

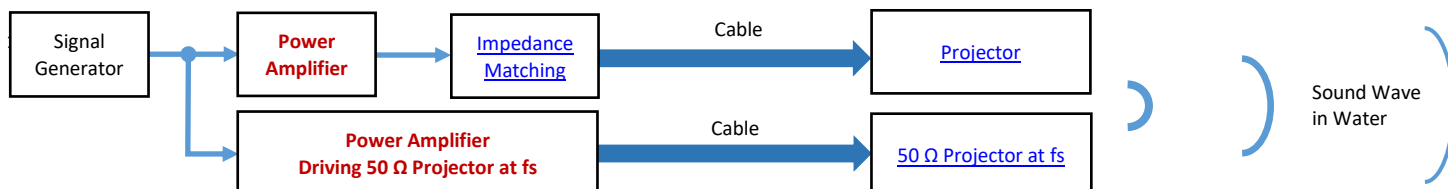


BII5110 Series Power Amplifier Driving Sonar Transducer / Projector

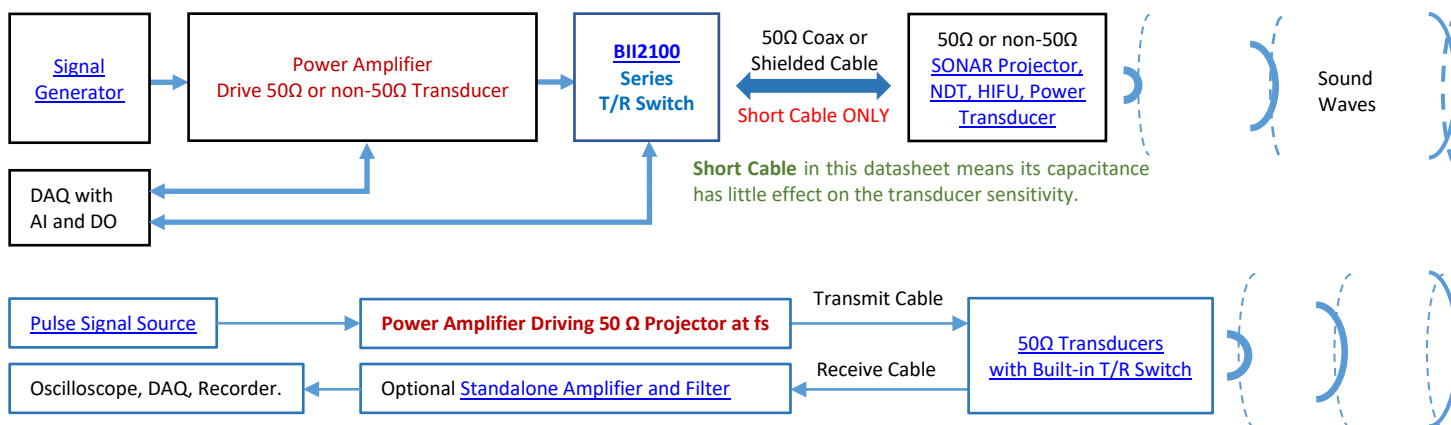
BII5110 series are switching power amplifiers which offer high efficiency and low power consumption for use in underwater, NDT, and HIFU acoustic pulsing system. Input and output signals of the PA are pulse signals: Single Pulse, Burst Pulses, and Spikes.

SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.



Related Product:

Underwater Transducer : SONAR, NDT, and HIFU	Impedance Matching between Transducers and Amplifiers
--	---

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	Linera 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	+30 V
Input Voltage Range	-0.5 V to 5.5 V
Output Peak Current	9 A

