

Interbotix X-Series Arm Quickstart

Congrats on getting your new X-Series Interbotix Arm on a Raspberry Pi!

In just a matter of minutes, you will be ready to start your manipulation project. This quickstart will cover getting connected to your Arm as well as some troubleshooting steps if something goes wrong. As an FYI, the password for the Pi is *interbotix*.

In Your Package...

The Robot Arm package should come with the following components:

- 1 x X-Series Interbotix Robot Arm Kit (including onboard U2D2 and X-Series power hub)
- 1 x Raspberry Pi 4B (4GB RAM) Kit
- 1 x Original Sony PS4 Controller



Dynamixel U2D2



Raspberry Pi 4B Kit



X-Series Motor Power Hub

Hardware Setup

There is not much required to get the Robot Arm up and running as most of the setup is done for you. Just make sure to do the following steps:

- Remove the Arm from its packaging and place on a sturdy tabletop surface near an electrical outlet. To prevent the robot from potentially toppling during operation, secure it to a flat surface (via clamping or using the holes on the base's perimeter). At your own risk, you could instead place a small heavy bean-bag on top of the acrylic plate by the base of the robot. Finally, make sure that there are no obstacles within the arm's workspace.
- Plug the 12V power cable into an outlet and insert the barrel plug into the barrel jack on the X-series motor power hub (located under the see-through acrylic on the base of the robot). You should briefly see the LEDs on the Dynamixel motors flash red.
- Plug in the micro-usb cable into the U2D2 (located under the see-through acrylic on the robot's base) and any USB port on the RPi.

- If you purchased the Pi Kit with an arm, then there is no need to connect a keyboard, mouse, or monitor to the Pi as it should already be preconfigured to work with your arm and paired with the PS4 controller. Just plug the 5V Raspberry Pi Power Supply cable into an outlet and insert the other side into the Type-C USB port. Then flick the switch on. Next, jump to the **Connecting to the Robot Arm** section.
- If you purchased the Pi Kit without an arm, but would like to use it with an arm, make sure to connect a keyboard, mouse, and HDMI monitor to it. Then, plug the 5V Raspberry Pi Power Supply cable into an outlet and insert the other side into the Type-C USB port. Finally, flick the switch on the power cable and continue with the next section.

PS4 Controller Setup

Getting a PS4 controller connected via Bluetooth to the Raspberry Pi is pretty straightforward. Once the Pi boots, click the *Bluetooth* icon on the top right of your Desktop, followed by *Setup New Device....* A window should pop up welcoming you to the 'Bluetooth device setup assistant.' Click the *Next* button. Then, press and hold the *Share* button on the PS4 controller. While holding the *Share* button, press and hold the *PS* button. After a few seconds, the triangular shaped LED located between the *L2* and *R2* buttons should start rapidly flashing white (about twice a second) at which point you can let go.

On the computer, click the 'magnifying glass' icon on the lower left of the 'Device' window. Wait until you see 'Wireless Controller' pop up, select it, and click *Next* on the bottom right of the window. A message should pop up asking if you would like to *Pair Device* or *Proceed Without Pairing*. Select *Pair Device* and click *Next* on the bottom right of the screen.

A new message should now display asking you to either connect to *Human Interface Device Service (HID)* or *Don't Connect*. Select the *Human Interface Device Service (HID)* option and click *Next*. In the following screen, you should see a message either saying that the *Device added successfully, but failed to connect* or that the *Device added and connected successfully*. This is typical and you should just click *Close* on the bottom right of the screen.

If the message said that the device connected successfully, you will need to disconnect and reconnect the controller for the next step. To do that, hold down the *PS* button for about 10 seconds until the blue LED at the front of the controller turns off. Then, tap the *PS* button on the controller (no need to hold it down), and after waiting a few seconds, you should see the LED at the front turn blue. At this point, you should see a small popup on the top right of the screen titled 'Bluetooth Authentication'. Make sure to click the *Always Accept* option. This means that the computer will always pair with your PS4 controller when you tap the *PS* button.

Install Arm ROS Packages

To install the ROS packages, open a terminal (**Ctrl-Alt-T**), and type the following four commands in sequence (first make sure to connect to the Internet).

1. `sudo apt install curl`
2. `curl curl`
`'https://raw.githubusercontent.com/Interbotix/interbotix_ros_manipulators/main/interbotix_ros_xsarms/install/rpi4/xsarm_rpi4_install.sh' > xsarm_rpi4_install.sh`
3. `chmod +x xsarm_rpi4_install.sh`
4. `./xsarm_rpi4_install.sh`

After you run the last command, you will be prompted with a question asking about your robot model. Type the abbreviation on the right-hand-side of the table below for your arm type.

| Robot Type | Abbreviation |
|----------------------------------|---------------|
| PincherX 100 Robot Arm | px100 |
| PincherX 150 Robot Arm | px150 |
| ReactorX 150 Robot Arm | rx150 |
| ReactorX 200 Robot Arm | rx200 |
| WidowX 200 Robot Arm | wx200 |
| WidowX 250 Robot Arm | wx250 |
| WidowX 250 6DOF Robot Arm | wx250s |
| ViperX 250 Robot Arm | vx250 |
| ViperX 300 Robot Arm | vx300 |
| ViperX 300 6DOF Robot Arm | vx300s |
| Mobile PincherX 100 Robot Arm | mobile_px100 |
| Mobile WidowX 200 Robot Arm | mobile_wx200 |
| Mobile WidowX 250 6DOF Robot Arm | mobile_wx250s |

You will also be asked if you would like the 'Joystick ROS package to run at system boot'. In explanation, this 'program' is what allows you to control the arm with the PS4 controller. By typing 'y' or 'yes', the Pi will automatically start this program when turned on. By typing anything else, the Pi will not start the program. Instead, you will have to manually run the program yourself every time. As a recommendation, if you want a Plug N' Play solution, then say 'yes'. If you want to do your own development on the Pi, then type 'no'.

If you typed 'no', you can manually run the program by opening a terminal (by pressing **Ctrl+Alt+T**) and typing...

```
roslaunch interbotix_xsarm_joy xsarm_joy.launch robot_model:=<robot_model> use_rviz:=false
```

where `<robot_model>` should be replaced with one of the model names in the table above. Note that the `use_rviz` parameter configures whether you'd like to see a virtual arm copy the same movements as the real arm. In general, I'd recommend setting this to false on the Raspberry Pi to take the load off the processor.

If you typed 'yes' and would like to disable that feature later on, open a terminal on the Pi and type `sudo systemctl disable xsarm_rpi4_boot.service`. However, if you just want to shut down the 'program' temporarily, but have it start again at the next boot, just type `sudo pkill ros` in the terminal. Note that this will cause the motors in the robot arm to torque off. So make sure the arm is in a 'resting' position before typing this command.

Once the installation procedure completes, restart the Pi. At this point, you can disconnect the mouse, monitor, and keyboard, and continue with the next section.

Connecting to the Robot Arm

After turning on the Pi, wait until you see the red LEDs on the U2D2 flash white. At this point, tap the PS button on the controller. Then wait until the white LED on the front of the controller turns to a solid blue (a few seconds). This means that the controller has successfully connected to the Pi over Bluetooth. Now go and have fun! Make sure to take a look at the guide below to get familiar with the button mappings.

Troubleshooting


If your PS4 controller isn't working...

- Verify that the controller is paired with the Pi by confirming that the LED on the front of the controller is blue. If it's flashing white or not on, try repeating the **PS4 Controller Setup**. If the LED is a different color like red, green, or pink, that means your controller is paired with the Pi but connected to the wrong port. Most likely, this is because another controller is already paired with the Pi.
- Make sure that your controller is charged
- Restart the Pi and try again

Your monitor is not displaying anything...

- By default, if the Pi does not detect a monitor plugged in at boot, it will not display anything, even if the monitor is plugged in later. To use the monitor, make sure it's plugged in to the Pi before turning the Pi on.

PS3 & PS4 Button Mappings

| Button | Action |
|---|---|
| START / OPTIONS | move the robot to its Home pose |
| SELECT/SHARE | move the robot to its Sleep pose |
| R2 | rotate the 'waist' joint clockwise |
| L2 | rotate the 'waist' joint counterclockwise |
| △ | increase gripper pressure in 0.125 step increments (max is 1) |
| X | decrease gripper pressure in 0.125 step increments (min is 0) |
| O | open gripper |
|  | close gripper |
| D-pad Up | increase the control loop rate in 1 Hz step increments (max of 40) |
| D-pad Down | decrease the control loop rate in 1 Hz step increments (min of 10) |
| D-pad Left | 'coarse' control - sets the control loop rate to a user-preset 'fast' rate |
| D-pad Right | 'fine' control - sets the control loop rate to a user-preset 'slow' rate |
| Right stick Up/Down | increase/decrease pitch of the end-effector |
| Right stick Left/Right | increase/decrease roll of the end-effector |
| R3 | reverses the Right stick Left/Right control |
| Left stick Up/Down | move the end-effector (defined at 'ee_gripper_link') vertically in Cartesian space |
| Left stick Left/Right | move the end-effector (defined at 'ee_gripper_link') horizontally in Cartesian space |
| L3 | reverses the Left stick Left/Right control |
| PS | If torqued on, holding for 3 seconds will torque off the robot; if torqued off, tapping the button will torque on the robot |



Other Info

If you purchased a Pi Kit from us and would like to work with it in a headless state, create a hotspot on your personal computer called 'master-hotspot' without requiring a password. The Pi is configured to automatically connect to this network when it's available.

To review the software and/or look at other questions customers have asked, please take a look at our GitHub page: https://github.com/Interbotix/interbotix_ros_manipulators. If you need assistance, feel free to contact us at trsupport@trossenrobotics.com. For other robotic kits, check out our website at <https://www.trossenrobotics.com>.

That's all! Have fun and good luck!

- From the InterbotiX Team