

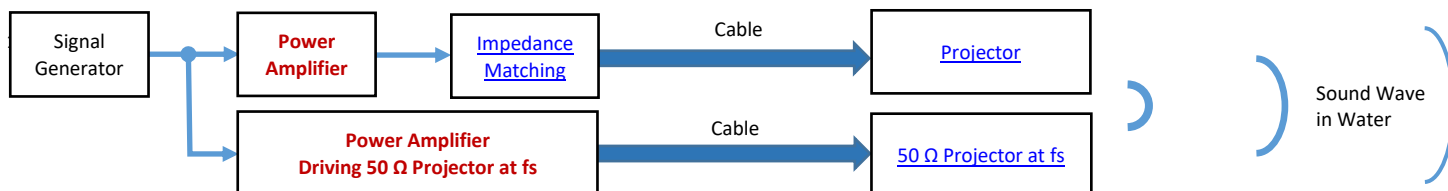


### BII5100 Series Power Amplifier Driving Sonar Transducer / Projector

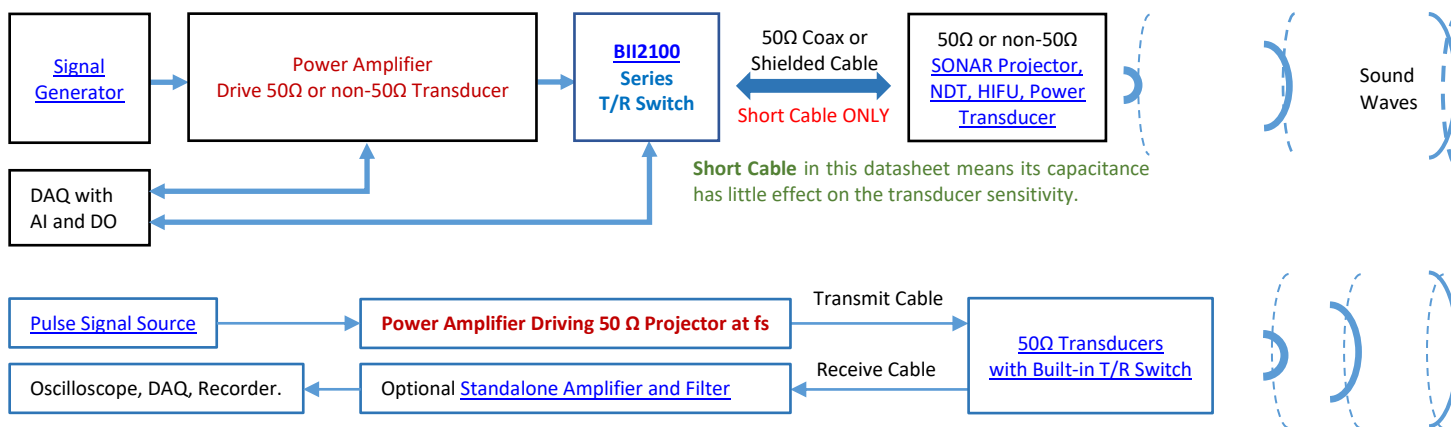
BII5100 series are switching power amplifiers which offer high efficiency and low power consumption for use in underwater, NDT, and HIFU acoustic system up to 500 kHz. Input and output signals of the PA are pulses or square signals.

#### SYSTEM CONFIGURATION

##### (a) Transmitting Sounds.



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



#### Related Product:

<a href="#">Underwater Transducer</a> : SONAR, NDT, and HIFU	<a href="#">Impedance Matching</a> between Transducers and Amplifiers
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#### APPLICATIONS

Sub-bottom Investigation, Seafloor-mapping System	Acoustic Modem, Communication, Acoustic Beacon/Transponder
Navigation Echosounder, Underwater Acoustic Positioning	Fishery Sounder, Netsonde, Dipping Sonar, Sonobuoy, HIFU Transducer, Cavitation
Robotics, Proximity Detection, Sound Ranging	Automatic Sizing, Sorting & Positioning of Parts
Level Measurement, Speed Measurement	Counting, Monitoring, Remote Control, Alarming, Motion Detection
Edge Detection, Web Guiding System	Surface/Profile Characterization and Quality Control

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

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

#### 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.


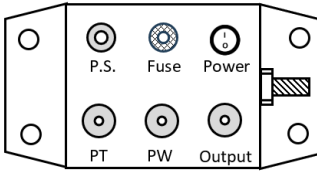
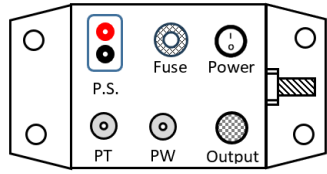
#### Are 50Ω Power Amplifiers suitable to drive non-50Ω transducers?

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.

