

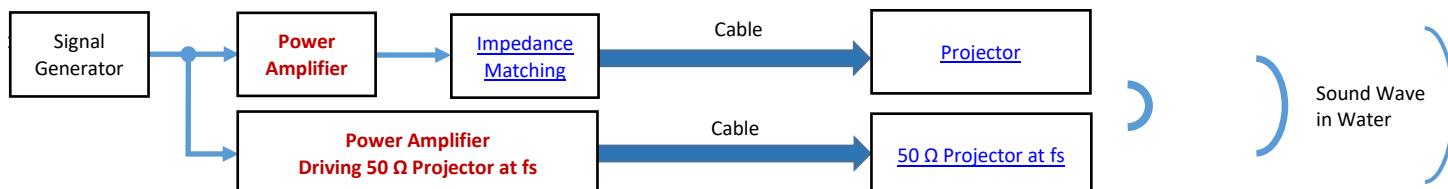


BII5100 Series Power Amplifier Driving Sonar Transducer / Projector

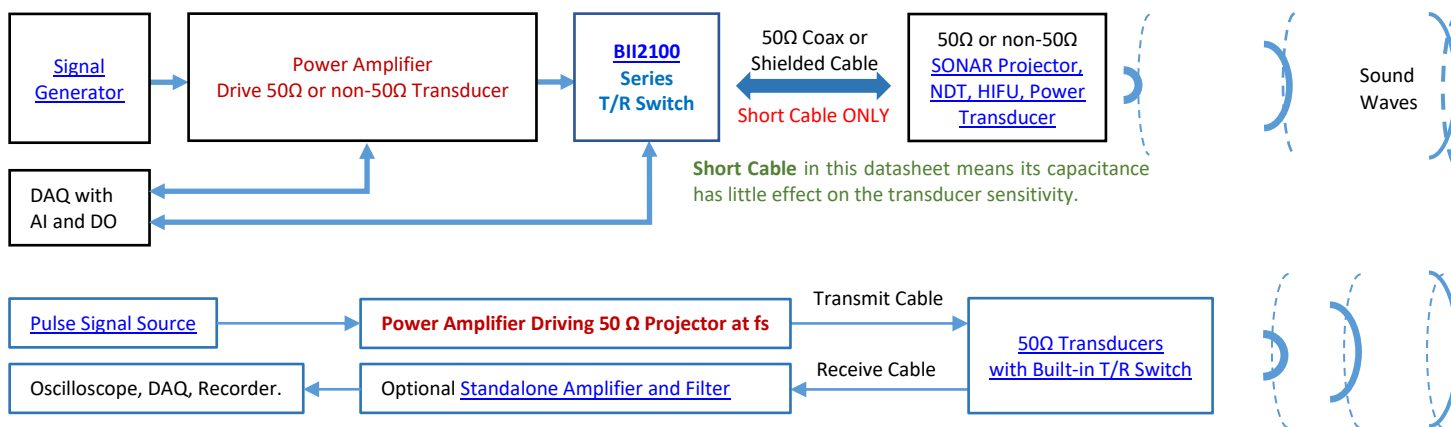
BII5100 series are switching power amplifiers which offer high efficiency and low power consumption for use in underwater, NDT, and HIFU acoustic system up to 500 kHz. Input and output signals of the PA are pulses or square signals.

SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.



Related Product:

Underwater Transducer : SONAR, NDT, and HIFU	Impedance Matching 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

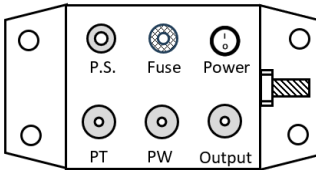
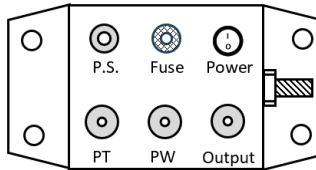
Which Power Amplifier, Linear or Switching, Is Suitable to Drive Piezoelectric SONAR, HIFU, and NDT Transducers?

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.	

