



Single Channel – CE Certified

### Description

Frequency Devices' Models 960 & 960B instruments are single channel wideband high-gain amplifier instruments. The bandwidth is adjustable from 10 Hz to 1 MHz wide and the gain can be set from 0 dB to 80 dB in 1 dB steps.

The Amplifier has an input impedance of 1 M $\Omega$  shunted by 47pF in single ended mode and 2 M $\Omega$  shunted by 47pF in differential ended mode. The common mode rejection ratio (CMRR) is greater than 55 dB in differential mode.

Standard operational features include:

- Adjustable gain to 80 dB
- Adjustable bandwidth to 1 MHz
- Differential or single ended input
- Differential or single ended output
- Output can drive 50 $\Omega$  load
- Off-set adjustment
- Overload indicator
- BNC Connectors for all I/O

The optional battery powered 960B is particularly well suited to applications requiring isolation from an electrically noisy primary power source.

Compact size and manual rotary switch front panel controls makes the 960 amplifier a popular, cost effective, easy-to-use solution for signal conditioning applications in the following areas:

- Biomedical Applications
- Data Recording/Playback
- EKG/EEG Data Amplification
- Medical Research
- Seismic Analysis
- Vibration Analysis
- Communications

The 960 & 960B Amplifiers have a built in notch filter for 60 Hz or 50 Hz

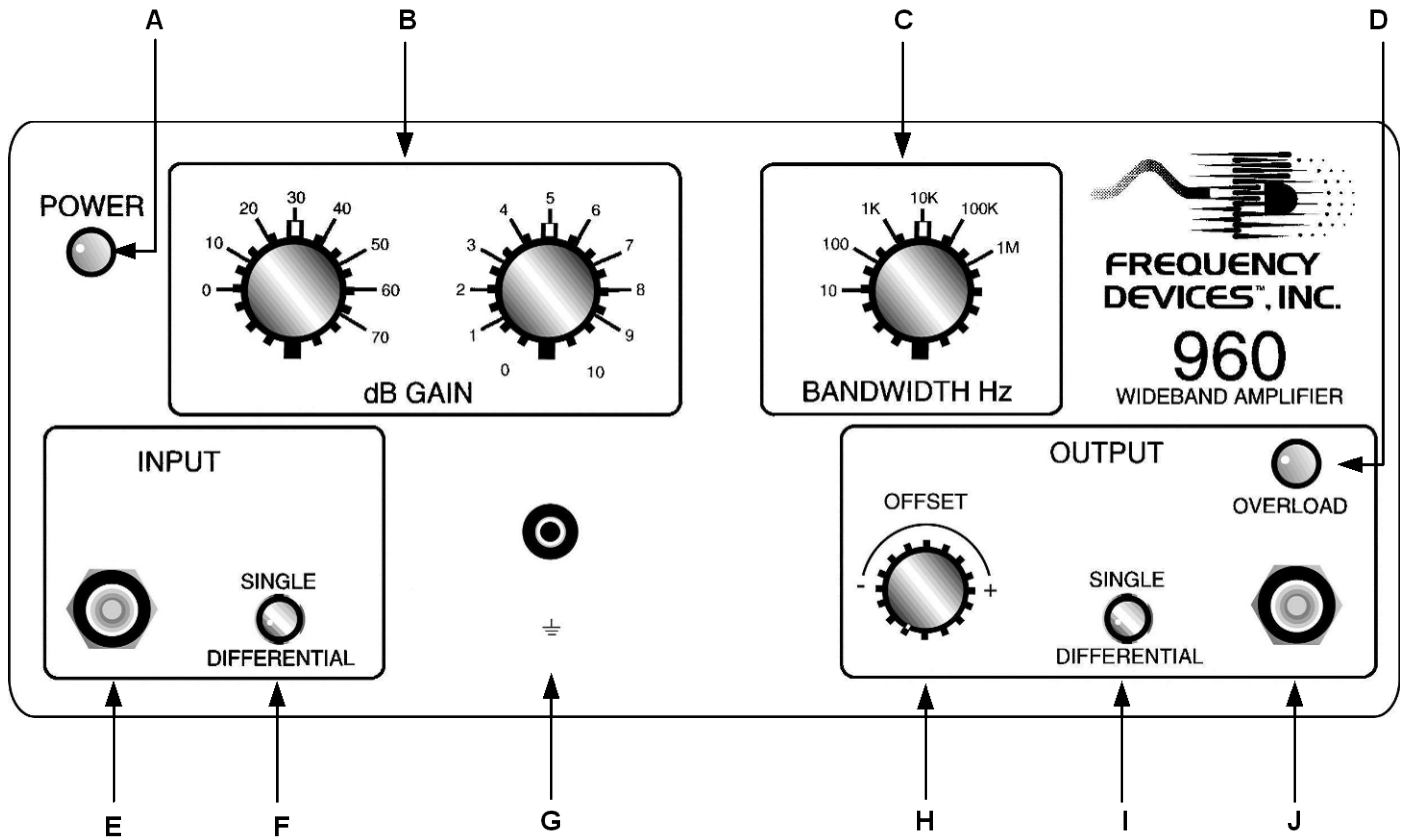


### Models

- |             |                                 |
|-------------|---------------------------------|
| <b>960</b>  | Standard AC Powered             |
| <b>960B</b> | AC Powered, with battery option |



Location of Front Panel Terminals and Controls



**A. POWER Status Lamp:** This red LED indicates whether or not the amplifier power is on. On the 960B battery operated model this lamp will blink when the battery needs recharging.

