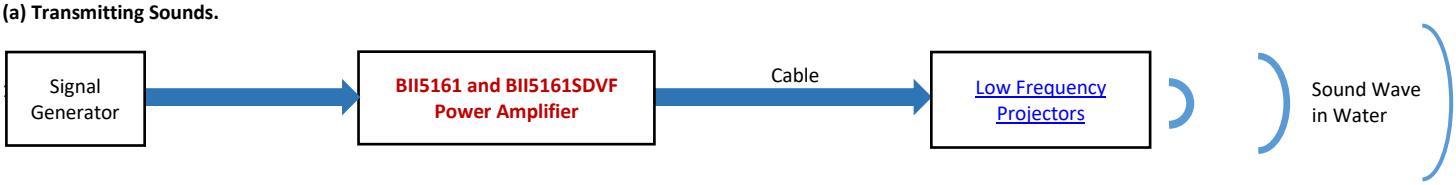
Low Frequency Power Amplifiers

DESCRIPTION

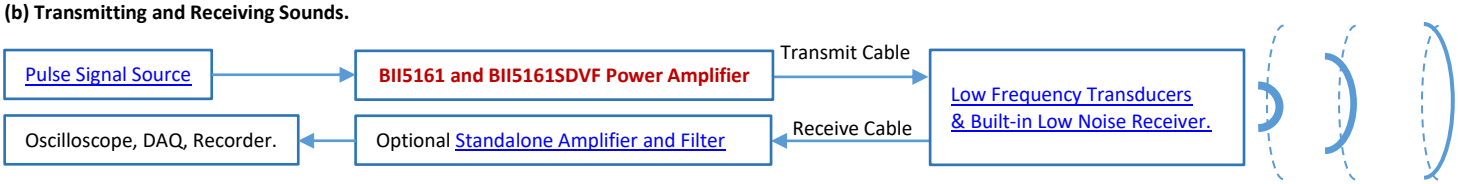
BII5160 series amplifiers are portable low frequency power amplifiers which drive piezoelectric transducers to generate low frequency sounds ranging from 100Hz to 20kHz. Transducers in low frequency range feature high impedance, low efficiency, and low power factor. The amplifiers are optimized for low frequency transducers.

SYSTEM CONFIGURATION

(a) Transmitting Sounds.



(b) Transmitting and Receiving Sounds.



Related Product:

BII5000 Power Amplifiers	Low Frequency Transducers	Piston Transducers	Communication Transducer

Typical Applications

Noise Generation, Studies of Materials, Physical Acoustics.	Exploration Seismology, Seismic Wave, Seafloor-mapping System, Sub-bottom Investigation.
Underwater Communication, Telephone, Diver Recall System.	Playback of Recorded Marine Animal Sounds, Acoustic Deterrents to Marine Animals.
Artificial Acoustic Target, Echo-Repeater Target, Navigation.	Bioacoustics, Underwater Sound Stimulus, Oceanography and Hydrography.

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage:	+60 VDC
Input Voltage:	10 Vpp
Output Peak Current:	10 A

