Doppler Transducer: Speed Measurement

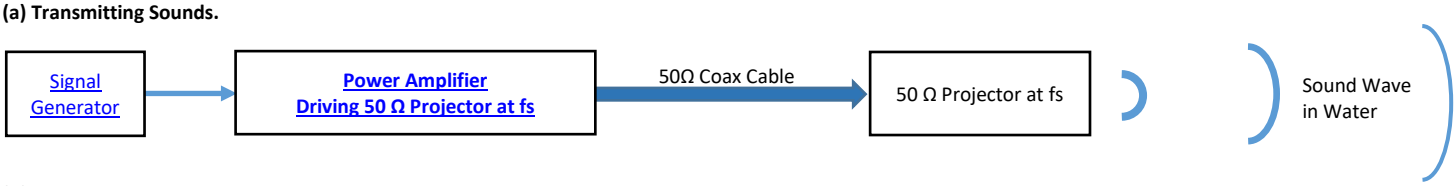
BII Doppler transducers are broadband and optimally designed for use in Doppler SONARS (Doppler Effect) which measure velocity of ships and moving objects, and detect motion of ocean surface, internal waves, or current.

TYPICAL APPLICATIONS

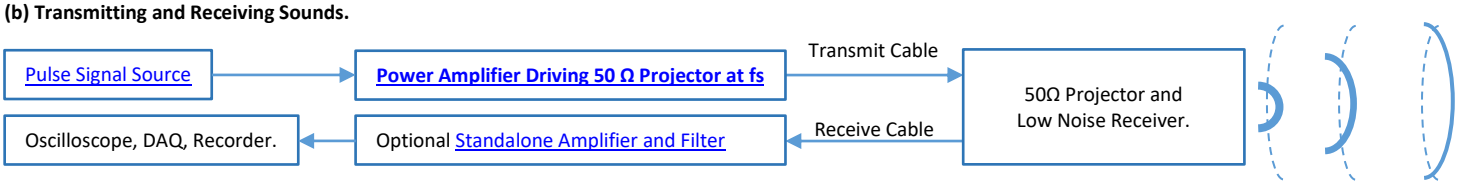
Doppler Sonar, Speed Determination and Log	Security, Detection of Moving Object	Ship Speed/Ocean Current/Flow Measurement
Acoustic Doppler Profiler (ADCP), Velocimeter	Support Janus Configuration	Acoustic Correlation Sonar for Speed Measurement

SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.



RELATED PRODUCTS

Signal Generator Signal Generation for Acoustic Systems: SONAR, HIFU, NDT...	Power Amplifier for SONAR, NDT, and HIFU.

TRANSDUCER SPECIFICATIONS

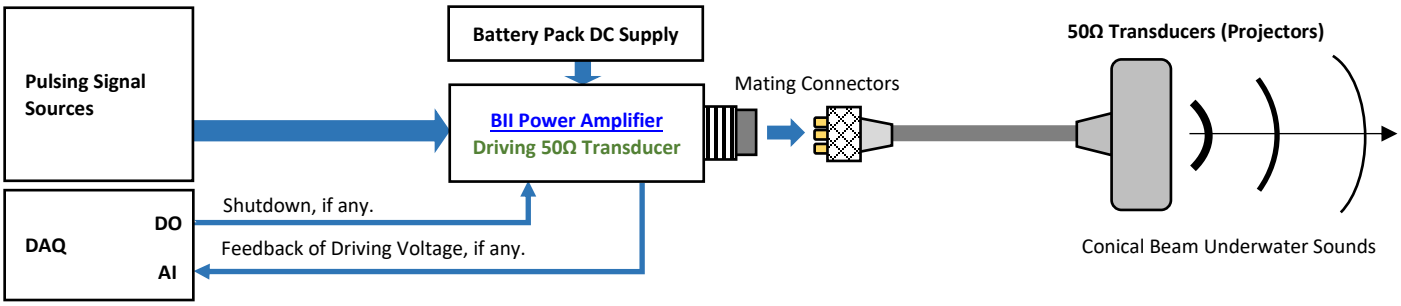
IM: Impedance matching to 50Ω. **LNR:** Low Noise Receiver. **TVR**: Transmitting Voltage Response, (dB µPa/V@1m). **FFVS**: Free-field Voltage Response, dB V/µPa.

