Preamplifier Datasheet

BII-1090 series are digitally programmable-gain amplifiers for uses in echo sounding, communication, object detection, distance measurement, fishery sounder, ultrasonic system, etc... and are invaluable components in these SONAR and ultrasound systems which detect a variety of sources with varying signal levels. Gain-selection of 60 dB in decade scale is accomplished by a two-bit digital word (TTL/CMOS level compatible) or manual setup.

**How to choose preamplifier with noise density?** Generally, if frequency of interest covers low frequency range up to 10 kHz, a preamplifier with low current noise should be used. If frequency of interest only covers high frequency range greater than 10 kHz, a preamplifier with low voltage noise should be used. More accurate noise level can be calculated with impedance of transducers (or hydrophones) and RTI noise density of preamps.

<table>
<thead>
<tr>
<th>Preamplifier</th>
<th>BII-1091</th>
<th>BII-1092</th>
<th>BII-1093</th>
<th>BII-1094</th>
<th>BII-1095</th>
</tr>
</thead>
</table>
| Gain (dB):   | 1. Default: 20/40/60 | 1. Default: 0/20/40
  2. Bespoke 20/40/60/80 | 1. Default: 0/20/40/60
  2. Bespoke 20/40/60/80/0 | 0/20/40 | 0/30/60 |
| Settling Time, 0.01%: | 8 μs | 2 μs | 2 μs | 1 μs | 1 μs |
| Default -3dB Bandwidth: | 20/40dB: 1.5MHz
  60dB: 250kHz | 0/20/40dB: 1MHz
  60dB: 400kHz | 0/20/40dB: 1MHz
  60dB: 400kHz
  40dB: 7MHz | 0/20dB: 10MHz
  60dB: 3MHz | 0/30dB: 3MHz
  60dB: 3MHz |
| Bespoke -3dB Bandwidth: | 0/20dB: 1.5MHz
  40dB: 250kHz | 20/40/60dB: 1MHz
  80dB: 400kHz | 20/40/60dB: 1MHz
  80dB: 400kHz | N/A | N/A |
| Input Referred Noise: | 8 nV/√Hz
  0.3 pA/√Hz | 12 nV/√Hz
  1.0 FA/√Hz | 12 nV/√Hz
  1.0 FA/√Hz | 3.2 nV/√Hz
  0.2 FA/√Hz | 3.2 nV/√Hz
  0.2 FA/√Hz |
| Input Impedance: | 20 MΩ | 44 MΩ | 44 MΩ | 44 MΩ | 20 MΩ |
| Maximum Output (Vpp): | Vs – 5 | Vs – 3.4 | Vs – 3.4 | Vs – 3.4 | Vs – 3.4 |
| Output Impedance: | 10 Ω | 10 Ω | 10 Ω | 50 Ω | 50 Ω |
| Cable Driving Capability: | 30 m | 200 m | 200 m | 200 m | 200 m |
| Supply Voltage Vs: | +9 to +30VDC | +8.2 to +30VDC | +8.2 to +30VDC | +5.5 to +30VDC | +5.5 to +30VDC |
| Quiescent Current: | 3 mA | 10 mA | 12 mA | 6.3 mA | 6.3 mA |
| Size (LxWxH) (Coated PCB): | 33x8.9x5 mm | 38x8.9x7 mm | 41x8.9x7 mm | 38x8.9x7 mm |
| Weight (Coated PCB): | 4.0 g | 6.0 g | 7.0 g | 5.0 g | 5.0 g |

**Gain Selection Voltage:**

- CMOS/TTL Compatible
- Logic Low 0: Gain Selection Wire to COM or 0 to +0.8 VDC
- Logic High 1: Gain Selection Wire Open or +2.4 VDC to Vss

**Warning:** digital outputs, switches, relays, optocouplers etc. can be used for gain selection and the voltage protection rating of these devices must be greater than power supply voltage level.

**Gain Selection:**

- Digitally and Manually
- Wires. A1, A0 and Digital Common

**Maximum Input:**

2.4 Vpp or (Maximum Output)/Gain, whichever is less.

**Input Type:**

- Differential (either single ended or differential input signals are accepted).

**Suggested DC Supply:**

- +9 VDC Battery, Marine Battery, Automobile Battery, Fixed DC Linear Power Supply, Not Included.
- DO NOT use variable power supply whose maximum supply voltage is higher than the above rated voltage.
- DO NOT use switching mode DC power supply.

