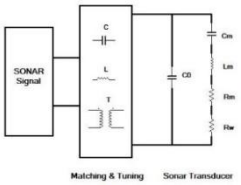
SE=SL-TL+AG-NL

Benthowave Instrument Inc.

Acoustic Solutions for SONAR, HIFU, NDT, AE benthowave.com Revised on 2025/04/23

BII6000 Series Matching Network: Impedance Matching between Transducers and Amplifiers

The impedance (or admittance) of a piezoelectric transducer (SONAR, HIFU, NDT, AE Sensor, Hydrophone.) is frequency-dependent ranging from hundreds kΩ to several Ω, and is capacitive, resistive, or inductive at different frequency ranges. An impedance matching and tuning unit is a necessary device to change the impedance of the transducer in a specific frequency range to meet the load requirements of a power amplifier for maximum and efficient power transfer (high power factor) from the electric to the mechanical, or to match the input impedance of a preamplifier for maximum and efficient power transfer from the mechanical to the electric, or achieve optimum source resistance for minimum noise figure NF. Besides, BII6000s are necessary components in study of dielectric and ferroelectric (piezoelectric) materials.



Typical Applications

(1) Impedance matching between Amplifiers (Power Amplifier and Preamplifiers) and Piezoelectric Transducers.

Broadband Acoustic System: Pulsing-echo System such as SONAR, Echo-sounding, Ultrasonic NDT, Ultrasonic Imaging, Communication, Sound Detection, etc.

Narrowband Acoustic System: Ultrasonic Power Applications of HIFU (High Intensity Focused Ultrasound), Degassing, Cleaning, Physical/Chemical Processing, etc.

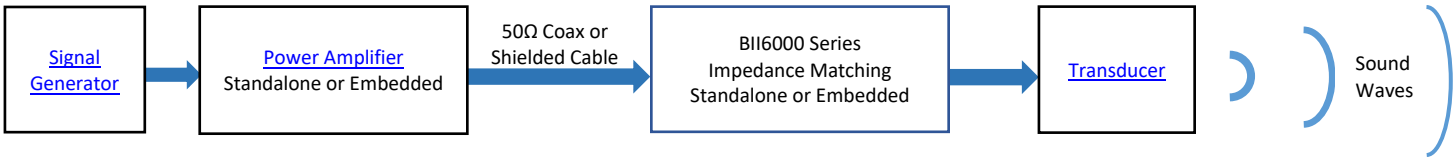
(2) Wideband Step-up and Step-down Transformers for Study of Materials.

If you are looking for acoustic solutions on Transmitting and Receiving with one transducer, please refer to T/R Switch Module for system configuration.

Package and Installation:

1. **Standalone Instrument**: Enclosure with Mounting Flange (4 mounting holes) and Panel-mount Connectors.
2. **Embedded Components**: Enclosure with Mounting Flange (4 mounting holes/Slots), Cable/Wire Bundles, and Wire Leads, for being Installed in end user's enclosures such as transducer housing, instrument enclosure, underwater case, submersibles, floating platform, Onshore/offshore work stations, etc.

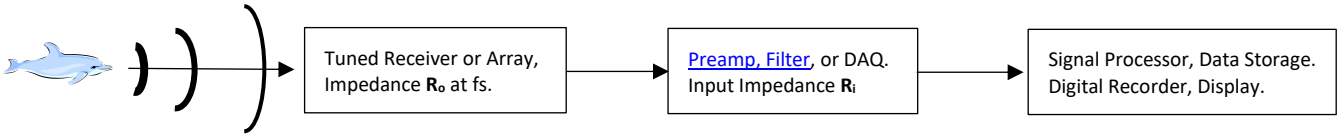
1. Acoustic System of Sound Generation: Underwater Sounds, NDT Pulsing Sounds, …



2. Acoustic System of Sound Detection: Underwater Sounds, NDT Pulsing Sounds, AE, …

Tuned Transducer as a Receiver

Tuned transducers (hydrophones, AE sensor, NDT receivers, etc…) are band pass sound receivers and projector **operating around resonance fs**, which feature broadband, possible maximum power transfer from the transducer to preamplifier, and offer flexible solutions to special transducer demanding in underwater acoustics and NDT (Non-destructive Test). Impedance of a tuned transducer is resistive at fs.



Three Major Operations of tuned receivers: Impedance matching $R_o = R_i$, Open Circuit $R_i >> R_o$, and $R_o < R_i << \infty$.

(1). Impedance matching between the transducer and its signal conditioning circuit, $R_o = R_i$:

a. Sound energy being reflected from the transducer is minimized. b. Maximum power transfer from transducer to preamplifier or signal conditioner.

Advantages:

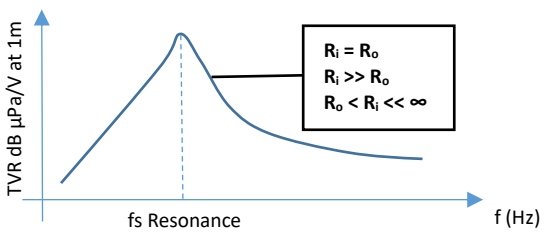
a. Broaden the bandwidth, reduce impulse rings, increase spatial resolution in tracking, positioning, and NDT applications.

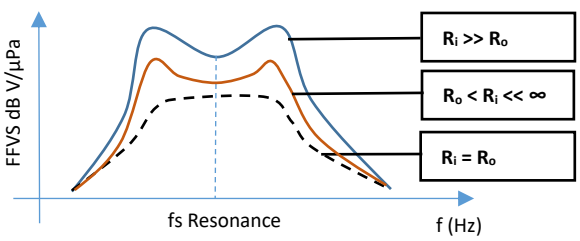
b. Reduce mutual interaction among array elements in an array. Reduce interference to incident acoustic waves.

Disadvantage: The sensitivity drops 6 dB around fs comparing to FFVS (open circuit voltage).

(2). Input impedance of signal conditioner R_i >> transducer impedance R_o: Output voltage of receiver is FFVS (open circuit voltage).

Typical TVR and FFVS of Tuned Transducer:





f_s is motional (mechanical) resonance frequency of a Piezoelectric Transducer at which its TVR reaches maximum.

C_0 is shunt (clamped) capacitance of a Piezoelectric Transducer around f_s.

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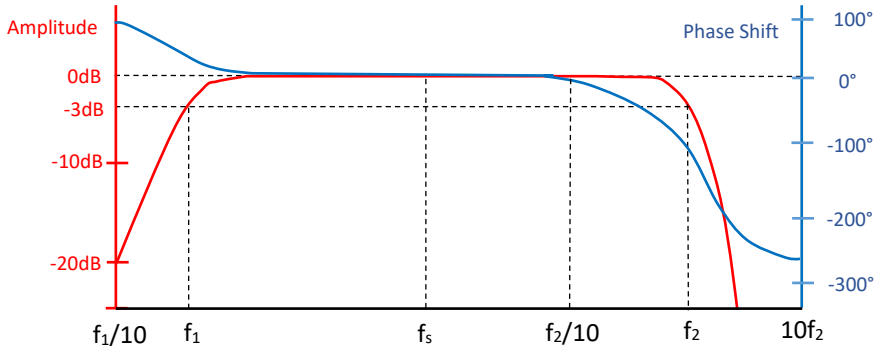
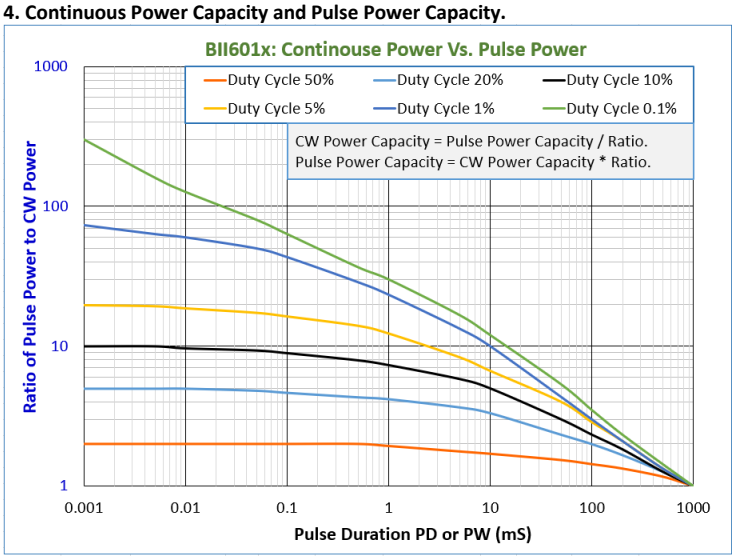
3. Typical Frequency Response of a Wideband Transformer Which is a key Component for Impedance Matching



4. Continuous Power Capacity and Pulse Power Capacity.



How to use Chart of Continuous Power Capacity and Pulse Power Capacity?

D: Duty Cycle, PD: Pulse Duration (or Pulse Width PW), CW: continuous Sinusoidal Wave (signal).

Example 1. My project needs pulse power 500W RMS, D = 5%, PD = 1mS, how do I order BII601x?

a. With the chart, find out **Ratio of Pulse Power to CW Power** ≈ 13.

b. Calculate CW Power = Pulse Power/13 = 500W RMS/13 ≈ 38.46 W RMS. Round the fraction to larger integer 39 or 40 Wrms.

d. Use CW Power 39 or 40 Wrms to order BII601x Derices.

Example 2. Continuous power capacity of my BII6014 is 60W RMS, what is its pulse power capacity with pulse signal of Duty Cycle (**D**) 10% and Pulse Duration (**PD**) 10mS?

a. Look up the chart, Ratio of Pulse Power to CW (Continuous Waveform) Power = 5 at D=10%, PD=10mS.

b. Pulse Power Capacity = 60W RMS * 5 = 300 W RMS at D=10%, PD=10mS.

Example 3. My BII6011 possesses pulse power capacity 500W RMS with Duty Cycle 1% and Pulse Duration 1mS, what is its continuous power capacity?

a. Look up the chart, Ratio of Pulse Power to CW Power ≈ 23 at D=1%, PD=1mS.

b. Continuous Power Capacity = 500W RMS / 23 ≈ 21.74W RMS.

APPLICATIONS

Impedance Matching between Power Amplifiers and Acoustic Transducers/Projectors.
Step-up Voltage Transformer for study of dielectric, ferroelectric, and piezoelectric materials.
Impedance Matching between preamplifiers and Piezo-Sensors at fs.
Broadband Transformer for 50Ω Matching from 0.01 to 20 MHz.

