Figure 1 Model 6600 Precision Phasemeter

SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

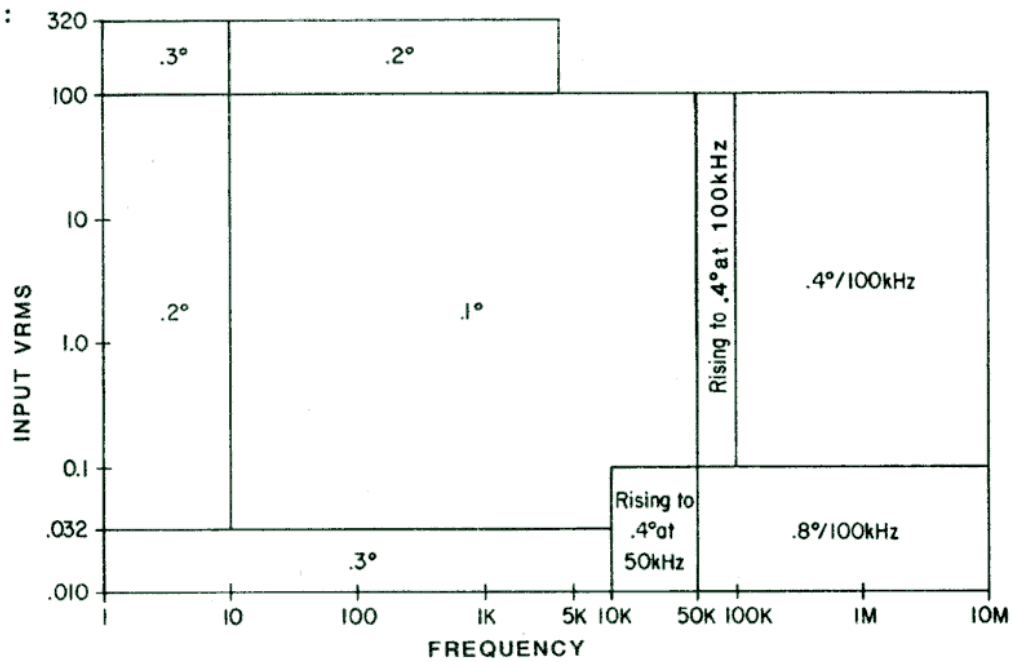
The Model 6600 Precision Phasemeter measures the phase angle between two waveforms of coincident frequency, over a range of 10Hz to 10MHz with a typical accuracy of 0.1° and 0.1° resolution. It will accept a wide range of input signal levels automatically without range switching from 10 millivolts to 320 volts rms, and input waveforms of sine, square, triangle, and pulses of >50ns. A 4 digit, LED display provides continuous direct read-out of phase angles between 0.0° and 360.0°. An analog output provides a dc voltage equal to 10mV/° for use with an external meter or recorder.

The Model 6600 is carefully inspected, aged, and adjusted before shipment, and ready for operation when unpacked. If it has been damaged in shipment, make a claim with the carrier and notify Krohn-Hite immediately.

1.2 SPECIFICATIONS

FREQUENCY RANGE: 10Hz to 10MHz (1Hz Optional)
ACCURACY

Sine Wave:



Square Wave: Double the sine wave specification.

INPUT

Signal Amplitude: Auto ranging from 0.01V to 320Vrms.

Waveforms: Sine, triangle, square and >50ns pulse. (The phasemeter is triggered on the positive going transition of the input waveform. A sine-wave on the reference input and a square wave on the signal input is allowed).

Impedance: 1 Megohm in parallel with a 50pf.

MAXIMUM DC COMPONENT: ±200 volts.

RESPONSE

Time Constant: >10Hz, less than 500msec; <10Hz, less than 5sec.

Settling Time: To within specified accuracy, within 1 to 8 seconds, dependent on input amplitude and frequency (>10Hz).

