AIM

To study performance characteristic of angular position error detector using two potentiometer.

EQUIPMENTS REQUIRED

Pair of Potentiometer (D.C system), Synchro trans-mitter controll transformer (A.C system), servo potentiometer

There are built-in-source for error detector these are 1.C. (dc) regulated +5V (nominal)

AC: 400Hz, 1.2 Vpp (nominal). DVM is provided in pannel for DC measurement and for AC measurement external CRO is provided

THEORY.

Error detector consists of two servo potentio-meter with calibrated dials of 1° resolution mounted on the panel. and there outputs are permanantly wired to a unity gain instrum. amplifier.

Demodulator ac output of the potentiometer is connected to input demodulator and output comes out to be phase sensitive dc signal.

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The output voltage when the power supply has been applied to the system is given as e(t).

$e(t) = K_e\,\theta(t)$

where,

$\theta(t)$ is the shaft position and K_e is the constant of proportionality.

so, $K_e = \dfrac{\text{Voltage applied, volts}}{\text{Maximum angular span, radians}}$

Use of the two potentiometers in parallel applied from the same source enables the comparison of the shafts positions.

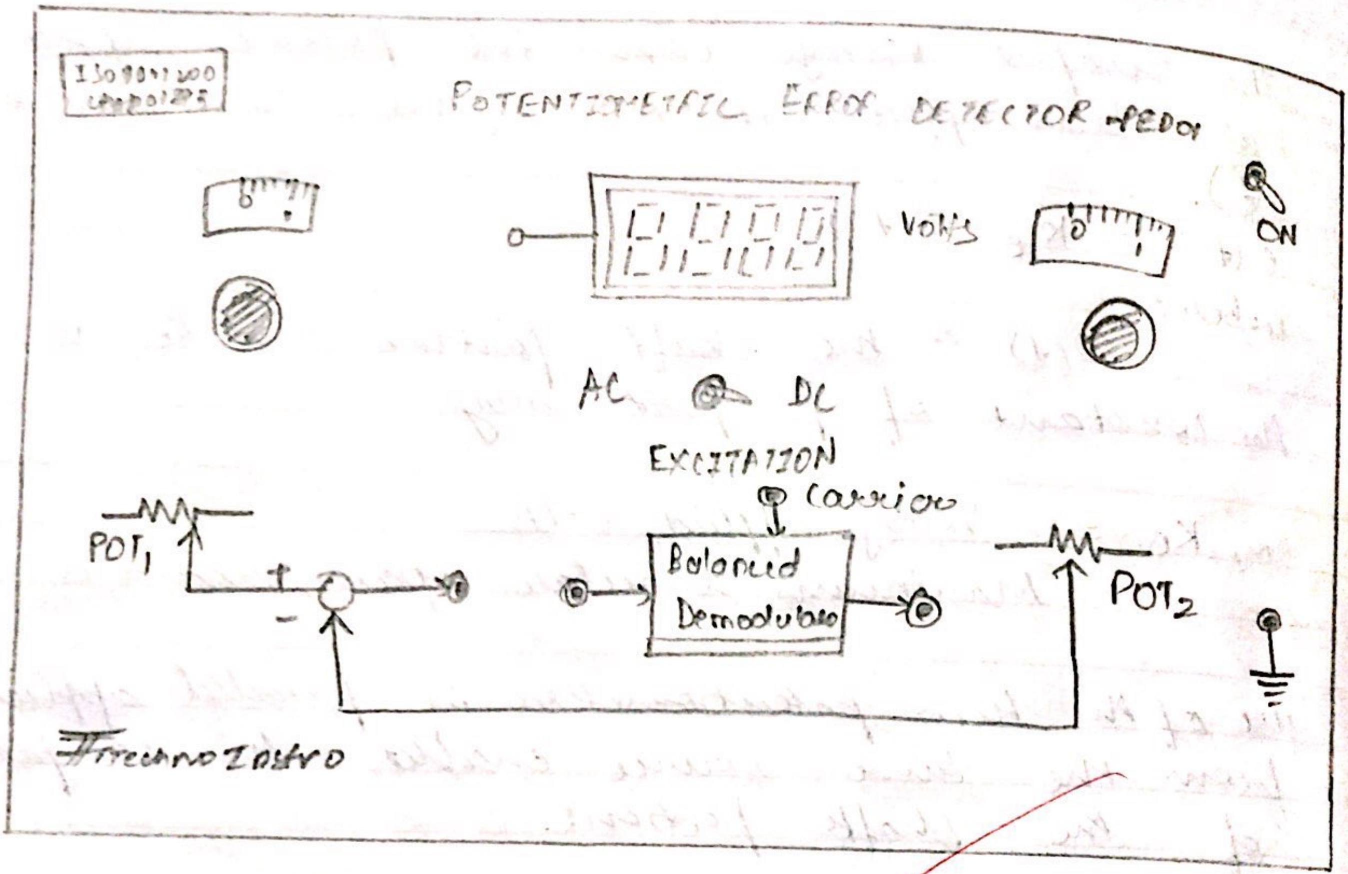
$e(t) = K_e(\theta_1(t) - \theta_2(t)) = K_e\,\theta_e(t)$

