Signal Recovery Models 7280 and 7280BFP
Specifications

The table gives the specifications for the models 7225/7225BFP and 7265 DSP Lock-in Amplifiers. The few cases where the specifications differ between the two models are shown on a gray background.

	7280	7280BFP
		
General	Dual-phase DSP lock-in amplifiers operating over a reference frequency range of 0.5 Hz to 2.0 MHz. Direct digital demodulation using a main ADC sampling rate of 7.5 MHz. Wide range of extended measuring modes and auxiliary inputs and outputs. User-upgradeable firmware.	
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 θ Phase Angle Noise	The following outputs are available: X In-phase Y Quadrature R Magnitude θ Phase Angle Noise
Harmonic Detection	*n*F, $n \leq 32$	
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 F1 is the external and F2 the internal reference	
Frequency Ranges for Dual Harmonic and Dual Reference Modes:		
Standard Unit	F1 and F2 ≤ 20 kHz	
With option -/99	F1 and F2 ≤ 800 kHz	
With option -/98	F1 and F2 ≤ 2.0 MHz	
Virtual Reference	Locks to and detects a signal without a reference (100 Hz ≤ F ≤ 2.0 MHz)	

Noise	Measures noise in a given bandwidth centered at the reference frequency F	
Spectral Display	Gives a visual indication of the spectral power distribution of the input signal in a user-selected frequency range lying between 1 Hz and 2.0 MHz. Note that although the display is calibrated in terms of frequency, it is not calibrated for amplitude. Hence it is only intended to assist in choosing the optimum reference frequency	Not available
Display	320 × 240 pixel (¼ VGA) electroluminescent panel giving digital, analog bar-graph and graphical indication of measured signals. Menu system with dynamic key function allocation. On-screen context sensitive help	Not fitted

Signal Channel

Voltage Input

Modes	A only, -B only or Differential (A-B)
Full-scale Sensitivity	
0.5 Hz ≤ F ≤ 250 kHz	10 nV to 1 V in a 1-2-5 sequence
250 kHz < F ≤ 2.0 MHz	100 nV to 1 V in a 1-2-5 sequence
Max. Dynamic Reserve	> 100 dB
Impedance	100 MΩ // 25 pF
Maximum Safe Input	20 V pk-pk
Voltage Noise	5 nV/√Hz @ 1 kHz
C.M.R.R.	> 100 dB @ 1 kHz

Frequency Response	0.5 Hz to 2.0 MHz
Gain Accuracy	±0.3% typ, ±0.6% max. (full bandwidth)
Distortion	-90 dB THD (60 dB AC gain, 1 kHz)
Line Filter	attenuates 50, 60, 100, 120 Hz
Grounding	BNC shields can be grounded or floated via 1 kΩ to ground
Current Input	
Mode	Low Noise, Normal or Wide Bandwidth
Full-scale Sensitivity	
Low Noise	10 fA to 10 nA in a 1-2-5 sequence
Normal	10 fA to 1 µA in a 1-2-5 sequence
Wide Bandwidth	
F ≤ 250 kHz	1 pA to 100 µA in a 1-2-5 sequence
F > 250 kHz	10 pA to 100 µA in a 1-2-5 sequence
Max. Dynamic Reserve	> 100 dB
Frequency Response (-3 dB):	
Low Noise	≥ 500 Hz
Normal	≥ 50 kHz
Wide Bandwidth	≥ 1 MHz
Impedance	
Low Noise	< 2.5 kΩ @ 100 Hz
Normal	< 250 Ω @ 1 kHz
Wide Bandwidth	< 25 Ω @ 10 kHz
Noise	

Low Noise	13 fA/√Hz @ 500 Hz
Normal	130 fA/√Hz @ 1 kHz
Wide Bandwidth	1.3 pA/√Hz @ 1 kHz
Gain Accuracy	± 0.6% typ, midband
Line Filter	attenuates 50, 60, 100, 120 Hz
Grounding	BNC shield can be grounded or floated via 1 kΩ to ground

Reference Channel

TTL Input	
Frequency Range	0.5 Hz to 2.0 MHz
Analog Input	
Impedance	1 MΩ // 30 pF
Sinusoidal Input	
Level	1.0 V rms*
Frequency Range	0.5 Hz to 2.0 MHz
Squarewave Input	
Level	250 mV rms
Frequency Range	2 Hz to 2 MHz
	*Note: Lower levels can be used with the analog input at the expense of increased phase errors
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 @ 1 kHz
Orthogonality	90° ±0.0001°

