

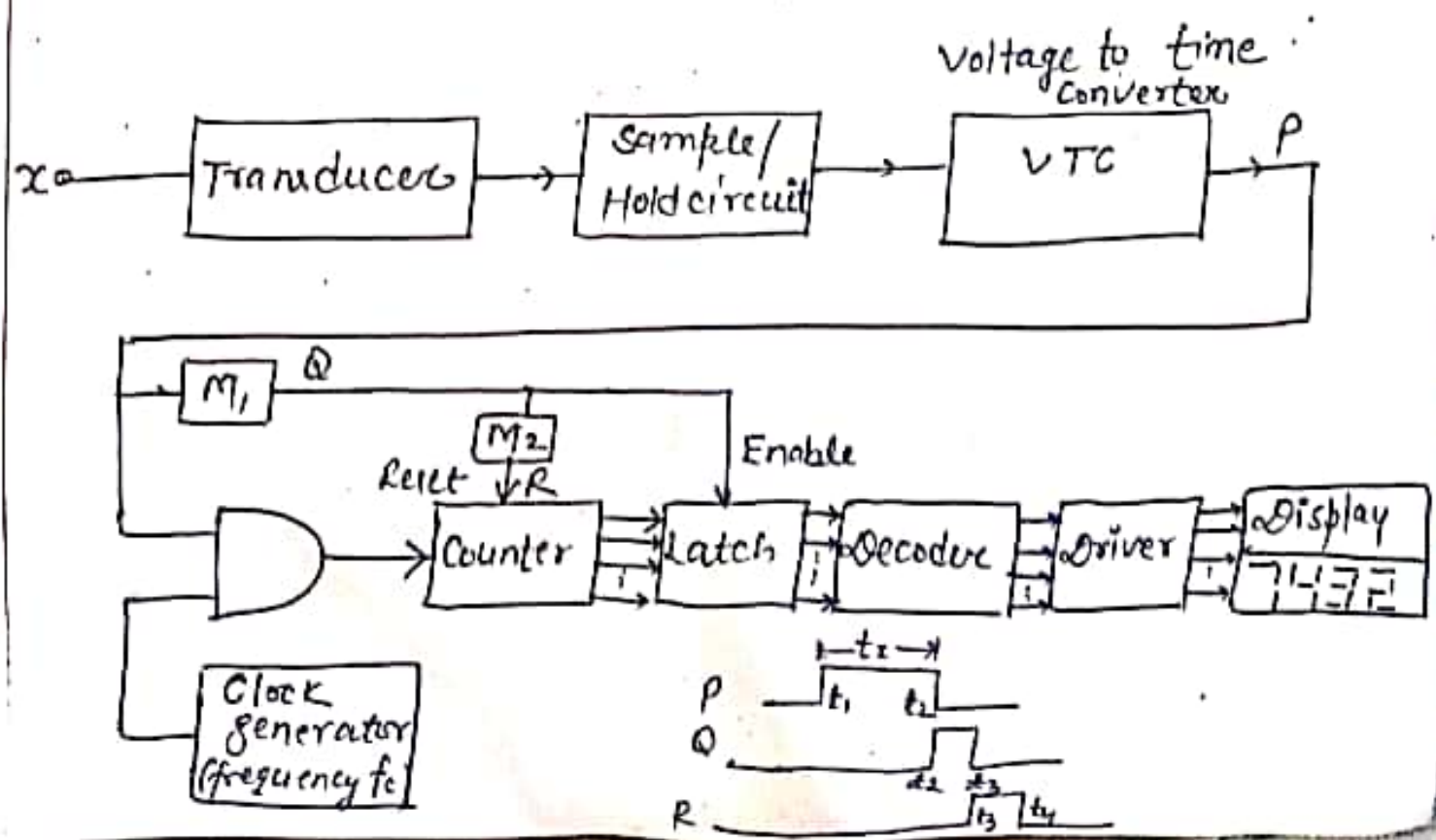
* Importance of Digital measurement *

Digital measuring instruments are self-contained device that automatically present the value of measured quantity on a digital display.

The measurement result are converted into a digital code for subsequent transmission and processing in measuring system.

Any physical quantity can be measured through following process:

Let x is the quantity to be measured



Fundamental Nature of Digital Measurement ^③

Measurement, which is produced by an additive (or equivalent) measurement operation.

A commonly used digital scheme for the measurement of a physical quantity 'x' in terms of the standard time period of clock pulse. That is shown in figure (on previous page)

It consist of following steps;

→ The quantity 'x' is converted into an electrical signal. This is achieved by employing a suitable transducer or sensor.

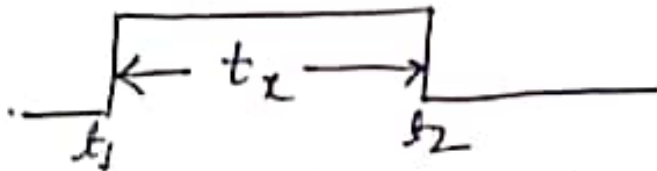
→ If 'x' is time varying signal then the output of transducer (V) will be also vary.

In this case 'V' is sampled and sampled value is held for a time, sufficient for the instrument to carry out the measurement.

→ 'V' is converted into a single pulse or periodic pulse of width t_x proportional to V.

it means

$$t_x \propto V$$



the circuit used for this purpose (voltage equivalent time)

is called VTC (voltage to time converter)

also it is known as voltage to pulsewidth converter.

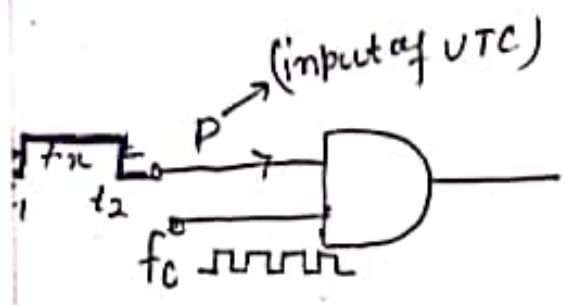
→ Time interval ' t_x ' is converted into Binary number. through the gate counter [a counter is a device which stores (and sometimes display) the number of times a particular event or process has occurred. often in relationship to a clock. the value on output lines represent a number in the binary or BCD number system.]

→ Binary coded information is converted into decimal through decoder and converted information is displayed in the form of illuminated numbers through Driver.

A latch is used to have the facility of transferring the contents of the counter to the subsequent circuit at time t_2 .

When the counting of pulses during interval t_x is just over, by a narrow pulse generated by the monostable multivibrator M_1 .

At time t_3 the counter is reset by narrow pulse generated by another monostable multivibrator (M_2)



the pulse of highly accurate and stable frequency f_c are allowed to pass through an electronic gate which is opened for the time duration t_x and closed for all other times

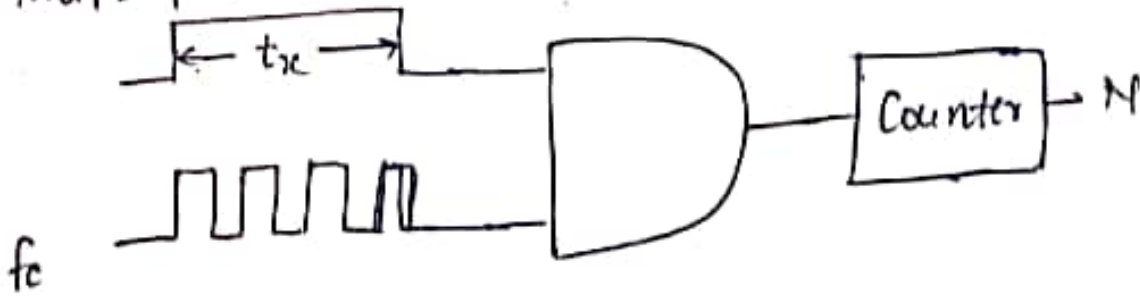
Let $N =$ total number of pulse passed through the gate during t_x

Then

$$N = f_c t_x$$

⑥

Then the number of clock pulse counted and this is proportional to time t_x



$$N = f_c \cdot t_x$$

$$\therefore N \propto t_x$$

$$\therefore \boxed{N \propto x}$$

Digital measurement of x is done in terms of number of clock pulse. therefore the accuracy of measurement is primarily dependent upon the stability and the accuracy of the clock..

★ Advantage of Digital Measurement ★

- The error due to parallax is totally eliminated.
- Resolution can be improved almost without a limit by increasing the number of digit in the display.
- Ex - the resolution of 8 bit digit display is in 10^8 .
- Such digital instrument are absolutely free from any mechanical movement

hence no frictional error is involved.

- No delicate (जाज़ूक) construction is required.
- No controlling & damping torque needed.
- Microprocessor or digital computer can be used.
- digital output can be stored.
- Variation in the component value due to temperature, humidity, vibration, and variations, and variations in supply voltage and noise level etc do not affect the accuracy.

Disadvantage

- it is much more complex than the analog ones.
- it is costlier than analog ones.

The main element in a S/H circuit, which holds the voltage, is a capacitor that allow to charge to the desired voltage and then disconnected to hold the voltage for desired length of time.