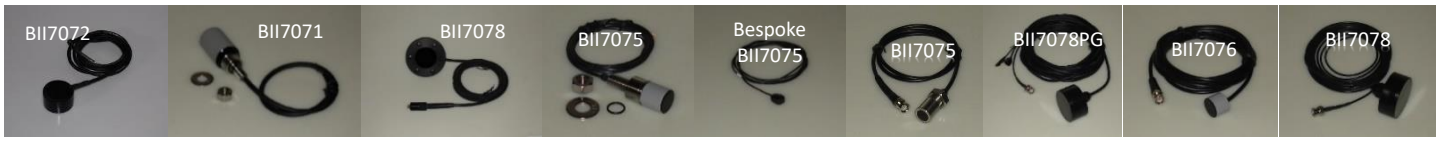
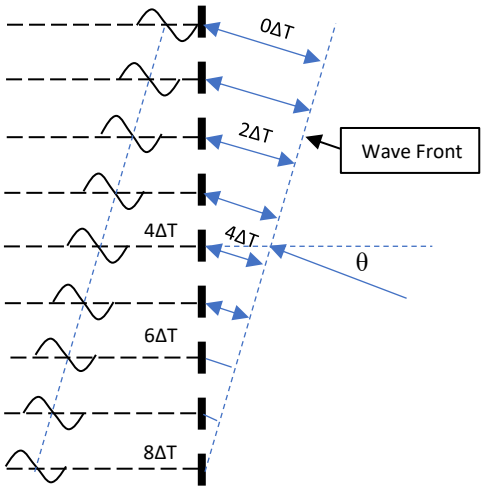


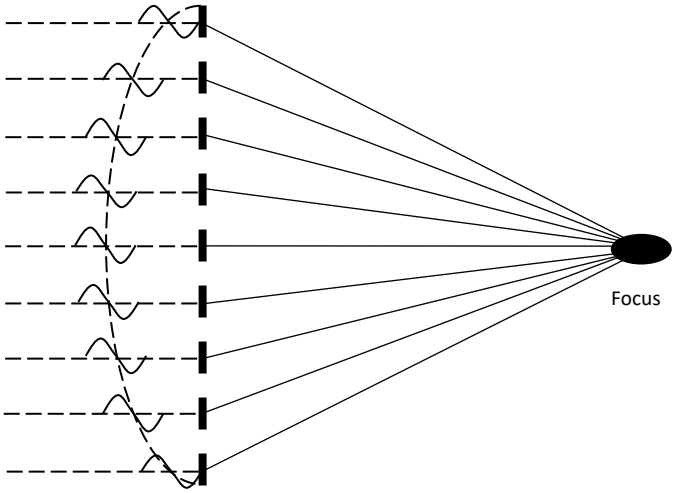
BII7070 Series Directional Hydrophone (Acoustic Sensor) and Planar Array Element

BII's directional hydrophones have conical beams and low Qm for uses in detection of weak signals, broadband signals, pipeline leaks, and tracking of sound sources underwater. Hydrophones with low noise below sea-state zero are available for directional sound measurements such as Dolphins' whistles and clicks (about 0.2 to 150 kHz, 50 to 128 µS.) in a long distance. These acoustic sensors are also designed for applications in air to detect acoustic emission and stress waves. The couplant such as water or gel is necessary material to provide efficient acoustic coupling between the hydrophone face and the piece under test in air applications.
Below the critical frequency fc, the hydrophones are of single beam without side lobes. This feature makes hydrophones be ideal candidates for target angle estimation systems or sound source tracking systems. The hydrophones have higher sensitivity and can transmit signal over long cable with built-in preamplifiers.

Linear (Rectangular) Array Beam Steering



Linear, Annular, and Planar Array Beam Focusing



Typical Applications

Direction-finding Sonar, Tracking of Acoustic Tags. LBL/SBL/USBL Positioning System. Locating Marker/Pinger/Beacon/Transponder Acoustic Pipeline Leak Detection.	Array elements for Array Focusing and Beam Steering. Noise Measurement, Bioacoustic Research of Marine Animals. Structural Health Monitoring, Acoustic Emission Detection/AE Sensor. Monitoring Aquarium/Pool Safety/Alarm System.

