Girl Powered
Robotics Workshop

Instructions Booklet

Parts Needed for Your Robot

3x - 2 in Shaft

2x - 3 in Shaft

1x - 3.5 in Shaft

3x - 4 in Shaft

5x - Bearing Flat

15x - 1 Post Hex Nut Retainer w/ Bearing Flat

7x - 4 Post Hex Nut Retainer

5x - 1 Post Hex Nut Retainer

30x - 8-32 x 0.375 in Screw

4x - 8-32 x 0.5 in Locking Screw

2x - 8-32 x 1 in Screw

6x - 8-32 x 1.5 in Locking Screw

8x - 0.125 in Spacer

4x - 0.375 in Spacer

3x - 0.5 in Spacer

2x - 0.875 in Spacer

10x - High Strength Shaft Insert

4x - 0x2 Connector Pin

30x - 8-32 Nut

21x - Rubber Shaft Collar

3x - 300mm V5 Smart Cable

1x - 600mm V5 Smart Cable

1x - 900mm V5 Smart Cable

2x - Rubber Bands

1x - Claw Assembly

4x - V5 Smart Motor

1x - V5 Battery Cable

1x - V5 Robot Brain

1x - V5 Radio

2x - V5 Battery Clip

1x - V5 Battery

2x 1x2x1x25 C-Channel

3x - 2x2x2x20 U-Channel

2x - Angle 2x2x14x20

2x - 1x2x1x35 C-Channel

2x - 4 in Wheel

2x – 1x8 Bar

1x - 12 Tooth Gear

2x - 4 in Omni Wheel

1x - High Strength Pinion Insert

1x - High Strength 12 Tooth Pinion

1x - High Strength 84 Tooth Gear

Parts Organization Instructions - I

- Open and inspect all items in the VEX Box (A)

- All the parts in (A) are organized, as seen on next page

- Inspect all robot parts arranged on your table (B)

- The "Transparent Divided Box" (C) is provided to organize all the small parts.

- Inspect and organize all the parts at your table, as shown in the following pages

- Ensure your table has all of these parts. Note: Some of the small parts may have been placed inside the Transparent Plastic Divided Box.

- If you do not find all the parts, look harder; check under boxes and papers; see if they have dropped onto the floor.

VEX Box: Electronics
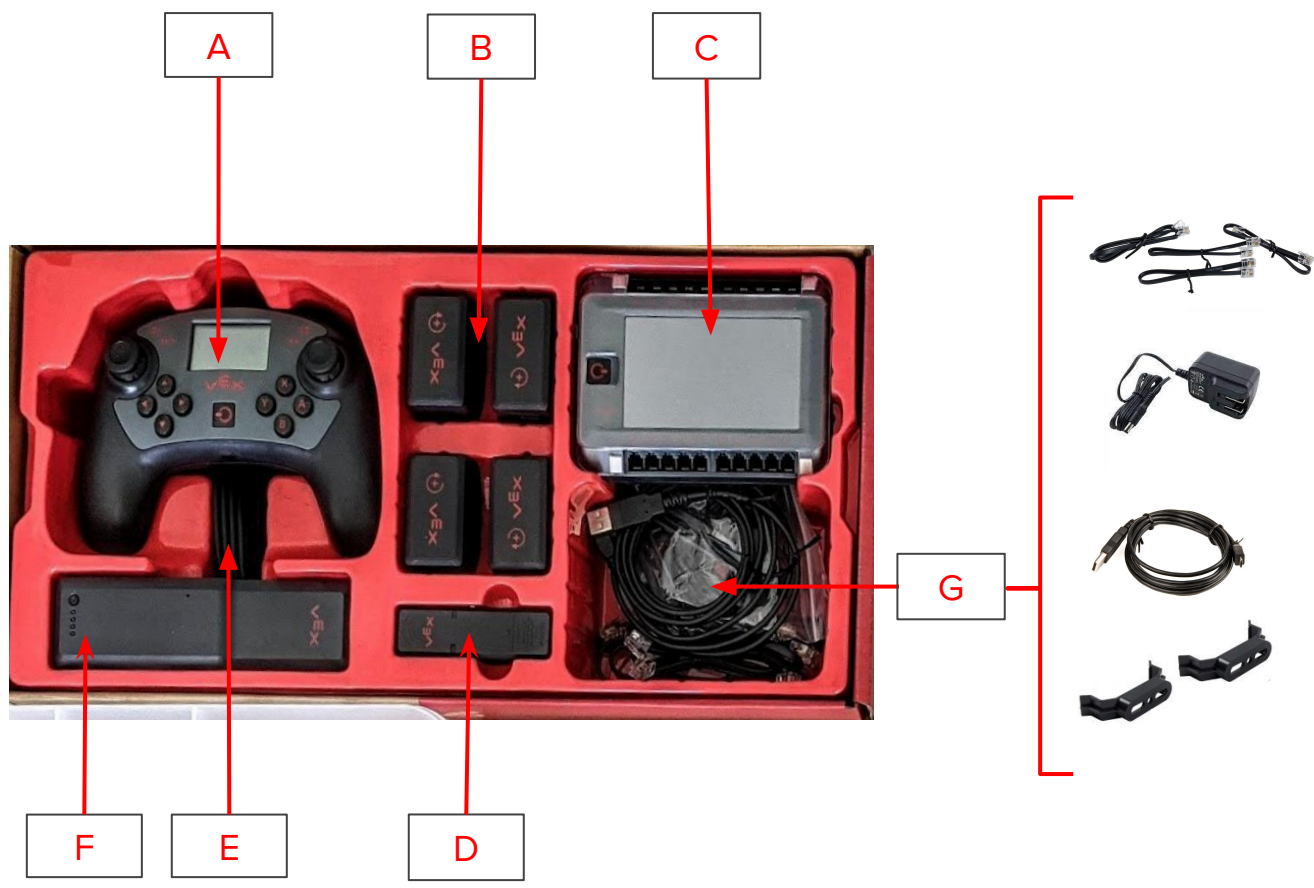
Robot Parts
(on your table)
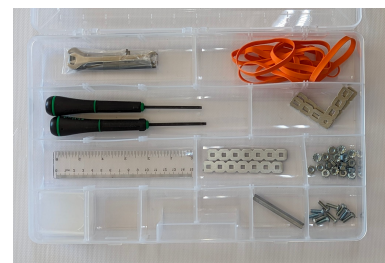
Transparent Plastic Divided Box for small parts

If after checking your table and your surroundings you still do not find all the parts, contact a local Tech Volunteer.
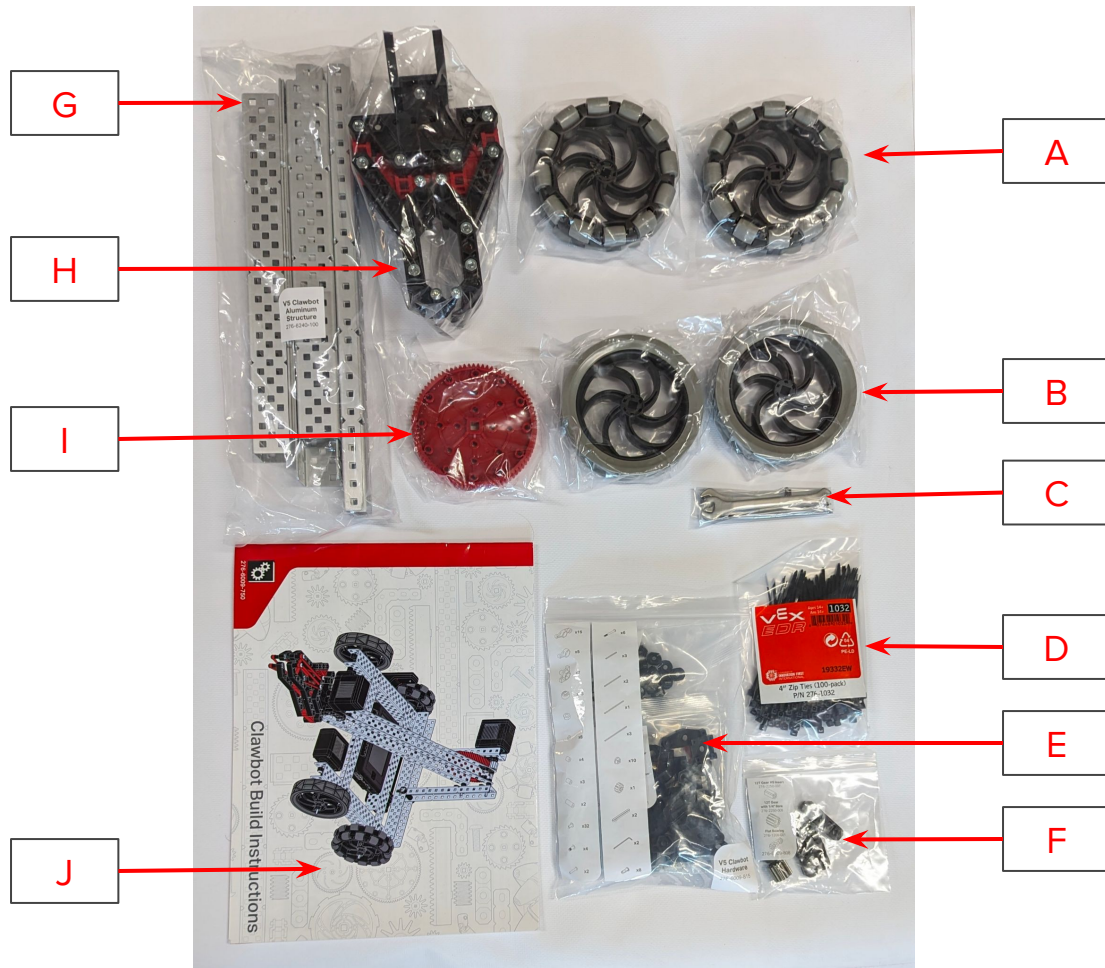
Parts Organization Instructions - II

Electronic Parts

A. Controller (1 item)

B. Motors x 4

C. Robot Brain (1 item)

D. Robot Radio (1 item)

E. Battery Cable (1 item)

F. Robot Battery (1 item)

G. Multiple Items:

1. Set of 5 Smart Cables (3 diff. lengths) *(part # 276-**6364**)*
2. Robot Battery Charger (1 item)
3. Micro USB Cable (1 item)
4. 2 Battery Clips

Parts Organization Instructions - III

Clawbot (Robot) build Hardware and Parts

A. 4" Omni Wheels (2 items)

B. 4" Traction Wheels (2 items)

C. Open Ended Wrench

D. Cable Ties

E. Multiple small items *(see page 7 for details and organization tips)*

F. 12T Metal Gear & Inserts

G. Set of 9 Aluminium Channels *(see page 8 for details)*

H. Claw Assembly (1 item)

I. 84 tooth gear (1 item)

J. Clawbot Build Instructions Booklet

Parts Organization Instructions - IV
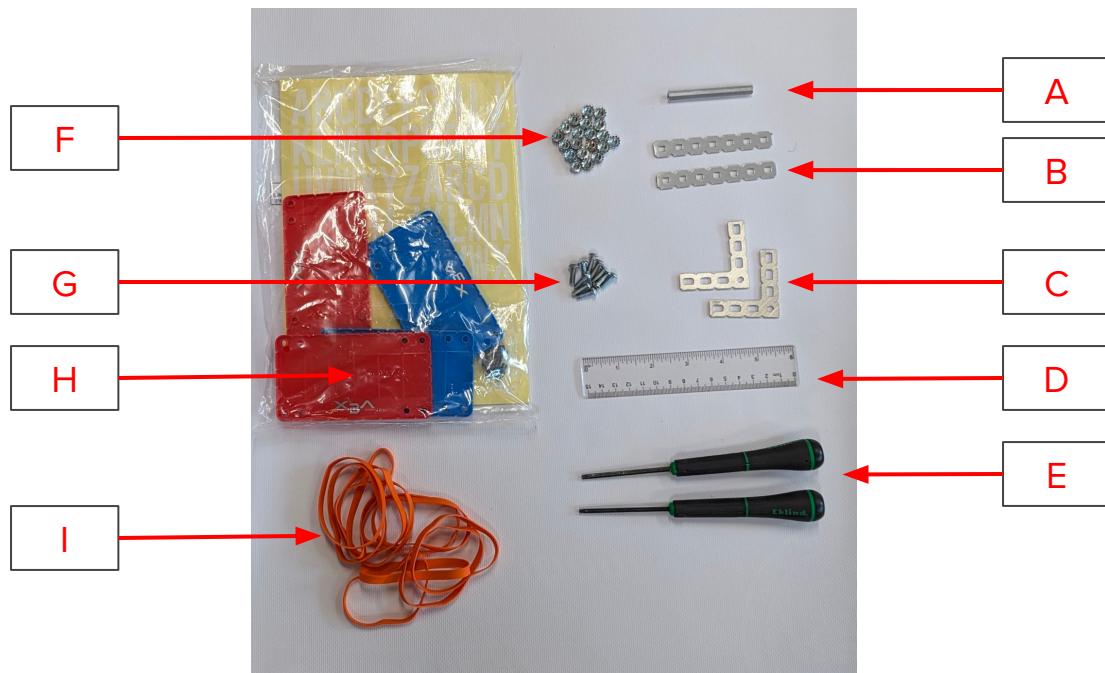
Additional Parts Provided

