Hydrophone and Ultrasonic Preamplifier

BII's low noise low power preamplifiers (amplifiers) have built-in filters, and their gains are fixed or programmable with digital and analog control. These preamplifiers (amplifiers) are custom-fit for use in broadband (wideband) underwater SONAR, ultrasonic (Ultrasound, NDT, AE) system and material study.

Typical Applications

Hydrophone, SONAR, Underwater Communication, Navigation. Seafloor-mapping, Sub-bottom Investigation, Sediment Profiler, Acoustic Image. Streamer/Towed Array, Sonobuoy, Target Strength Testing.	Ultrasonic (Ultrasound, AE, NDT) Testing, Material Characterization. Low Noise Ultrasonic Preamplifier, Instrumentation, Pulse Amplifier. Sonic Cavitation Noise.

BII1080 Series Low Noise Preamplifier: 1 Hz to 2.2 MHz, 5.2 nV/√Hz, 3.1 (fA/√Hz).

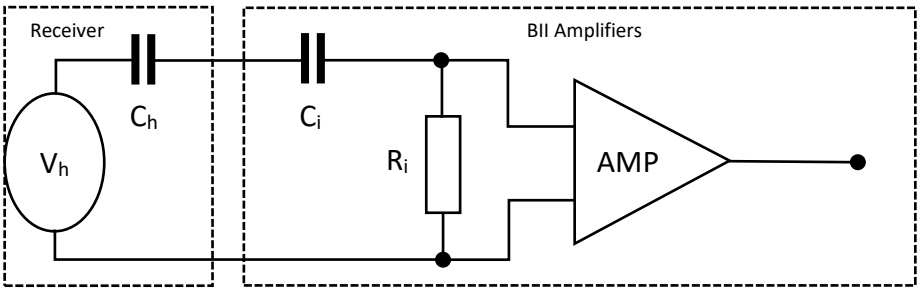
Specification

HPF: High Pass Filter; **BPF**: Band Pass Filter; **LPF**: Low Pass Filter. **SE**: Single-ended, **DF**: Differential. **RTI**: Referred to the input of the preamp. R_i: Input Impedance. V_s: Supply Voltage. I_Q: Quiescent Current; V_{omax}: Output Voltage Swing; Z_0: Output Impedance. **TRS:** 3.5 mm TRS Jack.

Low Noise Preamplifier:	**BII1081**		**BII1082**	
Input Signal Type:	Differential (**DF**)	Single Ended (**SE**)	Differential (**DF**)	Single Ended (**SE**)
Input Referred Noise: (f ≥ 1 kHz)	Refer to Input Referred Noise.			
	Gain ≥ 20 dB: e_n = 5.2 (nV/√Hz), i_n = 3.1 (fA/√Hz).			
	Gain = 10 dB: e_n = 12.0 (nV/√Hz), i_n = 3.1 (fA/√Hz).			
	Roughly, electronic noise density at input, RTI, $V_n^2 = e_n^2 + [\, i_n$ * impedance of the transducer (or hydrophone)$]^2$.			
Input Impedance R_i: (Differential Input Signal)	≤ 44 MΩ at Gain ≤ 40 dB.	≤ 22 MΩ at Gain ≤ 40 dB.	≤ 44 MΩ at Gain ≤ 40 dB.	≤ 22 MΩ at Gain ≤ 40 dB.
	≤ 5 MΩ at Gain = 40 ~ 60 dB.	≤ 2.5 MΩ at Gain = 40 ~ 60 dB.	≤ 5 MΩ at Gain = 40 ~ 60 dB.	≤ 2.5 MΩ at Gain = 40 ~ 60 dB.
	Specify R_i when ordering to set up -3dB high pass filter frequency with Capacitance C_h of a piezoelectric sensor.			
	When input signal is single-ended, Input Impedance Ri is half stated value.			
Maximum Input:	2.4 Vpp or (Maximum Output V_{omax})/Gain, whichever is less.			
Built-in Filter:	White noise level is proportional to the square root of bandwidth.			
	Filters of Preamps. Both oceanic ambient noises and the self-noises of electronic devices decrease when frequency increases. It is recommended to choose a built-in high pass filter to reject noises in low frequency range. For example, if you are interested in the signals greater than 1 kHz, you may specify a high pass filter of a preamp with -3dB cut-off frequency 100 Hz to improve signal to noise ratio of the signals of the interest.			
	HPF: First Order; **LPF:** Second Order.			
	A High Pass Filter Consisting of Standalone Piezoelectric Hydrophones and Standalone Preamps. **-3dB High Pass Frequency:** $f_{-3dBH} = 1/(2\pi R_i C_h)$. that is, $R_i = 1/(2\pi f_{-3dBH} * C_h)$. R_i: Input Resistance or Impedance of Preamp. C_h: Capacitance of piezoelectric hydrophone/sensor/transducer at 1 kHz (non-resonance measurement) or f_s (resonance measurement such as NDT pulsing system). For example: (1) A differential hydrophone 10nF at 1kHz and preamp R_i 44MΩ constitute high pass filter with -3dB frequency 0.36Hz. (2) A single-ended hydrophone 10nF at 1kHz and preamp R_i 10MΩ constitute high pass filter with -3dB frequency 3.18Hz.			
Gain Options:	10, 20, 40, or 50 dB.		20, 40, or 60 dB.	
	Note: Gain < 20 dB is available with higher **Input Referred Voltage Noise**. Refer to Input Referred Noise.			
-3dB Bandwidth:	Refer to Frequency Response.			
	(1). 1 Hz to 2.2 MHz at Gain ≤ 40 dB. (2). 1 Hz to 0.6 MHz at Gain at 50 or 60 dB.			
Settling Time, 0.1%:	48 ns			
Output Signal Type:	Single-ended (**SE**)		Differential or Balanced (**DF**)	
Output Impedance:	50 Ω.		10 Ω.	
Maximum Output V_{omax}:	V_{omax} = (Supply Voltage Vs - 4), in Vpp.			
Cable Driving Capability:	1. 50Ω-Impedance Matching Coaxial Cable System: ≥ 300m.			
	2. Custom-fit Cable Length up to 305 m or 1000 ft, refer to Cable-Drive Capability. The chart is based on 5Vpp Sinusoidal signals. Maximum cable length which a hydrophone can drive is proportional to output voltage level of the hydrophone.			
Supply Voltage Vs:	+7.5 to +20 VDC			
Current (Quiescent):	13 mA		17 mA	
Suggested DC Supply:	+9VDC Batteries, 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.			
Operating Temperature:	-40 to 60 °C or -40 to 140 °F			
Storage Temperature:	-40 to 60 °C or -40 to 140 °F			