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage	+60 VDC
Input Voltage Range	-0.5 V to 5.5 V
Output Peak Current	6 A

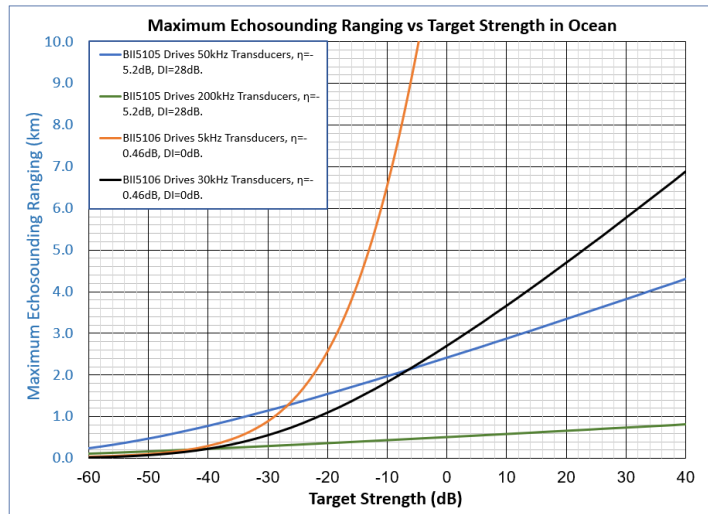
SPECIFICATIONS

	BII5101	BII5105	BII5106
Power Amplifier:			
Status:	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.	ACTIVE	ACTIVE
Waterproof:	Not waterproof. Always use the device in Dry Air for electrical safety.		
Operating Frequency:	1 kHz to 500 kHz	50 kHz to 500 kHz	2 kHz to 100 kHz
Signal Type:	Warning: the device performance degrades if operating frequency less than Minimum Operating Frequency. The maximum usable frequency is limited by reactive component of the load which causes long rise and fall edge of the pulse.		
	Pulse, Pulse Trains. TTL/CMOS Logic Level Compatible . Minimum Pulse Width PW (or Pulse Duration PD) = 1 μ S.		
Source Level Capability: (in Water)	195.8 + η + DI in dB re μ Pa at 1m. DI: Directivity Index (dB) of Transducer, η : Transducer Efficiency, in dB. η of broadband planar transducers such as NDT Transducers could be ≤ -5 dB, η of broadband spherical or cylindrical transducers could be ≥ -0.5 dB. For low and medium frequency (large size) cylindrical and spherical transducer, $\eta \geq 0.85$. SL $\approx$ 195.3 dB at $\eta = 0.9$ (or -0.46 dB), DI = 0 dB (cylindrical or spherical transducers). SL $\approx$ 203.3 dB at $\eta = 0.4$ (or -4.0 dB), DI = 11.5 dB (typical directional communication transducers without side lobes). SL $\approx$ 218.6 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°).		
	Operating Mode: Switching Mode.		
	Impedance Matching: None	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 Ω 10 pF		
Input Logic Voltage:	TTL and CMOS Compatible. Logic Low "0" : 0 to 0.8V. Logic High "1" : 2 to 5V.		
Output Type:	Differential	Single-ended	Single-ended
Output Connector:	Detachable 0.15m or 6" Wire Bundles.	BNC Jack, Panel Mounted.	BNC Jack, Panel Mounted.
Output Signal:	Square Signal		
Output Voltage Vo:	2*(Supply Voltage Vs – 0.66 Ω *Output Current), in Vpp.	4.5*(Supply Voltage Vs – 0.66 Ω *Output Current), in Vpp.	4.5*(Supply Voltage Vs – 0.66 Ω *Output Current), in Vpp.
Output Current Io:	≤ 6 A peak current.		
Load:	$\geq V_o/I_o$ or 9.3 Ω , whichever is higher.	Driving 50 Ω Transducers.	Driving 50 Ω 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 Operating Frequency .		
RMS Power Capability:	309W@+56VDC Power Supply 261W@+48VDC Power Supply 189W@+36VDC Power Supply 117W@+24VDC Power Supply 45W @+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 Untuned Transducers: Power efficiency depends on impedance phase angle θ of the untuned transducer. It is NOT recommended to drive untuned transducers (active load) with square and pulse waves.		
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. 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:	13 mA.		
DC Supply Connector:	On-board	DC Power Jack	DC Power Jack
Fuse:	N/A	7A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4"x1-1/4".	7A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4"x1-1/4".
Accessory Cable:	6" or 0.15 m wires	1. DC Power Supply Cables: DCBP20 .	1. DC Power Supply Cables: DCBP20 .
Cable Connector:	Wire Leads	2. Grounding Cable: GWL18	2. Grounding Cable: GWL18
Package:	PCB	Metal Enclosure	Metal Enclosure

