

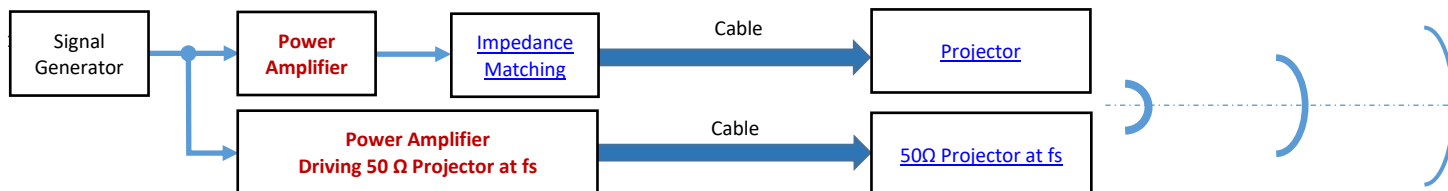


BII5120 Series Power Amplifier

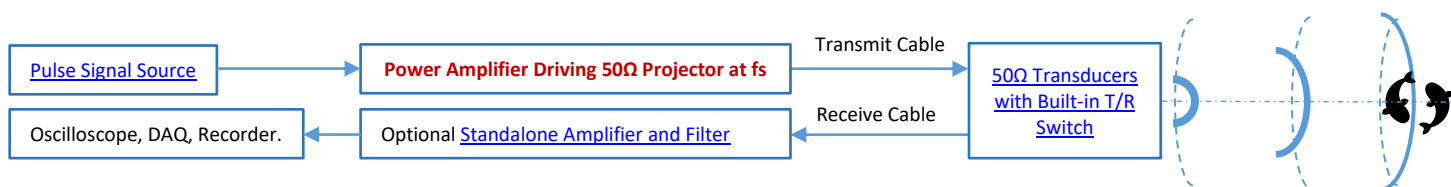
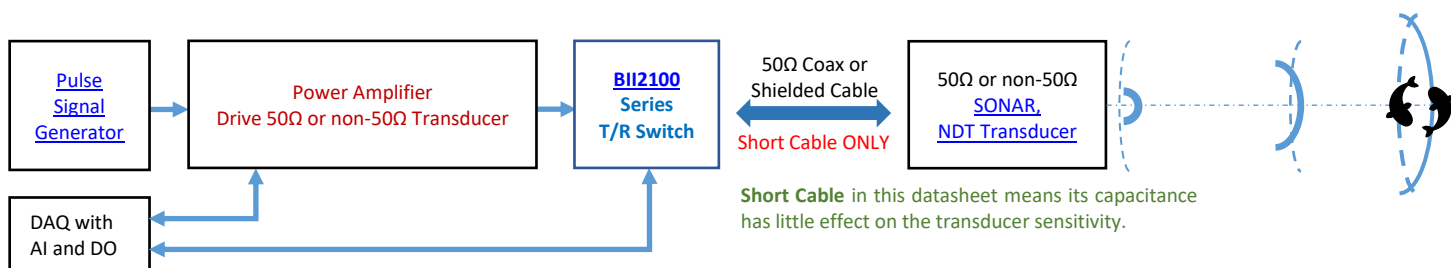
Engineered for the precise excitation of piezoelectric transducers over the 200 Hz to 2 MHz frequency range, these linear power amplifiers deliver the high output power, low distortion, and wide bandwidth required by demanding underwater acoustic systems, including SONAR, echo sounding, sub-bottom profiling, underwater Imaging, underwater communications, positioning system, bioacoustics, noise and acoustic target simulation, and High-Intensity Focused Ultrasound (HIFU).

SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.



Related Product:

Underwater Transducer : SONAR, NDT, and HIFU	Impedance Matching between Transducers and Amplifiers
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TYPICAL APPLICATIONS

Image Sonar, NDT, HIFU Transducer	Communication, Modem, Beacon, Positioning, Chirp, FSK, PSK and Spread Spectrum System
Underwater Sound Velocimeter/Sound Velocity Probe	Phantom Echo Generation, Phantom Clicks, Sound Playback, Bioacoustics, Acoustic Deterrent
Distance Gage, Echo Sounding	Navigation, Obstacle Avoidance/Tracking, Inspection and Survey

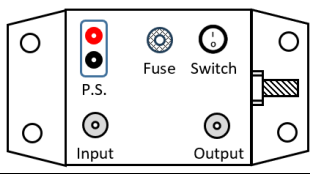
Which Power Amplifier, Linear or Switching, Is Suitable to Drive Piezoelectric SONAR, HIFU, and NDT Transducers?

