

# Specification of robot - KUKA KR 5 sixx R650

## Introduction

In this paper, we will present specifications of industrial robot. *KUKA KR 5 sixx R650* is the robot chosen for this study. This quick presentation will introduce only specification of the robot and not electrical or controller part of the robot. Firstly, we will introduce a description of this robot. Secondly, we will present technical data. In the last section, we will present application fields.

## Robot description

### Overview of the robot

*KUKA KR 5 sixx R650* is a robot destined to accurate task. Hence, this robot is light with a weight of 28 kg. Moreover, the working envelope is weak with  $1,000 \text{ mm}^3$ . This robot has six degrees of freedom. We will describe these different axes in the section regarding technical data. Actuators of the robot are electrical motors and joints are all angular joints.

### Components of the robot

In this section, we will present the main components which constitute the robot. This robot is an industrial robot and can be compared to a human body. The components of this robot are shown in the figure 1.1.

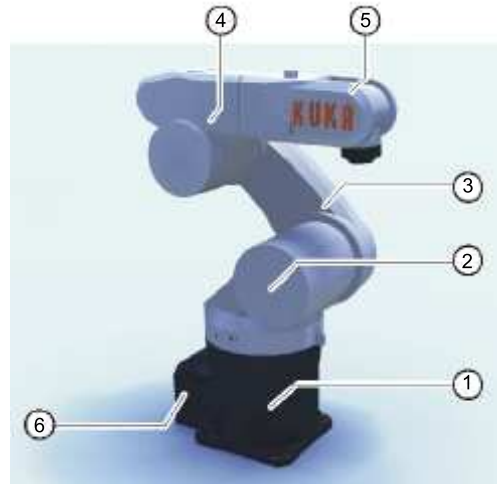


Figure 1.1: Components of the robot

The different parts of the robot shown in the figure 1.1 are:

- 1 - Base frame: Base allows communication between the user and the robot via cable. This part can be considered like a waist of human body.
- 2 - Rotating column: Rotating column play the role of shoulder.
- 3 - Link arm: Link arm allow to connect the rotating column and the arm. We can consider the link arm like an upper arm to connect the shoulder the elbow.
- 4 - Arm: Arm allows to connect the in-line wrist and the link arm. We can compare it to a forearm which connects wrist and elbow of human body.
- 5 - In-line wrist: In-line wrist plays the role of wrist.

In the next section, we will present more precisely axes data.

## Technical data

### Axes data

#### Angular data

*KUKA KR 5 sixx R650* is composed of six axes as shown of figure 1.2:

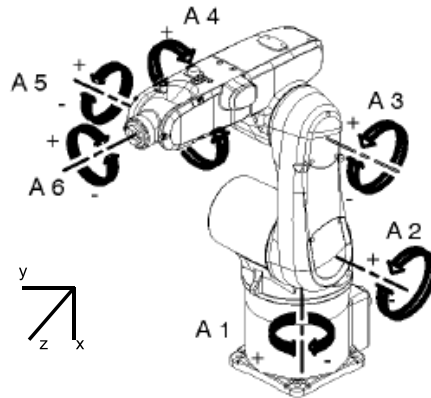


Figure 1.2: Axes of the robot

The different axes are:

- A1 - Allow a rotation around  $x$  axis.
- A2 - Allow a rotation around  $y$  axis.
- A3 - Allow a rotation around  $y$  axis.
- A4 - Allow a rotation around  $z$  axis.
- A5 - Allow a rotation around  $x$  axis.
- A6 - Allow a rotation around  $z$  axis.

The range of motion of each axis is represented in the table 1.1.

Axis	Range of motion, software-limited
1	$\pm 170^\circ$
2	$+45^\circ$ to $-190^\circ$
3	$+166^\circ$ to $-119^\circ$
4	$\pm 190^\circ$
5	$\pm 120^\circ$
6	$\pm 350^\circ$

Table 1.1: Range of angular axis

### Velocity and repeatability data

The velocity around each axis is represented in the table 1.2.

