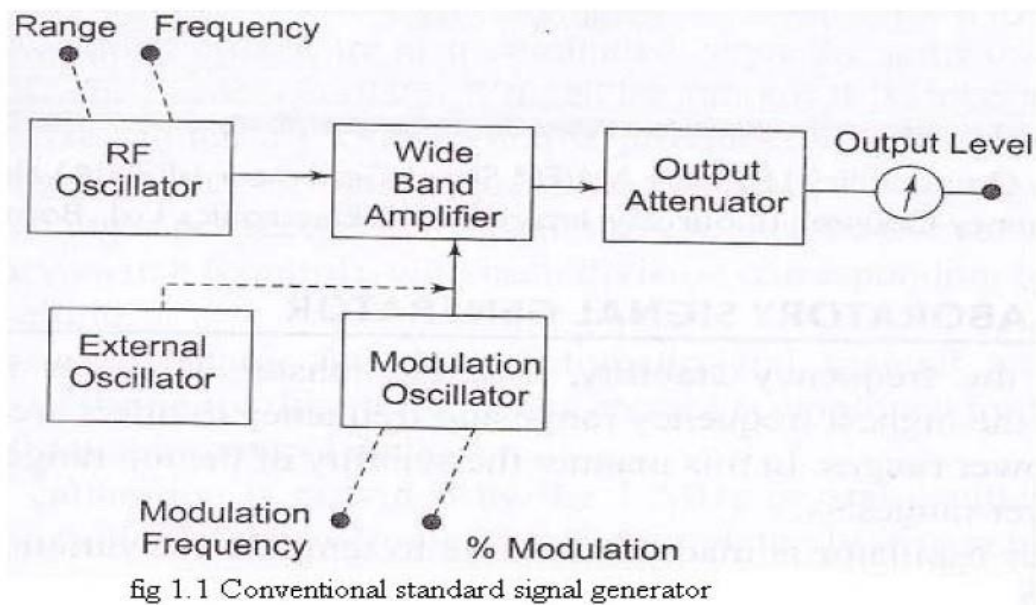


## Unit II

### Signal Generators and Analysis Instruments:

#### STANDARD SIGNAL GENERATOR

A standard signal generator produces known and controllable voltages. It is used as power source for the measurement of gain, signal to noise ratio (SN), bandwidth standing wave ratio and other properties. It is extensively used in the measuring of radio receivers and transmitter instrument is provided with a means of modulating the carrier frequency, which is indicated by the dial setting on the front panel. The modulation is indicated by a meter. The output signal can be Amplitude Modulated (AM) or Frequency Modulated (FM). Modulation may be done by a sine wave, Square, rectangular, or a pulse wave. The elements of a conventional signal generator



#### FUNCTION GENERATOR

A function generator produces different waveforms of adjustable frequency. The common output waveforms are the sine, square, triangular and saw tooth waves. The frequency may be adjusted, from a fraction of a Hertz to several hundred kHz. Various outputs of the generator can be made available at the same time. For example, the generator can provide a square wave to test the linearity of a rectifier and simultaneously provide a saw tooth to drive the horizontal deflection amplifier of the CRO to provide a visual display. Capability of Phase Lock the function generator can be phase locked to an external source. One function generator can be used to lock a second function generator, and the two output signals can be displaced in phase by adjustable amount. In addition, the fundamental frequency of one generator can be phase locked to a harmonic of another generator, by adjusting the amplitude and phase of the harmonic; almost any waveform can be generated by addition.

The function generator can also be phase locked to a frequency standard and its output waveforms will then have the same accuracy and stability as the standard source. The block diagram of a function generator is illustrated in fig. Usually the frequency is controlled by varying the capacitor in the LC or RC circuit. In the instrument the frequency is controlled by varying the magnitude of current which drives the integrator. The instrument produces sine, triangular and square waves with a frequency range of 0.01 Hz to 100 kHz.

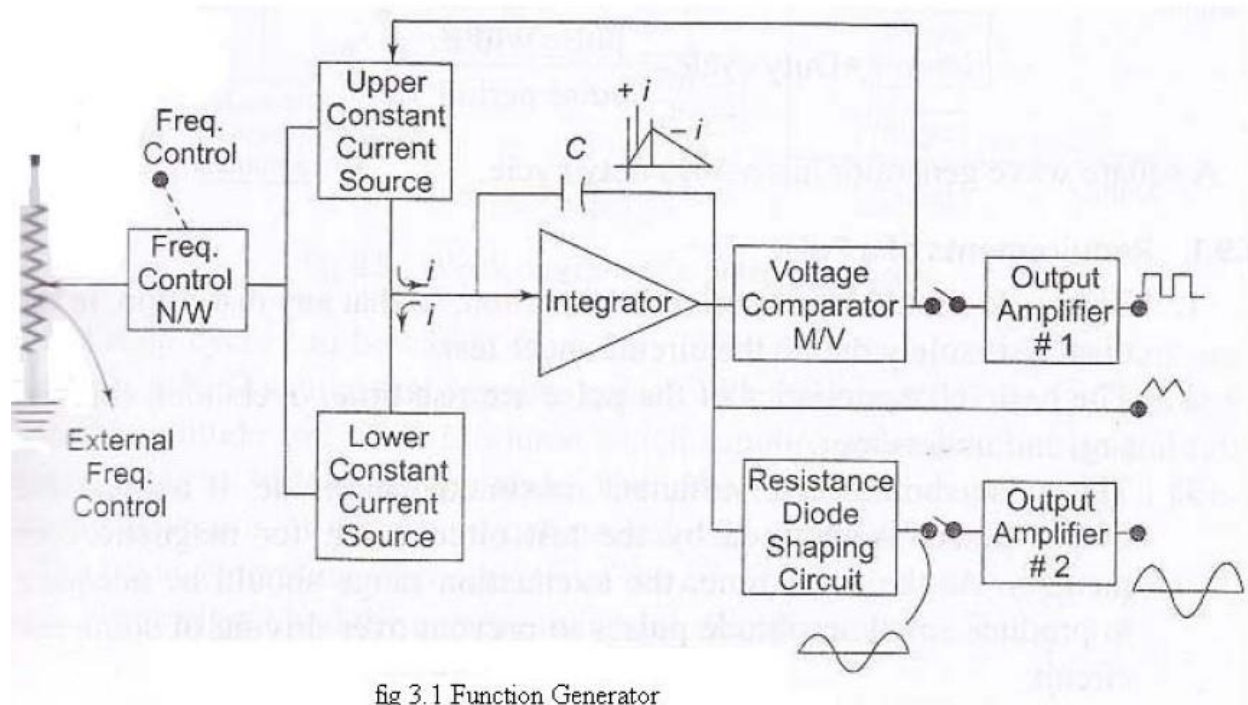


fig 3.1 Function Generator

The frequency controlled voltage regulates two current sources. The upper current source supplies constant current to the integrator whose output voltage increases linearly with time, according to the equation of the output signal voltage. An increase or decrease in the current increases or decreases the slope of the output voltage and hence controls the frequency. The voltage comparator multi-vibrator changes states at a pre-determined maximum level of the integrator output voltage. This change cuts off the upper current supply and switches on the lower current supply. The lower current source supplies a reverse current to the integrator, so that its output decreases linearly with time. When the output reaches a pre-determined minimum level, the voltage comparator again changes state and switches on the Lower current source. The output of the integrator is a triangular waveform whose frequency is determined by the magnitude of the current supplied by the constant current sources. The comparator output delivers a square wave voltage of the same frequency.

$$e = -\frac{1}{C} \int_0^t i dt$$

The resistance diode network alters the slope of the triangular wave as its amplitude changes and produces a sine wave with less than 1% distortion.

### **PULSE GENERATOR**

A pulse generator is an electronic device that emits electrical signals in pulses - normally rectangular pulses. These pulse generators are used for a wide variety of applications, but most commonly as bench test equipment when developing logic circuits of various forms. These generators are used as measuring devices in combination with a CRO. They provide both quantitative and qualitative information of the system under test. They are made use of in transient response testing of amplifiers. The fundamental difference between a pulse generator and a square wave generator is in the duty cycle.

$$\text{Duty cycle} = \frac{\text{pulse width}}{\text{pulse period}}$$

### **Requirements of a Pulse**

1. The pulse should have minimum distortion, so that any distortion, in the display is solely due to the circuit under test.
2. The basic characteristics of the pulse are rise time, overshoot, ringing, sag, and undershoot.
3. The pulse should have sufficient maximum amplitude, if appreciable output power is required by the test circuit, e.g. for magnetic core memory. At the same time, the attenuation range should be adequate to produce small amplitude pulses to prevent over driving of some test circuit.
4. The range of frequency control of the pulse repetition rate (PRR) should meet the needs of the experiment. For example, a repetition frequency of 100 MHz is required for testing fast circuits.
5. Some pulse generators can be triggered by an externally applied trigger signal; conversely, pulse generators can be used to produce trigger signals, when this output is passed through a differentiator circuit.
6. The output impedance of the pulse generator is another important consideration. In a fast pulse system, the generator should be matched to the cable and the cable to the test circuit. A mismatch would cause energy to be reflected back to the generator by the test circuit, and this may be reflected by the generator, causing distortion of the pulses.
7. DC coupling of the output circuit is needed, when dc bias level is to be maintained. The basic circuit for pulse generation is the asymmetrical multi-vibrator. A laboratory type square wave and pulse generator is shown in Fig below.

The frequency range of the instrument is covered in seven decade steps from 1Hz to 10 MHz, with a linearly calibrated dial for continuous adjustment on all ranges.

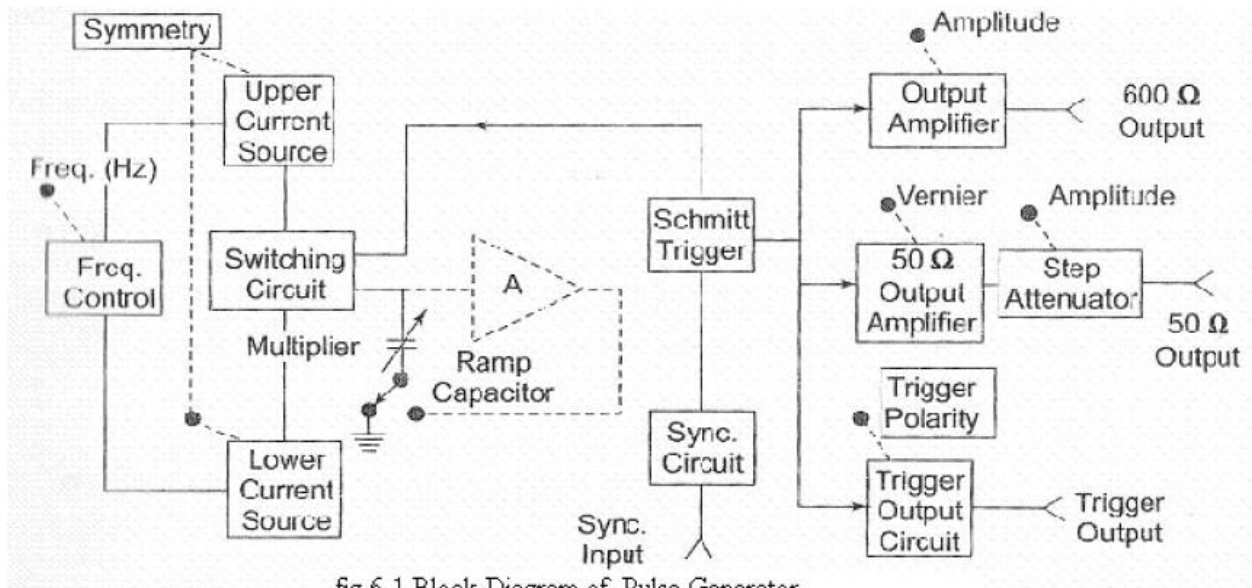


fig 6.1 Block Diagram of Pulse Generator

## DISTORTION FACTOR METER

Distortion meter is an essential tool for audio perfectionists, measuring unwanted changes in sound signals that affect clarity.