Device Part Number

BII6011

Working Mode, Housing, and Cable/Connector

1. Standalone Device. Metal Housing (**MH**), Four Mounting Holes, Panel Mount Connectors, a Grounding Stud.
2. Embedded Device. Metal Housing (**MH**) or Plastic Housing (**PH**), Mounting Holes and Slots, 0.3m (1 ft) Cables or Wire Bundles, Wire Leads.
3. Reserved.
4. Embedded Component, Metal Bracket with Chassis (**MBC**), Four Mounting Slots, Wire Bundle, Wire Leads.
5. Embedded Component, Printed Circuit Board (**PCB**), Four Mounting Holes, Round Pads on PCB (PADS) for Soldering Wires.
6. Standalone Device for Underwater Uses. Plastic Housing with Underwater Mateable Connectors (**PHUMC**).

Quick Reference of Matching Network Devices

SD: Standalone Device; **EC**: Embedded Component being embedded into buyer's enclosure or housing; **IMT**: Impedance Matching and Tuning; **BT**: Broadband Transformer. **MH**: Metal Housing with Four Mounting Holes; **MBC**: Metal Bracket with Chassis with Four Mounting Slots; **PH**: Plastic Housing with Four Mounting Holes; **PHUMC**: Plastic Housing with Underwater Mateable Connectors, Bolt-fastening Mounting (3/8"-16 x 1⅛" 316 SS Screw); **PCB**: Printed Circuit Board with Four or Six Mounting Holes.

PN	USAGE	FREQUENCY	PACKAGE	FEATURES and CUSTOMIZATION
BII6011	SD	1 kHz to 10 MHz	PH, MH(1)	Panel-mounted Connectors. Options: High Temperature.
BII6012	EC	1 kHz to 10 MHz	PH, MH(1)	Cable/Wire Bundles with Wire Leads.
BII6014	EC	100 Hz to 30 kHz	MBC	High Power in Audio Frequency, Wire Bundles with Wire Leads.
BII6015	EC	1 kHz to 10 MHz	PCB	Printed Circuit Boad with Mounting Holes.
BII6016	SD	1 kHz to 1 MHz	PHUMC	Underwater Mateable Devices. Water-proofed.
Note(1): BII uses third-party's metal housing in production. Because of variation of suppliers' production, BII can NOT guarantee that BII can use metal housing for a specific impedance matching device. When metal housing is NOT available, BII will use plastic enclosures at BII's discretion.				

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Specifications

Matching Network	**BII601x Series,** replace x with 1, 2, 4, 5, or 6 for ordering.
Applications:	Single Ended Piezoelectric Transducers. Impedance Matching and Tuning at f_s
	ON Differential Driving of Piezoelectric Transducers: With proper design of piezoelectric elements and structures, a transducer can implement dipole, multipole, or differential operation mode with single ended input driving signal. BII manufacture dipole, multipole, or differential transducers which ONLY need single-ended driving signals.
f_s Range:	1 kHz to 10 MHz. f_s is motional (series) resonance frequency of a transducer.
Usable Frequency Range:	0.1 kHz to 10 MHz, refer to a specific device for its usable frequency range.
-3dB Bandwidth Δf_{-3dB}:	Δf_{-3dB} ≥ Transducer Bandwidth.
Integration:	BII integrate BII601x into BII transducers as 50Ω transducers.
Gain (V_{out}/V_{in}):	Transducer load / PA Load.
Isolation or Insulation:	Input and Output are isolated. Insulation voltage: 1200 V.
Power Capacity:	**Continuous Sinusoidal Power (CW Power)** up to 280 Wrms.
	Pulse Power up to 10000 W at **Duty Cycle ≤ 1% and Pulse Duration/Length ≤ 10 mS**. Customized, specify when ordering.
	Refer to Continuous Power and Pulse power.
	1. ONLY pulsing signal can be applied to the devices to avoid overheating when power capacity ≥ CW Power. 2. Higher power the device is being used, less duty cycle and less pulse length should be used.
Device Type:	Magnetic Devices based on Ferromagnetic Materials.
Input Signal:	Both Single Ended Signals and Differential Signals are acceptable.
Input Terminals:	Signal and Common, or Signal + and Signal -.
Input Cable Length, if any:	0.3 m or 1 ft.
Output Signal:	Single-ended.
Output Terminals:	Signal and Common.
Output Cable Length, if any:	0.3 m or 1 ft.
Grounding Terminal:	ONLY for Standalone Device with Metal Housing: **Grounding Stud,** Two #10-24 nuts and Two #10 washers are included. Support Single-Point Grounding with Multiple Devices. Grounding Cable GWL18 or GWL16**,** 0.6m AWG18 or AWG16 Green Wire with #10 Ring Terminal and Wire Lead. One #10 washer and one 4mm Banana Plug (Green) included.
Input DC Resistance:	1 mΩ to 1 Ω.
	Output DC offset of power amplifiers should be low enough such as at μV level to avoid DC overcurrent. Recommended are power amplifiers with AC-coupling output or negligible DC-offset output.
Thermal Cooling:	Although BII6000 series are high efficiency device, Well-Ventilated place, Forced-air Fan, Mounting on High Thermal Conductivity Base would help cooling the devices to avoid overheating especially in high power application.
Physical Size:	Varies with power ratings determined by transducers.
Weight:	5 g to 15 kg depending on power capacity and operating frequency.
Mounting:	Four holes and/or slots for installing the device to a firm base. Refer to the respective drawings for the size.
	Fasteners (Screws, Washers, Nuts, etc.) for installing or mounting the devices: **not included.**
Operating Temperature:	**Default**: -10 to +60 °C, or 14 to 140 °F
	Customization: a. -10 to +120 °C, or 14 to 248 °F. b. -10 to +200 °C, or 14 to 392 °F. available for MH package.
Storage Temperature:	-40 to +60 °C, or -40 to 140 °F

WARNING: HIGH VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with the specification. DO NOT TOUCH THE DEVICE, ITS WIRES, CABLES, AND CONNECTORS BEFORE THE POWER SUPPLIES AND SIGNAL SOURCES ARE SHUT DOWN.

The buyer should observe the National Electrical Code or other related codes of buyer's country to assemble and integrate this device into buyer's product or system, and follow the code to ground and insulate this device. It is buyer's sole responsibility to make sure the proper insulation and grounding for operating safety before putting the device into service.

1. All exposed bare wires, metal wires, wire leads, solders, and joints are insulated with insulation material such as heat shrink tubing, fully insulated wire splice connector, etc. The insulation voltage must be greater than twice the maximum voltage of the device.
2. Ground the device (including metal chassis and/or metal housing, cable shield, etc.) firmly for operation safety.
3. Coax with BNC is not intended for hand-held use at voltages above 30VAC/60VDC. Make sure that the BNC shield of the signal source is firmly grounded for operation safety before hooking up the device to the signal source.

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A. BII6011 Series Standalone Device.

(1) 1 kHz to 10 MHz. Metal Housing (**MH**), Four Holes for Mounting, a Grounding Stud (316SS, #10-24 Screw).
(2) Available are higher service temperature up to 200 °C (392 °F).
(3) Size of Metal Housing varies with power capacity, operating frequency, etc. refer to Metal or Plastic Housing for size info.
(4) **Mounting Hole** Φ5.5mm (Φ0.217") accepts M5 or #10 screw. BII does not supply screws.

Wiring Information of Panel-mounted and In-line Connectors (Adaptor Accessories)

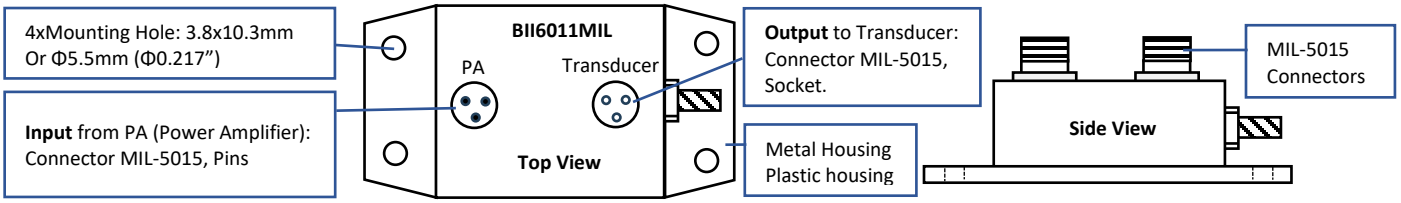
MIL3: MIL-5015 type 3-contact Connector. **XLR3**: XLR 3-contact Connector. **Connector Gender**: **P or M,** Pin, Male; **S or F,** Socket, Female.				
Single-Ended Signal	**MIL3P or MIL3S**	~~**DIN3P or DIN3S**~~	**XLR3P or XLR3S**	**BNC**
Signal	Contact C or G	~~Contact 3~~	Contact 2	Center Conductor
Signal Common	Contact B	~~Contact 1~~	Contact 3	BNC Shell Body
Grounding	Contact A	~~Contact 2~~	Contact 1	BNC Shell Body
Differential Signal	**MIL3P or MIL3S**	~~**DIN3P or DIN3S**~~	**XLR 3-contact Connector**	
Signal +	Contact C or G	~~Contact 3~~	Contact 2	
Signal -	Contact B	~~Contact 1~~	Contact 3	
COM and Grounding	Contact A	~~Contact 2~~	Contact 1	
Connector Gender:	**Input Connector** are male or pin contacts. **Output Connector** are female or socket contacts.			
Grounding:	**Grounding Metal Case for operating safety. Grounding Stud: #10-24 Screw, Nut and Washer included.** Support Single-Point Grounding with Multiple Devices. ONLY for BII's standalone devices with metal enclosure.			
	BII's embedded devices MUST be installed in buyer's (end user's) grounded enclosures for operating safety by Buyer (End User).			
Adaptor Accessories:	Refer to Connector adaptor accessories. Contact BII for bespoke connector adaptor which are not listed in this document.			
	BNC to MIL-C-5015, Underwater Connector, XLR, DIN, SMA, SMC, etc.			
	MIL-C-5015 Connector to Underwater Connector, BNC, XLR, DIN, etc.			

