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# Function Generator

## MODEL FG-500



Instruction Manual

**Elenco™ Electronics, Inc.**

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## SPECIFICATIONS

### OUTPUT:

- **Waveforms:** Sine, Triangle, Square
- **Impedance:**  $600\Omega$  +/-10%.
- **Frequency:** 1Hz - 1MHz in 6 decade steps with variable ranges.

### SINE WAVE:

- **Amplitude:** 0 - 3Vpp at 9VDC input.
- **Distortion:** Less than 1% (at 1kHz).
- **Flatness:** +/-0.05dB 1Hz - 100kHz.

### SQUARE WAVE:

- **Amplitude:** 8V (no load) at 9VDC input.
- **Rise Time:** Less than 50ns (at 1kHz).
- **Fall Time:** Less than 30ns (at 1kHz).
- **Symmetry:** Less than 5% (at 1kHz).

### TRIANGLE WAVE:

- **Amplitude:** 0 - 3Vpp at 9VDC input.
- **Linearity:** Less than 1% (up to 100kHz).

### POWER REQUIREMENTS:

- Standard 9V Battery or 9V to 18VDC at input.

### OPERATING TEMPERATURE:

- 32°F (0°C) to 122°F (50°C).

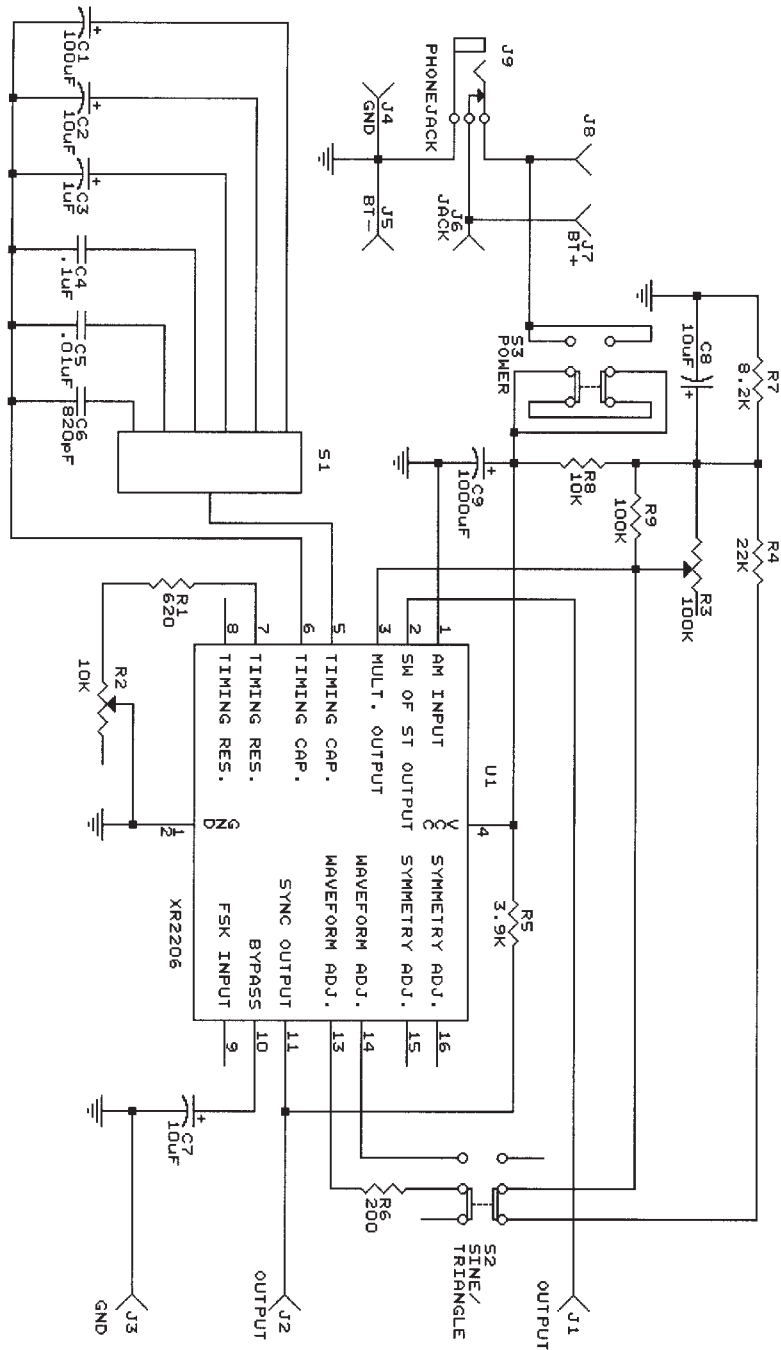
## TWO YEAR WARRANTY

All Elenco models are guaranteed for two full years on all parts and service. For the first 3 months, your function generator is covered at absolutely no charge. For the remaining 21 months, a nominal service charge is required to cover shipping and handling.

When returning merchandise for repair, please include proof of purchase, a brief letter of explanation of problem, and sufficient packing material. Before returning any merchandise please call our service department at (847) 541-3800 to obtain a return authorization number (RMA).

Service Department

# SCHEMATIC DIAGRAM



# INTRODUCTION

Your FG-500 Function Generator contains a complete function generator capable of producing sine, square and triangle wave forms. The frequency of this generator can be continuously varied from 1Hz to 1MHz in 6 steps. A fine frequency control makes