Experiment#4

4.1. Objective: To obtain the open loop step response of DC motor.

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

Quantity	Apparatus	
1	SA150D	Servo Amplifier
1	PS150E	Power Supply
1	MT150F	Motor-Tacho Unit
1	Function Generator	
1	Oscilloscope	

4.3. Approximate Time Required: One to two Hours

4.4. Prerequisites: Experiment#1, familiarization with oscilloscope and function generator.

4.5 Discussion

A DC motor cannot change speed instantly due to the inertia of the armature and any additional rotating load. This effect has very important consequences for control system design. To measure the transient response of a control system simple test signals need to be applied. The most common is the step signal, as is used in this practical. Following figures show the schematic and block diagrams of armature controlled DC motor.

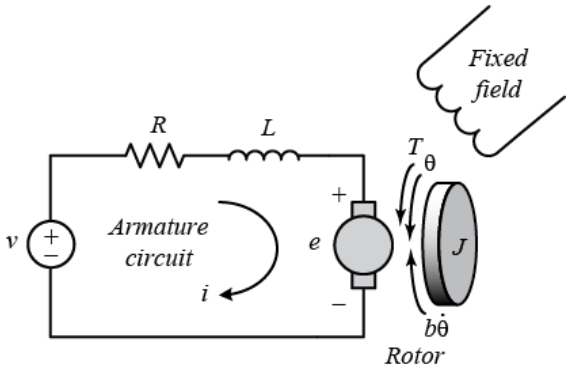

Figure-4.1: Schematic Diagram of Armature Controlled D.C Motor

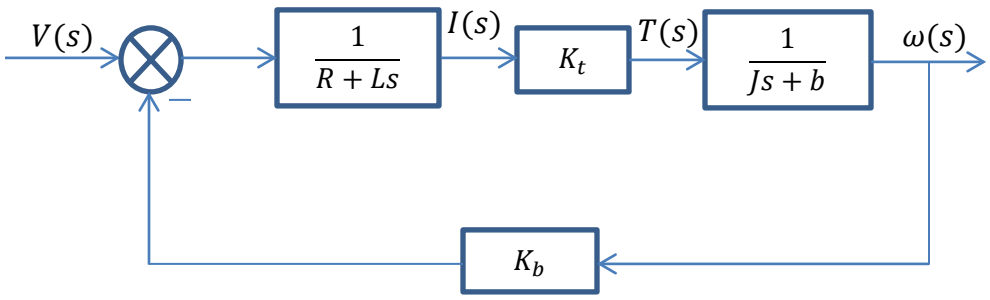

Figure-4.2: Block Diagram of Armature Controlled D.C Motor

The transfer function of armature controlled DC motor with angular speed as output is given as

$$\frac{\omega(s)}{V(s)} = \frac{\frac{K_t}{R}}{Js + (b + \frac{K_t K_b}{R})}$$

If V(s) has step form the step response of the speed can be observed on oscilloscope by connecting oscilloscope to tachogenerator voltages. However, this would all happen very quickly and it may become difficult to have a good look on the motor response. Therefore, series of low frequency pulses can be applied to capture series of identical step responses on oscilloscope as depicted in figure-4.4. Time period of the pulse train must be sufficiently greater than motor time constant in order to allow the motor to reach steady state response.

