BII-7140 Series Specification

Acoustic Elements for Arrays, Streamers, Beacons and Positioning. The acoustic elements feature small size, low cost and easy integration, and are ready to be assembled in discrete arrays such as linear (broadside, end-fire, Mills Cross), planar and 3-D arrays to implement different acoustic applications. Depending on the operating frequency, these elements can be treated as Points, Lines or Rectangle Aperture in array signal processing. Beam steering, bearing measurement, side-lobe suppression, user-defined beam pattern (broad or narrow), array focusing can be achieved by complex weighting (Digital or FFT Beamforming) technique. Differential output and shielded twisted pair cable provide great EMI noise rejection over long cable. Multiple elements can be combined in series or parallel to make up an array distributing hundreds meters in field.

- Oil-filled Streamer Element/Towed Array/Seabed Array
- Acoustic Beacons: Pingers, Tags and Remote Tracking
- Monitoring Seismic Sources/Airgun/Watergun
- Vector Hydrophone Element, Acoustic Positioning
- Passive Acoustic Monitoring System (PAM System), Sonobuoy
- Marine Seismic Detector/Exploration/Borehole Seismic

1. **Omnidirectional (Toroidal) Beam Elements**
2. **Conical Beam Elements for Linear and Planar Array**

### Specifications of Omnidirectional (Toroidal) Beam Directivity Elements

<table>
<thead>
<tr>
<th>Acoustic Element</th>
<th>BII-7141</th>
<th>BII-7142</th>
<th>BII-7143</th>
<th>BII-7144</th>
<th>BII-7145</th>
<th>BII-7146</th>
<th>BII-7147</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aperture Size (dBkL:mm)</td>
<td>Φ9.5x8</td>
<td>Φ9.5x8</td>
<td>Φ9.5x8</td>
<td>Φ7.5x7</td>
<td>Φ9.5x8</td>
<td>Φ6.35x6</td>
<td>Φ4.36x4.5</td>
</tr>
<tr>
<td>Sensitivity @ 1kHz (dBV/μPa):</td>
<td>-202.0 ± 2</td>
<td>-201.0 ± 2</td>
<td>-207.0 ± 2</td>
<td>-184.7 ± 2</td>
<td>-181.4 ± 2</td>
<td>-189.0 ± 2</td>
<td>-192.8 ± 2</td>
</tr>
<tr>
<td>Usable Frequency in Water (+3dB V/μPa):</td>
<td>1Hz ~ 120kHz</td>
<td>1Hz ~ 120kHz</td>
<td>1Hz ~ 120kHz</td>
<td>1Hz ~ 180kHz</td>
<td>1Hz ~ 140kHz</td>
<td>1Hz ~ 230kHz</td>
<td>1Hz ~ 330kHz</td>
</tr>
<tr>
<td>Usable Frequency in Air (-3dB V/μPa):</td>
<td>1Hz ~ 9kHz</td>
<td>1Hz ~ 9kHz</td>
<td>1Hz ~ 9kHz</td>
<td>1Hz ~ 10kHz</td>
<td>1Hz ~ 9kHz</td>
<td>1Hz ~ 12kHz</td>
<td>1Hz ~ 15kHz</td>
</tr>
<tr>
<td>Capacitance C, @ 1kHz:</td>
<td>2.32nF ±10%</td>
<td>1.5nF ±10%</td>
<td>1.34nF ±10%</td>
<td>0.12nF ±10%</td>
<td>0.12nF ±10%</td>
<td>0.13nnF ±10%</td>
<td>0.069nF ±10%</td>
</tr>
<tr>
<td>Dissipation @ 1kHz:</td>
<td>0.011</td>
<td>0.008</td>
<td>0.02</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
<td>0.005</td>
</tr>
<tr>
<td>Shielding of Sensing Element:</td>
<td>Shielded</td>
<td>Shielded</td>
<td>Shielded</td>
<td>Unshielded</td>
<td>Unshielded</td>
<td>Unshielded</td>
<td>Unshielded</td>
</tr>
</tbody>
</table>

Unshielded sensing elements pick up EMI noise if any in air and shallow water. Electronic filters are recommended in subsequent signal processing circuit.

- **Accelerometer Sensitivity** (dB μPa/(m/s²)):
  - BII-7141: 109.2
  - BII-7142: 109.6
  - BII-7143: 115.2
  - BII-7144: 103.0
  - BII-7145: 103.6
  - BII-7146: 110.0
  - BII-7147: 93.0

- **Underwater Projector:**
  - No

- **Resonance Frequency fs:**
  - N/A

- **Quality factor Qm at fs:**
  - N/A

- **Maximum Drive Voltage:**
  - N/A

- **Maximum Pulse Width:**
  - N/A

- **Maximum Duty Cycle:**
  - N/A

- **TVR at fs (dB μPa/V@1m):**
  - N/A

- **Maximum Depth:**
  - 300 m

- **Housing Size with Cable & Wires:**
  - ΦD x Length = Φ12.6 x 32 mm
  - 0.11x32

- **Overall Size with Solder Pins:**
  - ΦD x Length = Φ12.6 x 26 mm
  - N/A

- **Weight (in air):**
  - 9 grams
  - 8 grams

- **Sensitivity Matching at 1kHz:**
  - Tolerance: ±2.0 (Default); b. ±1.0; c. ±0.5; d. ±0.3; e. ±0.1 in dB V/μPa.

- **Directivity Pattern:**
  - Omnidirectional in low frequency range, Toroidal in high frequency range. Refer to graph of Beam Pattern.

- **Electrical Insulation:**
  - > 500 MΩ at 500 VDC.

- **Cable/Wiring/Pins:**
  - 1. Default: Differential Output: Shielded Twisted Two Conductor Cable (ΦD=3.6mm) (SC36)
  - 2. Single Ended Output: Coax RG174/U (ΦD=2.8mm) (RG174)
  - 3. Three AWG26 Wires (AWG26)
  - 4. Solder Pins on Both Ends: Brass alloy with gold finish, Φ1x5 mm. (SP)

- **Cable/Wire Length:**
  - 1. Default: 0.15m.
  - 2. Customized: up to 100m.
  - a. Sensitivity loss over extension cable (dB) = 20*log[Cc/(Cc+Cf)]. Cc: Hydrophone Capacitance; Cf: Capacitance of Extension Cable. Shielded cable is of 100μF/meter roughly. Valid for hydrophone without preamplifier.
  - b. Operating depth is limited by the cable length without a suitable underwater sealing part.

- **Electrical Leads:**

- **Mounting Options:**
  - Free Hanging (FH)

- **Operation Temperature:**
  - BII-7140 Coax: -10°C to +70°C or 14°F to 158°F.
  - AWG26 Wires: -10°C to +105°C or 14°F to 221°F.
  - RG174 Coax and Solder Pins: -10°C to +120°C or 14°F to 248°F.

- **Storage Temperature:**
  - -20°C to +60°C or -4°F to 140°F.

- **Wiring of Differential:**
  - Two Conductor Shielded Cable
  - AWG26 Wires
  - Solder Pins
### Wiring of Single Ended:

<table>
<thead>
<tr>
<th>Signal +</th>
<th>White or Red</th>
<th>White or Red</th>
<th>Pin 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal -</td>
<td>Black</td>
<td>Black</td>
<td>Pin 3</td>
</tr>
<tr>
<td>Common &amp; Shielding</td>
<td>Shield</td>
<td>Green</td>
<td>Pin 2</td>
</tr>
</tbody>
</table>

**Shielded Cable or Coax**

- **Length**
- **Wires**
- **Solder Pins**

**Physical Size (Dimensional Unit: mm):**

- **Shielded Cable or Coax**
- **Wires**
- **Solder Pins Φ1**

**Beam Pattern**

- **Vertical Beam XZ Plane**
- **Horizontal Beam XY Plane**

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**WARNING** for Projector Applications: **DANGER** — HIGH VOLTAGE on wires. Wires shall be insulated for safety. DO NOT TOUCH THE WIRES BEFORE THE DRIVING SIGNAL IS SHUT DOWN. Cable shield must be grounded firmly for safety.

For 50Ω BNC Male connector, it is buyer’s sole responsibility to make sure that the (female) BNC shield of the signal source is firmly grounded for operating safety before hooking up transducer/hydrophone to the signal source. Coax with BNC is not intended for hand-held use at voltages above 30Vac/60Vdc.

**Sound Measurement in Air:** The hydrophones can be used to detect sounds in air. Receiving sensitivity in air is same to the one in water in low frequency range.
How to Order

<table>
<thead>
<tr>
<th>Hydrophone</th>
<th>Cable Length</th>
<th>Cable</th>
<th>Connector</th>
<th>Sensitivity Matching Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
<td>in meter</td>
<td>Refer to Options</td>
<td>Refer to Options</td>
<td>Refer to Options. in dB V/µPa, at 1kHz.</td>
</tr>
<tr>
<td>Example of Part Number</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BII-7141-0.15m-SC36-WL-2dB</td>
<td>BII-7141 Hydrophone, 0.15m Shielded cable (ΦD=3.6mm), Wire Leads. Sensitivity Matching Tolerance: ±2.0 dB.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BII-7141-1m-AWG26-WL-1dB</td>
<td>BII-7141 Hydrophone, 1m AWG26 Wires (Three 1m wires), Wire Leads. Sensitivity Matching Tolerance: ±1.0 dB.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BII-7143-50m-RG174-BNC-1dB</td>
<td>BII-7143 Hydrophone, 50m RG174 Coax with BNC male. Sensitivity Matching Tolerance: ±1.0 dB.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specifications of Conical Beam Elements

**Acoustic Element**

**BII-7149**

Typical Applications: Linear and Planar Array.

Aperture Size: Length x Width = 6.5 x 6.5 mm, Square Planar Aperture.

Sensitivity @ 1kHz (dB V/µPa): -205.5 + Sensitivity Loss over the cable, dB V/µPa. Variation: ± 2 dB.

Usable Frequency in Water (±3dB V/µPa): 1 Hz ~ 550 kHz. Usable frequency of an array is limited by geometry tolerance of installation comparing to sound wavelength.

Usable Frequency in Air (±3dB V/µPa): 1 Hz ~ 16 kHz

Capacitance Cc @ 1kHz: 0.36 nF ±10%

Dissipation @ 1kHz: 0.026

Signal Type: Single Ended

Shielding of Sensing Element: Shielded

Acceleration Sensitivity (dB A/µPa/m/s²): 143.6 along acoustic axis. Other direction: 141.0.

Underwater Projector: Yes. Do NOT use projectors in air to avoid damage.

Resonance Frequency fs: 420 ± 5% kHz

Quality factor Qm at fs: 3.5

Maximum Drive Voltage:
1. Default: 300 Vrms.
2. Customized to 600 Vrms.

Maximum Pulse Width: 100 ms

Maximum Duty Cycle:
1. 10% at Maximum Drive Voltage. 100% at 10.6 Vrms.
2. ±2.0 % kHz

TWR at fs (dB V/µPa@1m):
1. ≤ 150.0

Maximum Depth: 100 m in water.

Housing Size: ΦD x Length = Φ12.6 x 32 mm

Weight (in air):
10 grams. Actual weight depends on Cable Types and Length.

Sensitivity Matching at 1kHz: Tolerance: ±2.0 (Default); ±1.0; ±0.5; ±0.3; ±0.1. in dB V/µPa.

Sensitivity Matching at 1 kHz:
1. Sensitivities of hydrophones are tested at 1 kHz.
2. Hydrophones whose sensitivity variations are out of specified tolerance are rejected.

Directivity Pattern: Conical Beam

-3dB Beam Width: 9900°/kHz

Electrical Insulation: > 500 MO at 500 VDC.

Cable:
1. Coax RG174/U (ΦD=2.8mm) (RG174).
2. Coax RG178/U (ΦD=1.8mm) (RG178).
3. Three AWG26 Wires (AWG26).
4. Shielded Twisted Two Conductor Cable (ΦD=3.6mm) (SC36).

Cable Length:
1. Default: 1 m. 2. Customized: up to 20 m.
   a. Sensitivity Loss over Extension Cable (dB) = 20*log(Cc/(Cc+Cc)).
   b. Operating depth is limited by the cable length without a suitable underwater sealing part.

Connector:
1. Default: Wire Leads (WL)
2. BNC Male (BNC)
3. 3.5 mm (⅜") TRS Plug (TRS35)
4. ¼" (6.35 mm) TRS Plug (TRS635)
5. XLR Plug (XLR)
6. Underwater Mateable Connector (UMC)
7. Custom (custom)

Mounting Options: Free Hanging (FH)

Operation Temperature:
1. Shielded Cable and RG174 Coax: -10°C to +70°C or 14°F to 158°F.
2. AWG26 Wires: -10°C to +105°C or 14°F to 221°F.
3. RG178 Coax: -10°C to +120°C or 14°F to 248°F.
   Note: Limited by connector service temperature if any.

Storage Temperature: -20°C to +60°C or -4°F to 140°F.

Customization: Please contact BII to customize BII-7140 series for your specific acoustic projects.

**Wiring of Single Ended:**

- Two Conductor Shielded Cable
- AWG26 Wires
- Coax with Wire Leads

**Signal**
- White or Red
- White or Red
- Center Contact

**Signal Common**
- Black
- Black
- Shield

**Shielding**
- Shield
- N/A
- Shield

**WARNING for Projector Applications:** DANGER — HIGH VOLTAGE on wires. Wires shall be insulated for safety. DO NOT TOUCH THE WIRES BEFORE THE DRIVING SIGNAL IS SHUT DOWN. Cable shield must be grounded firmly for safety.
Physical Size (Dimensional Unit: mm):
The cylinder surface of the element can be used for clamps or jigs to position the element. To avoid damaging element surface:
1. The clamping force should be less than 5 N.
2. The surfaces of the clamps or jigs must be smooth and do not have any sharp and spike.

How to Order

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Cable Length</th>
<th>Cable</th>
<th>Connector</th>
<th>Sensitivity Matching Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BII-7149-10m-RG174-BNC-2dB</td>
<td>BII-7149 Hydrophone, 10m RG174/U Coax Cable, BNC Male, Sensitivity Matching Tolerance: ±2.0 dB.</td>
<td>in meter</td>
<td>Refer to Options</td>
<td>Refer to Options</td>
<td>in dB V/μPa, at 1kHz.</td>
</tr>
<tr>
<td>BII-7149-10m-AWG26-WL-1dB</td>
<td>BII-7149 Hydrophone, Two 10m AWG26 Wires, Wire Leads. Sensitivity Matching Tolerance: ±1.0 dB.</td>
<td>Refer to Options</td>
<td>Refer to Options</td>
<td>Refer to Options. in dB V/μPa, at 1kHz.</td>
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