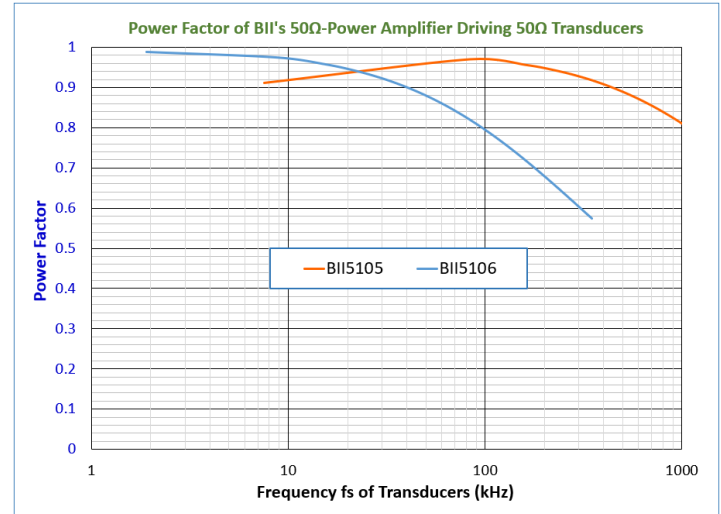
Grounding Terminal:	N/A	Grounding Stud #10-24.	Grounding Stud #10-24.
Mounting Holes:	4 x $\Phi 4.87$ mm ($\Phi 0.192$ ") Screws are not supplied.	4 x $\Phi 5.5$ mm ($\Phi 0.217$ ")	4 x $\Phi 5.5$ mm ($\Phi 0.217$ ")
Size LxWxH (mm):	Round PCB, $\Phi D \times H = 101.6 \times 50.8$	180.5x110.3x75	180.5x110.3x75
Weight in Air:	155 grams	0.8 to 1 kg.	0.8 to 1 kg.
Operating Temperature:	-20 to 70°C or -4 to 158°F		
Storage Temperature:	-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.

Echo Sounding Range in Water = 0.5*Communication Range at 0dB TS



Power Factor Driving 50Ω Transducers



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 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.

How do I connect the wire of BII Power Amplifier to my devices?

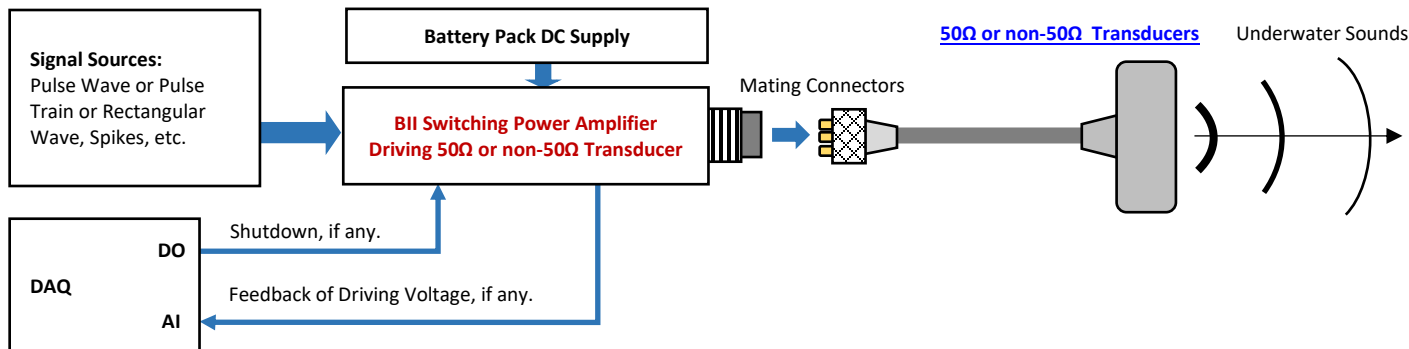
WARNING: HIGH VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. DO NOT TOUCH THE DEVICE, ITS WIRES, CABLES, AND CONNECTORS BEFORE THE POWER SUPPLIES AND SIGNAL SOURCES ARE SHUT DOWN.

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.

