

Model 5186

Low Noise Differential Voltage Preamplifier

Instruction Manual

222517-A-MNL-D

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

PerkinElmer Instruments is part of Perkin Elmer, Inc., and includes the businesses formerly trading as EG&G Princeton Applied Research, EG&G Instruments and EG&G 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)

Trademarks

 is a trademark of PerkinElmer, Inc.

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1.1 Description

The model 5186 is a high-impedance (100 MΩ), AC-coupled, differential voltage preamplifier. It has a frequency range of 0.5 Hz to 1 MHz, switched gains of 10, 40 and 60 dB (×10, ×100 and ×1000) and an input noise of 4 nV/√Hz at 1 kHz.

The instrument is a general purpose preamplifier which can be connected to grounded sources in a manner that breaks ground loops. In addition, since it has a truly differential input, the unit can be used to measure floating sources, such as the output from an AC bridge, without imposing an asymmetrical load on to the source.

The model 5186 can be powered from its own internally housed (alkaline) batteries, an external low voltage supply (±15 V or ±18 V DC) or from a line power supply via the model PS0108 (optional extra). It can also be powered from most PerkinElmer Instruments lock-in amplifiers. Connection of external power to the instrument is by a 5-way DIN connector on the rear panel.

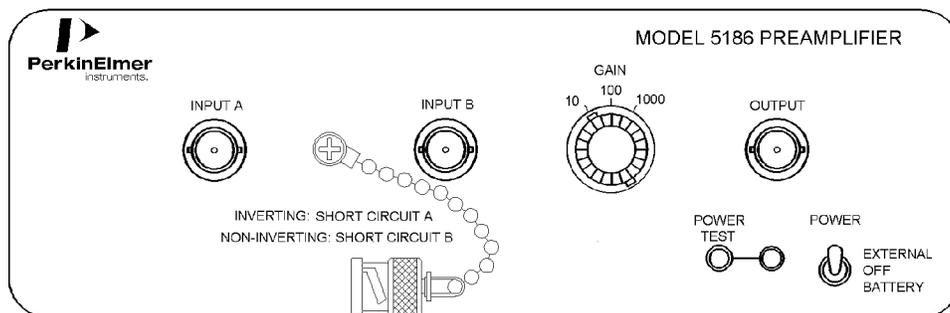


Figure 1-1, Model 5186 Front Panel

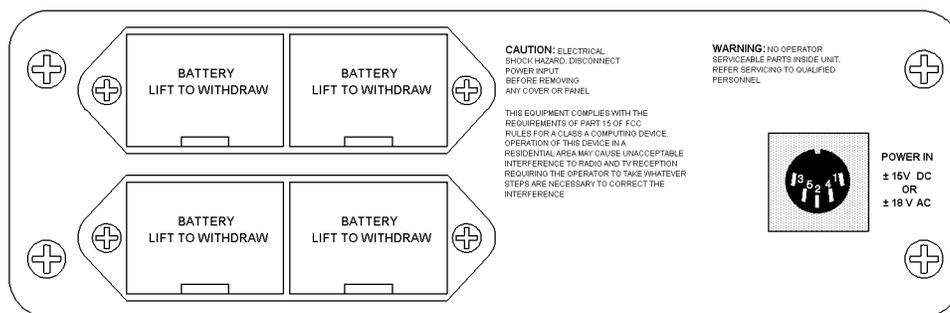


Figure 1-2, Model 5186 Rear Panel

1.2 Options

The model 5186 is supplied complete with four 9 V alkaline batteries. The following optional extras are available.

- Model PS0108** Remote Line Power Supply for the model 5186. See Appendix B for details of this unit.
- Model PS0109** Pack of 20 alkaline batteries for the model 5186
- Model C0218** Power cable. This cable allows the user to power the model 5186 from any one of the following PerkinElmer Instruments Lock-in Amplifiers:
Model 5102, 5104, 5109, 5110, 5205, 5206, 5207, 5208, 5209, 5210, 5302, 7220, 7225, 7260, 7265 or 7280.
- Model K0304** Rack mounting kit. This allows 1 or 2 model 5186 preamplifiers to be mounted in a standard 19" rack.

2.1 Introduction

The following procedure is provided to facilitate initial performance checking of the Model 5186. In general, the procedure should be performed after inspecting the instrument for shipping damage, but before using it experimentally. If any damage is noted, PerkinElmer Instruments should be notified immediately and a claim filed with the carrier. The shipping container should be saved for inspection by the carrier.

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 10 mV, 100 mV and 1 V 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 does not light, refer to Section 3.2 for a discussion of the 5186's battery requirements.

Note: Those users who have purchased the PerkinElmer Instruments 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. Then press the adjacent **POWER TEST** button. The associated indicator should light, indicating that the external supply is functioning properly.
- 2) Set the preamplifier's **GAIN** switch to the **×10** setting and connect the shorting BNC plug that is attached to the front panel to the **INPUT B** BNC connector.
 - 3) Connect the oscilloscope to the **OUTPUT** BNC connector.

- 4) Allow approximately 1 minute for the model 5186 circuitry to stabilize
- 5) Set the signal generator to 1 kHz, 1 V pk-pk and connect it to the model 5186 **INPUT A** BNC connector. Use the oscilloscope to monitor the signal generator amplitude settings so as to obtain consistency between input settings and output readings.
- 6) Monitor the preamplifier output; the output level should be 10 V pk-pk.
- 7) Set the signal generator to 1 kHz, 100 mV pk-pk. Then set the model 5186 **GAIN** switch to **×100** and again monitor the output; the output level should be 10 V pk-pk.
- 8) Set the signal generator to 1 kHz, 10 mV pk-pk. Then set the model 5186 **GAIN** switch to **×1000** and once more monitor the output; the output level should be 10 V pk-pk.
- 9) Disconnect the signal generator from the model 5186 **INPUT A** BNC connector, and replace it with the shorting BNC plug which should now be removed from the **INPUT B** BNC connector. Reconnect the signal generator to the model 5186 **INPUT B** BNC connector.
- 10) Monitor the preamplifier output; the output level should be 10 V pk-pk.
- 11) 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 Introduction

The Model 5186 Preamplifier can be powered from an external power 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 A** and **INPUT B** BNC connectors. The amplified signal, given by the expression $(A - B) \times \text{amplifier Gain}$, is provided at the **OUTPUT** BNC connector. If single-ended operation is desired, the shorting BNC attached to the front panel should be fitted to the unused input BNC connector.

3.1.01 Power Switch

The three position **POWER** switch allows **EXTERNAL**, **OFF**, or **BATTERY** to be selected. To operate the 5186 from an external power source, set the switch to the up position. To operate the 5186 from internal batteries, set the switch to the down position. In the center position, the 5186 is unpowered. The status of the selected power source can be ascertained by pressing the **POWER TEST** button; the adjacent LED will light if the power source voltage, whether of the external power source or the 5186 internal batteries, is above the minimum required value for reliable operation.

3.1.02 Input

There are two input BNC connectors, **INPUT A** and **INPUT B**, configured as a differential input. Although either input can be used separately, differential operation minimizes interference from ground loop currents, and therefore is the preferred mode of operation, even when the source is inherently single-ended. In differential mode, the input signal should be connected across the two inputs.

In differential mode operation, the maximum common mode input voltage is 5 V at a gain of $\times 1000$ with a typical CMRR of better than 100 dB at 1 kHz..

3.1.03 Output

The 5186 output can generate greater than 10 V peak to peak signals into loads greater than 100 k Ω . The 450 ohm output impedance provides a convenient 10:1 output attenuator if the amplifier is loaded with 50 ohms, which can be useful if the 5186 is required to drive coax cable greater than one meter in length at signal frequencies approaching 1 MHz.

