Models 960 & 960B

Wideband High-Gain
Amplifier Instrument

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 MΩ shunted by 47pF in single ended mode and 2 MΩ 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 50Ω 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

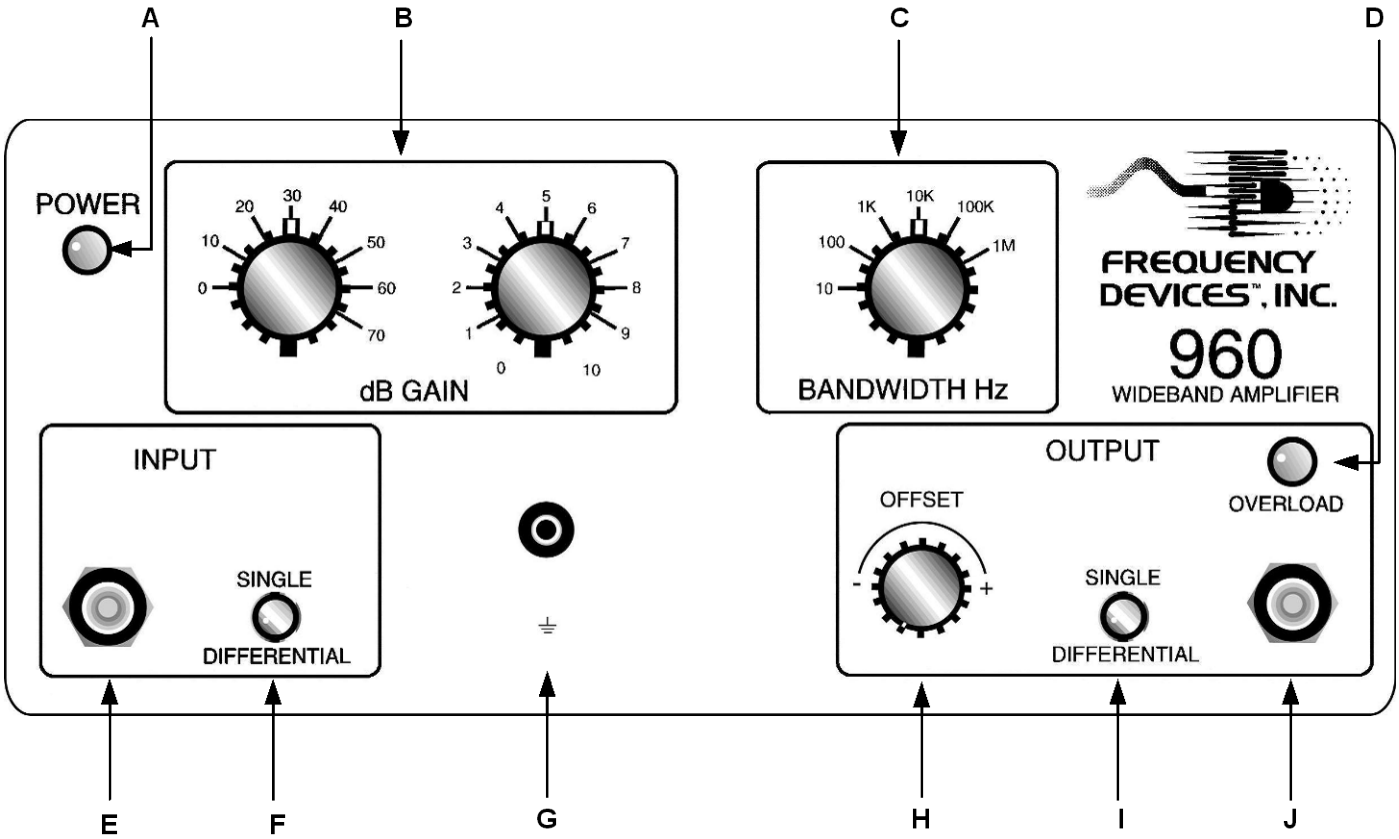
The 960 & 960B Amplifiers have a built in notch filter for 60 Hz or 50 Hz

Models

960	Standard AC Powered
960B	AC Powered, with battery option

1784 Chessie Lane, Ottawa, Illinois 61350 • Tel: 800/252-7074, 815/434-7800 • FAX: 815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com

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.

