BII7690 Series: Low Q_m NDT & Imaging Transducers for High Axial and Lateral Resolutions

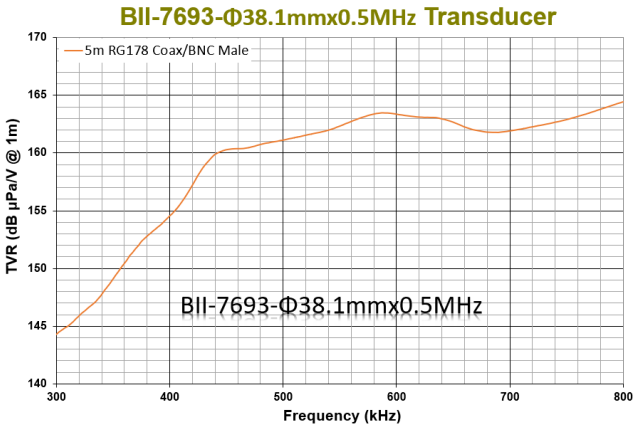
BII7690 series low Q_m (Mechanical Quality Factor) broadband ultrasonic transducers (Longitudinal, Shear Wave, and Guided Waves) are designed primarily for use in ultrasonic pulse system: short-distance echo sounding underwater, NDT (Non-destructive Testing), and Acoustical Imaging (Microscope, Holography, and Tomography). The typical Q_m is from 1 to 3 which results in clean pulse responses. Concave (bowl or spherical sector) acoustic apertures are available to increase lateral resolution. Beam steering and focusing are implemented with linear (rectangular) array. They are immersion transducers and can also be used as contact transducers. The couplant (water, gel, grease, oils, commercial couplant, and shear-wave couplant) is a necessary material to provide efficient acoustic coupling between the transducer face and the subject (piece under test). High resolution image can be formed with the techniques of **Synthetic Aperture Imaging** and **Synthetic Aperture Sequential Imaging**. Plastic and rubber housing resist attack by acids, alkalis, salt solutions and most other chemicals. There is no risk of corrosion when exposed to naturally corrosive conditions. They will not rust or corrode from electrochemical and galvanic environment. Solvents shall not be used with transducers, such as hydrochloric acid, isopropyl alcohol, ethyl lactate, acetone, xylene, Iso hexanes, mineral spirits, etc... DO NOT use the transducers with flammable and/or explosive materials.

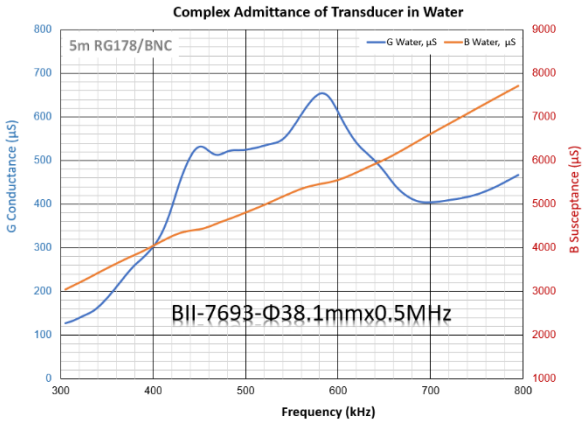
Typical Applications	
Sound Velocity Profiler/Velocimeter/Velocity Probe Short Range Communication & Navigation, Underwater Robot Object Detection/Tracking, Obstacle Avoidance Underwater Distance Gage, Altimeter, Liquid Level Detector	B-Mode Imaging, Doppler Ultrasound, Diagnostic Ultrasound, Thermoacoustic Tomography Physical Acoustics, Materials & Fluids Characterization, Shear Wave Impedometry Flaw Detection, Thickness Gaging, Process Control Maintenance/Inspection of Underwater Structure/Structural Health Monitoring