**Operating Temperature:**

- -40 to 85 °C or -40 to 185 °F

**Storage Temperature:**

- -40 to 85 °C or -40 to 185 °F

**Gain Selection Table**

<table>
<thead>
<tr>
<th>Digital A1</th>
<th>Digital A0</th>
<th>BII-1091 Gain</th>
<th>BII-1092 Gain</th>
<th>BII-1093 Gain</th>
<th>BII-1094 Gain</th>
<th>BII-1095 Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>20 dB (0 dB)</td>
<td>0 dB (20 dB)</td>
<td>0 dB (20 dB)</td>
<td>0 dB</td>
<td>0 dB</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>40 dB (20 dB)</td>
<td>20 dB (40 dB)</td>
<td>20 dB (40 dB)</td>
<td>20 dB</td>
<td>30 dB</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>60 dB (40 dB)</td>
<td>40 dB (60 dB)</td>
<td>40 dB (60 dB)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>N/A</td>
<td>60 dB (80 dB)</td>
<td>60 dB (80 dB)</td>
<td>40 dB</td>
<td>60 dB</td>
</tr>
</tbody>
</table>

**Package**

- Coated PCB with Wires and Wire Leads
  - Gain Selection: 1. Default: 5 cm wires; 2. Bespoke Length.

**Package**

- Metal Housing with four mounting holes
  - Input Connector Options: 1. BNC Jack (BNC): for Single Ended Signal or,
    2. 3.5mm TRS Jack (TR35S): for Single Ended Signal and differential signal.
  - Output Connector Options: 1. BNC Jack (BNC): for Single Ended Signal or,
    2. 3.5mm TRS Jack (TR35S): for Single Ended Signal and differential signal.
  - Gain Selection: 3.5mm TRS Jack on housing, Gain Selection Cable: 1m Shielded Cable with 3.5mm TRS Plug and Wire leads.
  - Power Supply: Power Connector Jack on housing, Power Supply Cable: 1m Shielded Cable with Power Connector Plug and Wire leads.
  - Size: LxWxH = 81.03x38x31 mm
  - Weight: 80 grams.

**Accessories:** A1: Bespoke length RG58 Coax with BNC Male to BNC Male.
A2: Bespoke length cable with 3.5mm TRS Plug to 3.5mm TRS Plug.
A3: Bespoke length cable with 3.5mm TRS Plug to Wire Leads.

### How to Order Preamplifiers of Coated PCB

<table>
<thead>
<tr>
<th>Part Number</th>
<th>-Gain in dB</th>
<th>-HPF/LPF</th>
<th>-Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preamplifier</td>
<td></td>
<td>-3dB High Pass and Low Pass Frequency, in kHz</td>
<td>PCB: Coated PCB</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>BII-1091-0/20/40dB-1kHz-PCB:</td>
<td>9</td>
<td>BII-1091, 0/20/40dB Gain, -3dB Highpass Filter: 1kHz, Coated PCB.</td>
<td></td>
</tr>
<tr>
<td>BII-1092-1kHz/100kHz-PCB:</td>
<td>1</td>
<td>BII-1092, -3dB Bandpass Filter: 1kHz to 100kHz, Coated PCB.</td>
<td></td>
</tr>
</tbody>
</table>

### Coated PCB Wiring: BII-1091, BII-1092, BII-1094, BII-1095:

<table>
<thead>
<tr>
<th>Input: Power Supply</th>
<th>Single Ended Output</th>
<th>Gain Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-: Blue Wire</td>
<td>Common: Black Wires</td>
<td>A0: Blue Wire</td>
</tr>
<tr>
<td></td>
<td>Output Signal: White Wire</td>
<td>Digital COM: Black Wire</td>
</tr>
<tr>
<td></td>
<td>Common: Black Wire</td>
<td></td>
</tr>
</tbody>
</table>

### BII-1093:

<table>
<thead>
<tr>
<th>Input: Power Supply</th>
<th>Differential Output</th>
<th>Gain Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-: Blue Wire</td>
<td>Common: Black Wires</td>
<td>A0: Blue Wire</td>
</tr>
<tr>
<td></td>
<td>Output Signal +: White Wire</td>
<td>Digital COM: Black Wire</td>
</tr>
<tr>
<td></td>
<td>Output Signal -: Green Wire</td>
<td></td>
</tr>
</tbody>
</table>

