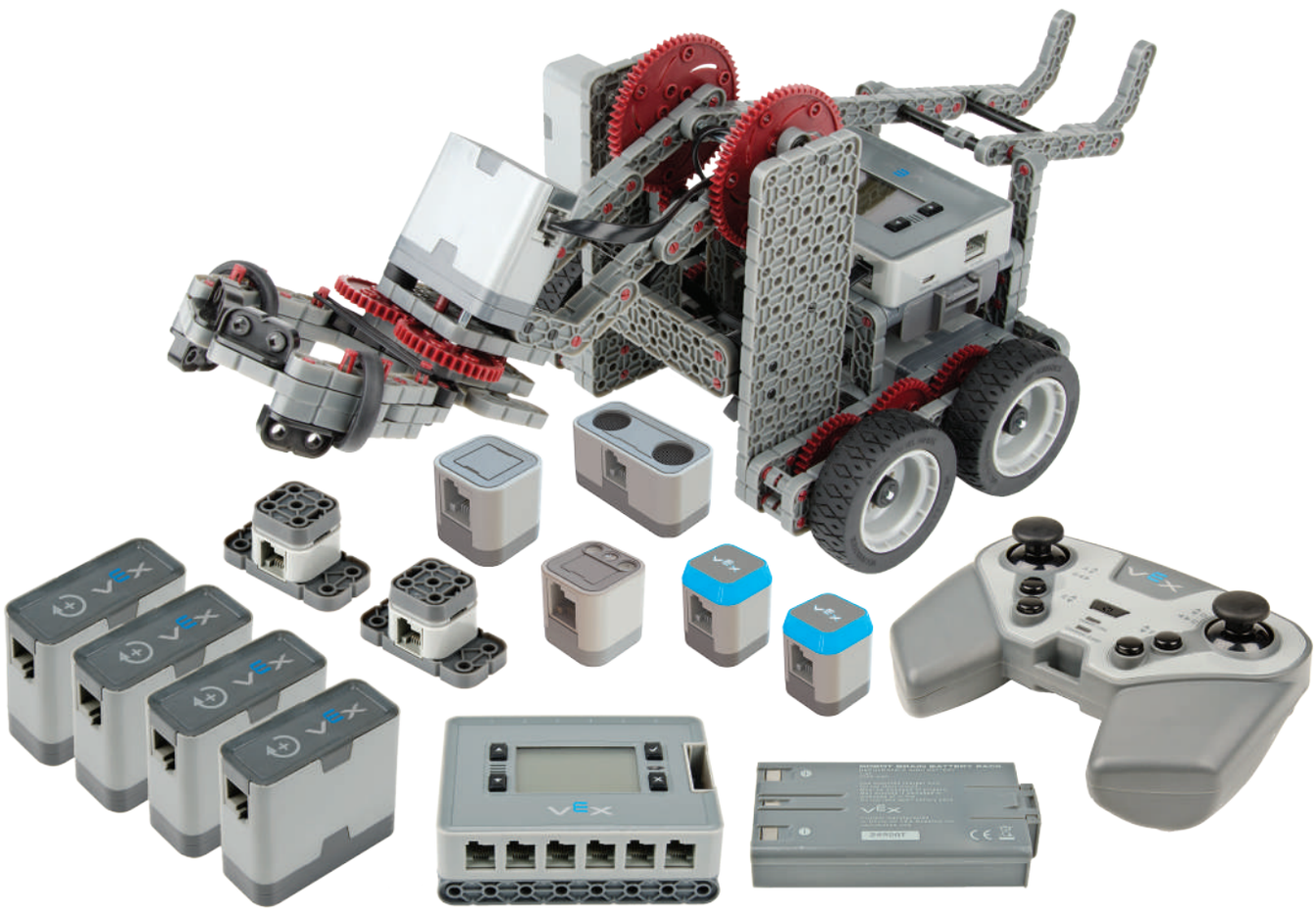
VEX IQ

Super Kit

User Guide



228-2500-750 V.20130930

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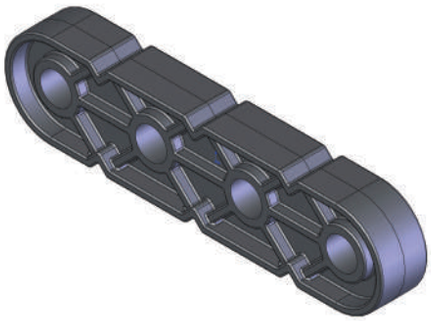
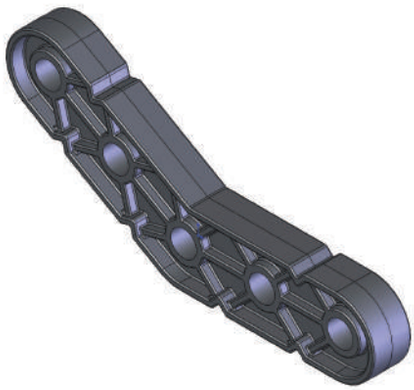
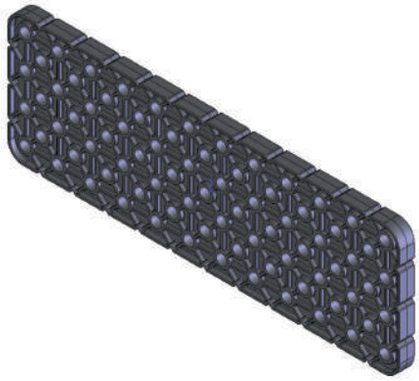
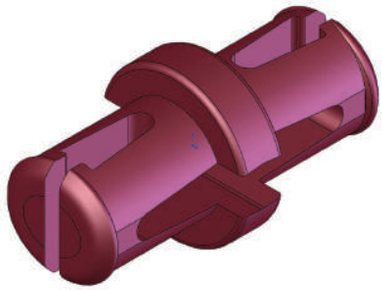
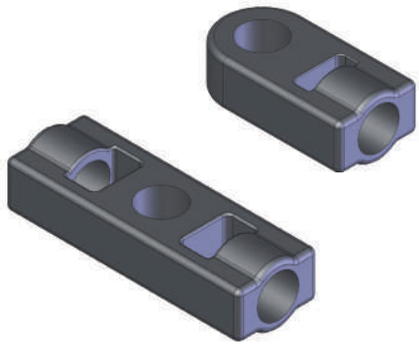
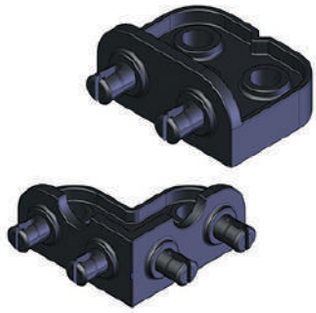
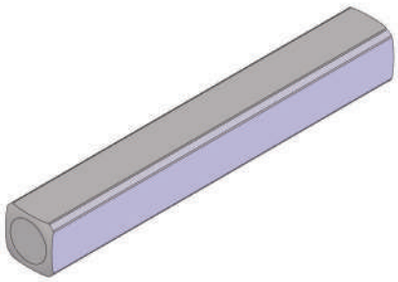
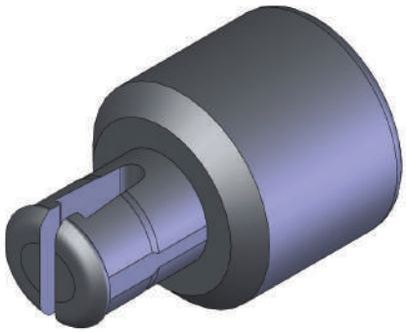
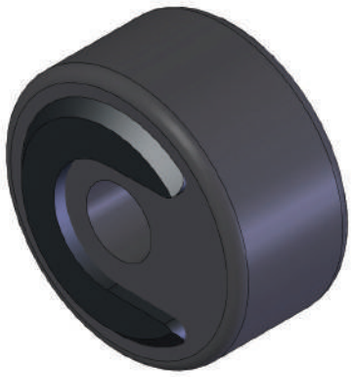
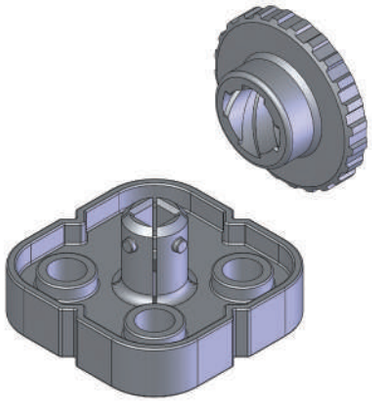
Kit Hardware Overview:

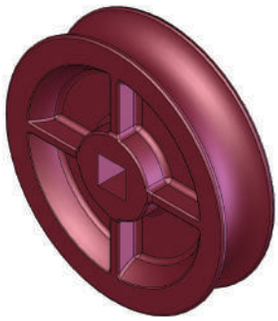
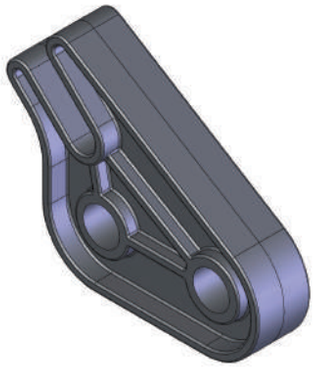
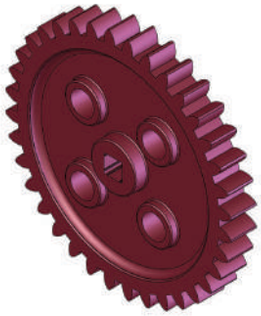
If you can imagine it, you can build it with VEX IQ. Here's an overview of common part types and their primary functions to help you get started.

Common part types and primary functions

Beams various sizes	**Specialty Beams** angle, tee, right-angle beams	**Plates** various sizes
		
Structural parts.	Structural parts.	Structural parts.
Connector Pins various lengths	**Standoffs** various lengths	**Standoff Connectors** various types
		
Use with beams, plates, corner connectors, and more.	Maintain desired spacing between beams and plates.	Connect standoffs and connector pins.

Corner Connectors various types

Create corner connections between beams, plates, or other VEX IQ parts.

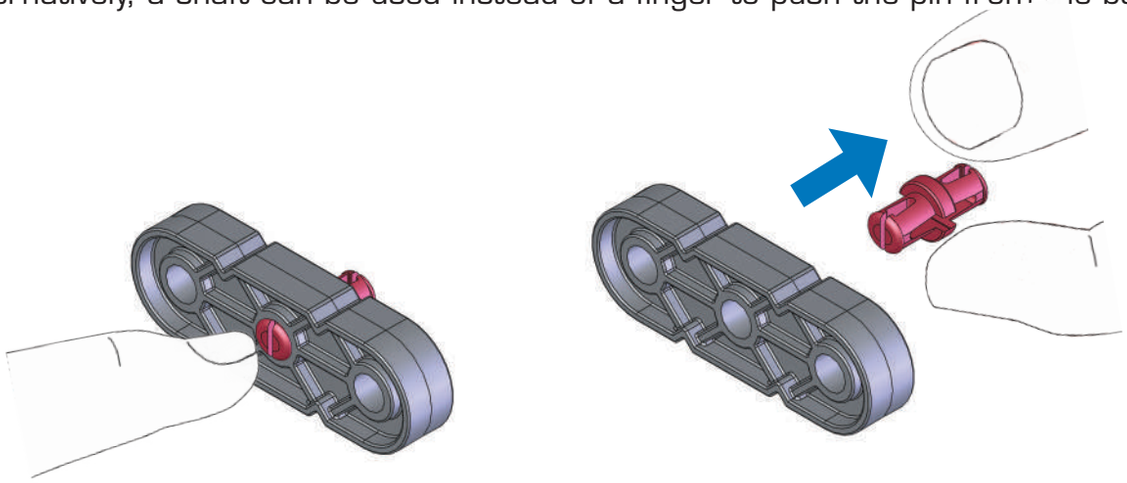
Shaft various lengths	**Shaft Bushing**	**Shaft Lock Plates** various sizes
		
Transmit power to, or allow rotation of, wheels, pulleys, gears, and more.	Interfaces shafts with beams and plates, allowing the shaft to spin and be held in desired location.	Plates that lock onto shafts allowing design components to spin with the shaft.
Rubber Shaft Collars	**Twist Lock Shaft Collars**	**Washers & Spacers**
		
Holds objects on shafts and/or the shaft itself in place.	Holds objects on shafts and/or the shaft itself in place.	Use with shafts, reduces friction and maintains desired spacing.

Pulleys various sizes	**Rubber Belts** various sizes	**Rubber Band Anchor**
		
Drive belts or make rollers and small wheels.	Use with pulleys, as a form of stored energy, and/or as a fastener.	Use with rubber belts and bands.
Gears various sizes	**Wheel hubs and tires** various sizes	**Smart Motor**
		
Transmit power to another gear and/or mechanism.	Rolling and powering movement.	Creates rotary motion.

VEX IQ Kit Assembly Tips:

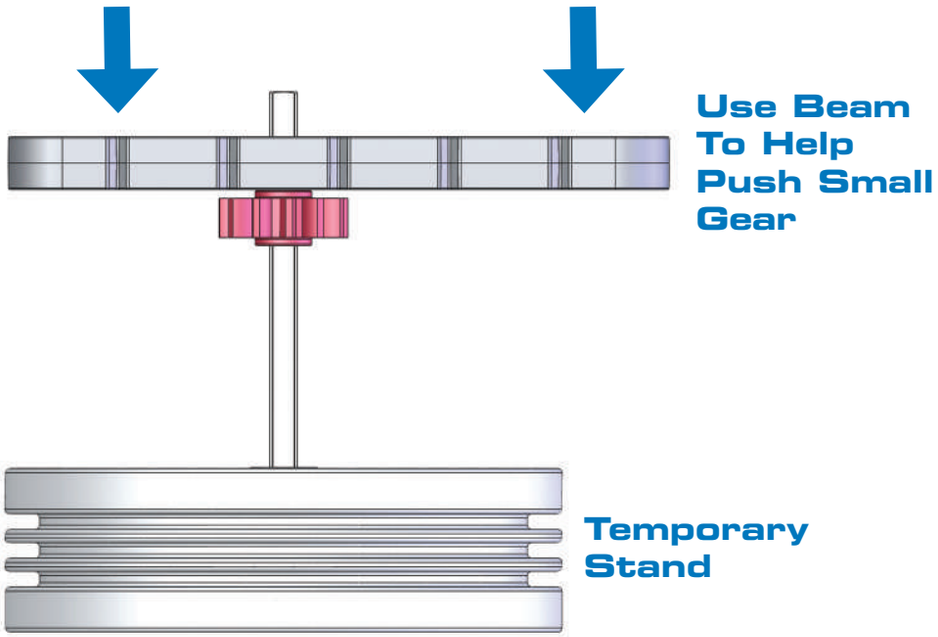
Removing Connector Pins

To remove connector pins from structural components, gently push the pin with your finger from the back of the structural components to free it slightly, then it will be easier to pull it out. Alternatively, a shaft can be used instead of a finger to push the pin from the back.



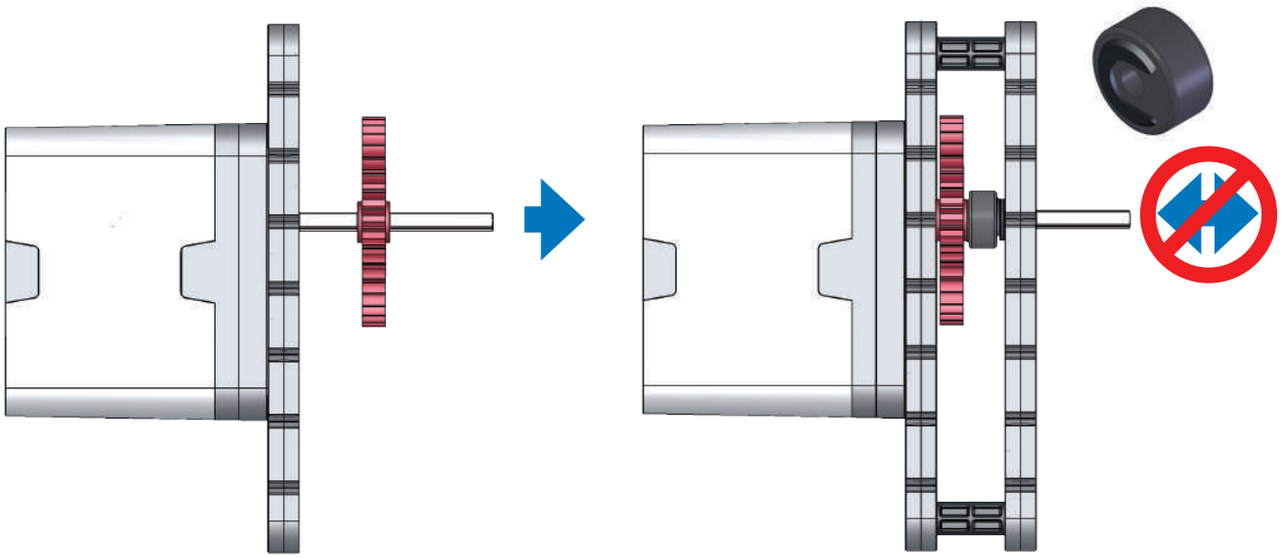
Fitting Small Gears, Pulleys, and Wheel Hubs onto Shaft

VEX IQ shafts are built to last and run flawlessly in powered applications. Gears, pulleys, and wheel hubs fit very tightly on the VEX IQ shaft to ensure quality mechanisms with minimal amounts of “wiggle”. Because of the intentionally tight fit, sliding smaller gears, pulleys, and wheel hubs can be tough for some users. To help in this process, insert the shaft into a large wheel hub (which acts as a temporary stand), then use the leverage from a beam or plate to push the smaller gear, pulley, or wheel hub to the desired place. Then the temporary stand can be removed and the shaft with small gears, pulleys, or wheel hubs can be mounted on its mechanism.



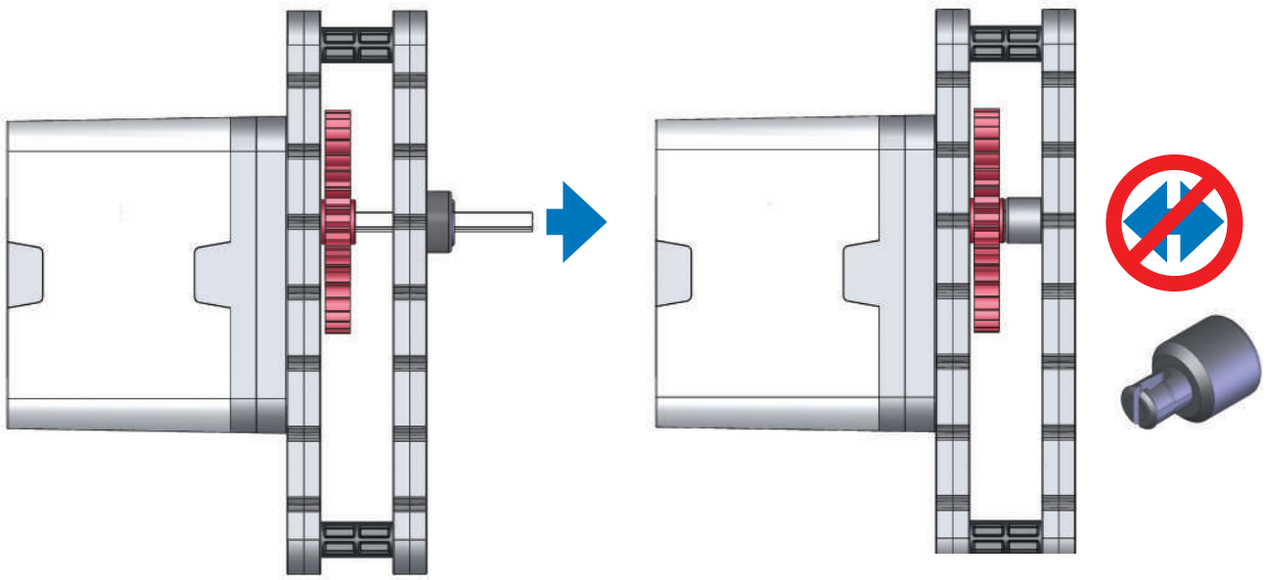
Keeping the Shaft Supported & Seated in Smart Motors & Assemblies

Having a motor turn a shaft in the VEX IQ system is accomplished easily with only a few parts. However, without proper shaft support and either a rubber shaft collar and/or a shaft bushing, the shaft will quickly shift or fall out of your mechanism or Smart Motor.



Improper Support (Shaft can fall out)

Proper Support (Shaft can't fall out)



Improper Support (Shaft can fall out)

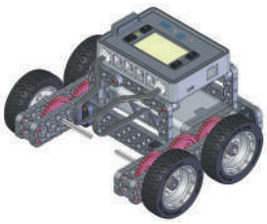
Proper Support (Shaft can't fall out)

Using VEX IQ Hardware:

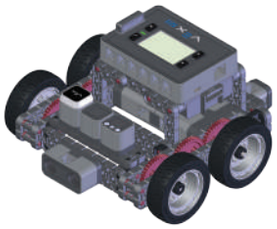
To get yourself acquainted with the VEX IQ system, build the Clawbot from the provided instructions on the following pages. The VEX IQ Clawbot was designed to be quickly and easily assembled, and then driven around using the included Driver Control program. The claw and storage "backpack" allow you to drive around, pick up, and store a variety of small objects.

There are four options for assembling the Clawbot:

Standard Drive Base



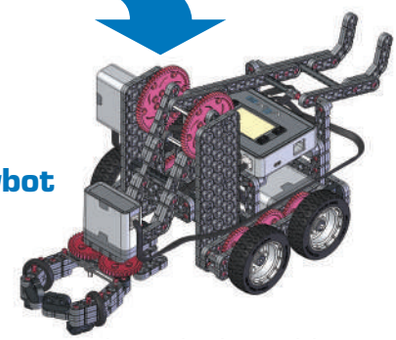
Quick and versatile drive base. Build instructions on pages 10-27.



Autopilot Robot

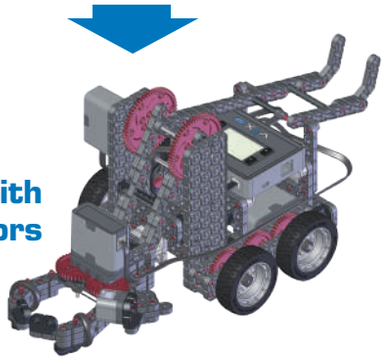
Turn your standard Drive Base into an Autopilot explorer. Build instructions on pages 10-27 and pages 78-84.

Clawbot



Drive, pick up, and manipulate objects. Build instructions on pages 10-65.

Clawbot with Sensors



Make the Clawbot smarter with sensors. Build instructions on:

- Gyro Sensor, pages 66-67
- Touch LED, pages 68-70
- Distance Sensor, pages 70-72
- Bumper Switch, pages 73-75
- Color Sensor, pages 76-77

After you assemble your Clawbot, pages 85 through 111 contain important information about how to setup and use the VEX IQ control system. Be sure to periodically visit vexrobotics.com/vexiq/firmware to access the Software Update utility to ensure your Robot Brain, Controller, Smart Motors, and Sensors all have the latest firmware.

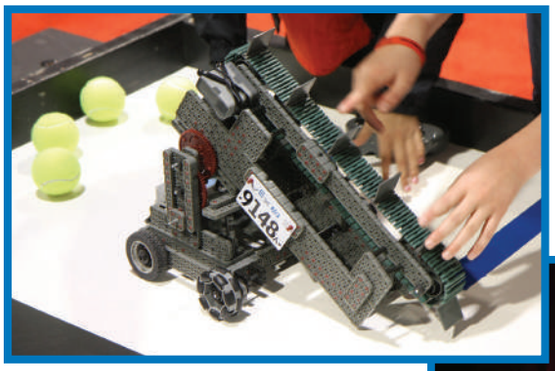
Free curriculum, containing additional lessons and activities, including the use of the Clawbot, is available at vexrobotics.com/vexiq/education. These lessons can help build student confidence with the VEX IQ platform.

VEX IQ CHALLENGE

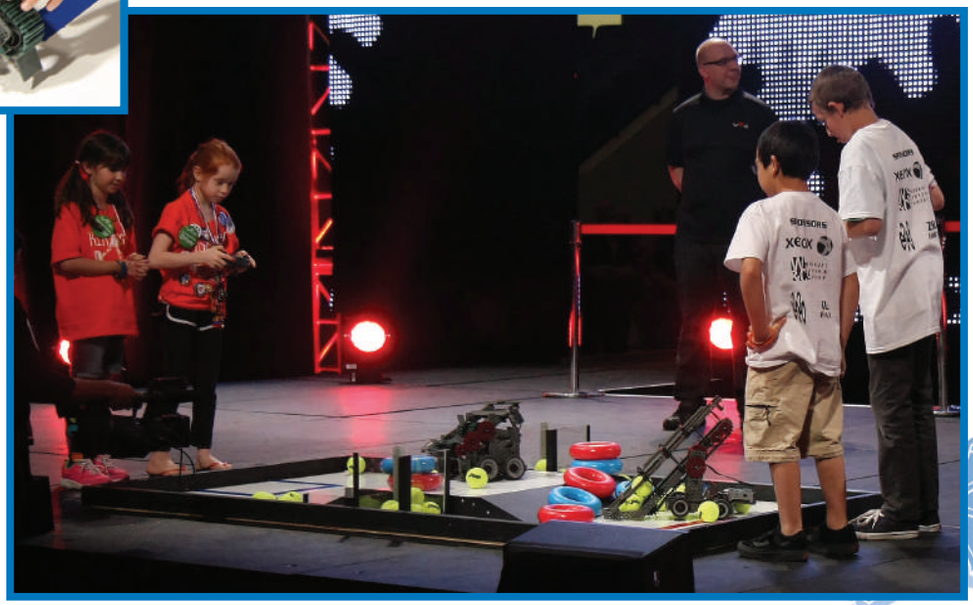
Once you've mastered building the Clawbot, challenge yourself further with the VEX IQ Challenge. Presented by the Robotics Education & Competition Foundation, the VEX IQ Challenge is a STEM program for elementary and middle school students (ages 8-14). The power of the VEX IQ system combined with the REC Foundation's years of experience inspiring students through robotics competitions is giving younger students more affordable access to the inspiration, excitement and learning that comes from participating in a STEM challenge.

In the VEX IQ Challenge, students, with guidance from their teachers and mentors, build a robot using the VEX IQ robotics platform to solve an engineering challenge that is presented in the form of a game. VEX IQ Challenge teams will work together to score points in Teamwork Challenges. Teams then get to show off their robot's skills individually in the robot and autonomous Skills Challenges. Students will also use an Engineering Notebook to develop an understanding of the design process. In addition to building robots, the STEM Challenge component of the VEX IQ Challenge encourages students to actively learn about science, technology, engineering and math.

Local VEX IQ Challenge events are held in many different cities, states, and countries. Top teams from around the world will participate in local, regional and national VEX Robotics Competitions. Teams will then qualify for VEX Robotics international competitions and the VEX Robotics World Championship event held each Spring.

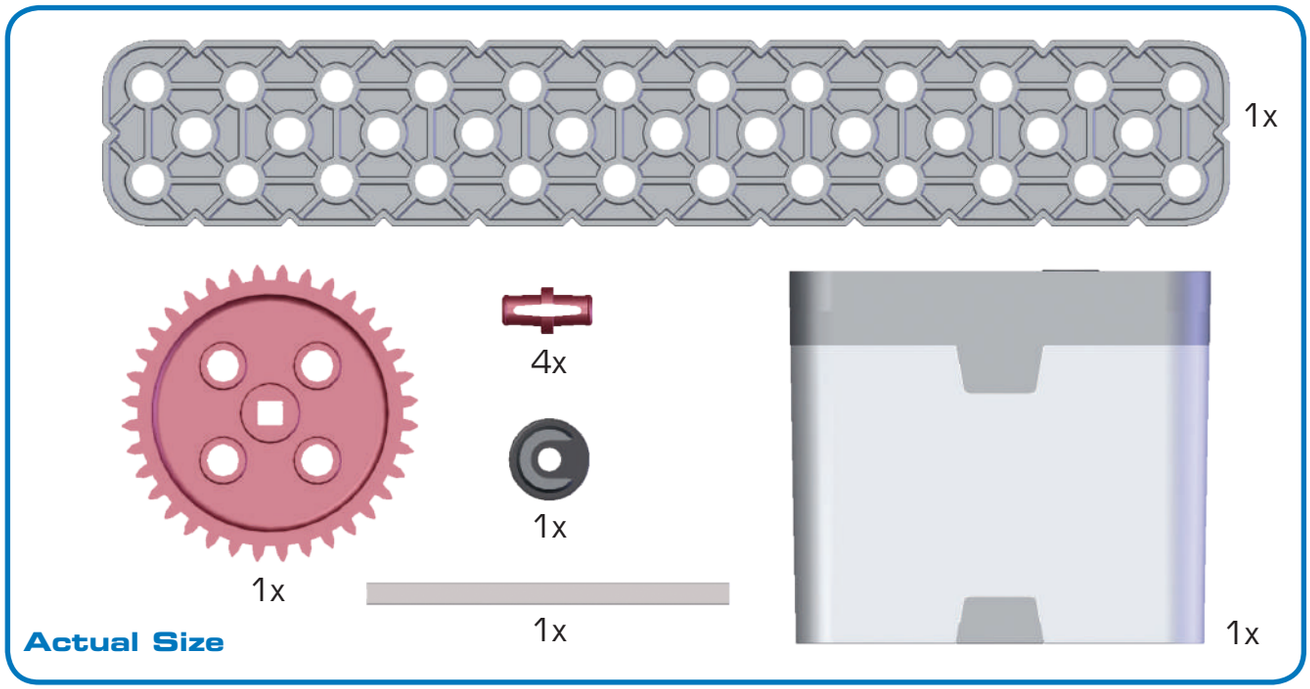


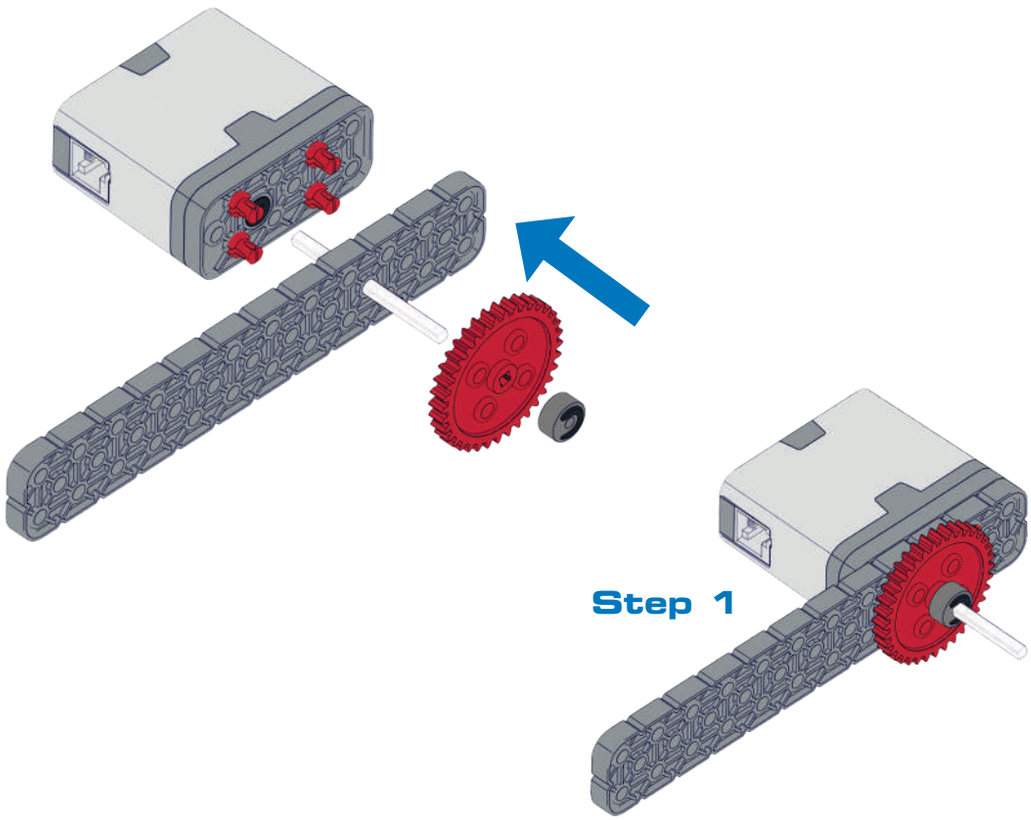
Visit RobotEvents.com to find the date and location of a VEX competition near you. Teams can register online to get an official team number and Welcome Kit and to sign up for VEX IQ Challenge events.

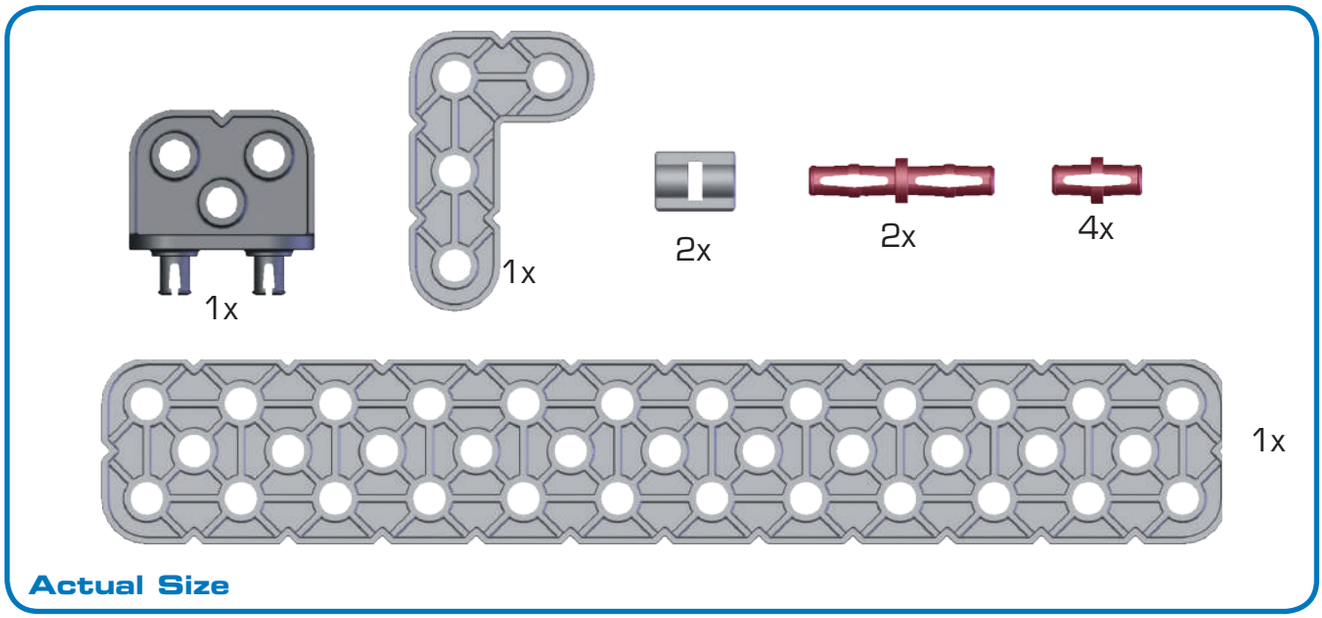


Clawbot Instructions

Part 1 Base







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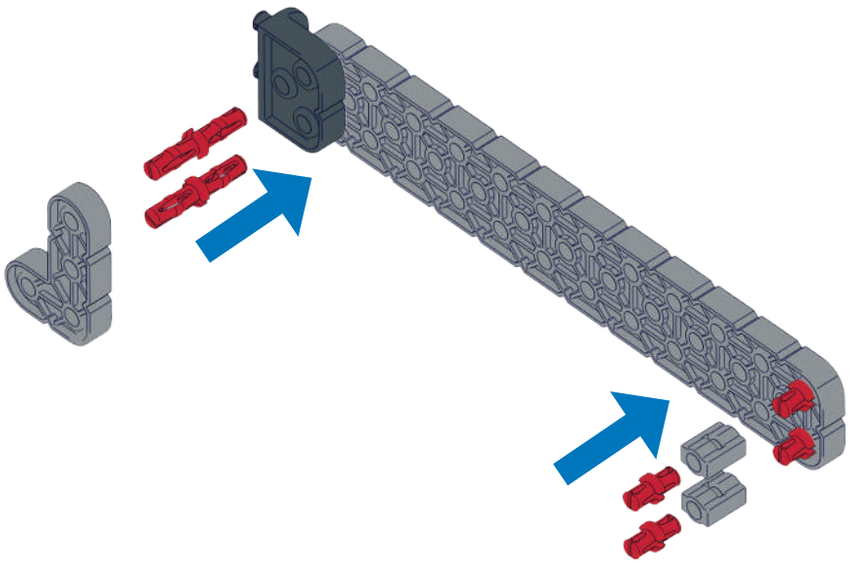

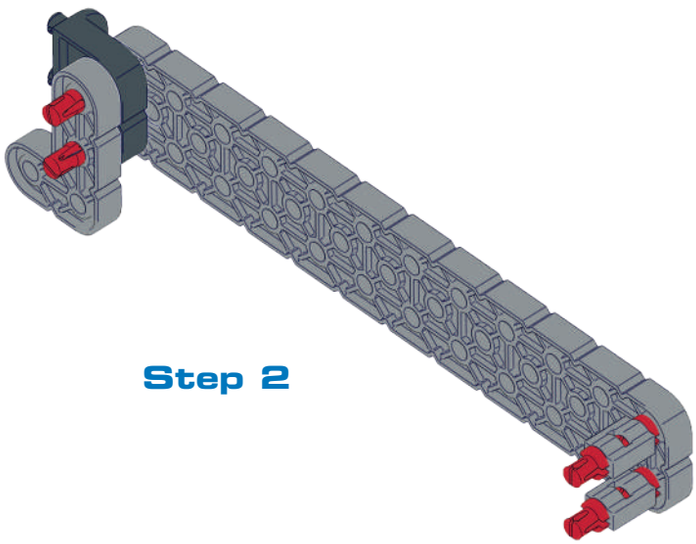

Step 2

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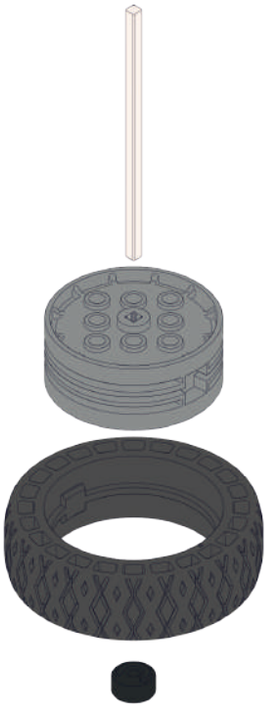

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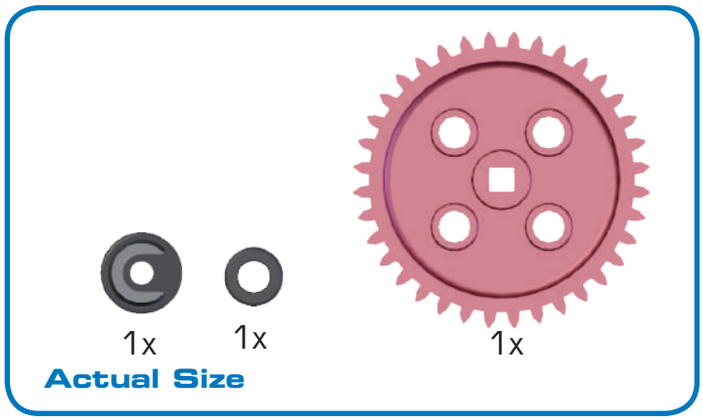

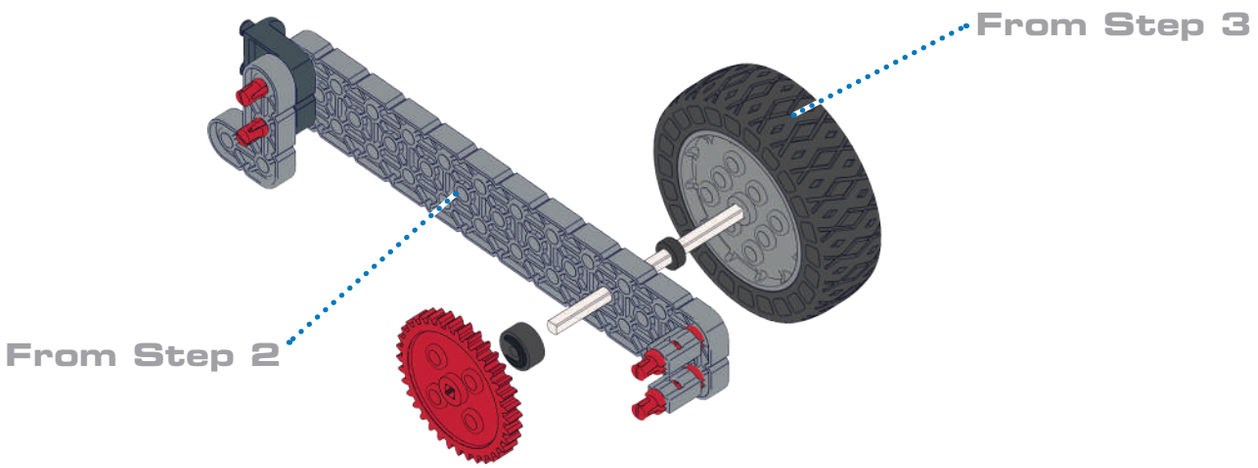

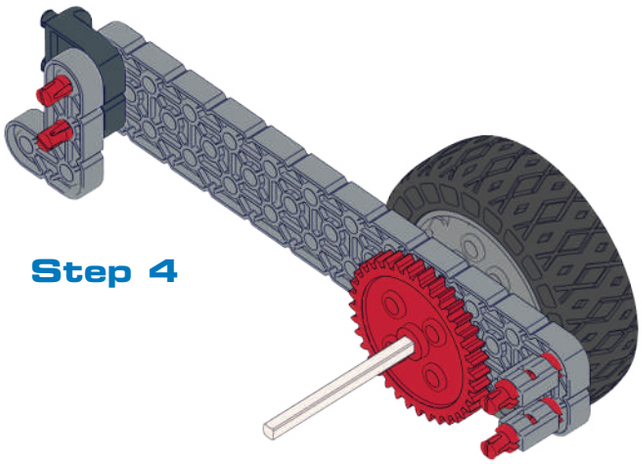

Step 4

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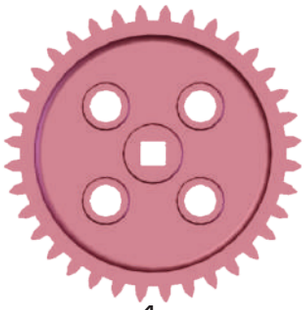
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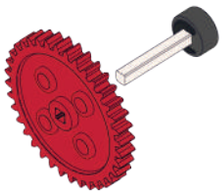

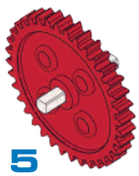

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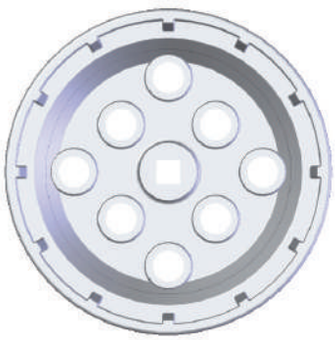
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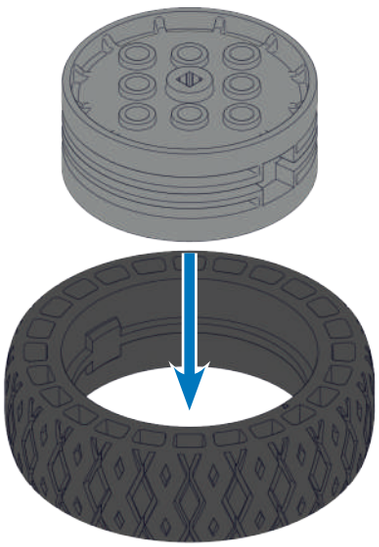

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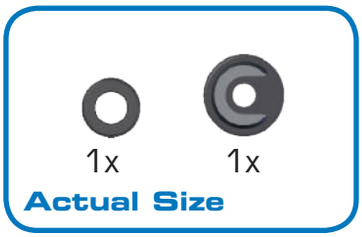
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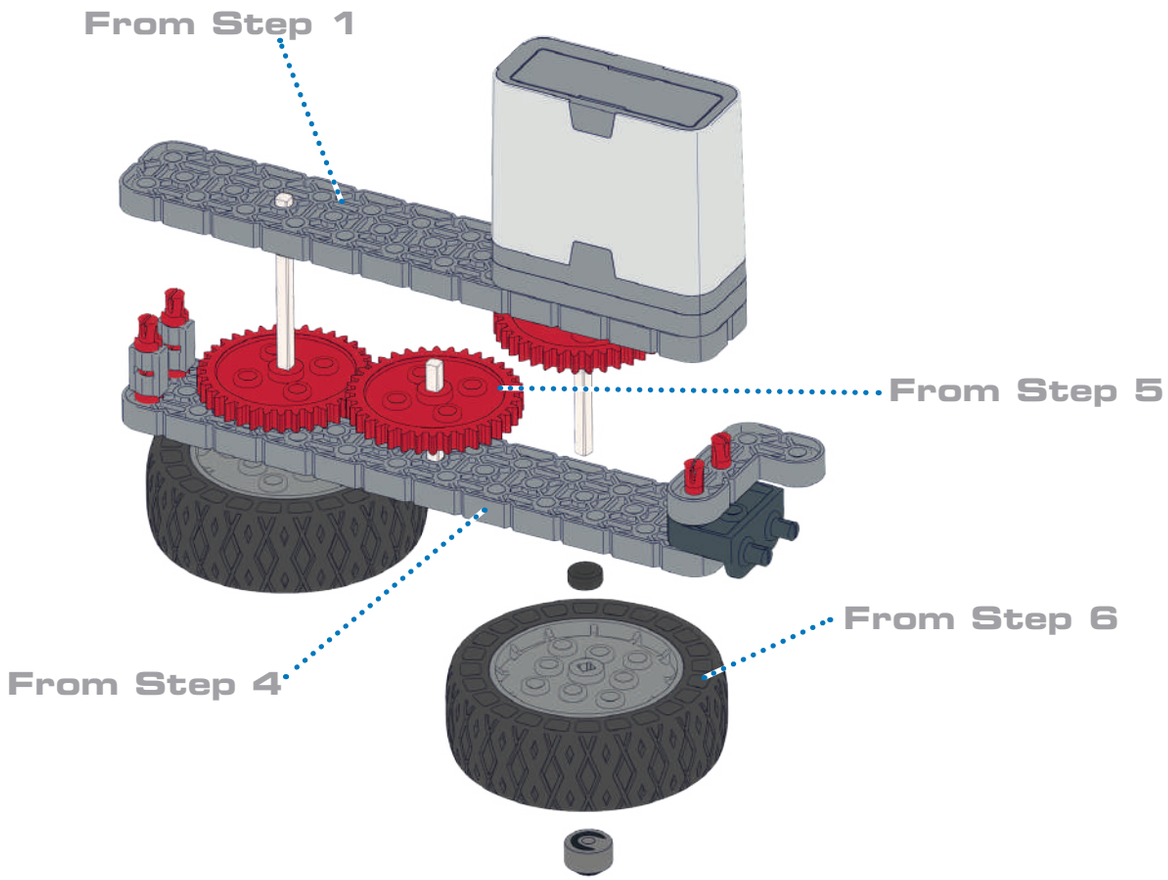
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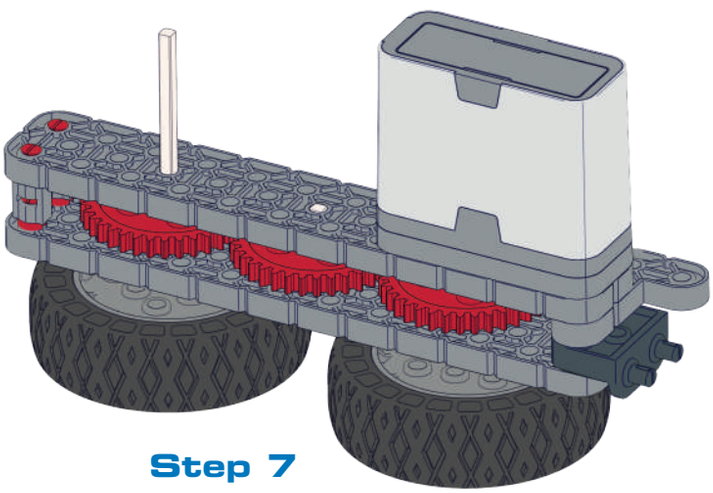

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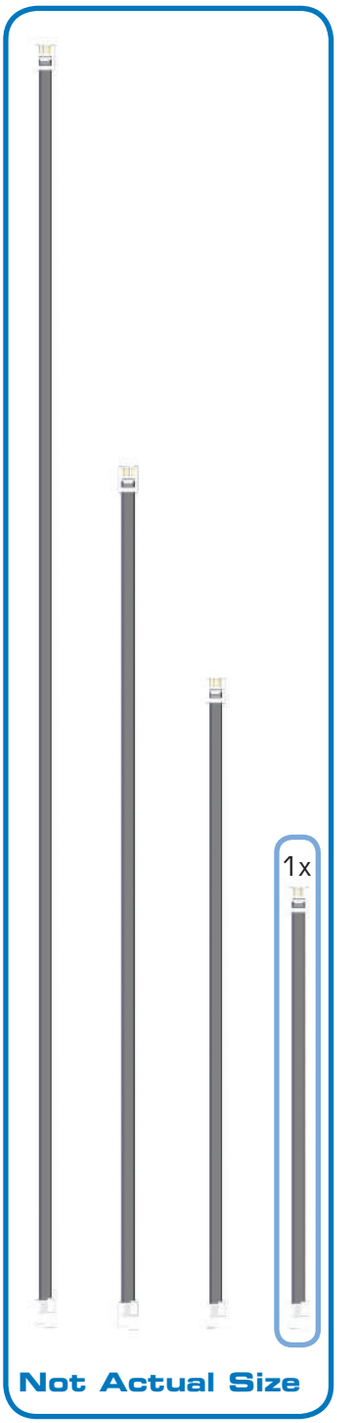
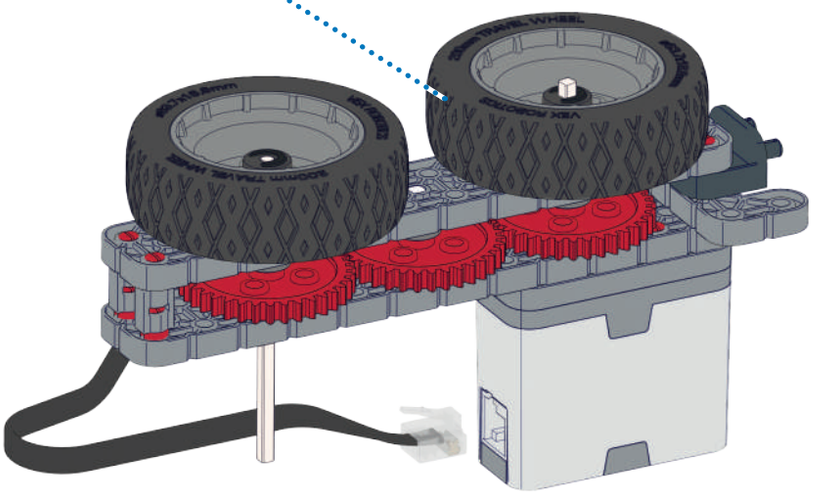
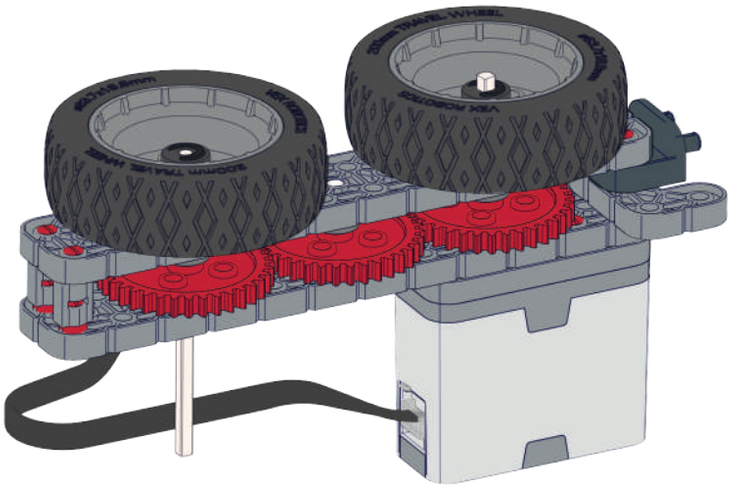


From Step 7





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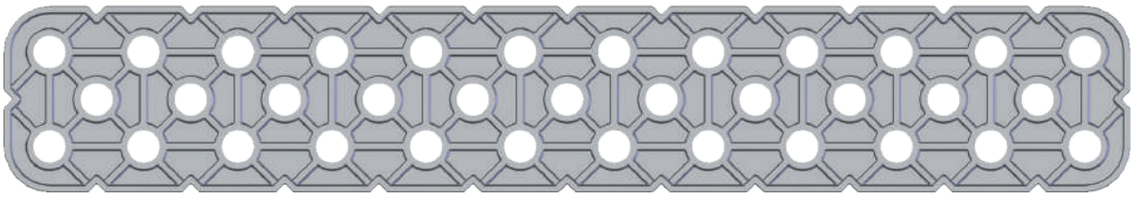
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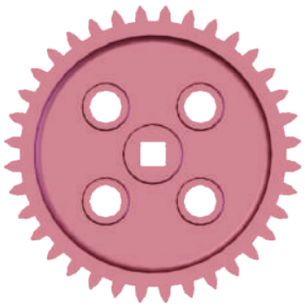
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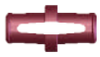
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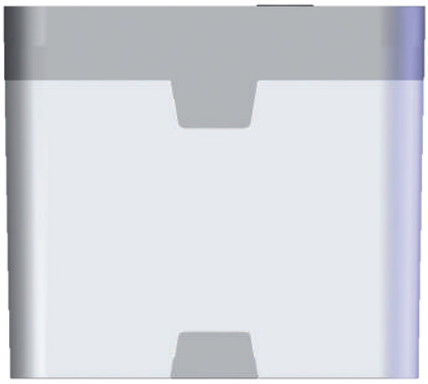
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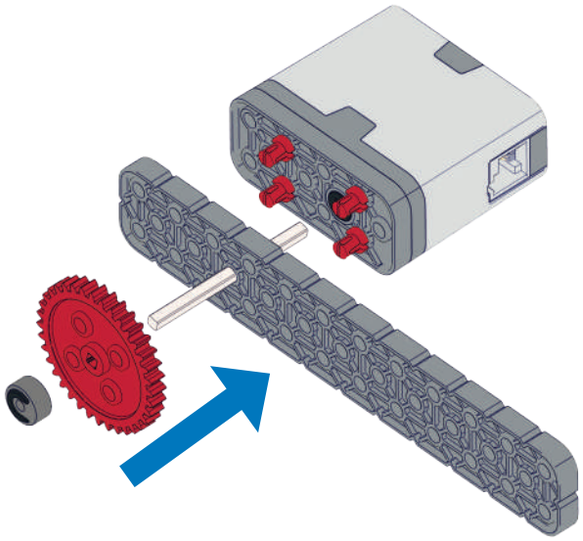

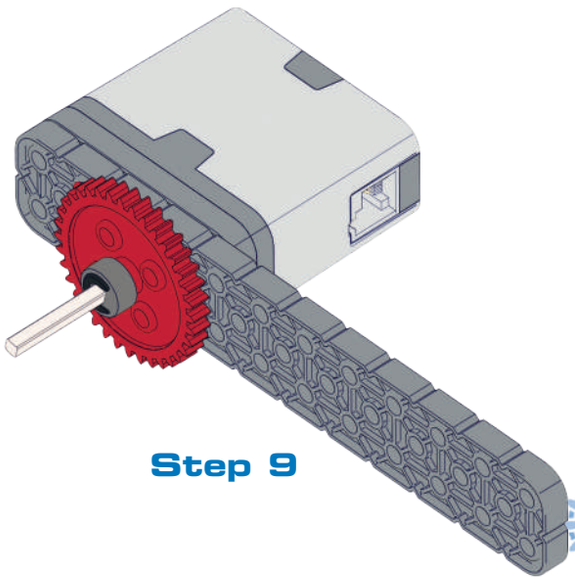

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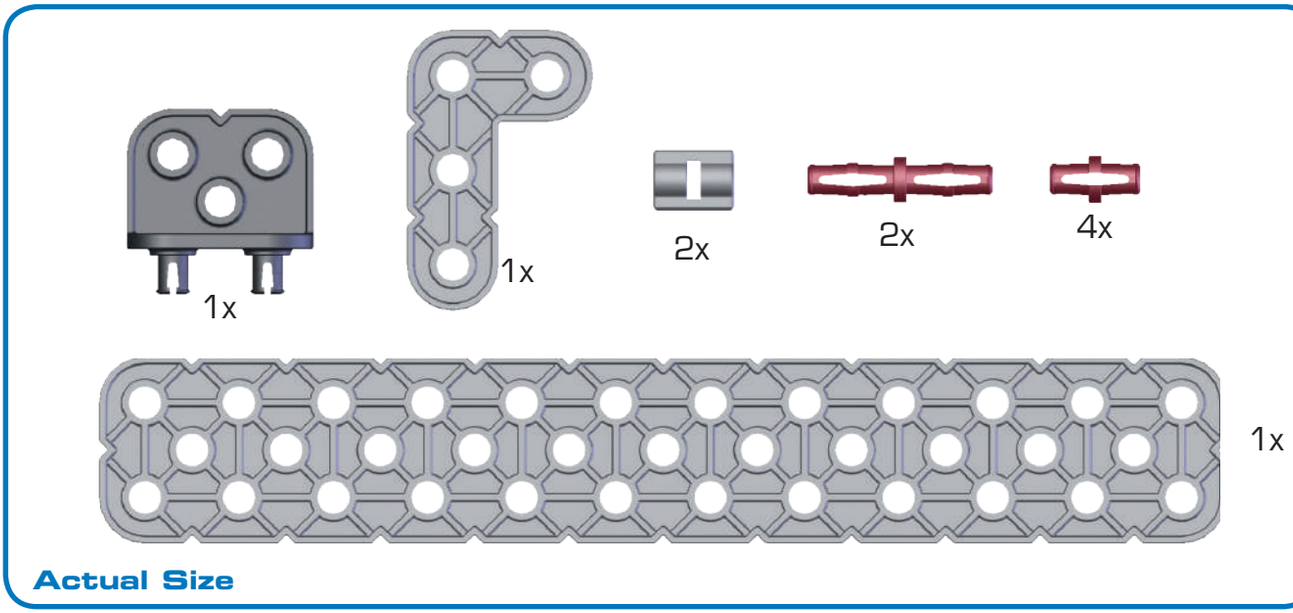
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4x
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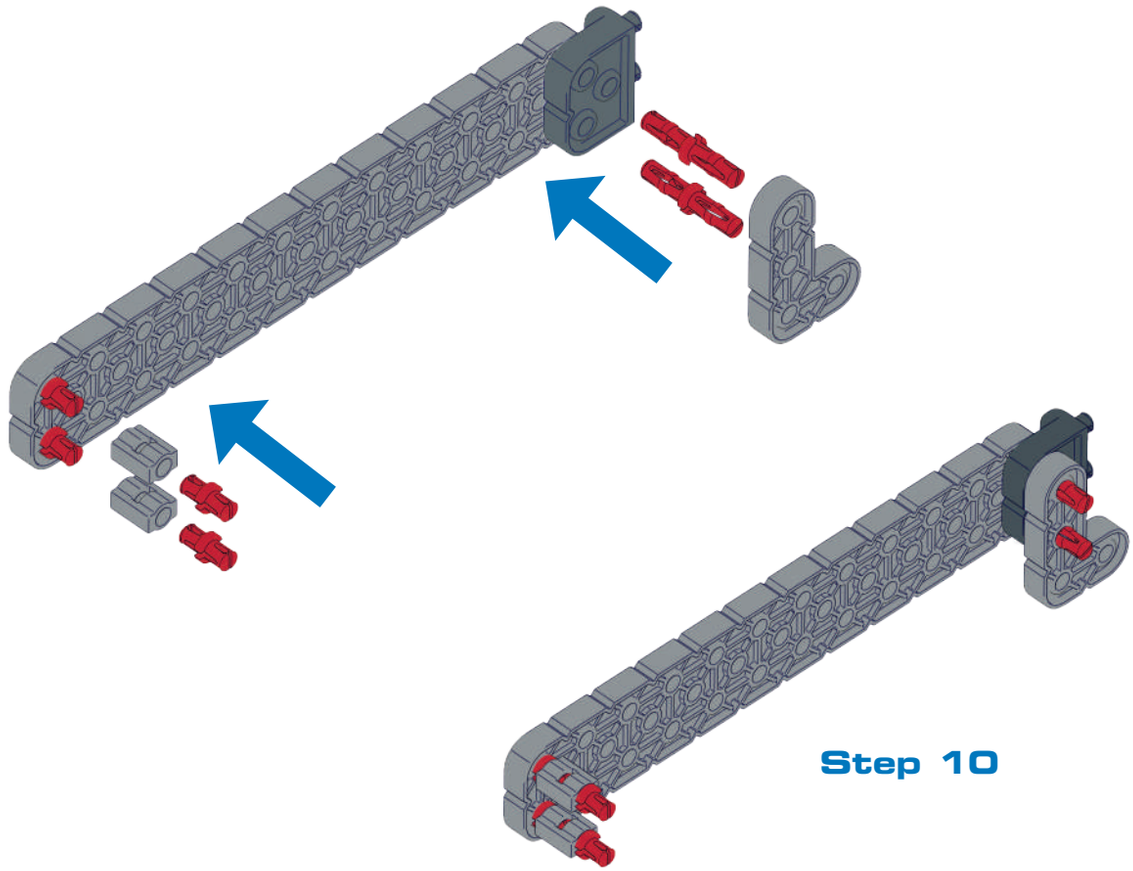
Actual Size


Step 10

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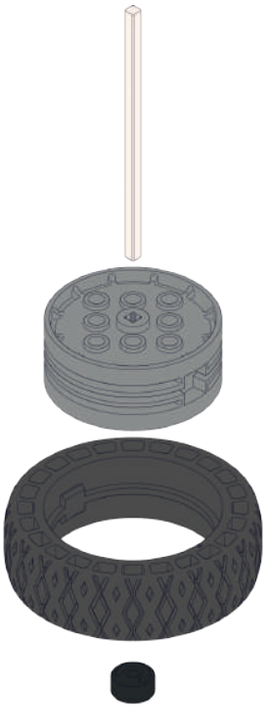
Actual Size



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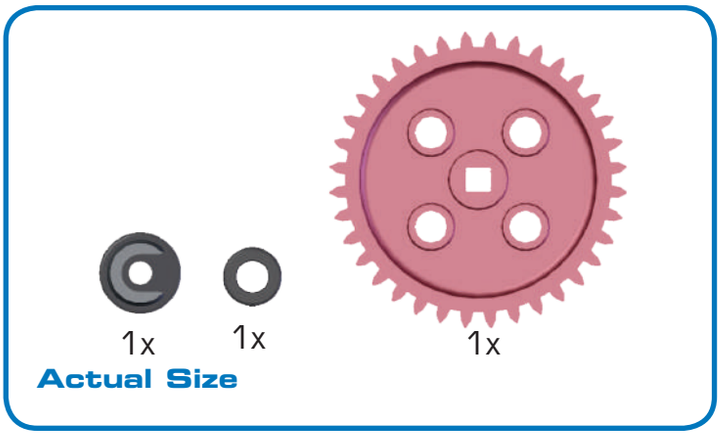

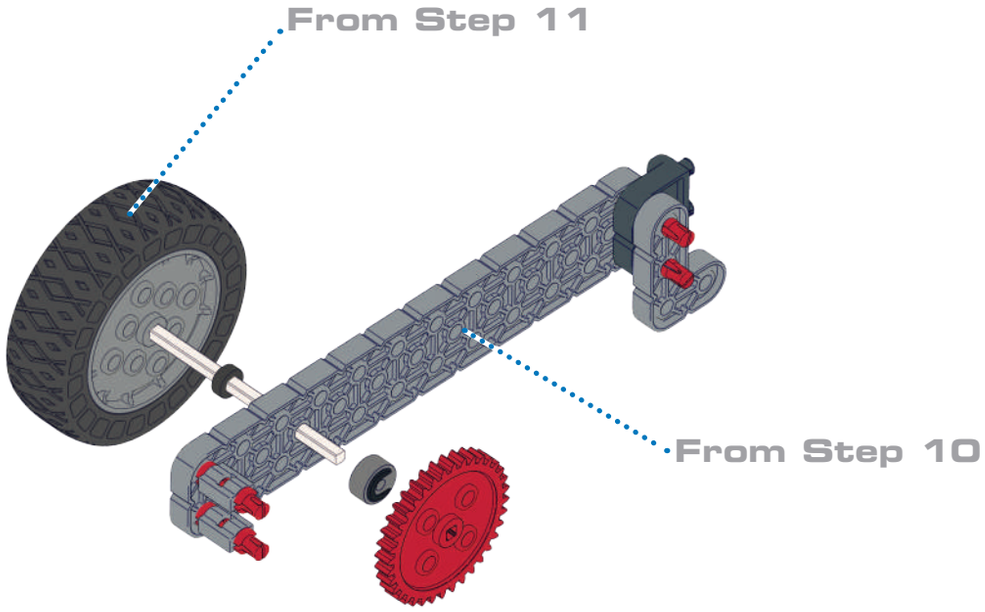

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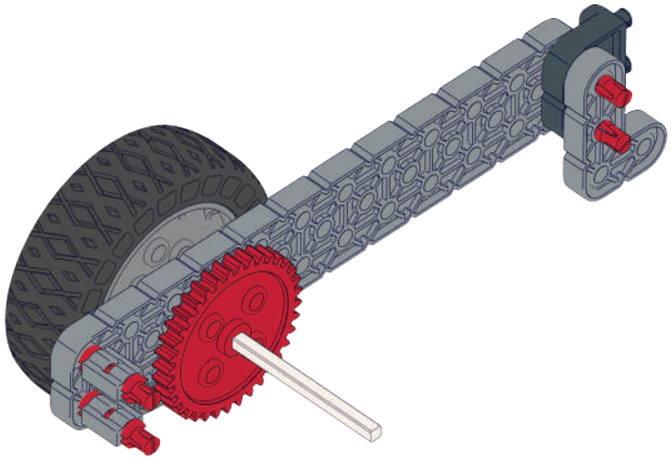

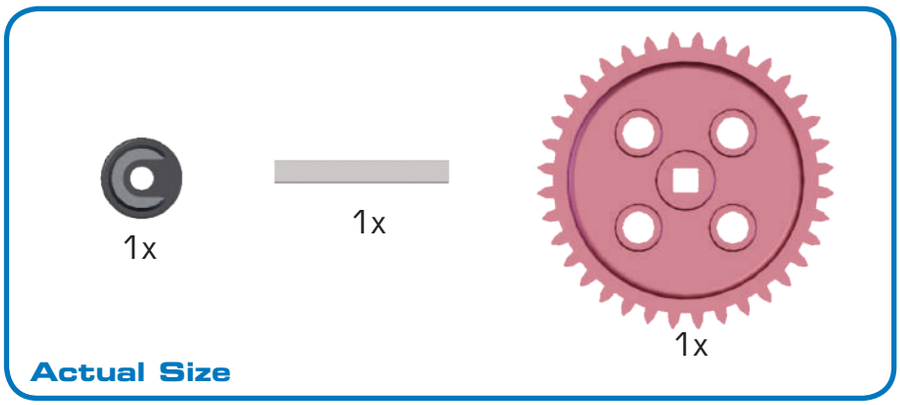

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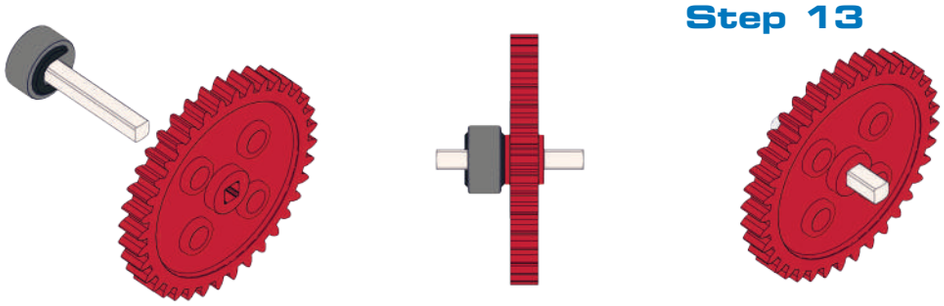

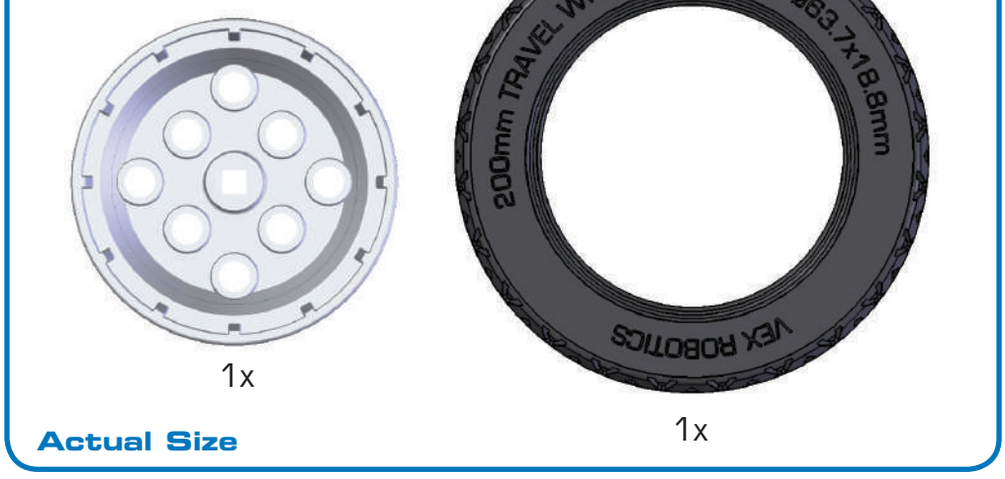

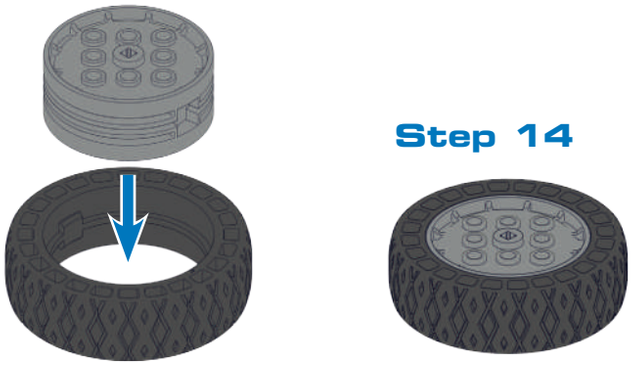

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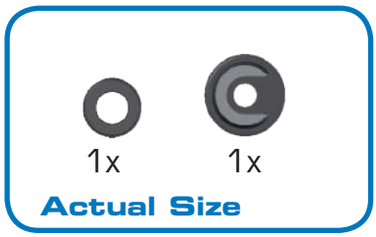
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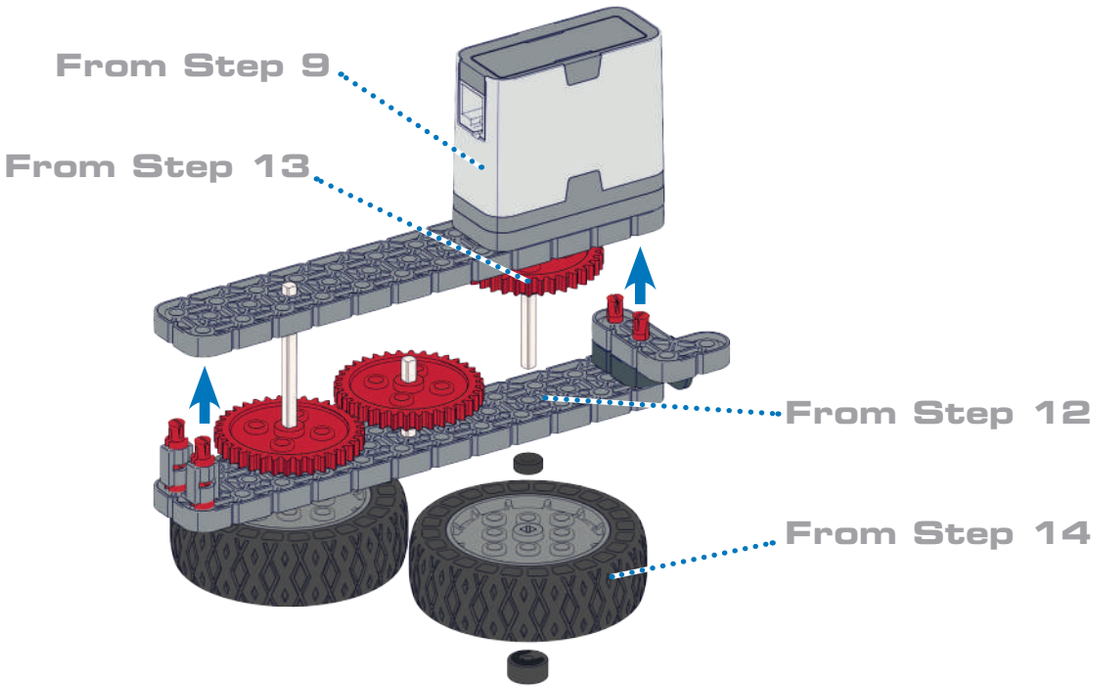
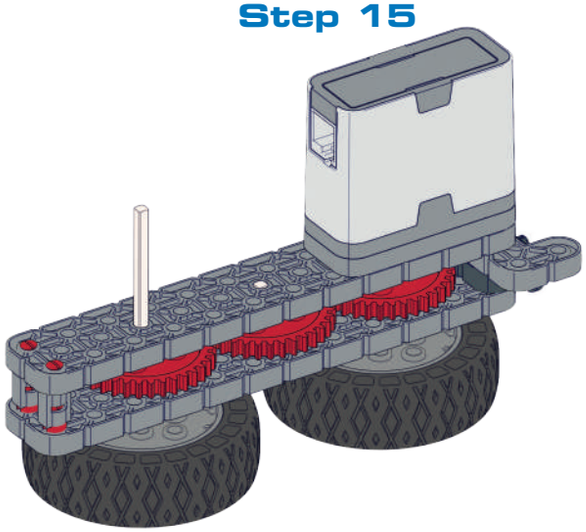
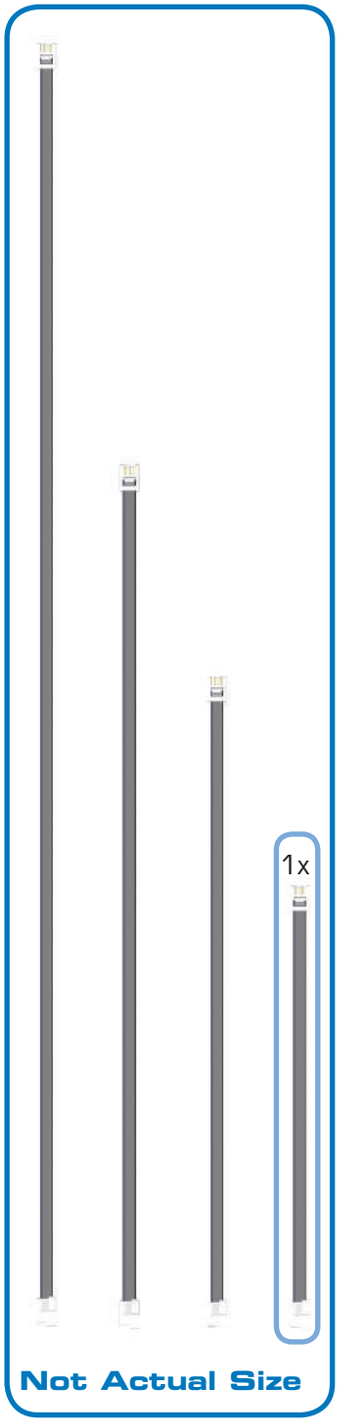
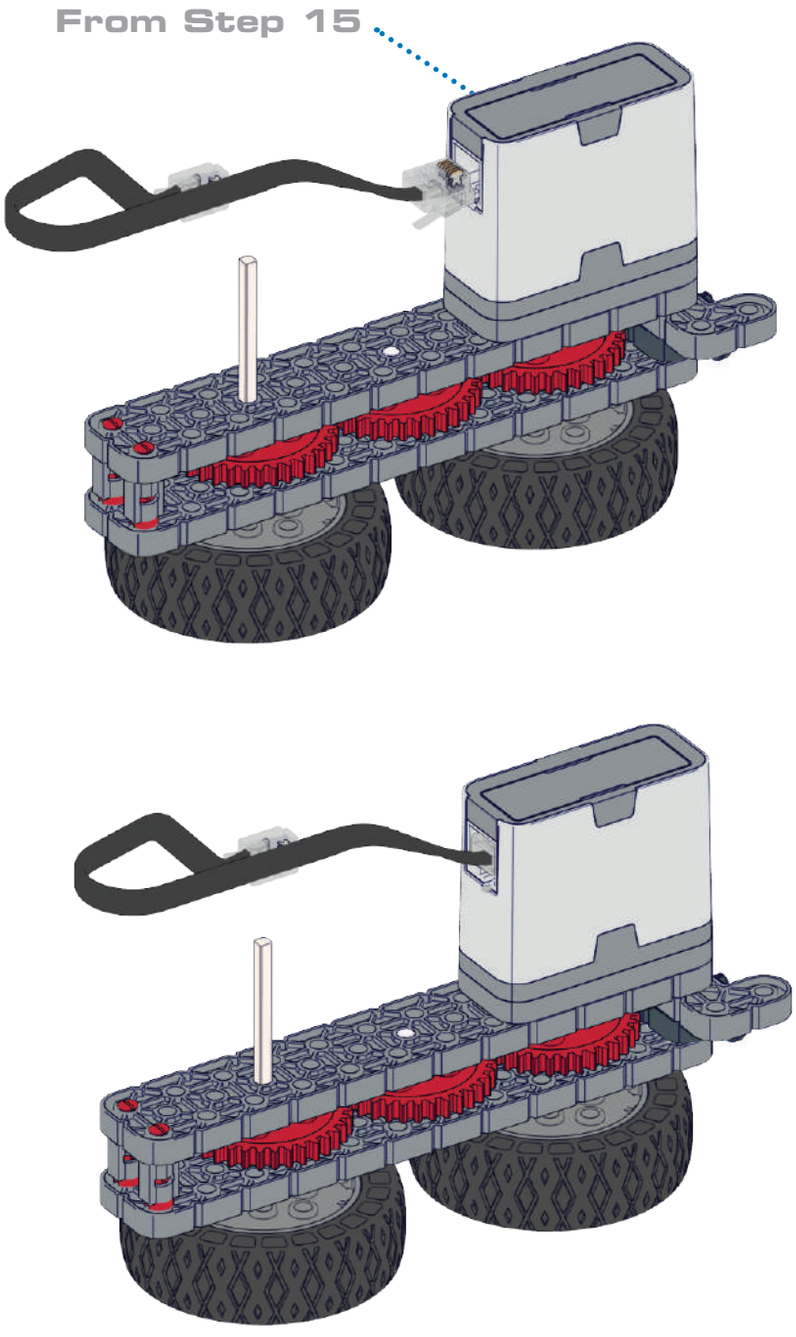
Actual Size


From Step 9
From Step 13
From Step 12
From Step 14

Step 15







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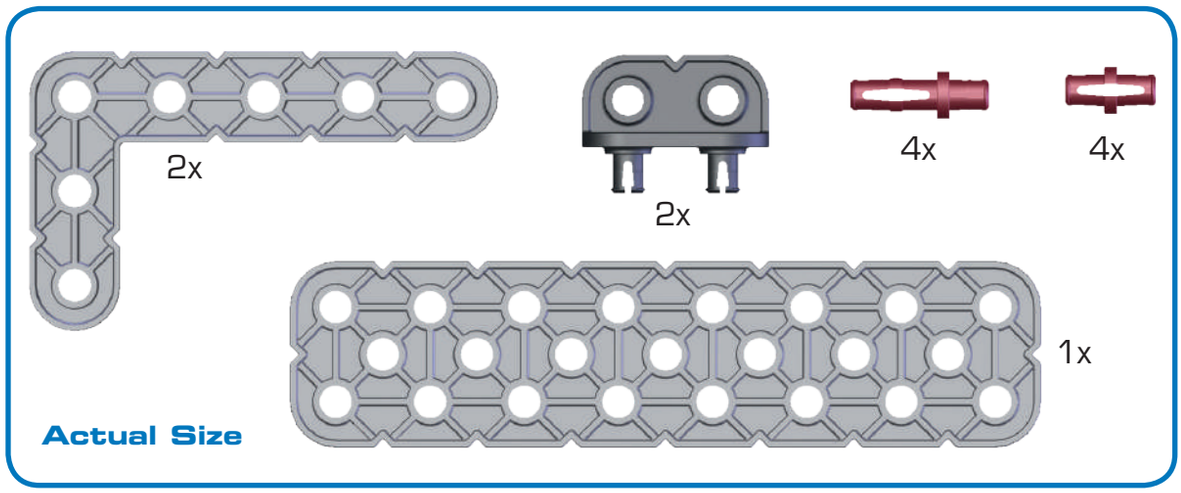
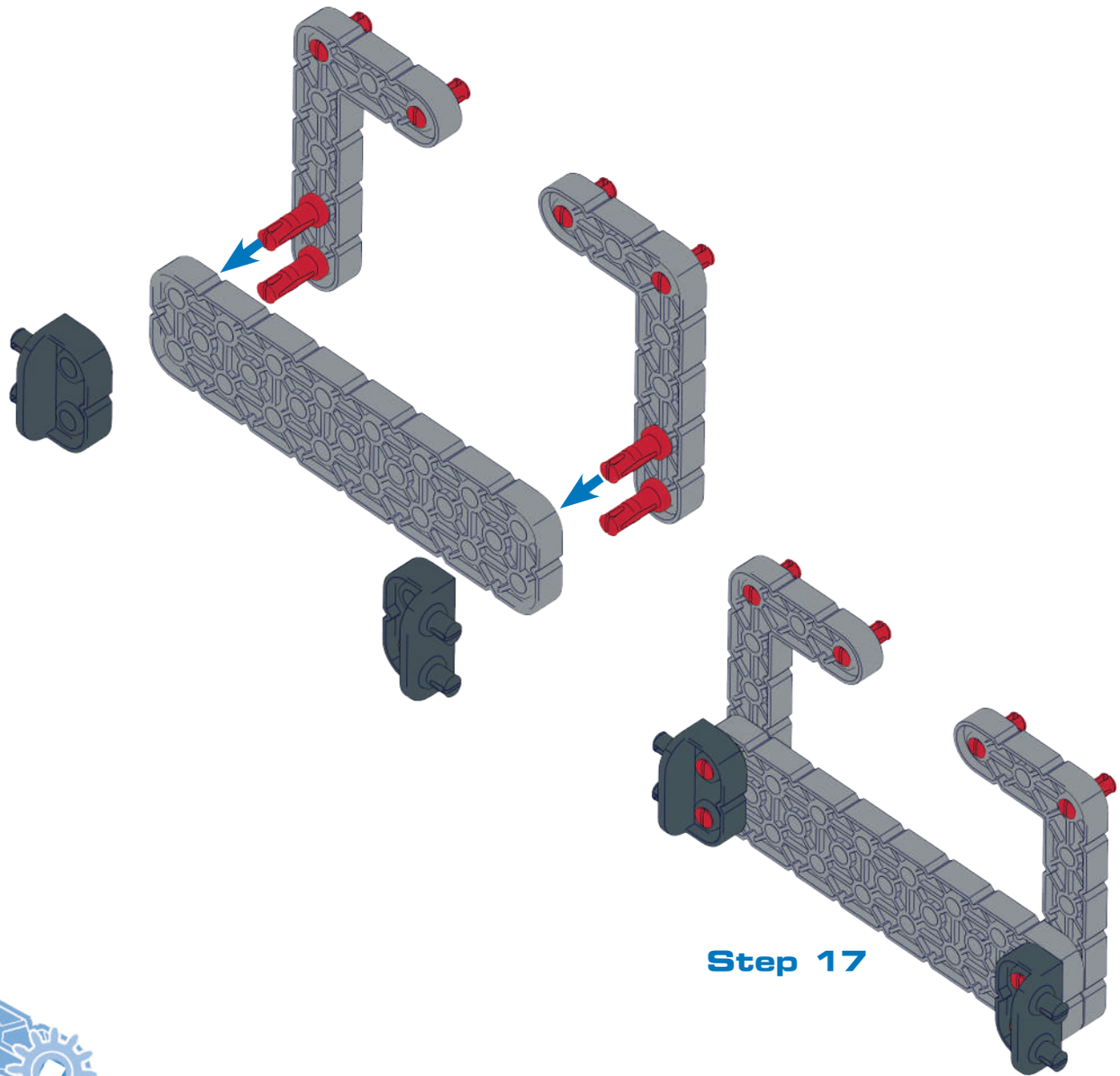
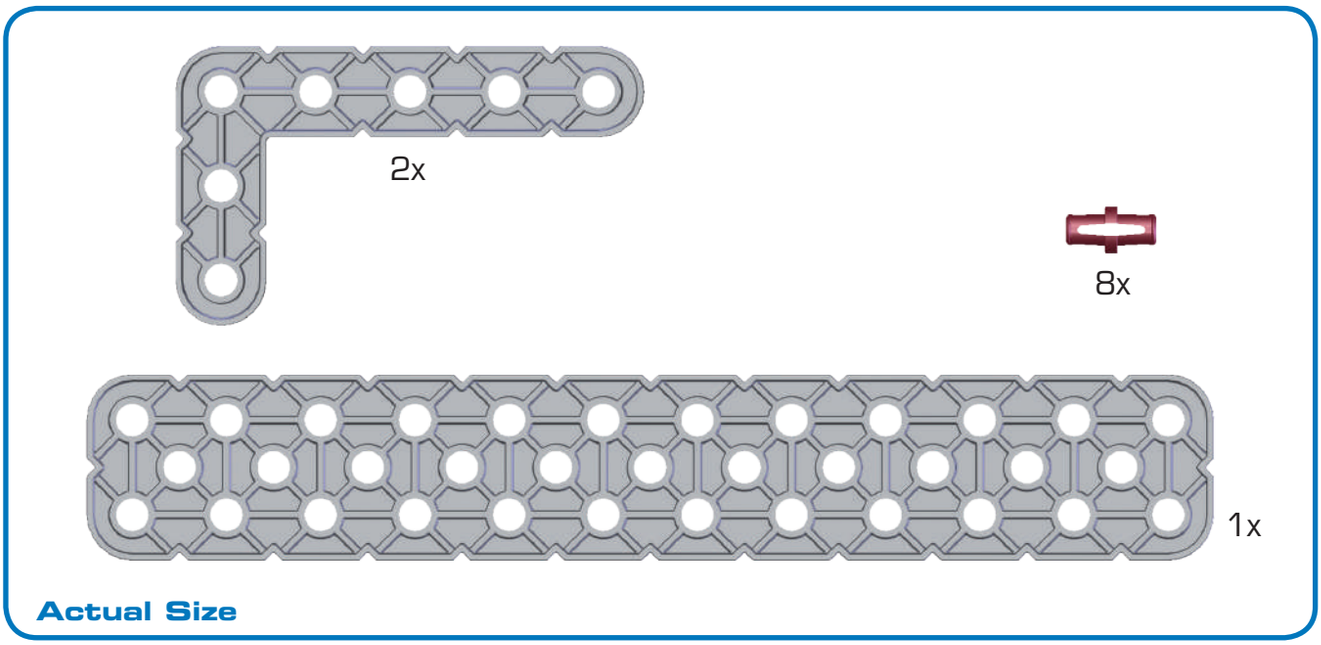
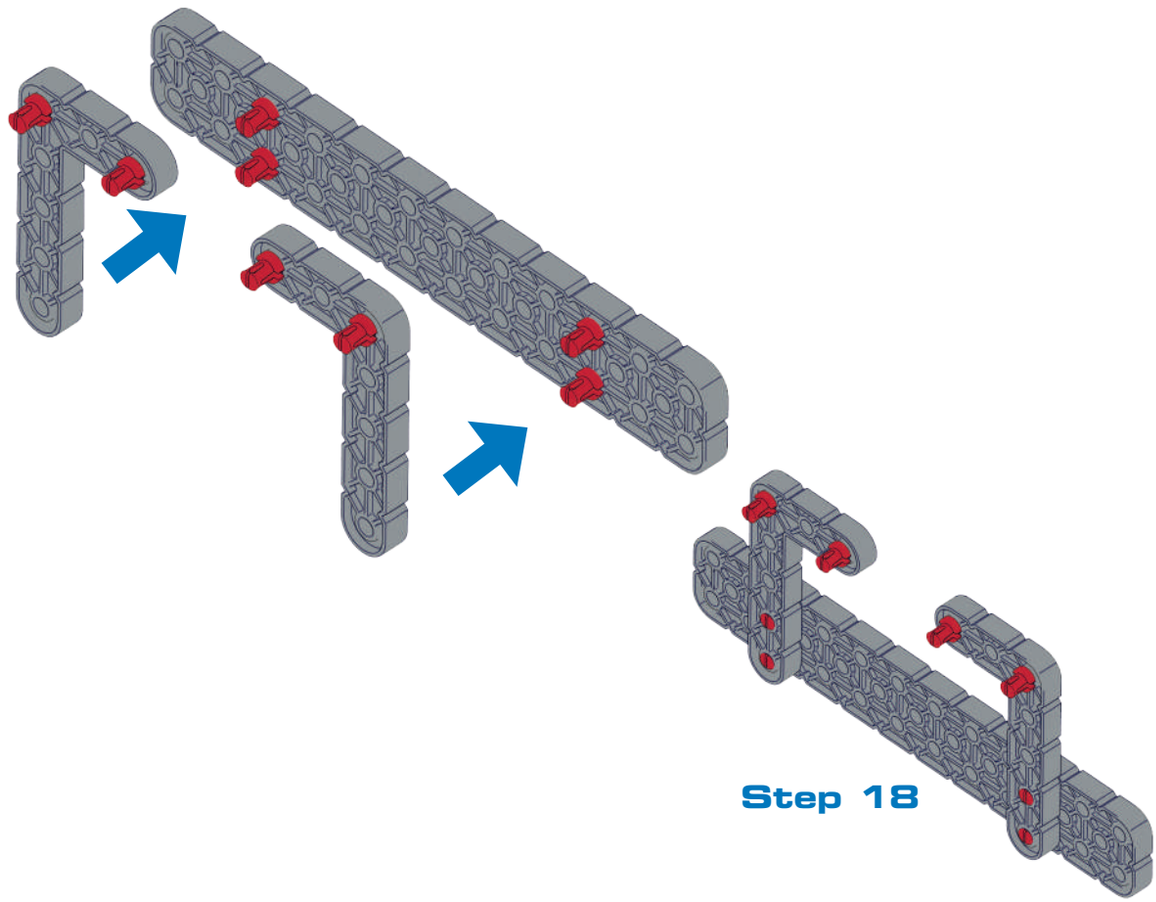




Step 17





Step 18

Actual Size

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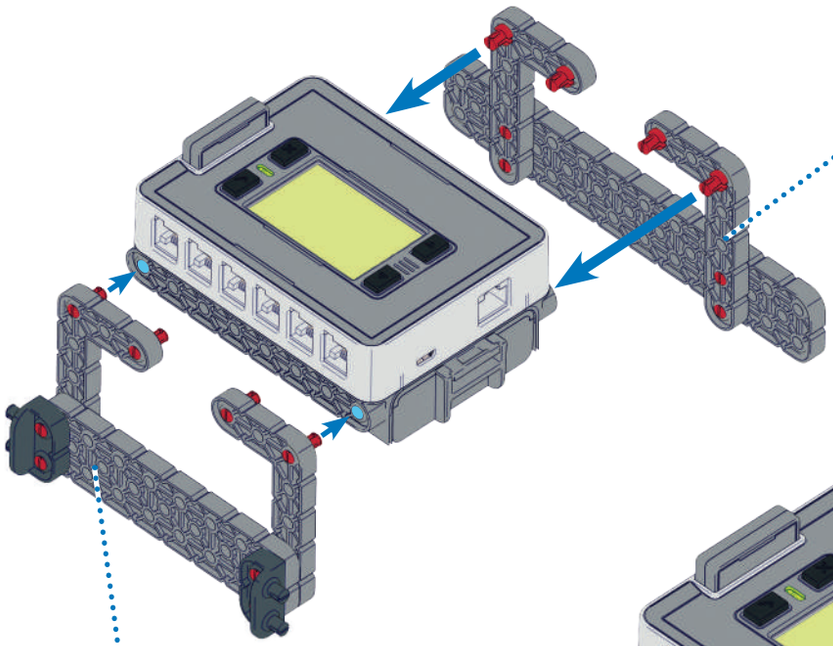
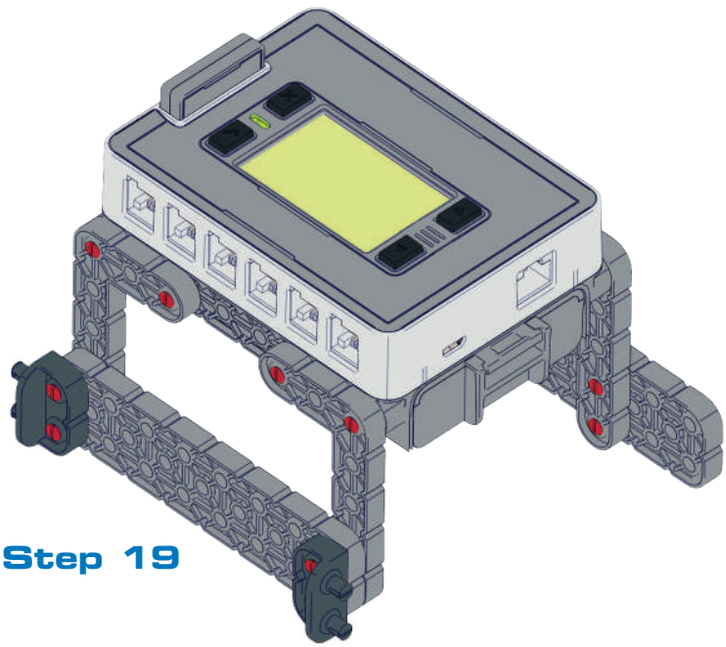
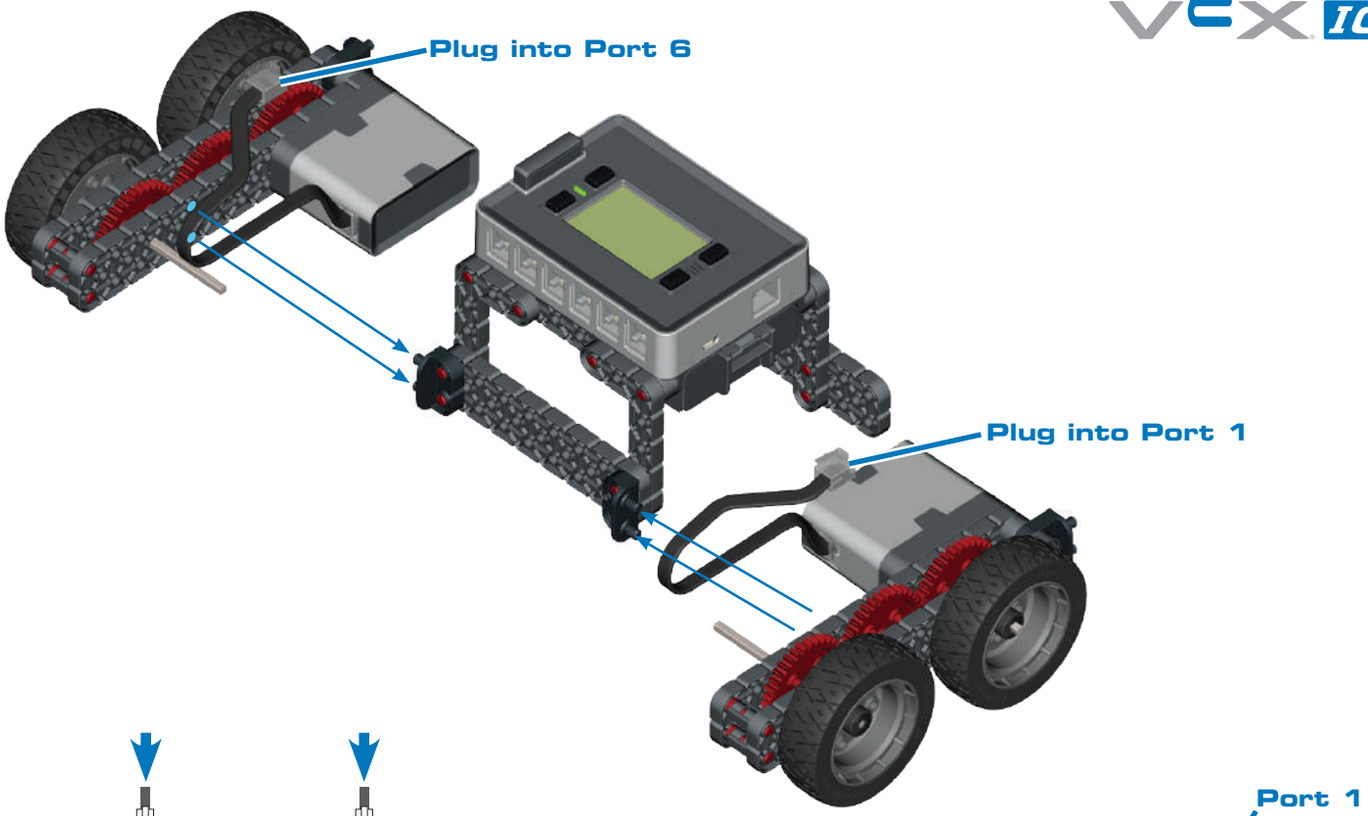


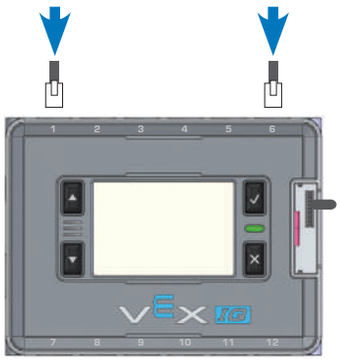
From Step 18

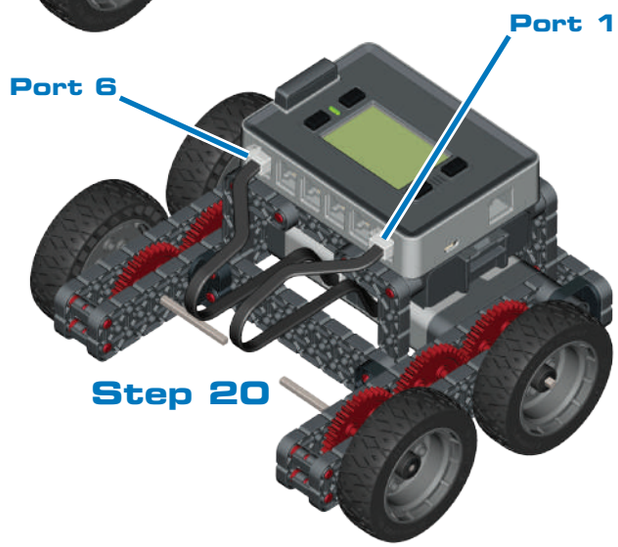
From Step 17



Step 19







Step 20

Refer to pages 85 through 111 for information on the built in Driver Control program in the Robot Brain.

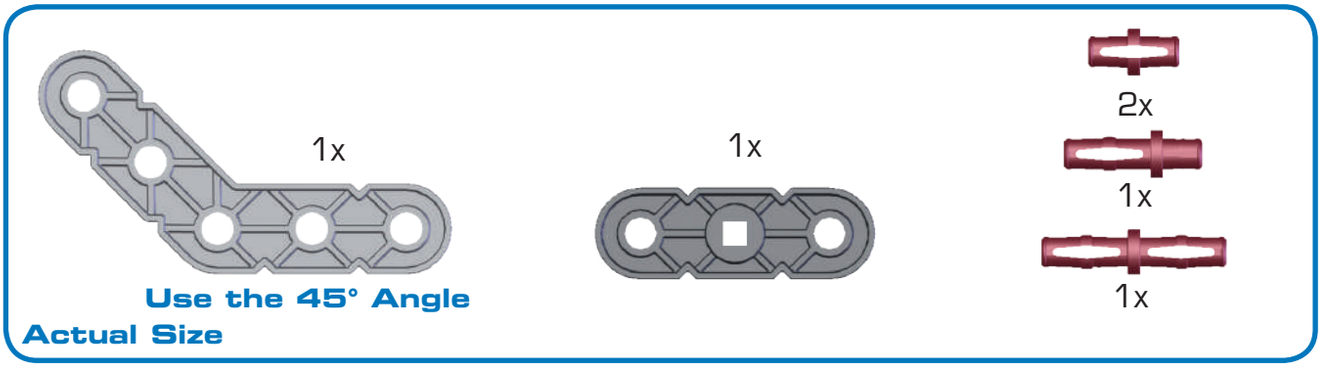
Robot Base is now Ready to Run! Test it before continuing the Build.

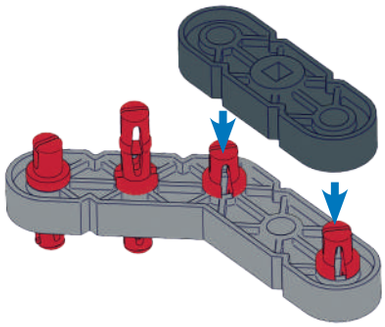
- Insert Robot Battery into Brain.
- Connect the Controller to the Robot Brain with the Tether Cable.
- Turn on the Robot Brain by pressing the check button.
- Run the Driver Control Program.
- Move the left joystick - does the left side move?
- Move the right joystick - does the right side move?

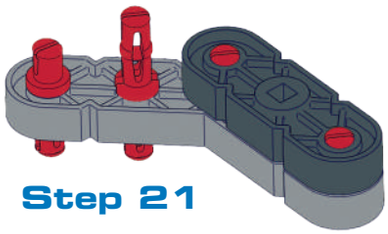
If the robot base does not perform as expected, refer to pages 85-111.

To continue building the Clawbot, follow the instructions on pages 28-65.
To build the Autopilot robot, follow the instructions on pages 78-84.

