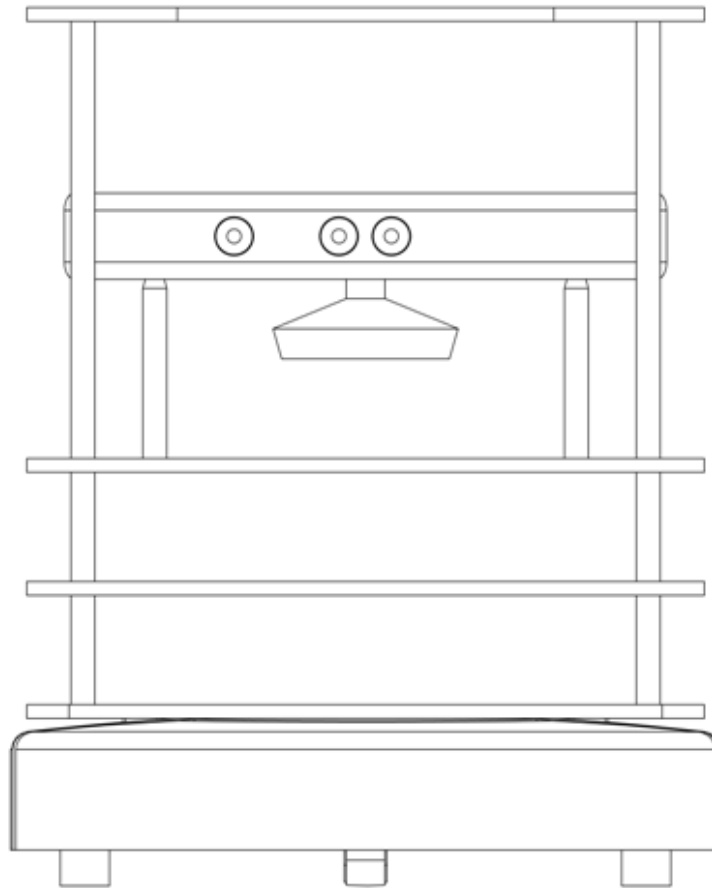


# TURTLEBOT

PERSONAL ROBOT



## USER MANUAL

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## INTRODUCTION

TurtleBot is an easy-to-use personal robot for research and hobby activities. In this guide you will find information about the setup and operation of your TurtleBot.

## What's Included

Based on the type of TurtleBot kit you have purchased, the following parts are included:

### Parts Only Kit:

- TurtleBot Standoffs (8x 2", 4x 8")
- #6-32 Machine screws (22x)
- #6 Flat Washers (26x)
- 2" T10 Torx L-key (1x)
- TurtleBot Plates (1x bottom plate, 2x mid plate, 1x top plate)
- Power and Gyro Board (1x)
- USB stick ROS installer (1x)

### Core Kit:

- All items listed in the "Parts Only kit"
- Microsoft Kinect (1x)

### Complete Kit:

- All items listed in the "Parts Only kit"
- Serial-to-USB converter (1x)
- Microsoft Kinect (1x)
- ROS Compatible PC (1x)
- iRobot Create with battery and quick charger (1x)

### Assembled Kit:

- #6-32 screws (8x)
- #6 washers (8x)
- 2" T10 Torx L-key (1x)
- One fully assembled TurtleBot and accessories
- Power and Gyro Board (1x)
- Serial-to-USB converter (1x)

## GETTING STARTED

This section details how to set up your PC.

### PC Setup

If you purchased a fully assembled unit from Clearpath Robotics, it is set up and ready to go. The user login and password are both **turtlebot**. Otherwise, you will require the laptop and the included USB Thumb Drive, which contains the ROS installer. Instructions are below:

- Plug in and charge the netbook
- Insert USB Thumb Drive into the netbook.
  - If you have an **Asus** netbook, power on and press Escape at startup, select Generic Flash Disk.
  - If you have a **Lenovo** netbook, power on and press Enter at startup. When the Startup Interrupt Menu appears, press F12 and select USB HDD.
- Wait while Ubuntu loads from Thumb Drive.
- Log in as user **turtlebot**, password **turtlebot**.
- Double click “Install ROS Ubuntu”
- Proceed through the installer, selecting the “log me in automatically” option.
- As the computer is restarting, you may plug the Create and Kinect into the netbook.