Specifications

Power Amplifier	**BII5161**	**BII5161SDVF**
Status:	**ACTIVE**	**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.	
Waterproof:	Not waterproof. **Always use the device in Dry Air for electrical safety.**	
Frequency	100 Hz to 20 kHz	
Signal Type:	SONAR Signals, Communication Signals, Aquatic/Marine Animal Sounds, Ambient and Ship/Vehicle Noises, Arbitrary Signals, etc.	
Source Level Capability:	194.0 + η + DI	
	in dB re µPa at 1m, **in Water**. DI: Directivity Index (dB) of Transducer, η: Transducer Efficiency, in dB.	
	Source Level is much less than 194 dB in low frequency range because of low efficiency and low power factor.	
Operating Mode:	Linear	
Impedance Matching:	None	
Voltage Gain:	57.2 dB, or x 725.	
Input Type:	Single ended	
Input Connector:	BNC Jack	
Input Impedance	20KΩ||7pF	
Maximum Input Level:	Maximum Output Voltage Vo_{max} /Gain or 2Vpp whichever is less.	
Output Type:	Single ended	
Output Impedance Zo:	Zo = j0.0773*f, in Ω. f: Operating Frequency, in Hz. Refer to Chart of Output Complex Impedance Zo.	
Output Connector:	97 Series Standard Cylindrical Connector, MIL-5015 Style. 3 Socket, Thread Fastening.	
Voltage Output Vo:	Vo = Input Level * Gain, or (2*Supply Voltage Vs – 10)*14.5, in Vpp, Whichever is less.	
	Refer to chart of Maximum Output Voltage vs. DC Supply Voltage.	
	Warning: Buyer MUST observe Voltage Rating of the transducer and avoid overvoltage damage to the transducer.	
Current Output:	0.7142 Apeak, Maximum.	
Load:	Low Frequency Piezoelectric Transducers.	
Shut-down Control:	None	Digital Signal, TTL/CMOS compatible. **Digital 0 or LOW**: OFF. **Digital 1 or HIGH**: ON.
	Shutdown (SD) is used to shut down the device and enable the device to operate normally.	

Shut-down Control Voltage:	None	**Logic Low or "0"**: 0 to +0.8 VDC. **Logic High or "1"**: +3.5 VDC to Vs.
	Warning: Control voltage greater than Vs will damage the device.	
Shut-down Connector:	None	BNC Jack
Output Disable Time:	None	1 µS
Output Enable Time:	None	3 µS
Voltage Feedback:	None	**Output at VF terminals** = Driving Voltage of Transducer * Feedback Gain. **Feedback Gain** = 0.01.
	Voltage Feedback (VF) output is used to monitor driving voltage applied to the transducer.	
Full Power Bandwidth:	Refer to Frequency Response. Load dependant.	
RMS Power Capability Prms:	208W@+58VDC. 158W@+48VDC. 98W @+36VDC. 38W @+24VDC.	
Power Efficiency:	Driving Tuned Transducers (**Resistive load**): 67% at +58 VDC. 64% at +48 VDC. 60% at +36 VDC. 50% at +24 VDC.	
(Operating at I_{omax})	Driving Untuned Transducers: Power Efficiency of driving tuned transducers*cosθ. θ: Impedance Phase of Untuned Transducers.	
Power Factor:	Refer to Chart of Power Factor.	
DC Supply Voltage Vs:	+8 to +58 VDC	
	Warning: DC Supply voltage greater than MAXIMUM RATINGS will damage the devices.	
DC Supply Current Is:	7.0 A at Maximum Power Output.	
	DC Supply Current of Pulsing Signals: When a device works with pulsing signals such as SINE pulse or voltage spikes, the DC current from DC power supply is much less than the rating. $Current = Rated\ DC\ Supply\ Current * \sqrt{D}$. D: Duty Cycle of the pulsing sugnal = Pulse Width / Period. For example: Driving a Transducer with SINE pulse whose D = 1%, DC current from DC power supply Is = 7.1A * $\sqrt{0.01}$ = 0.71 A.	
Suggested DC Supply:	Marine Battery and 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 Iq:	**Active**: 59mA; **Shutdown**: 24mA.	
Power Supply Connector:	Dual Binding Post Terminal (Red and Black). **Red Terminal**: +VDC Power Supply. **Black Terminal**: Common and Grounding of Power supply. **Warning: Black Terminal must be grounded firmly for safety.**	
Size (LxWxD):	0.28x0.26x0.18 m	
Weight:	5.0kg	5.2kg
Transducer Case:	No transducer case in default. Available upon request. Portable, Waterproof, Light Weight, Durable, Highly Chemical Resistant.	
Console Case:	Portable, Waterproof, Light Weight, Durable, Highly Chemical Resistant.	
Signal Generator:	Laboratory Signal/Function Generator; Playback of Digital Recorder; Computerized DAQ System; Embedded DAC System.	
(Not included)	BII Sonar Signal Generator.	
Transducers:	Not Included, Order Separately.	
Console and Wiring:	BII5161, BII5161SDVF.	
WARNING: The buyer should observe the National Electrical Code or other related codes of buyer's country to integrate this device into buyer's product or system, and follow the code to ground this device. It is buyer's sole responsibility to make sure the proper grounding for operating safety before putting the device into service.		

