

Model 5184
Ultra Low-Noise
Voltage Preamplifier

Instruction Manual

222516-A-MNL-E

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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1.1 Description

The Model 5184 is a medium-impedance (5 MΩ), AC-coupled, voltage preamplifier which features an ultra low-noise FET input stage (800 pV/√Hz at 1 kHz). It has a frequency range of 0.5 Hz to 1 MHz and a fixed gain of 60 dB (×1000). The 5184 is ideal for use with medium impedance cryogenic sources and IR detectors such as HgCdTe, InSb and InAs.

The model 5184 incorporates a special input stage which can be floated to give the ground loop immunity normally associated with differential inputs, without the usual accompanying noise penalty of the input devices required in differential circuits.

The model 5184 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 **SIGNAL RECOVERY** lock-in amplifiers. Connection of external power to the instrument is by a 5-way DIN connector on the rear panel.

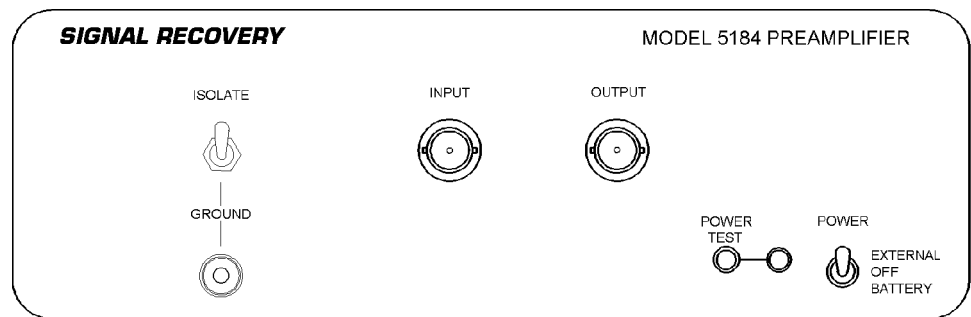


Figure 1-1, Model 5184 Front Panel

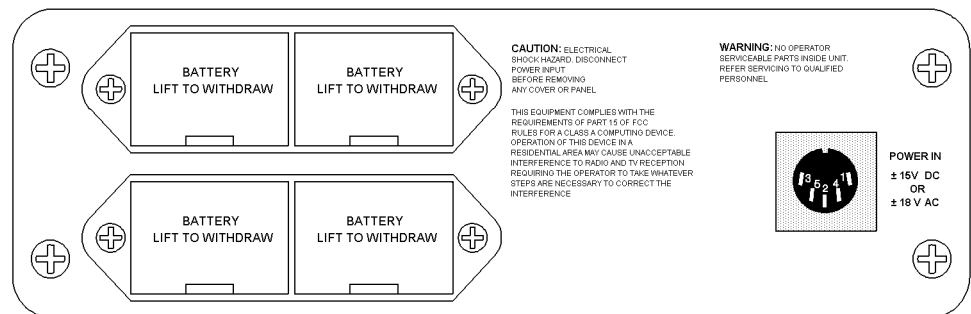


Figure 1-2, Model 5184 Rear Panel

1.2 Options

The model 5184 is supplied complete with four 9 V alkaline batteries. The following optional extras are available.

- | | |
|---------------------|--|
| Model PS0108 | Remote Line Power Supply for the model 5184. See Appendix B for details of this unit. |
| Model PS0109 | Pack of 20 alkaline batteries for the model 5184 |
| Model C0218 | Power cable. This cable allows the user to power the model 5184 from any one of the following SIGNAL RECOVERY (formerly EG&G/PerkinElmer) 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 5184 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 5183. In general, the procedure should be performed after inspecting the instrument for shipping damage, but before using it experimentally. If any damage is noted, **SIGNAL RECOVERY** 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 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 5184's battery requirements.

Note: Those users who have purchased the **SIGNAL RECOVERY** external power supply option model PS0108 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 5184 input **GROUND / ISOLATE** switch to the down (**GROUND**) position.
 - 3) Connect the oscilloscope to the **OUTPUT** BNC connector.
 - 4) Allow approximately 1 minute for the model 5184 circuitry to stabilize

- 5) Set the signal generator to 1 kHz, 10 mV pk-pk and connect it's output to the **INPUT** 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 5184 output; the output level should be 10 V pk-pk.
- 7) Set the 5184 input **GROUND / ISOLATE** switch to the up (**ISOLATE**) position.
- 8) The output level should still be 10 V pk-pk.
- 9) 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 5184 Preamplifier can be powered from an external power source or from internal alkaline cells as selected from a front-panel switch. In operation, the voltage to be measured is connected to the AC-coupled **INPUT** BNC connector. The preamplifier amplifies the signal voltage by a fixed 60 dB (1000 times) which is then output from the **OUTPUT** BNC connector.

3.1.01 Power Switch

The three position **POWER** switch allows **EXTERNAL**, **OFF**, or **BATTERY** to be selected. To operate the 5184 from an external power source, set the switch to the up position. To operate the 5184 from internal batteries, set the switch to the down position. In the center position, the 5184 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 5184 internal batteries, is above the minimum required value for reliable operation.

3.1.02 Input

The 5184 input circuit is of an asymmetrical differential configuration. When the **GROUND / ISOLATE** switch is set to the down (**GROUND**) position, the screen of the BNC input socket is grounded and the input may be used in the conventional single-ended mode. When the **GROUND / ISOLATE** switch is set to the up (**ISOLATE**) position, the input stage is floated and the input may be used in the “pseudo-differential” mode. This gives the ground loop immunity normally associated with differential inputs without the accompanying noise penalty associated with differential input stages. In “pseudo-differential” mode the signal voltages should be connected to the BNC **INPUT** socket and the signal ground to the **GROUND** terminal on the front panel. The maximum common mode input voltage is 300 mV peak to peak and the maximum voltage difference between the shell of the BNC signal input connector and the front panel ground terminal is ± 600 mV.

3.1.03 Output

The 5184 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 5184 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 5184 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 eight 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.

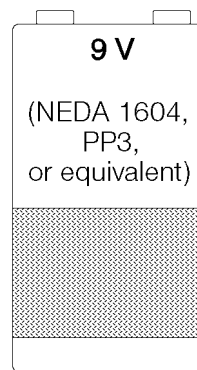


Figure 3-1, Battery Type

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 **SIGNAL RECOVERY** lock-in amplifiers which provide ± 15 V DC. Connection is by a DIN 5-way socket on the rear panel of the 5184.

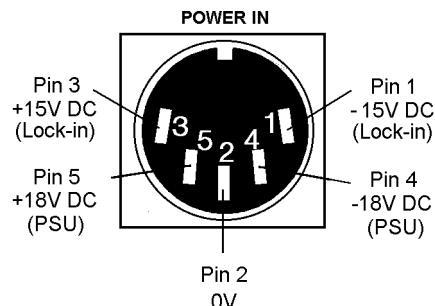


Figure 3-2, External Power Input Connector Pinout

Specifications

General

AC coupled voltage amplifier with fixed x1000 (60dB) voltage gain and a maximum frequency response extending from 0.5 Hz to 1 MHz. Pseudo-differential input and single-ended output via BNC connectors.