DRIFT

Vs. Time: (30 days without CALIBRATE reset) Sine Wave, ±0.025° from 20Hz to 100kHz; ±0.1° at 10Hz; ±0.1° per 100kHz above 100kHz. Square Wave, ±0.025° from 10Hz to 5kHz; ±0.05° to 100kHz; ±0.1° per 100kHz above 100kHz.

Vs. Temperature: (Without CALIBRATE reset) ±0.01°/°C, 10Hz to 100kHz; ±0.05°/°C to 1MHz; ±0.05°/°C per MHz above 1MHz.

ANALOG OUTPUT: (for use with an external meter or recorder) 0-3.6 volts DC, 10mV DC/degree phase, impedance 50 ohms.

DISPLAY: 0.5", 7 segment, green LED.

DISPLAY RANGES: 0.0° to 360.0°.

RESOLUTION: 0.1°.

REPEATABILITY: Better than 0.1°.

POWER CABLE: 7 feet, removable.

DIMENSIONS: 3.5"/(9cm) high, 16.5"/(41.9cm) wide, 16"/(40.6cm) deep.

WEIGHTS: Net 15 lbs/(6.75kg), Shipping 18 lbs/(8.1kg).

AMBIENT TEMPERATURE RANGE: 0°C to 50°C.

FRONT PANEL CONTROLS: POWER, Reference Waveform, Signal Waveform, CALIBRATE (0° and 360°), phase adjust (0° and 360°).

POWER REQUIREMENTS: 90-132V or 198-264V, single phase, 50-400Hz, 40W.

OPTIONS

RK-316: Rack Mount Kit for a standard 19" rack spacing.
Option 001: BCD Output.
Option 002: 1Hz operation.
Option 003: Rear panel BNC connectors for REFERENCE and SIGNAL inputs.

Specifications are subject to change without notice.

1.3 TYPICAL PERFORMANCE

Typical performance of the Model 6600 is shown in Figure 1.1 with matched inputs. The graph with interrupted lines is the specified response with unmatched inputs over the input range of 0.1 to 100V.

