



# JACO<sup>2</sup>

## 6 DOF

Advanced specification  
guide



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## Revisions

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1.0.3	N. Tremblay	New Template	2017-03-17

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## Contents

REVISIONS.....	2
CONTENTS.....	3
SPECIFIC UTILIZATION LIMITATIONS.....	4
SPECIFIC ELECTRICAL LIMITATIONS .....	4
<i>Recommended maximum actuators utilization</i> .....	4
SOFTWARE POSITION LIMITATIONS OF ACTUATORS.....	4
<i>Software position limitations of actuators</i> .....	4
<i>Software position limitations of fingers</i> .....	4
ADVANCED CONFIGURATIONS .....	6
POSITION INDEXATION OF THE ARM .....	6
RESET TORQUE .....	6
KINEMATIC PARAMETERS .....	8
BASIC PARAMETERS OF JACO <sup>2</sup> .....	8
<i>Classic DH Parameters</i> .....	10
DIRECTIONS OF EACH JOINTS IN ANGULAR SPACE .....	11
INERTIAL PARAMETERS.....	11
ADVANCED SENSORS INFORMATION .....	13
ACCELEROMETERS POSITIONS.....	13

## Specific Utilization limitations

### Specific electrical limitations

#### Recommended maximum actuators utilization

	Big actuators (75mm)	Small actuators (58mm)	Fingers actuators
Maximum RPM	6 RPM	8 RPM	600RPM
Maximum Command/sec	36 ° / sec	48 ° / sec	30 mm / sec 10800 ° / sec
Maximum repetitive Current	1.5A	1.6A	1,4A
Maximum temperature	80°C	80°C	80°C

Utilization over these maximum recommended parameters may affect lifetime of the arm and its modules.

Please refer to JACO<sup>2</sup> specification sheet for additional information

### Software position limitations of actuators

The following limitations indicate the software limitations that are presents in JACO<sup>2</sup> controller to ensure safety of the robot. These limitations are there to protect the arm and its environment.

#### Software position limitations of actuators

When moving JACO<sup>2</sup> actuators, the following minimum and maximum positions should be followed. If the command sent to any of these actuators goes further than these values, the actuators will stop moving.

Actuator #	Minimum (degrees)	Maximum (degrees)
1	-10 000	10 000
2	50	310
3	19	341
4	-10 000	10 000
5	-10 000	10 000
6	-10 000	10 000

### Software position limitations of fingers

When moving JACO<sup>2</sup> fingers, the following minimum and maximum positions should be respected. If the command sent to any of these fingers goes further than these values, the fingers will stop moving.

Finger #	Minimum	Maximum (degrees)
1	0 mm (0 °)	18.9 mm (6800°)
2	0 mm (0 °)	18.9 mm (6800°)

3	0 mm (0 °)	18.9 mm (6800°)
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## Advanced configurations

## Position indexation of the arm

**Figure 1 : Reset position**

Angular position is : [180, 180, 180, 180, 180, 180]

**Reset Torque**

In order to reset the torque sensors zero, you must first place the arm in a position where gravity does not influence joint torques. The set zero position [180, 180, 180, 180, 180, 180] is good but it is suggested to use the position [\* , 180, 180, 0, 0, 180] since this position also limits perpendicular torques on the actuators.



## Kinematic Parameters

### Basic parameters of JACO<sup>2</sup>

Theses following parameters are all necessary values for JACO<sup>2</sup> kinematics.

Robot length values (meters)		
<b>D1</b>	0.2755	Base to elbow
<b>D2</b>	0.4100	Arm length
<b>D3</b>	0.2073	Front arm length
<b>D4</b>	0.0741	First wrist length
<b>D5</b>	0.0741	Second wrist length
<b>D6</b>	0.1600	Wrist to center of the hand
<b>e2</b>	0.0098	Joint 3-4 lateral offset

Alternate parameters	
<b>aa</b>	$((30.0 \cdot \pi) / 180.0)$
<b>ca</b>	$(\cos(aa))$
<b>sa</b>	$(\sin(aa))$
<b>c2a</b>	$(\cos(2 \cdot aa))$
<b>s2a</b>	$(\sin(2 \cdot aa))$
<b>d4b</b>	$(D3 + sa/s2a \cdot D4)$
<b>d5b</b>	$(sa/s2a \cdot D4 + sa/s2a \cdot D5)$
<b>d6b</b>	$(sa/s2a \cdot D5 + D6)$

