1) This experiment is a study of DC and AC servomotor. These motors are useful in a variety ofapplications. For example, if you want to build a robotic arm that picks an object and places it at a desired point. Joints of this arm contain motors which provide movement. Co-ordinated control of these motors will lead to this arm behaving in a particular desired manner.

2) To control these motors you need to first model it from the first principles. Typically one makes some assumptions to make the model easy enough to be analysed with and also not compromising on workability. On a lighter note following quote from [2] holds true "All models are wrong, but some are useful". There are always some assumptions and unknown, not perfectly measurable quantities.

3) Parameters such as mass, moment of inertia, etc, appear in model equations. These parameters are unknown and must be estimated by conducting experiments such as load tests, no-load tests, etc.

4) This experiment lays out what specific tests you must perform for estimating relevant parameters required in the DC and AC motor model.

[2] G. E. P. Box, and N. R. Draper, Empirical model building and response surfaces, John Wiley & Sons, New York, 1987

DC Motor study

http://privateweb.iitd.ac.in/~shaunak/sen/2014Sem1_EEP301/ACMotorStudy.pdf

Harhsvardhan Siddharth

Motivation

- DC Motor is widely used in industries and traction, and requires a speed control module for operation.
- DC motors have traditionally been modeled as a 2 order linear system.
- DC motors have been widely used in the electromechanical systems due to its simple structure, ease of implementing variable speed control and low cost.
- Knowing the characteristics of a DC motor is of importance for its modeling and control.

Objectives of the experiment

- The transfer function of a DC motor with respect to the shaft position is:

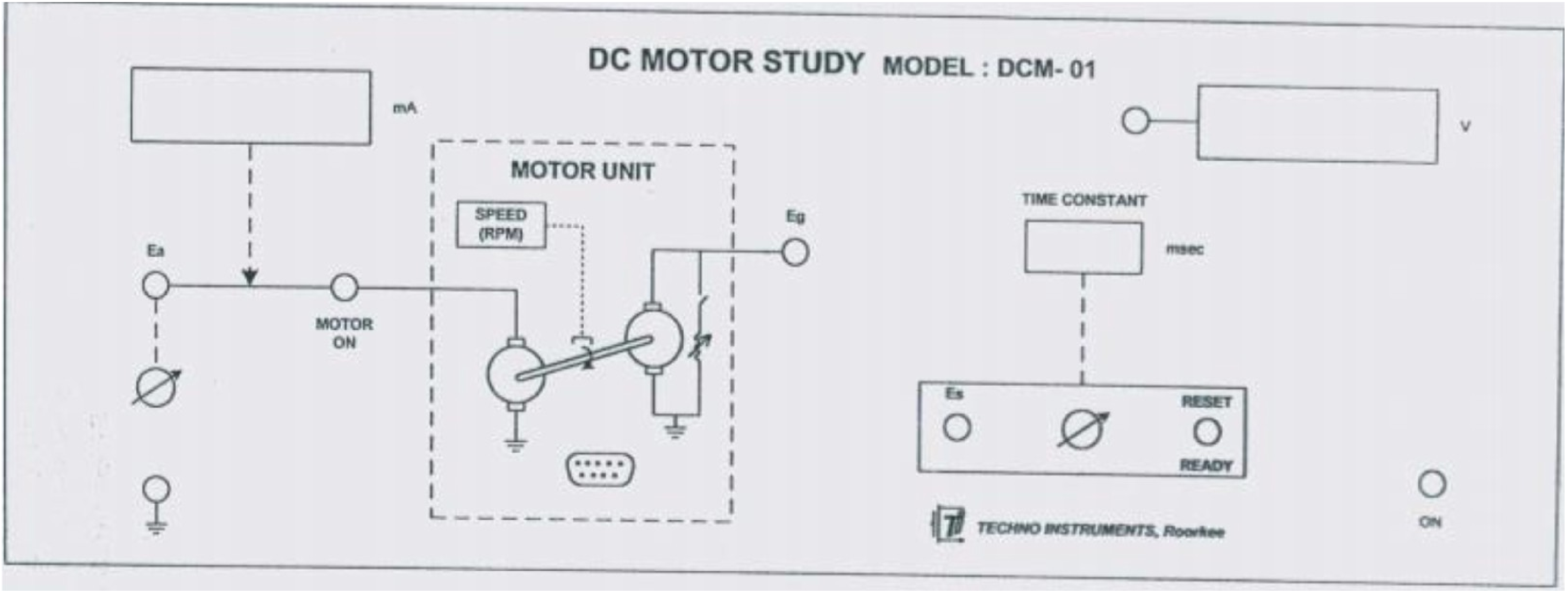
$$\frac{\theta(s)}{E(s)} = \frac{K_m}{s(s\tau_m + 1)}$$

- Aim is to find the constants K_m and τ_m from the motor characteristics.

$$K_M = \frac{K_T}{R_a B + K_T K_b} \quad : \quad \text{Motor gain constant}$$

$$\tau_m = \frac{R_a J}{R_a B + K_T K_b} \quad : \quad \text{Motor time constant}$$

Panel diagram



Questions

- Is the DC motor a linear system or a nonlinear system?
- What are the nonlinearities that have been ignored during the linearization?
- Where do these nonlinearities originate in the DC motor system?
- What are the consequences of ignoring these nonlinearities?
- What are the effects of different types of nonlinearities of the DC motor?

