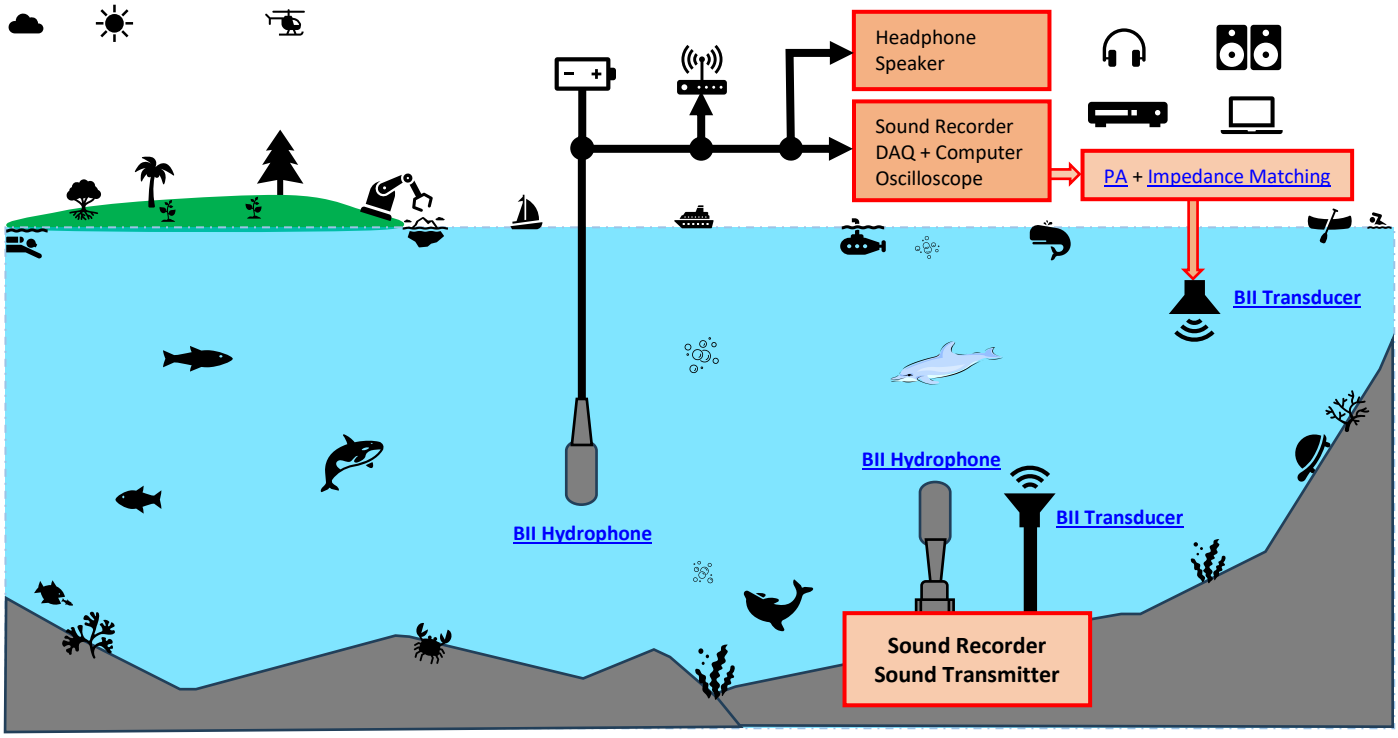
BII7120 Series Low Noise, Low Power, and Low Frequency Hydrophone: Noise Level Below Sea State Zero

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 600µA quiescent current at 5VDC 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 avoids interferences to acoustic field under test. The preamplifier integrated in the hydrophone can drive cable up to 200m without signal loss. Available cable terminals include audio connectors (TRS, XLR), BNC, and underwater mateable connectors.

The housing and mounting part are corrosion resistant plastics and/or stainless steels.

Underwater Sound Listening, Recording, and Communication



Typical Applications

Underwater Sounds Recording, Listening, and Communication, 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).

