

# Laboratory Tutorial#5

**5.1. Objective:** Open loop vs closed control of speed of a D.C motor.

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

<u>Quantity</u>	<u>Apparatus</u>	
1	OU150A	Operation Amplifier Unit
1	AU150B	Attenuator Unit
1	SA150D	Servo Amplifier
1	PS150E	Power Supply
1	MT150F	Motor-Tacho Unit
1	LU150L	Load Unit

**5.3. Approximate Time Required:** One to two Hours

**5.4. Prerequisites:** Laboratory Tutorial#1 and Laboratory Tutorial#2.

## **5.5. Discussion**

Referring back to Laboratory Tutorial#2 on motor characteristics, we have developed a curve of signal input to the servo-amplifier against speed. This means without any load you can set the motor to run at a specified speed by determining the value of input signal. With an open loop system there can be reasonable speed control when operating without load or with a fixed load. But the open loop system would be very unsuitable if a variable load is connected to motor shaft.

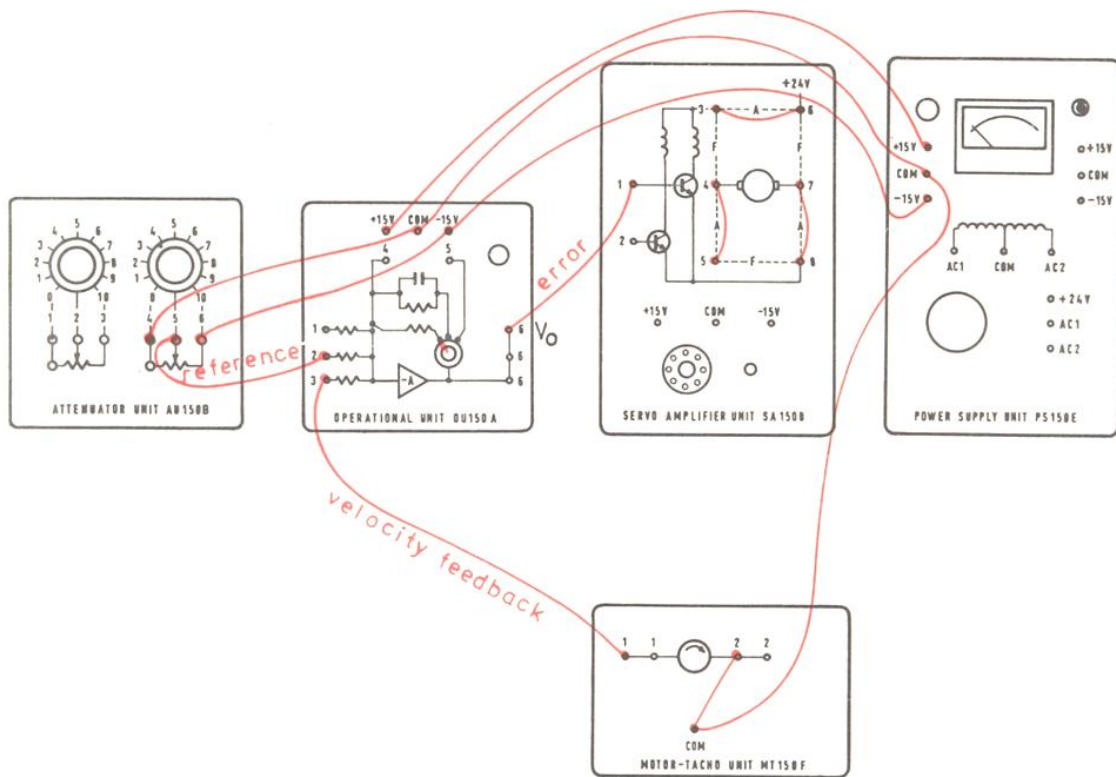
In this practical we are going to show the improvement that can result from closing the loop and using feedback. That is, the actual speed will be compared with required speed. This produces an error signal to actuate the servo-amplifier output so that the motor maintains a constant speed.

## **5.6. Experimental Set Up**

As a first experiment we will operate the motor in open loop under constant and variable load conditions. The patch diagram for open loop speed control is given in figure-2.5. Table-2.2 developed in Laboratory Tutorial#2 can be used here to analyze the performance of the system under variable load conditions.

In next experiment we will simply feedback a signal proportional to the speed, using the Tachogenerator. We then compare it with a reference signal of opposite polarity, so that the

sum will produce an error signal proportional to the difference between reference speed and actual speed of the motor. The patch diagram of the simple closed loop speed control of a DC motor is shown in figure-5.1.



**Figure-5.1:** Simple Closed Loop Speed Control of a DC Motor

Connect the potentiometer slider to an input of the operational amplifier. To find out the effect of load on speed we can use the magnetic brake as a load.

S.No	Reference Voltage	Tachogenerator Voltage	Error Voltage	Speed rev/min

Table: 5.1: Closed Loop Speed Control