

# Benthowaye Instrument Inc. Underwater Sound Solutions

www.benthowave.com

## **BII5020 Series Power Amplifier**

## DESCRIPTION

BII5020 series linear power amplifiers are ideal to drive piezoelectric transducers used in acoustic systems of underwater, air, and ultrasonics (solids).

## SYSTEM CONFIGURATION



## APPLICATIONS

Object Detection and Tracking, Bioacoustic and Biological Research.	Underwater Wireless Communication/Modem.
Distance Gage, Navigation, Obstacle Avoidance.	Acoustic Beacon & Positioning: Pinger and Transponders.
Phantom Echo Generation, Phantom Clicks, Sound Playback.	FSK, PSK and Spread Spectrum System.

## ABSOLUTE MAXIMUM RATINGS

Power Amplifier	BII5021, BII5022	BII5024
Supply Voltage:	+44 VDC	+32 VDC
Output Peak Current:	5 A	1.32 A
Input Voltage:	10 Vpp	10 Vpp

## SPECIFICATIONS

	BII5021	<u>BII5022</u>	<u>BII5024</u>	
Power Amplifier	BII-5021	BII-5022	O     O     O     O       P.S.     Fuse     Power       O     O     O       Input     Output	
	ACTIVE	ACTIVE	ACTIVE	
Status:	ACTIVE: Product device re lifetime-buy period is in eff	commended for new designs. LIFEBUY: BII has anno fect. OBSOLETE: BII has discontinued the production of	unced that the device will be discontinued, and a f the device.	
Waterproof:	Not waterproof. Always us	se the device in Dry Air for electrical safety.		
On a matting for an an	100 Hz to 500 kHz	100 Hz to 500 kHz	6 to 500 kHz.	
(Small Signal)	Small Signal: Load $\geq 100\Omega$ ,	Output Voltage $\leq$ Half V <sub>omax</sub> , Output Current $\leq$ Half I <sub>omax</sub>	3X•	
(Small Signal)	Warning: the device perfor	rmance degrades if operating frequency less than Mini	mum Operating Frequency.	
	Pulsed Signals.	Pulsed Signals ONLY to avoid overheat and damage.	Pulsed Signals.	
Signal Type.	Continuous Signals.	<b>Pulse Width PW</b> $\leq$ 100 mS, and <b>Duty Cycle D</b> $\leq$ 25%.	Continuous Signals.	
Source Level Capability:	188.6 + DI.			
(in Water)	in dB re μPa at 1m. DI: Directivity Index (dB) of the transducer.			
Operating Mode:	Linear			
Impedance Matching:	No Built-in Impedance Mat	tching.	Built-in Impedance Matching.	
Gain:	30.9 dB or x 35.		42 dB or x 125.6	
Input Type:	Single ended		Single ended	
Input Connector:	On-board	None, Wire Bundles.	BNC Jack	
Input Impedance:	20 KΩ    7 pF			
Maximum Input Level:	Maximum Output Voltage Vo <sub>max</sub> /Gain or 2Vpp whichever is less. 1 Vpp		1 Vpp	
Output Type:	Differential		Single ended	
Output Connector:	On-board None, Wire Bundles. BNC Jack		BNC Jack	
Voltage Output:	<ul> <li>4.2 Ap current output: Maximum Vo<sub>max</sub> = (Vs - 7), in Vp.</li> <li>0.6 Ap current output: Maximum Vo<sub>max</sub> = (Vs - 3.1), in Vp.</li> </ul>		Input Level * Gain, or 125.6 Vpp.	
Current Output:	lo ≤ 4.2 A peak.	lo ≤ 5 A peak.	lo ≤ 1.32 A peak.	
Load:	≥ Vo/lo	≥ Vo/Io	Driving 50 Ω Transducers.	
Stand-by Control Voltage: (Shut-down)	TTL/CMOS Compatible. Logic Low "0": Output Disabled. 0 to +0.8 VDC. Logic High "1": Output enabled. +2.4 VDC to Supply Voltage Level Vs.		Not Available.	
Output Disable Time:	1μS		N/A	
Output Enable Time:	3 μS		N/A	
Full Power Bandwidth:	150Hz to 90kHz@+42VDC Supply. 150Hz to 100kHz@+36VDC Supply. 150Hz to 200kHz@+24VDC Supply. 150Hz to 500kHz@+24VDC Supply.		Refer to Frequency Response.	
RMS Power Capability:	86W@+42VDC Supply. 71\	N@+36VDC Supply.	41W@+24VDC Supply.	
(SINE Signal)	41W@+24VDC Supply. 11\	N@+12VDC Supply.	11W@+12VDC Supply.	
Power Efficiency:	Driving Tuned Transducers (Resistive load):		Driving Tuned Transducers (Resistive load):	



