Signal Inputs	DIRECT	5316 NORMAL MODE	5316 XMFR MODE	5317	5381 Conversion Gain A/V					
Sensitivity	1 µV - 1 V	100 nV - 1 V	1 nV - 10 mV	100 nV - 1 V	10^{-9}	10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4}
Frequency Response	1 mHz - 1 MHz	100 mHz - 1 MHz	1 Hz - 50 kHz Dependent On Source Resistance	100 mHz - 1 MHz	1 Hz to 1 kHz	1 Hz to 10 kHz	1 Hz to 50 kHz	1 Hz to 100 kHz	1 Hz to 200 kHz	1 Hz to 200 kHz
Input Impedance	10 MΩ/25 pF	100 MΩ - 15 pF	Transformer Primary Low Impedance	100 MΩ - 15 pF	1 Ω - 50 kΩ DEPENDENT ON CONVERSION GAIN AND FREQUENCY					
Input Noise	25 nV/√Hz @ 1 kHz									
Input Modes	DIFF	SINGLE/DIFF	SINGLE/DIFF	SINGLE/DIFF	SINGLE					
CMRR @ 50/60 Hz	40 dB	100 dB	140 dB	100 dB	NOT APPLICABLE					

Note: All indicated sensitivities are without output expand.

Figure A-1. DIRECT VS. PREAMP INPUT CHARACTERISTICS

A.1 Signal Channel

Frequency range

With DIRECT INPUT selected: 1 mHz to 1MHz in 3 ranges (NORMAL, LOW 1, LOW 2).

With PREAMP selected: frequency range depends on preamplifier type (see table above).

Input impedance

With DIRECT INPUT selected: 10 MΩ in parallel with 30 pF (NORMAL and LOW 1), 100 MΩ in parallel with 30 pF (LOW 2).

With PREAMP selected: input impedance depends on preamplifier type (see table above).

Sensitivity

With DIRECT INPUT selected:

AC coupling, timeconstant > 10 ms: 1 µV to 1 V in 1-2-5 sequence;
timeconstant < 20 ms: 100 µV to 1V in 1-2-5 sequence;
DC coupling: 10 mV to 1 V in 1-2-5 sequence.

With PREAMP selected: sensitivity depends on preamplifier type (see table above).

Preamplifiers

Although the Model 5302 can achieve excellent results in many applications without a preamplifier, we recommend use of one or more of the following plug-in preamplifiers to utilize fully the 5302's capabilities.

5315 Multiplexer	5316 Hi Impedance/Transformer
5317 Hi Impedance	5320 Wide Frequency/Transformer
5381 Current	5383 Remote

Signal-Channel filters

Line Filters:
First and second harmonic notch filters can be switched in to suppress line related pick-up. Notch frequencies are 50 and 100 or 60 and 120 Hz, depending on factory settings.

Main filter:
Frequency range: 2 Hz to 1 MHz.
Normal configuration: 4th order filter in FLAT, BANDPASS, LOWPASS, HIGHPASS, or NOTCH modes; Q = 2.
Special configuration: two 2nd order sections with independent frequency and function control in FLAT, BANDPASS, LOWPASS, HIGHPASS, or NOTCH modes; Q of first filter can be set to 0.7, 2, or 10.

Dynamic Reserve

Up to 125 dB.

A.2 Reference channel

Modes

Internal: waveforms from the internal synthesizer are applied directly to the demodulator. Phase lock is instantaneous and phase noise is lowest. The frequency range is 1 mHz to 1 MHz.

External: below 100 Hz, the digital reference circuit locks to the reference input within one cycle providing very low phase noise. At frequencies above 100 Hz, the analog phase-locked loop provides optimum performance. The frequency range is 1 mHz to 1 MHz. To speed up reference lock at extreme low frequencies use internal mode at the approximate frequency followed by switching to an external reference mode.

