CENTRAL SCIENTIFIC COMPANY

OPERATING INSTRUCTIONS

Electronic Module System Function Generator
No. 32389

1. Introduction

The Function Generator is a waveform generator that students can use with the Amplifier/Power Supply (32386) to provide sine, square, and triangular waves in the following frequency ranges: 4-50, 40-500, 400-5000, and 4000-50000 Hz.

When the function generator and the amplifier/power supply are used with equipment from the Cenco Electronic Module System, students can perform accurate experiments such as measuring the speed of sound, producing transverse waves, examining standing wave patterns, and examining nodal patterns produced by microwaves.

2. Specifications

Output Limited by APS: $\pm 6V_{pk}$, and $\pm 100\ mA_{pk}$ minimum
Frequency: 4 frequency ranges, 4 Hz to 50 kHz; calibration accuracy, ±5% including drift from 10°C to 40°C ambient

3. Setup and Operation

Plug the function generator into the side connector of the amplifier/power supply. Use the three controls to obtain the appropriate waveforms and the frequencies for your experiment:

- The **frequency range switch** selects one of the four frequency ranges.
- The **waveform selector switch** produces the actual waveform.
- The **frequency control knob** continuously varies the waveform within the selected frequency range.

Use the function generator for a variety of experiments and demonstrations. For instance, use it with a single Auxiliary Loudspeaker (32396) to investigate sound reflection and refraction, or with two loudspeakers to investigate interference phenomena.

A. Reflection and Transmission of Sound Waves: Plug one loudspeaker into the output of the amplifier/power supply and the connected function generator (see Fig. 1).

Figure 1

Adjust the frequency of the function generator to about 4000 Hz; adjust the gain until the signal is barely audible at a 1m distance from the speaker. Experiment with a variety of objects by holding them near the loudspeaker and observing the reflection and the transmission of sound waves.

Caution! Do not set the gain of any low-impedance load (e.g., a loudspeaker) higher than 5 with a 10W load, or higher than 40 with a 40W load. If you do, you will overdrive the amplifier and distort the output waveform. A distorted waveform is heard as an impure tone provided the frequency is within the audible range and the distorted waveform shows up on an oscilloscope.

B. Diffraction of Sound Waves: Use the same experimental setup and the same control settings used in experiment A. Place a piece of wood about 25cm from the speaker and probe the area about 75cm beyond the wood. Observe all changes in signal loudness and all instances when no signal is heard (i.e., nulls). Mark the location of each occurrence.

C. Standing Waves: Place the loudspeaker about 0.5m above and facing toward a hard table top. Probe the area between the speaker and the table; mark and record the null locations. The distance between any two consecutive nulls is 0.5 wavelengths.

D. Speed of Sound: Set the frequency of the function generator to about 4000 Hz. Connect two loudspeakers to the oscillator output and place them about 25cm apart. Measure the exact distance between the centers of the two loudspeakers; draw a line to mark this distance. Mount a meter stick parallel to the line joining the speakers so you can locate the nodes. Be sure the meter stick is near the parallel line (see Fig. 2.).

Figure 2

Measure the distance from the line marking the distance between centers of the loudspeakers to the meter stick. Locate the audible maxima and minima positions. Measure the distance from a node to each of the loudspeaker sources. Use this measurement to calculate the wavelength.

Remember that $V = lf$, where V is the speed of sound, l is the wavelength, and f is the frequency. Using this formula, your wavelength measurements, and the known frequency setting, calculate the speed of sound.

E. Ultrasonic Waves: This experiment investigates ultrasonic wave phenomena using the Ultrasonic Transducer (32398) shown in Fig. 3.

Figure 3

Connect the ultrasonic transducer to the output of the amplifier/power supply and the function generator. These three instruments

function together as a sound wave transmitter. Connect the Six-Range DC Meter (32381) to a second amplifier/power supply to serve as the sound wave detector. Use a diode to rectify the AC signal that passes into the meter. Alternatively, you can feed the detected signal directly into an oscilloscope input instead of the meter.

Important! Critically tune the function generator you are using with the ultrasonic transducer to a frequency of 40 kHz. Adjust the frequency control knob on the function generator until the maximum meter deflection occurs with the transmitter and the detector just a few centimeters apart.

Repeat experiments A through E and compare the ultrasound results to the results obtained with regular sound waves. Cardboard and wood work as obstacles for the reflection experiment. Explore the area 5-10cm behind an obstacle for the diffraction experiment. To investigate standing waves, position the source about 10-15cm from the reflector and probe the area between them. The distance between two consecutive maxima or minima equals one-half the wavelength.

Students can also use the function generator with the Microwave Transmitter (32383) to modulate the microwave transmitter signal so it identifies nodal patterns. For more information about using the function generator, consult the Student Lab Manual for Modular Electronics Systems (30195-02).

4. Maintenance

The function generator requires no special maintenance. If you experience any problems with this apparatus or need more information about operating it, contact Central Scientific Company. To ensure better service, please do not return any equipment until we have sent you authorization.

5. Accessories

Description	Catalog No.
Amplifier/Power Supply	32386
Auxiliary Loudspeaker	32396
Ultrasonic Transducer	32398
Microwave Transmitter	32383
Six-Range DC Meter	32381
Student Lab Manual for Modular Electronics Systems	30195-02

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