Transducer Connector Assembly

In the case that the size of the mating connector is bigger than mounting hole size of the transducer, BII does NOT assemble connector to the cable end, and BII ships both the transducer with wire leads and the mating connector to buyer. After installing the transducer on the mounting wall, buyer assembles an solder the connector to transducer cable.

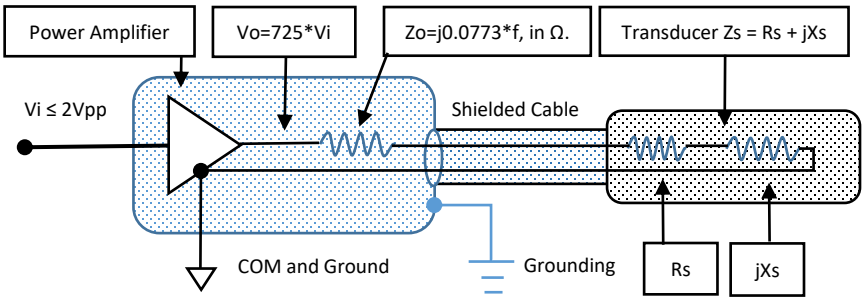
Wirings

Transducer	**3-Contact Mating Connector,** MIL-5015 Style.	**Wire Leads of Transducer**
Signal	Pin C	Red or White Wire
Signal Common	Pin B	Black Wire
Shielding and Grounding	Pin A	Shield

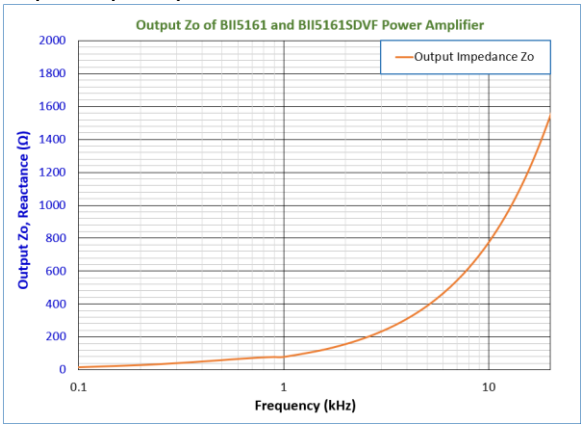
How to Order

BII5161, BII5161SDVF	-Adaptor Accessory
Example of Part Number:	**Description**
BII5161	BII5161, Linear Power Amplifier, Driving 50Ω Transducer. No any accessory.
BII5161SDVF	BII5161SDVF, Linear Power Amplifier, Driving 50Ω Transducer. No any accessory.
BII5161-DCBP18-GWL18-MIL-UMCF3S	BII5161, Linear Power Amplifier, Driving 50Ω Transducer. Accessories: DCBP18, GWL18, and MIL-UMCF3S.
BII5161SDVF-DCBP18-GWL18-MIL-UMCF3S	BII5161SDVF, Linear Power Amplifier, Driving 50Ω Transducer. Accessories: DCBP18, GWL18, and MIL-UMCF3S.

Equivalent Driving Circuit of BII5161 and BII5161SDVF.



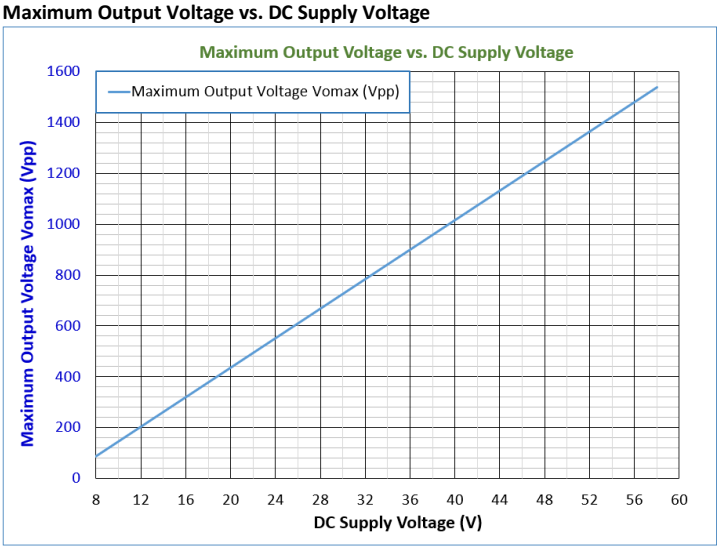
Output Complex Impedance Zo



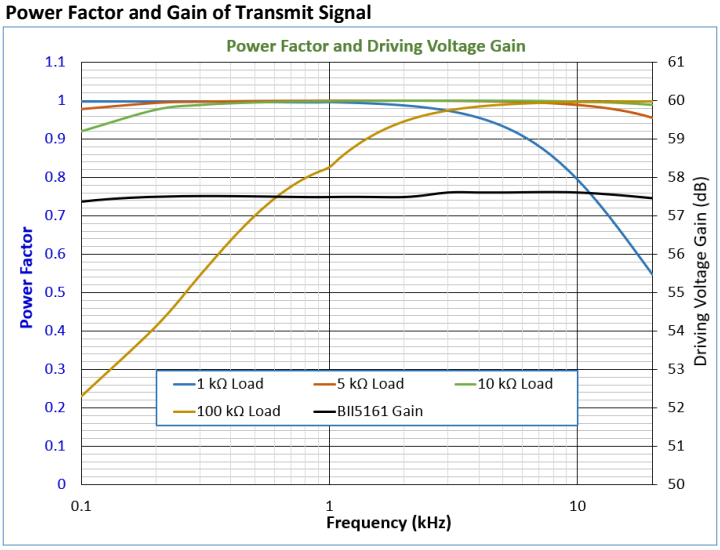
Operation Tips:

1. when a transducer's jXs = -j0.0773*f at a specific frequency f_{PF}, the maximum power factor 1 is achieved at f_{PF}. In this case, the Zo of power amplifier tunes out or cancels out reactance of the transducer.
2. Generally, a low frequency transducer possesses high impedance which is from kΩ or tens kΩ. Zo (j0.0773*f) of BII5161 and BII5161SDVF can be ignored.

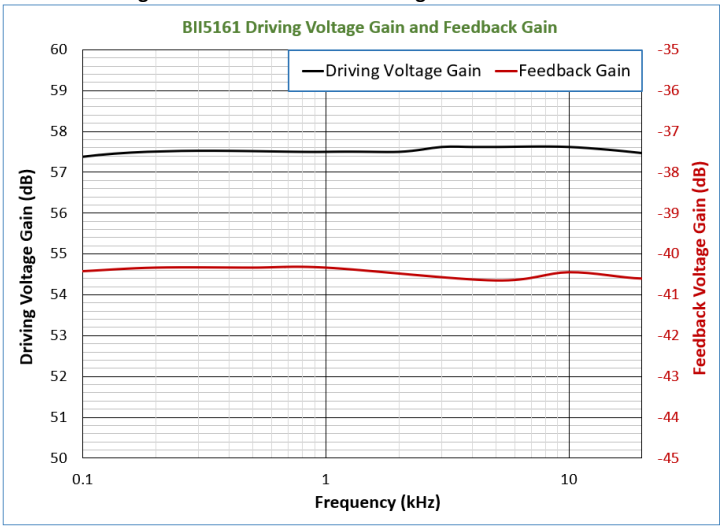
Maximum Output Voltage vs. DC Supply Voltage