Equivalent Input Circuit Model of BII Amplifiers.

V_h: Voltage of Receiver under sound Pressure; C_h: Capacitance of piezoelectric hydrophone/sensor/transducer at 1 kHz (non-resonance measurement) or f_s (resonance measurement such as NDT pulsing system). R_i: Input Resistance or Impedance of Preamp.



-3dB frequency of High Pass Filter at input
$= 1/(2\pi * R_i * C_h * C_i/(C_h+C_i))$

1. How to Order Preamp with PCB.

(1) Standard BII1081 and BII1082, Coated PCB. BII keeps standard parts in stock.

Part Number	-Input Type	-Gain	-R_i Input Impedance, Refer to R_iC_h Filter.	-LPF	-PCB
BII1081	DF	40 dB.	44 MΩ	Low Pass Filter: 2.2 MHz.	Coated PCB
	SE		22 MΩ		
BII1082	DF		44 MΩ		
	SE		22 MΩ		
Example:		**Description:**			
BII1081-DF-40dB-44MΩ-2.2MHz-PCB:		BII1081 Preamp, Input: Differential, 40dB Gain, Input Impedance: 44MΩ, -3dB Low Pass Filter: 2.2MHz, Coated PCB.			
BII1081-SE-40dB-22MΩ-2.2MHz-PCB:		BII1081 Preamp, Input: Single-ended, 40dB Gain, Input Impedance: 22MΩ, -3dB Low Pass Filter: 2.2MHz, Coated PCB.			
BII1082-DF-40dB-44MΩ-2.2MHz-PCB:		BII1082 Preamp, Input: Differential, 40dB Gain, Input Impedance: 44MΩ, -3dB Low Pass Filter: 2.2MHz. Coated PCB.			
BII1082-SE-40dB-22MΩ-2.2MHz-PCB:		BII1082 Preamp, Input: Single-ended, 40dB Gain, Input Impedance: 22MΩ, -3dB Low Pass Filter: 2.2MHz, Coated PCB.			

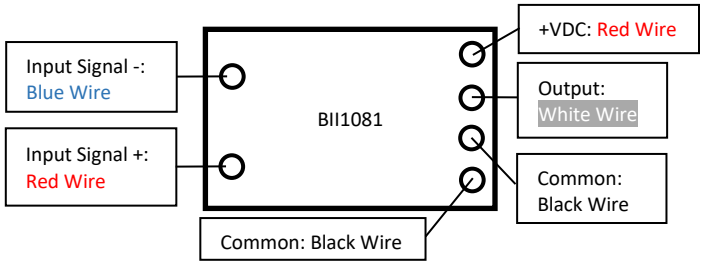
(2) How to Order Bespoke Preamplifiers (Coated PCB).

