

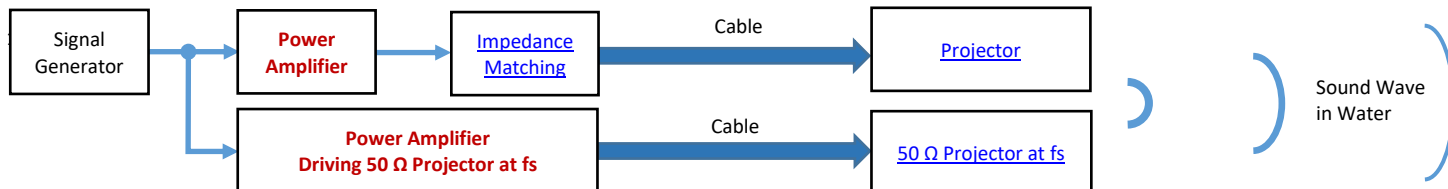
BII5000 Series Power Amplifier

DESCRIPTION

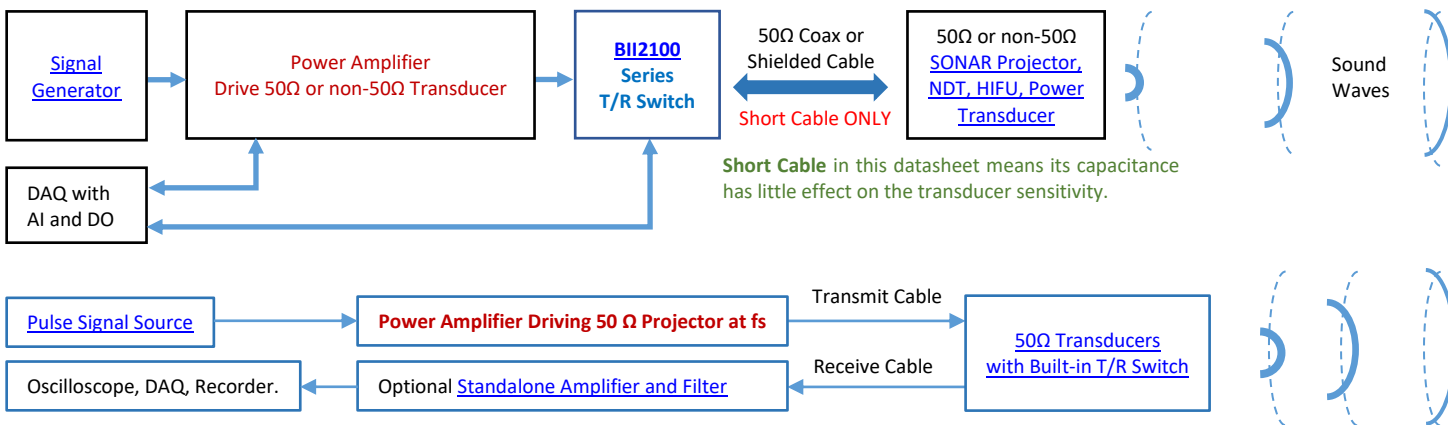
32 W_{rms} Linear power amplifiers as embedded components for +12VDC battery-powered underwater acoustic system up to 120kHz.

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

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

- (1) 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.
- (2) It is NOT recommended for 50Ω Power Amplifiers to drive the transducer whose impedance is less than 50Ω. The power amplifier is most likely to be damaged by overvoltage, exceeding rated power or overheat.

How do I connect the wire of BII Power Amplifier 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.

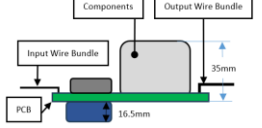
Note: a. by default, BII does NOT provide these connectors. If buyer needs connectors, please specify when ordering.

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

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

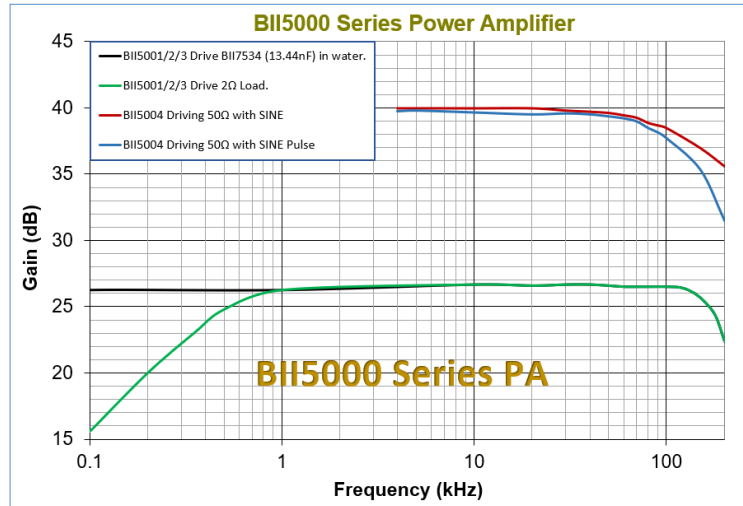
Power Amplifier				
Status:	LIFEBUY	ACTIVE	ACTIVE	ACTIVE
Source Level Capability:	ACTIVE: Product device recommended for new designs. LIFEBUY: BII has announced that the device will be discontinued, and a lifetime-buy period is in effect. OBSOLETE: BII has discontinued the production of the device. 185.8 + η + DI, in dB re $\mu\text{Pa}\cdot\text{m}$. DI: Directivity Index, in dB. η of broadband planar transducers such as NDT Transducers could be $\leq -5\text{dB}$, η of broadband spherical or cylindrical transducers could be $\geq -0.5\text{dB}$. For low and medium frequency (large size) cylindrical and spherical transducer, $\eta \geq 0.85$. SL $\approx$ 185.3 dB at $\eta = 0.9$ (or -0.46 dB), DI = 0 dB (cylindrical or spherical transducers). SL $\approx$ 193.3 dB at $\eta = 0.4$ (or -4.0 dB), DI = 11.5 dB (typical directional communication transducers without side lobes). SL $\approx$ 203.8 dB at $\eta = 0.3$ (or -5.2 dB), DI = 28 dB (typical echo sounding directional transducers with -3dB Beam Angle of 6° to 8°).			
Signal Type:	SINE Pulse, Chirp/FM, FSK, PSK, Square Waveform, CW, etc.	Pulsed Signal: Duty Cycle $\leq 10\%$, Pulse Width $\leq 100\text{ms}$.	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 k Ω 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:	Driving Tuned Transducers (Resistive load): 69%.			
(at max. output current)	Driving Untuned Transducers: Efficiency of driving tuned transducers*cos θ . θ : Impedance Phase of Untuned Transducers.			
Maximum Output:	$V_{\text{omax}} = 2 * (\text{Supply Voltage } V_s - 0.7)$, in Vpp, at $V_s = +8$ to +12 VDC. $V_{\text{omax}} = 2 * (\text{Supply Voltage } V_s - 1.2)$, in Vpp, at $V_s = +14$ VDC. $V_{\text{omax}} = 2 * (\text{Supply Voltage } V_s - 1.3)$, in Vpp, at $V_s = +16$ VDC.			79.5 Vpp at $V_s = +8\text{VDC}$ 113.5 Vpp at $V_s = +12\text{VDC}$ 147.6 Vpp at $V_s = +16\text{VDC}$
Max. Output Current:	6 A			1.2 A
Minimum Load:	2, or (Maximum Output in Vp) / (6 Ap), in Ω , whichever is greater.			50 Ω 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 V_s . 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 I_s :	4.3 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. $\text{Current} = \text{Rated DC Supply Current} * \sqrt{D}$. 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 $I_s = 4.3\text{A} * \sqrt{0.01} = 0.43\text{A}$.			
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	36 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			

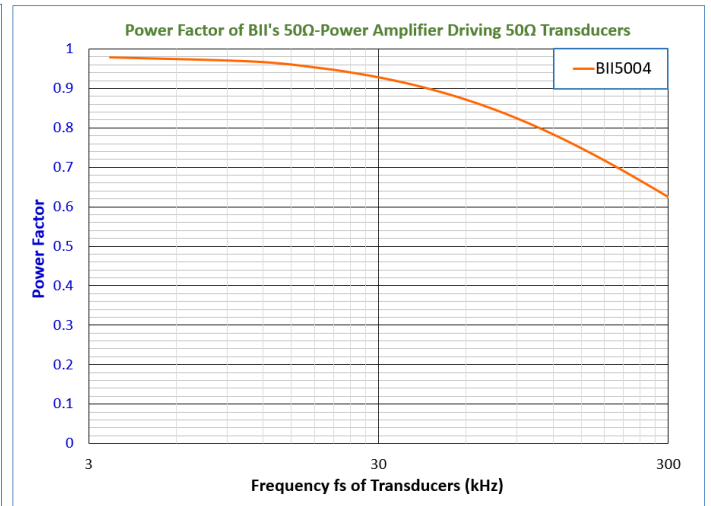
Note: Forced-air cooling by a fan is recommended to cool down the amplifier during service of full power and continuous waveform.

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.