As soon after this the AC amplifier are free of drift and transformer coupled output allows a single supply operation.

On the other hand potentiometer error detector supplied with AC signal

$e(t) = K_e\,\theta_e\,V \sin\omega_c t$

Error Detector



$\theta_e(t) = \sin \omega_s t$

e(t) may also be represented as a suppressed carrier signal

$$e(t) = \frac{1}{2} K_s V \left(\cos(\omega_c - \omega_s)t - \cos(\omega_c + \omega_s)t \right)$$

$$e(t) = K_s \, \theta_e (V \sin \omega_c t \cdot V' \sin \omega_c t)$$

$$= \frac{K_e V V'}{2} \theta_e (1 - \cos 2\omega_c t)$$

The above signal passed through a low pass filter and remove $2\omega_c$ component in order to yeild the output.

$$e_o(t) = \frac{K_s V V'}{2} \theta_e$$

PROCEDURE

→ Linearity Range of the potentiometer

Maximum percentage deviation of the output Voltage from its ideal value and is defined by angle of potentiometer output is available.

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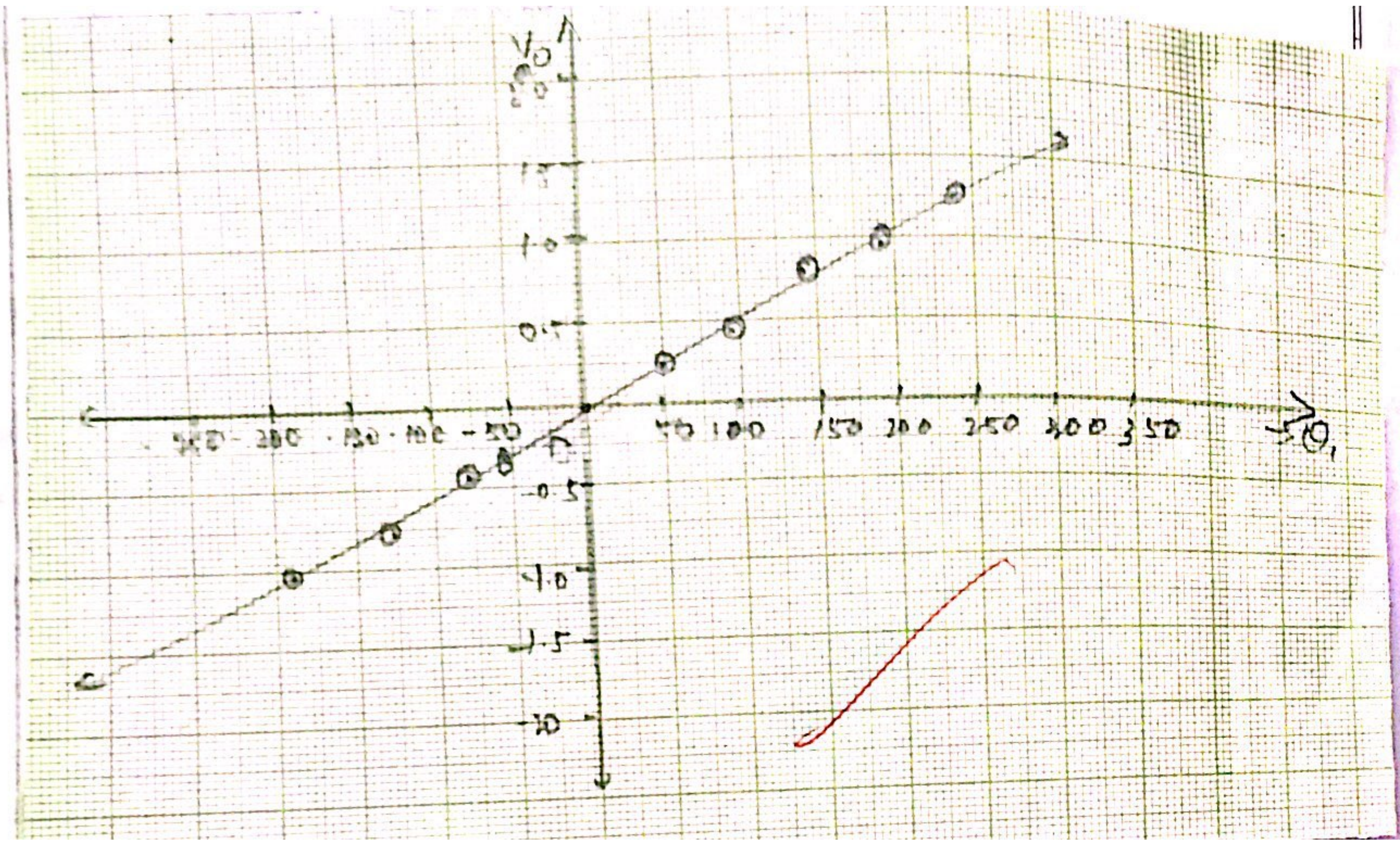
#) DC exitation

$\theta_2 = 180^\circ$

θ_1	θ_2	V_0
10	+170	2.45
30	150	2.17
50	130	1.93
70	110	1.64
90	90	1.35
110	70	1.04
130	50	0.75
150	30	0.44
170	10	0.15
190	-10	-0.15
210	-30	0.44
230	-50	0.75
250	-70	1.03
270	-90	1.33
290	-110	1.62
310	-130	1.91
330	-150	2.19
350	-170	2.48



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→ FOR DC Ex.

Set excitation switch to DC.

Keep POT 2 fixed at any position and do not disturb the position let it be θ_2.

Turn POT 1 in steps of 20°. record the angular position of θ_1 and output V_o.

V_o V/s θ_1 observe linearity Range.

error Detector Coeff.

$$K_e \text{ (slope)} = \frac{\text{Change in output Voltage}}{\text{change in the shaft position}}$$

$$= \frac{\Delta V_o}{\Delta \theta_e}$$

→ FOR AC Ex.

Display the 'carrier' on the CRO and measure amplitude and frequency

Now observe V_o on CRO while turning either POT 1 or POT 2 slowly

The phase V_o changes

$\theta_e = (\theta_1 - \theta_2)$

Now connect V_o to the input of the 'balanced Demodulator'

Plot graph Demodulator output V_{DEM} V/s θ_e

		-4.15
10	-170	-3.69
30	-150	-3.25
50	-130	-2.78
70	-110	-2.29
90	-90	-1.80
110	-70	-1.28
130	-50	-0.78
150	-30	-0.26
170	-10	-0.02
190	0	+0.21
210	10	+0.72
230	30	+1.19
250	50	+1.77
270	70	+2.67
290	90	+3.12
310	110	+3.64
330	130	+4.10
350	150	

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θ1	θ	Vo
10	-170	-4.15
30	-150	-3.69
50	-130	-3.25
70	-110	-2.38
90	-90	-2.29