

**Spherical Sector Directivity Transducer**

BII7760 series transducers are high power spherical sector beam transducers with a wide range of frequencies available (up to 2 MHz) to insonify and listen wide field of interest in water or liquids, or to insonify the R & D subject as ultrasonic sources.

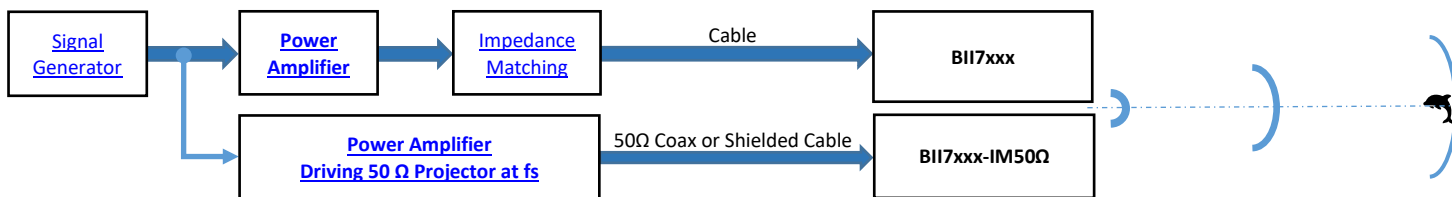


**Typical Applications**

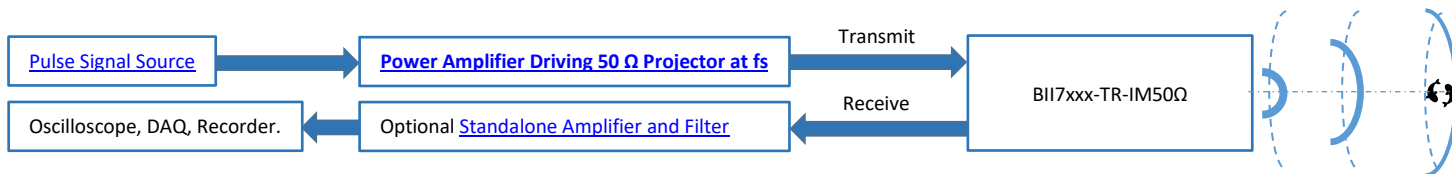
Wide Beam Ultrasonic Source    Directional Underwater Communication    Navigation/Obstacle Avoidance/Fishery Sonar    Pinger/Locator/Transponder

**SYSTEM CONFIGURATION (Simplified Flow Charts: Control Signals, DC Power Supplies, etc. are NOT shown.)**

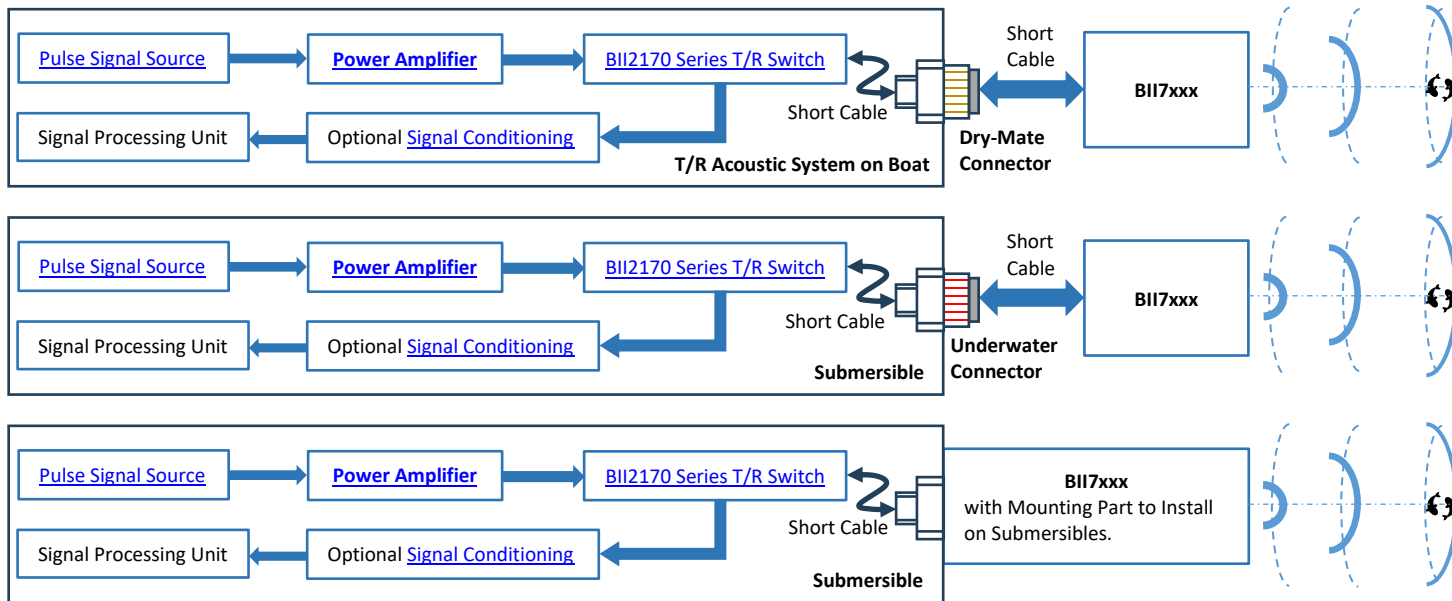
(a) Generation of Underwater or Ultrasonic Sounds with BII7xxx and BII7xxx-IM50Ω.



