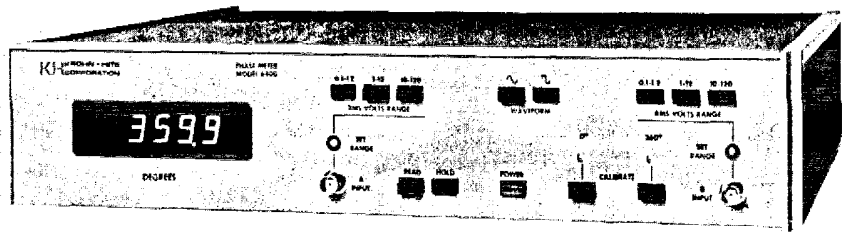
model 6400A

3Hz to 5MHz
DIGITAL PHASEMETER



- **Accuracy:** 0.1°
- **Resolution:** 0.1°
- **Display Range:** 000.0° to 360.0°
- **Input Voltage Range:** 0.01-120 Volts RMS
- **Accepts Sine, Triangle, Square and Positive Pulse Waveforms**
- **Analog Output**
- **Optional BCD Output**

The Krohn-Hite Model 6400A offers precision phase angle measurements with 0.1° accuracy and 0.1° resolution!

The 6400A provides phase measurements over a broad frequency range of 3Hz to 5MHz, and accepts a variety of input waveforms including sine, triangle, square waves, and positive pulses. The 6400A accepts a wide range of input signal levels, from 10 millivolts to 120 volts RMS, with absolutely no effect on phase accuracy from unequal input levels, as commonly found in other phasemeters. A 7 segment, planar gas discharge display provides a continuous, direct readout of phase angles between 000.0° and 360.0°.

Two common factors that will affect the accuracy of a phasemeter are crossover distortion and/or broadband noise present on either or both of the input signals. A unique circuit design used in the 6400A significantly reduces any effects that may be caused by these two factors. Another problem found in most phasemeters is the inability to respond to very small phase angles, resulting in fluctuations or inconsistencies in the meter reading. (Sometimes referred to as ambiguity). To overcome this problem, the 6400A uses a special design technique that virtually eliminates any ambiguities that may occur at readings near 0°, 180° and 360°.

Additional features of the 6400A include: a 3 position, pushbutton control on each channel for selecting the proper input voltage range. Front panel indicators are used to indicate when the proper input voltage range has been selected; a READ/HOLD control, that allows either continuous display of the phase angle reading, or storage of the reading for an extended period; a CAL mode of operation that provides an instant check and/or adjustment of zero and full scale calibration; and an analog output equal to -10mv/degree phase, for use with an external meter or strip chart recorder. An optional BCD output is also available. Operation of the 6400A requires only selecting the proper input level for each channel, and observing the readout in degrees.

The 6400A could be the answer to your phase measurement problems. Its superior performance and low price make it ideally suited for monitoring of servo control systems; low impedance measurements; adjustment of crystal resonance; testing and adjustment of filter networks; controlling laser trimming of resistor networks; measurements in AC power systems; calibration laboratories and general testing and measurement.

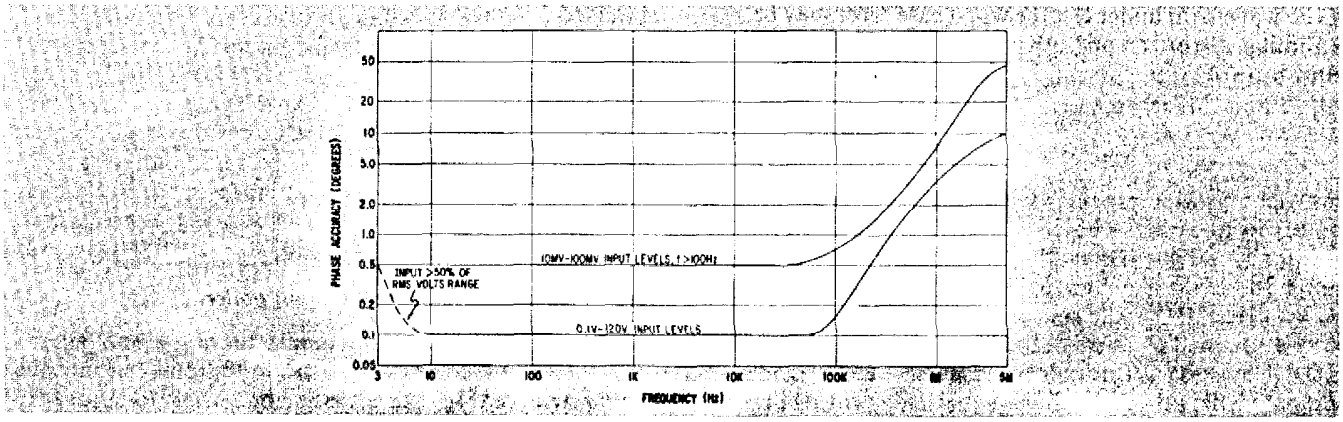


Figure 1. Typical Performance

DIGITAL PHASEMETER

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SPECIFICATIONS

FREQUENCY RANGE: 3Hz to 5MHz.

ACCURACY (For typical performance, refer to Figure 1):
Sine Wave: ±0.1° ±1 digit from 20Hz to 50kHz, rising to ±0.7° at 100kHz; ±0.2° at 10Hz; for any amplitude within the selected voltage range. Above 100kHz, ±0.7° per 100kHz, with equal amplitude and the same voltage range on each input.

Square Wave: ±0.1° ±1 digit from 10Hz to 20kHz, rising to ±0.7° at 100kHz; for any amplitude within the selected voltage range. Above 100kHz, ±0.7° per 100kHz, with equal amplitude and the same voltage range on each input.

INPUT SIGNAL AMPLITUDE:
0.01-120 volts RMS in three ranges: 0.1-1.2, 1-12, 10-120 (can be extended with Tektronix type P6006, P6007, P6013A, P6049A or P6060 matched probes).

(For input levels between 0.01-0.1 volts RMS, the 0.1-1.2 volt range is used; refer to Figure 1 for typical performance.)

INPUT WAVEFORMS:
Sine, triangle, square and positive pulse waveforms. (The phasemeter is triggered on the negative going transition of the input waveform, in both sine and square wave positions of the WAVEFORM switch).

INPUT IMPEDANCE: 1 Megohm in parallel with 50pf.

MAXIMUM DC COMPONENT:
± 200 volts (can be extended with Tektronix type P6006, P6007, P6013A, P6049A or P6060 matched probes.)

RESPONSE:
Time Constant: Less than 500 msec.

Settling Time: To within specified accuracy, within one to eight seconds, dependent upon input signal amplitude.

DISPLAY: 0.55 inch, 7-segment, planar gas discharge.

DISPLAY RANGE: Continuous, 000.0° to 360.0°

RESOLUTION: 0.1°.

REPEATABILITY: Better than 0.1°.

DRIFT:
VS Time (30 days without CAL reset):

Sine Wave: ± 0.1° from 10Hz to 50kHz; ± 0.4° per 100kHz above 50 kHz.

Square Wave: ± 0.1° from 10Hz to 20KHz; ± 0.4° per 100kHz above 50kHz.

Analog Output: ±0.1mv (±0.01°).

VS Temperature (without CAL reset):
± 0.06°/°C, 10Hz to 100kHz; above 100kHz, add ±0.05°/°C per MHz to 5MHz.

AMBIENT TEMPERATURE RANGE: 0°C to 45°C.

DISTORTION PRESENT ON THE INPUT SIGNAL:
If there is distortion present on one of the signals, a phase error may be introduced, depending on the relationship between the fundamental and its harmonics. If the amplitudes of all odd or even harmonics add up to zero at the zero crossing of the fundamental, then the harmonics will produce no phase error. If the resultant of the amplitudes is not zero, however, it will cause a shift in the zero crossing of the input waveform. (Worst case would occur when the maximum of the harmonic coincides with the negative zero crossing of the fundamental.) The effect of an even harmonic will not only shift the zero crossing of the waveform, but also altar the symmetry of the comparator or detector output. If a symmetry control loop is added to the phasemeter circuit, the effect of the even harmonic on accuracy can be minimized. The 6400A uses the type of symmetry loop mentioned above.

