



OL4000 DSP Lock-in Card



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The DSP AC Lock-in/DC card consists of a dual-phase AC lock-in amplifier and DC signal measurement amplifier on a single card.

The card is optimized for general purpose DSP applications. Two gain stages, and four gain ranges are provided to enhance the signal input flexibility. Four auxiliary A/D converter inputs are provided. Dual general purpose D/A converter outputs are also available.

This card provides enhanced monitoring capabilities by allowing the user to view both the signal and reference outputs. In addition, two programmable analog outputs may be monitored for multi-function readouts of the DSP process. On board memory allows the card to be used in embedded PC applications, digital signal storage, etc. Multi-purpose digital I/O provide control for external pre-amps and other devices.

OL4000 Features

- 5Hz to 100kHz range
- Signal Auto-Ranging, Auto-Reserve
- Auto-Zeroing in Software
- Adjustable Constant Time
- Software-based A/D Calibration
- DC signal input capability
- Four Programmable Gain Ranges
- Phase-Lock Loop circuitry ensures accurate timing characteristics.
- DC-to-DC on-board power conversion for ultra low power supply noise.
- High Density Programmable Logic Devices
- 60Hz/120Hz (50Hz/100Hz) Notch Filters
- Standard ISA Bus PC compatible

The Lock-in uses DSP (digital signal processing) to perform the "synchronous rectification" which is central to the operation of all lock-in amplifiers. By transferring the synchronous rectification process from the analog domain to the digital domain, the non-linearities, gain, offset errors and drift, harmonic distortion, etc. inherent to the process of analog multiplication are virtually eliminated.

Some important benefits achieved by using DSP are:

Increased Accuracy

The gain and offset errors of the analog low-pass filters which average the outputs of the analog multipliers are virtually eliminated by implementing the low pass filtering function with DSP.

Reliability

Digital Lock-in components are much less prone to failure and drift. Also there are no gain, offset, or phase pots to readjust. Gains and offsets are software-calibrated, eliminating common sources of error.

Increased Dynamic Reserve

Dynamic Reserve is related to measurement sensitivity and refers to the amount of noise that can be rejected without affecting the measurement by more than 5% of the reading. The formula for dynamic reserve is: $DR = 20 \cdot \log(\text{noise}/\text{signal})$. The Lock-in achieves dynamic reserve up to 100 dB (noise/signal = 100,000). This means that the unit can effectively measure a signal buried within noise 100,000 times as large. The most practical benefit of this increase in dynamic reserve will be increased accuracy in the measurement of low level signals.

Increased Linearity

Linearity is determined by the excellent inherent linearity of the A/D converter that feeds the DSP, and by the small amount of harmonic distortion (produced mainly by quantisation error) of the DSP.

Electrical & Mechanical Specifications

- Zero control automatically subtracted when selected
- Computer interface ISA Standard Bus for PCs
- Integration Time: 0.001s - 60s
- Power requirements: 5VDC @2A from PC bus
- Weight: 341g (12.4 oz).
- Size: 10.5 x 4.2 inches approx.

Specifications

Sampling Rate:	
200kHz	18-bit resolution
AC Voltage Mode:	
F.S. Sensitivity	$2 \times 10^{-5} \text{V}$ to 2V
Resolution	$1.0 \times 10^{-9} \text{V}$
Basic Accuracy	+/-0.1%
DC Voltage Mode:	
Voltage Range	-2 to +2 volts
Resolution	$1.0 \times 10^{-4} \text{volts}$
Basic Accuracy	+/- 0.1%
Dynamic Reserve	100dB without pre-filtering
Reference:	
Frequency Range	5Hz to 100kHz
Reference Input	TTL or sine, 750mVp-p min

OL 4000-100 Preamplifier

The optional OL 4000-100 Preamplifier provides additional hardware for mating a wide variety of signal sources directly to the OL 4000. It eliminates the need for custom interface hardware and is designed specifically for use with Application Software included with the OL 4000. It provides the following benefits when used with the OL 4000:

- Signal preamplification for low level signals
- Current-to-voltage converter
- Single-ended and differential voltage input

Software

A Windows 95/98 compatible application program is provided as an elementary interface to configure and control the various operational modes of the OL 4000 and optional OL 4000-100.

An Application Program Interface (API) is included which provides experienced c++ programmers the software "tools" to customise the configuration and signal acquisition using a Windows Dynamic Link Library (DLL) for OEM applications. For users lacking such

resources, software customisation services are available.

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