Reference Inputs

Analog: the standard inputs at the front-panel REF IN connector are a squarewave of amplitude 100 mV or greater, or a sinusoid of frequency 1 Hz - 1 MHz and amplitude 1 V rms or greater. Reference inputs of less than the standard values can be used at the expense of increased phase noise.

Digital: the rear-panel TTL REF IN connector allows the reference channel to be driven from TTL sources. The reference circuits will always trigger on a positive-going transition. TTL compatible pulse sequences not acceptable to the front-panel reference input can be used.

In order to obtain the best accuracy and reproducibility in the external reference modes, it is advisable to execute the auto-tune function or the LOCK command after any change in reference frequency.

NF - Reference Harmonic Operation

In an NF mode, where N has a value from 2 to 8, the reference frequency is exactly N times the fundamental frequency of the reference input or the internal synthesizer, subject to an upper frequency limit of 1 MHz.

Acquisition Time

This is the time required for the Reference Channel to lock in frequency and phase to the reference input or the internal synthesizer.
External modes: 1 period + 1 second.

Internal mode: 1 period + 1 second in hard phase, instantaneous in soft phase.

Phase shift
Implemented either by reference-channel hardware (Hard Phase) or by vector rotation implemented in software in the demodulator (Soft Phase).

Accuracy: Hard Phase 3°, Soft Phase 1 m°.

Setting Resolution:
Coarse: 0.1°; front-panel knob adjusts phase 360° with 0.1° resolution. Front-panel key adds 90° to the setting with each press.
Fine: 0.001°; After initial phase adjustment in normal mode, FINE PHASE can be used to trim final adjustment. Range is ±1° with 1 m° resolution.

Orthogonality: 0.1°

A.3 Demodulator

Demodulation function
8-step Walsh or squarewave.

Time Constant of Output Filter
1 μs to 1000 s.

Weighting Function of Output Filter
Exponential 6 dB/octave or 12 dB/octave, rectangular (6 dB/octave) or triangular (12 dB/octave).

Digital Outputs
±10000 fs, ±12500 max.

Analog Outputs
CH1, CH2:   ±10.0 V fs, 1 kΩ impedance, 1 mV resolution.
FAST OUT X,Y: ± 9.4 V fs ±3%, 100 Ω impedance.

Stability
Normal: ±1 LSB/°C   (typical)
Hi STAB: ±1 LSB/10° C (typical)
FAST OUT: ±100 μV/°C

A.4 Oscillator

Type
Quartz Controlled Synthesizer

Frequency Range
1 mHz to 1 MHz

Frequency Stability
±30 ppm/°C

Frequency Setting Resolution
0.1% of frequency (typical)

Output Amplitude and Impedance
5 mV - 5 V rms, 450 Ω

Amplitude Stability
0.02%/°C (typical)

Amplitude Setting Resolution
Above 0.5 V: 20 mV
Below 0.5 V: 2.0 mV

Harmonic Distortion
0.2% to 20 kHz; < 1% above 20 kHz.

A.5 Auxiliary I/O

ADC Inputs

There are four ADC inputs on the back panel. The digitized outputs can be read from the ADCS screen or with the use of the ADC command.

Range: ±12.5 V, corresponding to ±12500 decimal (resolution 1 mV).

Input Impedance: 20 kΩ in parallel with 30 pF.

DAC Outputs

There are two DAC outputs on the back panel. The inputs are implemented from the DACS screen or with the use of the DAC command.

Range: ±12.5 V, corresponding to ±12500 decimal (resolution 1 mV).

Output Impedance: 1.0 kΩ.

A.6 Curve store memory

Memory Size

10000 points by 16-bit (15 bits + sign) memory can be subdivided into n separate curves (12 max) each of 10000/n points (e.g. four curves each of 2500 points).

Storage Rate

200 points/second (max)

Readout Rate

RS232: 200 points/second (typical)
IEEE: 250 points/second (typical).

A.7 Power requirements

100 - 117 V ac or 200 - 240 V ac (47 - 63 Hz)
390 W.