

## BII-7740 Series Annular Array Transducer: Amplitude Shading/Weighting, Array Focusing & Spreading and Dual Beams

BII-7740s are bespoke high power broadband annular array (ring-array) transducers which have radially distributed symmetric ring elements on the circular radiation face. The elements are driven separately with voltage sources to support the amplitude shading (Weighting), array focusing and spreading (Phase Shift or Time Delay), acoustical imaging (Microscope, Holography, and Tomography), and tune the best compromise between main-beam sharpness and the side-lobe suppression. A dual beam or dual frequency transducer can be implemented by wiring different elements for transmit and receive. Besides, BII-7740s can also be used in passive SONAR (listening sounds).

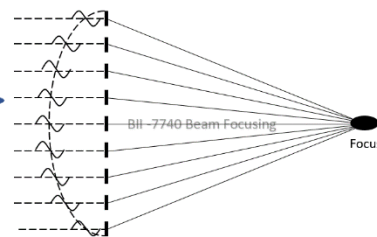
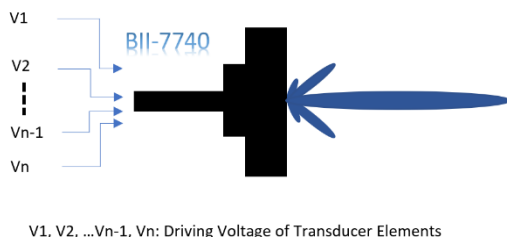
### Typical Applications

|  |                                       |                                |
|--|---------------------------------------|--------------------------------|
| Acoustic Imaging, Doppler Ultrasound, NDT, Diagnostic Ultrasound | High Resolution Sonar, Chirp/FM Sonar | Navigation, Obstacle Avoidance |
| Direction-finding Sonar, Echo Sounding                           | Underwater Robotic and Vehicle        | Fishery Sonar, Bioacoustics    |



BII-7740 Series Annular Array:

1. Piston-type Transducer  
Amplitude Shading/Weighting  
Side-lobe Suppressing  
Dual Beam, Dual Frequency
2. Spherical Transducer  
Beam Focusing and Spreading

