Current Input (I)

The current input on the SR830 uses the A input BNC. The current input has a 1 kΩ input impedance and a current gain of either 10^6 or 10^8 Volts/Amp. Currents from 1 μA down to 2 fA full scale can be measured.

The impedance of the signal source is the most important factor to consider in deciding between voltage and current measurements.

For high source impedances, greater than 1 MΩ (10^6 gain) or 100 MΩ (10^8 gain), and small currents, use the current input. Its relatively low impedance greatly reduces the amplitude and phase errors caused by the cable capacitance-source impedance time constant. The cable capacitance should still be kept small to minimize the high frequency noise gain of the current preamplifier.

For moderate to low source impedances, or larger currents, the voltage input is preferred. A small value resistor may be used to shunt the signal current and generate a voltage signal. The lock-in then measures the voltage across the shunt resistor. Select the resistor value to keep the shunt voltage small (so it does not affect the source current) while providing enough signal for the lock-in to measure.

Which current gain should you use? The current gain determines the input current noise of the lock-in as well as its measurement bandwidth. Signals far above the input bandwidth are attenuated by 6 dB/oct. The noise and bandwidth are listed below.

Gain	Noise	Bandwidth
10^6	130 fA/√Hz	70 kHz
10^8	13 fA/√Hz	700 Hz

AC vs DC Coupling

The signal input can be either AC or DC coupled. The AC coupling high pass filter passes signals above 160 mHz (0.16 Hz) and attenuates signals at lower frequencies. AC coupling should be used at frequencies above 160 mHz whenever possible. At lower frequencies, DC coupling is required.

A DC signal, if not removed by the AC coupling filter, will multiply with the reference sine wave and produce an output at the reference frequency. This signal is not normally present and needs to be removed by the low pass filter. If the DC component of the signal is large, then this output will be large and require a long time constant to remove. AC coupling removes the DC component of the signal without any sacrifice in signal as long as the frequency is above 160 mHz.

The current input current to voltage preamplifier is always DC coupled. AC coupling can be selected following the current preamplifier to remove any DC current signal.