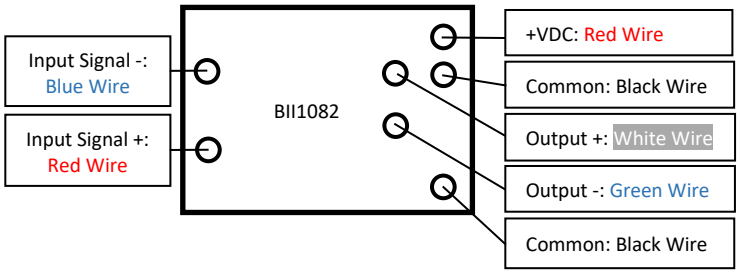
Part Number	-Input Type	-Gain	-R_i Input Impedance	-LPF	-PCB
BII1081	DF	Gain in dB.	$R_i = 1/(2\pi f_{-3dBH} * C_h)$, Refer to R_iC_h Filter.	-3dB Low Pass Frequency, in Hz, kHz, or MHz.	Coated PCB
	SE				
BII1082	DF				
	SE				
Example:			**Description:**		
BII1081-DF-20dB-20MΩ-1MHz-PCB:		BII1081 Preamp, Input: Differential, 20dB Gain, Input Impedance: 20MΩ, -3dB Low Pass Filter: 1MHz, Coated PCB.			
BII1081-SE-40dB-10MΩ-200kHz-PCB:		BII1081 Preamp, Input: Single-ended, 40dB Gain, Input Impedance: 10MΩ, -3dB Low Pass Filter: 200kHz, Coated PCB.			
BII1081-DF-50dB-1MΩ-600kHz-PCB:		BII1081 Preamp, Input: Differential, 50dB Gain, Input Impedance: 1MΩ, -3dB Low Pass Filter: 600kHz, Coated PCB.			
BII1082-DF-20dB-20MΩ-1MHz-PCB:		BII1082 Preamp, Input: Differential, 20dB Gain, Input Impedance: 20MΩ, -3dB Low Pass Filter: 1MHz, Coated PCB.			
BII1082-SE-40dB-10MΩ-200kHz-PCB:		BII1082 Preamp, Input: Single-ended, 40dB Gain, Input Impedance: 10MΩ, -3dB Low Pass Filter: 200kHz, Coated PCB.			
BII1082-DF-60dB-1MΩ-600kHz-PCB:		BII1082 Preamp, Input: Differential, 60dB Gain, Input Impedance: 1MΩ, -3dB Low Pass Filter: 600kHz, Coated PCB.			

(3) Coated PCB with Wires and Wire Leads.

BII1080 Series	BII1081	BII1082
Input Wiring:	5cm wires, twisted.	
	Differential Input Wiring: **Red**: Input Signal +; **Blue**: Input Signal -; **Input signal common**: Power Supply Common, **Black**.	
	Single-ended Input Wiring: **Red**: Input Signal; **Blue**: Input Common and wire **Blue Wire** to **Power Supply Common.**	
Output Wiring:	5cm wires, twisted.	5cm wires, twisted.
	White: Output Signal. **Black**: Output Common.	White: Output Signal +; **Green**: Output Signal -. **Black**: Output Common.
Power Supply Wiring:	5cm wires, twisted. **Red**: +VDC; **Black**: Common. **Common of DC Power Supply is the commons of input and output.**	
Size:	Coated PCB LxWxH = 33x10x5 mm	Coated PCB LxWxH = 40x10x5 mm
Weight:	6 grams	9 grams

(4) Coated PCB Wiring: "Output –" is the reverse (180° phase difference) of "Output +". "Output –" MUST NOT be connected to Common or Ground.
Signal Input Type of Coated PCB: Differential, either single ended (**SE**) or differential (**DF**) input signals are accepted. Refer to Input Wiring.





2. Metal or Plastic Housing with Four Mounting Holes.

(1) Wirings

1. **BNC**: "Bayonet Neill–Concelman", miniature quick connect/disconnect radio/audio frequency connector used for coaxial cable. **Fastening Type**: Bayonet Lock.
2. **XLR**: Employed for balanced audio interconnections, 3 to 7 contacts. **Fastening Type**: Latch Lock. Only supported by BII Plastic Housing because of its large size.
3. **3.5mm TRS** stand for Tip, Ring, and Sleeve, miniature, quick connect/disconnect audio frequency connector used for shielded cable. **Fastening Type**: None.
4. **DIN**: Electrical cylindrical connectors, 3 to 14 contacts, Φ20mm diameter, used for audio, RF, digital, and DC or AC power signals. **Fastening Type**: Threaded.
5. **DC Power Connector**: Supply DC voltage and current to devices, miniature, quick connect/disconnect, used for shielded cable. **Fastening Type**: None.

Packages:	**Signal Type**	**Small Metal Housing with Four Mounting Holes**	**Large Metal or Plastic Housing with Four Mounting Holes**
Input Connector:	Single Ended	BNC Jack (**BNC**)	BNC Jack (**BNC**)
	Differential	3.5 mm (1/8") TRS Jack (**TRS35**)	XLR Plug with with 3 Sockets (**XLR**)
Output Connector:	Single Ended	BNC Jack (**BNC**)	BNC Jack (**BNC**)
	Differential	3.5 mm (1/8") TRS Jack (**TRS35**)	XLR Plug with with 3 Sockets (**XLR**)
Power Supply:	DC Power Connector Jack on Housing. Options of Power Supply Cable: DCBP24, DCBS18V.		
Size LxWxH (mm):	77x50.6x33 (No BNC Jacks) or 77x50.6x43 (with BNC Jacks)		109.45x83.4x65 (No BNC Jacks) or 109.45x83.4x67 (with BNC Jacks)
Weight:	100 grams ± 10%		150 grams ± 10%
Accessories:	A1: Bespoke length RG58, RG174, or RG178 Coax with BNC Male to BNC Male. A2: Bespoke length cable with 3.5mm TRS Plug to 3.5mm TRS Plug. A3: Bespoke length cable with 3.5mm TRS Plug to Wire Leads. A4: Bespoke length cable with 3.5mm TRS Plug to XLR Receptacle with 3 Male Pins. A7: Bespoke length cable with XLR Receptacle Male Pin to Wire Leads. Default: 1m.		