Ordering Information on Device Parameters (Terms or Initials)

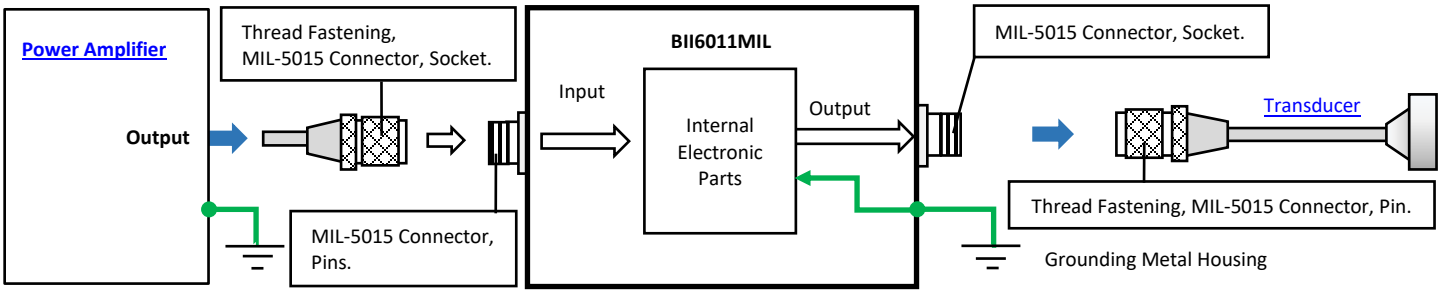
CW Power: Continuous Sinusoidal Signal Power delivered to Transducer from PA, in RMS Watt (Sine/Chirp Pulses, etc.). Pulse Power or Peak Power (Spike or Single Pulse for NDT) can be calculated with the chart Continuous Power Capacity and Pulse Power Capacity. The CW POWER can be ignored with blank if RMS power of the transducer and/or the amplifier is known. In these cases, BII will use RMS power of the transducer and/or the amplifier to design the power capacity of the device; **PW**: Maximum Pulse Width in μS, mS, or S; **D:** Maximum Duty Cycle in %; **fs:** Frequency of Impedance Matching, in kHz or MHz, generally, fs is motional (series) resonance frequency of a transducer; Z_{TX}**:** Transducer Impedance, in Ω; **θ:** Transducer Phase in °; Z_{IM}**:** Impedance for Optimum Power Transfer from the PA to the Transducer, in Ω; **PA**: Power Amplifier; **TX**: Transducer; **PN:** Part Number. **Refer to Power Amplifier for available options and wirings. Refer to Transducer for available options and wirings.**

(1) BII6011MIL

1 kHz to 1 MHz. Metal or Plastic Housing. Four Mounting Holes; **Input and Output**: Panel Mount Connectors MIL-5015 style, -4° F (-20° C) to 176° F (80° C) service temperature range. Size of Metal Housing varies with power capacity, operating frequency, etc. refer to Metal/Plastic Housing for different size options.



System Block Diagram and Wirings:



How to Order, refer to Ordering Information for explanations of the terms or initials.

BII6011MIL	**-CW Power or Blank**	**-fs-Z_{TX}/θ or BII Transducer PN**	**-Z_{IM} or BII PA PN**
Example of Part Number:	**Description**		
BII6011MIL-500Wrms-6kHz-2kΩ/-60°-50Ω	BII6011MIL, Metal Housing with MIL-5015 Connectors as Input and Output; CW Power: 500W RMS; Transducer: fs=6kHz, Z=2kΩ, θ=-60°, Transforming Transducer impedance to 50Ω at 6kHz.		
BII6011MIL-BII7563/70-BII5122MIL	BII6011MIL, Metal Housing with MIL-5015 Connectors as Input and Output; Impedance matching between BII7563/70 Transducer and BII5122MIL Power Amplifier at transducer's fs.		
Adaptor Accessories:	Refer to Connector adaptor accessories. Contact BII for bespoke connector adaptor which are not listed in this document.		
	MIL-C-5015 Connector to Underwater Connector, BNC, XLR, DIN, etc.		

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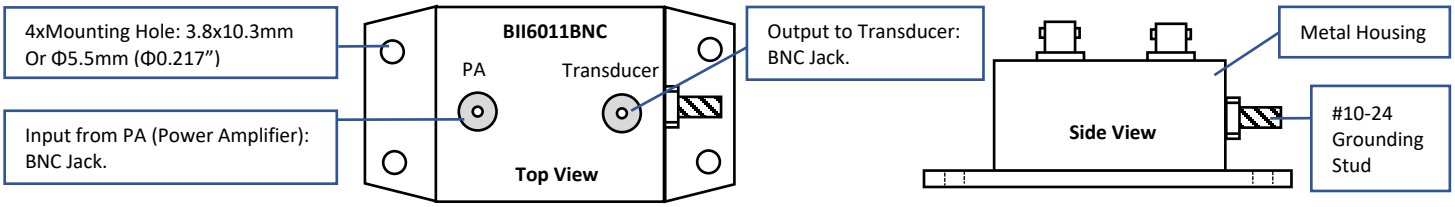
(2) BII6011BNC.
1 kHz to 10 MHz. **Input:** Panel Mounted BNC Jack. **Output:** Panel Mounted BNC Jack.



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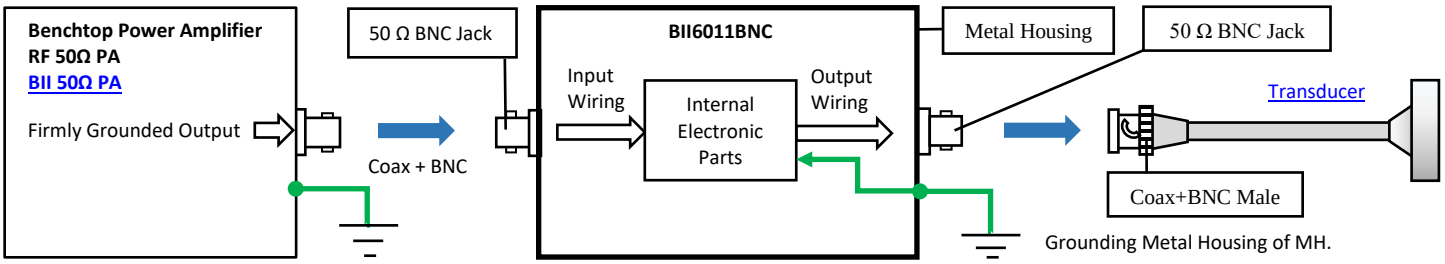
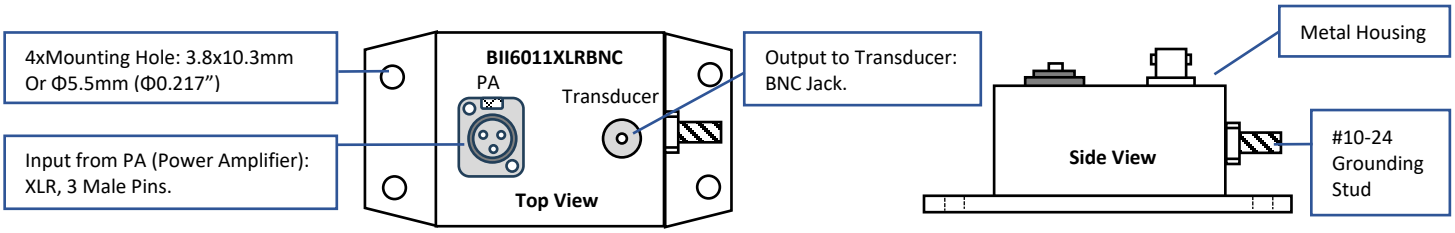


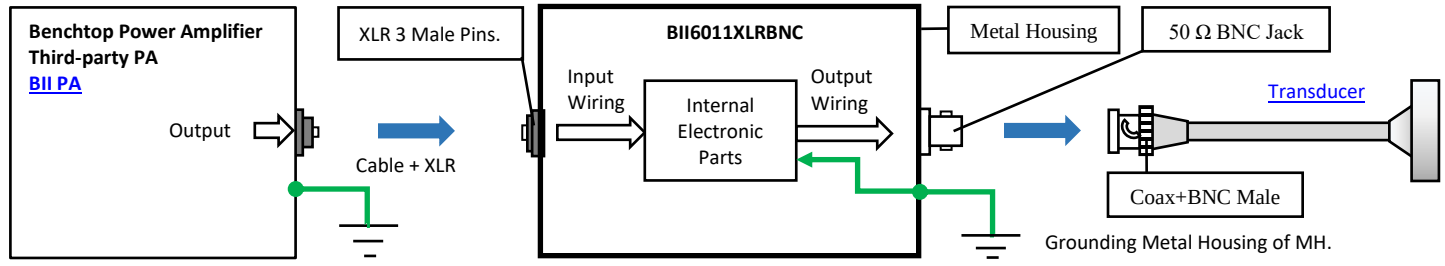
How to Order, refer to Ordering Information for explanations of the terms or initials.

BII6011BNC	**-CW Power or Blank**	**-fs-Z_{TX}/θ or BII Transducer PN**	**-Z_{IM} or BII PA PN**
Example of Part Number:	**Description**		
BII6011BNC-50Wrms-1MHz-20Ω/-50°-50Ω	BII6011BNC, Metal Housing (MH) with BNC Jacks as Input and Output; CW Power: 50W RMS; Transducer: fs=1MHz, Z=20Ω, θ=-50°, Transforming Transducer impedance to 50Ω at 1MHz.		
BII6011BNC-BII7691/1MHz-BII5122BNC	BII6011BNC, Metal Housing (MH) with BNC Jacks as Input and Output; Impedance matching between BII7691 1MHz Transducer and BII5122BNC Power Amplifier at transducer's fs.		
Adaptor Accessories:	Refer to Connector adaptor accessories. Contact BII for bespoke connector adaptor which are not listed in this document.		
	BNC to MIL-C-5015, Underwater Connector, XLR, DIN, SMA, SMC, etc.		

(3) BII6011XLRBNC.
1 kHz to 1 MHz. **Input:** Panel Mounted XLR 3 Male Pins. **Output:** Panel Mounted BNC Jack.



System Block Diagram and Wirings:



How to Order, refer to Ordering Information for explanations of the terms or initials.

BII6011XLRBNC	**-CW Power or Blank**	**-fs-Z_{TX}/θ or BII Transducer PN**	**-Z_{IM} or BII PA PN**
Example of Part Number:	**Description**		
BII6011XLRBNC-200Wrms-50kHz-200Ω/-60°-50Ω	BII6011XLRBNC, Metal Housing (MH); Input Connector: XLR 3 male Pins, Output Connector: BNC Jack; CW Power: 200Wrms; Transducer: fs=50kHz, Z=200Ω, θ=-60°; Transforming Transducer impedance to 50Ω at 50kHz.		
BII6011XLRBNC-BII7623DP-BII5068MIL	BII6011XLRBNC, Metal Housing (MH); Input Connector: XLR 3 male Pins, Output Connector: BNC Jack; Impedance matching between BII7623DP Transducer and BII5068MIL Power Amplifier at transducer's fs.		