Parameter	Linear Power Amplifier	Switching Power Amplifier
Input Signal:	Analog Voltage Signals from Analog Output or D/A Converter.	Digital Voltage Signals from Digital Outputs.
Output Signal:	Analog Signals: SINE, SINE Pulse, Chirp/FM, FSK, PSK, Spikes, etc.	Pulse Signals: Square Signal, Spikes, Single Pulse, etc.
Power Efficiency:	$\eta \leq 70\%$	$\eta \geq 90\%$
Power Capacity:	High Power with Heavy Bulky Physical Size.	High Power with Light Small Physical Size.
Air-Flow Cooling:	Forced-air Fan is necessary in high power CW applications.	Not necessary in most high power applications.
Harmonics:	None or very low.	Odd frequency Harmonics.
	Impedance matching device, Piezoelectric transducers and Air/water/Solids are bandpass filters which attenuate specific signals.	

ABSOLUTE MAXIMUM RATINGS

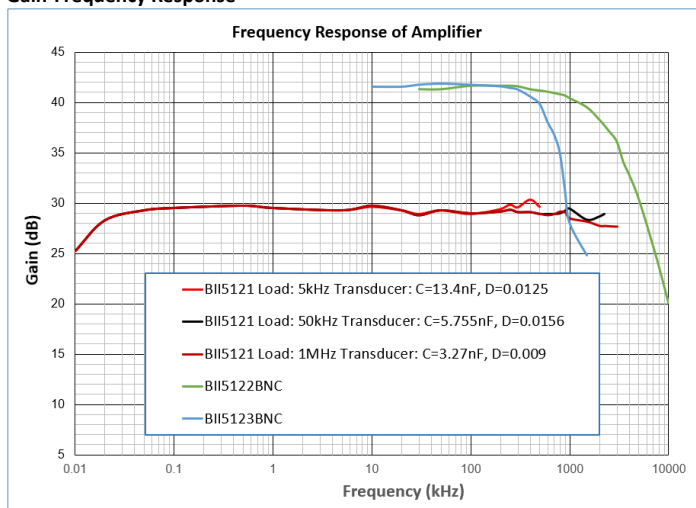
DC Supply Voltage:	+36 VDC
Output Peak Current:	12 A at Pulse Width ≤ 6 mS, Duty Cycle $\leq 50\%$
Shut-down Control Voltage:	-20 to +20 VDC
Input Voltage:	20 Vpp

