JACO²

User guide

KINOVA ROBOTICS

kinovarobotics.com

ABOUT THIS DOCUMENT

- Read all instructions before using this product.
- Keep these instructions for future reference.
- Read all warnings on the product and in this guide.
- Follow all instructions.

This document contains information regarding the setup and the operation of Kinova's JACO² arm. It is intended for:

- Field service, customer support and sales employees of authorized distributor of JACO²
- End user

Symbols, definitions and acronyms


Important information regarding the safety of Kinova's products and their operator.[1]


Tip on the maintenance, operation and manipulation of Kinova's products.


Refer to accompanied documents


Direct current


Alternating current


Operating temperature range


Compliance with WEEE[2] directive


Compliance with ROHS[3] directive


Type BF Applied Part device

Warranty

For more information regarding the warranty included with your product, please refer to the Terms of sale for JACO².

[1] In order to ease the use of this document, a list of the most important warnings is presented in Appendix 4.
[2] Waste electrical and electronic equipment
[3] Restriction of hazardous substances

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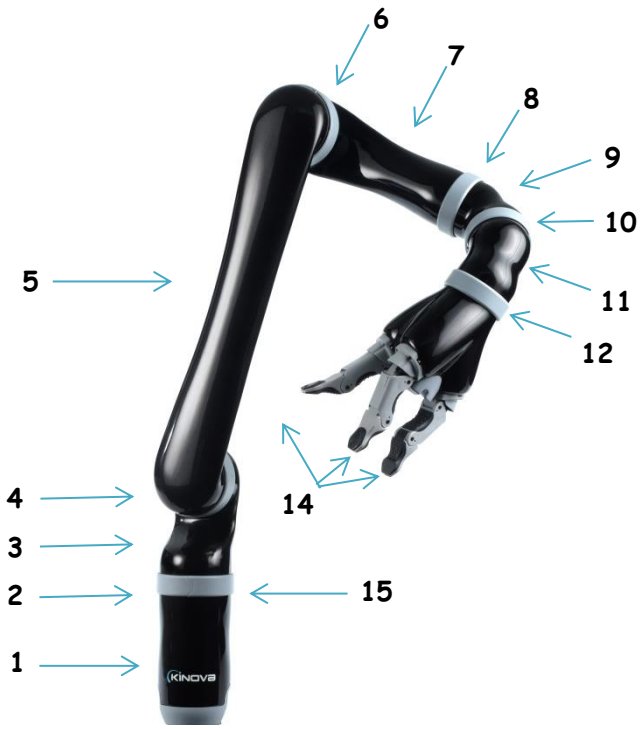
GENERAL INFORMATION

The JACO² arm is a light-weight robot composed of six inter-linked segments. Through the controller or through the computer, the user can move the robot in three-dimensional space and grasp or release objects with the gripper (if any).

- Do not modify this equipment without authorization of the manufacturer.
- The Normal Use Definition contains some fundamental information to the proper operation of the JACO² arm.
- It is not recommended to let the JACO² arm under heavy rain or snow.

Part Identification

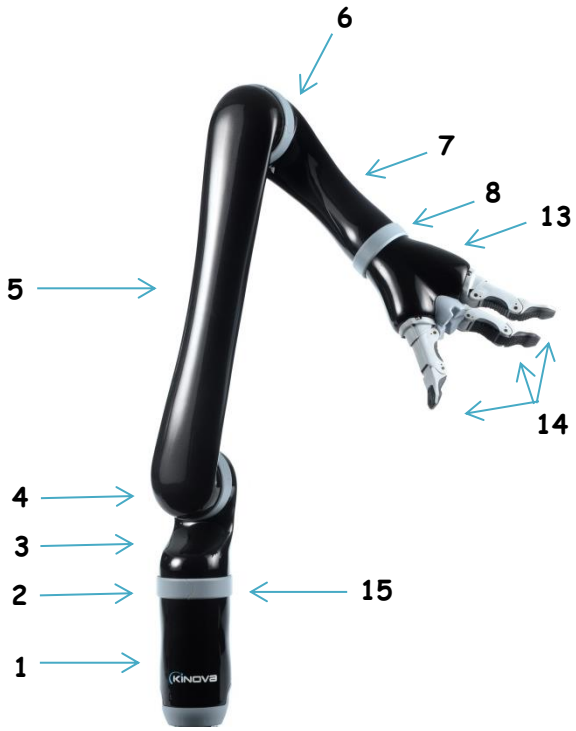
DOF



PART ID	NAME
1	Controller
2	Actuator #1
3	Shoulder
4	Actuator #2
5	Arm
6	Actuator #3
7	Forearm
8	Actuator #4
9	Wrist #1
10	Actuator #5
11	Wrist #2
12	Actuator #6
13	Gripper
14	Fingers
15	Plastic Ring

Figure 1 - JACO²-6 part ID

4 DOF



PART ID	NAME
1	Controller
2	Actuator #1
3	Shoulder
4	Actuator #2
5	Arm
6	Actuator #3
7	Forearm
8	Actuator #4
9	Wrist #1
10	Actuator #5
11	Wrist #2
12	Actuator #6
13	Gripper
14	Fingers
15	Plastic Ring

Figure 2 - JACO²-4 part ID

External Connection

The following figure shows the external connectors located on the JACO² arm controller[4].

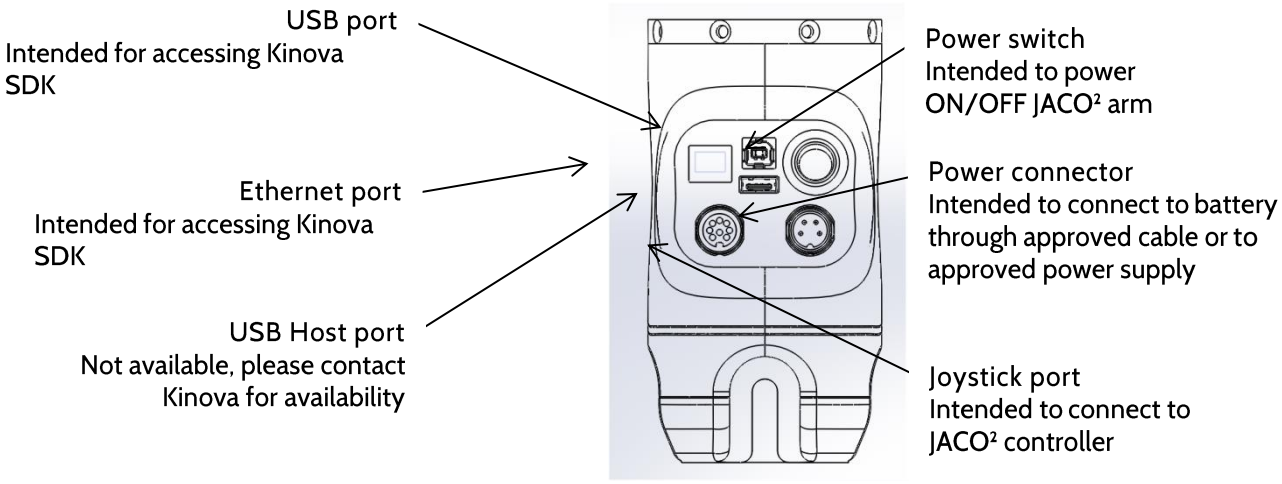


Figure 3 – JACO² controller external connectors

- Control Port and Power Connector are intended to be connected only with Kinova approved device. Connecting other devices may result in bad performance or even make your JACO² inoperable and void your warranty.
- Do not defeat the safety purpose of the polarized or grounding type plug. If the provided cable does not fit in your outlet, consult an electrician for replacement of obsolete outlet.
- To prevent risk of fire or electric shock, avoid overloading wall outlets and extension.
- Protect the cords from being walked on or pinched.

[4] If you need more specific information about the use of any optional accessories and/or system, please contact your local distributor or Kinova Support (see Contacting Support).