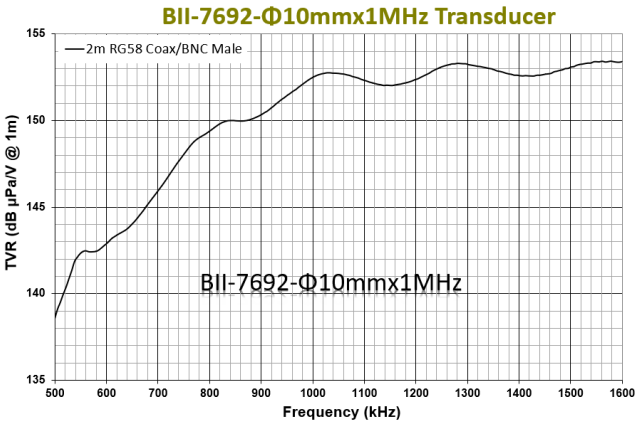
Useful Formula and parameters for Selecting Ultrasonic Transducers		
Q: Lumped System Quality Factor; **λ**: Wavelength; **D**: Aperture Diameter; **F**: Focal Length of Disk or Concave Aperture; **FWHM**: Full Width at Half Maximum. **MIPP**: Maximum Input Pulse Power. **MPW**: Maximum Pulse Width. **MCIP**: Maximum Continuous Input Power.		
Best Axial Resolution ≈ 0.95Q*λ.	Best Lateral Resolution = Minimum Beam Width ≈ FWHM = 1.4λ*F/D.	Near Field Length N = $D^2/(4\lambda)$.
Rayleigh Distance = $\pi D^2/(4\lambda)$.	Fraunhofer Zone Distance = $2.3D^2/(4\lambda)$.	Angle of Divergence = $\sin^{-1}(1.22\lambda/D)$
Wave Mode Conversion at Oblique Incidence: L, S, Rayleigh (Surface), Lamb, Stonely, and Scholte Waves, Snell's Law: $\sin\theta_L/C_L = \sin\theta_L'/C_L' = \sin\theta_s'/C_s'$. Bespoke Acrylic or Plexiglas (or other engineering plastics such as Polystyrene, Nylon, PTFE, etc…) Wedge are available. Please specify physical size when ordering.		
Immersion Testing from Water to Steel: First Critical Angle: 15°, compressive wave to shear wave mode conversion. Second Critical Angle: 27°, shear wave to surface wave mode conversion.		**Contact Testing from Plexiglas to Steel:** First Critical Angle: 28°, compressive wave to shear wave mode conversion. Second Critical Angle: 58°, shear wave to surface wave mode conversion.
Related Products: BII7740 Annular Array Transducer: Acoustic Imaging with Array Focusing and Side-lobe Suppression		

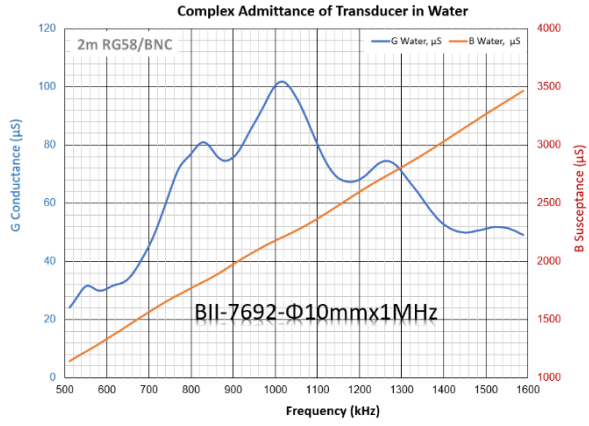
Single Element Transducers
Rectangular (Linear) and Cylindrical (Curvilinear) Array Transducer

Typical Parameters of Customized Transducers









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NDT Transducers for Deep Water, Shallow Water, and in-Air Applications

L-wave Transducers. In-water Parameters. -3dB BW: one-way beam width; TVR unit: dB µPa/V@1m; FFVS (Free Field Voltage Sensitivity) unit: dB V/µPa.

Single Element Transducers: The single element is to transmit sounds and/or receive sounds.

fs MHz	Disk Element Size ΦD (mm)	TVR in water	FFVS in water	-3dB BW in water	MIPP (W)	MPW (s)	MCIP (W)	Admittance in Water at fs	Housing Size ΦODxH (mm)
0.1	Φ38.1	157.0	-189.0	23.0°	3000W	2.0s	10W	G=3.6 mS; B=1.9 mS, with 1m Shielded Cable.	Φ48x(30 to 50)
0.2	Φ38.1	158.5	-190.6	11.2°	3000W	1.3s	15W	G=14.5 mS; B=7.5 mS, with 1m Shielded Cable.	Φ48x(20 to 40)
0.3	Φ38.1	163.5	-197.0	7.6°	1900W	0.8s	15W	G=1.66 mS; B=2.67 mS, with 1m Shielded Cable.	Φ48x(20 to 40)
0.5	Φ38.1	161.0	-200.6	4.6°	600W	1.0s	10W	G=0.524 mS; B=4.807 mS, with 5m RG178 Coax	Φ48x(20 to 40)
0.4	Φ31.8	165.0	-200.0	7.0°	1300W	0.6s	13W	G=2.06 mS; B=1.85 mS, with 5m Shielded Cable.	Φ42x(20 to 40)
1.0	Φ25.4	172.0	-197.6	3.4°	300W	0.86s	10W	G=2.651 mS, B=5.471 mS, with 1m RG58 Coax.	Φ33x(20 to 40)
1.0	Φ10	150.0	-213.0	8.8°	47W	0.8s	2W	G=0.25 mS, B=2.17 mS, with 2m RG58 Coax.	Φ21x(15 to 20)
2.0	Φ8.5	172.5	-216.9	5.2°	95W	0.13s	1W	G=18.523 mS, B=23.1 mS, with 5m RG58 Coax.	Φ21x(15 to 20)
2.25	Φ25.4	187.0	-213.0	1.5°	300W	0.35s	13W	G=17.0 mS, B=29 mS, with 1m RG58 Coax.	Φ33x(20 to 40)
3.5	Φ19.0	190.0	-217.0	1.3°	173W	0.2s	7.5W	G=23 mS, B=40 mS, with 1m RG58 Coax.	Φ27x(20 to 40)
3.5	Φ5.0	168.0	-217.8	5.0°	33W	0.085s	0.54W	G=2.53 mS, B=4.86 mS, with 1m RG274 Coax.	Φ9.52x15
5.0	Φ12.7	185.0	-220.0	1.4°	76W	0.15s	3W	G=21.6 mS, B=37.0 mS, with 1m RG174 Coax.	Φ21x(15 to 20)
5.0	Φ5.0	175.1	-221	3.3°	33W	0.06s	0.55W	G=3.66 mS, B=9.92 mS, with 1m RG174 Coax.	Φ9.52x15
7.5	Φ12.7	194.0	-224.0	1.0°	76W	0.1s	3W	G=48.0 mS, B=81 mS, with 1m RG174 Coax.	Φ21x(15 to 20)
7.5	Φ5.0	182.2	-224.5	2.2°	33W	0.04s	0.56W	G=5.56 mS, B=22.31 mS, with 1m RG174 Coax.	Φ9.52x15