SPECIFICATIONS

	BII5111	BII5112	BII5111BNC	BII5112BNC
Power Amplifier:				
Status:	ACTIVE	ACTIVE	ACTIVE	ACTIVE
Waterproof:	Not waterproof. Always use the device in Dry Air for electrical safety.			
Operating Frequency:	50 kHz to 10 MHz	5 kHz to 500 kHz	50 kHz to 10 MHz	10 kHz to 500 kHz
Source Level Capability: (in Water)	Warning: Operating Frequency range is absolutely determined by impedance matching network and transducer. Please observe the frequency range of both impedance matching network and transducer to avoid damage of the power amplifier. Refer to load. 191.0 + η + DI 194.1 + η + DI 191.0 + η + DI 194.1 + η + DI in dB re μPa at 1m. DI: Directivity Index (dB) of Transducer, η: Transducer Efficiency, in dB. η of broadband planar transducers such as NDT Transducers could be ≤ -5dB, η of broadband spherical or cylindrical transducers could be ≥ -0.5dB. For low and medium frequency (large size) cylindrical and spherical transducer, $\eta \geq 0.85$. BII5112 SL $\approx$ 193.6 dB at $\eta = 0.9$ (or -0.46 dB), DI = 0 dB (cylindrical or spherical transducers). BII5112 SL $\approx$ 201.6 dB at $\eta = 0.4$ (or -4.0 dB), DI = 11.5 dB (typical directional communication transducers without side lobes). BII5112 SL $\approx$ 216.9 dB at $\eta = 0.3$ (or -5.2 dB), DI = 28 dB (typical echo sounding directional transducers with -3dB Beam Angle of 7°). BII5111 SL $\approx$ 209.0 dB at $\eta = 0.1$ (or -10 dB), DI = 28 dB (typical pulsing NDT transducers with -3dB Beam Angle of 6° to 8°).			
Operating Mode:	Switching Mode.			
Gain:	Output Voltage/Input Voltage.			
Input Signal Type:	DC Coupling. Positive Pulse & Pulse Trains. 50nS $\leq$ Pulse Width $\leq$ 200mS. Duty Cycle $\leq$ 50%. Logic Signals, TTL/CMOS Logic Level Compatible. Note: Pulse Width PW (or Pulse Duration PD) in this document include pulse widths of pulse trains and single pulse. Warning: Neither Negative Pulse nor Negative Pulse Trains are suitable to the device.			
Input Connector:	None, Wire Leads.	None, Wire Leads.	BNC Jack, Panel Mounted.	BNC Jack, Panel Mounted.
Input Impedance:	1 M Ω 5 pF			
Input Logic Voltage Level:	TTL and CMOS Compatible. Logic Low "0": 0 to 0.8V. Logic High "1": 3.5 to 5V.			
Output Type:	AC Coupling.			
Output Connector:	Single-ended	Differential	Single-ended	Single-ended
Output Signal:	Pulsed/Burst Pulse Train.			
Output Voltage, High, V_H :	$V_S - 0.025$, in Vpp.	$2*(V_S - 0.025)$, in Vpp.	$3.65*(V_S - 0.025)$, in Vpp.	$7.3*(V_S - 0.025)$, in Vpp.
Output Voltage, Low, V_L :	≤ 0.025 V			
Output Current I_o :	≤ 8 A peak	≤ 8 A peak	≤ 2.2 A peak	≤ 2.2 A peak
Load:	Warning: Over-current leads to damage of the power amplifier. Please carefully calculate the current delivered to the load before putting the device into service. Load Current $I_o = V_H/\text{Load}$. Tuned Transducers or resistive load. Note: A Tuned Transducer is resistive load (Not reactive load) at its operating frequency. Warning: Do not use the power amplifier to drive untuned transducers (active load) with pulse waves. Highly capacitive or reactive load may cause over-current issue, which will destroy the device, with high frequency pulse signals. $\geq V_H/I_o$ or 3.375Ω, whichever is greater.			
Pulse Power Capability:	108.0W@+27VDC 85.0W@+24VDC 21.0W@+12VDC	216.0W@+27VDC 170.0W@+24VDC 42.0W@+12VDC	108.0W@+27VDC 85.0W@+24VDC 21.0W@+12VDC	216.0W@+27VDC 170.0W@+24VDC 42.0W@+12VDC
Power Efficiency:	Driving Tuned Transducers (Resistive load): 98.0%@+27VDC Supply. 97.7%@+24VDC Supply. 95.4%@+12VDC Supply.			
Supply Voltage V_S :	+10 to +27 VDC. Warning: DC Power Supply exceeding +27VDC may destroy the device.			
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:	1 mA.	2 mA.	1 mA.	2 mA.
DC Supply Connector:	60 mm Wire Bundle	60 mm Wire Bundle	Sheathed Banana Jack	Sheathed Banana Jack
Fuse:	N/A	N/A	5A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".	5A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".
Accessory Cable:	60 mm Wire Bundles	60 mm Wire Bundles	1. DC Power Supply Cables: DCBP20 .	
Cable Connector:	Wire Leads	Wire Leads	2. Grounding Cable: GWL18 .	
Package:	PCB	PCB	Metal Enclosure	Metal Enclosure

Grounding Terminal:	N/A	N/A	Grounding Stud #10-24.	Grounding Stud #10-24.
Mounting Holes:	4 x $\Phi 3.2\text{mm}$ ($\Phi 0.126''$) Screws are not supplied.	4 x $\Phi 3.2\text{mm}$ ($\Phi 0.126''$)	4 x $\Phi 5.5\text{mm}$ ($\Phi 0.217''$)	4 x $\Phi 5.5\text{mm}$ ($\Phi 0.217''$)
Size LxWxH (mm):	68.6 x 36.1 x 19.3	68.6 x 36.1 x 19.3	147.2 x 67.2 x 67	147.2 x 67.2 x 67
Weight in Air:	25 grams	30 grams	0.68 kg	0.7 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.

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 overheating.

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.

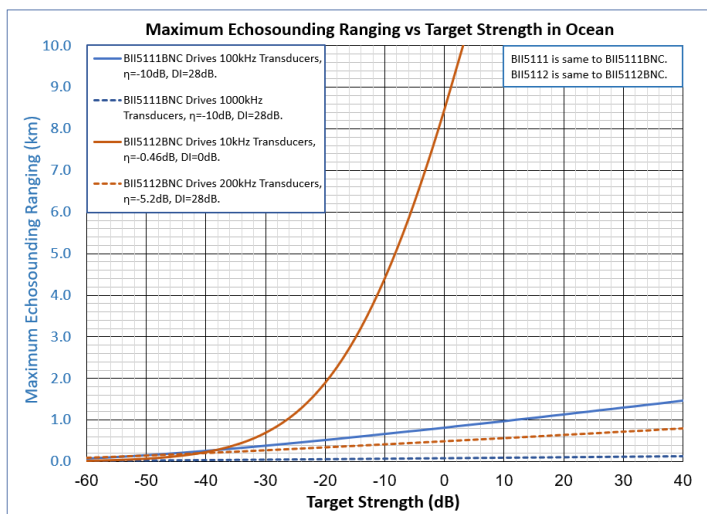
1. Butt Splice Connectors, Fully Insulated. Buyers shall refer to the instructions of the manufacturer to strip proper wire leads and crimp the connector for secure connection. If possible, **heat shrink tube** is recommended to sheath the splice and function as strain relief.