Power Factor and Gain of Transmit Signal

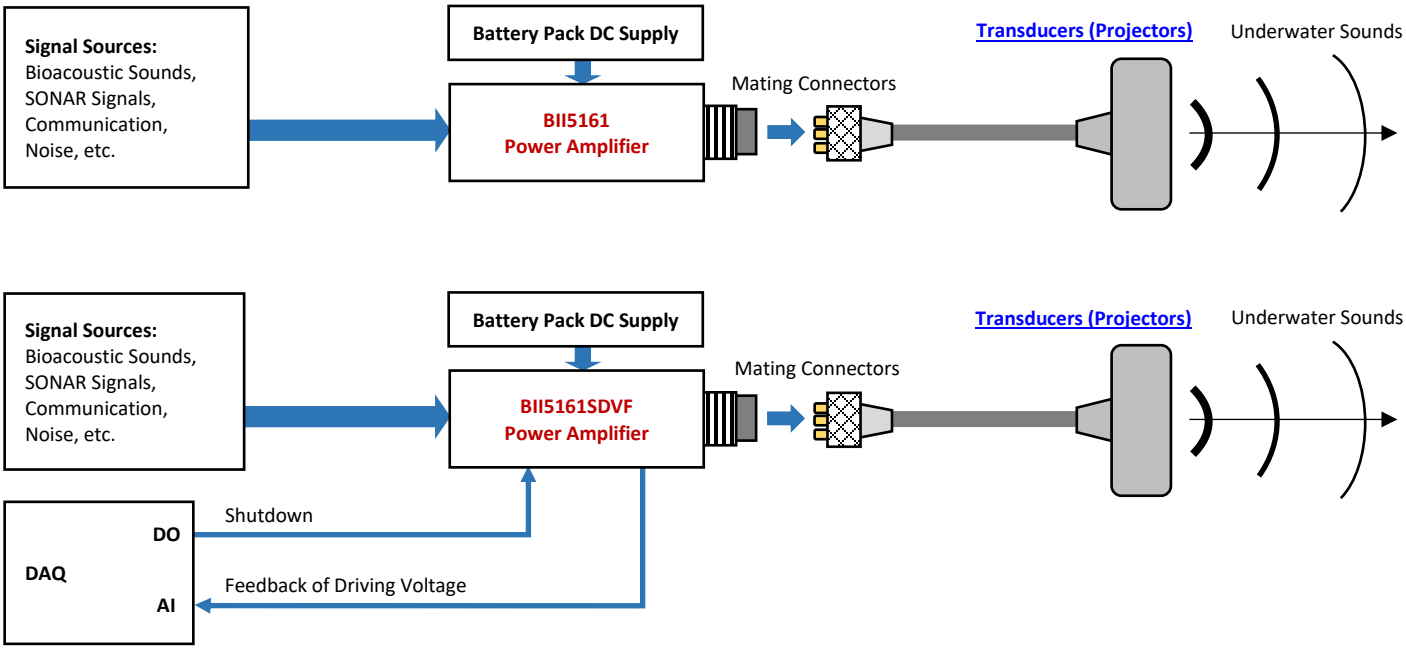


Feedback Voltage Gain and Gain of Transmit Signal

