1.2 SPECIFICATIONS

1.2A SIGNAL CHANNEL SPECIFICATIONS

Frequency Range
Model 124A: 2 Hz – 210 kHz
Model 124AL: 0.2 Hz – 210 kHz*

Sensitivity: 21 full-scale ranges in 1-2-5 sequence. Full-scale voltages are determined by the choice of preamplifier. Sensitivity and all other preamplifier-determined specifications are given in Table I-1.**

Signal Channel Modes of Operation

(1) FLAT: Flat response within ±1% from 10 Hz to 110 kHz, ±2% from 110 kHz to 210 kHz, and ±10% below 10 Hz.

(2) BANDPASS: Provides a tunable bandpass response with the center frequency set by front-panel digital dials over a range of 2 Hz to 110 kHz. Setting accuracy is within ±2% or 0.05 Hz, whichever is greater. Bandwidth is adjustable over a range of 1% to 100% (at 3 dB points), corresponding to a range of Q between 100 and 1, by means of the front-panel Q control.

(3) NOTCH: Essentially the same as the Flat mode, but with the addition of a tunable notch that provides up to 80 dB of attenuation at any specific frequency. The notch is tuned with the same controls as set the bandpass frequency.

(4) LOW PASS: Essentially the same as the Flat mode, but with the addition of a low pass filter that provides a 12 dB per octave rolloff above the set frequency.

(5) HIGH PASS: Essentially the same as the Low Pass mode, but with the substitution of a high pass filter in place of the low pass filter.

1.2B REFERENCE CHANNEL SPECIFICATIONS

Modes

(1) INTERNAL: Frequency of the internal reference oscillator is set by means of front-panel digital dials and/or rear-panel VCO control voltage. Setting accuracy is within ±2% or 0.05 Hz, whichever is greater. VCO control voltage of 0 to ±10 V corresponds to the full frequency range on all bands. VCO input impedance is 10 kilohms. The amplitude stability is typically 0.01%. The frequency stability is typically 0.05% of the set frequency.

(2) EXTERNAL: The internal reference oscillator will lock in both frequency and phase to virtually any externally generated signal crossing its mean only twice each cycle. Maximum input voltage is ±20 V dc. Minimum time required on either side of the mean is 100 ns. Amplitude excursion must be at least 50 mV above and below the mean. Input impedance is 1 megohm.

When locked on, the reference oscillator will track the external signal over a frequency range of 100:1 within the range of the set band of frequencies. Maximum frequency acquisition (lock-on) times for each frequency band are given in the following table.

BAND	FREQUENCY RANGE	MAXIMUM TIME*
X1	0.2 Hz to 21 Hz	15 minutes
X10	2 Hz to 210 Hz	2 minutes
X100	20 Hz to 2.1 kHz	10 seconds
X1 K	200 Hz to 21 kHz	2 seconds
X10 K	2.1 kHz to 210 kHz	2 seconds

Once the frequency has locked, the phase will track at the rate shown in the diagram on the following page.

Phase Adjustment: Calibrated 10 turn potentiometer provides 0-100° phase shift. Linearity of phase setting is within ±2° from 2 Hz to 21 kHz, and within ±5° from 21 kHz to 210 kHz. Resolution is 0.1°. A four-position quadrant switch provides 90° phase shift increments.

1.2C DEMODULATOR CHARACTERISTICS

ACVM: An ACVM position on the function switch permits the Model 124A to be used as a conventional or frequency-selective ac voltmeter. Accuracy is within ±1% from 2 Hz to 20 kHz, increasing to ±10% at 210 kHz.

Dc Output Stability and Noise: Dependent on the operating mode selected by the front-panel Function switch, as shown in the Stability & Noise Table (next page).

*Model 124AL has significantly longer severe-overload recovery time (80 s vs 30 s with 5000 times full scale overload for one minute).

**Two additional preamplifiers, the Model 184 and the Model 185, are available. For information, contact the factory or the factory representative in your area.

*Time can be shortened appreciably by momentarily switching to Internal Mode and manually setting the oscillator to the proper frequency.