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

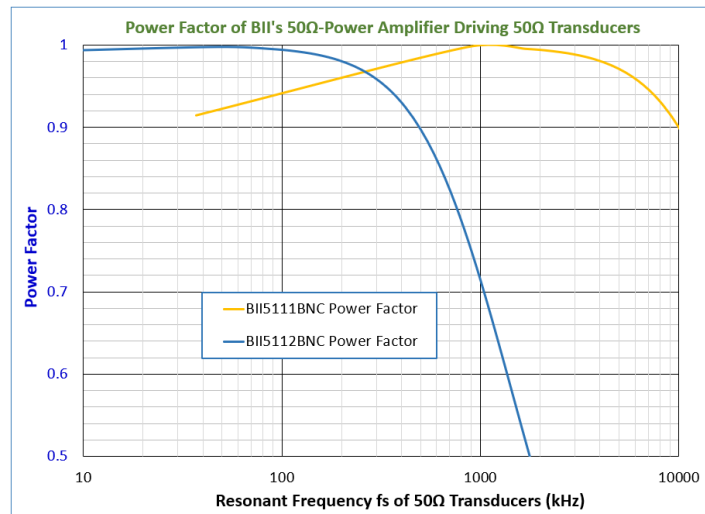
Note: a. by default, BII does NOT provide these connectors. If buyer needs connectors, please specify when ordering.

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

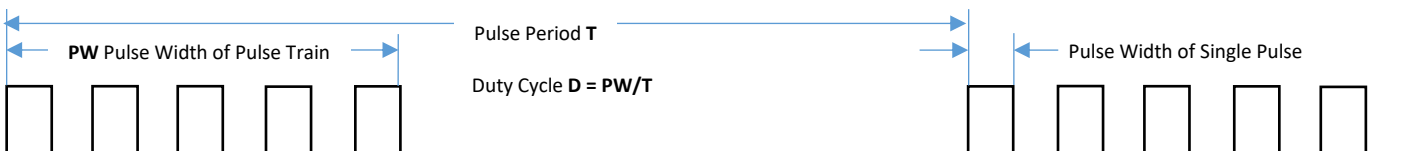
Echo Sounding Range in Water = 0.5*Communication Range at 0dB TS