SPECIFICATIONS

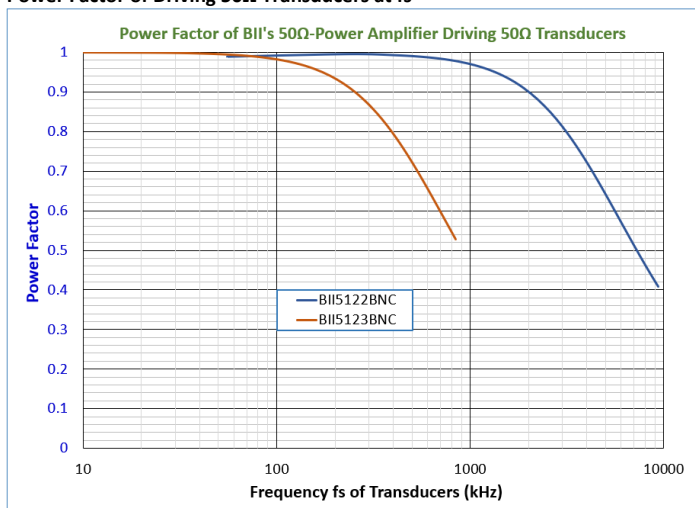
	BII5121	BII5122BNC	BII5123BNC
Power Amplifier			
Status:	ACTIVE		ACTIVE
	ACTIVE: Product device recommended for new designs. LIFEBUY: BII has announced that the device will be discontinued, and a lifetime-buy period is in effect. OBSELETE: BII has discontinued production of the device.		
Waterproof:	Not waterproof. Always use the device in Dry Air for electrical safety.		
Power Bandwidth: (-3dB)	20 Hz to 2 MHz	30 kHz to 2 MHz	10 kHz to 250 kHz
	Refer to Gain-Frequency Response .		
	Warning: DO NOT operate the device at frequencies lower than the minimum frequency stated above to avoid performance degradation and device damage.		
Signal Type:	Pulsed Signals and Continuous Signals.	Pulse Signal Only: Duty Cycle D ≤ 25%, Pulse Duration PD ≤ 10 Seconds.	
	Pulsing Signals of SONAR and Communication: Tone Burst (Sinusoidal) Excitation, Chirp Pulse, Coded Excitation (Barker/Golay), etc.		
	Continuous Signals, Arbitrary Signals, Aquatic/Marine Animal Sounds, Ambient and Ship/Vehicle Noises, etc.		
Source Level Capability: (in Water)	192.0 + η + DI		
	in dB re μPa at 1m. DI: Directivity Index (dB) of Transducer, η: Transducer Efficiency, in dB.		
	η of broadband planar transducers such as NDT Transducers could be ≤ -5dB, η of broadband spherical or cylindrical transducers could be ≥ -0.5dB.		
	For low and medium frequency (large size) cylindrical and spherical transducer, η ≥ 0.85.		
	SL ≈ 191.5 dB at η = 0.9 (or -0.46 dB), DI = 0 dB (cylindrical or spherical transducers).		
	SL ≈ 199.5 dB at η = 0.4 (or -4.0 dB), DI = 11.5 dB (typical directional communication transducers without side lobes).		
	SL ≈ 214.8 dB at η = 0.3 (or -5.2 dB), DI = 28 dB (typical echo sounding directional transducers with -3dB Beam Angle of 6° to 8°).		
	SL ≈ 210.0 dB at η = 0.1 (or -10 dB), DI = 28 dB (typical pulsing NDT transducers with -3dB Beam Angle of 6° to 8°).		
Operating Mode:	Linear		
Impedance Matching:	No Built-in Impedance Matching.	Built-in Impedance Matching.	
Voltage Gain:	29.5 dB or 30	41.76 dB or 122.5	
Input Type:	Single ended or Differential	Single ended	
Input Connector:	On-board	BNC Jack	
Input Impedance:	10 kΩ 6 pF	5 kΩ 6 pF	
Maximum Input Level:	Maximum Output Level/Gain, or 2Vpp, whichever is less.		
Output Type:	Differential	Single Ended	
Output Impedance Zo:	Zo = -j0.6773/f, in Ω.	Zo = j0.011*f, in Ω.	Zo = j0.1146*f, in Ω.
	f: Operating Frequency, in kHz. For example, Zo of BII5123BNC = j1.15 Ω at 10 kHz.		
Output Connector:	On-board	BNC Jack	
Voltage Output:	Maximum V _{Omax} = (2*Vs - 8) in Vpp.	Input Level * Gain, or 4.1*(2*Vs – 8), in Vpp, whichever is less.	
Current Output:	I _o ≤ 10 A peak	I _o ≤ 2.44 A peak	
Load:	≥ Vo/Io or 3Ω, whichever is greater.	50Ω Transducers	
Shut-down Control:	On-board ON/OFF Switch: Manually or Digitally	N/A	
Shut-down Switch:	OFF Position: Output Enabled. Operates normally. DIO Position: TTL/CMOS Logic High: Output Enabled. TTL/CMOS Logic Low: Output Disabled.	N/A	
Stand-by Control Voltage: (Shutdown)	TTL/CMOS Compatible. Logic Low "0": Output Disabled. Logic Low "0": 0 to +0.8 VDC. Logic High "1": Output enabled. Logic High "1": +0.8 to +5 VDC.	N/A	
	Warning: Control voltage higher than +20VDC or lower than -20VDC will damage the device.	N/A	
Output Disable Time:	1 μS		
Output Enable Time:	1 μS		
RMS Power Capability:	133W at +35 VDC Power Supply. 78W at +24 VDC Power Supply. 18W at +12 VDC Power Supply.		
Power Efficiency:	Driving Tuned Transducers (Resistive load): 67% at +32 VDC and max. output current. 64% at +24 VDC and max. output current. 49% at +12 VDC and max. output current.		
	Driving Untuned Transducers: Power Efficiency of driving tuned transducers*cosθ. θ: Impedance Phase of Untuned Transducers.		
Grounding Terminal:	ONLY for Standalone Device BII5123BNC and BII5122BNC: Grounding Stud, two #10-24 nuts and two #10 washers are included. Support Single-Point Grounding with Multiple Devices. Grounding Cable GWL18, 0.6m AWG18 Green Wire with #10 Ring Terminal and Wire Lead. One #10 washer and one 4mm Banana Plug (Green) included.		
DC Supply Voltage Vs:	+8 to +35 VDC.		

