Model 5105

Dual-Phase Analog Lock-in Amplifier Module

FEATURES

- **5 Hz to 20 kHz operation (or single "spot" frequency up to 100 kHz)**
- **Voltage mode input**
- **Squarewave demodulation**
- **Adjustable low-pass and high-pass signal channel filters**
- **Up to 80 dB dynamic reserve**
- **Complete with software**

APPLICATIONS

- **Chopped light measurements**
- **Multiple instrument systems**
- **Teaching the principles of phase-sensitive detection**

DESCRIPTION

The model 5105 is a compact dual-phase lock-in amplifier ideal for those signal recovery applications not demanding the performance offered by more sophisticated instruments in the **SIGNAL RECOVERY** range. It does not incorporate controls for manual operation but instead is operated entirely via an RS232 interface using simple ASCII character string commands. This approach allows the unit to be located closer to the signal source than is the case with PC card based instruments, thereby improving performance.

The instrument uses two switching type (squarewave) demodulators to measure the magnitude of the input signal in-phase (X) and in quadrature (Y) with the applied reference signal, and outputs both analog and digital representations of these values. The analog outputs are provided at front panel BNC connectors while the digital values, and in addition the resulting signal vector magnitude and phase angle, are available as responses to RS232 commands.

The signal channel includes high and low-pass filters which can be set to "bracket" the signal of interest thereby further improving the noise rejection, while the reference channel will operate from an external TTL or analog reference waveform.

Included with each instrument is a copy of **5105Acquire,** a simple but versatile software package supporting up to ten instruments for Windows PC, giving access to all the instrument's controls and outputs. In addition, LabVIEW drivers are available for users wishing to use that environment to develop their own control software.

Supplied complete with a separate line power supply and 9-pin RS232 cable, the model 5105 is ready to use "out of the box". Its low cost and high performance allows phase sensitive signal recovery techniques to be used in many new applications.

Specifications

General
Dual-phase analog lock-in amplifier operating over a reference frequency range of 5 Hz to 20 kHz, but also available calibrated for use at one user-specified spot frequency in the range 20 kHz to 100 kHz

Measurement Modes
The instrument can simultaneously measure these outputs:

X	In-phase	
Y	Quadrature	
R	Magnitude	
θ	Phase Angle	
Harmonic	F only	

Signal Channel

Modes	Pseudo-differential
Grounding	BNC shield can be grounded or floated via 1 kΩ to ground using internal jumper
Full-scale Sensitivity	10 µV to 1 V in a 1-3.16-10 sequence (10 dB steps)
Max. Dynamic Reserve	> 80 dB
Impedance	10 MΩ // 30 pF
Maximum Safe Input	20 V pk-pk
Voltage Noise	< 30 nV/√Hz @ 1 kHz
C.M.R.R.	> 40 dB @ 1 kHz
Frequency Response	5 Hz to 100 kHz

www.signalrecovery.com

Model 5105 Specifications

Input (continued)

Gain Accuracy	± 2% typical for digital outputs; ± 6% typical for analog outputs
Gain Stability	200 ppm/°C typical

Signal Channel Filters

High-pass Signal Channel Filter
- -3 dB frequency: 1 Hz, 10 Hz, 100 Hz or 1 kHz

Low-pass Signal Channel Filter
- -3 dB frequency: 50 Hz, 500 Hz, 5 kHz or 50 kHz

Frequency Accuracy: ± 10%

Reference Channel

Mode	TTL or Analog
Frequency Range	5 Hz to 20 kHz
Analog Impedance	1 MΩ // 30 pF
Phase Set Resolution	0.1° increments
Phase Set Accuracy	± 1°
Phase Noise	≤ 0.015° rms @ 1 kHz, 100 ms, 12 dB TC ≤ 0.007° rms @ 10 kHz, 100 ms, 12 dB TC
Phase Drift	< 0.05°/°C
Orthogonality	± 1°
Acquisition Time	1 s + 2 cycles max

Demodulator and Output Processing

Mode	Squarewave switching demodulator + HP/LP filters

Zero stability/Dynamic Reserve

Mode	Dynamic Reserve (Filters Off)	Zero Stability
High DR	46 dB	500 ppm/°C
Normal	26 dB	100 ppm/°C
High Stability	6 dB	40 ppm/°C

Output Filters

Time Constants
  Analog and Digital Outputs

Fast Mode	300 µs, 1 ms, 3 ms or 10 ms (316 µV to 1 V FS sensitivity)
Normal Mode	30 ms, 100 ms, 300 ms or 1 s
Digital Outputs only	3 s and 10 s
Accuracy	±10%
Slope	6 dB/octave or 12 dB/octave
Offsets	±20% full-scale, X and/or Y