(b) Transmitting and Receiving Underwater or Ultrasonic Sounds with BII7xxx-TR-IM50Ω:



(c) Transmitting and Receiving Underwater Sounds with BII7xxx: Cables ( $\leq xx$  m, Cable C (100pF/m)  $\leq 10\%$  Transducer Cf) between Transducers and T/R Switch.



**RELATED PRODUCTS**

<a href="#">Power Amplifier</a> for SONAR, NDT, and HIFU	<a href="#">Impedance Matching</a> between Transducers and Amplifiers	<a href="#">Transmit and Receive Switch</a> with Preamp and Filter
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**Specification**

<b>Transducers are tested in water at 20°C unless stated otherwise.</b>						
<b>FG:</b> Fixed Gain; <b>PG:</b> Programmable Gain; <b>DF:</b> Differential Output; <b>SE:</b> Single Ended Output; <b>BPF:</b> Band Pass Filter; <b>HPF:</b> High Pass Filter; <b>LPF:</b> Low Pass Filter.						
<b>f<sub>s</sub>:</b> Resonant Frequency; <b>IM:</b> Impedance Matching; <b>η<sub>ea</sub>:</b> Electroacoustic Efficiency; <b>PF:</b> Power Factor; <b>TVR:</b> Transmitting Voltage Response; <b>SL:</b> Sound Level; <b>FFVS:</b> Free-field Voltage Response, Receiving Voltage Response ( <b>RVR</b> ), or Voltage Sensitivity; <b>DRP:</b> Directional Response Pattern; <b>HxV:</b> Horizontal x Vertical Beam Angles. <b>SLL:</b> Sidelobe Level; <b>SRD:</b> Sound Ranging Distance along Axis of Main Lobe; <b>Z:</b> Complex Impedance; <b> Z :</b> Impedance Amplitude; <b>θ:</b> Impedance Phase; <b>Y:</b> Admittance; <b>G:</b> Conductance of Admittance; <b>B:</b> Susceptance of Admittance; <b>Q<sub>m</sub>:</b> Mechanical Quality Factor; <b>Q<sub>e</sub>:</b> Electrical Quality Factor; <b>MIPP:</b> Maximum Input Pulse Power; <b>MPW:</b> Maximum Pulse Width at MIPP and at f <sub>s</sub> ; <b>MCIP:</b> Maximum Continuous Input Power. <b>TR:</b> Transmit and Receive; <b>TRSW:</b> Transmit and Receive Switch with built-in low noise preamp and bandpass filter. <b>BW:</b> -3dB Bandwidth or Beamwidth; <b>PND:</b> Pressure Noise Density, <b>LNR:</b> Low Noise Receiver, <b>SC:</b> Signal Conditioning, <b>OPL:</b> Overload Pressure Level.						
<b>Transducer:</b>	<b>BII7762/200</b>	<b>BII7762/400</b>	<b>BII7762/600</b>	<b>BII7760Q/1000</b>	<b>BII7760Q/2000</b>	
<b>Applications:</b>	Emit and Receive Sounds					
<b>Pulse-echo System:</b>	Half-duplex or Semiduplex					
<b>Sound Ranging SRD:</b>	Pulse-Echo or Echo Sounding Ranging: refer to <a href="#">Echosounding Ranging vs Target Strength in Ocean</a> . Update in Process.					
<b>Signal Type:</b>	Pulsed SINE, Chirp, PSK, FSK, Pulsed Square Waveform, Continuous Wave, etc.					
<b>Resonant Frequency f<sub>s</sub>:</b>	200 kHz	400 kHz	600 kHz	1 MHz	2 MHz	
	1. In stock: 100, 120, 150, 200, 250, 300, 400, 500, 600 kHz, 1 MHz, 2 MHz. 2. Customized: 100 kHz to 2 MHz.					
	<b>Note: untuned transducers can operate at its 3<sup>rd</sup> harmonics.</b>					
<b>Quality Factor:</b>	<b>High Q<sub>m</sub></b>	Not Available		≥ 8		
	<b>Low Q<sub>m</sub></b>	≤ 4 to 5		≤ 4 to 5		
	<b>Note</b>	<b>f<sub>s</sub> &gt; 500 kHz:</b> Append <b>LQ</b> to Part Number for Low Q <sub>m</sub> transducer. For example, BII7760Q/1000LQ is 1MHz transducer with Q <sub>m</sub> ≤ 5. <b>f<sub>s</sub> &gt; 500 kHz:</b> Append <b>HQ</b> to Part Number for High Q <sub>m</sub> transducer. For example, BII7760Q/1000HQ is 1MHz transducer with Q <sub>m</sub> ≥ 8. -3dB Bandwidth=f <sub>s</sub> /Q <sub>m</sub> . Generally, <b>High Q<sub>m</sub> Transducers</b> are for transmit high power only. <b>Low Q<sub>m</sub> Transducers</b> are for Pulse-Echo Acoustic System.				