Doppler Transducer	**BII7616/45**	**BII7616/70**	**BII7616/150**	**BII7615/300**	**BII7614/600**	**BII7612/1200**
Resonance f_s:	45 kHz	70 kHz	150 kHz	300 kHz	600 kHz	1.2 MHz
Echo Range:	760 m	600 m	400 m	200 m	80 m	15 m
Operating Depth:	Maximum, 300 m or 3MPa and Limited by the cable length if the cable has wire leads or a non-waterproof connector.					
Mounting Options:	1. Default: Free Hanging (**FH**) 2. Free-hanging with Male Underwater Connector (**FHUWC-2P, FHUWC-3P.**) 3. Bolt-Fastening Mounting with Free Hanging (**BFM-FH-M10, BFM-FH-3/8".)** 4. End-face Mounting (**EFMM**). 5. Thru-hole Mounting with Single O-ring (**THM-5/8"**), for BII7612/1200 ONLY. 6. Flange Mounting (**FGM-Φ220, FGM-Φ190, FGM-Φ165, or FGM-Φ110.**)					
	Please refer to online document **AcousticSystem.pdf** for a complete list of Mounting Options and more details.					
Size (ΦDxH):	Φ168x100mm	Φ168x80mm	Φ168x65mm	Φ141x60mm	Φ114x55mm	Φ60x45mm
	Actual length depends on Mounting Parts.					
Weight in Air: (with 1m Cable)	4.5 kg	3.5 kg	2.8 kg	2.2 kg	1.6 kg	0.6 kg
	Actual weight depends on Mounting Parts, Cable Types and Length.					
Operation Temperature:	1. Default: -10 °C to +60 °C or 14 °F to 140 °F. 2. Bespoke High Temperature Transducer: -10 °C to 120 °C, or 14 °F to 248 °F. Append HT to part number.					
Storage Temperature:	-20 °C to +60 °C or -4 °F to 140 °F.					
Power Amplifier:	BII5000 Power Amplifiers for SONAR, NDT, HIFU. Order Separately as standalone devices.					
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 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.						
Ordering Information:	1. **Transmitting and Receiving Sounds.** Append **IMLNR** to part number. For example: **BII7615/300IMLNR**: BII7615 300kHz Transducer with built-in Impedance matching to 50Ω and built-in low noise receiver.					
	2. **Emitting Sounds ONLY**. Append **IM** to part number. For example, BII7615/300IM: BII7615 300kHz Transducer with built-in Impedance matching to 50Ω.					
BII761x/xxxIM and BII761x/xxxIMLNR, Transmitting Sounds: High Power, Broadband, Conical Directivity, 50Ω Load.						
Transmit Frequency:	$f_s \pm 25\% * f_s$					
	Minimum Transmitting Frequency: fs - 25%*fs.					
	Warning: Operating Frequency < Minimum Transmitting Frequency: transducer impedance is very low which causes over-current issue to power amplifier, and results in overheat issue (damage) to power amplifier and the transducer.					
Impedance Matching:	Built-in, Impedance matching to 50Ω.					
Signal Type:	**Pulsing Signals ONLY**: SINE Pulses, Chirp, PSK, FSK, Pulsed Square Waveform, etc.					