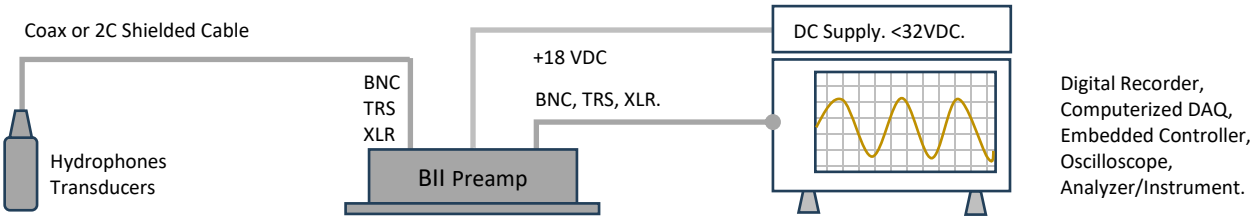
(2) Standard Preamps, Metal or Plastic Housing. BII keeps standard parts in stock.

Part Number	**-Gain**	**-R_i Input Impedance.**	**-LPF**	**-Input/Output Connector**	**-Accessory Cable Length**	**-Type**
BII1081	40dB	Refer to R_iC_h Filter. 44 MΩ for DF Input. 22 MΩ for SE Input.	-3dB LPF: 2.2MHz.	BNC/BNC, TRS/BNC, XLR/BNC.	0.6m, 0.9m, 1.8m, 10m, 20m. A1 to A7. DCBP24, DCBS18V.	
BII1082				TRS/TRS, XLR/XLR.		
Note: **BNC** is for single-ended signal. Both **TRS and XLR** are for differential signals.						
Example:	**Description:**					
BII1081-40dB-22MΩ-2.2MHz-BNC/BNC-DCBP24:	BII1081, Preamp, 40dB Gain, Input Impedance: 22MΩ, -3dB Low Pass Filter: 2.2MHz, Input: BNC Jack, Output: BNC Jack. DC Supply Cable: DCBP24.					
BII1081-40dB-44MΩ-2.2MHz-XLR/BNC-DCBP24:	BII1081, Preamp, 40dB Gain, Input Impedance: 44MΩ, -3dB Low Pass Filter: 2.2MHz, Input: XLR Plug with with 3 Sockets, Output: BNC Jack. DC Supply Cable: DCBP24.					
BII1082-40dB-44MΩ-2.2MHz-XLR/XLR-20m-A7-DCBS18V:	BII1082, Preamp, 40dB Gain, Input Impedance: 44MΩ, -3dB Low Pass Filter: 2.2MHz, Input and Output: XLR Plug with with 3 Sockets, 20m A7 Cable Accessories, DC Supply Cable: DCBS18V.					

(3) How to Order Bespoke Preamplifiers (Metal or Plastic Housing).

Part Number	**-Gain**	**-R_i Input Impedance.**	**-LPF**	**-Input/Output Connector**	**-Accessory Cable Length**	**-Type**
BII1081	In dB	$R_i = 1/(2\pi f_{-3dBH} * C_h)$. Refer to R_iC_h Filter.	-3dB LPF, in Hz, kHz, or MHz.	BNC/BNC, TRS/BNC, XLR/BNC.	Cable Length in meter. A1 to A7. DCBP24, DCBS18V	
BII1082				TRS/TRS, XLR/XLR.		
Note: **BNC** is for single-ended signal. Both **TRS and XLR** are for differential signals.						
Example:	**Description:**					
BII1081-40dB-10MΩ-2.2MHz-BNC/BNC-DCBP24:	BII1081, Preamp, 40dB Gain, Input Impedance: 10MΩ, -3dB Low Pass Filter: 2.2MHz, Input and Output: BNC Jacks. DC Supply Cable: DCBP24.					
BII1081-40dB-44MΩ-1MHz-XLR/BNC:	BII1081, Preamp, 40dB Gain, Input Impedance: 44MΩ, -3dB Low Pass Filter: 1MHz, Input: XLR Plug with with 3 Sockets, Output: BNC Jack.					
BII1082-40dB-1MΩ-2MHz-XLR/XLR-100m-A7-DCBS18V:	BII1082, Preamp, 40dB Gain, Input Impedance: 1MΩ, -3dB Low Pass Filter: 2MHz, Input and Output: XLR Plug with with 3 Sockets, 100m A7 Cable Accessories, DC Supply Cable: DCBS18V.					

(4) System Wirings of Standalone Preamp, Metal and Plastic Housing.



Components of an Acoustic Receiving System.

(5) Signals and Wiring of Panel-Mount Connectors

Input or Output Signals			**Power Supply**
Single Ended (SE)	**Differential/Balanced (DF):**		**Single DC Supply**
BNC Jack	**3.5mm TRS Jack**	**XLR (Balanced Audio)**	**Power Jack**
Center: Signal Shield: Common	Tip: Signal +, Positive or Hot. Ring: Signal -, Negative or Cold. Sleeve: Common/Ground.	Pin 2, Positive/Hot. Pin 3, Negative/Cold. Pin 1, Shield/Ground.	Center Contact: +VDC. Shell: Common.
Metal Case is for shielding and grounding.			

(6) Signals and Wiring of Accessory Cables

Input or Output Signals			**DC Supply Cable**
Single Ended (SE)	**Differential/Balanced Signal (DF)**		**Single DC Supply**
BNC and Coax	**3.5mm TRS and Cable**	**XLR (Balanced Audio)**	**Power Plug**
Center: Signal Shield: Common	Tip, White Wire: Signal +. Ring, Black Wire: Signal -. Sleeve, Shield: Common.	Pin 2, Positive/Hot. Pin 3, Negative/Cold. Pin 1, Shield/Ground.	Red Banana Plug: +VDC. Black Banana Plug: Common. Cable Shield, if any: Shielding.
Warning: "Signal –" is the reverse (180° phase difference) of "Signal +", and "Signal –" MUST NOT be connected to Common or Ground.			

(7) Accessories:

DC Supply Cable: DCBP24. One 1m DC supply cable with Red and Black Banana Plugs, and DC Power Plug.

Default 1m. Bespoke Length Available.

To Terminals of DC Supply:
a. One Red 4mm Banana Plug.
b. One Black 4mm Banana Plug.

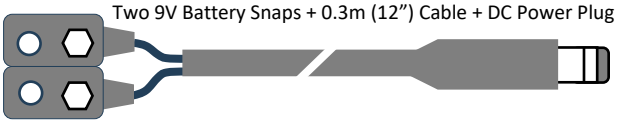
DC Power Plug.
To DC Power Jack
of the Device.

Red Banana Plug: +VDC. **Black Banana Plug:** Common.
One 1m DC supply cable. One end of the cable is with DC Power Plug, another end is Red and Black Banana Plugs. Depending on output terminals of buyer's DC Supply, buyer may assemble other type of connectors to DC supply cable at buyer's cost.

DC Supply Cable: DCBS18V. One 0.3m (12") DC supply cable with two 9V Battery Snaps which supplies +18VDC to amplifiers, and one DC Power Plug.

Two 9V Battery Snaps + 0.3m (12") Cable + DC Power Plug

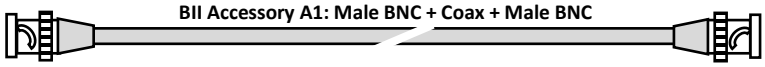
To Two 9V
Batteries.



DC Power Plug.
To DC Power Jack
of the Device.

A1: Bespoke length RG58, RG174, or RG178 Coax with BNC Male to BNC Male. Default: 0.6m.

BII Accessory A1: Male BNC + Coax + Male BNC

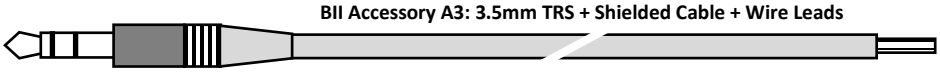


A2: Bespoke length cable with 3.5mm TRS Plug to 3.5mm TRS Plug. Default: 1.828m.

BII Accessory A2: 3.5mm TRS + Shielded Cable + 3.5mm TRS

A3: Bespoke length cable with 3.5mm TRS Plug to Wire Leads. Default: 0.9m.

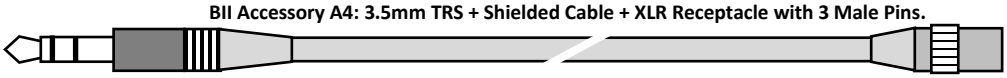
BII Accessory A3: 3.5mm TRS + Shielded Cable + Wire Leads



Wire Leads

A4: Bespoke length cable with 3.5mm TRS Plug to XLR Receptacle with 3 Male Pins. Default: 0.9m.

BII Accessory A4: 3.5mm TRS + Shielded Cable + XLR Receptacle with 3 Male Pins.



XLR Receptacle with 3 Male Pins.

Most recorders and analyzers use **XLR Plug with 3 Female Sockets** on front panel as differential/balance input connector and BII's XLR of A4 is compatible to it.

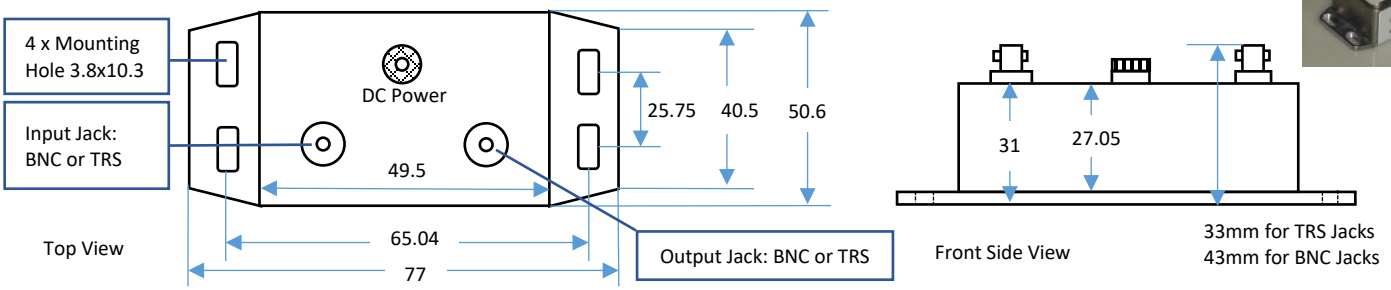
A7 Receiving Signal Cable. Part Number: XLR-P-WL-1m, Bespoke length cable with XLR Receptacle Male Pin to Wire Leads. Default: 1m.

