~~Vernier technique~~ ~~for small~~ time Interval
Measurement ~~technique~~ -

Time interval measurement is the measurement
of elapsed (paued) time between some designated
START and STOP phenomenon.

in case of pulied Radar system thue phenomenon ~~is~~ are
the transmitted pulle and the received echo.
~~Setrectors~~ are use to duect the presence of thue pulse
and a time discriminator is used to extract (onduling
the timing information from the pulse relative thae
event and deliver a pulse of standard amplitude
or width or both to the timing circuit.

i/p pulle can not have infinite rise time so the timing
usually occure when the pulse crosses a certain thretold.

A time interval meter (TIM), Time to digital converter (TDC)
, or Time counter are used to measure interval value
into a digital value. which can thun be diskelayed
in a decimal form.

The important specification to consider in time
interval measurement.

2 — Minimum dead time → the min. time b/w the stop pulse and the next start pulse

3 — Minimum pulse width —:— the shortest pulse the the TIM will recognise.

4 — Measurement Range —
         The longest possible time the instrument can measure

5 — Non-linearity of the conversion process.

6 — Quantisation step or LSB

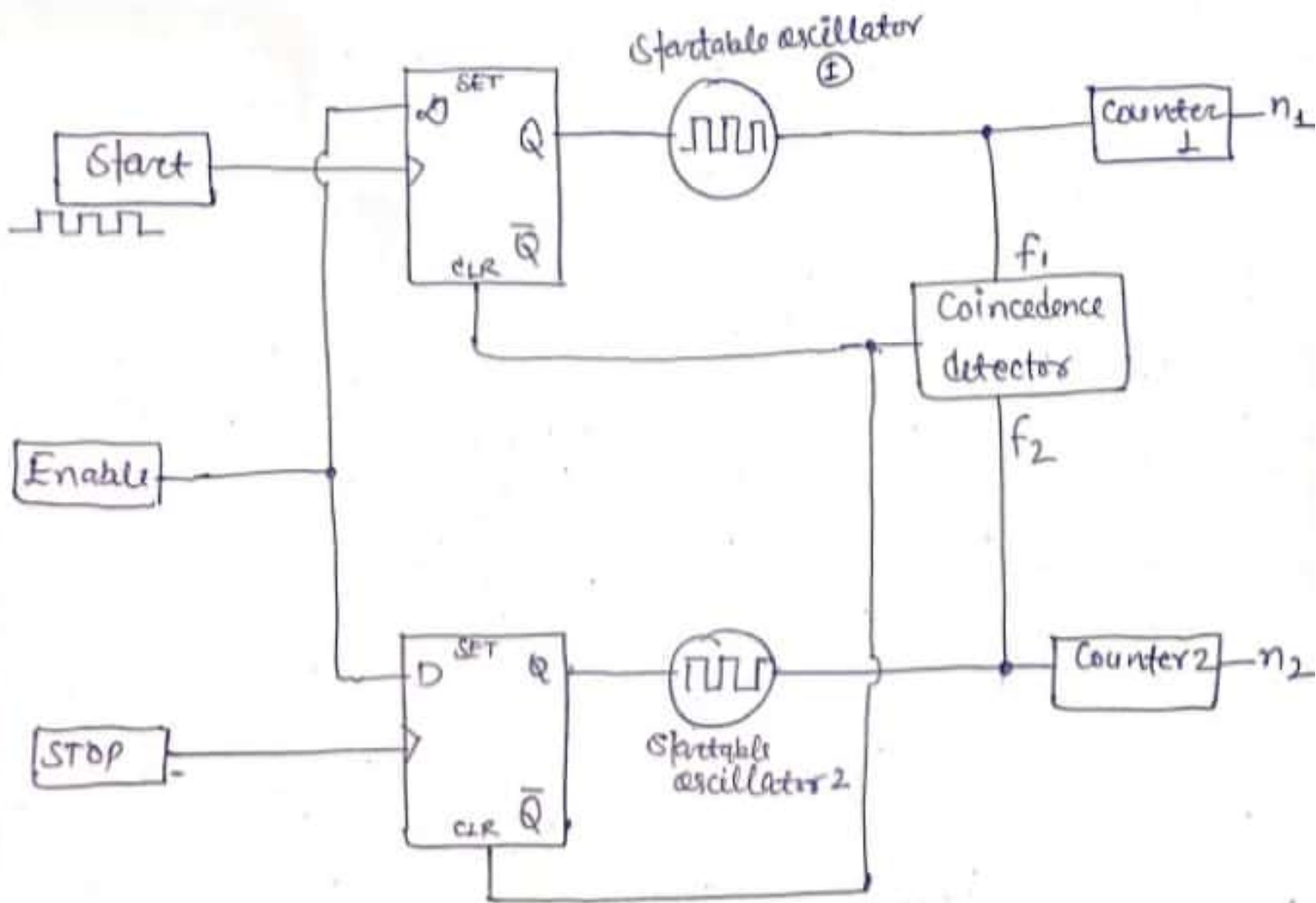7 — Readout Speed — How to fast the instrument can produce a result.

there are various technique and method of achieving precise and accurate Time Interval

1 — Time-stretcheing followed by a counter

2 — Time to valtage converstion followed by ADC conversion

2 — The vernier Method.
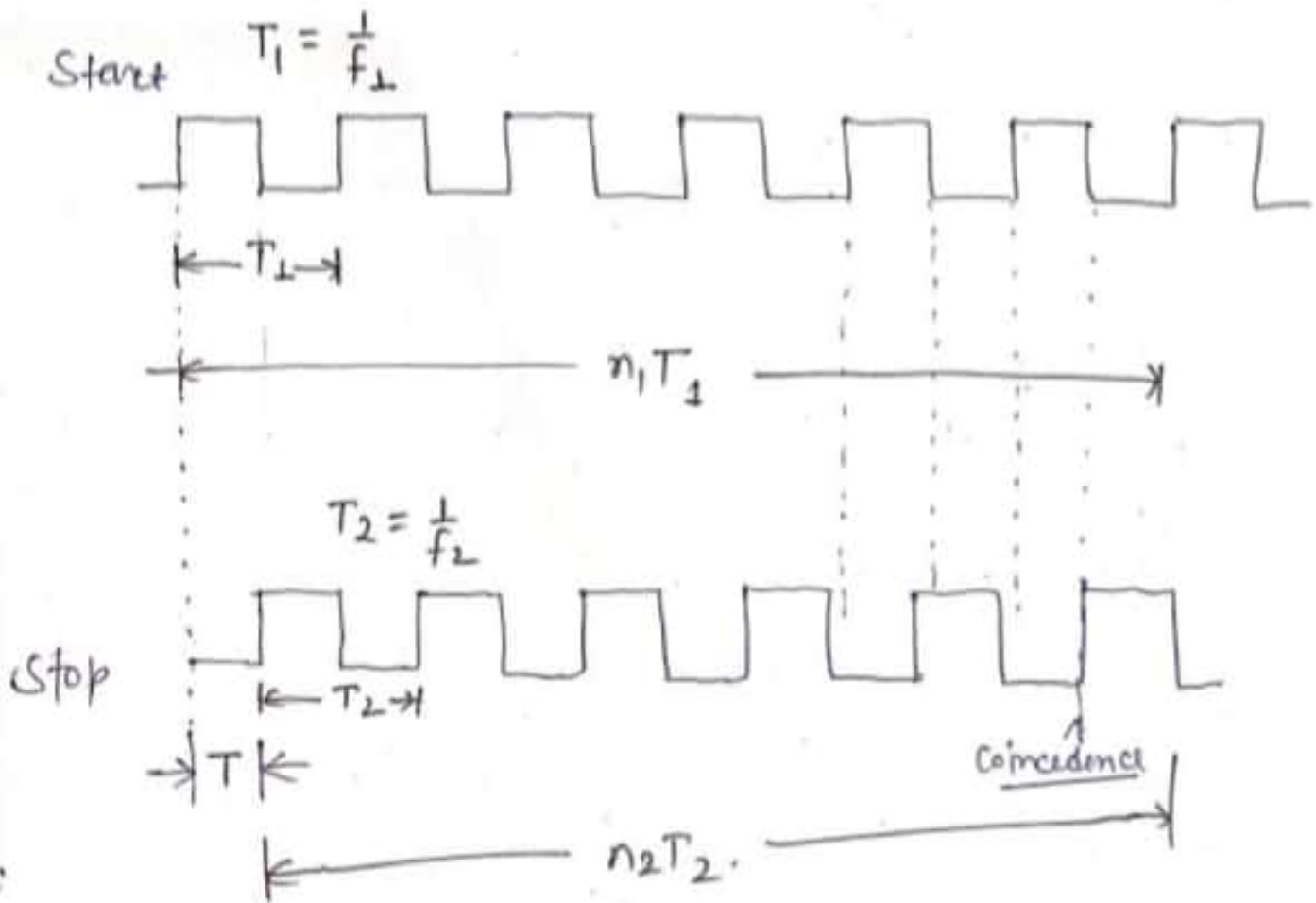
Vernier technique

Vernier method uses two startable oscillators with difference frequency $f_1 = \frac{1}{T_1}$ and $f_2 = \frac{1}{T_2}$

f_1 & f_2 differ only by a small amount.

The resoultion is therefore $r = T_1 - T_2$.

The startable oscillators are triggered by START and STOP instances respectively.

Start $T_1 = \frac{1}{f_1}$

$\leftarrow T_1 \rightarrow$

$n_1 T_1$

$T_2 = \frac{1}{f_2}$

Stop

$\leftarrow T_2 \rightarrow$

$\rightarrow |T| \leftarrow$

Coincidence

$n_2 T_2$.

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

from figure above

of one make the period T_2 shorter than the period T_1, the number of period in stop channel will gradually catch up caught up with the start channel and the two oscillator are in phase, the coincedence circuit is triggered which stop the counter and switch off both oscillator. the oscillator are