Laboratory Tutorial#1

Objective: To show how an automatic position control system works.

Equipment Required: Following equipment is required to perform above task.

Quantity	Apparatus	
1	OU150A	Operation Amplifier Unit
1	AU150B	Attenuator Unit
1	PA150C	Pre-amplifier Unit
1	SA150D	Servo Amplifier
1	PS150E	Power Supply
1	MT150F	Motor-Tacho Unit
1	IP150H	Input potentiometer Unit
1	OP150K	Output Potentiometer Unit
1	Multimeter	

Approximate Time Required: Two Hours

Discussion

We know how rotary potentiometers can generate an error signal to show the misalignment of the output cursor with that of the input cursor. Now if the output potentiometer is mounted on the shaft of the geared motor, we would have the basis of an automatic position control system. That is, we use the error signal to drive the motor in a direction such as to reduce the misalignment to zero, as shown in figure-2. In previous laboratory tutorial we found that the error signal could vary from positive to negative. On examining the field windings we found that one transistor would energise one winding for drive in one direction and other would cause reverse rotation. Now the pre-amplifier is able to provide this type of control because if there is a positive voltage on either of its inputs, then one of its outputs becomes positive, whilst if one of its inputs becomes negative, then the other output becomes positive.

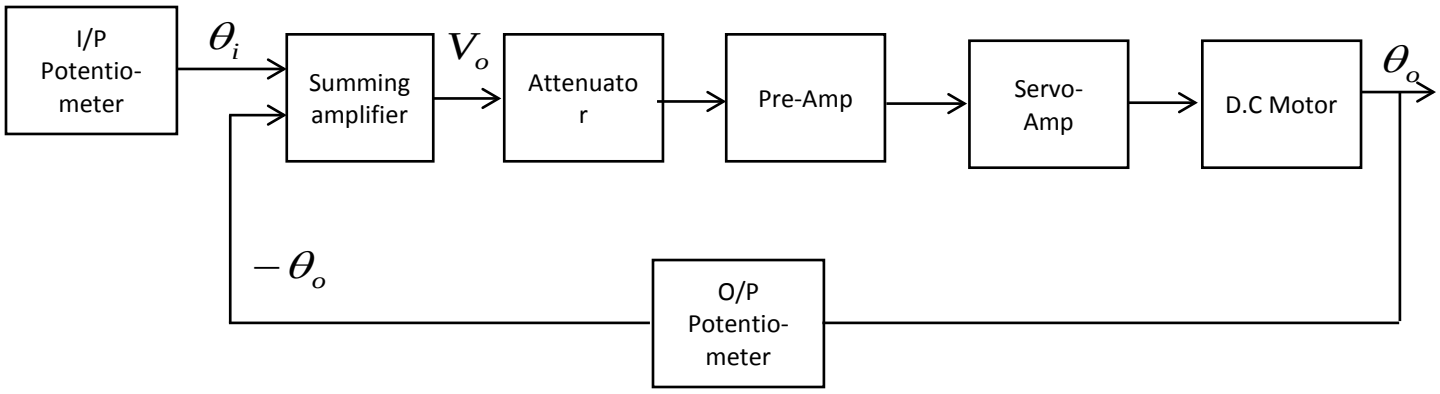

Figure-1: Block Diagram of Position Control System

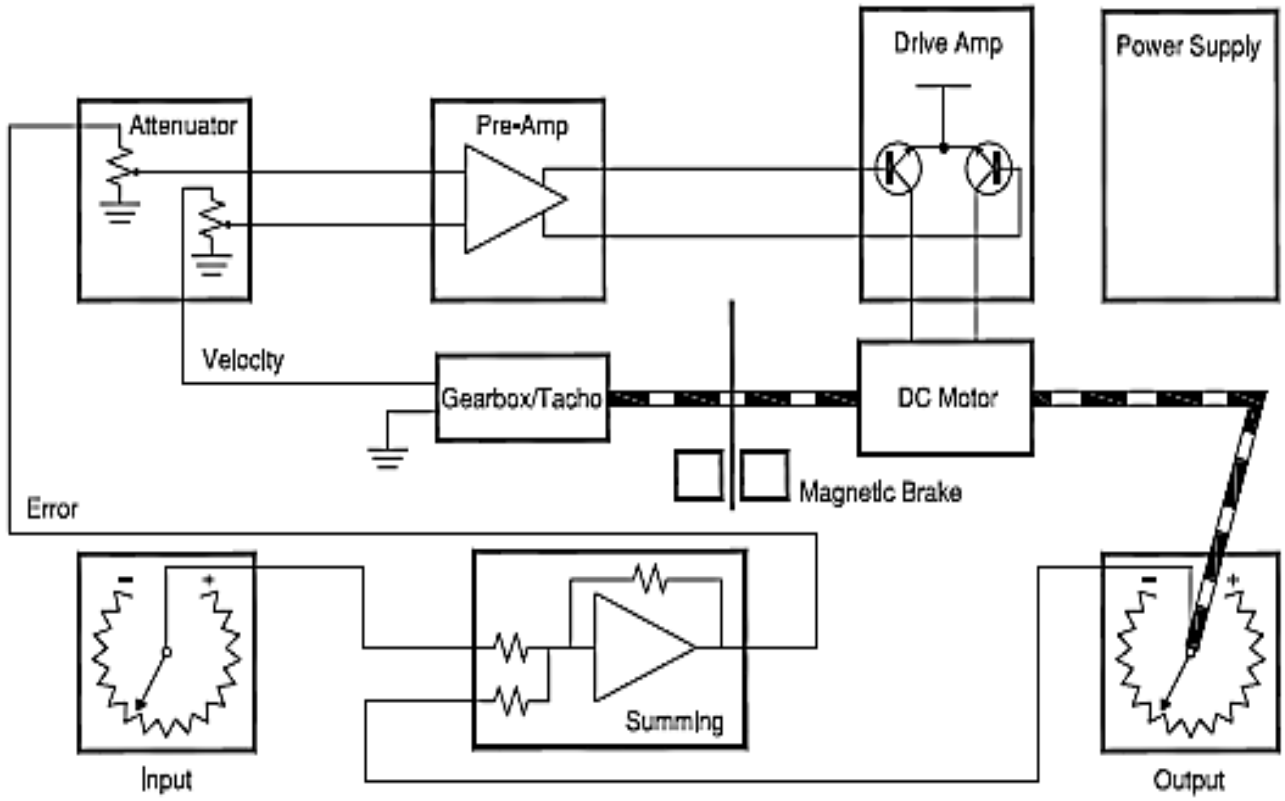

Figure-2: Position Control System

Experimental Set Up

We shall utilize the error signal (output V_o of the operational amplifier) to drive the output potentiometer via the pre-amplifier and the d.c motor, as shown in figure-3. The potentiometer on the Attenuator unit can now

be used as a gain control and should initially be set to zero before switching on the power. The slider should be connected to the input of the pre-amplifier. With the gain set to zero adjust the pre-amplifier zero so that motor does not rotate.

