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

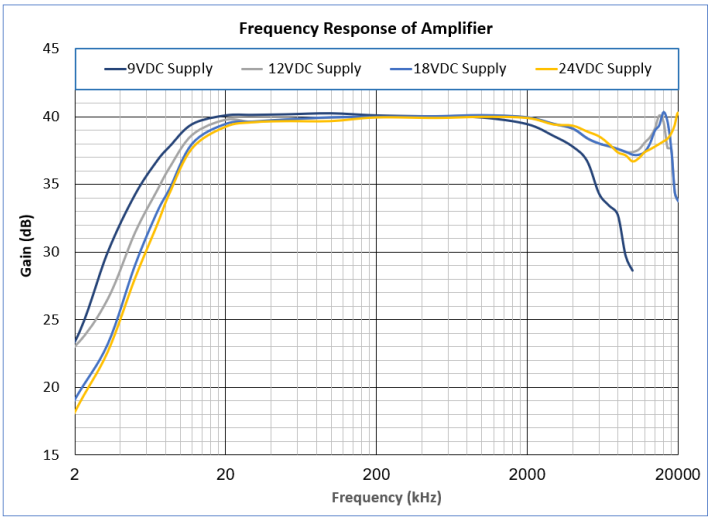
Hydrophone, SONAR, Underwater Communication, Navigation. Seafloor-mapping, Sub-bottom Investigation, Sediment Profiler, Acoustic Image. Target Strength Testing, Towed Array, Sonobuoy, Bottom Moored Systems.	Ultrasonic (Ultrasound, AE, NDT) Testing, Material Characterization. Low Noise Ultrasonic Preamplifier/Instrumentation,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

BII1040 Series Low Noise Ultrasonic Preamplifier: 7 kHz to 18 MHz, 3.0 nV/√Hz, 4 fA/√Hz.

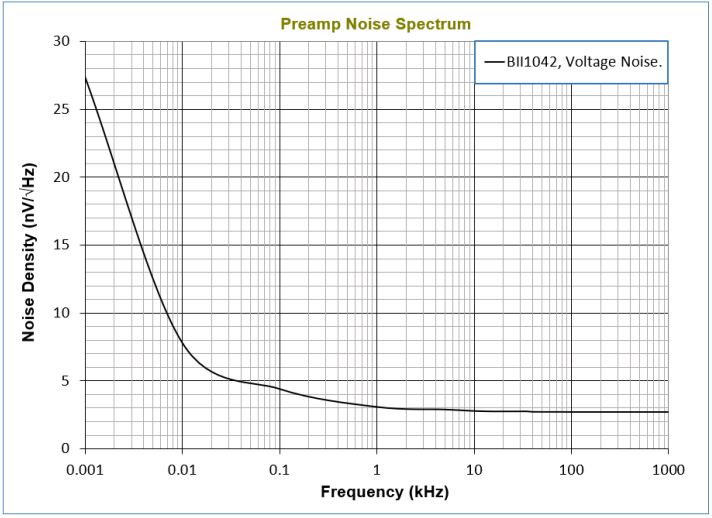
Specification

Low Noise Preamplifier:	**BII1042**
Input Type:	Single-ended
Input Referred Noise: (f ≥ 1 kHz)	Voltage Noise e_n = 3.0 nV/√Hz. Current Noise i_n = 4 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 = 1 MΩ || 8 pF, or 50 Ω || 8pF.
	Specify when ordering to set up -3dB high pass filter frequency with Capacitance C_h of a piezoelectric sensor. Refer to R_iC_h Filter.
	Ri 50Ω matches 50Ω coax cable impedance and damps down NDT transducer to achieve good transient or pulse response or reduce decaying time (or ringing) of the transducer.
Maximum Input:	(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. Built-in high pass filter 7kHz rejects noises in low frequency range and improve signal to noise ratio of the signals of the interest in NDT pulse or AE frequency range.
	System Filters 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) Hydrophone 10nF at 1kHz and preamp R_i 1MΩ constitute high pass filter with -3dB frequency 15.9Hz. (2) NDT Transducer 10nF at fs and preamp R_i 50Ω constitute high pass filter with -3dB frequency 318.3kHz.
Gain of Pass Band:	40 dB
	Single-ended Output: Gain in dB = 20*log(Single Ended Output/Input).
-3dB Bandwidth:	7 kHz to 5 MHz at +9 VDC Supply. 7 kHz to 16 MHz at +12VDC Supply. 7 kHz to 18 MHz at +18VDC Supply. 7 kHz to 22 MHz at +24VDC Supply.
Settling Time, 0.1%:	42 nS
Output Type:	Single-ended
Output Impedance:	50 Ω
Maximum Output V_{omax}:	V_{omax} = (Supply Voltage – 4) Vpp
Cable Driving Capability:	200 m cable or 50 Ω Coax Cable
Power Supply Vs:	+6.4 to +24 VDC.
	Warning: The device will be destroyed with Vs ≥ +35VDC.
Quiescent Current:	8 mA with +9 VDC. 9 mA with +12 VDC. 10 mA with +18 VDC. 14 mA with +24 VDC.
Suggested DC Supply:	1.2 V to 12.6 V Batteries (AA, AAA, C, and D, 9V, Coin Cell, Marine and Automobile). 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 70 °C or -40 to 158 °F
Storage Temperature:	-40 to 70 °C or -40 to 158 °F
Package	**Metal Housing with four mounting holes**
Input Connector:	BNC Jack (**BNC**)
Output Connector:	BNC Jack (**BNC**)
Power Supply:	Power Connector Jack on Housing. Power Supply Cable: DCBP24, DCBS18V.
Size LxWxH:	77x50.6x43 mm
Weight:	80 grams.