A. 2½ " Standoff (1 item)

B. 1x**7** flat channel (2 items)

C. 90° gusset (2 items)

D. One 6" inch ruler (1 item)

E. "Star" Screwdrivers (2 items)

F. "Keps" nuts (20)

G. ½" Screws (10)

H. License Plates

I. Rubber bands

Parts Organization Instructions - V

Organization of Transparent Divided Box

A. Flat Bearings

B. 21 Rubber Shaft Collars

C. Spacers (4 types)

D. Star Drive Key + Set of 9 Shafts (4 types) *(part # 276-6009-805)*

E. High Strength Gear Inserts

F. Metal gears & inserts: 12T gears with ¼" Bore, 12T gears HS Insert + 12T gears with ⅛" Bore (narrower)

G. Set of 27 Hex Nut Retainers (3 types) *(part # 276-6009-801)*

H. Set of 44 Steel Screws (4 types) *(part # 276-6009-804)*
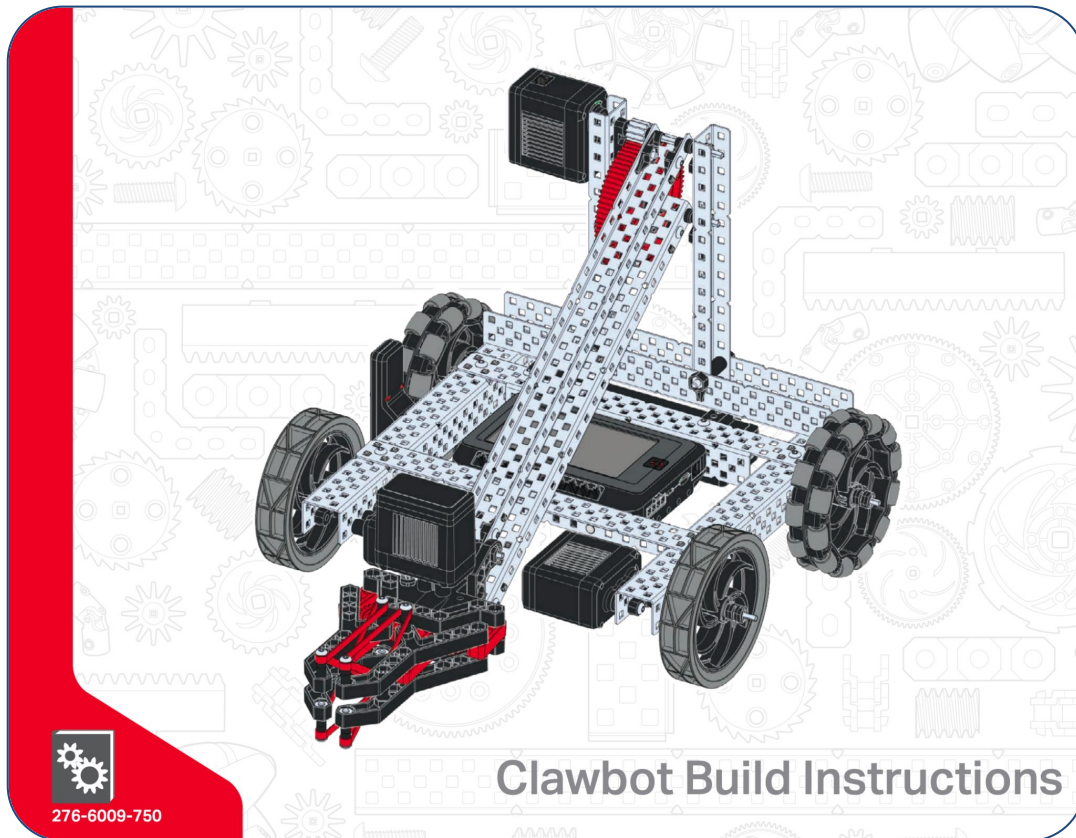
I. 32 Hex Nuts + *(part # 276-6009-802)*
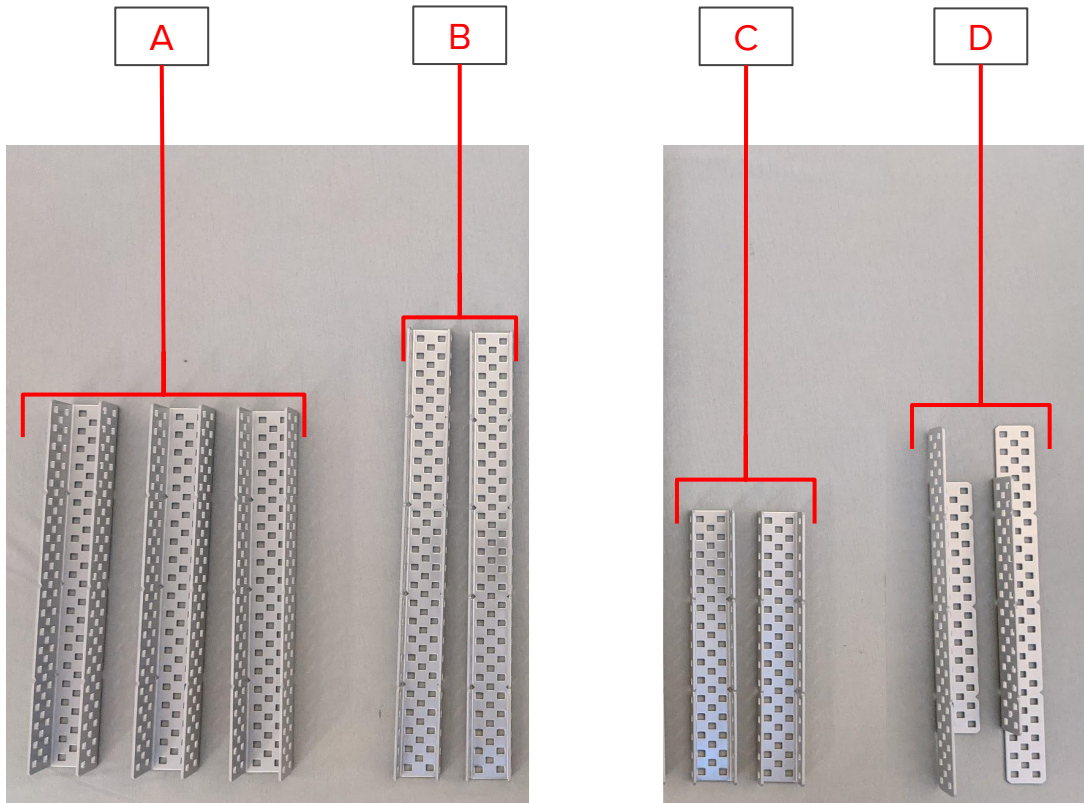
Set of 9 Metal Channels

A.   2x2x2x**20 U** channels (3 pieces)

B.   1x2x1x**25 C** channels - (2 pieces)

C.   1x2x1x**15 C** channels (2 pieces)

**D.**   2x2x14x**20 Angle** channels (2 pieces)

Build the Robot

Clawbot Build Instructions

276-6009-750

1. Follow the instructions in the included **Clawbot Build Instructions** booklet to build the robot.

2. If you wish to download a PDF version of the same, here's the link: *https://content.vexrobotics.com/docs/276-6009-750-Rev5.pdf*

3. Once you are done building your robot, remember to follow the instructions on modifying the claw in the next pages. (*Without this modification, your robot will not be able to compete in the game!*)
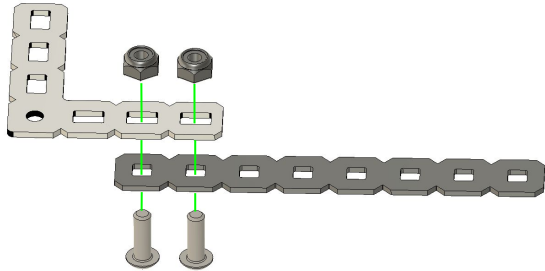
Modify the Claw - I

C1
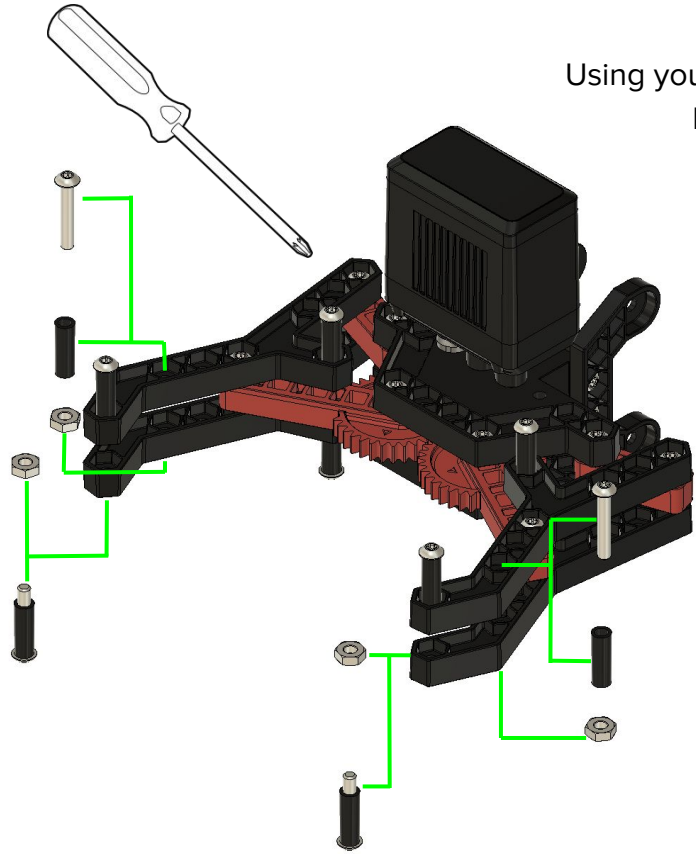
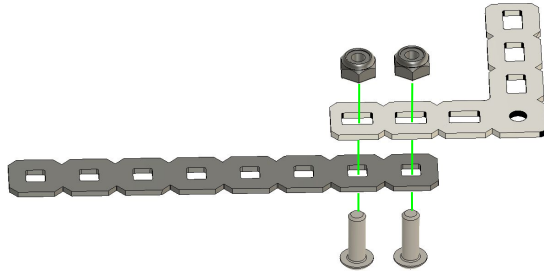Using your screwdriver, remove these parts from the claw.

C2

2x – Nylock Nut   **2x** – 0.5" Screw

1x – 90-Degree Gusset   **1x** – 1 x 8 Aluminum Bar

C3

2x – Nylock Nut   **2x** – 0.5" Screw

1x – 90-Degree Gusset   **1x** – 1 x 8 Aluminum Bar

Modify the Claw - II
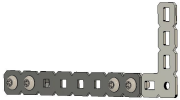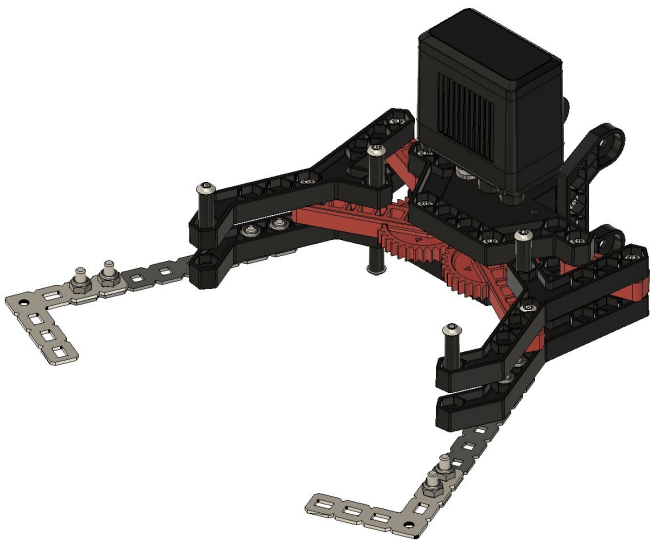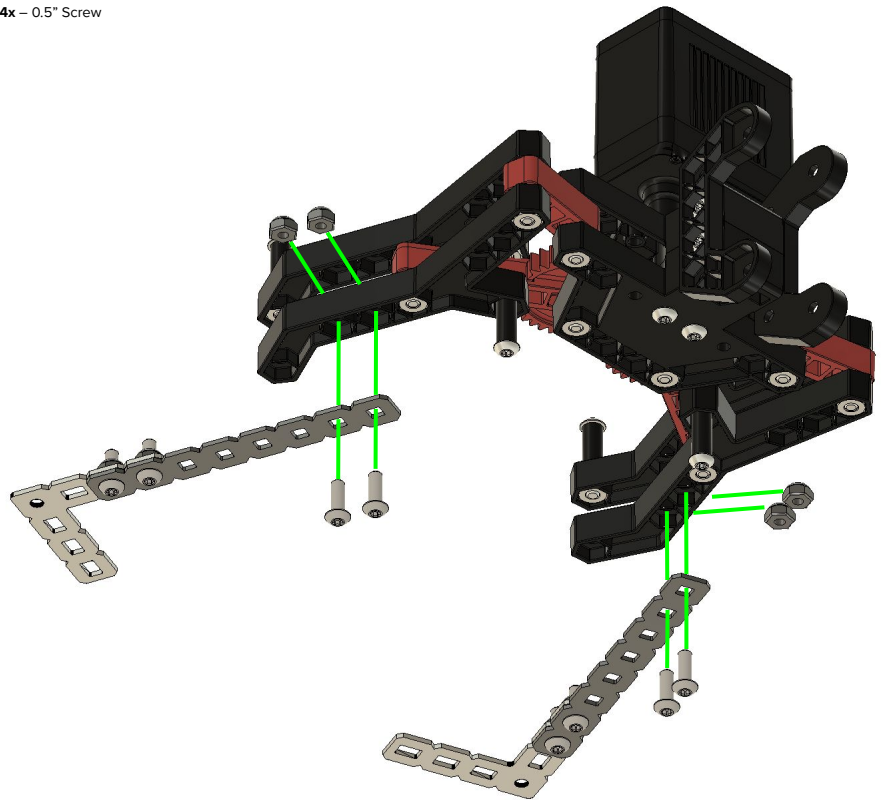
1x – Assembly from C2

1x – Assembly from C3

4x – Nylock Nut

4x – 0.5" Screw

← This is the completed claw: make sure that your claw looks like this before attaching it onto the robot!

Get Your Robot Inspected

- Once your build is complete, you need to get your robot **inspected**. Inspections are done in 2 stages
  - **Initial Inspection** - Done at the closest *Tech Help Desk* **THD** on the second floor
  - **Final Inspection** - Done, once you pass Initial Inspection, at the *Final Inspection, Laptops & Spare Parts Desk* **INS**, also on the second floor

- Once you pass Final Inspection, you will be handed the following essentials
  - A robot battery, to power your robot
  - A laptop, to program your robot *(Ask your mentor to accompany you for this; we need your mentor's ID proof to hand over the laptop)*
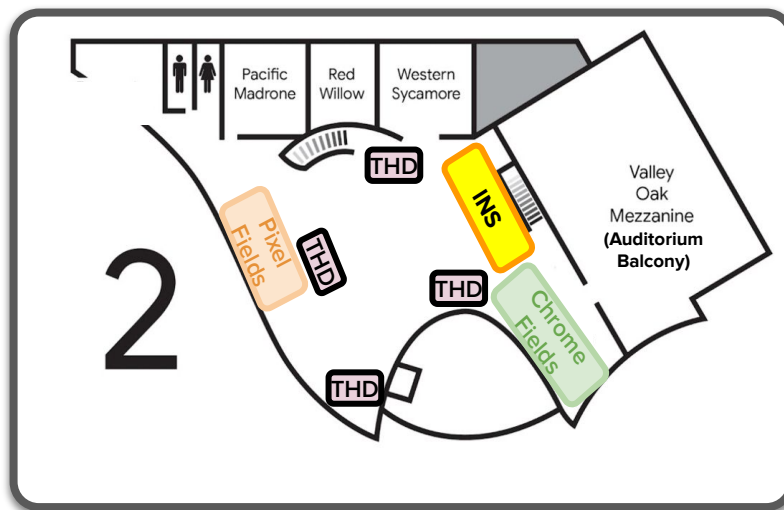
THD
Technical Help Desks
(Floor 2)