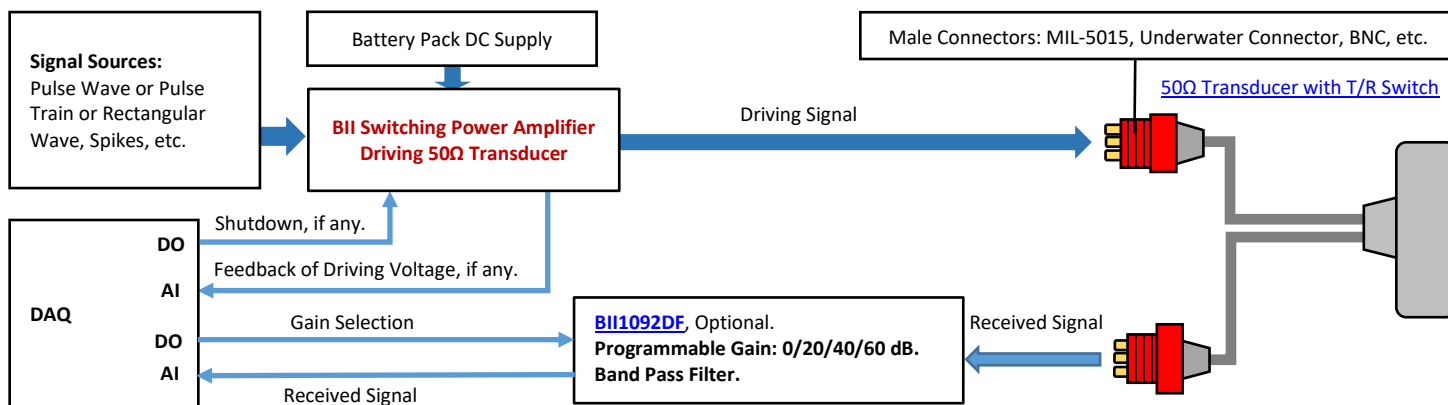
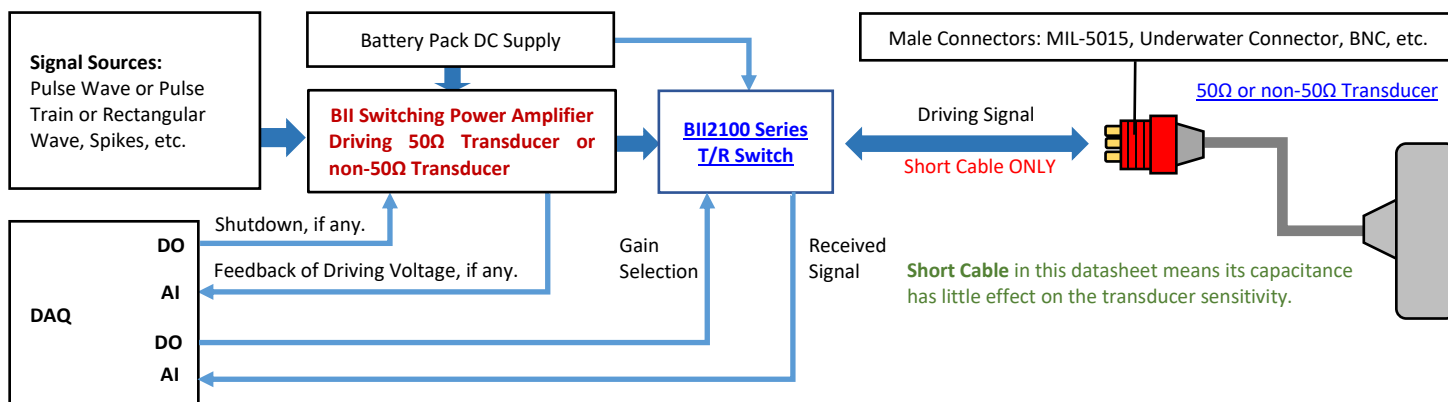
What if the connector of my transducer/projector is SMA or SMC Connector? Buyer may order a BNC to SMA (or SMC) adaptor from local electronic distributors in buyer's country. BII may ship the adaptor as accessory of the device. Please discuss with BII for customizations.

Acoustic System Block Diagram

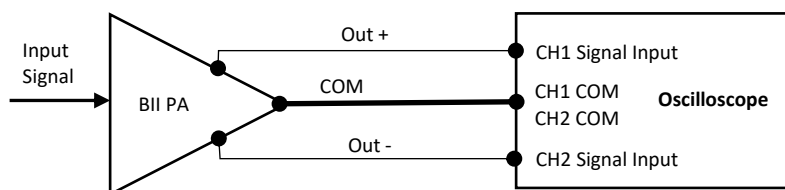
1. Generate Sounds and Waves.



