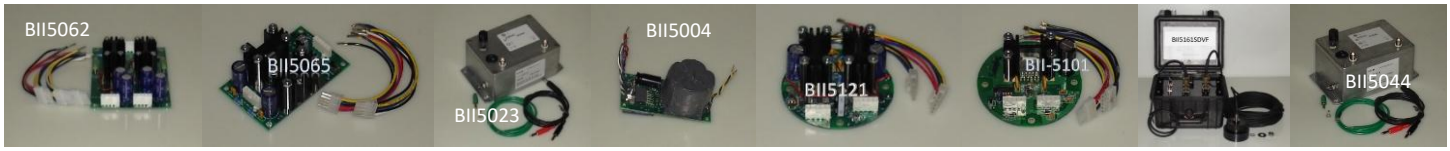
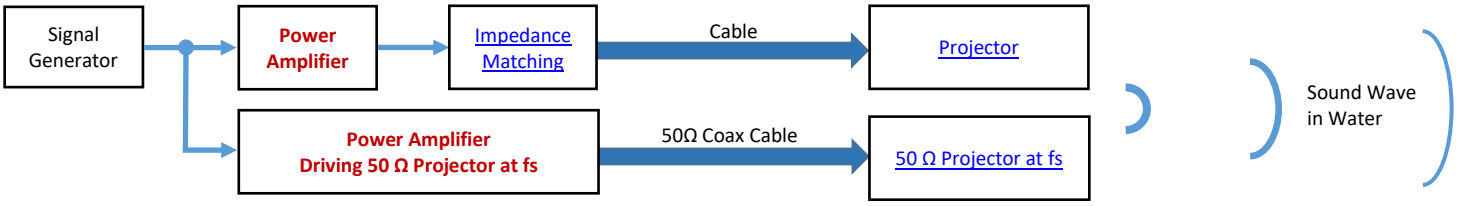


BII5120 Series Power Amplifier

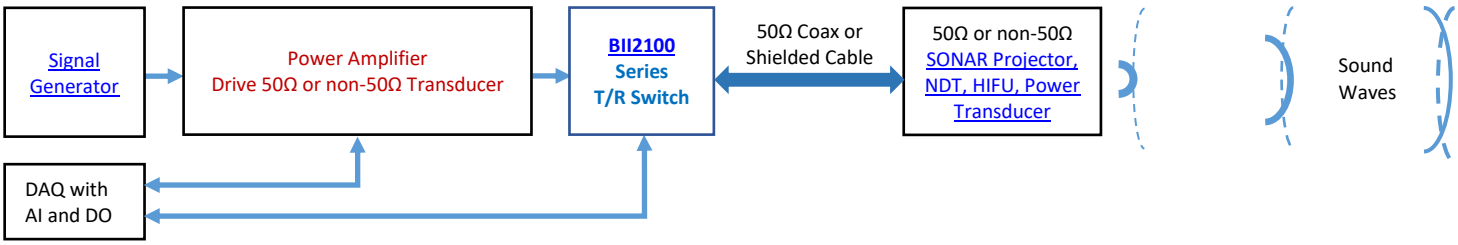
BII5120 series linear power amplifiers drive acoustic transducers from 20 Hz to 2 MHz to generate sounds (acoustic waves) in water, air, and solids.

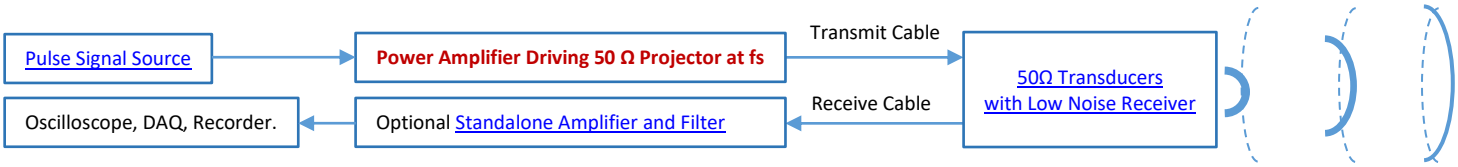
SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.





Related Product:

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

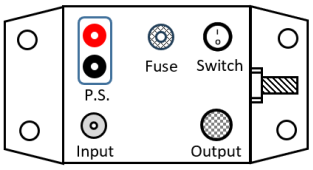
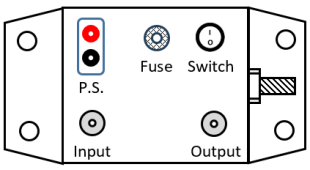
TYPICAL APPLICATIONS

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

ABSOLUTE MAXIMUM RATINGS

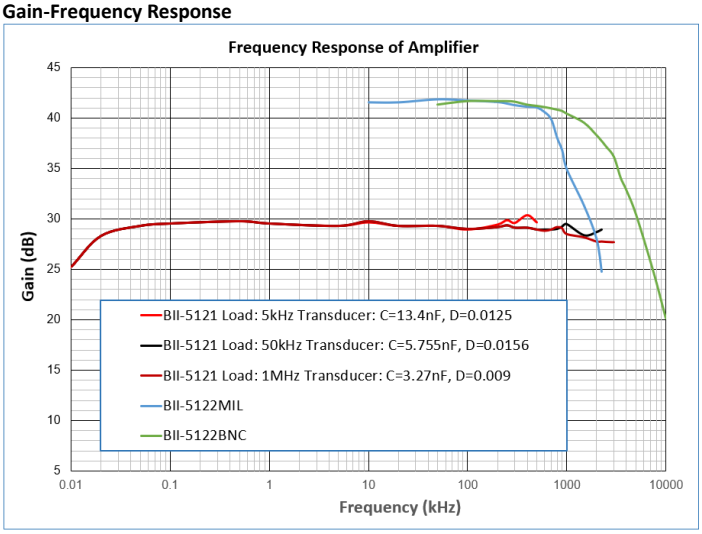
DC Supply Voltage:	+36 VDC
Output Peak Current:	12 A at Pulse Width ≤ 6 mS, Duty Cycle ≤ 50%
Shut-down Control Voltage:	-20 to +20 VDC
Input Voltage:	20 Vpp

SPECIFICATIONS

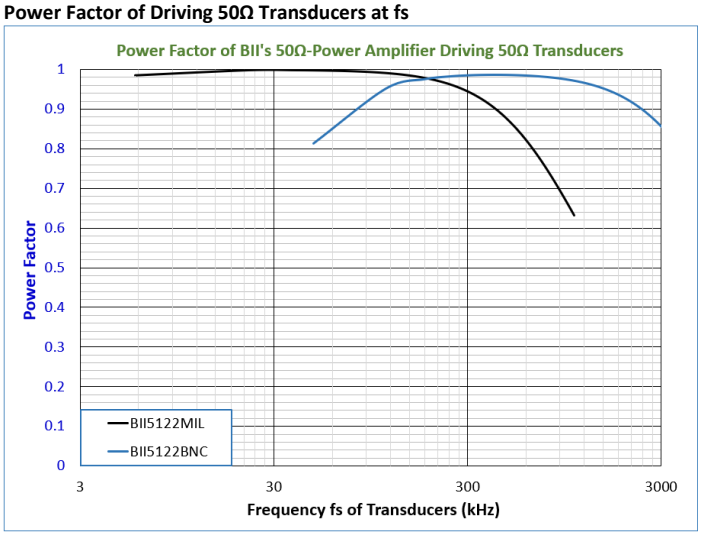
	BII5121	BII5122MIL	BII5122BNC
Power Amplifier			
Status:	**ACTIVE**	**ACTIVE**	
	ACTIVE: Product device recommended for new designs. **LIFEBUY**: BII has announced that the device will be discontinued, and a lifetime-buy period is in effect. **OBSOLETE**: BII has discontinued the production of the device.		
Waterproof:	Not waterproof. **Always use the device in Dry Air for electrical safety.**		
Operating frequency: (Small Signal)	20 Hz to 3 MHz	6 to 500 kHz	50 kHz to 3 MHz
	Small Signal: Load ≥ 100Ω, Output Voltage ≤ Half V_{omax}, Output Current ≤ Half I_{omax}.		
	Warning: the device performance degrades if operating frequency less than Minimum Operating Frequency.		
Signal Type:	SINE Pulse, Chirp/FM, FSK and PSK, Arbitrary Waveform, Spread Spectrum, Marine Animal Sound, Continuous Signals, 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.		
Operating Mode:	Linear		

Impedance Matching:	No Built-in Impedance Matching.	Built-in Impedance Matching.	Built-in Impedance Matching.
Voltage Gain:	29.5 dB or 30	41.76 dB or 122.5	41.76 dB or 122.5
Input Type:	Single ended or Differential	Single ended	Single ended
Input Connector:	On-board	BNC Jack	BNC Jack
Input Impedance:	10 kΩ || 6 pF	5 kΩ || 6 pF	5 kΩ || 6 pF
Maximum Input Level:	Maximum Output Level/Gain, or **2Vpp**, whichever is less.		
Output Type:	Differential	Single Ended	Single Ended
Output Connector:	On-board	MIL-5015, 3 Sockets.	BNC Jack
Voltage Output:	Maximum Vo_{max} = (2*Vs - 8) in Vpp.	Input Level * Gain, or 230 Vpp.	Input Level * Gain, or 230 Vpp.
Current Output:	Io ≤ 10 A peak	Io ≤ 3.46 A peak	Io ≤ 3.46 A peak
Load:	≥ Vo/Io	50Ω Transducers	50Ω Transducers
		Question: Are 50Ω Power Amplifiers suitable to drive non-50Ω transducers? if the impedance of a transducer is greater than 50 Ω at operating frequency, the 50Ω Power Amplifiers can drive this non-50Ω transducer, but the power delivered to non-50Ω transducer is reduced.	
Shut-down Control:	On-board ON/OFF Switch: Manually or Digitally	N/A	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	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	N/A
	Warning: Control voltage higher than +20VDC or lower than -20VDC will damage the device.		
Output Disable Time:	1 µS		
Output Enable Time:	1 µS		
Power Bandwidth: (-3dB)	20 Hz to 2 MHz, Refer to **Gain-Frequency Response.**	6 to 500 kHz	50 kHz to 2 MHz
	Warning: DO NOT operate the device at frequencies lower than the minimum frequency stated above to avoid performance degradation and device damage.		
RMS Power Capability:	133 W@+35 VDC Power Supply. 78 W@+24 VDC Power Supply. 18 W@+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 BII5122MIL 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 MAXIMUM RATINGS 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. $Current = Rated\ DC\ Supply\ Current * \sqrt{D}$. D: Duty Cycle of the pulsing sugnal = 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	65 mA
DC Supply Connector:	On-board	Sheathed Banana Jack.	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	Metal Enclosure
Grounding Terminal:	N/A	Grounding Stud #10-24.	Grounding Stud #10-24.
Mounting Holes:	4 x Φ4.87 mm through-holes	4 x Φ5.5mm (Φ0.217")	4 x Φ5.5mm (Φ0.217")
	Screws are not supplied.		
Physical Size (mm):	Round PCB, ΦDxH = Φ101.6x48	LxWxH = 231x120x75	LxWxH = 231x120x75
Weight in Air:	230 grams	1.8 kg	1.6 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

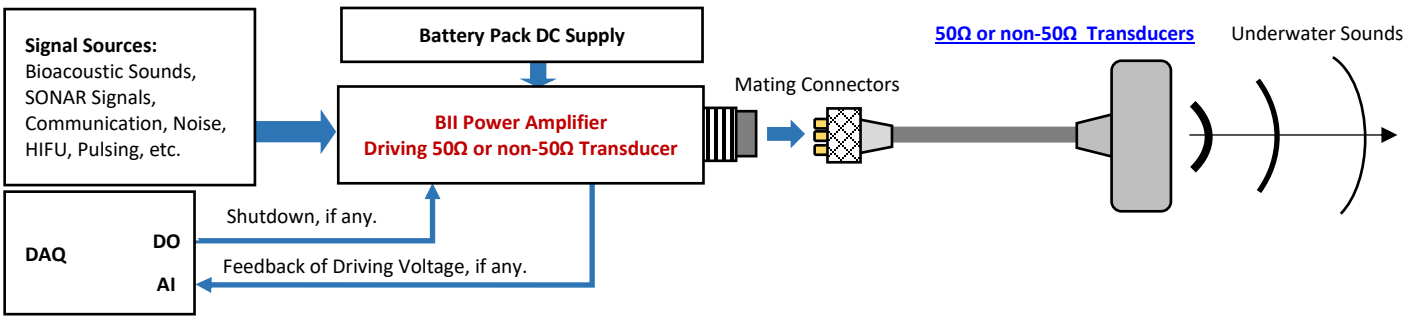


Power Factor of Driving 50Ω Transducers at fs

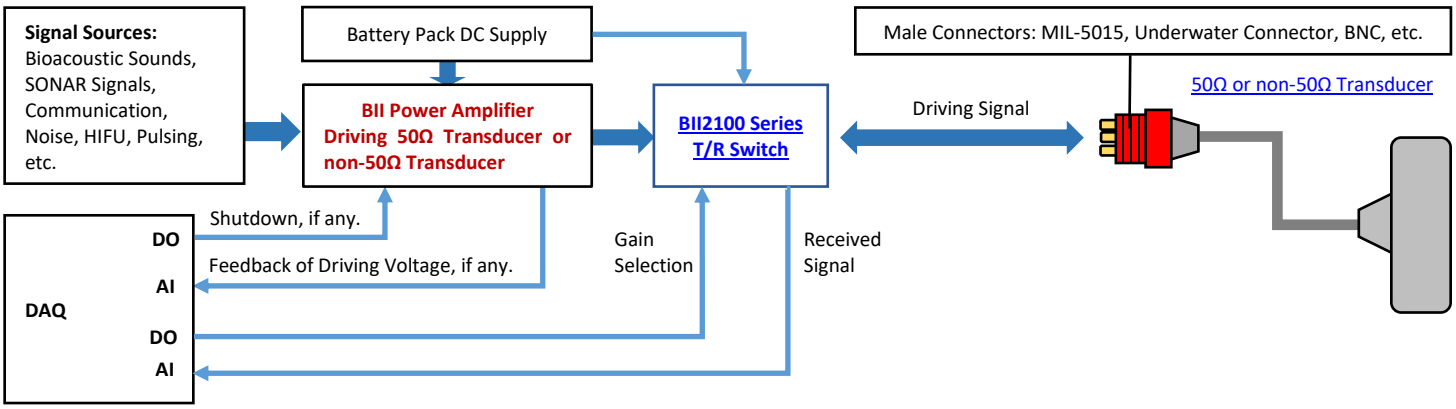


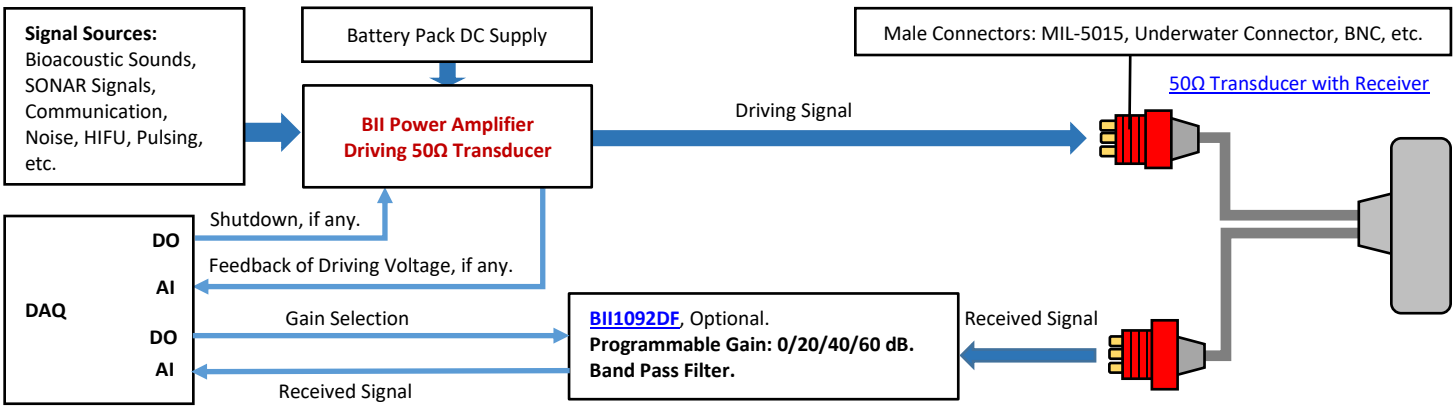
Acoustic System Block Diagram

1. Generate Sounds and Waves.

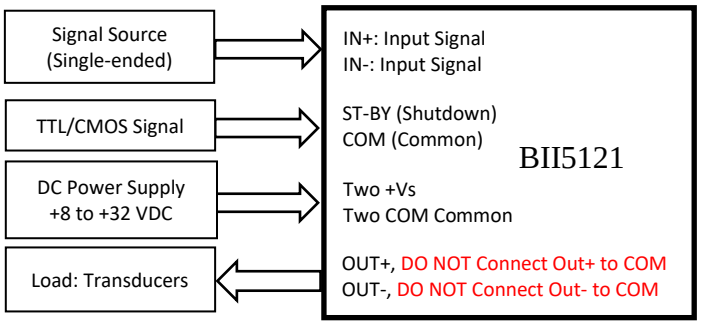


2. Transmitting and Receiving Sounds and Waves





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.

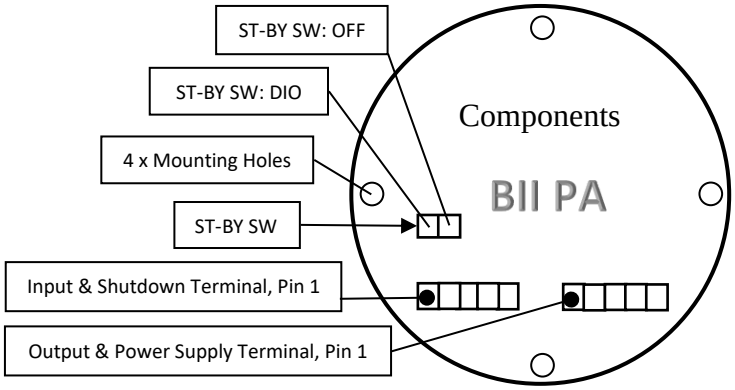
BII5121 TERMINALS and WIRINGS

Input and ST-by (Shutdown) Terminal

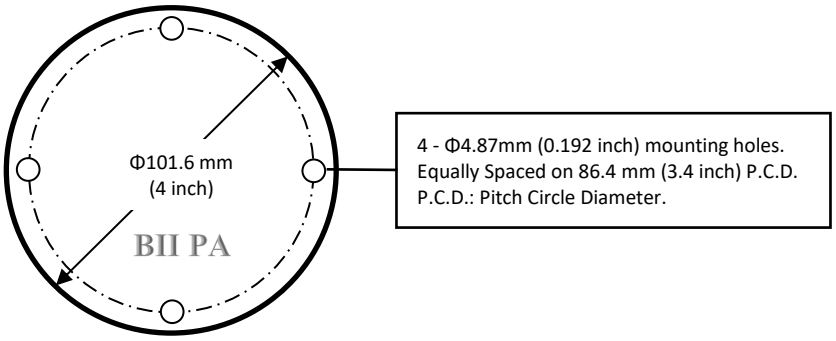
Pin 1: ST-BY (Shutdown)	White,	6" Wire
Pin 2: COM (Common)	Black,	6" Wire
Pin 3: IN+ (Input Signal)	Blue,	6" Wire
Pin 4: IN- (Input Common)	Yellow,	6" Wire
Pin 5: COM (Common)	Black,	6" Wire

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): ΦDxH = Φ101.6x48mm



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.

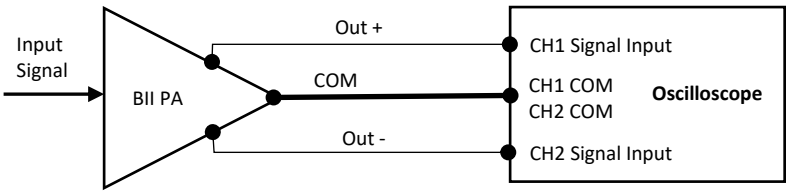
How to Extend Input and Output Wires of BII Power Amplifiers (PCB Package for Embedded Applications.)?

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.

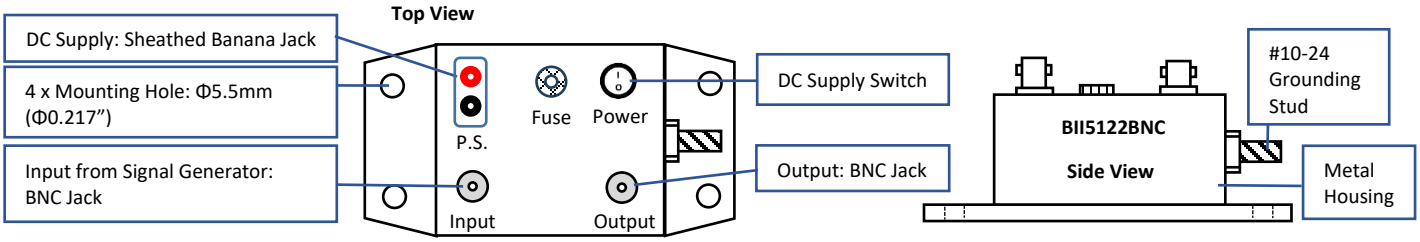
Note: a. by default, BII does NOT provide these connectors. If buyer needs connectors, please specify when ordering.
b. When wiring, please ensure insulation (avoid short circuit to damage the devices) and safety of operation.

Measure Differential Output of BII Power Amplifiers

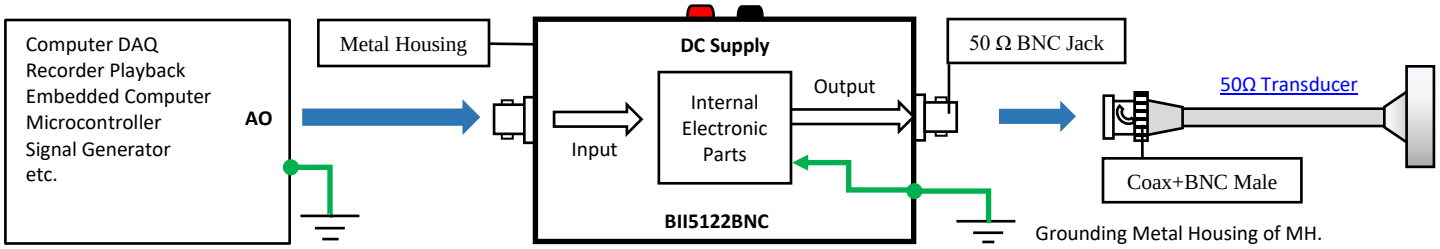


Warning: Outputs of the Power amplifier are differential,
DO NOT Connect Out + or Out - to any COM.

BII5122BNC: Output Connector: BNC Jack. Metal Enclosure, Overall Size: LxWxH = 231x120x75mm. Mounting Hole Φ5.5mm (Φ0.217") accepts M5 or #10 screw. Screws are not supplied.



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



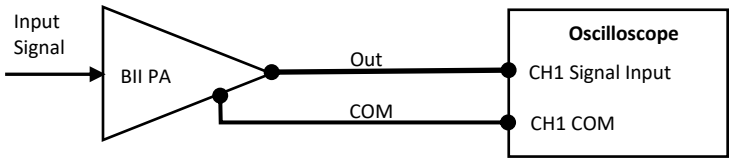
Buyer's Signal Source	BII5122BNC		50 Ω Transducer
	Input: BNC Jack	Output: BNC Jack	Coax + In-line BNC (Male)
Analog Output	Signal: Center Contact	Output Signal: Center Socket.	Signal: Center Pin.
Analog Common	Grounded Common: Body	Grounded Common: Body.	Grounded Common: Body.
DC Power Supply:	**Red 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 to 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.

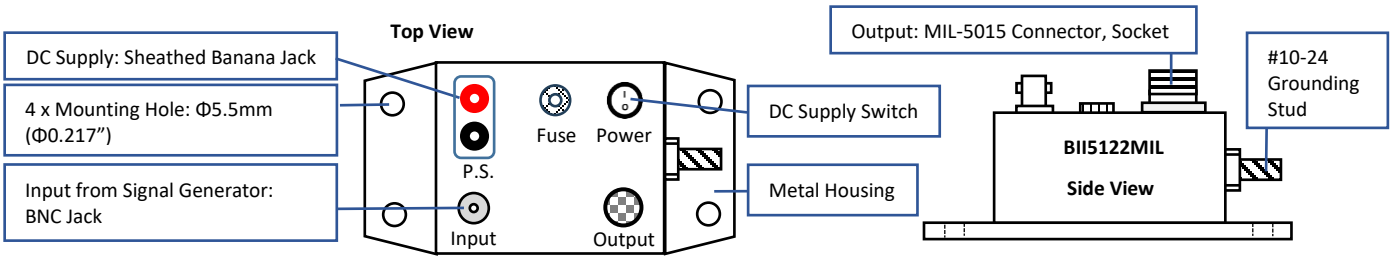
Customer's Question: What if the connector of my transducer/projector is SMA or SMC Connector?
BII Answers: Buyer may order a BNC to SMA (or SMC) adaptor from local electronic distributors in buyer's country. BII may ship the adaptor as accessory of the device. Please discuss with BII for customizations.

Measure Single Ended Output of BII Power Amplifiers

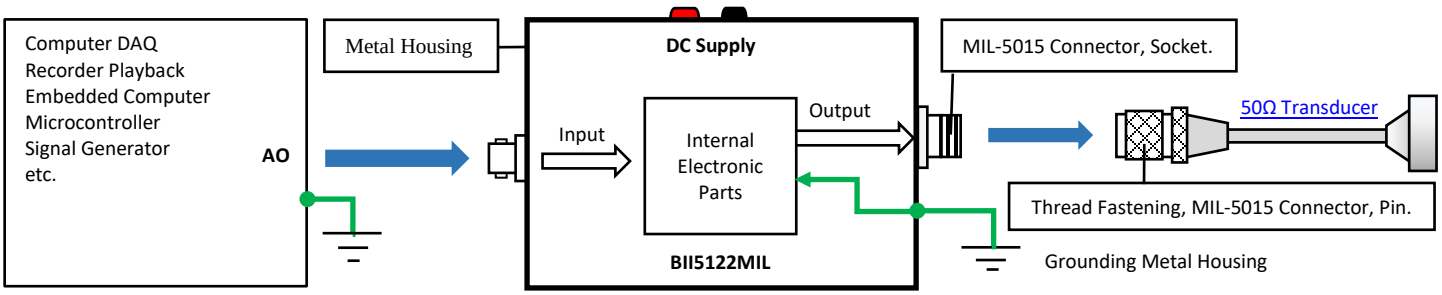


Warning:
1. Outputs of the power amplifier is high voltage, choose suitable oscilloscope probe with correct attenuation and voltage rating.
2. for operating safety, ensure proper grounding, and shut down power supply of the device before handing the cables, wiring and hookup, etc.

BII5122MIL: Output Connector: MIL-5015 Connector, Socket. Metal Enclosure, Overall Size: LxWxH = 231x120x75mm. Mounting Hole Φ5.5mm (Φ0.217") accepts M5 or #10 screw. Screws are not supplied.



System Block Diagram and Wirings: Driving 50Ω Transducer with MIL-5015 Connector, Pin.



Buyer's DAQ	**BII5122MIL**		**Buyer's 50 Ω Transducer**
	Input: BNC Jack	**Output: MIL-5015 Connector, Socket.**	**Cable + In-line MIL-5015 (Pin)**
Analog Output	Signal: Center Contact	Output Signal: Socket C	Signal: Pin C
		Common: Socket B	Common: Pin B
Analog Common	Grounded Common: Body	Grounding: Socket A	Grounding: Pin A
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. **"I" -> ON; "O" -> OFF.**		
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 to 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.			

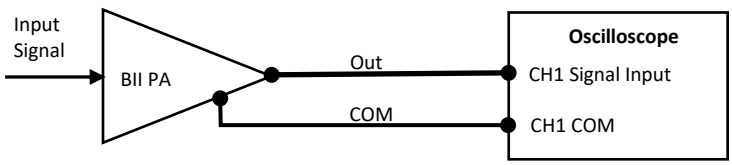
How to Order

BII5122MIL	-Adaptor Accessory
Example of Part Number:	**Description**
BII5122MIL	BII5122MIL, Linear Power Amplifier, Driving 50Ω Transducer.
BII5122MIL-MIL-UMCF3S	BII5122MIL, Linear Power Amplifier with Adaptor Accessory: MIL-UMCF3S, Driving 50Ω Transducer.
BII5122MIL-MIL-SUMC3S	BII5122MIL, Linear Power Amplifier with Adaptor Accessory: MIL-SUMC3S, Driving 50Ω Transducer.

Customer's Question: What if the connector of my transducer/projector is NOT MIL-5015 Connector with Pins?

BII Answers: 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. 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), you may make a connector adaptor from MIL-5015 (pin) to Underwater connector (Socket). BII may make this connector adaptor as accessory of the device. Please discuss with BII for customizations.

Measure Single Ended Output of BII Power Amplifiers



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

DC Supply Cable Pair: Part Number DCBP18.

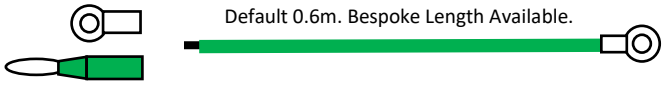
To Terminals of DC Supply:
a. Default: Wire Lead
b. One Red 4mm Banana Plug.
c. One Black 4mm Banana Plug.

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 wire-lead, another end is Sheathed Banana Plug. One pair banana plugs (Red and Black) are included. Depending on output terminals of buyer's DC Supply, buyer assembles Banana Plugs, or other type of connectors to DC supply cable at buyer's cost.

Grounding Cable and Terminals

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



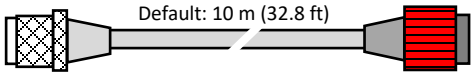
#10 Ring Terminal
#10-24 nut and #10 washer included.

Grounding Cable, Part Number: GWL18, Support Single-Point Grounding with Multiple Devices.
One 0.6m AWG 18 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 of connectors to grounding cable at buyer's cost.

Adaptor Accessory:

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

MIL-5015
3 Pin

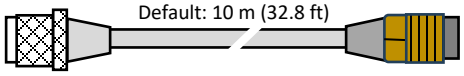


Underwater Connector, 3 Sockets.
Contact 2: Signal.
Contact 1: Common.
Contact 3: Shielding and Grounding.

Transducer with 3-Pin Underwater Connector and DLSA-M Locking Sleeve.

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

MIL-5015
3 Pin

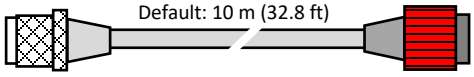


Underwater Connector, 3 Sockets.
Contact 2: Signal.
Contact 1: Common.
Contact 3: Shielding and Grounding.

Transducer with 3-Pin Underwater Connector and MCDLS-F Locking Sleeve.

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

MIL-5015
3 Pin

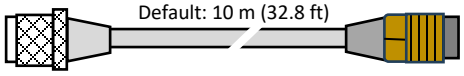


Underwater Connector, 2 Sockets.
Contact 2: Signal.
Contact 1: Common.

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

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

MIL-5015
3 Pin

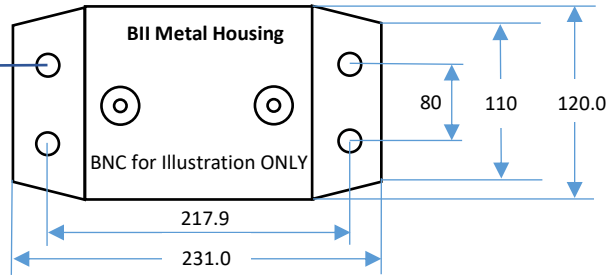


Underwater Connector, 2 Sockets.
Contact 2: Signal.
Contact 1: Common.

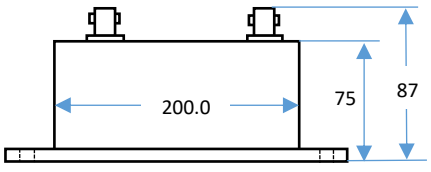
Transducer with 2-Pin Underwater Connector and MCDLS-F Locking Sleeve.

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

4 x Mounting Hole:
Φ5.5mm (Φ0.217").
Accepts M5 or #10
Screw (Not Supplied).



Top View



Side View