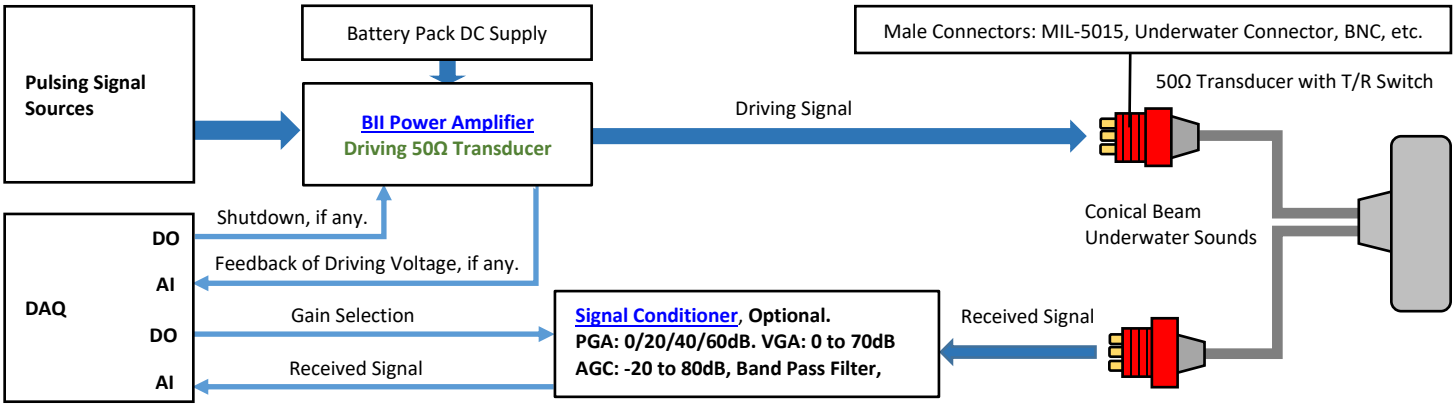
	Pulse Width: ≤ 200 mS; **Duty Cycle:** ≤ 20%.					
Directivity Pattern:	Conical Beam at fs. Refer to Graph of Directivity Pattern.					
-3dB Beam Width at f_s:	15.2°	8.5°	3.6°	2.2°	1.5°	1.4°
Side Lobe at f_s:	≤ -17.7 dB					
Quality Factor Q_m at f_s:	3.5	3.2	3.0	3.5	3.8	3.5
	-3dB bandwidth $\Delta f = f_s/Q_m$. Qm determines the transient response or the rise and fall rings of steady-state response.					
η_{ea} at f_s:	≥ 0.3 in Water, Electroacoustic Efficiency.					
Power Factor at f_s:	≥ 0.94					
TVR at f_s, ±3dB:	176.0	177.0	180.0	182.0	185.0	186.0
Radiation Sound Level SL:	SL = 20*logV_i + TVR, dB µPa @ 1m. Driving Voltage V_i is in unit of V_{rms}.					
Impedance at fs:	$Z = 50*e^{j\theta}$, in Ω, and Phase Angle $\lvert\theta\rvert \le 20°$ at fs.					
Driving Voltage V_i at f_s: (V_{imax}: Maximum V_i.)	Pulsed Driving Signal: Vimax = √(MIPP * |Z|), in Vrms. Z is impedance 50Ω at fs.					
	≤300 Vrms	≤300 Vrms	≤300 Vrms	≤300 Vrms	≤200 Vrms	≤100 Vrms
Input Power P_i:	$P_i = V_i^2 / Z$ at f_s. Z is impedance 50Ω at f_s.					
MIPP at f_s:	1800 W	1800 W	1800 W	1800 W	800 W	200 W
MPW at MIPP and f_s:	200 mS					
MCIP at f_s:	N/A. Pulsing Signal ONLY. **Duty Cycle:** ≤ 20%.					
MIPP: Maximum Input Pulse Power. **MPW**: Maximum Pulse Width. **MCIP**: Maximum Continuous Input Power. **f_s:** Resonance Frequency. Z is 50Ω at f_s.						
How to determine pulse width, duty cycle and off-time with input pulse power (peak power) at f_s: 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.						
Transmit Cable:	1. Shielded Cable (**SC**), Rubber or PVC Jacket. SC with Two Conductors for transmit sounds. 2. 50 Ω RG58 Coax (**RG58**). 3. 50 Ω RG174/U Coax (**RG174**). 4. 50 Ω Coax RG316/U (RG316) (Operating Temperature Range: -50°C To +200°C or -58°F to 392°F). 5. 50 Ω RG178/U Coax (RG178) (Operating Temperature Range: -70°C To +200°C or -94°F to 392°F). 6. Shielded Cable with Twisted Pair and Teflon (PTFE) Jacket, ΦD=4.0 mm (**SC40**), up to 200°C, AWG20 Conductors (Not Water-proofed, ONLY for Dry Air Use). 7. Two Conductor Unshielded Cable (**USC**) for Underwater Connector 2 Pins or 3 Pins.					
	Handling: Do not use the cable to support transducer weight in air and water if the transducer has a mounting part. Do not bend the cable.					
Cable Length:	1. Default: (a) 15 m. (b) 0.6m with Underwater Mateable Connector (2 pins) (**UMC2P**) and (3 pins) (**UMC3P**). 2. Custom-fit.					
Transmit Connector:	1. Default: Wire Leads (**WL**) 2. Underwater Mateable Connector (2 pins) (**UMC2P**) (Max. Diameter Φ21.5 to Φ35 mm). Locking Sleeve: DLSA-M. Underwater Mateable Connector (3 pins) (**UMC3P**) (Max. Diameter Φ21.5 to Φ35 mm). Locking Sleeve: DLSA-M. Undewater Mateable Connectors are fixed with 0.6m unshielded cable. UMC is from global manufacturers of underwater connectors. Its part number is listed in quote in detail. 3. MIL-5015 Style (3 pin) (**MIL3P**) (Max. Diameter Φ19 to Φ30 mm). 4. XLR Receptacle with 3 Male Pins (**XLR3P**), (Max. Diameter Φ20.2 mm). 5. DIN Receptacle with 3 Male Pins (**DIN3P**), (Max. Diameter Φ17 mm). 6. Male BNC (**BNC**) (Max. Diameter Φ14.3 mm), for Transmitting Grounded Signal.					
	Note: Underwater Mateable Connector is for uses underwater. Other connectors and wire leads are for dry uses and are not waterproofed.					
BII761x/xxxIMLNR, Receiving Sounds: Broadband Low Noise Receiver.						
Directivity Pattern:	Conical Beam at fs.					
-3dB Beam Width at f_s:	76°	50°	23°	15°	15°	10°
Side Lobe at f_s:	None.	None.	≤ -17.7 dB	≤ -17.7 dB	≤ -17.7 dB	≤ -17.7 dB
FFVS at f_s (± 2dB):	-160.0 dB V/µPa.	-160.0 dB V/µPa.	-160.0 dB V/µPa.	-160.0 dB V/µPa.	-160.0 dB V/µPa.	-160.0 dB V/µPa.
-3dB Bandwidth:	Built-in Band Pass Filter: f_s ± 50%*f_s, 1st and/or Second order, 20 or 40 dB/Decade Roll-off.					
Signal Conditioning:	Optional, Standalone Amplifier and Filters to compensate the loss of sound propagation and spreading or filter out noises. Order separately.					
Pressure Noise Density:	22 dB	25 dB	27 dB	29 dB	33 dB	40 dB
	Referred to Input (RTI), in µPa/√Hz, at f_s.					
Input Dynamic Range:	≥ 90 dB in -3dB Bandwidth.					
Output Signal Type:	Differential	Differential	Differential	Differential	Differential	Single-ended
Output Impedance:	10 Ω	10 Ω	10 Ω	10 Ω	10 Ω	50 Ω
Cable Drive Capability:	50 m					
Cable:	Four-Conductor (4C) Shielded Cable					Cable Bundle: 2C Shielded Cable + 50Ω Coax.
Receive Connector:	1. Default: Wire Leads (**WL**) 2. Underwater Mateable Connector (3 pins) (**UMC3P**) (Max. Diameter Φ21.5 to Φ35 mm). Locking Sleeve: DLSA-M. Underwater Mateable Connector (4 pins) (**UMC4P**) (Max. Diameter Φ21.5 to Φ35 mm). Locking Sleeve: DLSA-M. Undewater Mateable Connectors are fixed with 0.6m unshielded cable. UMC is from global manufacturers of underwater connectors. Its part number is listed in quote in detail.					