Dual Element Transceivers: Large aperture element: transmit sounds; Small aperture element: receive sounds. Both elements are isolated acoustically.

fs MHz	Transmit Aperture ΦD (mm)	Receive Aperture Φd (mm)	TVR in water	FFVS in water	-3dB BW: Transmit x Receive, in water.	MIPP (W)	MPW (s)	MCIP (W)	Housing Size ΦODxH (mm)
0.5	Φ38.1	Φ10	160	-200.6	5.2° x 20°	500	10	10	Φ48x(20 to 40)
0.5	Φ25.4	Φ5	155	-200.6	7.8° x 38°	400	10	8	Φ33x(20 to 40)
0.5	Φ19.0	Φ5	150	-200.6	10° x 38°	300	10	7	Φ27x(20 to 40)

Housing Material:	1. Default: Corrosion Resistance, Rust-free: Plastics and Rubbers. 2. Customization: 316/316L SS Housing is available on request.
Wave Type:	Longitudinal, Compressional or Compression Wave. Water, gel, grease, oils or commercial couplant should be used.
Pulse Driving Signal: (For Fundamental fs)	Spike (Negative or Positive) and SINE/Chirp/FM pulses. Warning: High power continuous signal should not be used to drive transducers which shall be destroyed by overheating. **How to determine pulse width, duty cycle and off-time with input pulse power (peak power):** 1. Determine the input pulse power (IPP, peak power) with sound intensity required by the project. IPP MUST be less than MIPP. 2. Pulse Width ≤ (MIPP * MPW*(120°c-T)/103°c)/IPP. T: Water Temperature in °c. 3. Duty Cycle D ≤ MCIP*(120°c-T)/103°c)/IPP. 4. Off-time ≥ PW*(1-D)/D.
Third Harmonic:	2.9fs ~ 3.2fs; Transducers can operate at 3fs and an impedance matching network at 3fs should be used. Pulsing Signal Driving ONLY: Duty Cycle ≤ 1%, Pulse Length ≤ 1 mS.
Q_m:	1 to 3, Mechanical Quality Factor.
Beam Pattern:	Conical
Side Lobe Level:	≤-17.7 (dB)
Maximum Depth:	1. Default: 10 m to 300 m Underwater, refer to housing type options. 2. Bespoke: 950m Underwater, Append **DW** to part number. Note: Operating depth is 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 (THSO) 3. Thru-hole Mounting with Double O-ring (THDO) 4. Bolt Fastening Mounting (Stainless Steel): (BFMSS) 5. End-face Mounting: (EFM) 6. Flange Mounting: (FGM) 7. Flush mounting: (FSM) Please refer to online document **AcousticSystem.pdf** for a complete list of Mounting Options and more details.
Cable-Out:	By default, the cable goes out of the device from the end face. To save space and have the device shorter, the cable can go out of the device from the side wall for uses in air or shallow water (< 50m). Specify when ordering. Please refer to **Housing Types**.
Cable:	1. Two Conductor Shielded Cable (SC) 2. RG58 Coax 50Ω (RG58)