Power Factor Driving 50Ω Transducers

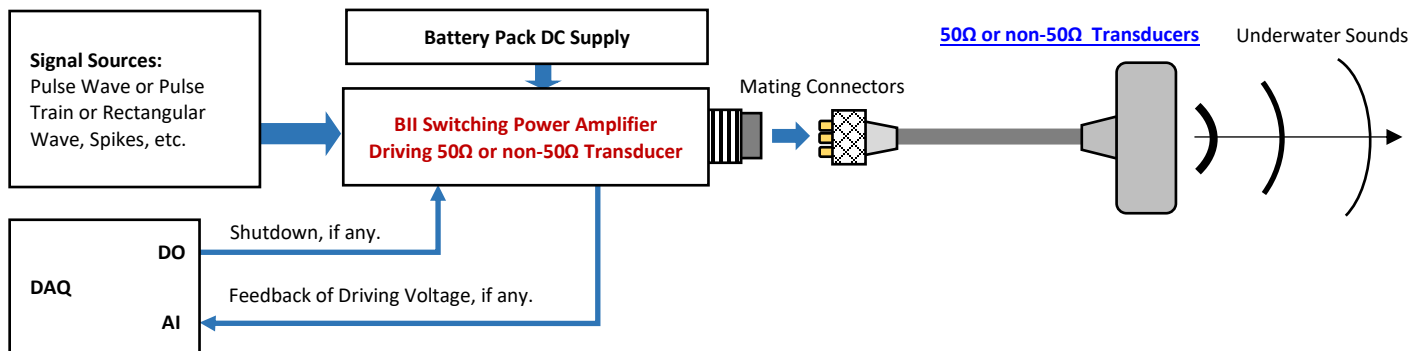


Pulse Width

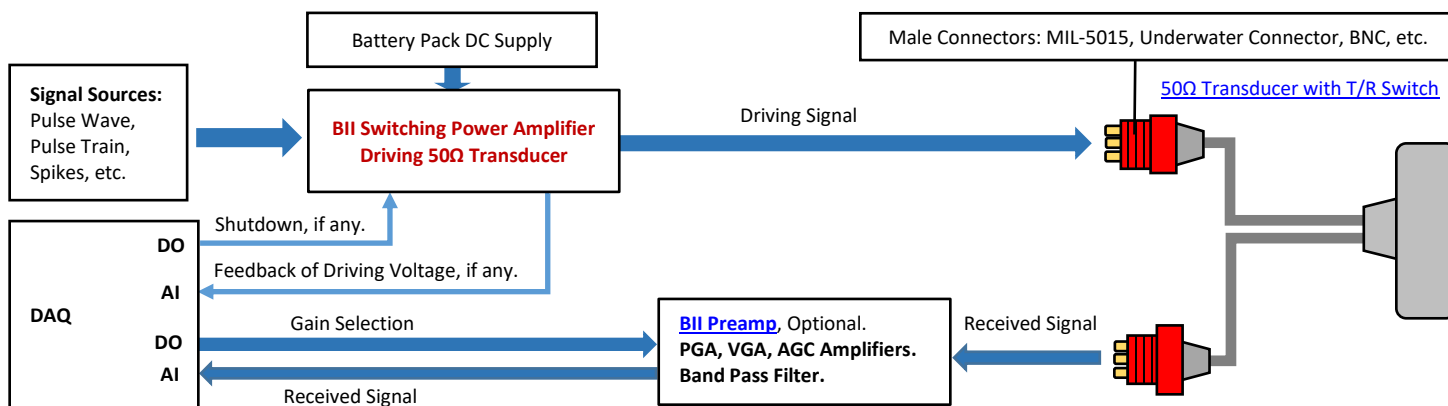
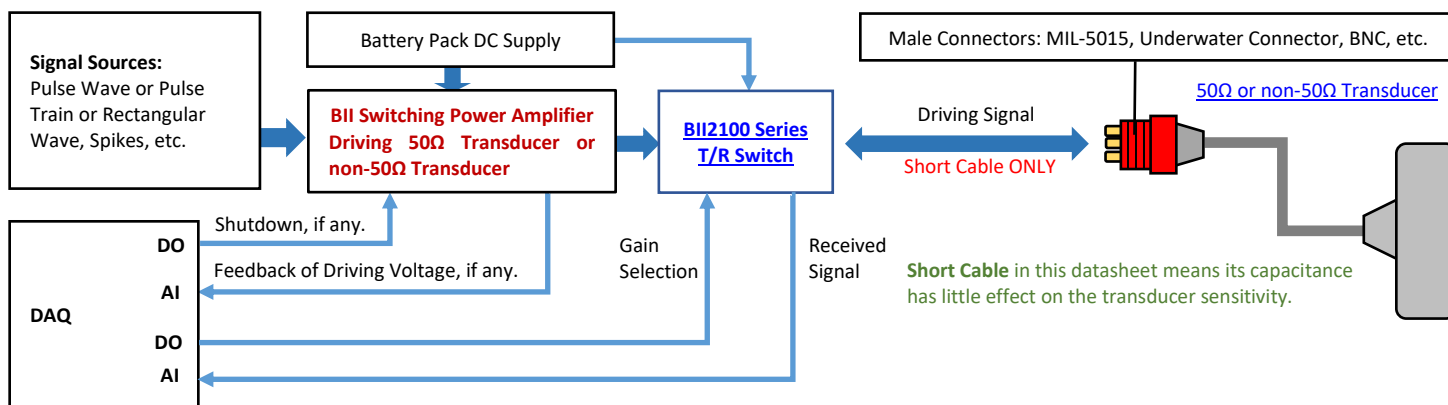


Acoustic System Block Diagram

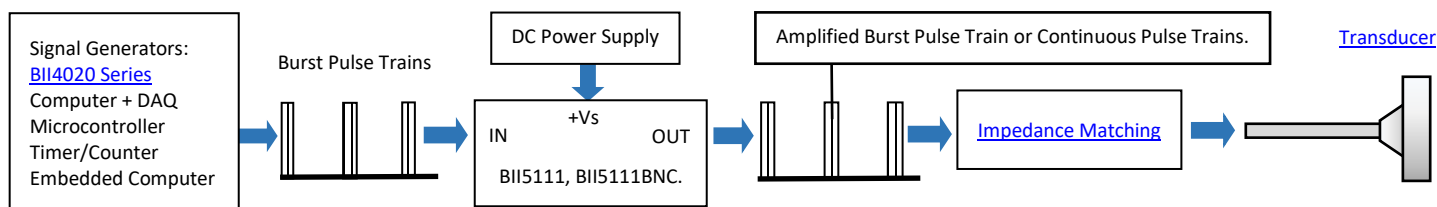
1. Generate Sounds and Waves.



2. Transmitting and Receiving Sounds and Waves

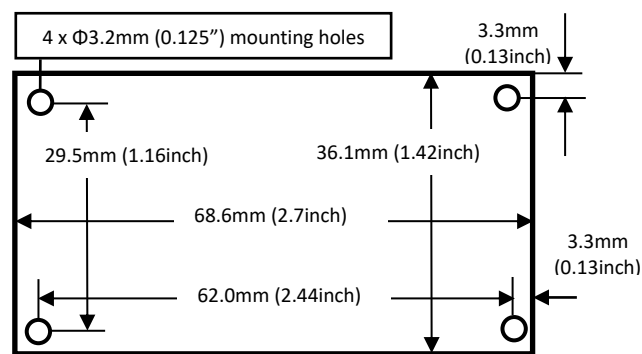
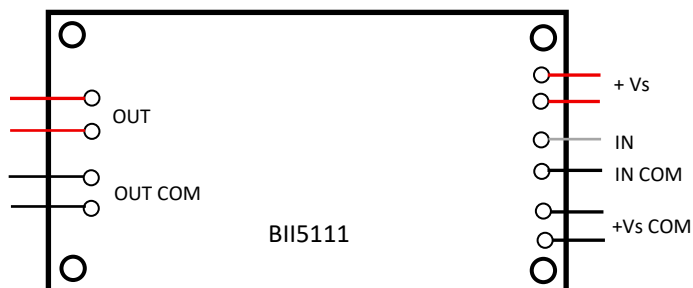


BII5111 and BII5111BNC Signal Block Diagram



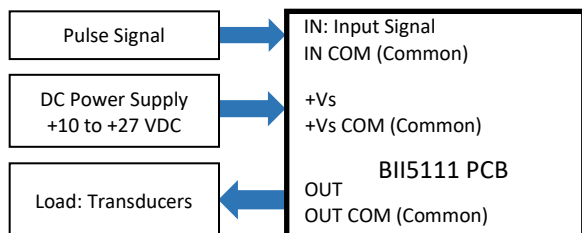
BII5111 CONTROLS and TERMINALS:

BII5111 Physical Size (PCB):



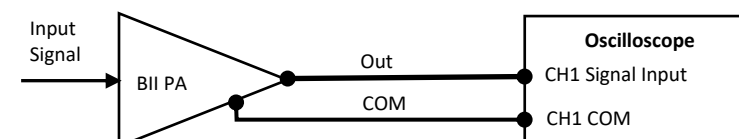
Wire Bundle	Signal	Wires' Colour	Wire Bundle	Signal	Wires' Colour
IN	Input Signal	White, 60mm.	OUT	Output	Red x 2, 60mm.
IN COM	Input Signal common	Black, 60mm.	OUT COM	Output Common	Black x 2, 60mm.
+Vs	Power Supply Positive Voltage	Red x 2, 60mm.	Vs COM	Power Supply Common	Black x 2, 60mm.

