# Piezo Film Lab Amplifier

- Charge or Voltage Mode Operation
- BNC Input and Output
- 0.01 to 1000 mV/pC Sensitivity Range in Charge Mode
- 1M to 1G Input Resistance, -40 to 40dB Gain in Voltage Mode
- Multi-Pole, Low-Pass and High-Pass Filtering with -3dB Frequencies Ranging from 0.1Hz to 100kHz
- Internal Battery (2 x 9V) or external 24VDC Power Supply Operation




**The Piezo Film Lab Amplifier** is a versatile preamplifier for use with Piezoelectric sensors. The electric signal from the piezo film is generated within the electrodes of a capacitor. It is important to arrange an input that controls the rate of charge leakage appropriately for the application. Simply connecting a piezo film element to the input of an oscilloscope will usually create a high-pass filter that removes any low frequency content of the original piezo signal, and this can lead to disappointment or incorrect evaluation of the material's true potential. This has led MEAS to develop a new low-cost Piezo Film Lab Amp, specifically aimed at developers and engineers exploring the material. Both first-time users and seasoned professionals will benefit from the wide range of sensitivity adjustment in either voltage or charge modes, and the functionality of the high- and low-pass filters.

## FEATURES

- Wide Dynamic Range
- Charge and Voltage Modes
- Response to 0.1Hz
- Active HP and LP Filters

## APPLICATIONS

- Low Frequency Dynamic Strain
- Pyroelectric Signals
- Audio-band and Acoustic Signals
- Machine Vibration
- Piezo Cable and Traffic Sensor Interface

## performance specifications

| | |
|---|---|
| **ELECTRICAL** | |
| Supply Voltage | Internal 2 x 9V Battery or External 24VDC (using the supplied 100-240VAC 50/60Hz power supply unit) |
| Max Input Voltage | 30V |
| Max Linear Output Swing | ±4V (battery), ±5V (ext) |
| Voltage Mode: | |
| Input Resistor Values | 1M, 10M, 100M, 1G Ω |
| Gain | 0 to +40dB in 10dB Increments with -40dB Switch |
| Noise | 30mV rms (0.20 Vpp)typ, 1Hz to 100kHz, 1G Input, +40dB (lower on battery power) |
| Charge Noise: | |
| Feedback Capacitor Values | 100pF, 1nF, 10nF, 100nF |
| Sensitivity Range | 0.01 to 1000 mV/pC |
| Noise | 20mV rms (0.13 Vpp) typ, 1Hz to 100kHz, 100pF, +40dB Gain (lower on battery power) |
| **ENVIRONMENTAL** | |
| Operating Temperature | 0 to 50°C |
| Operating Humidity | 5 to 95% RH Non-Condensing |
| Survival Temperature | -20°C to +60°C, Power Off |
| Linearity | <1% |

## description of controls

### Mode Selector Switch




The setting of this switch determines whether the amplifier is functioning in “charge mode” or “voltage mode.” In charge mode, the input appears like a short-circuit sensor and all charge that is generated by the sensor glows into the input and appears on a feedback capacitor within an op-amp circuit. In “voltage mode,” the input appears like an open circuit and no charge flows. The settings of the various input and filter controls then modify the actual performance in either setting.

### **Feedback Capacitance Selector** (charge mode)




When the amplifier is operating in charge mode, this control changes the sensitivity of the initial amplifier stage. In typical use, it will be set to the value closest to the sensor under test. Selecting a feedback capacitance lower than that of the sensor will create further apparent gain, while selecting a higher feedback capacitance will reduce overall gain. A quantity of charge applied to the input numerically equal to the feedback capacitance value (for example, 100 pC of charge, with 100 pF setting of feedback capacitance) will generate one volt from the initial stage, before further modification by the filters and gain control.

### **Input Impedance Selector** (voltage mode)




When the amplifier is operating in voltage mode, this control changes the electrical resistance seen at the input of the amplifier. For a given value of sensor capacitance (C), different values of input resistance (R) create different low-frequency response characteristics. The simple RC filter network forms a high-pass filter, which operates independently from the low frequency selector switch. The influence of this impedance selector must therefore be considered separately from the low frequency selector (see Appendix B).