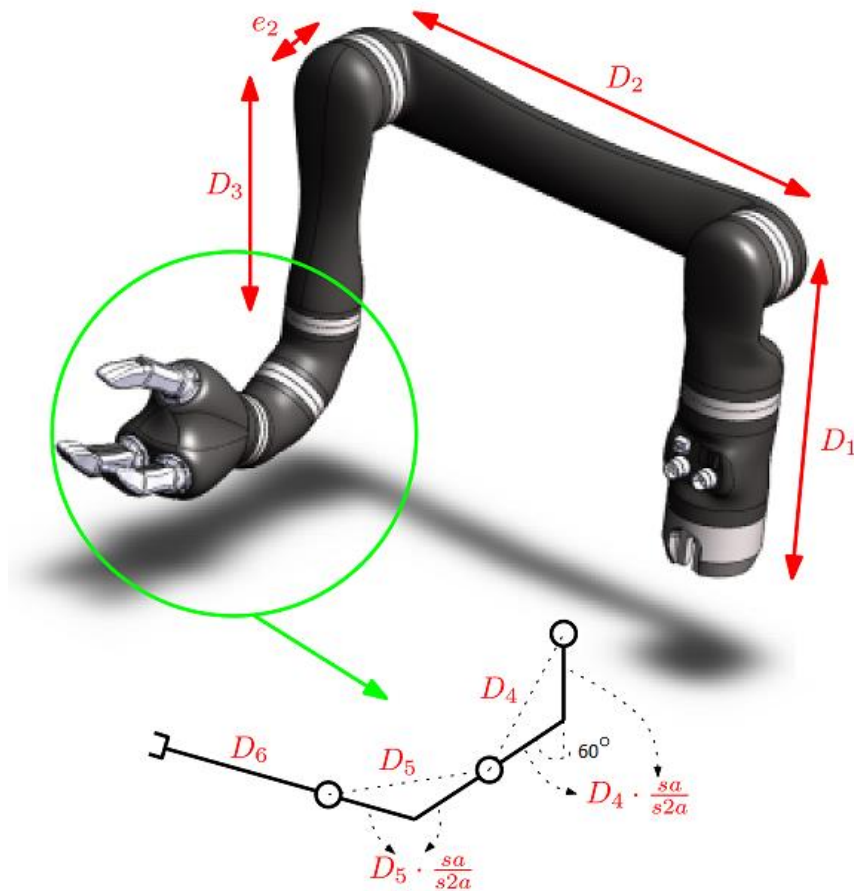


Figure 2: Robot length values



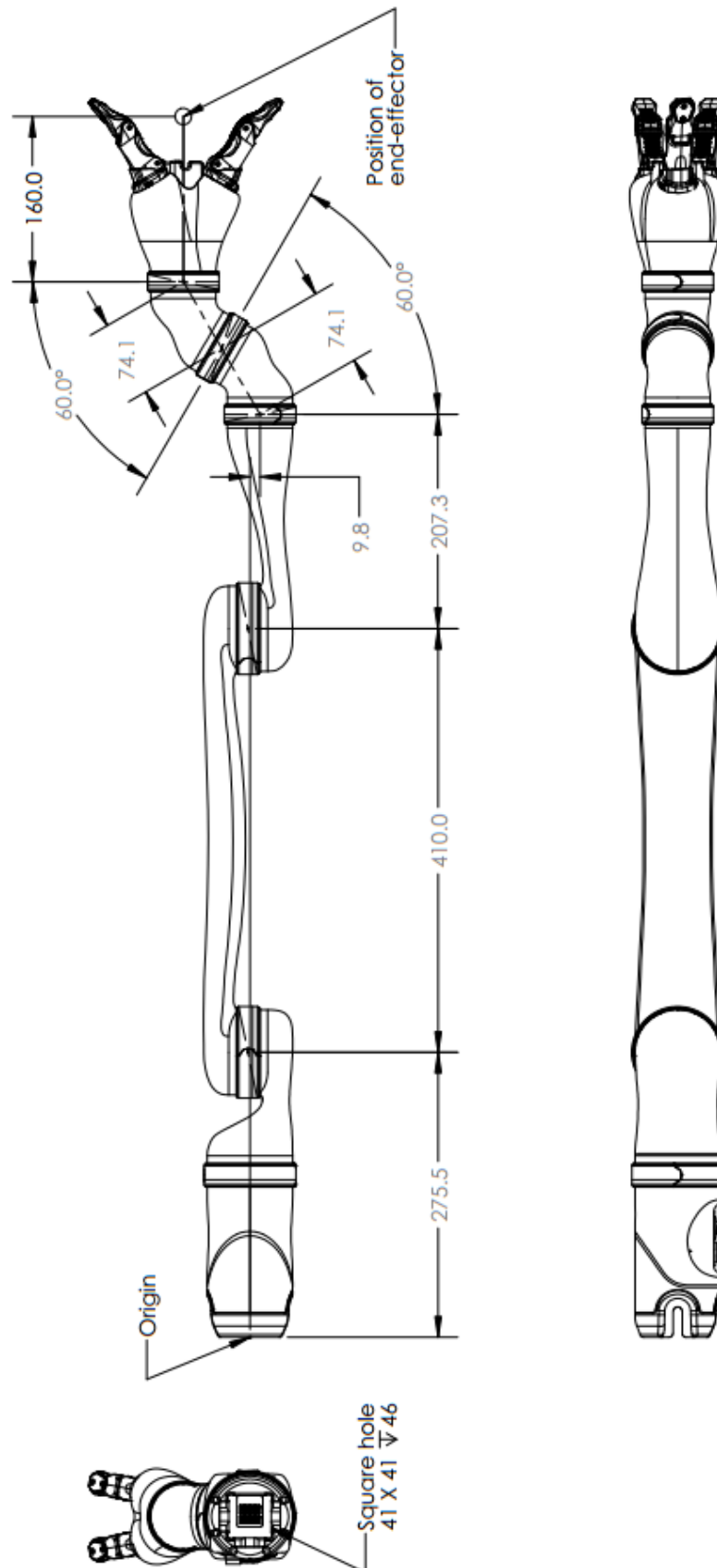


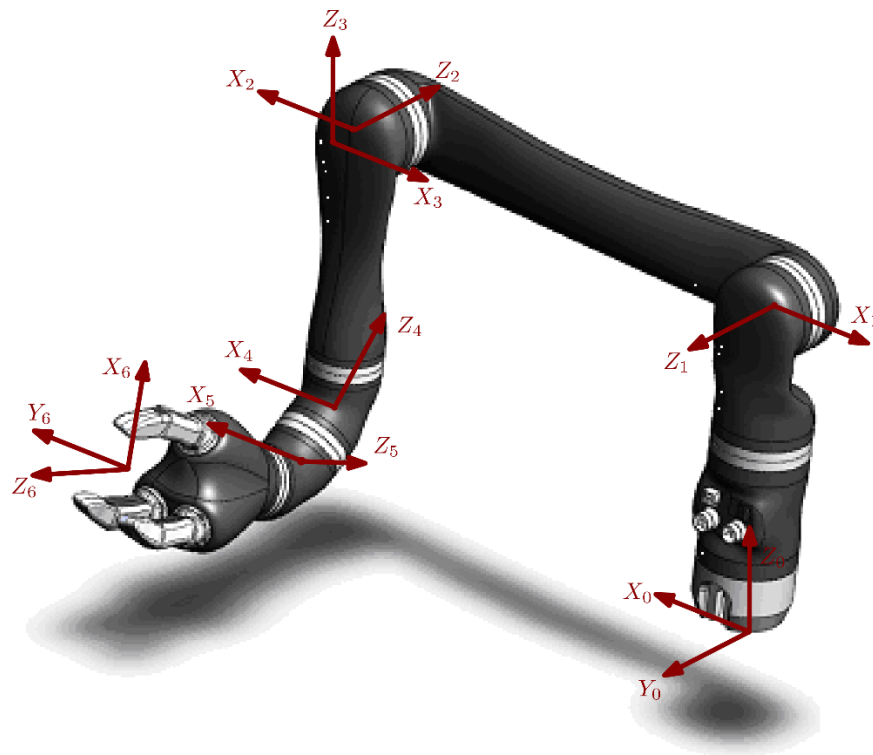
Figure 3: Detailed robot length values (units in mm)

## Classic DH Parameters

The following charts represents the classic DH parameters of JACO<sup>2</sup> arm:

Classic DH parameters				
i	$\alpha(i-1)$	$a(i-1)$	$d_i$	$\theta_i$
1	$\pi/2$	0	D1	$q_1$
2	$\pi$	D2	0	$q_2$
3	$\pi/2$	0	-e2	$q_3$
4	$2 \cdot \pi$	0	-d4b	$q_4$
5	$2 \cdot \pi$	0	-d5b	$q_5$
6	$\pi$	0	-d6b	$q_6$