AC Motor study

http://privateweb.iitd.ac.in/~shaunak/sen/2014Sem1_EEP301/ACMotor Study.pdf

Motivation

- AC servomotors are small and efficient but critical for use in applications requiring precise position control.
- It’s applications include control of robotic structures, conveyor belts, solar tracking system, etc.
- For control purposes, AC servomotor is modelled as a linear 2^{nd} order system.
- As before here too knowing of the characteristics of a AC servomotor important for its modeling and control.

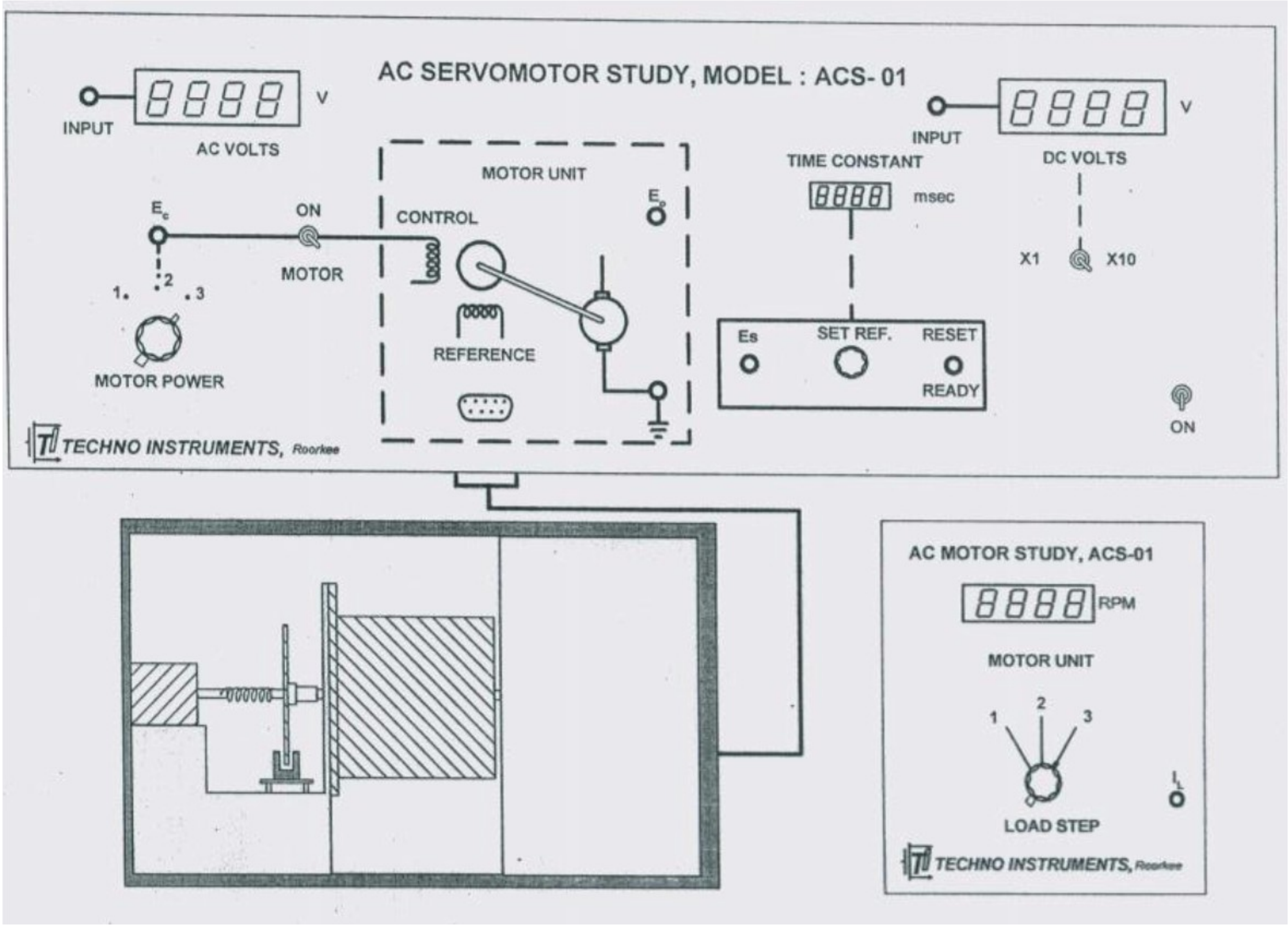
Objectives of the experiment

- The transfer function of a AC servomotor with respect to the shaft position is:

$$\frac{\theta(s)}{E_c(s)} = \frac{K_m}{s(s\tau_m + 1)}$$

- Aim of the experiment is to determine K_m and τ_m from the motor characteristics.

Panel diagram



Questions

- Is the AC servomotor a linear system or a nonlinear system?
- What are the nonlinearities that have been ignored during the linearization?
- Where do these nonlinearities originate in the AC servomotor system?
- What are the consequences of ignoring these nonlinearities?
- What are the effects of different types of nonlinearities of the AC servomotor?