SR510 LOCKIN INSTRUCTIONS

Here are some quick instructions for using the lock-in amplifier. Look also in the Hints and Useful Documents area of the course website. Finally, the Stanford Research Systems website has a lovely set of information about lock-in amplifiers at http://www.thinksrs.com/downloads/PDFs/ApplicationNotes/AboutLIAs.pdf It is common to test your lock-in by setting up a 100mV amplitude sine wave on the function generator. Then:

1) CONNECT WAVEFORM GENERATOR 'SYNC' TO THE REFERENCE INPUT.

A lock-in needs to know what frequency signal you are looking for. By connecting a sync signal to the far right BNC, you have just told it the frequency. Hit the far right 'Select' button to see the frequency. Make sure that the 'f/2f' button is highlighted on 'f'.

2) CONNECT YOUR SIGNAL TO THE FAR LEFT 'SIGNAL INPUTS'.

The SR510 will accept a signal that can either be a voltage (connect to the A input), a differential voltage (connect the two voltages to A and to B respectively) or a current (connect to the 'I' BNC). Typically, you will use the A input for a voltage from e.g., the output of some amplifier. Now you have provided the signal that the lock-in aims to detect. Assuming that there is some signal at the reference frequency, the lock-in improves your chances of seeing it. Select the sensitivity scale to match the rough signal size you expect. A common test would be to use your waveform generator output to send a 100mV sine wave to the input. Set the sensitivity scale to 100mV and expect a full-scale reading on the front panel meter.

3) SET THE LOCK-IN TIME CONSTANT TO 100 MILLISECONDS.

A lock-in amplifier detects the signal of interest by, effectively, multiplying the input signal by a unit square wave and low pass filtering the result. The time constant sets the 3dB point of the low pass filter. 100 milliseconds is a good trade-off of rejecting lots of noise, while still allowing the signal to change on a human time-scale. To see signals that change rapidly, set a shorter time constant. For more signal averaging, use a longer time constant.

4) SET THE PHASE TO MAXIMIZE THE SIGNAL ON THE METER.

Assuming that you have a signal, you maximize it by adjusting the reference phase to match the signal phase. Do that using the 'Phase' buttons on the far-right of the panel. You know that you have found the phase of the signal when you hit the +/-90 degree buttons and the signal meter swings down to zero reading. Hit the buttons again to give 180 degrees and the signal should now produce a negative max. High 90 again and you get zero again. Hit it a final time, and you're back to a max. You've just rotated the phase around 2π radians. Lock-ins are excellent!.