Specification

Part Number:	BII7121FGDF	BII7121FGSE	BII7121PGDF	BII7121PGSE
Sensitivity FFVS @ 1 kHz:	-185 + Preamp Gain, ± 2 dB V/µPa.			
FFVS:	Bespoke, 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**.**			
Usable Frequency:	**In Water**: 1 Hz ~ 50 kHz at ±2dB V/µPa.			
	In Air: 1 Hz ~ 4 kHz at -3dB V/µPa.			
Preamp Gain:	Fixed Gain Preamp: 1. Default: 26 dB. 2. Customized: 10 to 60 dB available.		Programmable Gain Preamp: 1. Default: 20, 50 dB. 2. Bespoke combination of two gains from 10 to 60 dB.	
Gain Selection Voltage: (Programmable Gain Preamp)	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.	
Built-in Preamp:	Yes, Low Noise Preamp.			
Built-in Filter:	1. Default: -3dB Bandpass Pass Filter: 0.4 Hz to 50 kHz. 2. Bespoke High Pass or Band Pass filter. Specify when ordering. Note: Minimum high pass filter f_{-3dB}: 0.4 Hz.			
	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 200 Hz, 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.			
-3dB Beam Width:	Omnidirectional and Toroidal. Refer to **Graph of Directivity Pattern**.			
Output Type:	Differential	Single Ended	Differential	Single Ended
	To reject Electromagnetic Interference (EMI) over long cable, the differential (balanced) output is recommended.			
Maximum Output V_{omax}:	V_{omax} = (Supply Voltage Vs - 4) Vpp.		(Supply Voltage Vs – 3.4) Vpp.	
Overload Pressure Level:	185 or [20*log(V_{omax}/2.828) – Sensitivity], whichever is less. in dB µPa.			
Acceleration Sensitivity:	104.3 dB re µPa/(m/s²) at Acoustic Axis; ≤ 103.0 dBµPa/(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**) 3. Thru-hole Mounting with Single O-ring (**THSO**) 4. Thru-hole Mounting with Double O-ring (**THDO**) 5. Bolt Fastening Mounting (Plastics) (**BFMP**) 6. Bolt Fastening Mounting (Stainless Steel) (**BFMSS**) Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and more details.			
Cable:	Four Conductor Shielded Cable (SC)		Six Conductor Shielded Cable (SC)	
Cable Length:	1. Default: 10 m. 2. Custom-fit up to 200 m.			
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. 3. SMA (Plug, Male Pin) (**SMA**), Voltage Rating: 335 V_{RMS} Continuous. (Max. Diameter Φ9.24 mm), for SE ONLY. 4. SMC (Plug, Female Socket) (**SMC**), Voltage Rating: 335 V_{RMS} Continuous. (SMC) (Max. Diameter Φ6.4 mm), for SE ONLY. 5. 1/8" (3.5mm) TRS Plug (**TRS**) (Max. Diameter Φ10.5 mm), for SE or DF. 6. XLR Plug (pin) (**XLR**) (Max. Diameter Φ20.2 mm), for SE or DF. 7. MIL-5015 Style (pin) (**MIL**) (Max. Diameter Φ19 to Φ30 mm), for SE or DF. 8. Underwater Mateable Connector (pin) (**UMC**) (Max. Diameter Φ21.5 to Φ35 mm), for SE or DF. 9. +9VDC Battery Snap (**BS**)			
	Underwater Mateable Connectors are for underwater uses. Other connectors/wire leads are for dry uses and are not waterproofed.			
Current (Quiescent):	16 mA	13 mA	16 mA	12 mA
Supply Voltage Vs:	+7.5 to +32 VDC.			
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.			
Size:	ΦD = Φ28.5 mm, Length ≥ 60 mm and actual length depends on Mounting Parts.			
Weight:	≥ 0.55 kg with 10m 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.				

Wiring Information of Hydrophones with Fixed-gain Preamps:

Single Ended Output:	**Wire Leads**	**BNC Male/SMA/SMC, 9V Battery Snap**	**Underwater/XLR Connector**	**XLR Plug and 9V Battery Snap**	**TRS Plug and 9V Battery Snap**
+VDC	Red	Female Snap	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Male Snap	Pin 1	Battery Male Snap	Battery Male Snap
Signal	White	Center Pin or Contact	Pin 2	XLR Pin 2	TRS Tip
Signal Common	Blue, Green, or Yellow	BNC/SMA/SMC Shield	Pin 4	XLR Pin 1 and Pin 3	TRS Ring and Sleeve
Shielding	Shield	N/A	N/A	XLR Metal Shell	N/A
Differential Output:	**Wire Leads**	**Underwater/XLR Connector**		**XLR + 9V Battery Snap**	**TRS + 9V Battery Snap**