Warning: DC Supply voltage greater than <u>MAXIMUM RATINGS</u> will damage the devices.			
DC Supply Current Is:	7.1 A at Maximum Power Output.		
	DC Supply Current of Pulsing Signals: When a device works with pulsing signals such as SINE pulse or voltage spikes, the DC current from DC power supply is much less than the rating. <i>Current = Rated DC Supply Current * $\sqrt{D}$</i> . D: Duty Cycle of the pulsing signal = Pulse Width / Period. For example: Driving a Transducer with SINE pulse whose D = 1%, DC current from DC power supply Is = 7.1A * $\sqrt{0.01}$ = 0.71 A.		
	Suggested DC Supply: Marine Battery and Automobile Battery, or DC Power Supply with Grounded Output and Protection of Output Current Limit. Fully charged 12V Automobile or Marine Battery are from 12.6 to 14.4 VDC. Ensure that voltage of battery pack is less than maximum DC supply voltage.		
Quiescent Current Iq:	Active: 65 mA. Stand-by (Shut-down): 6 mA.	65 mA	
DC Supply Connector:	On-board	Sheathed Banana Jack.	
Fuse:	None	8A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".	
Accessory Cable:	6" or 0.15m wires, AWG16.	1. DC Power Supply Cables: DCBP18 .	
Cable Connector:	Wire Leads	2. Grounding Cable: GWL18 .	
Package:	PCB	Metal Enclosure	
Grounding Terminal:	N/A	Grounding Stud #10-24.	
Mounting Holes:	4 x Φ 4.87 mm through-holes	4 x Φ 5.5mm (Φ 0.217")	
	Screws are not supplied.		
Physical Size (mm):	Round PCB, Φ DxH = Φ 101.6x48	LxWxH = 231x120x75	
Weight in Air:	230 grams	1.6 kg	1.7 kg
Operating Temperature:	-20 to 70°C or -4 to 158°F		
Storage Temperature:	-20 to 70°C or -4 to 158°F		
Note: Forced-air cooling by a fan is recommended to cool down the amplifier during service of full power and continuous waveform.			
WARNING: 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.			

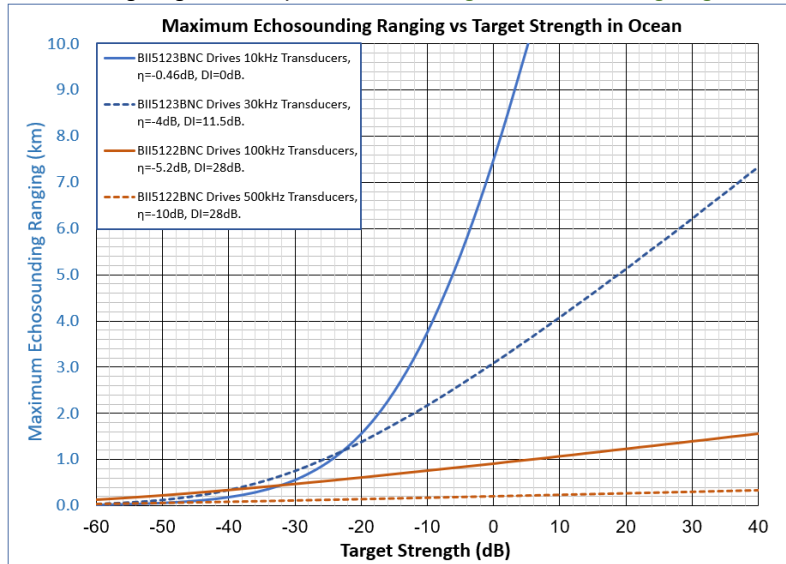
Gain-Frequency Response



Power Factor of Driving 50Ω Transducers at fs

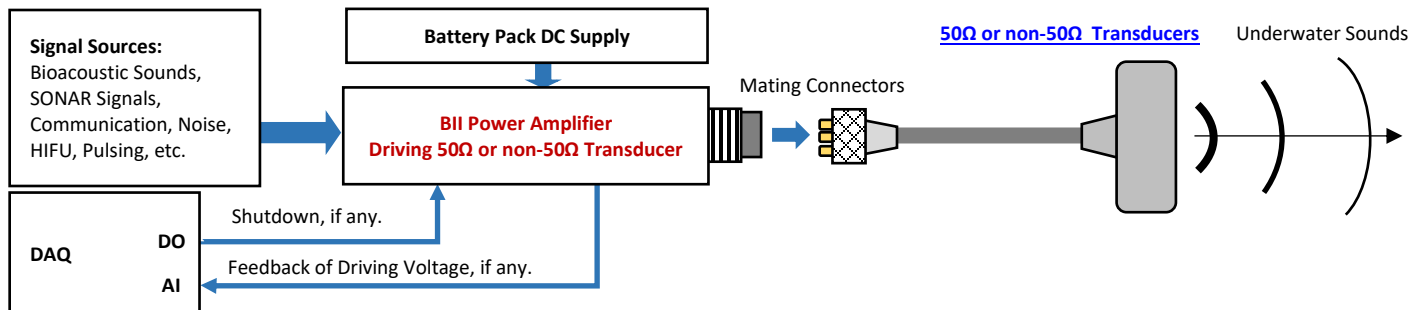


Echo Sounding Range in Water (Communication Range = 2 * Echo Sounding Range at 0dB Target Strength)

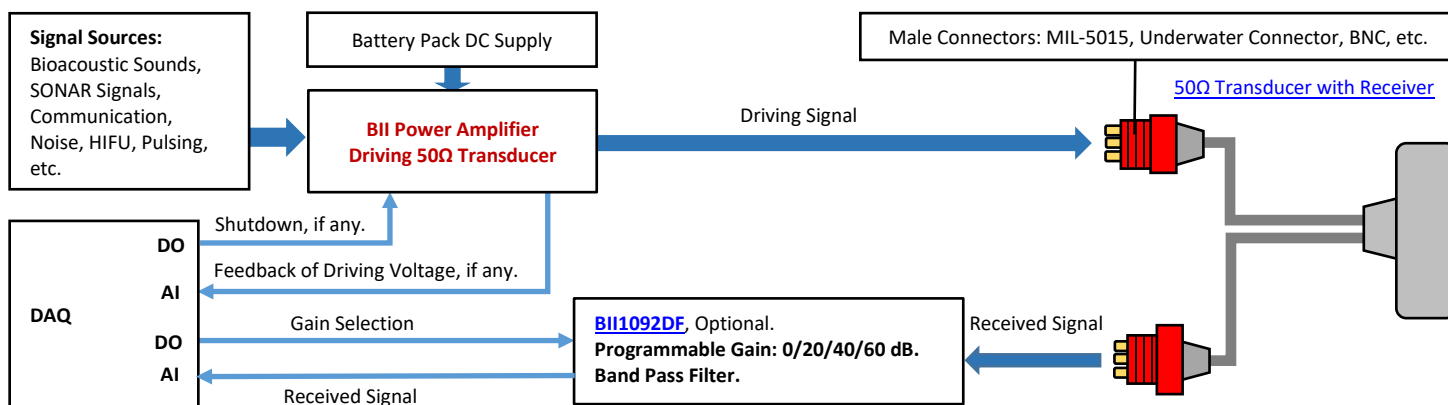
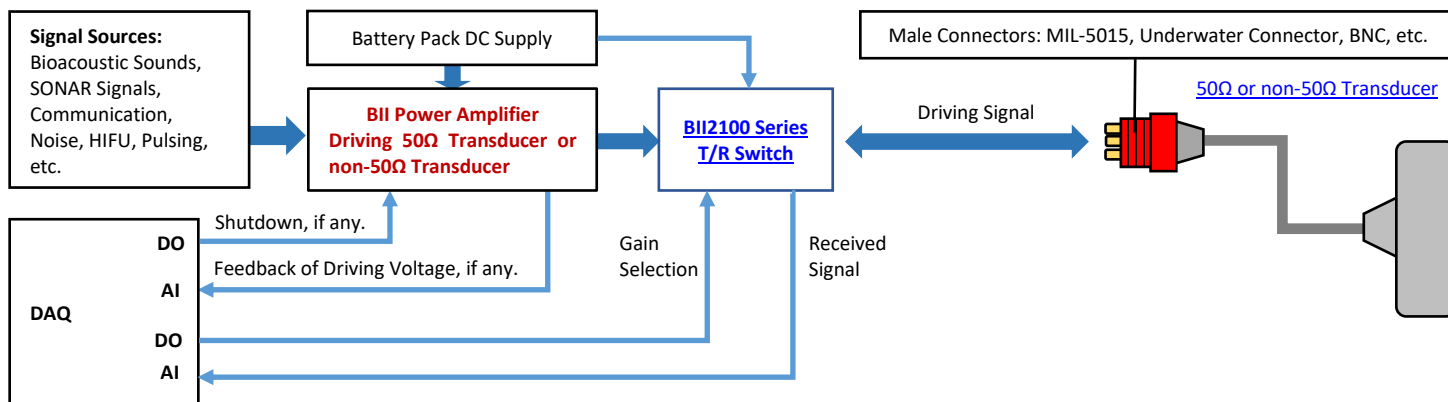


Acoustic System Block Diagram

1. Generate Sounds and Waves.



2. Transmitting and Receiving Sounds and Waves



Are 50Ω Power Amplifiers suitable to drive non-50Ω transducers?

- (1) If the impedance of a transducer is greater than 50Ω at operating frequency, the 50Ω Power Amplifiers can drive this non-50Ω transducer, but the power delivered to non-50Ω transducer is reduced.
- (2) A 50Ω Power Amplifiers should NOT drive a transducer whose impedance is less than 50Ω. The power amplifier is most likely to be damaged by overvoltage, exceeding rated power or overheating.

How do I connect the BII Power Amplifier wires 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.

How to Extend Input and Output Wires of Power Amplifiers (PCB Package for Embedded Applications.)?

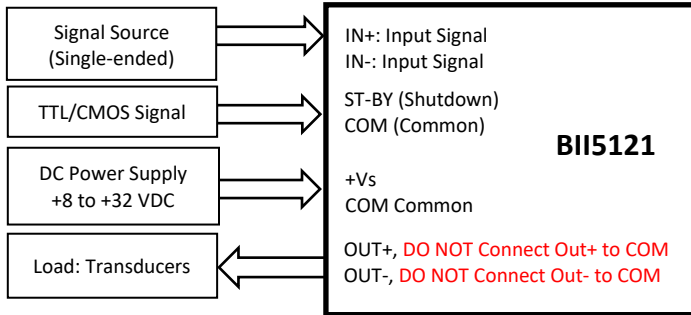
Input and output wires of BII PA (PCB Package) are 0.15m (6") **AWG16 wires** with wire leads.

1. **Butt Splice Connectors, Fully Insulated.** Buyers shall refer to the instructions of the manufacturer to strip proper wire leads and crimp the connector for secure connection. If possible, **heat shrink tube** is recommended to sheath the splice and function as strain relief.
2. **Banana Jack and Plug, Fully Insulated, Free Hanging (In-Line).** Crimp or solder. Crimp is recommended.

Note: a. by default, BII does NOT provide these connectors. If buyer needs connectors, please specify when ordering.

- b. When wiring, please ensure insulation (avoid short circuit to damage the devices) and safety of operation.

BII5121 SUGGESTED WIRING:



Configurations of ST-BY SWITCH (Shutdown SWITCH)		
OFF Position	DIO Position	
Output Enabled. Operates normally.	TTL/CMOS Logic High: Output Enabled.	TTL/CMOS Logic Low: Output Disabled.
When the Switch is open, the logic = "0" or low.		

WARNING:

Outputs of the Power amplifier are differential, DO NOT Connect Out + or Out - to COM.

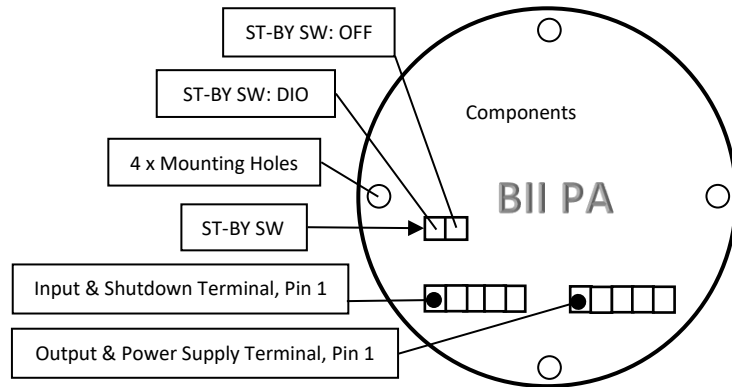
BII5121 TERMINALS and WIRINGS

Input and ST-by (Shutdown) Terminal

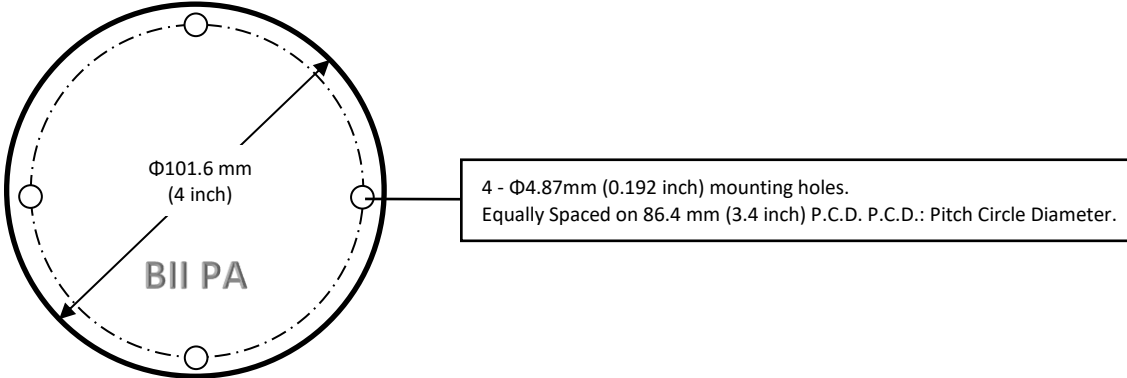
Pin 1: ST-BY (Shutdown)	White,	6" Wire
Pin 2: COM (Common)	Black,	6" Wire
Pin 3: IN+ (Input Signal)	Blue,	6" Wire
Pin 4: IN- (Input Common)	Yellow,	6" Wire
Pin 5: COM (Common)	Black,	6" Wire