## TURTLEBOT ASSEMBLY INSTRUCTIONS

Below are the instructions that can be followed in order to build your robot from the parts that come in the Complete kit:

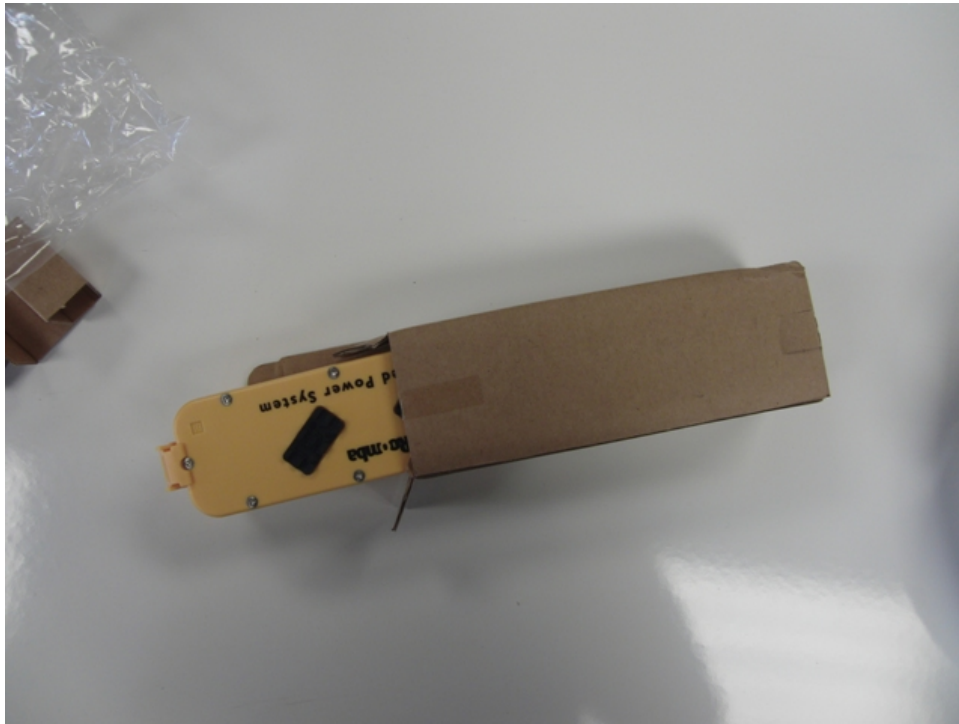
To start, remove the iRobot Create from its shipping box.



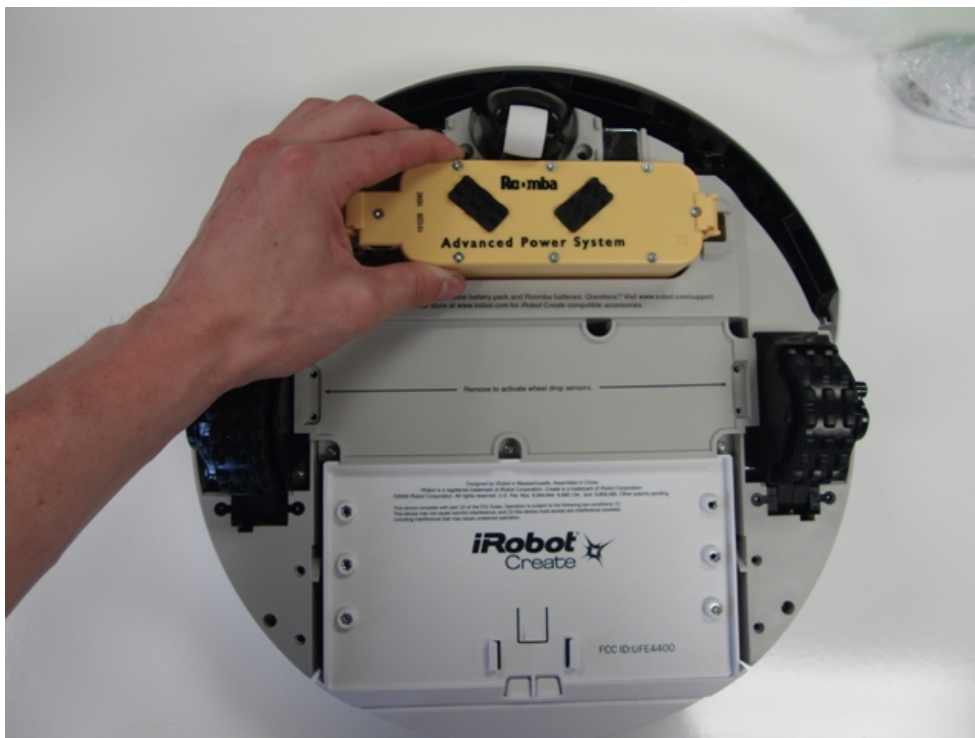
Take the Create out of its plastic wrapping.