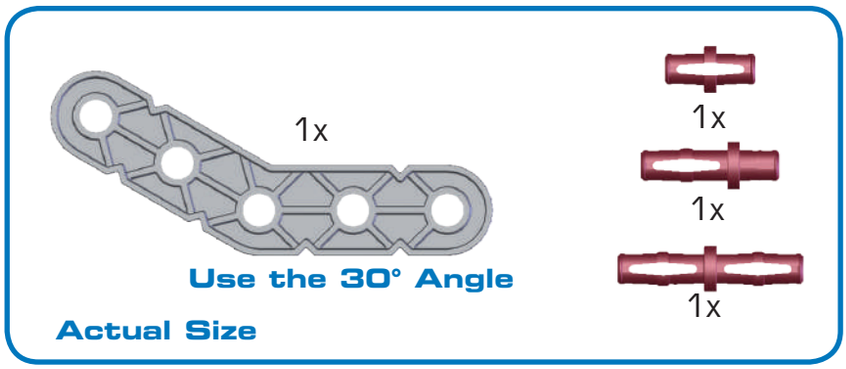
Part 2 Claw

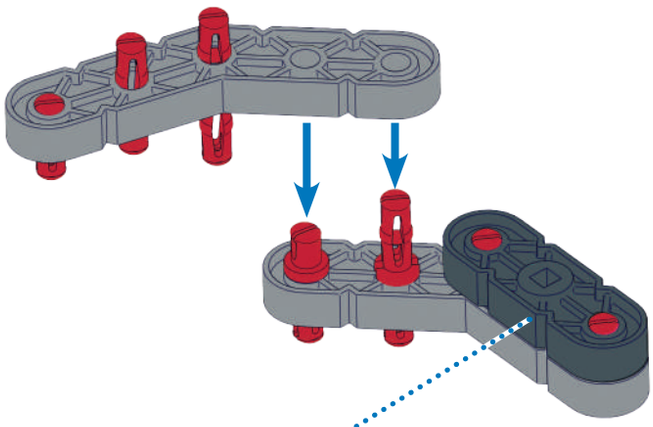




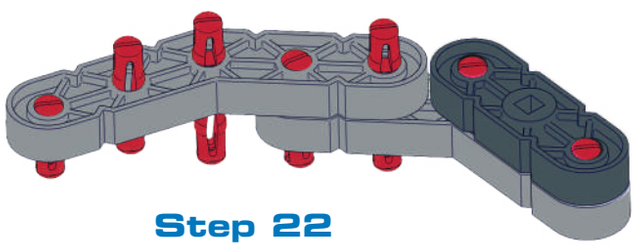


Step 21

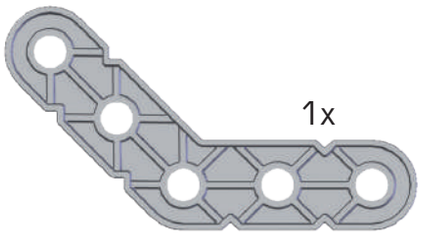




From Step 21

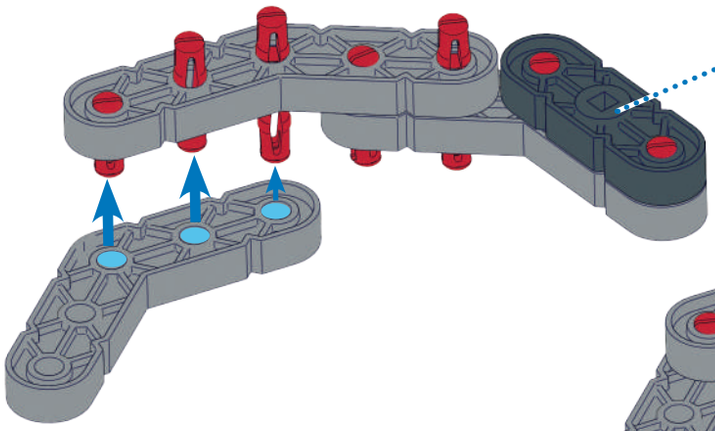


Step 22

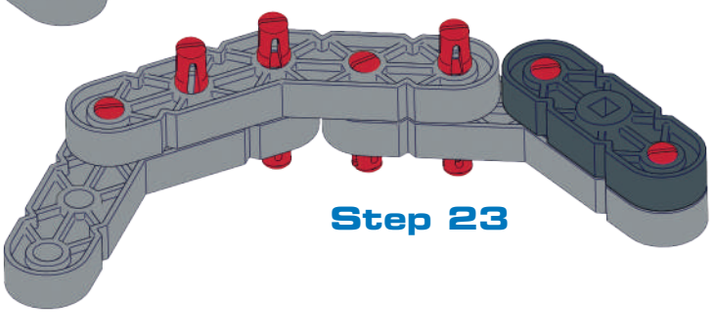


Use the 45° Angle

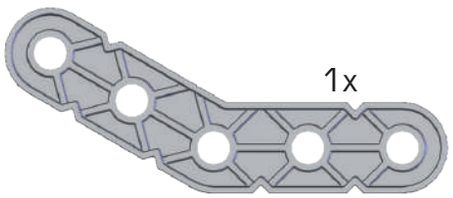
Actual Size



From Step 22

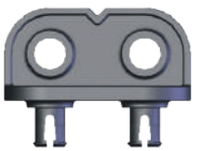


Step 23

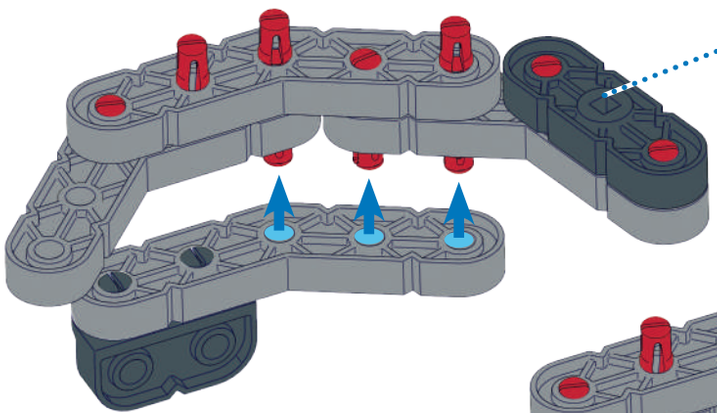


Use the 30° Angle

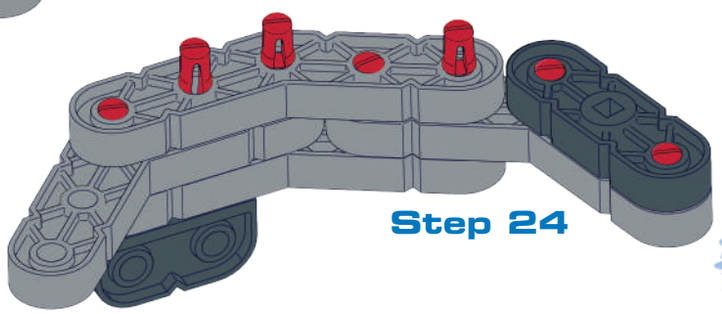
Actual Size



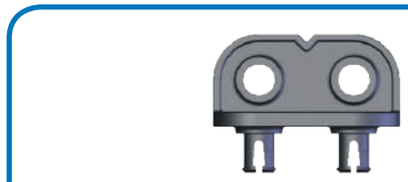
1x



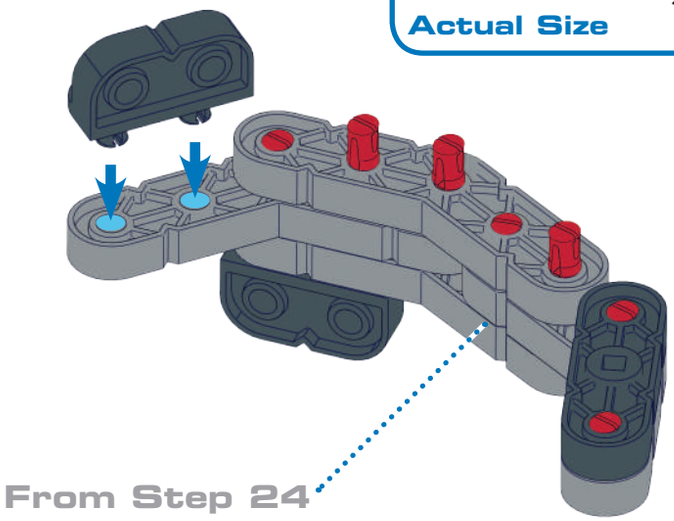
From Step 23



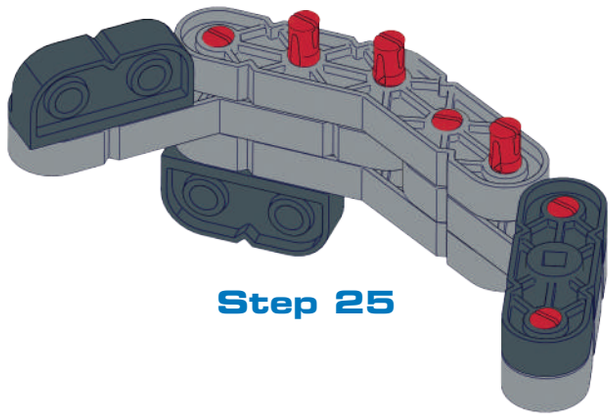
Step 24



Actual Size 1x

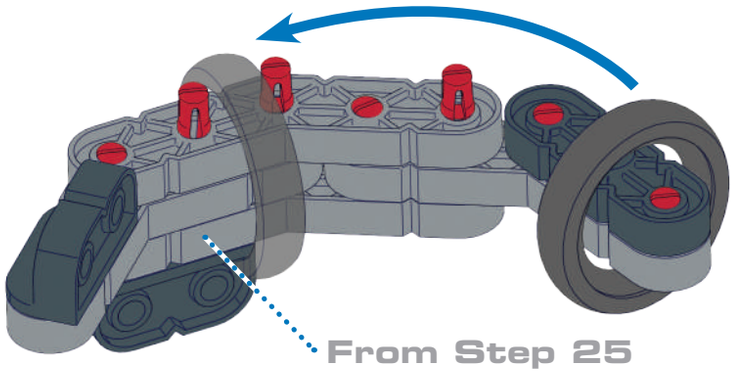


From Step 24

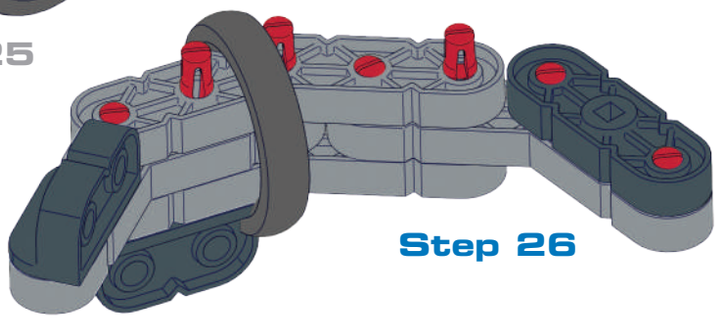


Step 25

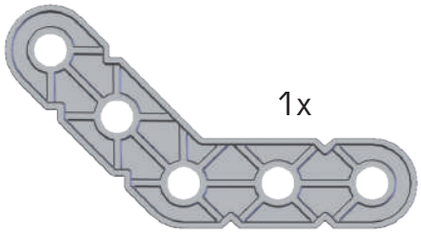
Actual Size 1x



From Step 25

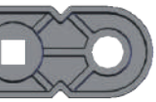


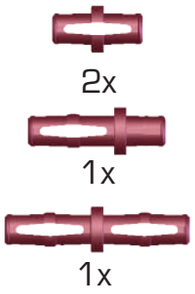
Step 26

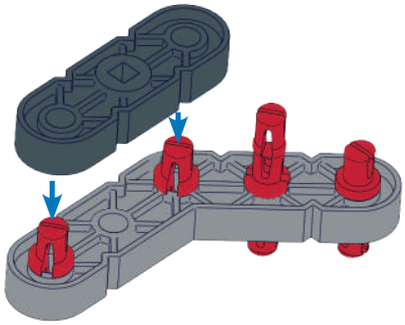


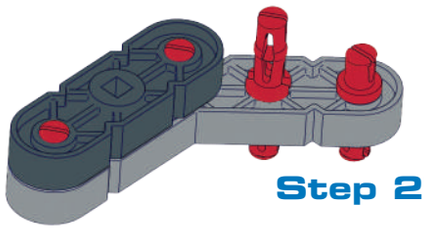
Use the 45° Angle

Actual Size

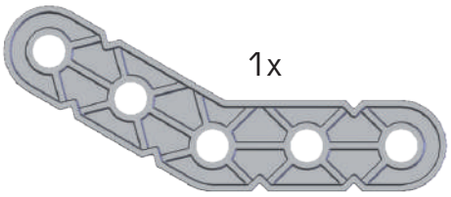






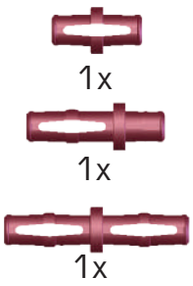


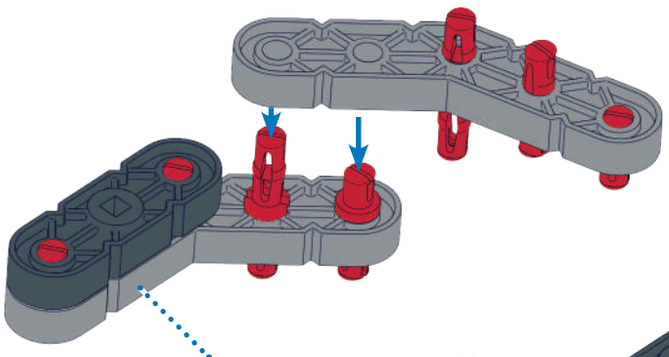
Step 27



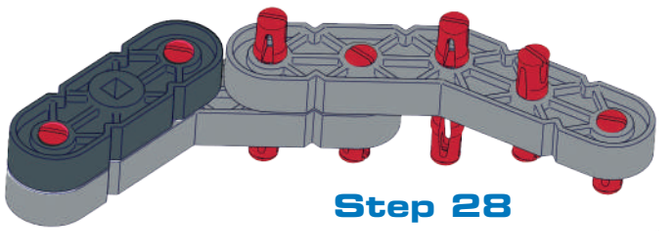
Use the 30° Angle

Actual Size

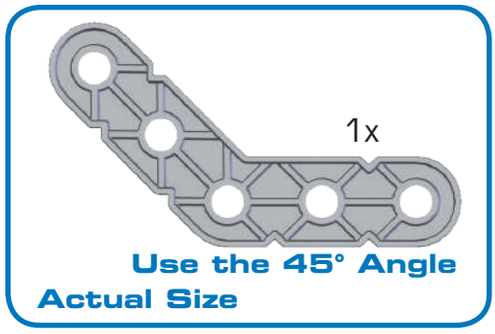




From Step 27

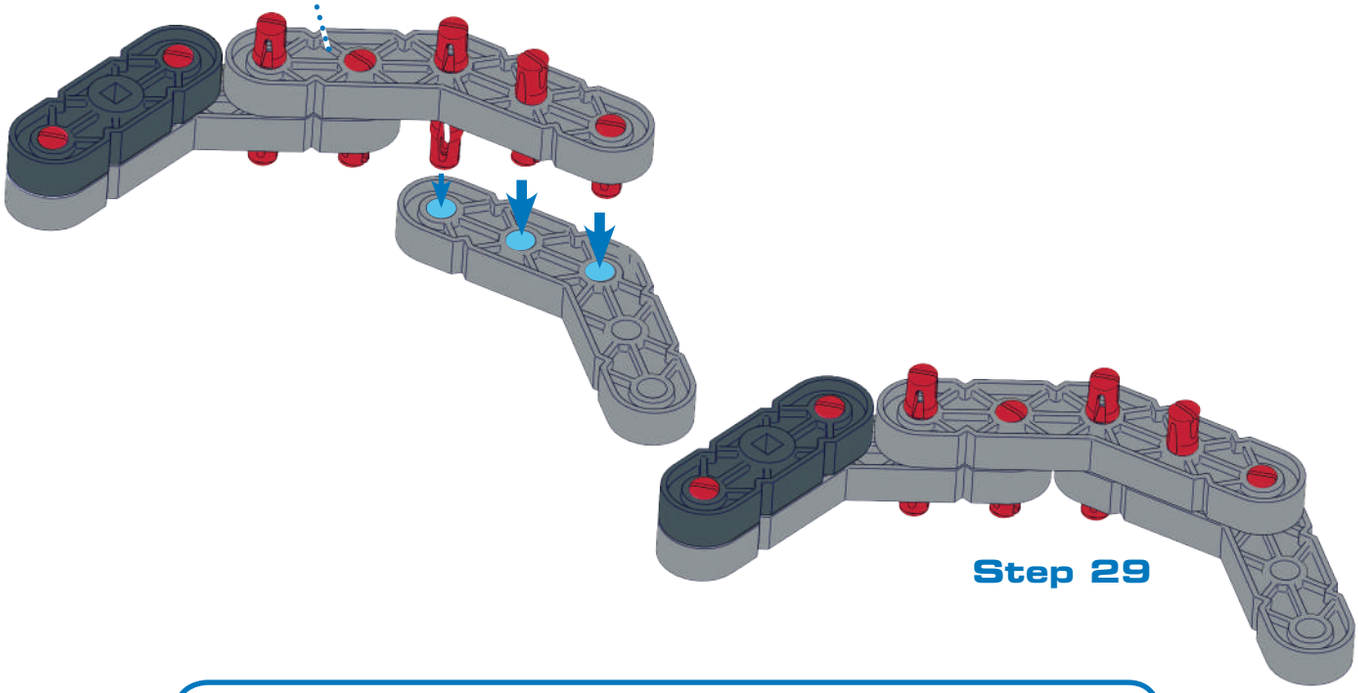


Step 28

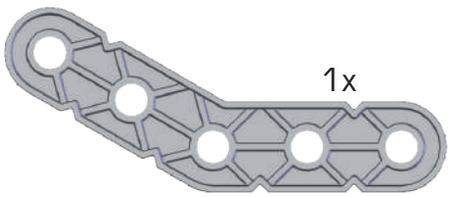


Use the 45° Angle
Actual Size

From Step 28

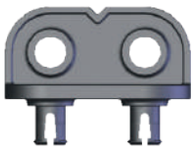


Step 29



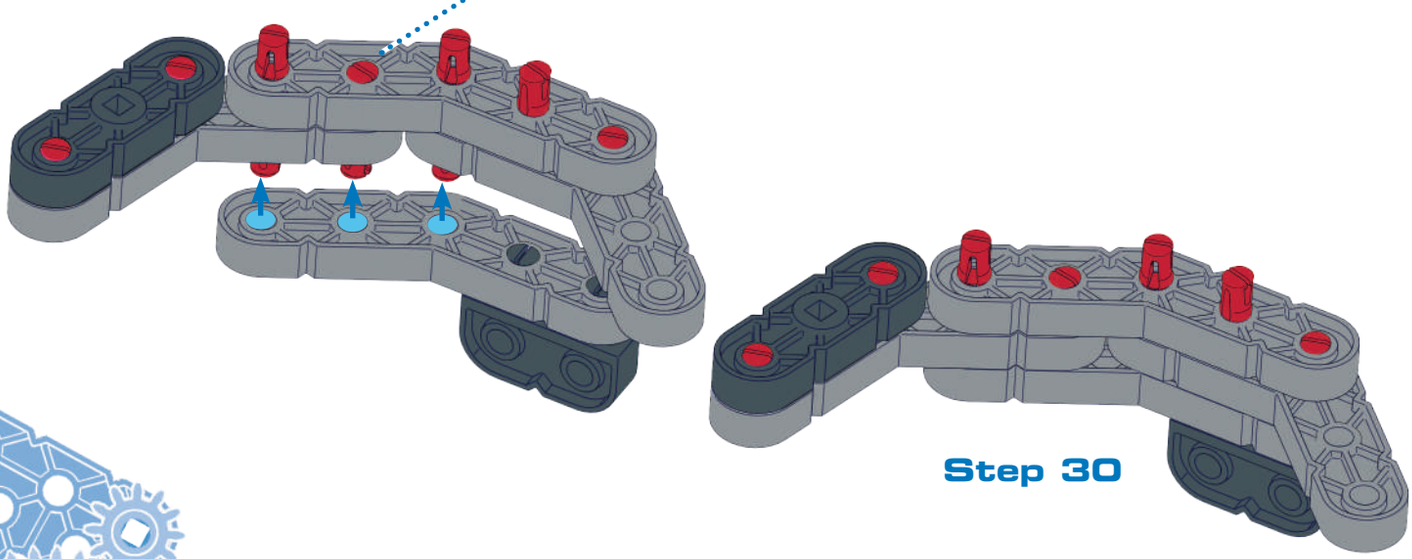
Actual Size

Use the 30° Angle

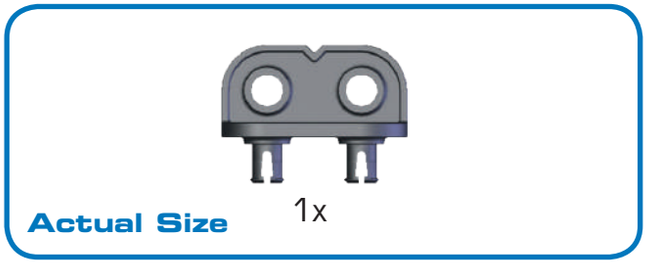


1x

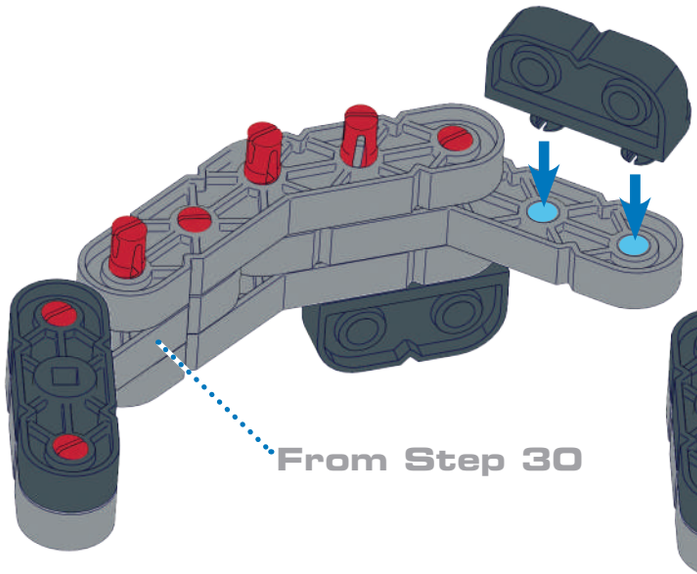
From Step 29



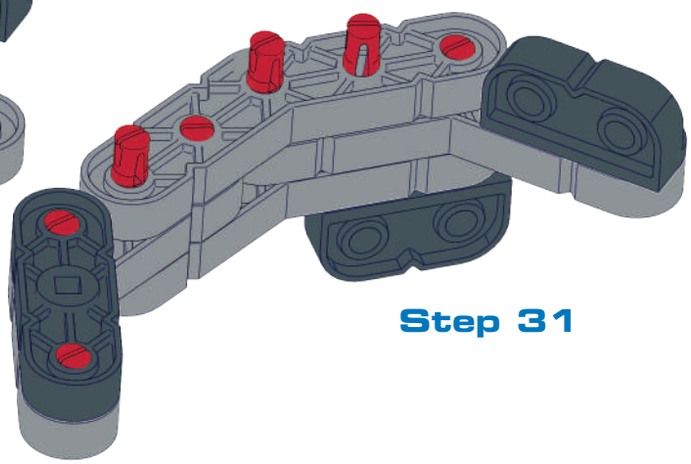
Step 30



Actual Size 1x

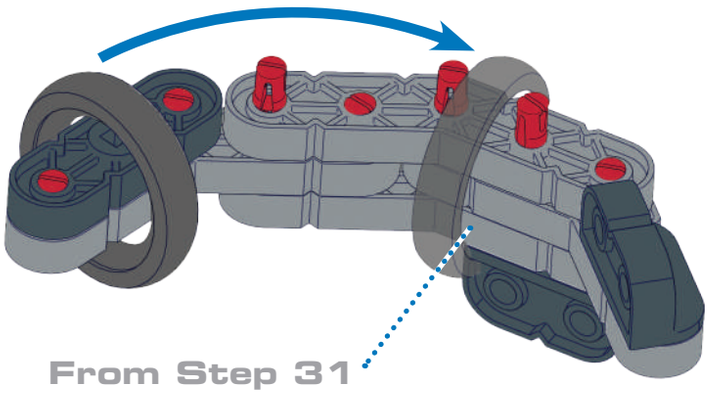


From Step 30

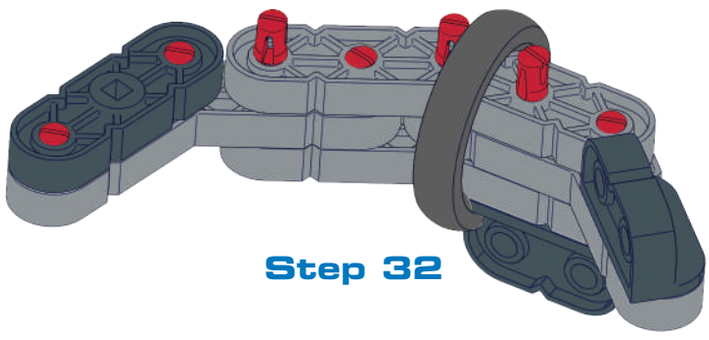


Step 31

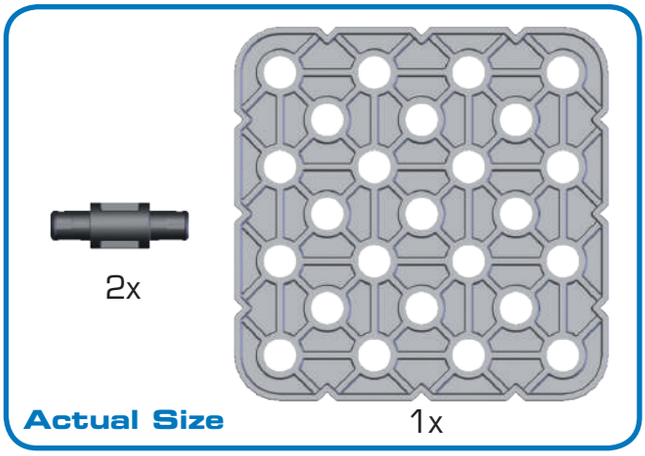
Actual Size 1x

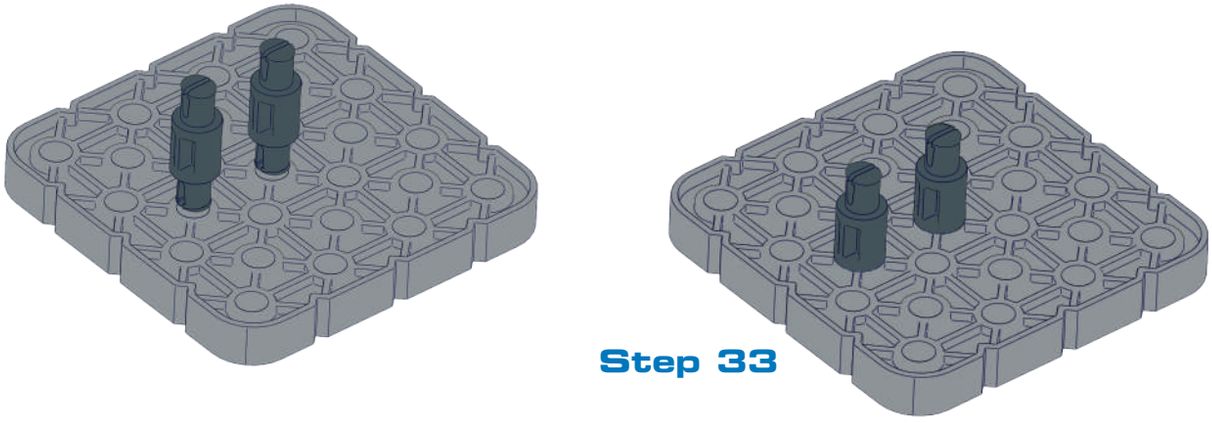


From Step 31

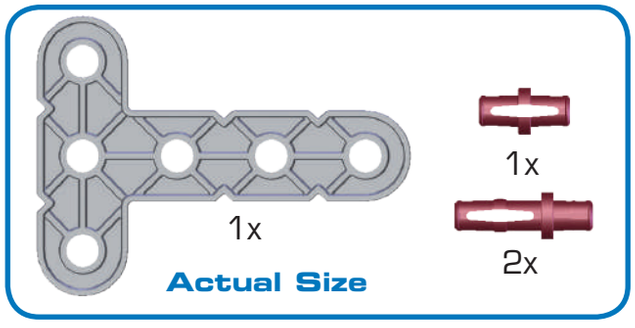


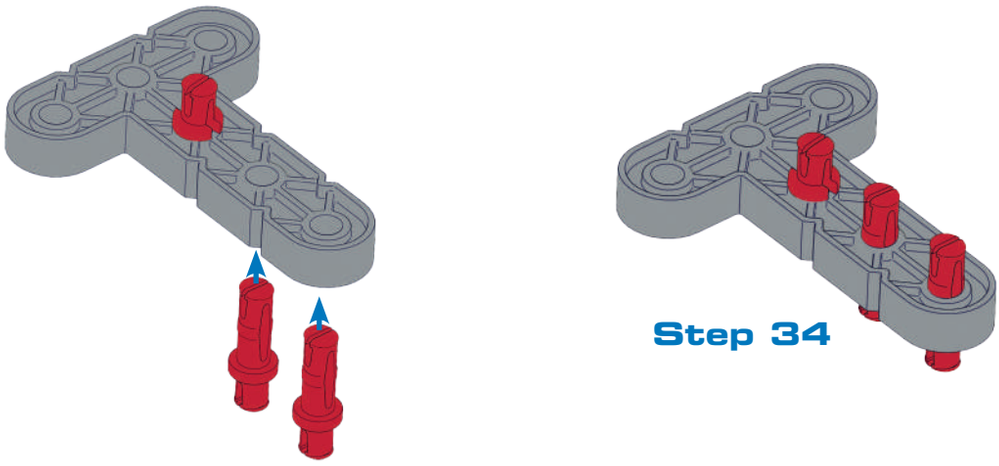
Step 32





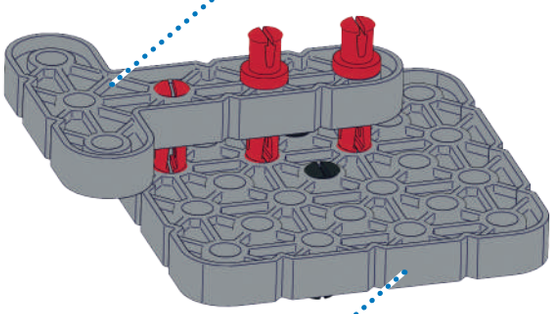
Step 33





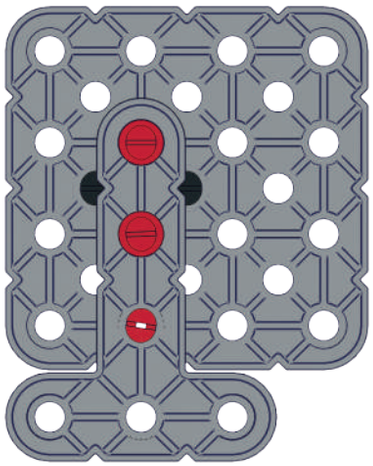
Step 34

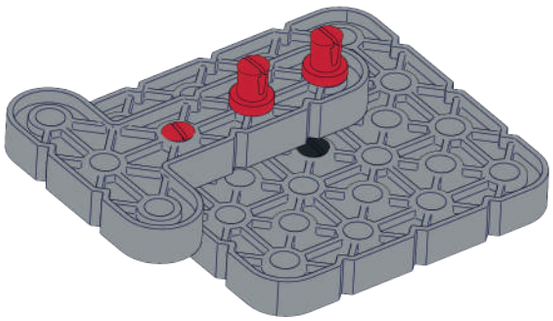
From Step 34



From Step 33

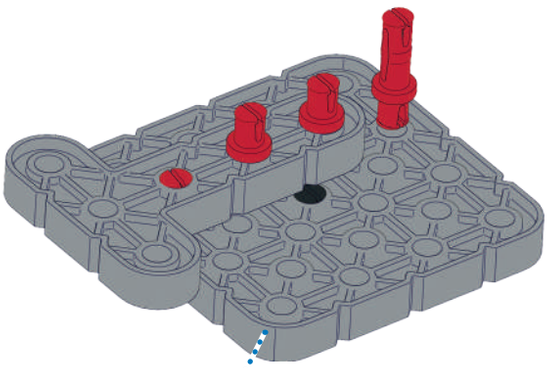
Step 35



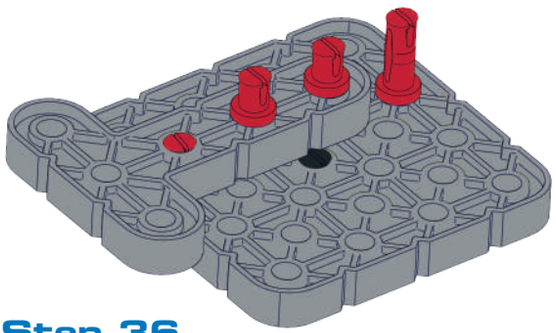


Actual Size

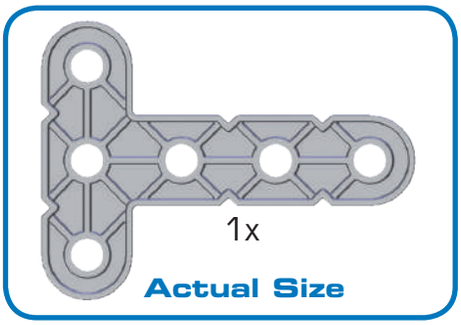
1x

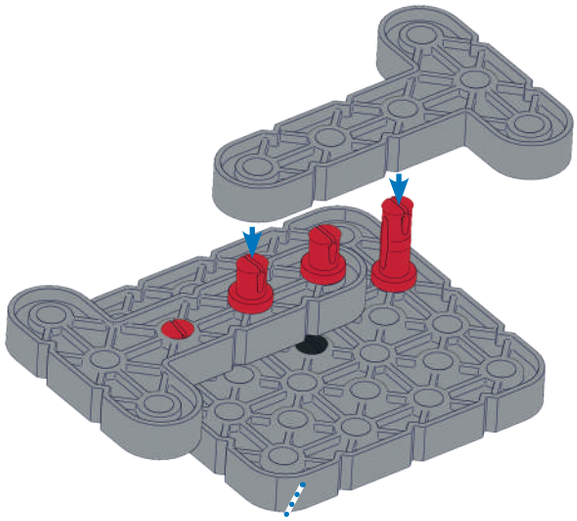


From Step 35

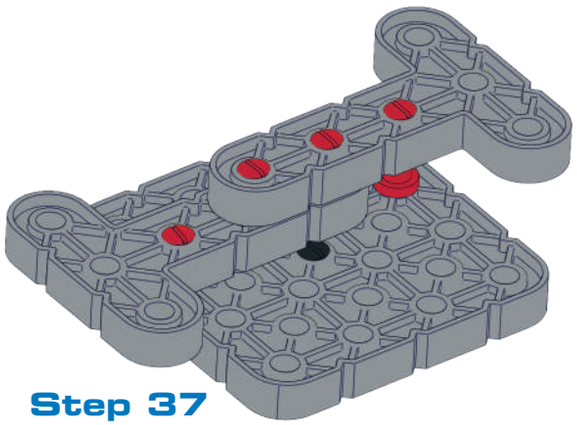


Step 36

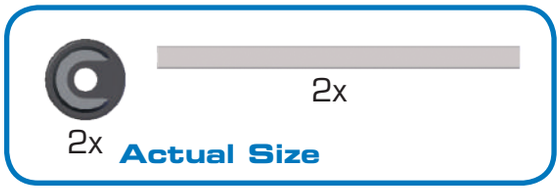


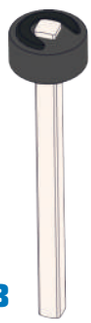


From Step 36



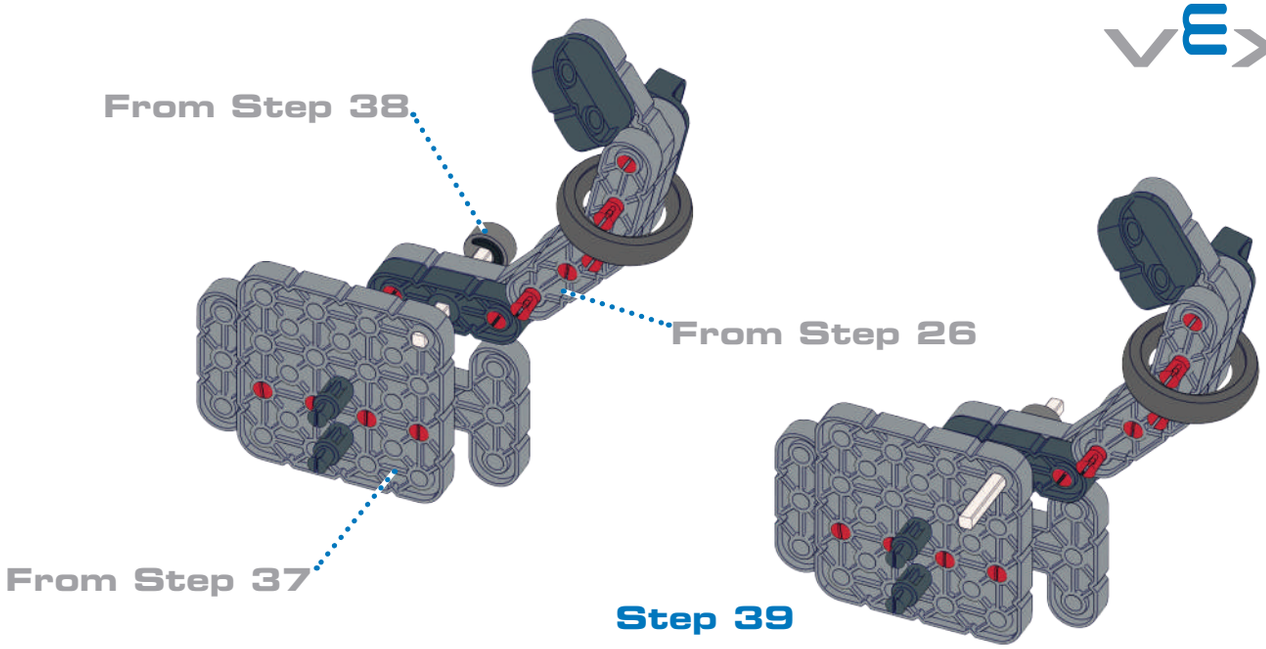
Step 37



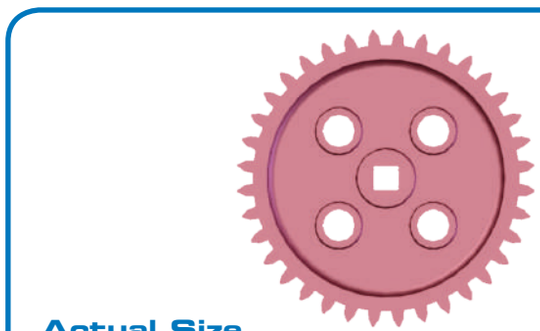


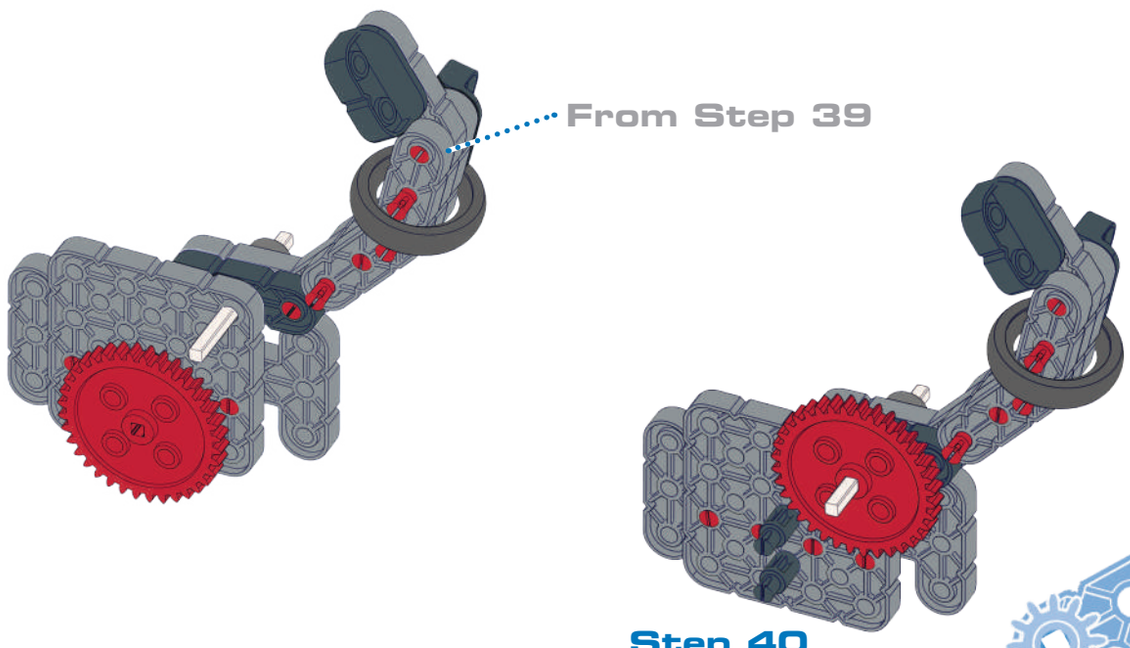
Step 38

Make (2x)