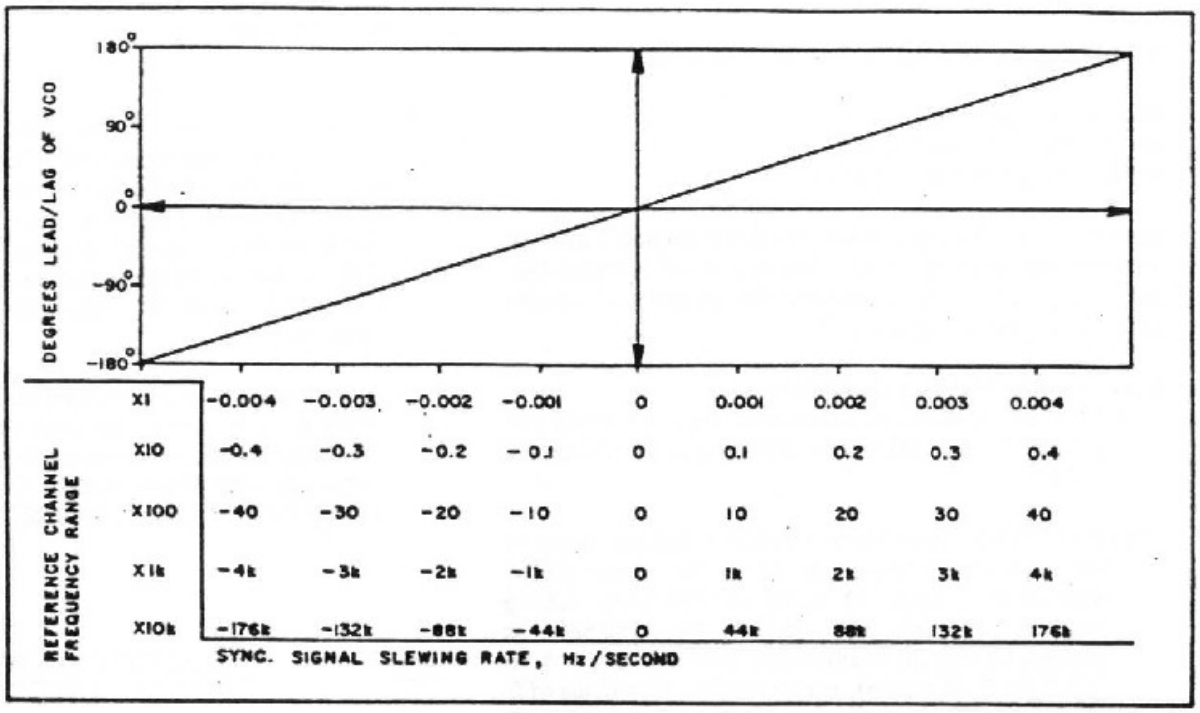

Figure 1-2. SYNC. SIGNAL SLEWING RATE

Function	Output Stability	Output Noise*
LOW DRIFT	<150 μV/°C	<100 μV rms
NORMAL	<1 mV/°C	<1 mV rms
HIGH DYN RANGE	<10 mV/°C	<10 mV rms

Demodulator Overload Limits: Dependent on Function switch setting as follows (see Subsection 3.21 for over-ride considerations).

LOW DRIFT ..... 10 x full scale
NORMAL ..... 100 x full scale
HIGH DYN RANGE ..... 1000 x full scale

This limit is defined as the ratio, at the input, of the maximum pk-pk voltage of a non-coherent signal, before overload, to the pk-pk voltage of a full-scale coherent sinewave. Note that, in terms of pk-pk noise to rms signal, the instrument will accept, without overload, interfering signals having an amplitude up to 3000 times the sensitivity setting. (See discussion in Subsection 3.21.)

Filter Time Constants: 1 ms to 300 s in 1-3-10 sequence, and a minimum time constant position having a time constant of less than 1 ms (determined by internal stray capacitance). The External position allows capacitance to be added via a rear-panel connector to obtain special values of time constant. Either 6 or 12 dB/octave rolloff as selected by means of front-panel switch is provided.

*Measured with time constant of 1 s and 12 dB/octave rolloff.

Equivalent Noise Bandwidth: 416 μHz minimum (300 s time constant with 12 dB/octave rolloff).

Zero Suppress: Calibrated control permits off-setting zer by ±1000% of full scale on Normal and High Dynamic Range only.

System Gain Stability: 100 ppm/°C; 100 ppm/24 Hr in the Flat mode and with Function switch set to NORMAL.

1.2D OUTPUTS

Meter Reading: Choice of either center-zero or lefthand-zero panel meter of taut-band construction, providing 0.5% linearity.

Optional Digital Readout: The Model 124A may be ordered with an optional digital readout in place of the standard panel meter. The readout is a 3½ digit display with a linearity of 0.05% of the reading, ±1 count. In addition, a BCD output is provided at the rear panel. The output levels are DTL/TTL compatible: Logic 0 = +0.2 V ±0.2 V, 5 mA maximum sinking current; Logic 1 = +3.5 V ±1.0 V, 100 μA maximum sourcing current.

Function Out: A dc signal corresponding to the panel-meter reading. An output of 10 V corresponds to full-scale deflection. The output impedance is 1 kΩ.

Signal Monitor: Enables continuous monitoring of the signal channel output ahead of the demodulator. In L DRIFT operation, a full scale rms input sinewave gives 100 mV rms sinewave at the Signal Monitor jack. In NORMAL operation, the signal monitor output with a full-scale input is 10 mV, and in HI, it is 1 mV. Dynamic

Operating Dynamic Range Tradeoff	Output Dynamic Range	PSD Dynamic Reserve	PSD Dynamic Range	Total Dynamic Range
LO DRIFT	6.6×10^4	10	6.6×10^5	6.6×10^8
NORMAL	10^4	10^2	10^6	10^9
HI DYN RNG (Reserve)	10^3	10^3	10^6	10^8

Table I-2. MODEL 124A DYNAMIC RANGE SPECIFICATIONS

Over-ride considerations apply as explained in Subsection 3.2I. Output impedance is 600 Ω.

Internal line frequency pickup is less than 20 nV rms (referred to the Direct inputs of a Type 116 Preamplifier) in any Signal Channel mode except Bandpass and Notch, where the level may rise to 500 nV at highest Q settings.

Reference Channel: A sinewave output at the reference oscillator frequency. Amplitude is continuously adjustable by means of the front-panel Level control over a range of 0 V to 10 V rms with less than 2% distortion. Output impedance is 600 ohms.

1.2E DYNAMIC RANGE SPECIFICATIONS

Vary as a function of the operating Dynamic Range Tradeoff as indicated in the table above.

1.2F OTHER CHARACTERISTICS

Overload: Front-panel light indicates overload at critical circuits.

Reference Unlock: Front-panel light indicates that the reference oscillator has not completed frequency lock.

Internal Calibrator: Square-wave calibrator signal supplied. Rms amplitude of fundamental frequency component adjustable from 20 nV to 100 mV in 1-2-5 sequence. Typical accuracy indicated in Figure I-3.

Ambient Temperature Range: Unit can be operated at ambient temperatures ranging from 15°C to 45°C.

Auxiliary Power Output: Regulated ±24 V at up to 100 mA is available at rear-panel connector.

Power Requirements: 105-125 or 210-250 V; 50-60 Hz; unit can also be powered from batteries by supplying ±31 V to rear panel connector. Batteries must be able to supply at least 400 mA at +31 V and 360 mA at −31 V.

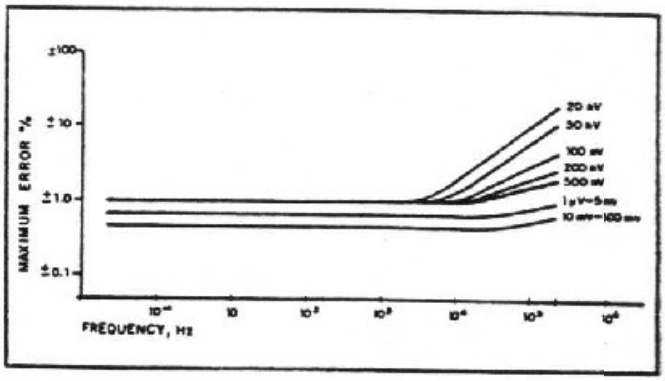

Figure I-3. TYPICAL CALIBRATOR ACCURACY

Size: 17-1/8" W x 7" H x 18-1/4" D (43.6 cm W x 17.8 cm H x 46.5 cm D).

Weight: 34 lbs (15.5 kg).

Accessories: Model 123 AC Zero Offset provides square wave at the reference frequency which can be used to suppress signals at the input of the Model 124A. Other accessories include a computer interface system, fixed and variable speed light choppers, and a broad selection of special purpose preamplifiers. The AM-1, AM-2, and 190 input transformers allow better noise performance to be achieved when using a high-input impedance preamplifier to process a signal arising in a low source impedance.

The Model 184 Current-Sensitive Preamplifier is also available. This preamplifier, which plugs in like the Models 116, 117, 118, and 119 Preamplifiers, provides 1 V out for input currents ranging from 1 nA to 10 μA as selected by a front-panel Range switch. Frequency range varies with sensitivity, being 2 Hz to 3 kHz on the 1 nA range and 2 Hz to 200 kHz on the 10 μA range.

*NOTE: These are maximum values and do not apply for all positions of the Sensitivity switch. For a general discussion of the meaning of these terms and their significance, see Appendix A at the rear of this manual. Also, see Subsection 3.2I.