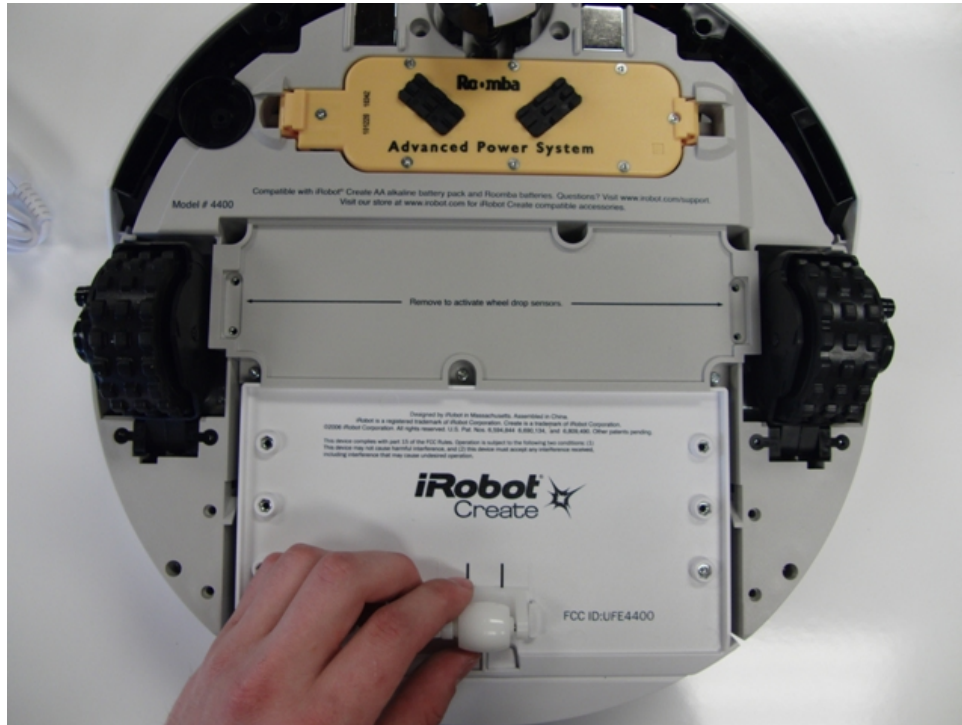
Remove the yellow rechargeable Roomba battery from its case.



Insert the rechargeable battery into its mounting slot on the bottom of the Create. Take care to ensure that both ends click into place; otherwise you may have charging issues.



Remove the 4<sup>th</sup> iRobot Create wheel from its packaging, and install it in the appropriate location on the bottom of the Create.



Remove the PCB from the anti-static bag. Locate the DB25 connector in the Create bay. Orient the PCB correctly and plug it into the Create connector. This requires significant force. Please ensure that the PCB is properly seated. Do not press on the red gyroscope daughter card on the PCB. Remove the serial port dust cover.



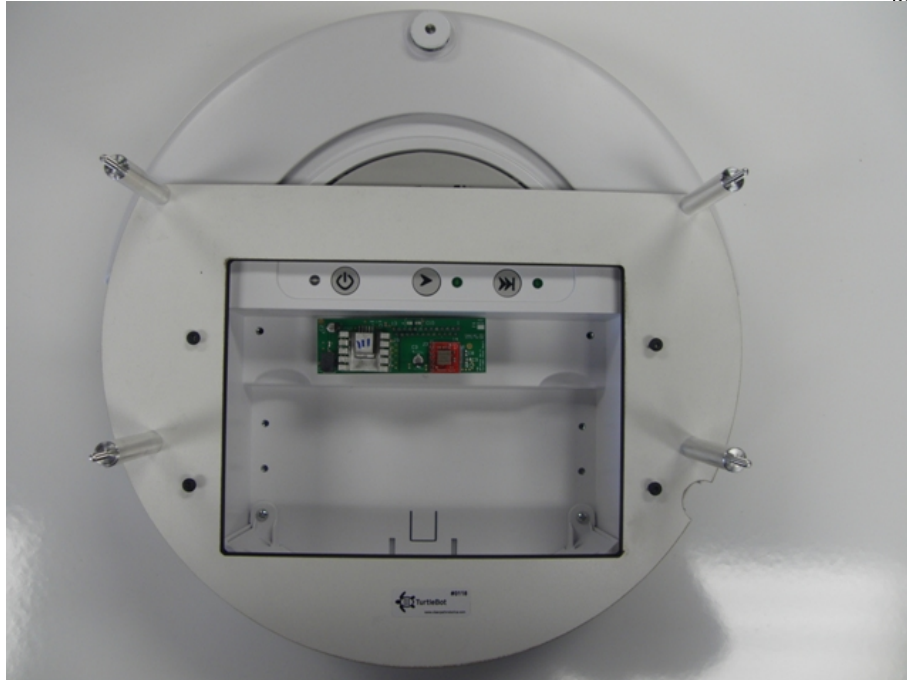
**Note for Serial numbers between 0101-0247:** You cannot remove the dust cover once the bottom plate is installed. If you feel that you would like to use the dust cover post-assembly, you may enlarge the hole in the bottom plate using whatever means necessary. We suggest using a rotary tool with a sanding bit or a reciprocating saw.



