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450S Digital Lock-in Amplifier

Features

Scitec Instruments Model 450S is a dual phase DSP lock-in amplifier. It has been designed for computer control and features both Ethernet and RS232 interfaces. All settings can be managed under browser control. State of the art electronics have been used to produce an instrument that is exceptionally versatile and easy to use. The instrument performs all the usual measurements of a dual phase lock-in amplifier, measuring the in-phase and quadrature components, vector magnitude and phase angle.

- **Dual phase instrument**
- **Voltage or current input**
- **Gain settings from 1 µV to 1 V**
- **Frequency range from 1 mHz to 200 kHz**
- **High performance wide bandwidth input gain stage**
- **Digital demodulation**
- **First and second order digital filters with time constants from 1 µs to 500 ks**
- **Operation at 1/8, 1/4, 1/2, 1, 2, 4, 8th harmonics of the reference signal.**
- **Ethernet and RS232 interfaces**
- **Control selection and adjustment by onscreen menus and sub-menus via web browser**
- **All outputs are general purpose and fully programmable**

Lock-in amplifiers are used to measure the amplitude and phase of small AC signals in the presence of much larger noise levels. They are widely used to recover small optical signals such as those encountered in spectroscopy and studies of fluorescence and luminescence. However, they also have applications in many other fields including electronics and cryogenics where they can be used in component characterisation, bridge networks and to measure the resistance of superconductors. The output from a lock-in amplifier is a DC voltage proportional to the amplitude of the input signal but with the noise removed. It is also a function of the relative phase difference between the input signal and the associated reference signal. This property allows lock-in amplifiers to be used for measuring the phase properties of the input signal as well. Scitec Instruments DSP lock-in amplifiers are dual phase instruments. Dual phase lock-in amplifiers have two demodulators which make measurements with a 90° phase separation.

A key figure of merit used for lock-in amplifiers is dynamic reserve. The dynamic reserve of a lock-in amplifier is defined as the ratio of the noise to signal that is allowed before saturation occurs. The maximum dynamic reserve for the Model 450S is 100dB (*), allowing an input signal buried in noise of up to 100,000 times larger to be recovered.
(*) This figure is subject to change

Specifications

Input Signal Channel

The input signal channel amplifies the input signal to a level suitable for digitisation. High performance, low-noise, broad-band amplifiers are used throughout. The input circuitry can accept voltage or current inputs via the front panel signal input BNC.

- **Input: voltage or current inputs, via front panel BNC**
- **Sensitivity: 1 µV to 1 V (for 1 V output) switched in 1, 2, 5, 10 steps**
- **Input Impedance: 108 ohm//50 pF, dc coupled**
- **Frequency: 1 mHz to 200 kHz**
- **Maximum Inputs: ±3 V before input protection circuitry comes into operation.**
- **Dynamic Reserve: 100 dB max(*), limited by a maximum signal input noise voltage of 1 V**

(*) This figure is subject to change

Demodulator

The output of the signal input stage is processed using a very high bandwidth digital demodulator to recover the input signal.

Low Pass Filters

Following demodulation, first or second order low pass filters may be selected.

- **Time Constant: 1 µs to 500 ks in 1, 2, 5, 10 steps**
- **Output: +/-1 V output corresponds to full scale input, with headroom to 4.5 V. Short circuit protection included**
- **Offset: Up to 1x full scale, switchable on or off**
- **780 kHz output update rate**

Reference Channel

- **Frequency: 1 mHz to 200 kHz**
- **Input Impedance: 100K**
- **Trigger: Zero crossing at 0 V and -0.1 V. TTL/CMOS trigger points at 2 V and 1 V**
- **Acquisition Time: 1.5 cycles + 2 µs**

General

- **Power: 9 V, 1.8 A**
- **Mechanical: 435(W) x 44(H) x 300(D) mm**
- **Temperature range: 0-50°C**

Warranty: 2 years from date of shipment

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