



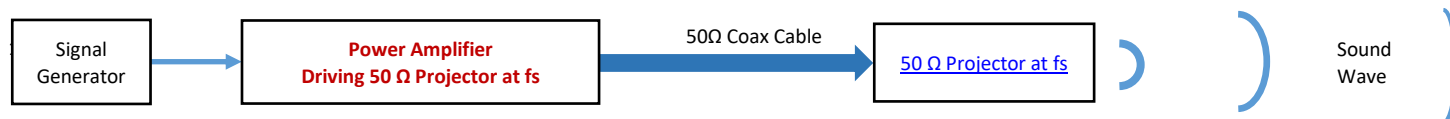
### BII5040 Series Power Amplifier

#### DESCRIPTION

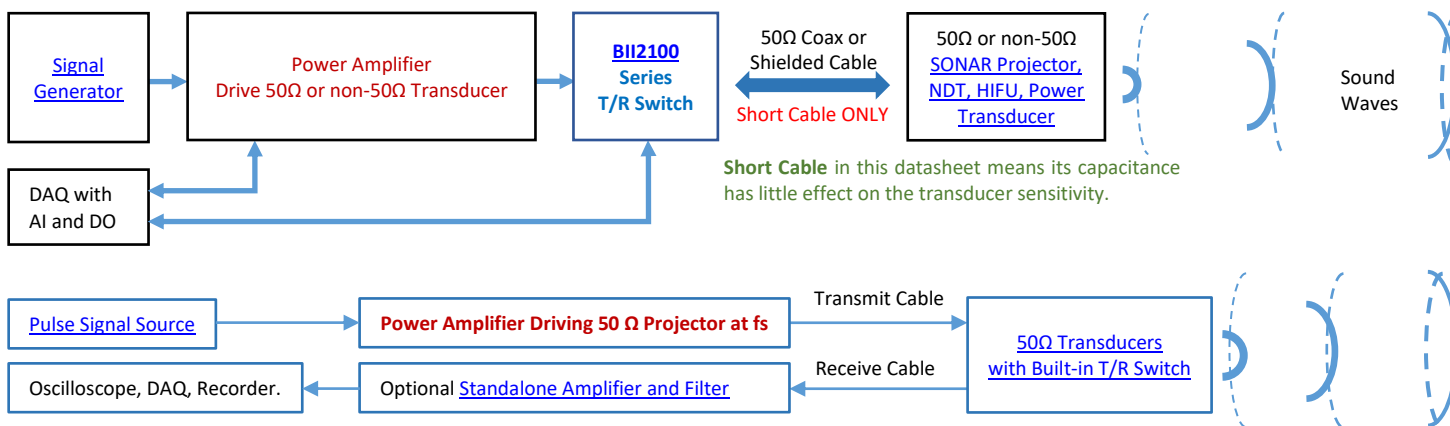
BII5040 series linear power amplifiers are ideal to drive 50kHz to 10MHz piezoelectric transducers for acoustic pulsing systems of underwater, air, and ultrasonics (solids).

#### SYSTEM CONFIGURATION

##### (a) Transmitting Sounds.



##### (b) Transmitting and Receiving Sounds.



#### APPLICATIONS

|                                                       |                                                                                      |
|-------------------------------------------------------|--------------------------------------------------------------------------------------|
| Driving Ultrasonic Transducers: SONAR, NDT, and HIFU. | Short Range Echosounding/Navigation, Sound Velocity Probe, Distance Gage, Altimeter. |
|-------------------------------------------------------|--------------------------------------------------------------------------------------|

#### Question:

##### 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 connector 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 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.

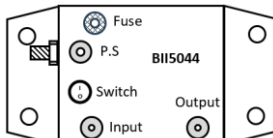
**Note:** a. by default, BII does NOT provide these connectors. If buyer needs connectors, please specify when ordering.

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

# ABSOLUTE MAXIMUM RATINGS

|                            |                 |
|----------------------------|-----------------|
| DC Supply Voltage:         | +36 VDC         |
| Input Voltage:             | 10 Vpp          |
| Output Peak Current:       | 2 A             |
| Shut-down Control Voltage: | -0.2 to +12 VDC |

