

Experiment - 4.

Aim:- To study the position control of AC servomotor.

Apparatus: Servomotor Unit, Control Unit.

Theory: Motor Unit. It consists a two phase AC servomotor.

It has the following technical specification as:

Operating voltage: $120V_{ac}$, max current $0.15Amp$

Rated shaft speed: $2400RPM$, Inertia: $4.6 \times 10^{-4} Kg/cm^2$

Torque - $0.085 \times 10^{-2} Nm$.

The motor drives a small load through gear train.

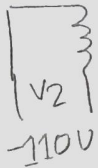
The gear ratio is $1:40$.

Hence the load shaft rotation is $2400/40 = 60RPM$. The angular displacement is sensed by a 360° servopotentiometer. A cable is attached to the unit with $9.1mm$ D type connectors.

Control Unit: It consists power supply servo-amplifier, error detector, and command potentiometer. There is a facility given to record the transient period of posn. control system under the step signal. The error detection produces a phase sensitive signal with relative amplitude.

Command Signal: There are two command signals are provided in the control unit. One is the continuous command V_c , which is given by the reference potentiometer. Sockets are provided for both the outputs for measurement purposes.

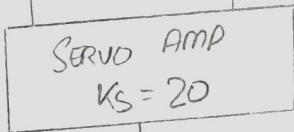
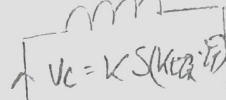
REFERENCE WINDING.



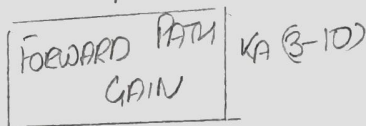
SERVOMOTOR.



CONTROL WINDING.



$$K = K_A \cdot E_t$$



$$E_t = V_R + V_O$$



FEEDBACK VOLTAGE

V_O

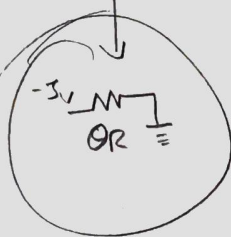
$$V_R = V_R' + V_S$$



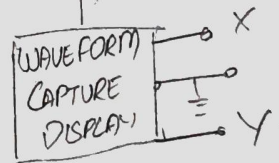
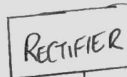
V_S



STEP



POSITION FEEDBACK POTE =



SYSTEM REPRESENTATION IN BLOCK DIAGRAM.

Error Detector: It is a input & one output block. One of them is positive oriented for command signal V_c , & one negative oriented for feedback V_o .

Gain Block: The gain setting provided upon the panel. This block provides forward gain K_f in equal steps from 3 to 10, selected by a rotatory.

Servo Amplifier Block: The servo amplifier is a push-pull transistorized amplifier operating from 36Vdc supply. Its voltage gain K_s , is fixed at 20 & its output has quadrature phase with motor reference winding voltage phase.

Waveform Capture / display block: The time response of the system is too slow for convenient display upon CRO. This memory card can capture the events, store it on a RAM and then display the stored contents on CRO for detailed studies. The unit has built in DC regulated power supplies for all blocks & motor unit reference winding operate upon 110 volt isolated AC supply.

Result:- As the value of gain increases, the % error will decrease.

K=7

V_R	V_0	Q_R	Q_0	$Q_R - Q_0 = \Delta$
66.0	8.4	30°	34°	-4
66.6	9.6	40°	43°	-3
66.2	12.26	60°	63°	-3
66.2	15.54	70°	75°	-5
66.2	18.0	90°	91°	-1
66.2	23.2	110°	118°	-8
66.2	23.2	120°	122°	-2
66.2	27.4	140°	142°	-2
66.2	30.6	160°	156°	4
66.4	34.2	180°	178°	2