## description of controls (continued)

**Input Attenuator Switch** (voltage mode)

This switch allows the input signal to be attenuated by 40 dB (linear factor of 100), when the amplifier is operating in voltage mode. This can be useful in cases where the open-circuit voltage being monitored is very high, and would cause the output voltage to clip. The setting of this switch does not affect the input impedance seen by the sensor.




**Low Frequency Selector**

The function of this control is to apply a multi-pole high-pass filter to the signal. Frequencies below the selected limit will be progressively attenuated. In charge mode operation, the signal will be -3 dB down (or approximately 0.7 X) at the selected frequency. In voltage mode, the influence of the RC filter must also be considered (see Input Impedance Selector). Reducing the low-frequency content of a signal may be useful when the signals of interest are relatively high in frequency and low in amplitude.




**High Frequency Selector**

This control applies a multi-pole low-pass filter to the signal. It can be used in conjunction with the Low Frequency selector to form a band-pass filter, where noise outside a selected band of frequency can be strongly attenuated.




**Gain Selector**

The purpose of this control is to allow selection of a final gain to be applied to the output of the filter stages. Selecting "0 dB" in voltage mode means that the overall gain of the amplifier is zero dB (linear 1X), when the Input Attenuator is also set to "0 dB". The gain is adjustable in 10 dB steps up to 40 dB (linear 100 X).



## Power Indicator

The green power indicator LED lights when the power switch is switched to "1" (ON position), using either the internal batteries or when the external 24 V power supply is connected.

### Batt Low

The red low battery LED lights when the voltage of the internal batteries falls below 8 V approx. When the battery power is no longer sufficient for correct operation, neither "Power" nor "Batt Low" will be illuminated when power switch is switched to "1".

### Battery Compartments

The battery compartments are accessible from the rear panel. To open a compartment, the battery tray should be lifted up slightly, then pulled outwards. Batteries can be left in the amplifier while it is being operated on external power.




### External Power Input

Just below the battery compartments lies the input connector for 24 VDC (center pin +ve). Use only the power supply provided with the amplifier.

### Power Switch

This switches power (from internal batteries or from external 24 VDC supply) to the amplifier on or off. To conserve battery life, power should be switched off when unit is not in use.

### Input BNC

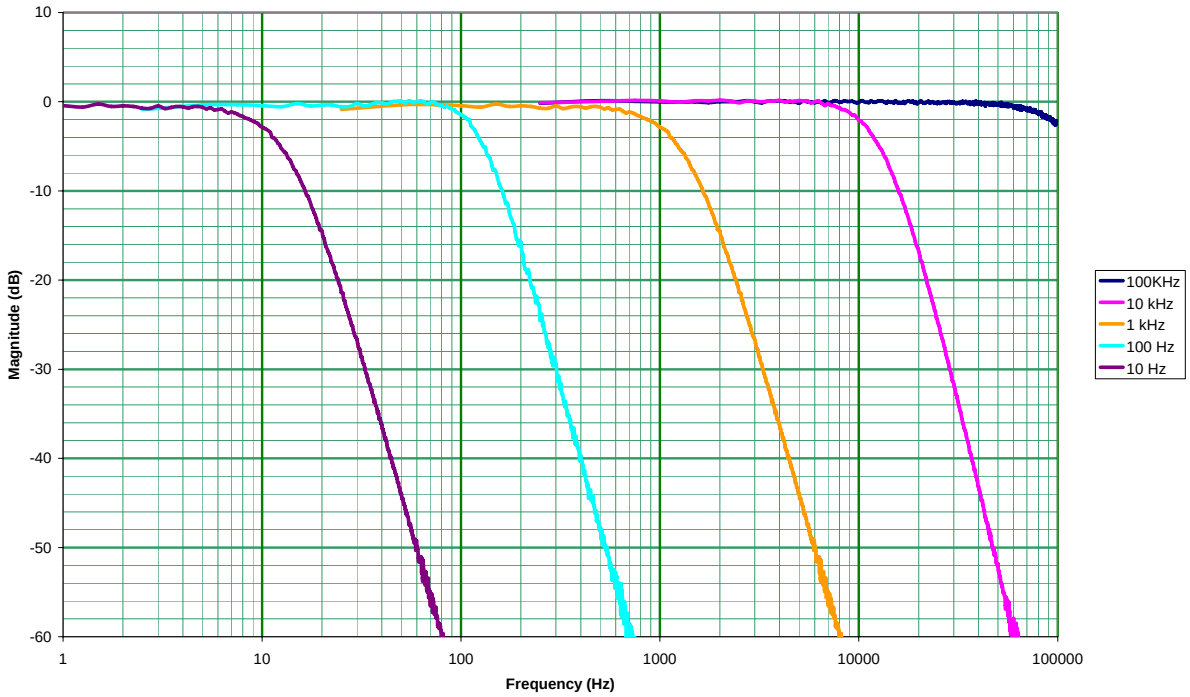
Signal input (for either voltage mode or charge mode operation) should be connected to the Input BNC. Input voltage should not exceed 30 V, and this voltage should not appear across a sensor capacitance in excess of 100 nF. The input adds approx 50 pF shunt capacitance, which must be borne in mind when calculating RC filter frequencies for low-value sensor capacitance in voltage mode.