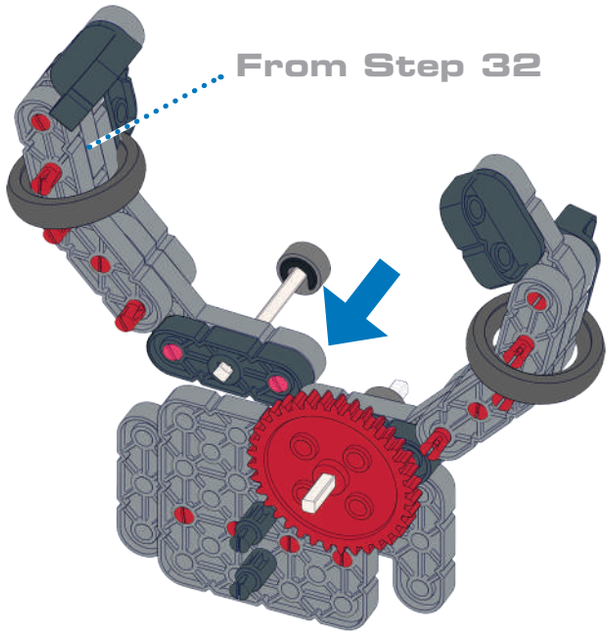


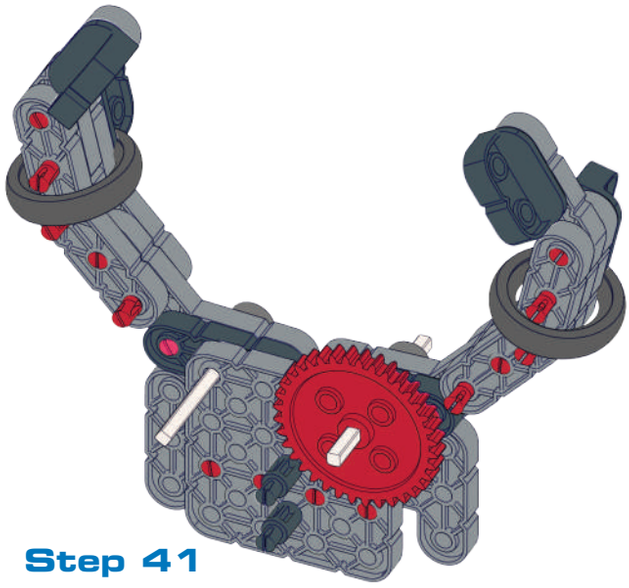
Step 39



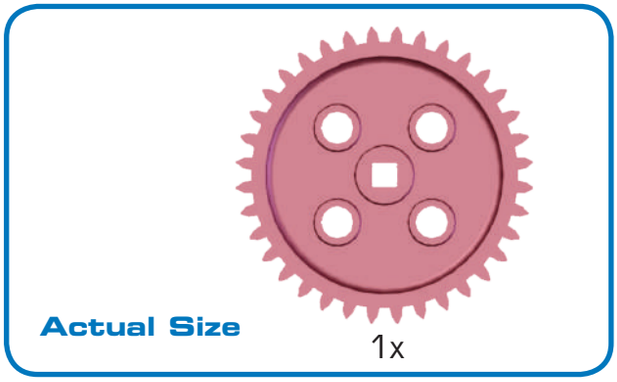


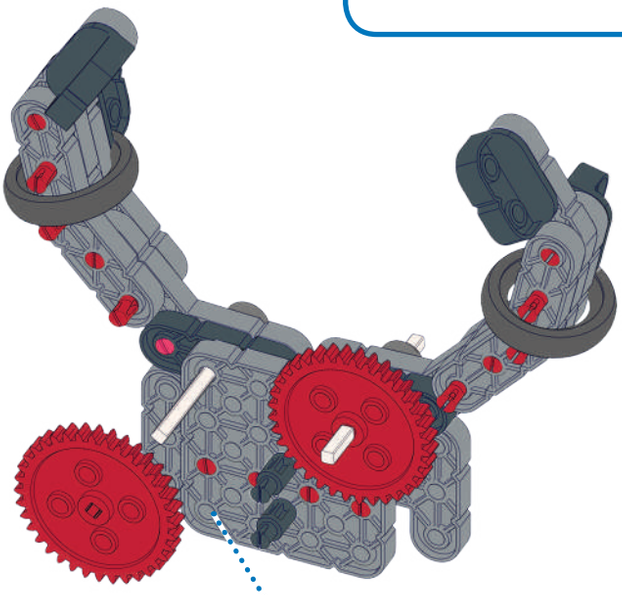
Step 40

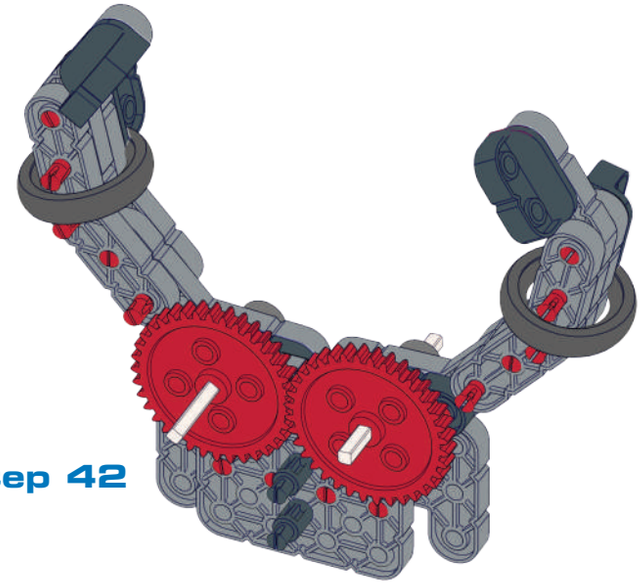




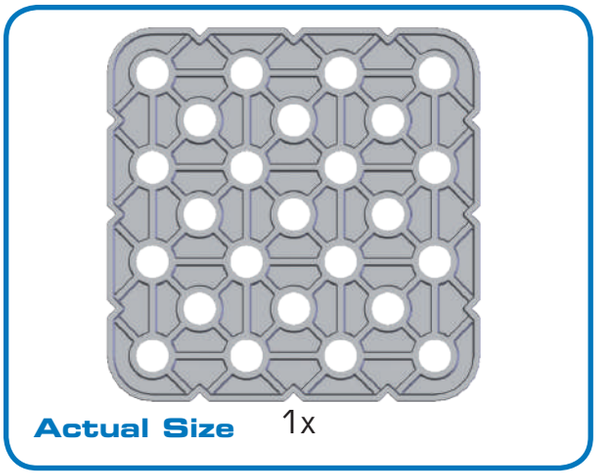
Step 41

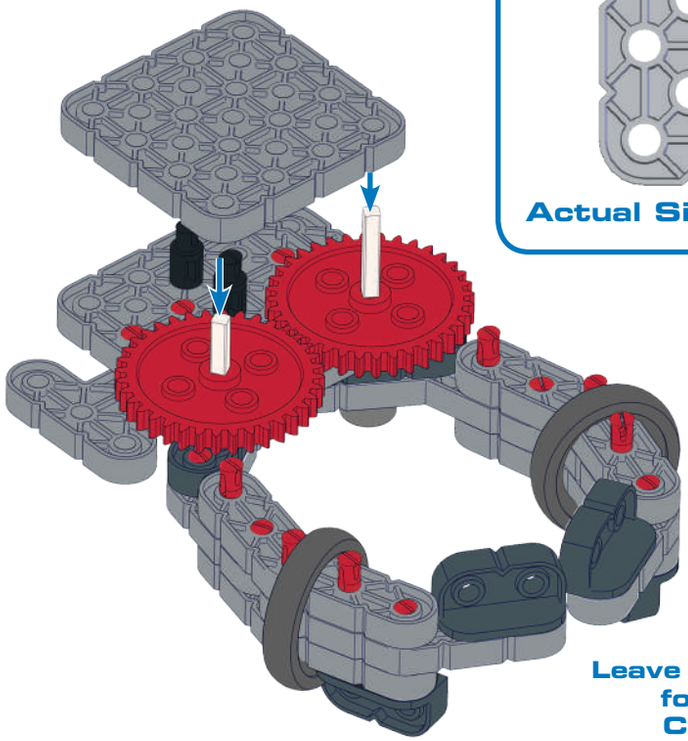


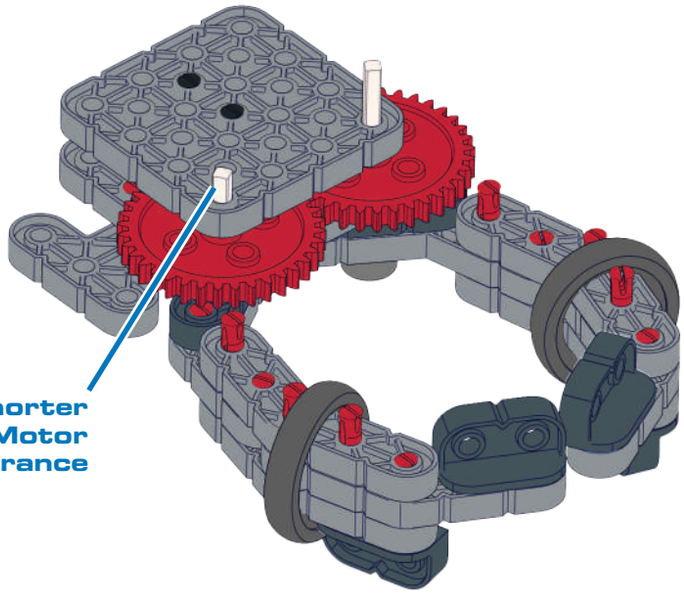


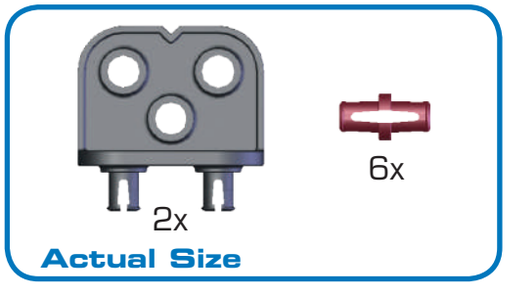


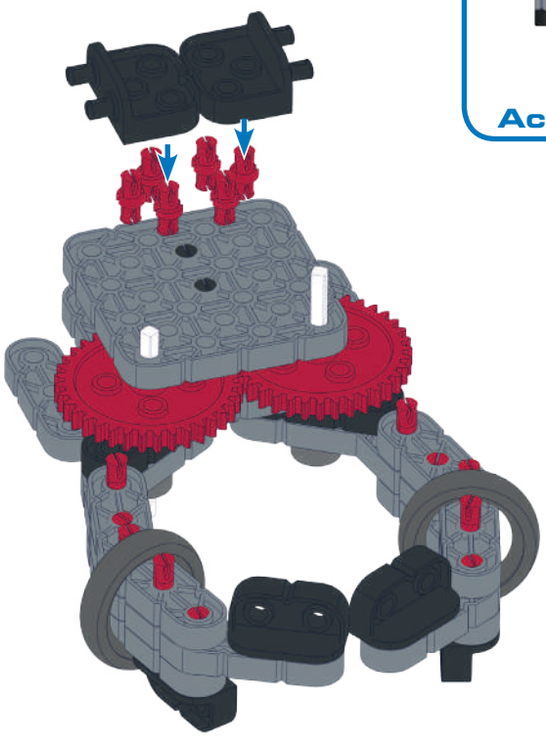
Step 42

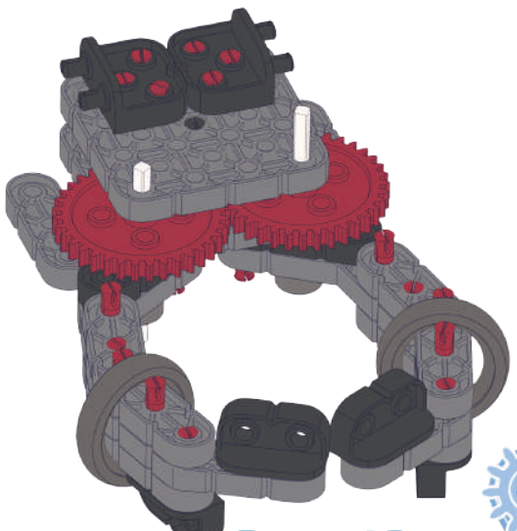

Actual Size
1x




Leave Shorter
for Motor
Clearance

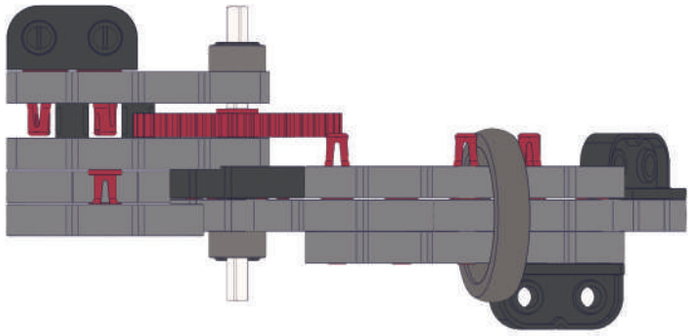

2x
6x
Actual Size

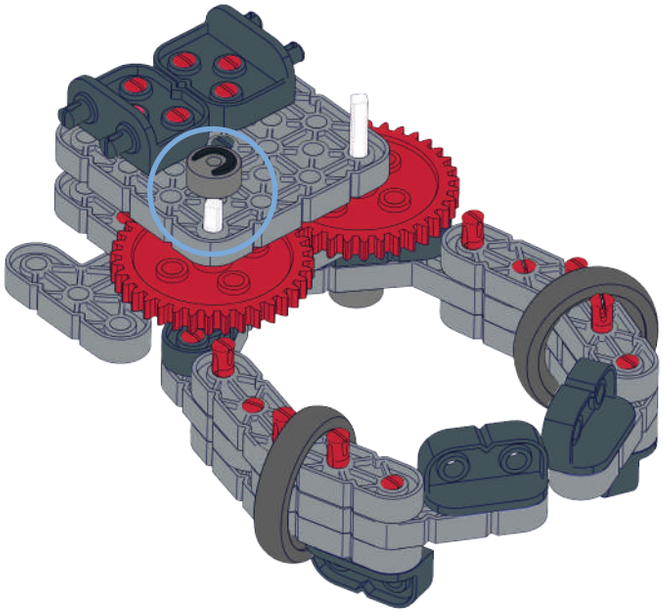


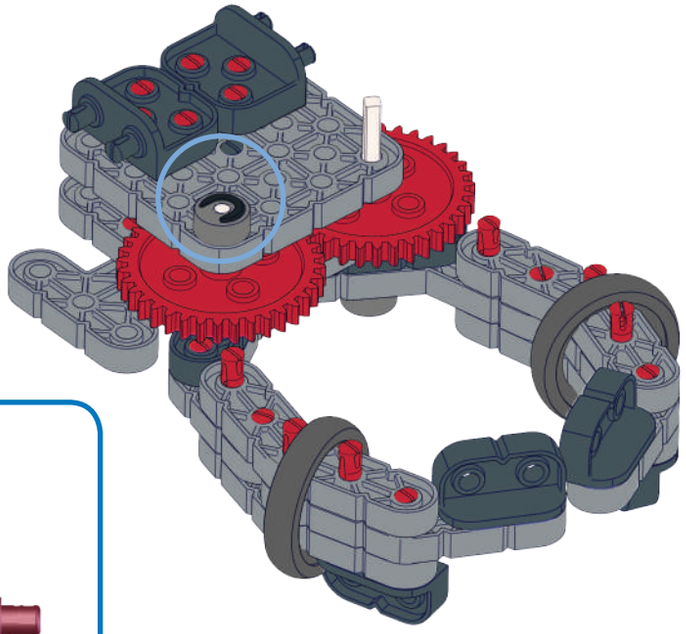


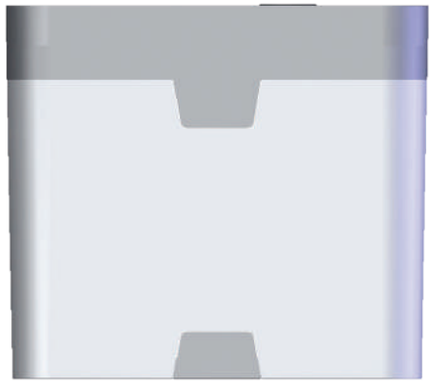
Step 43

1x
Actual Size





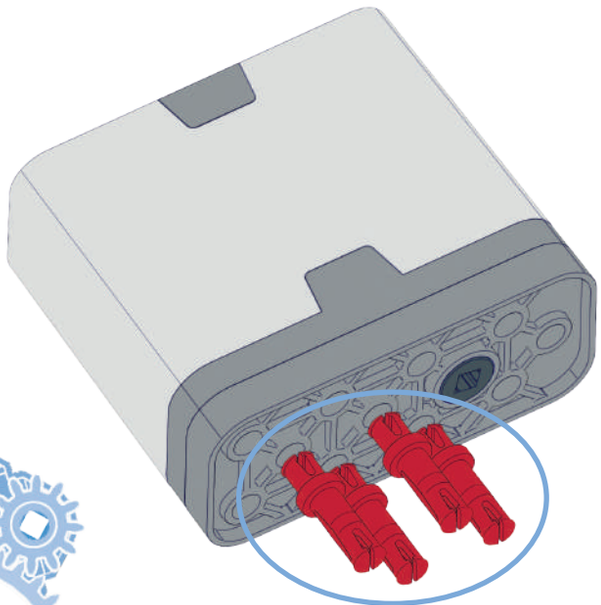


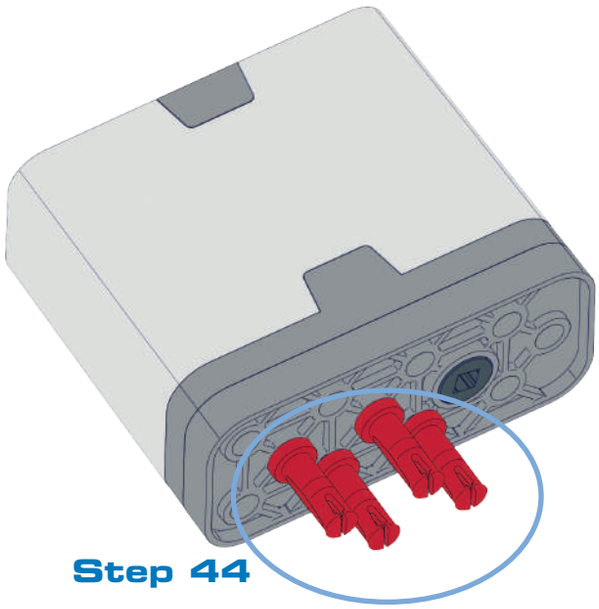


1x

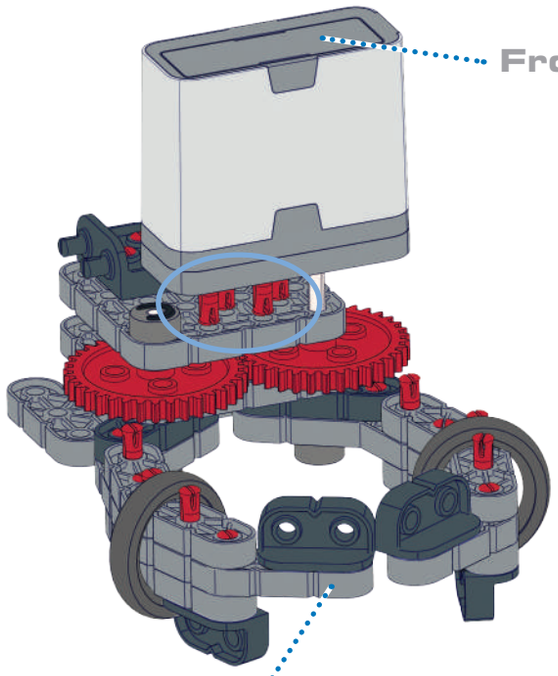
4x

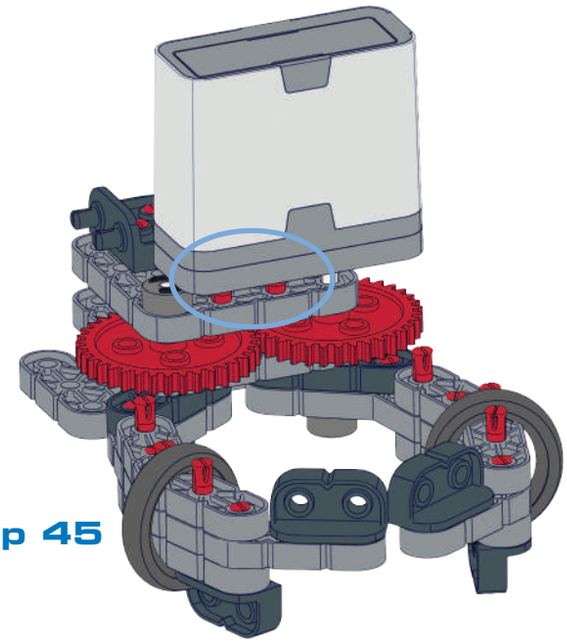
Actual Size

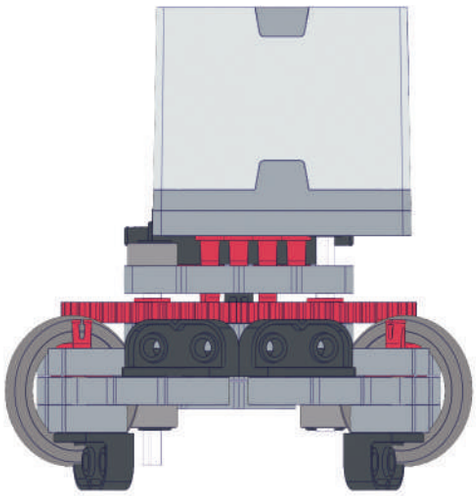




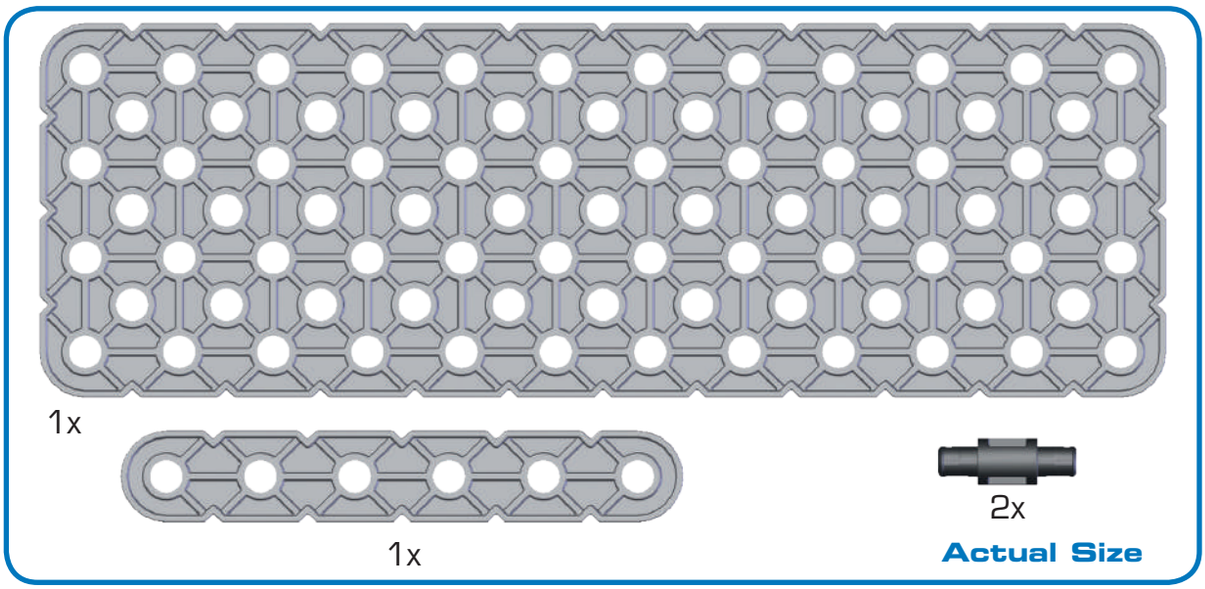
Step 44

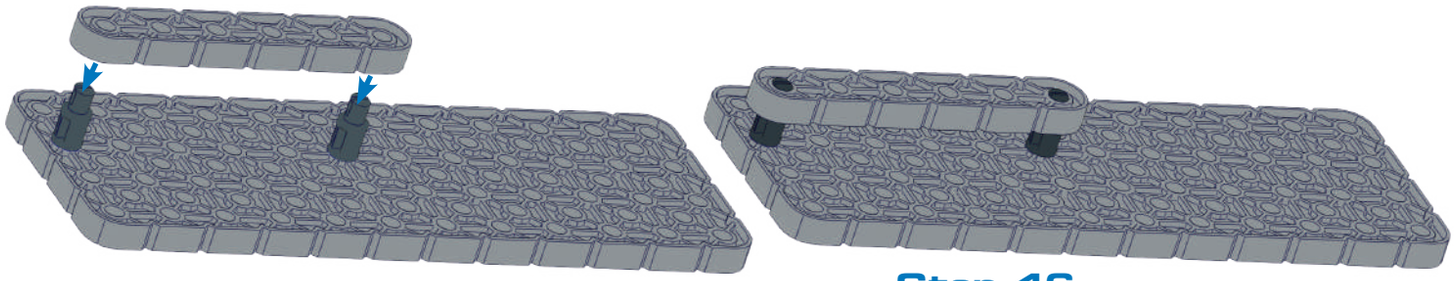

From Step 44
From Step 43


Step 45

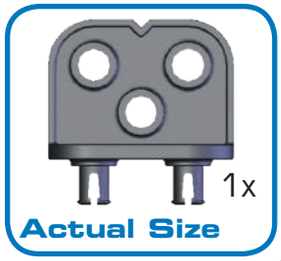


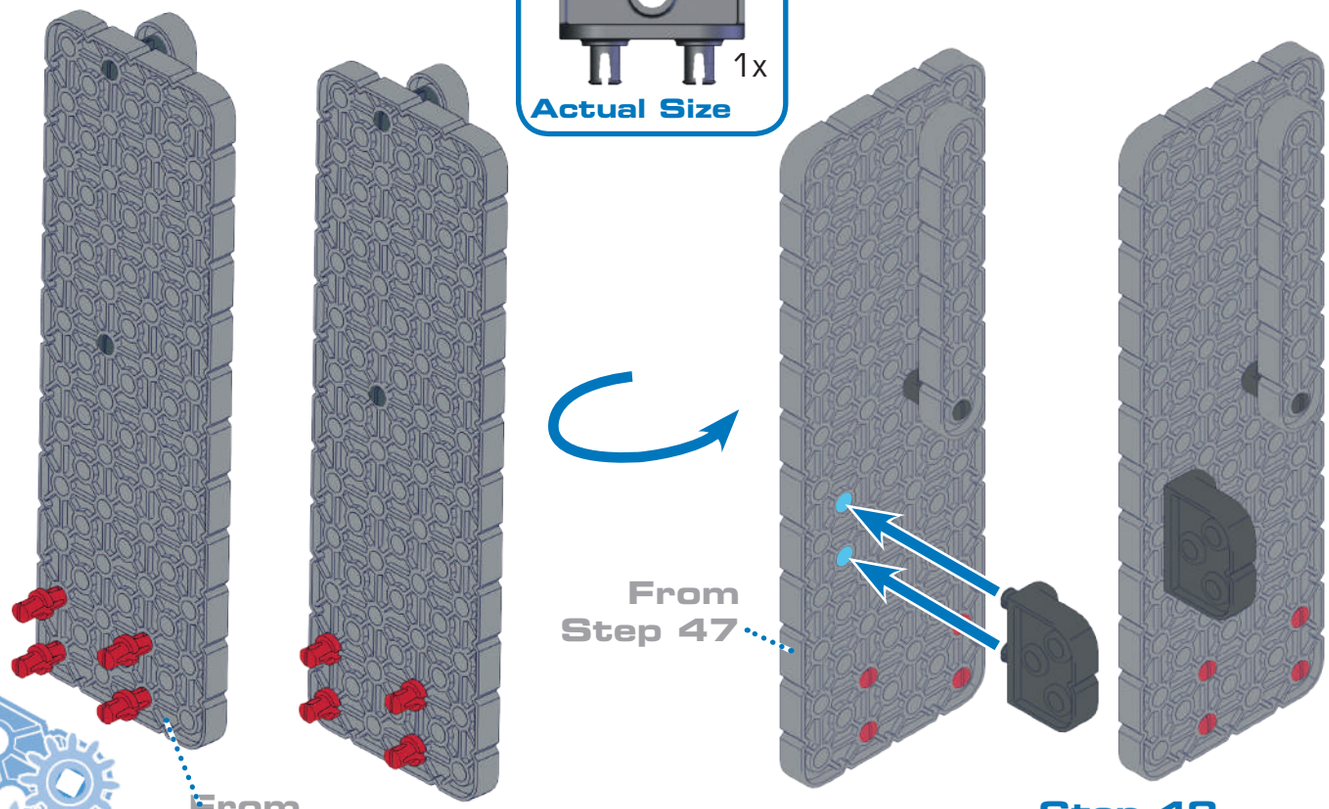
Part 3 Tower





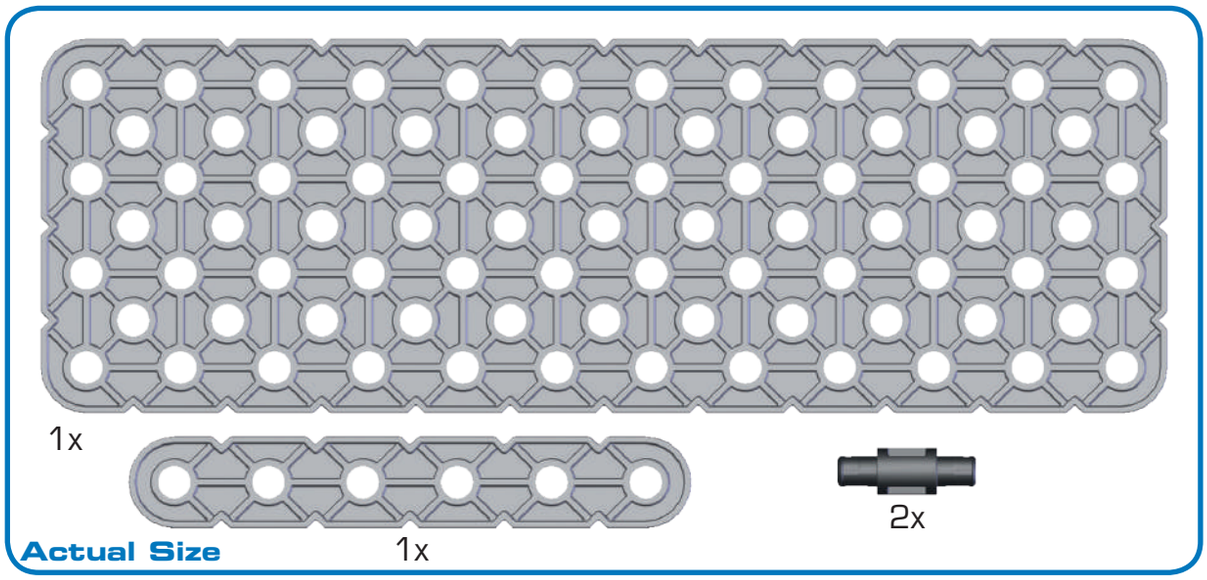
Step 46

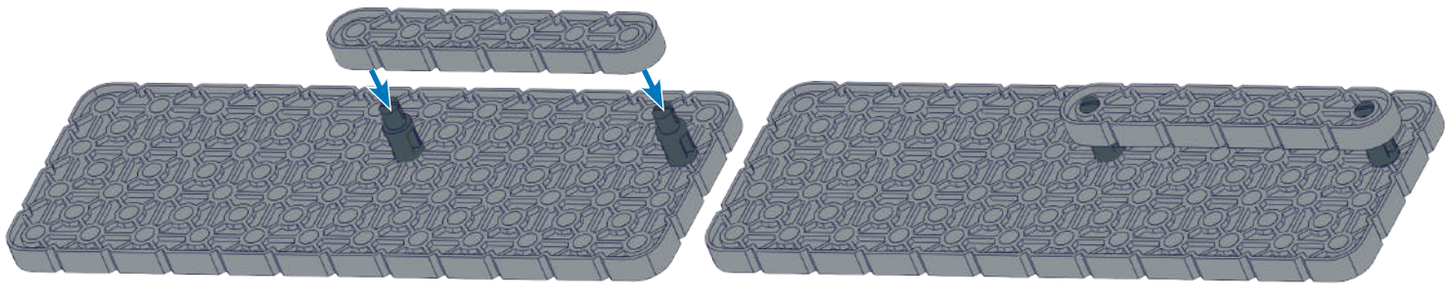




Step 47

Step 48





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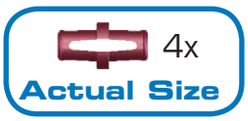
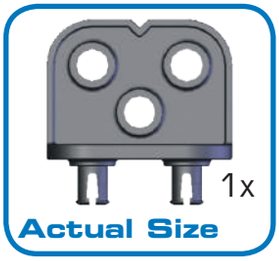
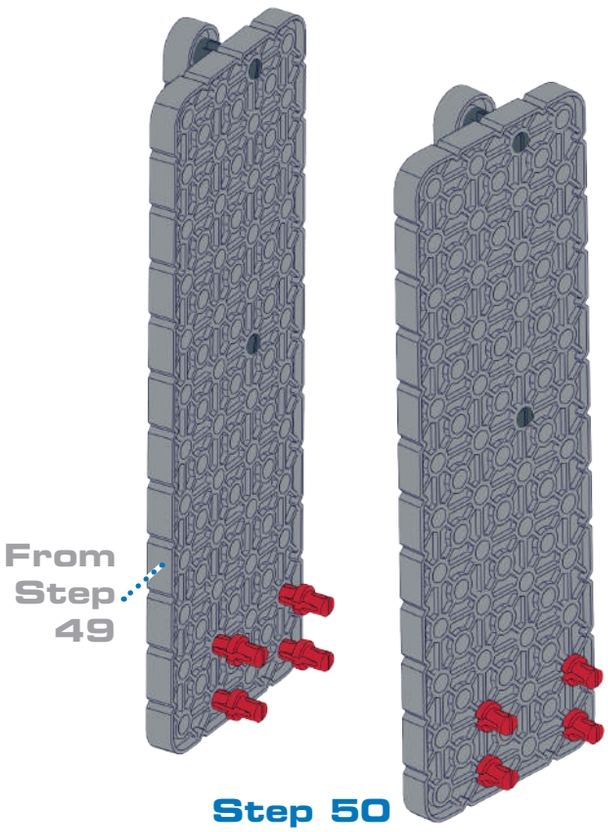
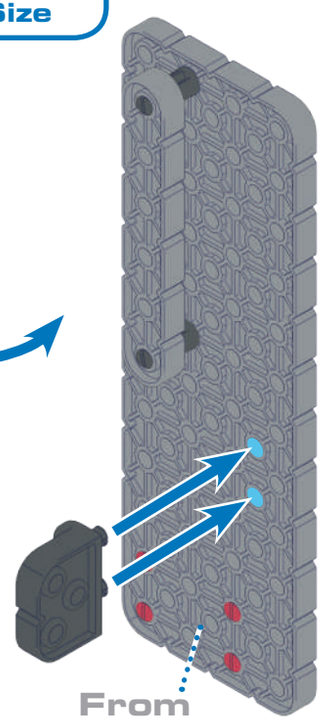
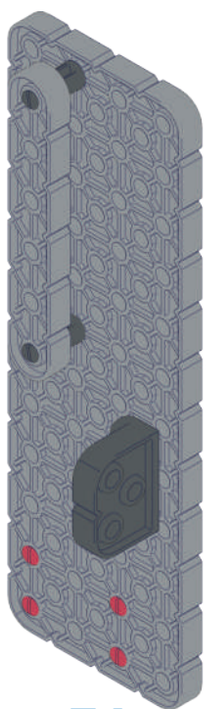