	3. MIL-5015 Style (3 pin) (**MIL3P**) (Max. Diameter Φ19 to Φ30 mm). MIL-5015 Style (4 pin) (**MIL4P**) (Max. Diameter Φ19 to Φ30 mm). 4. XLR Receptacle with 3 Male Pins (**XLR3P**), (Max. Diameter Φ20.2 mm). XLR Receptacle with 4 Male Pins (**XLR4P**), (Max. Diameter Φ20.2 mm). 5. DIN Receptacle with 3 Male Pins (**DIN3P**), (Max. Diameter Φ17 mm). DIN Receptacle with 4 Male Pins (**DIN4P**), (Max. Diameter Φ17 mm). 6. Male BNC (**BNC**) (Max. Diameter Φ14.3 mm). 7. 1/8" (3.5mm) TRS Plug (**TRS**) (Max. Diameter Φ10.5 mm).
	Note: Underwater Mateable Connector is for uses underwater. Other connectors and wire leads are for dry uses and are not waterproofed.
Power Supply of Receiving Circuit	
Supply Voltage V_s:	+8.5 to +32 VDC
Current (Quiescent):	6.8 mA
Suggested DC Supply:	+9VDC 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 above rated voltage. DO NOT use switching mode DC power supply.
DC Supply Connector:	1. Default: Wire Leads (**WL**) 2. +9VDC Battery Snap (**BS**), +18VDC power supply. 3. 4mm Banana Plug Pair (Red and Black Color) (**BP**), DC power supply.

System Block Diagram of Generate Sounds



System Setup of Transmitting and Receiving Sounds.



Wiring Information of Transmitting Sounds.