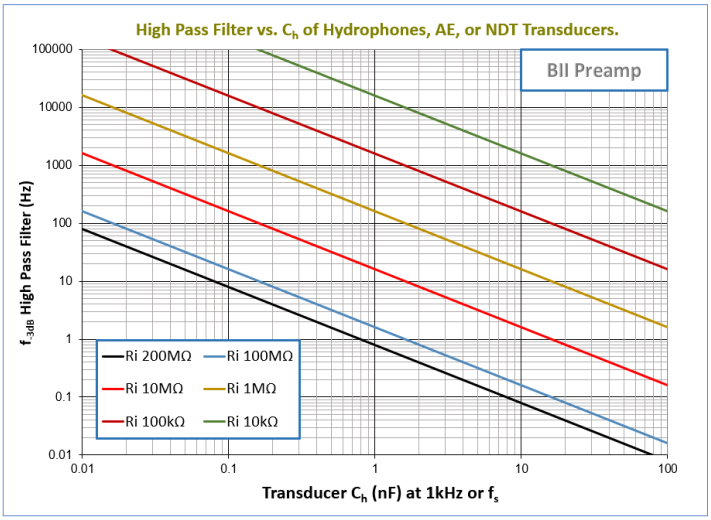
Frequency Response



Voltage Noise Density Referred to Input (RTI):



High Pass Filter vs. Ch of Hydrophone, AE, or NDT Transducer.



Standard Metal Housing. BII keeps standard parts in stock.

Part Number	-R_i Input Impedance. Refer to R_iC_h Filter, Built-in Filter and -3dB Bandwidth.	**-DC Supply Accessory Type**
BII1042	1 MΩ.	DCBP24, DCBS18V.
	50 Ω.	
High Pass Filter of the preamp is the combination of R_iC_h High Pass Filter and **HPF** High Pass Filter. R_iC_h High Pass Filter is determined by Hydrophone C_h.		
Example:	**Description:**	
BII1042-1MΩ-DCBS18V:	BII1042, Preamp, Input Impedance: 1MΩ, DC Supply Cable: DCBS18V.	
BII1042-50Ω-DCBS18V:	BII1042, Preamp, Input Impedance: 50Ω, DC Supply Cable: DCBS18V.	

Signals and Wiring of Panel-Mount Connectors

Input or Output Signals	**Power Supply**
BNC Jack, Single Ended (SE).	**Power Jack, Single DC Supply**
Center: Signal Shield: Common	Center Contact: +VDC. Shell: Common.
Metal Case is for shielding and grounding.	

Signals and Wiring of Accessory Cables

Input or Output Signals	**DC Supply Cable**
BNC and Coax, Single Ended (SE).	**Power Plug, Single DC Supply**
Center: Signal Shield: Common	Red Banana Plug: +VDC. Black Banana Plug: Common. Cable Shield, if any: Shielding.

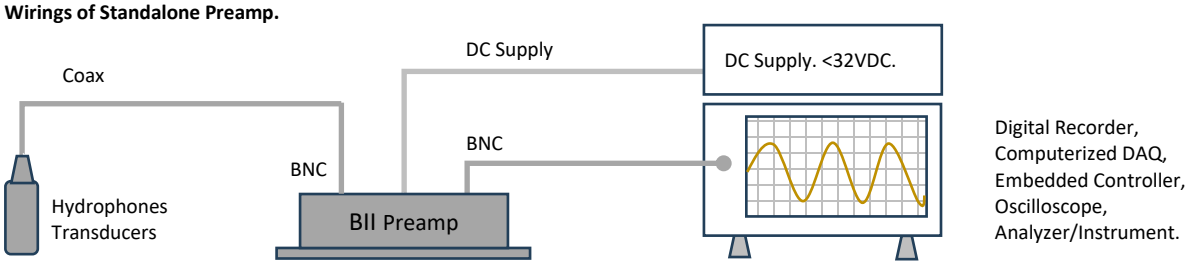
Questions

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.