- Robot related queries
- Programming Queries
- Technical queries
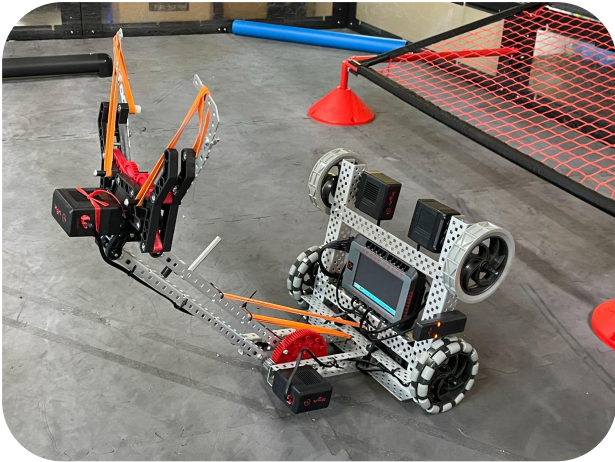- Robot Initial Inspections

INS
Final Inspection, Laptops & Spare Parts Desk
(Floor 2)

- Robot Final Inspections
- Laptop Pick Up / Drop Off
- Robot Spare Parts
- Robot Kit Drop Off *(end of Day 2)*

12

Drive Your Robot!

So—you've built the robot and got it inspected! Now it's safe to operate and drive it! But before you do, here are some common driving mistakes to avoid!

1. Robot tipping: To prevent this, try to use the controller to gradually slow down. Not only will this avoid any tipping, but it will give you more control of where you want to go!

2. Grabbing triballs: Make sure to have the triball fully in the claw before grabbing it. Think of the claw like a mouth that needs to have a full bite of food :).
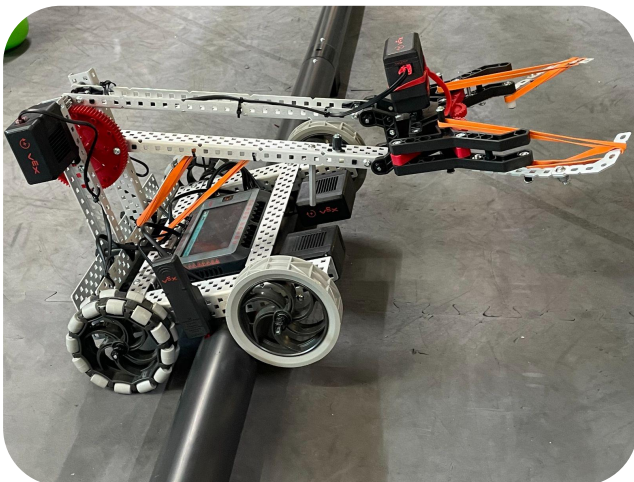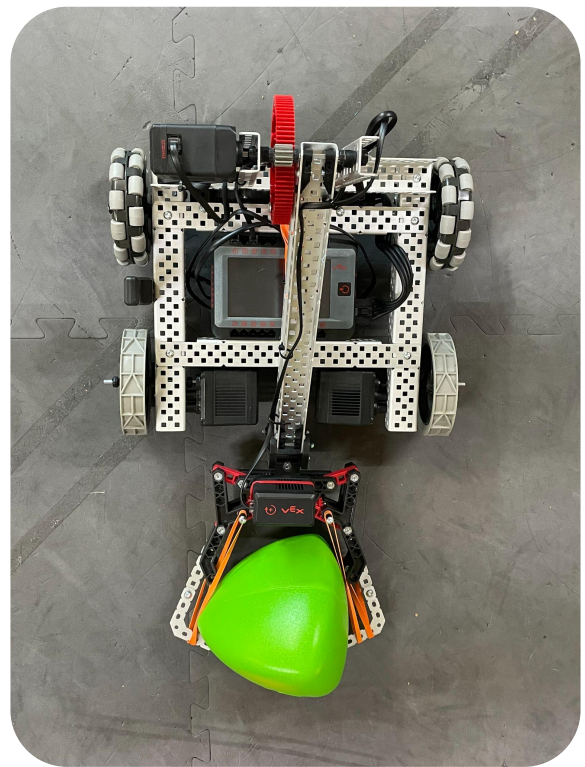
3. Getting stuck on the barrier: The barrier going across the middle of the field is very large, so use caution if you try to cross it; otherwise, go around!

Understand The Game

This year's game is called Over Under. You will soon see why!

Familiarize yourself with the field setup and other details in the Game Summary below.

How the Game is Scored

Autonomous Bonus Winner		8 Points
Each Triball Scored in a Goal	A	5 Points
Each Triball Scored in an Offensive Zone	B	2 Points
Elevation - 2nd Tier		15 Points

One Robot from each Alliance starts in each Offensive Zone. During the Autonomous Period, Robots are not allowed to contact tiles or game elements on the opposite side of the Neutral Zone or in the opposite Offensive Zone. Robots may enter the Neutral Zone during the Autonomous Period at their own risk.

OVER UNDER
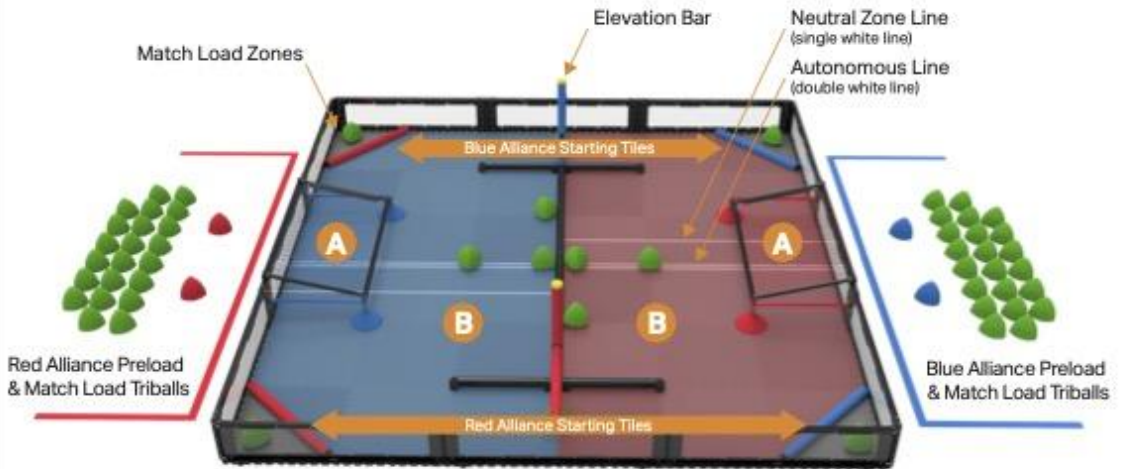
Google Play Store   Apple Store

The VEX via app provides real-time tournament status for:
- Schedule - Match times
- Ranking - Alliance selection
- Win/Loss record and Win Points
- Skills - Highest to lowest results
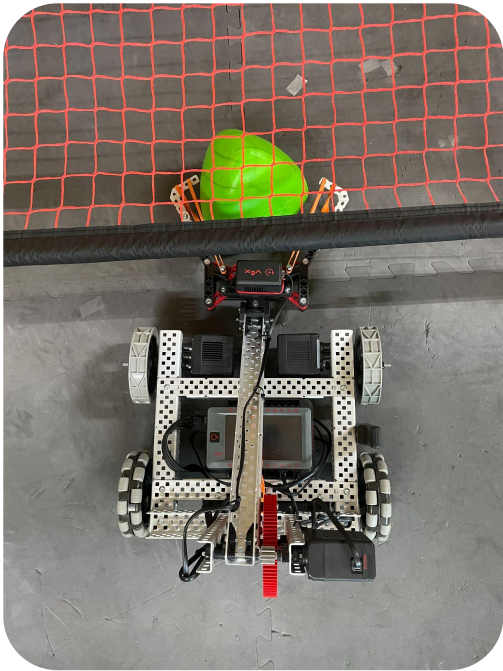- Match results and awards

VEX Hub App

Google Play Store   Apple Store

In the VEX Robotics Competition Hub App you can find:
- Game Manual
- Score Calculator
- Match Timer

Match Load Zones

Elevation Bar

Neutral Zone Line (single white line)

Autonomous Line (double white line)

Blue Alliance Starting Tiles

Red Alliance Starting Tiles

Red Alliance Preload & Match Load Triballs

Blue Alliance Preload & Match Load Triballs
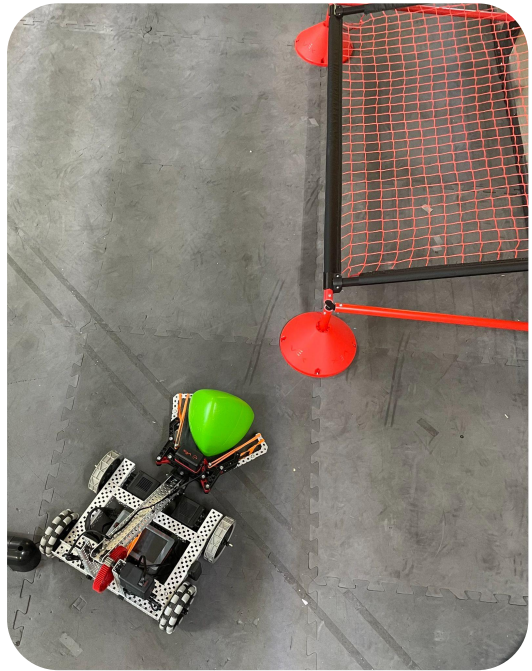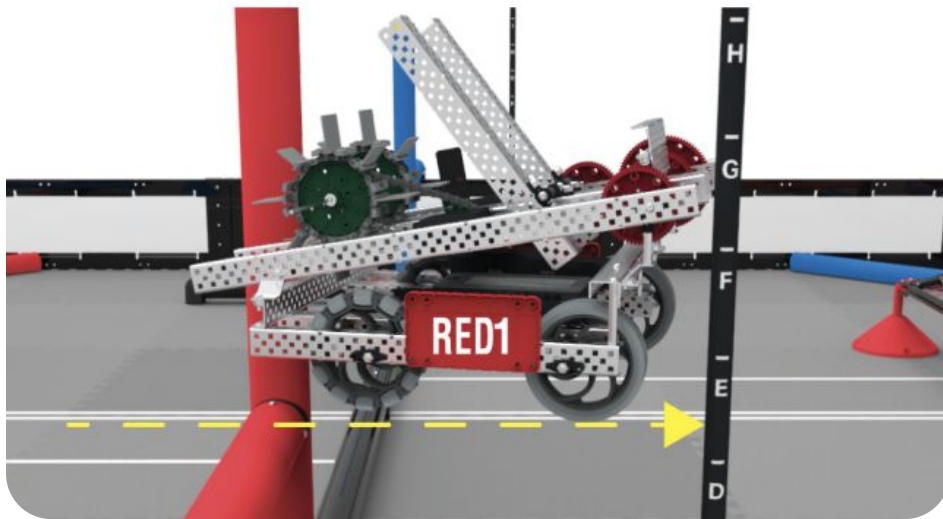
Game Summary

Understand The Game - Scoring

Triball in Goal

+5 Points per Triball in Goal

Triball in Offensive Zone

+2 Points per Triball in Zone

Elevated Robot

+15 points

Program Your Robot - I

Overview

You will be using VEXCode Pro V5 (which uses the language C++) to program your robot.

You can open the editor by **double clicking the icon to the right on your computer's desktop**. In case the project is not already open, it is located in the "Code" folder on your desktop.

You can edit the function "**autonomous()**" to customize your robot's autonomous routine. You can also edit some variables to customize the user control.

To compile and download the code, click the following button on the top right of the window (also make sure the icons next to it are green):

Driver Control
usercontrol()

There are 3 variables near the top of the main.cpp file that affects usercontrol(): **arcadeControl**, **driveSpeed**, and **threshold**.

```cpp
bool arcadeControl = true;      // controls whether the drivebase is driven in tank style (false) or arcade style (true)
double driveSpeed = 0.75;       // changes the maximum drive speed (range is from 0 to 1)
int threshold = 5;              // controls the minimum speed of the drivebase
```

arcadeControl controls whether the robot is controlled via arcade or tank drive. Set the variable to false to use tank drive to control the robot, and true to use arcade drive. Tank drive uses each joystick to control its corresponding side (left joystick for left side, right joystick for right side), while arcade drive uses the left joystick to move forward and backward and the right joystick to turn left and right.

driveSpeed ranges from 0 to 1 and can be increased to make your robot move faster.

threshold controls the minimum speed of the drivebase. This can range from 0 to 100 (percentage of the joystick).

16

Autonomous

autonomous()

This function is where autonomous code, which runs without driver input, goes. It runs for the first 15 seconds of the match.

```
62   void autonomous(void)
63   {
64       // ..............................................................
65       // Insert autonomous user code here.
66       // ..............................................................
67   }
```

moveDistance (double inches)
- inches = number of inches to move
- Positive distance is forwards
- Example: moveDistance(5);

turnAngle (double degrees)
- degrees = number of degrees to move
- Positive amount turns to the right
- Example: turnAngle(90);

openClaw()
- opens claw

closeClaw()
- closes claw

holdClaw()
- holds claw tight around tri-ball, prevents dropping

moveArm (double velocity)
- velocity ranges from -200 to 200
- Positive velocity raises the arm
- Example: moveArm(150);

holdArm()
- holds arm up while moving around

delay(int milliseconds)
- pauses the program's execution for a specific number of milliseconds
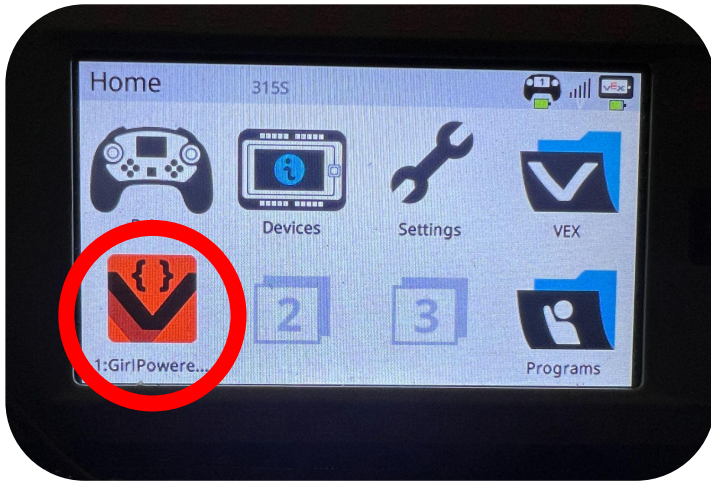- Example: delay(1000);

