

# SECTION I CHARACTERISTICS

## 1.1 INTRODUCTION

The Model 113 Low-Noise Preamp provides high gain, low noise amplification of wideband signals from dc to 300 kHz. Adjustable high and low frequency rolloffs allow the bandwidth to be reduced. Two inputs, with individual coupling switches, allow either differential or single-ended operation. Calibrated gain is switch selectable from  $\times 10$  to  $\times 10^4$  in a 1-2-5 sequence, and an uncalibrated gain vernier provides  $\times 1$  to  $\times 2.5$  range expansion.

The unit may be powered either from the ac line or from its own batteries. The nickel-cadmium batteries recharge automatically during line operation.

Other features include an overload fast-recovery switch, special circuitry that reduces the effects of ground-loop currents, front-panel dc zeroing and common mode rejection screwdriver controls, and battery test provisions.

The Model 113 is well suited for use as a preamplifier for other Princeton Applied Research signal processing instruments.

## 1.2 SPECIFICATIONS

### (1) INPUTS

Two channels, each with a three position switch to provide for ac or dc coupled, single-ended or differential operation. Input connectors are BNC type.

### (2) INPUT IMPEDANCE

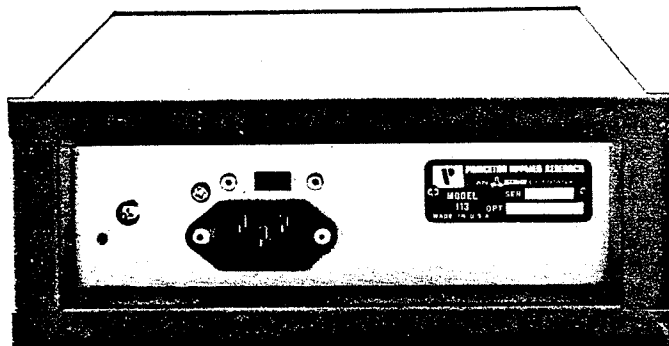
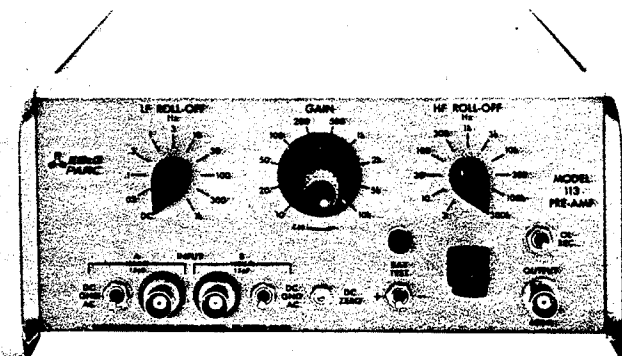
- (a) Ac coupled: through  $0.1 \mu\text{F}$ , shunted to ground with 100 megohms and 15 pF in parallel.
- (b) Dc coupled: 1 gigohm, shunted by 15 pF.

### (3) MAXIMUM INPUT WITHOUT DAMAGE

- (a) Dc coupled: Common-Mode,  $\pm 10 \text{ V}$ ; Differential,  $\pm 7.5 \text{ V}$ .
- (b) Ac coupled: coupling capacitors can withstand 200 V. Transients which pass through coupling capacitors cannot exceed dc coupled operation limits.

### (4) MAXIMUM INPUT SIGNAL CONSISTENT WITH LINEAR OPERATION (see Subsection 3.10)

- (a) Common mode: 1 V rms.
- (b) Differential mode (gains of 10 to 100):  $\pm 500 \text{ mV}$ .
- (c) Differential mode (gains of 200 through 10 k):  $\pm 50 \text{ mV}$ .



(5) COMMON MODE REJECTION

FREQUENCY	FOR GAIN > 200	FOR GAIN < 200
dc to 100 Hz	120 dB (min)	100 dB (min)
1 kHz	100 dB	80 dB
10 kHz	80 dB	60 dB
100 kHz	60 dB	40 dB

(6) GAIN

x10 to x10<sup>4</sup> calibrated gain settings. Accuracy of calibrated gains is ±2% when gain vernier is in the calibrate position. Gain vernier provides uncalibrated gain range expansion of up to x2.5 (minimum).

(7) FREQUENCY RESPONSE

Rolloff frequencies are switch selectable. Front panel switch markings indicate 3 dB point of 6 dB/octave rolloff curve. Rolloffs are selectable as follows:

- (a) Low Frequency: dc position and 0.03 Hz to 1 kHz positions in 1-3-10 sequence.
- (b) High Frequency: 3 Hz to 300 kHz in 1-3-10 sequence.

(8) NOISE

At 10 Hz with a 2 megohm source impedance, noise figure is 0.3 dB maximum. At 1 kHz with a 1 megohm source impedance, noise figure is 0.2 dB maximum. See Section III for further discussion and noise figure contours.

(9) DC DRIFT

- (a) Referred to input (dc coupling): maximum 10 μV/°C or less than 10 μV/24 hours at constant ambient temperature. A front panel screwdriver control provides for dc zeroing.
- (b) Referred to output: less than 1 mV/°C, or less than 1 mV/24 hours at constant ambient temperature.

(10) DISTORTION

Typical distortion is less than 0.01%.

(11) OUTPUT VOLTAGE

10 volts pk-pk ahead of 600 ohms.

(12) OUTPUT IMPEDANCE

600 ohms.

(13) OVERLOAD RECOVERY

Resets immediately with spring-loaded front-panel toggle. See Figure III-2 for characteristic recovery data.

(14) POWER REQUIREMENTS

- (a) Rechargeable nickel-cadmium batteries provide approximately 30 hours operation between charges. A front-panel, three-position, spring-loaded toggle switch and test lamp permit test of each of the two internal batteries.
- (b) Ac line operation: 105-125 V ac or 210-250 V ac, 50-60 Hz, 5 watts. Internal batteries will recharge automatically while unit is connected to ac power line.

(15) DIMENSIONS

8.6" W x 4.1" H x 11.3" D (21.8 cm x 10.4 cm x 28.7 cm).

(16) WEIGHT

4 pounds (1.8 kg).

(17) ACCESSORIES

If the source impedance is less than 100 ohms, best low-noise performance will be obtained if a Model AM-1, AM-2, or 190 input transformer is used. Both the AM-1 and the AM-2 have 1:100 turns ratios. The AM-1 has a 3 dB bandwidth of from 1 kHz to 10 kHz at 10 ohms source impedance, and the AM-2 has a bandwidth of from 1 kHz to 150 kHz with a 1 ohm source. The Model 190 has a 1:10:100 turns ratio. The three dB bandwidth is from 0.25 Hz to 500 Hz with a 1 ohm source. See Section III for further details regarding these transformers.

Flanges are available for mounting on a single unit or two units side by side in a 19" relay rack. See Subsection III-12 for the part numbers of these flanges.