Equations for transformation from DH algorithm to JACO <sup>2</sup> physical angles
$Q1(\text{Jaco}^2) = -Q1(\text{DH Algo})$
$Q2(\text{Jaco}^2) = Q2(\text{DH Algo}) + 90$
$Q3(\text{Jaco}^2) = Q3(\text{DH Algo}) - 90$
$Q4(\text{Jaco}^2) = Q4(\text{DH Algo})$
$Q5(\text{Jaco}^2) = Q5(\text{DH Algo}) + 180$
$Q6(\text{Jaco}^2) = Q6(\text{DH Algo}) - 90$



**Figure 4: Classic DH parameters frame position**

Represented JACO<sup>2</sup> angular position is : [180, 270, 90, 180, 180, 0]

## Directions of each joints in angular space

The following image represents the positive direction of rotation of each actuator on the JACO<sup>2</sup> arm:

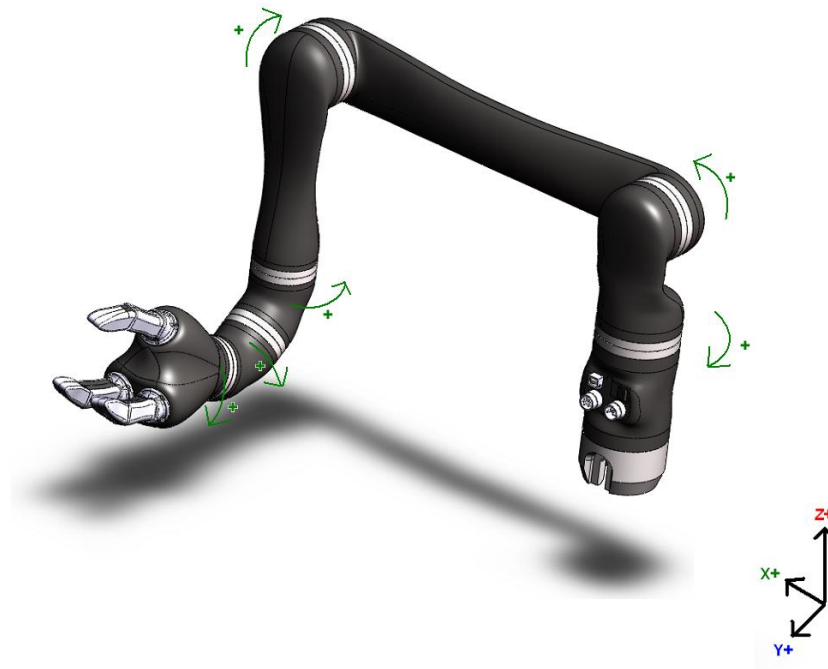
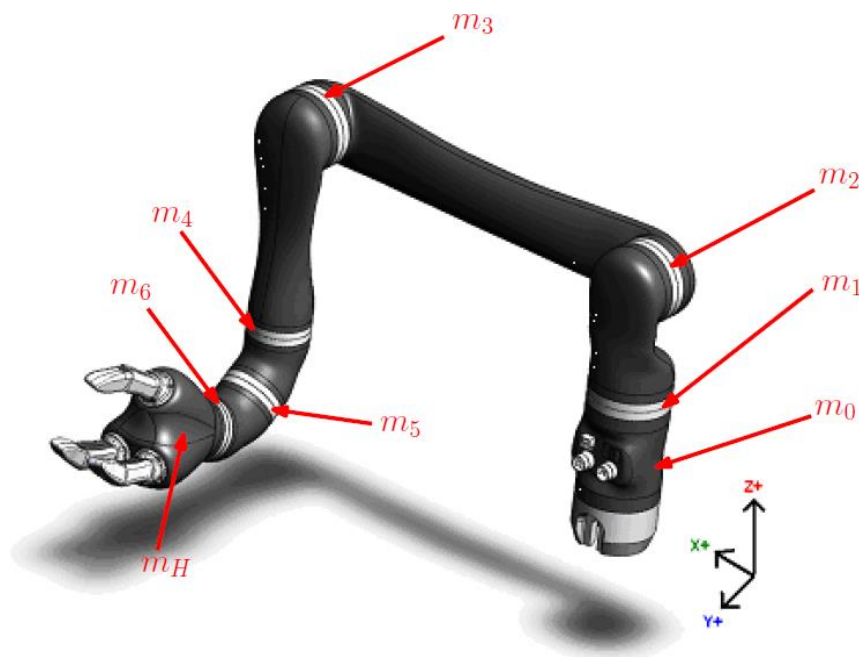


