Experiment-3

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

Apparatus: Motor unit, control unit.

Theory: **Motor Unit:** - It consist of permanent magnet armature controlled geared servo motor. It has technical specification as:

Voltage: 12 Vdc, 5W; Rated Shaft Speed: 50 RPM

Torque: 3.5 kg/cm at load shaft.

The angular displacement is sensed by a 360° servo potentiometer.

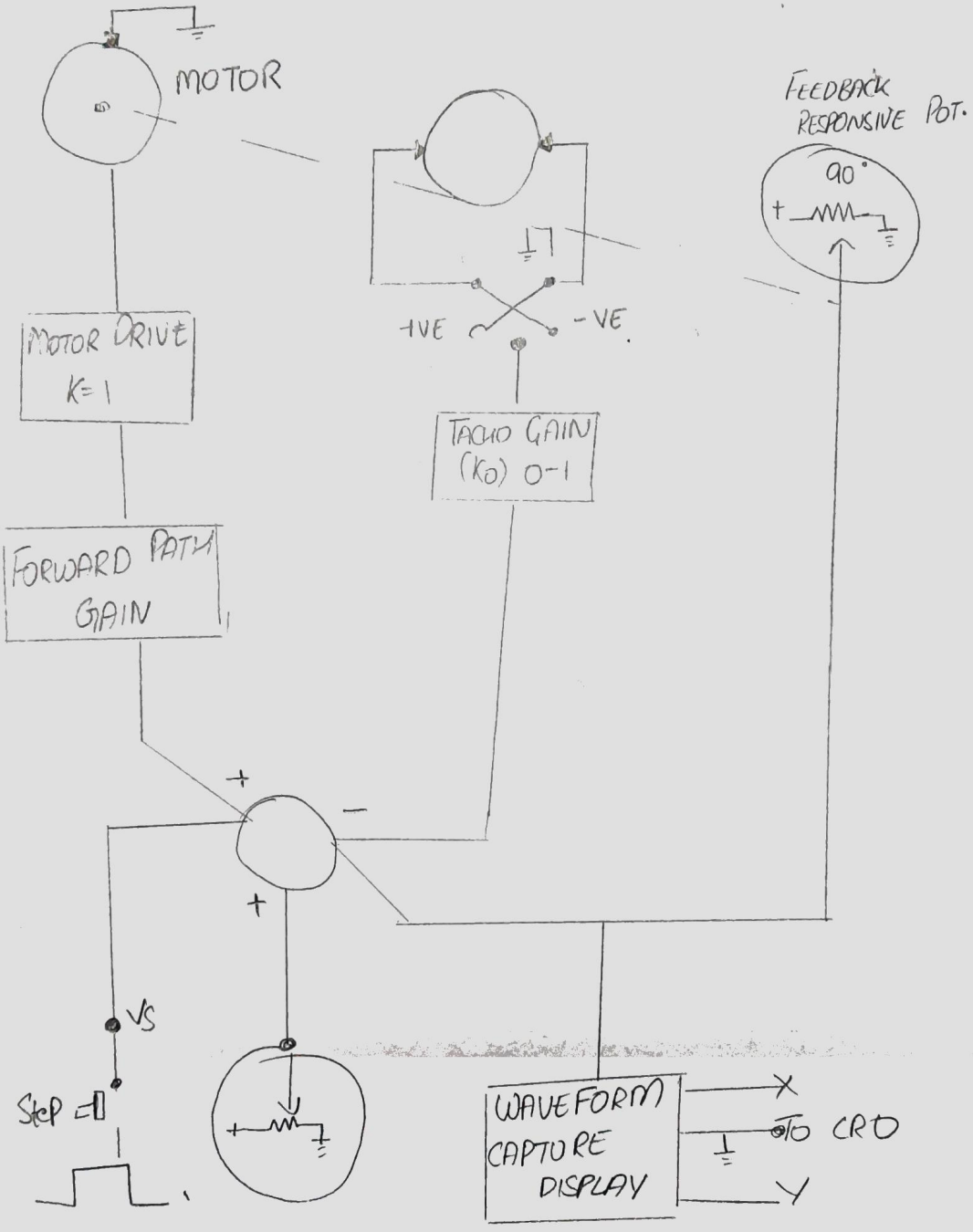
Control Unit: This unit has reference servo potentiometer, source voltage, error detector, amplifier, motor driver circuit, a RAM card & necessary regulated supplies for the circuit. The details of the control is given below:

1. **Command Signal:-** There are 2 commands signals are provided in the control unit. One is the continuous command signals are provided in the control unit.

2. **Error Detector:** It is a four & one output block, two of them are positive mounted for command signal and two negative mounted for feedback.

The output of this block is:

$$e_c = e_{c1} + e_{c2} + (-e_{f1} + e_{f2}).$$



System Representation in Block Diagram.

3. Gain Blocks: There are two gain settings provided upon the panel. One block provided forward path gain K_A in equal steps from 3 to 10, selected by rotary switch provided upon the panel.

4. Motor drivers block: The drivers used gain equal to one & is in form of complementary push pull stage to run the motor in either direction.

5. Waveform capture/display block: The time response of the system is too slow for convinient display on CRO.

6. DVM:- A 3½ digit digital voltmeter is provided to take reading of command & feedback voltages.

Procedure:

1. Connect motor unit with the control unit. Set tacho feedback = 0.
2. Switch on the power. Set $K_A = 3$.
3. Starting from one end say 30°, move command potentiometer in steps of 30° approximately upto 300°

Result: As the value of gain increases, the i. Error will decreas

K=3

θ_R	V_R	θ_o	V_o	$\Delta\theta = \theta_o - \theta_o$
0°	-0.01	4.5°	0	-4.5°
30°	0.18	29°	0.16	1°
60°	0.34	56°	0.35	4°
90°	0.61	87°	0.58	3°
120°	0.82	121°	0.82	-1°
150°	1.03	143°	0.98	7°
180°	1.22	170°	1.17	10°
210°	1.44	198°	1.138	12°
240°	1.65	227°	1.58	13°
270°	1.86	256°	1.79	24°
300°	2.06	286°	2.00	14°
330°	2.27	317°	2.24	17°

K=5

θ_R	V_R	θ_o	V_o	$\Delta\theta = \theta_o - \theta_o$
30°	0.17	28°	0.16	2°
60°	0.39	58°	0.38	2°
90°	0.6	88°	0.58	2°
120°	0.81	106°	0.78	14°
150°	1.02	145°	1.0	5°
180°	1.21	174°	1.2	6°
210°	1.42	202°	1.39	8°
240°	1.63	250°	1.59	10°
270	1.84	251	1.73	19°