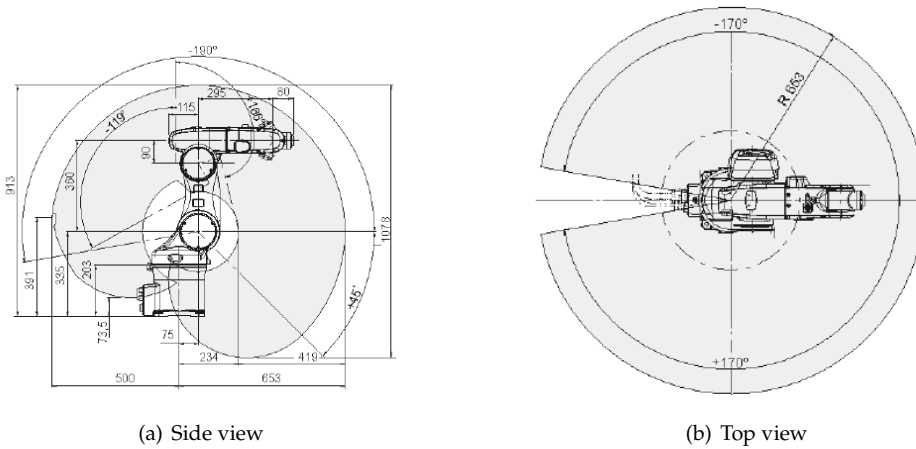


Figure 1.3: Working envelope

Axis	Speed with rated payload 5kg
1	375°/s
2	300°/s
3	375°/s
4	410°/s
5	410°/s
6	410°/s

Table 1.2: Velocity around axis

The maximum velocity is 8,200mm/s. The repeatability of the *KUKA KR 5 sixx R650* is  $\pm 0.02mm$ .

### Working envelope

The working envelope diagram is presented in figure 1.3. All distances measures are in millimetres. The working envelope is 1,000 mm<sup>3</sup>. Two weaknesses of the robot is shown on the figure 1.3. It exists two dead zones where the robot cannot perform:

- On the figure 1.3(b), we can see that the robot have a dead angle of 20° behind the base.
- On the figure 1.3(a), we can see that the robot have a dead zone around the rotating column 1.1.

## Load limitations

The weight of the load is 5 kg. Moreover, limits regarding forces which can be applied on the robot are presented on the table 1.3 and the figure 1.4.

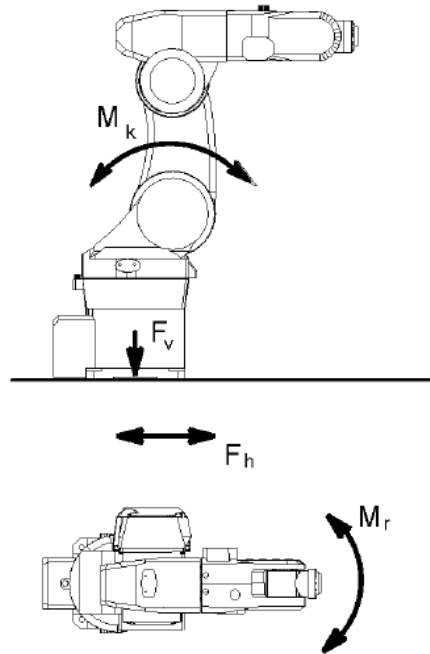


Figure 1.4: Load acting on the foundation

Type of Load	Maximum forces/torque
$F_v$ - vertical force	1000 N
$F_h$ - horizontal force	1050 N
$M_k$ - tilting moment	1000 Nm
$M_r$ - torque	1100 Nm

Table 1.3: Maximum forces which can be applied

## Mounting

### Mounting base

The base must be mounted on a floor or a ceiling. The figure 1.5 shows the properties to mount the base on a floor or a ceiling.

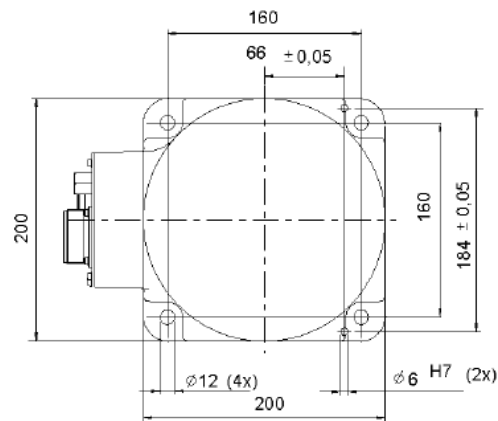


Figure 1.5: Mounting base

### Mounting flange

In case to add a gripper, the figure 1.6 show the properties of the support:

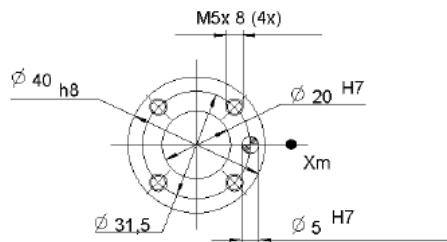


Figure 1.6: Mounting flange

### Application fields

The robot can carry these following applications:

- Handling, loading and unloading.
- Soldering.
- Fastening
- Handling for other machines
- Packaging and order picking.

- Painting, surface treatment.
- Application of adhesives and sealants.
- Plastics processing machines.
- Measuring, testing and inspection.
- Assembly.
- Inserting, mounting.

## Bibliography

- [1] KUKA, Kuka Data Sheet, Kuka KR 5 sixx R650, WM-Nr. 841612-117/D+E/3/11.06.
- [2] KUKA, Kuka Specifications, Kuka KR 5 sixx R650, V0.4 20.02.2007.