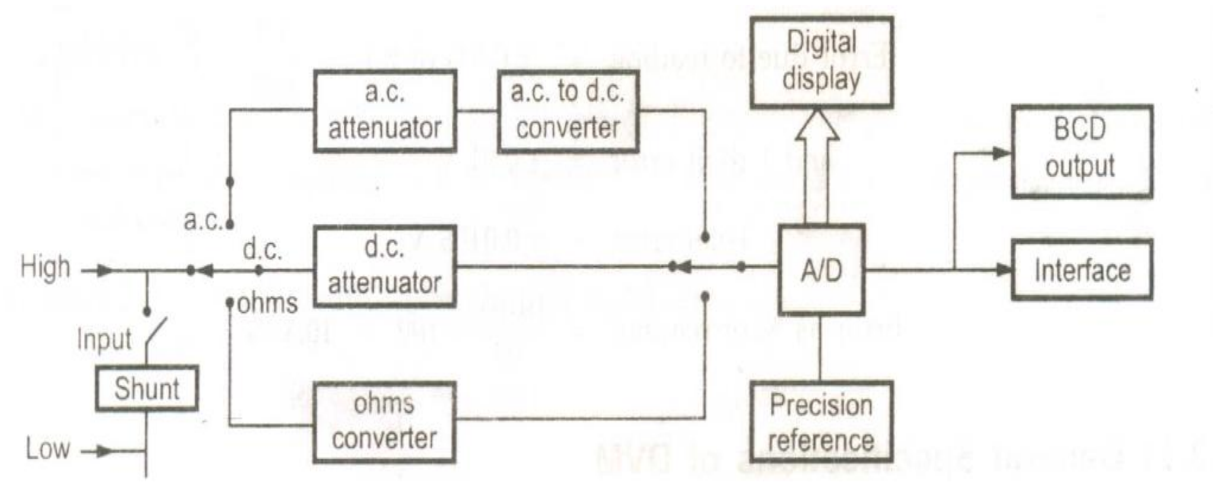
DIGITAL MULTIMETERS AND FREQUENCY METER

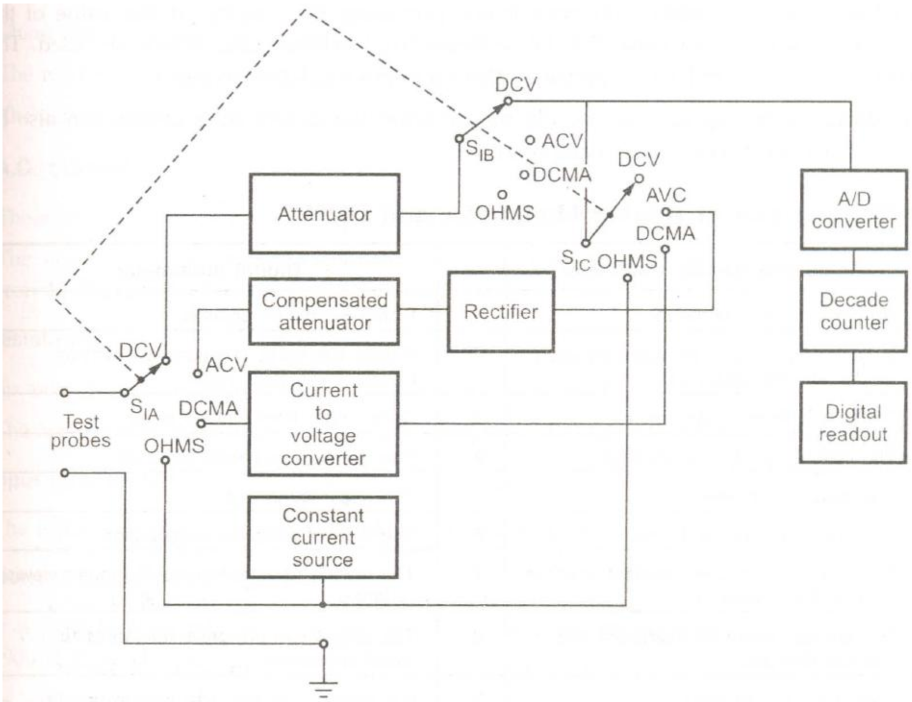
Digital multimeters:

The digital multimeter is an instrument which is capable of measuring a.c. voltages, d.c. voltages, a.c. and d.c. currents and resistances *over* several ranges. The basic circuit of a digital multimeter is always a d.c. voltmeter as shown in the Fig



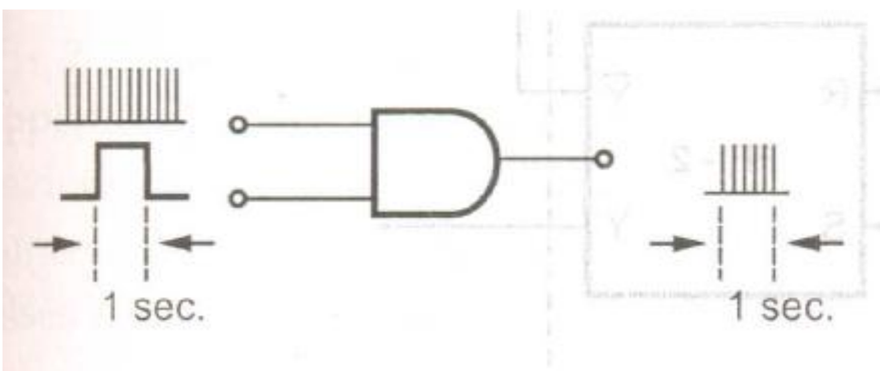
The current is converted to voltage by passing it through low shunt resistance. The a.c. quantities are *converted* to d.c. by employing various rectifier and filtering circuits. While for the resistance measurements the meter consists of a precision low current source that is applied across the unknown resistance while gives d.c. voltage. All the quantities are digitized using analog to digital converter and displayed in the digital form on the display.

The basic building blocks of digital multimeter are several *AID* converters, counting circuitry and an attenuation circuit. Generally dual slope integration type ADC is prefprred in the multimeters. The single attenuator circuit is used for both a.c. and d.c. measurements in many commercial multimeters. The block diagram of a digital multimeter is shown in the Fig.



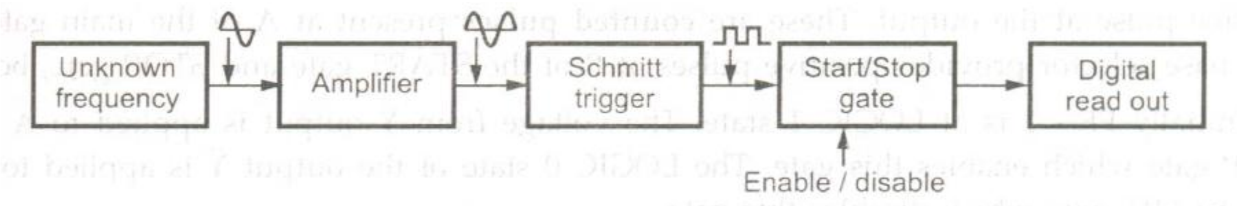
Digital Frequency meter:

Principle:



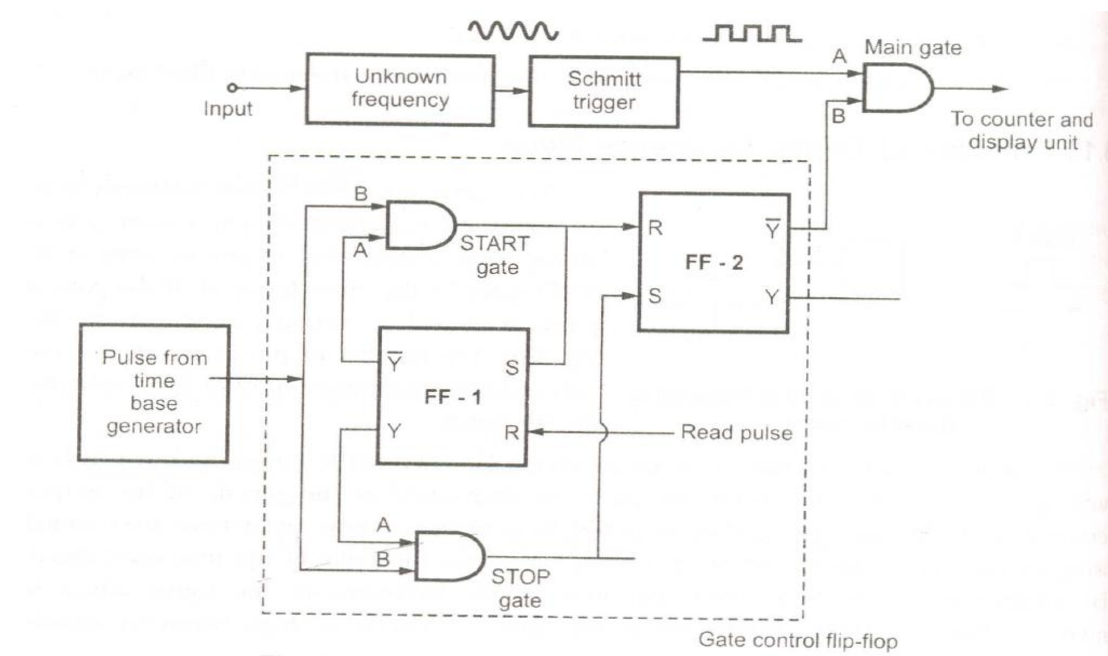
The signal waveform whose frequency is to be measured is converted into tngger pulses and applied continuously to one terminal of an AND gate. To the other terminal of the gate, a pulse of 1 sec is applied as shown in the Fig. The number of pulses counted at the output terminal during period of 1 sec indicates the frequency.

The signal whose frequency is to be measured is converted to trigger pulses which is nothing but train of pulses with one pulse for each cycle of the signal. At the output terminal of AND gate, the number of pulses in a particular interval of time are counted using an electronic counter. Since each pulse represents the cycle of the unknown signal, the number of counts is a direct indication of the frequency of the signal which is unknown. Since electronic counter has a high speed of operation, high frequency signals can be measured.



Block diagram of digital frequency meter

The signal waveform whose frequency is to be measured is first amplified. Then the amplified signal is applied to the schmitt trigger which converts input signal into a square wave with fast rise and fall times. This square wave is then differentiated and clipped. As a result, the output from the schmitt trigger is the train of pulses for each cycle of the signal. The output pulses from the schmitt trigger are fed to a START/STOP gate. When this gate is enabled, the input pulses pass through this gate and are fed directly to the electronic counter, which counts the number of pulses. When this gate is disabled, the counter stops counting the incoming pulses. The counter displays the number of pulses that have passed through it in the time interval between start and stop. If this interval is known, the unknown frequency can be measured.



The output of unknown frequency is applied to the Schmitt trigger which produces positive pulse at the output. These are **counted pulses** present at A of the t11<lingate. The time base

selector provides positive pulses at B of the START gate and STOP gate, both. Initially FF - 1 is at LOGIC 1 state. The voltage from Y output is applied to A of the STOP gate which enables this gate. The LOGIC a state of the output Y is applied to input A of START gate which disables this gate. When STOP gate enables, positive pulses from the time base pass through STOP gate to S input of FF - 2, setting FF - 2 to LOGIC 1 state. The LOGIC a level of Y of **FF - 2** is connected to B of main gate, which confirms that pulses from unknown frequency source can't pass through the main gate. By applying a positive pulse to R input of FF - I, the operation is started. This changes states of the FF - 1 to Y = 1 and Y = O. Due to this, STOP gate gets disabled, while START gate gets enabled. The same pulse is simultaneously applied to all decade counters to reset all of them, to start new counting.

With the next pulse from the time base passes through START gate reseting FF - 2 and it changes state from LOGIC a to LOGIC 1. As Y changes from a to 1, the gating signal is applied to input B of the main gate which enables the main gate.

Now the pulses from source can pass, through the main gate to the counter. The counter counts pulses. The state of FF - 1 changes from a to 1 by applying same pulse fromSTART gate to S input of FF - 1. Now the START gate gets disabled, while STOP gategets enabled. It is important that the pulses of unknown frequency pass through the maingate to counter till the main gate is enabled.

The next pulse from the time base generator passes through STOP Gate to S input of FF - 2. This sets output back to 1 and Y =*0* O. Now main gate gets disabled. The source supplying pulses of unknown frequency gets disconnected. In between this pulse and previous pulse from the time base selector, the number of pulses are counted by the counter. When the interval of time between two pulses is 1 second, then the count of pulses indicates the frequency of the unknown frequency source.

Source : http://elearningatria.files.wordpress.com/2013/10/ece-iii-electronic-instrumentation-10it35-notes.pdf