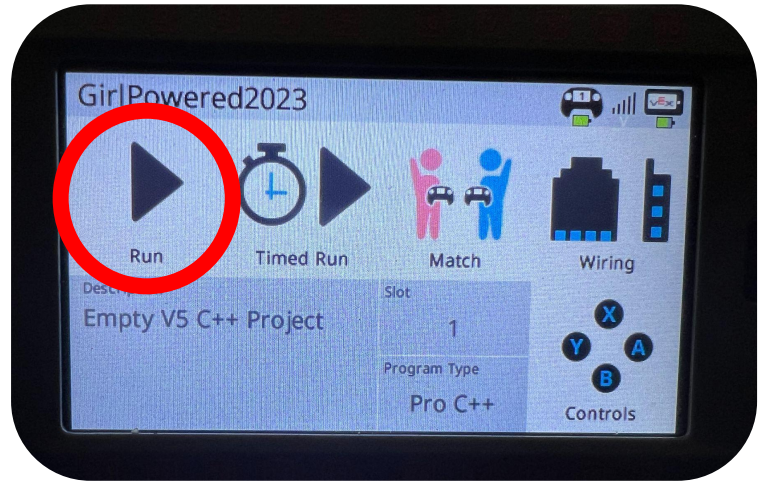# Run the Robot (via Brain)

Figure 1: Select Program
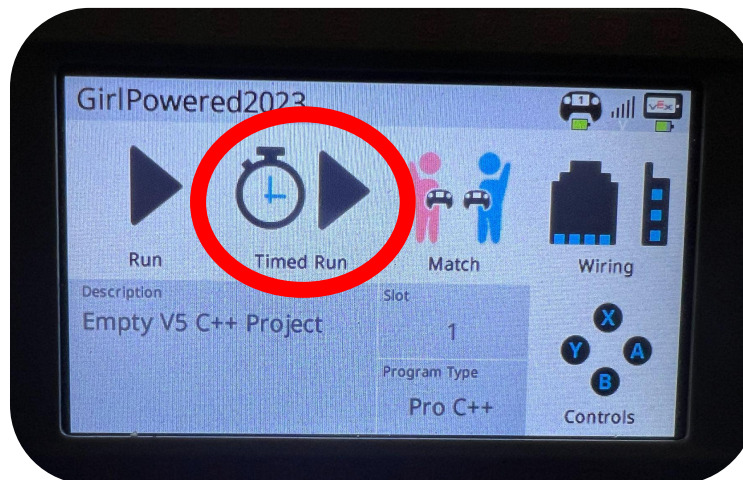

Figure 2: Run Program

Figure 3: Begin Timed Run
(ONLY FOR TESTING AUTONOMOUS)

Testing Driver Control
Make sure you select your program (**Figure 1**)! Then, run the program (**Figure 2**).

Testing Autonomous
To test your autonomous when not competing, first select your program (**Figure 1**). Then, begin a timed run (**Figure 3**).

During Competition
To run your program during competition, first plug your controller into the field tower, then select your program (**Figure 1**), and finally run the program (**Figure 2**). **DO NOT select Timed Run for competition.**

Run the Robot (via Controller)

Controller Navigation
To move around on the screen, use the **left and right arrows**.
To select an option, press **A**.
To go back from a selected option, press **B**.
To turn on or start the controller, hold the **power button**.

Figure 1: Programs

Figure 2: Select Program

Figure 3: Run Program

Figure 4: Timed Run
ONLY FOR TESTING AUTON

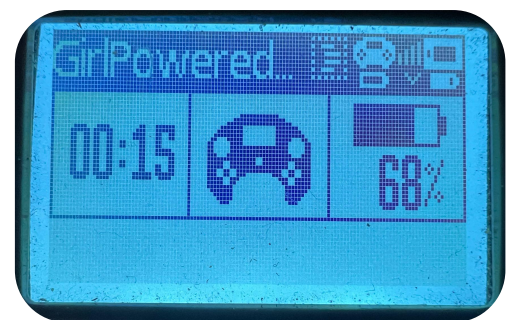**Figure 5**: Start Timed Run

Figure 6: Ongoing Program

Testing Driver Control
On the home screen, select "Programs" (**Figure 1**). After that, select your program called "GirlPowered2023" (**Figure 2**). Then, select "Run" (**Figure 3**).