Output and Power Supply Terminal

Pin 1: +Vs	Red,	6" Wire
Pin 2: +Vs	Red,	6" Wire
Pin 3: COM (Common)	Black,	6" Wire
Pin 4: OUT+	Blue,	6" Wire
Pin 5: OUT-	Yellow,	6" Wire



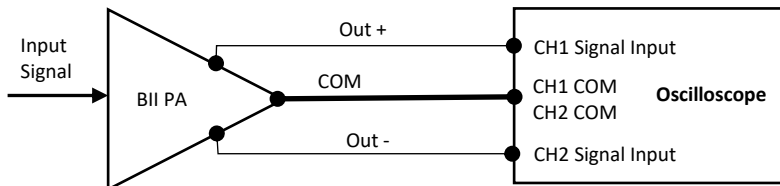
BII5121 Physical Size (unit mm): $\Phi D \times H = \Phi 101.6 \times 48 \text{ mm}$



BII5121 SHIPMENT:

1. Assembled board, Qty.: 1;
2. Input and ST-BY Plug with 6" wires, Qty.: 1;
3. Output and Power Supply plug with 6" wires, Qty.: 1.

Measure Differential Output of BII Power Amplifiers



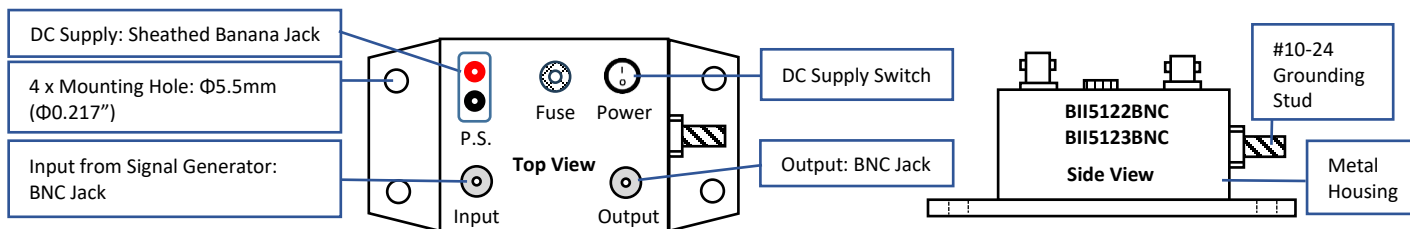
Warning: Outputs of the Power amplifier are differential, DO NOT Connect Out + or Out - to any COM.

How to Order

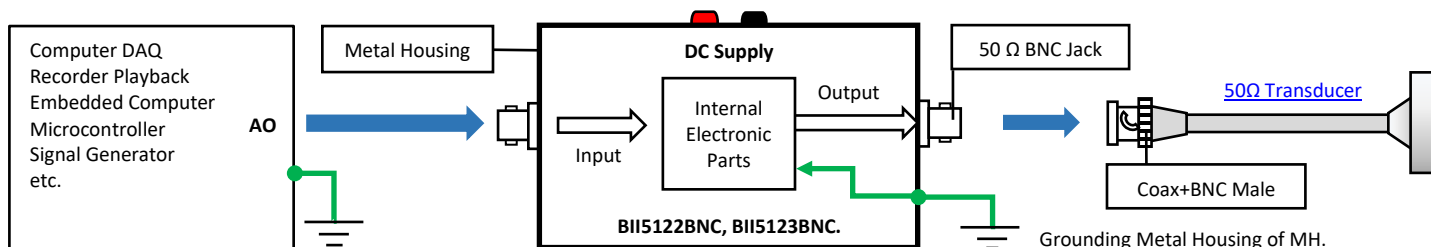
Example of Part Number:	Description
BII5121	BII5121, Linear Power Amplifier.

BII5122BNC and BII5123BNC

Output Connector: BNC Jack. Metal Enclosure, Overall Size: LxWxH = 231x120x75mm. Mounting Hole $\Phi 5.5\text{mm}$ ($\Phi 0.217''$) accepts M5 or #10 screw. Screws are not supplied.



System Block Diagram: Driving 50Ω Transducer with BNC Male.



Buyer's Signal Source	BII5122BNC, BII5123BNC.		50 Ω Transducer
	Input: BNC Jack	Output: BNC Jack	Coax + In-line BNC (Male)
Analog Output	Signal: Center Contact	Output Signal: Center Socket.	Signal: Center Pin.
Analog Common	Grounded Common: Body	Grounded Common: Body.	Grounded Common: Body.
DC Power Supply:	Red Sheathed Banana Jack: +VDC. Black Sheathed Banana Jack: Common of the DC Power Supply.		
DC Supply Switch:	Turn ON and Turn OFF DC Supply.		
Fuse:	8A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".		
Accessories included:	1. Two DC supply cables, Part Number: DCBP18 . 2. Included: One Grounding Cable, Part Number: GWL18 .		
Grounding Metal Case for operating safety.	Grounding Stud: #10-24 Screw 316SS. Nut and Washer are included.		
1. Install the device on a safe solid object to avoid sliding. An air free-flowing area and good thermal conducting object allow the device to cool down. 2. Never use the device in the event of slide happening, otherwise, loss of the device into water, property damage, and person injury may occur.			