### Output BNC

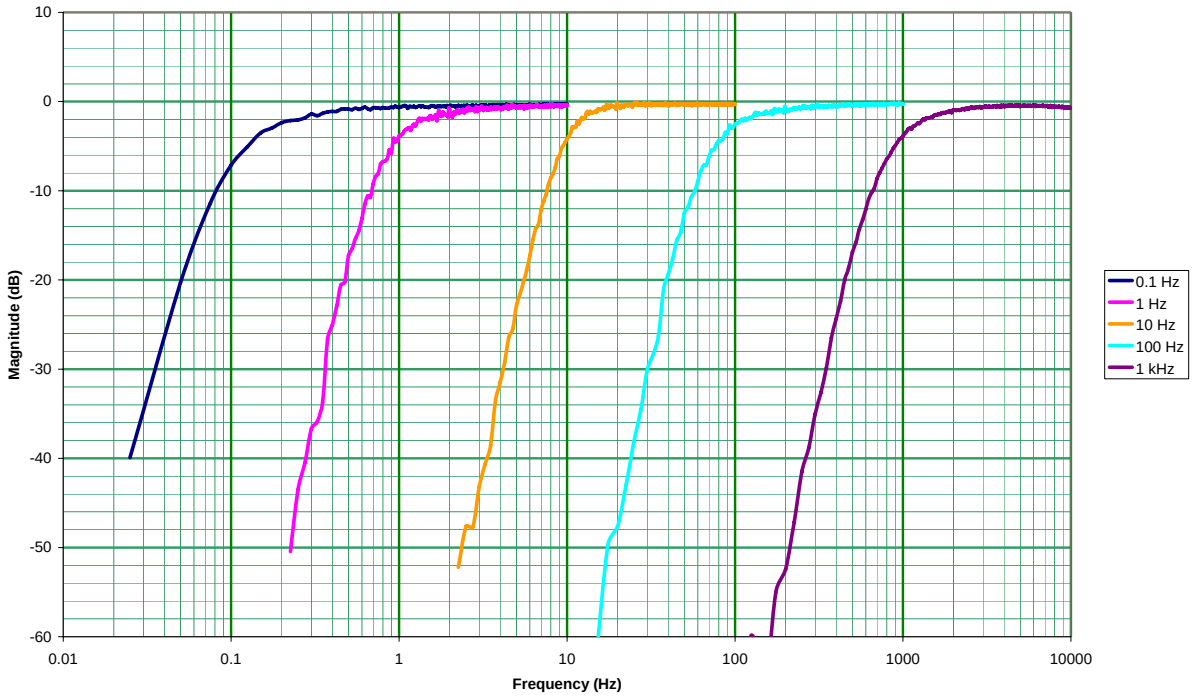
Impedance 50 ohms max. The output of the amplifier is intended to drive the input of an oscilloscope, signal analyzer, or data acquisition system.