<b>TVR @f<sub>s</sub></b> <b>μPa/V@1m</b>	<b>High Q<sub>m</sub></b>	Not Available	Not Available	163.0 dB	165.0 dB	168.3 dB
	<b>Low Q<sub>m</sub></b>	148.0 dB	151.0 dB	158.5 dB	160.0 dB	164.0 dB
<b>FFVS @f<sub>s</sub> (V/μPa):</b>		-196 dB	-199 dB	-202 dB	-212.5 dB	-216 dB
		Sensitivity Loss over Extension Cable (dB) = 20*log[C <sub>H</sub> /(C <sub>H</sub> +C <sub>C</sub> )]. C <sub>H</sub> : Hydrophone Capacitance; C <sub>C</sub> : Capacitance of Extension Cable. Cable is of 100 pF/meter roughly. Valid for a transducer without preamplifier.				
<b>-3dB Beamwidth at f<sub>s</sub>:</b>		60°	60°	40°	23°	27°
		<b>Customized: up to 60°. Transducer size varies with -3dB Beamwidth, and maximum diameter: 0.25m.</b>				
<b>Main Lobe Fluctuation:</b>	≤ ± 2 dB					
<b>Directivity Pattern:</b>	Spherical Sector					
<b>Side Lobe Level:</b>	≤ -20 dB					
<b>Free Capacitance:</b>	4.8 nF	6.3 nF	7.65 nF	2.0 nF	0.93 nF	
<b>Dissipation:</b>	0.008	0.008	0.005	0.005	0.003	
<b>Admittance at f<sub>s</sub>:</b>	G=6.8mS, B=5.6mS.	G=9.0 mS, B=8.5 mS	G=10.1mS, B=15.2mS.	G=19.5mS, B=6.68mS.	G=26.0mS, B=7.0mS.	
<b>Driving Voltage:</b>		≤ 600 V <sub>rms</sub>	≤ 600 V <sub>rms</sub>	≤ 600 V <sub>rms</sub>	≤ 500 V <sub>rms</sub>	≤ 210 V <sub>rms</sub>
		Higher MIPP can be achieved with built-in impedance matching network which amplifies the driving voltage inside transducer.				
<b>MIPP at f<sub>s</sub>:</b>	850 W	400W	960 W	470 W	450 W	
<b>MPW at MIPP and f<sub>s</sub>:</b>	4 Seconds	3 Seconds	2.0 Seconds	0.62 Seconds	0.35 Seconds	
<b>MCIP at f<sub>s</sub>:</b>	20 W	20 W	25 W	7.7 W	9.5 W	
MIPP: Maximum Input Pulse Power at f <sub>s</sub> ; MPW: Maximum Pulse Width at MIPP and at f <sub>s</sub> ; Maximum Continuous Input Power at f <sub>s</sub> . <b>How to determine pulse width, duty cycle and off-time with input pulse power (peak power) at f<sub>s</sub>:</b> 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.						
<b>Operating Depth:</b>	≤ 100 m	≤ 100 m	≤ 50 m	≤ 50 m	≤ 50 m	
	<b>Limited by the cable length if the cable has wire leads or a non-waterproof connector.</b>					
<b>Mounting Options:</b>	1. Default: Free Hanging ( <b>FH</b> ) 2. Thru-hole Mounting with Single O-ring ( <b>THM-M10, THM-7/16"</b> , or <b>THM-5/8"</b> .) 3. Thru-hole Mounting with Double O-ring ( <b>THDO-7/16"</b> ) 4. Bolt Fastening Mounting (Stainless Steel) ( <b>BFM-M6, BFM-7/16"</b> , or <b>BFM-5/8"</b> .) 5. Bolt Fastening Mounting (Plastics) ( <b>BFMP-M12, or BFMP-NPT3/8"</b> .) 6. Bolt-Fastening Mounting with Free Hanging ( <b>BFM-FH-1/4"</b> , <b>BFM-FH-3/8"</b> .) 7. Free-hanging with Male Underwater Connector ( <b>FHUWC-2P, FHUWC-3P.</b> ) 8. End-face Mounting ( <b>EFMS</b> or <b>EFMM.</b> ) 9. Flange Mounting ( <b>FGM-Φ220, FGM-Φ190, FGM-Φ165, FGM-Φ140, or FGM-Φ110.</b> ) 10. Flush Mounting ( <b>FSM-M10, FSM-M14, FSM-M35, FSM-M56.</b> )					
	Please refer to online document <a href="#">AcousticSystem.pdf</a> for a complete list of Mounting Options and more details.					
	<b>Cable Options:</b>	<b>Transmit Signals:</b> 1. Shielded Cable ( <b>SC</b> ), Rubber Jacket. Two Conductors (AWG20, 600V, 4A.). 2. Unshielded Cable ( <b>USC</b> ), Rubber Jacket. Two Conductors (AWG18, 600V, 10A.). 3. 50 Ω RG58 Coax ( <b>RG58</b> ). 4. 50 Ω RG174/U Coax ( <b>RG174</b> ). 5. 50 Ω Coax RG316/U ( <b>RG316</b> ) (Operating Temperature Range: -50°C To +200°C or -58°F to 392°F).				

	<p>6. 50 Ω RG178/U Coax (<b>RG178</b>) (Operating Temperature Range: -70°C To +200°C or -94°F to 392°F).</p> <p>7. Shielded Cable, Twisted Pair, Teflon (PTFE) Jacket, ΦD=3.2 mm (<b>SC32</b>), up to 200°C, 600V, 0.8A, Not Water-proofed.</p> <p>8. Shielded Cable, Twisted Pair, Teflon (PTFE) Jacket, ΦD=4.0 mm (<b>SC40</b>), up to 200°C, 600V, 4A, Not Water-proofed.</p> <p><b>Receive Signals: ONLY for BII7xxx-TR-IM50Ω.</b></p> <p>1. <b>Fixed FFVS:</b> Shielded Cable (<b>SC</b>), Rubber or PVC Jacket. Four Conductors (AWG24 or AWG26/28).</p> <p>2. <b>Programmable FFVS:</b> Shielded Cable (<b>SC</b>), Rubber or PVC Jacket. Six Conductors (AWG24 or AWG26/28),</p> <p>3. <b>Programmable FFVS:</b> Cable Bundles (<b>CB</b>), Rubber or PVC Jacket. 4C SC (AWG24 or AWG26/28) + 2C SC (AWG24).</p> <p>4. <b>Programmable FFVS:</b> Cable Bundles (<b>CB</b>), Rubber or PVC Jacket. 4C SC (AWG24 or AWG26/28) + RG58 or RG174 Coax.</p> <p><b>Handling: Do not use cable to support transducer weight in air; Always use mounting part if any; Do not bend the cable.</b></p>				
Cable Length:	<p>1. Default: 1 m.</p> <p>2. Custom.</p>				
Connector Options:	<p><b>Transmit Signals:</b></p> <p>1. Default: Wire Leads (<b>WL</b>).</p> <p>2. (1). Underwater Mateable Connector (2 pins) (<b>UMC2P</b>)</p> <p>(1.1). Transducer Power ≥ 800 W rms: IL2M + Locking Sleeve: DLSA-M, Max. Diameter Φ35.5 mm.</p> <p>(1.2). Transducer Power &lt; 800 W rms: MCIL2M + Locking Sleeve: MCDLS-F, Max. Diameter Φ22 mm.</p> <p>(2). Underwater Mateable Connector (3 pins) (<b>UMC3P</b>)</p> <p>(2.1). Transducer Power ≥ 800 W rms: IL3M + Locking Sleeve: DLSA-M, Max. Diameter Φ35.5 mm.</p> <p>(2.2). Transducer Power &lt; 800 W rms: MCIL3M + Locking Sleeve: MCDLS-F, Max. Diameter Φ22 mm.</p> <p>Note: Underwater Mateable Connectors (<b>UMC</b>) is from well-known global manufacturers. Its part number is listed in quote in detail.</p> <p>3. MIL-5015 Style (3 pin) (<b>MIL3P</b>) (Max. Diameter Φ19 to Φ30 mm).</p> <p>4. XLR Receptacle with 3 Male Pins (<b>XLR3P</b>), (Max. Diameter Φ20.2 mm).</p> <p>5. DIN Receptacle with 3 Male Pins (<b>DIN3P</b>), (Max. Diameter Φ17 mm).</p> <p>6. Male BNC (<b>BNC</b>) (Max. Diameter Φ14.3 mm), for Transmit or Receive Grounded Signal.</p> <p><b>BNC with RG178 or RG316 Coax: Service Temperature up to 165°C or 329°F.</b></p> <p><b>Receive Signals: ONLY for BII7xxx-TR-IM50Ω.</b></p> <p><b>Signal Connectors for Fixed FFVS:</b></p> <p>(1). Default: Wire Leads (<b>WL</b>).</p> <p>(2). Underwater Mateable Connector (4 pins) (<b>UMC4P</b>) (Max. Diameter Φ22 mm). Locking Sleeve: MCDLS-F.</p> <p>(3). XLR Receptacle with 4 Male Pins (<b>XLR4P</b>), (Max. Diameter Φ20.2 mm).</p> <p>(4). DIN Receptacle with 4 Male Pins (<b>DIN4P</b>), (Max. Diameter Φ17 mm).</p> <p>(5). XLR Receptacle with 3 Male Pins (<b>XLR3P</b>) for Signals, (Max. Diameter Φ20.2 mm).</p> <p>(6). DIN Receptacle with 3 Male Pins (<b>DIN3P</b>), (Max. Diameter Φ17 mm).</p> <p>(7). 1/8" (3.5mm) TRS Plug (<b>TRS</b>) (Max. Diameter Φ10.5 mm).</p> <p><b>Signal Connectors for Programmable FFVS:</b></p> <p>(1). Default: Wire Leads (<b>WL</b>).