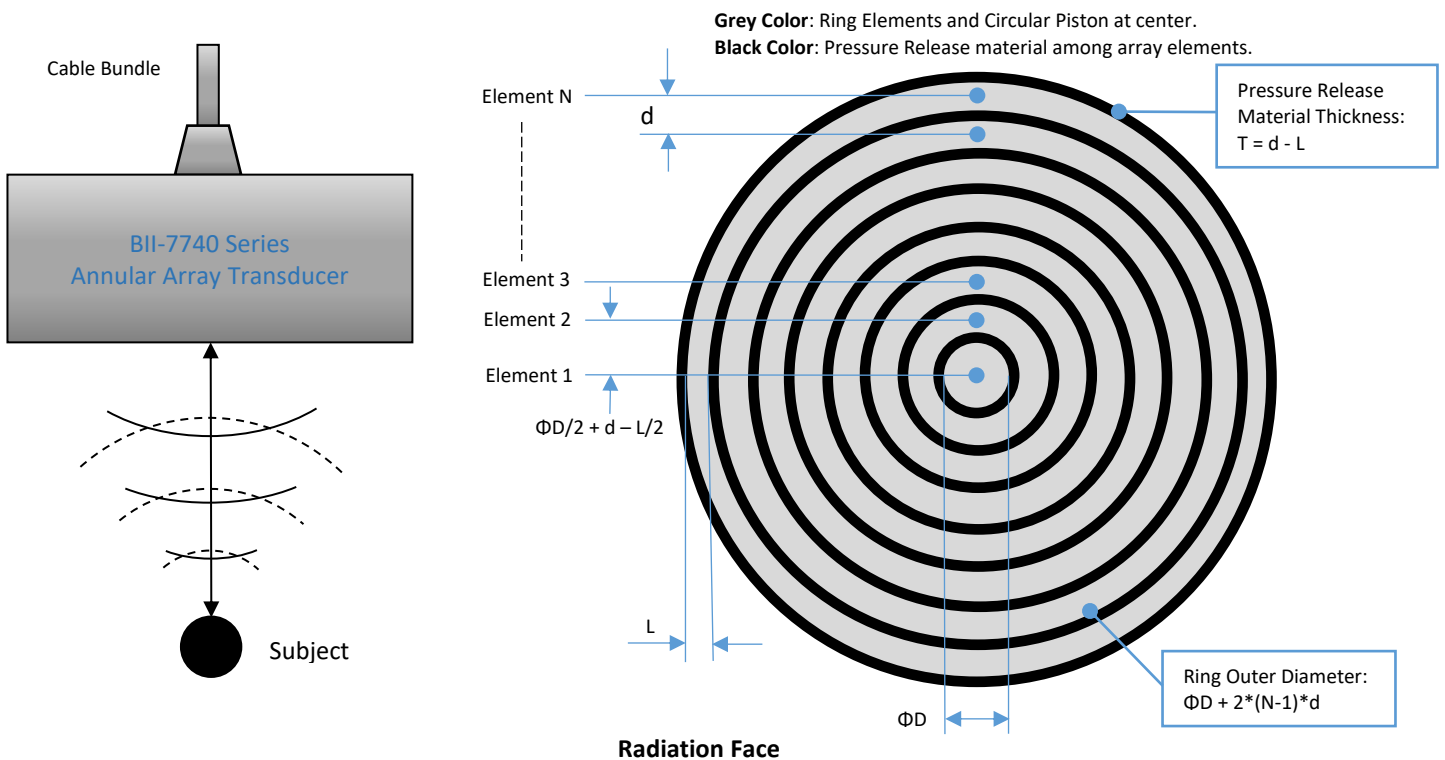


### Transducer Specification

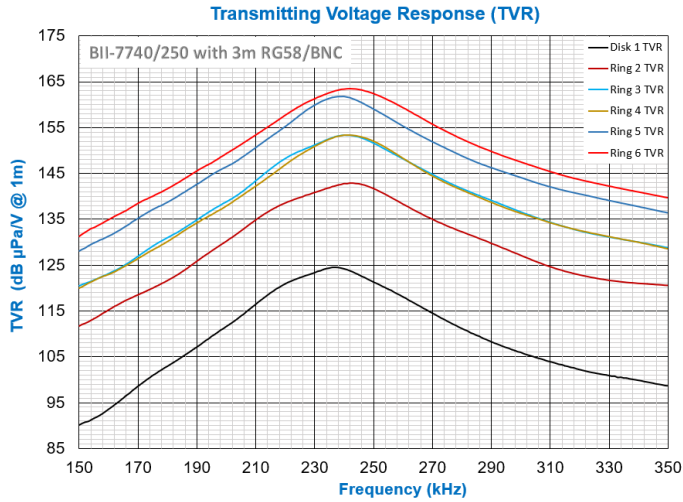
|   |   |
|---|---|
| Part Number:  | BII-7740 Series Annular Array Transducer, refer to <a href="#">How to Order</a> to specify array parameters.  |
| Signal Type:  | Pulse and burst SINE/Square/Chirp/FM and CW excitation.   |
| Resonant Frequency fs:  | Available from 40 to 500 kHz, customized.   |
| Orientation:  | Plane Circular Piston at Center: #1. Numbering of Array Elements: Outward Sequentially, 1, 2, 3, ...,n, ...   |
| Number of Elements N:   | Customized. The number includes circular piston at center, and is confined by sizes of housings and mounting parts.   |
| Circular Piston at Center:  | Diameter of Circular Piston: $\Phi D$ in mm, Customized. Its Array Element Number $N = 1$ .   |
| Ring Element Spacing d:   | <ol style="list-style-type: none"> <li>1. Centric Spacing <math>d</math> among Ring Elements: <math>d = L + T</math>, in mm; Customized, generally, <math>d \leq \lambda/2</math>.</li> <li>2. Spacing between center of circular piston to its neighboring first ring element: <math>\Phi D/2 + d - L/2</math>.</li> </ol> <p><math>\lambda</math>: Wavelength of Underwater Sound.<br/> <math>d</math>: Distance between central lines of two neighboring ring elements <b>excluding Circular Piston at Center</b>.<br/> <math>L</math>: Radial Length of a ring element.<br/> <math>T</math>: Radial length of pressure release materials among the ring elements.</p> |
| Ring Elements:  | <ol style="list-style-type: none"> <li>1. Ring Outer Diameter = <math>\Phi D + 2*(N-1)*d</math>.</li> <li>2. All ring elements has identical radial length. Radial Length of ring elements: <math>L</math> in mm, customized. Contact BII for availability.</li> </ol>  |
| TVR:  | 110.0 to 180.0 dB $\mu Pa/V@1m$ at fs, all rings are tied together. Transmitting Voltage Response.  |
| FFVS:   | -210.0 to -170.0 dB $V/\mu Pa$ at fs, all rings are tied together. Free-field Voltage Sensitivity.  |
| Quality Factor $Q_m$ :  | 3 to 5 (typical 3.5). -3 dB bandwidth of $TVR = fs/Q_m$ .   |
| Beam Pattern:   | Conical   |
| -3dB Beam Width:  | <p>One Way: <math>88350^\circ kHz*mm/(f*\Phi ID)</math> without amplitude shading/weighting, all rings are tied together.</p> <p>Two Way: <math>63612^\circ kHz*mm/(f*\Phi ID)</math> without amplitude shading/weighting, all rings are tied together.</p>   |