Specifications

GENERAL		
	6 DOF	**4 DOF**
TOTAL WEIGHT	4,4 Kg	3.6 Kg
PAYLOAD	2.6 Kg (mid-range continuous) 2.2 Kg (full-reach peak/temporary)	4.4 Kg (mid-range continuous) 3.5 Kg (full-reach peak/temporary)
REACH	90 cm	75 cm
MATERIALS	Carbon fiber (links), Aluminum (actuators)	
JOINT RANGE (SOFTWARE LIMITATION)	±27.7 turns	
MAXIMUM LINEAR ARM SPEED	20 cm/s	
POWER SUPPLY VOLTAGE	18 to 29 VDC	
AVERAGE POWER	25 W (5W in STANDBY)	
PEAK POWER	100 W	
COMMUNICATION PROTOCOL	RS485	
COMMUNICATION CABLES	20 pins flat flex cable	
WATER RESISTANCE	IPX2	
OPERATING TEMPERATURE	-10 °C to 40 °C	

Marking and Label

Please note that these labels may slightly differ from the ones accompanying your device depending of your country. The following figure depicts the information about the label affixed on the JACO² arm controller.

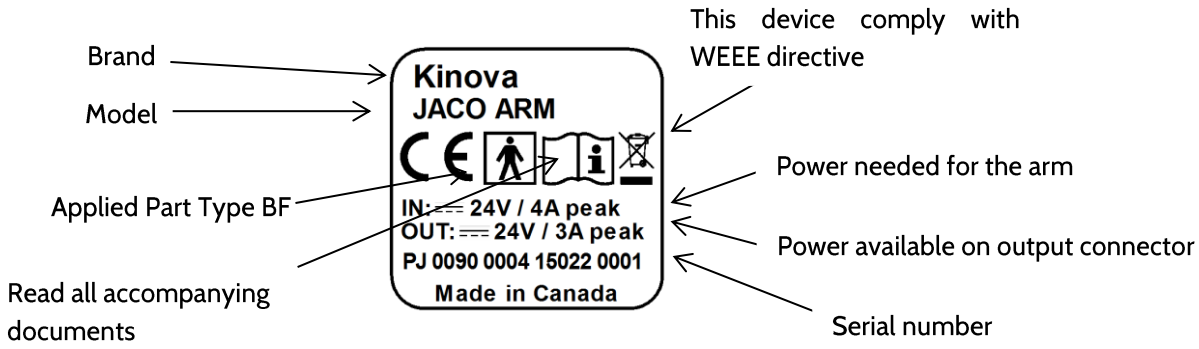


Figure 4 - JACO² Label view

The following figure presents more info about the label apposed on the JACO² arm box.

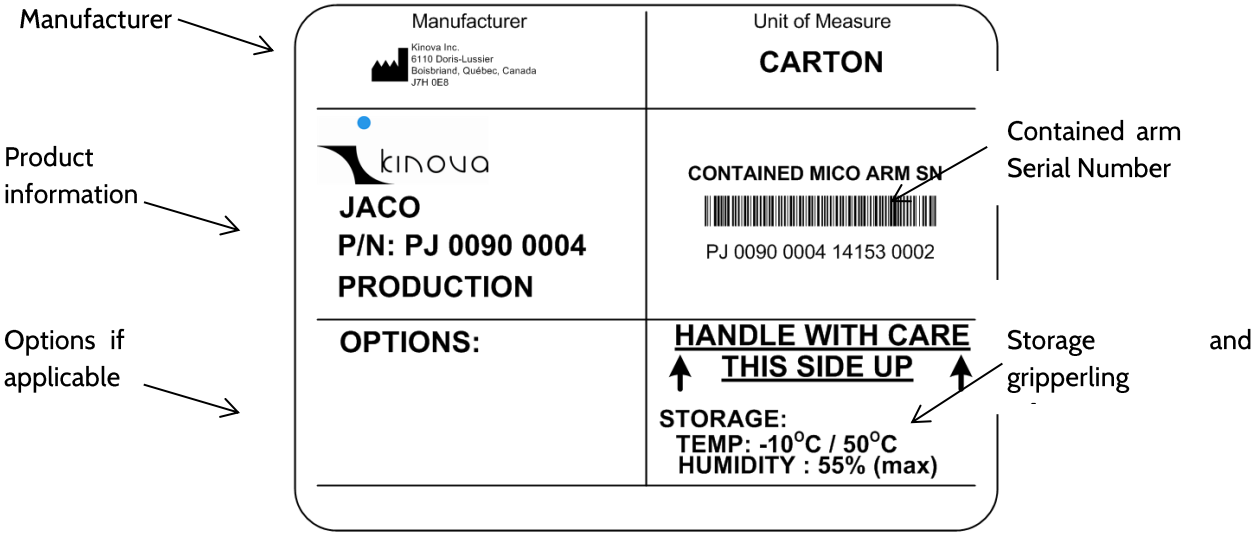


Figure 5 - JACO² Box Label view

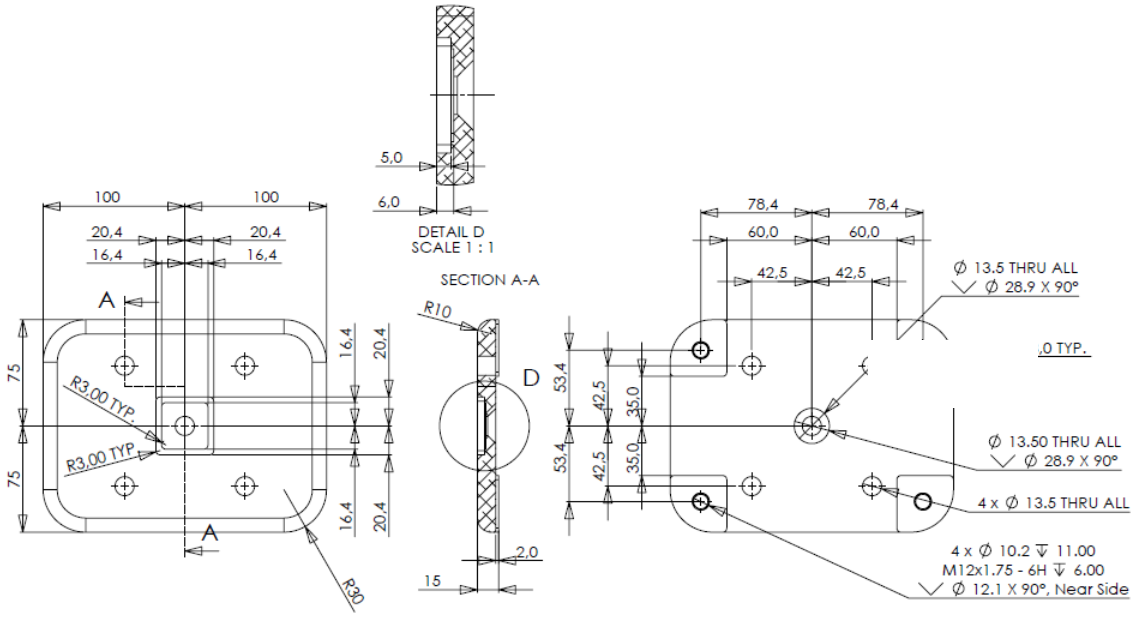
INSTALLATION OF THE JACO² ARM

The JACO² arm's installation comprises the following four steps:

1) Mechanical integration;
2) Electrical integration;
3) End-effector electrical integration (optional);
4) Control integration.

1) Mechanical integration

The JACO² arm is designed to be installed on a fixed surface or mobile platform. Please make sure the arm is fixed in such a way that its base cannot fall or break during operations involving maximum reach of the arm. Here is a guide on how to install the arm on the mounting kit (XK 0000 0014) supplied with your JACO² arm.



