

# 5402

## Low Noise Current Amplifier

### Features

- Low input impedance
- Low noise
- Single-ended virtual ground input
- Six gain settings
- DC to > 4 MHz frequency response
- Internal rechargeable batteries

### Applications

- Photodiode amplification
- Photomultiplier amplification
- Ion collector amplification
- Electron multiplier amplification
- Impedance measurements

### Overview

The Model 5402 is a low noise current input preamplifier designed for use whenever the signal source is a current source - for example, an electron multiplier, ion collector, photo multiplier, or photodiode, or when measuring sample impedances. The gain (transimpedance) is switch selectable with six settings enabling the amplifier, on its most sensitive range, to detect fractions of a picoamp without noise degradation.

The unit has a bandwidth of 100 kHz on its highest gain (1 GV/A) and greater than 4 MHz on its lowest gain (10 kV/A), while still maintaining low input current noise ranging from 25 fA  $\sqrt{\text{Hz}}$  on the 1 GV/A range to 5 pA $\sqrt{\text{Hz}}$  on the 10 kV/A range. The gain setting is changed by simply pressing a push-button, with the present setting being indicated by an LED. The setting is retained when the power switch is turned off and restored when it is turned on again.

Switch selectable output filters allow AC or DC output coupling, and three choices of low pass filtering which can reduce overall noise, especially when working at high gains if the full bandwidth is not required.

The Model 5402 is powered by two internal lithium-ion rechargeable batteries which allow operation for up to 48 hours on a single charge. This method of powering delivers the lowest possible noise as well as allowing isolated operation, preventing problems which might be caused by ground loops.

A plug-in line power supply, model PS0112, is included which is capable of recharging the batteries in one model 5402; recharge time is a maximum of three hours.



# Specifications

## Input

Mode	Single-ended
Coupling	DC
Connector	BNC socket
Maximum safe input voltage	±20 V DC
Input Bias Current	1 pA typical
Input Referred Voltage Noise	2.5 nV/√Hz typical
Input Referred Current Noise	See Table A-1

## Gain & Frequency Response

Gain	Switch selectable (6 settings) to 1 G, 100 M, 10 M, 1 M, 100 K, 10 K V/A
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Accuracy	± 0.5 dB
Flatness in pass-band	± 0.5 dB
Frequency Response	See Table A-1

## Output Filters

Output Coupling (high-pass)	When set to DC, amplifier is DC coupled. When set to AC, low-frequency cut off is 0.1 Hz
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Output Filter (low-pass)	Low pass Butterworth filter with 18 dB/octave roll-off filter reduces overall noise, especially when working at high gains, if full bandwidth is not required.
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Cut off frequency settings:	
10 MHz	Full bandwidth
1 MHz	1 MHz ± 150 kHz
100 kHz	100 kHz ± 15 kHz

Gain	Bandwidth (-3dB) with $C_{in} = 10 \text{ pF}$	Bandwidth (-3dB) with $C_{in} = 1 \text{ nF}$	Input Referred Current Noise (typical)
10 K	> 5 MHz	> 500 kHz	5 pA/√Hz
100 K	> 2 MHz	> 200 kHz	1 pA/√Hz
1 M	> 800 kHz	> 100 kHz	500 fA/√Hz
10 M	> 450 kHz	> 80 kHz	100 fA/√Hz
100 M	> 250 kHz	> 25 kHz	50 fA/√Hz
1 G	> 100 kHz	> 20 kHz	25 fA/√Hz

Table A-1 Typical Frequency Response

## Output

Impedance	50 Ω
Connector	BNC jack
Max voltage swing	> 5 V pk-pk
Polarity	Current flowing into the input produces a positive output voltage
Protection	Output is short-circuit protected

## Power

Internal	Rechargeable lithium ion batteries provide up to 48 hours of use. Batteries recharge automatically when DC power is connected. Recharge time is max of 3 hours
External	9 V DC @ 350 mA max
Connector	1.3 mm DC power socket, inner pin positive, outer barrel negative

## General

Dimensions	
Excluding connectors	3½" w x 1¼" d x 2¾" high (85 mm x 31 mm x 71 mm)
Including connectors	4½" w x 1¼" d x 2¾" high (114 mm x 31 mm x 71 mm)
Weight	7.5 oz. (210 g) excluding optional power supply
Operating Temperature	5° to 40°C
Storage Temperature	-25° to 70°C

## Ordering Information

<b>Model 5402</b>	Low noise current amplifier complete with line power supply (PS0112) and user manual
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