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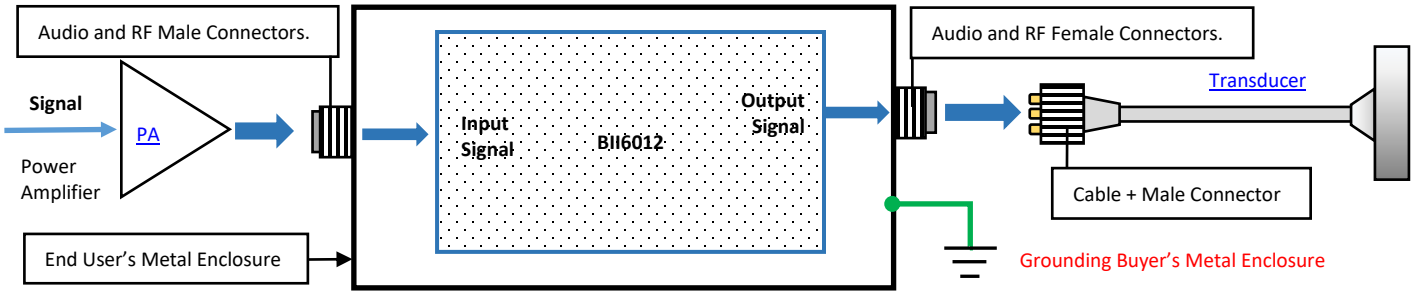
B. BII6012 Series Embedded Component Device.

Metal or Plastic Housing (**MH or PH**) with Four Mounting Holes. 0.3m (1ft) Cable or Wire Bundles, Wire leads.
The device is used as an embedded component. 1 kHz to 10 MHz. Pulse Signal ONLY for high power applications to avoid overheating the device. For example, Pulse Duration PD ≤ 100 mS, Duty Cycle: ≤ 1%, at 3000 W rms, 30 kHz.
Note: Fasteners (Screw, Washer, Nut etc.) for mounting/installation are NOT included.

BII6012: 0.3m (1ft) Cable or Wire Bundles with Wire Leads as Embedded Components.

System Block Diagram



Wiring Information of Cable with Wire Leads and Wire Bundles

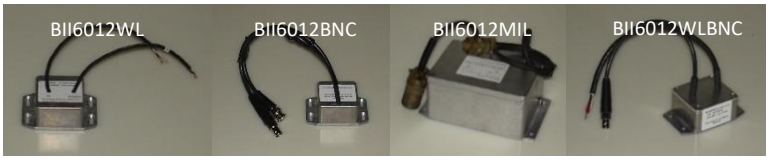
Single-Ended Signal	**Wire Bundle + Wire Leads**	**Shielded Cable + Wire Leads**	**Coaxes + Wire Leads**
Signal	Red Wire	Red or White Wire	Coax Center Contact
Signal Common	Black Wire	Black Wire	Coax Shield
Shielding if any.	---	Shield	
Differential Signal	**Wire Bundle + Wire Leads**	**Shielded Cable + Wire Leads**	
Signal +	Red Wire	Red or White Wire	
Signal -	Black Wire	Black Wire	
Shielding if any.	---	Shield	
Input Cables or Wire Bundles:	Label "1". Cables or Wire Bundles Length of Input are 0.15m (6"), 0.3m (1ft), or 0.6m (2ft).		
Output Cable or Wire Bundles:	Label "0". Cables or Wire Bundles Length of Output are 0.15m (6"), 0.3m (1ft), or 0.6m (2ft).		
Warning: End users MUST install the device inside a metal enclosure and ground the metal enclosure for operating safety.			
BII will choose suitable wire bundles or cables for this device. Buyer does NOT need to specify wire or cable types.			

Ordering Information on Device Parameters (Terms or Initials)

CW Power: Continuous Sinusoidal Signal Power delivered to Transducer from PA, in RMS Watt (Sine/Chirp Pulses, etc.). Pulse Power or Peak Power (Spike or Single Pulse for NDT) can be calculated with the chart Continuous Power Capacity and Pulse Power Capacity. The CW POWER can be ignored with blank if RMS power of the transducer and/or the amplifier is known. In these cases, BII will use RMS power of the transducer and/or the amplifier to design the power capacity of the device; **PW**: Maximum Pulse Width in μS, mS, or S; **D:** Maximum Duty Cycle in %; **fs:** Frequency of Impedance Matching, in kHz or MHz, generally, fs is motional (series) resonance frequency of a transducer; $\boldsymbol{Z_{TX}}$**:** Transducer Impedance, in Ω; **θ:** Transducer Phase in °; $\boldsymbol{Z_{IM}}$**:** Impedance for Optimum Power Transfer from the PA to the Transducer, in Ω; **PA**: Power Amplifier; **TX**: Transducer; **PN:** Part Number. **Refer to Power Amplifier for available options and wirings. Refer to Transducer for available options and wirings.**

How to Order, refer to Ordering Information for explanations of the terms or initials.

BII6012	**-CW Power or Blank**	**-fs-Z_{TX}/θ or BII Transducer PN**	**-Z_{IM} or BII PA PN**
Example of Part Number:	**Description**		
BII6012-500Wrms-30kHz-600Ω/-60°-50Ω	BII6012, Metal or Plastic Housing; CW Power: 500W rms; Transducer: fs=20kHz, Z=500Ω, θ=-60°; Transforming Transducer impedance to 5Ω at 30kHz.		
BII6012-BII7623DP-BII5065	BII6012, Metal or Plastic Housing (MH or PH); Impedance matching between BII7623DP Transducer and BII5065 Power Amplifier at transducer's fs.		



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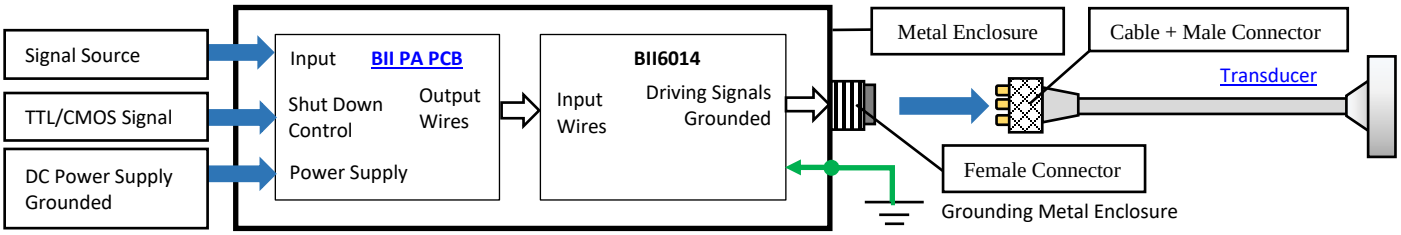
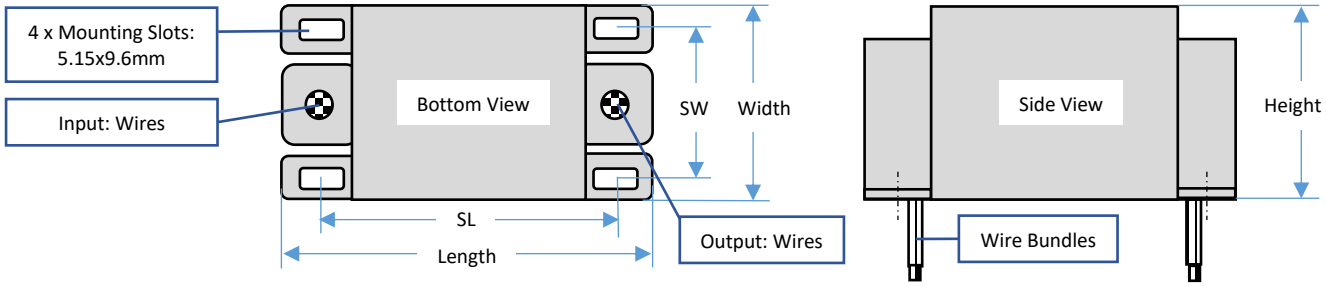
D. BII6014 Embedding Components, High Power in Audio Frequency Range 100Hz to 30kHz, Embedded in Grounded Metal Enclosure.
Metal Bracket with Chassis (**MBC**). Four Mounting Holes; **Input and Output**: 0.3m (1ft) Wire Bundles with Wire Leads.

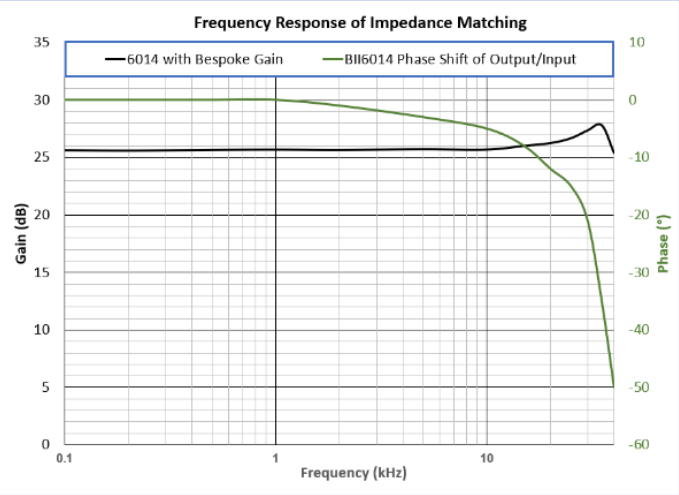
System Block Diagram and Wirings of Embedding Use in Grounded Metal Enclosure.





Physical Size	Length (mm)	Width (mm)	Height (mm)	SL (mm)	SW (mm)	Weight (kg)	Continuous Power (Sinusoidal & Square Signals, etc.), Natural Cooling.	Pulse Power (SINE Pulses, Burst Pulses, Pulse Trains, etc.), Natural Cooling.
Size 1	70	63.5	77.8	43	50.8	≈ 1.15	10 W RMS	Refer to Continuous Power Capacity and Pulse Power Capacity.
Size 2	82.6	63.5	77.8	55.6	50.8	≈ 1.50	15 W RMS	
Size 3	89	63.5	77.8	62	50.8	≈ 1.60	20 W RMS	
Size 4	108	79.5	96.8	74.7	63.5	≈ 3.65	60 W RMS	
Size 5	114	95.3	115.8	84.1	76.2	≈ 6.35	120 W RMS	
Size 6	191	111.3	133.4	149.4	88.9	≈ 12.7	280 W RMS	

Typical Frequency Response.