Specification

Part Number:	**BII7075FG BII7075PG**	**BII7076FG BII7076PG**	**BII7077FG BII7077PG**	**BII7078FG BII7078PG**	**BII7078FGLN**
Sensitivity @ 1kHz:	-194.0 + Preamp Gain, dB V/µPa. Variation: ± 3 dB.				-188 + Preamp Gain
FFVS:	Free-field Voltage Sensitivity, Refer to Graph of **FFVS vs. Frequency**.				
Usable Frequency in Water:	9 Hz to 450 kHz	3 Hz to 450 kHz	2 Hz to 450 kHz	1 Hz to 450 kHz	3 Hz to 450 kHz
Usable Frequency in Air: (-3dB V/µPa)	9 Hz ~ 16 kHz	3 Hz ~ 8 kHz	2 Hz ~ 6 kHz	1 Hz ~ 3 kHz	3 Hz ~ 3 kHz
-3dB Beam Width:	9900°/f(kHz)	4650°/f(kHz)	3200°/f(kHz)	1700°/f(kHz)	1700°/f(kHz)
Frequency f_{-3dBML}:	74 kHz	41 kHz	32 kHz	15 kHz	15 kHz
	f_{-3dBML}: Main Lobe drops -3dB at ±90° normal to acoustic axis.				
Critical Frequency f_c:	180 kHz	100 kHz	78 kHz	36 kHz	36 kHz
	f_c: Side lobes exist in the case of operating frequency f > fc; The hydrophone has no side lobe in the case of f ≤ fc.				
±90° Sidelobe Frequency f_n:	240 kHz	133 kHz	104 kHz	49 kHz	49 kHz
	f_n: First Side Lobes exist at ±90° normal to acoustic axis in the case of operating frequency f = fn.				
Pressure Noise Density:	Refer to Graph of **Pressure Noise Density**.				
Preamp Gain (dB):	Fixed Gain Preamp. Default: 40 dB Gain. Bespoke: -40 to +60 dB. **FG** is appended to the part number.				
	Programmable Gain Preamp. 0/20/40/60 dB Gain. **PG** is appended to the part number.				
	If buyer does NOT specify a preamp, BII will use a low noise preamp in the hydrophone.				
	Note: If Digital Outputs or switches are used to select gains, Voltage Protection Rating or Absolute Maximum Voltage Ratings of these devices must be greater than V_s Supply Voltage.				
Gain Selection Voltage: (Programmable Gain Preamp)	CMOS/TTL Compatible **Logic Low 0**: Gain Selection Wire to COM or 0 to +0.8 V. **Logic High 1**: Gain Selection Wire Open or +2.4 V to Vs.				N/A
Built-in Bandpass Filter:	Customized High Pass filter and Low Pass Filter. Specify when ordering.				
	If buyer does NOT specify -3dB cut-off frequencies, BII will use default -3dB cut-off frequencies suitable to the hydrophone.				
	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.				
Output Type:	1. Single Ended, Append **SE** to the part number. 2. Differential, Append **DF** to the part number.				
	To reject Electromagnetic Interference (EMI) over long cable (≥ 20m), the differential (balanced) output is recommended.				
Maximum Output V_{omax}:	(Supply Voltage Vs - 4), in Vpp.				
Overload Pressure Level:	20*log(V_{omax}/2.828) - Sensitivity, in dB µPa.				
Receiving Face:	Circular Planar Face				
Directivity Pattern:	Conical Beam, Refer to Graph of **Directivity Pattern.**				
Sidelobe Level:	1. Default: < -17.8 dB when f > fc; No side lobe when f ≤ fc. 2. Bespoke Sidelobe Suppression is available upon request for BII7074FG and BII7074PG: ≤-30 dB. Main lobe is about 1.1 to 1.28 times wider.				
Acceleration Sensitivity:	143.6 dB µPa/(m/s²) along acoustic axis.				138.0 dB µPa/(m/s²)
	Other direction: 141.0 dB µPa/(m/s²).				135.0 dB µPa/(m/s²).
Maximum Operating Depth:	300 m, Limited by cable length with wire leads.				
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 Orientation:	1. Default: Perpendicular to end face of hydrophone. 2. Customization: Perpendicular to side wall of hydrophone (reducing the overall height), appending **SW** to the part number.				
Cable:	1. Fixed Sensitivity Hydrophone: Four Conductor Shielded Cable (SC). 2. Programmable Sensitivity Hydrophone: Six Conductor Shielded Cable (SC).				
Cable Length:	1. Default: 10 m. 2. Custom-fit Cable Length ≤ 200m.				
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 (pin) (**XLR**) (Max. Diameter Φ20.2 mm), for SE or DF. 7. MIL-5015 Style (pin) (**MIL**) (Max. Diameter Φ30 mm with 3 contacts), 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**) (Exclusive to preamplified hydrophone)				
Supply Voltage Vs:	+8.5 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.				
Current (Quiescent):	**Fixed Gain Preamp**: 4.8 to 9.8 mA depending output type and cable length. **Programmable Gain Preamp**: 9 mA, 13 mA, or 22 mA depending output type.				
Size (ΦDxH):	Φ21x50 mm	Φ27x50 mm	Φ33x50 mm	Φ60x30 mm	Φ60x30 mm
Weight:	≥ 0.6 kg with 10m cable. Extra Cable: about 60 grams/meter.				
Operation Temperature:	-10°C to to 60°C, or 14°F to 140°F				
Storage Temperature:	-20°C to to 60°C, or 4°F to 140°F				
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.					