# SPECIFICATIONS

|                                            |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                            |                                                                                                                    |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Power Amplifier                            | <a href="#">BII5042</a><br>                                                                                                                                                                                                                                      | <a href="#">BII5041</a><br>               | <a href="#">BII5044</a><br>     |
| Status:                                    | ACTIVE                                                                                                                                                                                                                                                                                                                                            | ACTIVE                                                                                                                     | ACTIVE                                                                                                             |
| Waterproof:                                | Not waterproof. <b>Always use the device in Dry Air for electrical safety.</b>                                                                                                                                                                                                                                                                    |                                                                                                                            |                                                                                                                    |
| Operating Frequency: (Small Signal)        | 50 kHz to 15 MHz                                                                                                                                                                                                                                                                                                                                  | 50 kHz to 15 MHz                                                                                                           | 50 kHz to 10 MHz                                                                                                   |
| Signal Type:                               | Voltage Spikes, Sine Pulse/Burst, Chirp/FM Pulse, Spread Spectrum, FSK and PSK Signals, Continuous Signal CW, etc.                                                                                                                                                                                                                                | <b>Pulsed Signals ONLY</b> to avoid overheat and damage.<br><b>Pulse Width PW</b> ≤ 100 mS, and <b>Duty Cycle D</b> ≤ 25%. | Voltage Spikes, Sine Pulse/Burst, Chirp/FM Pulse, Spread Spectrum, FSK and PSK Signals, Continuous Signal CW, etc. |
| Source Level Capability: (in Water)        | 185.7 + η + DI, in dB re μPa at 1m. DI: Directivity Index (dB) of Transducer, η: Transducer Efficiency, in dB.<br>η of broadband planar transducers such as NDT Transducers could be ≤ -5dB.<br>For high frequency broadband planar NDT transducer, η ≤ 0.1.<br>SL = 203.7 dB in Water at η = 0.1 (or -10 dB), DI = 28 dB (Disk NDT Transducers). |                                                                                                                            |                                                                                                                    |
| Operating Mode:                            | Linear                                                                                                                                                                                                                                                                                                                                            |                                                                                                                            |                                                                                                                    |
| Impedance Matching:                        | No Built-in Impedance Matching.                                                                                                                                                                                                                                                                                                                   |                                                                                                                            | Built-in Impedance Matching.                                                                                       |
| Gain:                                      | 20 dB or x10                                                                                                                                                                                                                                                                                                                                      | 20 dB or x10                                                                                                               | 27dB or x22.4                                                                                                      |
| Input Type:                                | Single ended                                                                                                                                                                                                                                                                                                                                      | Single ended                                                                                                               | Single ended                                                                                                       |
| Input Connector:                           | On-board                                                                                                                                                                                                                                                                                                                                          | None, Wire Bundles.                                                                                                        | BNC Jack                                                                                                           |
| Input Impedance:                           | 200 Ω    4pF                                                                                                                                                                                                                                                                                                                                      | 200 Ω    4pF                                                                                                               | 200 Ω    4pF                                                                                                       |
| Maximum Input Voltage:                     | Max. Output Voltage Vomax/Gain, in Vpp, or 5Vpp, whichever is less.                                                                                                                                                                                                                                                                               |                                                                                                                            |                                                                                                                    |
| Output Type:                               | Differential                                                                                                                                                                                                                                                                                                                                      | Differential                                                                                                               | Single ended                                                                                                       |
| Output Connector:                          | On-board                                                                                                                                                                                                                                                                                                                                          | None, Wire Bundles.                                                                                                        | BNC Jack                                                                                                           |
| Output Voltage:                            | Vomax=(Supply Voltage Vs – 7), in Vp.                                                                                                                                                                                                                                                                                                             |                                                                                                                            | 112 Vpp@+32 VDC.<br>76.2 Vpp@+24 VDC.                                                                              |
| Output Current:                            | Io ≤ 2.0 A                                                                                                                                                                                                                                                                                                                                        |                                                                                                                            | Io ≤ 0.9 A                                                                                                         |
| Load:                                      | ≥ Vo/Io or 10 Ω, whichever is greater.                                                                                                                                                                                                                                                                                                            |                                                                                                                            | Driving 50 Ω Transducers.                                                                                          |
| Shut-down Control:                         | On-board ON/OFF Switch: Manually or Digitally                                                                                                                                                                                                                                                                                                     | Digital Output or Not Used                                                                                                 | Not used                                                                                                           |
| Shut-down Switch:                          | <b>OFF Position:</b><br>Output Enabled. Operates normally.<br><b>DIO Position:</b><br>TTL/CMOS Logic High: Output Enabled.<br>TTL/CMOS Logic Low: Output Disabled.                                                                                                                                                                                | N/A                                                                                                                        | Not used                                                                                                           |
| Shut-down Voltage:                         | TTL/CMOS Compatible:<br><b>Shut-down:</b> Logic Low or 0 to +0.4 VDC. <b>Active:</b> Logic High or +0.8 to +5 VDC.                                                                                                                                                                                                                                |                                                                                                                            | Not Applicable                                                                                                     |
| Output Disable Time:                       | 1 μS                                                                                                                                                                                                                                                                                                                                              |                                                                                                                            |                                                                                                                    |
| Output Enable Time:                        | 3 μS                                                                                                                                                                                                                                                                                                                                              |                                                                                                                            |                                                                                                                    |
| Power Bandwidth (-3 dB):                   | 100 kHz to 10 MHz                                                                                                                                                                                                                                                                                                                                 |                                                                                                                            |                                                                                                                    |
| RMS Power Capability:                      | <b>SINE CW, SINE Pulse and Arbitrary Pulsing Waveform, etc.:</b> 14.5 W @ Vs = +24 VDC. <b>31.3 W @ Vs = +32 VDC.</b><br><b>Voltage Spikes and Single Pulse:</b> 29 W @ Vs = +24 VDC. <b>62 W @ Vs = +32 VDC</b>                                                                                                                                  |                                                                                                                            |                                                                                                                    |
| Power Efficiency: (at max. output current) | Driving Tuned Transducers (Resistive load):<br>50% at +24 VDC. 56% at +32 VDC.<br>Driving Untuned Transducers: Power Efficiency of driving tuned transducers*cosθ. θ: Impedance Phase of Untuned Transducers.                                                                                                                                     |                                                                                                                            |                                                                                                                    |
| Supply Voltage Vs:                         | +12 to +32 VDC                                                                                                                                                                                                                                                                                                                                    |                                                                                                                            |                                                                                                                    |
| Suggested DC Supply                        | Marine Battery, Automobile Battery, or DC Power Supply with Grounded Output and Protection of Output Current Limit.<br><b>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.</b>                                                               |                                                                                                                            |                                                                                                                    |
| Quiescent Current:                         | <b>Shut-down:</b> 0.8 mA. <b>Active:</b> 53 mA.                                                                                                                                                                                                                                                                                                   |                                                                                                                            | 53 mA                                                                                                              |
| DC Supply Connector:                       | On-board                                                                                                                                                                                                                                                                                                                                          | None, Wire Bundle.                                                                                                         | DC Power Jack.                                                                                                     |
| Fuse:                                      | N/A                                                                                                                                                                                                                                                                                                                                               |                                                                                                                            | 2.5A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".                                                                  |
| Accessory Cable:                           | 0.15m or 6" wires                                                                                                                                                                                                                                                                                                                                 | 60 mm wires                                                                                                                | 1. DC Power Supply Cables: <a href="#">DCBP20</a> .                                                                |
| Cable Connector:                           | Wire Leads                                                                                                                                                                                                                                                                                                                                        | Wire Leads                                                                                                                 | 2. Grounding Cable: <a href="#">GWL18</a> .                                                                        |
| Package:                                   | PCB                                                                                                                                                                                                                                                                                                                                               | PCB                                                                                                                        | Metal Enclosure                                                                                                    |

