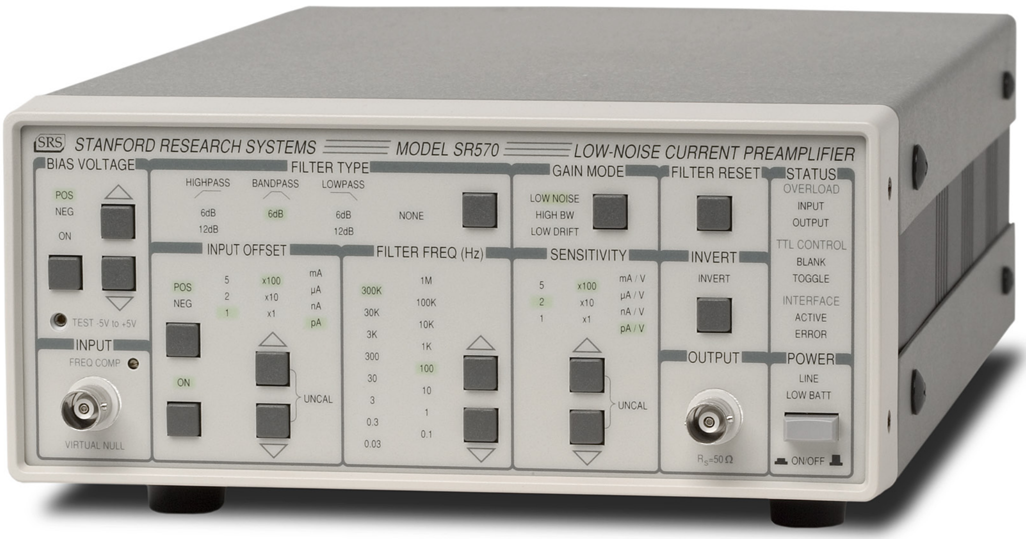
Low-Noise Current Preamplifier

SR570 — DC to 1 MHz current preamplifier



SR570 Current Preamplifier

- **5 fA/√Hz input noise**
- **1 MHz maximum bandwidth**
- **1 pA/V maximum gain**
- **Adjustable bias voltage**
- **Two configurable signal filters**
- **Variable input offset current**
- **Line or battery operation**
- **RS-232 interface**

- **SR570 ... $2595** ***(U.S. list)***

The SR570 is a low-noise current preamplifier capable of current gains as large as 1 pA/V. High gain and bandwidth, low noise, and many convenient features make the SR570 ideal for a variety of photonic, low-temperature and other measurements.

Gain

The SR570 has sensitivity settings from 1 pA/V to 1 mA/V that can be selected in a 1-2-5 sequence. A vernier gain adjustment is also provided that lets you select any sensitivity in between.

Gain can be allocated to various stages of the amplifier to optimize the instrument's performance. The low-noise mode places gain in the front end of the amplifier for the best noise performance. The high-bandwidth mode allocates gain to the later stages of the amplifier to improve the frequency response of the front end. In the low-drift mode, the input amplifier is replaced with a very low input-current op amp, reducing the instrument's DC drift by a factor of 1000.

Filters

The SR570 contains two first-order RC filters whose cutoff frequency and type can be configured from the front panel. Together, the filters can be configured as a 6 or 12 dB/oct rolloff low-pass or high-pass filter, or as a 6 dB/oct rolloff band-pass filter. Cutoff frequencies are adjustable from 0.03 Hz to 1 MHz in a 1-3-10 sequence. A filter reset button is included to shorten the overload recovery time of the instrument when long filter time constants are used.

Input Offset and DC Bias

An input offset-current adjustment is provided to suppress any unwanted DC background currents. Offset currents can be specified from ±1 pA to ±1 mA in roughly 0.1 % increments. The SR570 also has an adjustable input DC bias voltage (±5 V) that allows you to directly sink current into a virtual null (analog ground) or a selected DC bias.

Toggle and Blanking

Two rear-panel opto-isolated TTL inputs provide additional control of the SR570. A blanking input lets you quickly turn off/on the instrument's gain which is useful in preventing front-end overloading. A toggle input inverts the sign of the gain in response to a TTL signal, allowing you to perform synchronous detection with a chopped signal.

Battery Operation

Three rechargeable lead-acid batteries provide up to 15 hours of battery-powered operation. An internal battery charger automatically charges the batteries when the unit is connected to the line. The charger senses the battery state and adjusts the charging rate accordingly. Two rear-panel LEDs indicate the charge state of the batteries. When the batteries become discharged, they are automatically disconnected from the amplifier circuit to avoid battery damage.

No Digital Noise

The microprocessor that runs the SR570 is "asleep" except during the brief interval it takes to change the instrument's setup. This ensures that no digital noise will contaminate low-level analog signals.