Transducer Wiring:	**Shielded Cable**	**Coax, BNC.**	**UMC3P, Locking Sleeve: DLSA-M.**	**MIL3P**	**DIN3P**	**XLR3P**
Signal:	White or Red	Center Contact	Contact 2	Contact C or G	Pin 3	Pin 2
Signal Common:	Black	Shield	Contact 1	Contact B	Pin 1	Pin 3
Shielding and Grounding	Shield	Shield	Contact 3	Contact A	Pin 2	Pin 1
Please contact us for bespoke wirings of differential transducers such as dipole, quadrupole, multimode rings, and flextensional sources.						
Wiring of Unshielded Cable:	**Wire Leads WL**	**UMC2P** (0.6m USC Cable originally coming from manufacturer of the connector, Fixed.). Locking Sleeve: DLSA-M.				
Signal	White	Contact 2				
Signal Common	Black	Contact 1				

Differential Wiring Information of Receiving Sounds.

Differential Output:	**Wire Leads**	**UMC4P/XLR4P**	**DIN4P**	**DIN3P/XLR3P + 9V BS**		**TRS + 9V BS**
+VDC	Red	Pin 3	Pin 4	Battery Female Snap		Battery Female Snap
Common	Black	Pin 1	Pin 1	Battery Male Snap		Battery Male Snap
Signal+	White	Pin 2	Pin 3	DIN Pin3	XLR Pin 2	TRS Tip

Signal-	Blue, Green, or Yellow	Pin 4	Pin 2	DIN Pin1	XLR Pin 3	TRS Ring
Signal Common	N/A	Pin 1	Pin 1	DIN Pin2	XLR Pin 1	TRS Sleeve
Shielding	Shield	Metal Shell	Metal Shell	Metal Shell		N/A
Optional DC Supply Connector: 4mm Banana Plug Pair, Red Plug for +VDC, **Black Plug** for Common of the DC power supply.						

Single-ended Wiring Information of Receiving Sounds.

Single Ended Output:	**Wire Leads**	**BNC Male + 9V BS.**	**UMC4P or XLR4P**	**XLR3P + 9V BS**	**TRS Plug + 9V BS**
+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
Optional DC Supply Connector: 4mm Banana Plug Pair, Red Plug for +VDC, **Black Plug** for Common of the DC power supply.					

How to Order Transducers. The default options are for stock items which are regularly available.

FH: Free Hanging. **SC for Low Frequency Transmit**: Shielded Cable (Rubber Jacket, 600V) with 2 conductors. **Coax for High Frequency Transmit:** 50 Ω Coaxial Cable. **SC for Low Frequency Receive**: Shielded Cable with 4 conductors. **Coax for High Frequency Receive:** 50 Ω Coaxial Cable. **WL**: Wire Leads. **HPF**: -3dB High Pass Filter Frequency. **LPF**: -3dB Low Pass Filter Frequency. **Cable of DC Supply** is two-conductor shielded cable in case that receive cable is coax.					
Receiving Cable is fixed to be four-conductor Shielded cable. Transmitting cable can be customized to be Coax or two-conductor shielded cable.					
Length of Transmitting and receiving cables are same in default.					
Undewater Mateable Connector UMC2P and UMC4P are fixed with 0.6m unshielded cables.					
Part Number	**Appendix**	**-Mounting**	**-Cable Length**	**-Transmit/Receive Cable**	**-Connector of Transmit/Receive/DC Supply**
BII7616/45, BII7616/70, BII7616/150, BII7615/300, BII7614/500, BII7612/1200.	**IM, IMLNR.**	Default: **BFM-FH-3/8".**	Default: 15m.	Shielded Cable **SC**, RG58 **Coax.**	WL, UMC, MIL, BNC, XLR, DIN, BS, BP, etc.
Example:		Description			
BII7615/300IMLNR-BFM-FH-3/8"-15m-RG58/SC-BNC/XLR3P/BP		BII7615/300, 300kHz Transducer, Built-in Impedance Matching Network as 50Ω load at fs, Built-in Low Noise Receiver, Bolt-Fastening Mounting with Free Hanging: BFM-FH-3/8", 2x15m Cable Bundles, Transmit Cable: RG58 Coax, Receive Cable: Shielded Cable, Connectors: BNC for Transmit, 3-pin XLR for Receive, Banana Plugs for DC Supply.			
BII7615/300IM-BFM-FH-3/8"-15m-SC/SC-MIL3P/XLR4P/BS		BII7615/300, 300kHz Transducer, Built-in Impedance Matching Network as 50Ω load at fs, Bolt-Fastening Mounting with Free Hanging: BFM-FH-3/8", 2x15m Cable Bundles, Transmit Cable: Shielded Cable, Receive Cable: Shielded Cable, Connectors: 3-pin MIL-5015 Connector for Transmit, 4-pin XLR for Receive, 9V Battery Snap for DC Supply.			
BII7612/1200IMLNR-FH-10m-RG58/RG174-BNC/BNC/BS		BII7612/1200, 1.2MHz Transducer, Built-in Impedance Matching Network as 50Ω load at fs, Built-in Low Noise Receiver, Free Hanging, 2x10m Cable Bundles, Transmit Cable: RG58 Coax, Receive Cable: RG174 Coax (an extra SC cable as power supply cable), Connectors: Two BNC Male for Transmit and Receive, 9V Battery Snap for DC Supply.			
BII7616/45IMLNR-EFMM-0.3m-SC/SC-WL/WL/WL		BII7616/45, 45kHz Transducer, Built-in Impedance Matching Network as 50Ω load at fs, Built-in Low Noise Receiver, End-face Mounting EFMM, 2x0.3m Cable Bundles, Transmit Cable: Shielded Cable, Receive Cable: Shielded Cable, Connectors: Wire Leads for Transmit, Receive, and DC Supply.			