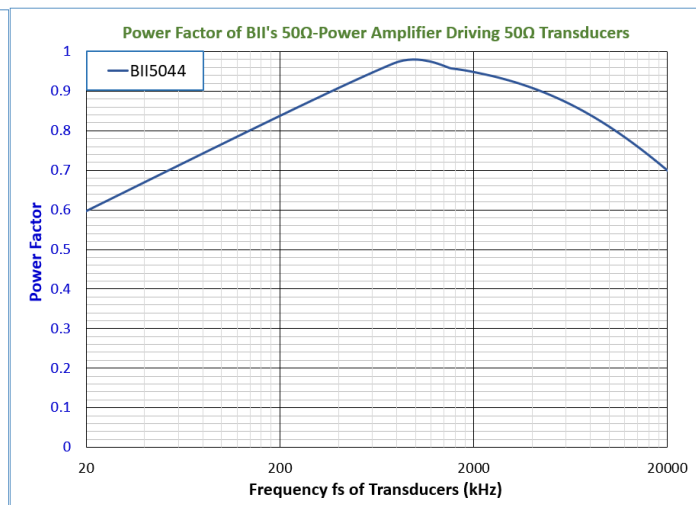
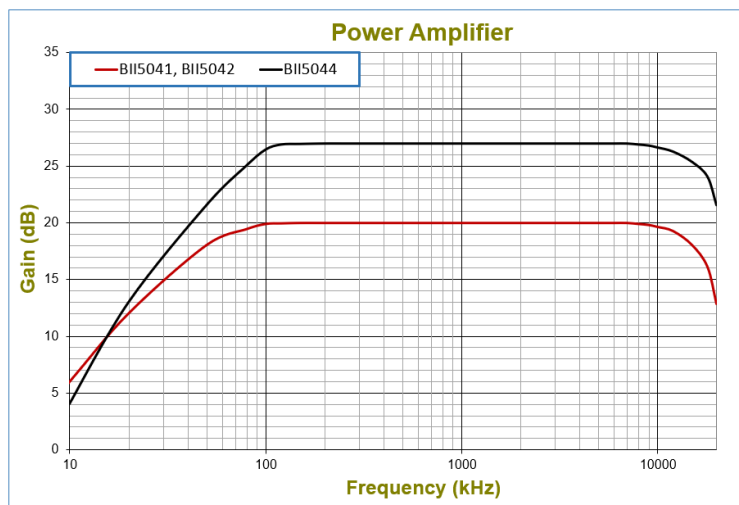
|                        |                                                          |                                                                          |                                                                          |
|------------------------|----------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Grounding Terminal:    | N/A                                                      | N/A                                                                      | Grounding Stud #10-24.                                                   |
| Mounting Holes:        | 4 x $\Phi 4.87\text{mm}$                                 | 4 x $\Phi 3.2\text{mm}$                                                  | 4 x $\Phi 5.5\text{mm}$ Mounting Holes.<br>Accept M5 and #10 Screws.     |
| Physical Size (mm):    | Round PCB:<br>$\Phi D \times H = \Phi 101.6 \times 50.8$ | Rectangular PCB:<br>$L \times W \times H = 68.6 \times 36.1 \times 36.3$ | Metal Enclosure:<br>$L \times W \times H = 180.5 \times 110.3 \times 75$ |
| Weight in Air:         | 53 grams                                                 | 13 grams                                                                 | 1.2 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.**