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	3. RG174/U Coax 50Ω (RG174) 4. RG178B/U Coax 50 Ω (RG178) 5. Custom (custom)
Cable Length:	1. Default: 1m, 2. Custom.
Connector:	1. Default: Wire Leads (WL) 2. BNC Male 50Ω (BNC) 3. Underwater Mateable Connector (Pin) (UMC) 4. MIL-5015 Style (Pin) (5015) 5. Custom (custom)
Weight:	≥ 0.55 kg with 10 m cable. Actual weight depends on Mounting Parts, Cable Types and Length.
Operation Temperature:	1. -10 to +60 °C, or 14 to 140 °F. 2. Customized High Temperature Transducer, refer to BII7770 Series: -15°C to 198°C or 5°F to 390°F.
Storage Temperature:	-20 to +60 °C, or -4 to 140 °F.
Impedance Matching:	Order Separately, Not included. Available options of Impedance matching: 2 to 32, 50, 60, 70, 75, or 100 Ω. 1. Standalone BII6000 Device: Refer to BII6000 Impedance Matching between transducers and power amplifiers. 2. Built-in BII6000 Device: Append **-IM** to the part number for integrating BII6000 in the transducer, and specify impedance in Ω. For example, BIIxxxx-IM50Ω: BIIxxxx transducer with built-in Impedance Matching unit as a 50 Ω load.
T/R Switch:	Refer to BII2100 Transmitting & Receiving Switch; Not Included. Order Separately, Append **-TR** to part number.
Temperature Sensor:	1. Default: No built-in temperature sensor. 2. Built-in temperature sensor. Append **-TS** to part number (BIIxxxx-TS) for integrating a temperature sensor in the transducer.
Pulser-Receiver:	BII8010 series Ultrasonic Pulser-Receiver.

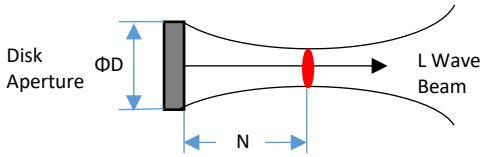
Wiring:	**Shielded Cable**	**Coax/BNC/SMA/SMC**	**Coax/Wire Leads**	**Underwater Connector**	**MIL-5015 Connector**
Driving Signal	White or Red	Center Contact	Coax Center Conductor	Contact 2	Contact C
Signal Common	Black	Shield	Coax Shield	Contact 1	Contact B
Shielding & Grounding	Shield	Shield	Coax Shield	Contact 3	Contact A

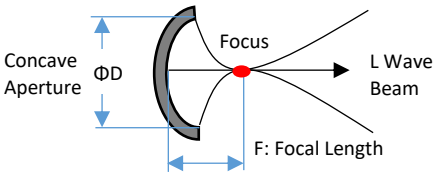
WARNING: DANGER — HIGH VOLTAGE on wires. Wires shall be insulated for safety. DO NOT TOUCH THE WIRES BEFORE THE DRIVING SIGNAL IS SHUT DOWN. Cable shield must be grounded firmly for safety.

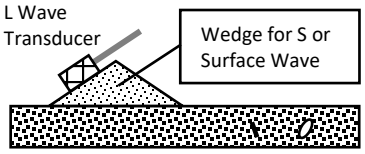
for 50Ω BNC Male connector, it is buyer's sole responsibility to make sure that the (female) BNC shield of the signal source is firmly grounded for operating safety before hooking up transducer/hydrophone to the signal source. Coax with BNC is not intended for hand-held use at voltages above 30Vac/60Vdc.

These products are tested and calibrated in water. It is buyer's responsibility and liability to calibrate and maintain the transducers according to respective NDT national standards of buyer's country.

Aperture Options of Single Element:







Single Element Transducer Aperture ΦD. Bespoke aperture size is available on request. The grey shaded is not recommended. ✓ is in-stock element.

fs (MHz)	Φ5mm Φ0.197"	Φ8.5mm Φ0.335"	Φ9.5mm Φ0.375"	Φ10mm Φ0.394"	Φ12.7mm Φ0.5"	Φ19mm Φ0.75"	Φ25.4mm Φ1"	Φ31.8mm Φ1.25"	Φ38.1mm Φ1.5"
0.1					✓	✓	✓	✓	✓
0.2					✓	✓	✓	✓	✓
0.3					✓	✓	✓	✓	✓
0.42								✓	
0.5									✓
0.55					✓				
0.6							✓		✓
1.0			✓	✓	✓	✓	✓		
2.0		✓			✓		✓		
2.25			✓		✓		✓		
3.5	✓		✓		✓	✓			
5.0	✓		✓		✓	✓			
7.5	✓		✓		✓				

Concave Elements: ΦD x F. Bespoke aperture size and focal length are available on request. The grey shaded is not recommended. ✓ is in-stock element.