The following hardware will be required for the next step: 4x #6-32 screws, 4x 2" standoffs, a T10 torx driver or the 2" L-key that is included in the kit, and the TurtleBot bottom plate. Thread the fasteners in from the bottom of the plate into the 2" standoffs and secure them as shown below.



Using 4x more #6-32 screws, and 4x #6 washers, bolt secure the assembled bottom plate to the iRobot Create. The washers go in between the plate and the create, to raise the plate and prevent contact with the robot.



Now it is time to modify your Kinect. This will require your Kinect, the Kinect standoffs that came with the kit, and a T10 torx driver or the 2" L-key that came with the kit. To start, slide a flat head screw driver under the grill of the Kinect as shown, and remove the grill. Do this for each grill.



The result is shown below.



Now remove the 2 outermost screws from the Kinect. Note that these are tamper-proof screws. If using the supplied wrench, great care should be taken to ensure contact with the screw. One or two wrench slips will ruin the screw. Applying moderate to high axial force to the screw through the T10 implement of your choice (red arrow), slowly loosen the screw.



Thread the two Kinect standoffs into the holes as shown.



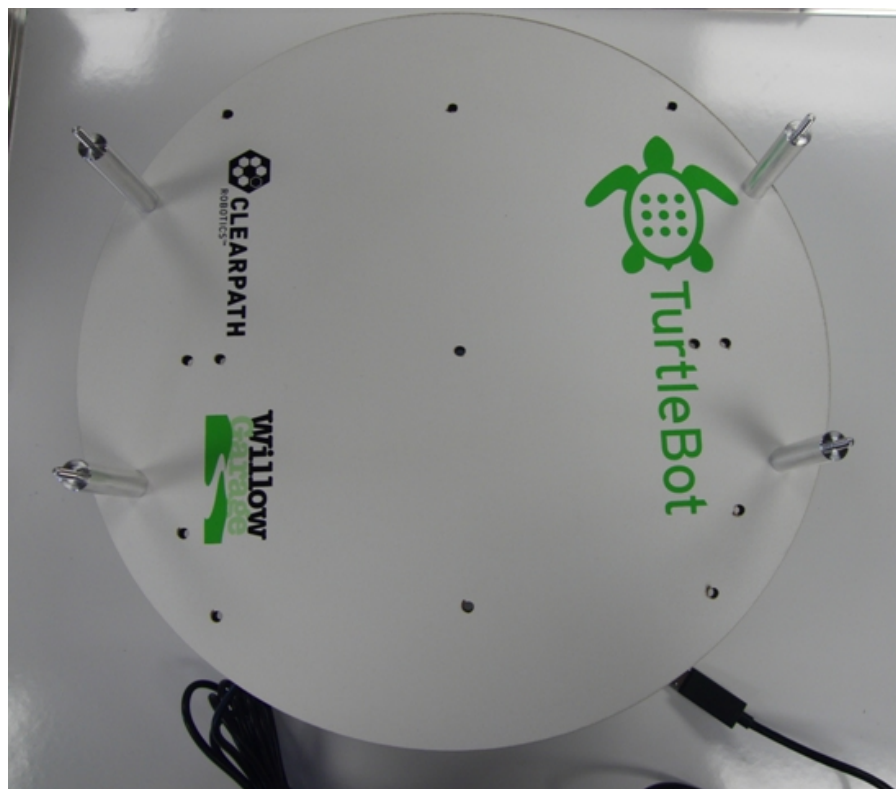
The flat of the tapered surface of the Kinect standoff should be flush with the edge of the Kinect housing, as shown below. This is crucial for sensor stability.



