4.2 Ohm's Law

Ohm's Law is a foundational principle in the field of electronics, stating the relationship between voltage, current, and resistance in an electrical circuit. It is succinctly expressed as eq. 1:

$$I = \frac{R}{V}, \tag{1}$$

where:

- I is the current flowing through the circuit (in amperes), and
- V is the voltage across the circuit (in volts),
- R is the resistance (in ohms).

Practical Example in Robotics:

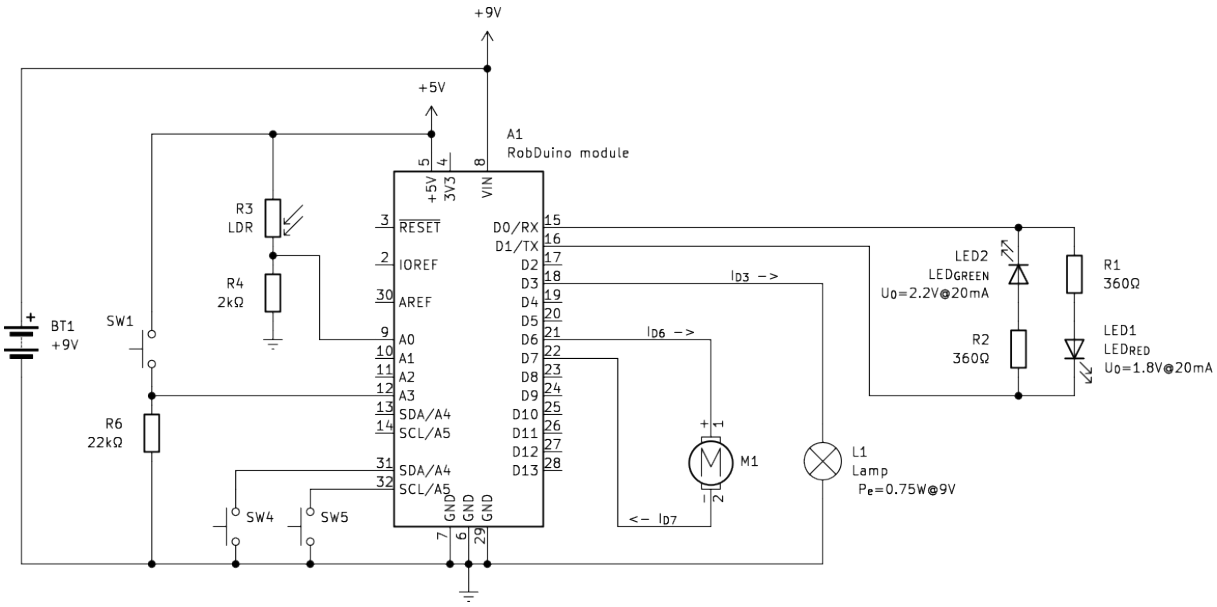

Figure 1: Example of tipical electrical scheme of robotic device with one degree of freedom.

1. Consider a simple robotic arm that uses a DC motor for movement (fig. 1). If the motor has a resistance of 20Ω and is connected to a 9V power supply, Ohm's Law can determine the current flowing through the motor:

$$I_{motor} = \frac{9V}{10\Omega} = 450mA. \tag{2}$$

Understanding this helps in selecting the right power source and ensuring that the motor and control electronics are compatible, preventing overheating and damage.

2. To apply Ohm's Law in calculating the current flowing through a light lamp with a power rating of 0.75W at a supply voltage of 9V, and connected to a digital output (D3), we start by understanding the relationship between power, voltage, and current. Ohm's Law is traditionally stated as eq. 1, but we can also express electrical power (Pe) in terms of voltage and current as eq. 3:

$$P_e = VI. \tag{3}$$

Since we are again interested in electrical current trough lamp we can fill in the data:

$$I_{D3} = \frac{P_e}{V} = \frac{0.75W}{9V} = 83mA. \tag{4}$$

4.2.1 Questions

1. Calculate electrical current trough resistor R_1 if the voltage across it is $U_{R_1} = 7.2V$!
2. Calculate the current trough resistor R_4 if measured voltage potential on A_0 pin is $V_{A_0} = 2V$!