SUGGESTED WIRING for BII5111:



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.
SHIPMENT: Assembled board, Qty.: 1		

Measure Single Ended Output of BII Power Amplifiers

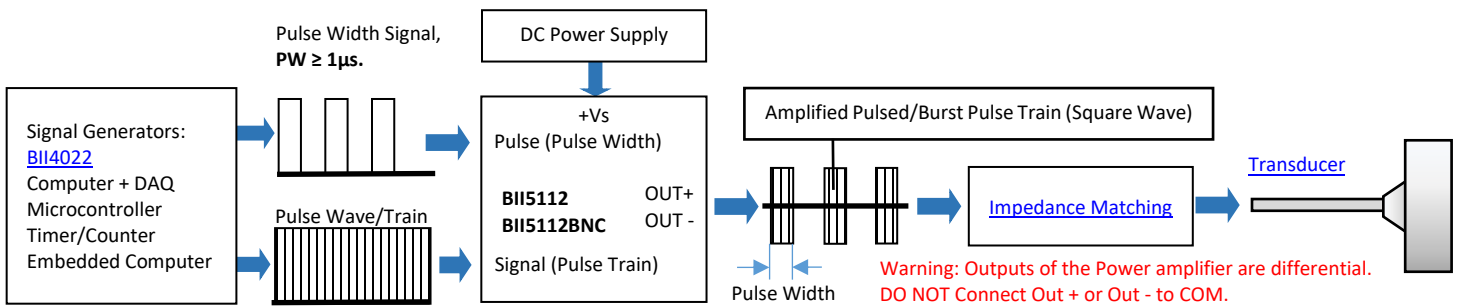


Warning:

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.

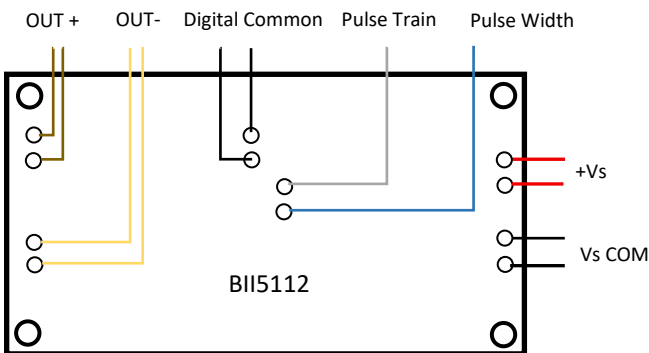
BII5112 and BII5112BNC Signal Block Diagram.

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

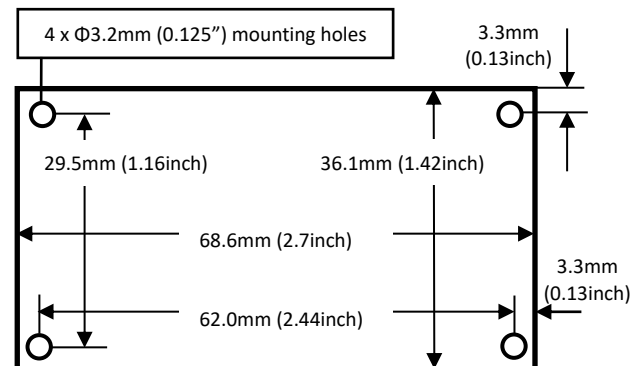


Generation of Square Waveform and Pulse Signal:		
Digital I/O Board or Microcontroller Digital I/O port.	Timer circuit or astable multivibrator.	Benthowave's SONAR signal generation modules.
SHIPMENT: Assembled board, Qty.: 1		

BII5112 CONTROLS and TERMINALS:

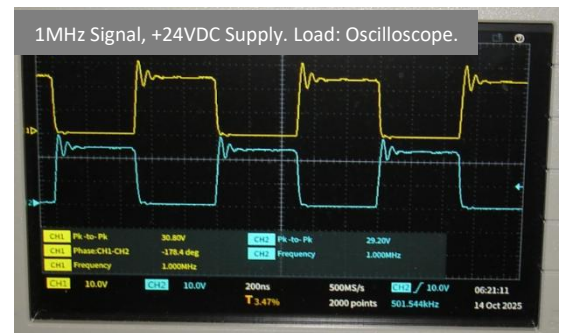
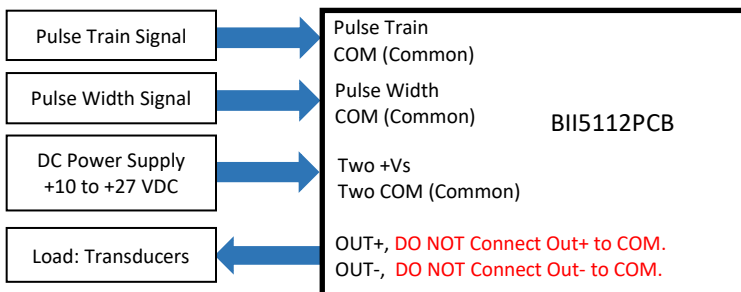


BII5112 Physical Size: Thickness = 19.3mm.

