JACO²

6 DOF

Advanced specification guide

KINOVA ROBOTICS

kinovarobotics.com

Revisions

Version	Primary Author(s)	Description of Version	Date Completed
1.0.1	A Lecours	First Draft	2014-05-11
1.0.2	A Lecours	New template	2015-08-05
1.0.3	N. Tremblay	New Template	2017-03-17

DISCLAIMER

Address any questions or comments concerning this document, the information it contains or the product it describes to:

- support@kinovarobotics.com

Contents

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 JACO² specification sheet for additional information

Software position limitations of actuators

The following limitations indicate the software limitations that are presents in JACO² 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 JACO² 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 JACO² 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°)

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 JACO²

Theses following parameters are all necessary values for JACO² kinematics.

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

Alternate parameters	
aa	((30.0*PI)/180.0)
ca	(cos(aa))
sa	(sin(aa))
c2a	(cos(2*aa))
s2a	(sin(2*aa))
d4b	(D3 + sa/s2a *D4)
d5b	(sa/s2a*D4 + sa/s2a *D5)
d6b	(sa/s2a*D5 + D6)

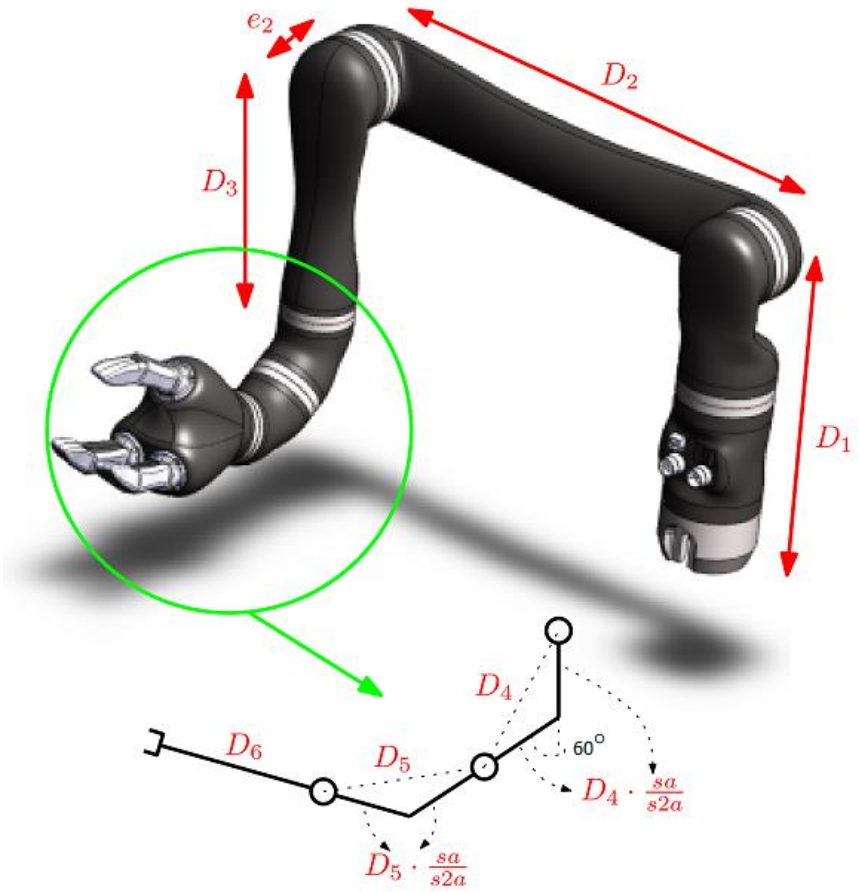


Figure 2: Robot length values

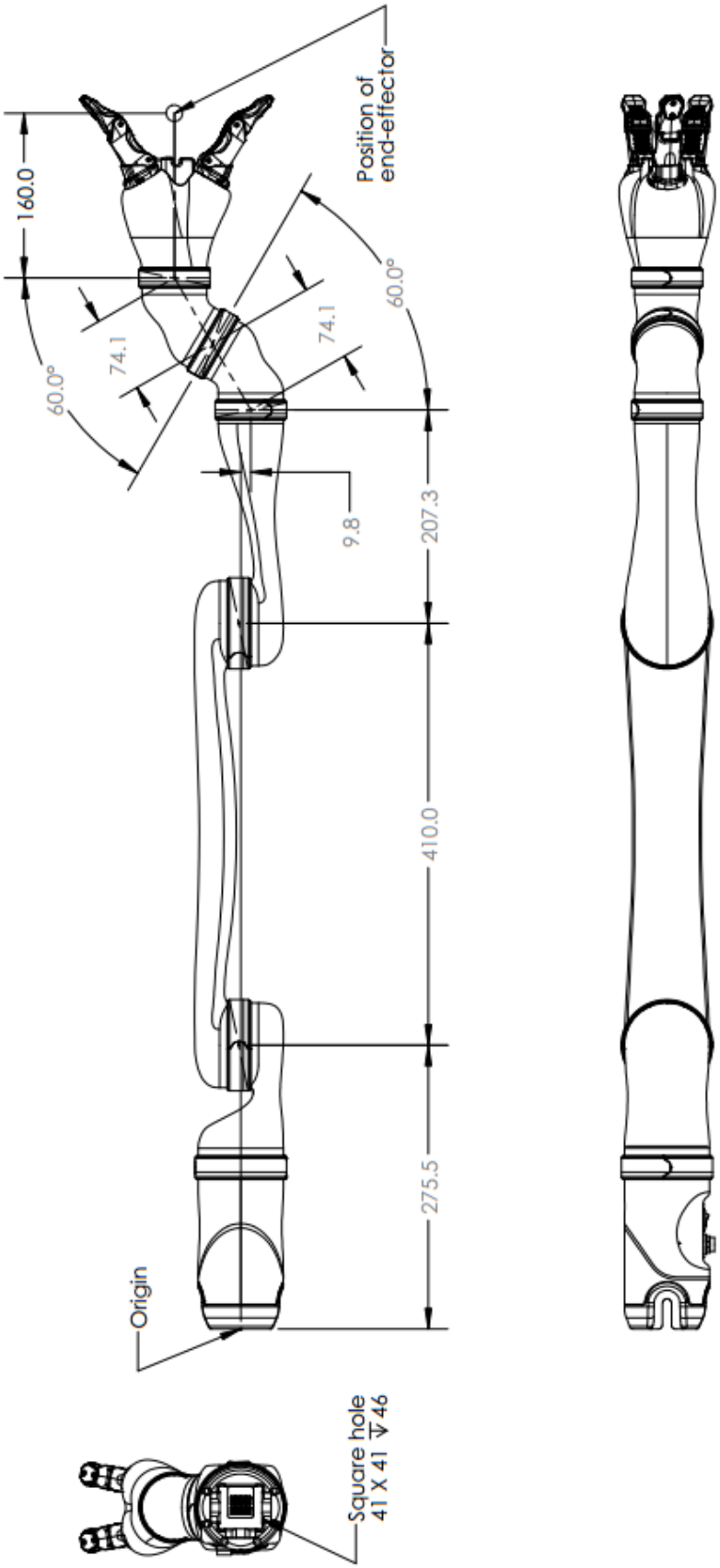


Figure 3: Detailed robot length values (units in mm)

Classic DH Parameters

The following charts represents the classic DH parameters of JACO² arm:

Classic DH parameters				
i	**alpha(i-1)**	**a(i-1)**	**di**	**theta1**
1	pi/2	0	D1	q1
2	pi	D2	0	q2
3	pi/2	0	-e2	q3
4	2*aa	0	-d4b	q4
5	2*aa	0	-d5b	q5
6	pi	0	-d6b	q6

Equations for transformation from DH algorithm to JACO² physical angles
Q1(Jaco²) = -Q1(DH Algo)
Q2(Jaco²) = Q2(DH Algo) + 90
Q3(Jaco²) = Q3(DH Algo) - 90
Q4(Jaco²) = Q4(DH Algo)
Q5(Jaco²) = Q5(DH Algo) + 180
Q6(Jaco²) = Q6(DH Algo) - 90