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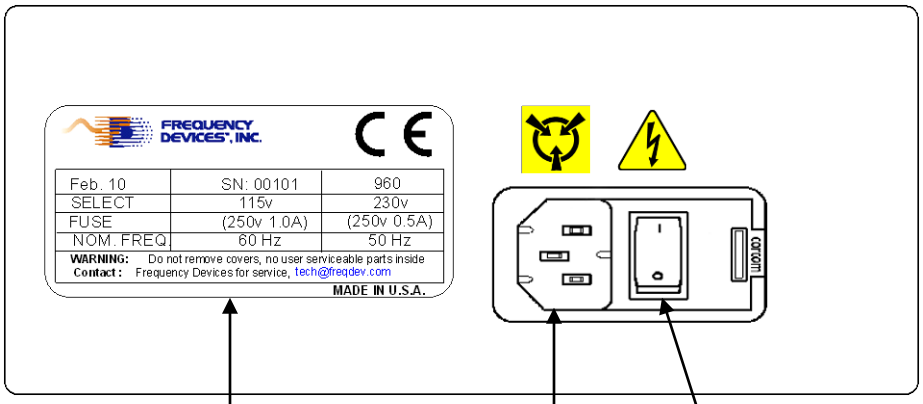
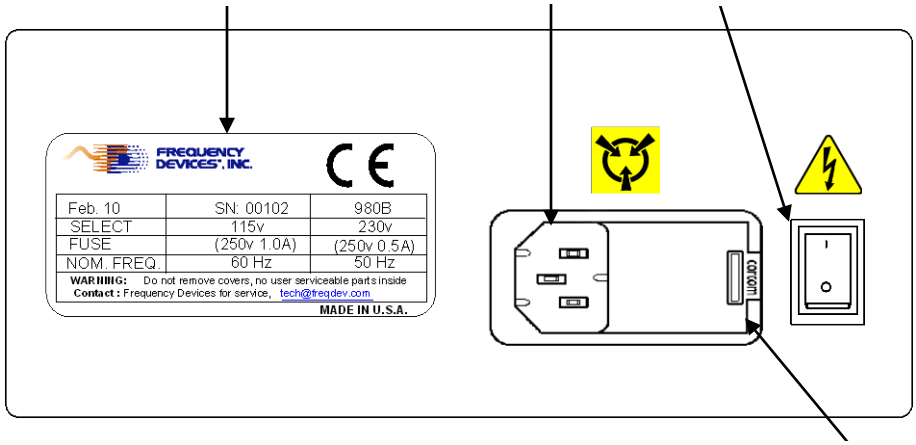
Location of Rear Panel Terminals, Controls and Labels

Model 960

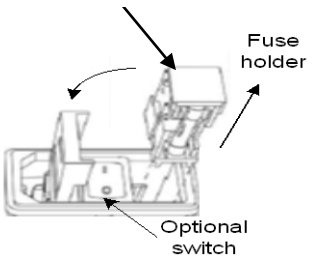


K **L** **M**

Model 960B



N



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 Differential Voltage	Any Continuous Value between ±40V
Bias Current	1 nA typ.; 2 nA max.
Common Mode Rejection ratio (0 dB Gain)	> 80 dB @ 1 kHz > 70 dB @ 10 kHz > 55 dB @ 100 kHz
Noise Voltage Density @ 70 dB Gain 1 MHz Bandwidth	12 µVrms/√Hz typ.
Minimum Discernable Signal*	
@ 1 kHz with 1 MHz Bandwidth	1 mV @ 0 dB Gain 20 µV @ 40 dB Gain 13 µV @ 70 dB Gain
@ 1 kHz with 10 kHz Bandwidth	1 mV @ 0 dB Gain 10 µV @ 40 dB Gain 2 µV @ 70 dB Gain

Output Characteristics:

Small Signal Bandwidth	>1 MHz @ 3 dB down
Output Max Voltage (Single Output)	20V p-p for RL-2KΩ 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 of Filters	Bessel with Constant 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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Single Channel – CE Certified Specifications

Power Supply

AC Line Power Operation	**960**	10 Watts max.
	960B	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	**960**	3.5 lbs; 1.58 kgs
	960B	5.4 lbs; 2.45 kgs
Case Material		ABS plastic
Color		Light Gray

A. AVAILABLE MODELS

1. 960*	Standard AC powered model [1]
2. 960B*	AC powered with battery powered option [1]

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

NOTE:

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

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