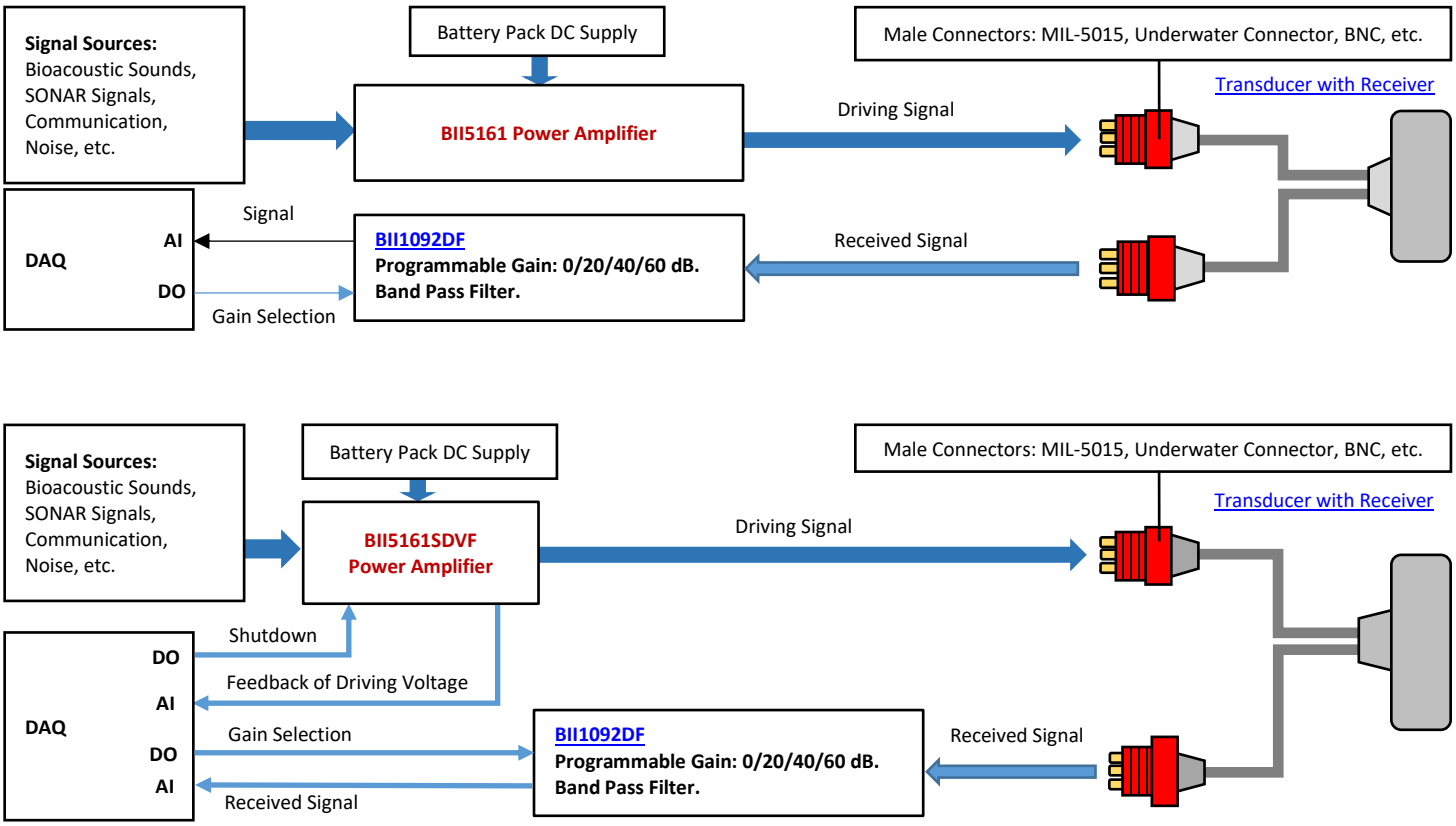


System Block Diagram

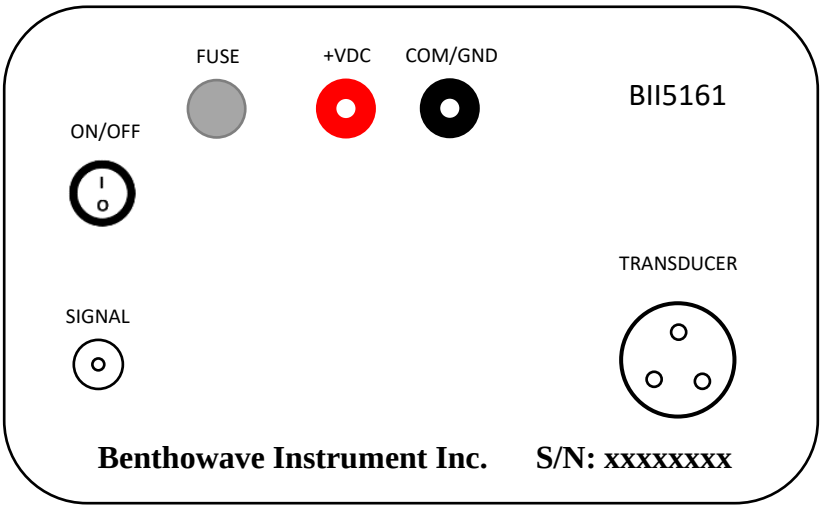
1. Generate Low Frequency Sounds.