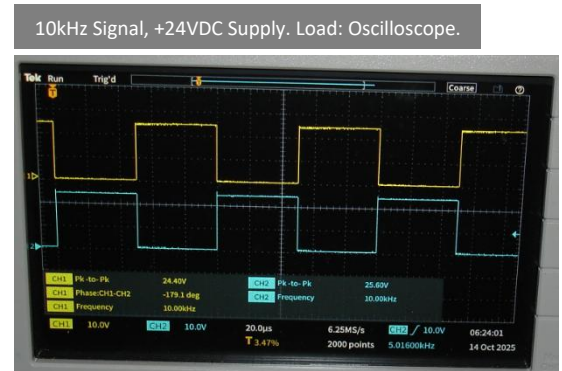
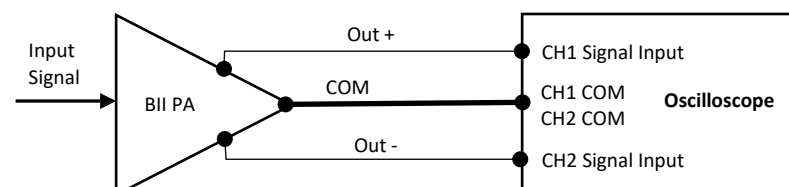


Wire Bundle	Signal	Wires' Colour	Wire Bundle	Signal	Wires' Colour
Vs COM	Power Supply Common and Signal Common	Black x 2	Pulse Train	Input Pulse Wave/Train	White
+Vs	Power Supply Positive Voltage	Red x 2	Pulse Width	Pulse Width Signal	Blue
OUT+	Output Signal +	Brown x 2	Digital Common	Digital Common	Black x 2
OUT -	Output Signal -	Yellow x 2			

BII5112 Series SUGGESTED WIRING:



Measure Differential Output of BII Power Amplifiers

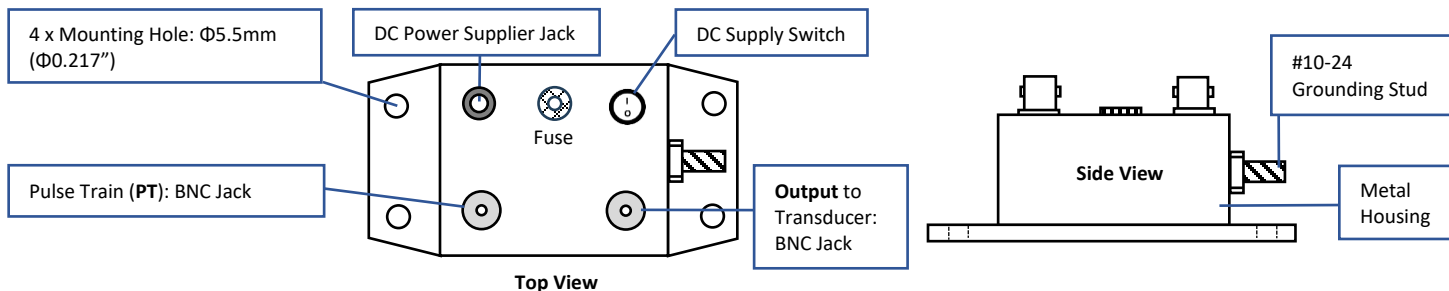


BII511BNC

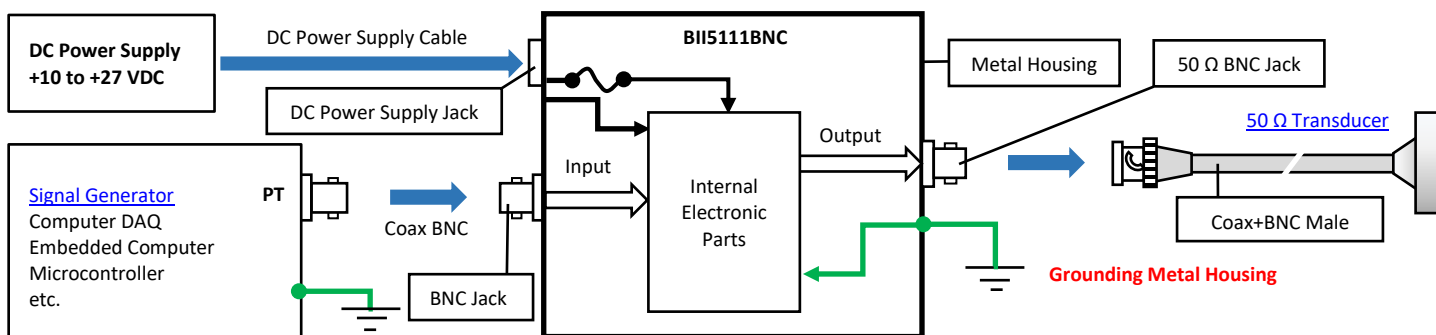
Output Connector: BNC Jack. Metal Enclosure, Mounting Hole $\Phi 5.5\text{mm}$ ($\Phi 0.217''$) accepts M5 or #10 screw. Screws are not supplied.

Overall Size: LxWxH = 147.2x67.2x67mm.

PT: Pulse Train. P.S.: Power Supply.



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

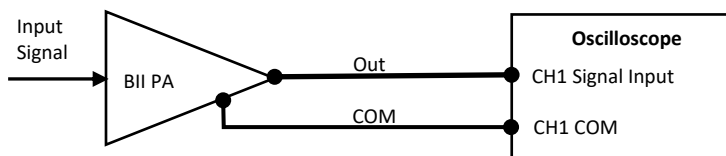


Buyer's Signal Source	BII5111NC Input: Pulse Train	BII5111BNC Output: Pulse Train	Transducer Cable and Connectors
BNC Jack	Two BNC Jacks	BNC Jack	Coax + In-line BNC Plug (Male)
Signal: Center Socket	Signal: Center Socket	Signal: Center Socket	Signal: Center Pin
Common: Body.	Grounded Common: Body.	Grounded Common: Body.	Common: Body.
DC Power Supply:	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:	5A, 250VAC or 60VDC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".		
Accessories Included:	1. DC supply cables, Part Number: DCBP20 . 2. One Grounding Cable, Part Number: GWL18 .		
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.