fs (MHz)	Φ38x32mm	Φ33x23mm	Φ25.4x36mm	Φ19x36mm	Φ12.7x25mm	Φ9.5x20mm	Φ6.35x15mm
0.3	✓	✓					
0.5	✓	✓					
1	✓	✓					
2	✓	✓		✓			
2.25							
3.5				✓	✓		
5				✓	✓	✓	✓
7.5					✓		

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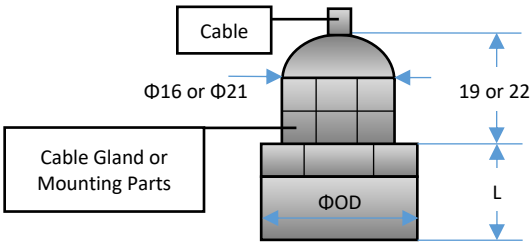
How to Order: Bespoke Acrylic or Plexiglas (or other engineering plastics) Wedge are available. Please specify physical size when ordering.

Part Number	Housing Type	-Aperture Size	-Cable Length	-Cable	-Connector
BII769	Refer to options	**Single Element Disk Aperture**: ΦD x Frequency **Concave Aperture**: ΦD x F x Frequency **Dual Element Disk Aperture**: ΦD x Φd x Frequency	in meter	Refer to the options	Refer to the options

Example	Description
BII7691-Φ38.1mmx0.1MHz-1m-SC-UMC	BII7691, NDT Transducer, Housing Type 1; Single Element Disk Aperture: Φ38.1mmx0.1MHz, 1m Shielded Cable, Underwater Mateable Connector (Pin).
BII7695-Φ6.35mmx7.5MHz-1m-RG174-BNC	BII7695, NDT Transducer, Housing Type 5; Single Element Disk Aperture: Φ6.35mmx7.5MHz, 1m RG174/U, BNC Male.
BII7695-IM50Ω-Φ6.35mmx7.5MHz-1m-RG174-BNC	BII7695, NDT Transducer, Housing Type 5; Impedance Matching to 50Ω; Single Element Disk Aperture: Φ6.35mmx7.5MHz, 1m RG174/U, BNC Male.
BII7691-Φ12.7x30mmx5MHz-1m-RG178-BNC	BII7691, NDT Transducer, Housing Type 1; Concave Aperture: Φ12.7x30mmx5MHz, 1m RG178B/U, BNC Male.
BII7693-Φ25.4mmxΦ5mmx0.5MHz-1m-RG174-BNC	BII7693, NDT Transducer, Housing Type 3; Dual Element Disk Aperture: Φ25.4mmxΦ5mmx0.5MHz, Two x 1m RG174/U, BNC Male.

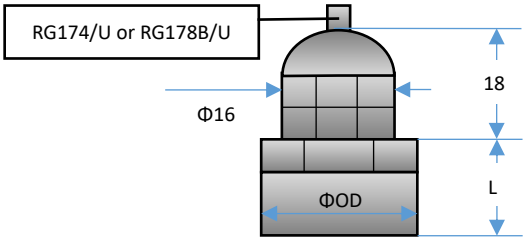
Followings are available standard housings (Size Unit: mm):

Type 1



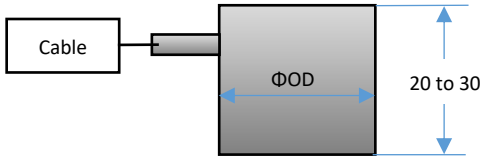
Housing Type 1:
1. Maximum diameter of acoustic aperture: Φ38.1 mm or Φ1.5".
2. A shielded cable or coax goes out from end face of the housing.
3. Maximum Underwater Depth: 300 m.
4. Housing OD: Φ21 to Φ48 mm. Frequency Dependant.
5. Length L: 10 to 28 mm. Frequency Dependant.
6. Free hanging with cable gland: hexagonal wrenching flats 18.5mm for clamping.

Type 2



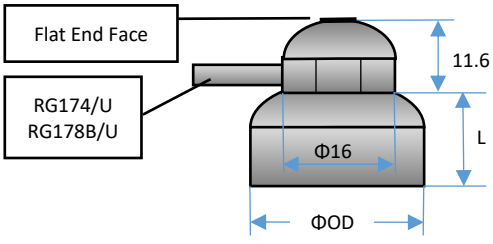
Housing Type 2:
1. Maximum diameter of acoustic aperture: Φ19.1 mm or Φ3/4".
2. A RG174/U or RG178B/U coax goes out from end face of the housing.
3. Maximum Underwater Depth: 50 m.
4. Housing OD: Φ16 to Φ26 mm. Frequency Dependant.
5. Length L: 12.7 to 17.7 mm. Frequency Dependant.
6. Free hanging with cable gland: hexagonal wrenching flats 14.6mm for clamping.