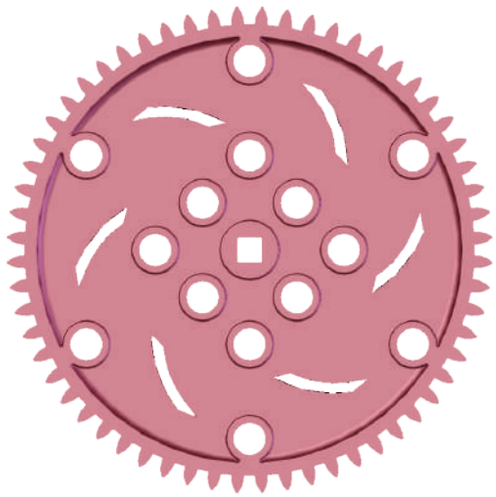


Step 50





Step 51

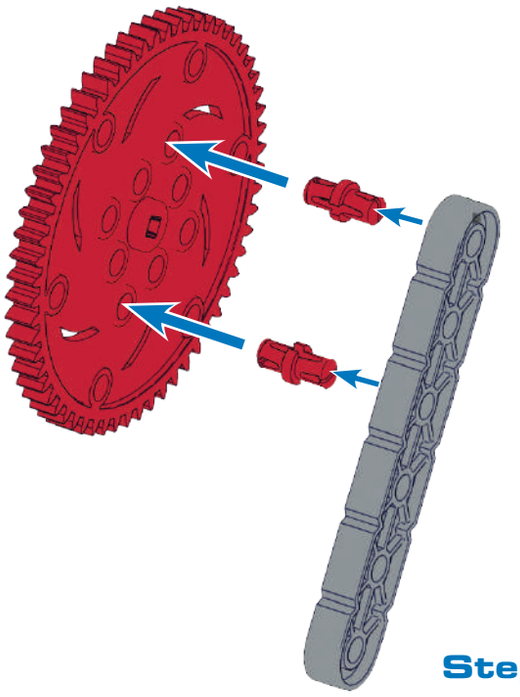


1x

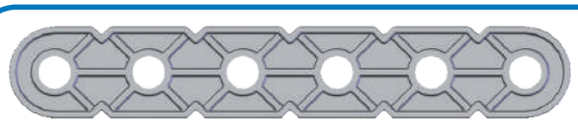
1x

2x

Actual Size



Step 52

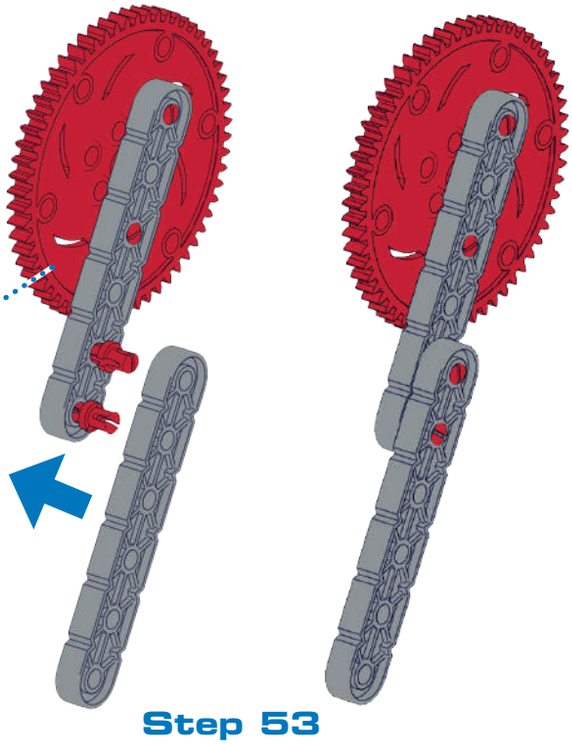


Actual Size

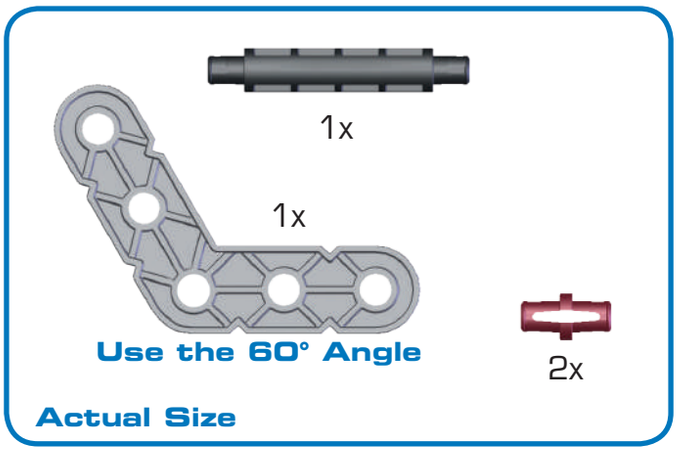
1x

2x

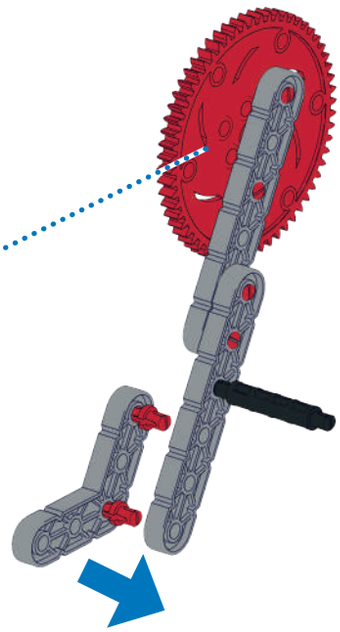
From Step 52



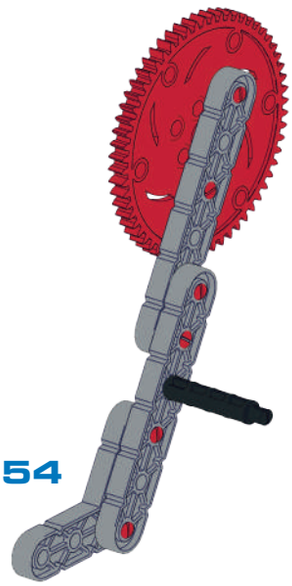
Step 53

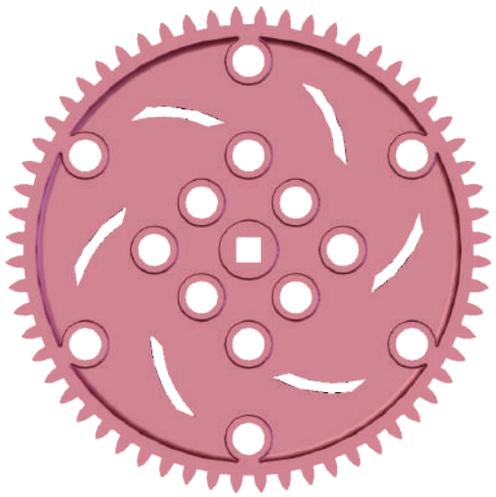


From Step 53



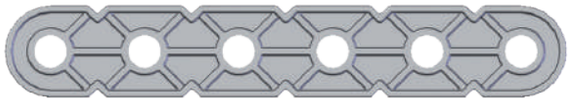
Step 54





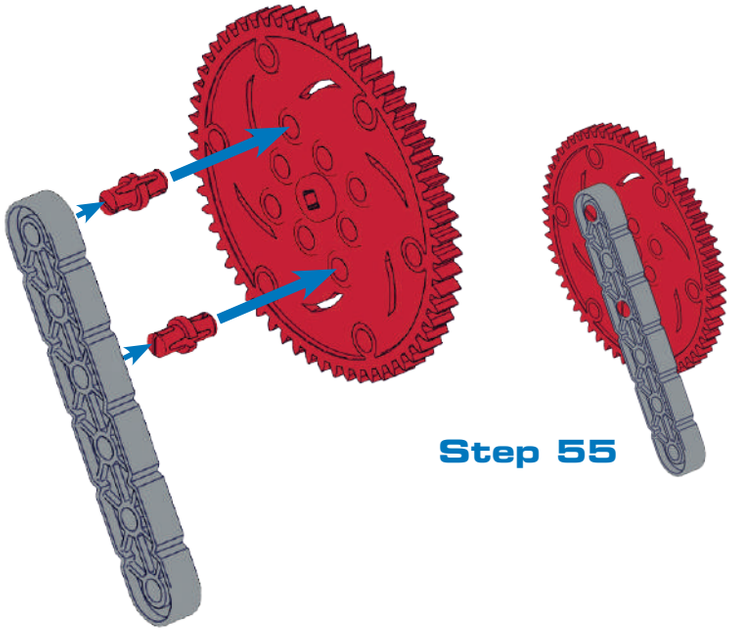
1x

2x

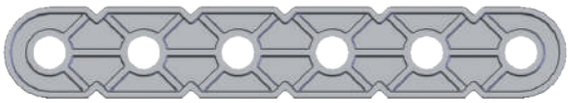


1x

Actual Size



Step 55

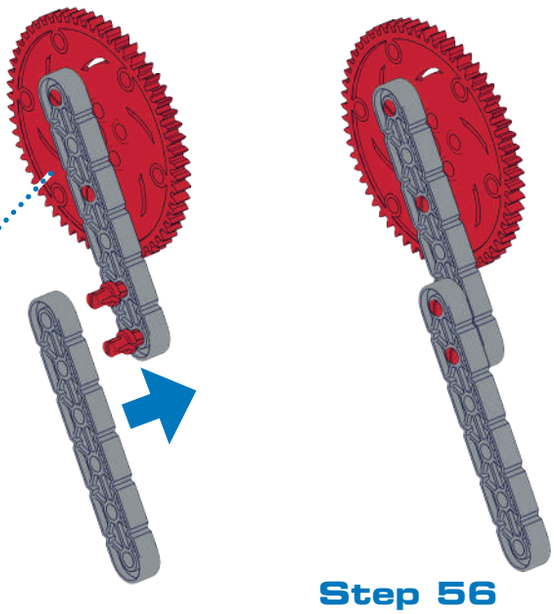


Actual Size

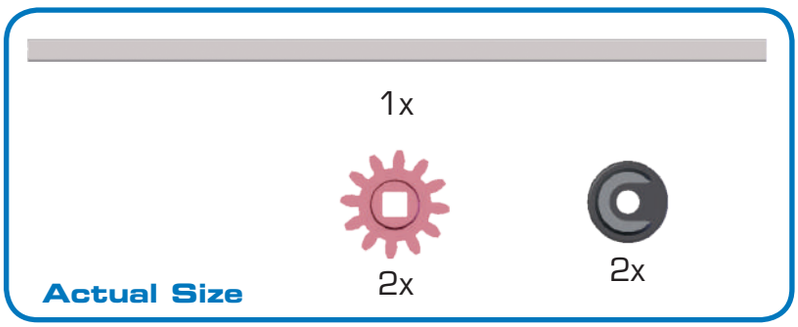
1x

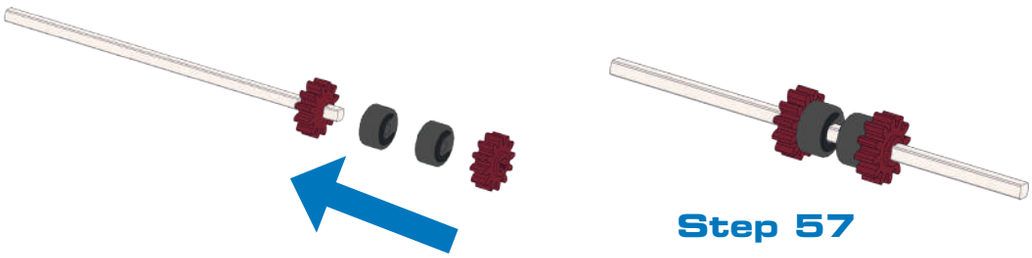
2x

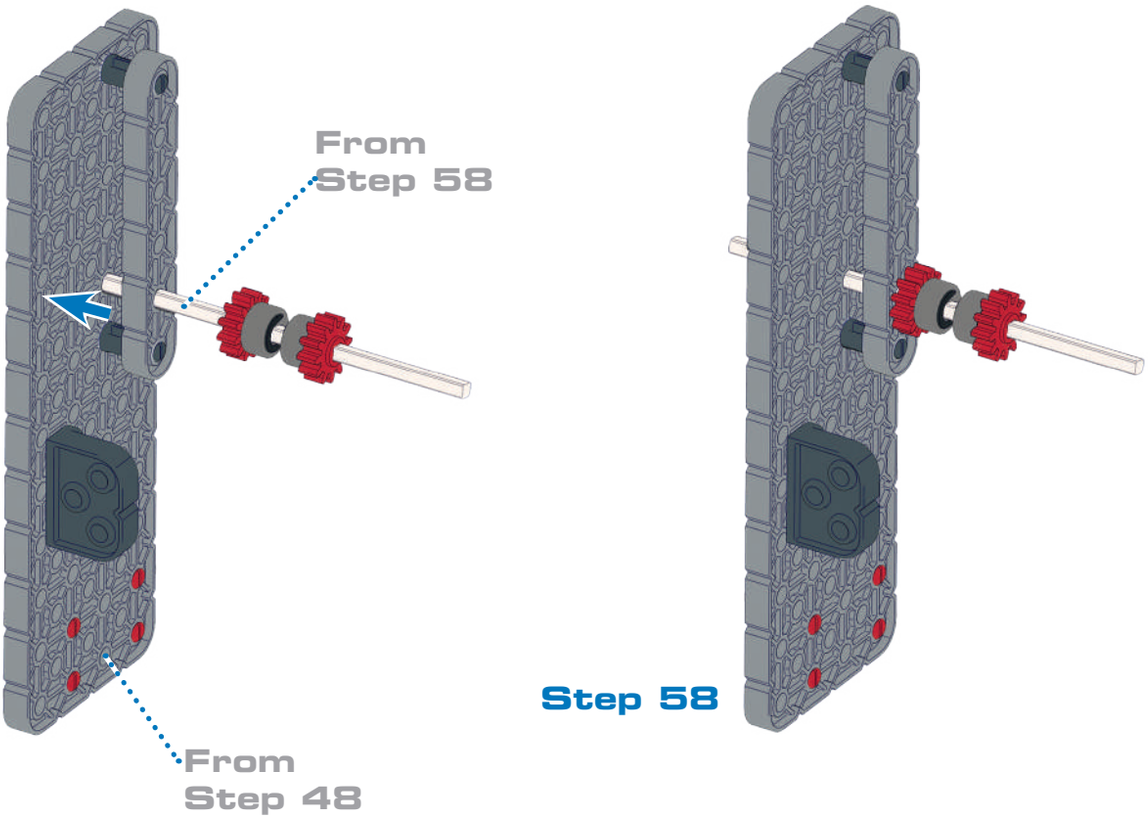
From Step 55

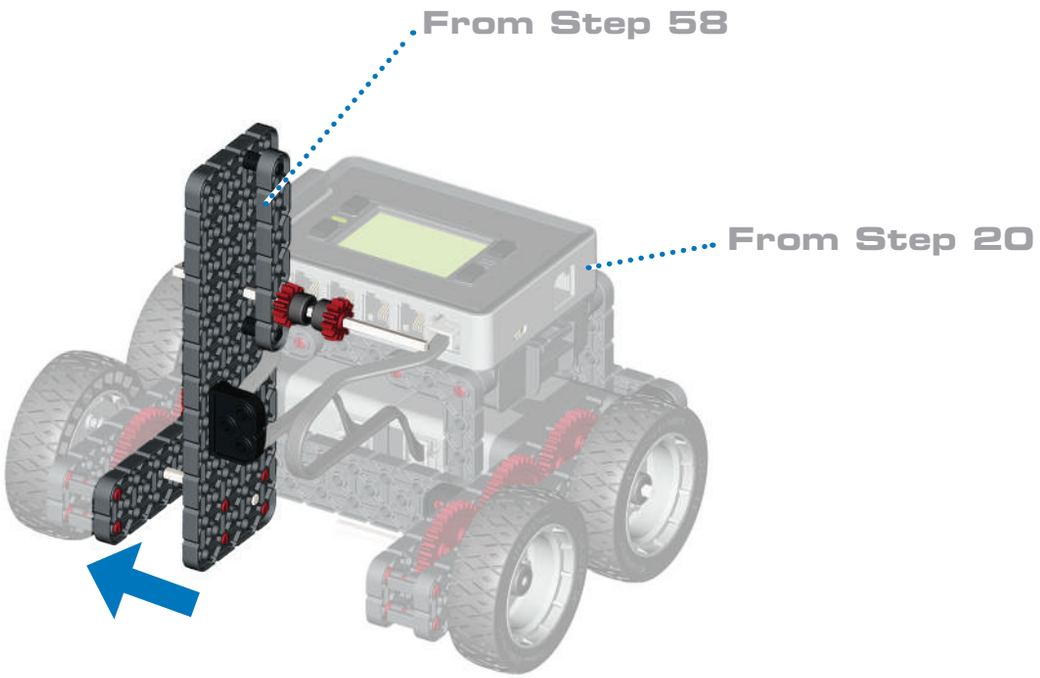


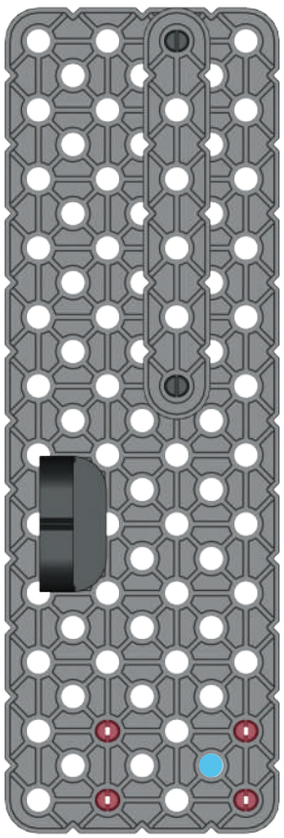
Step 56

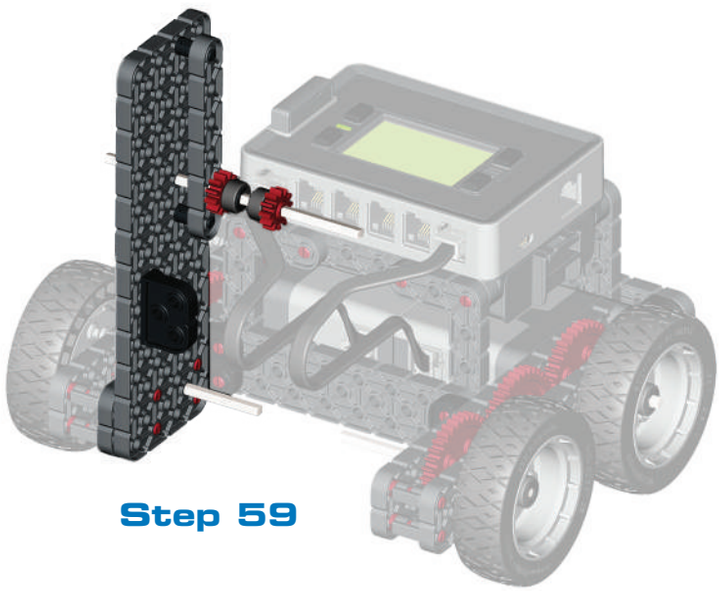

1x
2x
2x
Actual Size


Step 57

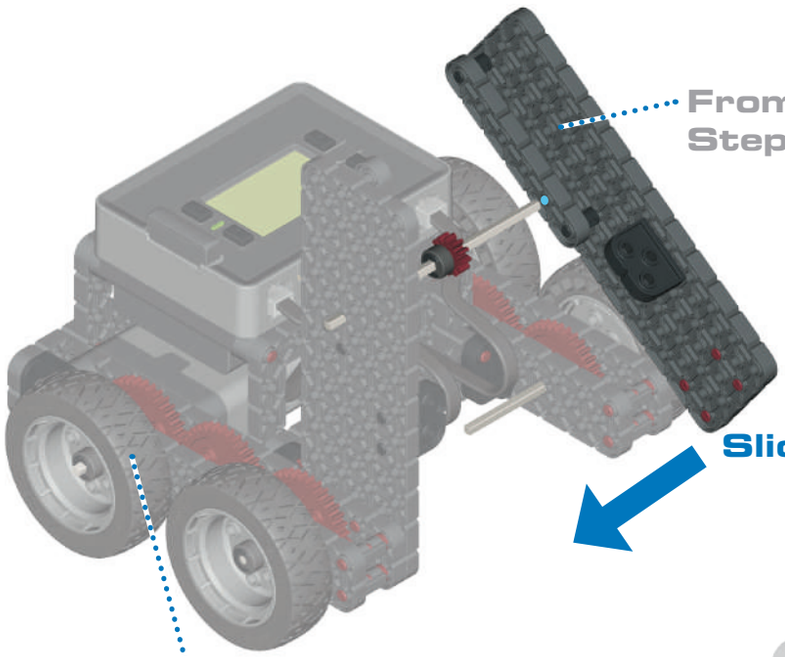

From
Step 58
From
Step 48
Step 58



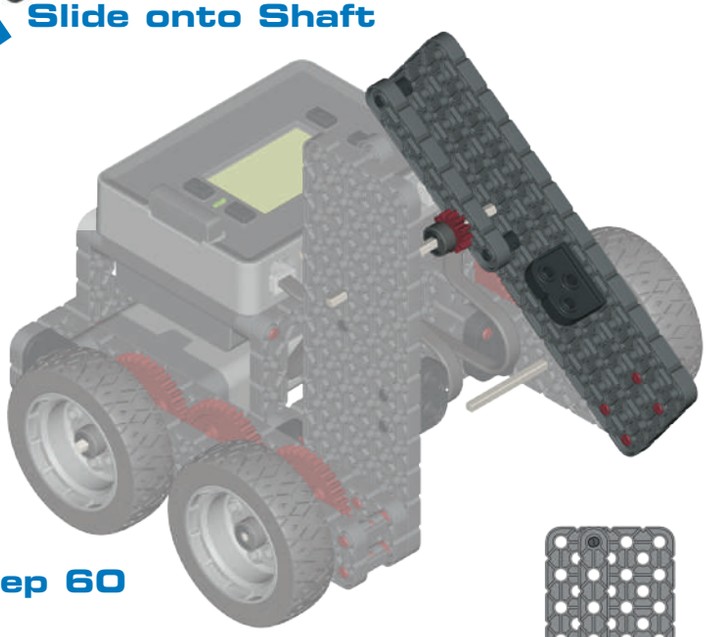




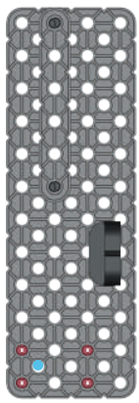
Step 59

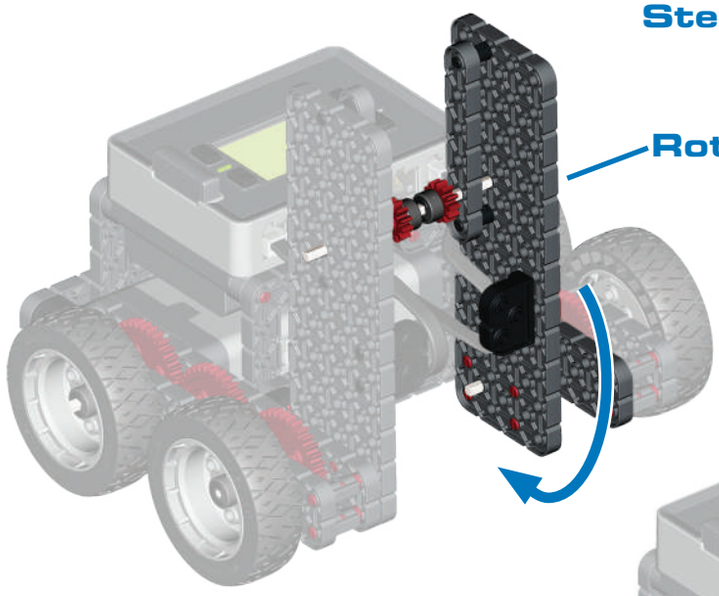


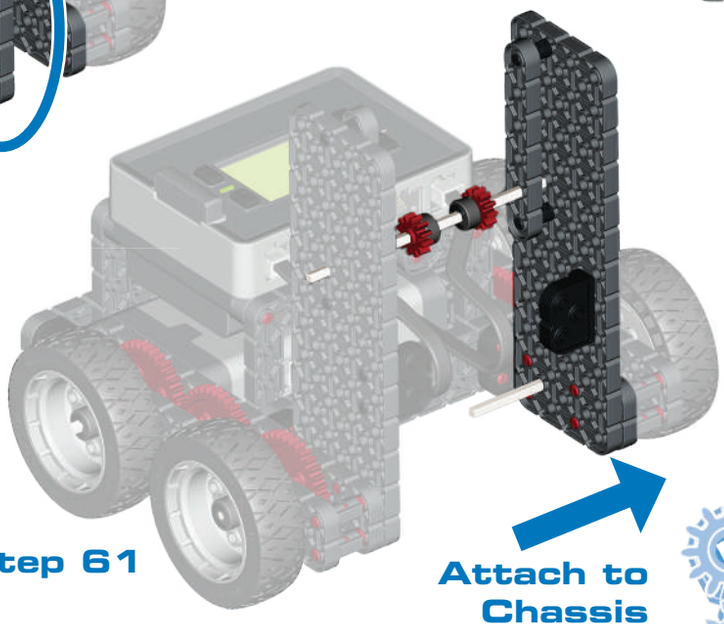
Slide onto Shaft

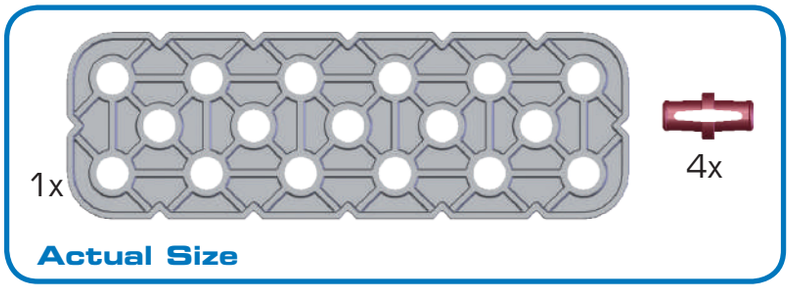


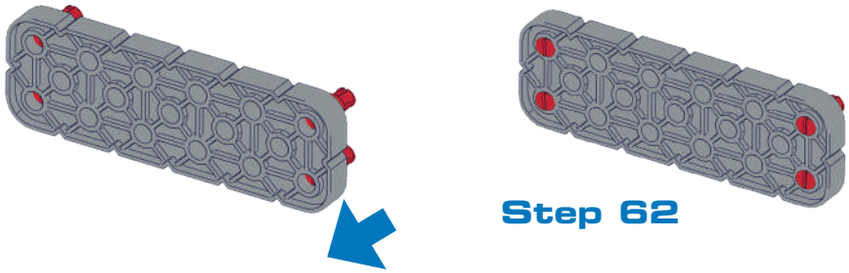
Step 60







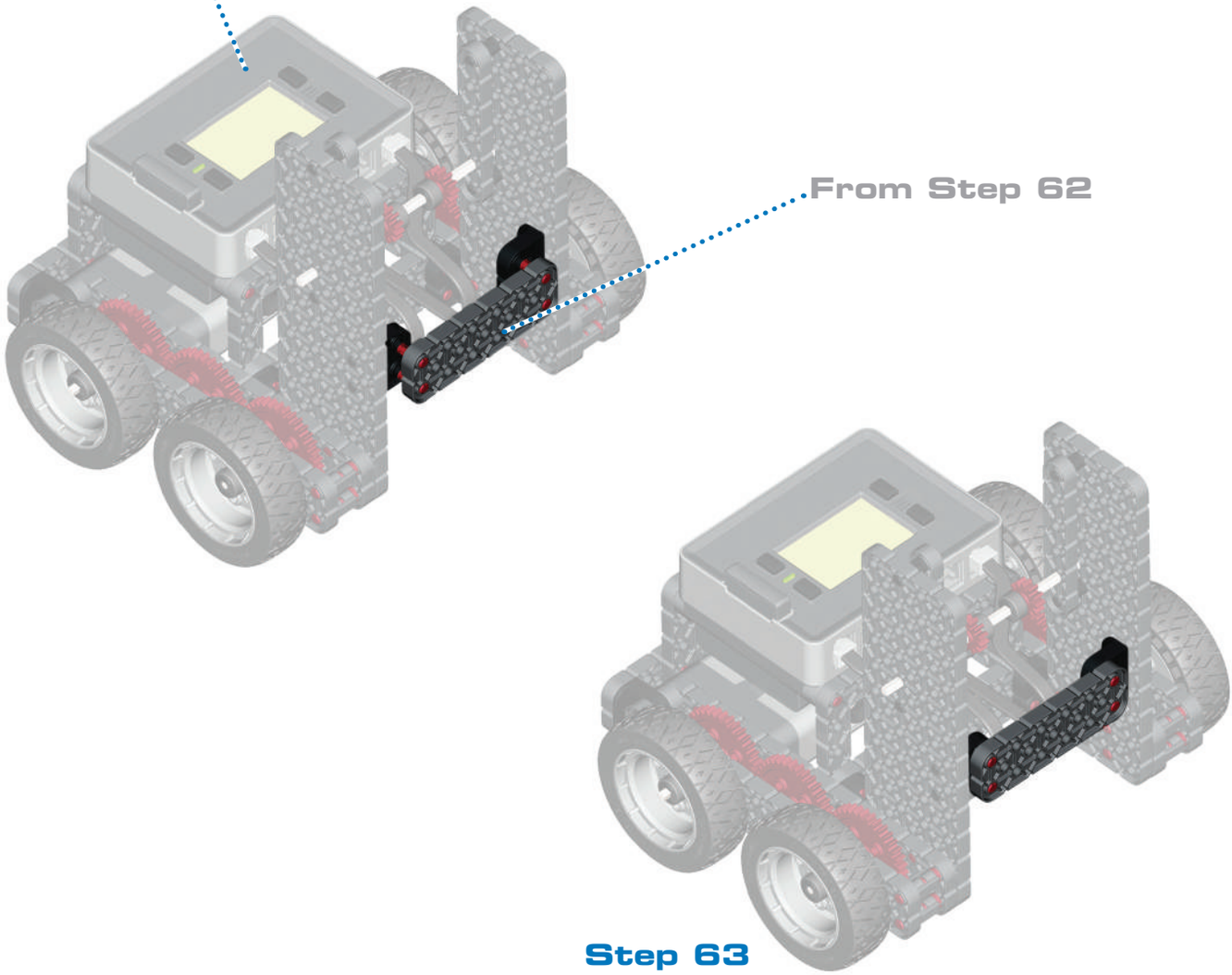




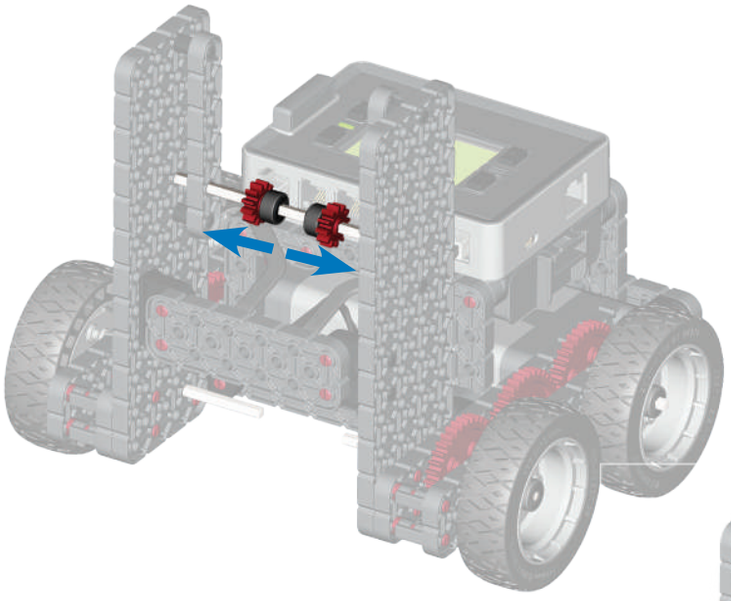
Step 62

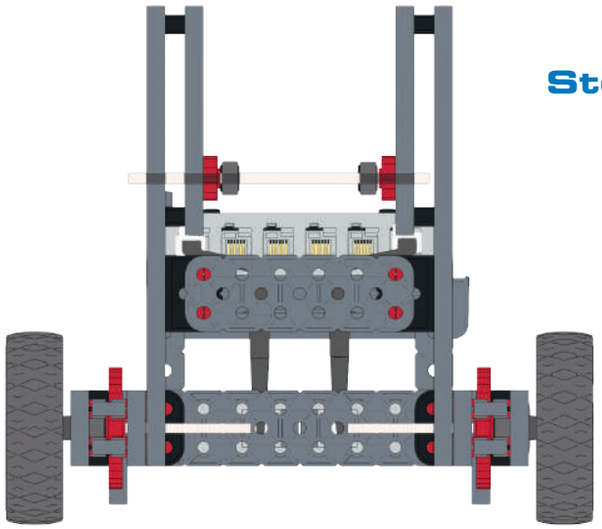
From Step 61

From Step 62

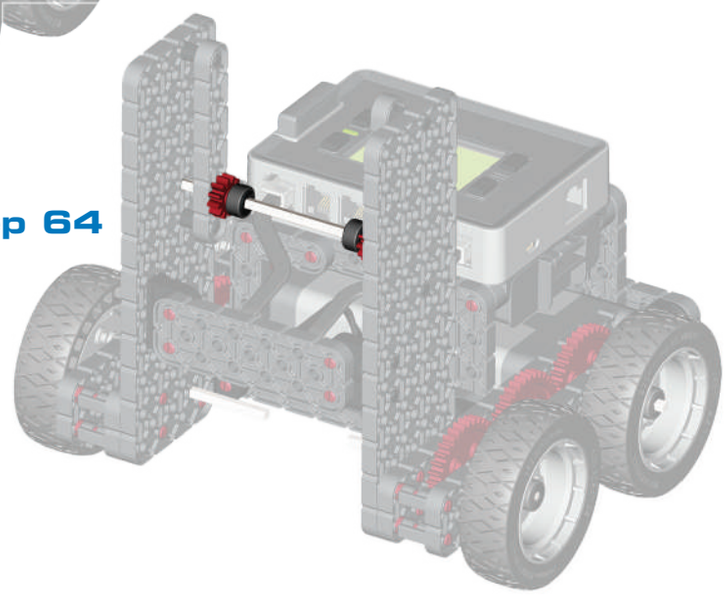


Step 63



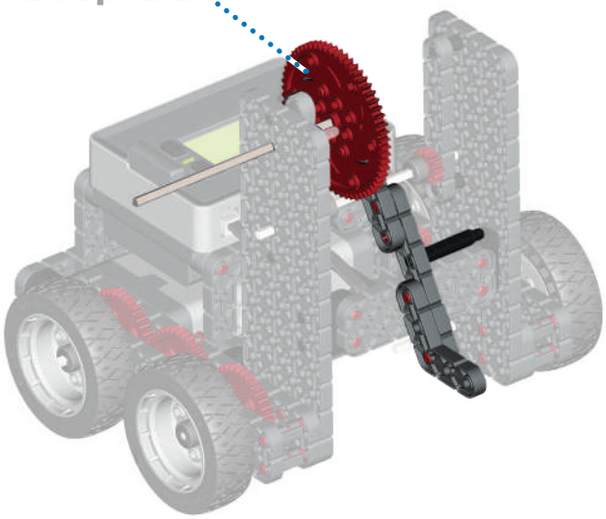


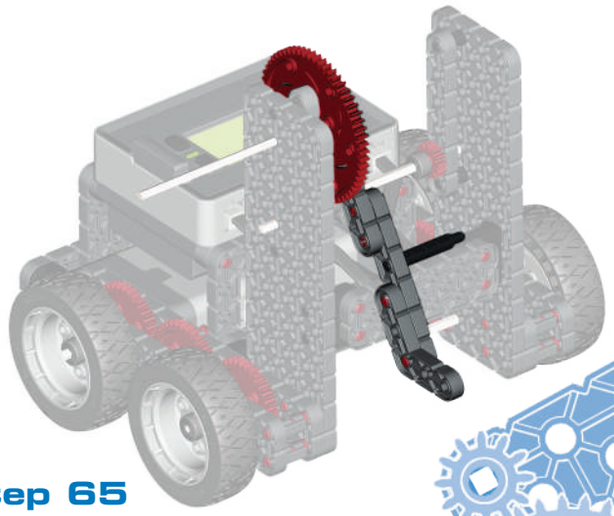
Step 64



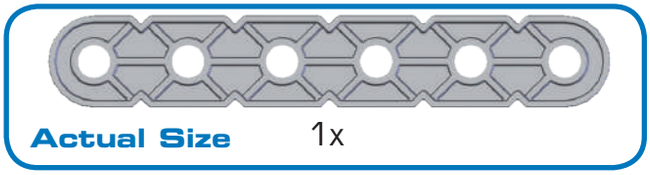
Actual Size 1x

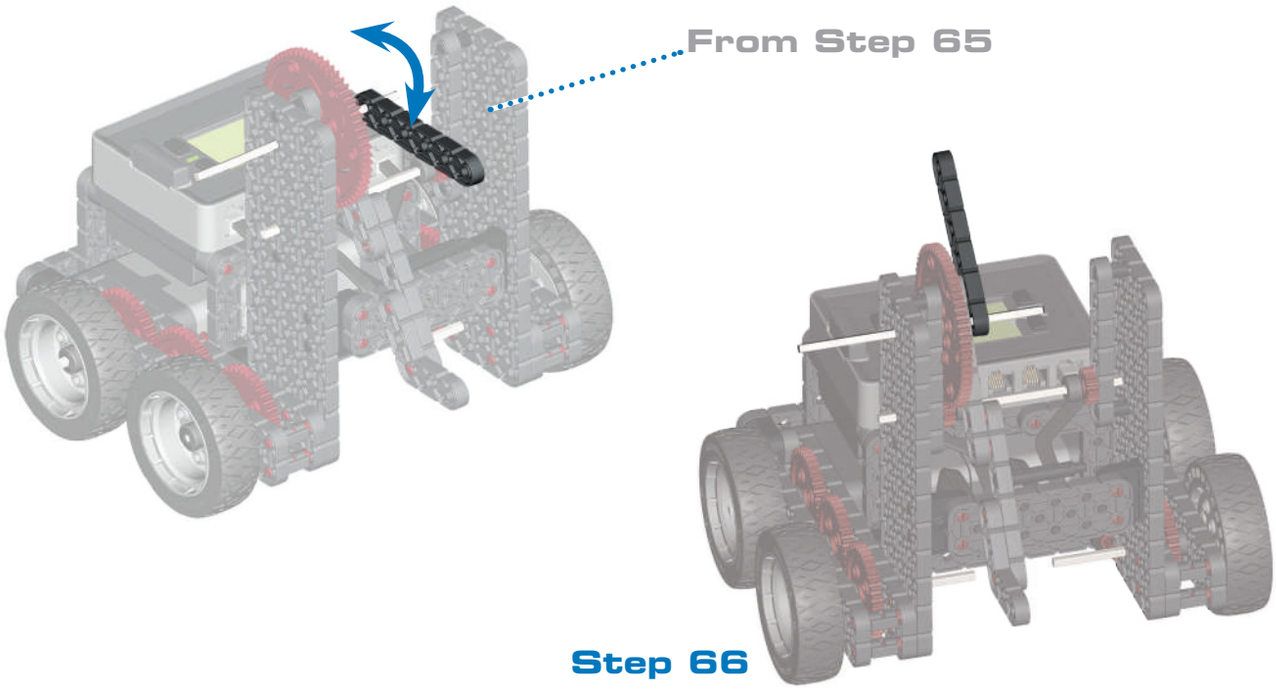
From Step 56



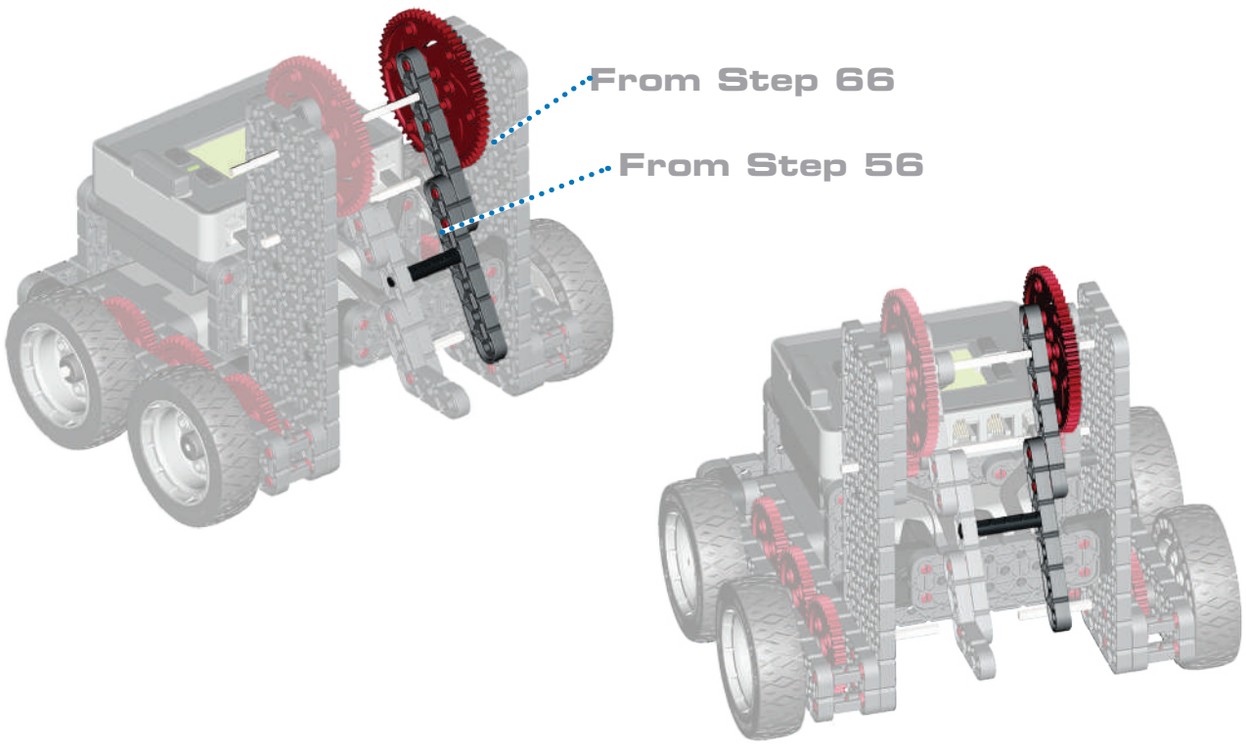


Step 65

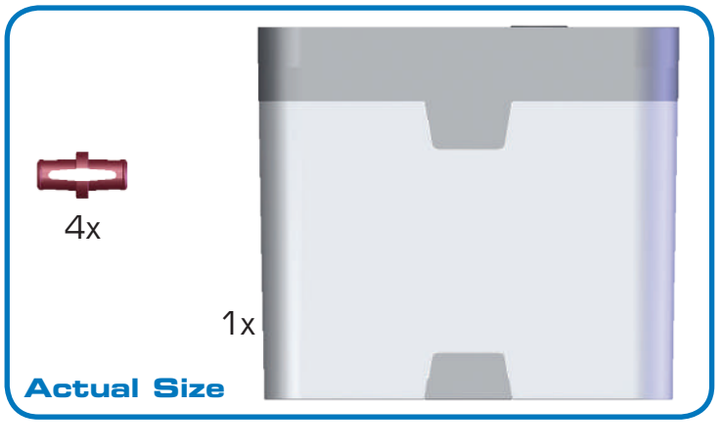


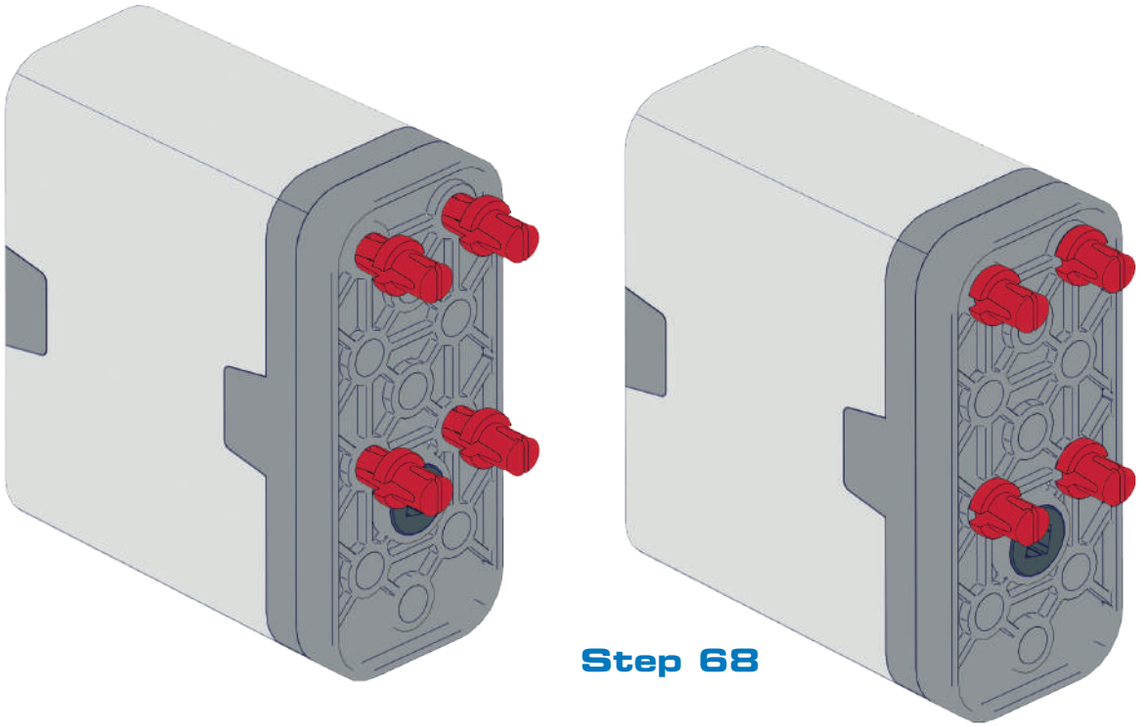


Step 66



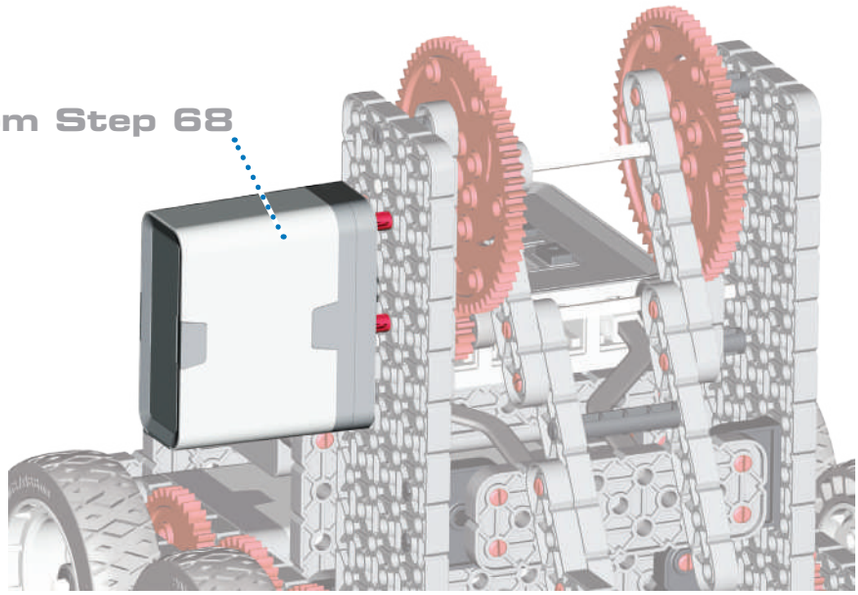
Step 67

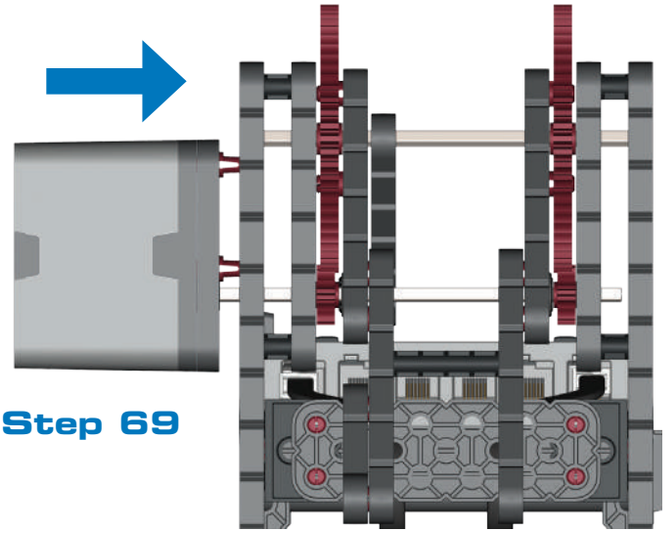




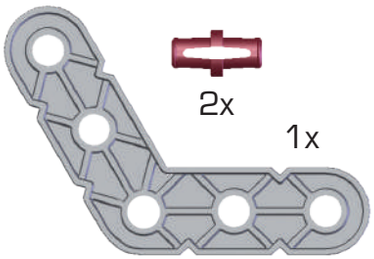
Step 68

From Step 68



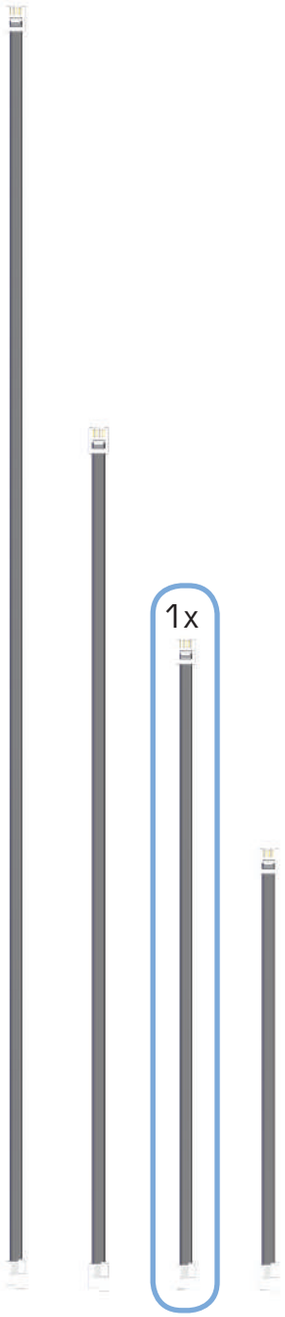


Step 69

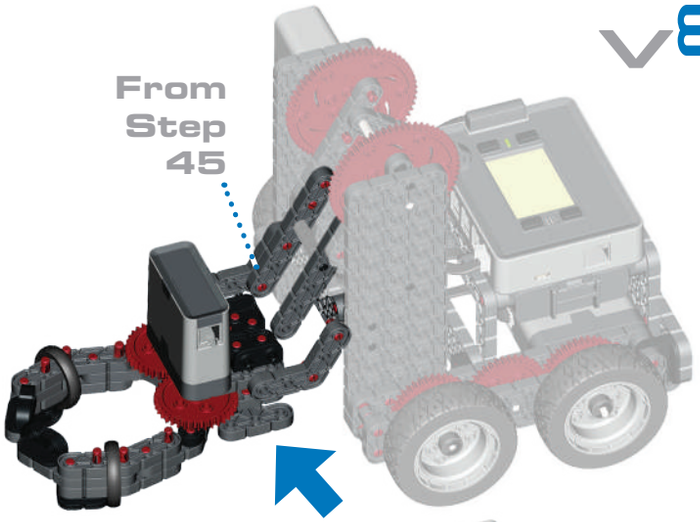


Use the 60° Angle

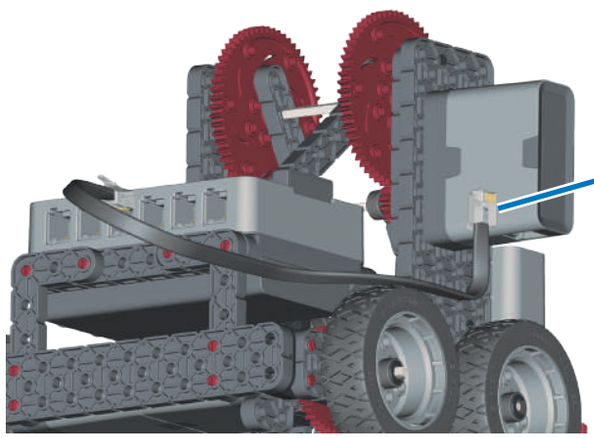
Actual Size

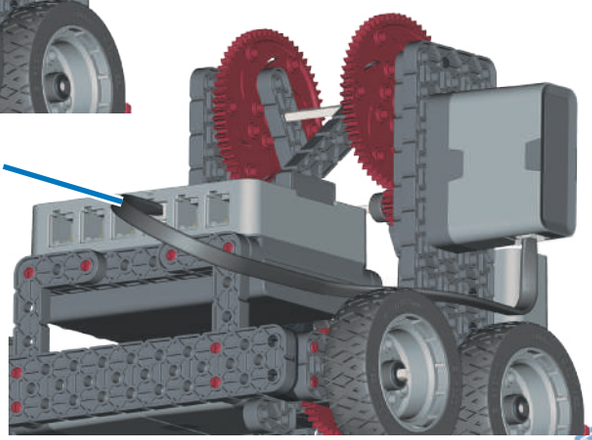


Not Actual Size

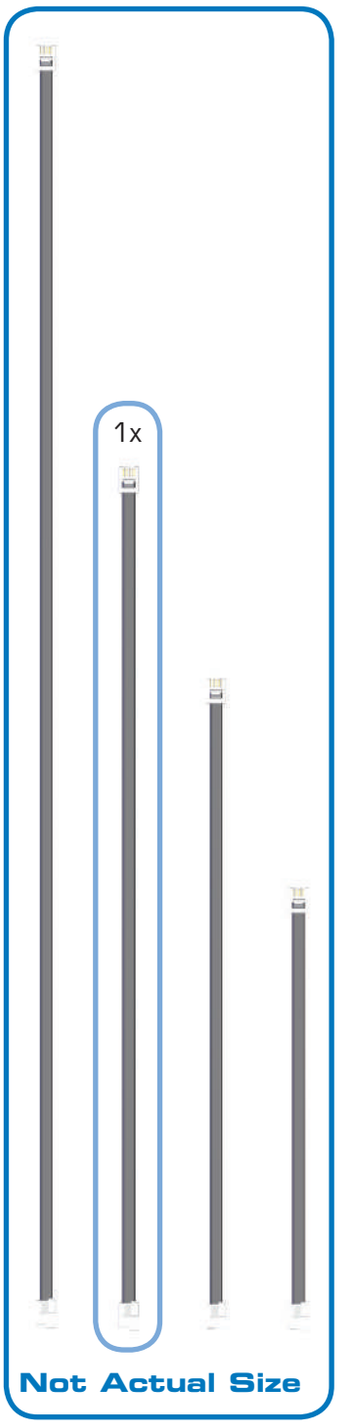


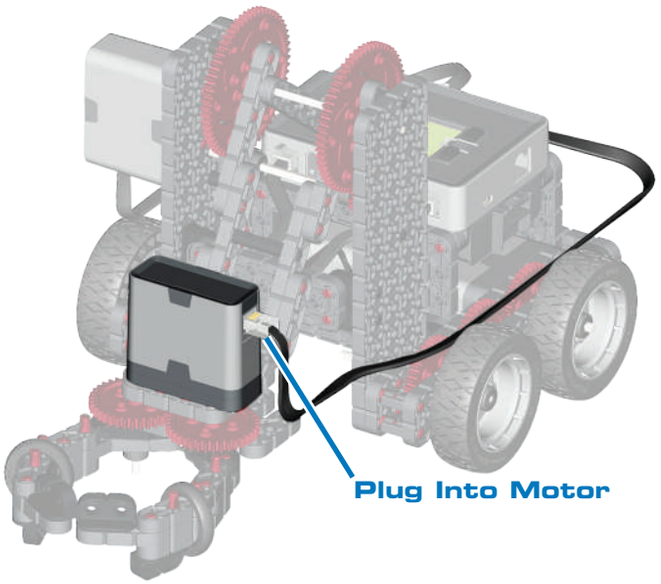
Step 70





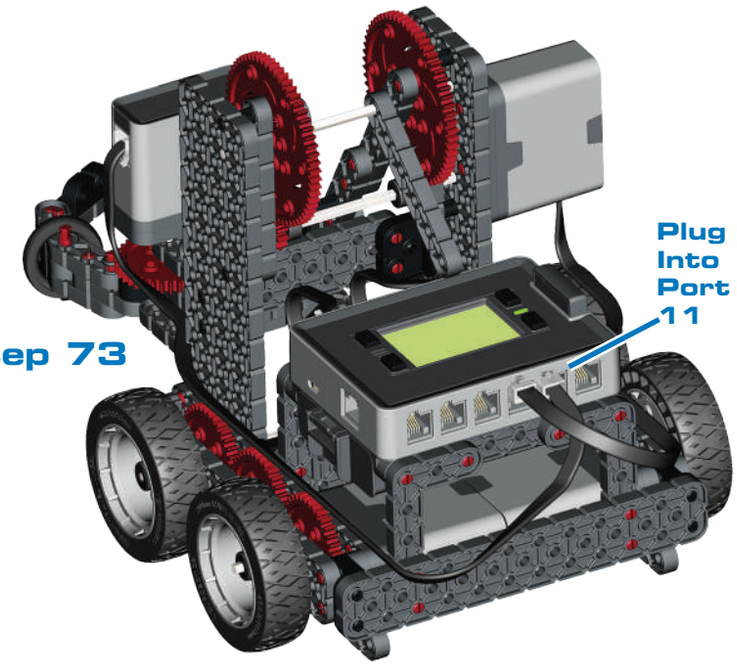
Step 71

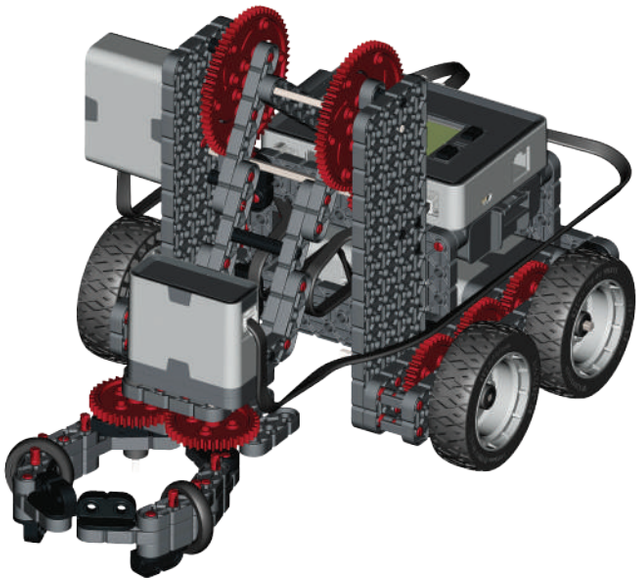


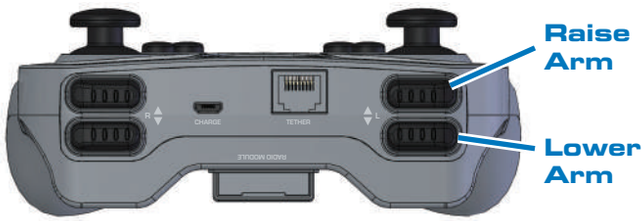


Step 72

Step 73

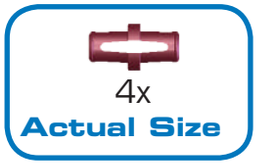


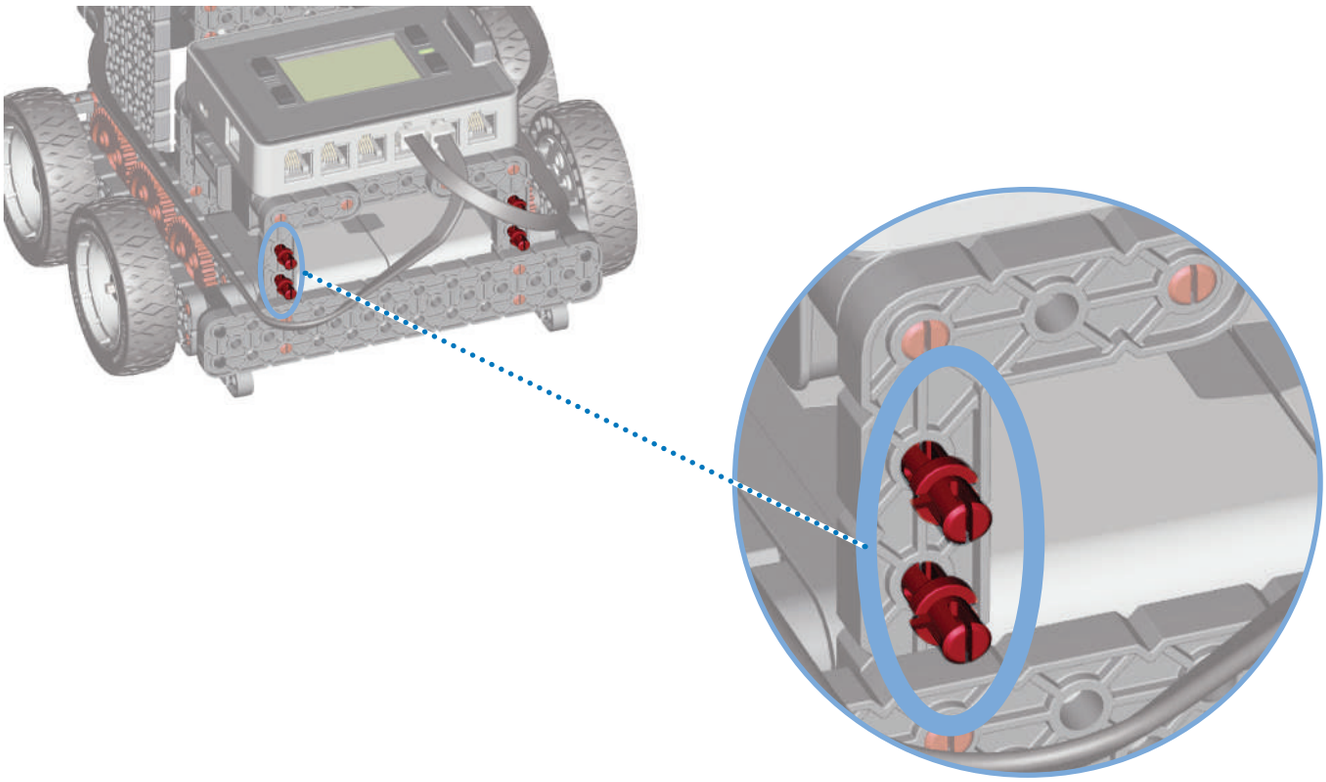




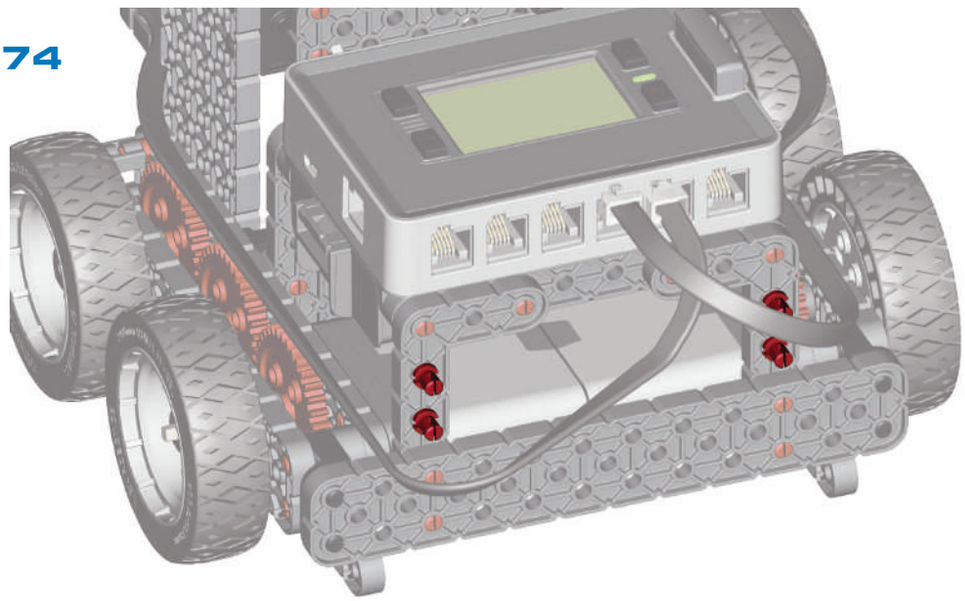
Robot Claw is now Ready to Run!