**B. dB Gain Switch:** These selector switches allow the user to set the gain from 0 dB to 80 dB in 1 dB steps.

**C. Bandwidth Switch:** This switch changes the amplifier bandwidth from 10 Hz up to 1 MHz in decades.

**D. Overload Lamp:** This red LED comes on when the output of the amplifier is over driven and is no longer in linear gain mode. It will come on when the output is about 24 volts peak-to-peak. Reduce the gain or the input signal to turn this light off for best operation.

**E. Input BNC:** This is the input connector for the amplifier. In single input mode the input signal is applied to the center pin of the BNC connector and the shell of the BNC connector is grounded. In differential input mode the

non-inverting input is the center pin of the BNC connector and the inverting input is the shell of the BNC connector.

**F. Single/Differential Switch:** This switch selects whether the amplifier input is in single ended or differential mode.

**G. GROUND Terminal:** This “Banana” type test jack provides neat and secure access to the internal ground. This terminal is a convenient junction for grounding external system and measurement instrumentation and/or apparatus.

**H. OFFSET Adjust:** This adjustment is intended to zero the offset that results from the instrument’s own internal circuitry.

**I. Single/Differential Switch:** This switch selects whether the amplifier output is in single ended or differential mode.

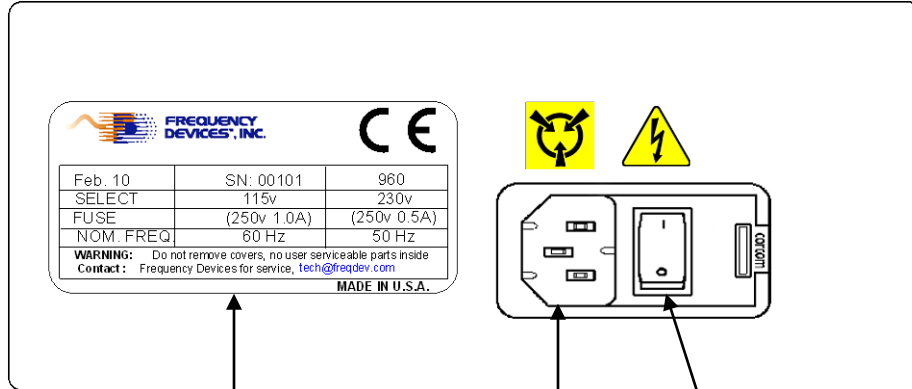
**J. Output BNC:** This is the output connector for the amplifier. In single output mode the output signal is applied to the center pin of

the BNC connector and the shell of the BNC connector is grounded. In differential output mode the non-inverting output is the center pin of the BNC connector and the inverting output is the shell of the BNC connector. When this switch is in differential mode the gain of the amplifier is automatically adjusted to correct the output gain.

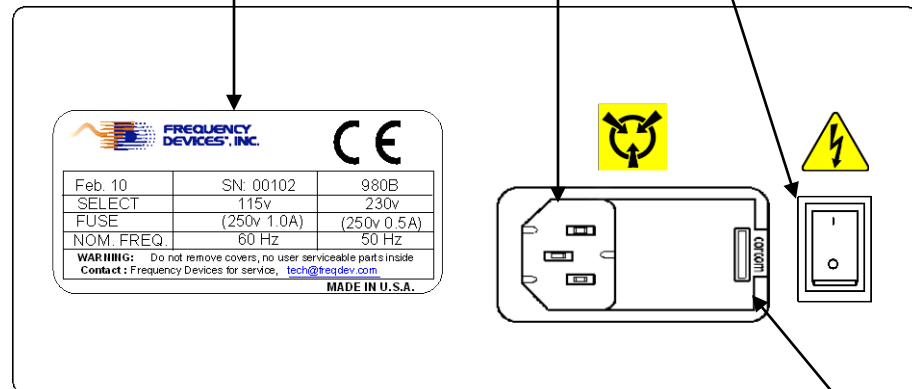


Location of Rear Panel Terminals, Controls and Labels

Model 960



Model 960B

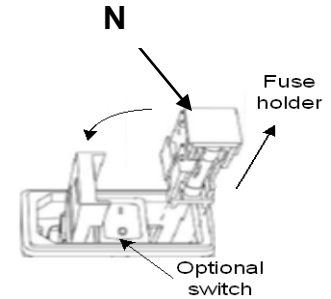


**K. IDENTIFICATION LABEL:** This label identifies the Model number, filter type, serial number, date of manufacture, operating power limits and fuse requirements of the instrument.

