**SINE WAVE GENRATOR :**

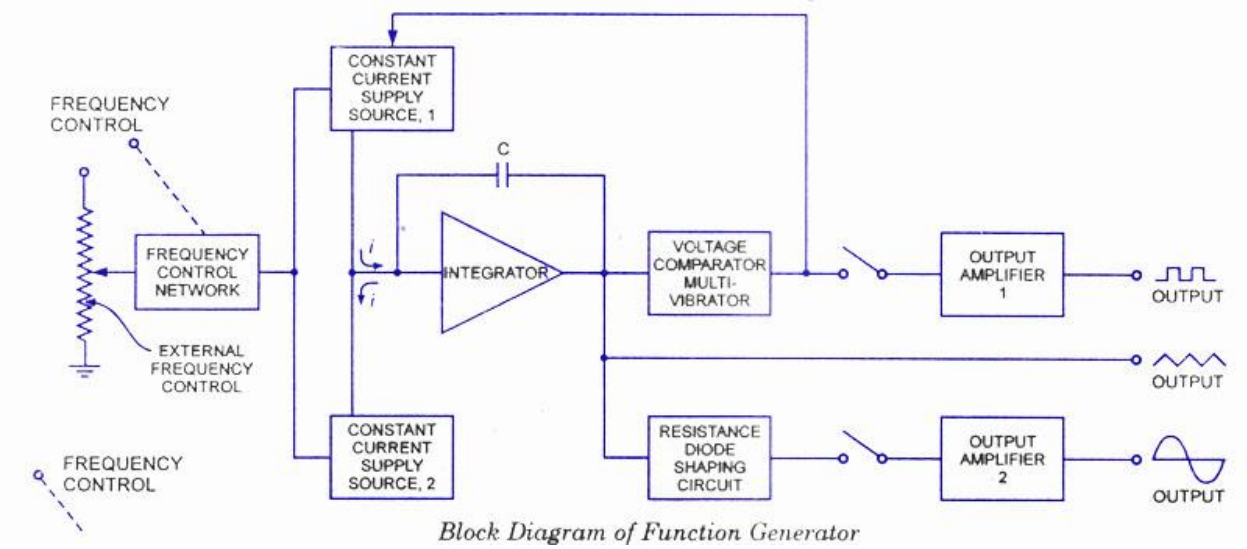
In electronic and communication applications, a signal that occurs naturally is known as a sine wave. There are numerous electronic devices that use sine waveforms like radio, etc. Usually, the power devices process otherwise generates sine waveforms. In power electronics, a sine wave generator is used frequently in some applications like a DC/AC power inverter. There are many ways to generate sine waves by using different oscillators like wein bridge, phase shift, Colpitts crystal, square wave, function generator, etc.

**Definition:** A circuit that is used to generate a sine wave is called a sine wave generator. This is one kind of waveform that appears from electricity outlets of home. This waveform can be observed in AC power as well as applicable in acoustics. We know that there are different types of waveforms that are generated by different electronic devices. So each waveform generates different sounds. A sine wave is one kind of signal that is utilized in acoustics. To design the sine wave generator circuit, there are different types of components are required like an integrated circuit, resistors, capacitors, transistors, etc.


Sine Wave Generator

## Working Principle

This is an outstanding tool to generate sine waves using wave drivers otherwise speakers. The frequency range of this generator will range from 1Hz to 800 Hz & the sine wave's amplitude to be changed. Students can notice the nature of quantum for standing wave models when the sine wave generator jumps from one resonant frequency to others. This generator includes in-built memory that permits it to find out the latest and primary frequencies for extra exploration.




*Block Diagram of Function Generator*

## Features

The features of the sine wave generator include the following.

- Adjust the output frequency using the knobs like Fine & Coarse.
- The sine wave signal voltage can be changed by adjusting the amplitude.
- It has a feature like a smart scan that allows the knobs for changing the frequency easily once turned continuously.
- In this generator device, a plastic case mainly includes a rear rod clamp & angled rubber feet for the options of dynamic mounting.
- An inbuilt clamp is used to place this generator over a standard rod.
- In this generator, the frequency can be displayed digitally with the resolution 0.1 Hz using red color LEDs.
- This generator stores an increment of frequency & will rotate during the range of frequency using the recognized growth for adapted convenience.

## Sine Wave Generator using Op-Amp

The sine wave generator circuit using an op-amp is shown below. A sign wave signal is used along with an arbitrary frequency is used in different designs of circuits. The following circuit can be designed with a dual op-amp, resistors, and capacitors. The following figure shows the schematic diagram of the sine wave generator.

The following circuit produces a sine wave by generating a square wave first at the necessary frequency using an A1 amplifier. The connection of this amplifier can be done like an astable oscillator and the frequency of this can be determined through resistor R1 and capacitor C1. The two-pole LPF using amplifier A2, it filters the output of square wave signal from amplifier A1. This filter cut off frequency is

equivalent to the frequency of square wave from amplifier A1.

The square wave signal is made up of the basic frequency & the abnormal harmonics of the basic frequency. Most of the harmonic frequencies remove by the LPF & the basic frequency remains at the o/p of amplifier A2. The square wave signal's basic frequency component is 1.27 times the square wave signal's peak amplitude. The output of the sine wave amplitude will be around 87% of the square wave signal.

The peak of this wave will depend on the supply voltage of the amplifier as well as the o/p swing condition of the amplifier. In addition, the peak of the sine & square wave will change the track within the supply voltage of the amplifier. In this circuit, the frequency is specified along with the calculated values of C1, C2, R1, C3, R4 & R5. Here the resistor values are 1K Ohms & this must be matched in value to assist in minimizing errors during the operation of actual frequency as compared with the operation of calculated frequency.

The following equations are used for the component selection. The necessary sine wave frequency is 'F'. The capacitor C1 value can be selected randomly. The other values of the component are calculated like the following.

**C2 = C1**

**C3=2C1**

**R1= 1/2F/0.693 * C1**

**R6 = R5**

**R5 = 1/8.8856 *F*C1**

**How to Generate Sine Wave in Arduino?**

Using the digital synthesis method, a sine wave can be generated using an Arduino in an accurate way. In this method, there is no requirement for extra hardware. The range of frequency is 0 – 16 KHz. Here, distortion is less than 1% on frequencies upto 3KHz. So this method is not only helpful for generating sound and music in tests or measurement equipment. In addition, the DDS method is used in telecommunication. Like FSK and PSK.

To implement the digital direct synthesis method within the software, we require four components like an accumulator & a tuning word; these are two lengthy integer variables, a digital-analog converter can be provided through the PWM unit. A reference CLK is derived through an interior hardware timer within the ATmega. The tuning word can be added to the accumulator. The MSB of the accumulator can be taken as an address of the sine wave table wherever the fetched value is generated as an analog value through the PWM unit. This entire process can be cycle timed through an interrupt procedure that works as the reference clock.

**DAC Sine Wave Generator**

Generating high-quality sine waves is difficult but using a non-linear DAC method is used to generate high-quality sine waves.

Additionally, by using the low-cost DAC-ADC technique, both ADC & DAC linearity information are precisely obtained through simply 1 hit per code. So, it is feasible to include the information of DAC linearity to the input of DAC codes, which stops the DAC nonlinearity at o/p to attain high purity.

This method is authenticated through wide simulation results, which confirmed its exactness and strength against dissimilar structures, resolutions, otherwise ADC/DAC performances. So, this high quality of sine waves is used widely in different

applications because of less cost and easy setup. As well, the linearity information of ADC & DAC is precisely acquired together without any accuracy instrumentation.