2. Transmitting and Receiving Sounds

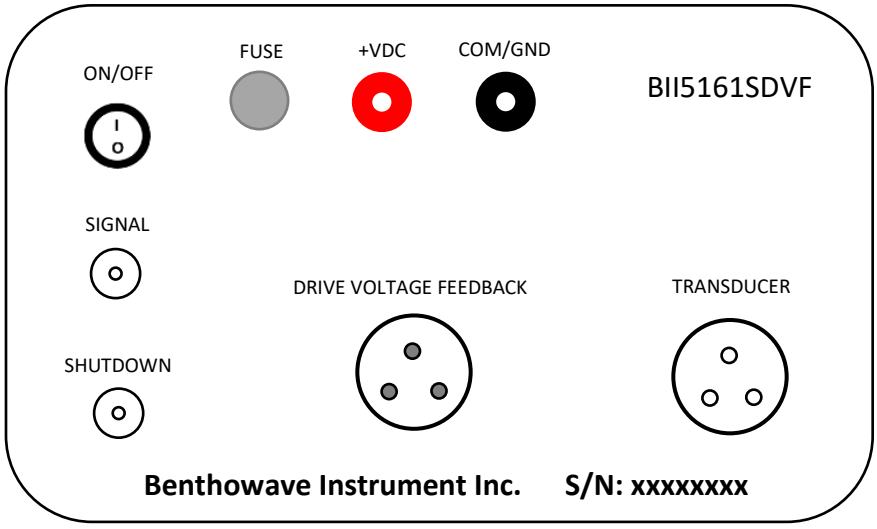


BII5161 Front Panel.



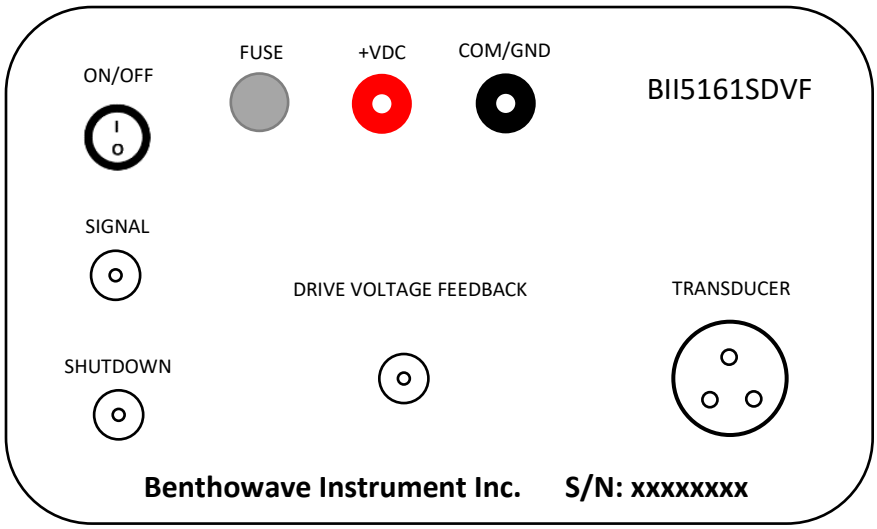
Power Supply:	**Dual Binging Posts. Red**: +DC Power Supply; **Black**: +DC Power Supply Common and Grounding. Warning: Black post must be grounded firmly for operating safety.
Power Supply Switch:	ON and OFF. Manual Control. **"I" -> ON; "O" -> OFF.**
Fuse Holder:	**Fuse**, 7A (Depending on the transducer power), 250VAC, 3AB, 3AG, 1/4" x 1-1/4".
Input Signal:	**BNC Jack**, BNC Center Contact: Signal; BNC Shield: Signal Common.
Transducer:	**Circular Connector, Receptacle,** Driving Signal to Transducer. Pin A: Cable Shield; Pin B: Transducer "-"; Pin C: Transducer "+".

BII5161SDVF Console and Wiring with Shutdown and Feedback of Driving Voltage (SDVF).



