

Chapter 1: Kinova Gen3 Lite Robot

1.1 Introduction

The Kinova Gen3 Lite robot is a lightweight robotic arm designed for research. It features up to six degrees of freedom, compact design, and advanced control capabilities, making it suitable for tasks requiring precision and flexibility. The robot includes a built-in controller, actuators, and sensors, enabling smooth integration and operation. With a payload capacity of up to 600 grams and a maximum reach of 760 millimeters, it is ideal for small-scale automation, manipulation, and learning environments.

——-to add real photo of the manipulator

1.2 Robot Geometry

The geometry of the manipulator is defined by its structure, which includes links and offsets between the robot's joints. The symbolic parameters L_1 to L_{11} are used to represent these geometric elements, as illustrated in Figure 1.1. The corresponding values of dimensions and offsets, along with their symbolic names, are provided in Table 1.1 below.

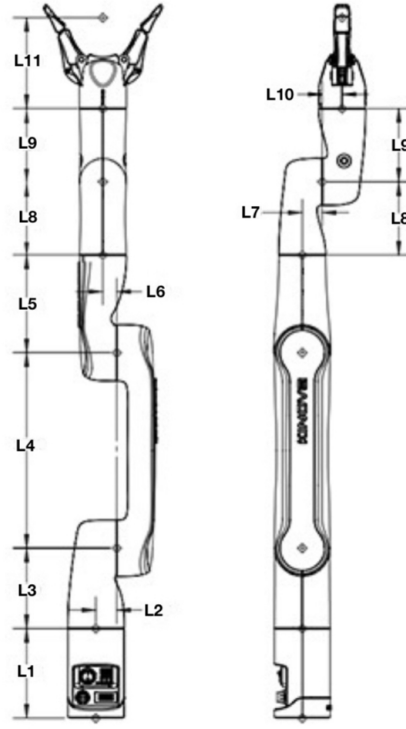


Figure 1.1: Manipulator Geometry

Description	Symbolic Parameter Name	Length (m)
Base to actuator 1	L_1	0.12825
Joint 1-2 offset	L_2	0.03
Actuator 1 to shoulder	L_3	0.115
Upper arm length	L_4	0.28
Forearm length (elbow to wrist)	L_5	0.14
Joint 3-4 offset	L_6	0.02
Joint 4-5 offset	L_7	0.0285
First wrist length	L_8	0.105
Second wrist length	L_9	0.105
Joint 5-6 offset	L_{10}	0.0285
Last actuator to gripper center	L_{11}	0.13

Table 1.1: Manipulator Geometric Parameters and Dimensions

1.3 Key Components and Features

The Kinova Gen3 Lite manipulator is equipped with six actuators, each responsible for driving one of the robot's joints. These actuators enable precise control over the robot's movements, ensuring flexibility and adaptability for a wide range of tasks.

The actuators, their corresponding joints, and the manipulator's components are illustrated in Figure 1.2.

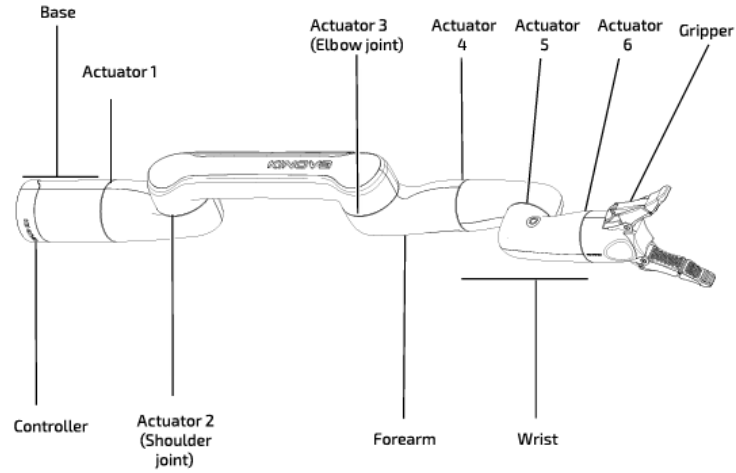


Figure 1.2: Manipulator Components

Furthermore, Table 1.2 and Table 1.3 provide a summary of the robot's key performance specifications, including joint position and speed limits. Additionally, the robot has a **maximum Cartesian speed of 25 cm/s**, representing the highest velocity the end-effector can achieve while operating within its workspace.

Actuator	Lower Limit	Upper Limit
1	-154.1° (-2.68 rad)	$+154.1^\circ$ ($+2.68$ rad)
2	-150.1° (-2.61 rad)	$+150.1^\circ$ ($+2.61$ rad)
3	-150.1° (-2.61 rad)	$+150.1^\circ$ ($+2.61$ rad)
4	-148.98° (-2.60 rad)	$+148.98^\circ$ ($+2.60$ rad)
5	-144.97° (-2.53 rad)	$+145.0^\circ$ ($+2.53$ rad)
6	-148.98° (-2.60 rad)	$+148.98^\circ$ ($+2.60$ rad)

Table 1.2: Joint Limits

Actuator	Speed Limit
Joints 1-5	$57.3^\circ/\text{s}$ (1 rad/s)
Joint 6	$90^\circ/\text{s}$ (1.57 rad/s)

Table 1.3: Speed Limits for Each Actuator

The above information is derived from data provided in the official user manual offered by the manufacturer. For additional details, please consult the Kinova Gen3 Lite User Guide [1], available on the Kinova Robotics website.