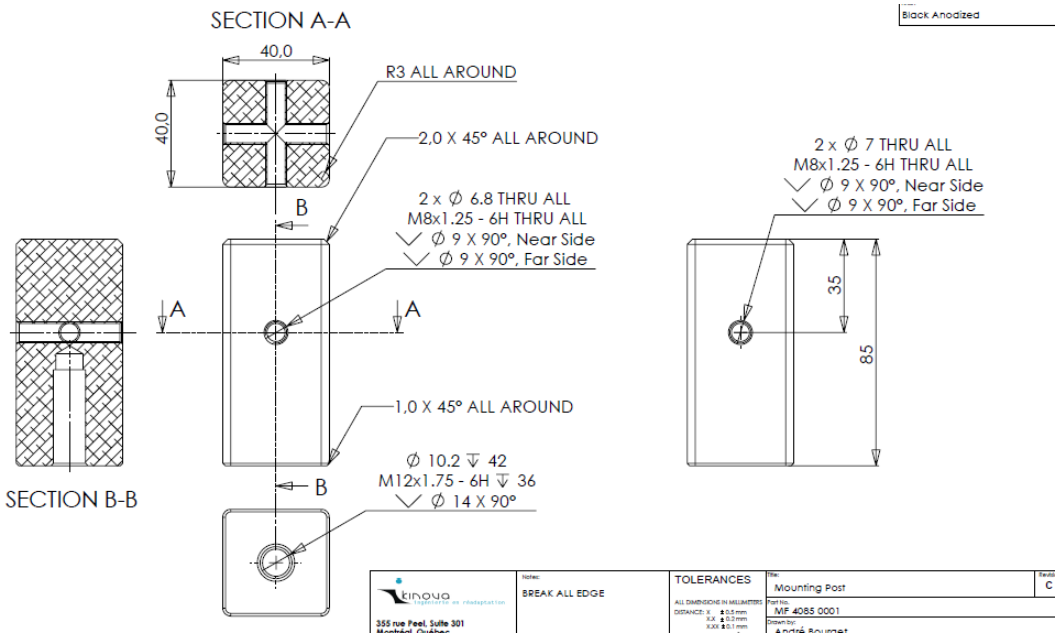


Figure 7 – Mounting post dimensions

STEP 1 Mounting kit assembly

Insert the mounting post into the square cavity on the top of the mounting plate and use an 8 mm Allen key to attach from the bottom of the mounting plate.

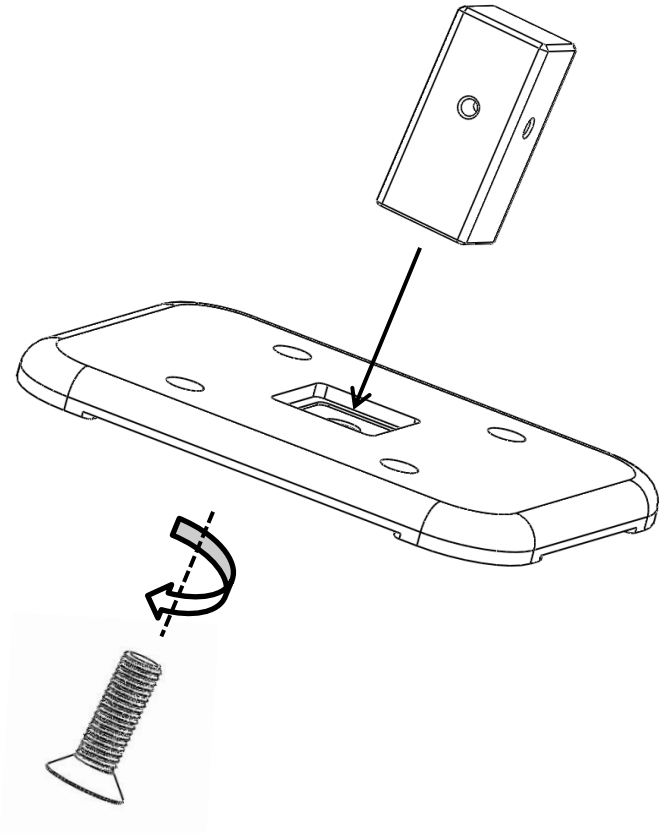


Figure 8 – Mounting kit assembly

STEP 2 Fixing the mounting kit

Fix the mounting kit to a solid flat surface. You can either place the larger side of the mounting kit on the edge of a solid flat surface and clamp it as firmly as possible by placing the two clamps supplied with the package on each side of the mounting post or secure four M12 screws through the holes in the mounting plate.

STEP 3 Robot arm installation

Insert the robot arm on the top of the mounting post. Screw the two M8 lever screws into the mounting post, one in the back of the controller and the other on one of the sides of the robot.

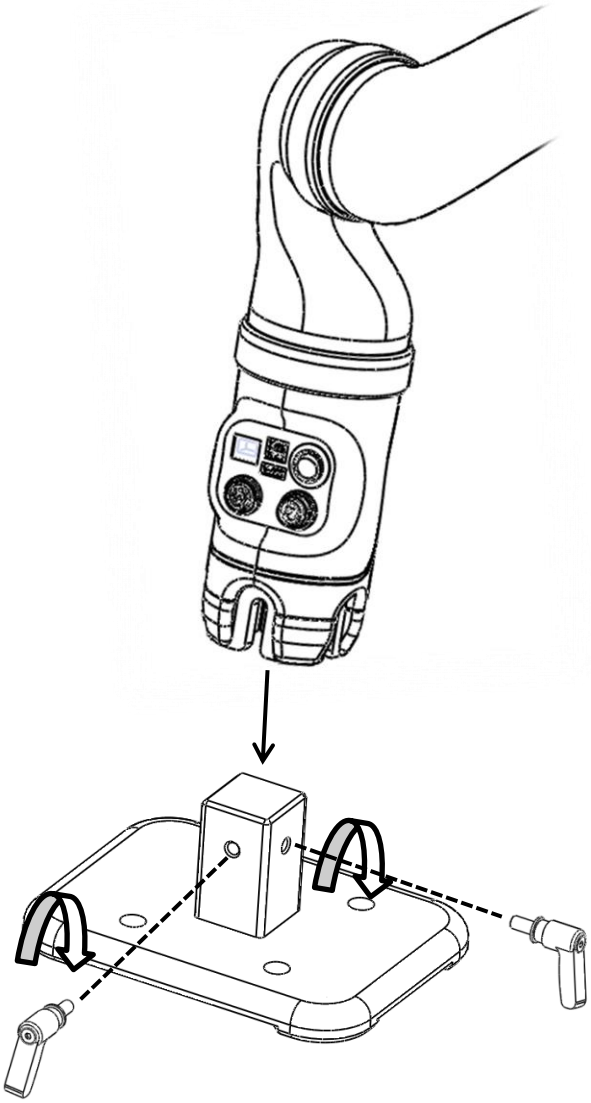


Figure 9 – Robot arm installation

2) Electrical integration

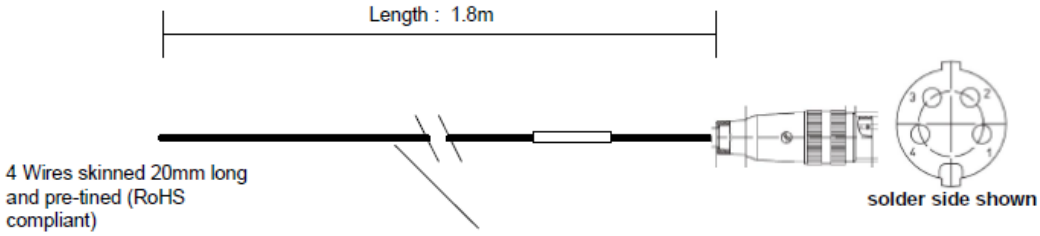
There are two ways of powering JACO².

i) Power outlet

You can power your JACO² using a standard 110/220 V power outlet by plugging the power cord (EH 0300 0001 (USA), EH 2500 0001 (EUR), EH 2500 0002 (AUS), EH 2500 0003 (UK)) into the Power Supply Unit (AE 0000 0029) on one end and into the power outlet on the other. Then plug the PSU into the JACO² controller power connector (reference Figure 3).

ii) Battery

You can use the battery power cord (EH 01M8 0003) by plugging one end into the JACO² controller power connector (reference Figure 3) and attaching the other to a 24V battery following this pinout:



Pinout Table		
Pin #	Signal	Wire color
1	24V	RED
2	24V	BROWN
3	GND	BLACK
4	GND	ORANGE

Figure 10 – EH 01M8 0003 pinout

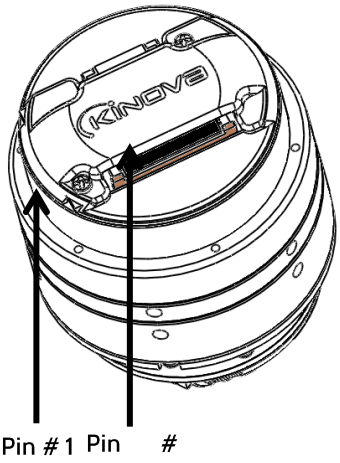
Make sure that your battery respects the electrical specifications of JACO².