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(Operating at Io <sub>max</sub> )	30% at +12 VDC. 55% at +2	24 VDC. 62% at +36 VDC. 64% at +42 VDC.	30% at +12 VDC. 55% at +24 VDC.
	Driving Untuned Transduc	ers: Power Efficiency of driving tuned transducers*cos	<ul> <li>θ: Impedance Phase of Untuned Transducers.</li> </ul>
Supply Voltage Vs:	+8 to +42 VDC		+8 to +30 VDC
	Marine Battery and Auton	nobile Battery, or DC Power Supply with Grounded Out	put and Protection of Output Current Limit.
Suggested DC Supply	Fully charged 12V Automo	bile or Marine Battery are from 12.6 to 14.4 VDC. Ensur	e that voltage of battery pack is less than maximum
	DC supply voltage.		
Quiescent Current:	Active: 36 mA. Shutdown	: 16 mA.	36 mA
DC Supply Connector:	On-board	None, Wire Bundle.	DC Power Jack.
Fuse:	N/A	N/A	5A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".
Accessory Cable:	6" or 0.15 m wires	60 mm wires	1. DC Power Supply Cables: DCBP24.
Cable Connector:	Wire Leads	Wire Leads	<ol><li>Grounding Cable: <u>GWL18</u>.</li></ol>
Package:	PCB	PCB	Metal Enclosure
Grounding Terminal:	N/A	N/A	Grounding Stud #10-24.
Mounting Holos	4 x Φ4.87mm	4 x Φ3.2mm	4 x Φ5.5mm. Accept M5 and #10 Screws.
Woulding Holes.	Screws are not supplied.		
Size (mm):	Round PCB:	Rectangular PCB:	Metal Enclosure:
3ize (mm).	ΦDxH = Φ101.6x50.8	LxWxH = 68.6x36.1x36	LxWxH = 180.5x110.3x75
Weight in Air:	170 grams	46 grams	1.2 kg
<b>Operating Temperature:</b>	-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 recommanded to co	al down the emplifier during convice of full newer and	continuous waveform

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**



### **BII5021 SUGGESTED WIRING:**



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



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#### BII5021 ST-BY SWITCH (Shutdown SWITCH)

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

## **BII5021 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



## BII5021 Physical Size (unit mm): $\Phi$ DxH = $\Phi$ 101.6x50.8mm



How to Extend Input and Output Wires of BII5021Power Amplifiers (PCB Package for Embedded Applications.)?

Input and output wires of BII5021 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.

## **BII5022 CONTROLS and TERMINALS:**

## BII5022 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.
СОМ	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, Bll does not solder wire.					
Default Factory-set: SW is wired to OFF, shut-down function is not available. To use shut-down function:					

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.



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**BII5022 SUGGESTED WIRING:** 



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

### 2. Shut-down function is available.

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.

## **Measure Differential Output of BII Power Amplifiers**



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

BII5024: Input and Output Connectors: BNC Jack. Metal Enclosure, Overall Size: LxWxH = 180.5x110.3x75mm. Mounting Hole  $\Phi$ 5.5mm ( $\Phi$ 0.217") accepts M5 or #10 screw. Screws are not supplied.



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



Signal Generator	BII5024		50 Ω 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



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Common: Body.	Grounded Common: Body.	Grounded Common: Body.	Common: Body.	
PC Device Strephy Cable Part Number: DCBP24, One 0.6 m DC supply cable with DC Power Plug and Banana Plugs. Red Banana Plug: +VDC, Black Bar			Red Banana Plug: +VDC, Black Banana Plug:	
DC Power Supply Cable	Common.			
DC Supply Switch:	Turn ON and Turn OFF DC Supply. "I" -> ON; "O" -> OFF.			
Fuse:	5A, 250VAC, Slow-Blow, 3AB, 3AG, 1/4" x 1-1/4".			
Accessories	1. One DC Power Supply Cables: DCBP24.			
Accessories: 2. One Grounding Cable, Part Number: <u>GWL18</u> .				
Grounding Metal Case	Grounding Stud: #10-24 Screw 316SS. Nut and Washer are included. Support Single-Point Grounding with Multiple Devices.			
for operating safety.	Note: The body of Power Supply Jack is connected to metal case.			
1. Install the device to a sa	fe solid object to avoid sliding. An air free-flo	wing 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, an	d person injury may occur.	

#### How to Order

Part Number:	Description
BII5024	BII5024, Linear Power Amplifier.

Customer's Question: 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.

#### DC Supply Cable Pair: Part Number DCBP24.



## 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**



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.

## Measure Single Ended Output of BII Power Amplifiers



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

### 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.

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#### **BII Metal Housing** 4 x Mounting Hole: ጥ d þ Φ5.5mm (Φ0.217"). റ Θ Accepts M5 or #10 (0) (0)79.7 95 110.3 Screw (Not Supplied). 75 G G 150.4 BNC for Illustration ONLY 165.5 Side View Top View 180.5