Type 3



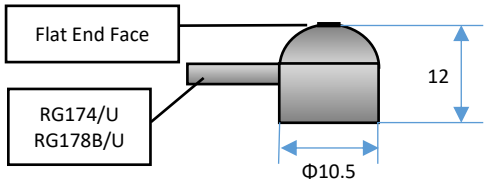
Housing Type 3:
1. Maximum diameter of acoustic aperture: Φ38.1 mm or Φ1.5".
2. A shielded cable or coax goes out from side wall of the housing.
3. Maximum Underwater Depth: 50 m.
4. Housing OD: Φ21 to Φ48 mm. Frequency Dependant.
5. Length L: 10 to 28 mm. Frequency Dependant.
6. Flat End Face for clamping.

Type 4



Housing Type 4:
1. Maximum diameter of acoustic aperture: Φ19.1 mm or Φ3/4".
2. Cable RG174/U or RG178B/U goes out from side wall of the housing.
3. Maximum Underwater Depth: 10 m.
4. Housing OD: Φ16 to Φ26 mm. Frequency Dependant.
5. Length L: 12.7 to 17.7 mm. Frequency Dependant.
6. Flat End Face for clamping.

Type 5



Housing Type 5:
1. Maximum diameter of acoustic aperture: Φ6.35 mm or Φ0.25".
2. Cable RG174/U or RG178B/U goes out from side wall of the housing.
3. Maximum Underwater Depth: 10 m.
4. Flat End Face for clamping.

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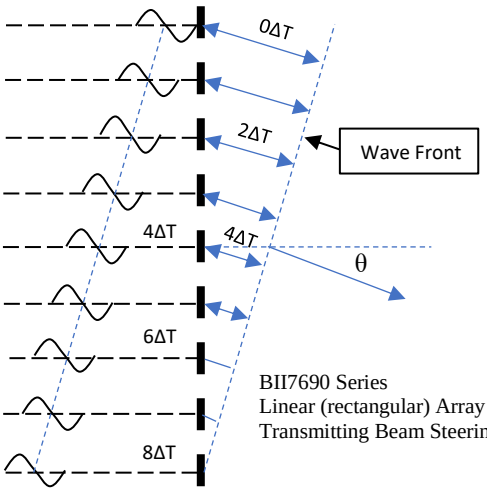
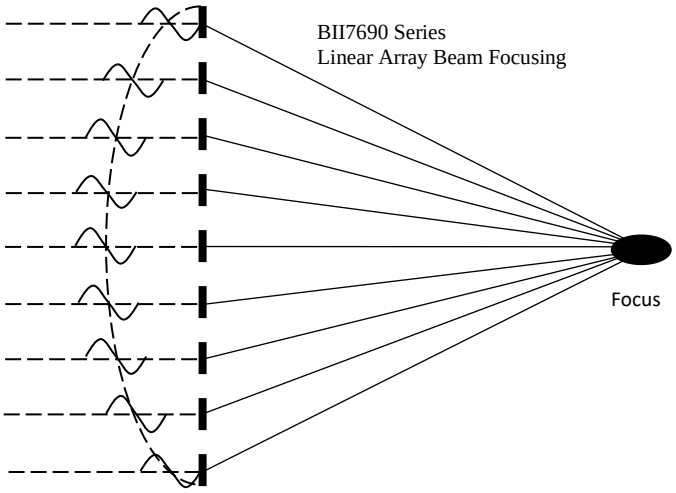
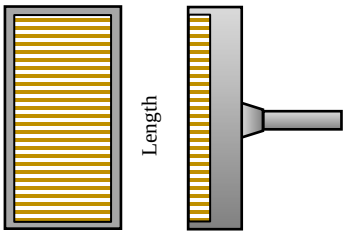
Rectangular (Linear) and Cylindrical (Curvilinear) Array



BII7690 Series
Linear (rectangular) Array
Transmitting Beam Steering

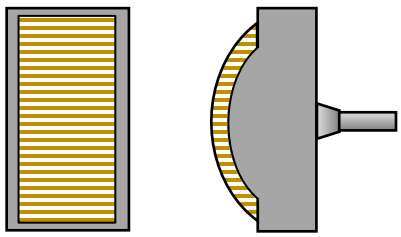


BII7690 Series
Linear Array Beam Focusing



Front View Left Side View

BII7690RA Linear Array (Rectangular Aperture)
Beam Steering
Focusing and Spreading
Amplitude Shading/Weighting
Side-lobe Suppressing



Front View Left Side View

BII7690CA Cylindrical Array (Curvilinear Aperture)
Beam Steering,
Focusing and Spreading
Wide Beam Width up to 120°