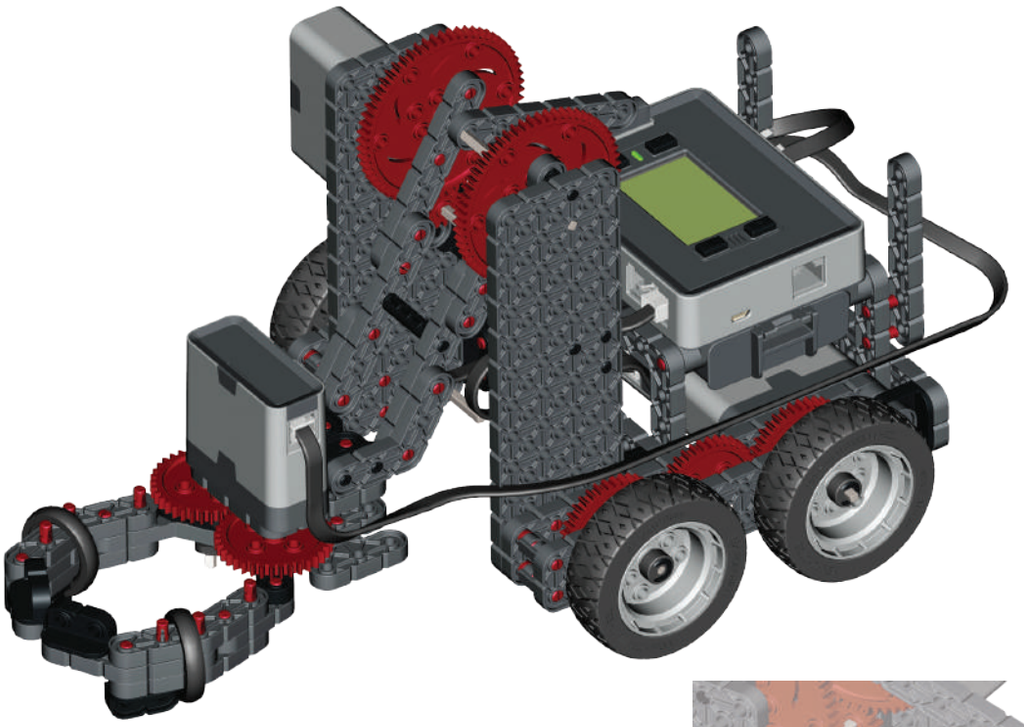
Part 4 Ball Holder

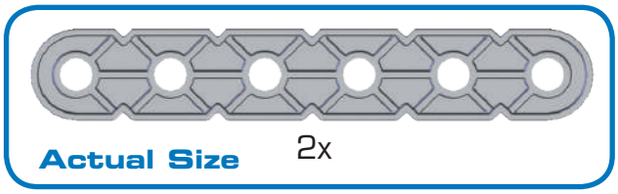


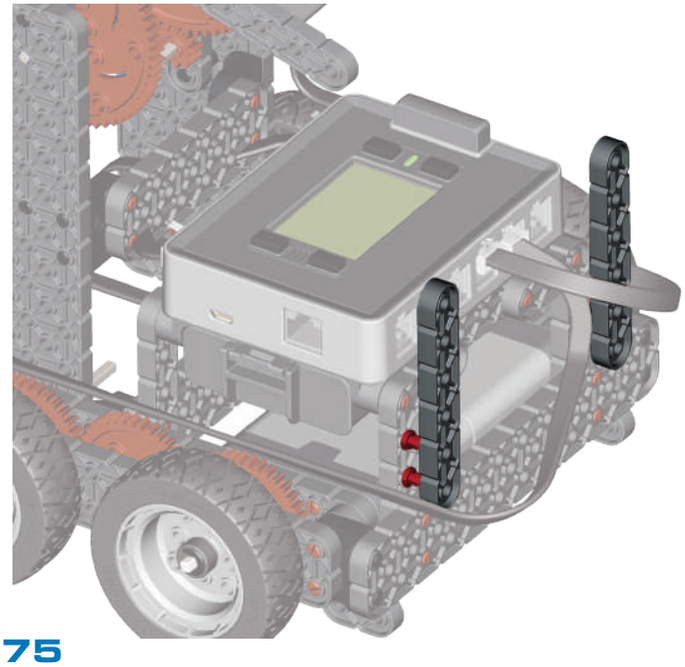


Step 74

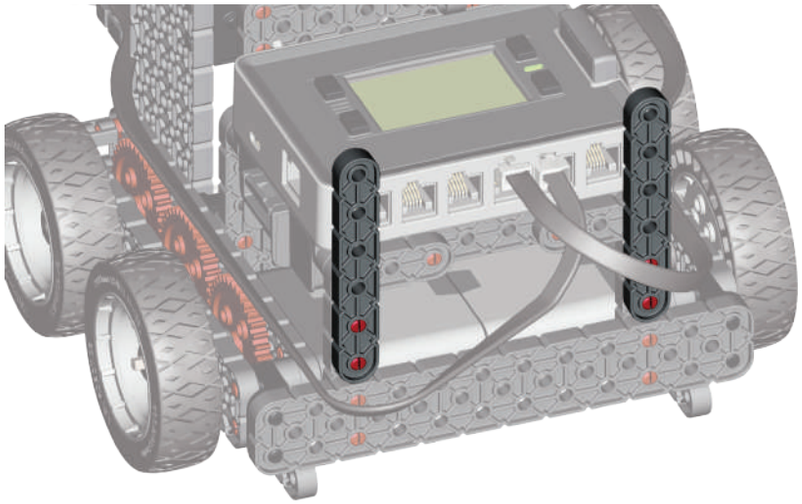


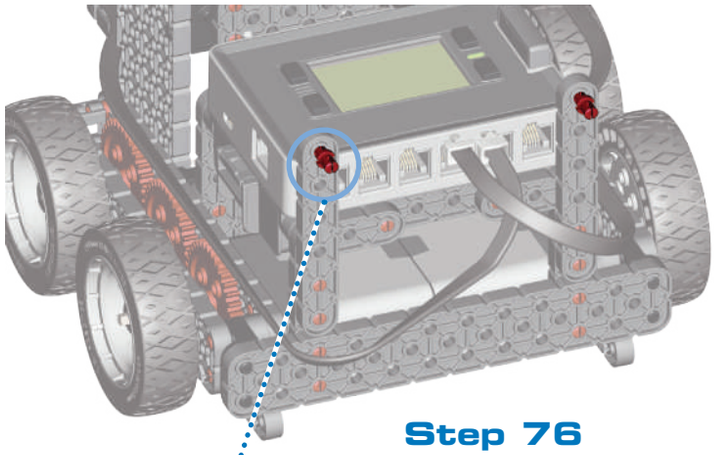


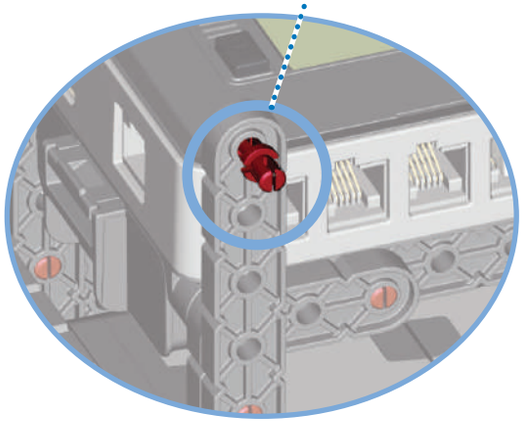




Step 75



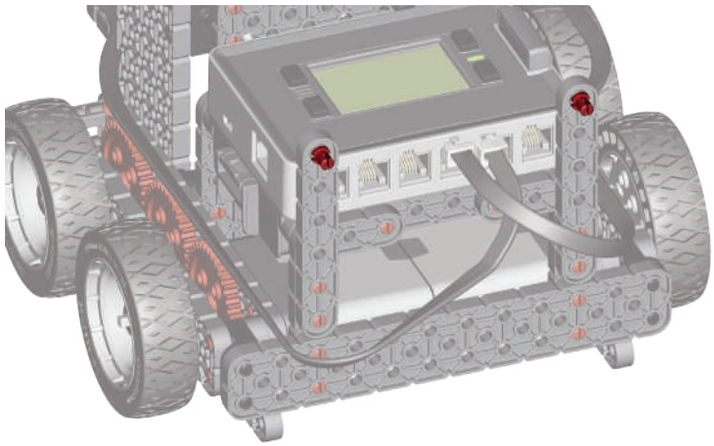


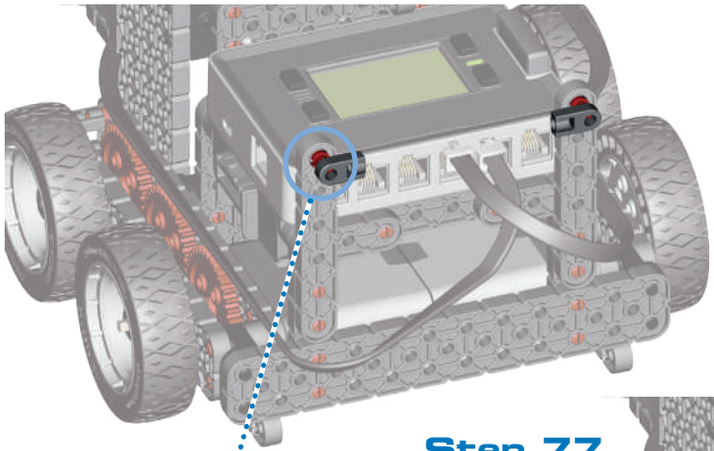


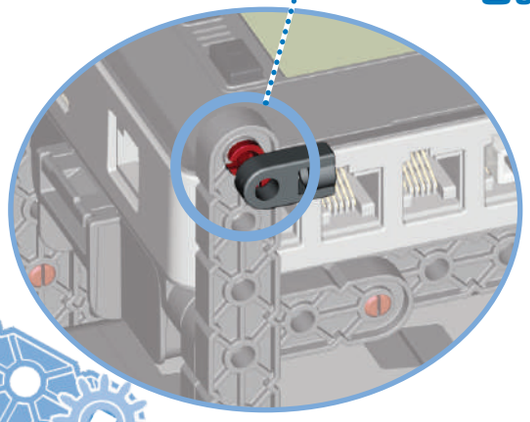
2x

Actual Size

Step 76



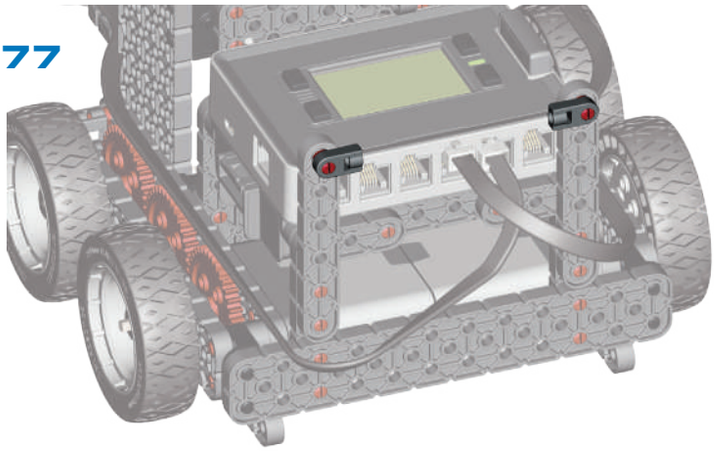


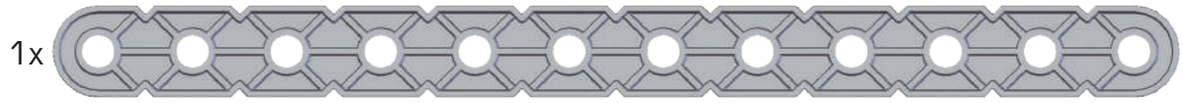


2x

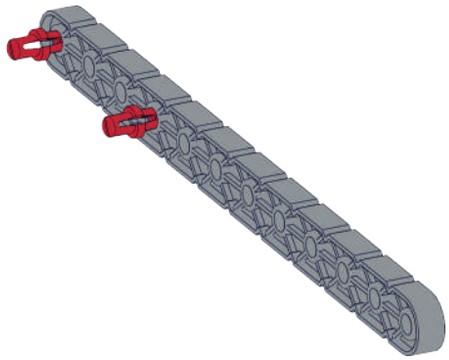
Actual Size

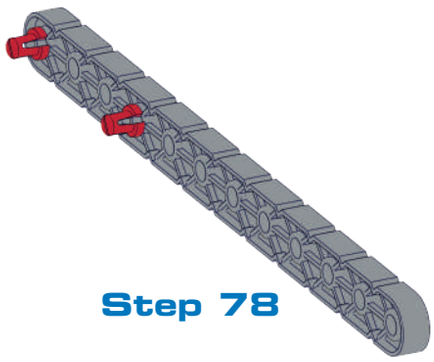
Step 77



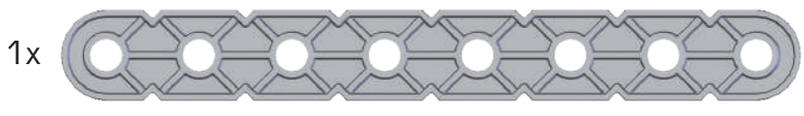


Actual Size

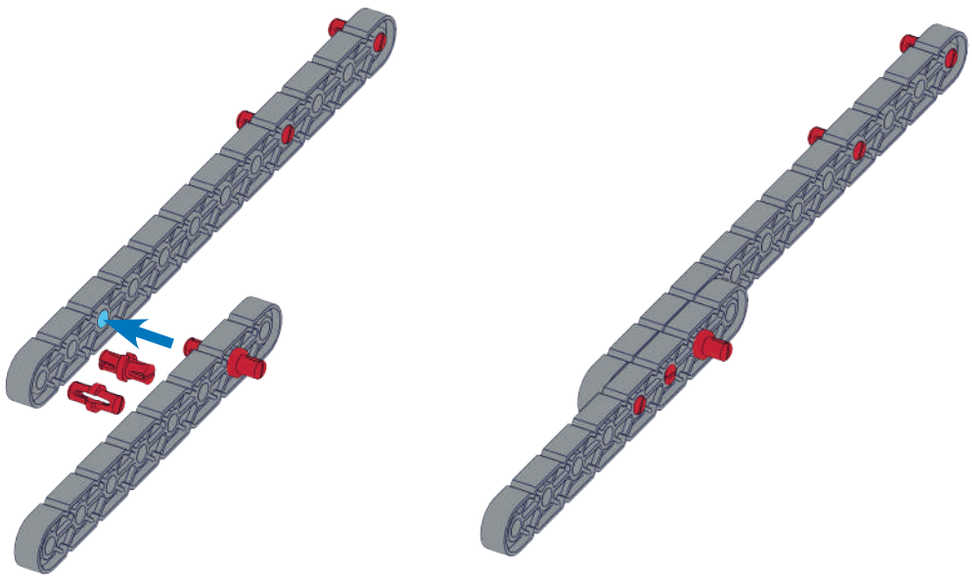




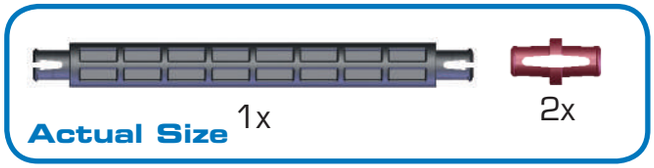
Step 78

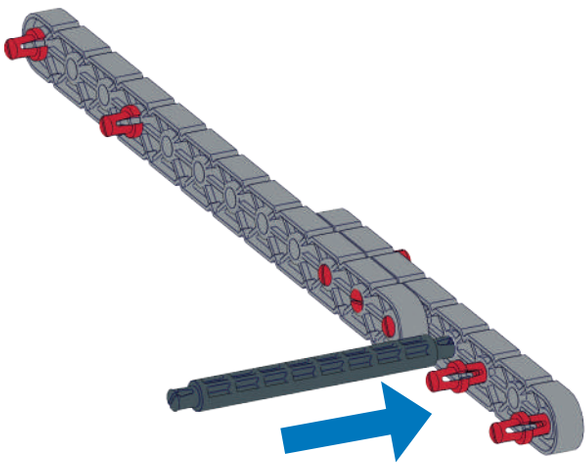


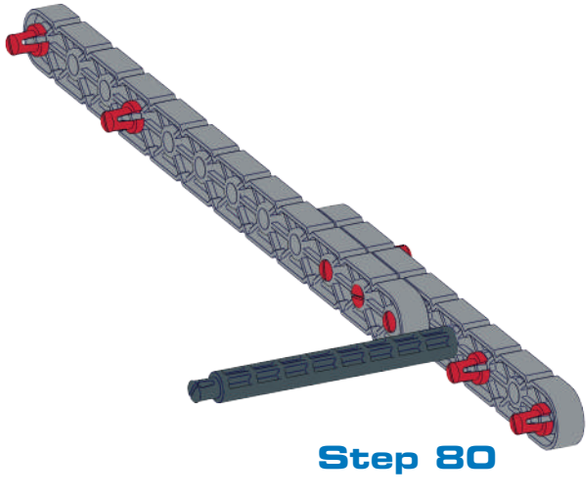
Actual Size



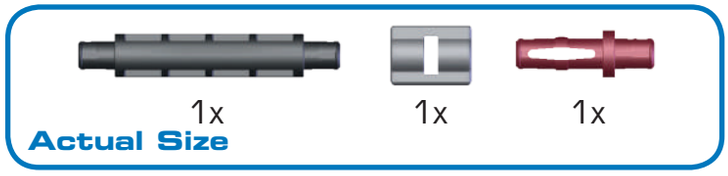
Step 79

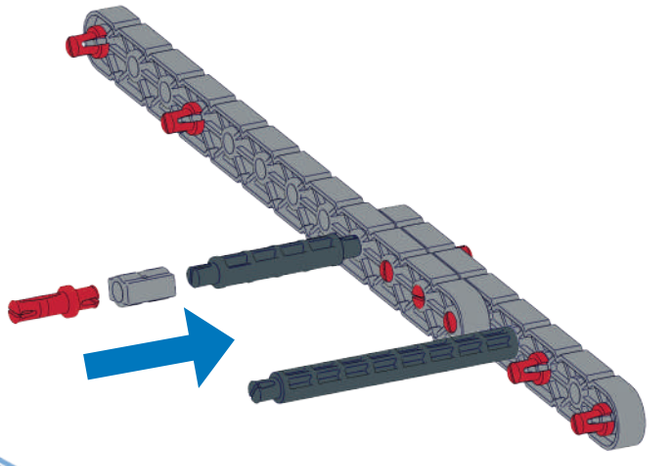


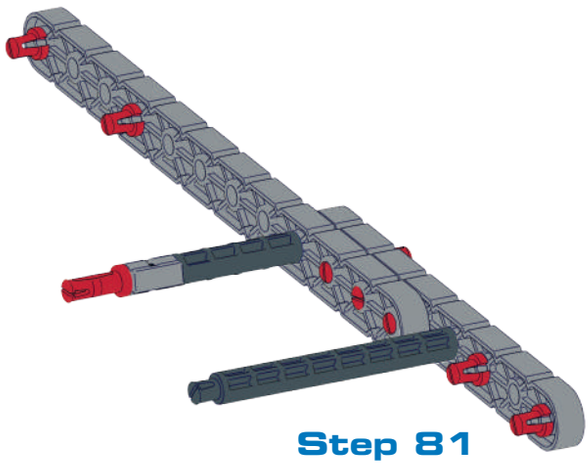




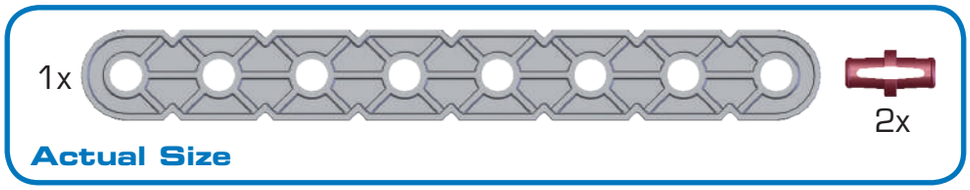
Step 80

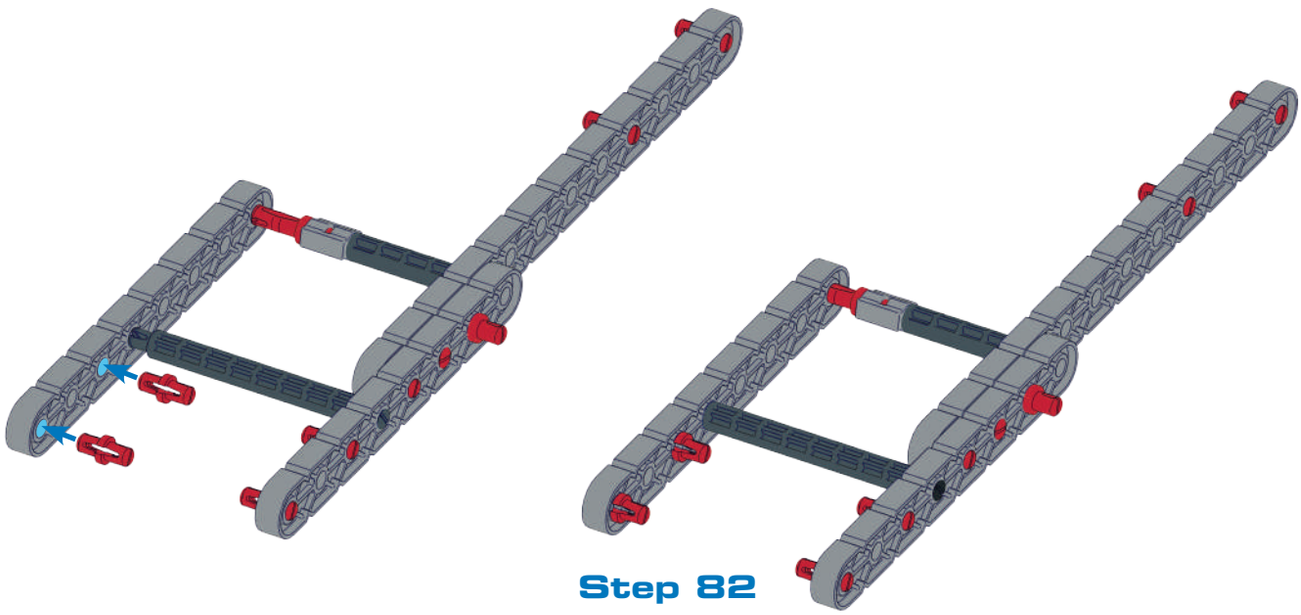




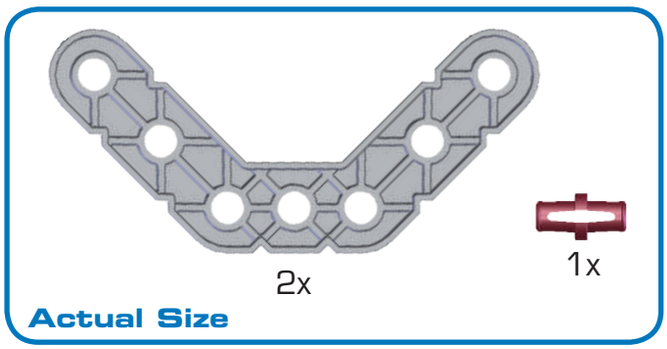


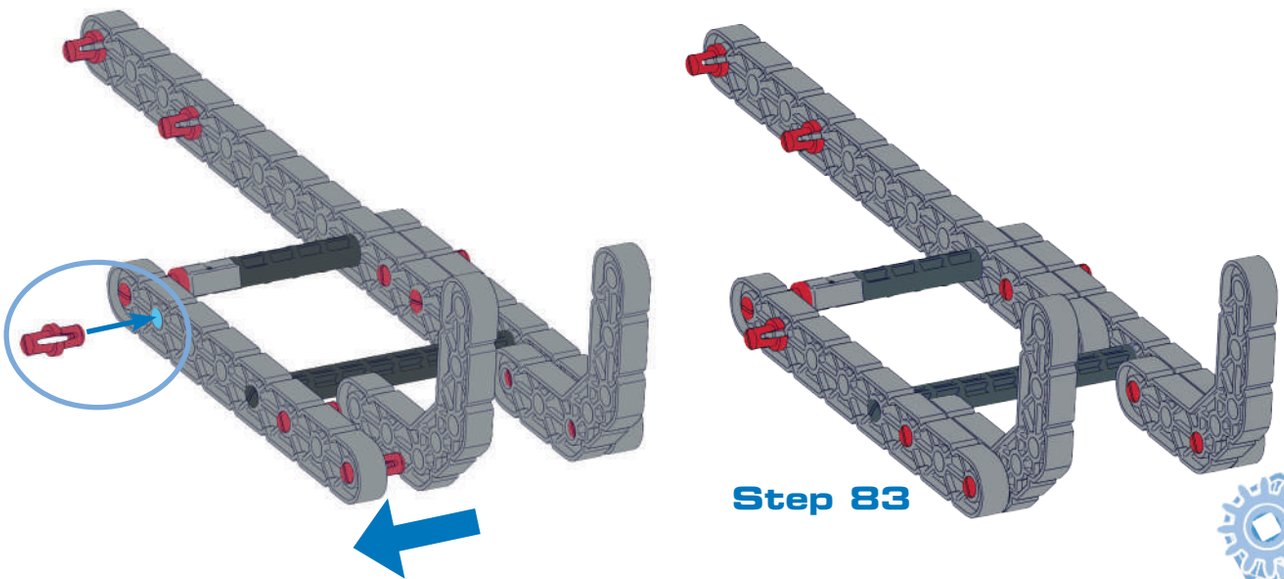
Step 81





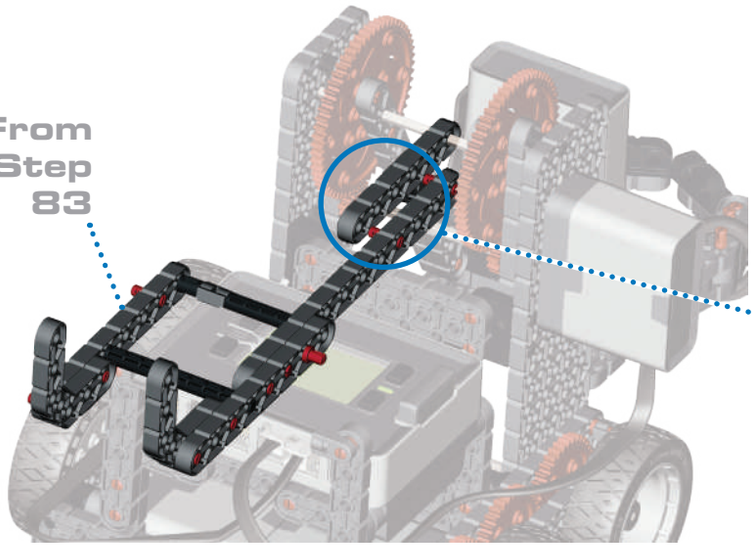
Step 82

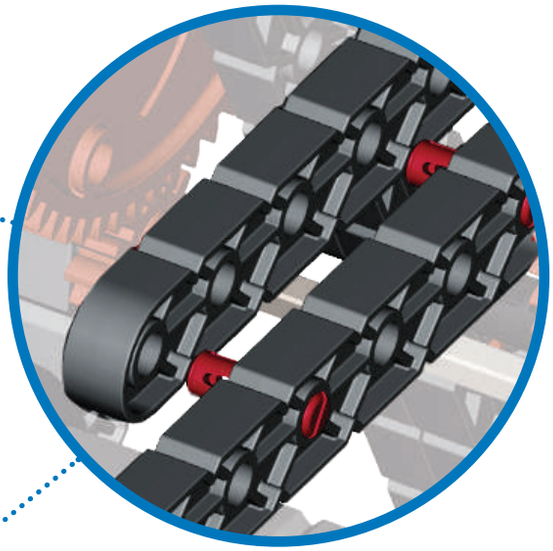




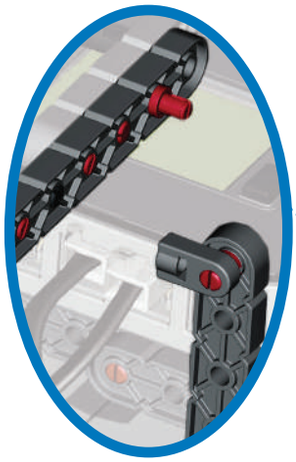
Step 83

From Step 83

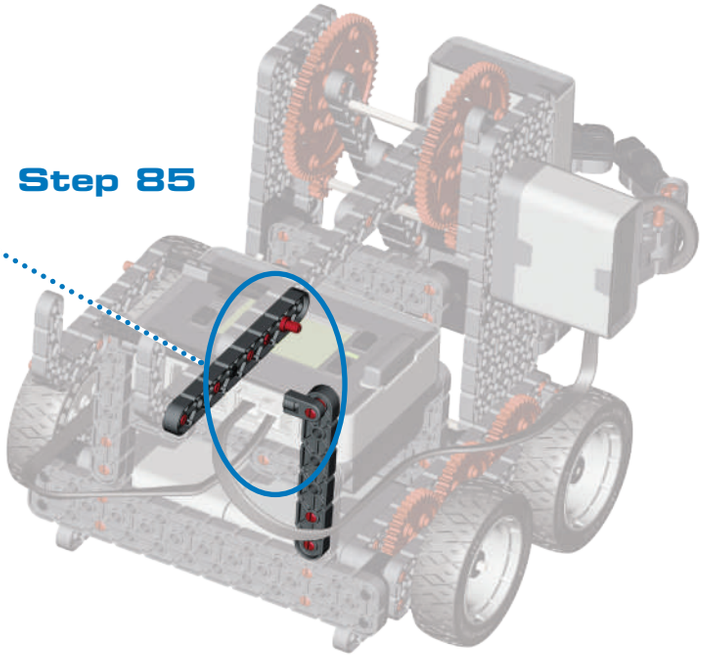


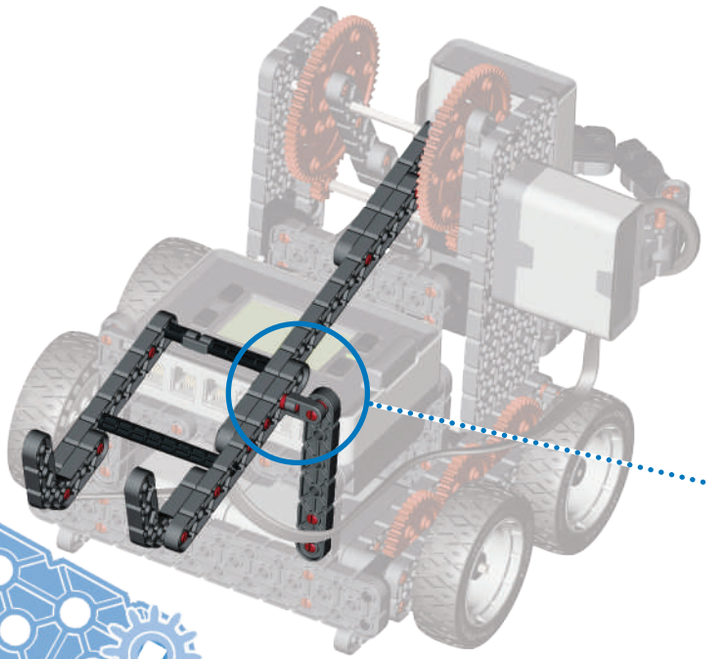


Step 84

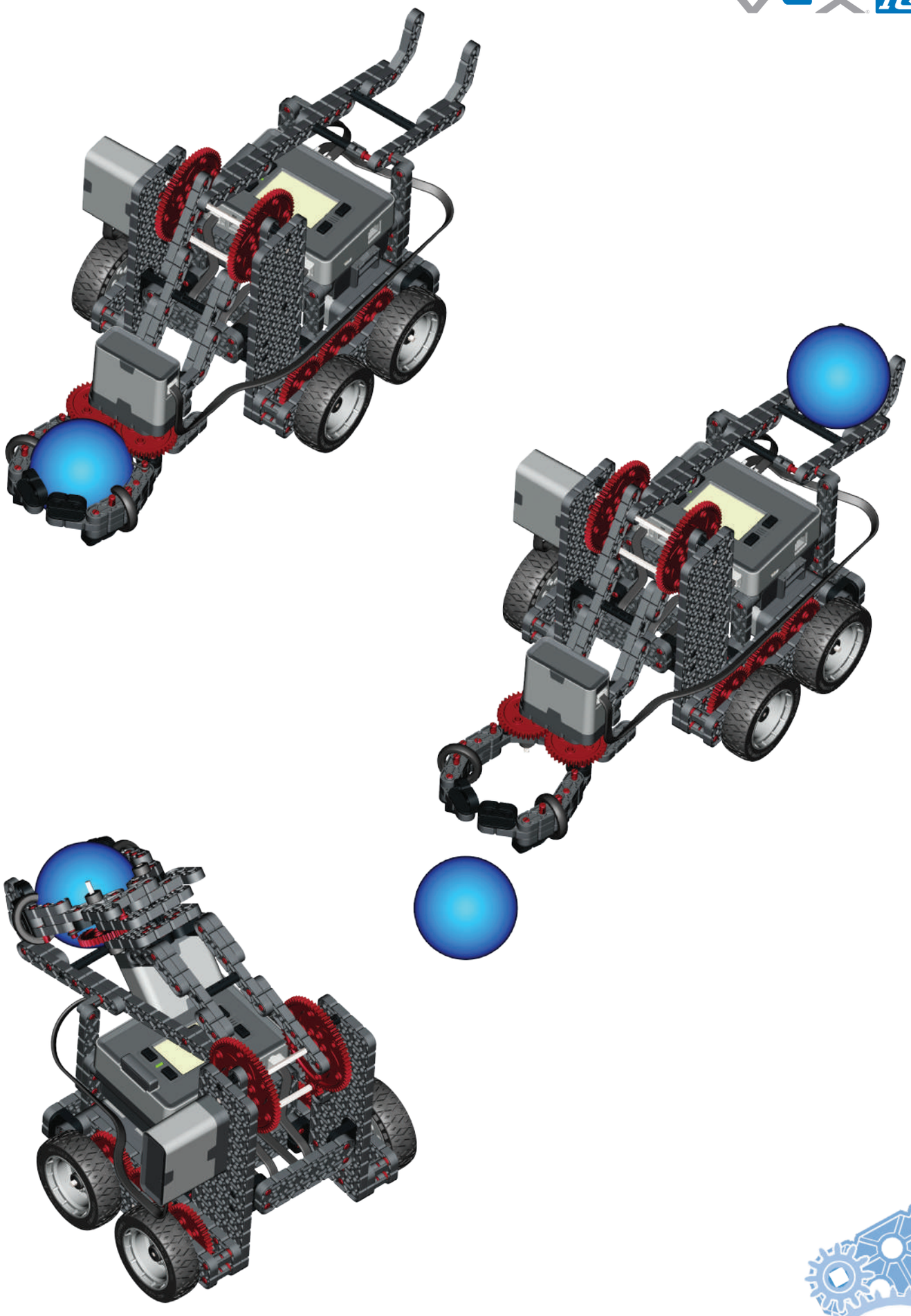


Step 85



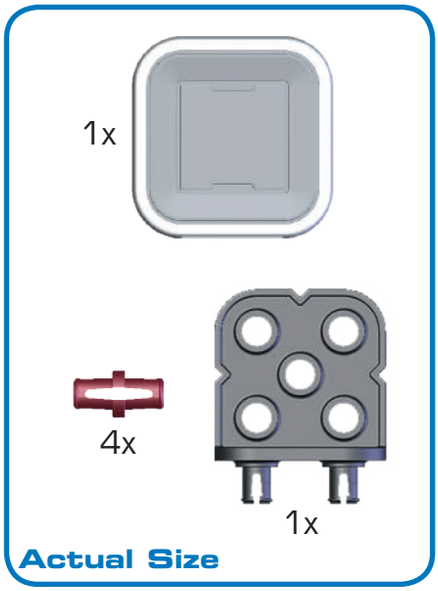


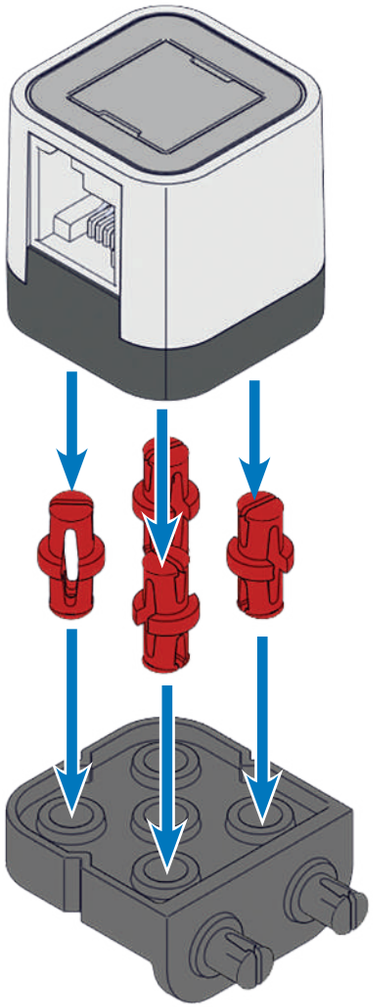
Step 86

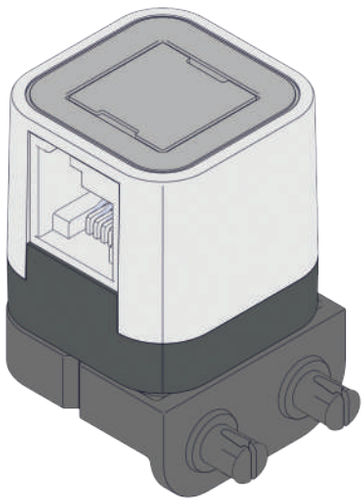


Part 5 Sensors

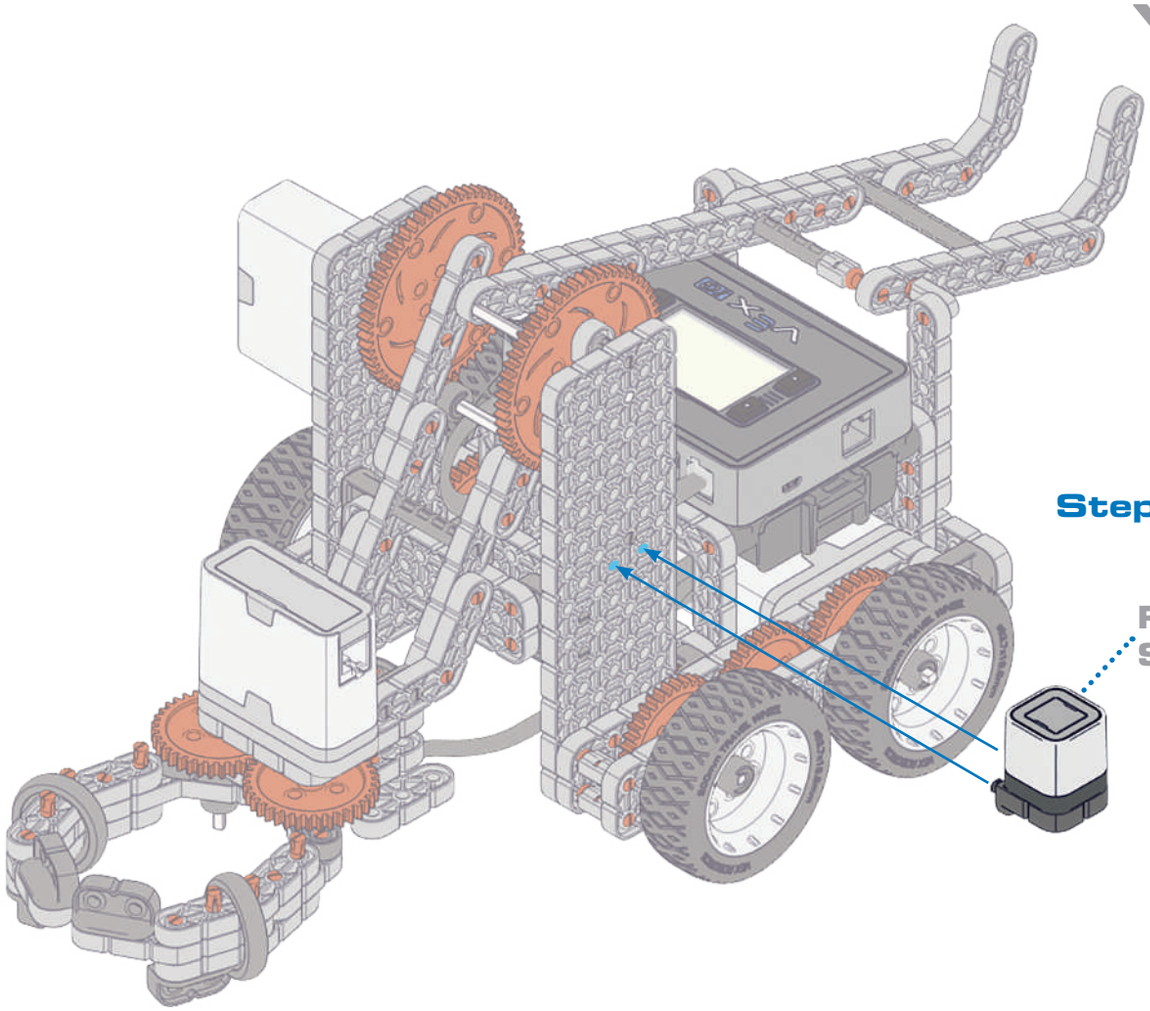
Gyro

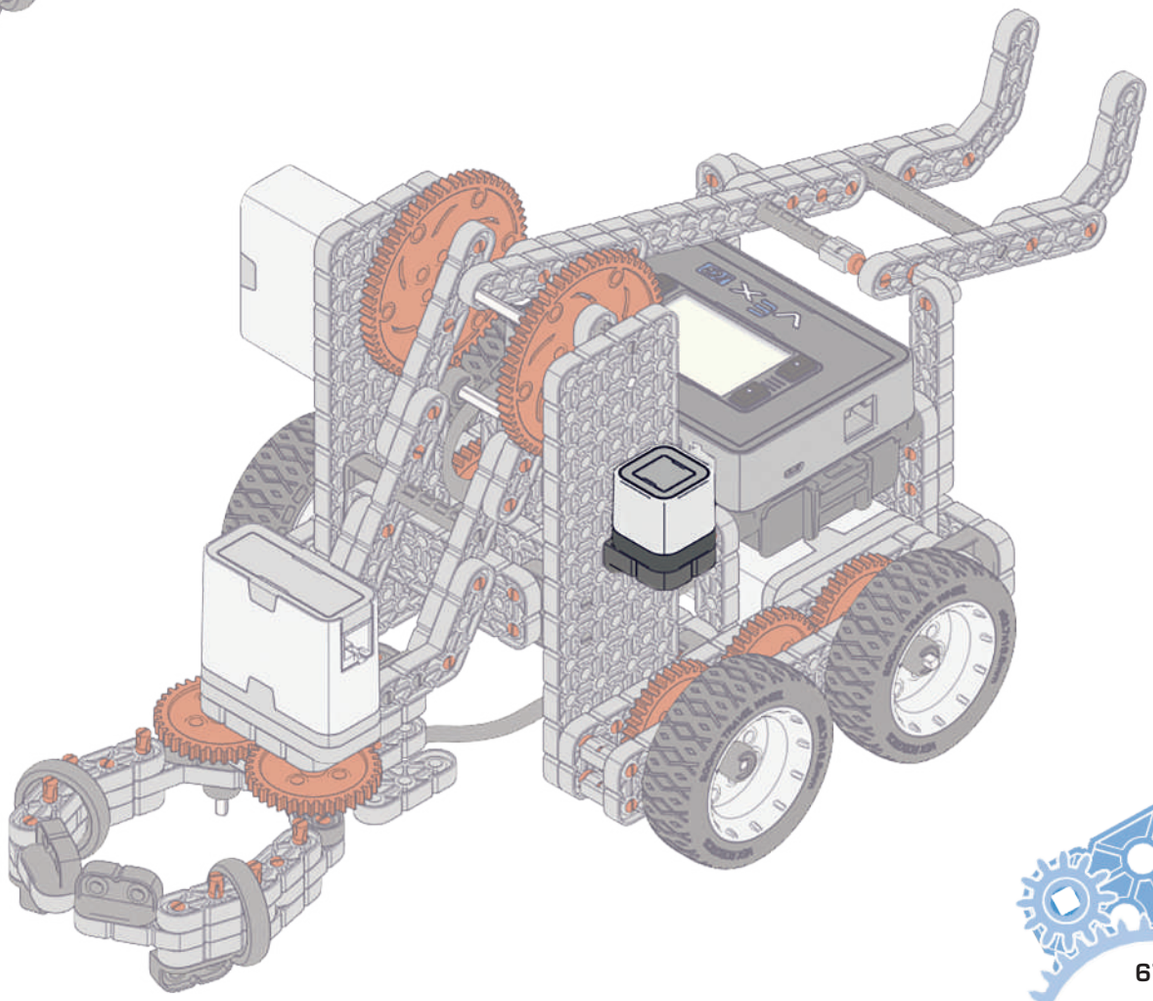




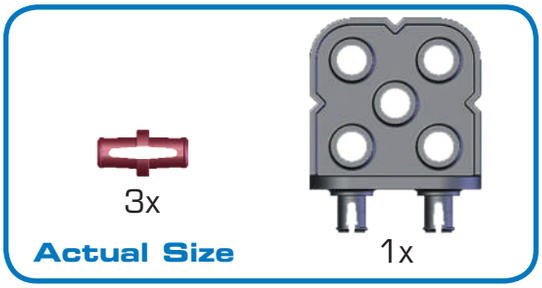


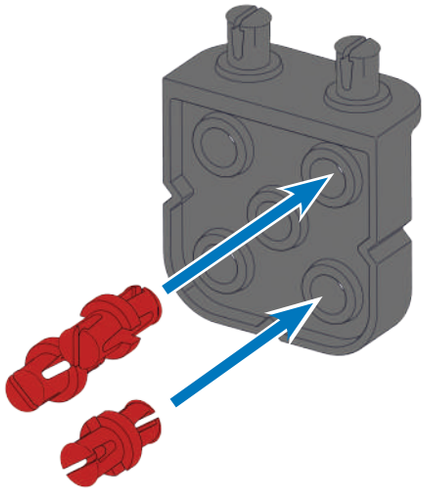
Step 1


Step 2
From
Step 1

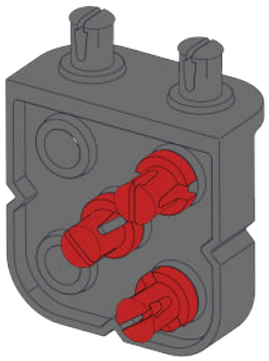


Touch LED



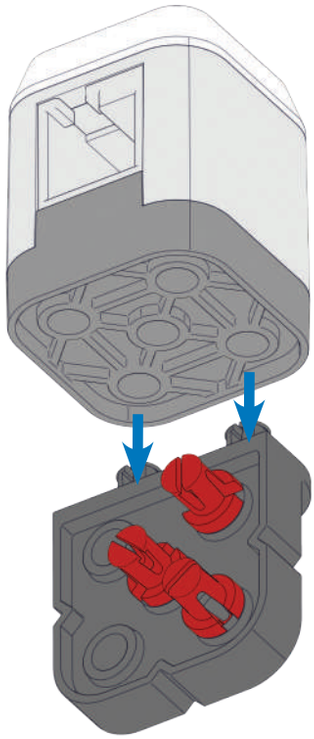


Step 1



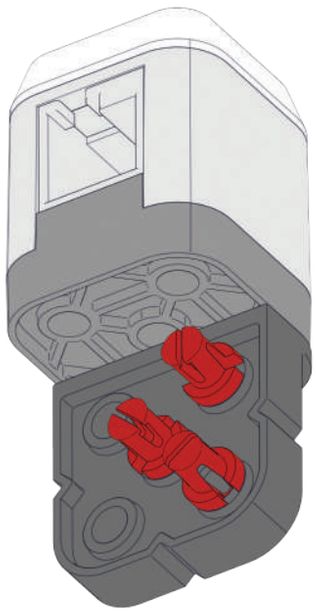
1x

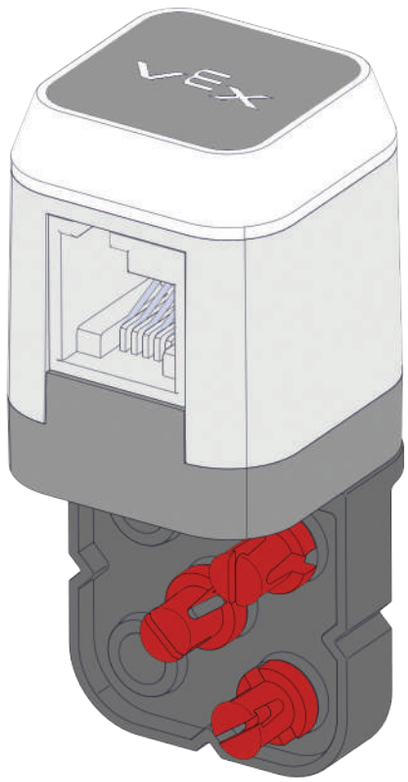
Actual Size

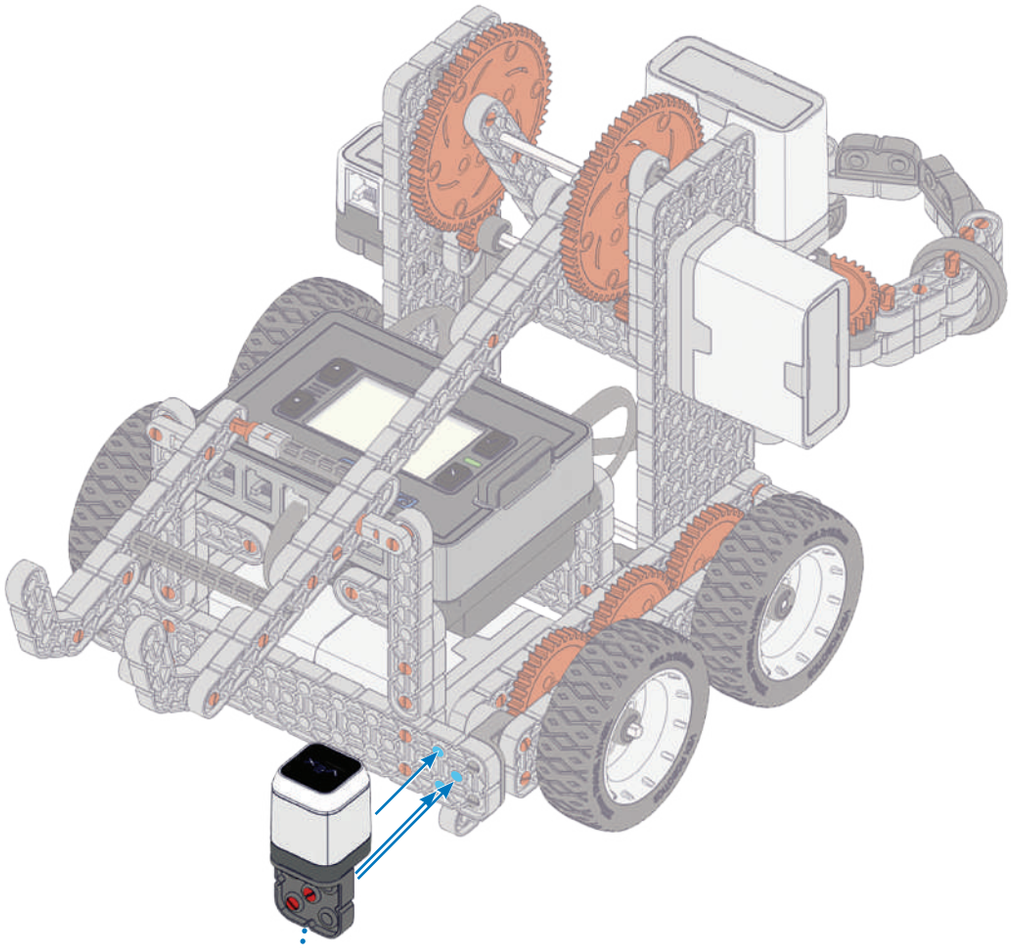


From Step 1

Step 2

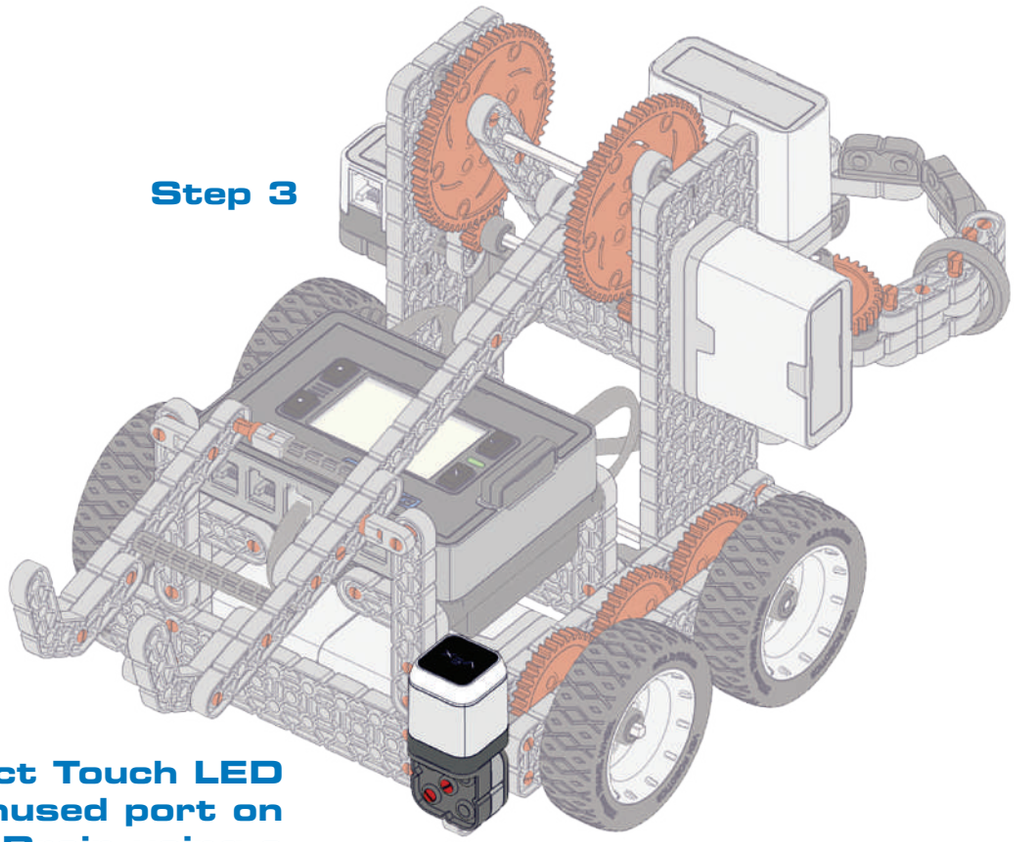




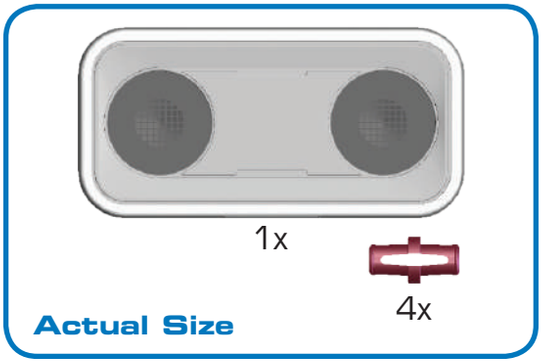


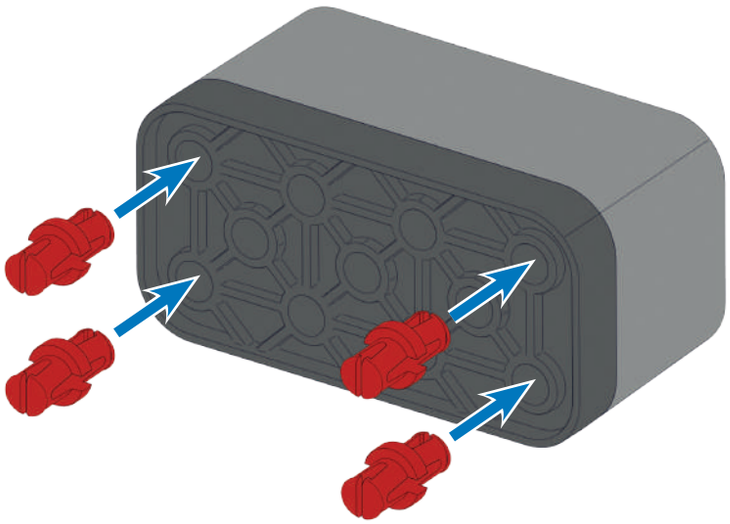
From Step 2

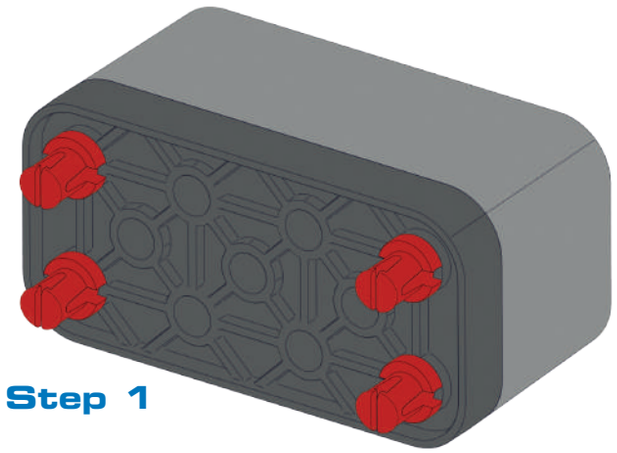
Step 3



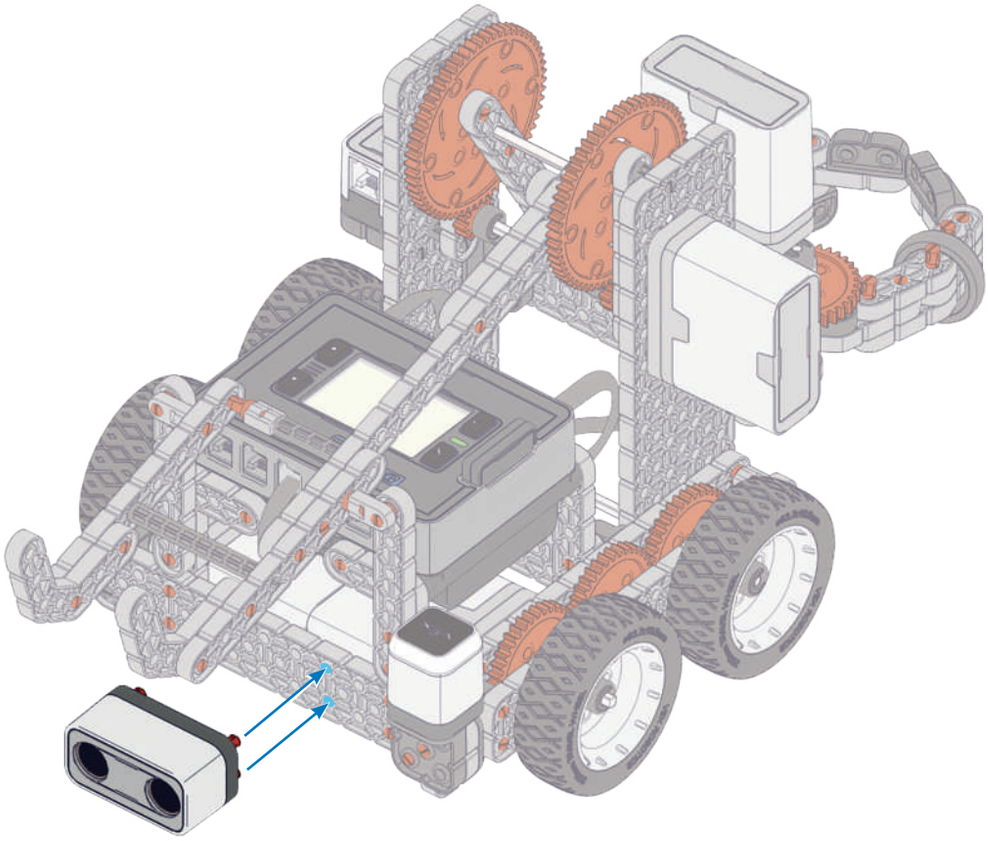
Connect Touch LED to any unused port on Robot Brain using a Smart Cable.





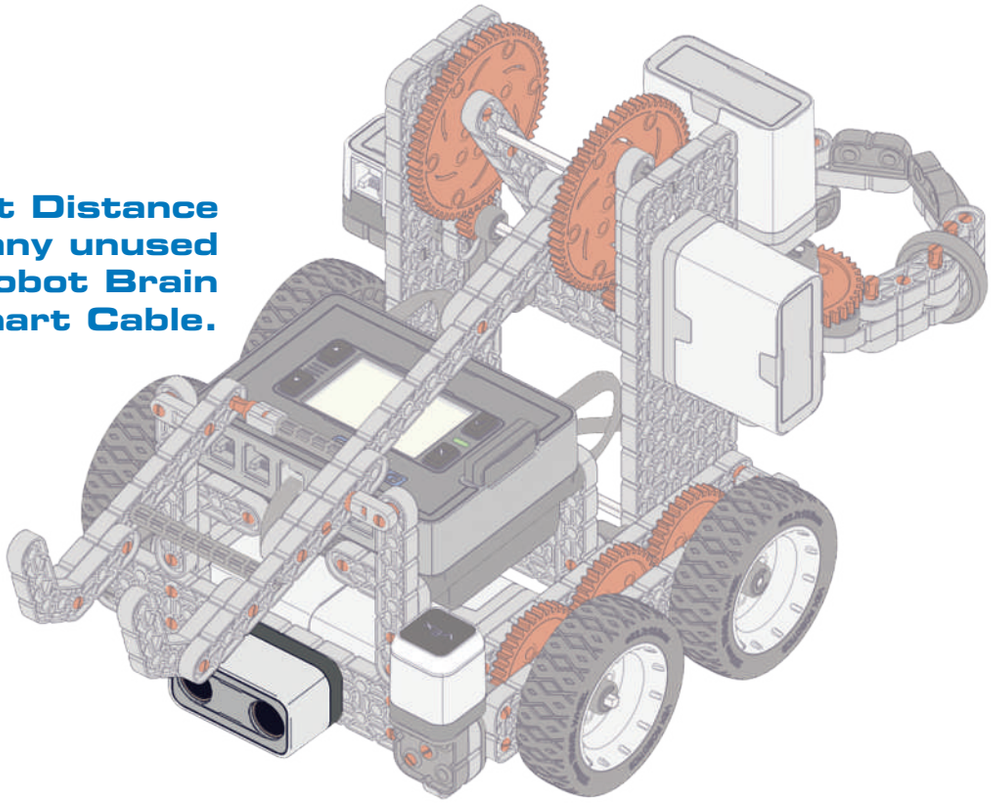


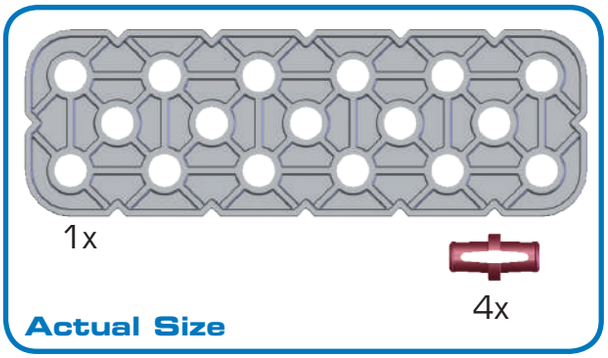
Step 1

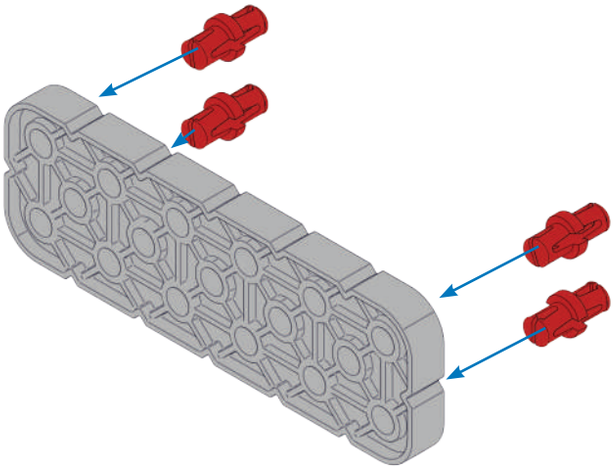


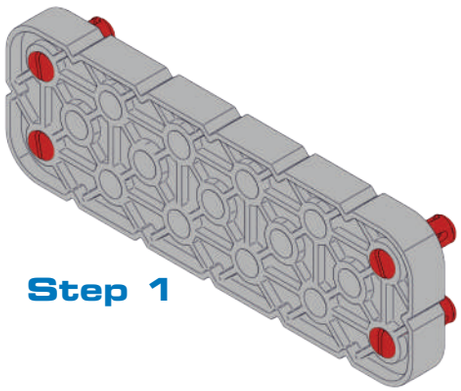
Step 2

Connect Distance Sensor to any unused port on Robot Brain using a Smart Cable.




1x
4x
Actual Size

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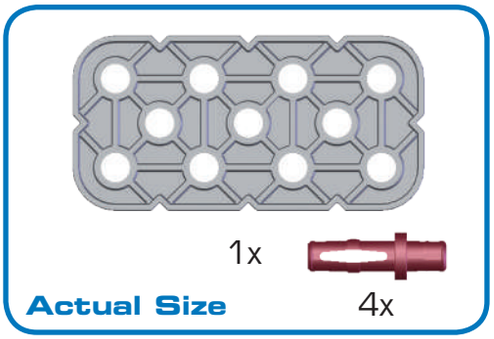
1x
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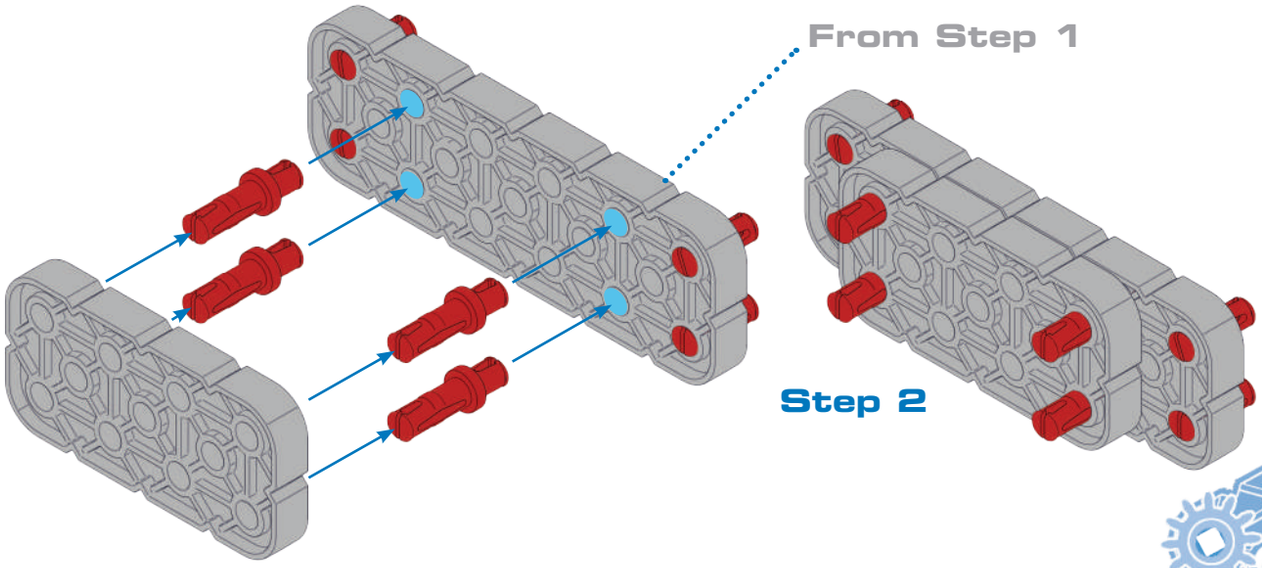
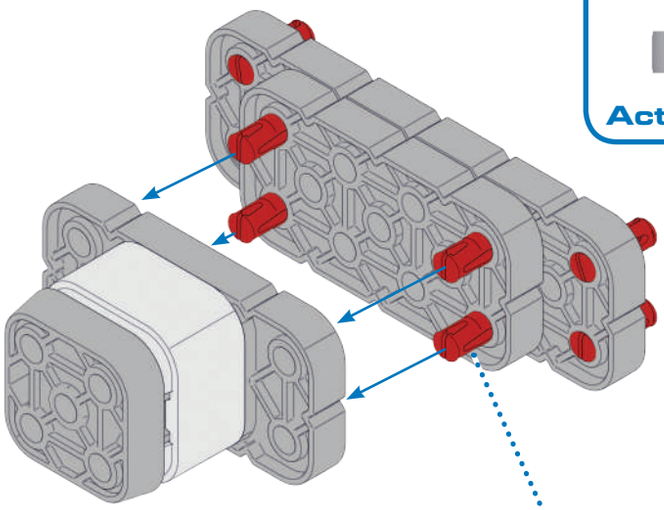
Actual Size


From Step 1
Step 2



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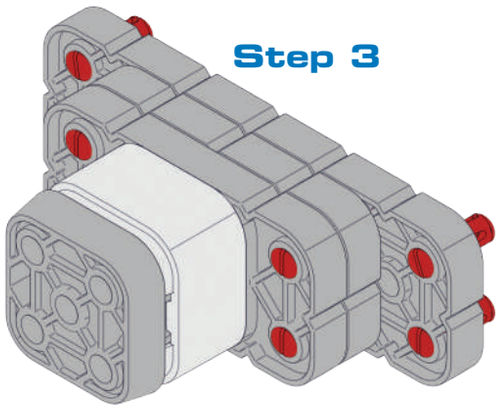

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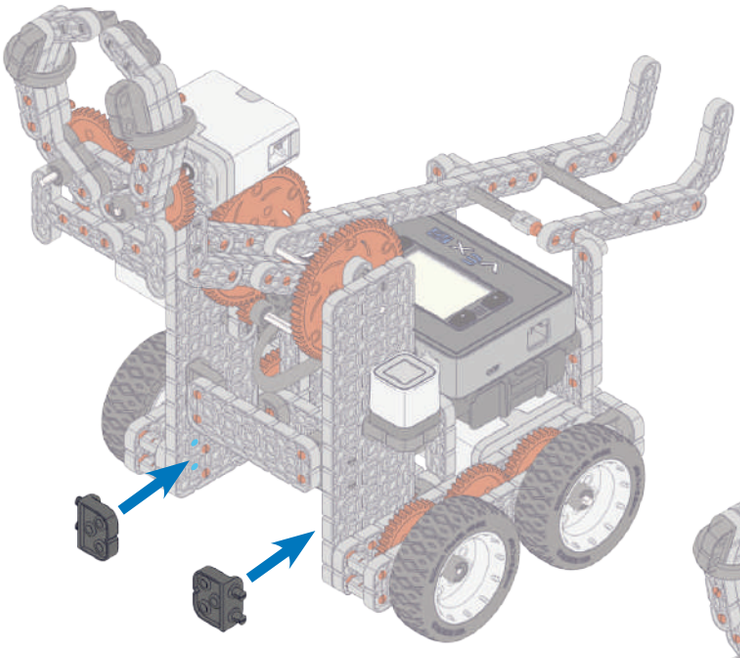

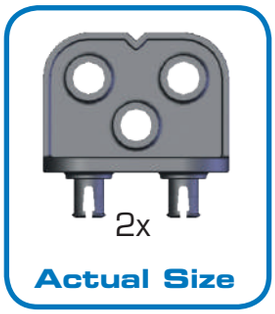

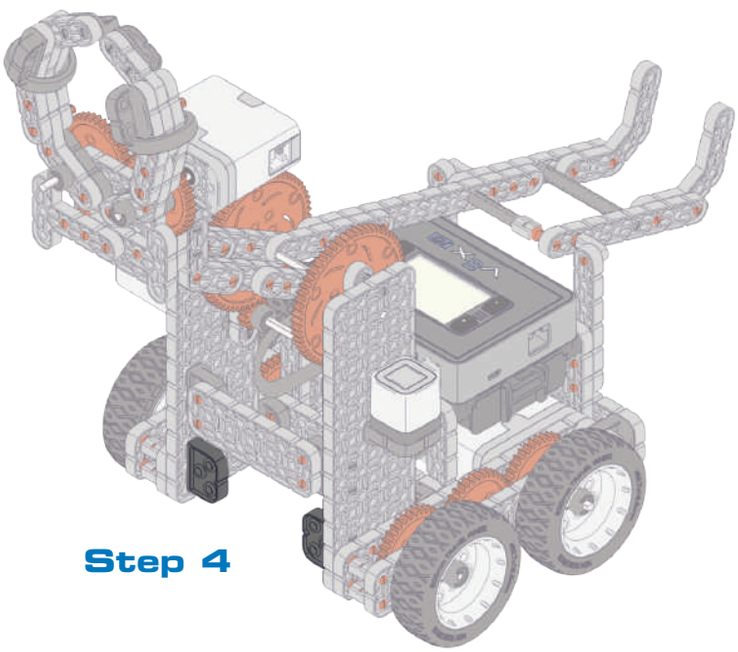

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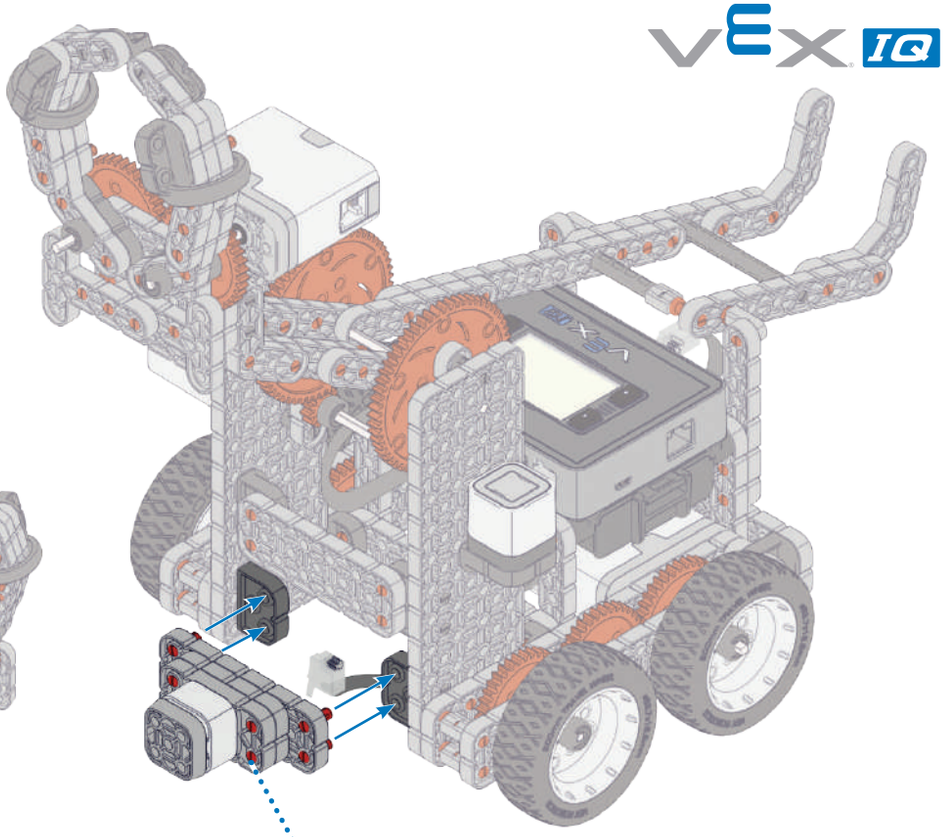

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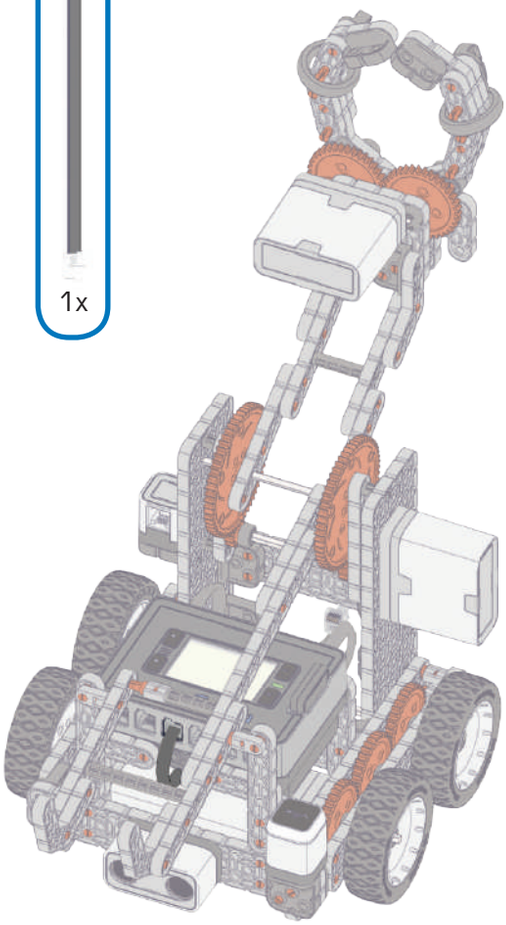
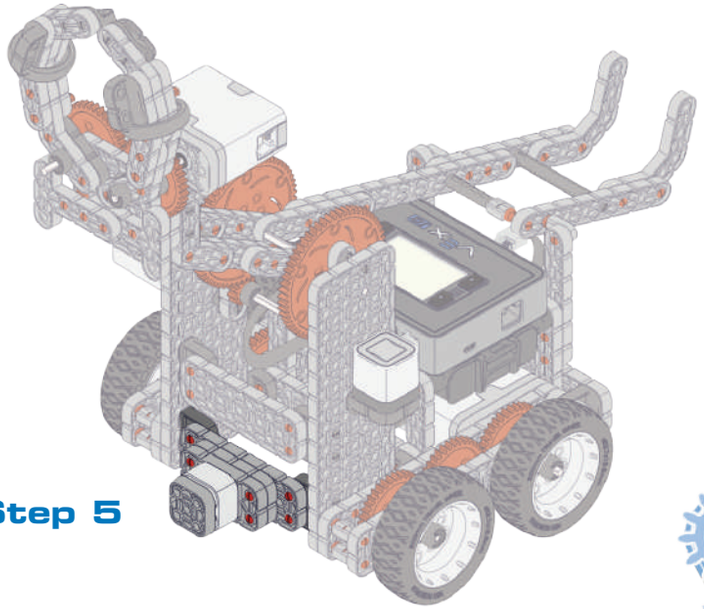
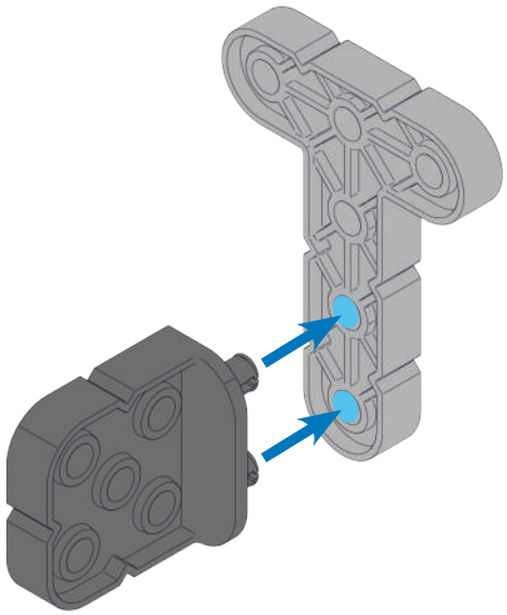


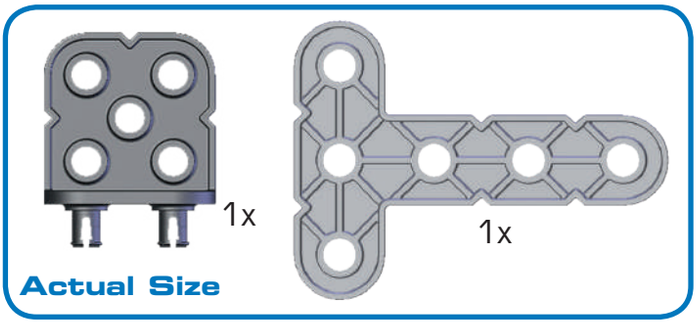
Connect Bumper Switch to Port 9 on Robot Brain using a Smart Cable.

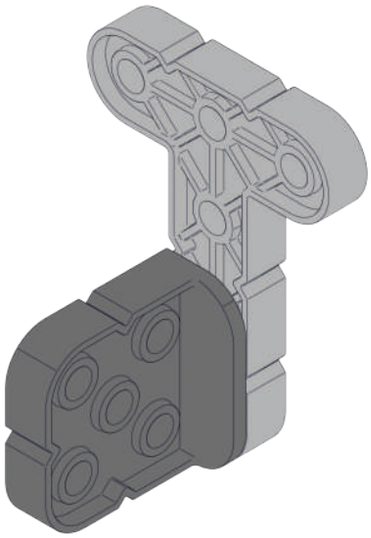


Step 5

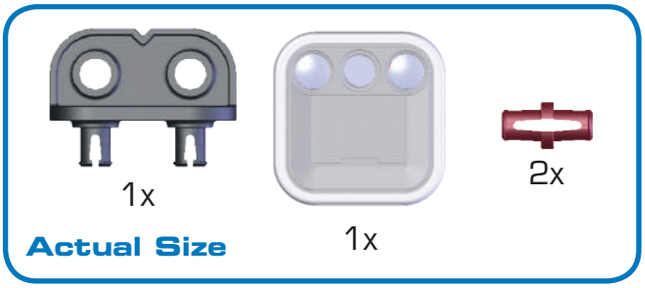
Color Sensor

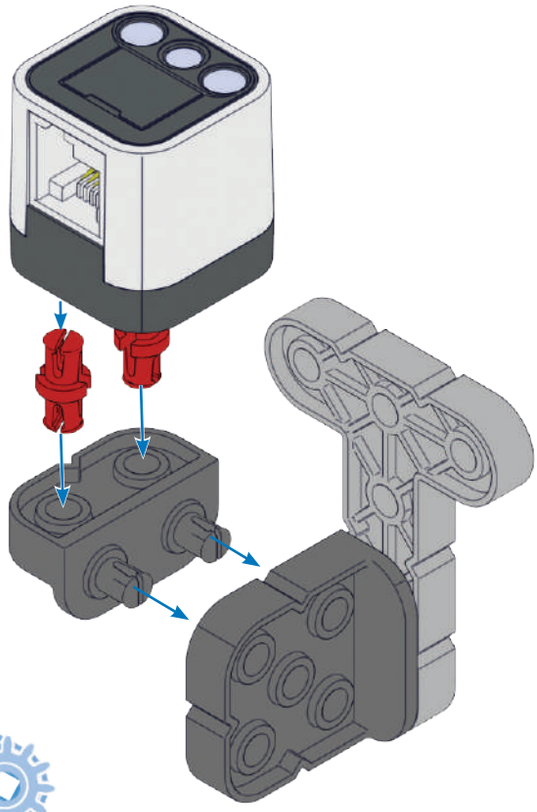


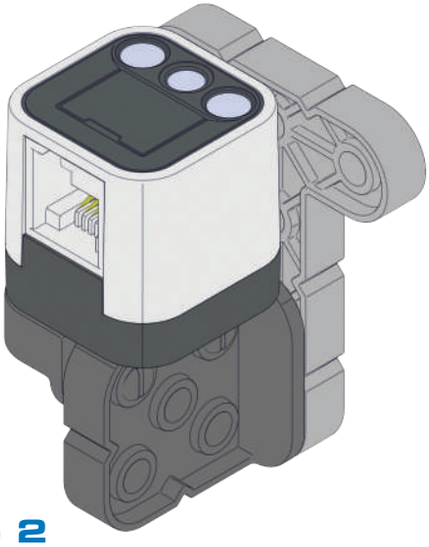




Step 1







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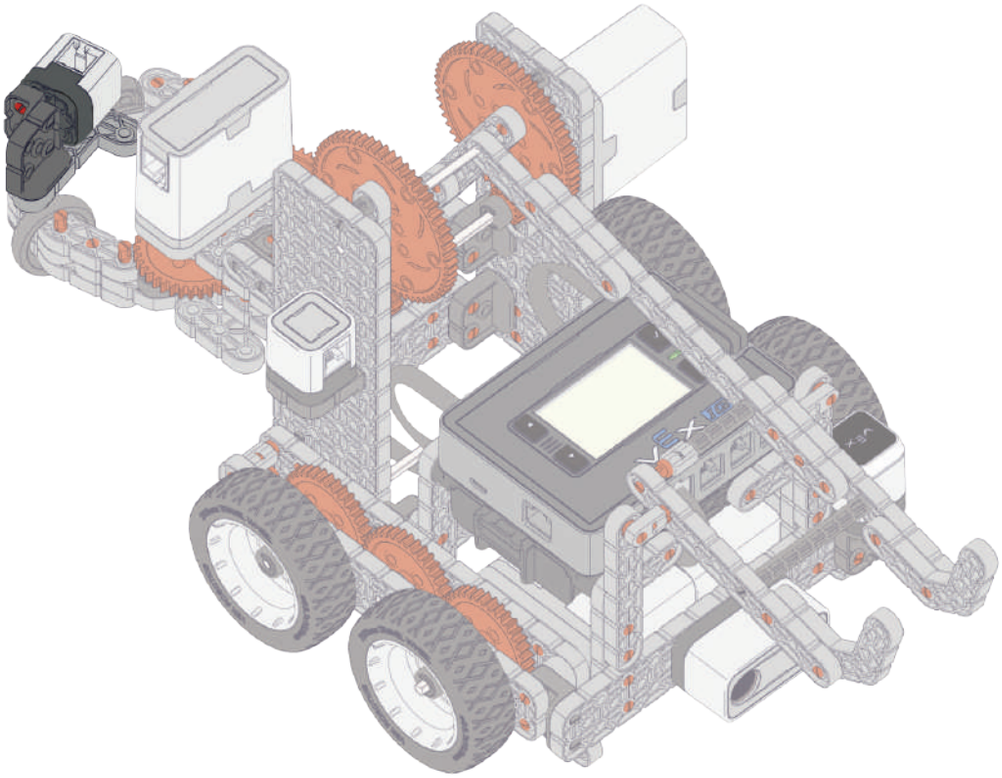
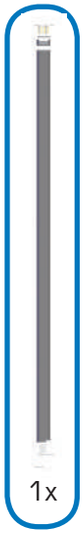
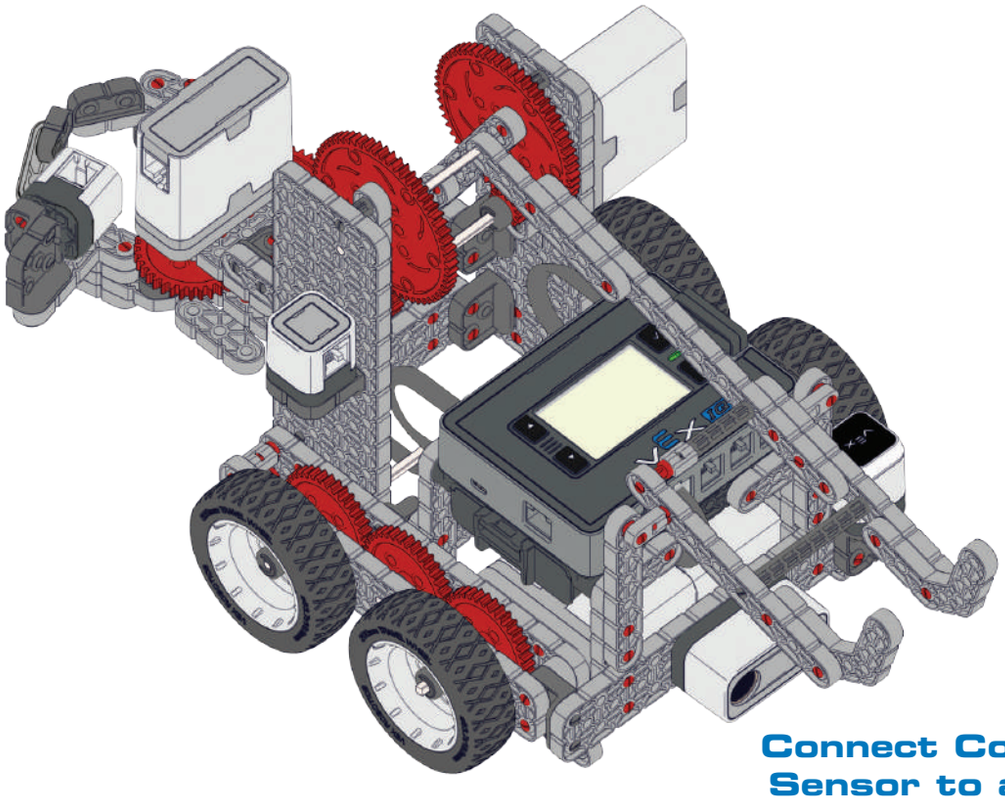




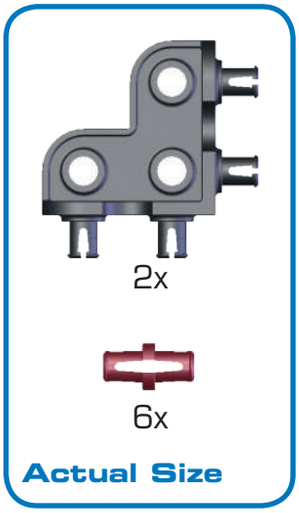


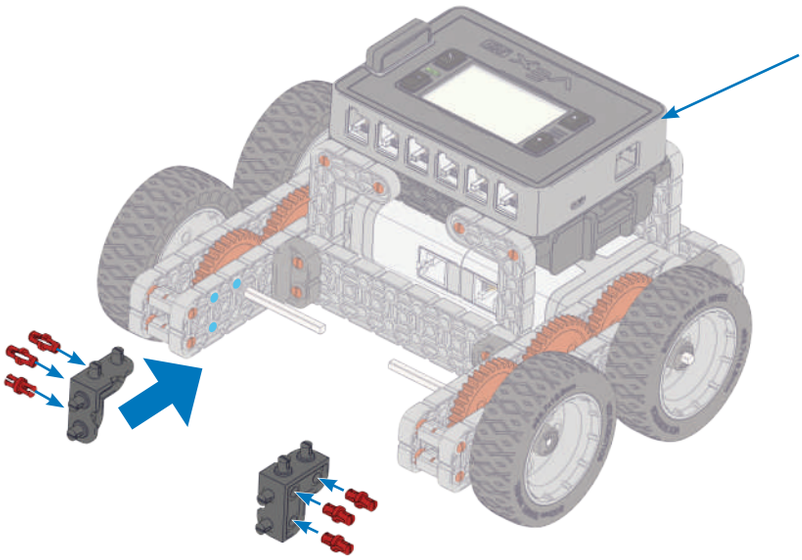
Connect Color Sensor to any unused port on Robot Brain using a Smart Cable.

