

# **Model 5187**

## **Differential Voltage Preamplifier**

*Instruction Manual*

222193-A-MNL-C

## **FCC Notice**

This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with this manual, may cause interference to radio communications. As temporarily permitted by regulation, operation of this equipment in a residential area is likely to cause interference, in which case the user at his own facility will be required to take whatever measures may be required to correct the interference.

## **Company Names**

SIGNAL RECOVERY is part of Advanced Measurement Technology, Inc, a division of AMETEK, Inc. It includes the businesses formerly trading as EG&G Princeton Applied Research, EG&G Instruments (Signal Recovery), EG&G Signal Recovery and PerkinElmer Instruments (Signal Recovery)

## **Declaration of Conformity**

This product conforms to EC Directives 89/336/EEC Electromagnetic Compatibility Directive, amended by 92/31/EEC and 93/68/EEC, and Low Voltage Directive 73/23/EEC amended by 93/68/EEC.

This product has been designed in conformance with the following IEC/EN standards:

EMC:           BS EN55011 (1991) Group 1, Class A (CSPIR 11:1990)  
                  BS EN50082-1 (1992):  
                          IEC 801-2:1991  
                          IEC 801-3:1994  
                          IEC 801-4:1988

Safety:        BS EN61010-1: 1993 (IEC 1010-1:1990+A1:1992)

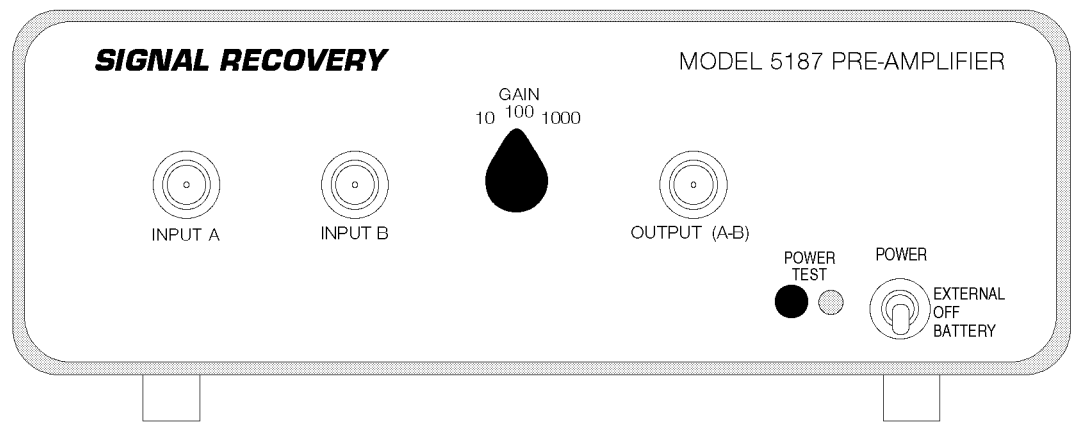
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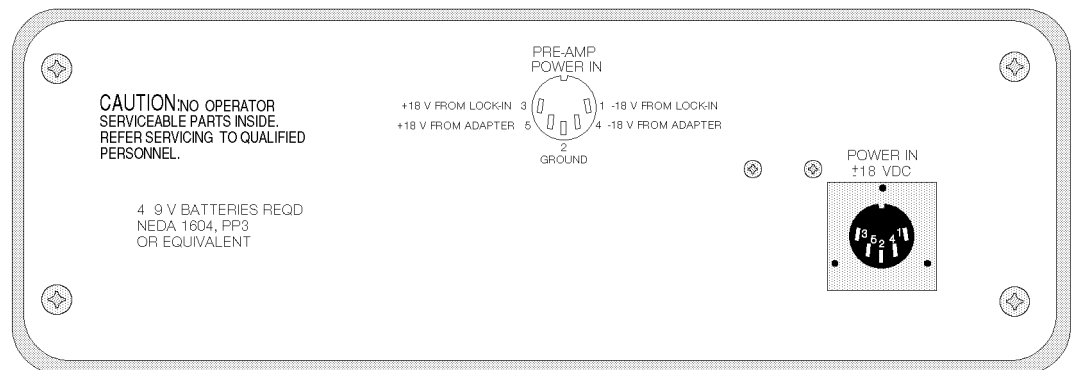
# Description and Specifications

## 1.1 Description

The Model 5187 is a battery operated or externally powered preamplifier designed to operate from signal sources of less than 1 k $\Omega$ . It has three gain settings, 10, 100, and 1000 and a differential input configuration. The input noise voltage is 1.2 nV/ $\sqrt{\text{Hz}}$ ; current noise 2 pA/Hz. This low-cost unit complements the **SIGNAL RECOVERY** range of lock-in amplifiers and other signal recovery instruments, providing a low-noise, high-gain input option. The unit can also be powered from a remote power supply or from most of the existing range of lock-in amplifiers.



Front Panel



Rear Panel

Figure 1-1, Model 5187 Low-Noise Preamplifier

## 1.2 Specifications

### General

AC coupled voltage amplifier with adjustable voltage gain and a maximum frequency response extending from 0.5 Hz to 1.1 MHz. True differential input and single-ended output via BNC connectors.

Battery powered from internal alkaline batteries or external DC power supplies.

### Inputs

Modes	True differential.
Coupling	AC
Impedance	16 k $\Omega$ in series with 10 $\mu$ F, see Figure 1-2

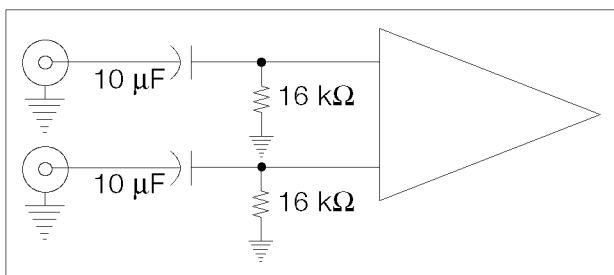


Figure 1-2, Equivalent Input Circuit

Frequency Response	
$\times 10$	1 Hz to 1.1 MHz
$\times 100$	1 Hz to 700 kHz
$\times 1000$	1 Hz to 100 kHz
C.M.R.R.	> 75 dB (100 Hz to 1 kHz)
Max common-mode input voltage, $\times 1000$ gain	5 V pk-pk
Max input without damage	$\pm 12$ V DC or 8 V rms. AC @ 50 Hz
Noise	see Figure 1-3. Typically 1.2 nV/ $\sqrt{\text{Hz}}$ and 2 pA/ $\sqrt{\text{Hz}}$ @ 1 kHz and $\times 1000$ gain
Gain	$\times 10$ , $\times 100$ or $\times 1000$ switch selectable
Gain Accuracy	$\pm 2\%$

### Output

Impedance	50 $\Omega$
Max voltage swing	>2 V pk-pk
Polarity	Non-inverting

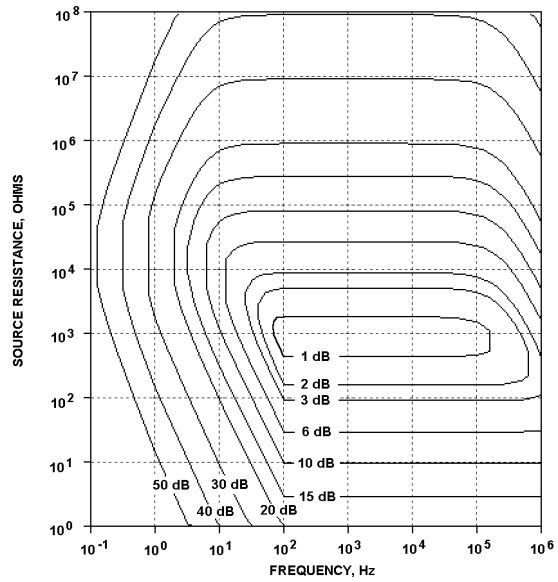


Figure 1-3, Typical Noise Figure Contours

## Power

Internal

Four 9 V alkaline batteries provide approximately 20 hours of use

External

a)

±15 V or ±18 V DC @ 20 mA

b)

110 V AC or 240 V AC via optional external model PS0108 power supply

## Dimensions

(excluding connectors)

8.25" wide × 11" deep × 3.5" high  
(210 mm wide × 279 mm deep × 89 mm high)

Weight

4.8 lbs. (2.2 kg) excluding power supply



### 2.1 Introduction

The following procedure is provided to facilitate initial performance checking of the Model 5187. In general, the procedure should be performed after inspecting the instrument for shipping damage (any noted to be reported to the carrier and to **SIGNAL RECOVERY**), but before using it experimentally. Should any difficulty be encountered in carrying out these checks, contact the factory or one of its representatives.

### 2.2 Equipment Needed

- 1) General purpose laboratory oscilloscope.
- 2) Signal generator capable of providing a 2 mV, 20 mV or 200 mV pk-pk sine wave at 1 kHz.

### 2.3 Procedure

- 1) Set the front-panel Power switch to the down (Battery) position. Then press the adjacent Power Test button. The associated indicator should light, indicating that the internal batteries are installed and functioning properly. If the Power Test indicator doesn't light, refer to Section 3.2.03 in Chapter 3 for a discussion of the 5187's battery requirements.

Note: Those users who have purchased the External Power supply option can use the external supply to perform the initial checks, in which case step 1 is replaced by the following operations.

- a) Make sure that the voltage selector switch on the external power supply is in the position indicating the line voltage to be used (110 V ac or 240 V ac).
  - b) Plug the line cord into the external power supply and the external power supply into the instrument power socket.
  - c) Set the power switch to the up (External) position.
- 2) Select the  $\times 10$  GAIN setting.
  - 3) Connect the oscilloscope to the output BNC connector.
  - 4) Set the signal generator to 1 kHz, 0.2 V pk-pk, and connect it to the A Input. Use the oscilloscope to make the signal generator amplitude settings so as to obtain consistency between input settings and output readings. 5. Monitor the output; the output level should be 2 V pk-pk.

- 6) Set the signal generator to 20 mV at 1 kHz. Then set the 5187 Gain to  $\times 100$  and monitor the output; the output level should be 2 V pk-pk.
- 7) Set the signal generator to 2 mV at 1 kHz. Then set the 5187 Gain to  $\times 1000$  and monitor the output; the output level should be 2 V pk-pk.
- 8) Return the power switch to the center (Off) position.

This completes the initial checks. If the instrument performed as indicated, one can be reasonably sure that it has arrived in good working order and is functioning properly.



### 3.1 Front Panel

#### 3.1.01 Introduction

The Model 5187 has been designed to be extremely easy to setup and use. It can be powered from an external source or from internal alkaline cells as selected from a front-panel switch. In operation, the signal to be measured is connected differentially to the input BNC connectors. The output is cabled directly to the input of the lock-in amplifier with which the 5187 is to be used.

#### 3.1.02 Power Switch

The three-position power switch allows External, Off, or Battery to be selected. To operate the Model 5187 from an external power source, set the switch to the up position. To operate the 5187 from internal batteries, set the switch to the down position. In the center position, the 5187 is unpowered. The status of the selected power source can be ascertained at a glance by pressing the Power Test button; the adjacent LED will light if the power source voltage, whether the external supply or internal batteries, is above the minimum required value for reliable operation.

#### 3.1.03 Inputs

There are two input connectors, **A** and **B**, configured as a differential input. Although either input can be used separately, we recommend differential operation wherever possible, even when working from an inherently single-ended source, to minimize interference from ground-loop currents.

#### 3.1.04 Gain

The three-position rotary Gain selector switch gives the user the choice of  $\times 10$ ,  $\times 100$ , or  $\times 1000$  voltage gain.

### 3.2 Operating the Model 5187

#### 3.2.01 Introduction

The instrument is powered as required either from the self-contained batteries, from the preamplifier power-socket of a compatible lock-in amplifier (Models 7265, 7220, 5110, 5210, etc), or from an external power supply, and the signal to be amplified is applied to the input connector(s); the amplified signal is available at the **OUTPUT** BNC connector through a resistance of 50  $\Omega$ .

*Note: Before operating from the external power supply (Appendix A), make sure the voltage selector switch on the external power supply is in the position indicating the line voltage to be used, and be sure the proper size line fuse is installed (200 mA for 110 V operation or 100 mA for 240 V operation). Operating from too high a line voltage will blow the line fuse and possibly damage the power*

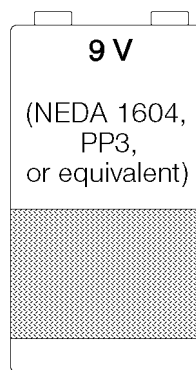
*transformer and circuit components.*

### 3.2.02 Signal Voltage and Gain

The gain selector accurately sets the gain to the indicated level. The maximum output that the amplifier can provide is 2.5 V (into 50  $\Omega$ ). For maximum input voltages, refer to the specifications.

### 3.2.03 Battery Operation

In battery powered operation, the Model 5187 requires four 9 V alkaline cells of the type commonly used to power transistor radios (Figure 3.1). These batteries will provide up to twenty hours operation at 2 V output.



**Figure 3-1, Required Battery Type**

The procedure for changing these batteries is quite straightforward, as follows.

- 1) Turn the unit off and disconnect the external power.

*Either:*

- 2) Remove the four large screws on the sides of the unit and remove the side bars.

*or:*

- 2) Remove the four M4 screws holding the upper part of the cover in place, two on each side.
- 3) Lift off the top cover.
- 4) Remove the old batteries.
- 5) Insert the new batteries, taking care to observe the correct polarity as marked on the base of the holders and the top of the batteries.
- 6) Reinstall the cover and secure it with the screws removed in step 2.

# Power Supply Unit (Model PS0108)

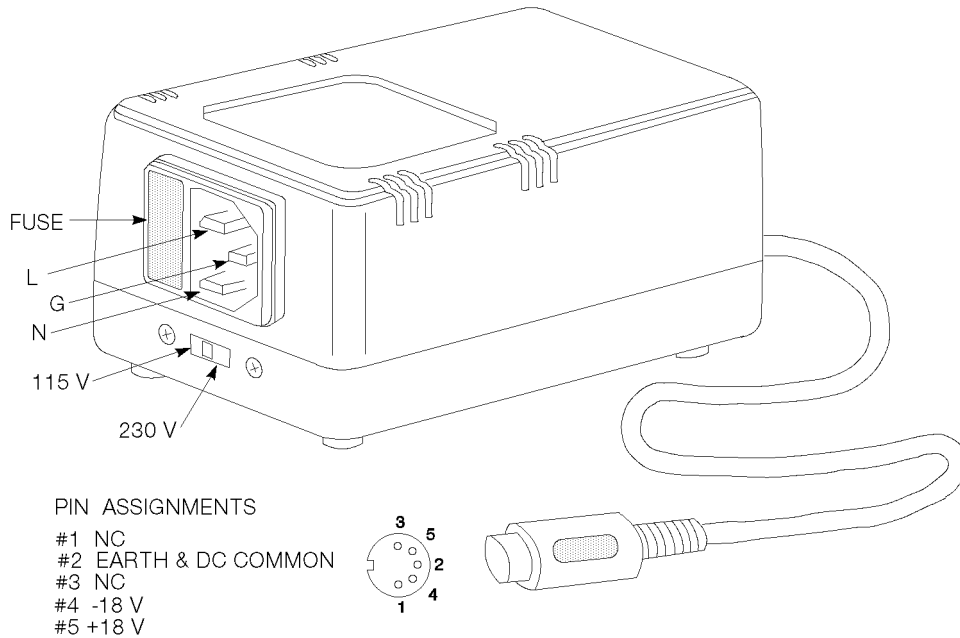


Figure A-1, Model PS0108 External Power Supply

Fuse Rating	
115 V operation	200 mA
230 V operation	100 mA
Fuse Type	5 mm × 20 mm, 250 V, Slow Blow



# WARRANTY

AMETEK SIGNAL RECOVERY, a part of AMETEK Advanced Measurement Technology, Inc, warrants each instrument of its own manufacture to be free of defects in material and workmanship for a period of ONE year from the date of delivery to the original purchaser. Obligations under this Warranty shall be limited to replacing, repairing or giving credit for the purchase, at our option, of any instruments returned, shipment prepaid, to our Service Department for that purpose, provided prior authorization for such return has been given by an authorized representative of AMETEK Advanced Measurement Technology, Inc.

This Warranty shall not apply to any instrument, which our inspection shall disclose to our satisfaction, to have become defective or unusable due to abuse, mishandling, misuse, accident, alteration, negligence, improper installation, or other causes beyond our control. This Warranty shall not apply to any instrument or component not manufactured by AMETEK Advanced Measurement Technology, Inc. When products manufactured by others are included AMETEK Advanced Measurement Technology, Inc equipment, the original manufacturers Warranty is extended to AMETEK Advanced Measurement Technology, Inc customers. AMETEK Advanced Measurement Technology, Inc reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

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## SHOULD YOUR EQUIPMENT REQUIRE SERVICE

- A. Contact your local AMETEK SIGNAL RECOVERY office, agent, representative or distributor to discuss the problem. In many cases it may be possible to expedite servicing by localizing the problem to a particular unit or cable.
- B. We will need the following information, a copy of which should also be attached to any equipment which is returned for service.
- |   |   |
|---|---|
| 1. Model number and serial number of instrument       | 6. Symptoms (in detail, including control settings)   |
| 2. Your name (instrument user)                        | 7. Your purchase order number for repair charges (does not apply to repairs in warranty)                            |
| 3. Your address                                       | 8. Shipping instructions (if you wish to authorize shipment by any method other than normal surface transportation) |
| 4. Address to which the instrument should be returned |   |
| 5. Your telephone number and extension                |   |
- C. If you experience any difficulties in obtaining service please contact:

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