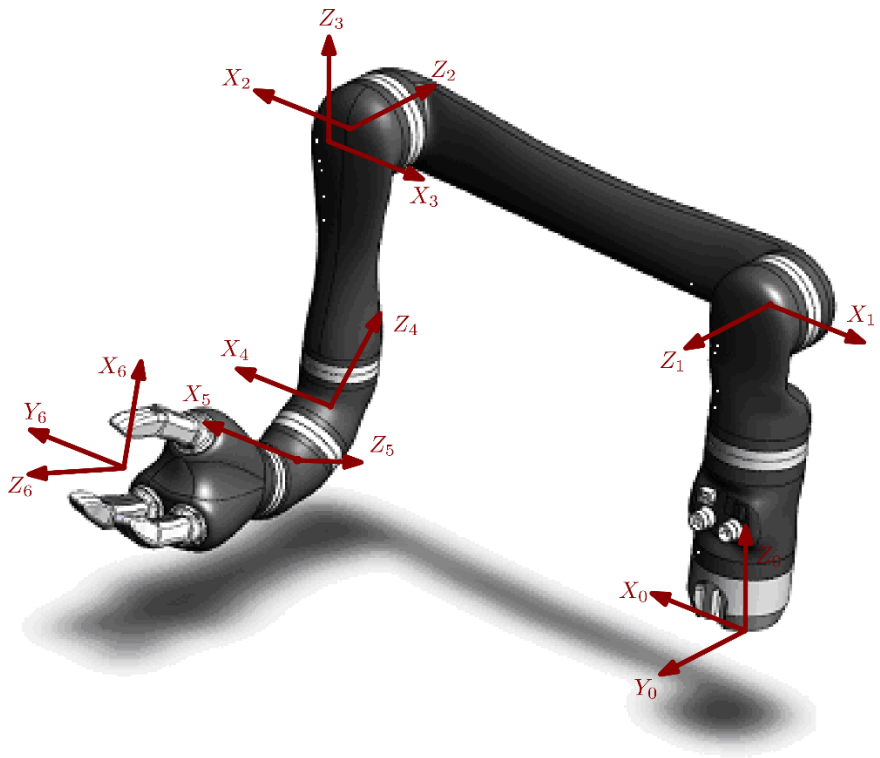


Figure 4: Classic DH parameters frame position

Represented Jaco² 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 JACO² arm:

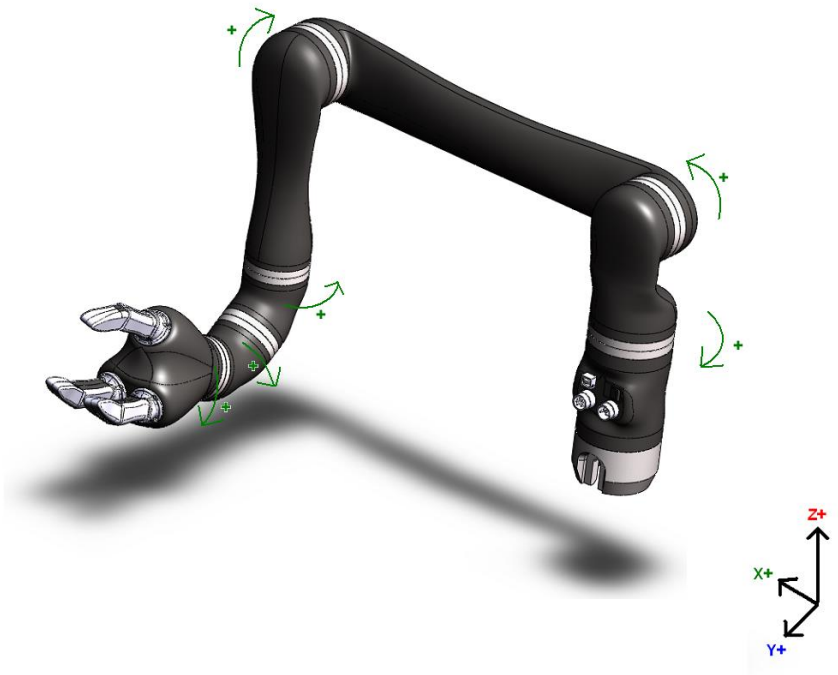
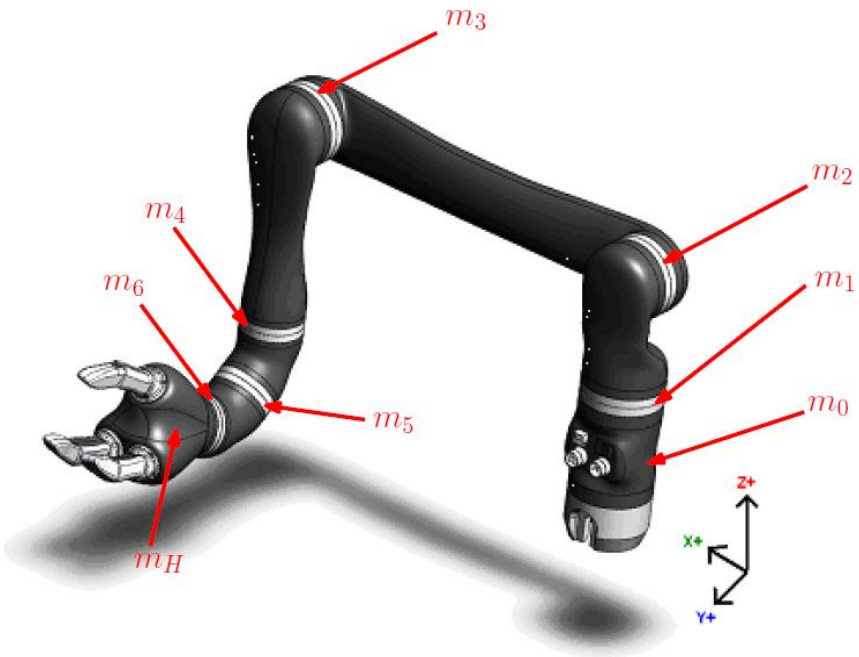


Figure 5: Directions of each joint in the angular space of the robot

Inertial parameters

The following image represents the inertial parameters of each JACO² module:



Inertial parameters	
m0	0.64 kg
m1	0.60 kg
m2	0.57 kg
m3	0.60 kg
m4	0.37 kg
m5	0.37 kg
m6	0.37 kg
mH	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.