3.2 Battery Operation

In battery powered operation, the 5186 requires four 9 V alkaline cells (type NEDA 1604, PP3 or equivalent). Each battery fits into its own removable tray accessible from the rear panel. When they are exhausted, all four batteries should be replaced together. Care should be taken when exchanging the batteries to observe the correct polarity which is marked on the inside of the battery trays and the top of the batteries. The batteries will provide up to twelve hours operation at 1 V rms. output level.

Nickel-cadmium rechargeable batteries can be used if preferred, but there will be a penalty of a reduction in the operating time obtained. In addition it will be necessary to recharge these batteries in an external charger.

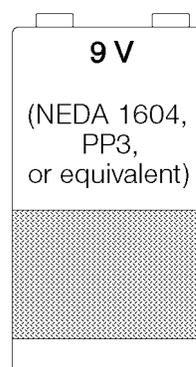


Figure 3-1, Battery Type

3.3 External Supply Operation

External power can be provided by a stand-alone external power supply (see Appendix B) providing ± 18 V DC, or the Preamplifier Power Output of most PerkinElmer Instruments lock-in amplifiers which provide ± 15 V DC. Connection is by a DIN 5-way socket on the rear panel of the 5186.

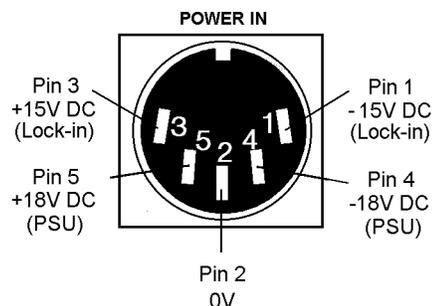


Figure 3-2, External Power Input Connector Pinout

Specifications

General

AC coupled voltage amplifier with adjustable voltage gain and a maximum frequency response extending from 0.5 Hz to 1 MHz. True differential input and single-ended output via BNC connectors.

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

Input

Modes	True differential
Coupling	AC
Impedance	100 MΩ // 20 pF
Frequency Response	0.5 Hz to 1 MHz
C.M.R.R.	
×1000 gain	> 110 dB (100 Hz to 1 kHz), degrading by 6 dB/octave above 1 kHz
×10 or ×100 gain	> 90 dB (100 Hz to 1 kHz), degrading by 6 dB/octave above 1 kHz
Max common-mode input voltage, x1000 gain	5 V pk-pk
Max input without damage	±15 V DC or 10 V rms. AC @ 50 Hz
Noise	see Figure A-1. Typically 4 nV/√Hz @ 1 kHz and ×1000 gain; 10 nV/√Hz @ 1 kHz and ×10 or ×1000 gain

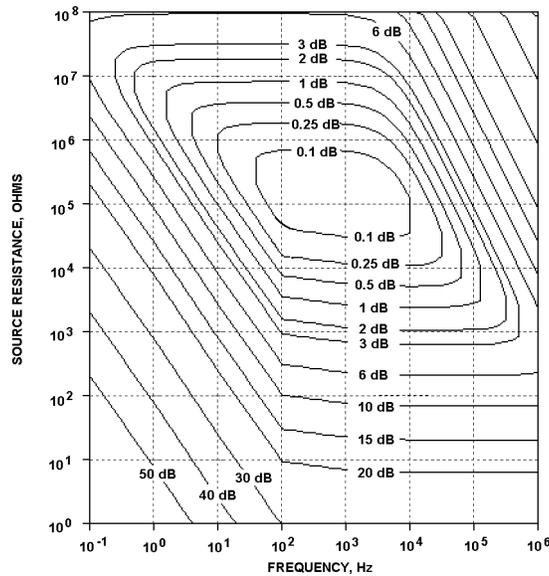


Figure A-1, Model 5186 Noise Figure Contours (Typical)

Gain	×10, ×100 or ×1000, switch selectable
Gain Accuracy	±1%

Gain Stability ± 150 ppm/ $^{\circ}$ C

Output

Impedance 450 Ω
Max voltage swing >10 V pk-pk
Slew rate > 22 V/ μ s
Polarity Non-inverting
Distortion < 0.01% T.H.D.