</p> <p>(2). Underwater Mateable Connector (6 pins) (<b>UMC6P</b>) (Max. Diameter Φ22 mm). Locking Sleeve: MCDLS-F.</p> <p>(3). XLR Receptacle with 6 Male Pins (<b>XLR6P</b>), (Max. Diameter Φ20.2 mm).</p> <p>(4). DIN Receptacle with 6 Male Pins (<b>DIN6P</b>), (Max. Diameter Φ17 mm).</p> <p>(5). XLR Receptacle with 3 Male Pins (<b>XLR3P</b>) for Signals, (Max. Diameter Φ20.2 mm).</p> <p>(6). DIN Receptacle with 3 Male Pins (<b>DIN3P</b>), (Max. Diameter Φ17 mm).</p> <p>(7). 1/8" (3.5mm) TRS Plug (<b>TRS</b>) (Max. Diameter Φ10.5 mm).</p> <p><b>Gain Selection (or FFVS Selection) Connectors for Programmable FFVS:</b></p> <p>(1). Default: Wire Leads (<b>WL</b>).</p> <p>(2). Male BNC (<b>BNC</b>).</p> <p>(3). DIN Receptacle with 3 Male Pins (<b>DIN3P</b>), (Max. Diameter Φ17 mm).</p> <p><b>Connectors for DC Power Supply:</b></p> <p>(1). None, Both DC Supply and Receiving Signal share one connector.</p> <p>(2). Wire Leads (<b>WL</b>).</p> <p>(3). +9VDC Battery Snap (<b>BS</b>). +9V or +18VDC Power Supply.</p> <p>(4). 4mm Banana Plug Pair (<b>Red</b> and <b>Black</b> Color) (<b>BP</b>).</p> <p><b>Underwater Mateable Connectors are for underwater uses. Other connectors/wire leads are for dry aerial uses and are not waterproofed.</b></p>				
	<p>1. <b>BNC:</b> "Bayonet Neill–Concelman" is a miniature quick connect/disconnect radio/audio frequency connector used for coaxial cable. <b>Fastening Type: Bayonet Lock.</b></p> <p>2. <b>XLR:</b> Employed for balanced audio and DC or AC power signal interconnections, 3 to 7 contacts. <b>Fastening Type: Latch Lock.</b></p> <p>3. <b>MIL:</b> MIL-5015 Style Connectors, interconnection solution for high power signals. -55°C to +125°C, <b>Fastening Type: Threaded. Dry Uses.</b></p> <p>4. <b>UMC:</b> Underwater Mateable Connectors, interconnection solution for high power or weak signals. <b>Fastening Type: Threaded. Underwater Uses.</b></p> <p>5. <b>DIN:</b> Electrical cylindrical connectors, 3 to 14 contacts, Φ20mm diameter, used for audio, RF, digital, and DC or AC power signals. <b>Fastening Type: Threaded.</b></p> <p>6. <b>3.5mm (1/8") TRS</b> stand for Tip, Ring, and Sleeve, miniature, quick connect/disconnect, audio frequency connector for shielded cable. <b>Fastening Type: None.</b></p>				
Size ΦDxH (mm):	Φ60 x 35	Φ60 x 35	Φ60 x 35	Φ27 x 35	Φ27 x 35
	<p>1. Length L ≥ 35. Actual length depends on Mounting Parts.</p> <p>2. <b>Transducer size varies with customized -3dB Beamwidth.</b></p>				
Weight:	≥ 0.55 kg with 10 m 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.				
IM at fs:	<p>1. Default 50Ω Impedance Matching: <b>-IM50Ω</b>. BIIxxxx-IM50Ω: BIIxxxx transducer with <b>built-in</b> Impedance Matching Network as 50Ω load at fs. For example, BII7760/200-IM50Ω: BII7760/200 transducer with built-in Impedance Matching Network as 50Ω load at fs.</p> <p>2. Bespoke <b>BII6000</b> Impedance Matching between transducers and power amplifiers. Order Separately as <b>standalone devices</b>.</p> <p>Phase Angle  θ  of Complex Impedance ≤ 20° at fs.</p>				