The effect of an odd order harmonic, however, is not as easily corrected. An odd order harmonic simply shifts the phase of the output of the comparator or detector loop. Since the symmetry is not affected there is no way to detect any phase error.

Figure 2 shows the maximum phase error introduced versus the percentage of harmonic distortion present on each input channel.

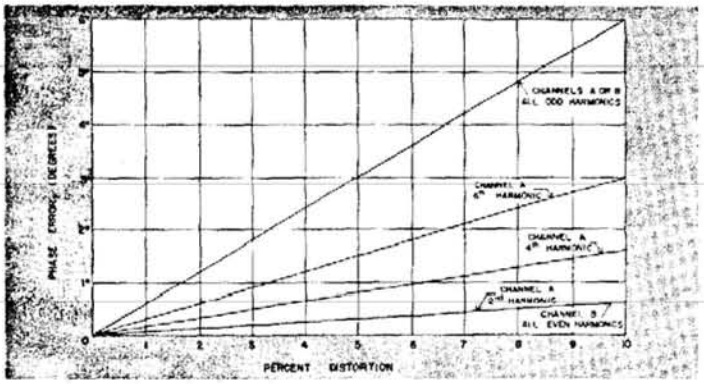


Figure 2. Maximum Phase Error* vs. % Harmonic Distortion

*(Worst case would occur when the maximum of the harmonic coincides with the negative zero crossing of the fundamental.)

NOISE PRESENT ON THE INPUT SIGNALS:
Another problem affecting phase accuracy is random noise. If there is a sufficient noise level on either input (or both), false triggering will occur and a phase error is introduced. The 6400A uses special circuits plus filtering to minimize the effects of noise on the phase accuracy. Typically, any broadband noise present on both inputs 40dB down from the input signals will produce only 0.05° error. Figure 3 gives a typical curve for phase error versus input frequency, for a signal to noise ratio of 10:1 on both inputs.

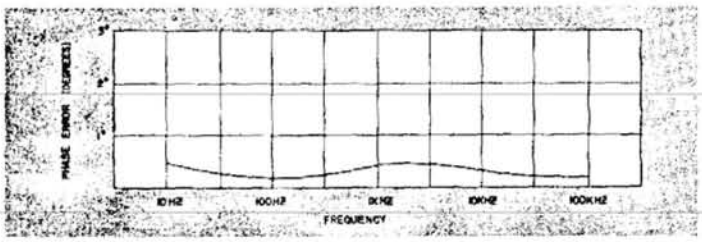


Figure 3. Phase Error vs. Random Noise.

ANALOG OUTPUT:
(for use with an external meter or recorder): 0-3.6 volts DC, -10mv DC/degree phase, impedance 250 ohms.

BCD OUTPUT (Optional):
Provides 14 lines of phase angle equivalent BCD output, plus polarity, data ready, read/hold and read rate control lines. Compatible with DTL, TTL logic.

PANEL CONTROLS AND ADJUSTMENTS:
Front Panel: 3 decade push-button RMS VOLTS RANGE control (each channel), plus push-button READ/HOLD, WAVEFORM, POWER, 0° CAL and 360°CAL.

Rear Panel: 115/230V LINE, CHASSIS/FLOATING.

TERMINALS:
Front Panel: A input, (BNC), B input, (BNC).

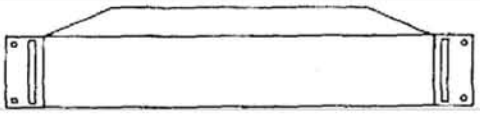
Rear Panel: A input, (BNC), B input, (BNC), analog output, (BNC); AMP type 200277-2 for BCD output (optional).

POWER REQUIREMENTS:
105-125 volts, or 210-250 volts, single phase, 50-60Hz, 40 watts.

DIMENSIONS AND WEIGHTS:

	H	W	D	Net	Shipping
U.S.	3½"	16½"	16"	15lbs	18 lbs
Metric	8.9 cm	41.9 cm	41 cm	6.8 kgs	8 kgs

OPTIONAL RACK MOUNTING KIT:
Part No. RK-319; permits installation of the 6400A into a standard 19" rack spacing.



Specifications are subject to change without notice.