+VDC	Red	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Pin 1	Battery Male Snap	Battery Male Snap
Signal+	White	Pin 2	XLR Pin 2	TRS Tip
Signal-	Blue, Green or Yellow	Pin 4	XLR Pin 3	TRS Ring
Signal Common	N/A	N/A	XLR Pin 1	TRS Sleeve
Shielding	Shield	N/A	XLR Metal Shell	N/A

Wiring Information of Hydrophones with One-bit Programmable Gain Preamps:

Differential Output:	**Wire Leads**	**Underwater/XLR Connector**	**XLR + 9V Battery Snap**	**TRS + 9V Battery Snap**
+VDC	Red	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Pin 1	Battery Male Snap, XLR Pin 1.	Battery Male Snap, TRS Sleeve.
Digital Common	Yellow or Brown	Pin 5	Yellow or Brown	Yellow or Brown
Digital A0 (FFVS Selection)	Blue	Pin 6	Blue	Blue
Output Signal+	White	Pin 2	XLR Pin 2	TRS Tip
Output Signal -	Green	Pin 4	XLR Pin 3	TRS Ring
Shielding	Shield	N/A	XLR Metal Shell	N/A
Single-Ended Output:	**Wire Leads**	**Underwater/XLR Connector**	**XLR + 9V Battery Snap**	**TRS + 9V Battery Snap**
+VDC	Red	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Pin 1	Battery Male Snap, XLR Pin 1.	Battery Male Snap, TRS Sleeve.
Digital Common	Yellow or Brown	Pin 5	Yellow or Brown	Yellow or Brown
Digital A0 (FFVS Selection)	Blue	Pin 6	Blue	Blue
Output Signal	White	Pin 2	XLR Pin 2	TRS Tip
Output Signal Common	Green	Pin 4	XLR Pin 3	TRS Ring
Shielding	Shield	N/A	XLR Metal Shell	N/A
Selecting Sensitivity of One-bit Digitally Programmable				
FFVS Selection Wire A0	**Hydrophone Sensitivity FFVS at 1kHz.**			
0 (Logic Low)	-185 + 20 dB V/µPa			
1 (Logic High)	-185 + 50 dB V/µPa			

How to Order Hydrophones. The default options are for stock items which are regularly available.

FG: Fixed Gain; **PG:** Programmable Gain; **DF:** Differential Output; **SE:** Single Ended Output. **HPF**: High Pass Filter; **LPF**: Low Pass Filter.					
Hydrophone	**-Preamp Gain**	**-HPF/LPF**	**-Mounting**	**-Cable Length**	**-Connectors for Signal/Gain/DC Supply**
BII7121FGDF BII7121FGSE	Default: 26dB.	-3dB Filter Frequency, in kHz. Default: 0.4Hz to 50kHz.	Refer to Options. Default: Free Hanging.	in meter. Default: 10m.	Refer to Options. Default: Wire Leads.
BII7121PGDF BII7121PGSE	20, 50dB.				

Example of Part Number:	Description
BII7121FGSE-26dB-Default-THSO-0.6m-WL	BII7121FGSE Hydrophone, 26dB Gain Preamp, Default Bandpass Filter; Thru-hole Mounting with Single O-ring (THSO), 0.6m Shielded Cable, Wire Leads for signal and DC Supply.
BII7121FGDF-26dB-10Hz-FH-100m-XLR/BS	BII7121FGDF Hydrophone, 26dB Gain Preamp, High Pass Filter: 10Hz; Mounting: Free Hanging, 100m Shielded Cable, 3-pin XLR Plug for Signals, +9V Battery Snap for DC Supply.
BII7121PGSE-20/50dB-Default-FH-30m-BNC/WL/BS	BII7121PGSE Hydrophone, 20/50dB Gain Preamp, Default Bandpass Filter; Mounting: Free Hanging, 30m shielded Cable, BNC Male for Signal, Wire Leads for Gain Selection, +9V Battery Snap for DC Supply.
BII7121PGDF-20/50dB-Default-FH-100m-XLR	BII7121PGDF Hydrophone, 20/50dB Gain Preamp, Default Bandpass Filter; Mounting: Free Hanging, 100m shielded Cable, 6-pin XLR Plug for Signal, Gain Selection, and DC supply.
BII7121PGDF-20/50dB-100Hz-FH-100m-XLR/WL/BS	BII7121PGDF Hydrophone, 20/50dB Gain Preamp, High Pass Filter: 100Hz; Mounting: Free Hanging, 100m shielded Cable, 3-pin XLR Plug for Signal, Wire Lead for Gain Selection, and 9V Battery Snaps for DC supply.

Question:

What if the mating connector of my DAQ module or recording device is NOT available from BII?

1. Buyer may order BII products with wire leads, and buyer assembles the mating connector to the cable end.
2. A connector adaptor might be assembled by BII by customization, and BII ships the adaptor to buyer as accessory of the device. Please contact BII for customizations.
3. 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.

Can the hydrophone with differential outputs be wired to single-ended inputs of a DAQ device (Data Acquisition Equipment) such as an Oscilloscope?

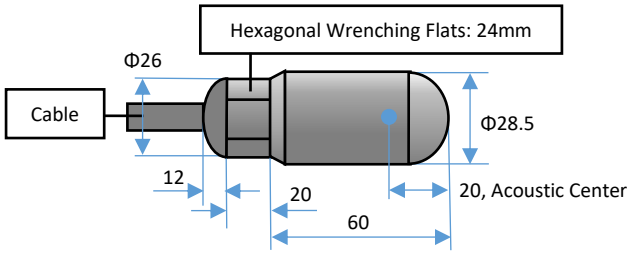
Yes, output+ and Common of a BII hydrophone can be used a single-ended signal, or Output- and Common of the hydrophone can be used a single-ended signal.
But, neither output+ nor output – of the hydrophone can be wired to common which is going to destroy the hydrophone by short circuit.

How do I use Gain Selection wires in field?

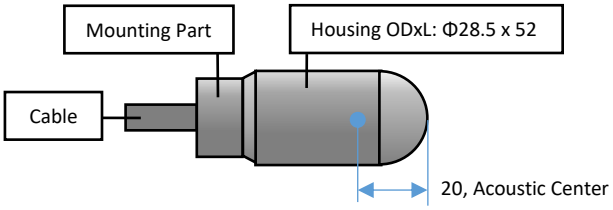
1. **Manual Gain Selection.**
   When a **Gain Selection wire** is floating or open, its digital logic is High or "1".
   When a **Gain Selection wire** is short to **Digital Common**, its digital logic is Low or "0".
   Sensitivity of a Hydrophone is fixed when its Gain Selection wires are fixed to **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.

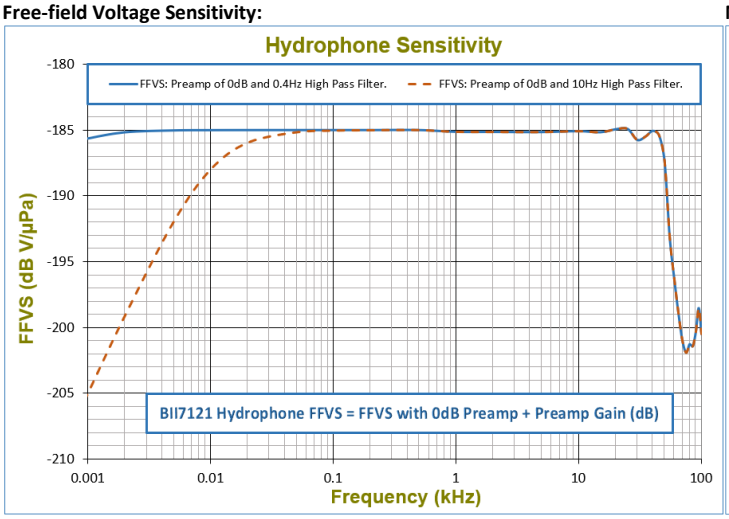
a. Size information of Free Hanging.



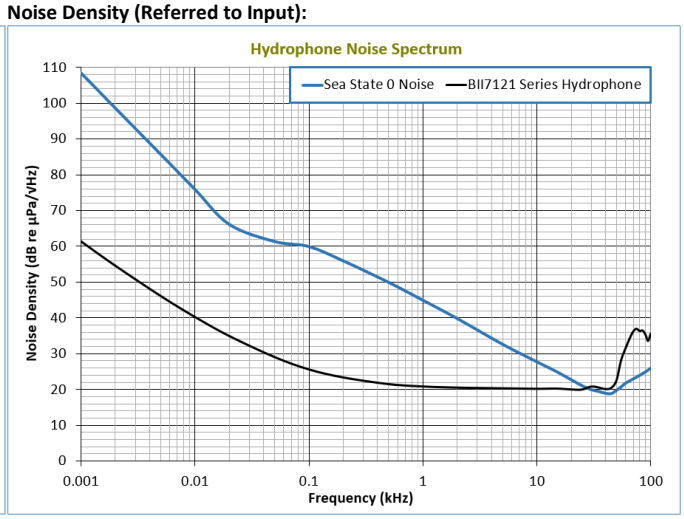
b. General Size information.



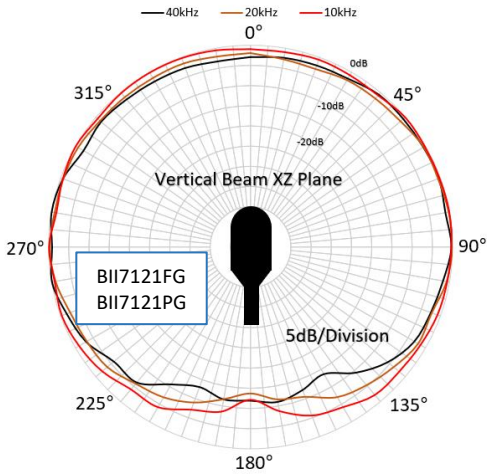
Free-field Voltage Sensitivity:

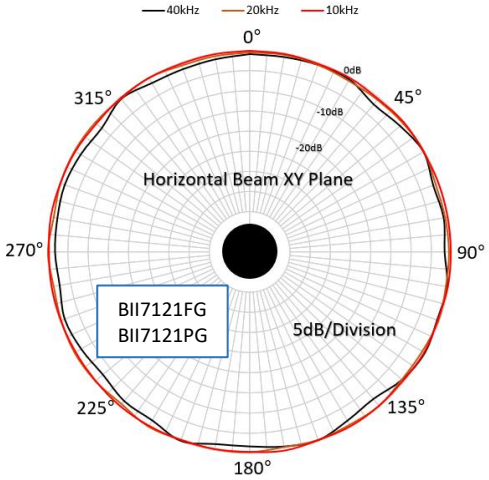


Noise Density (Referred to Input):



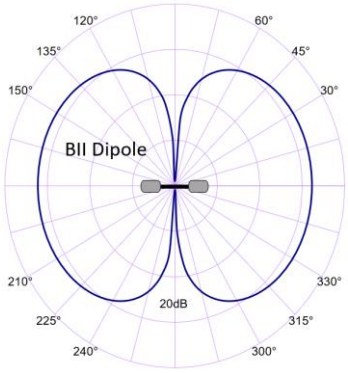
Directivity Pattern:

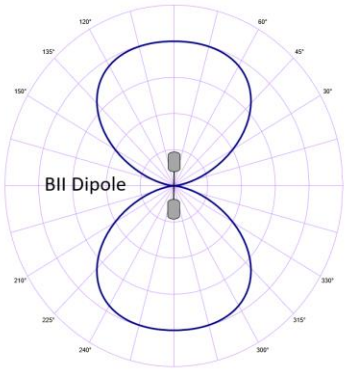
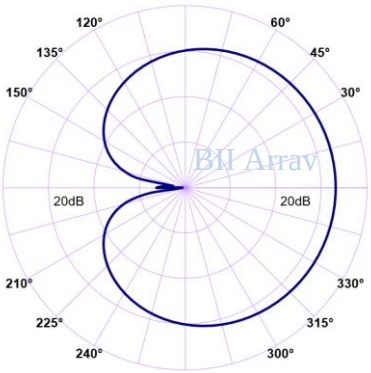




Simple Array Consisting of 2 or 3 Hydrophones.

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





Cardioid Pattern= Presure Hydrophone + Dipole.