Outputs

Main Analog (X and Y) Outputs
Amplitude	±1 V FS
Impedance	1 kΩ
Signal Monitor	10 V pk-pk maximum

Reference Output
Waveform	0 to 5 V rectangular wave
Impedance	TTL-compatible

Interface

Type
  RS232 via 9-pin D type plug, configured as a DTE device. Two ports are provided allowing up to sixteen model 5105 or compatible instruments to be controlled from a single computer port

Parameters (fixed)
  4800 baud, no parity, 8 data bits and 1 stop bit

Addressing
  Rear panel rotary switch assigns a unique address to each instrument

Controls
  Sensitivity, High and Low-Pass Filter settings, Dynamic Reserve, Reference Phase, Time Constant and Slope can all be set and read via RS232 command

Auto Functions
  Auto-Phase and Auto-Offset

Data Transfer Rate

6 - 8 readings per second typical

Outputs

X and Y	Max count = ±1200 (±1000 = FS)
Magnitude	Max count = 1200 (1000 = FS)
Signal Phase	Max count = ±1800, corresponding to ±180°
Ref Frequency	Response in millihertz

General

Software & RS232 Cable

5105Acquire, a full applications package for IBM PC or 100% compatible computer and supporting up to ten instruments, is supplied with each unit. This package allows access to all instrument controls and displays two selected instrument outputs.

In addition, a LabVIEW driver suitable for version 4.01 and later of LabVIEW is available by download from our website at **www.signalrecovery.com**

The instrument is also compatible with the full *SIGNAL RECOVERY* Acquire Lock-in Amplifier Applications software. A free demonstration version can be downloaded from the above website.

2 meter null-modem cable suitable for connecting the instrument to a 9-pin D-type RS232 plug on a PC computer is also included

Power Requirements: +18 V DC unregulated @ 300 mA, -18 V DC unregulated @ 80 mA

A separate power supply (model PS0108) suitable for 110 V 60 Hz or 230 V 50 Hz operation is supplied with each instrument

Dimensions
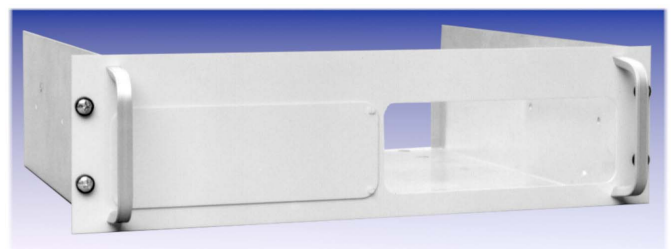|	
Width	8¼" (209 mm)
Depth	10½" (266 mm)
Height	3½" (85 mm)
Weight	5 lb (2.3 kg)

Remote Line Power Supply
Model PS0108
included with each instrument

Rack Mount Kit
Model K0304
Allows 1 or 2 model 5105 lock-in amplifiers to be mounted in a standard 19" rack.

Why should you choose *SIGNAL RECOVERY* products?

Model 5105 Dual Phase Analog Lock-in Amplifier Module

SIGNAL RECOVERY Product Features	Benefit to you
◆ Low cost module	Saves you money
◆ Ideal for teaching applications	Students learn the advantages of lock-in detection and, having done this can move on to develop their own simple data acquisition and analysis program to control the instrument
◆ Genuine analog outputs	When used as part of feedback loop, the experiment can be designed to be unconditionally stable
◆ Switching-type demodulator	Response matches square wave signals generated by chopped light experiments, giving outputs nearly a fifth bigger for the same signal than with sinusoidal responding instruments
◆ Daisy Chain RS232	Multiple instruments can be operated from a single RS232 port, avoiding the expense of a GPIB card and cables
◆ Excellent LabVIEW driver	Saves programming time
◆ Complete with operating software and compatible with the full Acquire package	Eliminates the need to develop programs
◆ Compatible with SRInstComms	Control the instrument from any ActiveX enabled programming language, such as Visual Basic, VBA (Excel, Word, Access) and VBScript (Internel Explorer)

Model 5106 Dual Phase Analog Lock-in Amplifier PCB Assembly

SIGNAL RECOVERY Product Features	Benefit to you
◆ Lowest cost *SIGNAL RECOVERY* lock-in	Ideal for incorporating into larger systems and for OEM use
◆ Genuine analog outputs	When used as part of feedback loop, the experiment can be designed to be unconditionally stable
◆ Switching-type demodulator	Response matches square wave signals generated by chopped light experiments, giving outputs nearly a fifth bigger for the same signal than with sinusoidal responding instruments
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◆ Compatible with SRInstComms	Control the instrument from any ActiveX enabled programming language, such as Visual Basic, VBA (Excel, Word, Access) and VBScript (Internel Explorer)