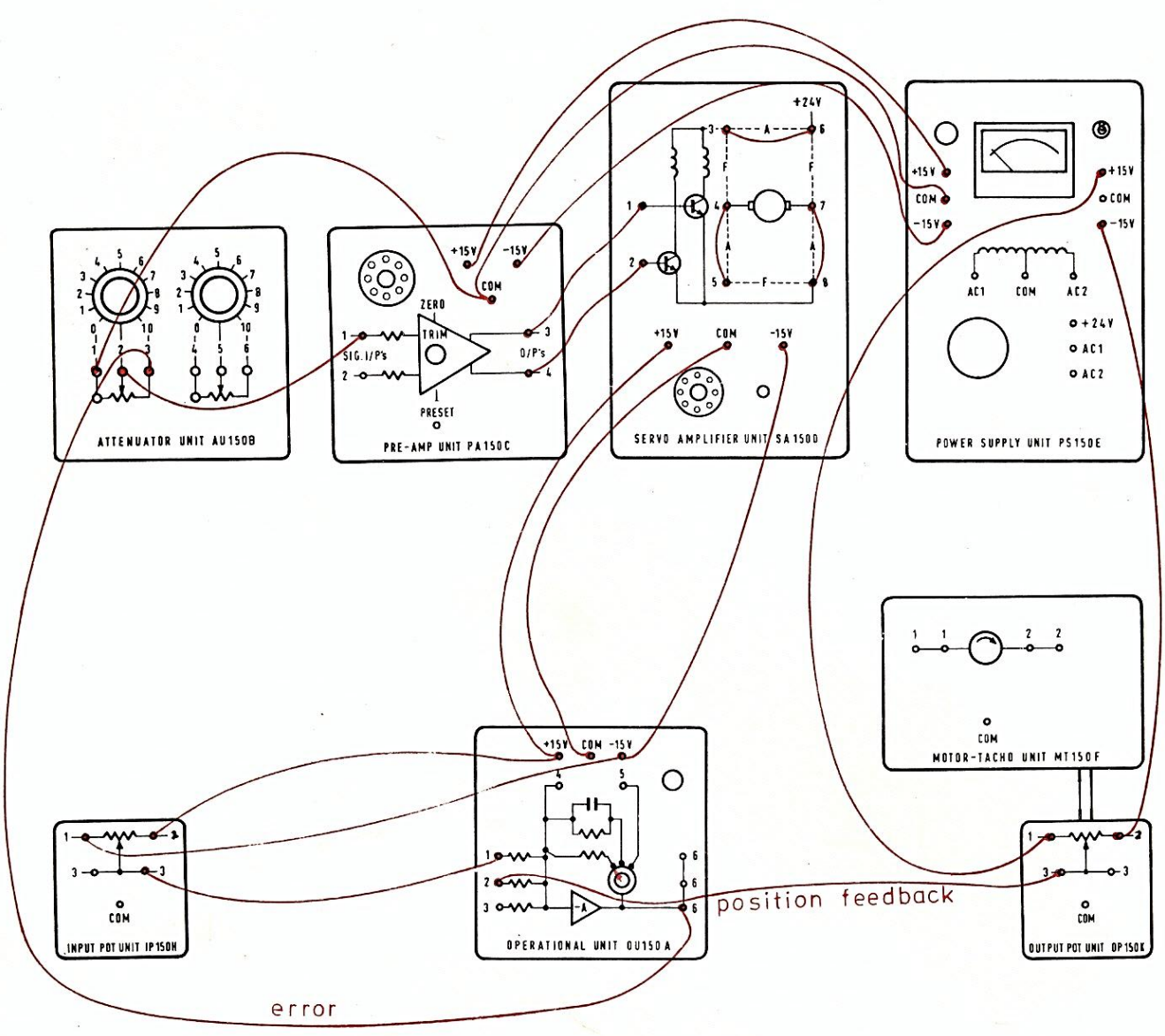

Figure-3: Closed loop position control system set up

Now set the input potentiometer to some arbitrary angle and increase the attenuator setting. The output shaft should rotate to an angle nearly equal to that of the input shaft. If the output cursor stops before arriving at the set position (i.e. system has steady state error) adjust the gain using attenuator unit so that the difference between input position and the output position is minimized. This could introduce overshoots in the system's

response or can even make the system unstable. Change the input position to several arbitrary angles and tabulate the results in following table.

S.No	**Input potentiometer** θ_i	**Output potentiometer** θ_o	***Misalignment*** $(\theta_o - \theta_i)$

Table-1: Position control System

Conclusion/ Comments: