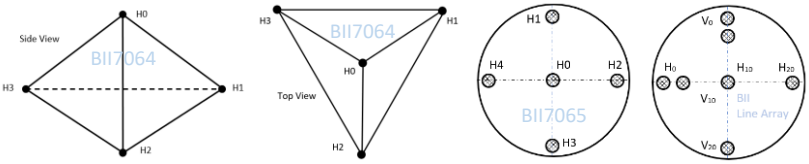
Benthowave Instrument Inc.

Underwater Sound Solutions www.benthowave.com



Vector Hydrophone Array: Measurement of Bearing

BII7060 series vector hydrophone arrays include two perpendicular line arrays, planar, and 3D discrete arrays which consist of Pressure Gradient Hydrophones or Dipole Hydrophones: Quadrupole Hydrophone Array and Tetrahedron Array. They are sensitive to both the amplitude and the direction of the acoustic wave in a plane, provide cosine and sine (or orthogonal "figure 8") directivity patterns in dipole plane. Depending on complex weighting of each element, different directional beam patterns can be implemented such as cardioid and endfire.

4-element Tetrahedron Array consist of four sensing elements with four outputs of each elements in a small compact size for estimation of bearing (azimuth) and elevation of sound source. **5-element planar array** consist of five sensing elements with five outputs of each elements for estimation of bearing (azimuth) and elevation of sound source. **Two perpendicular line arrays** (each line array has 21 elements) with Mills Cross implement beam steering to track and locate sound sources, and measure their bearing angles.

The particle velocity can be calculated with the pressure gradient. Besides, a triaxial dipole can be set up with two planar array orthogonally to overcome the ambiguity in three dimensions. Particle Velocity in x direction $u_x = -1/(j\omega\rho)*(ap/ax)$; ρ: Density; ap/ax: Pressure Gradient in the x direction.

Typical Applications

Particle Velocity Measurement Underwater Tracking System Bearing and location of underwater sound sources Vector and Conventional Hydrophones

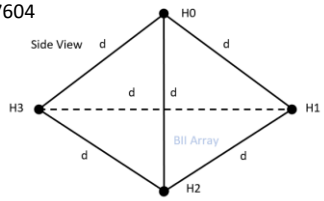
Related Products

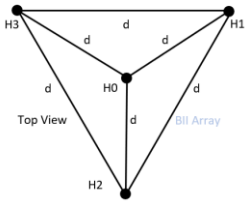
BII1000 Hydrophone Preamplifier BII7010 Broadband Hydrophone as Array Elements BII7140 Acoustic Elements for Oils-filled Arrays and Streamers

Array Topology

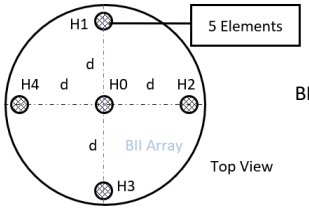
4-elements Tetrahedral Hydrophone Array

BII7604

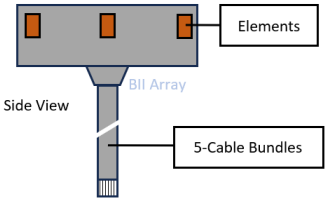




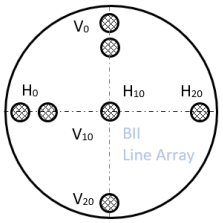
5-elements Planar Hydrophone Array



BII7605

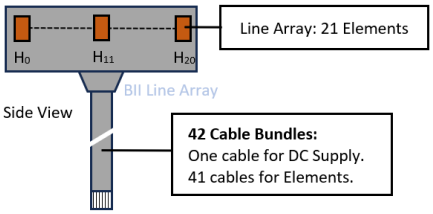


Two perpendicular line arrays with Mills Cross for beam steering.

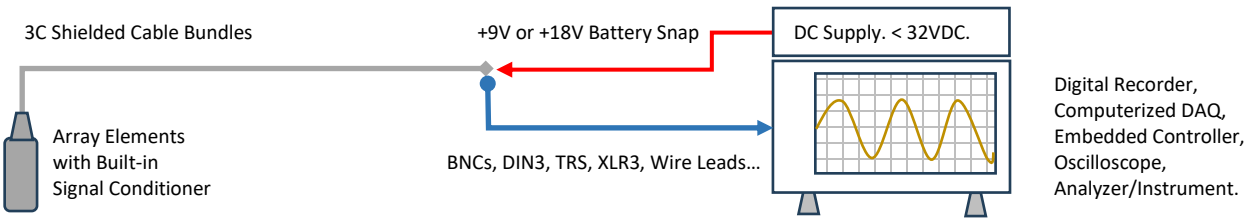


BII7602

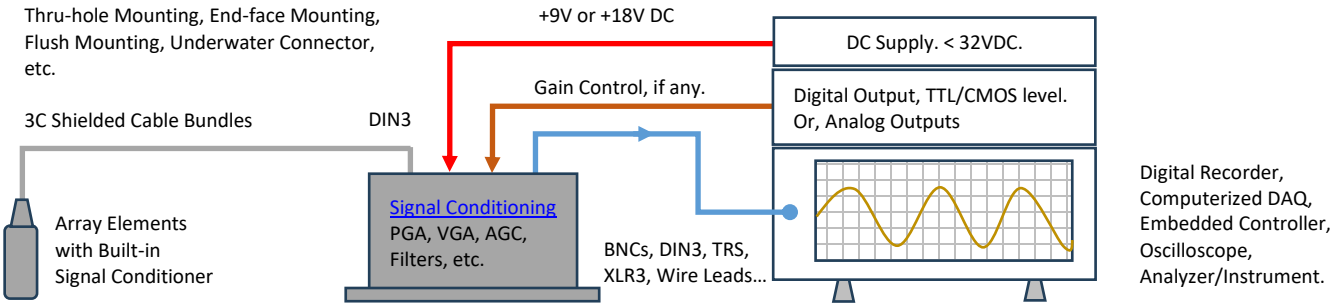
Two line arrays share center element: V_{10} or H_{10}. Each Line Array has 21 elements.



System Configuration of Receiving Sounds and Waves of Each Elements.



Installation to Underwater Submersibles: Thru-hole Mounting, End-face Mounting, Flush Mounting, Underwater Connector, etc.



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:	**BII7064-Φ4**	**BII7064-Φ18**	**BII7065-Φ4**	**BII7065-Φ18**	**BII7062-Φ6**
Array Type:	Four-element Tetrahedron Array or Six Dipoles.		Five-element Planar Array or Ten Dipoles.		Two Perpendicular Line Arrays.
	Bespoke array are available. Please contact BII for custom-fit arrays.				
Aperture of Array Element:	ΦDxL=Φ4x4mm.	ΦDxL=Φ18x15mm.	ΦD=Φ4mm.	ΦD=Φ18mm.	ΦD = Φ6 mm.
Element Spacing d:	Default: 20mm	Default: 100mm	Default: 20mm	Default: 65mm	Default: 7.5 mm
	Customized spacing between elements: 4.5 mm ≤ d << λ ≤ 150 mm. d is the spacing among array elements. If array spacing > 150 mm, Please consider discrete hydrophones as array element.				
Element Number:	4	4	5	5	41, Each Line Array has 21 elements.
Side Lobe Level:	None				**Cross-length**: No side lobes. **Along-length**: None at f ≤ 10kHz. **Along-length**: ≤ 14.3 dB at f > 10kHz.
Array Shading/Weighting:	None.				
	To suppress sidelobes of along-length directivity of BII7062-Φ6 at f > 10 kHz, It is recommended for user to do signal processing of Array Shading/Weighting.				
Dipole Directivity:	To achieve dipole directivity (figure "8"), the sound wavelength λ >> spacing of dipole elements. End user should determine usable frequency range of specific element-pair as a dipole.				
Element Sensitivity FFVS at 1 kHz, V/μPa.	-170.0 ± 0.3 dB	-150.0 ± 0.3 dB	-160.0 ± 0.3 dB	-160.0 ± 0.3 dB	-160.0 ± 0.5 dB
	Sensitivity match among elements at 1 kHz: ± 0.3 dB.				± 0.5 dB.
	Bespoke Element Sensitivity is available upon request.				
Element Directivity Pattern:	Omnidirectional at ≤ 75 kHz.	Omnidirectional at ≤ 20 kHz.	Conical	Conical	Conical
Dipole:	Voltage Sensitivity Response V = FFVS*(d/λ)*cosθ, in V/μPa.				
Pressure Gradient:	Voltage Sensitivity Response V = FFVS*(d/λ)*sinθ, in V/μPa.				
FFVS: Amplitude Constant related to element sensitivity; d: spacing distance between two elements; θ: Arriving angle from the axis of the two elements.					
Pressure Noise Density:	52 dB at 1 kHz	40 dB at 1 kHz	40 dB at 1 kHz	40 dB at 1 kHz	44 dB at 1 kHz
	Referred to Input (RTI), in μPa/√Hz. Pressure Noise Density at f > 1kHz is less than the one at 1kHz.				
Built-in Filters:	Bespoke BPF.				
	Minimum HPF: f_{-3dB} = 10 Hz.	Minimum HPF: f_{-3dB} = 0.2 Hz.	Minimum HPF: f_{-3dB} = 3 Hz.	Minimum HPF: f_{-3dB} = 0.2 Hz.	Minimum HPF: f_{-3dB} = 3 Hz.
	Default: 10Hz~100kHz at -3 dB V/μPa.	Default: 0.2Hz~20kHz at -3 dB V/μPa.	Default: 10Hz~100kHz at -3 dB V/μPa.	Default: 1Hz~20kHz at -3 dB V/μPa.	Default: 10Hz~500kHz at -3 dB V/μPa.
	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.				
Preamplifier:	Each element has a preamplifier. All preamplifiers are in water-proofed housing.				
Signal Conditioning:	If your project need extra signal conditioning before data acquisition, please refer to signal conditioning, and order separately. 1. Programmable Gain Amplifier PGA, 0/20/40/60 dB, etc. 2. Amplifiers with Built-in, High-pass, Low-pass, and Band-pass Filters.				
	Packages: **Standalone Devices** for portable uses, and **Coated PCB** with Wire Bundles for underwater submersibles.				
Signal Processing: BII does NOT provide signal processing software.	1. Monopole Omnidirectional: Vo = $\sum_{i=0}^{3} H_i$, i = 0, 1, 2, 3. 2. Dipole: $V_o = H_i - H_n$, i, n = 0, 1, 2, 3, and i≠n. 3. Pressure Gradient: $V_o = H_i - H_n$, i, n = 0, 1, 2, 3, and i≠n. 4. Tetrahedron Array Signal Processing.		1. Monopole Conical Directivity: Vo = $\sum_{i=0}^{4} H_i$, i = 0, 1, 2, 3, 4. 2. Dipole: $V_o = H_i - H_n$, i, n = 0, 1, 2, 3, 4, and i≠n. 3. Pressure Gradient: $V_o = H_i - H_n$, i, n = 0, 1, 2, 3, 4, and i≠n. 4. Planar Array Signal Processing.		Beam Steering. Beamforming. Sidelobe Suppression.
Signal Output Type:	Differential. Differential signal has better capability to reduce and reject EMI noise, especially over long cable. Each array element has a output.				
Maximum Output V_{omax}:	Supply Voltage V_s - 4, in Vpp.				
Overload Pressure Level:	20*log(V_{omax}/2.828) – Sensitivity, in dB μPa.				
Acceleration Sensitivity: μPa/(m/s²)	115.1 dB at Acoustic Axis.		112.6 dB at Acoustic Axis.		112.6 dB at Acoustic Axis.
	≤113.0 dB at other directions.		≤110.0 dB at other directions.		≤110.0 dB 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. Thru-hole Mounting with Single O-ring (**THM-5/8".**) 3. Bolt Fastening Mounting (Stainless Steel) (**BFM-5/8".**) 4. Bolt-Fastening Mounting with Free Hanging (**BFM-FH-M6, BFM-FH-M8, BFM-FH-M10, BFM-FH-3/8".**) 5. Free-hanging with Male Underwater Connector (**FHUWC-3P, FHUWC-4P.**) 6. End-face Mounting (**EFMM.**) 7. Flange Mounting (**FGM-Φ220, FGM-Φ110.**) 8. Flush Mounting (**FSM-M56.**)				

	Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and more details.		
Cable Options:	5xThree Conductor Shielded Cable (**SC**). One cable for DC Supply, four cables for element output.	6xThree Conductor Shielded Cable (**SC**). One cable for DC Supply, five cables for element output.	42xThree Conductor Shielded Cable (**SC**). One cable for DC Supply, 41 cables for element output.
Cable Orientation:	Perpendicular to end face of hydrophone.		
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.		
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). 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). 6. Underwater Mateable Connector (4 pins) (**UMC4P**) (Max. Diameter Φ21.5 to Φ35 mm). **UMC** is from global manufacturers of underwater connectors. Its part number is listed in quote in detail.		
	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 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 V_S:	+8.5 to +32 VDC		
Suggested DC Supply:	+9VDC Battery, Marine Battery, Automobile Battery, Fixed DC Linear Power Supply, Not Included. DO NOT use variable power supply whose maximum supply voltage is higher than the rated voltage. DO NOT use switching mode DC power supply.		
Current (Quiescent):	8 mA per Each Element.		
Overall Size (mm):	ΦDxL=Φ50x200.	ΦDxL=Φ110x500.	ΦDxH=Φ60x30.	ΦDxH=Φ168x30.	ΦDxH=Φ168x40.
	Other Mounting Types: actual length depends on Mounting Parts.				
Weight:	≥ 4.0 kg with 5 x 20m cable.	≥ 4.3 kg with 6 x 20m cable.	≥ 12 kg with 42 x 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: 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; **DF:** Differential Output; **BPF**: Band Pass Filter; **HPF**: High Pass Filter; **LPF**: Low Pass Filter.					
Part Number	**-Gain and Filter**	**-Mounting**	**-Cable Length**	**-Connectors for Signal**	**/DC Supply**
BII7064-Φ4, BII7064-Φ18, BII7065-Φ4, BII7065-Φ18, BII7062-Φ6.	Default.	FH: Free Hanging.	(Element Number +1) x 20m (65.6 ft)	WL, BNC, TRS, or XLR3, XLR4, BS.	
Example of Part Number:	**Description**				
BII7064-Φ4-FH-20m-WL	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connector: None, Wire leads.				
BII7064-Φ4-FH-20m-BNC/BS	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connectors: 4xTwo BNC Male for Output+ and Output- Signals, 1x9V Battery Snaps for DC Supply.				
BII7064-Φ4-FH-20m-TRS/BS	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connectors: 4xTRS for Signal, 1x9V Battery Snaps for DC Supply.				
BII7064-Φ4-FH-20m-DIN3/BS	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connectors: 4xDIN3 for Signal, 1x9V Battery Snaps for DC Supply.				
BII7064-Φ4-FH-20m-XLR3/BS	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connectors: 4xXLR3 for Signal, 1x9V Battery Snaps for DC Supply.				
BII7064-Φ4-FH-20m-DIN3	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connectors: 5xDIN3 for Signals and DC Power Supply.				
BII7064-Φ4-FH-20m-XLR3	BII7064-Φ4 Hydrophone, Free Hanging, 5x20m Shielded Cable, Connectors: 5xXLR3 for Signals 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	**-d**	**-Element FFVS**	**-HPF or HPF/LPF**	**-Mounting**	**-Shielded Cable Length**	**-Connectors for Signal**	**/DC Supply**
BII7064-Φ4, BII7064-Φ18, BII7065-Φ4, BII7065-Φ18. BII7062-Φ6.	Element Spacing, in mm.	Element Sensitivity, in dB V/µPa.	-3dB High Pass or Bandpass Filter Frequencies, in Hz, kHz.	Mounting Options.	in meter. Up to 305m (1000 ft). Cable Bundles.	Connector Options for Signals, and DC Supply.	
Example of Part Number:			**Description**				
BII7064-Φ4-30mm-160dB-10Hz/30kHz-FH-30m-WL			BII7064-Φ4 Hydrophone, Element Spacing: 30mm, Element Sensitivity: -160 dB V/µPa, Band Pass Filter: 10Hz to 30kHz, Free Hanging, 5x30m Shielded Cable, Connector: none, Wire leads.				
BII7064-Φ4-30mm-160dB-10Hz/30kHz-FH-30m-BNC/BS			BII7064-Φ4 Hydrophone, Element Spacing: 30mm, Element Sensitivity: -160 dB V/µPa, Band Pass Filter: 10Hz to 30kHz, Free Hanging, 5x30m Shielded Cable, Connector: 5xTwo BNC Male for Output+ and Output- Signals, 1x9V Battery Snaps for DC Supply.				
BII7064-Φ4-30mm-160dB-10Hz-BFM-FH-M6-100m-DIN3/BS			BII7064-Φ4 Hydrophone, Element Spacing: 30mm, Element Sensitivity: -160 dB V/µPa, High Pass Filter: 10Hz, Mounting BFM-FH-M6, 5x100m Shielded Cable, Connector: 4x3-pin DIN for Signals and 1xBattery Snap for +9VDC Batteries.				

BII7064-Φ4-30mm-160dB-10Hz-BFM-FH-M6-100m-XLR3/BS	BII7064-Φ4 Hydrophone, Element Spacing: 30mm, Element Sensitivity: -160 dB V/µPa, High Pass Filter: 10Hz, Mounting BFM-FH-M6, 5x100m Shielded Cable, Connector: 4x3-pin XLR for Signals and 1xBattery Snap for +9VDC Batteries.
BII7064-Φ4-30mm-160dB-10Hz-BFM-FH-M6-100m-DIN3/WL	BII7064-Φ4 Hydrophone, Element Spacing: 30mm, Element Sensitivity: -160 dB V/µPa, High Pass Filter: 10Hz, Mounting BFM-FH-M6, 5x100m Shielded Cable, Connector: 4x3-pin DIN for Signals and 1xWire Leads for DC Power Supply.
BII7064-Φ4-30mm-160dB-10Hz-FH-0.6m-UMC3P	BII7064-Φ4 Hydrophone, Element Spacing: 30mm, Element Sensitivity: -160 dB V/µPa, High Pass Filter: 10Hz, Free Hanging, 5x0.6m Shielded Cable, Connector: 5x3-pin Underwater Mateable Connector for Signals and DC Power Supply.

Wiring Information of Hydrophones with Fixed-gain Preamps:

DC and Signals:	Wire Leads	UMC3P	XLR3P	DIN3P	9V BS (Battery Snap)	BNC	TRS
+VDC	Red	N/A	N/A	N/A	Battery Female Snap	N/A	N/A
Common	Black	N/A	N/A	N/A	Battery Male Snap	N/A	N/A
Shielding	Cable Shield	Metal Shell	Metal Shell	Metal Shell	N/A	N/A	N/A
Signal+	Red or White	Pin 2	Pin 2	Pin 3	N/A	#1 BNC Center	TRS Tip
Signal-	Black	Pin 1	Pin 3	Pin 1	N/A	#2 BNC Center	TRS Ring
Signal Common & Shielding	Cable Shield	Pin 3	Pin 1	Pin 2	N/A	BNC Shell	TRS 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.

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 = $j/(2\pi fC_h)$, 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. But, neither output+ nor output – of the hydrophone can be wired to common which is going to destroy the hydrophone by 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.**

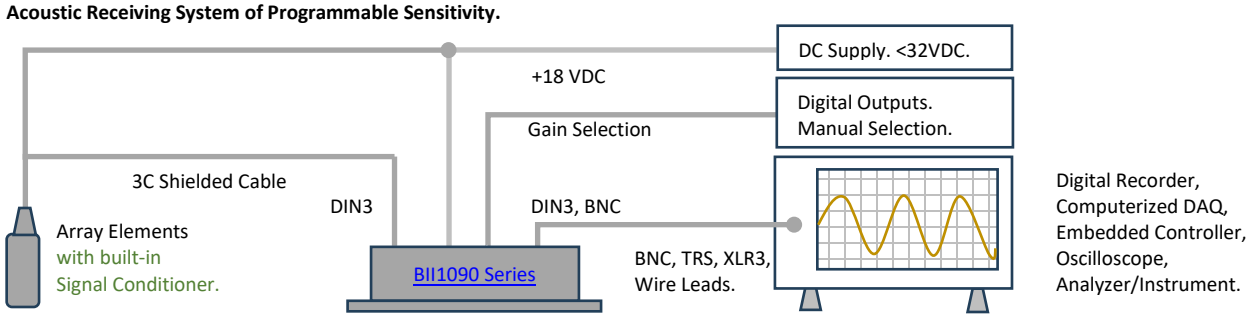
How to increase hydrophone sensitivity for extremely weak sounds?

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.

Acoustic Receiving System of Programmable Sensitivity.



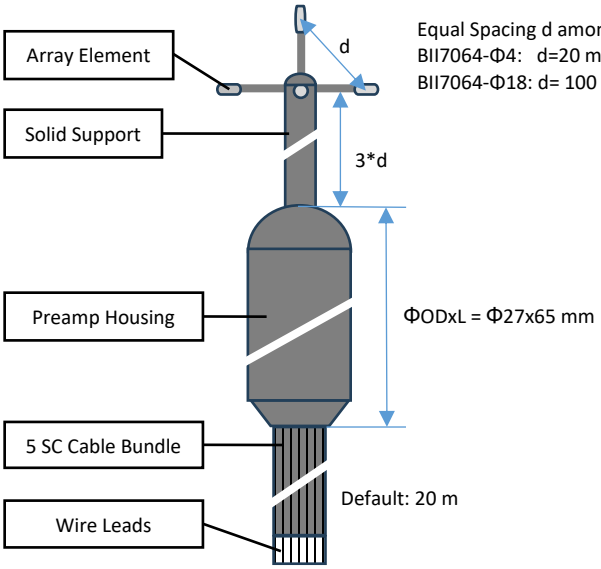
How do I use Gain Selection wires of a standalone PGA in field?

(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.

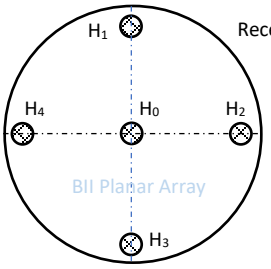
(2). **Gain Selection with Digital Outputs.** Digital Outputs of a DAQ (data acquisition device) select gains with TTL/CMOS logic levels.

BII7604 Four-Element Tetrahedron Array



Equal Spacing d among elements.
BII7064-Φ4: d=20 mm.
BII7064-Φ18: d= 100 mm.

BII7065 Five-Element Vector Hydrophone Array

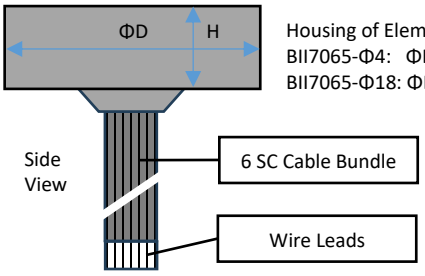


Receiving Face

Cable Bundles

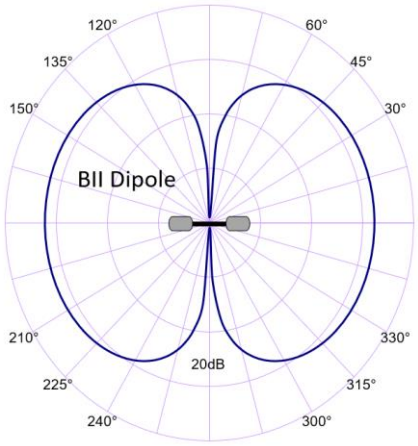
Voltage outputs are proportional to d/λ*cosθ or d/λ*sinθ
d: Element Spacing, λ: Wavelength, θ: Arriving angle of sound from dipole axis.

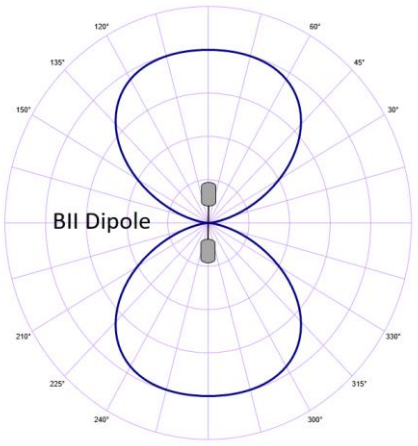
End User's Signal Processing → Measurement of Bearing



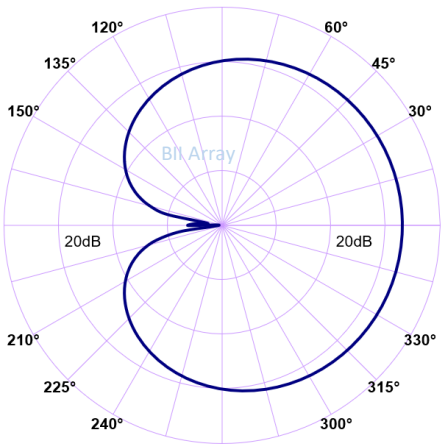
Housing of Elements and Preamps.
BII7065-Φ4: ΦDxH = Φ60x30 mm.
BII7065-Φ18: ΦDxH = Φ168x30 mm.

Dipole Directivity Response Pattern: Simple Array Consisting of 2 or 3 Array Elements.
"Figure 8" Pattern of a Dipole (Pressure-Gradient).

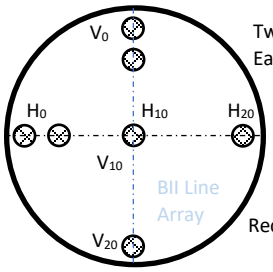




Cardioid Pattern= Presure Hydrophone + Dipole.



BII7062-Φ6 Two Line Arrays with Mills-Cross.



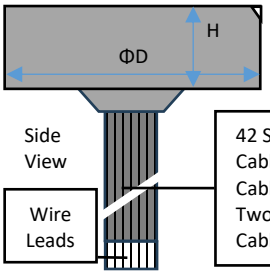
Two line arrays share center element: V_{10} or H_{10}.
Each Line Array has 21 elements.

Receiving Face

Cable Bundles

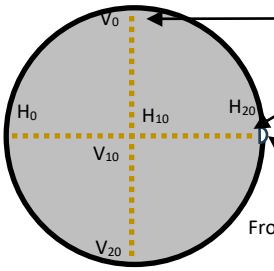
End User's
Signal Processing

Measurement of Bearing
Beam Steering
Beamforming



Housing of Elements and Preamps.
BII7062-Φ6: ΦDxH = Φ168x40 mm.

42 SC Cable Bundle.
Cable #0 to #20 for H Array.
Cable #21 to #41 for V Array.
Two arrays share #10 center element.
Cable without Numbering is for DC Supply.



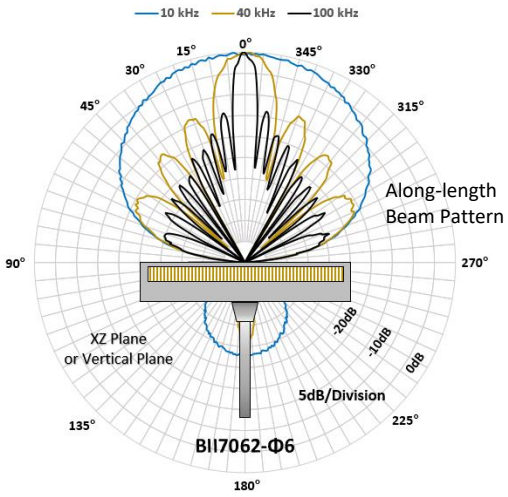
V Line Array, Element V_0

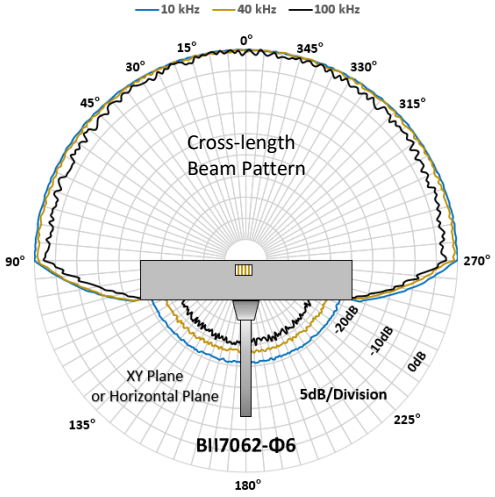
H Line Array, Element H_{20}.

Slot on Edge for Array Orientation.

Front View of Receiving Face

Line Array Directivity Response Pattern:





Application Tips on BII7062-Φ6 Two Linear Arrays with Mills-Cross.

1. **Measurement of Azimuth, Tracking, and Positionings of Sound Sources.** Two Linear Arrays (two x 21-elements) with Mills-Cross support beam steering electronically in software and avoid ambiguity.
2. **Target Angle Estimation**. Two Linear Arrays can be split into 4 line sub-arrays as a **Split Aperture Correlator** which ONLY needs 4 A/D converters to sample the data to estimate the target angle of a sound source.
3. **Searching/Monitoring Large Area**. Simpe arrays (2 to 5 elements) such as Dipoles (Pressure-Gradient), Quadrupoles, and Cardioid-Directivity Array has large -3dB beam angle to cover large area of the interest. Any element and any multiple elements of two linear arrays can be re-grouped to implement a simple array which has large beam angle.
4. **Avoiding Ambiguity**. Weighting/shading of array elements is recommended to suppress sidelobes.