XLR, Receptacle, 3 Male Pins.

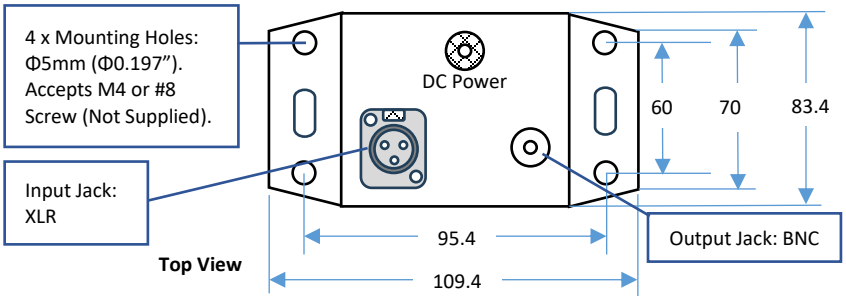
BII Accessory A7: XLR3P to Wire Leads.

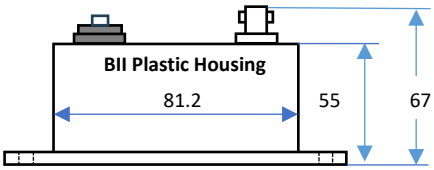
Wire Leads, or bespoke TRS, XLR, Male or Female, etc.

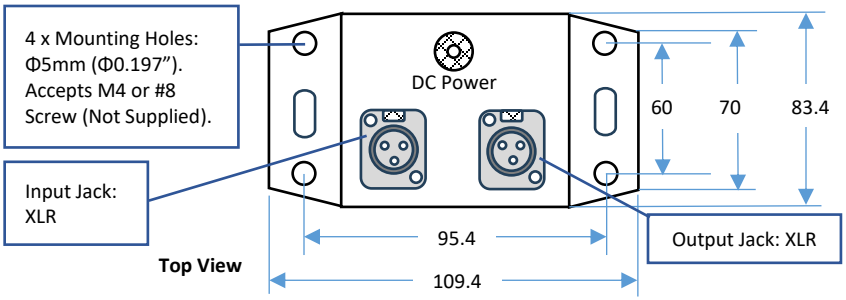
(8) Metal Housing, Outline Dimensions (mm), Illustration only, the scale is not 1:1.

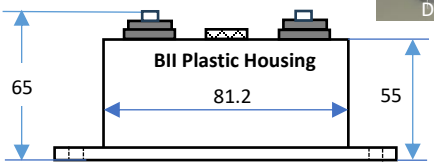


Plastic Housing, Outline Dimensions (mm), Illustration only, the scale is not 1:1.



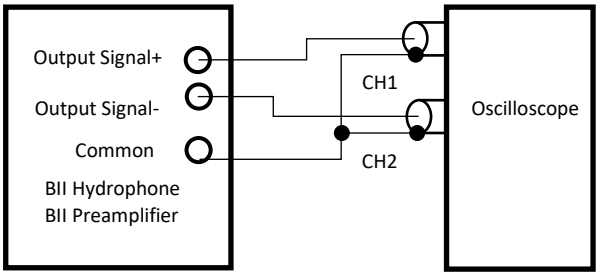




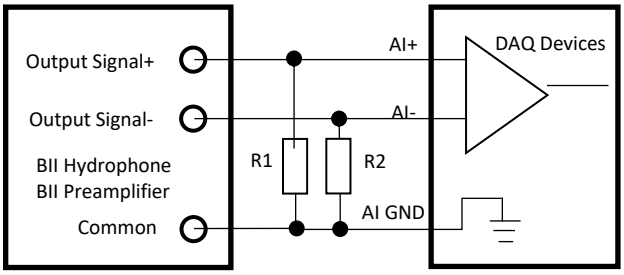


3. Preamplifier Wirings to DAQ (Data Acquisition): DAQ: Data Acquisition Hardware; AI: Analog Input; CH: Channel; GND: Ground.
R1 and R2 resistors are NOT necessary for most applications. If DAQ saturation occurs, use R1 = R2 = 10kΩ to 1MΩ resistors.