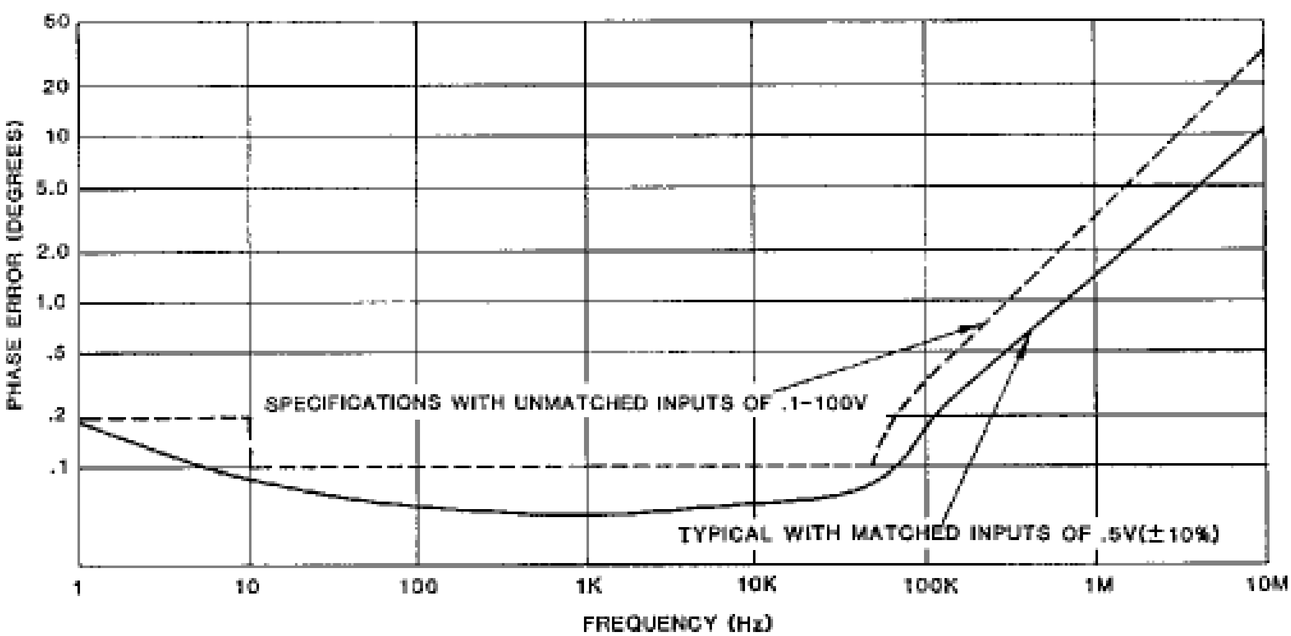


Figure 1.1 Typical Performance

1.4 FACTORS AFFECTING PHASEMETER ACCURACY

1.4.1 Inconsistencies In Meter Reading Near 0° and 360°

A problem affecting a phasemeter's accuracy is the inability of the phasemeter circuit to detect relatively small phase angles, resulting in meter fluctuations or inconsistencies in meter readings. The 6600 overcomes this inconsistency (or ambiguity as it is sometimes referred to) by using a specially designed network that permits measurements as small as 0.1° to be made without meter fluctuations or repeatability errors, and eliminates the need for multiple meter ranges, or shifting of the meter scale.

1.4.2 Noise Present On The Input Signals

Another problem affecting phase accuracy is random noise. If there is a sufficient noise level on either or both inputs, false triggering will occur and a phase error is introduced. The 6600 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 a 0.1° error. Figure 1.2 gives a typical curve for phase error versus input frequency, for a signal to noise ratio of 10:1 on both inputs.

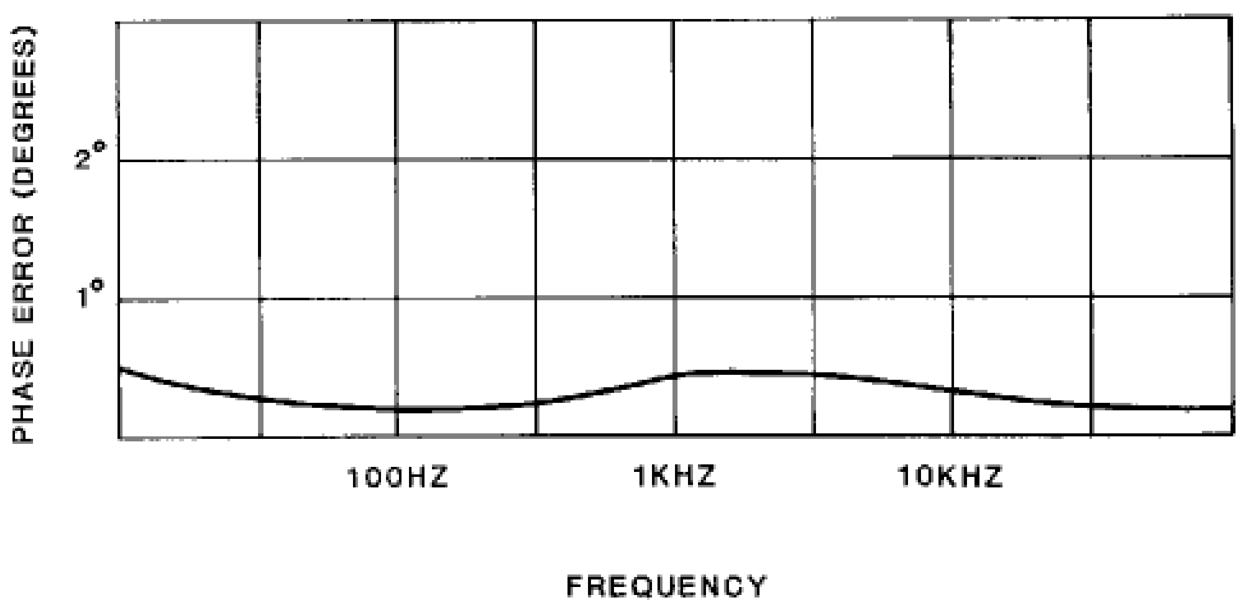


Figure 1.2 Phase Error for a 10:1 Signal-to-Noise Ratio

1.4.3 Distortion Present On The Input Signal

If there is distortion present on one of the input signals, a phase error may be introduced, depending upon the relationship between the fundamental and its harmonics. If the amplitude of all the odd or even harmonics add up to zero at the positive 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 positive zero crossing of the fundamental. The effect of an even harmonic will not only shift the zero crossing of the waveform, but also alter 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 6600 uses the type of symmetry loop mentioned above.

