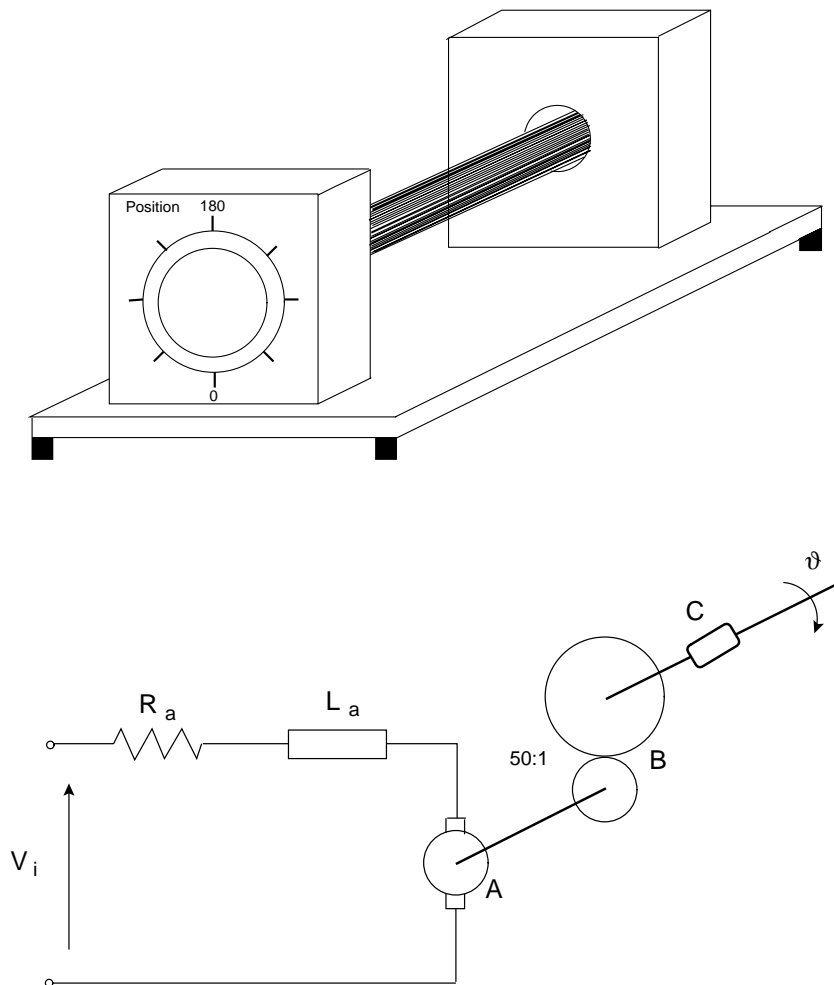


# Angular Position Control

## General Description

The process consists of a DC motor, a reduction unit, a potentiometer and a visualization system. The DC motor (A) generates the actuating signal for the position control system and the reducer (B) reduces the angular rotation velocity. The reducer draft drives the pointer on the graduated scale of the visualization panel and the position of the reducer draft is transferred by two cogwheel (50:1) to the potentiometer (C). The extremity of the potentiometric resistor are linked to the reference voltages  $\pm 8V$ .



## Motor Parameters

Nominal voltage	$24 V$
Armature inductance ( $L_a$ )	$2.8 mH$
Armature resistance ( $R_a$ )	$5.5 \Omega$
Motor torque constant	$0.046 Nm/A$
Nominal velocity	$4000 RPM$
Max motor voltage no motion	$\pm 2.3 V$
Max applicable voltage	$\pm 5 V$

## Mathematical Model

The open-loop transfer function of the process can be approximated as follows:

$$G(s) = \frac{K}{s(1 + T_f s)(1 + T_m s)}$$

with:

$$K = \frac{k_g k_M}{R_f}$$

$k_M$	overall motor constant ( $rad/V \cdot s$ )
$k_g$	generator constant ( $V/A$ )
$R_f$	resistance of the field circuit ( $\Omega$ )
$T_f$	generator field constant ( $s$ )
$T_m$	motor mechanical constant ( $s$ )

Due to a threshold present in the process, the full dynamics can be written as:

$$\theta(s) = \begin{cases} 0 & \text{if } |V_i| \in [0, 2.3] \\ \frac{20}{s(1 + \frac{1}{2000} s)(1 + \frac{1}{10} s)} V_i(s) & \text{if } |V_i| \in [2.3, 5] \end{cases}$$

where  $V_i$  is the voltage applied to the motor and  $\theta$  is the angle measured by potentiometer in degrees.