

# SIGNAL RECOVERY

...part of **AMETEK**® Advanced Measurement Technology Inc

**Lowest Cost**

## Applications:

- Scanned probe microscopy
- Audio research
- AC impedance measurements
- Electrochemistry research
- Optics research

## Features:

- 1 mHz to 120 kHz frequency range with an option to extend upper limit to 250 kHz
- Built-in web pages for control from any computer on the same network
- Dual Reference, Dual Harmonic and Virtual Reference modes
- Precision DDS sinewave oscillator with adjustable amplitude and frequency
- Oscillator output can be amplitude and/or frequency modulated
- Voltage and current mode inputs
- Harmonic measurements up to 127 x F
- 10  $\mu$ s to 100 ks output filter time constants
- 1.0 MHz main ADC sampling rate
- Auxiliary analog and digital inputs and outputs
- Internal data buffer for logging instrument outputs
- USB, RS232 and Ethernet computer interfaces
- Free LabVIEW driver

## Model 7230 DSP Lock-in Amplifier



**SIGNAL RECOVERY** is proud to introduce a new concept in general-purpose DSP Lock-in Amplifier design. The Model 7230 is the instrument that offers the excellent performance we are known for, but at a lower price than competitive models.

We've achieved this improvement in price/performance ratio by replacing traditional control buttons and display with easy-to-use control panels that can be operated from any computer via your favourite browser. No longer do you need to be in front of the instrument to operate it - now you can set up your experiment in the lab but return to the office while it runs, monitoring what is happening via your computer. And if you need to make a change to a setting then it's as easy as clicking a button on a web page.

You can use any web compatible device to operate the Model 7230, ranging from a simple netbook to the most powerful development machine, from an Android smartphone to the latest iPad. No special software is needed, since the panels work directly through the device's browser.

This is a completely silent instrument, because it does not require the use of cooling fans. It is also compact and light-weight, which makes it much easier to accommodate in crowded laboratories.

The Model 7230 is normally configured for operation over a frequency range extending from 1 mHz to 120 kHz. However, for a small extra charge it can also be delivered, or upgraded via a firmware update pack, to allow operation at frequencies of up to 250 kHz.

In summary, the Model 7230 offers a very cost-effective solution to users who need a lock-in amplifier suitable for straightforward applications but with the versatility to also be used in complex experiments.



Model 7230 can be controlled remotely using the web browser on anything from a powerful PC to an iPad or smartphone

[www.signalrecovery.com](http://www.signalrecovery.com)



# Model 7230: Specifications

**Note:** \* In the following specifications, the standard upper frequency range is 120 kHz, but it can be extended to 250 kHz by fitting the 7230/99 option.

## Measurement Modes:

- **Outputs:** The instrument can simultaneously show any four of these outputs on the front panel display:
 

X	In-phase
Y	Quadrature
R	Magnitude
$\theta$	Phase Angle
Noise	
- **Harmonic Detection:** nF,  $n \leq 127$
- **Dual Harmonic:** Simultaneously measures the signal at two different harmonics F1 and F2 of the reference frequency
- **Dual Reference:** Simultaneously measures the signal at two different reference frequencies, F1 and F2 where one reference signal is external and the other internal
- **Tandem Demodulation:** Demodulates the signal using the reference frequency F1, and then passes the resulting X channel output to a second demodulator running at an external reference frequency F2
- **Virtual Reference:** Locks to and detects a signal without a reference ( $100 \text{ Hz} \leq F \leq 120 \text{ kHz}^*$ )
- **Noise:** Measures noise in a given bandwidth centered at the reference frequency F

## Signal Channel:

- **Voltage Input**

Modes	A only, -B only or Differential (A-B)
Frequency Range	1 mHz to 120 kHz *
Sensitivity	10 nV to 1 V in a 1-2-5 sequence
Max Safe Input	$\pm 12.0 \text{ V pk}$
Input Noise	5 nV/ $\sqrt{\text{Hz}}$
Impedance	
FET Input	10 M $\Omega$ // 25 pF
Bipolar Input	10 k $\Omega$ // 25 pF
- **Current Input**

Modes	Low Noise Mode Wide Bandwidth Mode
Frequency Range	
Low Noise	1 mHz to 500 Hz
Wide Mode	1 mHz to 50 kHz
Sensitivity	
Low Noise	2 fA to 10 nA in a 1-2-5 seq.
Wide Mode	2 fA to 1 $\mu\text{A}$ in a 1-2-5 seq.
Input Noise	
Low Noise	13 fA/ $\sqrt{\text{Hz}}$ at 500 Hz
Wide Mode	130 fA/ $\sqrt{\text{Hz}}$ at 1 kHz
Impedance	
Low Noise	< 2.5 k $\Omega$ at 100 Hz
Wide Mode	< 250 $\Omega$ at 1 kHz

## Reference Channel:

- **TTL Input**

Connection	From back panel
Frequency range	1 mHz to 120 kHz *
- **Analog Input**

Connection	From front panel
Impedance	1 M $\Omega$ // 30 pF
Sinusoidal Input	
Level	1.0 V rms
Frequency range	0.5 Hz to 120 kHz *
Squarewave Input	
Level	250 mV rms
Frequency range	2.0 Hz to 120 kHz *
- **Phase set resolution** 0.001° increments

- **Phase noise at 100 ms TC, 12 dB/octave slope**

Internal reference	< 0.0001° rms
External reference	< 0.01° rms
- **Orthogonality** 90°  $\pm 0.0001^\circ$
- **Reference acquisition time**

Internal reference	instantaneous acquisition
external reference	2 cycles + 1 sec

## Oscillator:

- **Frequency**

Range	1 mHz to 120 kHz *
Setting Resolution	1 mHz
Absolute Accuracy	$\pm 50 \text{ ppm}$
- **Amplitude**

Range	1 $\mu\text{V}$ to 5 V
Setting Resolution	1 $\mu\text{V}$ (min)
- **Output Impedance** 50 $\Omega$
- **Amplitude and Frequency modulation options**

## Demodulators and Output Processing:

- **Harmonic Rejection** -90 dB
- **Output Filters**

Time Constant (TC)	10 $\mu\text{s}$ —100 ks in 1-2-5 seq.
Slope (roll-off)	
TC $\leq 5 \text{ ms}$	6 or 12 dB/octave
TC > 10 ms	6, 12, 18 or 24 dB/octave
- **Synchronous Filter** Available for F < 20 Hz

## Auxiliary Inputs:

- **ADC 1, 2, 3 and 4**

Maximum Input	$\pm 11 \text{ V}$
Resolution	1 mV
Accuracy	$\pm 20 \text{ mV}$
Trigger Mode	Internal, External or Burst

## Auxiliary Outputs:

- **Analog Outputs: DAC 1, 2, 3 and 4**

DAC1	X, X1, Mag2, User DAC1, Function Y, Y1, Pha2, User DAC2, Function X2, Mag, Mag1, User DAC3, Function Y2, Pha, Pha2, User DAC4, Function Noise, Ratio, Log Ratio and User Equations 1 & 2
DAC2	
DAC3	
DAC4	
Function	
Update rate	1.0 MHz or 1.0 kHz

## Data Storage Buffer:

- **Size** 100,000 data points
- **Max Storage Rate**

Fast Mode	1 MHz (limited variables)
Normal	1 kHz (all variables)

## PC Interfaces (from the Main Console):

- USB 2.0
- Ethernet
- RS232

## General:

- **Power supply**

via external PS0110 Power Supply Unit	
Voltage	100—250 VAC
Frequency	50/60 Hz
Power	40 VA max
- **Dimensions**

Width	15.5" (390 mm)
Depth	10.0" (250 mm)
Height	3.0" (64 mm)
- **Weight** 6.6 lb (3.0 kg)

For more detailed specifications or information on pricing, special purchase and accessory options, contact us at:

**SIGNAL RECOVERY**

[www.signalrecovery.com](http://www.signalrecovery.com)  
[info@signalrecovery.com](mailto:info@signalrecovery.com)

**AMETEK**<sup>®</sup>  
Advanced Measurement Technology

AMETEK AMT: Unit B1 Armstrong Mall, Southwood Business Park, Farnborough, Hampshire, GU14 0NR, United Kingdom  
Tel: +44 (0) 1252 556800 Fax: +44 (0)1252 556899