Testing Autonomous
To test your autonomous, select "Programs" (**Figure 1**). After that, select your program called "GirlPowered2023" (**Figure 2**). Then, select "Timed Run" (**Figure 4**). Finally, press **A** to start the autonomous (**Figure 5**).
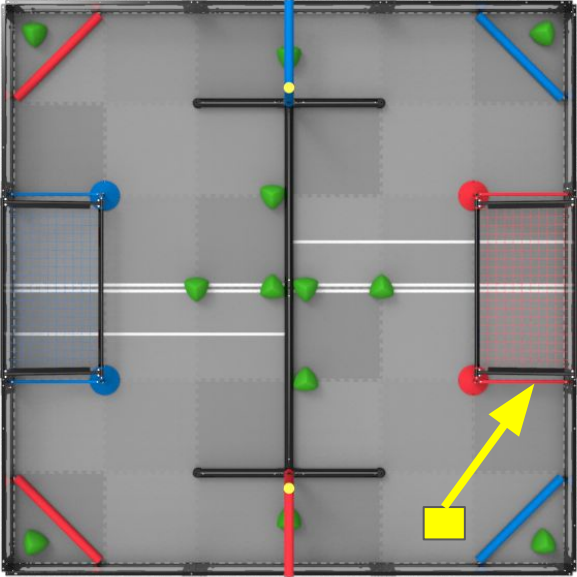
During Competition
To run your program during competition, plug your controller into the field tower. Then, select "Programs" (**Figure 1**). After that, select your program called "GirlPowered2023" (**Figure 2**). Finally, select "Run" (**Figure 3**). **DO NOT select Timed Run for competition.**
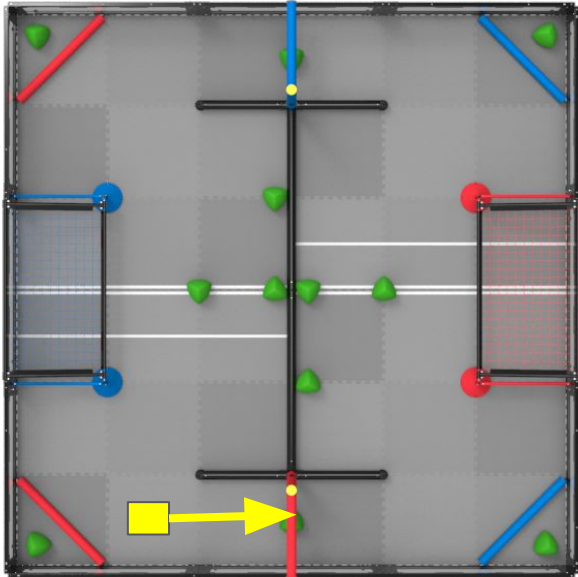
Example Autonomous Paths
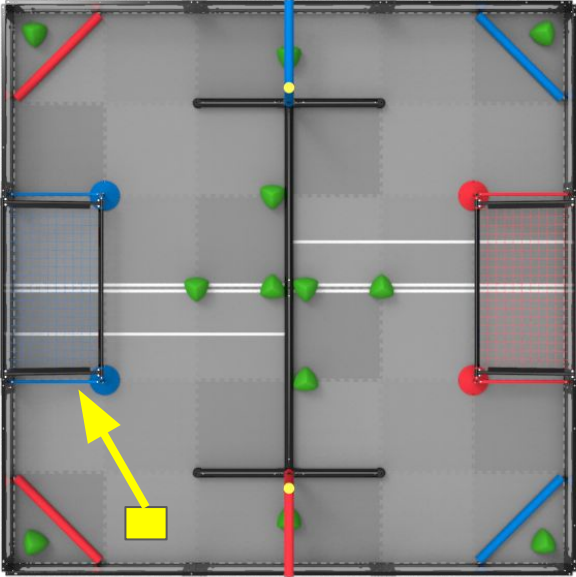
Push Alliance Triball into Goal
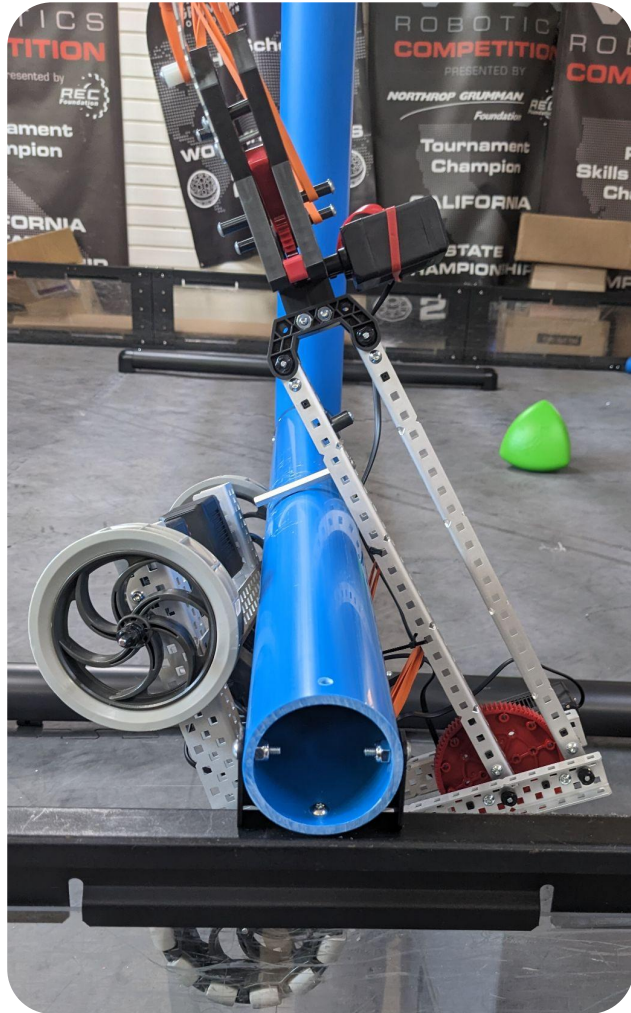

Push Alliance Triball into Goal

Push Triball into Offensive Zone

Design Challenge

Now— Are you ready for a challenge?
Yeah! Ok, try to make the clawbot hang from the horizontal pole!

Parts Provided
1. Single 2.5" Standoff
2. Rubber Bands
3. Zip ties

You can approach a Tech Volunteer for help with this step.

Compete with Your Robot

On Day 2, you will get to compete with other teams in this workshop! You will first compete within your own division: YouTube, Pixel and Chrome. The winners of each division, will then get to compete at a *Grand Final* which will be held in the Auditorium!

Familiarize yourself with the field setup and other details in the Game Summary. Talk to a Tech Volunteer if you have question.

And start developing a winning game strategy with your teammates!

A Few Important Tips!

- **Arrive on-time at your field for your match!**

- If you are not available at the field when your match starts, they *will* start without you, and you will forfeit that match!

- Observe other teams! Note their *Offensive Strategies*. Think about what *Defensive Strategies* work.

- Think of smart ways to win with what your robot is capable of doing. Now, can you improve your robot any further?

Return All Equipment

Mentors are ultimately responsible for their team returning of all equipment!

Dismantle everything once competitions are over*

- Please take the time to neatly dismantle all the parts and pack them back. Another team will use this kit in the future. Please be considerate!
- All electronics parts must go back into their original box *(see **page 4**)*.
- All small parts must be packed in the Transparent Plastic Divided Box *(see **page 7**)*.
- Place all large parts in the provided plastic ("Ziplock") bags for returns.

Return Inspections

- If your team purchased the Robot Kit, you don't have to dismantle the robot. Please be ready to show the purchase receipt and you will be given a box with <u>additional parts</u> that goes with the kit. Do get your kits inspected to ensure no missing parts.

- All other teams need to have their dismantled Robot Kit inspected before returning.
- Return Inspections are done at the *Final Inspection, Laptops & Spare Parts Desk* <mark>INS</mark> desk on the second floor (same place where laptops were issued).

### Return the disassembled & repackaged Robot Kit.

Return the Laptop.

- **All laptops need to be returned!** Laptop returns will be accepted once your Robot Kit passes Return Inspections (or you have purchased the kit).

Finally, don't forget to get the EQUIPMENT RETURN CHECKLIST stamped! Show this stamped checklist at the exit gate for a **small surprise**! 🎁🎁🎁🎁 Shhh!!
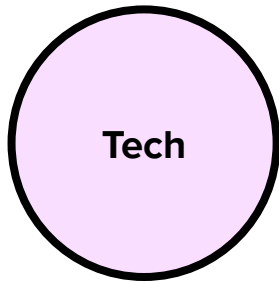
*Dismantling is not necessary if you have purchased the kit.

Need Help?
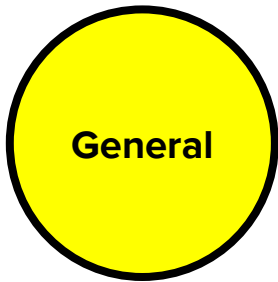
General

Tech

General Volunteer

Tech Volunteer

- Talk to a **General Volunteer** near you for your queries

- Talk to a **Tech Volunteer** near you for robot / programming related queries

- Walk to a **THD** for robot **Initial Inspection** or technical queries

- Walk to the **INS** Desk for robot **Final Inspection** + Laptop pickup

- **Return** your laptop + Robot Kit at the INS Desk at end of **Day 2**

- Walk to the **GHD** for any other help

GHD

General Help Desk (Floor 1)

- Lost & Found
- First Aid
- General Queries

THD

Technical Help Desk (Floor 2)

- Robot related queries
- Programming Queries
- Technical queries

INS

Final Inspection, Laptops & Spare Parts Desk (Floor 2)

- Robot Final Inspections
- Robot Spare Parts
- Laptop pick up / drop off
- Robot kit drop off