How to Order. CW Power: Continuous Sinusoidal Signal Power delivered to Transducer from PA, in RMS Watt (Sine/Chirp Pulses, etc.). Pulse Power or Peak Power (Spike or Single Pulse for NDT) can be calculated with the chart Continuous Power Capacity and Pulse Power Capacity. The CW POWER can be ignored with blank if RMS power of the transducer and/or the amplifier is known. In these cases, BII will use RMS power of the transducer and/or the amplifier to design the power capacity of the device; **fs:** Frequency of Impedance Matching, in kHz or MHz, generally, fs is motional (series) resonance frequency of a transducer; $\boldsymbol{Z_{TX}/\theta}$: Transducer Complex Impedance; $\boldsymbol{Z_{IM}}$: Impedance for Optimum Power Transfer from the PA to the Transducer, in Ω; **PA**: Power Amplifier; **TX**: Transducer; **PN:** Part Number. **Refer to Power Amplifier for available options and wirings. Refer to Transducer for available options and wirings.**

BII6014	-CW Power or Blank	-fs-Z_{TX}/θ or BII Transducer PN	-Z_{IM} or BII PA PN
Example of Part Number:	**Description**		
BII6014-60Wrms-8kHz-10kΩ/-60°-5Ω	BII6014, Metal Bracket with Chassis (**MBC**), CW Power: 600Wrms; Transducer: 8kHz, Z=10kΩ, θ=-60°; Transforming transducer's impedance to 5Ω at 8kHz.		
BII6014-BII7623DP-BII5065	BII6014, Metal Bracket with Chassis (**MBC**), Impedance matching between BII7623DP Transducer and BII5065 Power Amplifier at transducer's fs.		

Wiring Information of Wire Bundles with Wire Leads, 0.3m (1ft). **SE:** Single-ended Signal; **DF:** Differential Signal.

Input Signal: SE or DF.		Input Wire Bundle, Wire Leads.		Output Signal: SE	Output Wire Bundle, Wire Leads.			
Signal	Signal +	Yellow	Green/Yellow	Signal	Red	Red	Brown	Brown
Signal Common	Signal -	Black	Black	Signal Common	Blue/Yellow	Bue	Brown/Yellow	Blue/Yellow
Factory Setting: **Signal Common** is floating, NOT grounded. Buyer/End user grounds **signal common** if necessary.								
Warning: Install the device inside a metal enclosure and grounding the metal enclosure for operating safety.								

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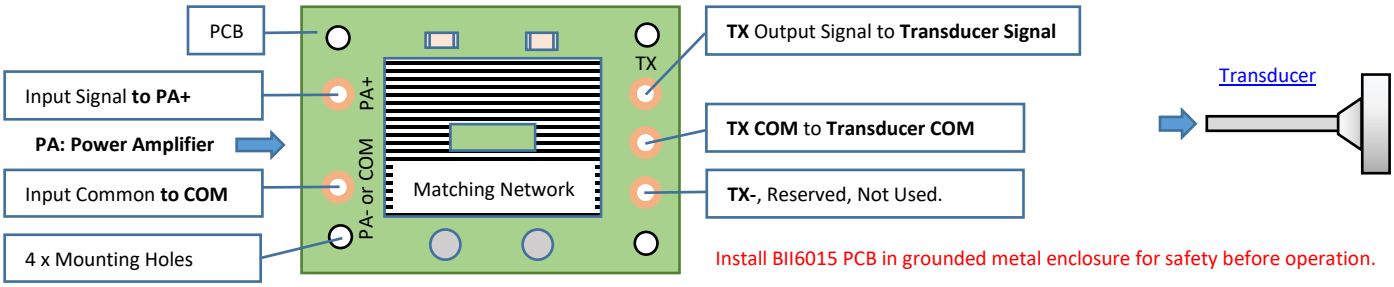
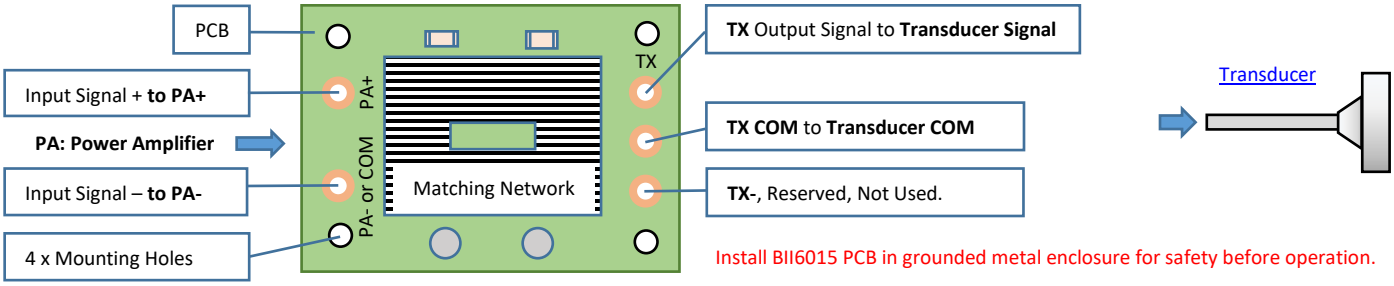
D. BII6015. 3 kHz to 10 MHz. Printed Circuit Board (PCB) with Four Mounting Holes.

(1) Wiring Information to Power Amplifiers with Single Ended Output.



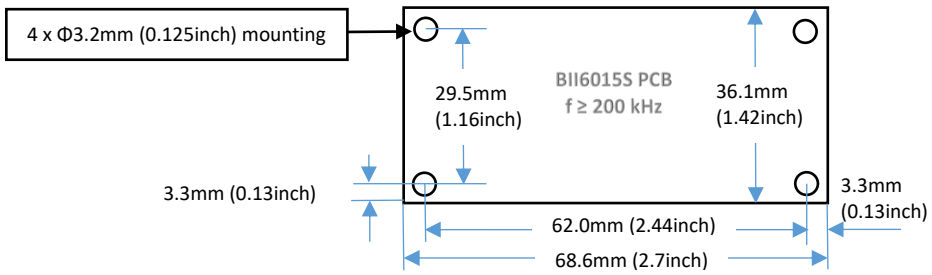
Install BII6015 PCB in grounded metal enclosure for safety before operation.

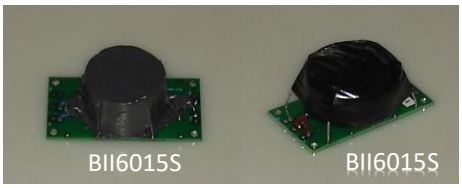
(2) Wiring Information to Power Amplifiers with Differential Outputs.



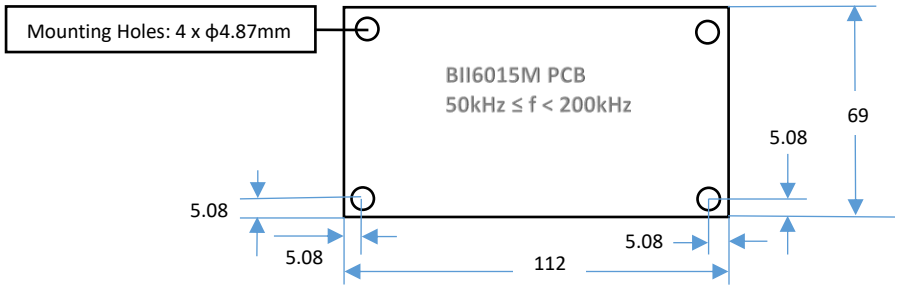
Install BII6015 PCB in grounded metal enclosure for safety before operation.

BII6015S or BII6025S Small PCB. Physical Size: LxW = 68.6x36.1mm, height depends on power rating. Operating frequency ≥ 200 kHz.

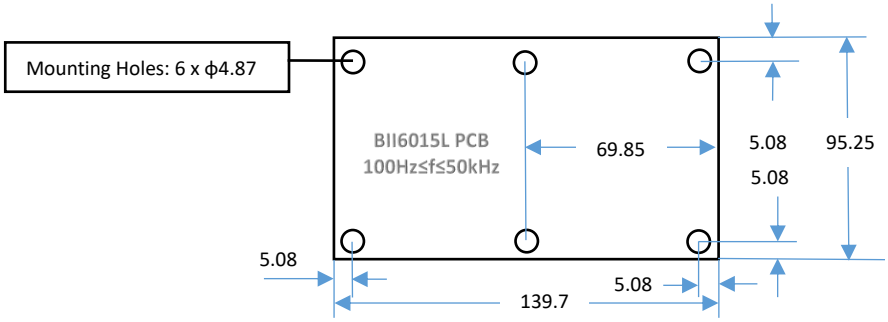




BII6015M or BII6025M Medium PCB. Physical Size: LxW = 112x69mm, height depends on power rating. 50 kHz ≤ Operating frequency ≤ 200 kHz.



BII6015L Large PCB. Physical Size: LxW = 140x95.25mm or 5.5”x3.5”, height depends on power rating. 100 Hz ≤ Operating frequency ≤ 100 kHz.



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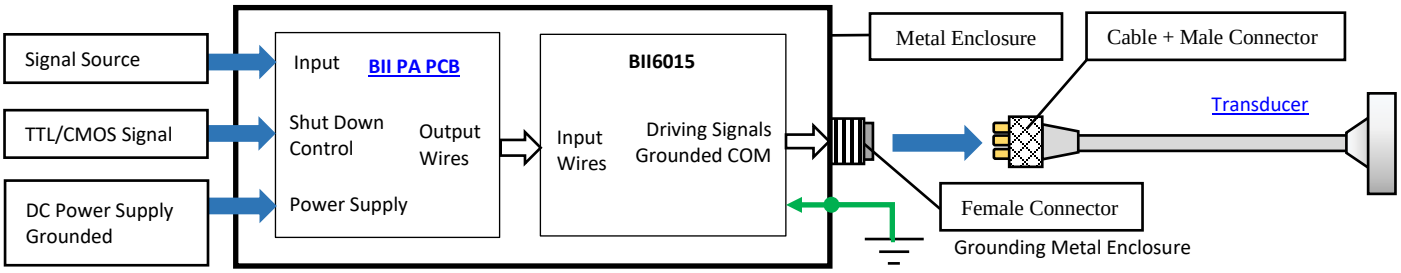
System Block Diagram: BII Power Amplifier (PCB) + BII6015 PCB.



Wirings

Outputs of Power Amplifiers	**Inputs of BII6015**	**Outputs of BII6015**	**Acoustic Transducers or Projector**
Differential Signal	**Round Pads on PCB**	**Round Pads on PCB**	**Transducer Cable**
Output Signal +	"**PA+**" Pad	"**TX**" Pad	Wire or Contact of Driving Signal
Output Signal -	"**PA-**" Pad	"**TX COM**" Pad	Wire or Contact of Driving Signal COMMON
N/A	N/A	"**TX -**" Pad, NOT USED.	N/A
Single-Ended Output	**Round Pads on PCB**	**Round Pads on PCB**	**Transducer Cable**
Output Signal	"**PA+**" Pad	"**TX**" Pad	Wire or Contact of Driving Signal
Output Common	"**COM**" Pad	"**TX COM**" Pad	Wire or Contact of Driving Signal COMMON
N/A	N/A	"**TX -**" Pad, NOT USED.	N/A
Grounding Metal Cases for operating safety.			Grounding Shield of the Transducer Cable.