Can BII explain why the capacitance of my hydrophone/transducer affect high pass filtering? (1). Hydrophone/transducer is high impedance devices in low frequency range. Its simplified complex impedance = $j/(2\pi fC_h)$, 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.

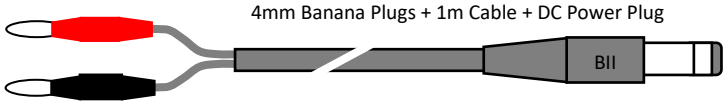
System Wirings of Standalone Preamp.



Accessories:

Part Number: DCBP24.

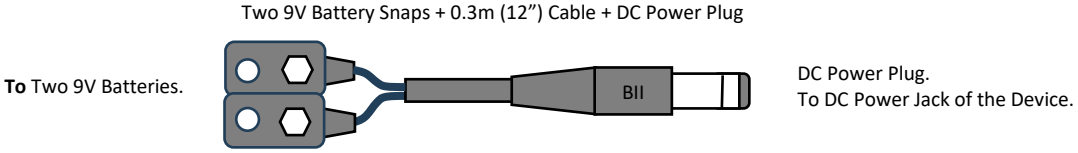
To Terminals of DC Supply:
a. One Red 4mm Banana Plug.
b. One Black 4mm Banana Plug.



Red Banana Plug or Red Wire Lead: +VDC.	**Black Banana Plug or Black Wire Lead:** Common.	**Cable Shield, if any**: Shielding.

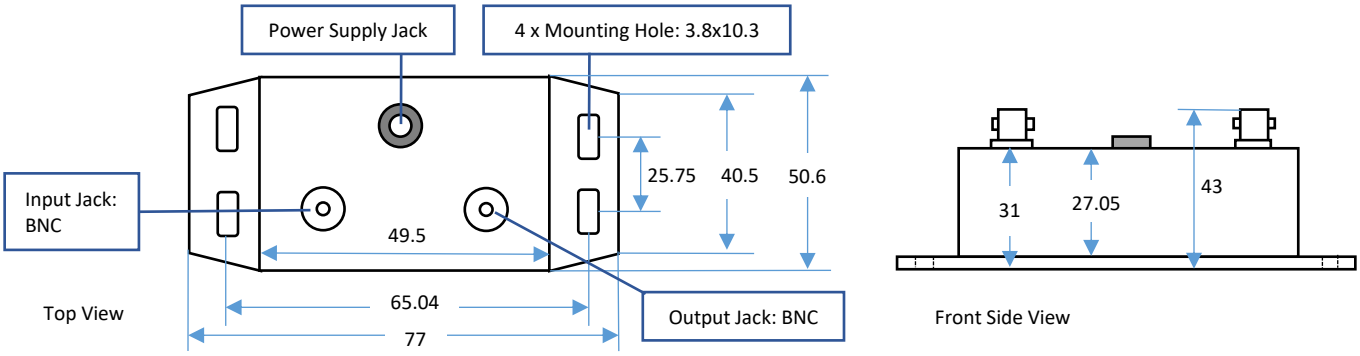
One 1m DC supply cable. One end is with Red and Black Banana Plugs, another end of the cable is with DC Power Plug. Depending on output terminals of buyer's DC Supply, buyer may assemble other type of connectors to DC supply cable at buyer's cost.

Part Number: DCBS18V.



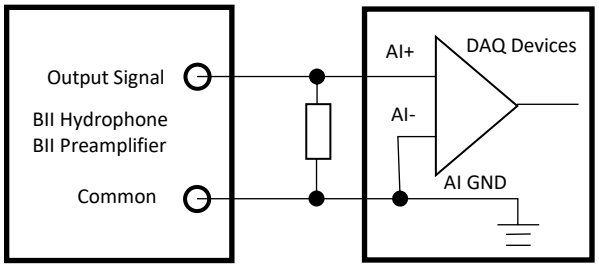
One 0.3m (12") DC supply cable. One end is two 9V Battery Snaps which supplies +18VDC to amplifiers, another end of the cable is with DC Power Plug.

BII1040 Series Preamplifier Metal Housing Package, Outline Dimensions (mm)



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

If input impedance of a DAQ device is greater than 100MΩ, use following wiring with one 100kΩ to 1MΩ resistor.



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