# ABSOLUTE MAXIMUM RATINGS

Part Number	BII5101, BII5105.	BII5106
DC Supply Voltage	+60 VDC	+60 VDC
Input Voltage Range	-0.5 V to 5.5 V	-0.5 V to 5.5 V
Output Peak Current	6 A	25 A

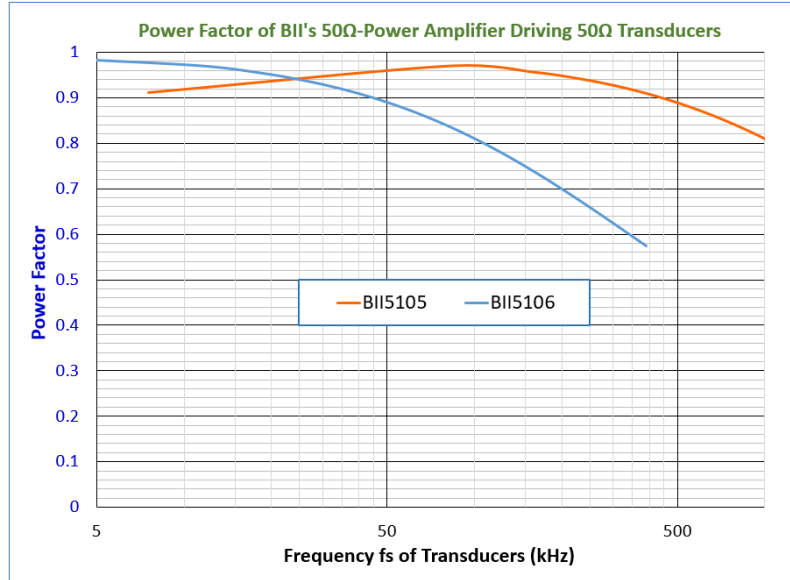
# SPECIFICATIONS

	BII5101	BII5105	BII5106
Power Amplifier:			
Status:	ACTIVE	ACTIVE	ACTIVE
	ACTIVE: Product device recommended for new designs. <b>LIFEBUY:</b> BII has announced that the device will be discontinued, and a lifetime-buy period is in effect. <b>OBSELETE:</b> BII has discontinued the production of the device.		
Waterproof:	Not waterproof. <b>Always use the device in Dry Air for electrical safety.</b>		
Operating Frequency:	1 kHz to 500 kHz	8 kHz to 500 kHz	5 kHz to 100 kHz
	<b>Warning: the device performance degrades if operating frequency less than Minimum Operating Frequency.</b> <b>The maximum usable frequency is limited by reactive component of the load which causes long rise and fall edge of the pulse.</b>		
Signal Type:	Pulse, Pulse Trains. <a href="#">TTL/CMOS Logic Level Compatible.</a> Minimum Pulse Width PW (or Pulse Duration PD) = 1 $\mu$ S.		
Source Level Capability: (in Water)	195.8 + $\eta$ + DI	195.8 + $\eta$ + DI	201.1 + $\eta$ + DI
	in dB re $\mu$ Pa at 1m. DI: Directivity Index (dB) of Transducer, $\eta$ : Transducer Efficiency, in dB.		
Operating Mode:	Switching Mode.		
Impedance Matching:	No Built-in Impedance Matching.	Built-in Impedance Matching.	Built-in Impedance Matching.
Gain:	Output Voltage/Input Voltage.		
Input Signal Type:	TTL and CMOS Compatible. Pulse Train, Logic Signals.		
Input Connector:	None	BNC Jack, Panel Mounted.	BNC Jack, Panel Mounted.
Input Impedance:	10 M $\Omega$    10 pF		
Input Logic Voltage:	TTL and CMOS Compatible. <b>Logic Low "0":</b> 0 to 0.8V. <b>Logic High "1":</b> 2 to 5V.		
Output Type:	Differential	Differential	Single-ended
Output Connector:	None	BNC Jack, Panel Mounted.	MIL-5015, 3 Sockets, Panel Mounted.
Output Signal:	Square Signal		
Output Voltage Vo:	2*(Supply Voltage Vs – 0.66 $\Omega$ *Output Current), in Vpp.	4.5*(Supply Voltage Vs – 0.66 $\Omega$ *Output Current), in Vpp.	8.2*(Supply Voltage Vs – 0.66 $\Omega$ *Output Current), in Vpp.
Output Current:	Pulse and Continuous Signals. <b>Io <math>\leq</math> 3 A peak current</b> Pulse Signal: Pulse Width (PW) $\leq$ 200 mS, Duty Cycle D $\leq$ 20%. <b>Io <math>\leq</math> 6 A peak current.</b>		
	<b>Io <math>\leq</math> 20 A peak current</b>		
	<b>Io <math>\leq</math> 20 A peak current</b>		
Load:	$\geq$ Vo/Io or 9.3 $\Omega$ , whichever is higher.	Driving 50 $\Omega$ Transducers.	Driving 50 $\Omega$ Transducers.
	The transducer should be tuned (or impedance matching) as resistive load instead of reactive load (untuned transducer). The maximum usable frequency is limited by reactive component of the load. Refer to <a href="#">Operating Frequency</a> .		
RMS Power Capability:	309W@+56VDC Power Supply 261W@+48VDC Power Supply 189W@+36VDC Power Supply 117W@+24VDC Power Supply 45W @+12VDC Power Supply	309W@+56VDC Power Supply 261W@+48VDC Power Supply 189W@+36VDC Power Supply 117W@+24VDC Power Supply 45W @+12VDC Power Supply	1050W@+56VDC Power Supply 890W@+48VDC Power Supply 650W@+36VDC Power Supply 410W@+24VDC Power Supply 170W @+12VDC Power Supply
Power Efficiency:	Driving Tuned Transducers (Resistive load): 92% at @Vs=+56VDC 91% at @Vs=+48VDC 88% at @Vs=+36VDC 81% at @Vs=+24VDC 63% at @Vs=+12VDC.	Driving Tuned Transducers (Resistive load): 92% at @Vs=+56VDC 91% at @Vs=+48VDC 88% at @Vs=+36VDC 81% at @Vs=+24VDC 63% at @Vs=+12VDC.	Driving Tuned Transducers (Resistive load): 93.7% at @Vs=+56VDC 92.6% at @Vs=+48VDC 90.2% at @Vs=+36VDC 85.4% at @Vs=+24VDC 70.8% at @Vs=+12VDC.
	Driving Untuned Transducers: Power efficiency depends on impedance phase angle $\theta$ of the untuned transducer. <b>It is NOT recommended to drive untuned transducers (active load) with square and pulse waves.</b>		
Supply Voltage Vs:	+10.5 to +56 VDC		
Suggested DC Supply:	Marine Battery, Automobile Battery, or DC Power Supply with Grounded Output and Protection of Output Current Limit. <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:	13 mA.		
DC Supply Connector:	On-board	DC Power Jack	Sheathed Banana Jack.
Fuse:	N/A	7A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4"x1-1/4".	20A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4"x1-1/4".
Accessory Cable:	6" or 0.15 m wires	1. DC Power Supply Cables: <a href="#">DCBP24</a> .	1. DC Power Supply Cables: <a href="#">DCBP24</a> .
Cable Connector:	Wire Leads	2. Grounding Cable: <a href="#">GWL18</a>	2. Grounding Cable: <a href="#">GWL18</a> .
Package:	PCB	Metal Enclosure	Metal Enclosure
Grounding Terminal:	N/A	Grounding Stud #10-24.	Grounding Stud #10-24.

<b>Mounting Holes:</b>	4 x $\Phi 4.87$ mm ( $\Phi 0.192$ " )	4 x $\Phi 5.5$ mm ( $\Phi 0.217$ " )	4 x $\Phi 5.5$ mm ( $\Phi 0.217$ " )
	Screws are not supplied.		
<b>Size LxWxH (mm):</b>	Round PCB, $\Phi D \times H = 101.6 \times 50.8$	180.5x110.3x75	231.0x120.0x75
<b>Weight in Air:</b>	155 grams	0.8 to 1 kg.	1 to 1.2 kg
<b>Operating Temperature:</b>	-20 to 70°C or -4 to 158°F		
<b>Storage Temperature:</b>	-20 to 70°C or -4 to 158°F		

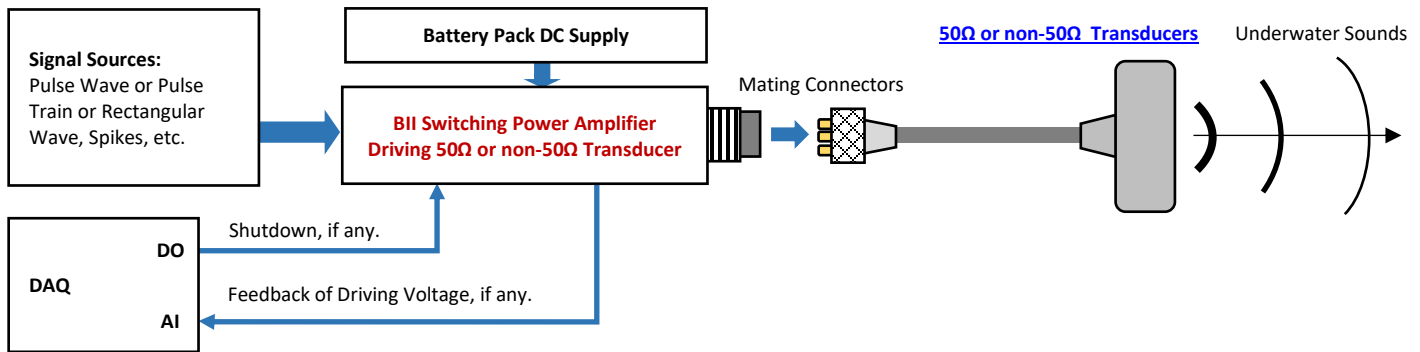
**WARNING:** The buyer should observe the National Electrical Code or other related codes of buyer's country to assemble and integrate this device into buyer's product or system, and follow the code to ground and insulate this device. It is buyer's sole responsibility to make sure the proper insulation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

## Power Factor Driving 50Ω Transducers

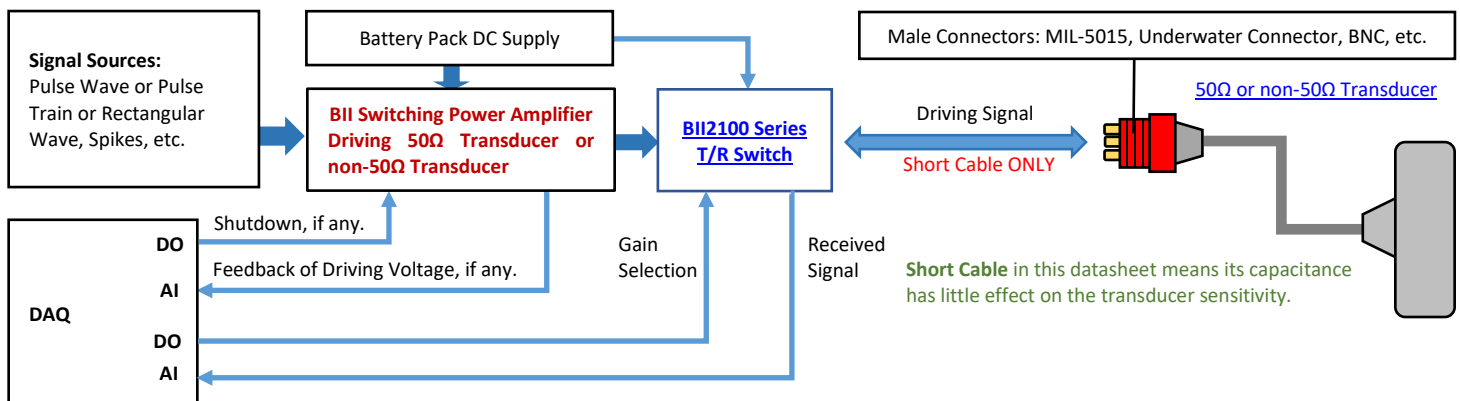


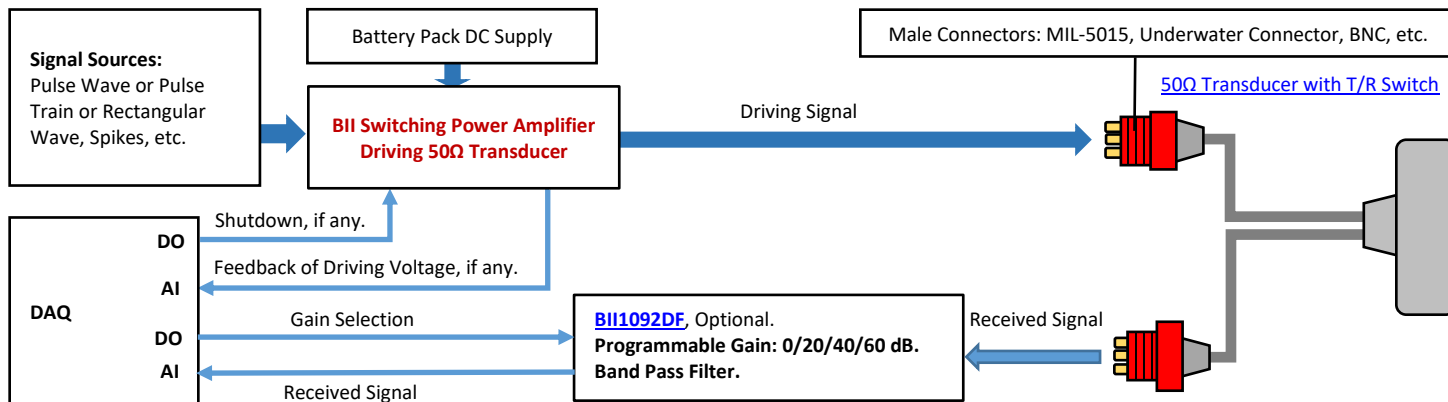
## Acoustic System Block Diagram

### 1. Generate Sounds and Waves.



### 2. Transmitting and Receiving Sounds and Waves

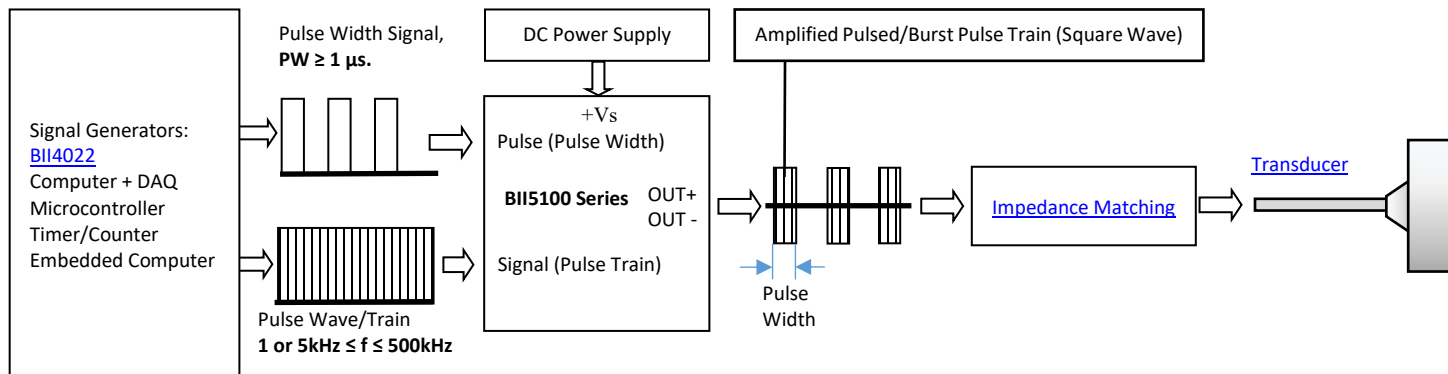




#### System Diagram:

Pulse Operation	Continuous Operation:
1. Apply Pulse Signal with Pulse Width $\geq 1 \mu\text{s}$ to <b>Pulse (Pulse Width)</b> terminal.	1. Apply Logic High or "1" to <b>Pulse (Pulse Width)</b> terminal.
2. Apply Pulse Train to <b>Signal (Pulse Train, 1 or 5 kHz <math>\leq f \leq 1\text{MHz}</math>)</b> terminal.	2. Apply Pulse Train to <b>Signal (Pulse Train, 1 or 5 kHz <math>\leq f \leq 1\text{MHz}</math>)</b> terminal.

#### BII5101, BII5105, BII5106, Signal Block Diagram



Generation of Square Waveform and Pulse Signal:		
Digital I/O Board or Microcontroller Digital I/O port.	Timer circuit or astable multivibrator.	Benthowave's SONAR signal generation modules.

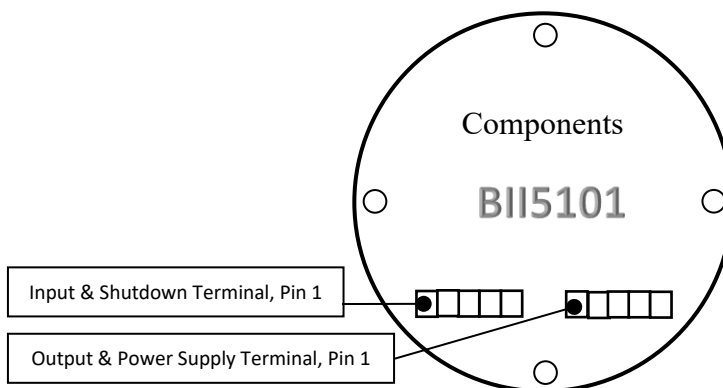
#### BII5101 TERMINALS and WIRINGS

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

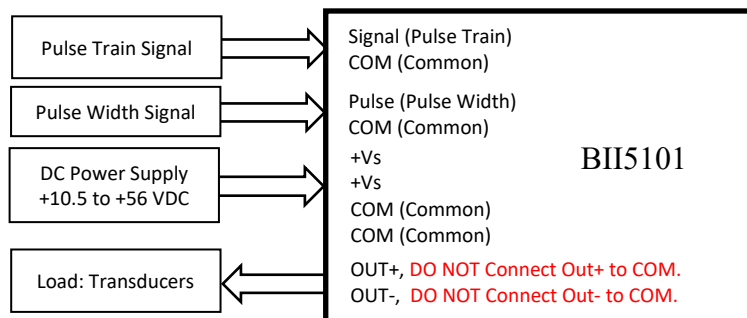
Pin 1: Signal,	Blue,	6" Wire
Pin 2: Pulse,	Yellow,	6" Wire
Pin 3: COM (Common)	Black,	6" Wire
Pin 4: COM (Common)	Black,	6" Wire
Pin 5: COM (Common)	No Wire	

##### Output and Power Supply Terminal

Pin 1 OUT+	Blue,	6" Wire
Pin 2: OUT-	Yellow,	6" Wire
Pin 3: COM (Common)	Black,	6" Wire
Pin 4: +Vs,	Red,	6" Wire
Pin 5: +Vs,	No Wire	

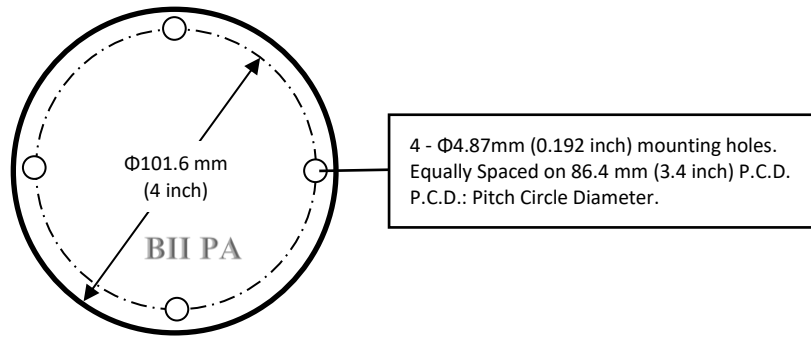


#### BII5101 SUGGESTED WIRING:



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

BII5101 Physical Size (unit mm):  $\Phi D \times H = \Phi 101.6 \times 50.8 \text{ mm}$



SHIPMENT:		
Assembled board, Qty.: 1	Input Terminal with 6" wires: Qty.: 1	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.

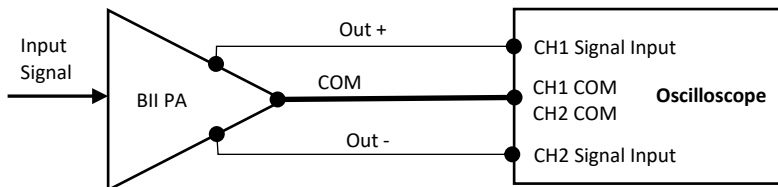
2. **Banana Jack and Plug, Fully Insulated, Free Hanging (In-Line).** Crimp or Solder. Crimp is recommended.

#### 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

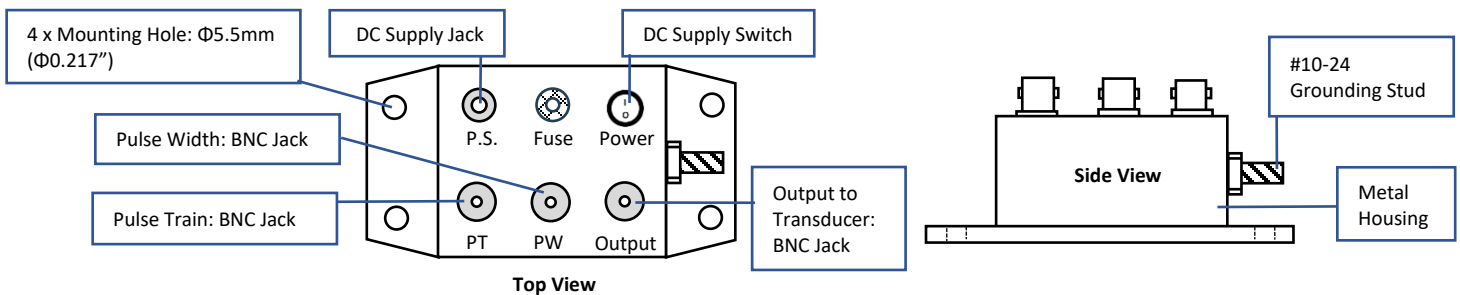


Warning: Outputs of the Power amplifier are differential,  
DO NOT Connect Out + or Out - to any COM.

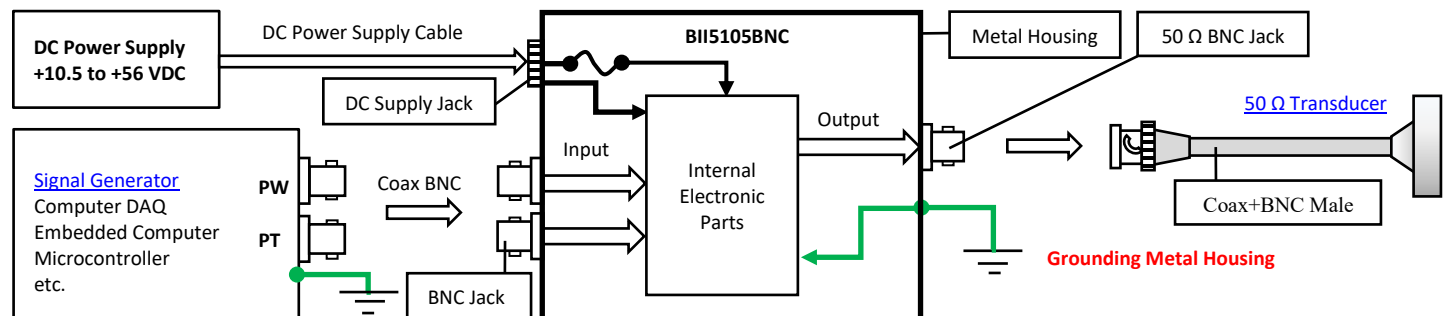
**BII5105:** Output Connector: BNC Jack. Mounting Hole  $\Phi 5.5 \text{ mm}$  ( $\Phi 0.217''$ ) accepts M5 or #10 screw. Screws are not supplied.

Metal Enclosure, Overall Size: LxWxH = 180.5x110.3x75mm.

**PW:** Pulse Width. **PT:** Pulse Train. **P.S.:** Power Supply.



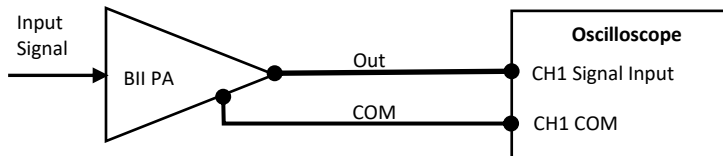
#### System Block Diagram and Wiring: Driving 50Ω Transducer with BNC Male.



Buyer's Signal Source	BII5105 Input: Pulse Width and Pulse Train	BII5105 Output	Transducer Cable and Connectors
BNC Jack	Two BNC Jacks	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.		
Fuse:	7A, 250VAC or 60VDC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".		
Accessories (Included):	1. DC supply cable, Part Number: <a href="#">DCBP20</a> . 2. Included: One Grounding Cable, Part Number: <a href="#">GWL18</a> .		
Grounding Metal Case for operating safety.	Grounding Stud: #10-24 Screw, Nut and Washer included. Support Single-Point Grounding with Multiple Devices. Note: The body of Power Supply Jack is connected to metal case.		
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.**

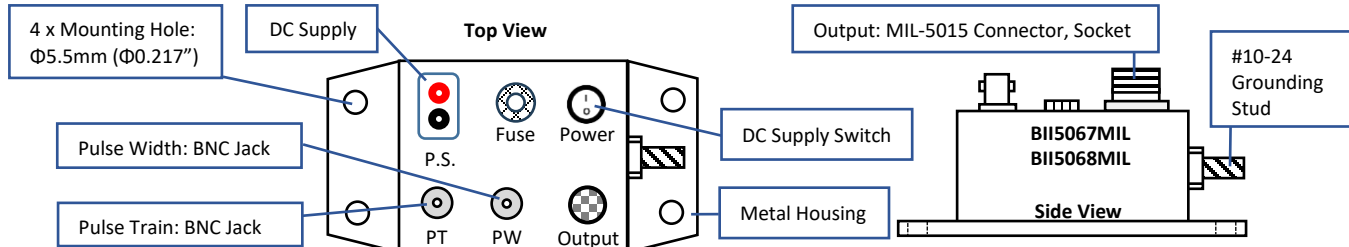
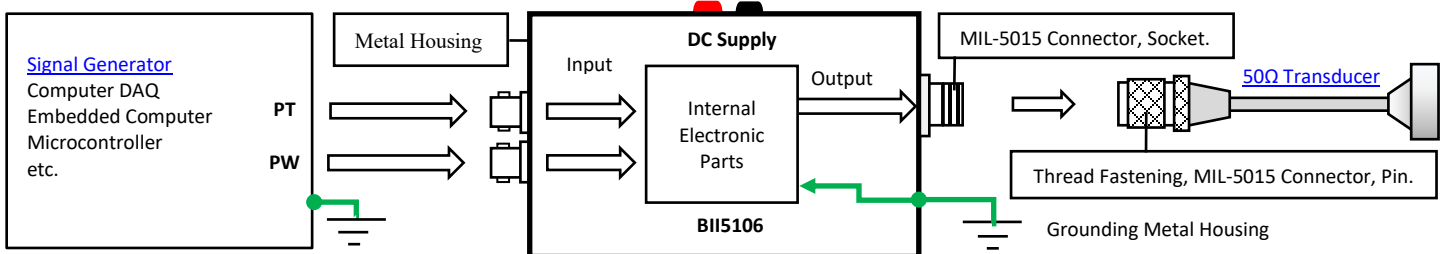
BII5105MIL	<a href="#">-Adaptor Accessory</a>
Example of Part Number:	Description
BII5105	BII5105, Linear Power Amplifier.
BII5105-MIL-SUMC	BII5105, Linear Power Amplifier with Adaptor Accessory: MIL-SUMC.

**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.

**BII5106:** Output Connector: MIL-5015 Connector, Socket. Mounting Hole  $\Phi 5.5\text{mm}$  ( $\Phi 0.217''$ ) accepts M5 or #10 screw. Screws are not supplied.  
Metal Enclosure, Overall Size: LxWxH = 231.0x120.0x75mm.

**PW:** Pulse Width. **PT:** Pulse Train. **P.S.:** Power Supply.

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

Buyer's Signal Source	BII5106: Input: Pulse Width and Pulse Train	BII5106: Output	Buyer's 50 Ω Transducer
BNC Jack	Two BNC Jacks	Output: MIL-5015 Connector, Socket.	Cable + In-line MIL-5015 (Pin)
Signal: Center Socket	Signal: Center Socket	Output Signal: Socket C	Signal: Pin C
Common: Body.	Grounded Common: Body.	Common: Socket B	Common: Pin B
		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:	20A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".		
Accessories Included:	1. Two DC supply cables, Part Number: <a href="#">DCBP18</a> . 2. One Grounding Cable, Part Number: <a href="#">GWL18</a> .		



**Grounding Metal Case for operating safety.**

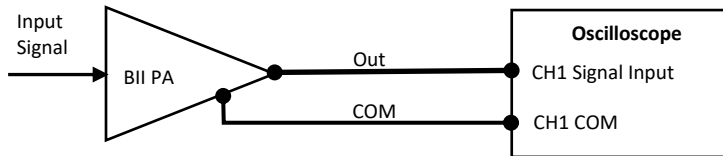
**Grounding Stud:** #10-24 Screw 316SS. Nut and Washer are included.

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.

BII5106	<a href="#">-Adaptor Accessory</a>
Example of Part Number:	Description
BII5106	BII5106, Linear Power Amplifier.
BII5106-MIL-UMC	BII5106, Linear Power Amplifier with Adaptor Accessory: MIL-UMC.

#### Measure Single Ended Output of BII Power Amplifiers



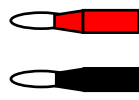
#### Warning:

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 DCBP18.

##### To Terminals of DC Supply:

- a. Default: Wire Lead
- b. One Red 4mm Banana Plug.
- c. One Black 4mm Banana Plug.



Default 0.6m. Bespoke Length Available.



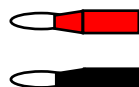
Sheathed Banana Plug.  
To sheathed Banana Jack of Power Amplifier.

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.

#### DC Supply Cable Pair: Part Number DCBP20.

##### To Terminals of DC Supply:

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



Default 0.6m. Bespoke Length Available.



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

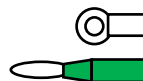
**Red Banana Plug:** +VDC. **Black Banana Plug:** Common.

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:

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



Default 0.6m. Bespoke Length Available.



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

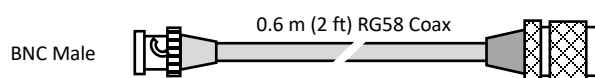
#### Grounding Cable, Part Number: GWL18, Support Single-Point Grounding with Multiple Devices.

One 0.6m AWG 18 Green Wire 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:

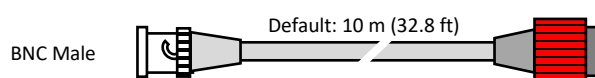
(1) **BNC-MIL**, BNC Male (Pin) to MIL3S (MIL-5015 type 3-Socket Connector Thread Fastening)



MIL-5015 Connector, 3 Sockets.  
Contact C or G: Signal.  
Contact B: Common.  
Contact A: Shielding and Grounding.

Transducer with 3-Pin MIL-5015 Connector.

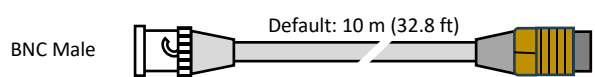
(2) **BNC-UMC**, BNC Male to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size:  $\Phi 35.5 \times 33.5 \text{mm}$ )



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

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

(3) **BNC-SUMC**, BNC Male to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size:  $\Phi 22 \times 28 \text{mm}$ )

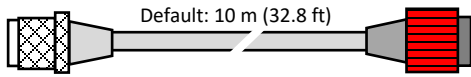


Underwater Connector, 2 Sockets.  
Contact 2: Signal.  
Contact 1: Common.

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

**(4) MIL-UMC,** MIL-5015 (3 Pins) to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size:  $\Phi 35.5 \times 33.5 \text{ mm}$ )

MIL-5015  
3 Pin



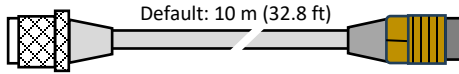
Underwater Connector, 2 Sockets.  
Contact 2: Signal.  
Contact 1: Common.



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

**(5) MIL-SUMC,** MIL-5015 (3 Pins) to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size:  $\Phi 22 \times 28 \text{ mm}$ )

MIL-5015  
3 Pin



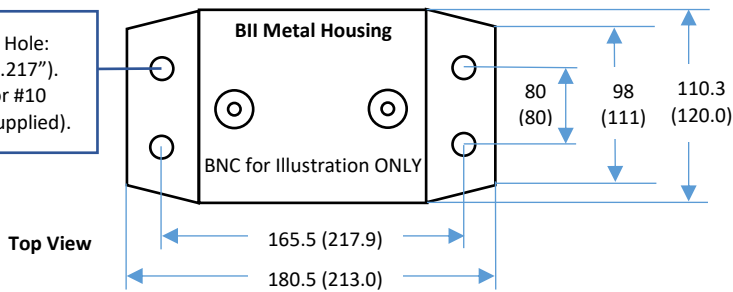
Underwater Connector, 2 Sockets.  
Contact 2: Signal.  
Contact 1: Common.



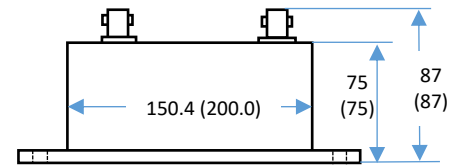
Transducer with 2-Pin Underwater Connector and MCDLS-F Locking Sleeve.

**BII5105, BII5106 (Sizes are in bracket), Metal Housings, Outline Dimensions (mm), Illustration only, the scale is not 1:1.**

4 x Mounting Hole:  
 $\Phi 5.5 \text{ mm}$  ( $\Phi 0.217''$ ).  
Accepts M5 or #10  
Screw (Not Supplied).



Top View



Side View