Ordering Information on Device Parameters (Terms or Initials)

CW Power: Continuous Sinusoidal Signal Power delivered to Transducer from PA, in RMS Watt (Sine/Chirp Pulses, etc.). Pulse Power or Peak Power (Spike or Single Pulse for NDT) can be calculated with the chart Continuous Power Capacity and Pulse Power Capacity. The CW POWER can be ignored with blank if RMS power of the transducer and/or the amplifier is known. In these cases, BII will use RMS power of the transducer and/or the amplifier to design the power capacity of the device; **PW**: Maximum Pulse Width in μS, mS, or S; **D:** Maximum Duty Cycle in %; **fs:** Frequency of Impedance Matching, in kHz or MHz, generally, fs is motional (series) resonance frequency of a transducer; $\boldsymbol{Z_{TX}}$**:** Transducer Impedance, in Ω; **θ:** Transducer Phase in °; $\boldsymbol{Z_{IM}}$**:** Impedance for Optimum Power Transfer from the PA to the Transducer, in Ω; **PA**: Power Amplifier; **TX**: Transducer; **PN:** Part Number. **Refer to Power Amplifier for available options and wirings. Refer to Transducer for available options and wirings.**

How to Order, refer to Ordering Information for explanations of the terms or initials.

BII6015	**-CW Power or Blank**	**-fs-Z_{TX}/θ or BII Transducer PN**	**-Z_{IM} or BII PA PN**

Example of Part Number:	**Description**
BII6015-100Wrms-30kHz-400Ω/-60°-5Ω	BII6015, Printed Circuit Board (PCB), CW Power: 100W; Transducer: 30kHz Transducer, Z=400Ω, θ=-60°; Transforming transducer's impedance to 5Ω at 30kHz.
BII6015-BII7561/600-BII5121	BII6015, Printed Circuit Board (PCB), Impedance Matching between BII7561/600 Transducer and BII5121 Power Amplifier.
Note: BII will choose suitable PCB size to meet the power requirement.	

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E. BII6016, Underwater Mateable Devices.

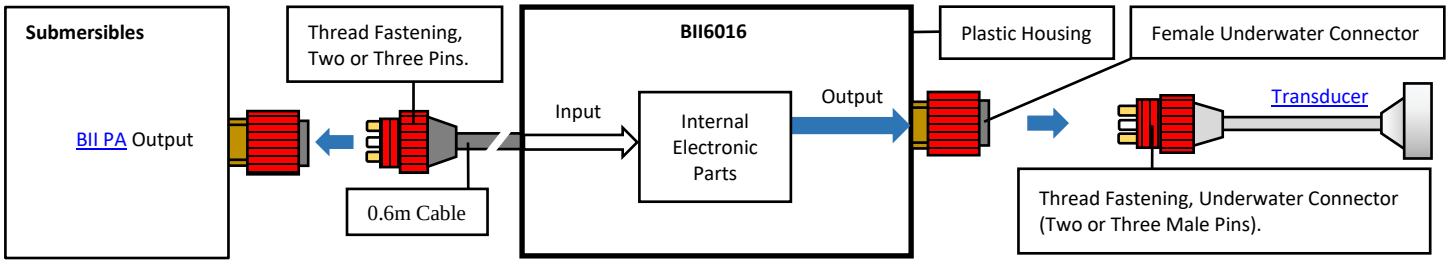
1 kHz to 1 MHz. **Input:** Underwater Mateable 2-Pin or 3-pin Connector with 0.6m Cable (2 ft). **Output:** Panel Mounted Underwater Mateable 2-Socket or 3-Socket Connector. Underwater mateable connectors are made by global underwater connector manufacturers which have sales branches all over the world. Please contact BII for more information about availability, compatibility and manufactures of the connectors.

Secure and fix the device on submersibles: besides the screw, the housing can be used for fastening or clamping to secure the device reliably on submersibles.
Force of Fastening or Clamping around Housing: ≤ 200 N.
Recommended Torque on the Screw: 6.5 Nm.
Installation Accessory: One 3/8"-16 Nut and One Washer (316 SS), included in shipment.
Depth Rating in Water: a. 300 m for Housing ΦOD > Φ60mm. b. 500 m for Housing ΦOD ≤ Φ60mm.
Housing Size ΦOD x H: Determined by BII. Customized with power, operating frequency, and depth ratings.

Notes on Installation: To avoid damage of the surface, the contact surface of end user's mounting parts must be flat, smooth, and free of sharpness and bumpiness. A cushion layer (not provided by BII) is necessary to ensure high quality tightness and contact between transducer surface and end user's mounting frames.

UMC2: Underwater Mateable 2-Contact Connector. **UMC3**: Underwater Mateable 3-Contact Connector. **Connector Gender**: **P**-Pin, Male; **S**-Socket, Female.					
Differential Signal	**UMC2P**	**UMC3P or UMC3S**	**Single-Ended Signal**	**UMC2P or UMC2S**	**UMC3P or UMC3S**
Signal +:	Pin 2	Pin 2	**Signal:**	Contact 2	Pin 2
Signal -:	Pin 1	Pin 1	**Signal Common:**	Contact 1	Pin 1
COM and Grounding:	N/A	Pin 3	**Grounding:**	N/A	Pin 3
Status:	ACTIVE	OBSOLETE	**Status:**	ACTIVE	OBSOLETE
Input Connector are male or pin contacts, **Output Connector** are female or socket contacts.					
Input of BII6016 accepts single-ended or differential signal.					
Output of BII6016 is single-ended signal.					

System Block Diagram and Wirings



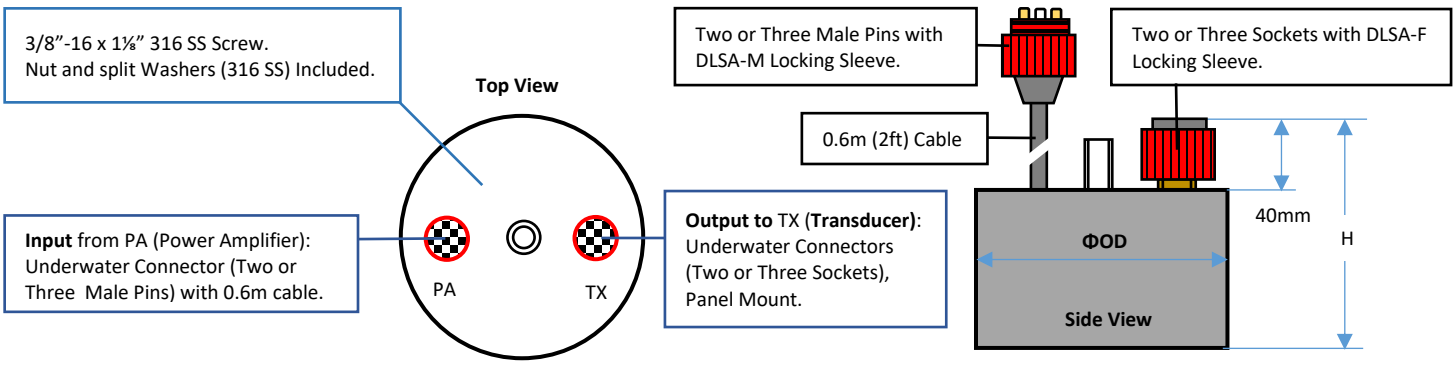
Ordering Information on Device Parameters (Terms or Initials)

CW Power: Continuous Sinusoidal Signal Power delivered to Transducer from PA, in RMS Watt (Sine/Chirp Pulses, etc.). Pulse Power or Peak Power (Spike or Single Pulse for NDT) can be calculated with the chart Continuous Power Capacity and Pulse Power Capacity. The CW POWER can be ignored with blank if RMS power of the transducer and/or the amplifier is known. In these cases, BII will use RMS power of the transducer and/or the amplifier to design the power capacity of the device; **PW**: Maximum Pulse Width in μS, mS, or S; **D:** Maximum Duty Cycle in %; **fs:** Frequency of Impedance Matching, in kHz or MHz, generally, fs is motional (series) resonance frequency of a transducer; Z_{TX}**:** Transducer Impedance, in Ω; **θ:** Transducer Phase in °; Z_{IM}**:** Impedance for Optimum Power Transfer from the PA to the Transducer, in Ω; **PA**: Power Amplifier; **TX**: Transducer; **PN:** Part Number. **Refer to Power Amplifier for available options and wirings. Refer to Transducer for available options and wirings.**

How to Order, refer to Ordering Information for explanations of the terms or initials.

BII6016	**-Connector Contacts**	**-CW Power or Blank**	**-fs-Z_{TX}/θ or BII Transducer PN**	**-Z_{IM} or BII PA PN**
Example of Part Number:		**Description**		
BII6016-UMC2-50Wrms-30kHz-400Ω/-60°-50Ω.		BII6016, Plastic Housing with Underwater Mateable 2-contacts Connectors as Input and Output. CW Power: 500Wrms. Transducer: 30kHz, Z=400Ω, θ=-60°; Transforming transducer impedance to 50Ω at 30kHz.		
BII6016-UMC2-30kHz-400Ω/-60°-BII5062.		BII6016, Plastic Housing with Underwater Mateable 2-contacts Connectors as Input and Output. Transducer: 30kHz, Z=400Ω, θ=-60°; Impedance matching to BII5062 Power Amplifier.		
BII6016-UMC2-BII7562/200-BII5121.		BII6016, Plastic Housing with Underwater Mateable 2-contacts Connectors as Input and Output. Impedance matching between BII7562/200 Transducer and BII5121 Power Amplifier.		

Outline Drawing



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Adaptor Accessory

A8 MIL-SUMC, MIL-5015 (3 Pins) to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size: Φ22x28mm)

MIL-5015 3 Pin — Default: 10 m (32.8 ft) — Underwater Connector, 2 Sockets. Contact 2: Signal. Contact 1: Common. → Transducer with 2-Pin Underwater Connector and MCDLS-F Locking Sleeve.

A9 MIL-UMCF3S, MIL-5015 (3 Pins) to UMC3S (Underwater Connector, 3 Sockets, Locking Sleeve: DLSA-F, Size: Φ35.5x33.5mm)

MIL-5015 3 Pin — Default: 10 m (32.8 ft) — Underwater Connector, 3 Sockets. Contact 2: Signal. Contact 1: Common. Contact 3: Shielding and Grounding. → Transducer with 3-Pin Underwater Connector and DLSA-M Locking Sleeve.

A10 MIL-SUMC3S, MIL-5015 (3 Pins) to Small UMC3S (Underwater Connector, 3 Sockets, Thread Locking, Size: Φ22x28mm)

MIL-5015 3 Pin — Default: 10 m (32.8 ft) — Underwater Connector, 3 Sockets. Contact 2: Signal. Contact 1: Common. Contact 3: Shielding and Grounding. → Transducer with 3-Pin Underwater Connector and MCDLS-F Locking Sleeve.

A11 MIL-UMCF2S, MIL-5015 (3 Pins) to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size: Φ35.5x33.5mm)

MIL-5015 3 Pin — Default: 10 m (32.8 ft) — Underwater Connector, 2 Sockets. Contact 2: Signal. Contact 1: Common. → Transducer with 2-Pin Underwater Connector and DLSA-M Locking Sleeve.

A12 MIL-SUMC2S, MIL-5015 (3 Pins) to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size: Φ22x28mm)

MIL-5015 3 Pin — Default: 10 m (32.8 ft) — Underwater Connector, 2 Sockets. Contact 2: Signal. Contact 1: Common. → Transducer with 2-Pin Underwater Connector and MCDLS-F Locking Sleeve.

A13 BNC-MIL, BNC Male (Pin) to MIL3S (MIL-5015 type 3-Socket Connector Thread Fastening)

BNC Male — 0.6 m (2 ft) RG58 Coax — MIL-5015 Connector, 3 Sockets. Contact C or G: Signal. Contact B: Common. Contact A: Shielding and Grounding. → Transducer with 3-Pin MIL-5015 Connector.

A14 BNC-UMCF3S, BNC Male to UMC3S (Underwater Connector, 3 Sockets, Locking Sleeve: DLSA-F, Size: Φ35.5x33.5mm)

BNC Male — Default: 10 m (32.8 ft) — Underwater Connector, 3 Sockets. Contact 2: Signal. Contact 1: Common. Contact 3: Shielding and Grounding. → Transducer with 3-Pin Underwater Connector and DLSA-M Locking Sleeve.

A15 BNC-SUMC3S, BNC Male to Small UMC3S (Underwater Connector, 3 Sockets, Thread Locking, Size: Φ22x28mm)

BNC Male — Default: 10 m (32.8 ft) — Underwater Connector, 3 Sockets. Contact 2: Signal. Contact 1: Common. Contact 3: Shielding and Grounding. → Transducer with 3Pin Underwater Connector and MCDLS-F Locking Sleeve.

A16 BNC-UMCF2S, BNC Male to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size: Φ35.5x33.5mm)

BNC Male — Default: 10 m (32.8 ft) — Underwater Connector, 2 Sockets. Contact 2: Signal. Contact 1: Common. → Transducer with 2-Pin Underwater Connector and DLSA-M Locking Sleeve.

A17 BNC-SUMC2S, BNC Male to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size: Φ22x28mm)

BNC Male — Default: 10 m (32.8 ft) — Underwater Connector, 2 Sockets. Contact 2: Signal. Contact 1: Common. → Transducer with 2-Pin Underwater Connector and MCDLS-F Locking Sleeve.

Wiring Information of In-line Connectors (Adaptor Accessories)

UMC2: Underwater Mateable 2-Contact Connector. **UMC3**: Underwater Mateable 3-Contact Connector. **MIL3**: MIL-5015 type 3-contact Connector. **XLR3**: XLR 3-contact Connector. **Connector Gender**: **P or M,** Pin, Male; **S or F,** Socket, Female.

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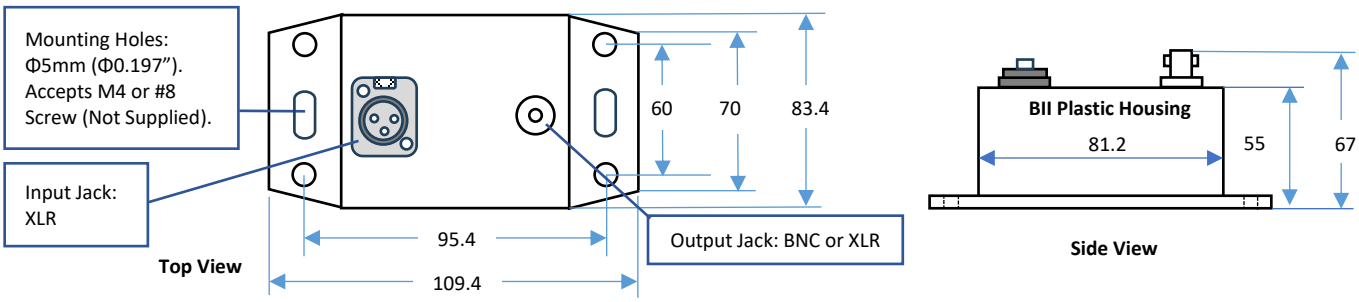
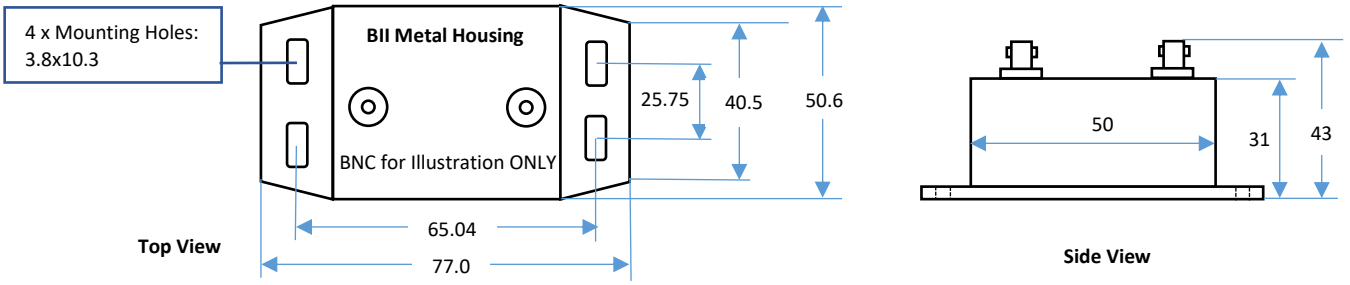
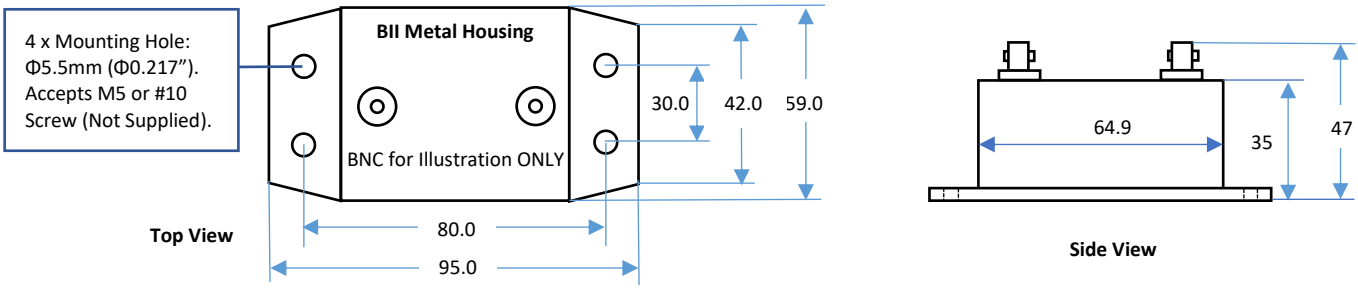
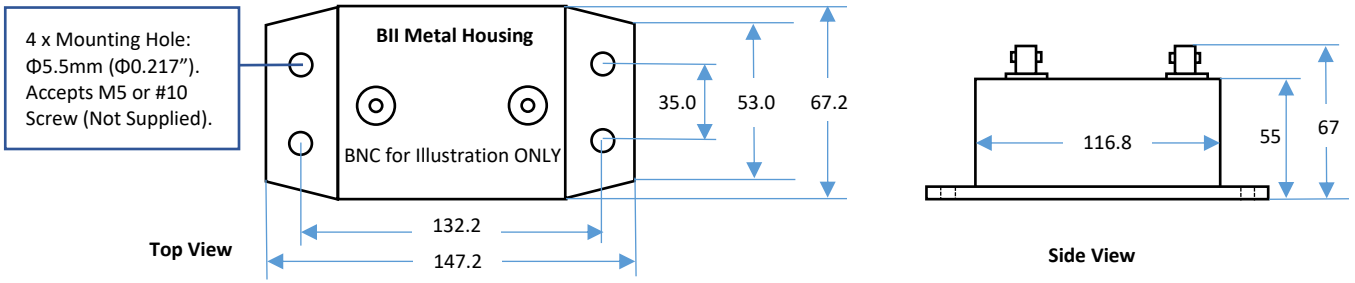
Single-Ended Signal	UMC2P or UMC2S	UMC3P or UMC3S	MIL3P or MIL3S	DIN3P or DIN3S	XLR3P or XLR3S	BNC
Signal	Contact 2	Contact 2	Contact C or G	Contact 3	Contact 2	Center Conductor
Signal Common	Contact 1	Contact 1	Contact B	Contact 1	Contact 3	BNC Shell Body
Grounding	N/A	Contact 3	Contact A	Contact 2	Contact 1	BNC Shell Body
Differential Signal	**UMC2P or UMC2S**	**UMC3P or UMC3S**	**MIL3P or MIL3S**	**DIN3P or DIN3S**	**XLR 3-contact Connector**	
Signal +	Contact 2	Contact 2	Contact C or G	Contact 3	Contact 2	
Signal -	Contact 1	Contact 1	Contact B	Contact 1	Contact 3	
COM and Grounding	N/A	Contact 3	Contact A	Contact 2	Contact 1	

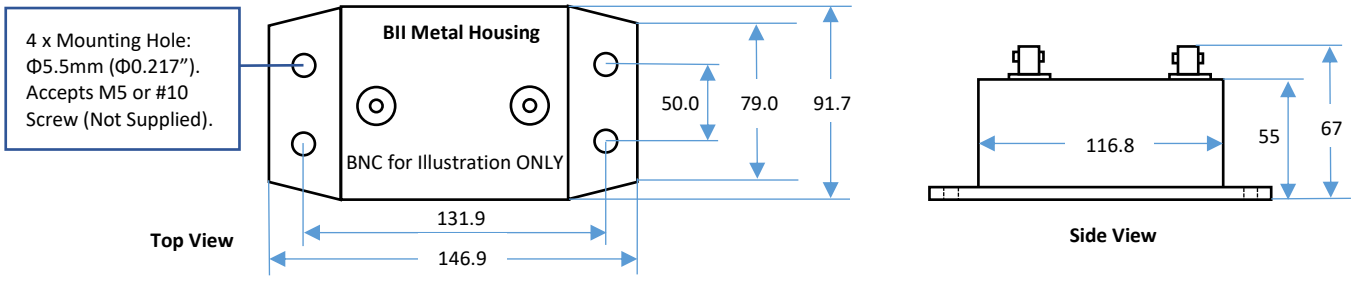
Metal or Plastic Housings Outline Dimensions (mm), Illustration only, the scale is not 1:1.