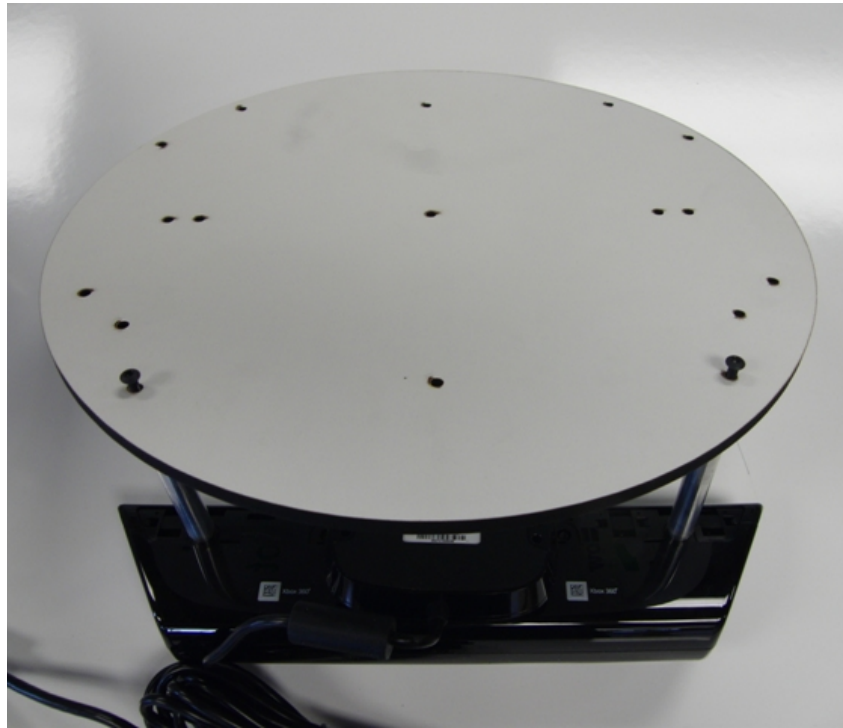
Now we return to the robot assembly. It would be wise before continuing to plug the Kinect cable into the PCB.



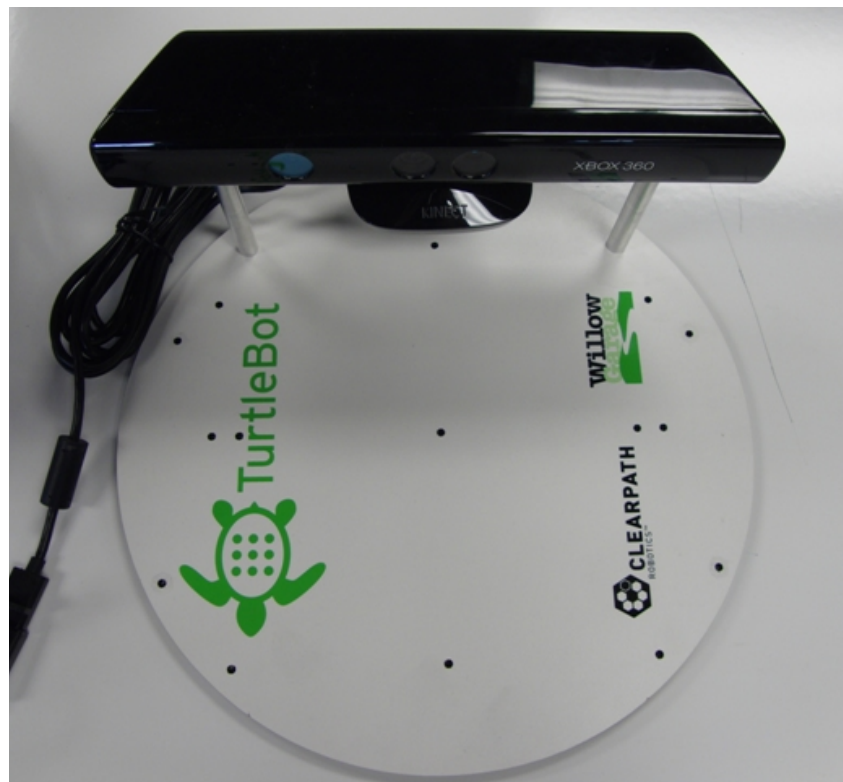
Place the second plate onto the 2" standoffs coming out of the bottom plate, and secure this plate with 4 additional 2" standoffs.



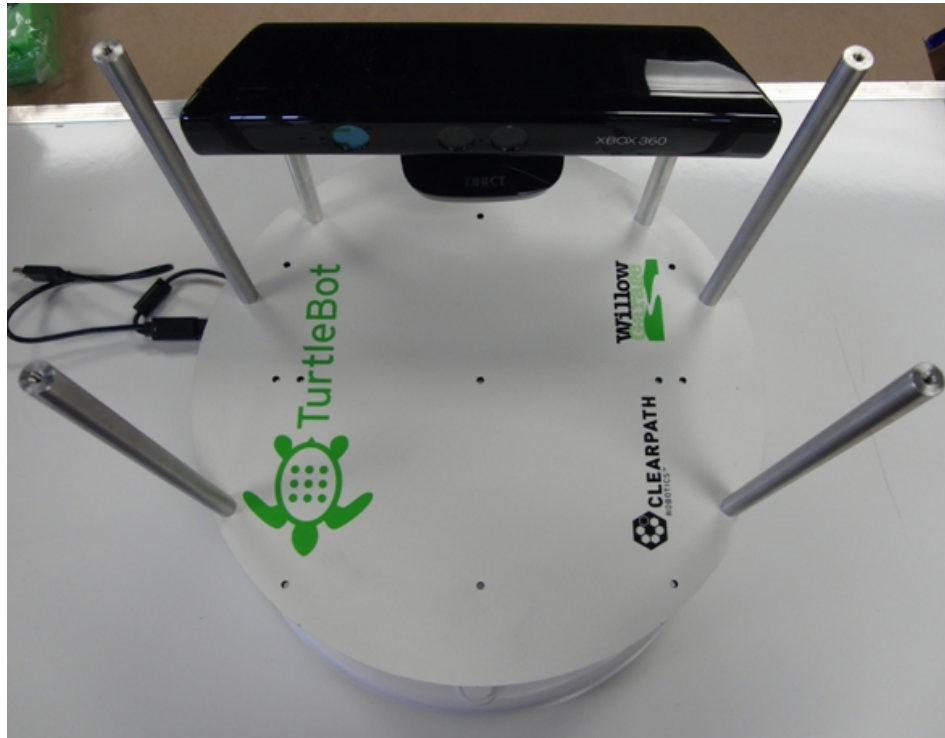
Taking the other plate and your assembled Kinect, mount the Kinect to the plate.



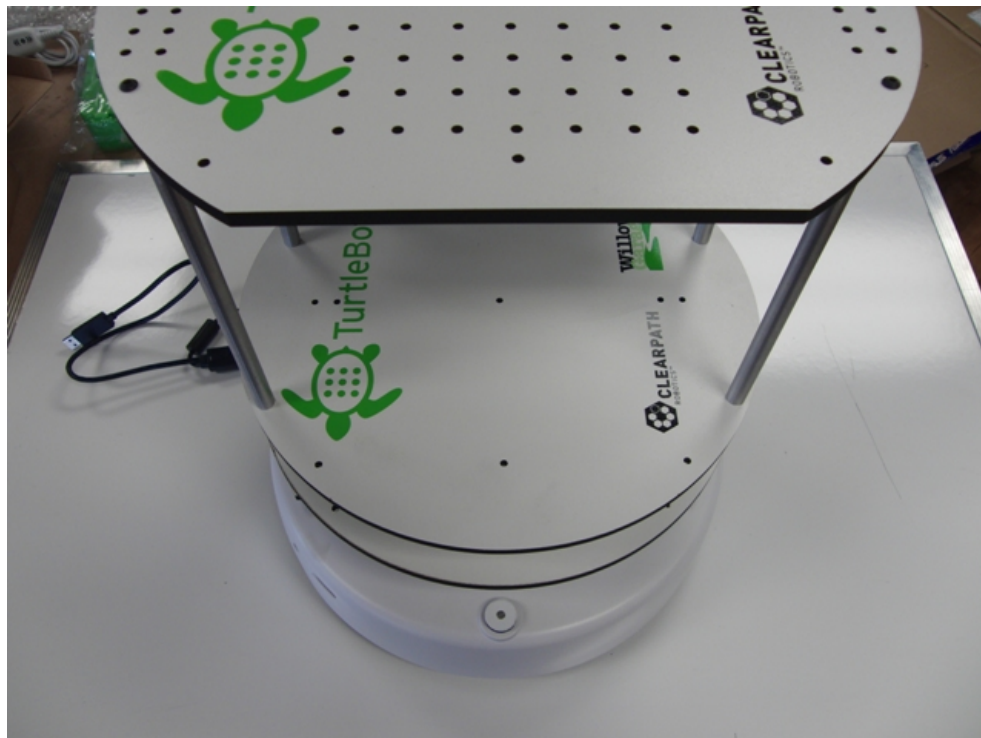
Orientation is important, so ensure that the Kinect faces the same direction as the turtle that is printed on the plate:



Now place this plate onto the standoffs, and attach it using the 4x 8" standoffs.



The final step is to attach the top plate using 4x #6-32 screws, as shown below.



Now it's time to plug the iRobot serial cable into its port.



Plug the serial-to-USB adapter into the other end of this cord.



Attach the modified Kinect cable to the Kinect.



After taking the USB stick and running the ROS install on your laptop, you may plug the iRobot create and the Kinect into the laptop via USB ports. Good luck on your adventures into the wide world of Science!

## MODIFYING YOUR EXISTING KINECT

This section is aimed specifically at those users who bought a Parts kit and have their own Microsoft Kinect which they would like to use with their TurtleBot.