Array Transducer	BII7690RA	BII7690CA
Array Structure:	Rectangular (Linear) Array	Cylindrical (Curvilinear) Array
Major Features:	Narrow Beam along the length. Wide beam along the width.	Wide Beam along the curved face. Wide beam along the width.
Acoustic Aperture:	Bespoke, refer to **How to Order**.	
Housing Material:	1. Default: Corrosion Resistance, Rust-free: Plastics and Rubbers. 2. Customization: 316/316L SS Housing is available on request.	
Wave Type:	Longitudinal, Compressional or Compression Wave. Water, gel, grease, oils or commercial couplant should be used.	
Signal Type: (For Fundamental fs)	Pulsed SINE, Chirp, PSK, FSK, Pulsed Square Waveform, CW, etc. Warning: High power continuous signal should not be used to drive transducers which shall be destroyed by overheating.	
	How to determine pulse width, duty cycle and off-time with input pulse power (peak power): 1. Determine the input pulse power (IPP, peak power) with sound intensity required by the project. IPP MUST be less than MIPP. 2. Pulse Width ≤ (MIPP * MPW*(120°c-T)/103°c)/IPP. T: Water Temperature in °c. 3. Duty Cycle D ≤ MCIP*(120°c-T)/103°c)/IPP. 4. Off-time ≥ PW*(1-D)/D.	
Resonance fs:	50 kHz to 1 MHz and the Third Harmonics 3fs.	
Third Harmonic:	2.9fs ~ 3.2fs; Transducers can operate at 3fs. Pulsing Signal Driving ONLY: Duty Cycle ≤ 1%, Pulse Length ≤ 1mS.	
Q_m:	2 to 4, Mechanical Quality Factor.	
Array Element Number N:	Custom-fit, N is determined by fs, d and -3dB along-Length or along-curve beamwidth. N = 76200/(fs*d*Along-Length Beamwidth)+1.	Custom-fit, N is determined by fs, d and -3dB along-Length or along-curve beamwidth. BII will work out N with along-curve beamwidth and Element spacing d.
Element Spacing d:	The distance among the center lines of two neighboring elements. Along Length or Curve. Default: λ/2 or Custom-fit, in mm.	
TVR:	> 160 dB µPa/V@1m @ fs. Transmitting Voltage Response.	
FFVS:	-205 to -195 dB V/µPa @ fs. Free-field Voltage Sensitivity.	
	Sensitivity Loss over Extension Cable (dB) = 20*log[C_h/(C_h+C_c)]. C_h: Hydrophone Capacitance; Cc: Capacitance of Extension Cable. Cable is of 100 pF/meter roughly.	
-3dB Beam Width:	Horizontal (Along-length or Along-curve) Plane: 0.1° to 120° at fs. Vertical (Cross-length, or Cross-curve) Plane: 1° to 50° at fs. Specify with H°xV° when ordering. For example, 5°x50° at fs, horizontal beam width 5°, vertical beam width 50°.	
Directivity Pattern:	Fan-shaped beam	
Steering Beam:	**Along-Length or Along-curve**: ±90°; **Cross-length or Cross-curve**: No.	
Beamforming:	Electronic beam steering and focusing in the scan plane.	
Side Lobe Level:	≤ -15 (dB)	≤ -20 (dB)
Driving Voltage:	1. Default: Maximum 600 Vrms. 2. TBD. To be determined with customization.	
MIPP:	Up to 5000 Watts, custom-fit Maximum Input Pulse Power.	
MPW @ MIPP:	Maximum Pulse Width. TBD. To be determined with customization.	
MCIP:	Up to 200 Watts, custom-fit Maximum Continuous Input Power.	

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Maximum Depth:	100 m Underwater. Operating depth is 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 (THSO) 3. Thru-hole Mounting with Double O-ring (THDO) 4. Bolt Fastening Mounting (Stainless Steel): (BFMSS) 5. End-face Mounting: (EFM) 6. Flange Mounting: (FGM) 7. Flush mounting: (FSM) Please refer to online document **AcousticSystem.pdf** for a complete list of Mounting Options and more details.
Cable-Out:	By default, the cable goes out of the device from the end face. To save space and have the device shorter, the cable can go out of the device from the side wall for uses in air or shallow water (< 50m). Specify when ordering.
Cable:	Each array element has a cable. 1. Two Conductor Shielded Cable (SC), 2. RG58 Coax 50Ω (RG58), 3. RG174/U Coax 50Ω (RG174), 4. RG178B/U Coax 50 Ω (RG178), 5. Custom (custom)
Cable Length:	1. Default: 1m, 2. Custom.
Connector:	1. Default: Wire Leads (WL) 2. Male BNC (BNC) 3. SMA (Plug, Male Pin) (SMA) 4. SMC (Plug, Female Socket) (SMC) 5. MIL-5015 Style (pin) (5015) 6. LEMO (Plug Male Pins) (LEMO) 7. Underwater Mateable Connector (pin) (UMC) 8. Customized, buyer specifies the connector. 9. Custom (custom) Note: Underwater Mateable Connector is for uses underwater. Other connectors and wire leads are for dry uses and are not waterproofed.
Weight:	≥ 0.3 kg with 10 m cable. Actual weight depends on Mounting Parts, Cable Types and Length.
Operation Temperature:	1. Default: -10 to +60 °C, or 14 to 140 °F. 2. Customized High Temperature Transducer: -15°C to 120°C or 5°F to 248°F.
Storage Temperature:	-20 to +60 °C, or -4 to 140 °F.
Temperature Sensor:	1. Default: No built-in temperature sensor. 2. Built-in temperature sensor. When ordering, append **TS** to part number for integrating a temperature sensor in the transducer.
Impedance Matching:	Order Separately, Not included. Available options of Impedance matching: 2 to 32, 50, 60, 70, 75, or 100 Ω. Standalone BII6000 Device: Refer to BII6000 Impedance Matching between transducers and power amplifiers.
T/R Switch:	Refer to BII2100 Transmitting & Receiving Switch, Standalone Unit; Not Included. Order Separately.