2. Transmitting and Receiving Sounds and Waves

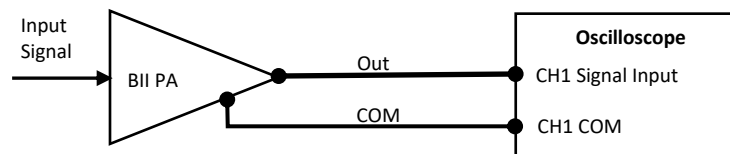


Measure Differential Output of BII Power Amplifiers



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

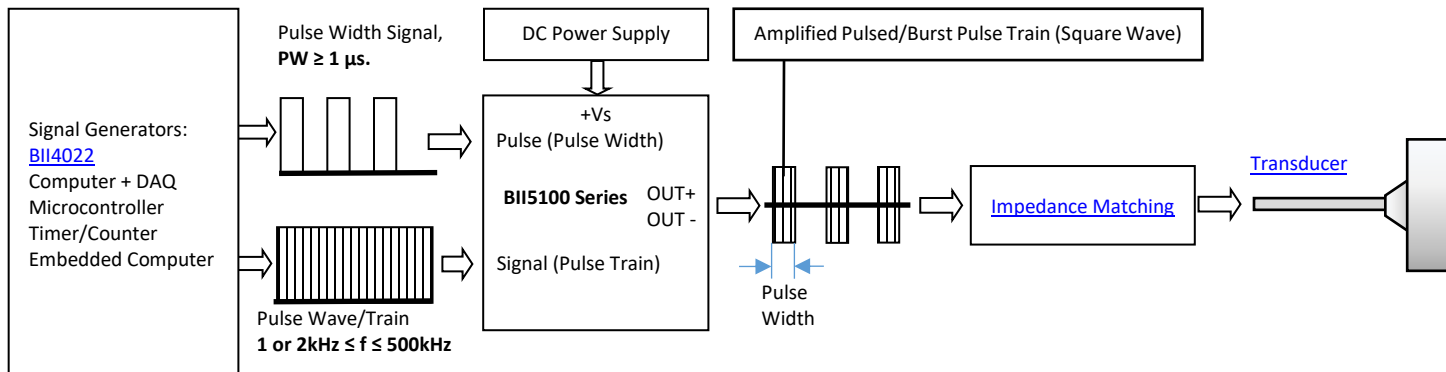


Warning:

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, wiring and hookup, etc.

System Diagram:

Pulse Operation	Continuous Operation:
1. Apply Pulse Signal with Pulse Width $\geq 1 \mu\text{s}$ to Pulse (Pulse Width) terminal.	1. Apply Logic High or "1" to Pulse (Pulse Width) terminal.
2. Apply Pulse Train to Signal (Pulse Train, 1 or 2 kHz $\leq f \leq 500\text{kHz}$) terminal.	2. Apply Pulse Train to Signal (Pulse Train, 1 or 2 kHz $\leq f \leq 500\text{kHz}$) terminal.

BII5101, BII5105, BII5106, Signal Block Diagram

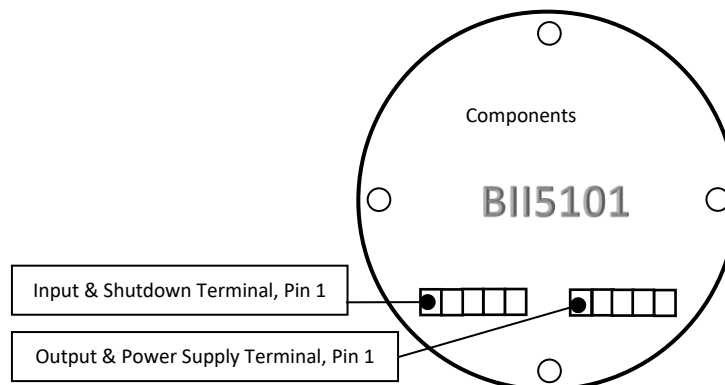
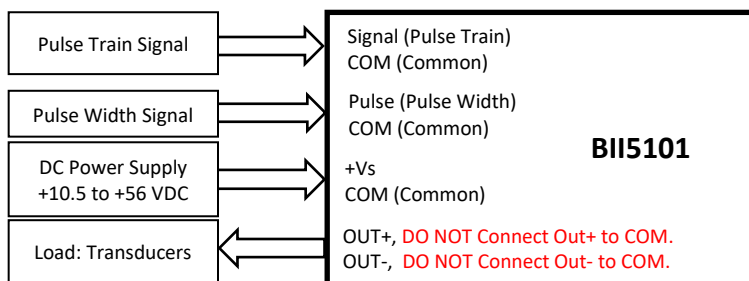
Generation of Square Waveform and Pulse Signal:		
Digital I/O Board or Microcontroller Digital I/O port.	Timer circuit or astable multivibrator.	Benthowave's SONAR signal generation modules.