Figure 5: Directions of each joint in the angular space of the robot

## Inertial parameters

The following image represents the inertial parameters of each JACO<sup>2</sup> module:



Inertial parameters	
<b>m0</b>	0.64 kg
<b>m1</b>	0.60 kg
<b>m2</b>	0.57 kg
<b>m3</b>	0.60 kg
<b>m4</b>	0.37 kg
<b>m5</b>	0.37 kg
<b>m6</b>	0.37 kg
<b>mH</b>	0.68 kg

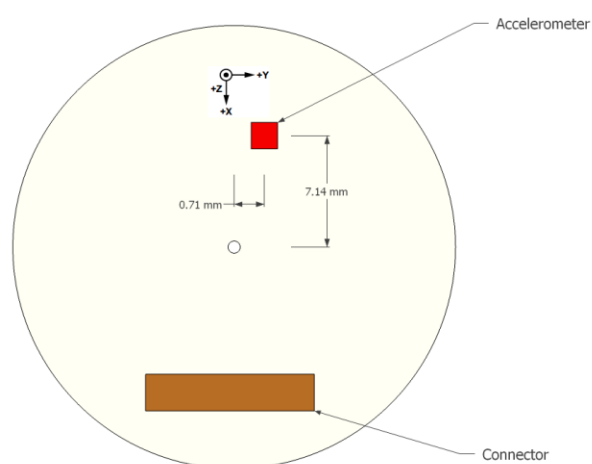
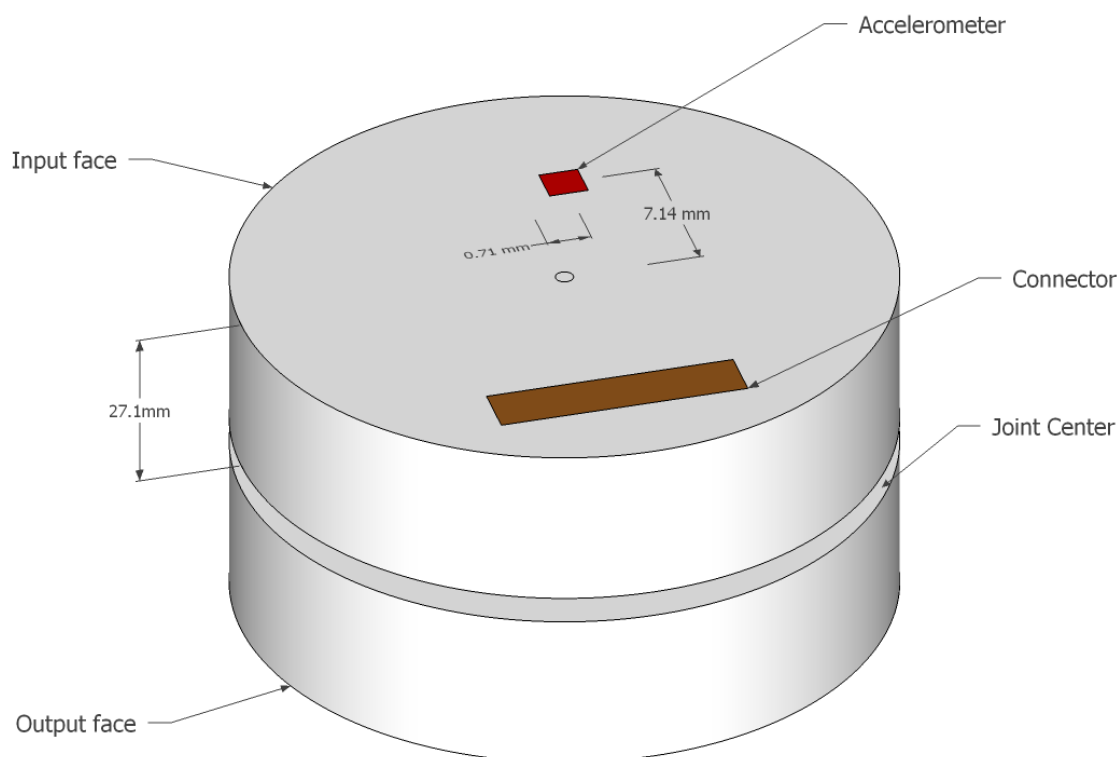
**Figure 6: Inertial parameters**

From Joint 6 to center of mass of the hand: ~8.5 cm

## Advanced sensors information

## Accelerometers positions

Accelerometers in each joint.



## Side view legend