Wiring:	**Shielded Cable**	**Coax/BNC/SMA/SMC**	**Coax/Wire Leads**	**Underwater Connector**	**MIL-5015 Connector**
Driving Signal	White or Red	Center Contact	Coax Center Conductor	Contact 2	Contact C
Signal Common	Black	Shield	Coax Shield	Contact 1	Contact B
Shielding	Shield	Shield	Coax Shield	Contact 3	Contact A
System Grounding	Shield	BNC Shield	Coax Shield	Contact 3	Contact A

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.

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.

These products are tested and calibrated in water. It is buyer's responsibility and liability to calibrate and maintain the transducers according to respective NDT national standards of buyer's country.

How to Order (Note: beamwidth is normalized in water.)

Array Transducers (L-wave): Beam Steering, Focusing, and Spreading. ✓ is in-stock element.

fs (MHz)	Linear (Rectangular) Array for Beam Steering & Focusing	Curvilinear Aperture for Wide Beam
0.05	✓	✓
0.06	✓	✓
0.07	✓	✓
0.1	✓	✓
0.15	✓	✓
0.2	✓	✓
0.3	✓	✓
0.4	✓	✓
0.5	✓	✓
0.6 to 0.9	available on request	available on request
1.0	✓	✓

Array Spacing d: the distance among the center lines of two neighboring elements.
Beam Width: The angle of main lobe at -3dB when driving signals to all array elements are identical (f, phase and amplitude are same.).

Transducer	**-fs**	**-N**	**-d**	**-Beam Width**	**-Mounting**	**-Cable Length**	**-Cable**	**-Connector**
BII7690RA BII7690CA	in kHz	Number of Elements	Spacing of Elements in mm	H°xV° in Water at fs	Refer to specs.	of Each Element in meter	Refer to specs.	

Example of Part Number:	Description
BII7690RA-300kHz-9-5mm-3°x30°-FH-3m-RG174-BNC	BII7690RA Rectangular (Linear) Array transducer, 300kHz; Array Elements: 9; Array Element Spacing d: 5mm; -3dB Beamwidth in Water: 3°x30°; Free Hanging, 9x3m RG174 Coax, BNC Male.

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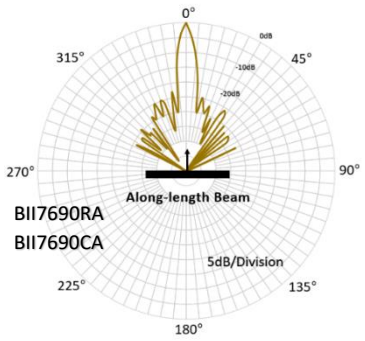
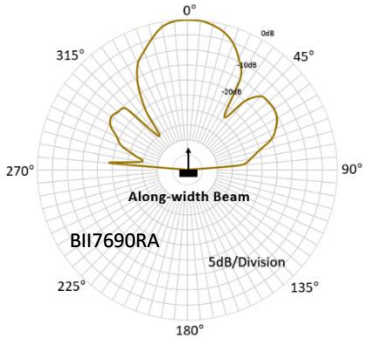
Directivity Pattern: illustration ONLY. Please refer to -3 dB beam width of a specific transducer.

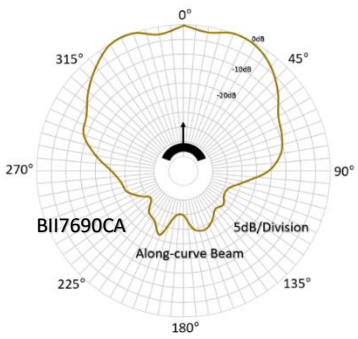
Along-length Beam Pattern



Along-width or Along-height Beam Pattern



Along-curve Beam Pattern



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