Wiring Information of Hydrophones with Fixed-gain Preamps:

Wiring of Single Ended Output:	**Wire Leads**	**BNC Male/SMA/SMC and 9V Battery Snap**	**Underwater 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
Wiring of Differential Output:	**Wire Leads**	**Underwater 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 Two-bit Programmable Gain Preamps:

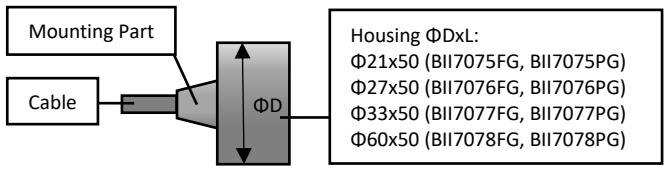
Wiring of Single Ended Output:	**Wire Leads**	**9V Battery Snap and BNC Male/SMA/SMC**	**Underwater Connector**	**XLR Plug + 9V Battery Snap**	**TRS Plug + 9V Battery Snap**
+VDC	Red	Battery Female Snap	Pin 3	Battery Female Snap	Battery Female Snap
Common	Black	Battery Male Snap	Pin 1	Battery Male Snap	Battery Male Snap
Digital Common		Black		Black	Black
Digital A1 (Gain Selection)	Yellow or Brown	Yellow or Brown	Pin 5	Yellow or Brown	Yellow or Brown
Digital A0 (Gain Selection)	Blue	Blue	Pin 6	Blue	Blue
Output Signal	White	BNC/SMA/SMC Center	Pin 2	XLR Pin 2	TRS Tip
Output Signal Common	Green	BNC/SMA/SMC Shield	Pin 4	XLR Pin 1 and Pin 3	TRS Ring and Sleeve
Shielding	Shield	Shield	N/A	XLR Metal Shell	N/A
Wiring of Differential Output:	**Wire Leads**	**Underwater Connector**	**XLR Plug + 9V Battery Snap**		**TRS Plug + 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			Black		Black
Digital A1 (Gain Selection)	Yellow or Brown	Pin 5	Yellow or Brown		Yellow or Brown
Digital A0 (Gain 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
Selecting Sensitivity FFVS of Two-bit Digitally Programmable					
Gain Selection Wire A1	**Gain Selection Wire A0**		**Sensitivity at 1kHz**		
0 (Logic Low)	0 (Logic Low)		-194 + 0 dB V/µPa		
0 (Logic Low)	1 (Logic High)		-194 + 20 dB V/µPa		
1 (Logic High)	0 (Logic Low)		-194 + 40 dB V/µPa		
1 (Logic High)	1 (Logic High)		-194 + 60 dB V/µPa		

