QS-DS-PhysLock-22-A

Datasheet

Qosain Scientific PhysLock

Introduction:

A lock-in amplifier is a simple, entry level low cost and standalone instrument which is useful for detecting and amplifying signals that are frequency synchronized with a reference signal. It is particularly important for detecting and measuring small signals in the presence of large noise. It is a device used to recover weak oscillating signals buried in overwhelming noise. The basic working principle of a lock-in amplifier is phase sensitive detection where an oscillating reference signal of frequency f_o is multiplied with the input signal that has been modulated at f_o and then passed through a low-pass filter. The design is based on a modulator/demodulator integrated circuit and uses a minimum number of components to accomplish input amplification, phase-sensitive detection, low-pass filtering, and dc amplification of the output signal. Physlock is based on the integrated circuit AD630 and will be helpful in teaching students about low-level signal detection which is commonplace in numerous tasks in the experimental physics laboratory. It can also be used in the research laboratory.

Specifications:

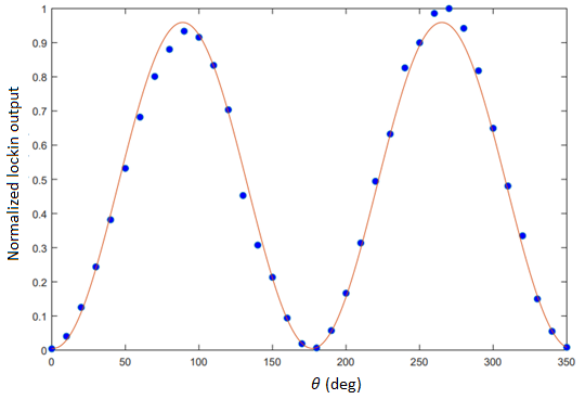
- Power 220 V, 50 Hz
- Reference signal amplitude > 1 V
- Dynamic Range 60 dB to 70 dB
- DC gains 1x or 10x
- AC input gains 1x, 50x, 100x, 500x, 1000x, 2000x, 5000x
- Low pass filter time constants 1 s, 0.1 s, 10 ms, 0.1 ms, 10 μs
- Form of input signal Low frequency (< 1 kHz) periodic signal (square to sine converter is also provided).

Features:

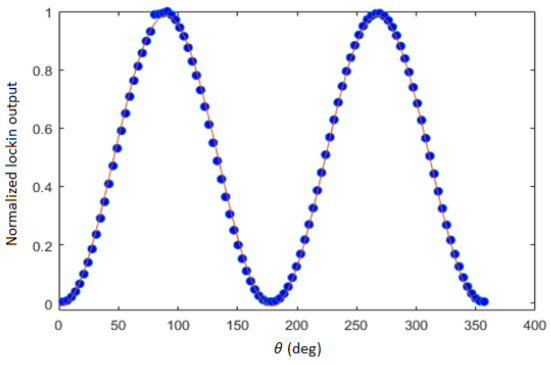
Typical Applications

- Verification of Malus' Law
- Low-level optical signals detection
- Detect noise-imposed signals

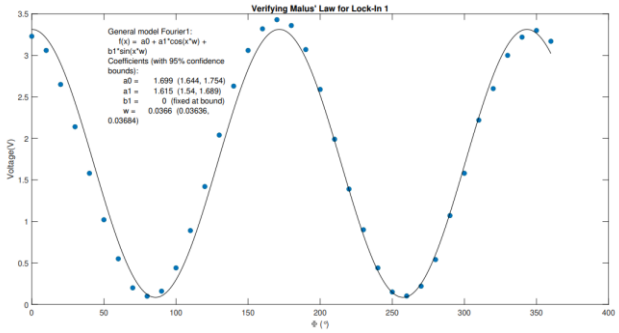
Sample Results



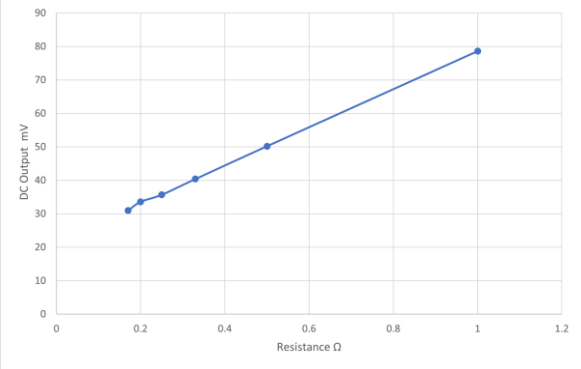
Verifying Maus Law: Intensity of an optical beam as a function of angle between laser source and analyzer, with a current type photodiode at a chopper frequency of 1 kHz, Time Constant: 1 s, I-V converter gain of 1 M, Input Gain: 1x, Reference Phase (Coarse): 1nF, Wavelength of Laser: 405 nm.



Verifying Maus Law: Intensity of an optical beam as a function of angle between laser source and analyzer. The signal is detected using PhysLock and a voltage type photodiode is used. The parameters are as follows, Time Constant: 1 s, Input Gain: 1x, Reference Phase (Coarse): 1nF, Frequency of Optical Chopper: 1 kHz, Wavelength of Laser: 405 nm.



Verifying Malus Law with PhysLock with Time Constant: 1 s, Input Gain: 1x, Reference Phase (Coarse): 1nF, Frequency of Optical Chopper: 1 kHz, Wavelength of Laser: 405 nm.



PhysLock output in mV when input signal is changed using Resistance in a voltage divider circuit.

Sample Data

Verifying Malus Law with PhysLock: Output Data with a Current Type Photodiode:

Analyzer Angle θ	DC output (mV)	Analyzer Angle θ	DC output (mV)
0	7.3	190	108.6
10	76.7	200	316.4
20	237.8	210	596
30	463	220	939
40	725	230	1202
50	1011	240	1570
60	1296	250	1710
70	1522	260	1873
80	1673	270	1900
90	1774	280	1790
100	1740	290	1554
110	1584	300	1234
120	1337	310	913
130	860	320	636
140	584	330	284.7
150	405	340	104.4
160	178.3	350	15.5
170	35.6	360	7.3

Verifying Malus Law with PhysLock: Output Data with Voltage Type Photodiode

Analyzer Angle θ	DC output (mV)	Analyzer Angle θ	DC output (mV)
3.5	2.3	182	2.5
7	5.8	185.5	6.4
10.5	15.3	189	10.5
14	30.4	192.5	22.9
17.5	51.1	196	41
21	77.3	199.5	64.4
24.5	109.4	203	92.6
28	146.2	206.5	125.9
31.5	187.3	210	162
35	233.3	213.5	201.8
38.5	283.3	217	245.5
42	338.1	220.5	290.9
45.5	394	224	385
49	450	227.5	410
52.5	504	231	433
56	566	234.5	480
59.5	625	238	525
63.5	684	241.5	569
66.5	737	245	610
70	792	248.5	647
73.5	836	252	675
77	875	255.5	708
80.5	906	259	730
84	930	262.5	744
87.5	941	266	750
91	957	269.5	758
94.5	957	273	754
98	941	276.5	746

101.5	920	280	734
105	892	283.5	716
108.5	839	287	692
112	812	290.5	666
115.5	763	294	637
119	712	297.5	604
122.5	659	301	563
126	598	304.5	522
129.5	537	308	480
133	479	311.5	433
136.5	422	315	389
140	364	318.5	340
143.5	307.5	322	297
147	255.4	325.5	254.4
150.5	207.9	329	212
154	164	332.5	171
157.5	124.1	336	134
161	89.2	339.5	103
164.5	60	343	74.1
168	36.5	346.5	49.3
171.5	19.3	350	29.4
175	8	353.5	15.3
178.5	2.7	357	6

Resources

- Instrument URL: www.physlogger.com/PhysLock.html
- Discussion: www.community.physlogger.com/c/physinstruments/physlock/50