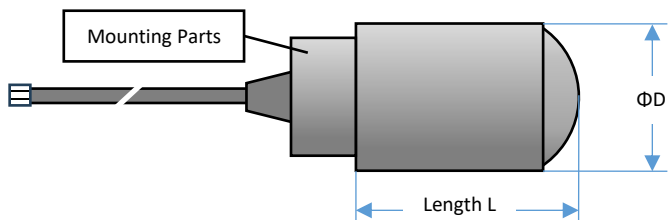
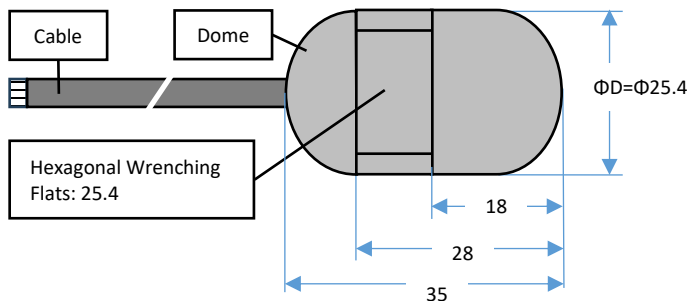
<b>TR Switch:</b>	<a href="#">BII2100</a> Transmitting & Receiving Switch Module with Built-in Preamp and Bandpass Filter. Order Separately as standalone devices or append <b>-TR</b> to the part number for integrating BII2100 into the transducer. For example, BII760/200-TR: BII760/200 transducer with built-in T/R Switch Module.
<b>Amplifier:</b>	<a href="#">BII5000</a> Power Amplifiers for SONAR, NDT, HIFU. Order Separately as standalone devices.
<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 connector, it is buyer's sole responsibility to make sure that the 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.	