Power

Internal Four 9 V alkaline batteries provide approximately 12 hours of use

External

a) ± 15 V or ± 18 V DC @ 27 mA

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

Dimensions

(excluding connectors) 8.25" wide \times 11" deep \times 3.5" high
(210 mm wide \times 279 mm deep \times 89 mm high)

Weight 5.3 lbs. (2.4 kg) excluding optional power supply

Power Supply Unit (Model PS0108)

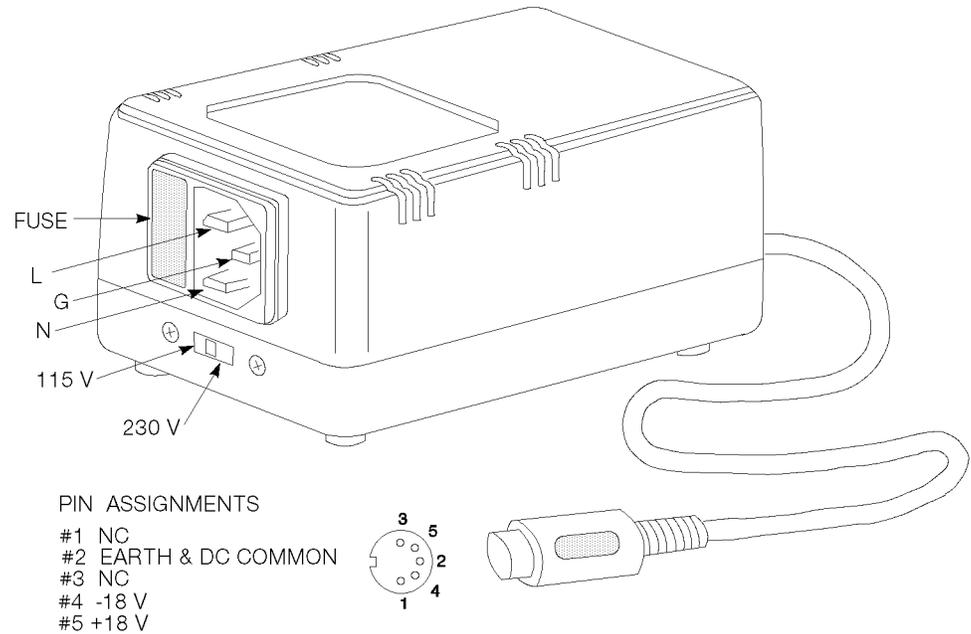


Figure B-1, Model PS0108 External Power Supply

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

WARRANTY

PerkinElmer Instruments Corporation 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 PerkinElmer Instruments Corporation.

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 PerkinElmer Instruments Corporation. When products manufactured by others are included in PerkinElmer Instruments Corporation equipment, the original manufacturers Warranty is extended to PerkinElmer Instruments customers.

PerkinElmer Instruments Corporation reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. THIS WARRANTY IS IN LIEU OF, AND EXCLUDES ANY AND ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AS WELL AS ANY AND ALL OTHER OBLIGATIONS OR LIABILITIES OF PERKINELMER INSTRUMENTS CORPORATION, INCLUDING, BUT NOT LIMITED TO, SPECIAL OR CONSEQUENTIAL DAMAGES. NO PERSON, FIRM OR CORPORATION IS AUTHORIZED TO ASSUME FOR PERKINELMER INSTRUMENTS CORPORATION ANY ADDITIONAL OBLIGATION OR LIABILITY NOT EXPRESSLY PROVIDED FOR HEREIN EXCEPT IN WRITING DULY EXECUTED BY AN OFFICER OF PERKINELMER INSTRUMENTS CORPORATION.

SHOULD YOUR EQUIPMENT REQUIRE SERVICE

- A. Contact your local PerkinElmer Instruments (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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