The effect of an odd order harmonic 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 1.3 shows the maximum phase error introduced versus the percentage of harmonic distortion present on each input channel.

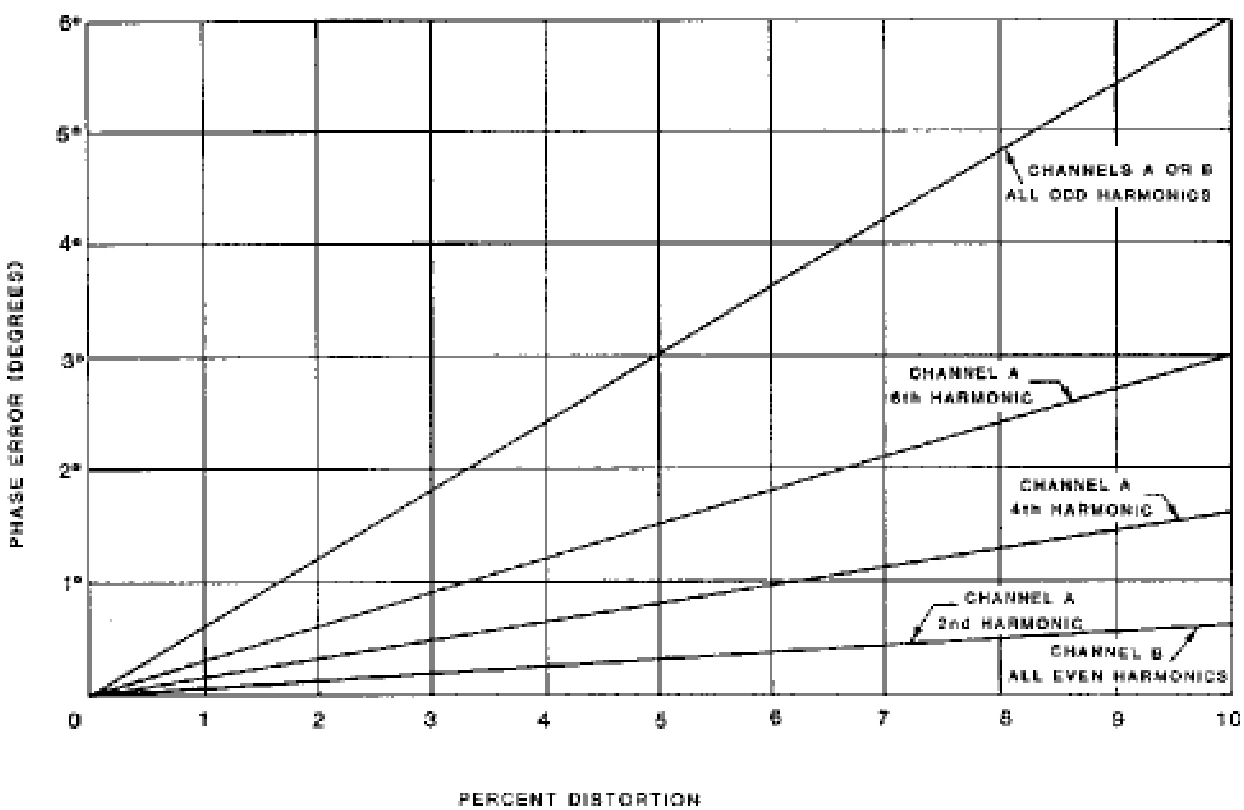


Figure 1.3 Maximum Phase Error vs. % Harmonic Distortion