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/√Hz on the 1 GV/A range to 5 pA/√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, 10 M, 10 M, 1 M,
100 K, 10 K V/A
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
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.

Cut off frequency settings:
10 MHz Full bandwidth
1 MHz 1 MHz ± 150 kHz
100 kHz 100 kHz ± 15 kHz

<table>
<thead>
<tr>
<th>Gain</th>
<th>Bandwidth (–3dB) with $C_{in} = 10$ pF</th>
<th>Bandwidth (–3dB) with $C_{in} = 1$ nF</th>
<th>Input Referred Current Noise (typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 K</td>
<td>&gt; 5 MHz</td>
<td>&gt; 500 kHz</td>
<td>5 pA/√Hz</td>
</tr>
<tr>
<td>100 K</td>
<td>&gt; 2 MHz</td>
<td>&gt; 200 kHz</td>
<td>1 pA/√Hz</td>
</tr>
<tr>
<td>1 M</td>
<td>&gt; 1 MHz</td>
<td>&gt; 100 kHz</td>
<td>500 fA/√Hz</td>
</tr>
<tr>
<td>10 M</td>
<td>&gt; 800 kHz</td>
<td>&gt; 80 kHz</td>
<td>100 fA/√Hz</td>
</tr>
<tr>
<td>100 M</td>
<td>&gt; 250 kHz</td>
<td>&gt; 25 kHz</td>
<td>50 fA/√Hz</td>
</tr>
<tr>
<td>1 G</td>
<td>&gt; 100 kHz</td>
<td>&gt; 20 kHz</td>
<td>25 fA/√Hz</td>
</tr>
</tbody>
</table>

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 2¼" 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
Model 5402
Low noise current amplifier
complete with line power supply
(PS0112) and user manual

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