Example of Part Number:	Description
BII511BNC	BII511BNC, Switching Power Amplifiers.

Measure Single Ended Output of BII Power Amplifiers



Warning:

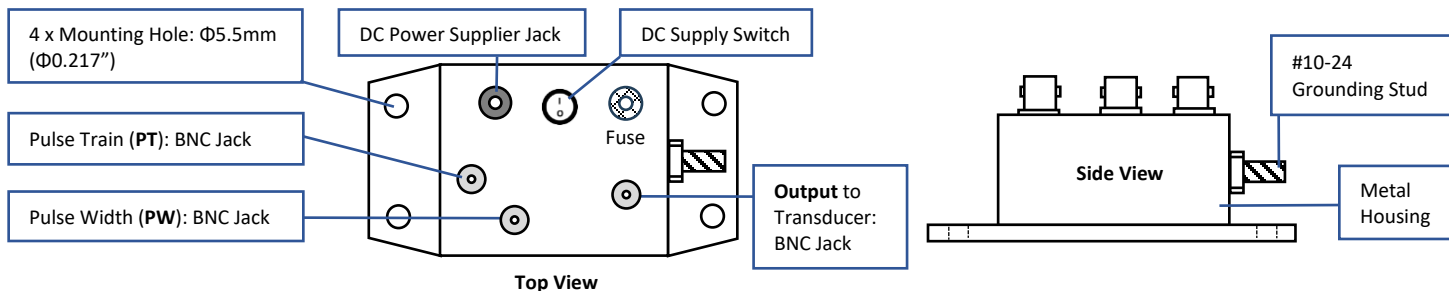
1. Outputs of the power amplifier is high voltage, choose suitable oscilloscope probe with correct attenuation and voltage rating.
2. for operating safety, ensure proper grounding, and shut down power supply of the device before handing the cables, wiring and hookup, etc.

BII5112BNC

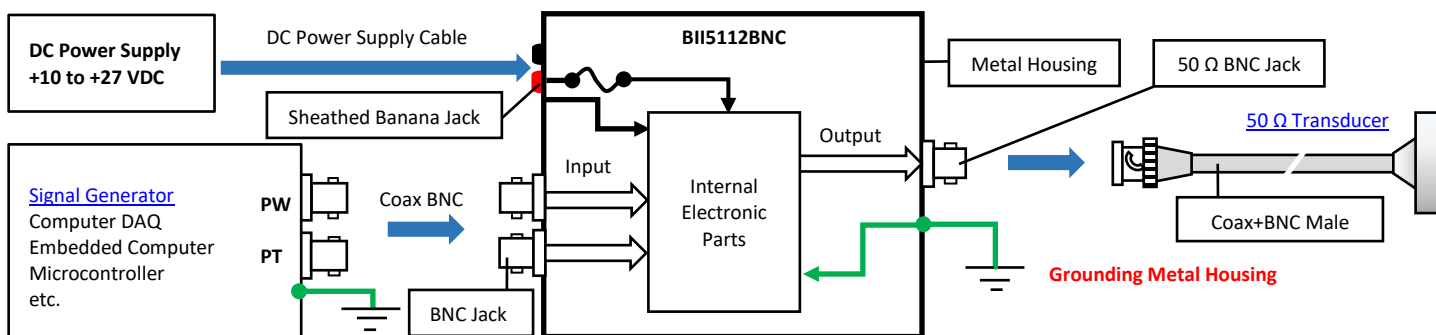
Output Connector: BNC Jack. Metal Enclosure, Mounting Hole $\Phi 5.5\text{mm}$ ($\Phi 0.217''$) accepts M5 or #10 screw. Screws are not supplied.

Overall Size: LxWxH = 147.2x67.2x67mm.

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



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

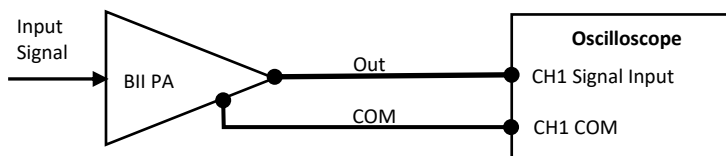


Buyer's Signal Source	BII5112BNC, Input: Pulse Width and Pulse Train.	BII5112BNC Output	Transducer Cable and Connectors
BNC Jack	Two BNC Jacks	BNC Jack	Coax + In-line BNC Plug (Male)
Signal: Center Socket	Signal: Center Socket	Signal: Center Socket	Signal: Center Pin
Common: Body.	Grounded Common: Body.	Grounded Common: Body.	Common: Body.
DC Power Supply:	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:	5A, 250VAC or 60VDC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".		
Accessories Included:	1. DC supply cables, Part Number: DCBP20 . 2. One Grounding Cable, Part Number: GWL18 .		
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.

Example of Part Number:	Description
BII5112BNC	BII5112BNC, Switching Power Amplifiers.

Measure Single Ended Output of BII Power Amplifiers

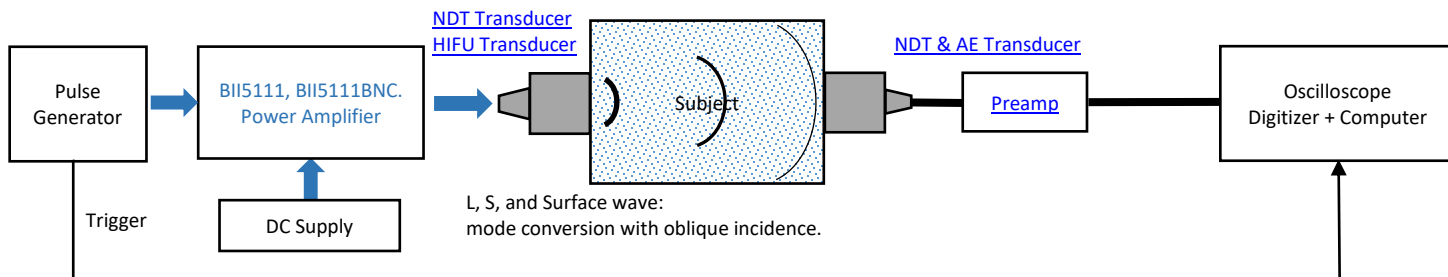


Warning:

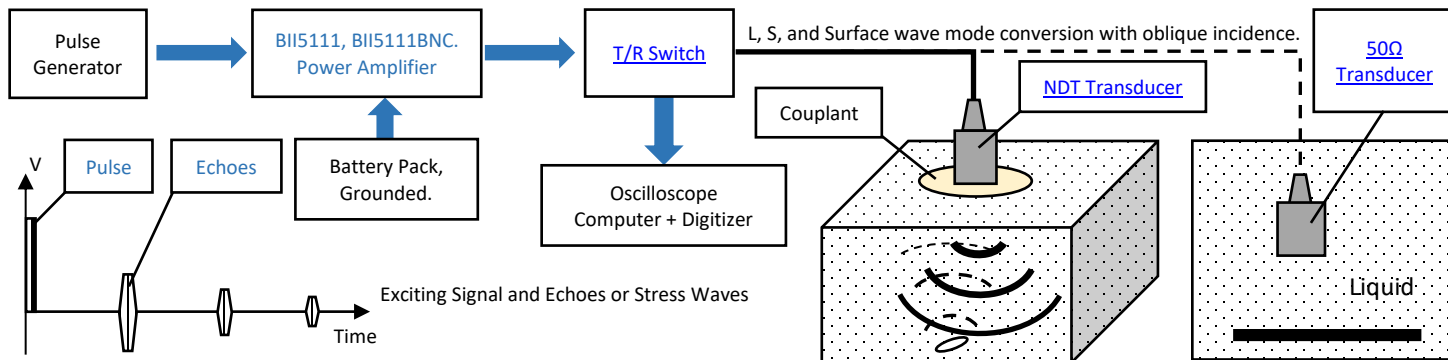
1. Outputs of the power amplifier is high voltage, choose suitable oscilloscope probe with correct attenuation and voltage rating.
2. for operating safety, ensure proper grounding, and shut down power supply of the device before handing the cables, wiring and hookup, etc.

Application Notes

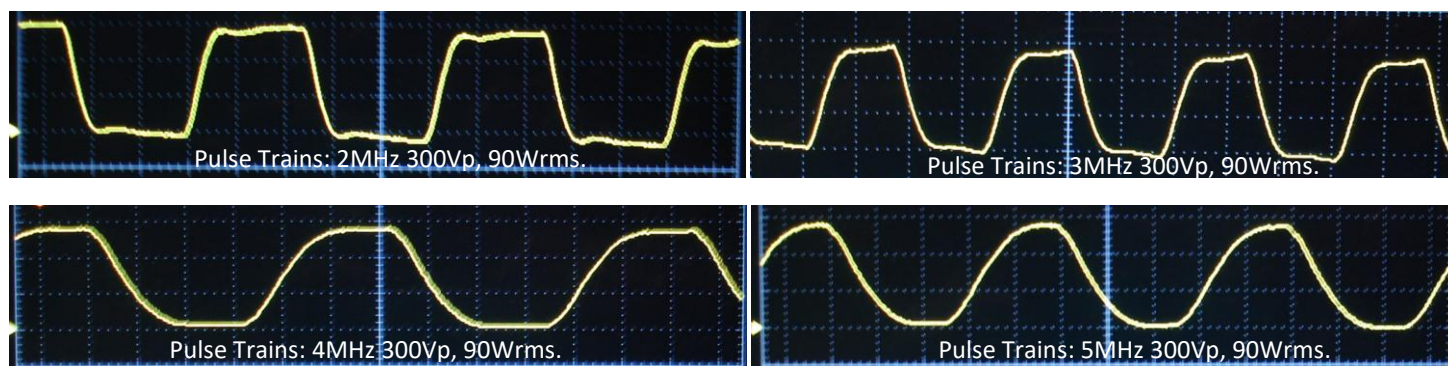
(1) NDT Pulser.



(2) NDT Pulser and Receiver.



3. Typical Waveform of Broadband Acoustic Pulsing Systems: Pulse Generator + BII5111 + Bespoke BII6010 + 500Ω Transducer, 300Vp, 90Wrms.



Accessories:

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.



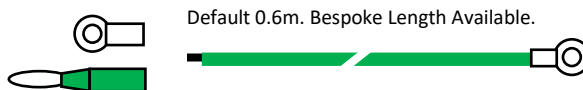
Red Banana Plug: +VDC. **Black Banana Plug:** Common.

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.

BII5111BNC and BII5112BNC, (Sizes are in bracket), Metal Housings, Outline Dimensions (mm), Illustration only, the scale is not 1:1.