3) End-effector electrical integration (optional)

JACO² has two expansion communication lines and power lines accessible on the last actuator with the output on the joystick port if you want to add an additional device at the tip of the robot. A “Y” cable is supplied with the robot (optional) to access both the joystick and the expansion lines. Here are the steps to integrate your end-effector to JACO²:

i) Input pinout

Here is the pinout on the last actuator to connect your end-effector:



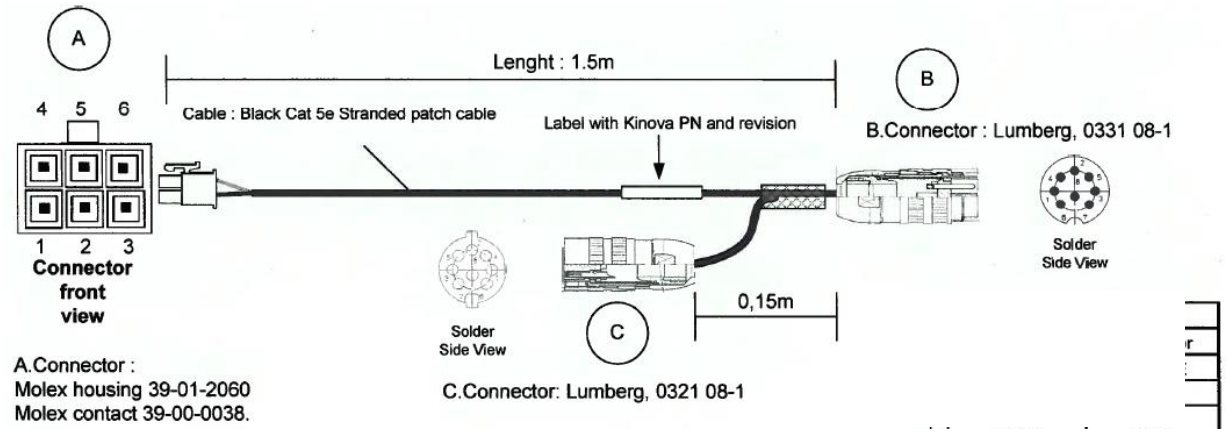
Pin #	Signal
1 to 8	24V input
9 to 16	GND
17	RS485 low
18	RS485 high
19	Exp 0
20	Exp 1

Figure 11 – K-58 pinout

Make sure to connect your end effector to Pin #19 and/or #20. Otherwise, you could severely damage the robot arm.

ii) *Output pinout*

Here is the output pinout of the two expansion lines. They are accessible either directly from the Joystick port (Reference on Figure 3) or the "Y" cable supplied with your JACO² if you still want to use the joystick,



Connector A		
#	**Signal**	**Function**
1	COM1	RS485_low
2	GND	GND
3	COM3	Exp 0
4	COM2	RS485_high
5	24V*	24V
6	COM4	Exp 1

*Maximum current 1,5 A

Figure 12 – EH 01M5 0001 pinout

4) Control integration

Once steps 1 & 2 (optionally 3) are completed, you can power on the robot by flipping the power switch to ON (Reference on Figure 3). To control the robot, you can use either the API or Kinova's joystick.

i) API

Connect the USB cable supplied with your package to the USB port. Install and open the Kinova SDK and follow the procedure and documentation included in the SDK.

ii) Joystick

Connect the joystick to the joystick port or to the C connector if you are using the "Y" cable. Refer to Kinova's joystick section in the user guide for all the details regarding the use of the joystick.

KINOVA'S JOYSTICK

The Kinova's standard controller is a 3 axis joystick mounted on a support which includes 5 independent push buttons and 4 external auxiliary inputs (on the back side).

Part Identification

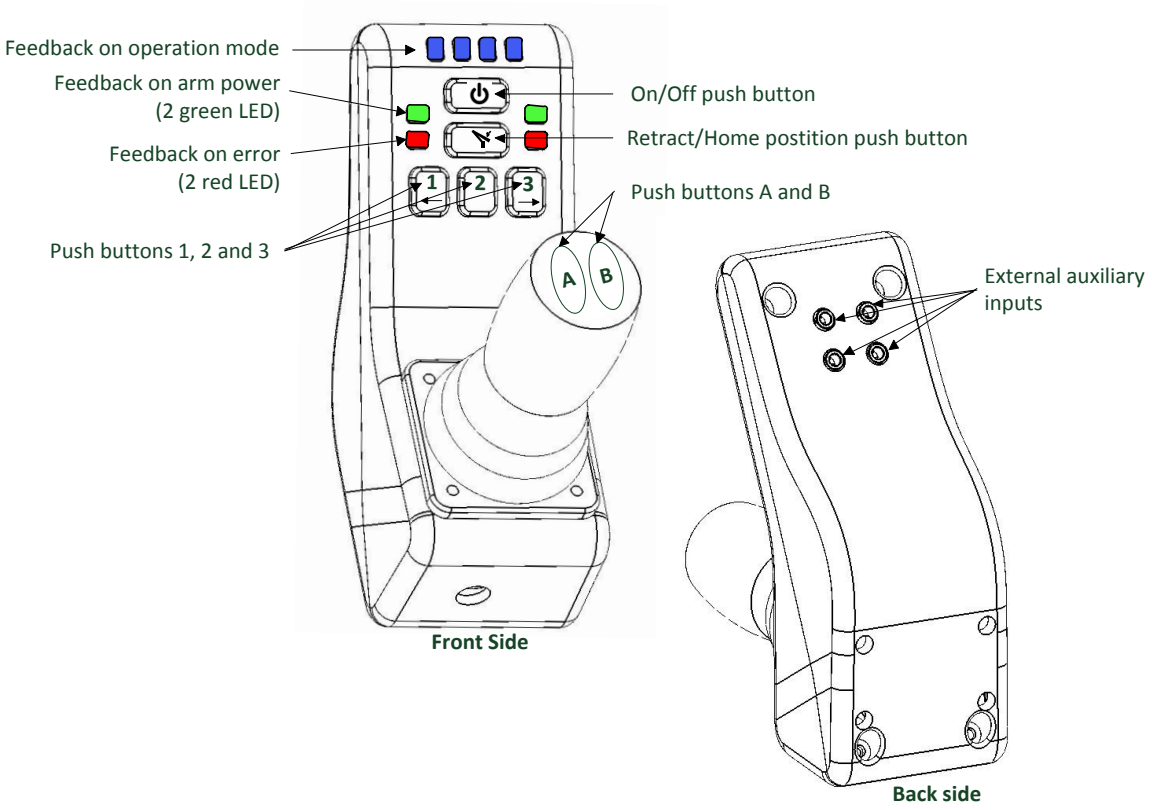


Figure 13 - Kinova's joystick part ID

Kinova's Joystick's Functions

Kinova's joystick allows two operation modes, i.e. the joystick may control the JACO² arm using either 2 or 3 axis. The "2-axis" operation mode will disable the rotation of the lever[5].

The following table lists the default factory settings for the use of the joystick's buttons for 3-axis and 2-axis control[6].

[5] See Appendix 1 for joystick movements).

BUTTONS	ONE CLICK	HOLD 2 SEC (*HOLD UNTIL POSITION IS REACHED)
⏻	Deactivate/Activate Joystick	Change joystick operating mode (2-axis Vs 3-axis)
	---	HOME/RETRACTED function*
3-AXIS		
1	Deactivate/Activate Drinking mode	---
2	---	Set Position
3	---	Go to pre-set position*
A	Reach Finger mode	Decrease speed
B	Reach Translation & Wrist mode	Increase speed
Ext1	Reach Finger mode	Decrease speed
Ext2	Reach Translation & Wrist mode	Increase speed
Ext3	---	HOME/RETRACTED function*
Ext4	Deactivate/Activate Drinking mode	---
2-AXIS		
1	Deactivate/Activate Drinking mode	---
2	Reach Wrist orientation & Finger mode	Decrease speed
3	Reach Translation-X/Y & Translation-Z/Wrist rotation mode	Increase speed
A	---	---
B	---	---
Ext1	Reach Wrist orientation & Finger mode	Decrease speed
Ext2	Reach Translation-X/Y & Translation-Z/Wrist rotation mode	Increase speed
Ext3	---	HOME/RETRACTED function*
Ext4	Deactivate/Activate Drinking mode	---

Figure 14 - Joystick Buttons Use

Visual retroaction

Kinova's joystick offers visual retroaction such as:

- Blue lights : Feedback on control mode (see following table)
- Green lights : Feedback on arm power
- Red lights : Feedback on error

BLUE LIGHTS RETROACTION

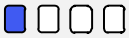
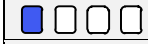
BLUE LIGHTS		CONTROL MODE
3-Axis		Translation (X-Y-Z)
		Wrist
		Fingers
		Drinking mode (to use with wrist rotation mode)
		Disabled controller
2-Axis		Translation (X-Y)
		Translation (Z) / Wrist Rotation
		Wrist Orientation
		Fingers
		Drinking mode (to use with wrist rotation mode)
		Disabled controller

Figure 15 – Feedback on control mode

When no blue lights are visible, the controller is disabled. To enable the controller, you must either proceed with the following options:

- The On/Off button must be pushed;
- The JACO² arm must be set in its HOME position by holding the HOME/RETRACTED function until the JACO² arm stops moving.

GREEN LIGHTS RETROACTION

The green lights offer visual feedback on the power status of the JACO² arm:

GREEN LIGHTS	POWER STATUS
Flashing	The JACO² arm has just been turned on and the internal communication is synchronizing. The JACO² arm is not yet ready to use.
Solid	The JACO² arm is powered and ready to use.

Figure 16 – Visual feedback on power status

RED LIGHTS RETROACTION

The red lights offer visual feedback on possible errors that may occur while operating the JACO² arm:

RED LIGHTS	CAUSES OF THE ERROR STATUS	ACTIONS TO BE TAKEN IN ORDER TO RESOLVE THE SITUATION
Flashing	The weight that is being lifted is too heavy or too much force is applied on the arm.	Safely put down the object, or release force applied on the arm, and wait until red lights turn off.
	The temperature of a section of the arm is too high.	The usage of the arm is excessive and doesn't respect the normal use definition. Safely put down any object that is in JACO²'s gripper, bring back the arm to its RETRACTED position, and wait until red lights turn off.
	The input voltage to the arm (or batteries) is too low.	Safely put down any object that is in JACO²'s gripper, bring back the arm to its RETRACTED position. Ensure the power supply is appropriate and connections are secure, or batteries are charged properly before using the arm again.
Solid	The JACO² arm is in fault.	Turn off the arm and turn it back on. If the problem remains, contact your distributor or Kinova.

Figure 17 – Visual feedback on error status

OPERATING PRINCIPLES

The JACO² arm operating principles are very simple and intuitive. The JACO² arm may be operated through several controllers. The following sections present the general control principles through Kinova's joystick.

Basic movements

The control over the JACO² arm is said to be Cartesian as the user only controls movements of and around the gripper. The different joints are piloted automatically following the given command. The following figure summarizes the different movements and modes of control related.

In the "*Translation mode*", the user controls the position of the gripper in space. The gripper will always keep its parallelism to the base of the arm. Translation X refers to left/right movements of the gripper. Translation Y refers to front/back movements of the gripper. Translation Z refers to up/down movements of the gripper.

In the "*Wrist mode*", the user controls the position of the arm around the center point of the gripper (reference point) which will not move (or move slightly) when operating this mode. Lateral orientation refers to a thumb/index circular movement of the wrist around the reference point. Vertical orientation refers to a top/bottom circular movement of the wrist around the reference point. Wrist rotation refers to a circular movement of the gripper around itself.

The *"Drinking mode"* is to be used with the wrist rotation only. While operating the JACO² arm in the *"Drinking mode"*, the reference point (normally set in the middle of the gripper), is offset in height and length to produce a rotation that will make a rotation around another point in the space of the arm

In the "*Finger mode"*, the user controls the opening and closing of the fingers.

The JACO² arm will sometimes respond differently to a given command than described in this section. This may be due to the singularity avoidance algorithms embedded in the kinematics. It is a normal protective behaviour of the JACO² arm and is position dependant.

HOME/RETRACTED Positions

The JACO² arm comes with two factory default pre-set positions that may be configured in Kinova SDK: the HOME and the RETRACTED position.

- The HOME position refers to the position of the arm when it is ready to be used. In the HOME position, JACO² is awaiting a command from the joystick.
- The RETRACTED position refers to the position of the arm when it is not used. The user should always place the arm in the RETRACTED position when it is unused as it diminishes the physical volume occupied by the arm. In the RETRACTED position, JACO² is in standby mode; the joystick features are disabled and power consumption is much lower.

Never use the HOME/RETRACTED function when carrying liquid. The HOME position is pre-set and the wrist may have to rotate and drop the liquid.

Operating the JACO² arm via Joystick

This section explains how to operate the JACO² arm with factory configuration[7], contact your reseller for operation instructions with your adapted configuration.

Before operating the JACO² arm, please make sure it is properly installed.

Do not manipulate cutting, very sharp or any dangerous tools or objects with the JACO² arm.

This equipment is not designed to act as a lift.

This equipment is not designed to be used in presence of flammable mixture. (Not AP or APG rated).

Do not install the JACO² arm near any heat sources, such as radiators. Do not use it to directly manipulate hot objects.

[7] You may also refer to the reminder presented in Appendix 3.

The following instructions will help you start with the device[8]. For a step-by-step formation on the use of the JACO² arm, please refer to appendix 2.

1) Turn ON the device by pushing the On/Off switch located on the JACO² arm controller.
2) Wait until the green lights on the controller stop flashing.
3) Put the JACO² arm in its HOME position by holding the HOME/RETRACTED function until the JACO² arm stops moving. The arm will slowly reach the HOME position.

When starting the JACO² arm, you are in 3-Axis operation mode and "*Translation mode*".

One must open the fingers at their maximum opening range when using them after powering up JACO².

To change the operating mode of the Joystick, hold the On/Off button for 2 seconds. At this point, the stick rotation is not effective anymore.

When the power is turned off, the JACO² arm will fall on itself and may damage itself, depending on its position at the time of disconnection. Be sure to support its wrist before turning the power off.

[8] Those steps may change upon different configurations.