selection of any frequency in between easy. The amplitude of the sine and triangle waveforms are adjustable from 0 to 3Vpp. This complete function generator system is suitable for experimentation and applications by the student. The entire function generator is comprised of a single XR-2206 monolithic IC and a limited number of passive circuit components. The unit is powered with a 9V battery or 9-18VDC wall transformer, such as Elenco's transformer (part # 9AC7).

# THEORY OF OPERATION

The heart of the FG-500 Function Generator is the XR-2206 monolithic function generator integrated circuit. The XR-2206 is comprised of four main functional blocks as shown in the functional block diagram (Figure 1). They are:

- A Voltage Controlled Oscillator (VCO)
- An Analog Multiplier and Sine-shaper
- Unity Gain Buffer Amplifier
- A set of current switches

The VCO actually produces an output frequency proportional to an input current, which is produced by a resistor from the timing terminals to ground. The current switches route one of the currents to the VCO to produce an output frequency. Which timing pin current is used, is controlled by the FSK input (pin 9). In the FG-500, the FSK input is left open, thus only the resistor on pin 7 is used. The frequency is determined by this formula:

$$f_o = 1/RC \text{ Hz}$$

where  $f_o$  is the frequency in Hertz  
 R is the resistance at pin 7 in Ohms  
 C is the capacitance across pin 5 and 6 in Farads

Note that frequency is inversely proportional to the value of RC. That is, the higher the value of RC, the smaller the frequency.

The resistance between pins 13 and 14 determine the shape of the output wave on pin 2. No resistor produces a triangle wave. A 200Ω resistor produces a sine wave.

# FUNCTIONAL BLOCK DIAGRAM

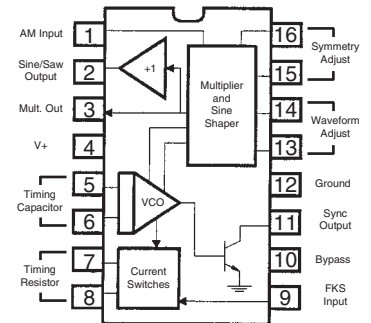
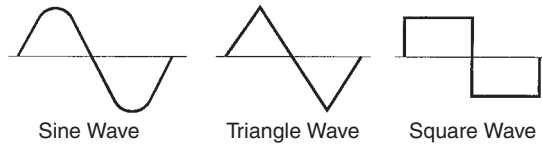