| Side Lobe Level:  | <p>One Way: <math>\leq -17.7</math> dB without amplitude shading/weighting, all rings are tied together.</p> <p>Two Way: <math>\leq -35.4</math> dB, without amplitude shading/weighting, all rings are tied together.</p>  |
| Maximum Driving Voltage:  | 300 to 600 Vrms, or voltage rating of cables, whichever is less.  |
| MIPP at fs:   | Maximum Input Pulse Power: 100W to 5000W RMS, Transducer dependent.   |
| MCIP at fs:   | Maximum Continuous Input Power: 1W to 60W RMS, Transducer dependent.  |
| MPW @ MIPP and fs:  | Maximum Pulse Width: $\leq 1$ S, Transducer dependent.  |
| <b>How to determine pulse width, duty cycle and off-time with input pulse power (peak power):</b>   |   |
| <ol style="list-style-type: none"> <li>1. Determine the input pulse power (IPP, peak power) with sound intensity required by the project. IPP MUST be less than MIPP.</li> <li>2. Pulse Width <math>\leq (MIPP * MPW*(120^\circ c-T)/103^\circ c)/IPP</math>. T: Water Temperature in <math>^\circ c</math>.</li> <li>3. Duty Cycle <math>D \leq MCIP*(120^\circ c-T)/103^\circ c/IPP</math>.</li> <li>4. Off-time <math>\geq PW*(1-D)/D</math>.</li> </ol> |   |
| Capacitance (nF@1kHz):  | Transducer dependent.   |
| Dissipation @ 1kHz:   | Transducer dependent.   |
| Admittance @fs:   | Transducer dependent.   |
| Depth Rating:   | Maximum, 100 m and Limited by the cable length if the cable has wire leads or a non-waterproof connector.   |
| Mounting Options:   | <ol style="list-style-type: none"> <li>1. Default: Free Hanging (FH)</li> <li>2. Thru-hole Mounting (inch or metric) (THM)</li> <li>3. Bolt Fastening Mounting (Stainless Steel) (BFMSS)</li> <li>4. End-face Mounting (EFM)</li> <li>5. Flange Mounting (FGM)</li> <li>6. Flush Mounting (FSM)</li> </ol> <p>Please refer to online document <a href="#">AcousticSystem.pdf</a> for a complete list of Mounting Options and more details.</p>  |
| Cable:  | <p>Each ring element has a cable.</p> <ol style="list-style-type: none"> <li>1. Two Conductor Shielded Cable (SC)</li> <li>2. 50 <math>\Omega</math> RG58 Coax (RG58)</li> <li>3. 50 <math>\Omega</math> RG174 Coax (RG174)</li> </ol>  |

