



MICO²

4 DOF

Advanced specification guide



kinovarobotics.com

DISCLAIMER

Kinova, Mico² 4 DOF, and the Kinova logo are trademarks of Kinova Inc., herein referred to as Kinova. All other brand and product names are trademarks or registered trademarks of their respective corporations.

The mention of any product does not constitute an endorsement by Kinova. This manual is provided under a lease agreement and may only be copied or used within accordance with the terms of such lease agreement. Except as permitted by such lease agreement, no part of this publication may be reproduced, stored in any retrieval system, or transmitted, in any form or by any means, electronic, mechanical, recording, or otherwise, without prior written consent of Kinova.

The content of this manual is provided for informational use only, is subject to change without notice, and should not be construed as a commitment by Kinova. Kinova assumes no responsibility or liability for any errors or inaccuracies that may appear in this document.

Changes are periodically made to the information herein; these changes will be incorporated into new editions of this publication. Kinova may make improvements and/or changes in the products and/or software programs described in this publication at any time.

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

- support@kinovarobotics.com

Kinova may use or distribute whatever information you supply in any way it believes appropriate without incurring any obligations to you.

Copyright © 2017 Kinova Inc. All rights reserved.

Contents

Revisions	Error! Bookmark not defined.
Disclaimer	2
Contents.....	3
Specific Utilization limitations	4
Specific electrical limitations	4
Recommended maximum actuators utilization	4
Software position limitations of actuators	4
Software position limitations of actuators	4
Software position limitations of fingers.....	4
Advanced configurations.....	5
Position indexation of the arm	5
Reset Torque	5
Kinematic Parameters	6
Basic parameters of Mico ² -4DOF	6
Classic DH Parameters	8
Directions of each joints in angular space.....	9
Inertial parameters	9
Advanced sensors information.....	10
Accelerometers positions	10

Specific Utilization limitations

Specific electrical limitations

Recommended maximum actuators utilization

	Big actuators (75mm)	Small actuators (58mm)	Fingers actuators
Maximum RPM	8 RPM	8 RPM	600RPM
Maximum Command/sec	48 ° / 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 MICO² 4DOF specification sheet for additional information

Software position limitations of actuators

The following limitations indicate the software limitations that are presents in MICO² 4DOF 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 MICO² 4DOF 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	35	325
4	-10 000	10 000

Software position limitations of fingers

When moving MICO² 4DOF 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°)

Advanced configurations

Position indexation of the arm



Figure 1: Reset position

Angular position is: [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] is good but it is suggested to use the position [^{*}, 180, 180, 0] since this position also limits perpendicular torques on the actuators.

Kinematic Parameters

Basic parameters of Mico²-4DOF

These following parameters are all necessary values Mico²-4DOF kinematics.

Robot length values (meters)		
D1	0.2755	Base to elbow
D2	0.2900	Arm length
D3	0.1233	Front arm length
D4	0.1600	Wrist to center of the hand
e2	0.0070	Joint 3-4 lateral offset