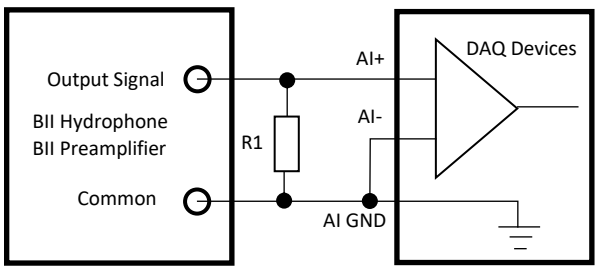
BII's Differential Output to BNC Input of an Oscilloscope



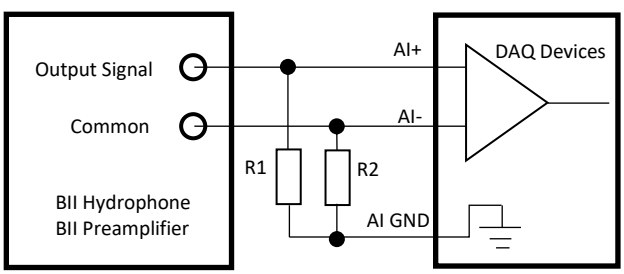
BII's Differential Output to Differential Input of a DAQ



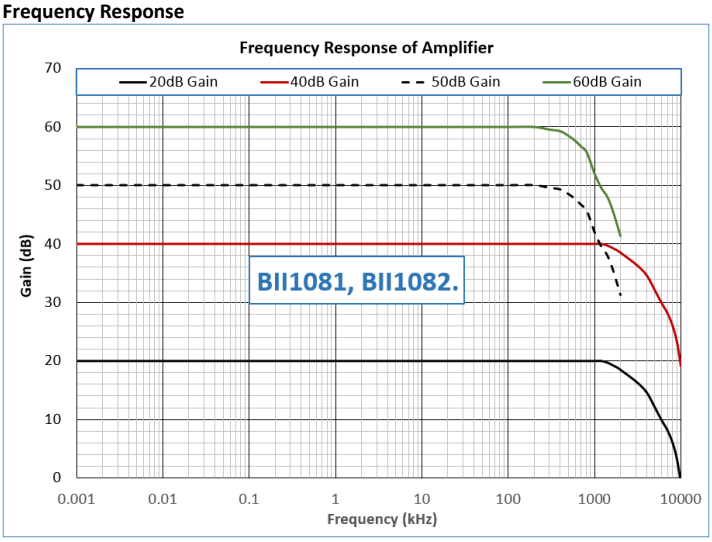
BII's Single-Ended Output to Single-Ended Input of a DAQ



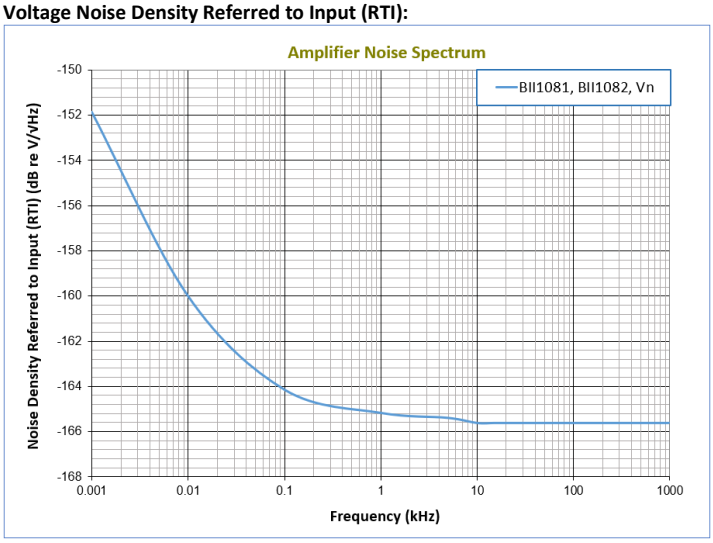
BII's Single-Ended Output to Differential Input of a DAQ



