V/µPa ± 2dB
	Sensitivity Loss over Extension Cable (dB) = 20*log[C_h/(C_h+C_c)]. Valid for hydrophone without preamplifier. C_h: Hydrophone Capacitance; C_c: Capacitance of Extension Cable. Cable is of 100 pF/meter roughly.			
FFVS:	Free-field Voltage Sensitivity, Refer to Graph of FFVS vs. Frequency.			
Usable Frequency: in Water, at ±3 dB V/µPa.	0.2 Hz ~ 180 kHz	0.5 Hz ~ 180 kHz	1 Hz ~ 180 kHz	1 Hz ~ 180 kHz
	C_h and R_i constitute a high pass filter. -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. For example: A BII7001 and a BII preamp of R_i = 100 MΩ are used to detect sounds, -3dB high pass frequency of detection = 0.12 Hz. A BII7001DF and a BII preamp of R_i = 200 MΩ are used to detect sounds, -3dB high pass frequency of detection = 0.23 Hz.			
Usable Frequency in Air:	1 Hz ~ 5 kHz at -3dB V/µPa.			
Capacitance C_h @ 1kHz:	13.6 nF ± 10%	3.4 nF ± 10%	1.0 nF ± 10%	2.4 nF ± 10%
Dissipation @ 1kHz:	0.015	0.015	0.004	0.0046
Noise Density at f << fs: dB µPa/√Hz	26.5 – 10*log f	27.0 – 10*log f	28.4 – 10*log f	24.2 – 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.			
Directivity Pattern:	Omnidirectional and Toroidal. Refer to Graph of Directivity Pattern.			
-3dB Beam Width:	Refer to Graph of Directivity Pattern.			
Side Lobe Level:	No side lobes.			
Signal Output Type:	Single Ended	Differential Output	Differential Output	Differential Output
	Differential signal has better capability to reduce and reject EMI noise, especially over long cable.			
Acceleration Sensitivity:	134.0 dB µPa/(m/s²)	134.0 dB µPa/(m/s²)	139.5 dB µPa/(m/s²)	134.4 dB µPa/(m/s²)
Underwater Projector:	Yes.	No	No	No
Resonance fs:	110 kHz	N/A	N/A	N/A
TVR at fs:	145 dB µPa/V at 1m.	N/A	N/A	N/A

	Approximately, TVR drops 12dB/octave below fs and drops 6dB/octave above fs.			
Maximum Drive Voltage:	300 Vpp	N/A	N/A	N/A
Maximum Pulse Length:	100 mS at Max. Drive Voltage	N/A	N/A	N/A
Duty Cycle:	10% at Maximum Drive Voltage. 100% at ≤ 30 Vpp or 10.6 Vrms.	N/A	N/A	N/A
Operating Depth:	300 m	300 m	900 m	600 m
	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-3P**). 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-M12**). 6. Bolt Fastening Mounting (Plastics) (**BFMP-NPT3/8”**). 7. Bolt Fastening Mounting (Stainless Steel) (**BFM-7/16”**).			
	Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and more details.			
Cable Options:	**SE**: Single Ended Output Hydrophones. **DF**: Differential Output Hydrophones.			
	1. **Default**: Coax RG174/U, ΦD=2.8 mm (**RG174**) (**SE**). 2. Coax RG58/U, ΦD=4.9 mm (**RG58**) (**SE**). 3. Shielded Cable with Polyurethane Jacket, ΦD=2.6 mm (**SC26**). (**SE**). 4. Shielded Cable with Rubber Jacket, ΦD=6.5 mm (**SC65**), (**SE**).			
	5. Default: Shielded Cable with Twisted Pair and PVC Jacket, ΦD=3.6 mm (**SC36**), (**DF**). 6. Shielded Cable with Twisted Pair and PVC Jacket, ΦD=6.0 mm (**SC60**), (**DF**). 7. Shielded Cable with Twisted Pair and Polyurethane Jacket, ΦD=4.7 mm (**SC47**), (**DF**).			
	8. Coax RG178/U, ΦD=1.8 mm (**RG178**) up to 200°C. (**SE**). 9. Shielded Cable with Twisted Pair and Teflon (PTFE) Jacket, ΦD=3.2 mm (**SC32**), up to 200°C. Non-waterproof, for dry use ONLY, (**DF**).			
	Differential/balanced signals over shielded twisted pair cable is recommended to reject Electromagnetic Interference (EMI).			
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. 1/8" (3.5mm) TRS Plug (**TRS**), Max. Diameter Φ10.5 mm, for SE or DF. 4. XLR Receptacle with 3 Male Pins (**XLR3**), Max. Diameter Φ20.2 mm, for SE or DF. 5. Underwater Mateable Connector (3 pin) (**UMC3P**), Max. Diameter Φ21.5 to Φ35 mm, for SE or DF. **UMC3P** is from global manufacturers of underwater connectors. Its part number is listed in quote in detail.			
	Underwater Mateable Connectors are for underwater uses. Other connectors/wire leads are for dry uses and are not waterproofed.			
Size (mm):	Free Hanging: ΦDxL=Φ19x45	Free Hanging: ΦDxL=Φ19x45	THM-7/16”: ΦDxL=Φ20.5x43	THM-7/16”: ΦDxL=Φ20.5x43
	Other Mounting Types: Actual length depends on Mounting Parts.			
Weight:	0.12 kg with 6m Coax/BNC Male. 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: -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: 100 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/SMA/SMC connector, it is buyer's sole responsibility to make sure that the BNC/SMA/SMC shield of the signal source is firmly grounded for operating safety before hooking up transducer/hydrophone to the signal source. Coax with BNC/SMA/SMC 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 Standard Hydrophones. BII Keeps Standard Products in Stock**.**

Hydrophone Part Number	**-Mounting Part**	**-Cable Length**	**-Cable Type**	**-Connector Type**
BII7001	**FH**: Free Hanging.	6 m (19.7ft)	**RG174** Coax	BNC
BII7001DF	**BFMP-3/8”NPT**: Bolt-fastening Mounting.	10 m (32.8ft)	**SC60** Shielded Cable with Twisted Pair	WL, TRS, or XLR.
Example:	**Description**			
BII7001-FH-6m-RG174-BNC	BII7001 Hydrophone, Free Hanging, 6m RG174 Coax, BNC Male.			
BII7001-BFMP-NPT3/8”-6m-RG174-BNC	BII7001 Hydrophone, Bolt-fastening Mounting: BFMP-NPT3/8”, 6m RG174 Coax, BNC Male.			
BII7001DF-BFMP-NPT3/8”-10m-SC60-TRS	BII7001DF Hydrophone, Bolt-fastening Mounting: BFMP-NPT3/8”, 10m Shielded Cable with Twisted Pair **SC60**, TRS Plug.			
BII7001DF-BFMP-NPT3/8”-10m-SC60-WL	BII7001DF Hydrophone, Bolt-fastening Mounting: BFMP-NPT3/8”, 10m Shielded Cable with Twisted Pair **SC60**, Wire Leads.			
BII7001DF-FH-10m-SC60-TRS	BII7001DF Hydrophone, Free Hanging, 10m Shielded Cable with Twisted Pair **SC60**, TRS Plug.			
BII7001DF-FH-10m-SC60-XLR3	BII7001DF Hydrophone, Free Hanging, 10m Shielded Cable with Twisted Pair **SC60**, XLR Receptacle with 3 Male Pins.			
BII7001DF-FH-10m-SC60-WL	BII7001DF Hydrophone, Free Hanging, 10m Shielded Cable with Twisted Pair **SC60**, Wire Leads.			

How to Order Bespoke Hydrophones. Non-stock.

Hydrophone Part Number	**-Mounting Part**	**-Cable Length**	**-Cable Type**	**-Connector Type**
BII7001, BII7001DF, BII7001DW, BII7001MW.	Mounting Options.	in meter.	Cable Options.	Connector Options.

Example:	Description
BII7001DW-THM-7/16”-0.6m-SC36-WL	BII7001DW Hydrophone, Thru-hole Mounting THM-7/16”, 0.6m Shielded Cable SC36, Wire Leads.
BII7001-HT-FH-6m-RG178-BNC	BII7001 Hydrophone, Service Temperature: -10°C to 120°C (14°F to 248°F). Free Hanging, 6m RG178 Coax, BNC Male.
BII7001DF-BFMP-NPT3/8”-15m-SC60-WL	BII7001DF Hydrophone, Bolt-fastening Mounting BFMP-NPT3/8”, 15m Shielded Cable **SC60**, Wire Leads.
BII7001DF-FH-0.6m-SC65-UMC3P	BII7001DF Hydrophone, Free Hanging, 0.6m Shielded Cable **SC65**, 3-pin Underwater Mateable Connector.

Wirings

Differential Output:	Wire Leads	Underwater Connector UMC3P	TRS Plug (Balanced Mono)	XLR Receptacle with 3 Male Pins	
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 UMC3P**	**BNC/SMA/SMC**	**Coax with Wire Leads**	**TRS**
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

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.

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.

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.

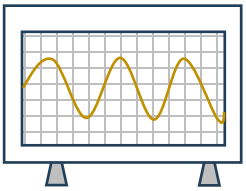
Can BII explain why the capacitance of my hydrophone/transducer affect high pass filtering? (1). Hydrophone/transducer is high impedance devices in low frequency range. Its simplified complex impedance = $j/(2\pi f C_h)$, C_h is the capacitance of hydrophone/transducer, f is frequency in Hz. This impedance 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 BII explain more on Single-ended (SE) and Differential (DF) measurement? (1). SE hydrophone + coax + BNC/SMA/SMC is compatible to most instruments such as oscilloscope, signal generators, and DAQ modules, etc.. Quick setup of SE measuring system and low cost with coax/BNC are the significant merits besides 50Ω matching in MHZ range measurement. The shortcomings are weak rejection on common-mode noise and inductive coupling of EMI. (2). DF hydrophone + Twisted-Pair Shielded Cable + WL/TRS/XLR/DIN is compatible to most audio recording and analyzing instruments, etc.. Efficient rejection of common mode noises and inductive coupling noise of EMI are the significant merits, especially over the long cable. The shortcomings are higher costs on hydrophones, cables, and differential signal processing circuits such as differential preamp and differential DAQ modules.

Typical Components of an Acoustic Receiving System. **Depending on the system requirements, the signal conditioner is optional.**

BII7001-FH-10m- RG174-BNC

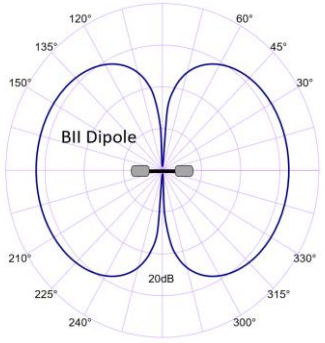
BII1056-20MΩ-BNC/BNC-DCBP24

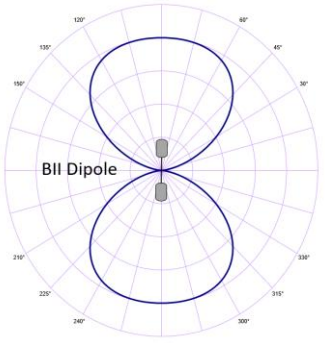


Digital Recorder, Computerized DAQ, Embedded Controller, Oscilloscope, Analyzer/Instrument.

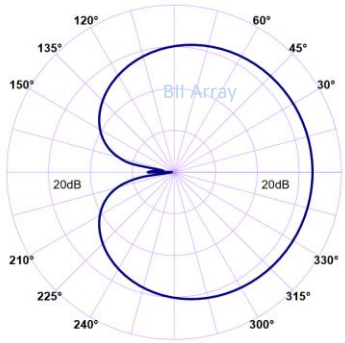
Simple Array Consisting of Hydrophones.

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

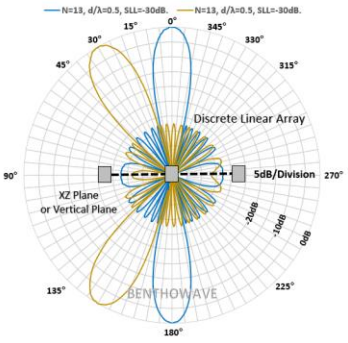




Cardioid Pattern

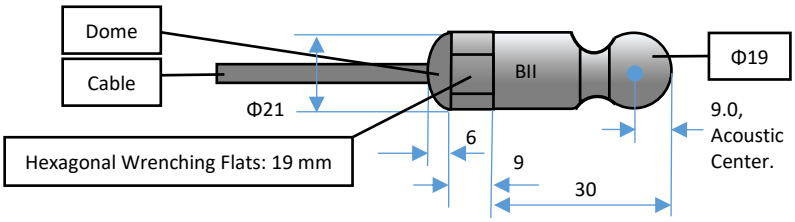


Linear Array with BII Discrete Hydrophones



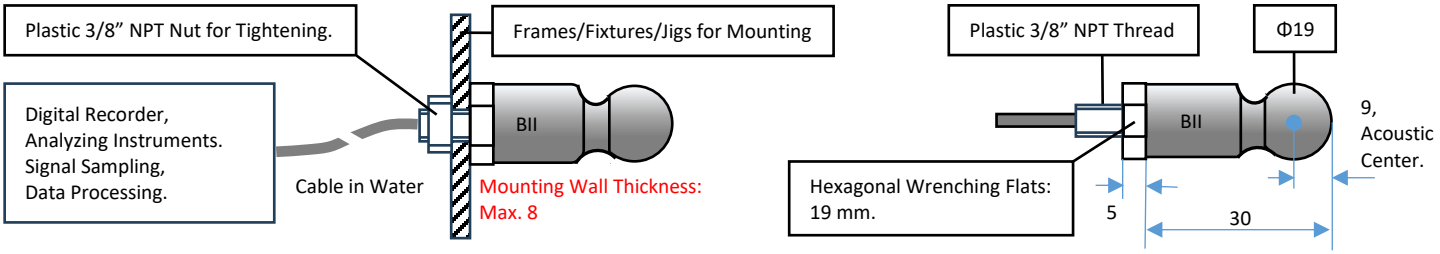
BII7001 and BII7001DF Physical Size (Dimensional Unit: mm): The overall length varies with the length of the mounting part.

1. Free Hanging with Smooth Domes.

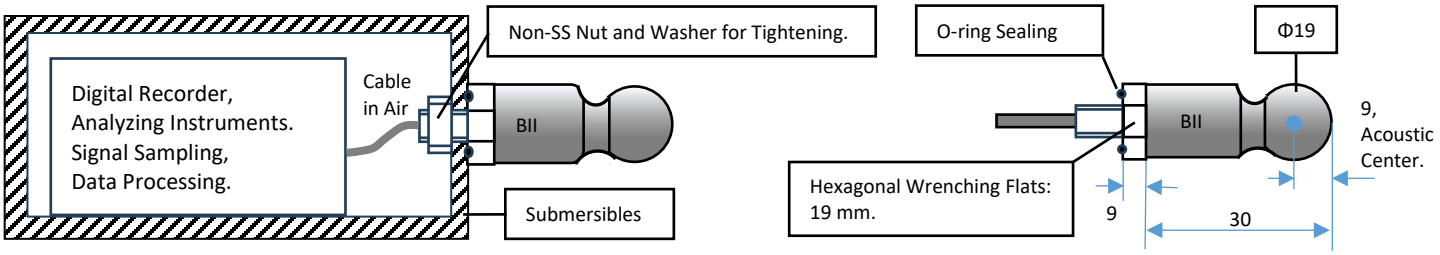


The hydrophone body has streamlined hemispherical domes which minimize the drag forces and the hydrodynamic noise caused by the hydrophone in motion or the flow past the hydrophone.

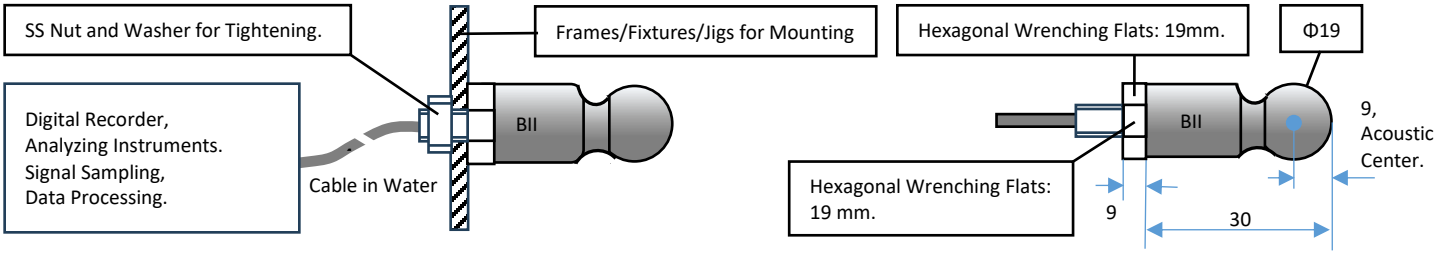
2. Bolt-Fastening Mounting BFM-NPT3/8", 3/8" NPT Thread Length: 15mm. Nut Height: 5mm.



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

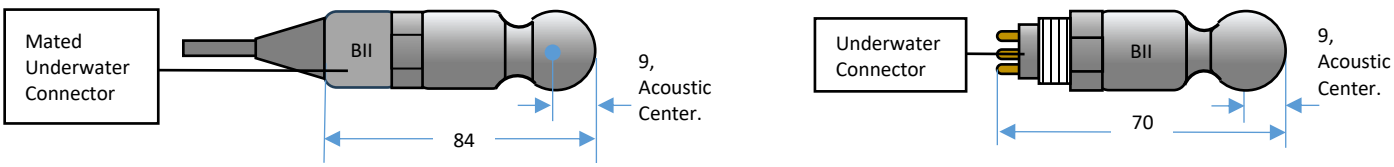


4. Bolt-Fastening Mounting BFM-7/16" (7/16"-20x22 UNF-2A).



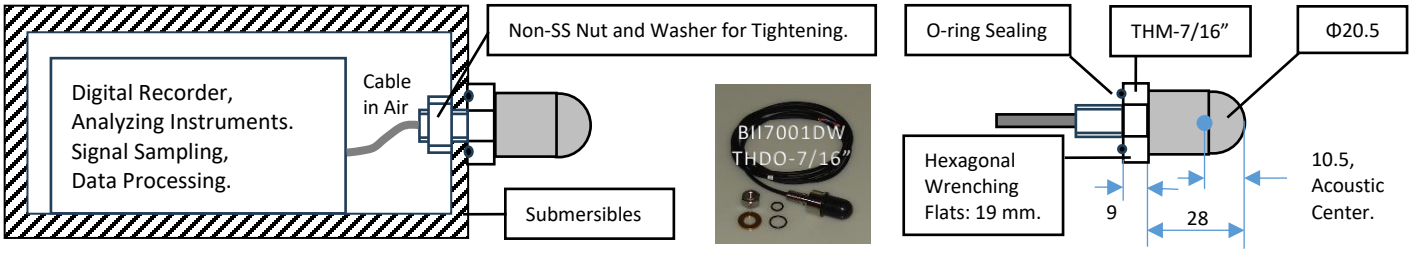
5. Free-hanging with Underwater Connector (FHUWC-3P), 3 Pins.

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: **UMC3S-10m-WL:** 10 m cable with Underwater Mateable Connector 3 Sockets (**UMC3S**) on one end and wire leads (**WL**) on other end. **UMC3S-10m-XLR3**: 10 m cable with and Underwater Mateable Connector 3 Sockets (**UMC3S**) on one end and XLR Receptacle with 3 Male Pins (**XLR3**).

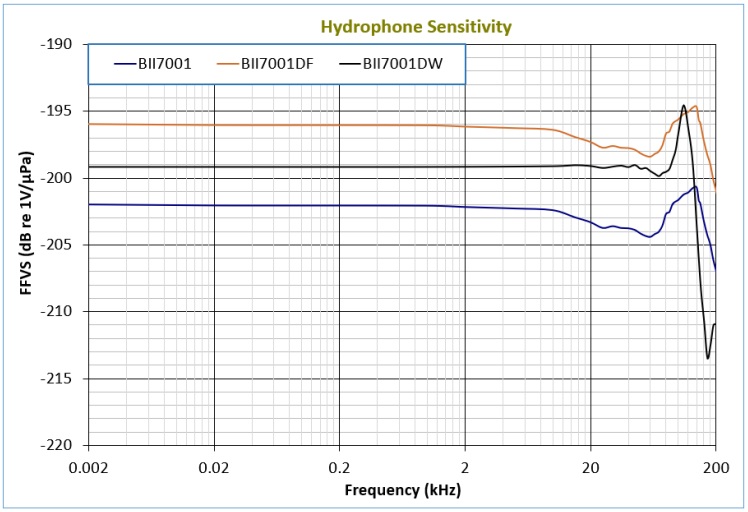


6. More Mounting/Installation Options: Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and details.

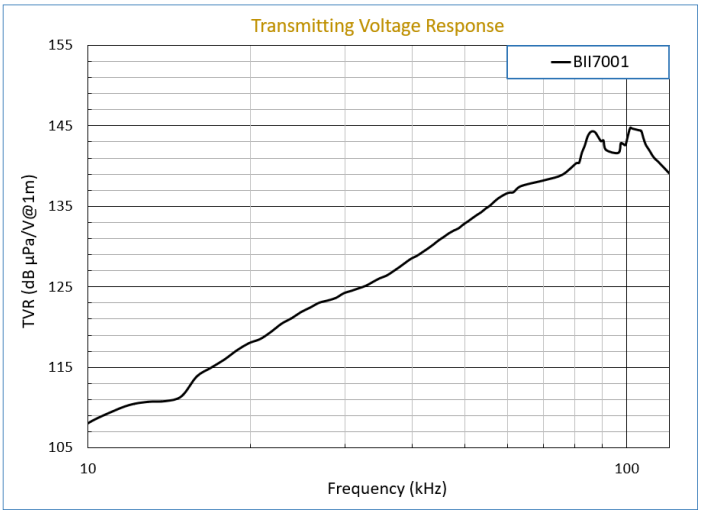
BII7001DW and BII7001MD Physical Size (Dimensional Unit: mm): The overall length varies with the length of the mounting part.



Free-field Voltage Sensitivity (FFVS):



Transmitting Voltage Response (TVR):



Directivity Pattern