### Parts required

1x Kinect Cable Modification Kit

### Tools Required

Side Cutters

Ruler

Wire Stripper

Terminal Crimper

Heat Gun

Locate the Kinect Cable Modification Kit Bag found in the Turtlebot Parts Kit. Verify the quantity of components found in the Modification Kit Bag:

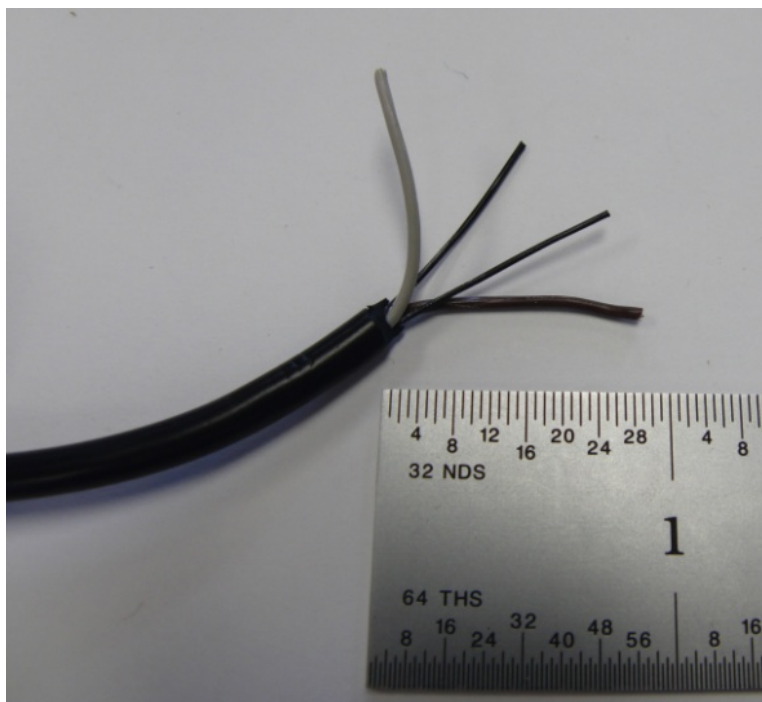
- 1x Unmodified Kinect Power Cable
- 1x Two position Male Molex Connector
- 1x Two position Female Molex Connector
- 4x Male Crimp Cable Ends
- 4x Female Crimp Cable Ends
- 2x Piece of Heat Shrink, 2" length



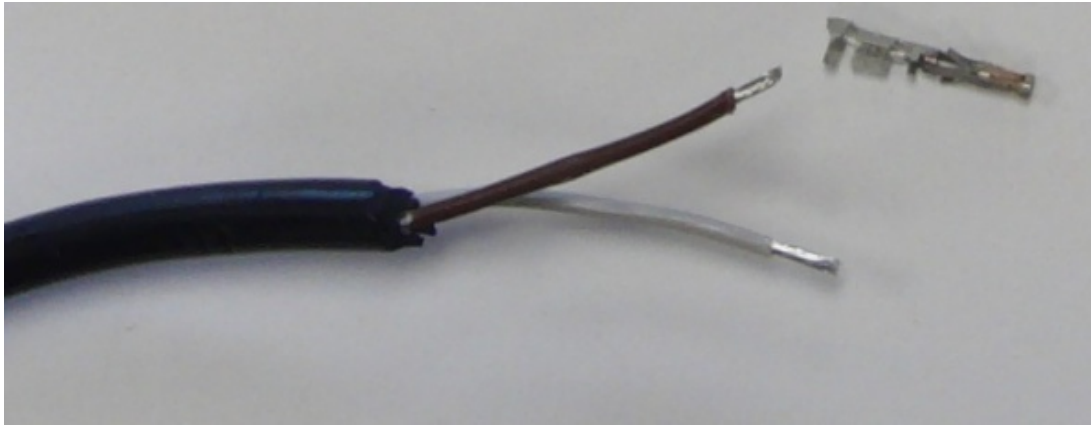
Lay the Kinect Power Cable flat then cut the cable three inches from the end of the ferrite filter block. The Location is displayed below.