DC Power Supply:	**Dual Binging Posts**. **Red**: +DC Power Supply; **Black**: +DC Power Supply Common and Grounding. Warning: Black post must be grounded firmly for operating safety.
Power Supply Switch:	ON and OFF. Manual Control. **"I" -> ON; "O" -> OFF.**
Fuse Holder:	**Fuse**, 7A (Depending on the transducer power), 250VAC, 3AB, 3AG, 1/4" x 1-1/4".
Input Signal:	**BNC Jack**, BNC Center Contact: Signal; BNC Shield: Signal Common.
Shutdown:	**BNC Jack**. Center Contact: Signal; Shield: Common.
Feedback of Driving Voltage:	**Circular Connector**, Pin. Cable Shield: Common; Red Wire: Feedback Signal High; Black Wire: Feedback Signal Low.
	Accessory: Included, mating connector with 1m shielded cable and wire lead.
Transducer:	**Circular Connector, Receptacle**. Driving Signal to Transducer. Pin A: Cable Shield; Pin B: Transducer "-"; Pin C: Transducer "+".

BII5161SDVF Console and Wiring with Shutdown and Feedback of Driving Voltage (SDVF). Available Soon.



DC Power Supply:	**Dual Binging Posts**. **Red**: +DC Power Supply; **Black**: +DC Power Supply Common and Grounding. Warning: Black post must be grounded firmly for operating safety.
Power Supply Switch:	ON and OFF. Manual Control. **"I" -> ON; "O" -> OFF.**
Fuse Holder:	**Fuse**, 7A (Depending on the transducer power), 250VAC, 3AB, 3AG, 1/4" x 1-1/4".
Input Signal:	**BNC Jack**, BNC Center Contact: Signal; BNC Shield: Signal Common.
Shutdown:	**BNC Jack**. Center Contact: Signal; Shield: Common.
Feedback of Driving Voltage:	**BNC Jack**, Center Contact: Feedback Signal; Shell: Common.
Transducer:	**Circular Connector, Receptacle**. Driving Signal to Transducer. Pin A: Cable Shield; Pin B: Transducer "-"; Pin C: Transducer "+".

Accessories.

Note: All Accessories are NOT included with BII5161 and BII5161SDVF by default. Available upon request when ordering.

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.

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.

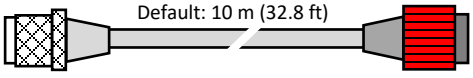
#10 Ring Terminal
#10-24 nut and #10 washer included.

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.

Connector Adaptor Accessory:

(1) MIL-UMCF3S, MIL-5015 (3 Pins) to UMC3S (Underwater Connector, 3 Sockets, Locking Sleeve: DLSA-F, Size: Φ35.5x33.5mm)

MIL-5015
3 Pin



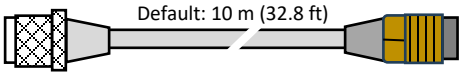
Default: 10 m (32.8 ft)

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.

(2) MIL-SUMC3S, MIL-5015 (3 Pins) to Small UMC3S (Underwater Connector, 3 Sockets, Thread Locking, Size: Φ22x28mm)

MIL-5015
3 Pin



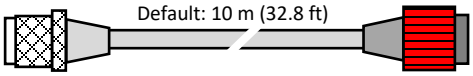
Default: 10 m (32.8 ft)

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

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

(3) MIL-UMCF2S, MIL-5015 (3 Pins) to UMC2S (Underwater Connector, 2 Sockets, Locking Sleeve: DLSA-F, Size: Φ35.5x33.5mm)

MIL-5015
3 Pin

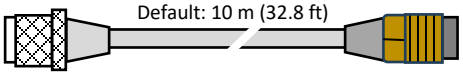


Underwater Connector, 2 Sockets.
Contact 2: Signal.
Contact 1: Common.

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

(4) MIL-SUMC2S, MIL-5015 (3 Pins) to Small UMC2S (Underwater Connector, 2 Sockets, Thread Locking, Size: Φ22x28mm)

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.