Figure 1

## FUNCTIONAL DESCRIPTION

The FG-500 is a function generator integrated circuit capable of producing high quality sine, triangle, and square waves of high stability and accuracy. A picture of each waveform is shown below:

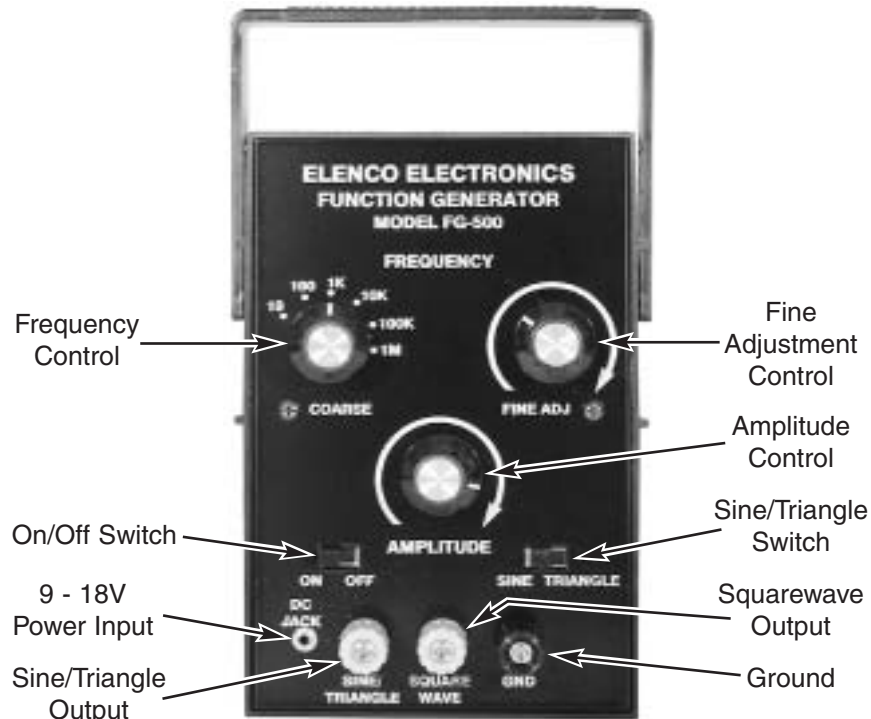


Sine Wave

Triangle Wave

Square Wave

## CONTROL PANEL FUNCTIONS



Frequency Control

Fine Adjustment Control

Amplitude Control

Sine/Triangle Switch

Squarewave Output

Ground

On/Off Switch

9 - 18V Power Input

Sine/Triangle Output

## CONTROLS

### RANGE SWITCHES

Six ranges of frequency are provided by the range switch as shown in Table 1.

POSITION	TYPICAL FREQUENCY RANGE
1	1Hz - 15Hz
2	10Hz - 150Hz
3	100Hz - 1.5kHz
4	1kHz - 15kHz
5	10kHz - 150kHz
6	100kHz - 1MHz

Table 1

### SINE/TRIANGLE SWITCH

This SINE/TRIANGLE Switch selects the waveform, sine wave or triangle wave, sent to the SINE/TRIANGLE output terminal.

### FREQUENCY MULTIPLIER

The multiplier is a variable control allowing frequency settings between fixed ranges. The ranges are as shown in Table 1.

### AMPLITUDE CONTROL

The Amplitude Control provides amplitude adjustment from near 0 to 3V or greater for both sine and triangle waveforms.

### ON/OFF SWITCH

The ON/OFF Switch turns the power to the FG-500 on or off.

### POWER JACK

This jack allows the FG-500 to be powered from an external power source of 9V to 18VDC. Putting a plug into the jack disconnects the internal 9V battery.

### OUTPUT TERMINAL

The output marked SINE/TRIANGLE provides the sine and triangle waveforms. The output marked SQUARE WAVE provides the square wave. The output marked GND provides the ground for all output waveforms.