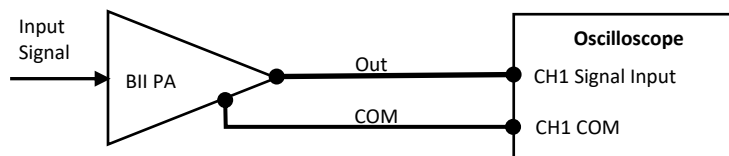
How to Order

Example of Part Number:	Description
BII5122BNC	BII5122BNC, Linear Power Amplifier, Driving 50Ω Transducer.
BII5123BNC	BII5123BNC, Linear Power Amplifier, Driving 50Ω Transducer.

Customer's Question: What if the connector of my transducer/projector is SMA or SMC Connector?

BII Answers: 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.

Measure Single Ended Output of BII Power Amplifiers



Warning:

- Outputs of the power amplifier is high voltage, choose suitable oscilloscope probe with correct attenuation and voltage rating.
- for operating safety, ensure proper grounding, and shut down power supply of the device before handling the cables, wiring and hookup, etc.



DC Supply Cable Pair: Part Number DCBP18.

To Terminals of DC Supply:

- One Red 4mm Banana Plug.
- One Black 4mm Banana Plug.



Sheathed Banana Plug.
To sheathed Banana Jack
of Power Amplifier.

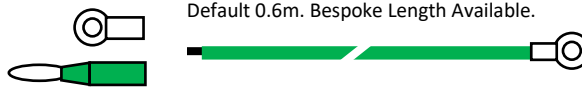


Two 0.6m DC supply cables. Red and Black. One end of the cable is one pair Banana Plugs (Red and Black), another end is Sheathed Banana Plug.

Grounding Cable and Terminals

Terminal to buyer's Grounding Terminal:

- a. Default: Wire Lead
- b. One #10 Ring Terminal
- c. One 4mm Banana Plug



Default 0.6m. Bespoke Length Available.

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

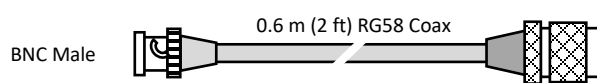


Grounding Cable, Part Number: GWL18, Support Single-Point Grounding with Multiple Devices.

One 0.6m AWG 18 Green Wire (or Green with a Yellow Stripe) 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 of connectors to grounding cable at buyer's cost.

Adaptor Accessory:

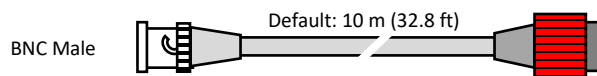
Accessory A13: BNC-MIL3S, BNC Male (Pin) to MIL3S (MIL-5015 type 3-Socket Connector Thread Fastening)



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.

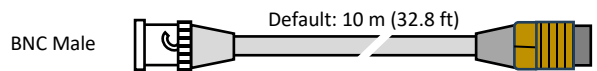
Accessory A14: BNC-UMCF3S, BNC Male to UMC3S (Underwater Connector, 3 Sockets, Locking Sleeve: DLSA-F, Size: $\Phi 35.5 \times 33.5$ mm)



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.

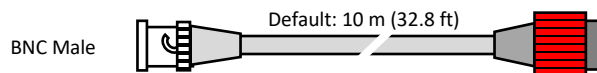
Accessory A15: BNC-SUMC3S, BNC Male to Small UMC3S (Underwater Connector, 3 Sockets, Thread Locking, Size: $\Phi 22 \times 28$ mm)



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.

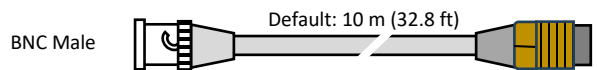
Accessory A16: BNC-UMCF2S, BNC Male to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size: $\Phi 35.5 \times 33.5$ mm)



Underwater Connector, 2 Sockets.
Contact 2: Signal.
Contact 1: Common.

Transducer with 2-Pin Underwater
Connector and DLSA-M Locking Sleeve.

Accessory A17: BNC-SUMC2S, BNC Male to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size: $\Phi 22 \times 28$ mm)



Underwater Connector, 2 Sockets.
Contact 2: Signal.
Contact 1: Common.

Transducer with 2-Pin Underwater
Connector and MCDLS-F Locking Sleeve.

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