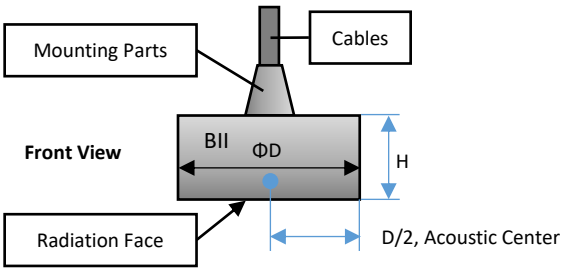
Question:

What if the mating connector of my DAQ module or recording device is NOT available from BII?

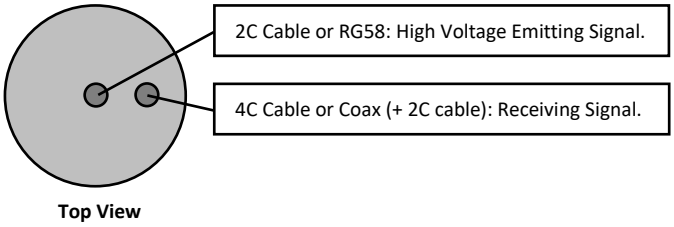
1. Buyer may order BII products with wire leads, and buyer assembles the mating connector to the cable end.
2. A connector adaptor might be assembled by BII by customization, and BII ships the adaptor to buyer as accessory of the device. Please contact BII for customizations.
3. Many adaptors for standard connectors are available in worldwide electronic suppliers such as BNC to SMA, BNC to SMC, XLR to TRS, etc. Check out your local suppliers.

Physical Size (Dimensional Unit: mm): The overall length varies with the length of mounting parts. Please refer to online information of mounting options.

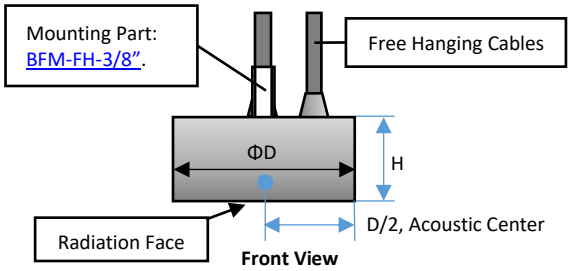
(1) Free Hanging



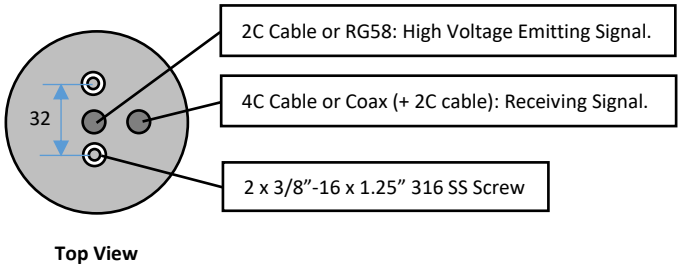
Cable-out Layout.