**L. AC POWER CONNECTION:** Denotes plug and fuse location.

**M. POWER ON/OFF Switch:** Is a two-position toggle switch on the back panel that interrupts/completes the power circuit.

**N. VOLTAGE Selector Module:** For 230 Vac operation, use a screwdriver blade to pry open the module door (entry point next to window), remove the red fuse cartridge, replace the 0.2 Amp, 250 V fuse with a 0.1 Amp, 250 Volt fuse, remove the shorting clip in the other leg and replace it with a second 0.1 Amp fuse. Turn the module 180 degrees, re-insert and close the module door. The numerals 230V will now show in the module window. Reverse procedure to change back to 115V.





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**Specifications**

**Input Characteristics**

Input Impedance:	
Differential	2 MΩ Shunted by 47pF
Single Ended	1 MΩ Shunted by 47pF
Coupling	DC
Input Voltage:	
Linear Differential	20V p-p (Gain Set at 0 dB)
Max Safe	Any Continuous Value
Differential Voltage	between ±40V
Bias Current	1 nA typ.; 2 nA max.
Common Mode	> 80 dB @ 1 kHz
Rejection ratio	> 70 dB @ 10 kHz
(0 dB Gain)	> 55 dB @ 100 kHz
Noise Voltage Density	
@ 70 dB Gain	12 μVrms/√Hz typ.
1 MHz Bandwidth	
Minimum Discernable	
Signal*	
@ 1 kHz with	1 mV @ 0 dB Gain
1 MHz Bandwidth	20 μV @ 40 dB Gain
	13 μV @ 70 dB Gain
@ 1 kHz with	1 mV @ 0 dB Gain
10 kHz Bandwidth	10 μV @ 40 dB Gain
	2 μV @ 70 dB Gain

**Output Characteristics:**

Small Signal	
Bandwidth	>1 MHz @ 3 dB down
Output Max Voltage	20V p-p for RL=2KΩ
(Single Output)	10V p-p for RL=50Ω
	(DC to 500 kHz)
	10V p-p for RL=2KΩ
	5V p-p for RL=50Ω
	(500 kHz to 1 MHz)
Output Max Power	0.25 Watt for RL=50Ω
Output Protection	Short Circuit to Ground
Output Impedance	50Ω Single
	100Ω Differential
Gain Settings	0 to 80 dB in 1 dB Steps
Gain Accuracy	±0.2 dB
Distortion @ 3.5 Vrms	> 90 dB 1 kHz-10 kHz
	(at 0 dB Gain)
Overload Light	lights at ≈ 24 V p-p
Transfer Function	Bessel with Constant
of Filters	Delay in the Pass-Band
Offset Voltage	Adjustable to Zero
Offset Voltage Range	
0-60 dB Gain Setting	± 0.5 VDC
70 dB Gain Setting	± 1.5 VDC

\* Minimum Discernable Signal is that signal that makes the output of the 960 Amplifier increase by 3 dB when measured with a wideband (2 MHz) True RMS Voltmeter.



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**Specifications**

**Power Supply**

AC Line Power Operation	<b>960</b>	10 Watts max.
	<b>960B</b>	15 Watts max.

**Voltage Frequency Range-Rear Panel:**

115 V	105 to 125Vac @ 50/60Hz
230 V	210 to 250Vac @ 50Hz
Fuse	115 V=0.2 Amp., 230 V = 2X-0.1 Amp.

**Battery Operation (960B)**

Time for full Charge	10 – 12 hours
Battery Life	Approx. 500 Charge/Discharge Cycles
Battery Charger	Automatic Uninterruptible
Charge Status Indicator (Front Panel)	3 Status Levels
Battery Operation	8 Hours typ.

**Temperature**

Operating Temperature:	0 °C to +50 °C
Storage Temperature:	-25 °C to +70 °C

**Mechanical**

Dimensions	3.7"H x 8.66"W x 10.6"D
	9.4cmH x 22.0cmW x 27.0cmD
Weight	3.5 lbs; 1.58 kgs
	5.4 lbs; 2.45 kgs
Case Material	ABS plastic
Color	Light Gray

**A. AVAILABLE MODELS**

- |          |   |
|----------|---|
| 1. 960*  | Standard AC powered model <sup>1</sup>              |
| 2. 960B* | AC powered with battery powered option <sup>1</sup> |

\*Please specify if you want the internal notch filter at 60 Hz or 50 Hz.

**NOTE:**

- See page 3, item "Q" Voltage selector Module. At time of shipment, Voltage is pre-selected in the 115 V<sub>AC</sub> position. For 230 V<sub>AC</sub> operation, this module must be rotated 180 degrees and an additional fuse must be added.