### Diagrams

- **BII-1091**
  - Input Signal +: Red Wire
  - Input Signal -: Blue Wire
  - Output: White Wire
  - Common: Black Wire
  - A1: Yellow Wire
  - A0: Blue Wire

- **BII-1092**
  - Input Signal +: Red Wire
  - Input Signal -: Blue Wire
  - Output: White Wire
  - Common: Black Wire

- **BII-1093**
  - Input Signal +: Red Wire
  - Input Signal -: Blue Wire
  - Output: White Wire
  - Output: Green Wire
  - Common: Black Wire

- **BII-1094**
  - Input Signal +: Red Wire
  - Input Signal -: Blue Wire
  - Output: White Wire
  - Common: Black Wire

- **BII-1095**
  - Input Signal +: Red Wire
  - Input Signal -: Blue Wire
  - Output: White Wire
  - Common: Black Wire
How to Order Preamplifiers with Metal Housing

<table>
<thead>
<tr>
<th>Part Number</th>
<th>-Gain</th>
<th>-HPF/LPF</th>
<th>-Input Connector</th>
<th>-Output Connector</th>
<th>-Accessory Cable Length-Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preamplifier</td>
<td>in dB</td>
<td>-3dB Bandpass Frequency in Hz or kHz</td>
<td>BNC: BNC Jack TRS: 3.5mm TRS Jack</td>
<td>BNC: BNC Jack TRS: 3.5mm TRS Jack</td>
<td>Blank: No Accessories; Accessory Cable Length in m; A1: RG58 Coax with BNC Male to BNC Male. A2: Cable with 3.5mm TRS Plug to 3.5mm TRS Plug. A3: Cable with 3.5mm TRS Plug to Wire Leads.</td>
</tr>
<tr>
<td>Blank: default gains.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example:
- BII-1092-1kHz/100kHz-TRS-0.5m-A3: BII-1092, 0/20/40/60dB Gain, -3dB Band Pass Filter: 1kHz to 100kHz; Input: TRS 3.5mm Jack; Output: TRS 3.5mm Jack; 0.5m A3 Cable Accessories.

BII-1090 Series Preamplifier with Metal Housing, Outline Dimensions (mm)

<table>
<thead>
<tr>
<th>Signal Type</th>
<th>BNC Jack</th>
<th>3.5mm TRS Jack</th>
<th>Power Supply and Wire Leads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Ended Signal:</td>
<td>Center: Signal Shield: Common</td>
<td>Tip: Signal Ring: Signal Sleeve: Common</td>
<td>N/A</td>
</tr>
<tr>
<td>Differential/Balanced Signal:</td>
<td>N/A</td>
<td>Tip: Signal +, Positive or Hot Ring: Signal -, Negative or Cold Sleeve: Common/Ground</td>
<td>N/A</td>
</tr>
<tr>
<td>Power Supply</td>
<td>N/A</td>
<td>N/A</td>
<td>Center Contact: +VDC, Red Wire Lead Shell: Common; Black Wire Lead</td>
</tr>
<tr>
<td>Gain Selection</td>
<td>Tip: A1; Ring: A0; Sleeve: Digital COM.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 x Mounting Hole: 3.96x9.53

Input Jack

Power Supply Jack

Output Jack

Gain Selection Jack

Top View

Side View

Note: The connectors can be customized on side walls. Please specify in detail when ordering if you need custom-fit connector positions.
Preamplifier Wirings to DAQ (Data Acquisition)

BII: Benthowave Instrument Inc.; DAQ: Data Acquisition Hardware; AI: Analog Input; CH: Channel; GND: Ground.

If input impedance of a DAQ device is greater than 100MΩ, use following wiring with two identical resistors of 100kΩ to 1MΩ.

BII’s Differential Output to Differential Input of a DAQ

BII’s Differential Output to BNC Input of an Oscilloscope

If input impedance of a DAQ device is greater than 100MΩ, use following wiring with one 100kΩ to 1MΩ resistor.

BII’s Single-Ended Output to Single-Ended Input of a DAQ

If input impedance of a DAQ device is greater than 100MΩ, use following wiring with two identical resistors of 100kΩ to 1MΩ.

BII’s Single-Ended Output to Differential Input of a DAQ