

# Application Note

**AI**

## A High Quality Function Generator Sys Using the XR-2206

### INTRODUCTION

Waveform or function generators capable of producing AM/FM modulated sine wave outputs find a wide range of applications in electrical measurement and laboratory instrumentation. This application note describes the design, construction and the performance of such a complete function generator system suitable for laboratory usage or hobbyist applications. The entire generator is comprised of a single XR-2206 monolithic IC and a limited number of passive circuit components. It provides an excellent tool for the engineer, student, or hobbyist with highly versatile laboratory instrument for waveform generation at a very small fraction of the cost of conventional function generators available today.

### GENERAL DESCRIPTION

The basic circuit configuration and the external components necessary for the high-quality function generator system is shown in Figure 1. The circuit shown in the figure is designed to operate with either a 12V single power supply, or with a  $\pm 6V$  split supplies. For most applications, split-supply operation is preferred since it results in an output DC level which is nearly at ground potential.

The circuit configuration of Figure 1 provides three basic waveforms: sine, triangle and square wave. There are four overlapping frequency ranges which give an overall frequency range of 1 Hz to 100 kHz. In each range, the frequency may be varied over a 100:1 tuning range.

The sine or triangle output can be varied from 0 to over 6V (peak to peak) from a 600 ohm source at the output terminal.

A squarewave output is available at the sync output terminal for oscilloscope synchronizing or driving logic circuits.

### TYPICAL PERFORMANCE CHARACTERISTICS

The performance characteristics listed below are not guaranteed or warranted by Exar. However, they represent the typical performance characteristics measured by Exar's application engineers during the laboratory evaluation of the function generator system shown in Figure 1. The typical performance specifications listed below apply *only* when all of the recommended assembly instructions and adjustment procedures are followed:

- (a) **Frequency Ranges:** The function generator system is designed to operate over four overlapping frequency ranges:
  - 1 Hz to 100 Hz
  - 10 Hz to 1 kHz
  - 100 Hz to 10 kHz
  - 1 kHz to 100 kHz

- (b) **Frequency Setting:** At any range setting, frequency is varied over a 100:1 tuning range with a potentiometer (see  $R_{13}$  of Figure 1).

- (c) **Frequency Accuracy:** Frequency accuracy of the XR-2206 is set by the timing resistor  $R$  and the timing capacitor  $C$ , and is given as:

$$f = 1/RC$$

The above expression is accurate to within  $\pm 5\%$  at any range setting. The timing resistor  $R$  is the series combination of resistors  $R_4$  and  $R_{13}$  of Figure 1. The timing capacitor  $C$  is any one of the capacitors  $C_3$  through  $C_6$  shown in the figure.

- (d) **Sine and Triangle Output:** The sine and triangle wave amplitudes are variable from 0V to 6 V<sub>pp</sub>. The amplitude is set by an external potentiometer,  $R_{12}$  of Figure 1. For any given amplitude setting, the triangle output amplitude is approximately twice as high as the sine output. The internal impedance of the output is 600 ohms.

- (e) **Sinewave Distortion:** The total harmonic distortion of a sinewave is less than 1% from 10 Hz to 10 kHz and less than 3% over the entire frequency range. The selection of a waveform is made by the triangle/sine switch,  $S_2$ .

- (f) **Sync Output:** The sync output provides a 50% duty cycle square pulse output with either full swing or upper half swing depending on the choice of output terminals on the printed circuit board (see Figure 1).

- (g) **Frequency Modulation (External Sweep):** Frequency can be modulated or swept by applying an external voltage to sweep terminal (Terminal 1 of Figure 1). If not used, this terminal should be left open-circuited.