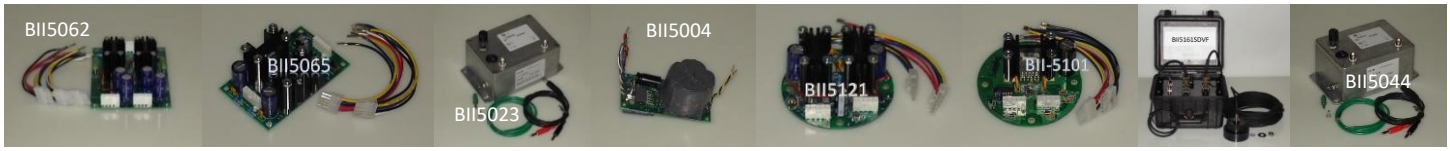


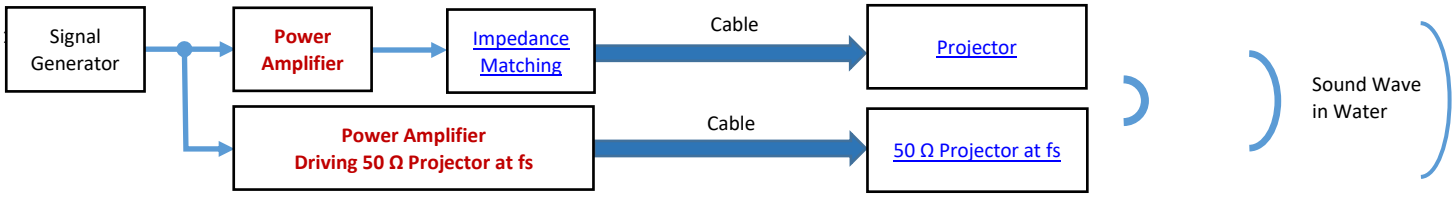
BII5000 Series Power Amplifier

DESCRIPTION

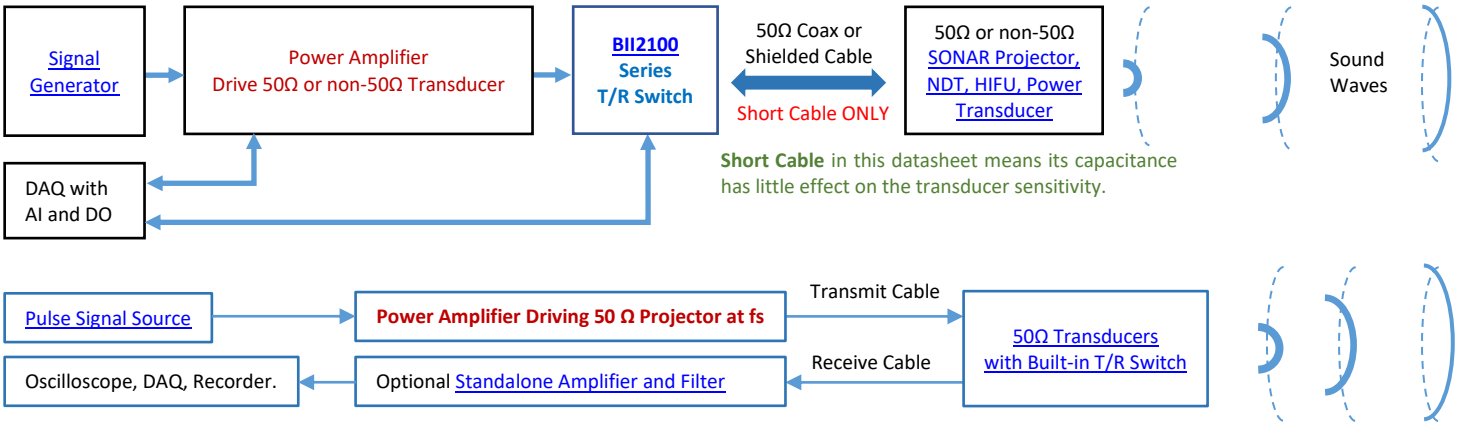
32 W_{rms} Linear power amplifiers as embedded components for +12VDC battery-powered underwater acoustic system up to 120kHz.

SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.