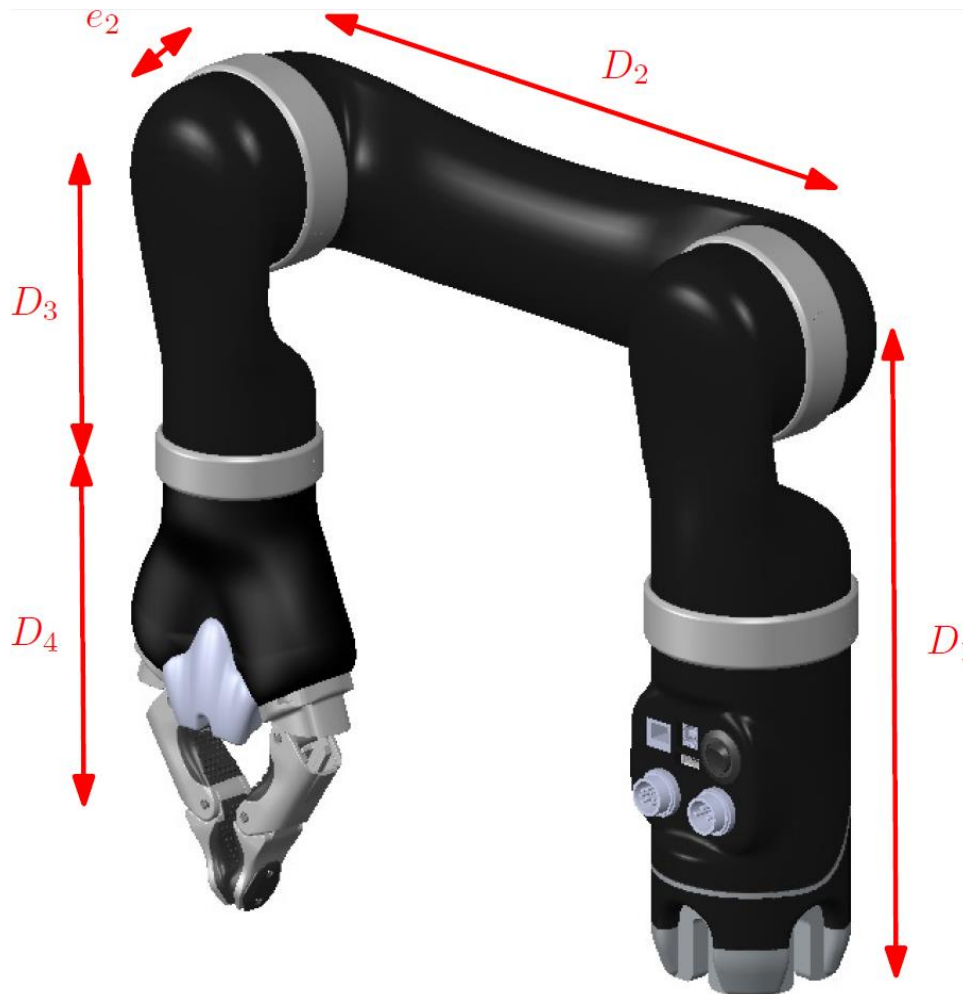


Figure 2: Robot length values

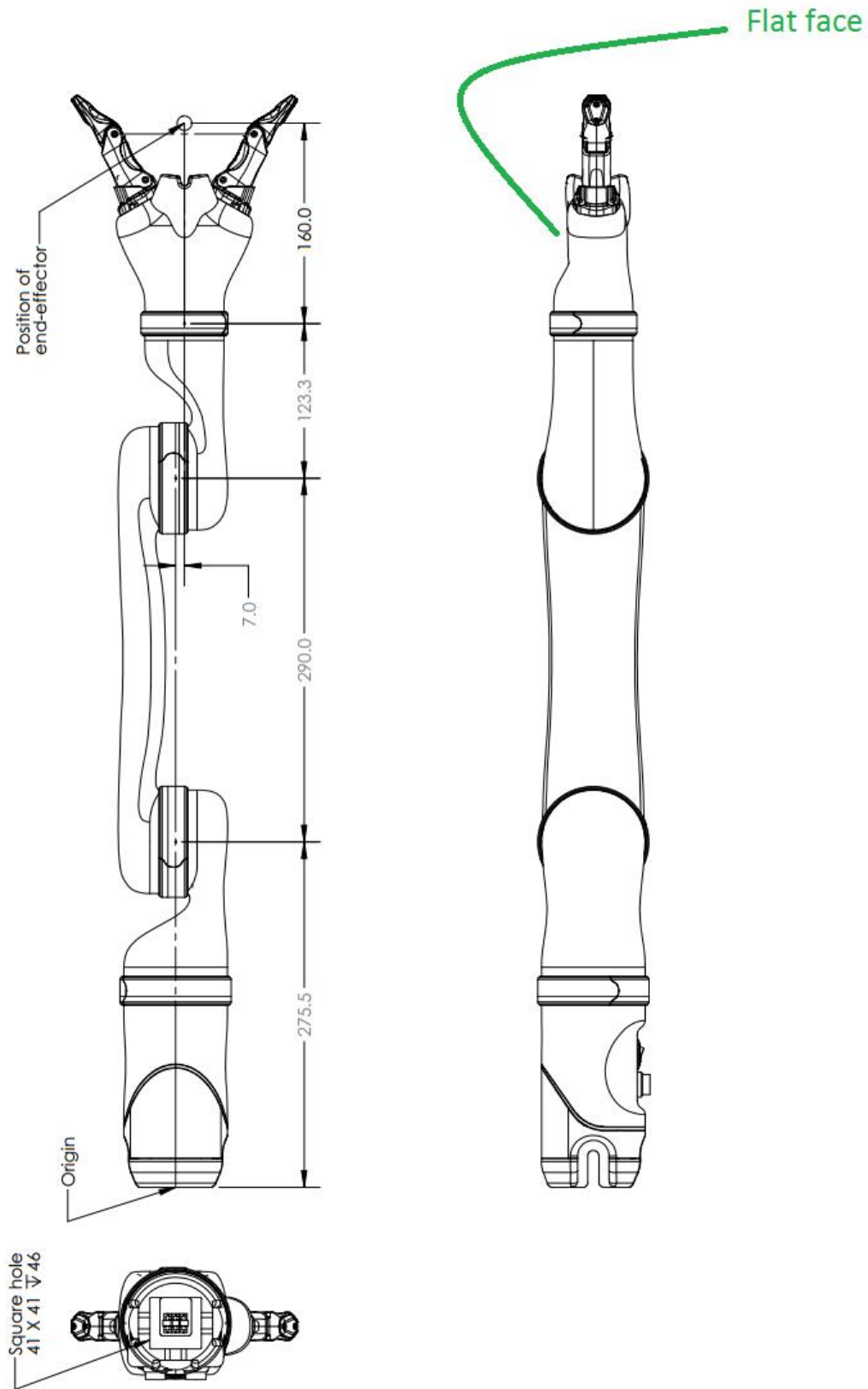


Figure 3: Detailed robot length values (units in mm)

Classic DH Parameters

The following charts represents the classic DH parameters of MICO² 4DOF arm:

Classic DH parameters				
i	$\alpha(i-1)$	$a(i-1)$	d_i	theta1
1	$\pi/2$	0	D1	q1
2	π	D2	0	q2
3	$\pi/2$	0	-e2	q3
4	π	0	D3+D4	q4

Equations for transformation from DH algorithm to Mico ² 4DOF physical angles
$Q1(\text{Mico}^2\text{-4DOF}) = -Q1(\text{DH Algo})$
$Q2(\text{Mico}^2\text{-4DOF}) = Q2(\text{DH Algo}) + 90$
$Q3(\text{Mico}^2\text{-4DOF}) = Q3(\text{DH Algo}) - 90$
$Q4(\text{Mico}^2\text{-4DOF}) = Q4(\text{DH Algo}) - 270$

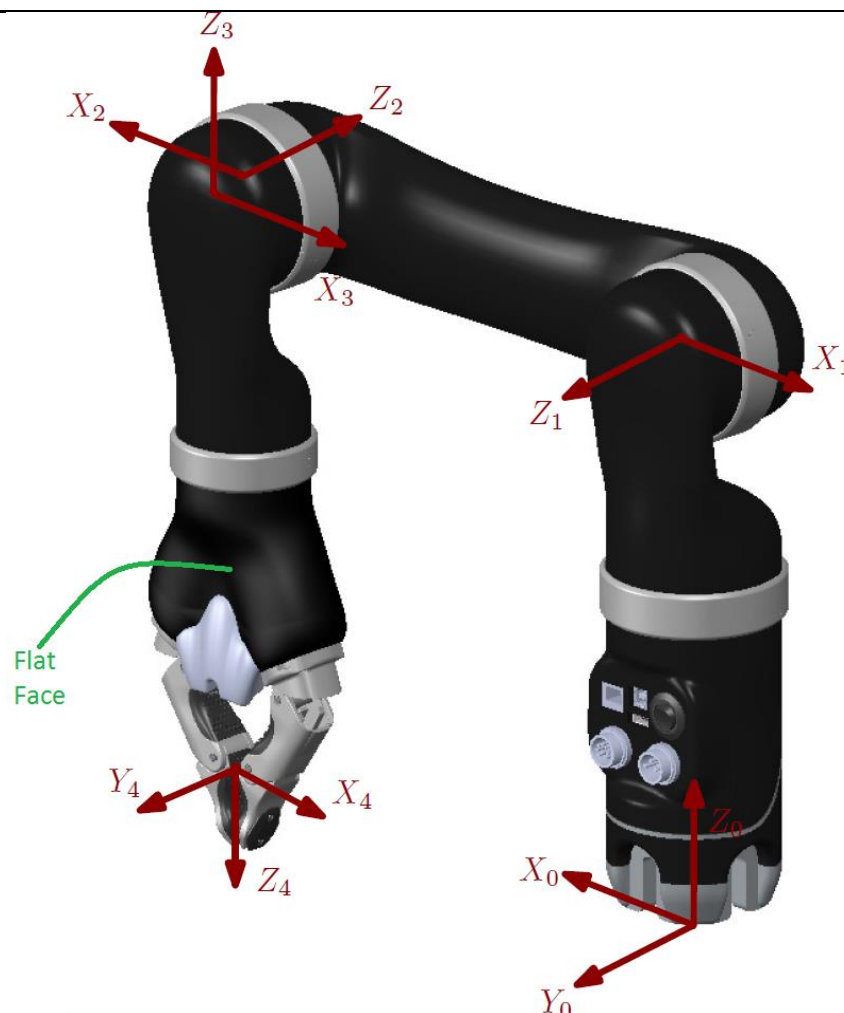


Figure 4: Classic DH parameters frame position

Represented Mico² 4DOF angular position is: [180, 270, 90, 270]

Directions of each joints in angular space

The following image represents the positive direction of rotation of each actuator on the MICO² 4DOF arm:

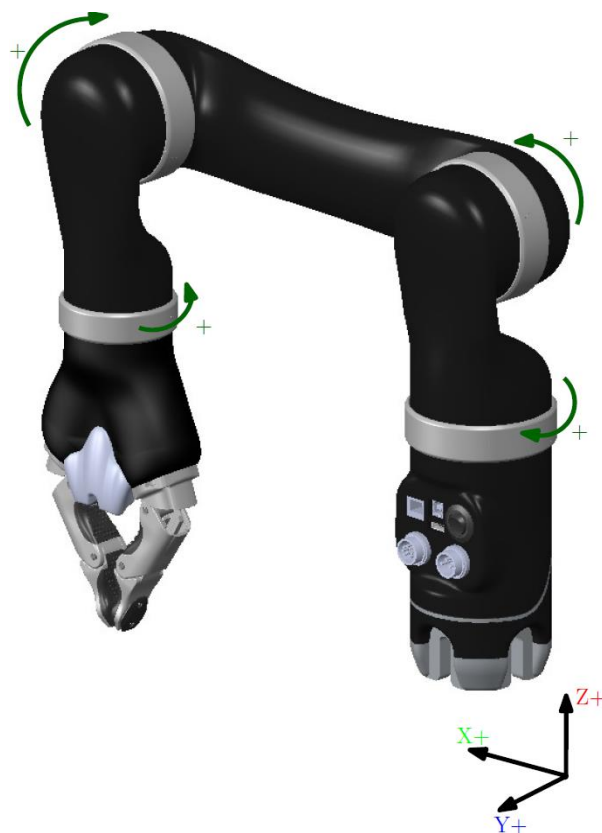
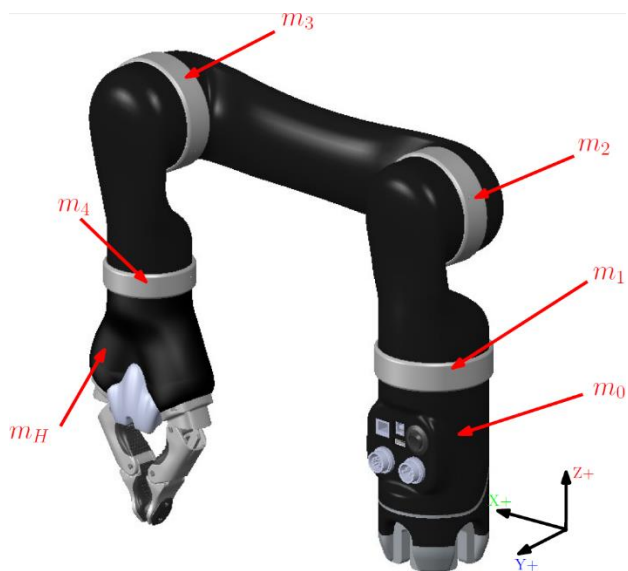


Figure 5: Directions of each joint in the angular space of the robot

Inertial parameters

The following image represents the inertial parameters of each MICO² 4DOF module:



Inertial parameters	
m0	0.64 kg
m1	0.60 kg
m2	0.60 kg
m3	0.60 kg
m4	0.37 kg
mH	0.55 kg

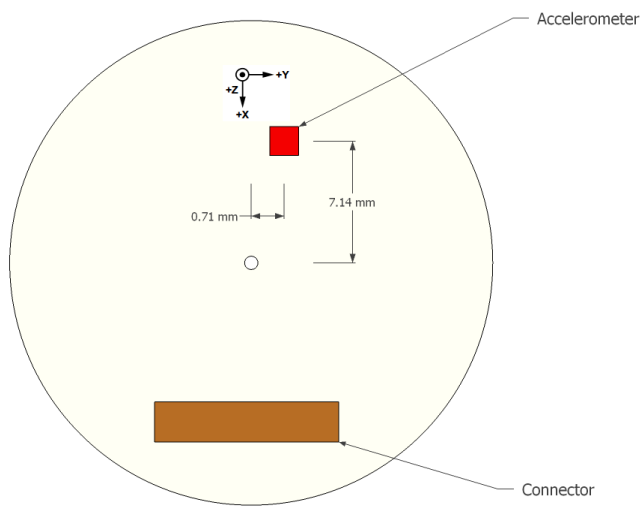
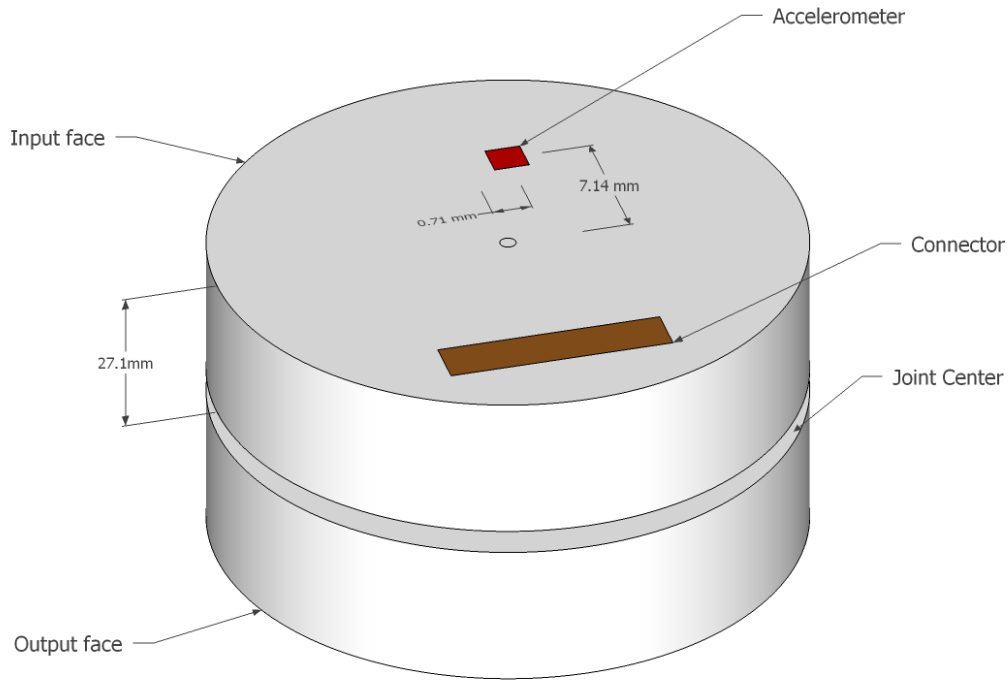
Figure 6: Inertial parameters

From Joint 6 to center of mass of the hand: ~7.5 cm

Advanced sensors information

Accelerometers positions

Accelerometers in each joint.



Side view legend