Acquisition Time		
Internal Reference	instantaneous acquisition	
External Reference	2 cycles + 50 ms	
Reference Frequency Meter Resolution	1 ppm or 1 mHz, whichever is the greater	

Demodulator and Output Processing

Output Zero Stability		
Digital Outputs	No zero drift on all settings	
Displays	No zero drift on all settings	Not Available
Analog Outputs	< 5 ppm/°C	
Harmonic Rejection	-90 dB	
Output Filters		
X, Y and R outputs only		
Time Constant	1 µs to 1 ms in a 1-2-5 sequence, and 4 ms	
Slope (roll-off)	6 and 12 dB/octave	
All outputs		
Time Constant	500 µs to 100 ks in a 1-2-5 sequence	
Slope	6, 12, 18 and 24 dB/octave	
Synchronous Filter	Available for F < 20 Hz	
Offset	Auto and Manual on X and/or Y: ±300% full-scale	
Absolute Phase Measurement Accuracy	≤ 0.01°	

Oscillator

Frequency	
Range	0.5 Hz to 2.0 MHz

Setting Resolution	1 mHz
Absolute Accuracy	± 50 ppm
Distortion (THD)	-80 dB @ 1 kHz and 100 mV rms
Amplitude (rms)	
Range	1 mV to 1 V
Setting Resolution	1 mV
Accuracy	±0.2%
Stability	50 ppm/°C
Output Impedance	50 Ω
Sweep	
Amplitude Sweep	
Output Range	0.000 to 1.000 V rms
Law	Linear
Step Rate	20 Hz maximum (50 ms/step)
Frequency Sweep	
Output Range	0.5 Hz to 2.0 MHz
Law	Linear or Logarithmic
Step Rate	1 kHz maximum (1 ms/step) @ output time constant settings of 500 µs or longer; 140 ms/point otherwise

Auxiliary Inputs

ADC 1, 2, 3 and 4	
Maximum Input	±10 V
Resolution	1 mV
Accuracy	±20 mV
Input Impedance	1 MΩ // 30 pF

Sample Rate	
ADC 1 only	40 kHz max.
ADC 1 and 2	17.8 kHz max.
Trigger Mode	Internal, External or burst
Trigger Input	TTL compatible

Outputs

Main Analog (CH1 and CH2) Outputs:

Function	X, Y, R, θ, Noise, Ratio, Log Ratio and User Equations 1 & 2.
Amplitude	±2.5 V full-scale; linear to ±300% full-scale
Impedance	1 kΩ
Update Rate	
X, Y or R @ TC ≤ 4 ms	7.5 MHz
All outputs @ TC ≥ 500 µs	1 kHz

Signal Monitor

Amplitude	±1 V FS
Impedance	1 kΩ

Auxiliary D/A Output 1 and 2:

Maximum Output	±10 V
Resolution	1 mV
Accuracy	±10 mV
Output Impedance	1 kΩ
8-bit Digital Port	0 to 8 lines can be configured as inputs, with the remainder being outputs. Each output line can be set high or low and each input line read to allow interaction with external equipment. Extra line acts as trigger input

Reference Output	
Waveform	0 to 3 V rectangular wave, active in External Reference Mode only
Impedance	TTL-compatible
Power - Low Voltage	±15 V at 100 mA rear panel 5-pin 180° DIN connector for powering ***SIGNAL RECOVERY*** preamplifiers

Data Storage Buffer

Size	32k × 16-bit data points, may be organized as 1×32k, 2×16k, 3×10.6k, 4×8k, etc.
Max Storage Rate	
From LIA	up to 1000 16-bit values per second
From ADC1	up to 40,000 16-bit values per second

User Settings

Up to 8 complete instrument settings can be saved or recalled at will from non-volatile memory	Not available

Interfaces

RS232 and GPIB (IEEE-488). A second RS232 port is provided to allow "daisy-chain" connection and control of up to 16 units from a single RS232 computer port

General

Power Requirements	
Voltage	110/120/220/240 VAC
Frequency	50/60 Hz
Power	200 VA max
Dimensions	
Width	17¼" (435 mm)
Depth	19" (485 mm)
Height	

With feet	6" (150 mm)
Without feet	5¼" (130mm)
Weight	25.4 lb (11.5 kg)