then disabled.

the number stored in the counter, n_1 & n_2 are then used to calculate the time interval according to equation

$$T = (n_1 - 1)T_1 - (n_2 - 1)T_2$$

Accuracy and Resolution using the vernier method can be very high if the startable oscillators are stable and if the difference in frequency b/w them is small $[(f_1 - f_2) << <<]$

the maximum conversion time for this method is given by

$$CT = \frac{T_1 \cdot T_2}{r} = \frac{T_1 T_2}{T_1 - T_2}$$

Analogue V/s Digital Techniques

Digital Method offers good linearity over a wide dynamic range.

Measurements are stable over a long time interval.

Analogue methods are able to achieve higher resolution than digital one's

Analogue method uses simple, low cost technology, which is an advantage

Analogue circuits suffer from temperature sensitivity, time drift. and are more prone (inclined) to external disturbance. this needs to be corrected by performing calibration..

Analogue methods are also difficult to implement in integrated circuit technology.

In order to obtain the advantages of both methods, a combination can be used.

Phase Measurement

Requirement of an Ideal phase meter

The ideal phase meter have following characteristics

→ It has high resolution and accuracy.

→ It is free from errors introduced by the presence of harmonics

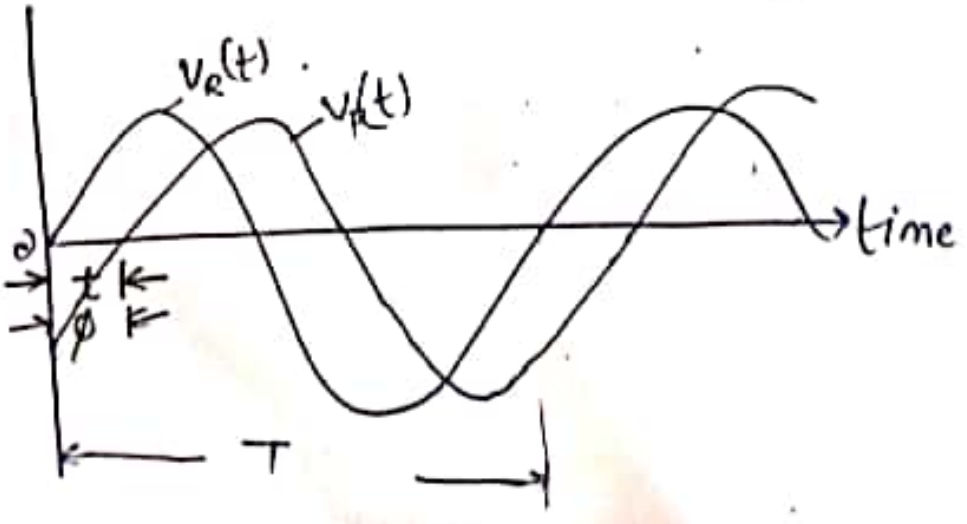
→ It has a simple set up procedure. the initial adjustment and checking of the phase meter shouldbe simple and relatively permanent

— It has ability to diffinguish b/w leading and lagging phase angles.

— It has wide frequency range, if it is meant for general use

phase measurement through time measurement

Let $V_R(t)$ → Reference voltage signal.
$V_p(t)$ → Phase shifted signal



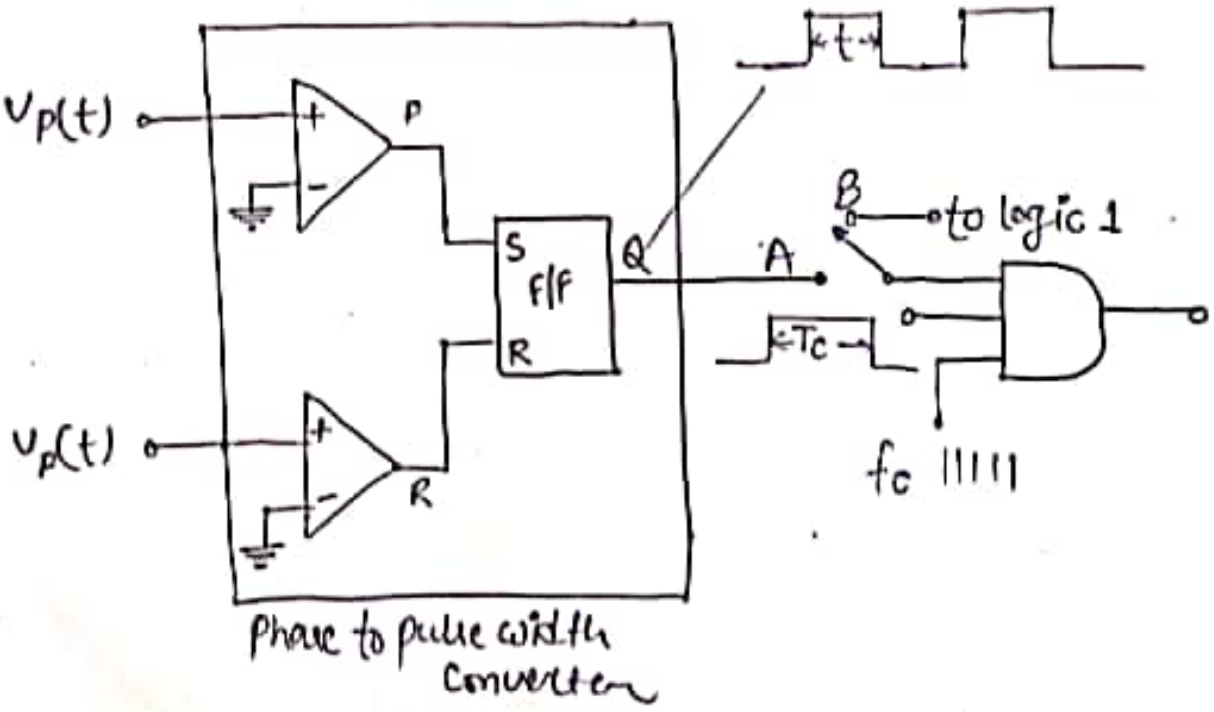
the phase relationship can be expressed in term of period T and the time delay t as

$$\phi^\circ = 360\left(\frac{t}{T}\right)$$

$\frac{t}{T}$ = constant that independent of signal frequency

Therefore ϕ does not change with a change in frequency to measure the phase difference b/w these two signal $[V_R(t) \& V_P(t)]$ it is only necessary to measure the t and T.

These measurements are carried out as shown in figure.



(Measurement of t & T)

for t and T measurement, switch S is thrown to position A and B, respectively. The flip-flop is positive edge triggered. Note that the reading will be in terms of the lead angle.