How to Order Hydrophones

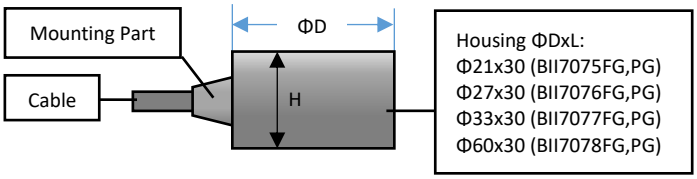
Part Number	**-Output Type**	**-Preamp Gain**	**-HPF/LPF**	**-Mounting**	**-Cable Length**	**-Connectors for Signal/DC Supply**
Refer to Table.	DF or SE.	Bespoke Preamp Gain, in dB.	-3dB Filter Frequencies, in kHz. Default: Usable Frequency in Water.	Refer to Options. Default: Free Hanging.	in meter. Default: 10m.	Refer to Options. Default: Wire Leads.
Example of Part Number:			Description			
BII7074FGLN-SE-30dB-FH-20m-BNC/BS.			BII7074FGLN Hydrophone, Single-ended Output, 30dB Preamplifier Gain, Free Hanging, 20m Shielded Cable, Connector: Male BNC for Signals, Battery Snap for +9VDC Batteries.			
BII7074FG-SE-20dB-0.3kHz-FH-20m-BNC/BS			BII7074FG Hydrophone, Single-ended Output, 20dB Preamplifier Gain, 0.3kHz High Pass Filter, Free Hanging, 20m Shielded Cable, Connector: Male BNC for Signals, Battery Snap for +9VDC Batteries.			
BII7074PG-DF-10Hz/200kHz-BFMSS-50m-XLR/BS			BII7074PG Hydrophone, Differential Output, 10Hz to 200kHz Band Pass Filter, Bolt Fastening Mounting (Stainless Steel) (BFMSS), 50m Shielded Cable, Connector: XLR Plug for Signals, Battery Snap for +9VDC Batteries.			

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

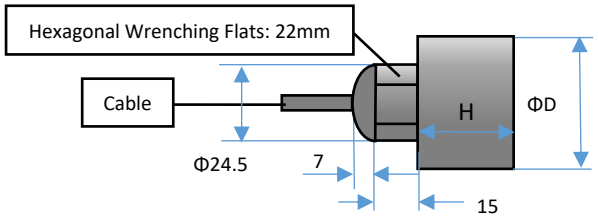
a. General Size information.



b. Size information of Customized Cable Orientation: Side Wall.