**Transducer Wiring:**

<b>Wiring:</b>	<b>Two Conductor Shielded Cable</b>	<b>BNC</b>	<b>Underwater Connector</b>	<b>MIL-5015 Connector</b>	<b>LEMO Connector</b>
Signal	White or Red	Center Contact	Contact 2	Contact C	Contact 2
Signal Common	Black	Shield	Contact 1	Contact B	Contact 1
Shielding and Grounding	Shield	Shield	Contact 3	Contact A	Contact 3

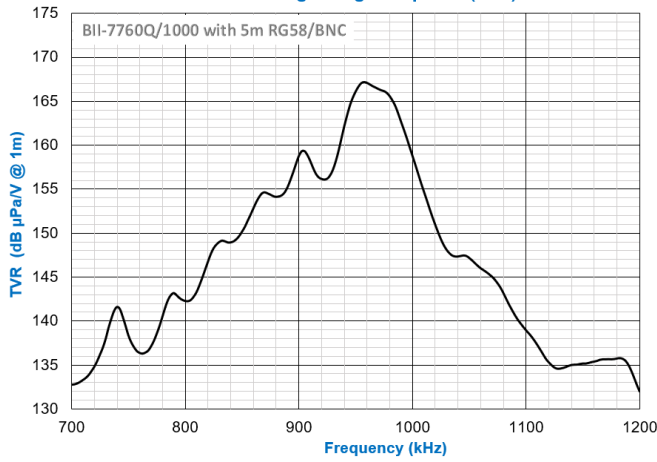
**How to Order Customized Transducers. Ignore the parameter for default value or option if it is not needed for your application.**

<b>Part Number</b>	<b>/f<sub>s</sub></b> in kHz	<b>-IM50Ω</b> Impedance Matching	<b>-BW</b> -3dB Beamwidth	<b>-Q<sub>m</sub></b> Default: LQ	<b>-Mounting</b> Refer to specs.	<b>-Cable Length</b> in meter	<b>-Cable</b> Refer to specs.	<b>-Connector</b>
<b>Example of Part Number:</b>			<b>Description</b>					
BII7760/200kHz-40°-FH-10m-SC-WL	BII7760 transducer, 200kHz, -3dB Beamwidth: 40°, Free Hanging, 10m Shielded Cable, Wire Leads.							
BII7760Q/1000LQ-FH-10m-SC-WL	BII7760 transducer, 1000kHz, low Q <sub>m</sub> , Free Hanging, 10m Shielded Cable, Wire Leads.							
BII7760Q/1000HQ-FH-10m-SC-WL	BII7760 transducer, 1000kHz, high Q <sub>m</sub> , Free Hanging, 10m Shielded Cable, Wire Leads.							
BII7760IM50Ω/200kHz-40°-FH-10m-SC-WL	BII7760 transducer, built-in Impedance Matching unit as 50Ω load, 200kHz, -3dB Beamwidth: 40°, Free Hanging, 10m Shielded Cable, Wire Leads.							
BII7760TSIM50Ω/200kHz-40°-FH-10m-SC-WL	BII7760 transducer, built-in temperature Sensor, built-in Impedance Matching unit as 50Ω load, 200kHz, -3dB Beamwidth: 40°, Free Hanging, 10m Shielded Cable, Wire Leads.							

**General Physical Size, Dimensional Unit: mm.**

**Physical Size of BII7760Q/1000 Free Hanging. Dimensional Unit: mm.**


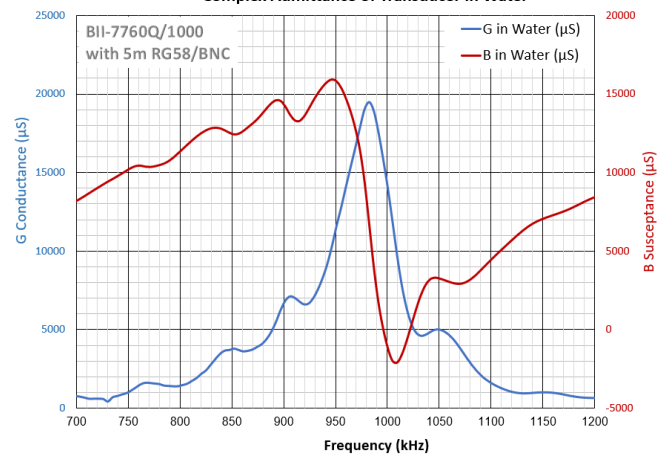
**TVR (Customized High  $Q_m \geq 8$ )**

**Transmitting Voltage Response (TVR)**

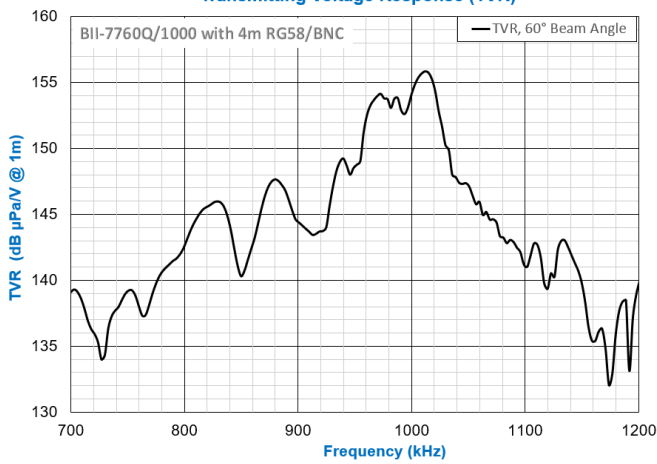


**Admittance: (Customized High  $Q_m \geq 8$ )**

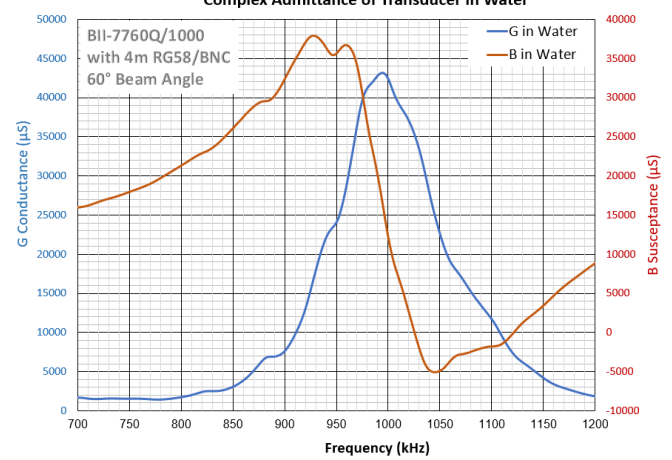
**Complex Admittance of Transducer in Water**



**Transmitting Voltage Response (TVR)**



**Complex Admittance of Transducer in Water**



**Directivity Pattern (Customized):**