RS-232 Interface

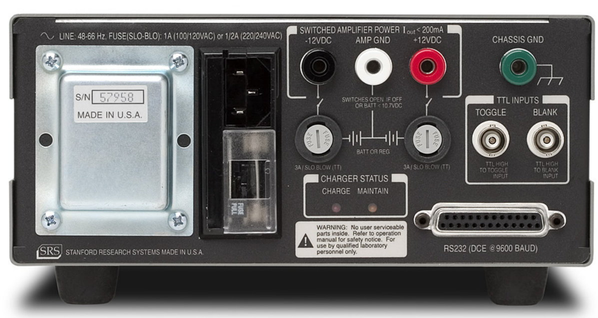
The RS-232 interface allows listen-only communication with the SR570 at 9600 baud. All functions of the instrument (except power on) can be set via the RS-232 interface. The RS-232 interface electronics are opto-isolated from the amplifier circuitry to provide maximum noise immunity.

Why Use a Current Amplifier?

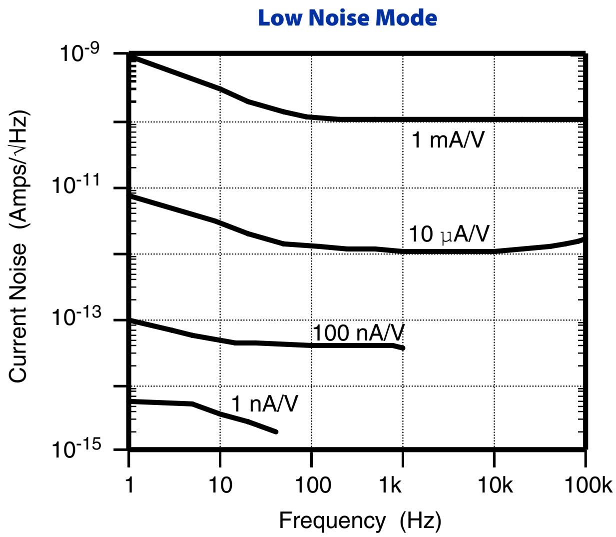
Many people wonder why current amplifiers are necessary. Why not simply terminate a current source with a resistor and amplify the resulting voltage with a voltage amplifier? The answer is twofold. To get a large voltage from a current, large resistors are necessary. In combination with cable capacitance, this can lead to unacceptable penalties in frequency response and phase accuracy. Current amplifiers have much better amplitude and phase accuracy in the presence of stray capacitance. Secondly, using resistive terminations forces the current source to operate into possibly large bias voltages—a situation which is unacceptable for many sources and detectors. Current amplifiers can sink current directly into a virtual null or to a selected DC bias voltage.

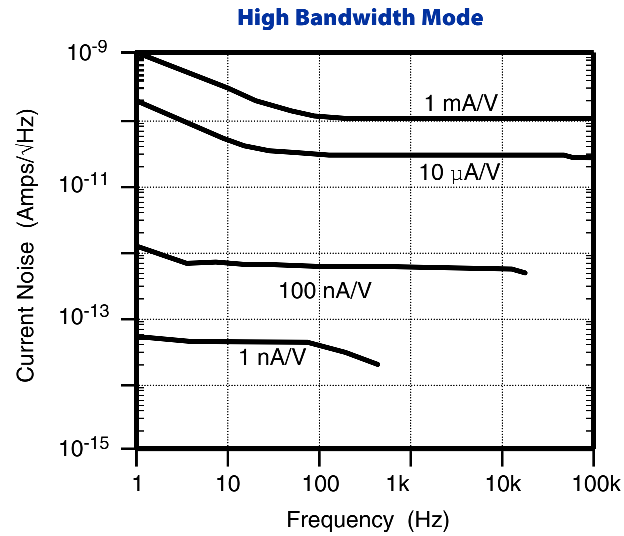
Ordering Information

SR570	Low-noise current preamplifier	$2595
O560RMD	Double rack mount kit	$100
O560RMS	Single rack mount kit	$100
O560SB	Spare battery set (3 batteries)	$200