THREE-AXIS MODE

JOYSTICK MOVEMENT	JACO² ARM MOVEMENT	AVAILABILITY
TRANSLATION MODE		
Incline FRONT	Gripper moves forward	6/4 DOF
Incline BACK	Gripper moves backward	6/4 DOF
Incline LEFT	Gripper moves left	6/4 DOF
Incline RIGHT	Gripper moves right	6/4 DOF
Rotate stick CLOCKWISE	Gripper moves up	6/4 DOF
Rotate stick COUNTER-CLOCKWISE	Gripper moves down	6/4 DOF
WRIST MODE		
Incline FRONT	Vertical orientation – Top side	6 DOF
Incline BACK	Vertical orientation – Bottom side	6 DOF
Incline LEFT	Lateral orientation – Thumb side	6 DOF
Incline RIGHT	Lateral orientation – Index side	6 DOF
Rotate stick CLOCKWISE	Wrist rotation clockwise	6/4 DOF
Rotate stick COUNTER-CLOCKWISE	Wrist rotation counter-clockwise	6/4 DOF
FINGER MODE		
Incline LEFT	Close Fingers	6/4 DOF
Incline RIGHT	Open Fingers	6/4 DOF

Figure 18 – Reminder for 3-Axis operation mode

TWO-AXIS MODE

JOYSTICK MOVEMENT	JACO² ARM MOVEMENT	AVAILABILITY
TRANSLATION-X & TRANSLATION-Y		
Incline FRONT	Gripper moves forward	6/4 DOF
Incline BACK	Gripper moves backward	6/4 DOF
Incline LEFT	Gripper moves left	6/4 DOF
Incline RIGHT	Gripper moves right	6/4 DOF
TRANSLATION-Z & WRIST ROTATION		
Incline FRONT	Gripper moves up	6/4 DOF
Incline BACK	Gripper moves down	6/4 DOF
Incline LEFT	Wrist rotation clockwise	6/4 DOF
Incline RIGHT	Wrist rotation counter-clockwise	6/4 DOF
WRIST ORIENTATION		
Incline FRONT	Vertical orientation – Top side	6 DOF
Incline BACK	Vertical orientation – Bottom side	6 DOF
Incline LEFT	Lateral orientation – Thumb side	6 DOF
Incline RIGHT	Lateral orientation – Index side	6 DOF
FINGER MODE		
Incline LEFT	Close Fingers	6/4 DOF
Incline RIGHT	Open Fingers	6/4 DOF

Figure 19 – Reminder for 2-Axis operation mode

NORMAL USE DEFINITION

The definition of a normal use of the JACO² arm also includes that you can lift, push, pull or manipulate a maximum load of:

- **Continuously** 2.6 Kg from minimum to middle reach (45 cm distance between the actuator #2 of JACO² and the load) for 6 DOF & 4.4 Kg from minimum to middle reach (35 cm distance between the actuator #2 of JACO² and the load) for 4 DOF;
- **Temporary** 2.2 kg from middle to full reach (90 cm distance between the actuator #2 of JACO² and the load) for 6 DOF & 3.5 kg from middle to full reach (75 cm distance between the actuator #2 of JACO² and the load) for 4 DOF ;

The arm is designed to be able to hold objects in the environment of the user, but it is a manipulator that in some positions and loads near the maximum reach and maximum loads holds for a long period, it can heat. When this occur, before overheating and being dangerous for either the user or the arm, red lights on the joystick will blink. This is a warning, simply put down any object in the gripper, and brings back the arm to HOME or RETRACTED positions and wait until the warning goes away before using the arm.

If you don't use a Joystick in your application, make sure to read all the error statuses and temperature of all actuators modules via the API to ensure that they do not go higher than recommended parameters. If this occurs, the arm should be held in an idle position near the base for a certain time without any object in the gripper to cool down the arm.

When lifting weight near the maximum load and reach, if the red lights of the controller blinks, put down the object in the gripper, and bring back the arm to HOME or RETRACTED position and wait until the warning goes away before using it.

During normal operation, the joints are subject to heating. The joints are normally covered with plastic rings which will protect the user from any danger that may be occurred by the heating of the metal parts.

CONSERVATIVE USE OF THE GRIPPER AND FINGERS

The fingers of the JACO² arm are made flexible in order to protect the internal mechanism. When using the fingers to push on objects, the user must take special care not flex the fingers beyond their maximal opening as this could damage the internal mechanism.

Do not force the fingers beyond their maximal opening as this could damage some internal components.

ELECTROMAGNETIC INTERFERENCE FROM RADIO WAVE SOURCE

Even if JACO² complies with all relevant standards, your arm may still be susceptible to electromagnetic interference (EMI), which is interfering electromagnetic energy (EM) emitted from sources such as radio stations, TV stations, amateur radio (HAM) transmitters, two way radios, and cellular phones. The interference (from radio wave sources) can cause the JACO² stop moving for a period of 10 seconds. In this case, the JACO² arm will simply re-initialize and you will be able to continue to use it. In extremely rare case, it can also permanently damage the JACO² arm control system.

The intensity of the interfering EM energy can be measured in volts per meter (V/m). JACO² can resist EMI up to certain intensity. This is called "immunity level". The higher the immunity level is, the greater is the protection. At this time, current technology is capable of achieving at least a 20 V/m immunity level, which would provide useful protection from the more common sources of radiated EMI.

There are a number of sources of relatively intense electromagnetic fields in the everyday environment. Some of these sources are obvious and easy to avoid. Others are not apparent and exposure is unavoidable. However, we believe that by following the warnings listed below, your risk to EMI will be minimized.

The sources of radiated EMI can be broadly classified into three types:

1) Gripper-held portable transceivers (e.g.: transmitters-receivers with the antenna mounted directly on the transmitting unit, including citizens band (CB) radios, walkie-talkie, security, fire and police transceivers, cellular phones, and other personal communication devices[9]).
2) Medium-range mobile transceivers, such as those used in police cars, fire trucks, ambulances and taxis. These usually have the antenna mounted on the outside of the vehicle.
3) Long-range transmitters and transceivers, such as commercial broadcast transmitters (radio and TV broadcast antenna towers) and amateur (HAM) radios[10].

Because EM energy rapidly becomes more intense as one move closer to the transmitting antenna (source), the EM fields from gripper-held radio wave sources (transceivers) are of special concern. It is possible to unintentionally bring high levels of EM energy very close to the JACO² control system while using these devices. Therefore, the warnings listed below are recommended to reduce the effects of possible interference with the control system of JACO².

⚠ Do not operate gripper-held transceivers (transmitter's receivers), such as citizens band (CB) radios, or turn ON personal communication devices, such as cellular phones, while the JACO² is turned ON.

⚠ Be aware of nearby transmitters, such as radio or TV stations, and try to avoid coming close to them.

[9] Some cellular phones and similar devices transmit signals while they are ON, even when not being used.
[10] Other types of gripper-held devices, such as cordless phones, laptop computers, AM/FM radios, TV sets, CD players, cassette players, and small appliances, such as electric shavers and hair dryers, so far as we know, are not likely to cause EMI problems to your JACO².

Be aware that adding accessories or components, close to JACO²'s base, may make it more susceptible to EMI (There is no easy way to evaluate their effect on the overall immunity of the power wheelchair and/or your JACO²).

Report all incidents of unintended shut down to your local distributor, and note whether there is a source of EMI nearby.

MAINTENANCE AND DISPOSAL

Cleaning Instruction

Only the external surfaces of JACO² may be cleaned. Cleaning may be done using a damp cloth and light detergent. The following described the steps for the cleaning JACO²:

- Prepare a water/soap preparation using a proportion of about 2ml of dish soap for 100ml of water;
- Immerge a clean cotton cloth in the preparation;
- Take out the cloth and wring out thoroughly;
- Gently rub the external surface to be cleaned.


Do not wash more than three times per day.


Do not immerse any part of the JACO² arm under water or snow.


JACO² is not intended to be sterile. No sterilization process should be applied to the arm.


Do not rub the external surfaces with abrasive materials.

Preventive Maintenance

The JACO² arm requires no maintenance other than cleaning and lubricating the fingers every 6 months.


Refer all services to qualified service personnel. A service is required when the apparatus has been damaged in any way, for example if the power-supply cord or plug is damaged, if the JACO² arm does not operate normally or has been dropped.