BII5101 TERMINALS and WIRINGS**Input and ST-by (Shutdown) Terminal**

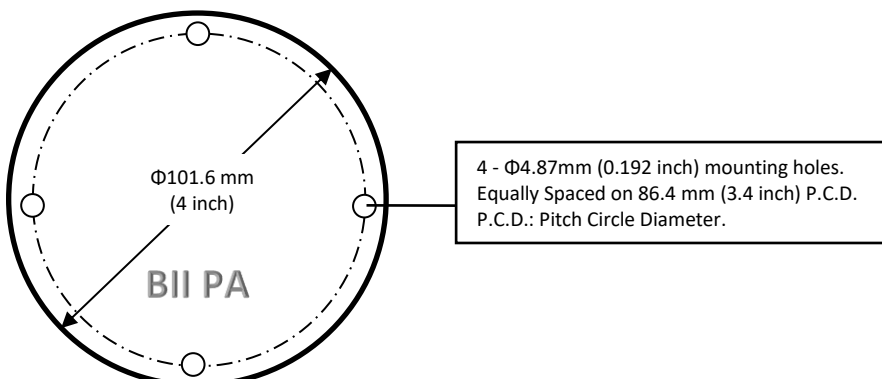
Pin 1: Signal,	Blue,	6" Wire
Pin 2: Pulse,	Yellow,	6" Wire
Pin 3: COM (Common)	Black,	6" Wire
Pin 4: COM (Common)	Black,	6" Wire
Pin 5: COM (Common)	No Wire	

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.

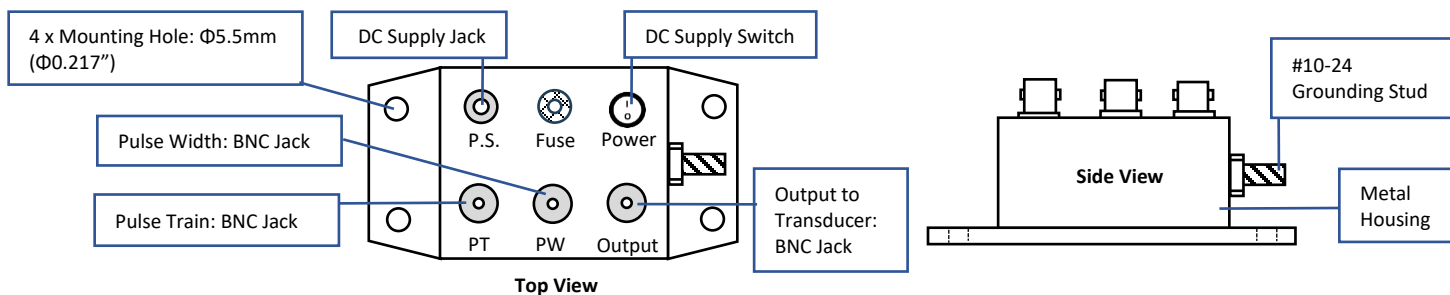
BII5101 Physical Size (unit mm): $\Phi D \times H = \Phi 101.6 \times 50.8 \text{mm}$ 