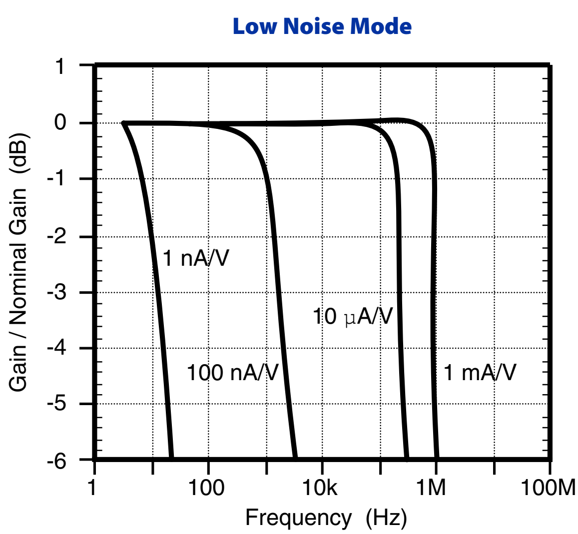


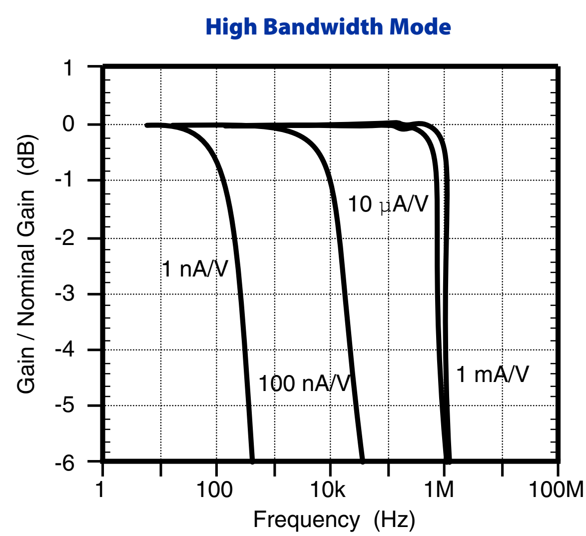
SR570 rear panel





Noise vs. frequency plots





Gain vs. frequency plots

SR570 Specifications

Input

Inputs	Virtual null or user-set bias (±5 V)
Input offset	±1 pA to ±1 mA adjustable DC offset current
Maximum input	±5 mA
Noise	See graphs on previous page
Sensitivity	1 pA/V to 1 mA/V in 1-2-5 sequence (Vernier adjustment in 0.5 % steps)
Frequency response	±0.5 dB to 1 MHz (Adjustable front-panel frequency response compensation for source capacitance)
Grounding	Amplifier ground is fully floating. Amplifier and chassis ground are available at rear panel. Input ground can float up to ±40 V.

Filters

Signal filters	2 configurable (low-pass or high-pass) 6 dB/oct rolloff filters. –3 dB points are settable in a 1-3-10 sequence from 0.03 Hz to 1 MHz.
Gain allocation	
Low Noise	Gain is allocated to the front end for best noise performance.
High Bandwidth	Front-end gain is reduced for optimum frequency response.
Low Drift	Low bias current amplifier is used for reduced drift at high sensitivity.
Filter reset	Long time constant filters may be reset with front-panel button.

Output

Gain accuracy	±(0.5 % of output + 10 mV) @ 25 °C
DC drift	See table below
Maximum output	±5 V into a high-impedance load

General

External blanking	TTL input sets gain to zero
External toggle	TTL input inverts gain polarity
Rear panel biasing	±12 VDC @ 200 mA, referenced to amplifier ground
Computer interface	RS-232, 9600 baud, receive only
Power	100/120/220/240 VAC, 6 W charged, 30 W while charging. Internal batteries provide 15 hours of operation between charges. Batteries are charged while connected to the line.
Dimensions	8.3" × 3.5" × 13.0" (WHD)
Weight	15 lbs. (batteries installed)
Warranty	One year parts and labor on defects in materials and workmanship

Sensitivity (A/V)	**Bandwidth***		**Noise (/√Hz)****		**Temp. coefficient** ±(% input + offset)/°C	**DC Input Impedance**
	High BW	*Low Noise*	*High BW*	*Low Noise*	*Low Drift (11 to 28 °C)*	*All Modes*
10^{-3}	1.0 MHz	1.0 MHz	150 pA	150 pA	0.01 % + 20 nA	1 Ω
10^{-4}	1.0 MHz	500 kHz	100 pA	60 pA	0.01 % + 2 nA	1 Ω
10^{-5}	800 kHz	200 kHz	60 pA	2 pA	0.01 % + 200 pA	100 Ω
10^{-6}	200 kHz	20 kHz	2 pA	600 fA	0.01 % + 20 pA	100 Ω
10^{-7}	20 kHz	2 kHz	600 fA	100 fA	0.01 % + 2 pA	10 kΩ
10^{-8}	2 kHz	200 Hz	100 fA	60 fA	0.01 % + 400 fA	10 kΩ
10^{-9}	200 Hz	15 Hz	60 fA	10 fA	0.025 % + 40 fA	1 MΩ
10^{-10}	100 Hz	10 Hz	10 fA	5 fA	0.025 % + 20 fA	1 MΩ
10^{-11}	20 Hz	10 Hz	5 fA	5 fA	0.040 % + 20 fA	1 MΩ
10^{-12}	10 Hz	10 Hz	5 fA	5 fA	0.040 % + 20 fA	1 MΩ

* Frequency compensation adjusted for flat frequency response
** Average noise in the frequency range below the 3 dB point but above the frequency where 1/f noise is significant