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

Input

Modes	Asymmetrical differential. Front panel ground terminal provided.
Coupling	AC
Impedance	5 M Ω //50 pF
Frequency Response	0.5 Hz - 1 MHz
C.M.R.R.	> 80 dB (100 Hz to 1 kHz)
Max differential input voltage	10 mV pk-pk
Max common-mode input voltage	300 mV pk-pk
Max signal low potential w.r.t. ground terminal	\pm 600 mV
Max input without damage	\pm 15 V DC or 10 V rms. AC @ 50 Hz
Noise	See Figure A-1 ; typ 800 pV/ $\sqrt{\text{Hz}}$ @ 1 kHz

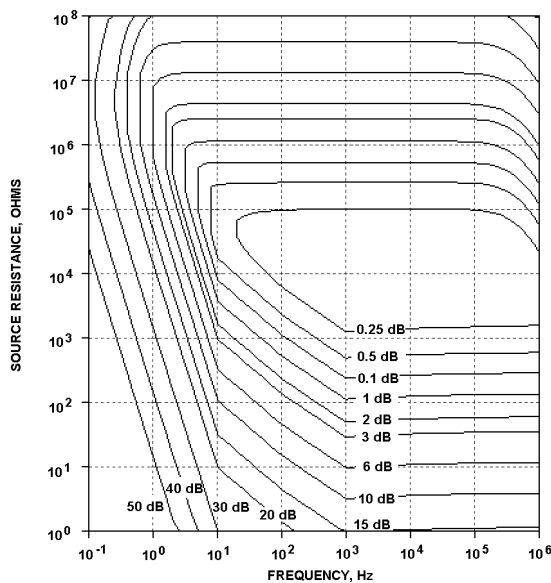


Figure A-1, Model 5184 Noise Figure Contours (Typical)

Gain	\times 1000 (60 dB) fixed
Gain Accuracy	\pm 1%
Gain Stability	\pm 800 ppm/ $^{\circ}$ C

Output

Impedance	450 Ω
Max voltage swing	>10 V pk-pk
Slew rate	> 22 V/ μ s
Polarity	Non-inverting
Distortion	< 0.1% T.H.D.

Power

Internal	Four 9 V alkaline batteries provide approximately 8 hours of use
External	
a)	± 15 V or ± 18 V DC @ 40 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)

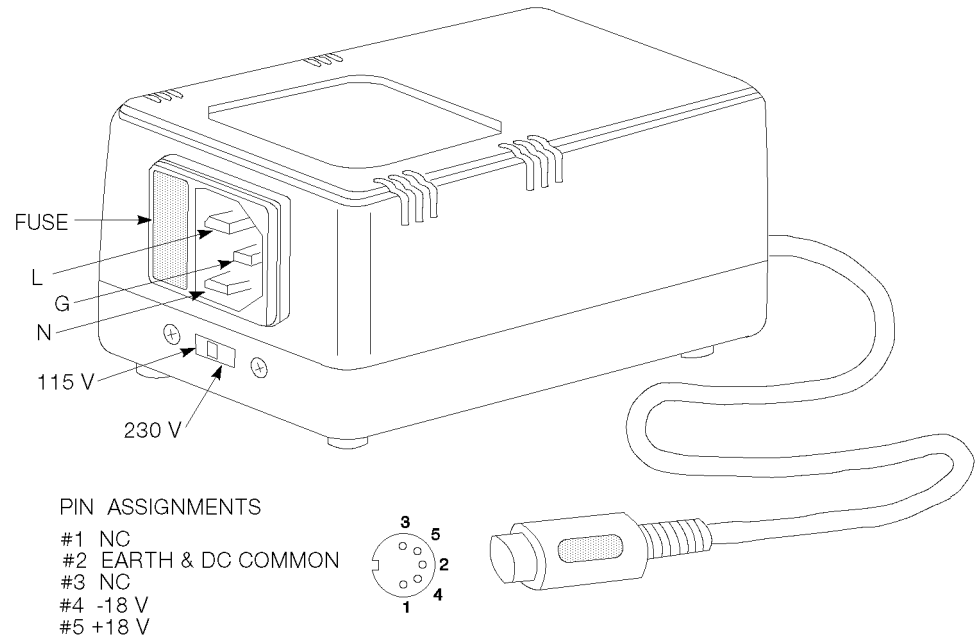


Figure B-1, Model PS0108 External Power Supply

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

WARRANTY

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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