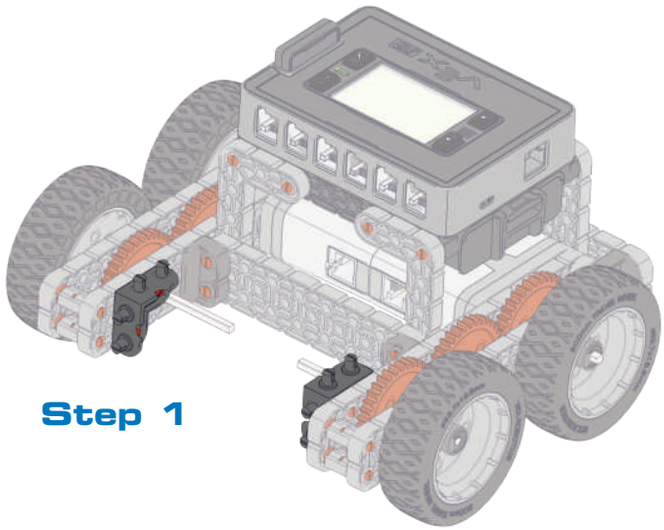
Your Clawbot with Sensors is now ready to Run!

Refer to pages 85-111 for important information about using your VEX IQ robot.

Autopilot Instructions







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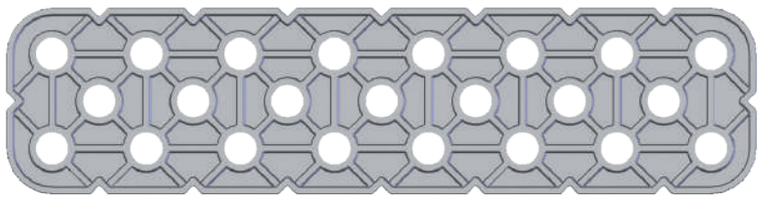
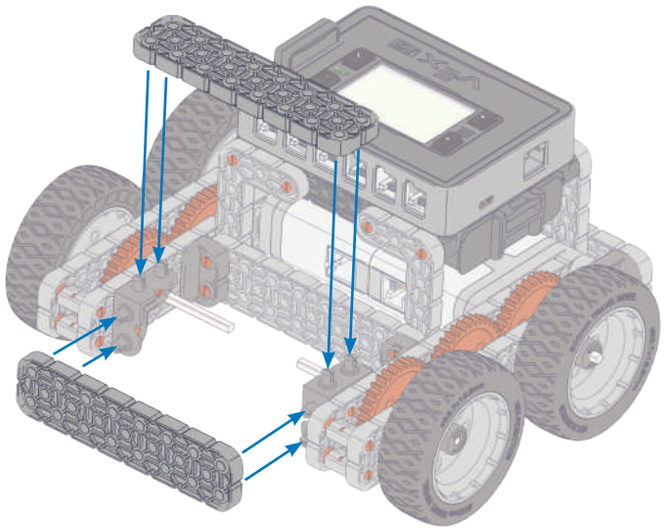
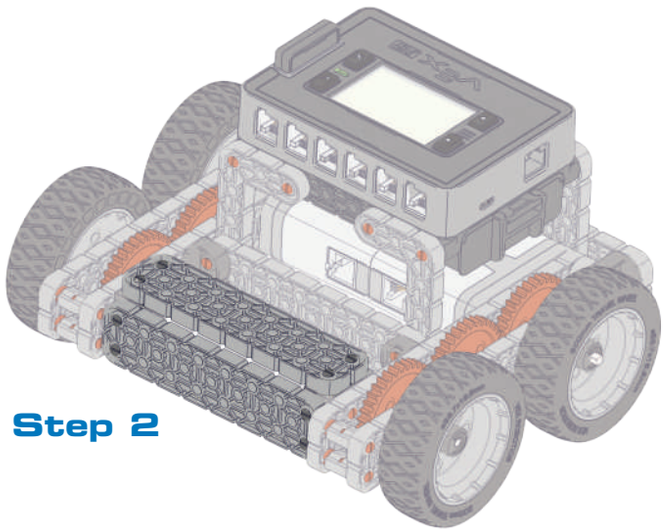


2x

Actual Size





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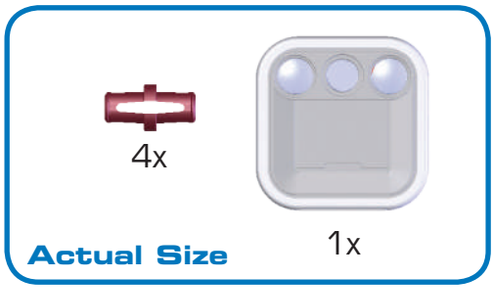
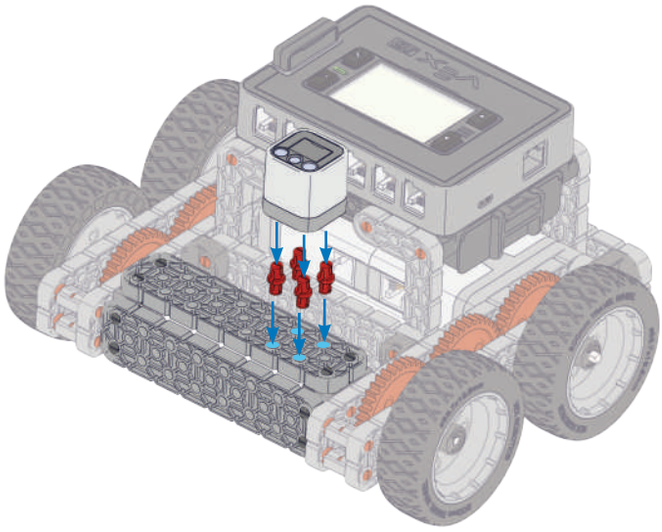
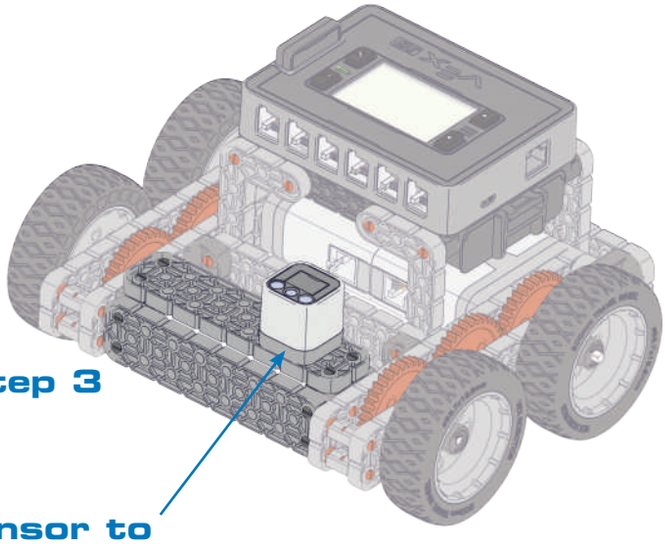
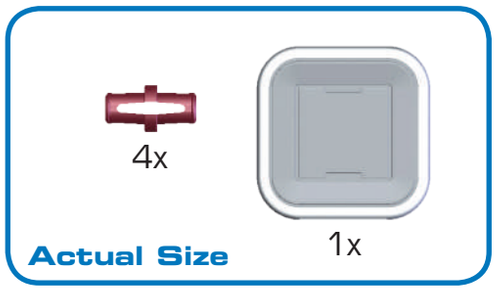


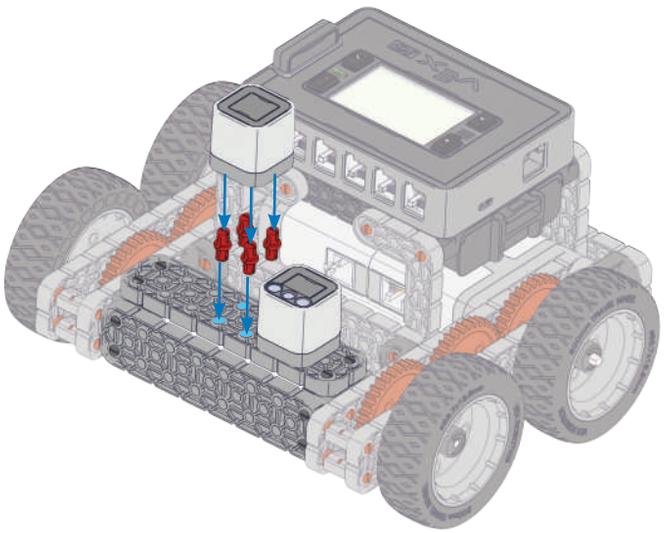


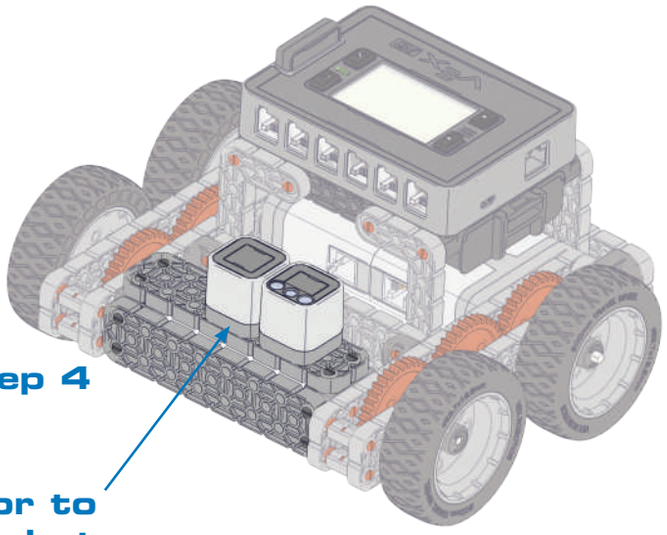


Step 3

Connect Color Sensor to any unused port on Robot Brain with a Smart Cable

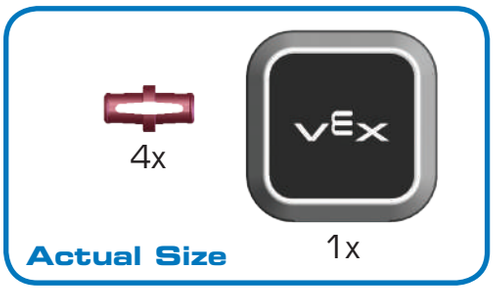


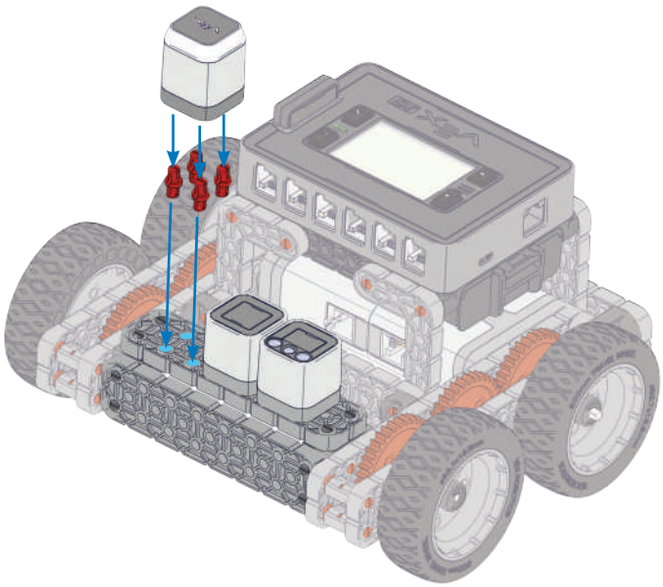


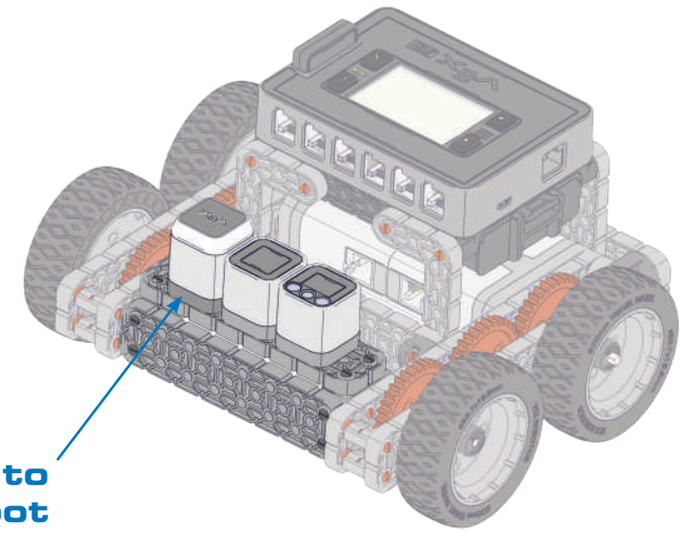


Step 4

Connect Gyro Sensor to any unused port on Robot Brain with a Smart Cable

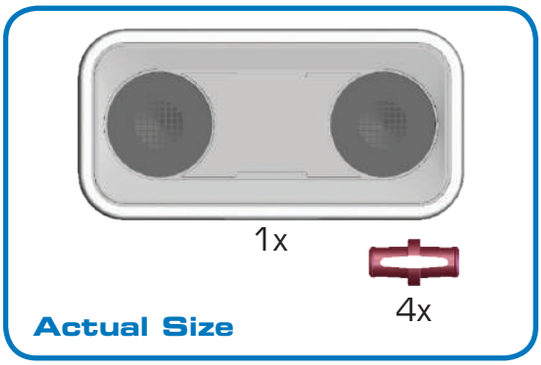


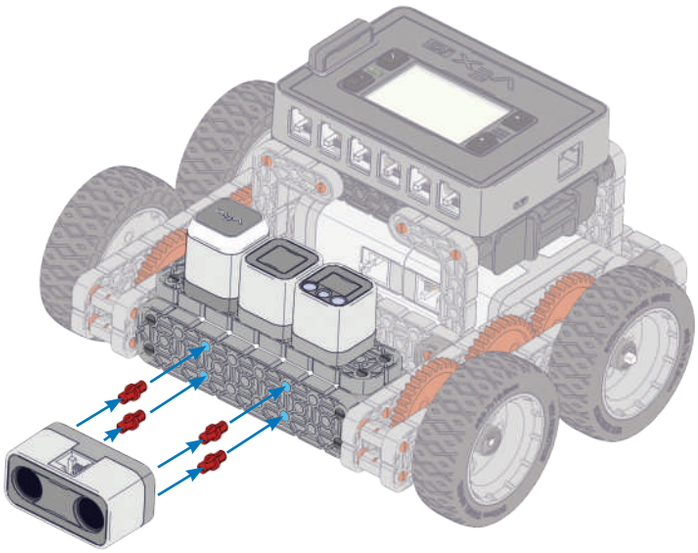




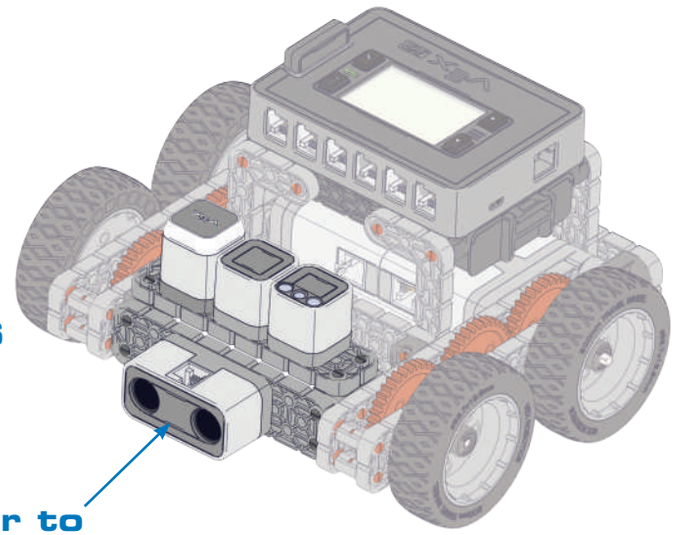
Connect Touch LED to any unused port on Robot Brain with a Smart Cable

Step 5

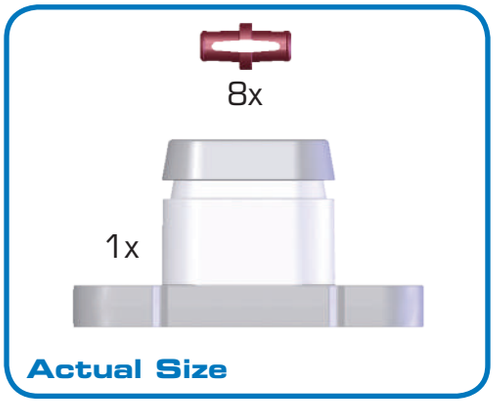


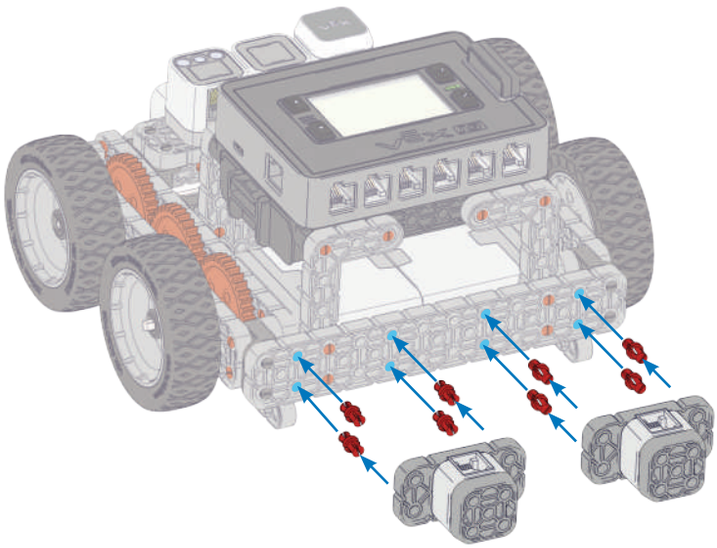


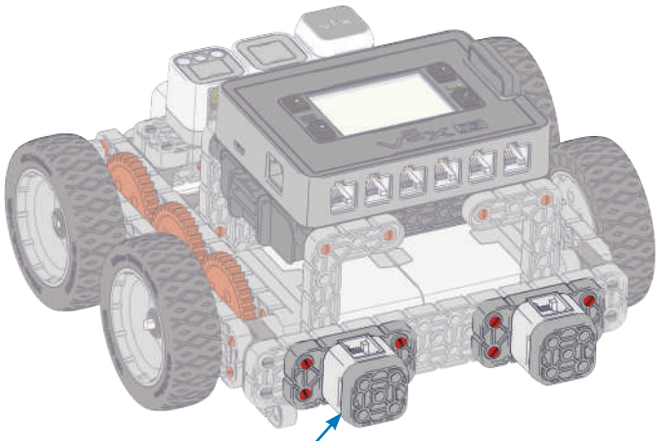
Step 6



Connect Distance Sensor to any unused port on Robot Brain with a Smart Cable







Connect Bumper Switches to any unused ports on Robot Brain with a Smart Cable

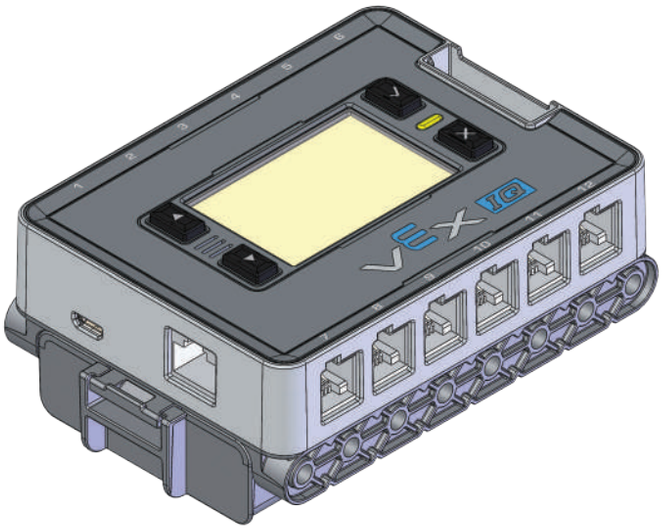
Control System Overview

Radio

The VEX IQ Controller and Robot Brain communicate with each other through either wireless Radio Communication or Tether Cable.

VEX Controller

The VEX IQ Controller is at the center of what makes VEX IQ robots fun to build and easy to use. The controller allows you to drive your robot immediately through the use of two dual-axis analog joysticks and eight buttons.

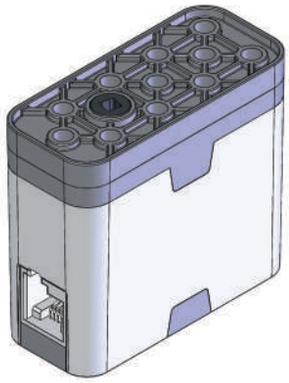


Robot Brain

The VEX IQ Robot Brain is the powerful command center of your robot. With 12 identical Smart Ports, a simple backlit LCD screen, built in programs, and support for custom programming from PC, Mac and Linux computers, bringing your robot to life has never been easier.

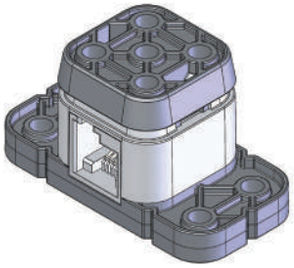
Smart Motor

The Smart Motor converts electrical energy from the battery into rotational energy. Motors are an essential part of the robot. They turn wheels, move arms and close claws.



Sensors

The Sensors for VEX IQ allow your robot to collect information and react to the world around it.



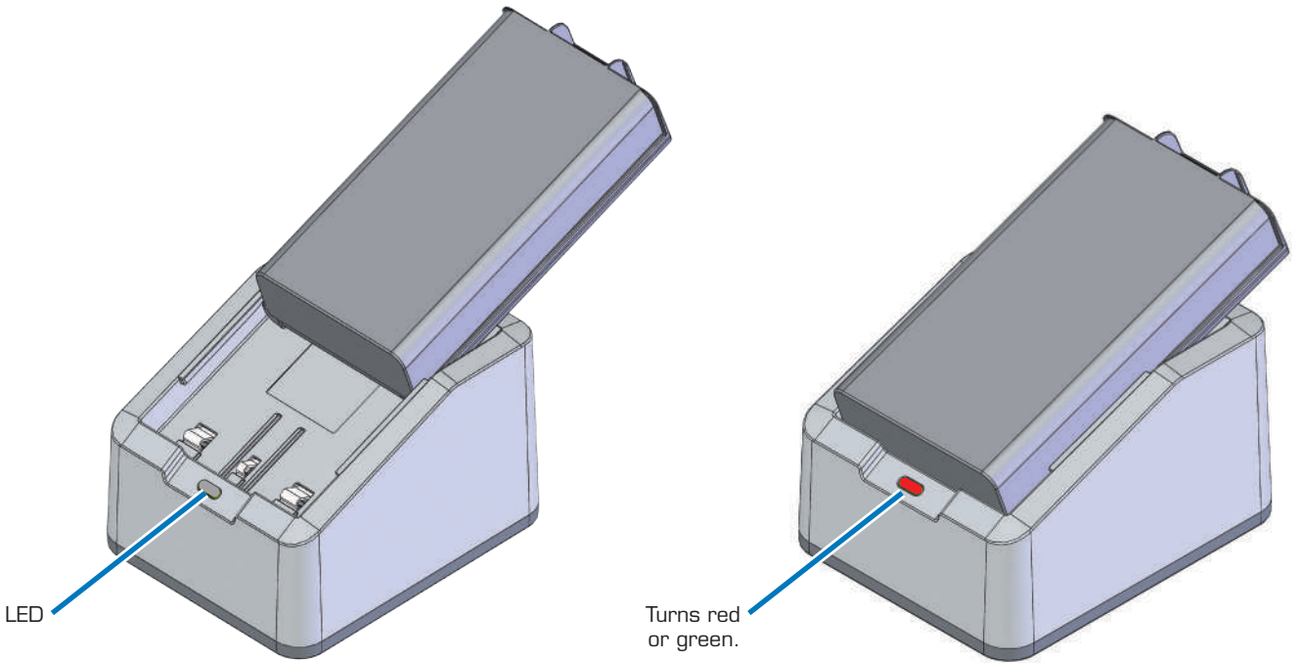
Robot Brain Setup

Robot Battery Charging and Usage

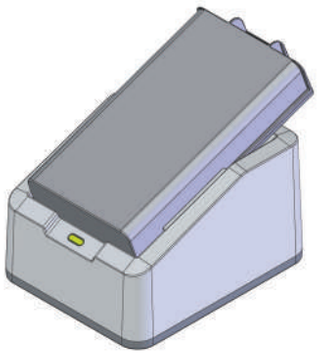
Items you need:

- Robot Battery Charger P/N: 228-2743
- Battery Charger Power Cord appropriate for your region
- Robot Battery P/N: 228-2604

See the Battery Safety information in the Appendices. Plug the Battery Charger Power Cord into Robot Battery Charger. Plug the power cord into an AC outlet. Insert the Robot Battery into the charger. The LED should turn red. The LED will turn green once the battery is charged. The battery will continue to trickle (slowly) charge after the LED is green.

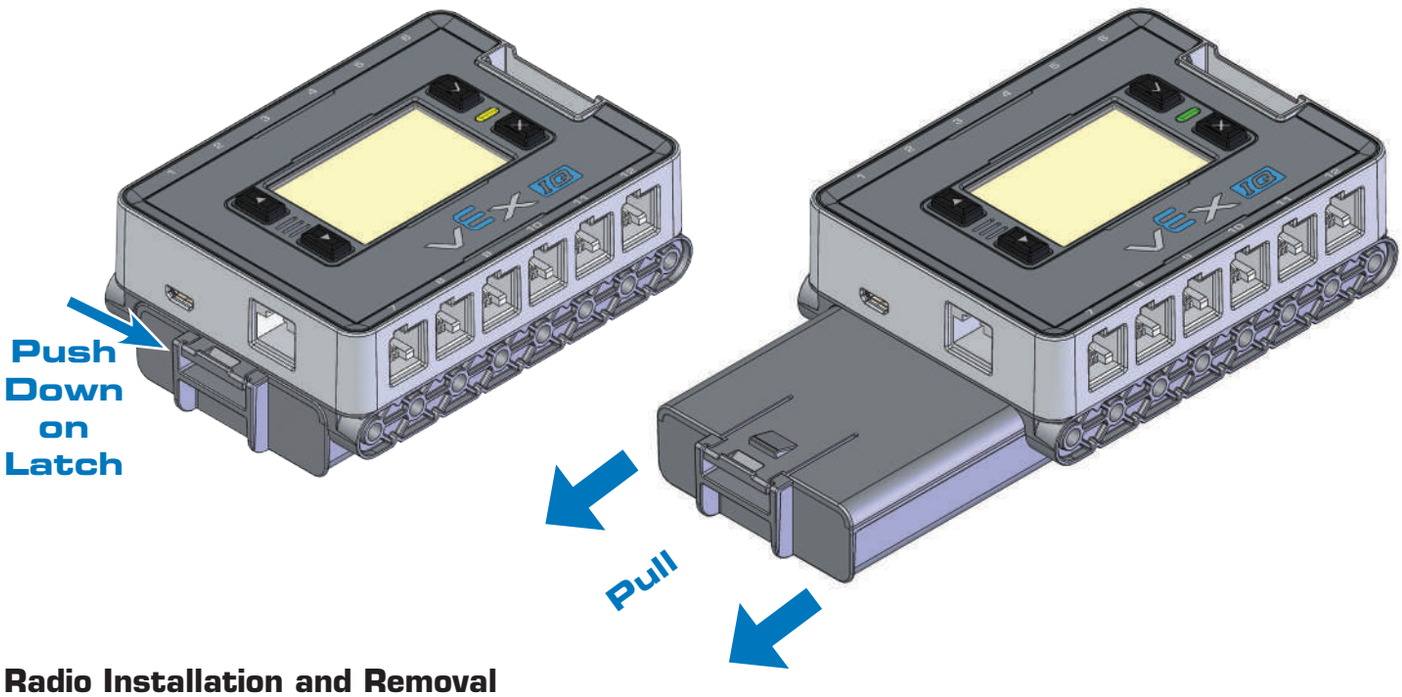


Robot Battery Charger LED



LED Color		Status
	Solid Green	Battery is Fully Charged
	Solid Red	Battery Charge in Progress
	Blinking Green	Over Temperature Fault
	Blinking Red	Battery Fault

Slide the Robot Battery into the Robot Brain until the latch clicks. To remove the Robot Battery, press the latch down and slide the battery out.

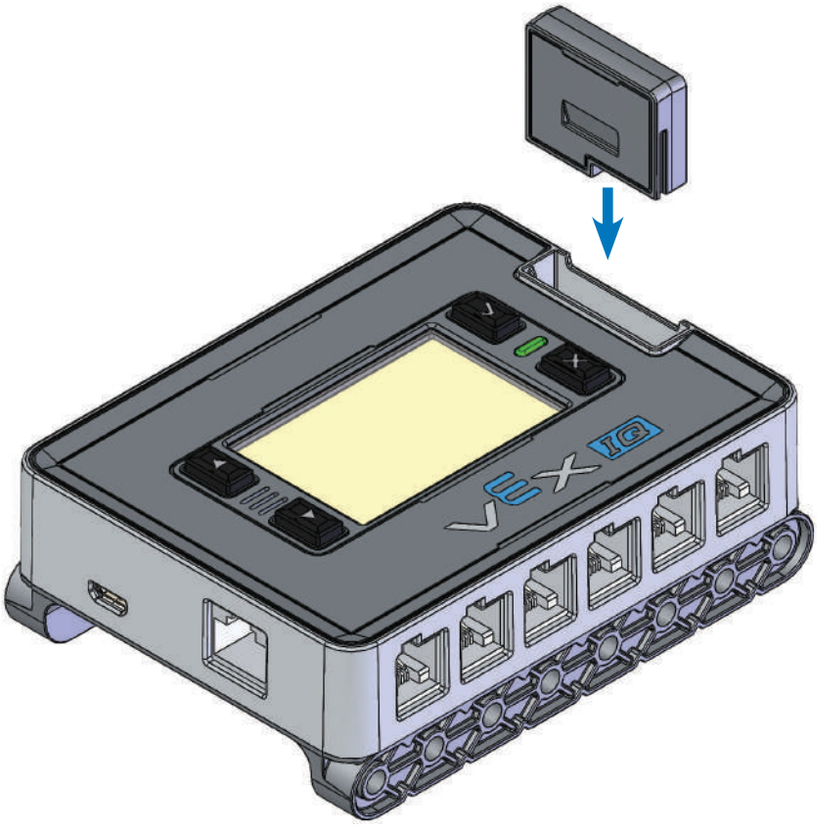


Radio Installation and Removal

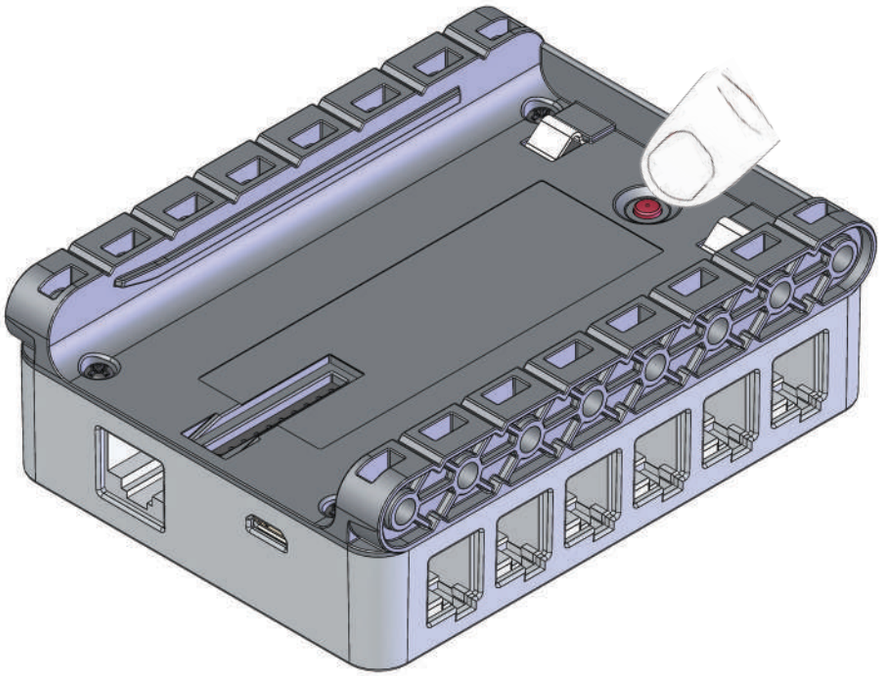
Items you need:
- Robot Brain P/N: 228-2540
- 900 MHz Radio P/N: 228-2621

The Robot Brain is designed to use a variety of Radio types, including the 900 MHz Radio. Be sure to use the same type of Radio in both the Robot Brain and the Controller.

Ensure there is no battery plugged into the Robot Brain. Slide the Radio into the Radio Socket. Orient the Radio so its VEX logo is away from the LCD screen. Press it in firmly.



In the event the radio needs to be removed, the Robot Battery must be removed. Press the red button on the bottom of the Robot Brain while simultaneously pulling on the top of the Radio.



VEX Controller Setup

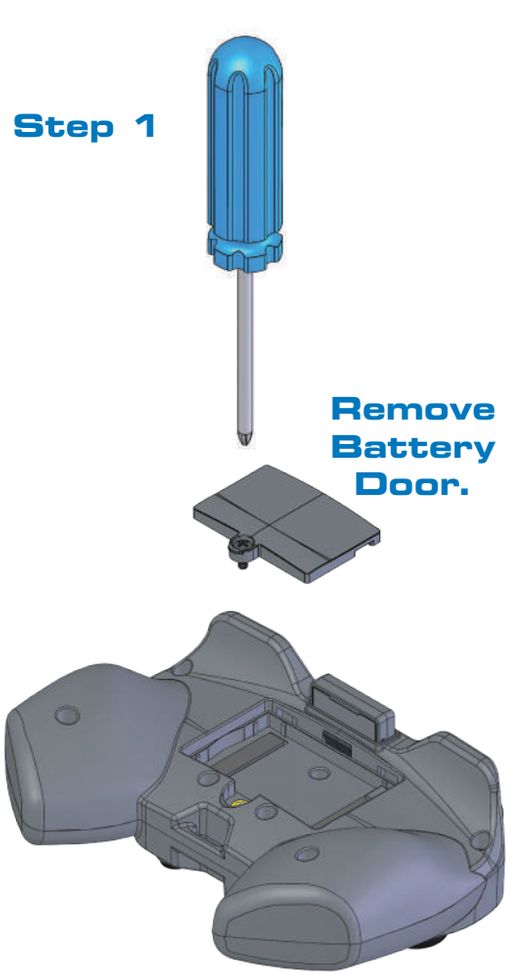
Controller Battery Installation and Removal

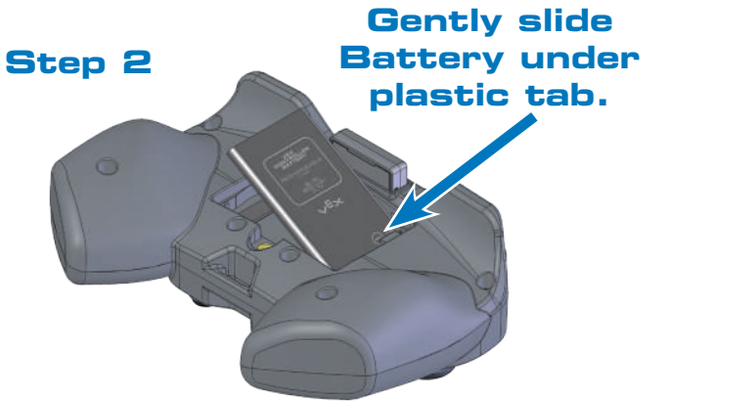
Items you will need:

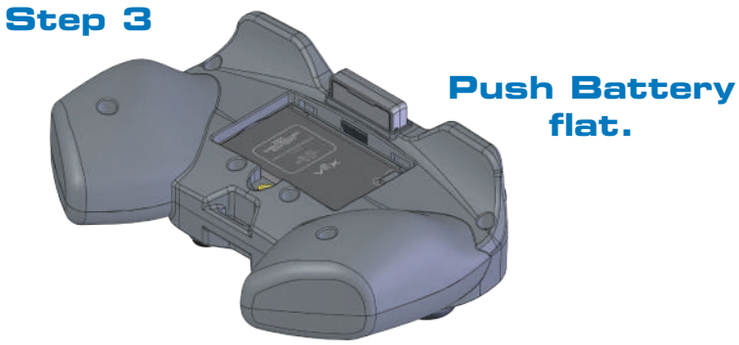
- Controller P/N: 228-2530
- Small Phillips head screwdriver
- Controller Battery P/N: 228-2779

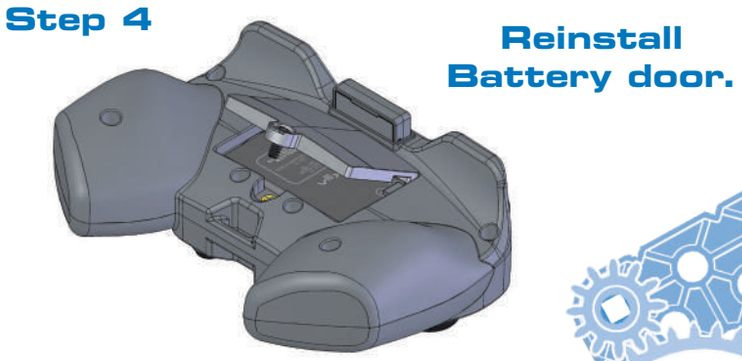
Notice: See the Appendices for Battery Safety and Disposal information

Remove the battery door on the back of the Controller using a small Phillips head screwdriver. Gently install the Controller Battery, ensuring that the "+" and "-" contacts align with the power connector also marked "+" and "-". Reinstall battery door.





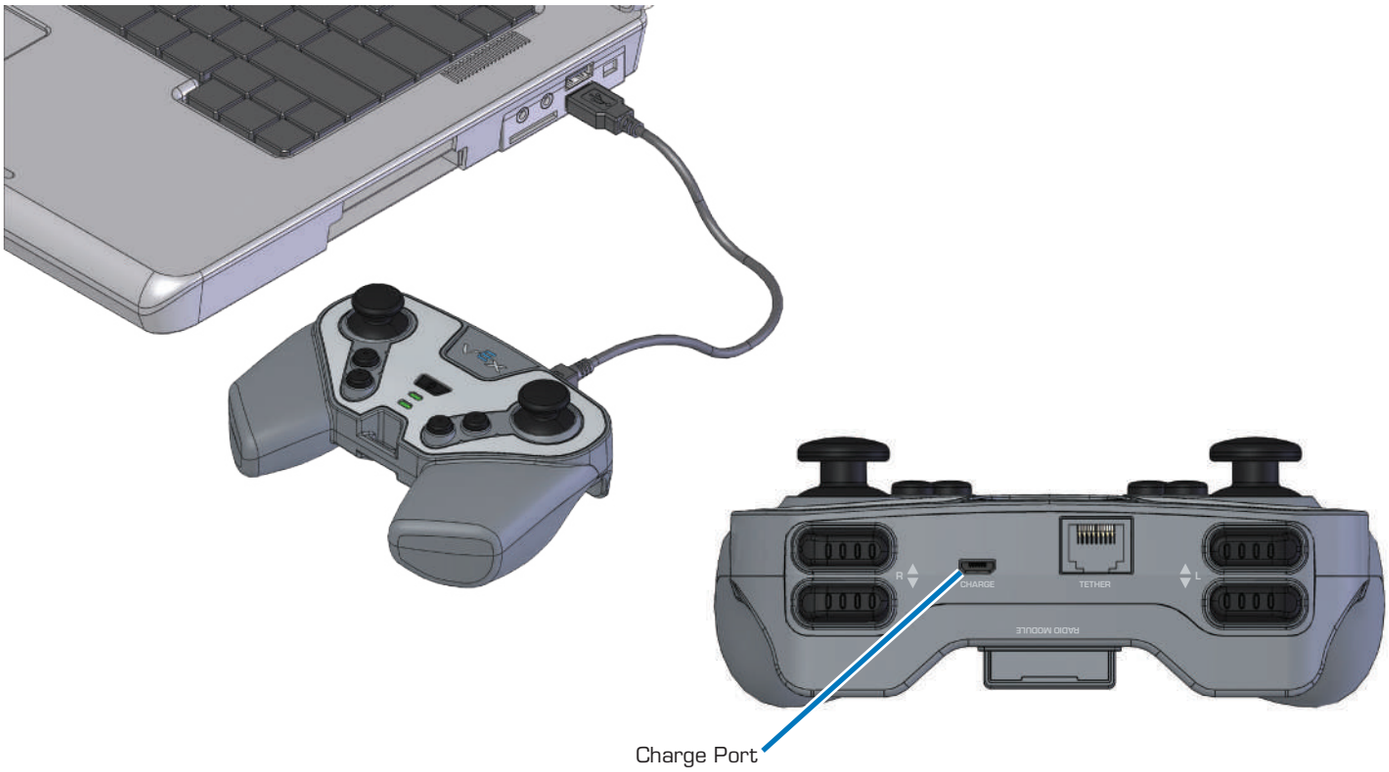




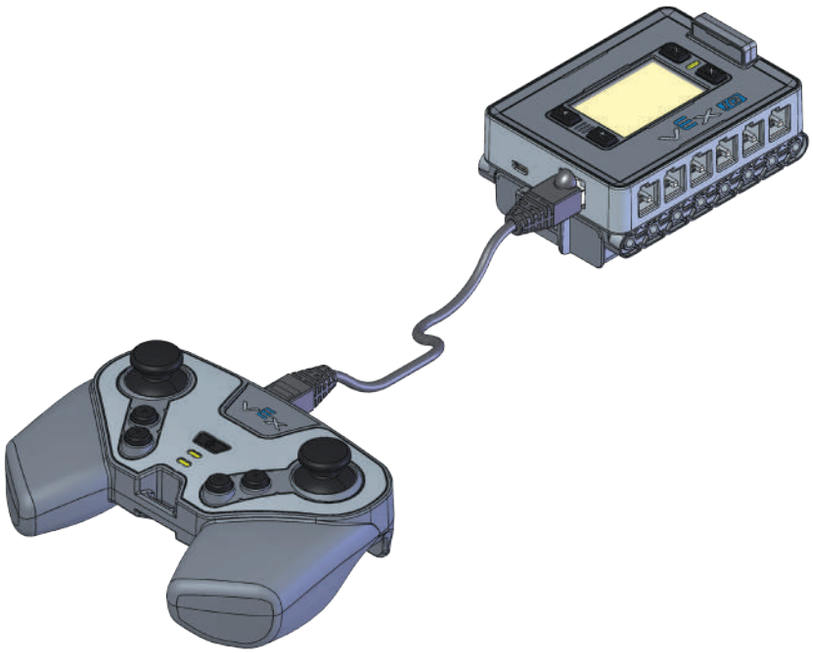
Controller Battery Charging

The VEX Controller Battery can only be charged while installed in the Controller. See the Battery Safety information in the Appendices. There are two ways to charge the Controller Battery:

Option A: Turn off the Controller. Connect the Controller to a USB port on a PC or a USB Wall Adaptor using the USB Cable P/N: 228-2785. Charging will start automatically. This is the recommended charging method.



Option B: Turn off the Controller and Robot Brain. Connect the Controller to the Robot Brain using a Tether Cable P/N: 228-2786. Turn the Robot Brain ON and charging will start automatically.



Controller Battery charging will take about 4 hours. While the Controller Battery is charging, the Charge/Game LED on the Controller will be solid red. When the Controller Battery is fully charged, the LED will change to solid green. See page 95 for detailed LED color diagram.

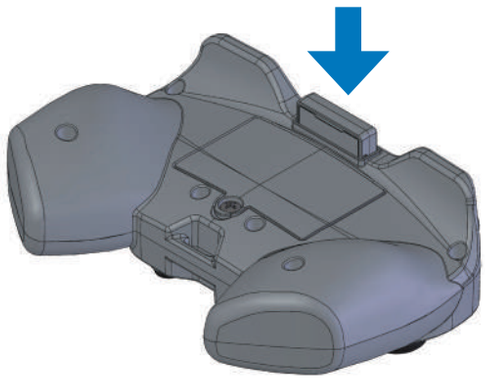
Charge / Game LED

Charge LED Color		Status
	Solid Green	Battery is completely charged
	Solid Red	Battery charge in progress
	Blinking Red	Battery fault
	Off	Not charging

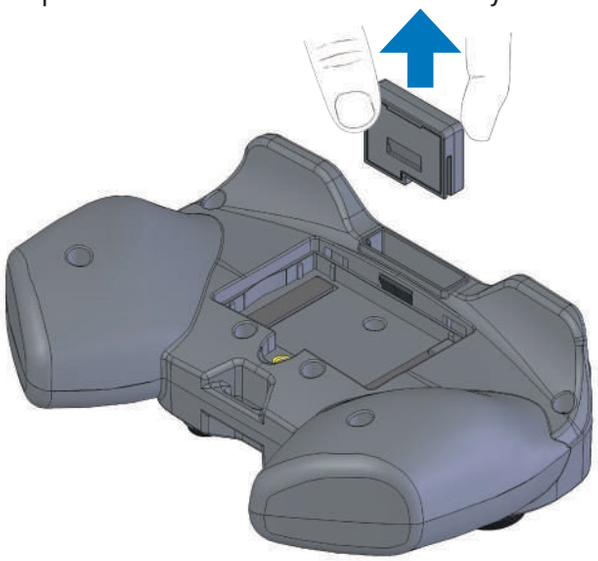
Radio Installation and Removal

The Controller is designed to use a variety of Radio types, including the 900 MHz Radio P/N: 228-2621. Be sure to use the same type of Radio in both the Robot Brain and the Controller.

Slide the Radio into the Radio Socket. Orient the Radio so the VEX logo faces the top of the Controller. Press it in firmly.



Removing the Radio should rarely, if ever, be done. To remove the Radio, first remove the battery door using a Phillips head screwdriver. Pull firmly on the Radio to remove it.

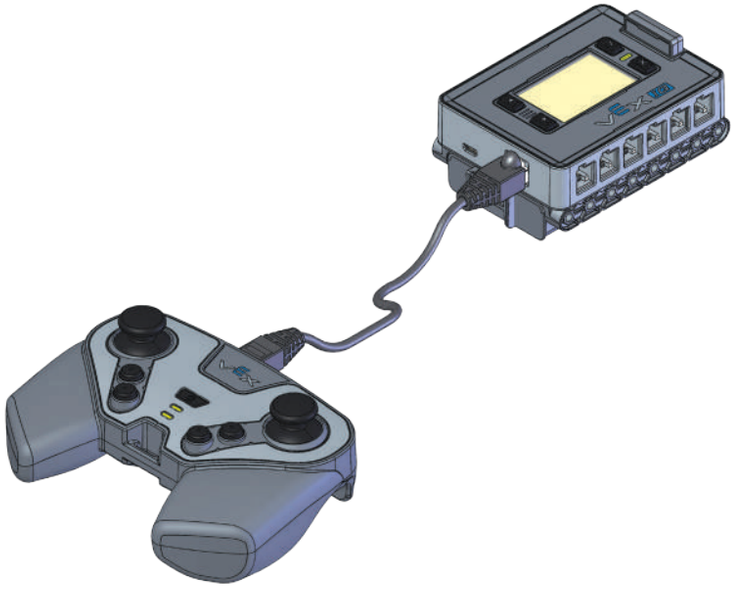


Initial Wireless Setup

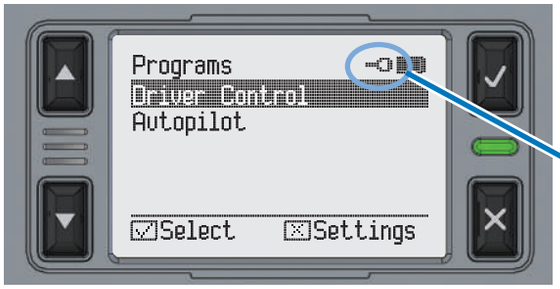
Items you will need:

- Robot Brain with Radio and Robot Battery installed
- VEX Controller with Radio and Controller Battery installed
- Tether Cable P/N: 228-2786

In order for the Robot Brain and Controller to communicate wirelessly, they must be paired together. Before pairing these devices together, a radio and battery must be installed into each of them. With both devices OFF, connect the Robot Brain to the Controller using the Tether Cable.



Turn the Robot Brain ON by pressing the Check button. The Controller will automatically link and pair to the Robot Brain. The Tether Icon will appear on the Robot Brain LCD screen.



Remove the Tether cable from Robot Brain and Controller. They are now communicating wirelessly as indicated by the Radio Bar icon on the LCD screen. The Robot Brain's LED and the Controller's Power/Link LED should be blinking green. Congratulations, your Robot Brain and Controller are now paired!

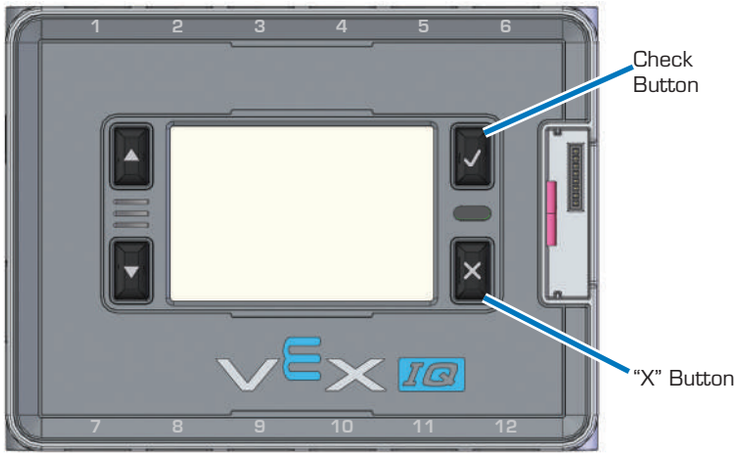
If the Robot Brain and Controller are not linked (indicated by animated "Searching" icon), turn them both OFF and repeat the process.

Icon Table

1 2 3 4 Animated icon	Searching Icon - Searching for Controller (not connected).
	Tether Icon - Connected by Tether Cable.
	Radio Link Icon - Connected by Radio (number of bars indicates signal strength).
	No Radio installed, no Tether connected.

Power On and OFF

Robot Brain ON: Press the Check button.
VEX Controller ON: Press the Power button.



Power OFF

Turning off the VEX Controller or Robot Brain will automatically turn OFF the other unit, if the units are connected wirelessly.

VEX Controller OFF: press and hold the Power Button for 2 seconds.
Robot Brain OFF: press and hold the "X" Button for 2 seconds.

LED Indicators

Robot Brain

The color of the LED indicates the status of the Robot Brain. Review table below. This information is very helpful when working with the Robot Brain.

LED Color		Status
	Solid Green	Robot Brain ON - with NO Radio Link (searching)
	Blinking Green	Robot Brain ON - with good Radio Link
	Solid Red	Battery level low - with NO Radio Link
	Blinking Red	Battery level low - with good Radio Link

VEX Controller

The color of the LEDs indicates the status of the Controller. Review table below. This information is very helpful when working with the Controller.

Power / Link LED

Power / Link LED Color		Status
	Solid Green	VEX Controller ON - with NO Radio Link (searching)
	Blinking Green	VEX Controller ON - with good Radio Link
	Solid Red	Battery level low - with NO Radio Link
	Blinking Red	Battery level low - with good Radio Link

Charge / Game LED

Charge / Game LED Color		Status
	Solid Green	Battery is completely charged
	Solid Red	Battery charge in progress
	Blinking Red	Battery fault
	Off	Not charging

VEX Controller Buttons and Joysticks

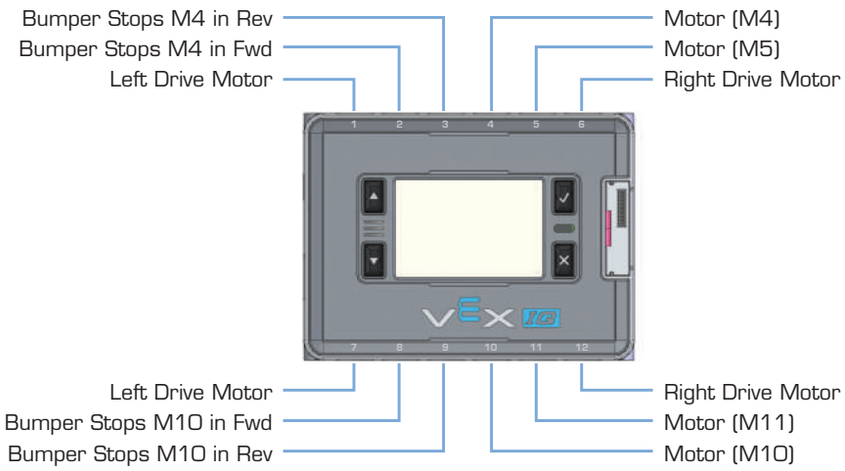
The Controller has (4) joystick axes labeled A, B, C and D that are used to control the robot. The further the joystick is moved in one direction, the faster the motor will spin. When the joystick is at rest, the motors do not receive any signal to move.

The Controller also has 4 pairs of buttons labeled E, F, R and L. These buttons turn the motors on at full speed in one direction. Each button pair controls the clockwise and counterclockwise direction of the motor.

See the Driver Control Program for a mapping of the joysticks and buttons to the ports on the Robot Brain, when using the built-in ***Drive Control*** program.