SHIPMENT:	Assembled board, Qty.: 1	Input Terminal with 6" wires: Qty.: 1	Output and Power Supply Plug with 6" wires: Qty.: 1
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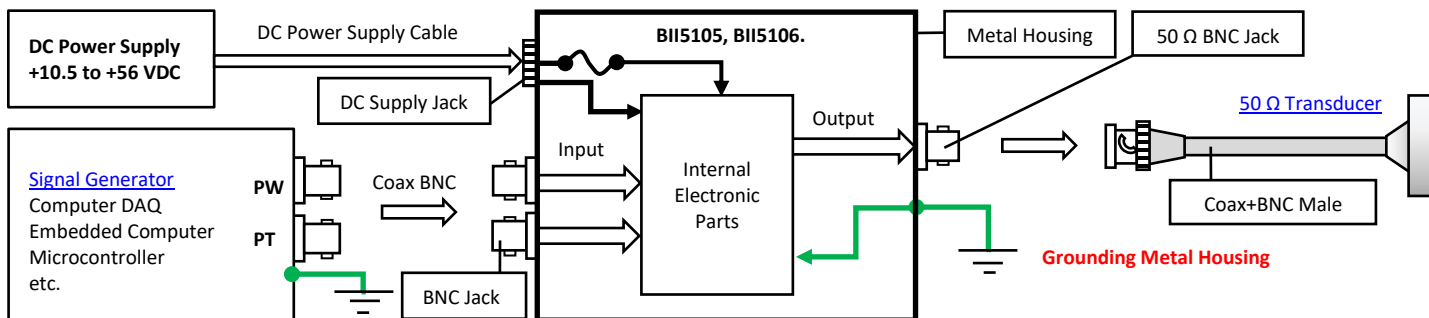
BII5105 and BII5106: Output Connector: BNC Jack. Mounting Hole $\Phi 5.5\text{mm}$ ($\Phi 0.217''$) accepts M5 or #10 screw. Screws are not supplied.

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

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



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



Buyer's Signal Source	Input: Pulse Width and Pulse Train	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: DCBP20 . 2. Included: One Grounding Cable, Part Number: GWL18 .		
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.			

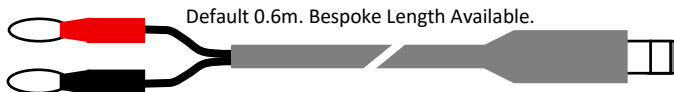
How to Order.

BII5105, BII5106.	-Adaptor Accessory
Example of Part Number:	Description
BII5105	BII5105, Linear Power Amplifier.
BII5105-MIL-SUMC	BII5105, Linear Power Amplifier with Adaptor Accessory: MIL-SUMC.
BII5106	BII5106, Linear Power Amplifier.
BII5106-MIL-SUMC	BII5106, Linear Power Amplifier with Adaptor Accessory: MIL-SUMC.

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.



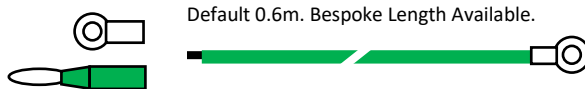
Red Banana Plug: +VDC. **Black Banana Plug:** Common.

One 0.6m DC supply cable. One end of the cable is with DC Power Plug, another end is Red and Black Banana Plugs.

Grounding Cable and Terminals

Terminal to buyer's Grounding Terminal:

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



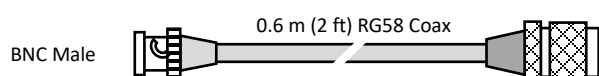
#10 Ring Terminal
#10-24 nut and #10
washer included.



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.

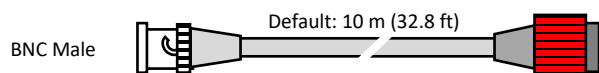
Accessory A13: BNC-MIL3S, BNC Male (Pin) to MIL3S (MIL-5015 type 3-Socket Connector Thread Fastening)



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.

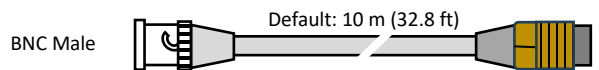
Accessory A14: BNC-UMCF3S, BNC Male to UMC3S (Underwater Connector, 3 Sockets, Locking Sleeve: DLSA-F, Size: $\Phi 35.5 \times 33.5$ mm)



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

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

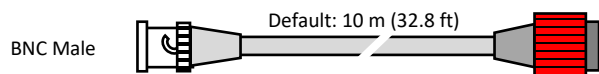
Accessory A15: BNC-SUMC3S, BNC Male to Small UMC3S (Underwater Connector, 3 Sockets, Thread Locking, Size: $\Phi 22 \times 28$ mm)



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

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

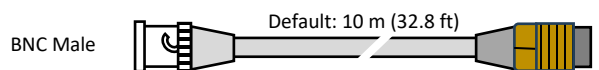
Accessory A16: BNC-UMCF2S, BNC Male to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size: $\Phi 35.5 \times 33.5$ mm)



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

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

Accessory A17: BNC-SUMC2S, BNC Male to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size: $\Phi 22 \times 28$ mm)



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.