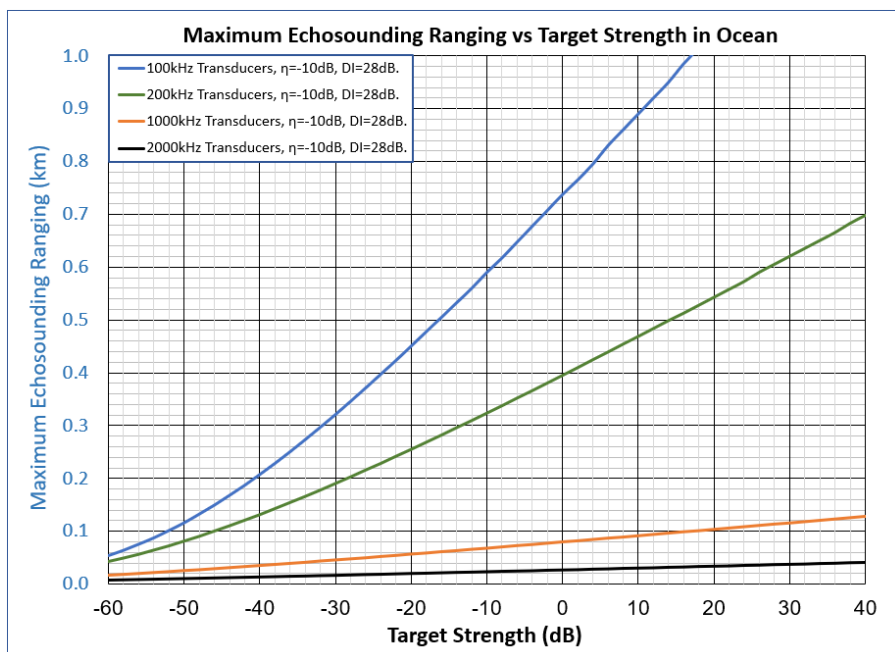
**WARNING:** The buyer should observe the National Electrical Code or other related codes of buyer's country to assemble and integrate this device into buyer's product or system, and follow the code to ground and insulate this device. It is buyer's sole responsibility to make sure the proper insulation and grounding for operating safety before putting the device into service.