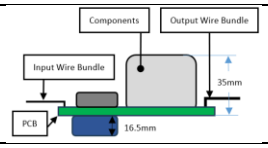
APPLICATIONS

Acoustic Beacon/Transponder/Acoustic Release/Position Marking	Acoustic Modem/Communication/Telemetry/ Netsonde
Sound Playback/Noise Simulation/Artificial Acoustic Target	Bioacoustics and Biology, Audiogram Studies/Audiometry

ABSOLUTE MAXIMUM RATINGS

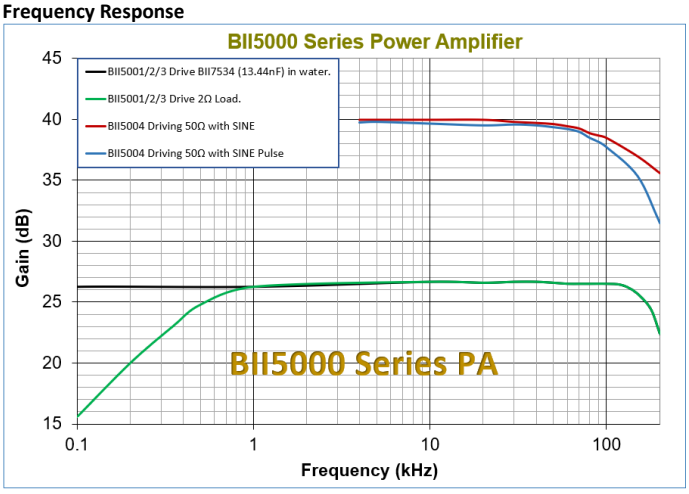
Power Amplifier:	**BII5001, BII5002, BII5003**	**BII5004**
DC Supply Voltage:	+19 VDC	+19 VDC
Input Voltage:	10 Vpp	10 Vpp
Output Peak Current:	6.5 A	1.2 A

SPECIFICATIONS

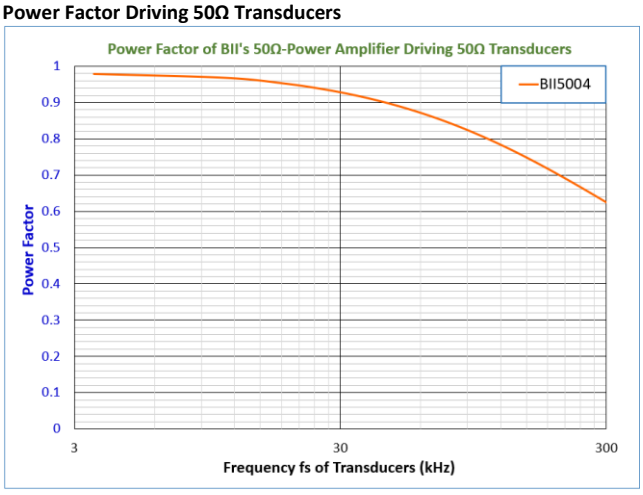
Power Amplifier	**BII5001**	**BII5002**	**BII5003**	**BII5004**
				
Status:	**LIFEBUY**	**ACTIVE**	**ACTIVE**	**ACTIVE**
	ACTIVE: Product device recommended for new designs. **LIFEBUY**: BII has announced that the device will be discontinued, and a lifetime-buy period is in effect. **OBSOLETE**: BII has discontinued the production of the device.			
Source Level Capability:	184.0 + DI, in dB re µPa*m. DI: Directivity Index, in dB.			
Signal Type:	SINE Pulse, Chirp/FM, FSK, PSK, Square Waveform, CW, etc.	**Pulsed Signal**: Duty Cycle ≤ 10%, Pulse Width ≤ 100mS.	SINE Pulse, Chirp/FM, FSK, PSK, Square Waveform, CW, etc.	
Operating Mode:	Linear Mode			
Impedance Matching:	No	No	No	Yes, mounted on PCB.
Gain:	26 dB or x20	26 dB or x20	26 dB or x20	40 dB or x 100
Power Bandwidth (-3 dB):	10 Hz to 120 kHz with load of BII low frequency transducer (customized BII7534, 13.44nF).			f_{min} to 100 kHz
Minimum Operating Frequency f_{min}:	10 Hz	10 Hz	10 Hz	Sine Pulse or CW: 4 kHz. Square Signal: 5.6 kHz.
	Warning: the device performance degrades if operating frequency less than Minimum Operating Frequency.			

Input Type:	Single Ended or Differential	Single Ended	Single Ended	Single Ended
Input Signal Level:	**Max. Input Signal Level** = (Maximum Output V_{omax})/Gain or **2 Vpp**, whichever is less.			
Input Impedance:	60 kΩ || 6 pF			
Output Type:	Differential Output	Differential Output	Differential Output	Singe Ended Output
RMS Power Capability:	16W@+8VDC Supply 23W@+10VDC Supply 32W@+12VDC Supply 37W@+14VDC Supply 43W@+16VDC Supply			
Power Efficiency: **(at max. output current)**	Driving Tuned Transducers (Resistive load): 69%.			
	Driving Untuned Transducers: Efficiency of driving tuned transducers*cosθ. θ: Impedance Phase of Untuned Transducers.			
Maximum Output:	V_{omax} = 2*(Supply Voltage V_s – 0.7), in Vpp, at Vs = +8 to +12 VDC. V_{omax} = 2*(Supply Voltage V_s – 1.2), in Vpp, at Vs = +14 VDC. V_{omax} = 2*(Supply Voltage V_s – 1.3), in Vpp, at Vs = +16 VDC.			79.5 Vpp at Vs=+8VDC 113.5 Vpp at Vs=+12VDC 147.6 Vpp at Vs=+16VDC
Max. Output Current:	6 A			1.2 A
Minimum Load:	2, or (Maximum Output in Vp) / (6 Ap), in Ω, whichever is greater.			50Ω Transducers.
Stand-by Control Voltage: **(Shut Down)**	**Digital Output Control:** Stand-by ON (Shut Down) Threshold Voltage, Logic Low or "0": 0 to 1.5 VDC. Stand-by OFF (Fully Operational) Threshold Voltage, Logic High or "1": 3.5 VDC to Vs. After Stand-by OFF is switched to ON, automatic mute about 20 seconds. Warning: voltage protection rating of Digital Output must be greater than power supply voltage level, otherwise the digital output shall be damaged by the power supply voltage.			
	Manual Control: Stand-by Wire (blue) Open: Stand-by OFF (Fully Operational). Stand-by Wire (blue) Short to COM: Stand-by ON (Shut Down).			
DC Supply Voltage V_s:	+8 to +18 VDC			
	Warning: DC Supply voltage greater than MAXIMUM RATINGS will damage the devices.			
DC Supply Current Is:	4.3 A at Maximum Power Output.			7.1 A at M
	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 = 4.3A * $\sqrt{0.01}$ = 0.43 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:	**Active**: 100 mA, **Stand-by ON (shut-down)**: 10 μA.			
Wires on PCB:	Detachable Connector with 6" (0.15m) wires	40mm wires	40mm wires	40mm wires
Size:	Round PCB. ΦDxH=Φ101.6x50.8 mm.	Rectangular PCB. LxWxH = 47x38x34 mm.	Rectangular PCB. LxWxH = 92x48.3x34 mm.	Rectangular PCB. LxWxH = 92x48.3x51.5 mm.
Mounting through-holes:	4xΦ4.87 mm	2xΦ3.81mm	4xΦ3.81 mm	4xΦ3.81 mm
Weight:	53 grams	14 grams	50 grams	190 grams
Operating Temperature:	-20 to 80°C or -4 to 176°F			
Storage Temperature:	-20 to 80°C or -4 to 176°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.				

Frequency Response

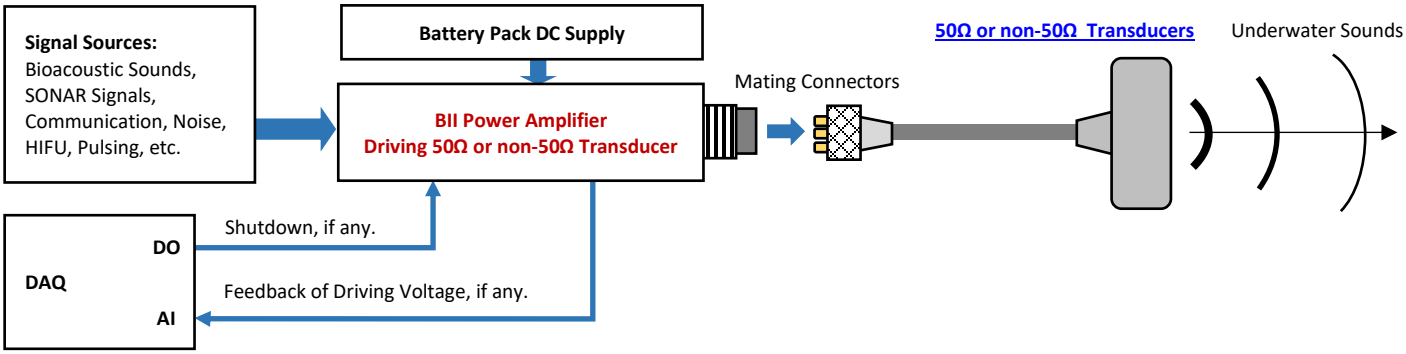


Power Factor Driving 50Ω Transducers

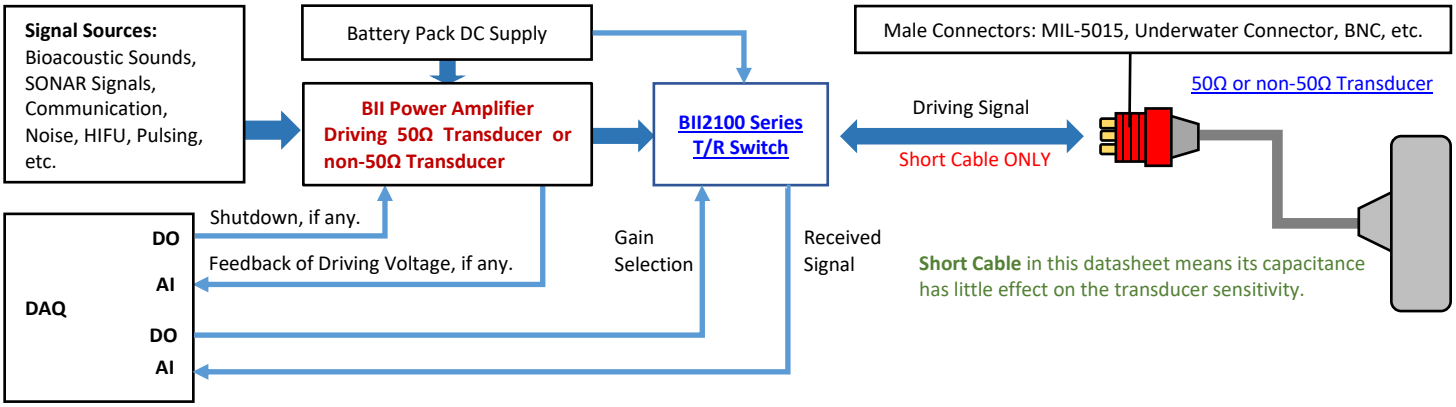


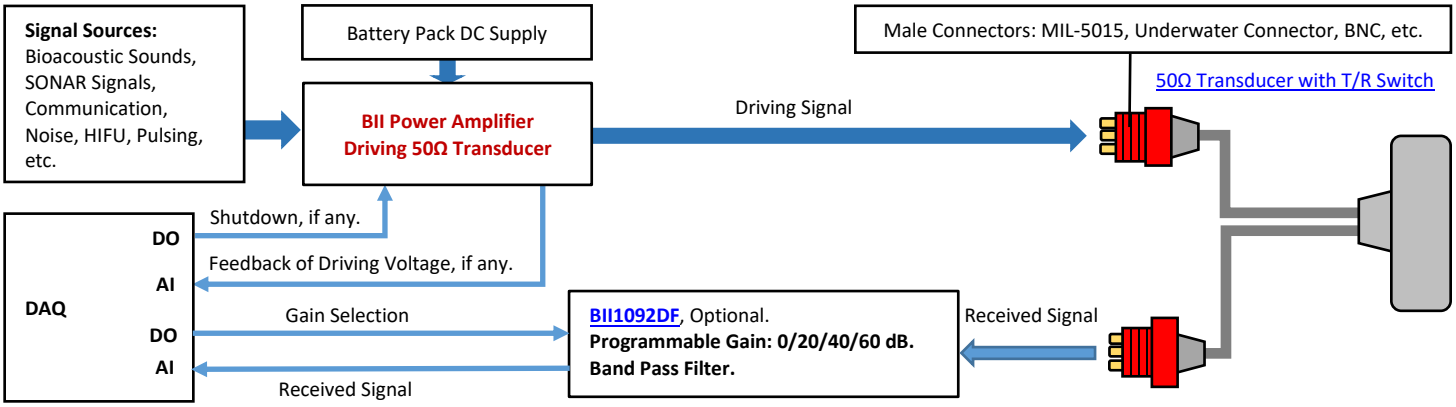
Acoustic System Block Diagram

1. Generate Sounds and Waves.



2. Transmitting and Receiving Sounds and Waves

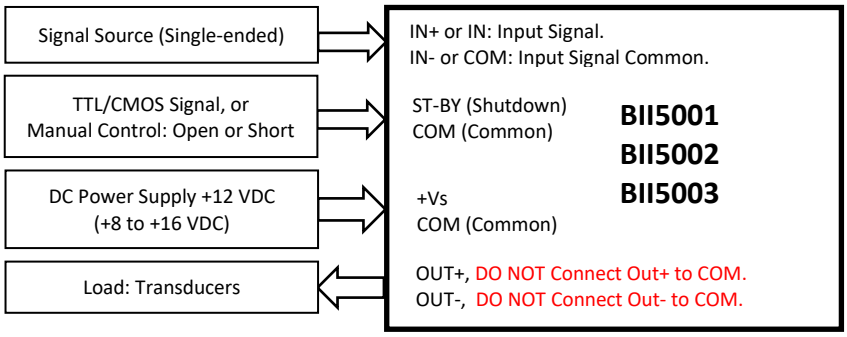




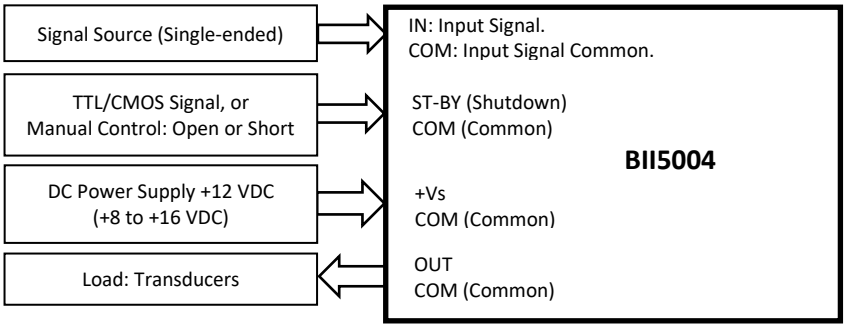
Question: Are 50Ω Power Amplifiers suitable to drive non-50Ω transducers?

Answers: 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.

SUGGESTED WIRING:



Warning: Outputs of the Power amplifier are differential, DO NOT Connect Out + or Out - to COM.
Note:
1. Switches can be used for "open" and "short" between ST-BY and COM.
2. Digital Output of DAQ Modules can be used to generate TTL/CMOS signals.
Warning: voltage protection rating of Digital Output must be greater than power supply voltage level, otherwise the digital output shall be damaged by the power supply voltage.



Note:
1. Switches can be used for "open" and "short" between ST-BY and COM.
2. Digital Output of DAQ Modules can be used to generate TTL/CMOS signals.
Warning: voltage protection rating of Digital Output must be greater than power supply voltage level, otherwise the digital output shall be damaged by the power supply voltage.

BII5001 ST-BY SWITCH
OFF Position: Operational.
DIO Position: TTL/CMOS Logic High or "1": Operational. TTL/CMOS Logic Low or "0": Stand-by mode (Shut-down Mode).

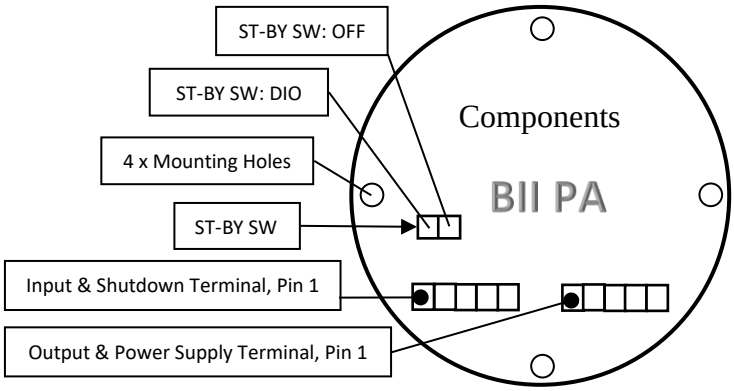
BII5001 TERMINALS and WIRINGS

Input and ST-by (Shutdown) Terminal

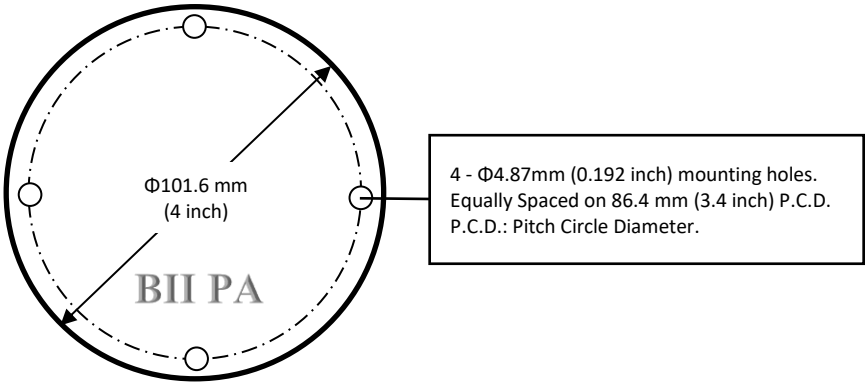
Pin 1: IN- (Input Common)	Blue,	6" Wire
Pin 2: Reserved		
Pin 3: IN+ (Input Signal)	Yellow,	6" Wire
Pin 4: COM (Common)	Black,	6" Wire
Pin 5: ST-BY (Shutdown)	White,	6" Wire

Output and Power Supply Terminal

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



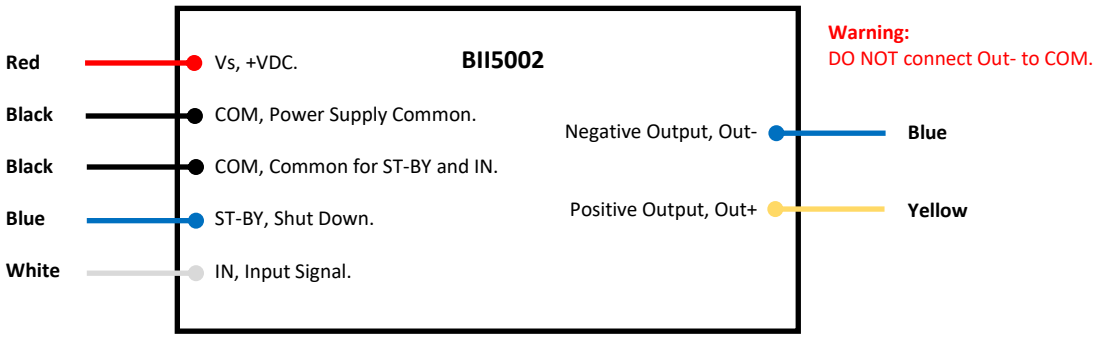
BII5001 Physical Size (Unit: mm): Φ101.6x50.8 mm.



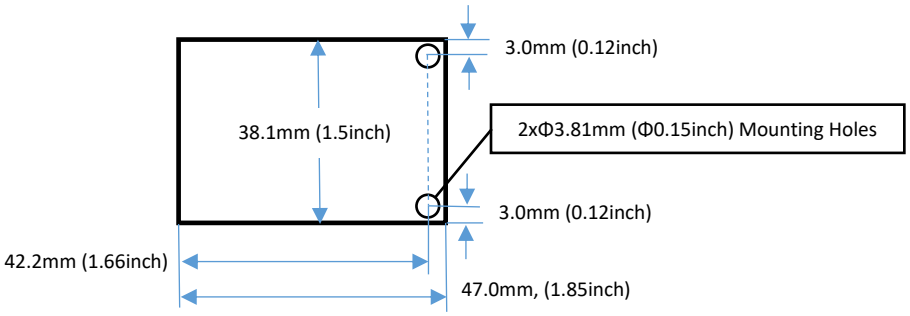
BII5001 SHIPMENT:

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

BII5002 Wiring

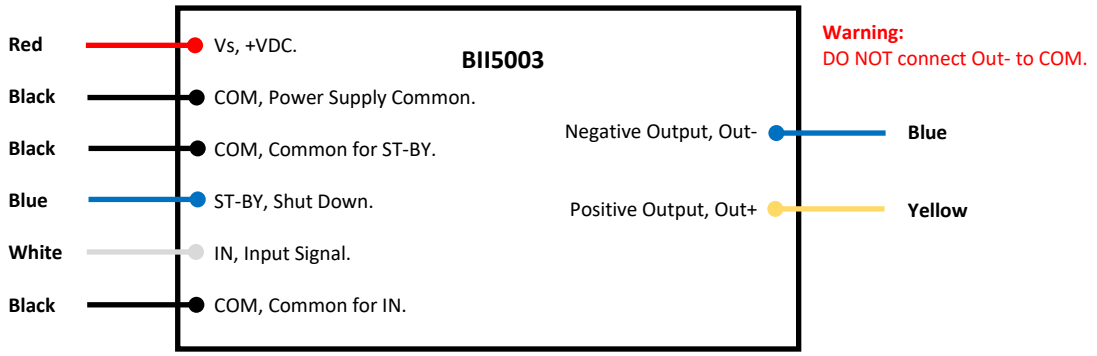


BII5002 PCB Physical Size:

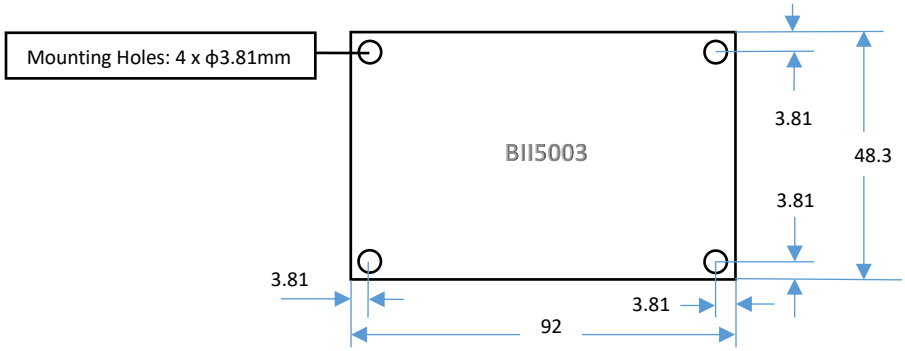


SHIPMENT: Assembled BII5002 board Qty.: 1

BII5003 Wiring

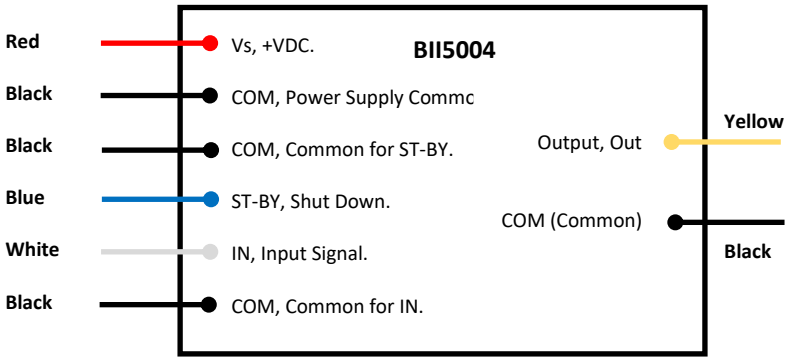


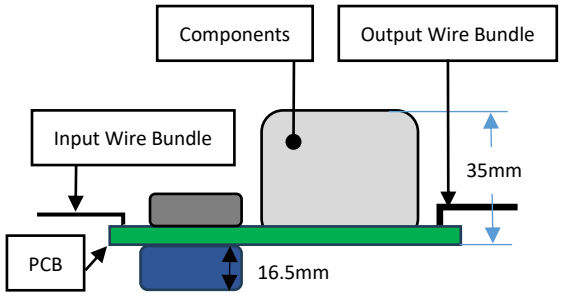
BII5003 PCB Physical Size (Unit: mm): LxWxH = 92x48.3x34mm (3.63”x1.9”x1.34”).



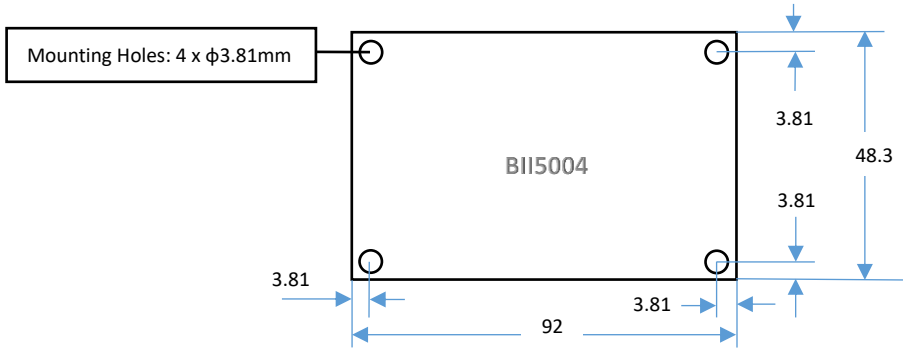
SHIPMENT: Assembled BII5003 board Qty.: 1

BII5004 Wiring



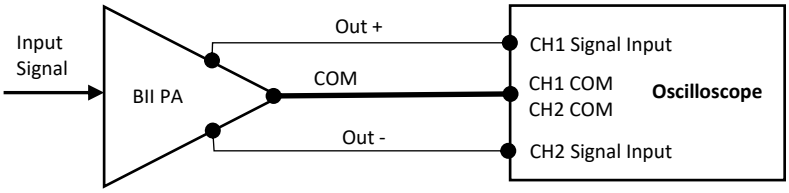


BII5004 PCB Physical Size (Unit: mm): LxWxH = 92x48.3x38.1mm (3.63”x1.9”x1.5”).



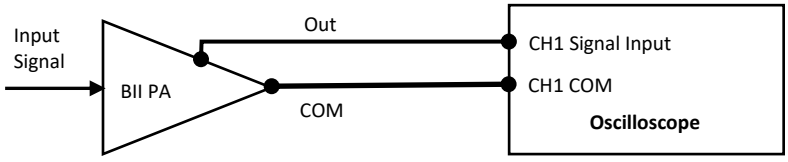
SHIPMENT: Assembled BII5004 board Qty.: 1

Measure Differential Output of BII Power Amplifiers



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

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, wirings and hookup, etc.

Power Amplifier in Metal Case with Four Mounting Holes

A PCB power amplifier is for high-power embedded applications in buyer's system with buyer's suitable cooling measures such as forced air fans. A metal-case power amplifier with four mounting holes is portable and is for pulsing signals (FM/Sine Pulses or Voltage Spikes) with duty cycle less than 10% and Pulse width less than 100mS.

Troubleshooting

The rise edge and fall edge of shut-down or stand-by voltage signal should be as steep as possible. The device will be out of function if a slow slope of rise edge and/or fall edge of shut-down (stand-by) voltage signal is applied to the device.

Solutions:

1. Apply shut-down or stand-by voltage signal with sharp rise/fall edge to the device, or
2. Turn off power supply and re-apply power to the device.

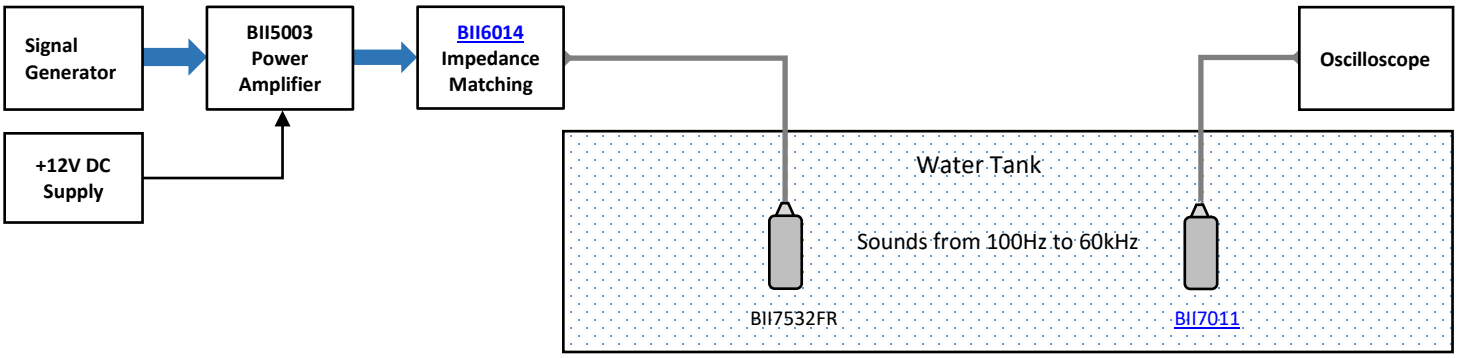
Application Notes

1. BII5003 Power amplifier and BII7532BT (or BII7532FR) generate sounds in water from 100Hz to 60kHz.

Setup at BII Laboratory

Warning: Dangerous High Voltage exists on cables and devices between BII5003 power amplifier and BII7532FR transducer. An End User MUST observe electrical codes of End User's country to ensure electrical safety for operators and devices, for example, Install both BII5003 and BII6014 in a firmly grounded instrument enclosure, and all exposed bare wires, metal wires, wire leads, solders, and joints shall be insulated with insulation material such as heat shrink tubing, fully insulated wire splicing connectors, etc. The insulation voltage must be greater than twice the maximum voltage of the device.

BII does NOT take any liability/responsibility for the setup's electrical safety.



2. BII5004 Power amplifier and Low Power 50Ω Transducers (Projectors, < 32 W_{RMS}.) generate sounds in water from 6 kHz to 100 kHz.

Setup at BII Laboratory

Warning: Dangerous High Voltage exists on cables and devices between BII5004 power amplifier and transducer. An End User MUST observe electrical codes of End User's country to ensure electrical safety for operators and devices, for example, Install both BII5004 in a firmly grounded instrument enclosure, and all exposed bare wires, metal wires, wire leads, solders, and joints shall be insulated with insulation material such as heat shrink tubing, fully insulated wire splicing connectors, etc. The insulation voltage must be greater than twice the maximum voltage of the device.

BII does NOT take any liability/responsibility for the setup's electrical safety.