# Appendix A: Filter response plots

**Upper Limiting Frequency Control**




**Lower Limiting Frequency Control**



## Appendix B: Influence of Input Impedance selection on low frequency response (voltage mode)

The table below shows the theoretical -3 dB frequency (in Hz) of the high-pass filter that is formed when a sensor of capacitance listed in first column is connected to the specified input impedance.

| | | 1 M | 10 M | 100 M | 1 G |
|---|---|---|---|---|---|
| 100 | p | 1592 | 159 | 16 | 1.6 |
| 220 | p | 723 | 72 | 7.2 | 0.72 |
| 470 | p | 339 | 34 | 3.4 | 0.34 |
| 1 | n | 159 | 16 | 1.6 | 0.16 |
| 2.2 | n | 72 | 7.2 | 0.72 | 0.072 |
| 4.7 | n | 34 | 3.4 | 0.34 | 0.034 |
| 10 | n | 16 | 1.6 | 0.16 | 0.016 |
| 22 | n | 7.2 | 0.72 | 0.072 | 0.0072 |
| 47 | n | 3.4 | 0.34 | 0.034 | 0.0034 |
| 100 | n | 1.6 | 0.16 | 0.016 | 0.0016 |

Note: the shaded cells have a -3 dB frequency that is below the range of the Low Frequency Selector, and in this case, the Low frequency Selector will determine the performance. In the case of the unshaded cells, the low frequency limit will be determined either by the Low Frequency selector, or by the data above, whichever is the higher.

## included in package

### 1) Piezo Film Lab Amplifier:







### 2) Power Supply:

Input: 100-240VAC, 50/60Hz, 1.8A
Output: 24VDC 1A
Connector: IEC 60320 C14 (inlet)



### 3) Power Supply Cable/Plug
### MUST BE ORDERED SEPARATLY

Connector: IEC 60320 C13

Regional Versions Available:
1007232-1 - Power Supply Plug, EU
1007232-2 - Power Supply Plug, UK
1007232-3 - Power Supply Plug, USA
1007232-4 - Power Supply Plug, Japan



## included in package

### 4) Accessories

(a) 2 x 9V Batteries, Type 1604A (6LF22/6LR61/MN1604), Mercury and Cadmium Free

(b) Piezo Sensor (modified SDT1-028K), p/n 1-1000288-1, 1m Shielded Cable, BNC Connector

(c) BNC “Tee” adapter

(d) 2 x BNC Cable, 0.58m Nominal, Bare End



The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. Measurement Specialties, Inc. reserves the right to make changes without further notice to any product herein. Measurement Specialties, Inc. makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does Measurement Specialties, Inc. assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications. All operating parameters must be validated for each customer application by customer’s technical experts. Measurement Specialties, Inc. does not convey any license under its patent rights nor the rights of others.

## ordering information

North America

Measurement Specialties, Inc.
1000 Lucas Way
Hampton, VA 23666
Sales and Customer Service
Tel: +1-800-745-8008 or
+1-757-766-1500
Fax: +1-757-766-4297
Technical Support
Email: piezo@meas-spec.com

Europe

MEAS Deutschland GmbH
Hauert 13
44227 Dortmund
Germany
Sales and Customer Service
Tel: +49 (0)231 9740 21
Technical Support
Tel: +49 (0)6074 862822
Email: piezoeurope@meas-spec.com

Asia

Measurement Specialties (China), Ltd.
F1.6-4D, Tian An Development Compound
ShenZhen, China 518048
Sales and Customer Service
Tel: +86 755 8330 1004
Technical Support
Email: piezo@meas-spec.com

LifeElectronics
Живое партнерство

**ООО «ЛайфЭлектроникс»** **“LifeElectronics” LLC**

*ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703*

*Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.*

*С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров*

*Мы предлагаем:*

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

*В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.*

*Конструкторский отдел помогает осуществить:*

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

*Тел: +7 (812) 336 43 04 (многоканальный)*
*Email: org@lifeelectronics.ru*

***www.lifeelectronics.ru***