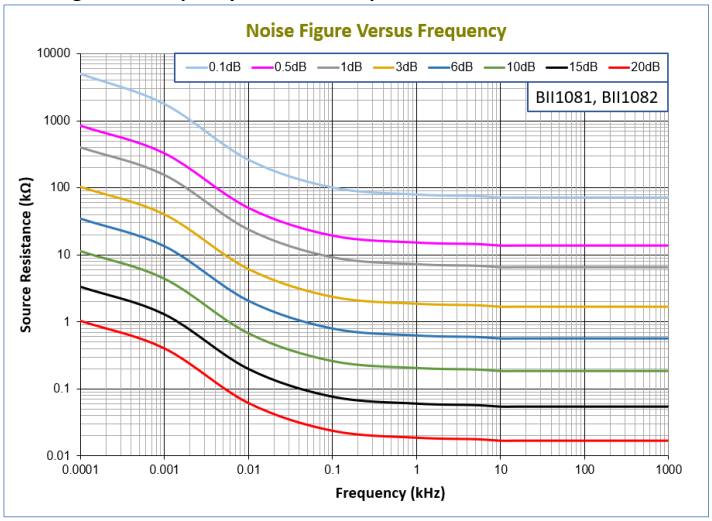
Frequency Response



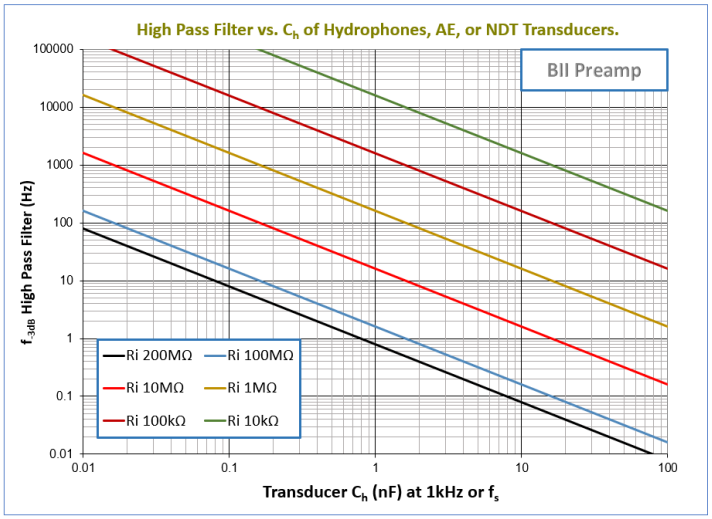
Voltage Noise Density Referred to Input (RTI):



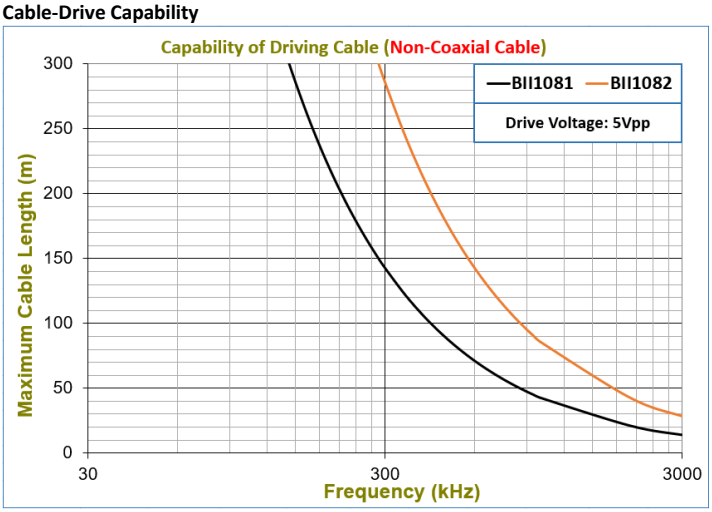
Noise Figure vs. Frequency and Source Impedance.



High Pass Filter vs. Ch of Hydrophones, AE, or NDT Transducers.



Cable-Drive Capability



Questions

What if the connector of my transducer/sensor is SMA or SMC Connector? SMA (or SMC) to BNC (Male) adaptors are available from many electronic distributors. BII may sell the adaptor as an accessory of the device upon request. **By default, BII does NOT supply the adaptor as accessories.**

How do I wire 50Ω transducer/sensor to preamplifiers in high frequency applications? Many BII preamplifiers have non-50Ω input resistances which does NOT match 50Ω in high frequency applications. Therefore, one T type BNC adaptor and one 50Ω BNC terminal are necessary between 50Ω transducer/sensor and the preamplifier to change the impedance of the preamp to be 50Ω. BII may ship T type BNC adaptor and one 50Ω BNC terminal as accessories of the device. Please specify this request when ordering. **By default, BII does NOT supply these two parts as accessories**. By the way it is NOT necessary to do 50Ω matching in low frequency range applications in which electromagnetic wave lengths are much greater than the cable length.

How do I wire BII preamplifiers to audio connectors XLR Plug with 3 Female Sockets (Differential Signal) of my recording devices? BII Preamplifiers have panel mount TRS Jacks as output connectors. Please order accessory A4 with preamplifiers. **By default, BII does NOT supply the cable assembly as accessories**.

My acoustic sensors generate differential signals in MHz range, are TRS connectors of BII preamps suitable for my applications? Our test shows the TRS connectors (Plug and Jack) of BII preamps can be used up to 20MHz. Test Conditions: TRS Jack with 0.2m cable and TRS plug with 1m cable. Oscilloscope: 1MΩ||30pF, Signal Source: DDS Signal Generator.

Can 3.5mm (1/8") TRS be configured for single-ended signal of a hydrophone/transducer which does not have built-in preamplifier? Yes, the preamp with differential-input TRS can accept single-ended signals from hydrophones/transducers whose TRS wiring should be like followings: **TRS Tip**: Signal. **TRS Ring and Sleeve:** Both terminals are soldered together for Signal Common and Shielding. Common and shielding should be "one-point" contact.

Can BII explain why capacitances of hydrophones/transducers affect high pass filtering? (1). Hydrophone/transducer is high impedance devices in low frequency range. Its simplified complex impedance = $j/(2\pi f C_h)$, C_h is the capacitance of hydrophone/transducer, f is frequency in Hz. This impedance is in series with preamp R_i and can reach several MΩ to hundreds MΩ depending on C_h and f. (2). Most high-performance operational amplifiers (IC chips) can use input resistors R_i up to 1 to 200 MΩ to avoid bumping into saturation issue.

My recorder (or signal processing device) is about 100m away from the hydrophone (or AE Sensor), which type of preamplifiers should I choose? Choose differential-output preamps to drive the 100m cable and ensure that your data acquisition device can accept differential signals.