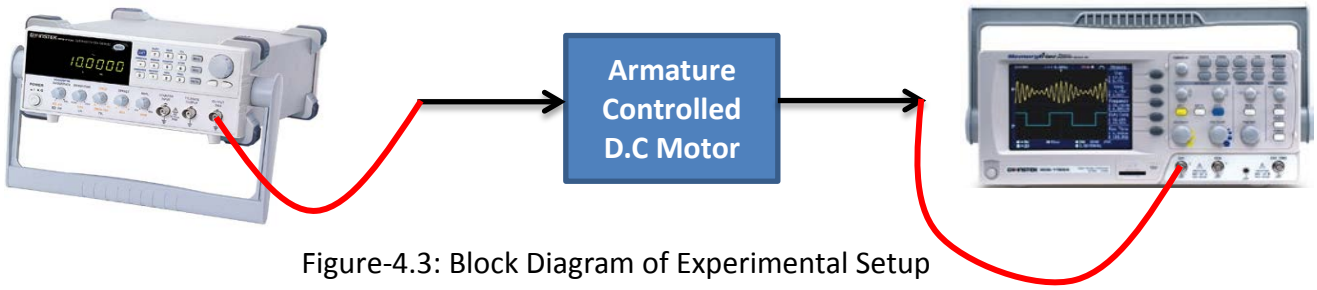

Figure-4.3: Block Diagram of Experimental Setup

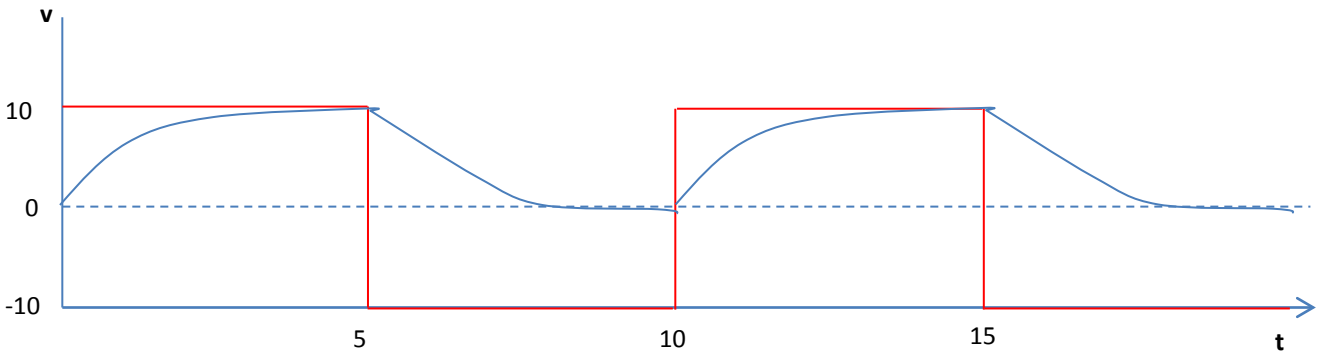

Figure-4.4: Expected Step Response Sequence

4.6 Experimental Set Up

Connect the function generator to input 1 of the servo amplifier as well to CH-1 of the oscilloscope. Set the function generator to generate a square wave of amplitude 10V and frequency to 0.1 to 0.5 Hz. Connect the tacho-generator output to CH-2 of the oscilloscope. Turn on the power supply and measure following parameters.

1. Time Constant_____
2. DC Gain_____
3. Delay Time_____
4. Steady State Value (Volts)_____
5. Steady State Value (rmp)_____

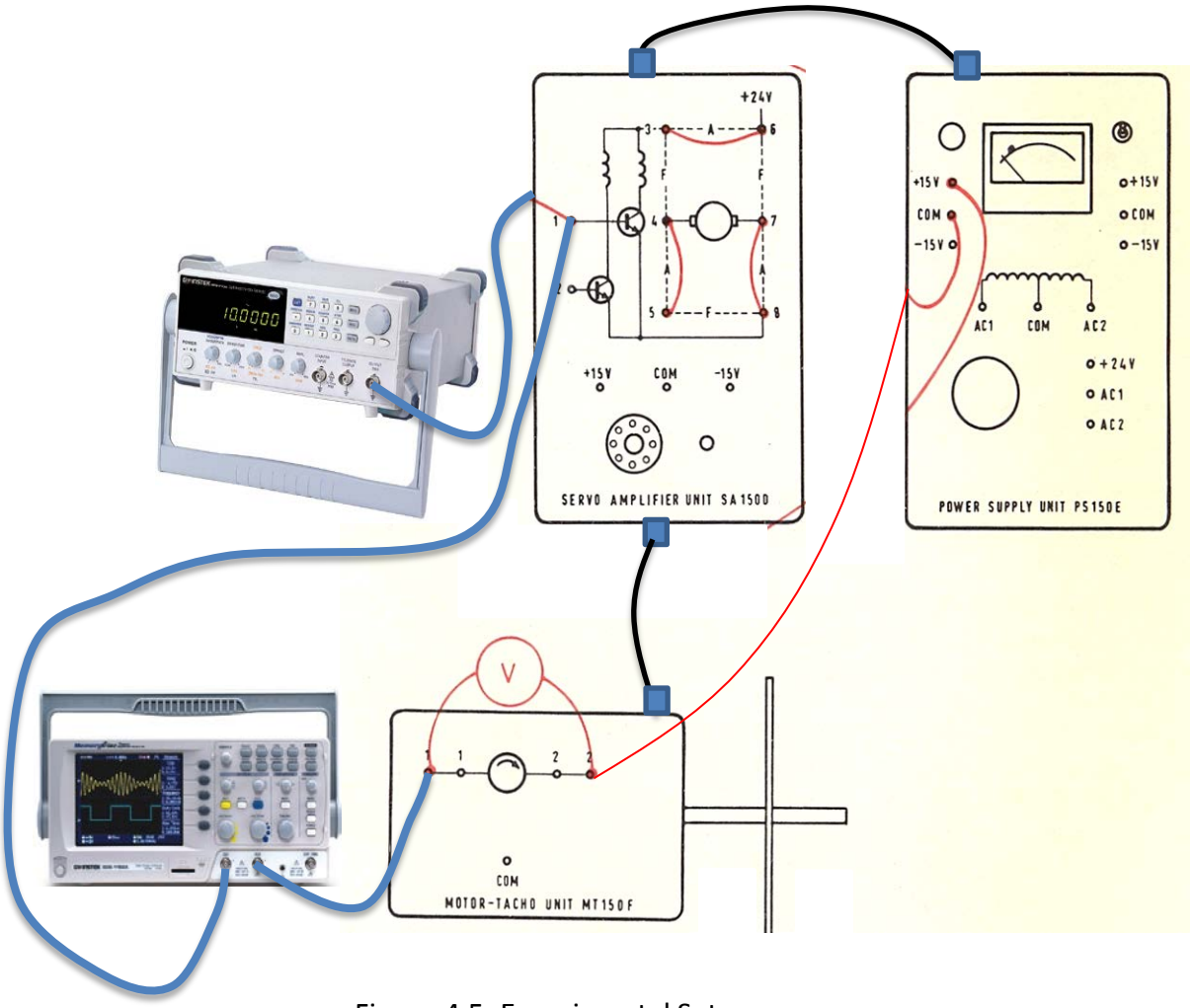

Figure-4.5: Experimental Setup

4.7 Lab Assignment: Repeat the same procedure for Field Controlled DC motor.

Conclusion/Comments