## Frequency Response

## Power Factor Driving 50Ω Transducers

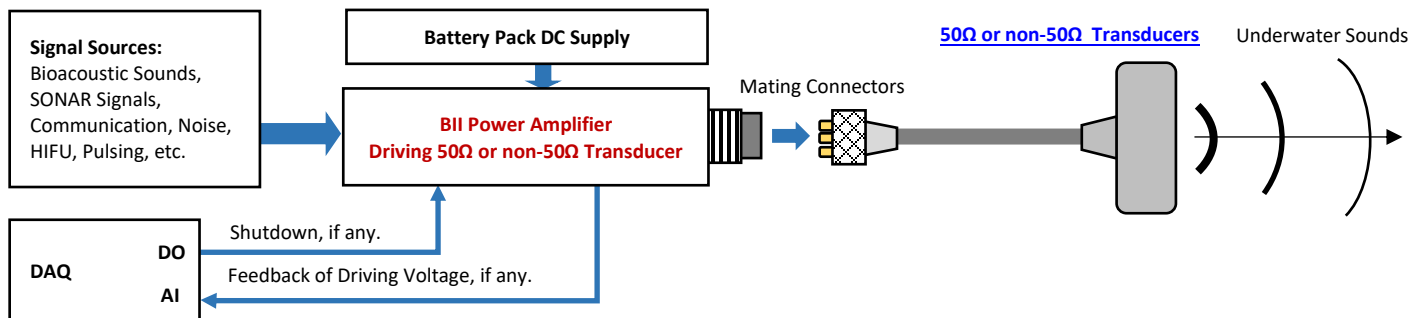


## Echo Sounding Range in Water (Communication Range = 2 \* Echo Sounding Range at 0dB Target Strength)

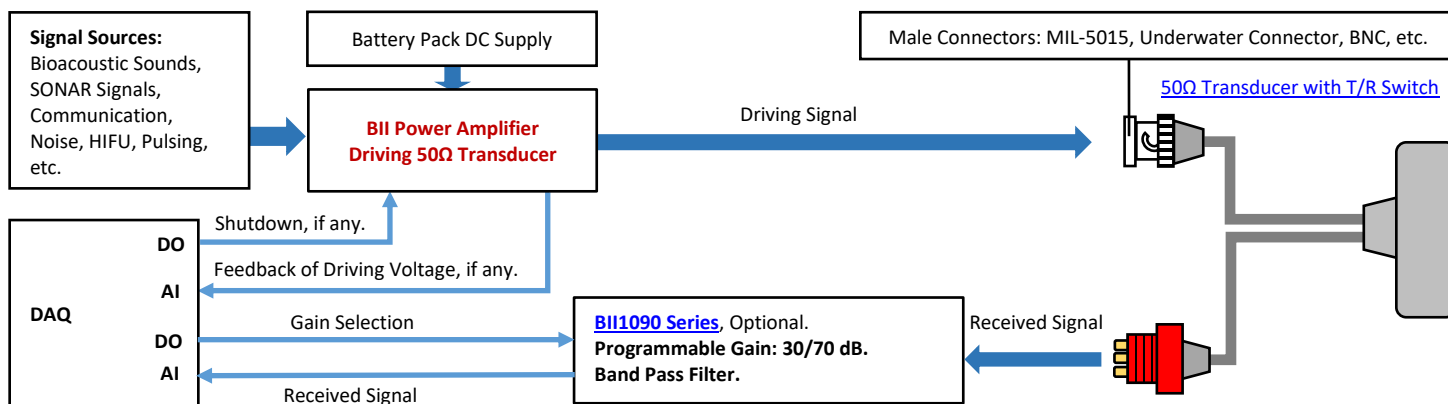
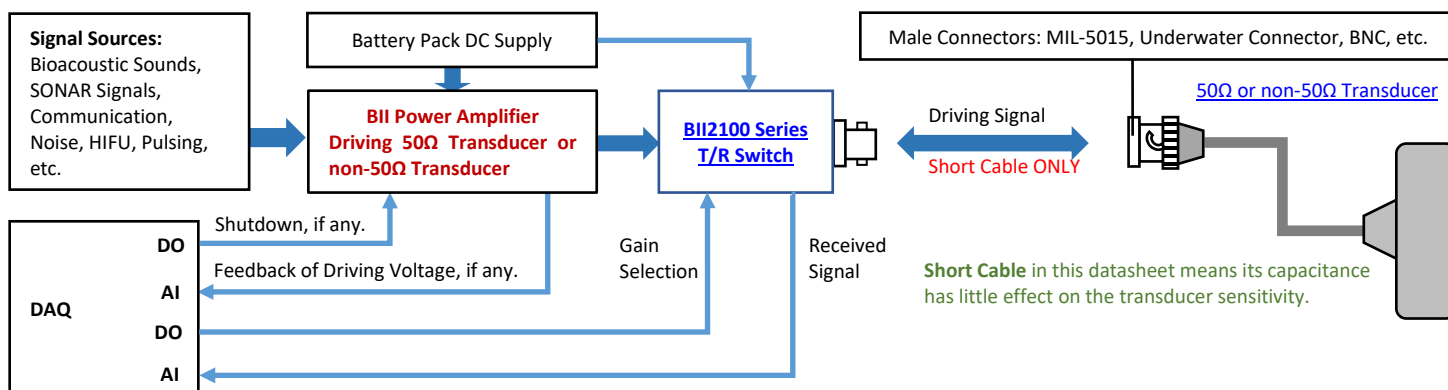


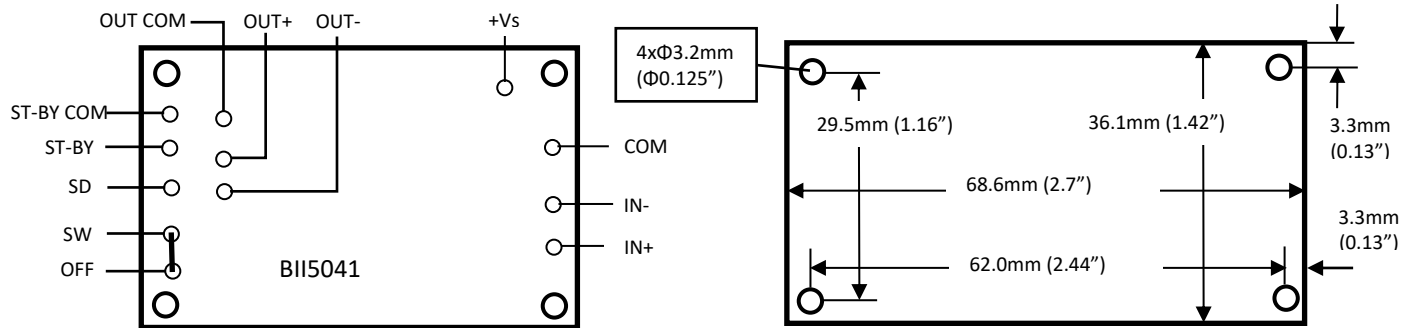
## Acoustic System Block Diagram

### 1. Generate Sounds and Waves.

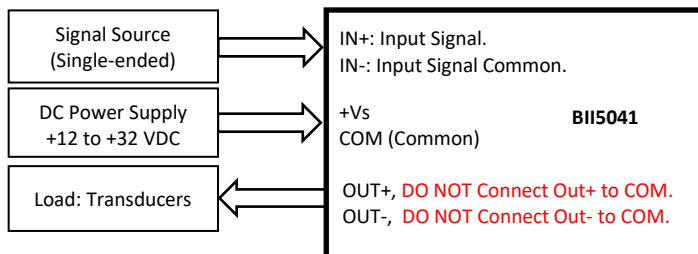


### 2. Transmitting and Receiving Sounds and Waves



**BII5041 CONTROLS and TERMINALS:****BII5041 Physical Size:**

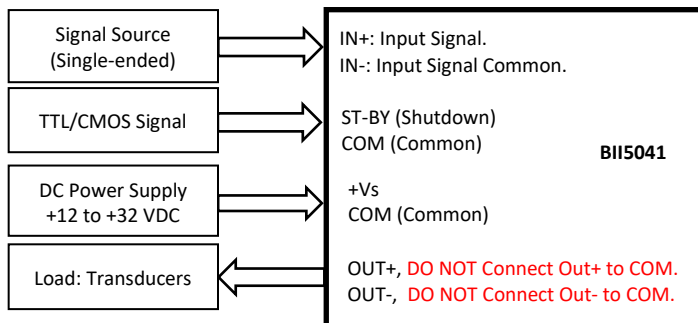
| Wire Leads                                                                                                                                                                                                                                      | Signal               | Wires' Colour | Wire Leads | Signal                   | Wires' Colour                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|------------|--------------------------|-------------------------------------------------|
| IN+                                                                                                                                                                                                                                             | Input Signal         | White         | ST-BY      | Shut Down Control        | Default: PCB Via Pad, BII does not solder wire. |
| IN-                                                                                                                                                                                                                                             | Input Signal common  | Blue          | ST-BY COM  | Shut Down Control Common | Default: PCB Via Pad, BII does not solder wire. |
| COM                                                                                                                                                                                                                                             | Power Supply Common  | Black         | SD         | Shut-down pin            | Default: PCB Via Pad, BII does not solder wire. |
| +Vs                                                                                                                                                                                                                                             | Power Supply Voltage | Red           | SW         | Shut-down pin            | Default: SW is wired to OFF                     |
| OUT-                                                                                                                                                                                                                                            | Negative Output      | Yellow        | OFF        | Shut-down OFF pin        | Default: OFF is wired to SW                     |
| OUT+                                                                                                                                                                                                                                            | Positive Output      | Blue          | OUT COM    | Output Common            | Default: PCB Via Pad, BII does not solder wire. |
| <b>Default Factory-set:</b> SW is wired to OFF, shut-down function is not available. To use shut-down function:<br>1. Cut off the wire between SW and OFF. 2. Solder a wire from SW to SD. 3. Solder wires to ST-BY and ST-BY COM respectively. |                      |               |            |                          |                                                 |

**BII5041 SUGGESTED WIRING: Shut-down function is not used and SW is wired to OFF.**

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

**BII5041 SUGGESTED WIRING: Shut-down function is used.**

To use shut-down function: Cut off the wire between SW and OFF; Solder a wire from SW to SD; Solder wires to ST-BY and ST-BY COM respectively.



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

**BII5041 SHIPMENT:** Assembled board, Qty.: 1

# BII5042 ST-BY SWITCH (Shutdown SWITCH)

|                      |                 |                      |                                                                               |
|----------------------|-----------------|----------------------|-------------------------------------------------------------------------------|
| <b>OFF Position:</b> | Output Enabled. | <b>DIO Position:</b> | TTL/CMOS Logic High -> Output Enabled; TTL/CMOS Logic Low -> Output Disabled. |
|----------------------|-----------------|----------------------|-------------------------------------------------------------------------------|

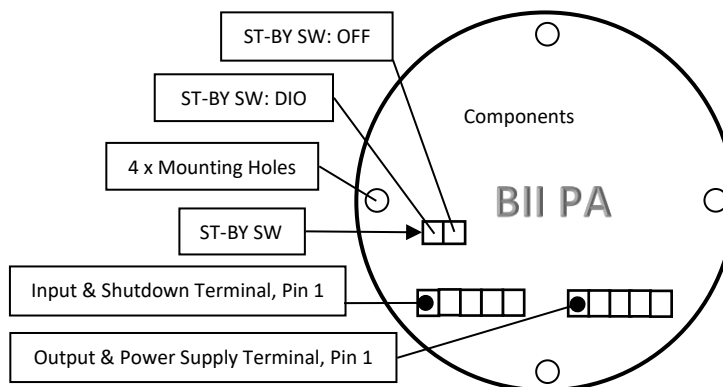
## BII5042 TERMINALS and WIRINGS

### Input and ST-by (Shutdown) Terminal

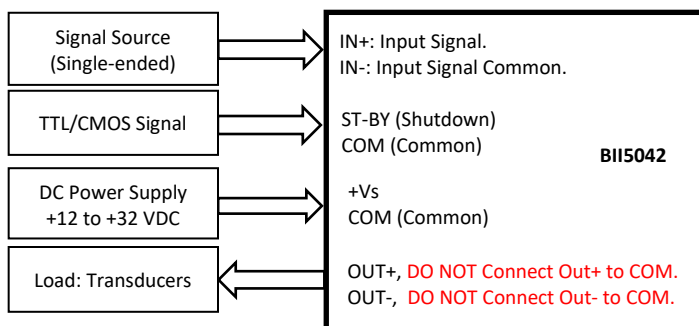
|                           |         |         |
|---------------------------|---------|---------|
| Pin 1: ST-BY (Shutdown)   | White,  | 6" Wire |
| Pin 2: COM (Common)       | Black,  | 6" Wire |
| Pin 3: IN+ (Input Signal) | Blue,   | 6" Wire |
| Pin 4: IN- (Input Common) | Yellow, | 6" Wire |
|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