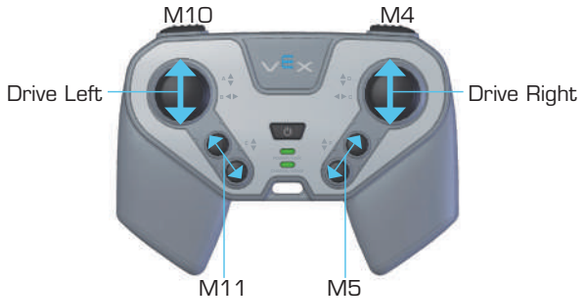
Driver Control Program

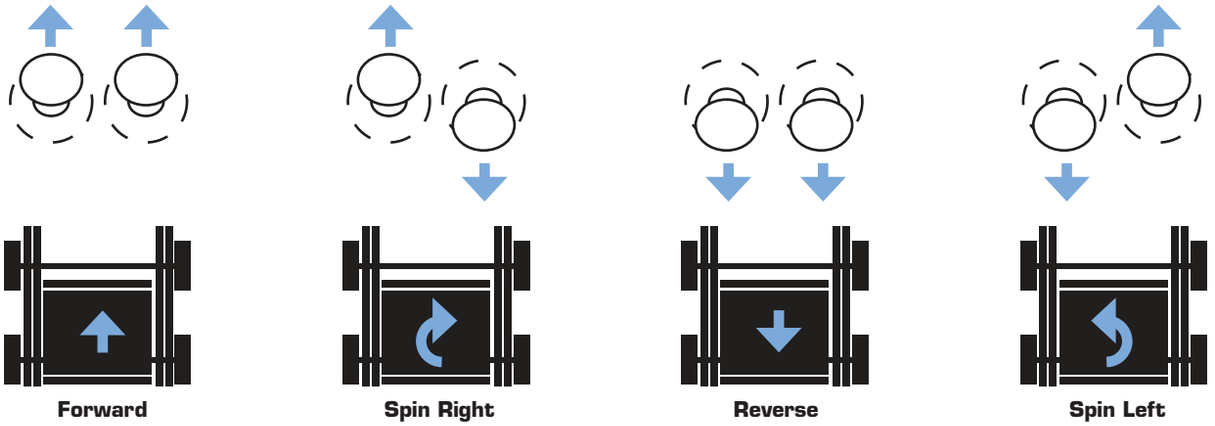
The Driver Control Program is a default program built into the Robot Brain so it can be used with the Controller without programming. It maps the Controller joysticks and buttons to control specific ports on the Robot Brain. There are three modes in the Driver Control Program: ***Left Stick***, ***Right Stick***, and ***2 Joystick***.



In ***2 Joystick*** mode, two joysticks will be used to drive the robot. The A axis on the left joystick controls the left drive motor and the D axis on the right joystick controls the right drive motor.

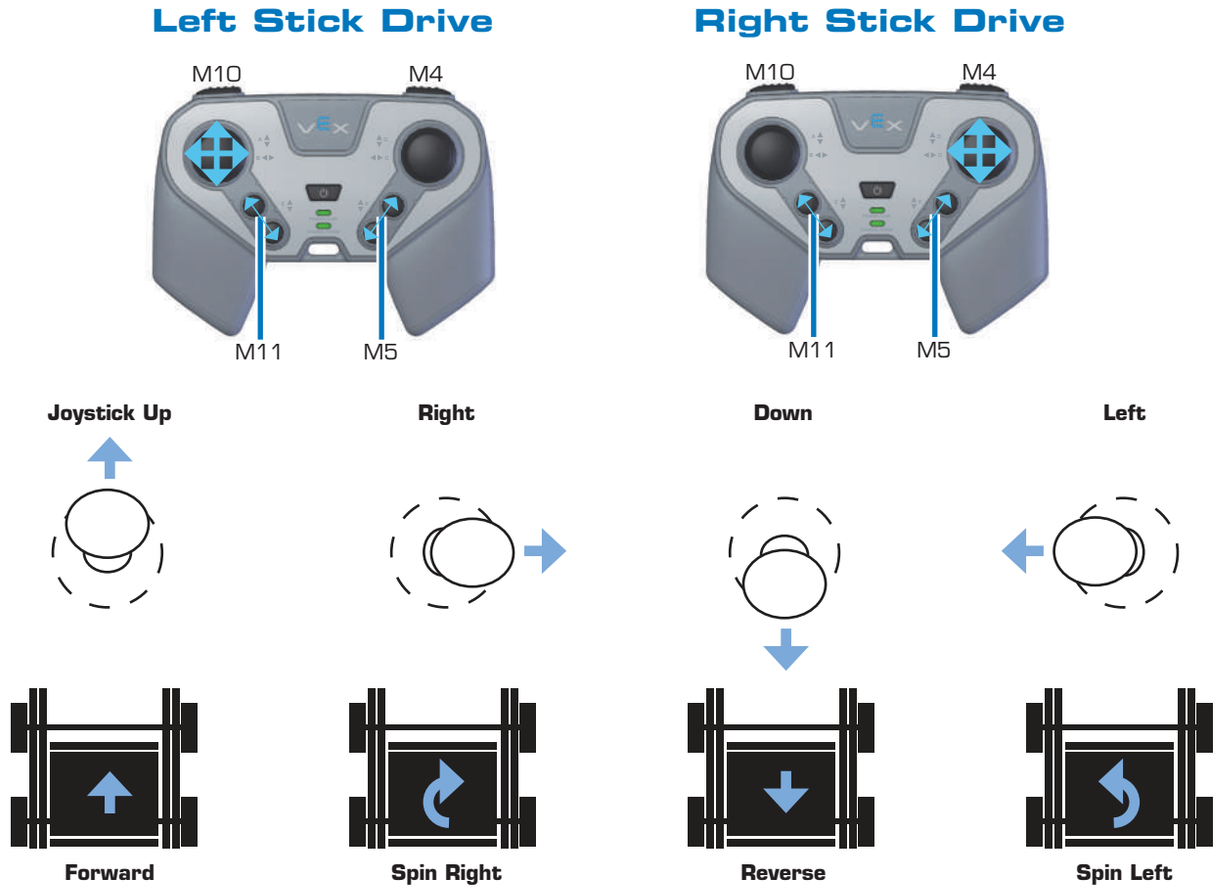
2 Joystick Drive





Forward **Spin Right** **Reverse** **Spin Left**

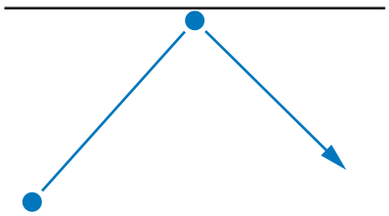
In both ***Left Stick*** and ***Right Stick*** mode, one joystick will be used to drive the robot. In ***Right Stick*** the D axis on the right joystick will be used to drive the robot forward and backward. The C axis will be used to turn the robot left and right. In ***Left Stick***, the A axis on the left joystick will be used to drive the robot forward and backward. The B axis will be used to turn the robot left and right.



Autopilot Program

The Autopilot program is a default program built into the Robot Brain so that your Autopilot Robot (see pages 10 through 27 and continued on 78 through 84 for build instructions) can explore a room by itself - no Controller needed. It contains three built-in in modes for exploring: random, spiral, and lawnmower mode. The three diagrams on the next page show these behaviors:

Random Mode



The robot will randomly explore your room by driving in a straight line. When it encounters obstacles, it will backup, spin a random amount, and depart in a new direction.

This is the default Autopilot explore mode; tapping the Touch LED during this mode will change to Spiral Mode.

The Touch LED will illuminate red when in this mode; when the Color Sensor sees a red object, the robot will change to this mode.

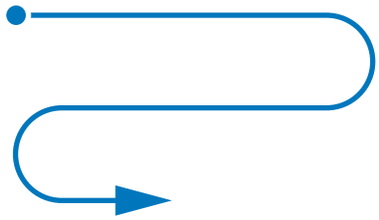
Spiral Mode

The robot will begin to explore by driving in a spiral with an ever increasing radius. When it encounters an obstacle, the robot will drive to a new location and begin to spiral again.

Tapping the Touch LED during this mode will change to either Lawnmower Mode if a Gyro Sensor is attached, or Random Mode if the Gyro Sensor is not attached.

The Touch LED will illuminate blue in this mode; when the Color Sensor sees a blue object, the robot will change to this mode.

Lawnmower Mode



The robot will begin to explore your room by driving back and forth, as if it were mowing a lawn. When it encounters an obstacle, it will turn away and continue in the opposite direction.

Tapping the Touch LED during this mode will change to Random Mode.

The Touch LED will illuminate green in this mode; when the Color Sensor sees a green object, the robot will change to this mode.

The Autopilot program requires at least two Smart Motors and either one Distance Sensor or up to two Bumper Switches to operate. Having both a Distance Sensor and two Bumper Switches connected will enhance the ability of the Autopilot Robot to explore its environment. The maximum number of sensors that the Autopilot program will utilize are:

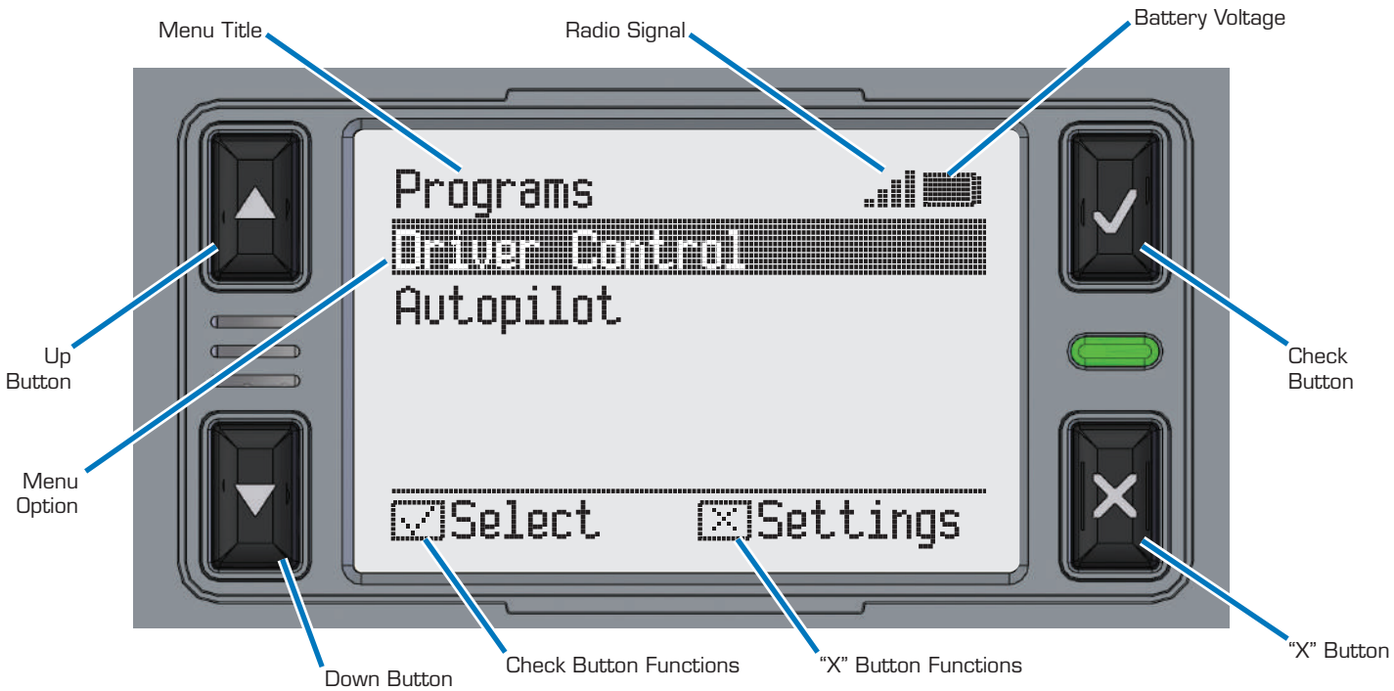
- (2x) Bumper Switch, mounted on the back side of the robot.
- (1x) Distance Sensor, mounted on the front side of the robot
- (1x) Touch LED
- (1x) Color Sensor
- (1x) Gyro Sensor

The default explore mode is Random Mode. To change between the three different modes, a Touch LED and or Color Sensor must also be connected to the Robot Brain. Tapping the Touch LED will cycle through the available explore modes. The current explore mode will be shown by illuminating the Touch LED in red for Random Mode, blue for Spiral Mode, and green for Lawnmower Mode. When the Color Sensor sees a red, blue or green object, it will cause the robot to enter into the explore mode associated with that color.

Sometimes, the Autopilot Robot may get stuck, such as between the legs of a chair or stool. If this occurs, the robot will stop moving and the Touch LED will blink on and off. Picking up the robot and moving it to a new location will allow the robot to continue exploring.

LCD on the Robot Brain

The LCD is a very powerful tool to help configure and operate the Robot Brain.

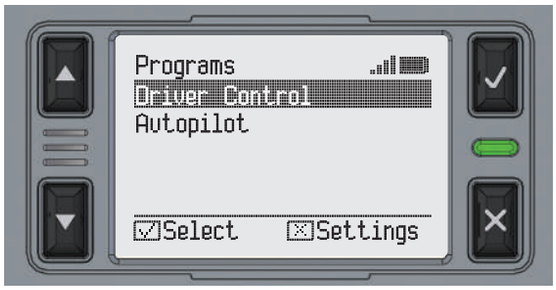


Start Screen and List of Programs

Programs

The ***Programs Screen*** of the Robot Brain is the first screen displayed after turning on the Robot Brain, and will contain a list of all programs that have been downloaded to it. The default program is ***Driver Control***, which allows you to use and control up to eight Smart Motors and four Sensors.

If additional programs have been downloaded to the Robot Brain, use the Up/Down arrows to navigate between programs. The currently selected program will be highlighted; to run the selected program, press the Check button.



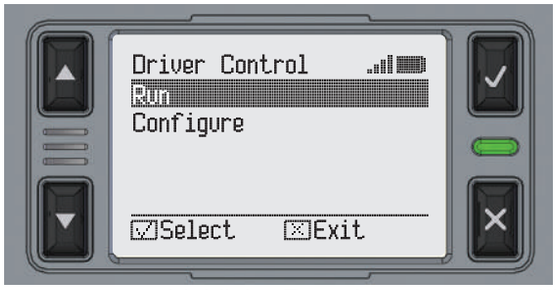
Use Up/Down arrows to highlight *Driver Control*, then press the Check button.

Run or Configure Driver Control

Programs › Driver Control

The ***Driver Control*** program is unique in that it contains the ability to customize the way it runs. This program is the default program loaded onto the Robot Brain.

When selecting the ***Driver Control*** program from the ***Programs Screen***, two additional options are presented: ***Run*** or ***Configure***. Use the Up/Down buttons to select the ***Run*** option, and press the Check button to begin running this program with the default settings.



Use Up/Down arrows to highlight *Run*, then press the Check button.

Program Running Screen

Programs › Driver Control › Run

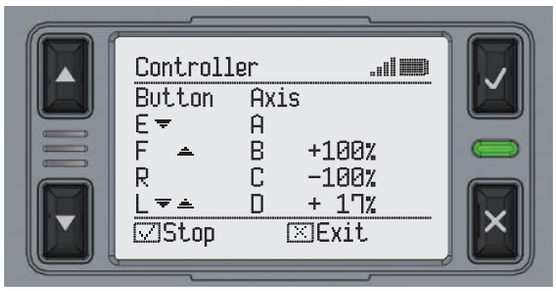
The ***Driver Control*** program is now running on the Robot Brain; the table on Page 96 contains the default mapping between the buttons on the Controller and the Smart Ports on the Robot Brain.

While a program is running, a clock will be displayed showing the total time that the program has been running. To stop the program, press the Check button. After stopping the program the Check Button will run it again. To exit the program, press the X button. To see the current status of the Robot Brain and Controller, press either the Up or Down button.

VEX Controller Status

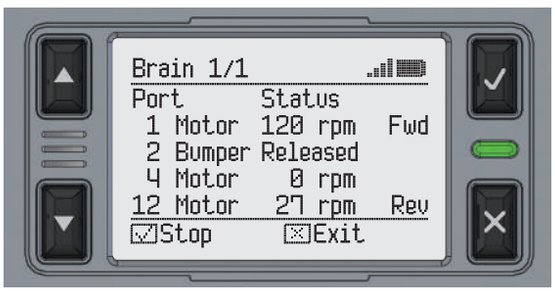
Programs › Driver Control › Run › Up or Down Button

Sometimes when running a program, it is helpful to see the current status of a particular motor, sensor, or Controller button. While a program is running, pressing the Up or Down button will cause it to cycle through up to four status screens. To return to the program running screen, continue pressing Up or Down buttons to cycle through the available screens. One screen will display the current values of the buttons and the joystick axes on the Controller. When buttons E, F, R or L are pressed, a corresponding arrow will be displayed next to those letters. The numbers next to joystick axis A, B, C, and D show the current analog joystick value.



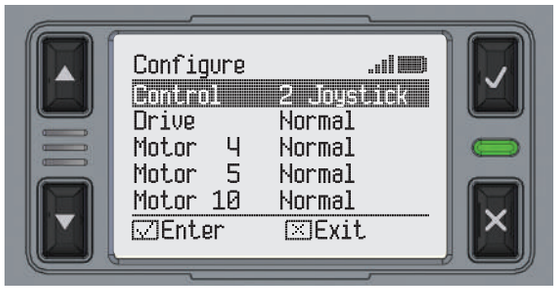
Smart Device Status

From one to three additional screens will be displayed showing the status of all connected devices, depending on how many Smart Motors or Sensors are currently connected to the Robot Brain.



Configure Drive Control

Programs › Driver Control › Configure
To customize the ***Driver Control*** program, exit any currently running programs and select ***Configure*** from the ***Home Screen*** › ***Driver Control*** menu.



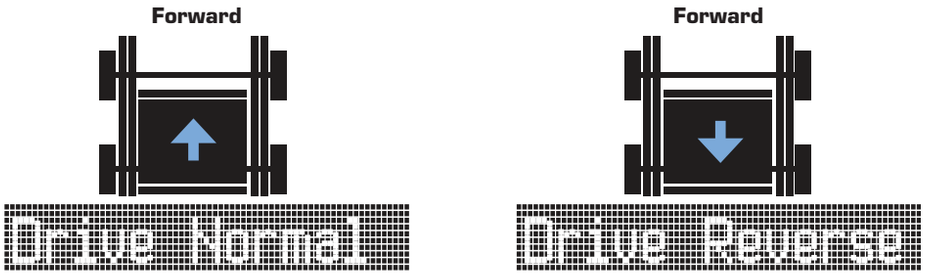
Use Up/Down arrows to highlight Configure, then press the Check button.

The ***Configure*** screen has two primary options: ***Control*** and ***Drive***, followed by a list of all additional Smart Motors and sensors connected to the Robot Brain. Use the Up/Down arrows to select each row; while selected, press the Check button to cycle through available options.

To customize the control mode for the robot drive train, select ***Control*** and press the Check button to cycle through ***Left Stick***, ***Right Stick***, and ***2 Joystick***. See Page 96 for more information about the Driver Control Program.

The ***Left Stick*** and ***Right Stick*** modes are similar to many video games, where both axes on a single joystick are used to control all forward, reverse, and turning options. ***Left Stick*** uses the left A/B joystick; ***Right Stick*** uses the right C/D joystick.

The ***2 Joystick*** mode uses the vertical axis on both joysticks on the VEX Controller to control the drivetrain. Axis A controls the left side of the robot, and Axis D controls the right side of the robot.

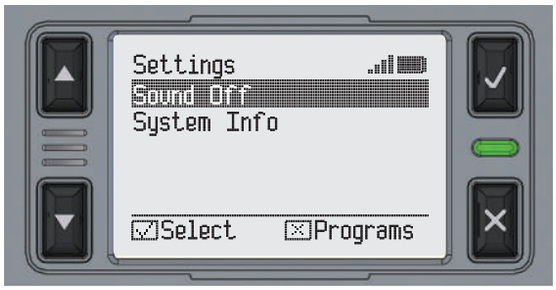


Sometimes, you may want to change which side of a robot is considered the front to make it easier to drive. The ***Drive*** option allows you to control this, so that pushing upwards on a joystick axis always makes your robot drive forward. To change this setting, highlight the ***Drive*** row, and press the Check button to cycle between ***Normal*** and ***Reverse***.

To change the direction that additional motors run, use the Up/Down arrows to highlight the desired motor port, and press the Check button to cycle between ***Normal*** and ***Reversed***.

Settings

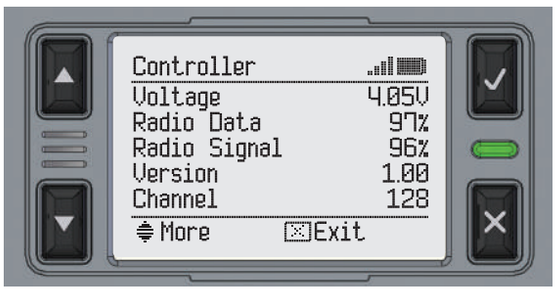
The ***Settings*** screen is accessed by pressing the X button while on the ***Programs***. This menu contains system wide options and information about the Robot Brain and VEX IQ Controller. The first row will either contain the text ***Sound On*** or ***Sound Off***, depending on which option is currently set. To change this setting, press the Check button while this row is selected.

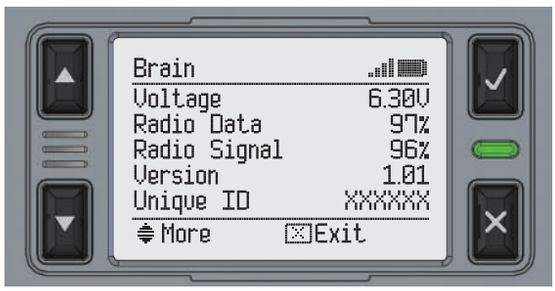


To view detailed information about the current status of the Robot Brain and the VEX Controller, use the Up/Down arrows to highlight the ***System Info*** row and press the Check button.

Settings › System Info

The ***System Info*** menu contains two menu screens: one for the VEX Controller and another for the Robot Brain. You can use the Up/Down arrows to toggle between these screens. Each of these screens will display the current battery voltage, the radio data accuracy, the radio signal strength, and the current firmware version.

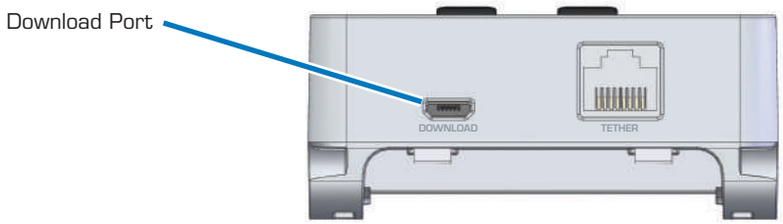




Connector Ports and Buttons

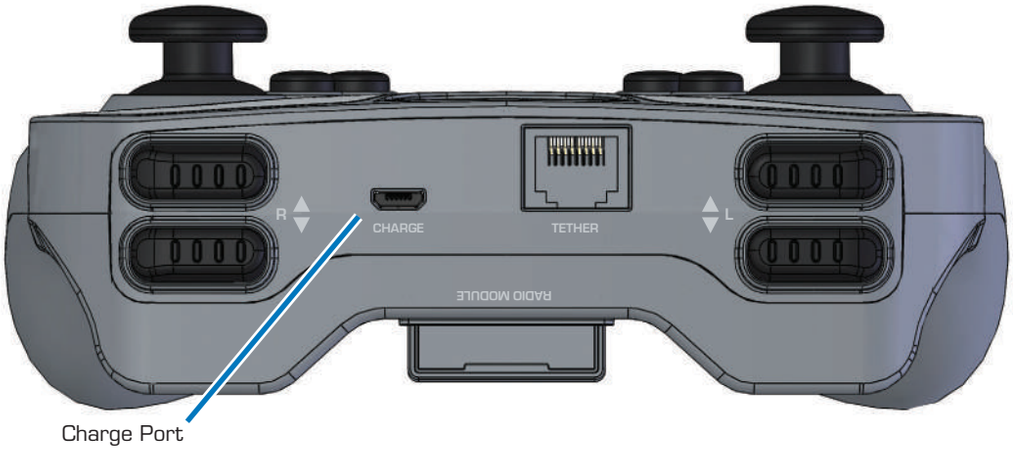
Download Port (Robot Brain)

The Download port is used to program the Robot Brain using either Modkit for VEX or ROBOTC. The Download port can also be used to upgrade the firmware in the Robot Brain. See vexrobotics.com/vexiq/firmware to get the VEX IQ Firmware Utility.

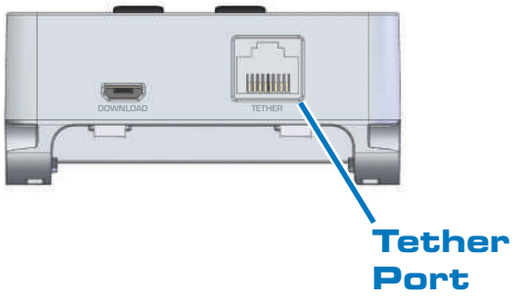


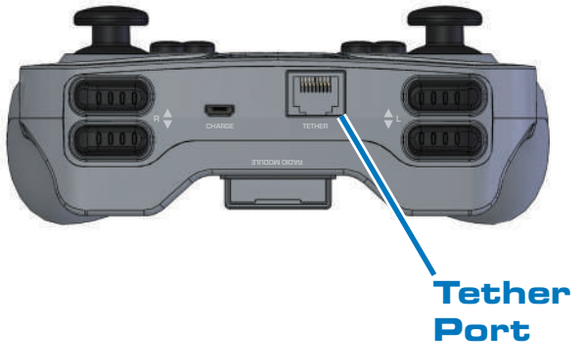
Charge Port (VEX Controller)

The Charge port is only used to charge the Controller. See page 90 for charging instructions.



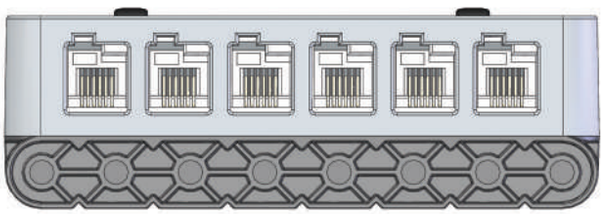
Tether Port (VEX Controller and Robot Brain)
The Tether Port has three functions:





1. It is used to "Pair" the Robot Brain with a Controller. Pairing is required to make the Robot Brain and Controller communicate with each other. Once paired, the process does not need to be repeated, unless you want a different Controller to communicate with the Robot Brain. See Page 92 for more information about the Wireless Setup.
2. The Tether Port allows for Wired Communication between the Robot Brain and Controller, when no radio channels are available.
3. The Tether Port can also be used to charge the Controller, when it is tethered to the Robot Brain, drawing power from the Robot Battery. See Page 90 for more information about changing the Controller.

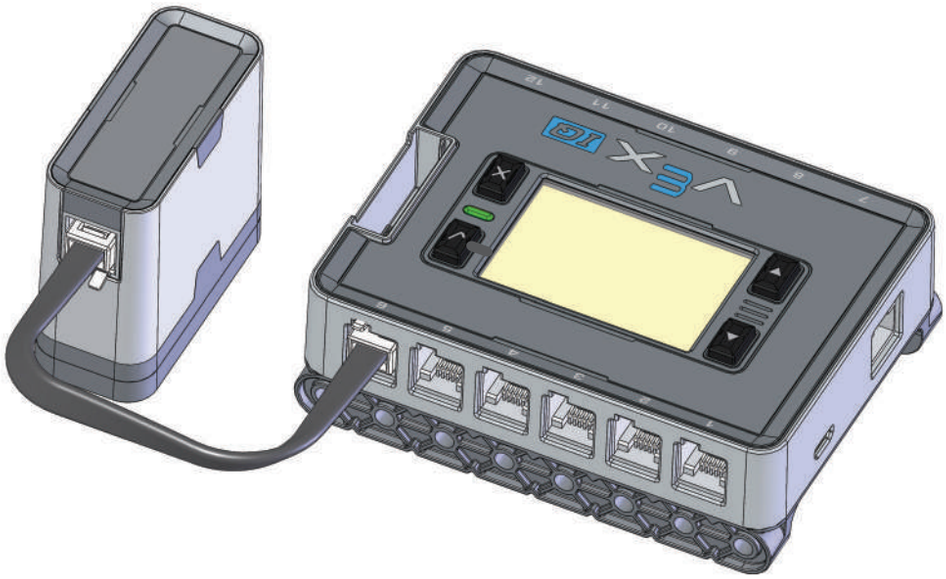
Smart Device Ports
There are 12 Smart Device ports designed for all VEX IQ electronic accessories, including Smart Motors and Sensors. All ports function the exact same way, so any accessory can be plugged into any port. See Page 96 for information on connecting devices when using the built-in ***Drive Control*** program.



Connecting a Smart Motor
Items you will need:

- Robot Brain with Radio and Robot Battery installed
- VEX Controller with Radio and Controller Battery installed
- Smart Motor P/N: 228-2560
- Smart Cable P/N: 228-2780

Smart Motors are used to make your robotic creations come alive with motion.
The Smart Motors are connected to the Robot Brain using Smart Cables. These cables come in assorted lengths between 200mm and 600mm long. All motors should only be connected to the Robot Brain when the power is OFF. Smart Cables can only be plugged in one way and they lock into place.
Connect a Smart Motor to port number 6 on the Robot Brain using a Smart Cable. Press each side of the cable firmly into the socket on the Smart Motor and Robot Brain until you hear the click of the lock snapping into place. Smart cables are removed from any device by pressing down on the release tab, then gently pulling out.



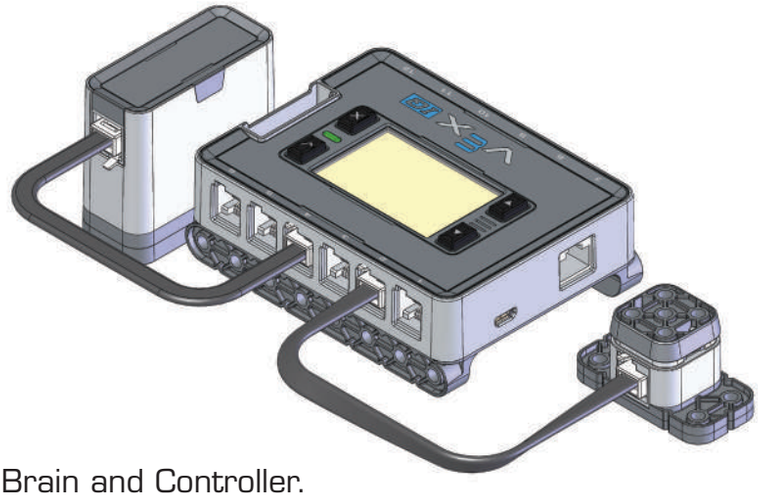
- Turn ON the Robot Brain and Controller.
- Select the Driver Control Program and run it.
- Move the D axis of the right joystick up and down to move the motor forward and reverse. Notice how the speed changes with the movement of the joystick.

Connecting a Bumper Switch

Items you will need:

- Robot Brain with Radio and Robot Battery installed
- VEX IQ Controller with Radio and Controller Battery installed
- Smart Motor P/N: 228-2560
- Bumper Switch P/N: 228-2677
- Smart cable P/N: 228-2780

Bumper switches are input devices that give the Robot Brain a signal when they are pressed. Bumper Switches can be used to turn off a motor when pressed.
All VEX IQ electronics are connected to the Robot Brain using Smart Cables. These cables come in assorted lengths. All sensors should only be connected to the Robot Brain when the power is OFF. Smart Cables can only be plugged in one way and they lock into place.
Connect the Bumper Switch to port 2 on the Robot Brain using the Smart Cable. Press each side of the cable firmly into the socket on the Bumper Switch and Robot Brain until you hear the click of the lock snapping into place. Connect a Smart Motor to the Robot Brain in port 4 using a Smart Cable.



- Turn On the Robot Brain and Controller.
- Select the Driver Control Program and run it.
- Press the top and bottom R buttons on the Controller. The Smart Motor should spin when either button is pressed.
- Press the Bumper Switch and hold it down.
- Now try to press the R buttons again to move the motor. Notice how one of them no longer works, because the Bumper Switch is sending the Robot Brain a signal to turn the motor OFF in that direction only.

Connecting a Touch LED

Items you will need:

- Fully assembled VEX IQ Robot such as the Standard Drive Base, Autopilot Robot, Clawbot or Clawbot with Sensors (See Page 8 for more information), Radio, and Robot Battery installed in the Robot Brain
- VEX IQ Controller with Radio and Controller Battery Installed
- Touch LED (228-3010)

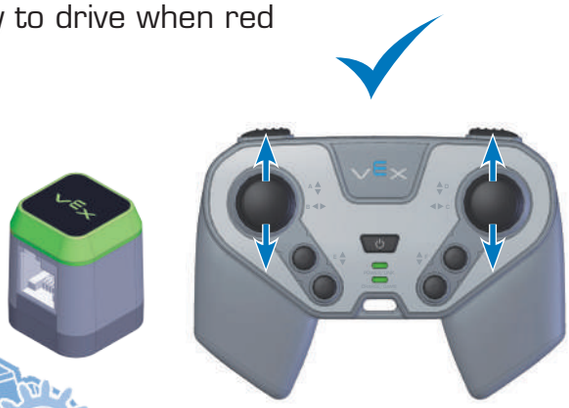
The Touch LED is an input device that responds to interaction from a person touching the top dome. The top dome of the sensor can glow in up to 16 million different colors. Touch LEDs are connected to the Robot Brain using Smart Cables. These cables come in assorted lengths between 200mm and 600mm long. All sensors should be connected to the Robot Brain with the power OFF. Smart Cables can only be plugged in one way; when fully inserted they lock into place.

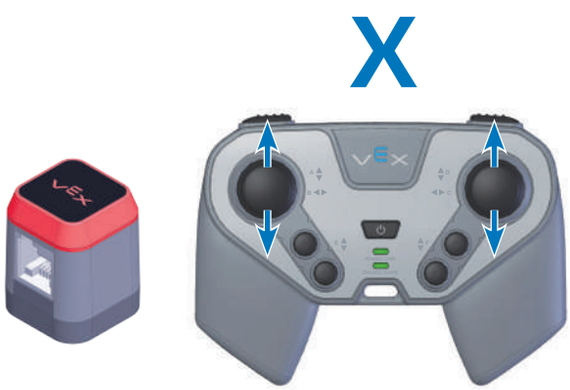
The default ***Driver Control*** program on the Robot Brain will automatically look for and find the four advanced VEX IQ sensors (Touch LED, Distance Sensor, Color Sensor, and Gyro Sensor) on any unused port. Connect the Touch LED to any unused Smart Port on the Robot Brain.

If there are multiple advanced sensors of the same type plugged in (for example, two Gyro Sensors), the ***Driver Control*** program will only respond to the sensor on the lower port number. There are no restrictions to type or quantity of sensor use when the Robot Brain is running a custom user-created program.

The default Touch LED functionality in the ***Driver Control*** program is to act like a traffic light for the robot. When the Touch LED glows green, the robot is free to drive. But when the Touch LED glows red, the robot must stop. The Touch LED can be changed between green and red by tapping the top dome of the Touch LED.

- Turn ON the Robot Brain and Controller.
- Select and run the ***Driver Control*** program.
- The robot starts in enabled mode with the Touch LED glowing green. Tap the top dome of the Touch LED to change between enabled (glowing green) and disabled (glowing red) mode.
- Try to drive when green
- Try to drive when red





Connecting a Distance Sensor

Items you will need:

- Fully assembled VEX IQ Robot such as the Standard Drive Base, Autopilot Robot, Clawbot or Clawbot with Sensors (See Page 8 for more information), Radio, and Robot Battery installed in the Robot Brain
- VEX IQ Controller with Radio and Controller Battery Installed
- Distance Sensor (228-3011)

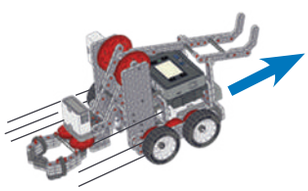
The Distance Sensor is an input device that measures the distance to an object by using high frequency sound waves. Distance Sensors are connected to the Robot Brain using Smart Cables. These cables come in assorted lengths between 200mm and 600mm long. All sensors should be connected to the Robot Brain with the power is OFF. Smart Cables can only be plugged in one way; when fully inserted they lock into place.

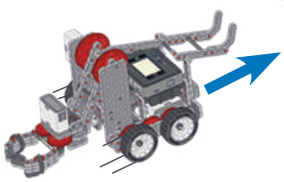
The default ***Driver Control*** program on the Robot Brain will automatically look for and find the four advanced VEX IQ sensors (Touch LED, Distance Sensor, Color Sensor, and Gyro Sensor) on any unused port. Connect the Distance Sensor to any unused Smart Port on the Robot Brain.

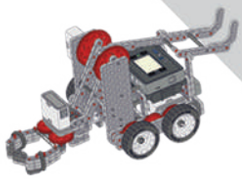
If there are multiple advanced sensors of the same type plugged in (for example, two Gyro Sensors), the ***Driver Control*** program will only respond to the sensor on the lower port number. There are no restrictions to type or quantity of sensor use when the Robot Brain is running a custom user-created program.

The default action of the Distance Sensor in the ***Driver Control*** program is to prevent the robot from running into an object or wall. When the Distance Sensor sees an object, it will first slow down the Clawbot as it approaches the object. If the robot gets too close, the Clawbot will stop to prevent a collision. If this occurs, drive in the opposite direction away from the object to regain full control of the robot.

- Turn ON the Robot Brain and Controller.
- Select and run the ***Driver Control*** program.
- Use the Controller to drive the Clawbot in reverse towards a wall. When the Distance Sensor sees an object that is too close to the robot, it will stop the robot from hitting that object.







Connecting a Color Sensor

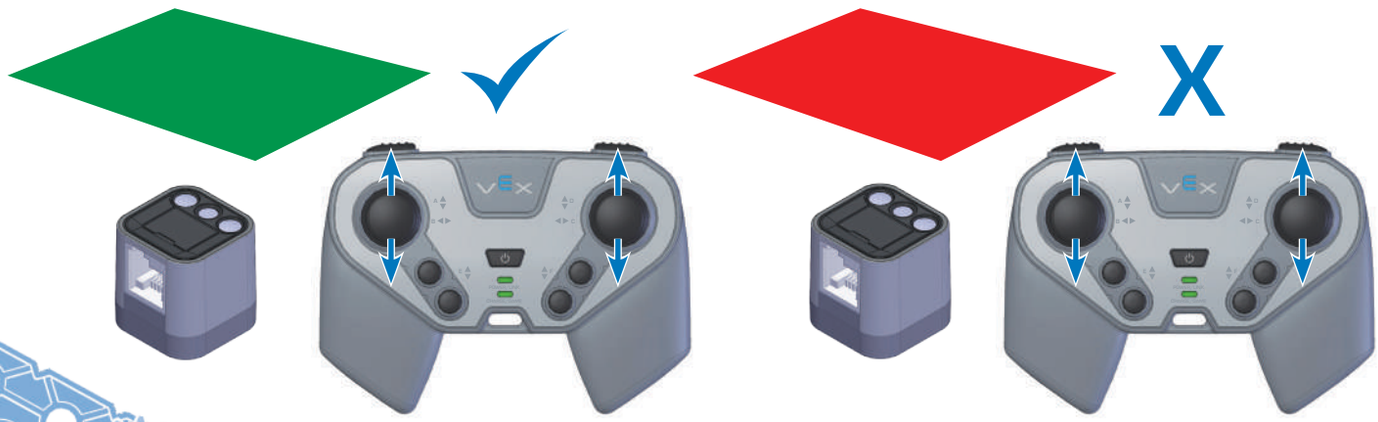
Items you will need:

- Fully assembled VEX IQ Robot such as the Standard Drive Base, Autopilot Robot, Clawbot or Clawbot with Sensors (See Page 8 for more information), Radio, and Robot Battery installed in the Robot Brain
- VEX IQ Controller with Radio and Controller Battery Installed
- Color Sensor (228-3012)

The Color Sensor is an input device that senses the color of an object. Color Sensors are connected to the Robot Brain using Smart Cables. These cables come in assorted lengths between 200mm and 600mm long. All sensors should be connected to the Robot Brain with the power is OFF. Smart Cables can only be plugged in one way; when fully inserted they lock into place.

The default ***Driver Control*** program on the Robot Brain will automatically look for and find the four advanced VEX IQ sensors (Touch LED, Distance Sensor, Color Sensor, and Gyro Sensor) on any unused port. Connect the Color Sensor to any unused Smart Port on the Robot Brain.
If there are multiple advanced sensors of the same type plugged in (for example, two Gyro Sensors), the ***Driver Control*** program will only respond to the sensor on the lower port number. There are no restrictions to type or quantity of sensor use when the Robot Brain is running a custom user-created program.
The default action of the Color Sensor in the ***Driver Control*** program is to sense colors of objects, and then have the robot react. The Color Sensor functionality works like the Touch LED functionality in the ***Driver Control*** program; however instead of touching the sensor to change between enabled and disabled, flashing red or green cards within range (0-200mm) of the sensor will toggle between these modes.

- Turn ON the Robot Brain and Controller.
- Select and run the Driver Control program.
- The robot will start in enabled mode. When a red card or object is shown in front of the color sensor, the robot will be disabled. When a green card is shown in front of the color sensor, the robot will be enabled.

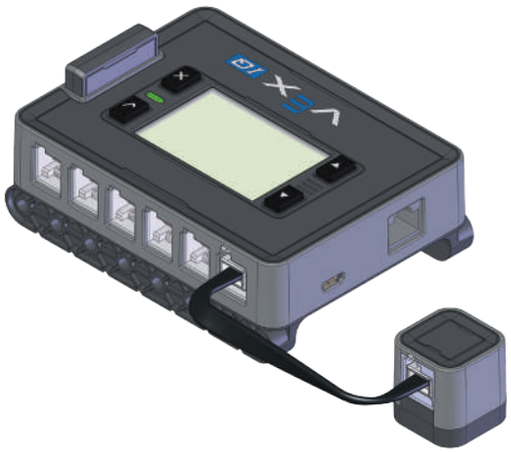


Connecting a Gyro Sensor

Items you will need:

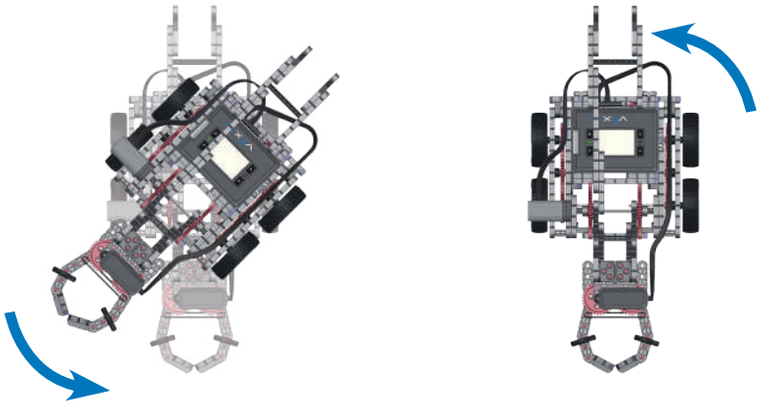
- Fully assembled VEX IQ Robot such as the Standard Drive Base, Autopilot Robot, Clawbot or Clawbot with Sensors (See Page 8 for more information), Radio, and Robot Battery installed in the Robot Brain
- VEX IQ Controller with Radio and Controller Battery Installed
- Gyro Sensor (228-3014)

The Gyro Sensor is a device that can detect how quickly an object is rotating. Gyro Sensors are connected to the Robot Brain using Smart Cables. These cables come in assorted lengths between 200mm and 600mm long. All sensors should be connected to the Robot Brain with the power is OFF. Smart Cables can only be plugged in one way; when fully inserted they lock into place.



The default ***Driver Control*** program on the Robot Brain will automatically look for and find the four advanced VEX IQ sensors (Touch LED, Distance Sensor, Color Sensor, and Gyro Sensor) on any unused port. Connect the Gyro Sensor to any unused Smart Port on the Robot Brain.
If there are multiple advanced sensors of the same type plugged in (for example, two Gyro Sensors), the ***Driver Control*** program will only respond to the sensor on the lower port number. There are no restrictions to type or quantity of sensor use when the Robot Brain is running a custom user-created program.
The default action of the Gyro Sensor in the ***Driver Control*** program is to keep the robot pointed in the same direction when not being driven by the Controller. If the Clawbot is pushed or spun by anything other than being driven by the Controller, the Clawbot will use the Gyro Sensor to measure how much it spun. The Clawbot will then automatically spin back to the original direction it was pointing.

- Turn ON the Robot Brain and Controller.
- Select and run the ***Driver Control*** program.
- Using the Controller turn the Robot to a new direction. When you stop driving, the robot will automatically turn back to the original direction.



Appendix A
Battery Safety and Disposal

228-2779 VEX IQ Controller Battery Rules

- Avoid letting children play with the battery.
- Dispose of the battery properly.
- Do not use, leave, store or charge the battery close to any heat source or at very high temperatures (for example, in strong direct sunlight or in a vehicle in extremely hot weather).
- Do not heat or set the battery on fire.
- Do not puncture, cut, beat, throw, drop or chisel the battery.
- Do not put the battery in water or allow it to get wet.
- Do not disassemble or refit battery.
- Do not connect the battery to any other instrument or device.
- Do not try to connect the battery to anything other than the Controller.
- Do not short circuit battery terminals together.
- If the battery gives off an odor, generates heat, or leaks chemicals, immediately remove the battery from the charger or device and stop using it.
- Do not touch battery leakage. Chemicals inside the battery can burn your skin or eyes. If battery leakage comes into contact with your eyes, DO NOT RUB THEM! Rinse immediately with clean running water and seek medical attention at once.

228-2604 Robot Brain Battery Rules

- Avoid letting children play with the battery. Adults should instruct children how to use the battery correctly during all usages.
- Avoid letting children take the battery out of the VEX IQ Robot Brain (Part #228-2540) or VEX IQ Charging Dock (Part # 228-2743) so as to play with battery.
- Dispose of the battery properly.
- Recharge the battery only with the VEX IQ Robot Battery Charger (Part # 228-2743), sold separately. Only recharge the battery under adult supervision.
- Do not use, leave, store or charge the battery close to any heat source or at very high temperatures (for example, in strong direct sunlight or in a vehicle in extremely hot weather.). Do not heat or set the battery on fire.
- Do not store or move the battery with metal objects.
- Do not puncture, cut, beat, throw, drop or chisel the battery.
- Do not put the battery in water or allow it to get wet.
- Do not disassemble and refit battery.
- Do not connect the battery to any other instrument or device
- Do not short circuit battery terminals together.
- If the battery gives off an odor, generates heat, or leaks electrolyte, immediately remove battery from charger or device and stop using.
- Do not touch battery leakage. Chemicals inside the battery can burn your skin or eyes. If battery leakage comes into contact with your eyes, DO NOT RUB THEM! Rinse immediately with clean running water and seek medical attention at once.

CAUTION!

Adults are recommended to periodically examine the transformer and power cable for conditions that may result in the risk of fire, electric shock, or injury (such as damage to the output cord, plug, housing or other parts) and in the event of such conditions, the transformer should not be used until properly repaired or replaced. The transformer is for indoor use only. Never connect outputs from two or more transformers – or to other systems where they could be interconnected. This transformer is specially designed for use solely with VEX IQ Brain Battery (Part # 228-2604) and must never be connected to any other electronics. The transformer should not be played with as a toy. The transformer is not to be cleaned with liquid or exposed to water. Disconnect power cord and Robot Battery from transformer before cleaning.

TRANSFORMER-CAUTION-ELECTRIC-TOY.

Not recommended for children under eight years of age. Care should be taken during handling and use to prevent electric shock. For indoor use only.

Software Update
Go to vexrobotics.com/vexiq/firmware to download the software update utility to update the Robot Brain, Controller, Smart Motors, and Sensors to the latest firmware version.

Getting Support
For additional support, please email support@vexrobotics.com.

If you would like to learn more about the VEX IQ system, please visit vexrobotics.com/vexiq/

To join our online community, please go to vexiqforum.com

Appendix B Compliance Statements

FCC Compliance Statement (United States)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment.

Industry Canada Compliance Statement

Industry Canada Compliance Statement (except 228-2621)

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est confirme à la norme NMB-003 du Canada.

Industry Canada Compliance Statement (228-2621)

Compliance with Industry Canada standards

This device complies with Industry Canada licence-exempt RSS standards(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Confirmité aux normes d'Industrie Canada

Cet appareil est confirme aux normes RSS exemptes de licence d'Industrie Canada. Son utilization doit répondre aux deux conditions suivantes: (1) cet appareil ne doit pas générer d'interférences et (2) il doit supporter toutes les interférences, y compris les interférences susceptibles de provoquer des dysfonctionnements.

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⚠ **Warning**: CHOKING HAZARD – Small parts.
⚠ **Avertissement**: RISQUE D'ASPHYXIE – Ce produit contient de petits éléments.
⚠ **Advertencia**: RIESGO DE ASFIXIA – Contiene piezas pequeñas.
⚠ **Achtung**: ERSTICKUNGSGEFAHR – Kleinteile.
⚠ **Attenzione**: RISCHIO DI SOFFOCAMENTO – Pezzi piccoli.

Ages 8+
Ans 8+

⚠ **WARNING:**
CHOKING HAZARD - Small parts.
Not for children under 3 years.

⚠ **AVERTISSEMENT:**
RISQUE D'ÉTOUFFEMENT -
Comporte de petites pièces. Ne convient pas aux enfants de moins de 3 ans.

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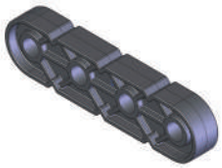
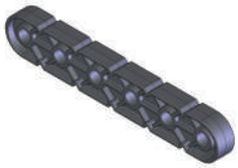
Super Kit Inventory

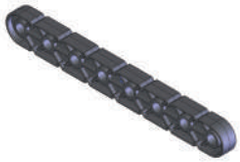
VEX IQ Super Kit



1x4 Beam
(10x)

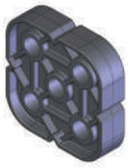


1x6 Beam
(10x)

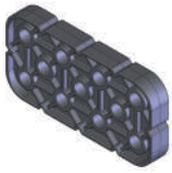


1x8 Beam
(12x)

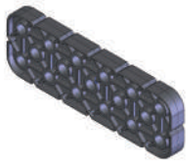
1x12 Beam
(6x)



2x2 Beam
(8x)

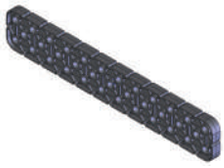


2x4 Beam
(8x)



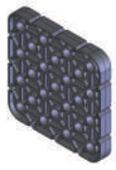
2x6 Beam
(8x)

2x8 Beam
(8x)



2x12 Beam
(6x)

2x16 Beam
(6x)



4x4 Plate
(4x)

4x12 Plate
(2x)

1x1 Connector Pin
(240x)

1x2 Connector Pin
(60x)

2x2 Connector Pin
(20x)

1/2x Pitch Standoff
(6x)

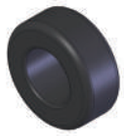
1x Pitch Standoff
(6x)

2x Pitch Standoff
(12x)

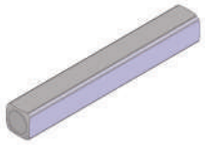
4x Pitch Standoff
(10x)

6x Pitch Standoff
(10x)

Shaft Washer
(40x)



1/4x Pitch Shaft Spacer
(50x)



2x Pitch Shaft
(2x)

4x Pitch Shaft
(4x)

6x Pitch Shaft
(4x)

8x Pitch Shaft
(2x)

Shaft Bushing
(4x)

Large Chassis Corner Connector
(10x)

Small Chassis Corner Connector
(30x)

2x Wide, 1x2 Corner Connector
(10x)

1x Wide, 1x1 Offset Corner Connector
(20x)

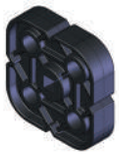
2x Wide, 2x1 Offset Corner Connector
(8x)

2x Wide, 2x1 Corner Connector
(6x)

2x Wide, 1x1 Offset Corner Connector
(6x)

2x Wide, 2x2 Corner Connector
(10x)

2x Wide, 1x2 Offset Corner Connector
(8x)

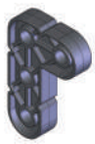


2x2 Shaft Lock Plate
(2x)

1x3 Shaft Lock Plate
(4x)

Rubber Shaft Collar
(40x)

3x4 Tee Beam
(4x)



2x3 Right Angle Beam
(4x)

30 Degree Angle Beam
(4x)

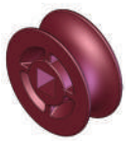
45 Degree Angle Beam
(4x)

60 Degree Angle Beam
(4x)

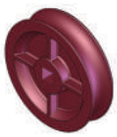
3x5 Right Angle Beam
(4x)

4x4 Offset Right Angle Beam
(6x)

Rubber Band Anchor
(2x)



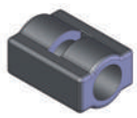
10mm Diameter Pulley
(2x)



20mm Diameter Pulley
(2x)

30mm Diameter Pulley
(2x)

40mm Diameter Pulley
(2x)



Mini Standoff Connector
(12x)

End Standoff Connector
(8x)

100mm Travel Rubber Tire
(2x)

Small Wheel Hub
(4x)

200mm Travel Rubber Tire
(4x)

12 Tooth Gear
(10x)

36 Tooth Gear
(10x)

60 Tooth Gear
(6x)

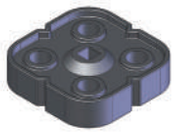
36 Tooth Crown Gear
(4x)

30mm Rubber Belt
(2x)

40mm Rubber Belt
(2x)

50mm Rubber Belt
(2x)

60mm Rubber Belt
(2x)



Inner Twist Lock Shaft Collar
(4x)

Outer Twist Lock Shaft Collar
(4x)

Controller
(1x)

Robot Brain
(1x)

Smart Motor
(4x)

Robot Battery
(1x)

900 MHz Radio
(2x)

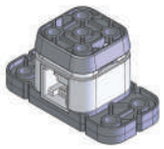
VEX Controller Battery
(1x)

200mm Smart Cable
(4x)

300mm Smart Cable
(4x)

400mm Smart Cable
(2x)

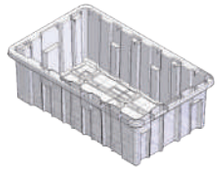
600mm Smart Cable
(2x)



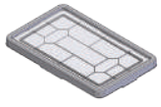
Bumper Switch
(2x)

Robot Battery Charger
(1x)

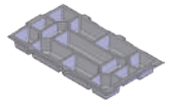
Battery Charger Power Cord
(1x)



Storage Bin
(1x)



Storage Lid
(1x)



Storage Tray
(1x)

Storage Tray Divider
(1x)

Touch LED
(2x)

Color Sensor
(1x)

Distance Sensor
(1x)

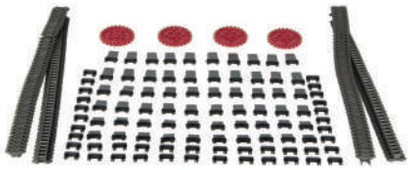
Gyro Sensor
(1x)

Expand and conquer.

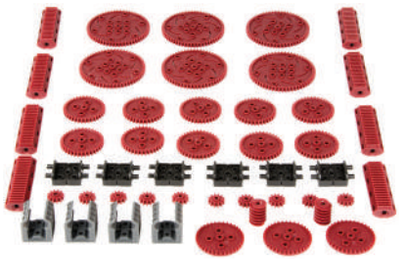
Once you've mastered the CLAWBOT, we challenge you to move onto even more advanced robot designs. Of course, all VEX mechanical gears, wheels, hardware and structural parts are cross-compatible for endless design possibilities. With hundreds more upgrade parts and accessories, the creative possibilities for your robot designs are limitless.
Visit www.VEXROBOTICS.com/VEXIQ for more information.

Smart Motor
SKU 228-2560

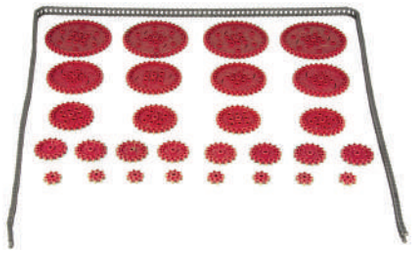
Tank Tread & Intake Kit
SKU 228-2878



Gear Kit
SKU 228-2532



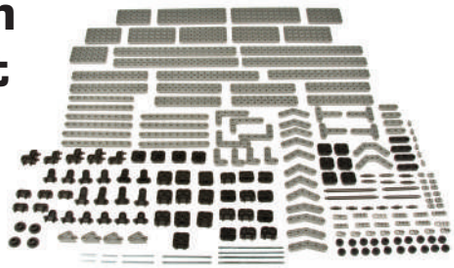
Chain & Sprocket Add-On Kit
SKU 228-2534



Wheel Kit
SKU 228-2523

200mm Travel Omni-Directional Wheels
SKU 228-2536

Foundation Add-On Kit
SKU 228-2531



Pin Add-On Kit
SKU 228-3058