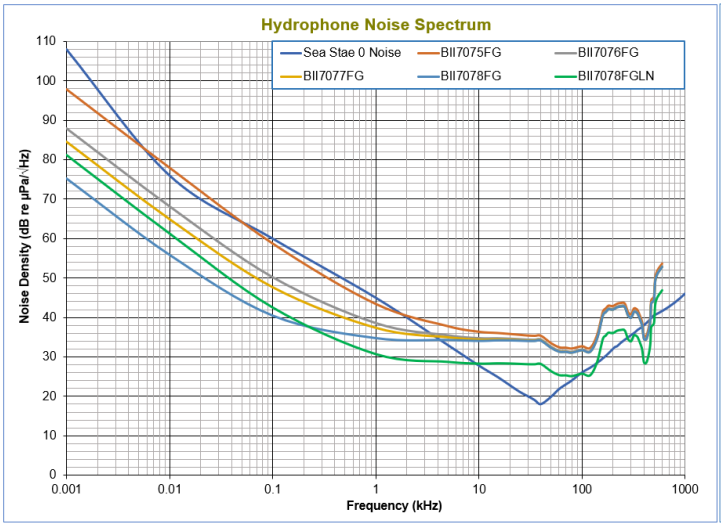


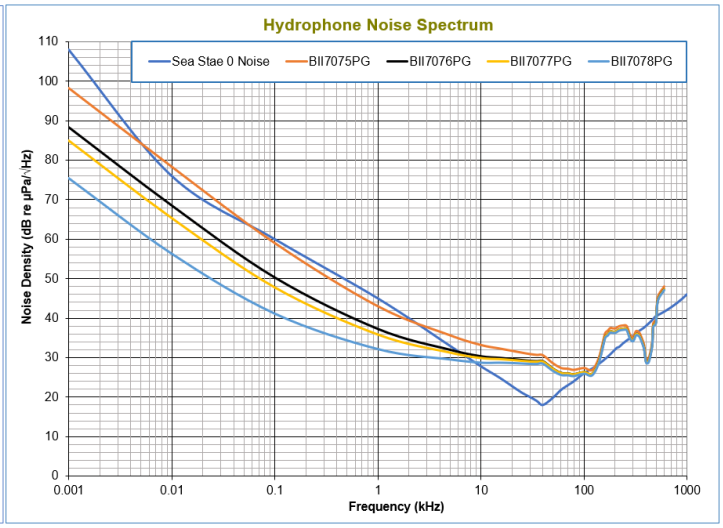
c. Size information of Free Hanging.



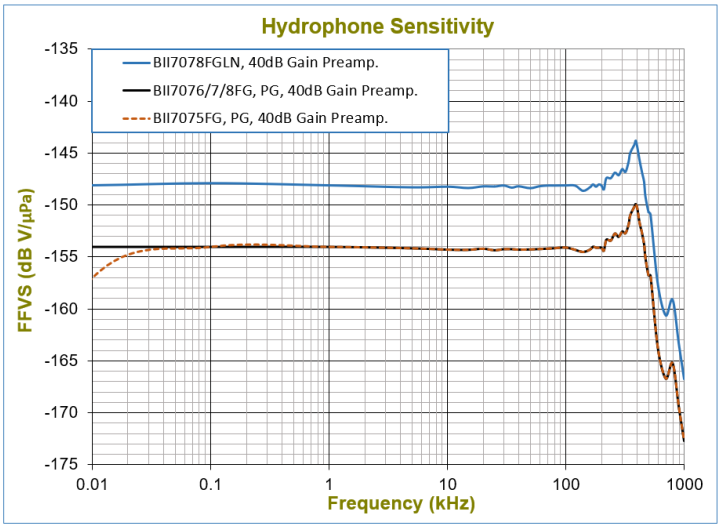
Φ21 (BII7075FG, BII7075PG)
Φ27 (BII7076FG, BII7076PG)
Φ33 (BII7077FG, BII7077PG)
Φ60 (BII7078FG, BII7078PG)

Pressure Noise Density (RTI, referred to the input): Noise Density of the hydrophone varies with the built-in preamplifier.

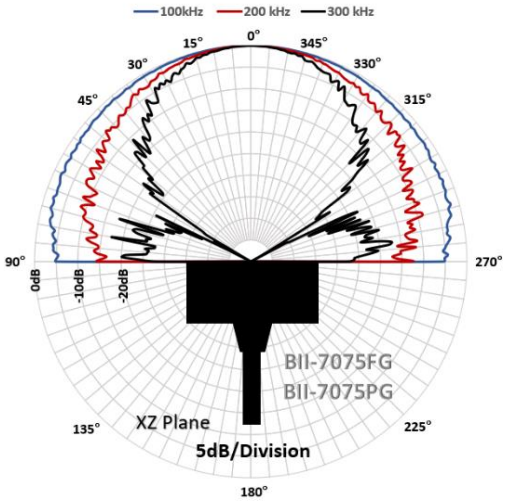




Free-field Voltage Sensitivity (FFVS)



Directivity Pattern



Directivity Pattern