There is no “home serviceable” part inside JACO², do not open.

Disposal


The JACO² arm contains parts that are deemed to be hazardous waste at the end of their life. For further information on gripperling and recycling contact your local recycling authority or local JACO² distributor. In any way, always dispose of product through a recognized agent.

PACKING MATERIAL

The JACO² arm packing material can be disposed as recyclable material.

METAL PARTS

The JACO² arm metal part can be disposed as recyclable scrap metal.

ELECTRICAL PARTS, CIRCUIT BOARDS AND CARBON FIBER

Please contact your local distributor to have information regarding disposal of such parts. You can also address questions directly to Kinova through our website (see Contacting Support).

CONTACTING SUPPORT

If you need help or have any questions about this product, this guide or the information detailed in it, please contact a Kinova representative at:

- Support@KinovaRobotics.com

We value your comments!

To help us assist you more effectively with problem reports, the following information will be required when contacting Kinova or your distributor support

- JACO²'s serial number[11]
- Date/Time of the problem
- Environment where the problem occurred (per example 30° Celsius, raining, ...)
- Actions performed immediately before the problem occurred

[11] This will allow the support agent to have all the information regarding your JACO² as the software version running in the device, the part revisions and characteristics, etc.

APPENDIX 1: JOYSTICK MOVEMENTS

As previously stated, the Kinova's joystick is a 3-Axis joystick mounted on a support. The joystick axes refer to the following actions:

- Incline left/right
- Incline front/back
- Rotation of the lever clockwise/counter-clockwise

The following figure shows Kinova's joystick's movements.

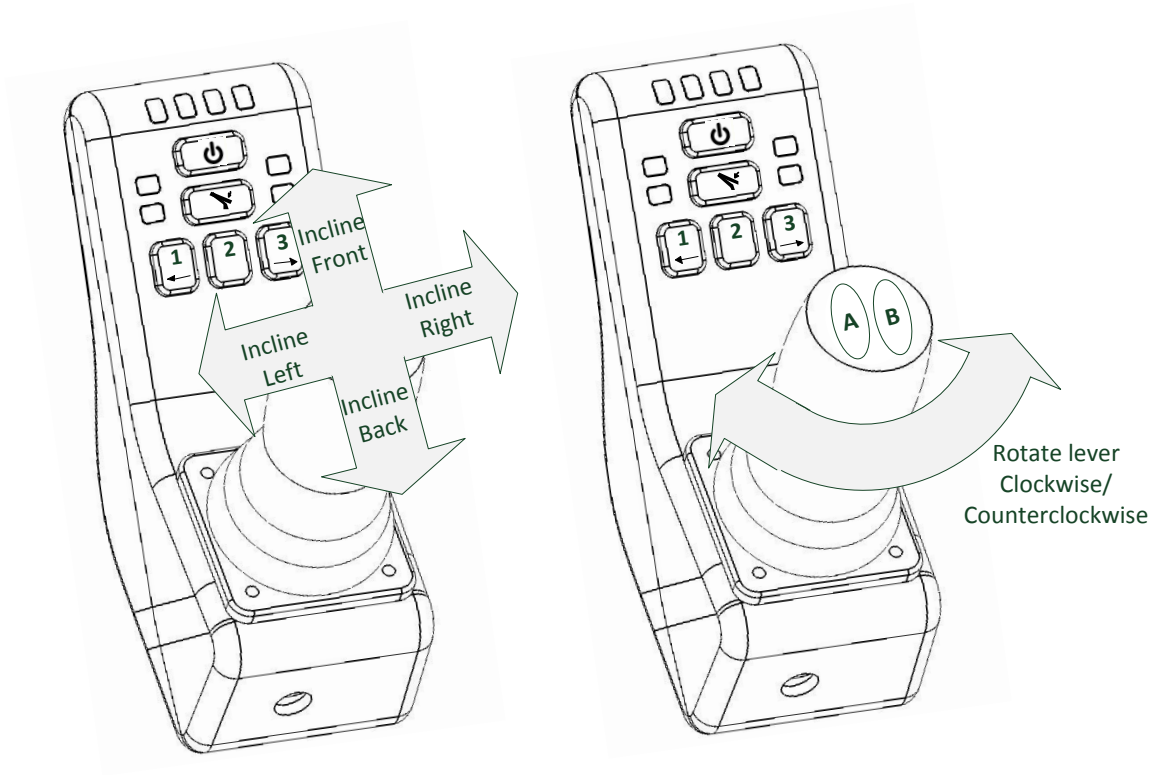


Figure 20 - Kinova's joystick possible commands

APPENDIX 2: STEP-BY-STEP APPROACH TO OPERATE THE JACO² ARM

This section explains how to operate the JACO² arm with the factory default configuration.

Getting started

1) Turn ON the device by pushing the **ON/OFF switch** located on the JACO² arm base.
2) Wait until the green lights on the controller stop flashing.
3) Put the JACO² arm in its **HOME** position by holding the **HOME/RETRACTED** function () until the JACO² arm stops moving. The arm will slowly reach the **HOME** position.

When starting the JACO² arm, you are in 3-Axis operation mode, ‘’Translation control mode”, meaning that any movement of the joystick will move the center of the gripper parallel to the floor.

To change the operating mode of the Joystick, hold the ON/OFF button for 2 seconds. At this point, the stick rotation is not effective anymore.

4) You may move the 3 axis of the joystick to experience the Translation control mode.

Don’t forget the lever rotation.

5) One hit on **Button B** will bring you in Wrist control mode meaning that any movement of the joystick will result in a rotation around the center of the gripper.

Another hit on Button B will bring you back in Translation control mode.

6) One hit on **Button 1** will activate the Drinking mode which may be used only in Wrist mode. When rotating the joystick lever, you will see the JACO² arm’s wrist rotation now compensate for height and distance while turning. This movement is ideal when trying to drink directly from a glass.

Another hit on Button 1 will disable Drinking mode.

7) One hit on **Button A** will bring you in the Finger control mode. The fingers will move per a left/right inclination of the joystick.

At any time, you may use the HOME/RETRACTED function () until the arm stops moving to bring it back into its HOME position.

If you hold the HOME/RETRACTED function () again, the arm will start to move toward its RETRACTED position.

8) Hold the **On/Off Button** (⏻) for 2 seconds to change the operating mode. This will disable the stick rotation. You are now in a 2-Axis Translation control mode.

   As the stick rotation won't have any effect, you may only control the horizontal translation of the arm (Translation-X and Translation-Y)

9) One hit on **Button 3** will bring you to control the vertical translation of the gripper (Translation-Z) and Wrist rotation.

Another hit on Button 3 will bring you back in Translation-X and Translation-Z control mode.

10) One hit on **Button 1** will activate the Drinking mode which may be used only in Wrist mode. When rotating the joystick lever, you will see that the JACO² arm's wrist rotation now compensate for height and distance while turning. This movement is ideal when drinking directly from a glass.

11) One hit on **Button 2** will bring you to control the wrist orientation (Lateral orientation and Vertical orientation).

12) One hit on **Button 2** will bring you to Finger control mode. The fingers will move according to a left/right inclination of the joystick.

Another hit on Button 2 will bring you back in Lateral orientation and Vertical orientation control mode.

APPENDIX 3: REMINDER ON THE JACO² ARM OPERATION

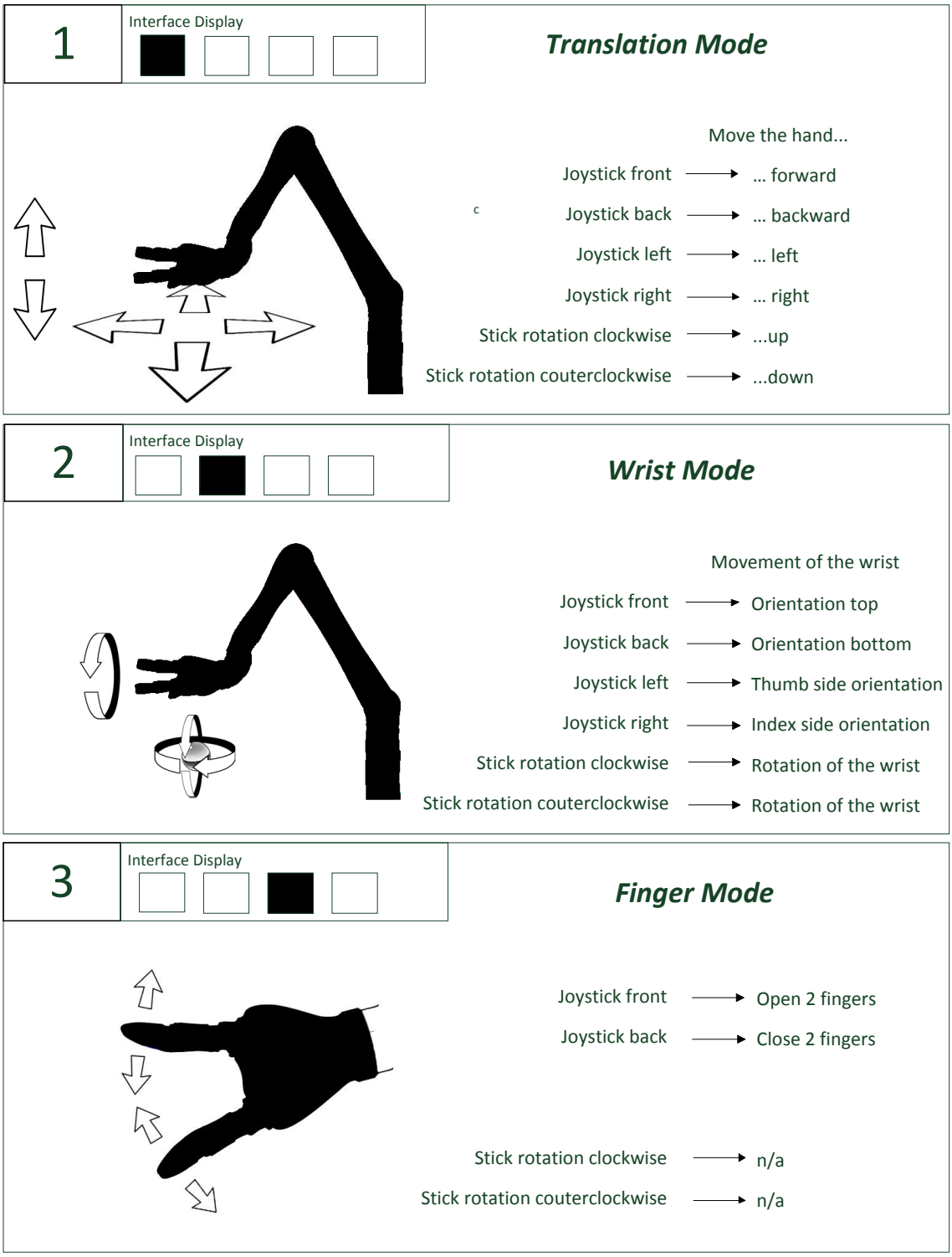


Figure 21 - Visual reminder for 3-Axis operation mode

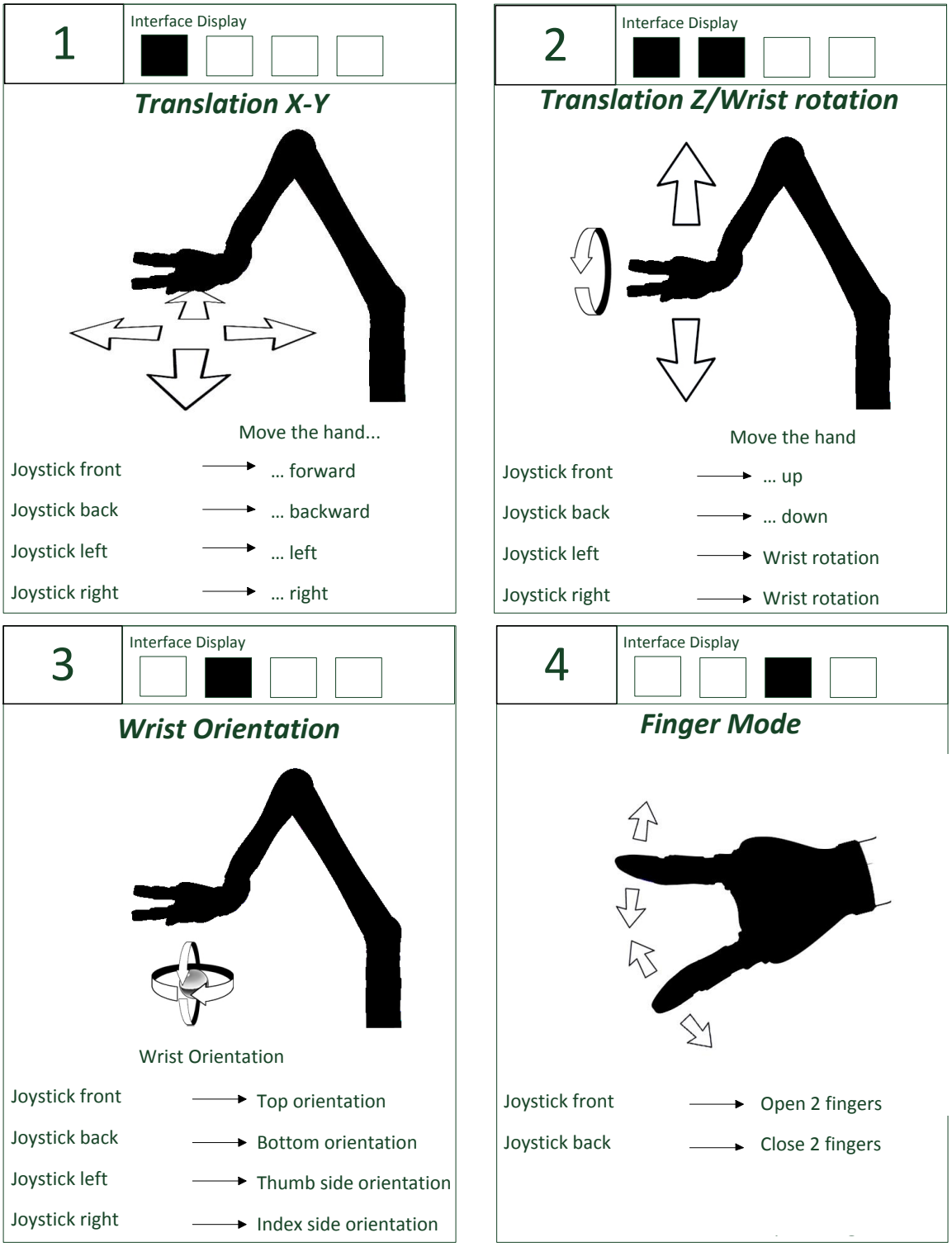


Figure 22 - Visual reminder for 2-Axis operation mode

APPENDIX 4: MAJOR WARNING REMINDER


It is not recommended to let the JACO² arm under heavy rain or snow.


Never use the HOME/RETRACTED function when carrying liquid. The HOME position is pre-set and the wrist may have to rotate and drop the liquid.


Do not manipulate cutting, very sharp or any dangerous tools or objects with the JACO² arm.


When the power is turned off, the JACO² arm will fall on itself and may damage itself, depending on its position at the time of disconnection. Be sure to support its wrist before turning the power off.


Do not force the fingers beyond their maximal opening as this could damage some internal components.


Do not immerse any part of the JACO² arm under water or snow.


When lifting weight near the maximum load and reach, if the red lights of the controller blinks, put down the object in the gripper, and bring back the arm to HOME or RETRACTED position and wait until the warning goes away before using it.