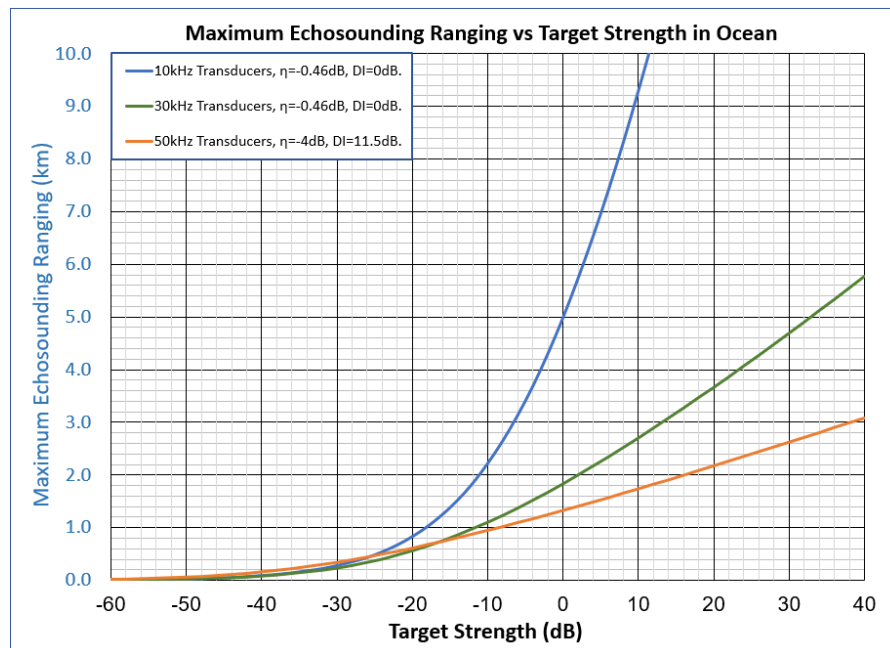
Frequency Response



Power Factor Driving 50Ω Transducers

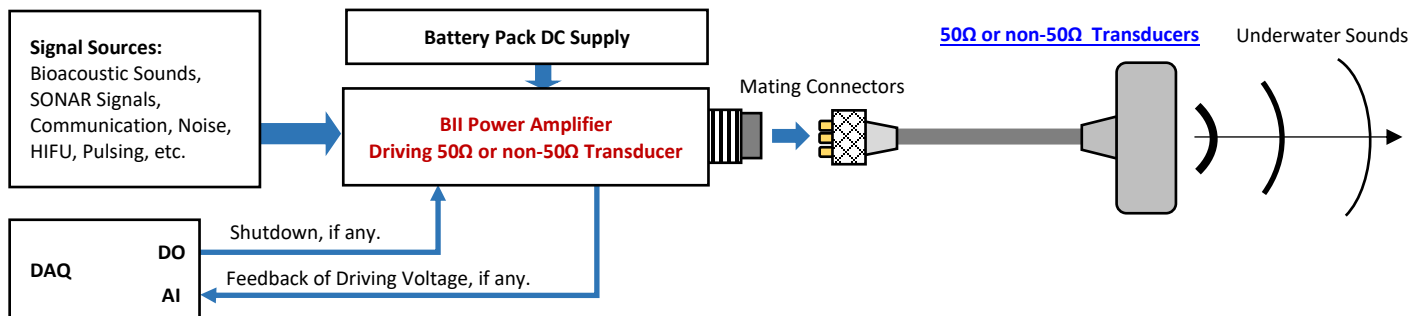


Echo Sounding Range (Communication Range = 2 * Echo Sounding Range at 0dB Target Strength)

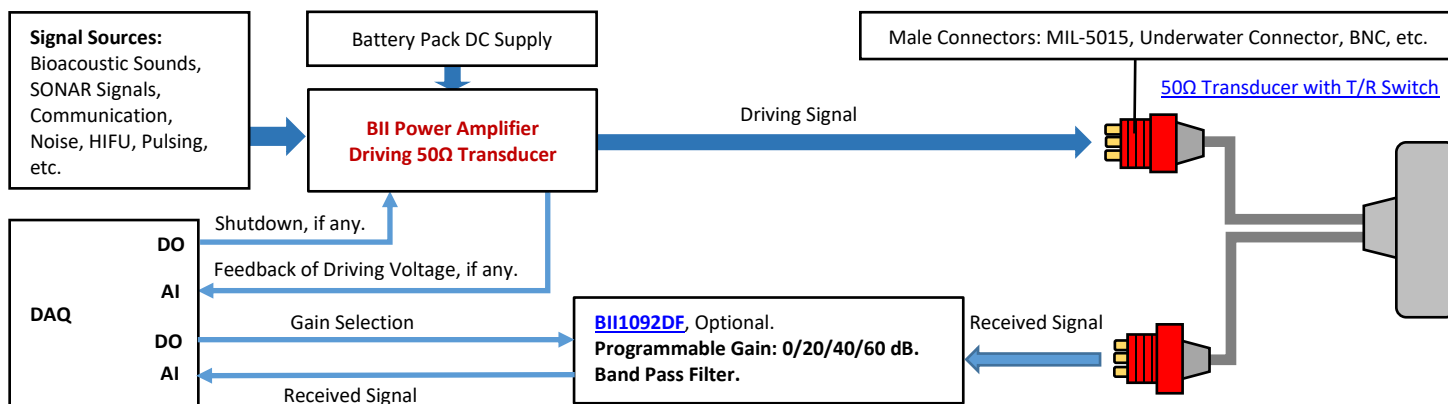
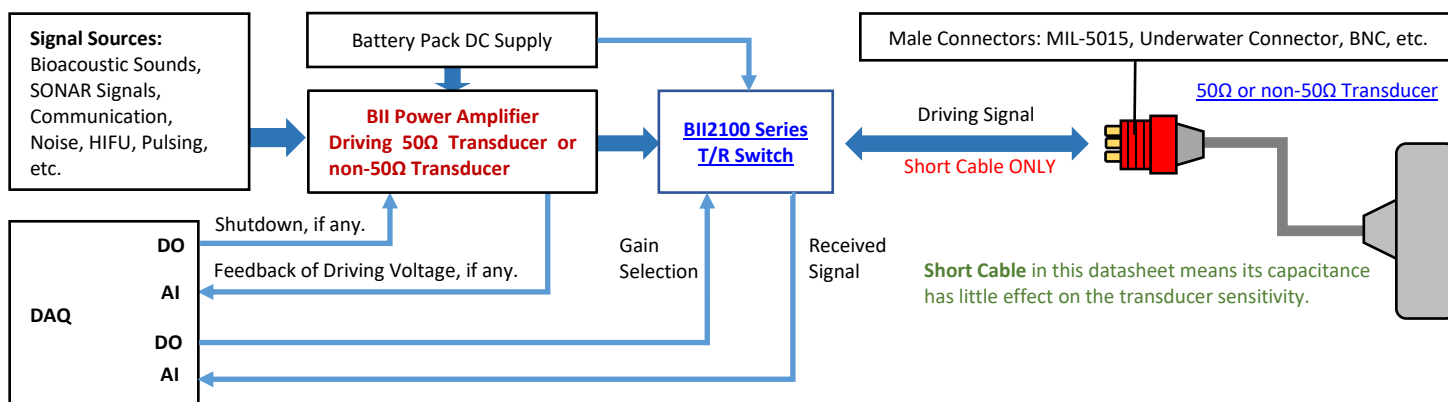


Acoustic System Block Diagram

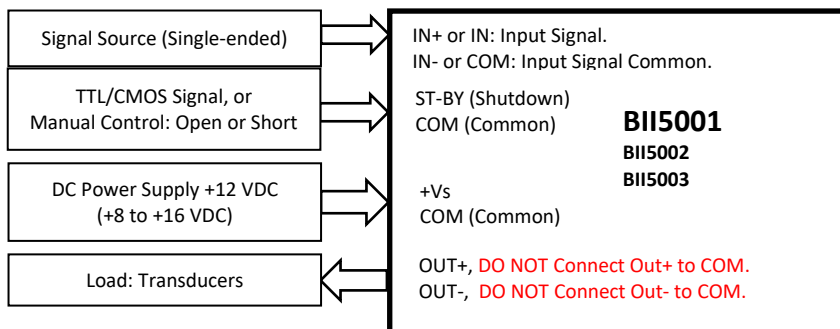
1. Generate Sounds and Waves.



2. Transmitting and Receiving Sounds and Waves



SUGGESTED WIRING:

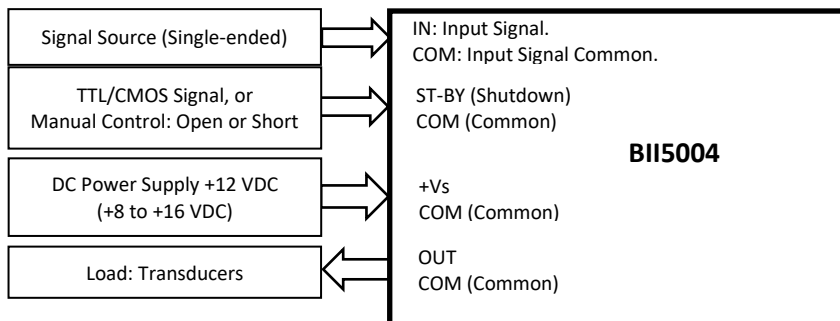


Warning: Outputs of the Power amplifier are differential, DO NOT Connect Out + or Out - to COM.

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).

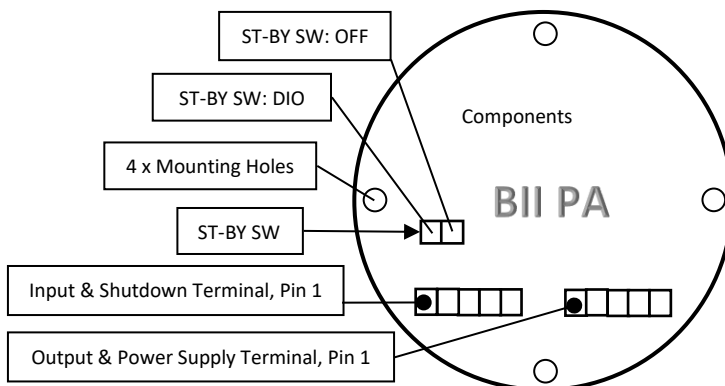
BII5001 TERMINALS and WIRINGS

Input and ST-by (Shutdown) Terminal

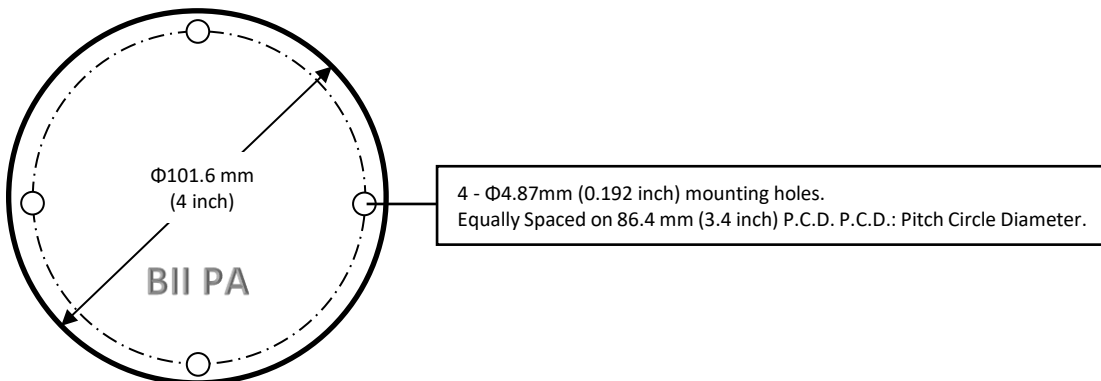
Pin 1: IN- (Input Common)	Blue,	6” Wire
Pin 2: Reserved		
Pin 3: IN+ (Input Signal)	Yellow,	6” Wire
Pin 4: COM (Common)	Black,	6” Wire
Pin 5: ST-BY (Shutdown)	White,	6” Wire

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



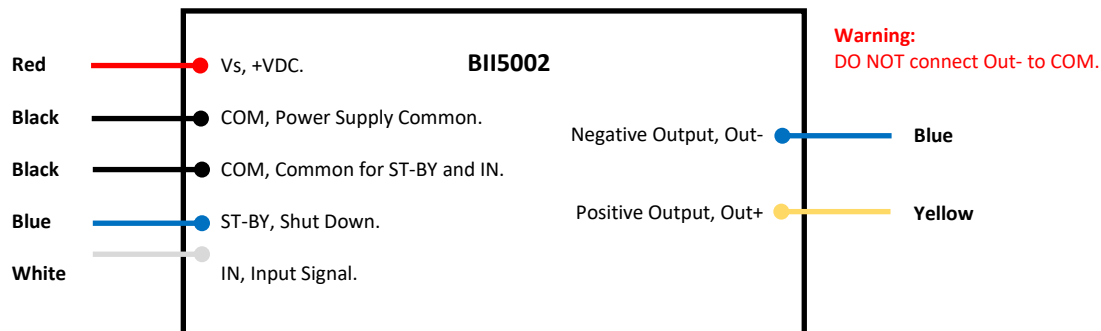
BII5001 Physical Size (unit mm): $\Phi D \times H = \Phi 101.6 \times 50.8 \text{ mm}$



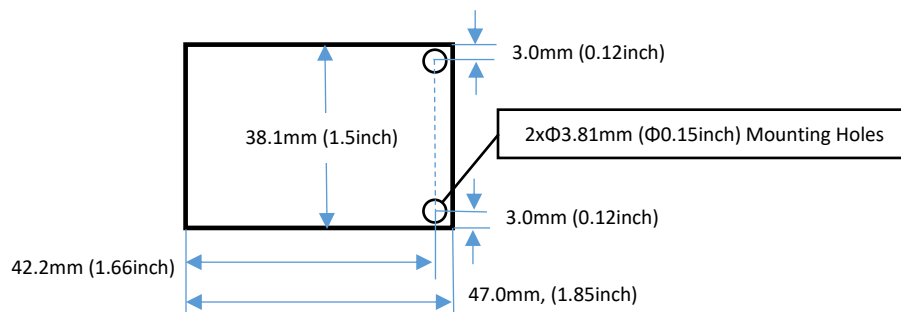
BII5001 SHIPMENT:

- | | |
|---|---------|
| 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



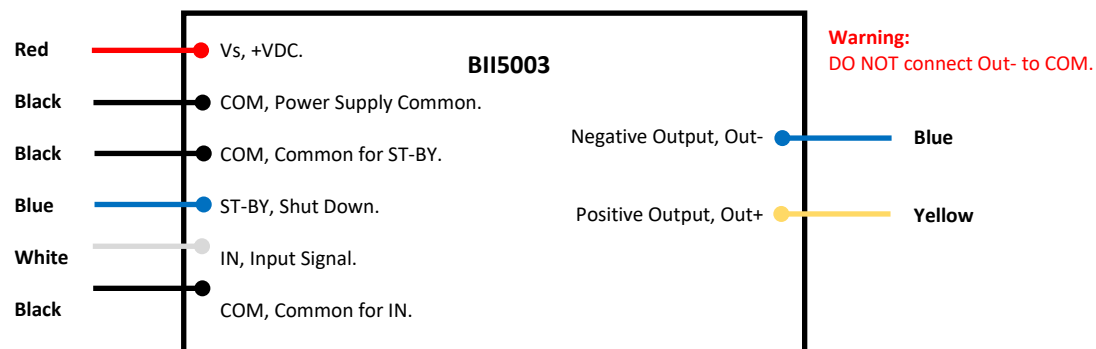
BII5002 PCB Physical Size:



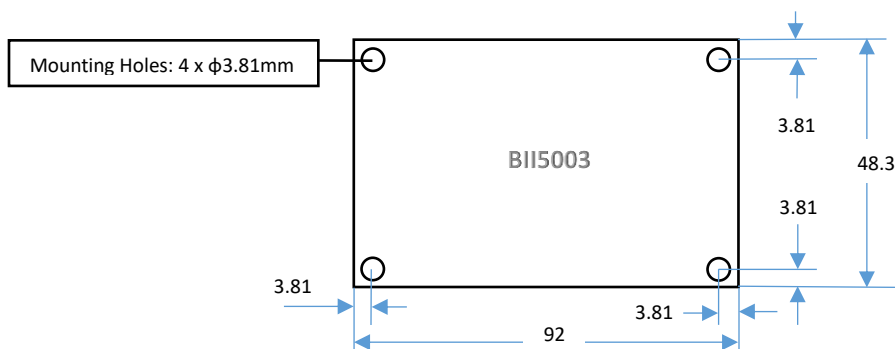
SHIPMENT: Assembled BII5002 board

Qty.: 1

BII5003 Wiring



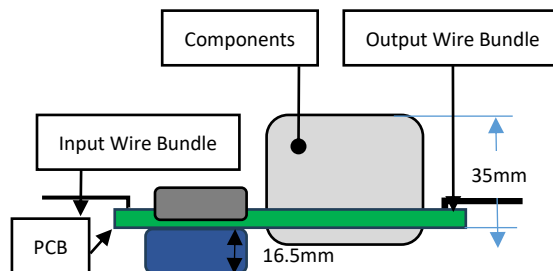
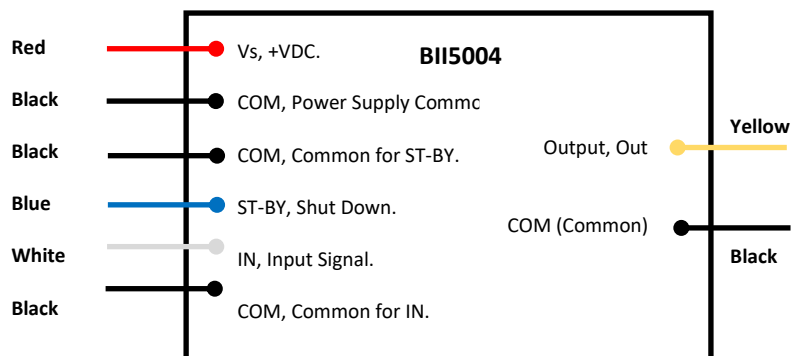
BII5003 PCB Physical Size (Unit: mm): LxWxH = 92x48.3x34mm (3.63"x1.9"x1.34").



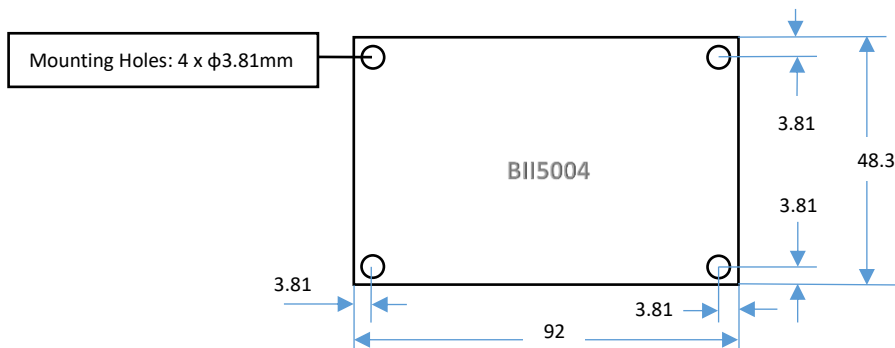
SHIPMENT: Assembled BII5003 board

Qty.: 1

BII5004 Wiring

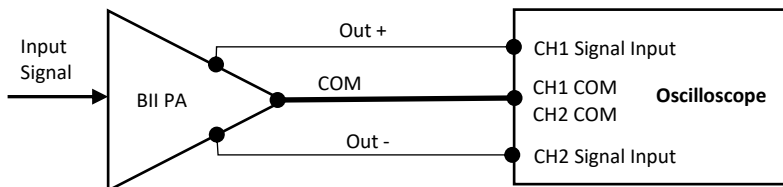


BII5004 PCB Physical Size (Unit: mm): LxWxH = 92x48.3x38.1mm (3.63"x1.9"x1.5").



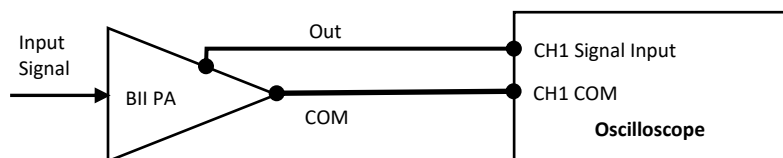
SHIPMENT: Assembled BII5004 board Qty.: 1

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.

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.

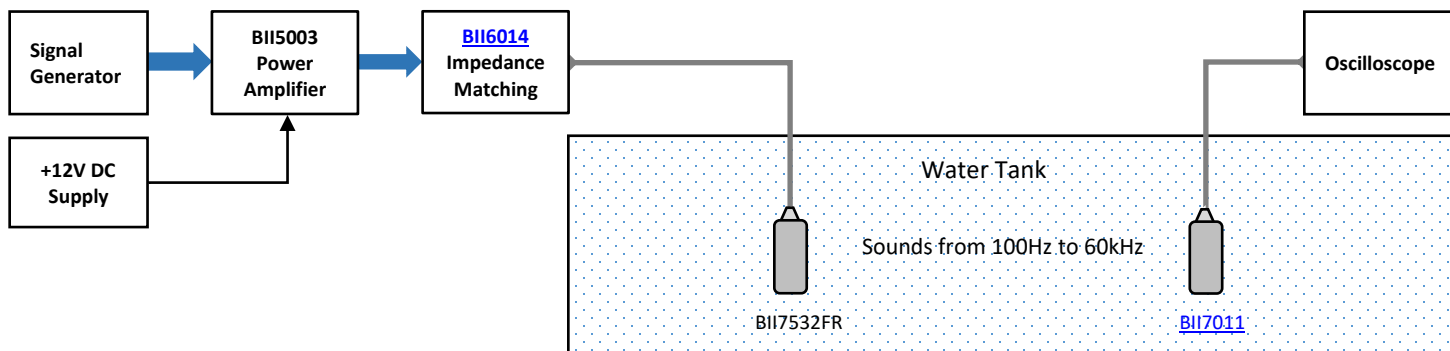
Application Notes

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

Test 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.

Test 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.