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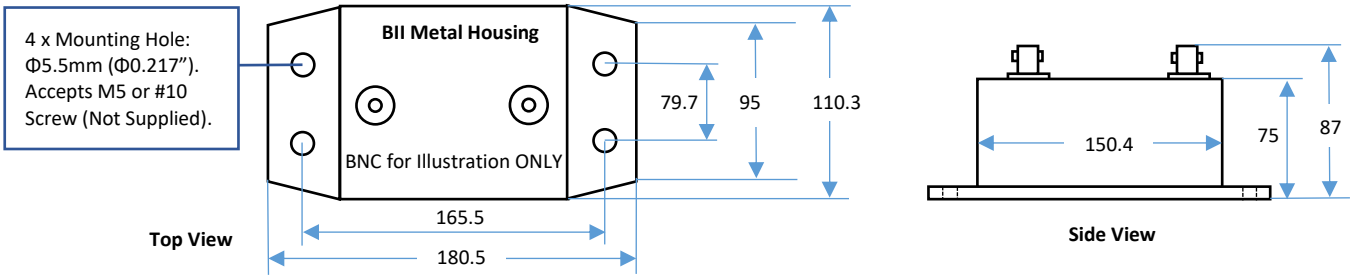
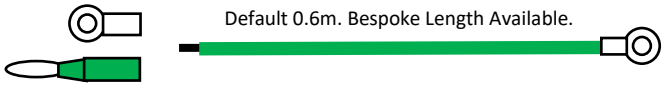


Grounding Cable and Terminals

Grounding Cable, Part Number: GWL18 or GWL16, Support Single-Point Grounding with Multiple Devices.
One 0.6m AWG 18 or AWG 16 Green Wire with #10 Ring Terminal and Wire Lead. One #10 Ring Terminal and one 4mm Banana Plug (Green) are included.
Depending on buyer's grounding terminal type, buyer assembles #10 Ring Terminal, 4mm Banana Plug, or other type connector to grounding cable at buyer's cost.

Terminal to buyer's Grounding Terminal:
a. Default: Wire Lead
b. One #10 Ring Terminal
c. One 4mm Banana Plug



#10 Ring Terminal
#10-24 nut and #10 washer included.

Cable and Connector Information for High Power Signals (from Power Amplifier and to Transducers). Non-UL Uses.

Cable/Wire Options:	**Wire and Cable Types**	**Ratings of Voltage, Current or Power, and Temperature.**
	AWG18 Wires (**WR**)	3000 Vrms, 10 Arms.
	Two Conductor Shielded Cable (**SC**)	600 Vrms, 5 Arms. -50°C To +90°C, or -58°F to 194°F.
	Two Two-conductor Shielded Cable Bundle (**2SC**)	600 Vrms, 10 Arms. -50°C To +90°C, or -58°F to 194°F.
	High Temperature Shielded Cable (**HTSC199**)	600 Vrms, 6 Arms, up to +199°C or 390 °F, Non-waterproof.
	Coax RG58 (50Ω) (**RG58**)	1400 Vrms, 4 Arms. -40°C To +80°C or -40°F to 176°F.
	Coax RG174/U (50Ω) (**RG174**)	1100 Vrms, 1.6 Arms. -40°C To +75°C or -40°F to 167°F.
	Coax RG178B/U (50Ω) (**RG178**)	750 Vrms, 0.86 Arms, -70°C To +200°C or -94°F to 392°F.
Connector Options: (In-line or Panel Mount)	**Connector Type**	**Ratings of Voltage, Current or Power, and Temperature.**
	1. Wire Leads (**WL**)	Used for Cables or Wires.
	2. 50Ω BNC (**BNC**), Bayonet Lock. Panel Mount or In-line. In-line BNC: Input uses Pin, output uses Socket. Panel Mount BNC: Both Input and Output use BNC Jacks.	500Vrms, 316W. Used for Grounded Signal with Metal Enclosures or Coax Cables.
	3. MIL-5015 Type Connector (**MIL**), Thread Fastening. Panel Mount or In-line. Input uses Pin, output uses Socket.	500Vrms, 13 A; Up to +125°C or 257°F, or, 900Vrms, 13 A; Up to +125°C or 257°F. Used for Metal Enclosures or Shielded Cables.
	4. Circular Connector DIN EN (**DIN**), Thread Fastening. Panel Mount or In-line. Input uses Pin, Output uses Socket.	250Vrms, 10 A; -40°C to +100°C or -40°F to 212°F. Used for Metal Enclosures or Shielded Cables.
	5. XLR Connector (**XLR**), Positive Latchlock. Panel Mount or In-line. Input uses Pin, Output uses Socket.	133Vrms, 15 A; -25°C to +75°C or -13°F to +167°F. Used for Metal Enclosures or Shielded Cables.
	6. Underwater Mateable Connector (**UMC**), Thread Fastening. Panel Mount or In-line. Input uses Pin, Output uses Socket.	600Vrms, 10A. Waterproof, IP68. Used for Metal Enclosures or Shielded Cables.
	Adaptor Accessory: a device support different connectors.	

How to Choose Cable and Connector for BII Devices:

Driving Voltage V_{drive} (V_{rms}) = $\sqrt{RMS\ Power * \frac{G}{G^2+B^2}}$. BII lists G-B data at fs and/or the graph of G-B vs Frequency in online datasheet.

Case 1. Deliver 1000 Wrms to 3 kΩ transducer at f_s. Note: $G/(G^2+B^2)$=3 kΩ is the resistive load of the transducer in load medium at f_s.
Driving voltage to transducer $V_{drive} = \sqrt{1000 * 3000}$ = 1732 V_{rms}. The current to 3 kΩ transducer $I_{drive} = V_{drive}/R_L$ = 1732Vrms/3000Ω = 0.57733 A_{rms}.
Therefore, AWG18 Wire and Wire leads are suitable.

Case 2. Deliver 500 Wrms to 300 Ω transducer at f_s. Note: $G/(G^2+B^2)$=300 Ω is the resistive load of the transducer in load medium at f_s.
Driving voltage to transducer $V_{drive} = \sqrt{500 * 300}$ = 387.3 V_{rms}. The current to 300 Ω transducer $I_{drive} = V_{drive}/R_L$ = 387.3Vrms/300Ω = 1.291 A_{rms}.
Therefore, Two Conductor Shielded Cable and MIL-5015 Type Connector or Underwater Mateable Connector (UMC) are suitable.

Case 3. Deliver 300 Wrms to 50 Ω transducer at f_s.
Driving voltage to transducer $V_{drive} = \sqrt{300 * 50}$ = 122.5 V_{rms}. The current to 50 Ω transducer $I_{drive} = V_{drive}/R_L$ = 122.5Vrms/50Ω = 2.45A_{rms}.
Therefore, (1) 50Ω RG58 Coax and BNC are suitable for whole frequency range.
(2) Two Conductor Shielded Cable and XLR Connector are suitable when f ≤ 1MHz.

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Questions

How do I assemble #10 Ring Terminal or 4mm Banana Plug to Grounding Cable?

1. for #10 Ring Terminal, crimp or solder is acceptable. Please choose a suitable crimp tool for crimping connector and cable, or a suitable solder station for soldering.
2. for 4mm Banana Plug, solder is acceptable. Please choose a suitable solder station for soldering.

What if the connector of my transducer/projector is SMA or SMC Connector?

Buyer may order a BNC to SMA (or SMC) adaptor from local electronic distributors in buyer's country. BII may ship the adaptor as accessory of the device. Please discuss with BII for customizations.

What if the connector of my transducer/projector is NOT MIL-5015 type connector with pins?

Buyer may order a MIL-5015 Connector (Pins) from BII to replace original transducer connector or use it as a component of the connector adaptor. MIL-5015 Connector has solder contacts. A buyer may also order the connector from local electronic distributors in buyer's country. For example, if you have a transducer with Underwater connector (pin), XLR (Pin), or DIN (Pin), you may make a connector adaptor from MIL-5015 (pin) to Underwater connector (Socket), XLR (Socket), or DIN (Socket). BII may make bespoke connector adaptor as accessory of the device. Please discuss with BII for customizations.

How do I connector the wire of BII6000 device to my devices?

WARNING: HIGH VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. DO NOT TOUCH THE DEVICE, ITS WIRES, CABLES, AND CONNECTORS BEFORE THE POWER SUPPLIES AND SIGNAL SOURCES ARE SHUT DOWN.

1. **Wire Splicing Methods: Soldering or Crimp**.
2. **Proper Insulation for Safety**: All exposed bare wires, metal wires, wire leads, solders, and joints are insulated with insulation material such as heat shrink tubing, fully insulated wire splice connector, etc. The insulation voltage must be greater than twice the maximum voltage of the device. 3. **Grounding the device** (including metal chassis and/or metal housing, cable shield, etc.) firmly for operation safety.

Can BII explain how to choose Impedance matching for Broadband Acoustic System (Low Quality Factor) and Narrowband Acoustic System (High Quality Factor)?

Generally there are two kind of acoustic system: Broadband (Low Q) and Narrowband (High Q).

Narrowband Acoustic System possesses merits of high quality factor, and very low energy loss on the device itself. High sound energy with high efficiency can be delivered to subjects such as HIFU system, Ultrasonic Degassing/Cleaning/Physical & Chemical Processing, etc.. Generally the sounds are continuous sounds, or burst sounds with pulse width greater than 200ms. **Broadband Acoustic System** possesses merits of low quality factor, wide bandwidth, much shorter "ringing" to reach stable state. High sound energy with low or median efficiency can be delivered to subjects such as Ultrasonic NDT system, SONAR Echo-sounding, Communication, AE Detection, etc.. Generally the sounds are pulsing sounds, burst sounds with pulse width of 10nS to 10ms, or continuous/burst communication signals.

BII chooses BII6010 parts (Low Q broadband or High Q Narrowband) suitable for BII transducers. When buyer orders BII6010 for buyer's own transducers, buyer should specify Low Q or High Q BII6010 clearly when ordering.