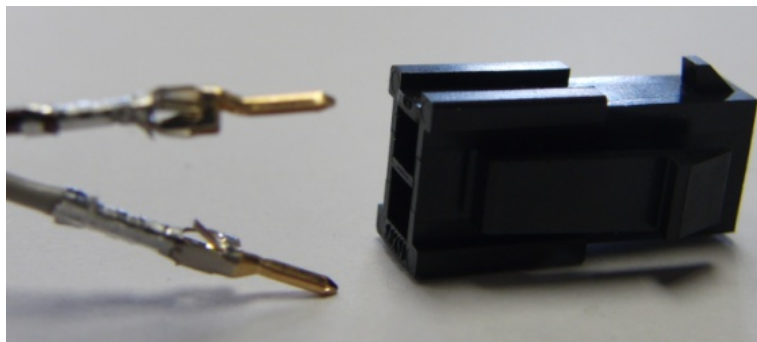
Strip one inch of the plastic sheath on each end of the power cable to expose the enclosed wires as shown below. **Use care to not damage the insulation on the wires.** Remove the two thin black plastic threads using side cutters, leaving the brown and white wires intact.



Strip the brown and white wires to expose 1/8" of wire on both ends of the cable. Twist the stranded ends to form the wire into one piece as shown below.



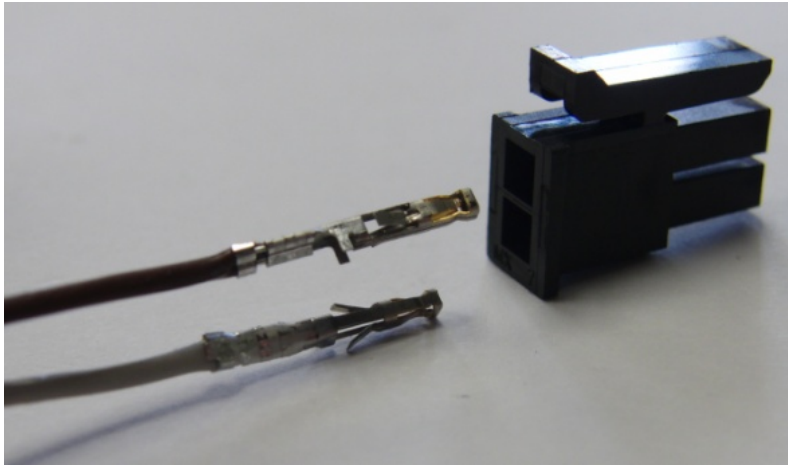
Slide one male crimp end over a section of stripped wire. Crimp the male end until it cannot be removed from the wire. Repeat these steps for the remaining wire. Slide a piece of heat shrink over the two wires and slide it down the wire such that it is clear of the crimp ends. Orient the Female Molex Housing so the small tooth shaped catch is facing up then slide the two male crimped ends into the back of the housing as shown below. The **brown wire** should be connected into the **top position**. Slide the crimp into the housing until a click sound is heard. Check the crimp engagement by lightly pulling on the cable. It should not pop out.



Slide the shrink wrap up to the rear of the Molex connector. Shrink the wrap using a heat gun until the wrap contracts around the wire. The cable should resemble that shown below.



Repeat these steps with the other side of the power cable. Crimp the female ends to the cable and insert into the Male Molex Connector. Place the brown wire into the top position of the male connector with the clip end as shown in Figure 6.



The final product!



## TIPS AND TROUBLESHOOTING

### Mechanical Tips

We do not recommend threading and unthreading any of the standoffs used in the construction of TurtleBot. The standoffs are made of aluminum, which is a soft material prone to fatigue damage. If much torque is used repeatedly on these parts, the threads will wear out. This recommendation also applies to the Kinect standoffs, which are threaded into the plastic Kinect housing. Once again, repetitive removal and insertion of these parts into the Kinect will cause the holes to wear and become ineffective.

### Troubleshooting

This section lists a few possible issues which may be encountered. Don't forget to consult the iRobot Create user manual if required.

- **Robot won't turn on.** Be sure that the battery is seated properly before charging. Sometimes leaving the serial cable plugged into the robot and the Kinect plugged into the PCB drains the battery, so charging takes much longer than usual.
- **Kinect is not responding and green light on Kinect adapter is off.** If the iRobot Create is in "passive" mode, it will not supply 12V to the Kinect power adapter. Either issue a motion command to the Create or use the *SetTurtlebotMode* service in *turtlebot\_node* to change the mode to "full" mode .

If you're having some trouble that you don't see here, or the suggested solution isn't working out, please get in touch and our expert team of Robot Whisperers will help you out however possible.

Please visit the following website for TurtleBot driver information:

<http://www.ros.org/wiki/Robots/TurtleBot>

And to find answers to all of your TurtleBot questions, check out:

<http://answers.ros.org>

For general ROS support or suggestions, a broad list of options can be found at:

<http://www.ros.org/wiki/Support>



## SERVICE AND SUPPORT

Clearpath Robotics is committed to your success and satisfaction. We are located in Waterloo, Ontario, and can accept phone calls from 9AM to 5PM Monday to Friday at our toll-free number.

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