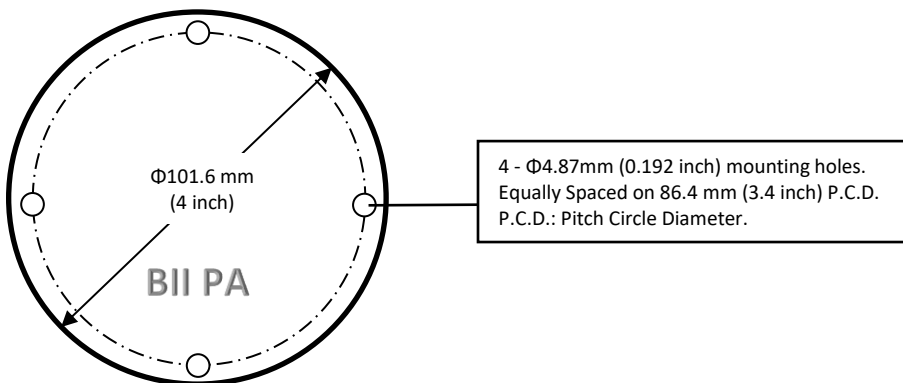


## BII5042 SUGGESTED WIRING:



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

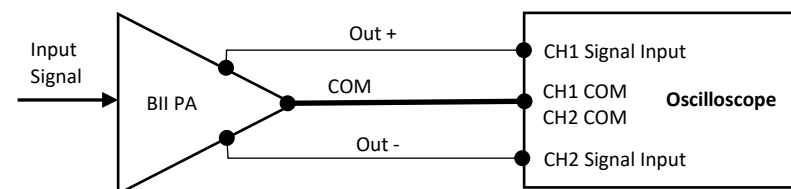
## BII5042 Physical Size (unit mm): $\Phi D \times H = \Phi 101.6 \times 50.8 \text{ mm}$



## BII5042 SHIPMENT:

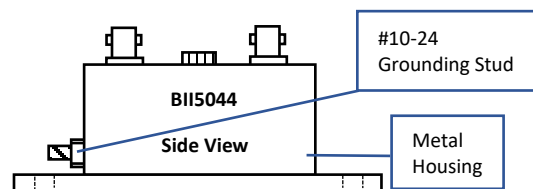
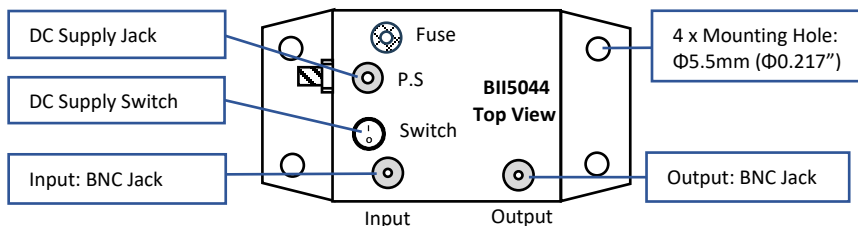
|                          |                                              |                                                      |
|--------------------------|----------------------------------------------|------------------------------------------------------|
| Assembled board, Qty.: 1 | Input and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

## Measure Differential Output of BII Power Amplifiers

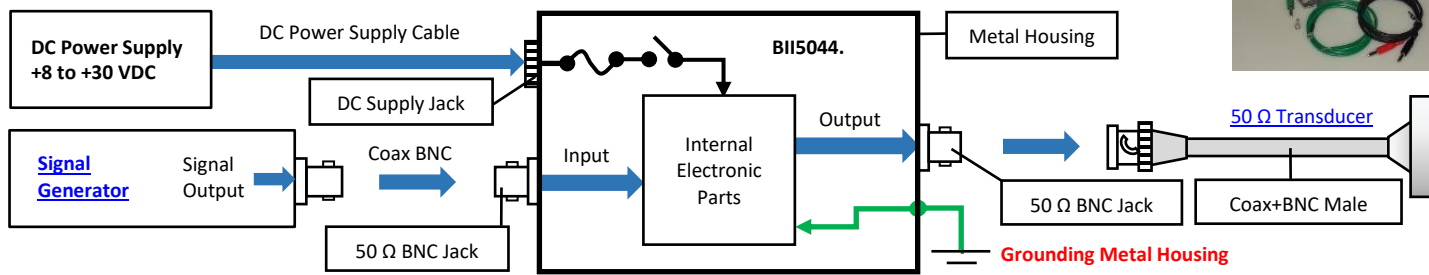


Warning: Outputs of the Power amplifier are differential, DO NOT Connect Out + or Out - to any COM.