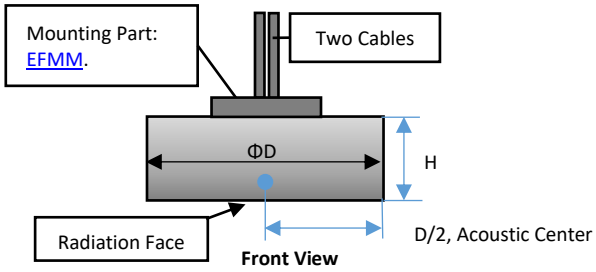
(2) Bolt Fastening Mount with Free Hanging Cable (BFM-FH-3/8").



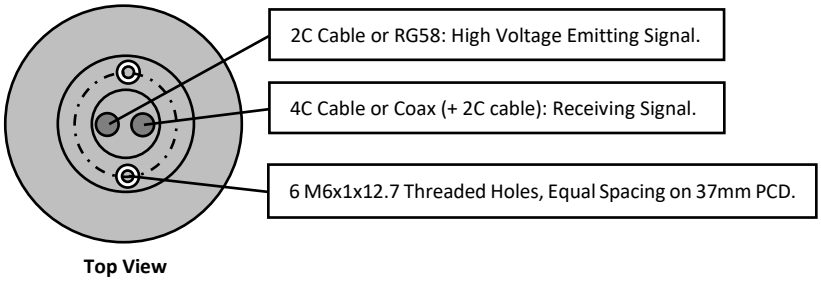
Cable-out Layout.



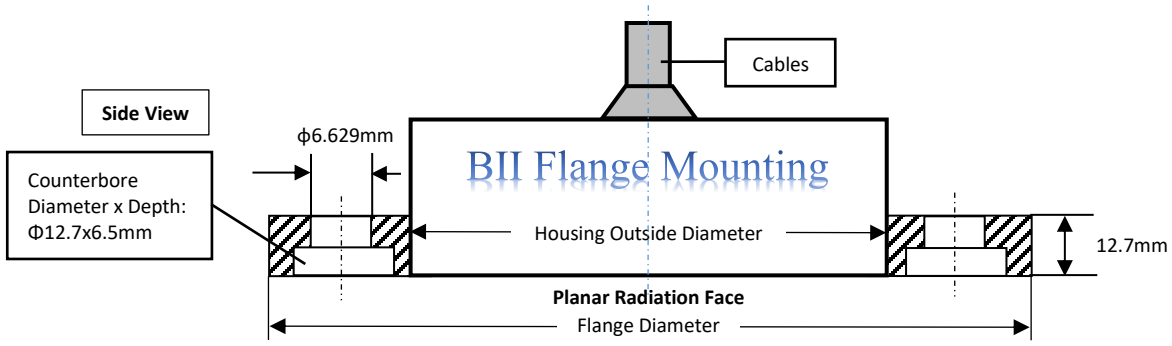
(3) End-face Mounting for Multi-Channel (EFMM)