|   |   |  |  |   |                    |                 |                           |                 |            |
|---|---|--|--|---|--------------------|-----------------|---------------------------|-----------------|------------|
|   | 4. 50 Ω RG178 Coax (RG178). Note: Operating Temperature Range of RG178 coax: -70°C To +200°C.<br>5. Wire and Cable Bundle (WCB)<br><b>Handling: Do not use the cable to support transducer weight in air and water. Do not bend the cable.</b>  |  |  |   |                    |                 |                           |                 |            |
| Cable Length:   | Default: 1 m for each channel. Specify when ordering.   |  |  |   |                    |                 |                           |                 |            |
| Connector:  | 1. Default: Wire Leads (WL)<br>2. 50 Ω BNC Male (BNC)<br>3. Underwater Mateable Connector (UMC)<br>4. MIL-5015 Style (5015)<br>5. Custom (custom)<br>Note: Underwater Mateable Connector is for underwater uses. Other connectors and wire leads are for dry uses and are non-waterproof. |  |  |   |                    |                 |                           |                 |            |
| Housing Diameter:   | Outer diameter of the largest Ring ≤ 153 mm. Maximum available housing diameter ΦOD ≤ 168 mm.   |  |  |   |                    |                 |                           |                 |            |
| Weight:   | > 1 kg in air. 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.  |  |  |   |                    |                 |                           |                 |            |
| Temperature Sensor:   | 1. Default: No built-in temperature sensor. 2. Built-in temperature sensor. Contact BII for details.  |  |  |   |                    |                 |                           |                 |            |
| Impedance Matching:   | <a href="#">Standalone impedance matching units</a> between transducers and power amplifiers. Order Separately.   |  |  |   |                    |                 |                           |                 |            |
| <b>Warning: Never driving transducer in air. Driving transducer in air (or air loading) will destroy the transducer.</b>  |   |  |  |   |                    |                 |                           |                 |            |
| <b>WARNING: 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.</b>  |   |  |  |   |                    |                 |                           |                 |            |
| 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. |   |  |  |   |                    |                 |                           |                 |            |
| <b>Wiring:</b>  | <b>Two Conductor Shielded Cable</b>   | <b>Coax/BNC</b>                              | <b>Underwater Connector</b>  | <b>MIL-5015 Connector</b>               |                    |                 |                           |                 |            |
| Signal  | White or Red  | Center Contact                               | Contact 2  | Contact C                               |                    |                 |                           |                 |            |
| Signal Common   | Black   | Shield                                       | Contact 1  | Contact B                               |                    |                 |                           |                 |            |
| Shielding and Grounding   | Shield  | Shield                                       | Contact 3  | Contact A                               |                    |                 |                           |                 |            |
| <b>How to Order</b>   |   |  |  |   |                    |                 |                           |                 |            |
| BII-7740  | /fs   | -ΦD  | -L   | -d                                      | -N                 | -Mounting       | -Cable Length             | -Cable          | -Connector |
| Transducer  | in kHz  | Diameter of Circular Piston at center, in mm | Radial Length of Ring Elements, in mm  | Centric Spacing of Ring elements, in mm | Number of Elements | Refer to specs. | of Each Element, in meter | Refer to specs. |            |
| Example of Part Number:   |   |  | Description  |   |                    |                 |                           |                 |            |
| BII-7740/70kHz-Φ20mm-7mm-10mm-8-FH-10m-SC-WL  |   |  | BII-7740 transducer, 70kHz, Diameter of Circular Piston at center: Φ20mm, Radial Length of Ring Elements: L=7mm, Centric Spacing of Ring Elements: 10mm, 8 Array Elements, Free Hanging, 8x10m Shielded Cable, Wire leads. |   |                    |                 |                           |                 |            |
| BII-7740/200kHz-Φ3mm-3mm-3.8mm-6-FH-5m-RG174 Coax-BNC:  |   |  | BII-7740 transducer, 200kHz, Diameter of Circular Piston at center: Φ3mm, Radial Length of Ring Elements: L=3mm, Centric Spacing of Ring Elements: 3.8mm, 6 Array Elements, Free Hanging, 6 x 5m RG174 Coax, BNC Male.     |   |                    |                 |                           |                 |            |

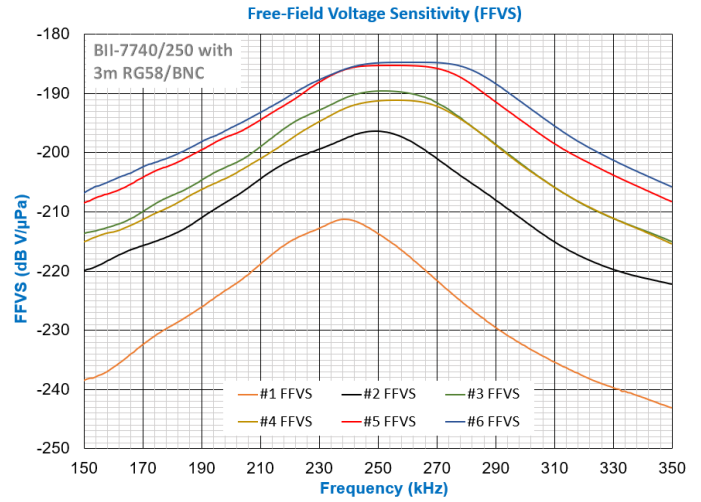
**Structure:** ONLY if ΦD = L, Spacing between center of circular piston to its neighboring first ring element = d.



**Customized 250kHz Transducer with Six Elements**  
**TVR**



**FFVS**



**Admittance**

**Complex Admittance of Transducer in Water**