**BII5044:** Input and Output Connectors: BNC Jack. Metal Enclosure, Overall Size: LxWxH = 180.5x110.3x75mm. Mounting Hole  $\Phi 5.5\text{mm}$  ( $\Phi 0.217''$ ) accepts M5 or #10 screw. Screws are not supplied.



**System Block Diagram and Wiring:** Driving 50 $\Omega$  Transducer with BNC Male.

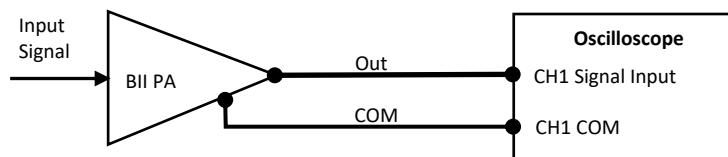


| Signal Generator                                                                                                                                          | BII5044                                                                                                                                                                                                 |                        | 50 $\Omega$ Transducer         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------------------|
| BNC Jack                                                                                                                                                  | Input: BNC Jack                                                                                                                                                                                         | Output: BNC Jack       | Coax + In-line BNC Plug (Male) |
| Signal: Center Socket                                                                                                                                     | Signal: Center Socket                                                                                                                                                                                   | Signal: Center Socket  | Signal: Center Pin             |
| Common: Body.                                                                                                                                             | Grounded Common: Body.                                                                                                                                                                                  | Grounded Common: Body. | Common: Body.                  |
| DC Power Supply:                                                                                                                                          | DC Power Jack. Center Contact: +VDC; Shell: Grounded Common.                                                                                                                                            |                        |                                |
| DC Supply Switch:                                                                                                                                         | Turn ON and Turn OFF DC Supply. "I" -> ON; "O" -> OFF.                                                                                                                                                  |                        |                                |
| Fuse:                                                                                                                                                     | 2.5A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".                                                                                                                                                       |                        |                                |
| Accessories:                                                                                                                                              | 1. One DC Power Supply Cables: <a href="#">DCBP20</a> .<br>2. One Grounding Cable, Part Number: <a href="#">GWL18</a> .                                                                                 |                        |                                |
| Grounding Metal Case for operating safety.                                                                                                                | <b>Grounding Stud:</b> #10-24 Screw 316SS. Nut and Washer are included. Support Single-Point Grounding with Multiple Devices.<br><b>Note: The body of Power Supply Jack is connected to metal case.</b> |                        |                                |
| 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

| Part Number: | Description                      |
|--------------|----------------------------------|
| BII5044      | BII5044, Linear Power Amplifier. |

### 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 handling the cables, wiring and hookup, etc.

## DC Supply Cable Pair: Part Number DCBP20.

### To Terminals of DC Supply:

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



DC Power Plug.  
To DC Power Jack  
of the Device.



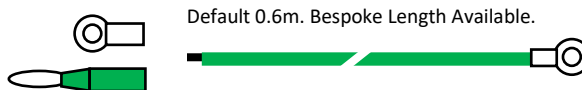
**Red Banana Plug:** +VDC. **Black Banana Plug:** Common.

One 0.6m DC supply cable. One end of the cable is with DC Power Plug, another end is Red and Black Banana Plugs. Depending on output terminals of buyer's DC Supply, buyer may assemble other type of connectors to DC supply cable at buyer's cost.

## Grounding Cable and Terminals

### Terminal to buyer's Grounding Terminal:

- Default: Wire Lead
- One #10 Ring Terminal
- One 4mm Banana Plug



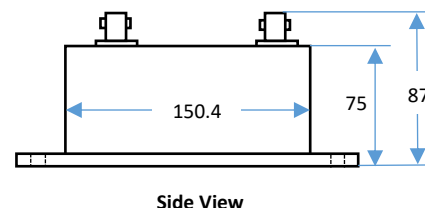
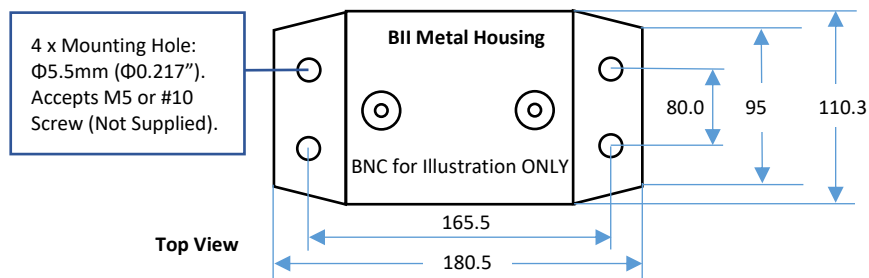
#10 Ring Terminal  
#10-24 nut and #10  
washer included.



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

One 0.6m AWG 18 Green Wire (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.

## BII5044 Metal Housings, Outline Dimensions (mm), Illustration only, the scale is not 1:1.



## 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.