Cable-out Layout for



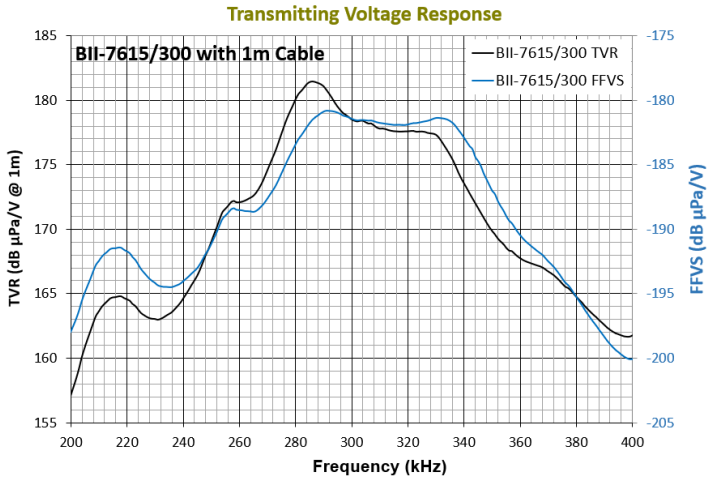
(4) Flange Mounting



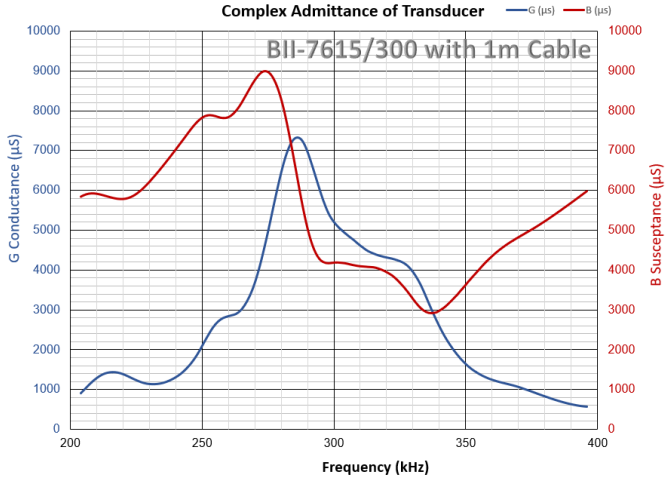
Part Number	Flange Diameter (mm)	Pitch Circle Diameter PCD (mm)	Housing Outside Diameter (mm)	M6x1 Mounting Hole Number on PCD	Flange Thickness (mm)
FGM-Φ220	Φ220	Φ195	Φ168	8	12.7
FGM-Φ190	Φ190	Φ165	Φ141	8	12.7
FGM-Φ165	Φ165	Φ140	Φ114	6	12.7
FGM-Φ140	Φ140	Φ115	Φ89	6	12.7
FGM-Φ110	Φ110	Φ85	Φ60	6	12.7

6. More Mounting/Installation Options: Please refer to online document AcousticSystem.pdf for a complete list of Mounting Options and details.

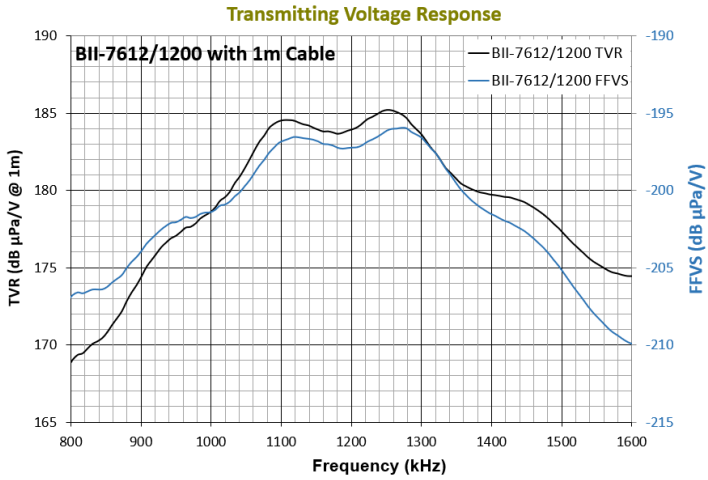
Transmitting Voltage Response (TVR) and Free-field Voltage Sensitivity (FFVS):



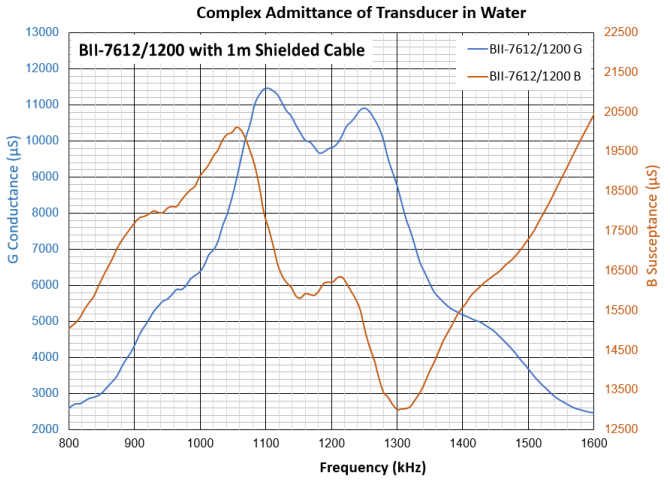
Admittance



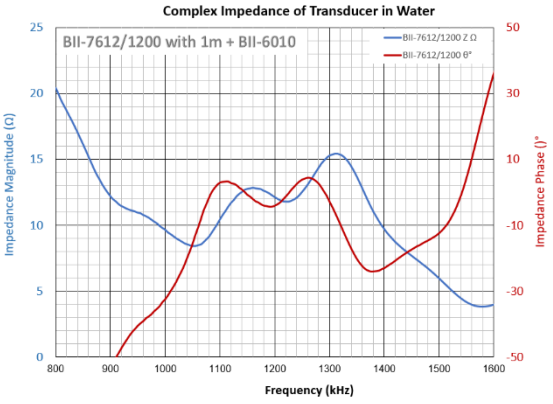
Transmitting Voltage Response (TVR) and Free-field Voltage Sensitivity (FFVS):



Admittance



Customized Impedance Matching



Directivity Pattern: