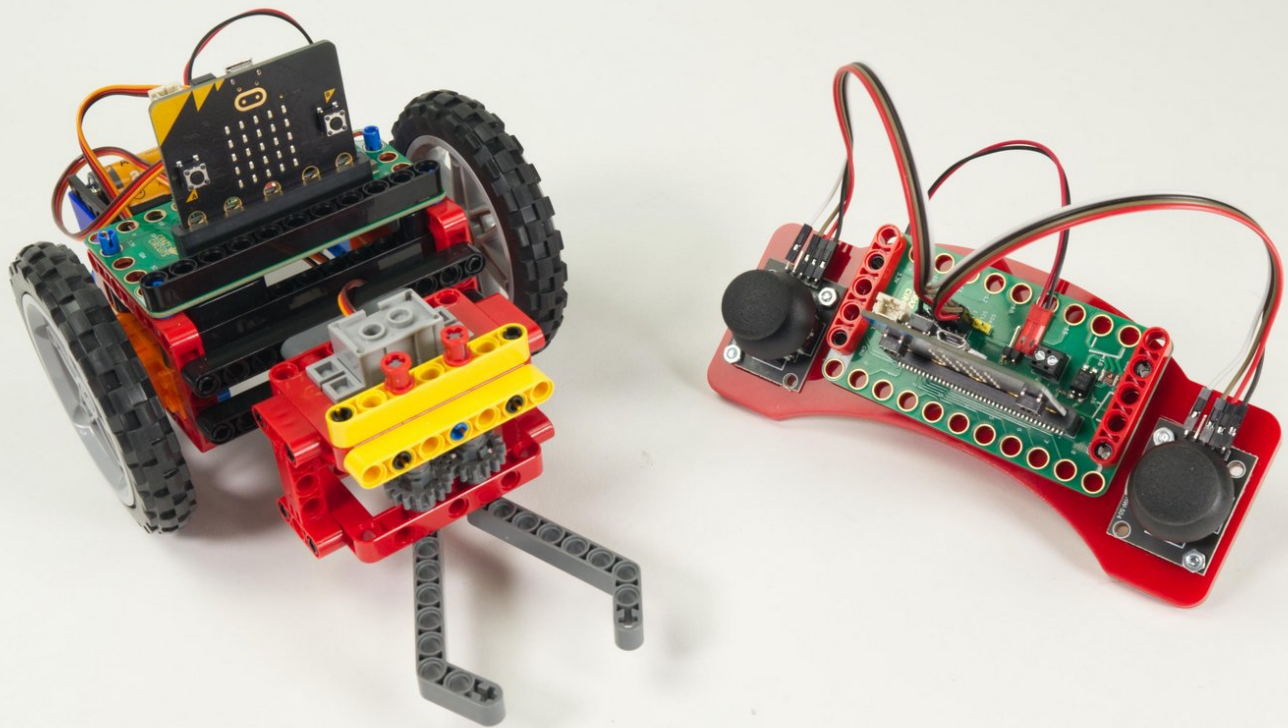




Rover Thumbstick Remote

Build a remote control with two thumbsticks to control your Rover.

Written By: Pete Prodoehl



INTRODUCTION

Build a remote control with two thumbsticks to control your **Rover**. The left thumbstick controls the left wheel (forward & backward) and the right thumbstick controls the right wheel. You can drive forward, reverse, or spin in either direction.

You can also manipulate the **Gripper** using the built-in buttons on each thumbstick to open and close the fingers. We've also made it easy to change the speed of the Rover using the A and B buttons on the micro:bit

If you want a more bare-bones remote check out our [Rover Simple Remote](#) or [Rover Bluetooth Control](#)



TOOLS:

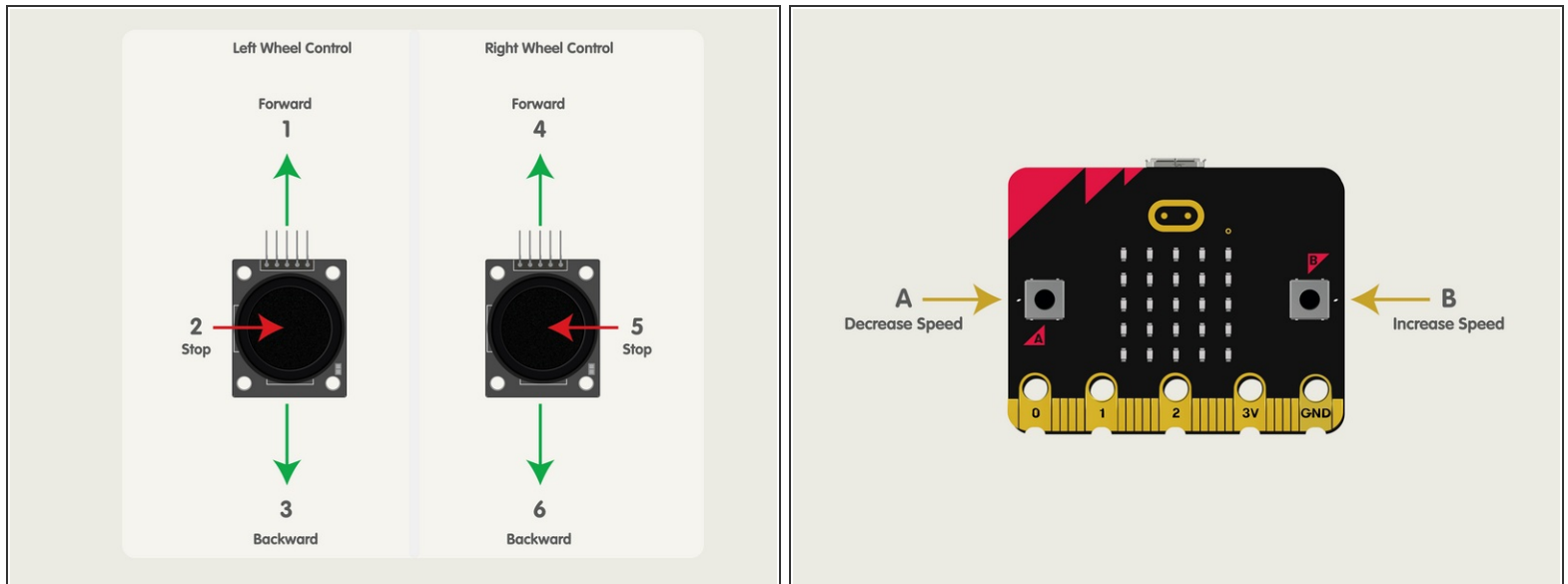
- [Computer](#) (1)
- [Phillips Screwdriver](#) (1)



PARTS:

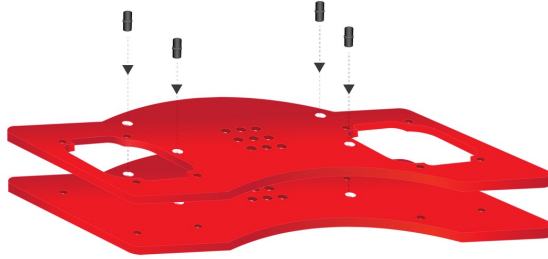
- [Bit Board Rover Kit](#) (1)
- [micro:bit](#) (2)
- [Rover Remote Kit](#) (1)

Step 1 — Rover and Remote



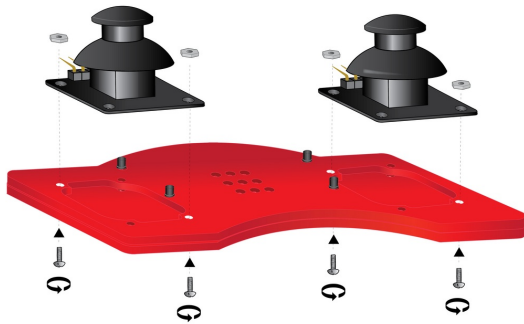
- If you've built the [Rover Main Body](#) and you want a full-featured remote control this guide will show you how to build one.
- We'll load new code onto the Rover's micro:bit so it can act as a receiver (**RX**), and we'll load code onto the second micro:bit so it can work as a transmitter (**TX**).
- Our remote will control the left and right wheels independently, which will allow the rover to move forward, backwards, and turn left and right. (And spin around in circles!)
- Since the thumbsticks have built-in buttons (that are activated when you press down) we'll use those to control the [Rover Gripper](#) if you have it attached.
- We've added one more feature. You can change the speed of the Rover by using the remote. By default it will start at 50% speed but you can decrease or increase this.
- Just press the **A** button on the Remote Control micro:bit to slow it down. (One press lowers 10% each time.)
- Pressing the **B** button will inversely increase the speed by 10% each time.

Step 2 — Stack Plates



- We'll begin by assembling the Rover Remote. You should only have to do this once when you first unpack your kit.
- **Begin by stacking** the two plastic plates as shown below. **Use four black pins** to connect them. The plate with two large cutouts should be on top

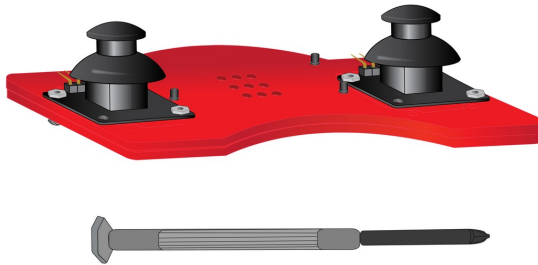
Step 3 — Position Thumbsticks



- **Position, and orient your two thumbsticks** as shown. **Secure each** with two screws and nuts

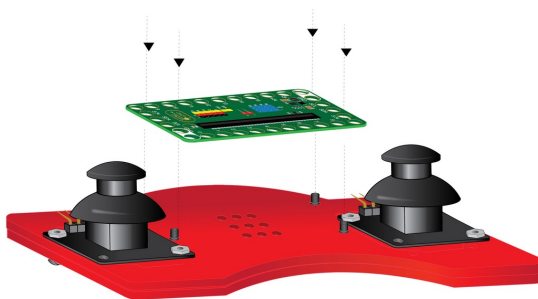
(nuts on top); hand-tightened at diagonally opposite corners.

Step 4 — Tighten Screws



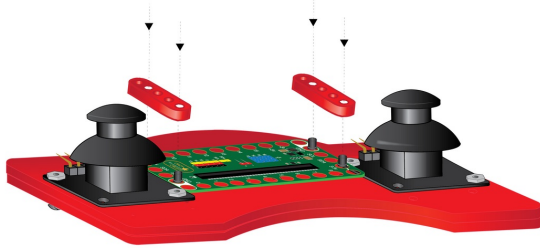
- Use a small Phillips Head Screwdriver to **tighten each of the four screws** holding the thumbsticks in place. Do not over-tighten.

Step 5 — Add the Bit Board



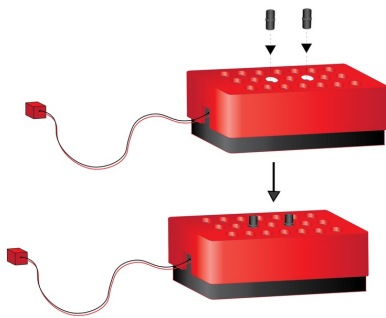
- **Orient your Bit Board** so that the long side with clustered pins faces the curved bump out and the black micro:bit slot faces the inward curve. **Press into place** atop the four black pins.

Step 6 — Add the Beams



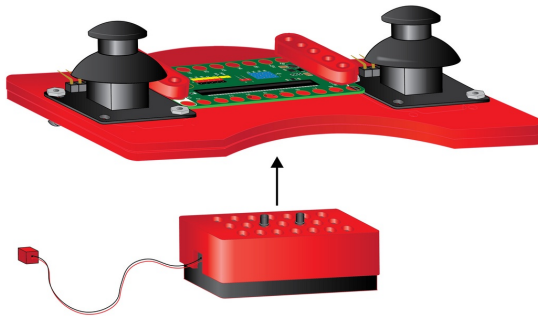
- **Use the (2) five-hole beams to secure the Bit Board** in place by pressing them onto the four black pins. **Use the beam holes shown in white.**

Step 7 — Add Pins to Battery Pack



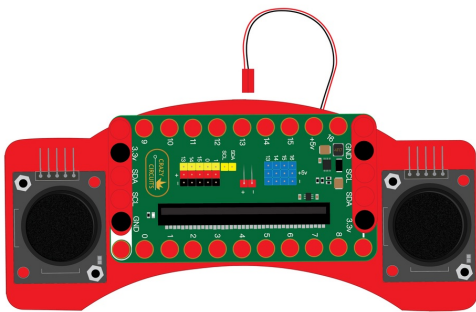
- **Press the two remaining black pins into place** where shown in white on the grid of holes **on the bottom of the battery pack.**

Step 8 — Add the Battery Pack



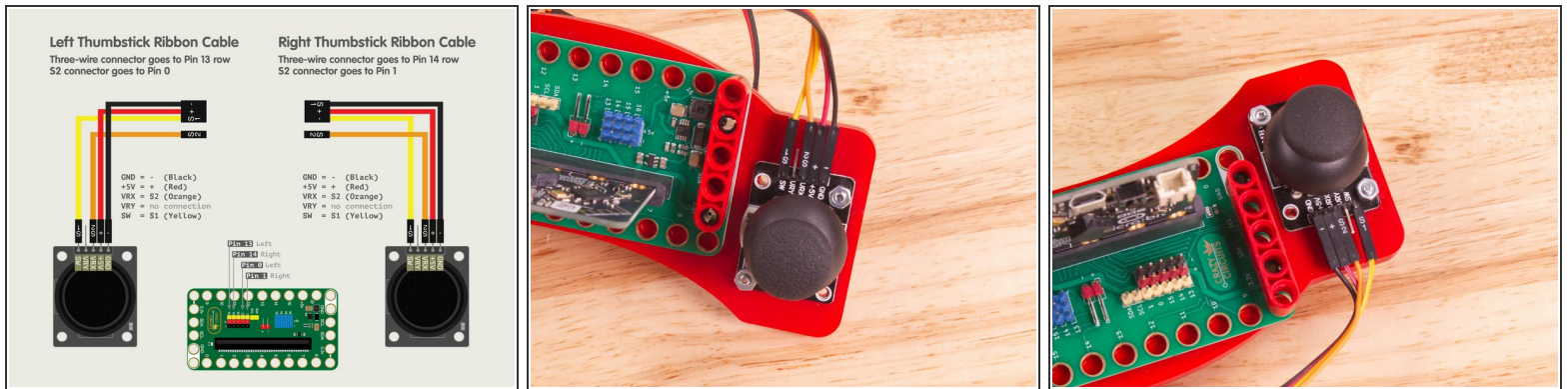
- **Attach the battery pack** by pressing the exposed ends of the pins in the battery pack into the grid of holes on the underside of the remote body.

Step 9 — Assembly Complete



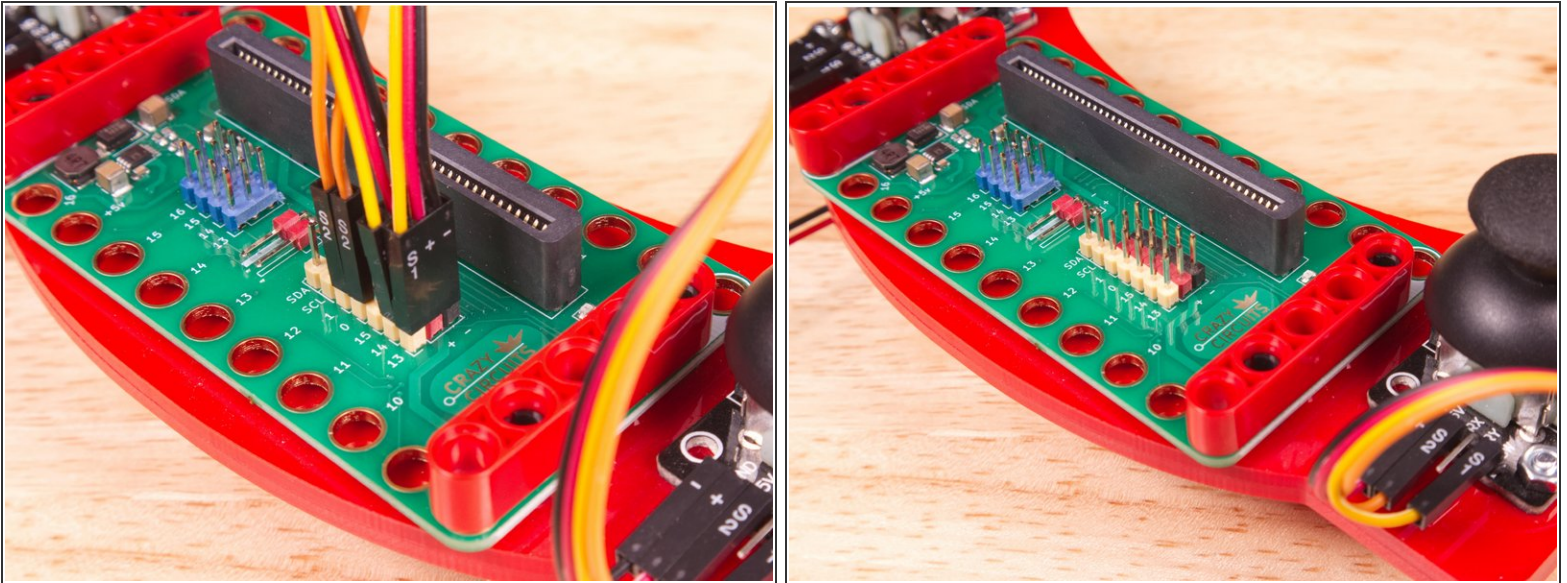
- Your Remote is now assembled.
- ⓘ We won't need to plug in the Battery Pack until after we load the code and are ready to test it out.
- In the next steps we'll connect the Thumbsticks to the Bit Board.

Step 10 — Wiring the Thumbsticks



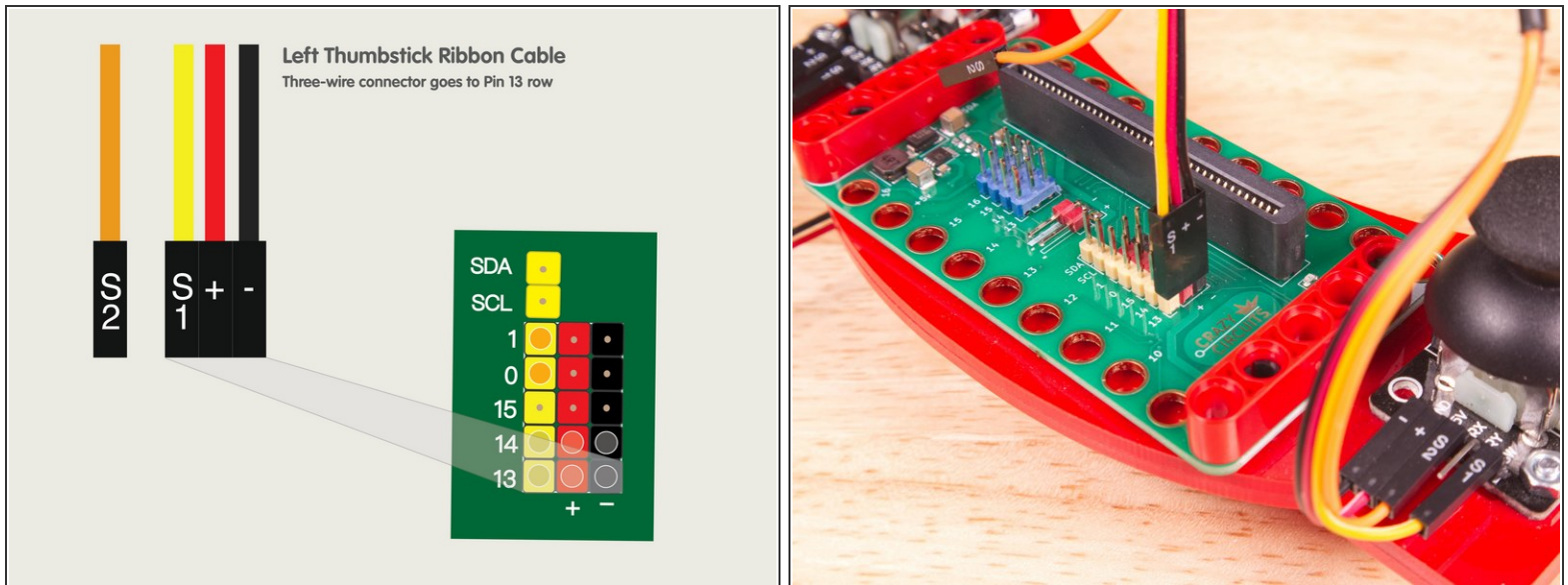
- The **Crazy Circuits Ribbon Cable** has two different ends. One end has a black connector with three wires going into it (-, +, and **S1**) and a single black connector with one wire going into it (**S2**).
- The other end has four single connectors which break out each wire individually. This is the end we'll connect to the Thumbsticks.
- Connect the **black** wire (-) to **GND** on the Thumbstick.
- Connect the **red** wire (+) to **+5V** on the Thumbstick.
- Connect the **orange** wire (**S2**) to **VRX** on the Thumbstick.
- Finally, connect the **yellow** wire (**S1**) to **SW** on the Thumbstick.
- Once you've connected the wires to one Thumbstick, do the same thing to the other Thumbstick.
- If both Thumbsticks are connected as shown we can move on to connecting the wires to the Bit Board!

Step 11 — Connecting to the Bit Board



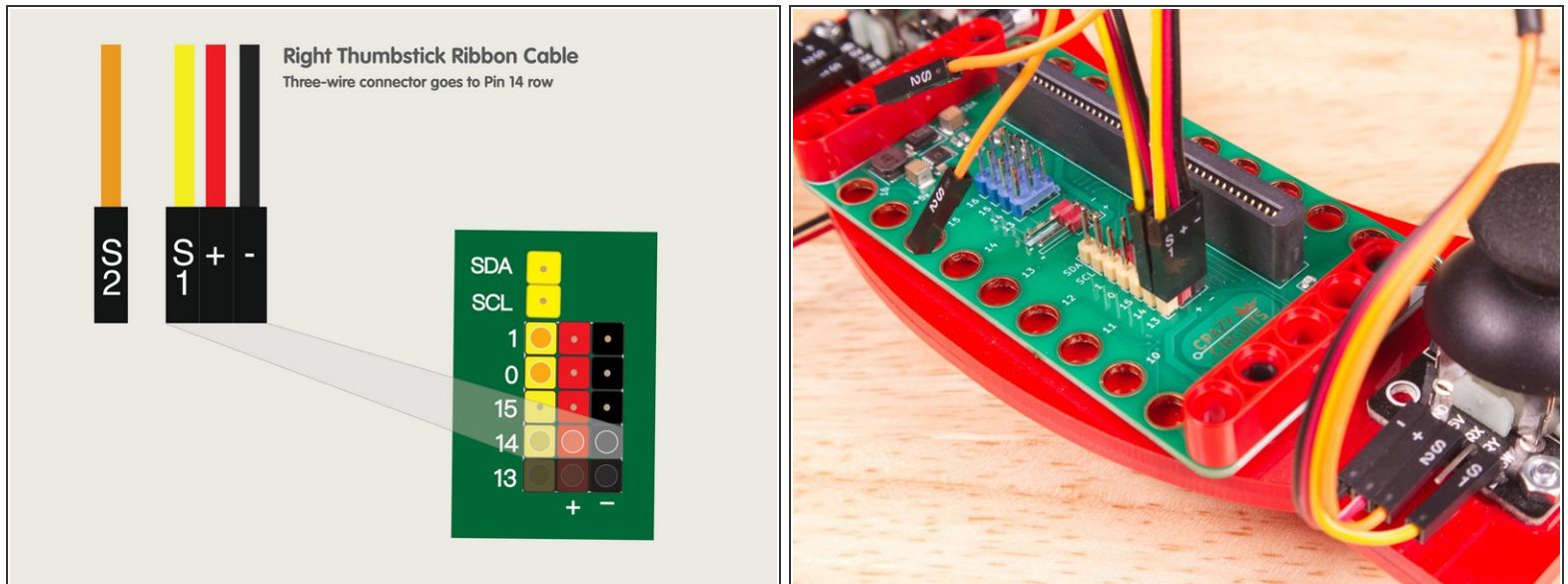
- We've broken this down into four steps, in the order that is easiest to assemble.
- ☑ Note: We recommend you remove the micro:bit from the Bit Board for this part, as it can make it easier to connect the wires.

Step 12 — Attach Left Side 3-Wire Connector



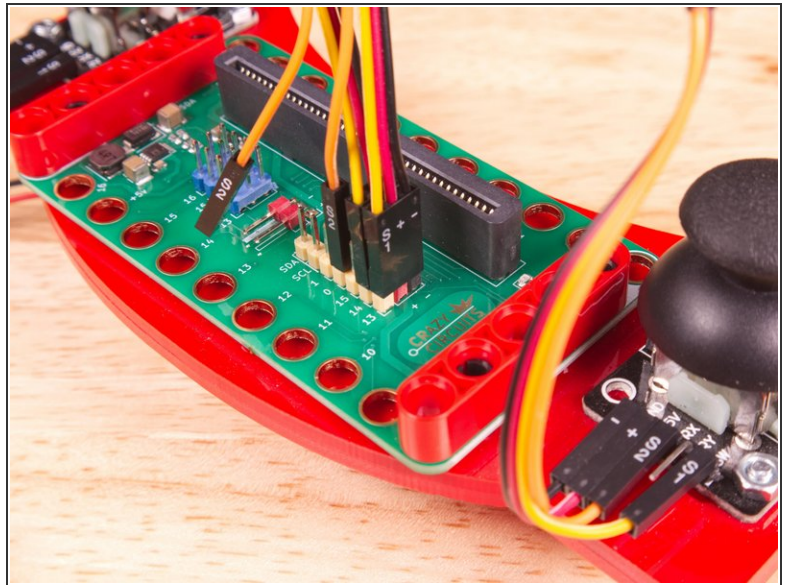
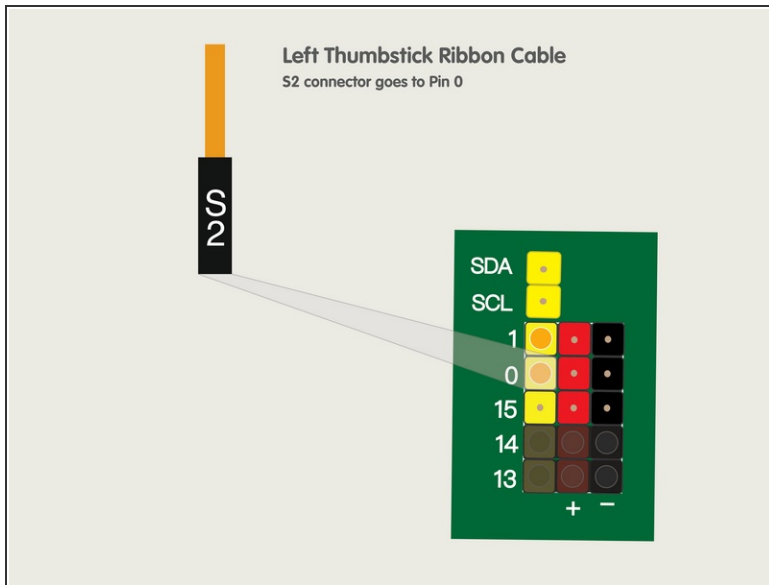
- Start by connecting the Left Thumbstick, with the 3-Wire Connector plugging into **Pin 13**.
- The **yellow** wire (**S1**) goes into the yellow **Pin 13**.
- The **red** wire (**+**) goes into the red pin next to Pin 13...
- And the **black** wire (**-**) goes into the black pin next to that.

Step 13 — Attach Right Side 3-Wire Connector



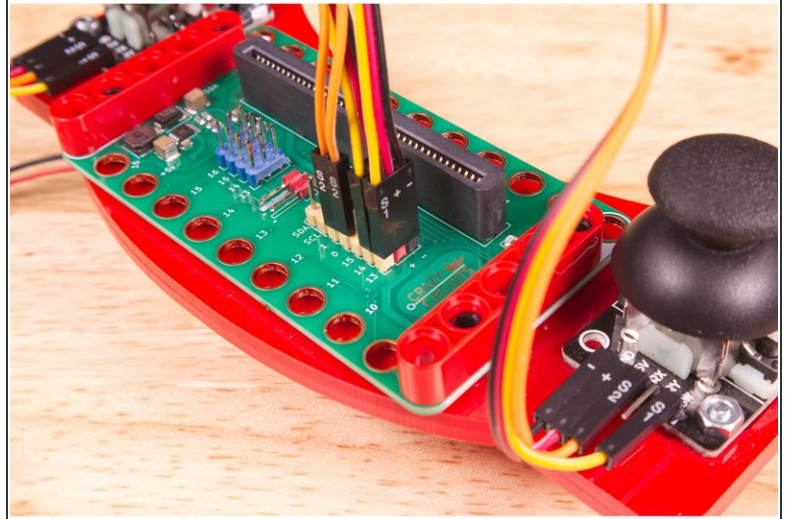
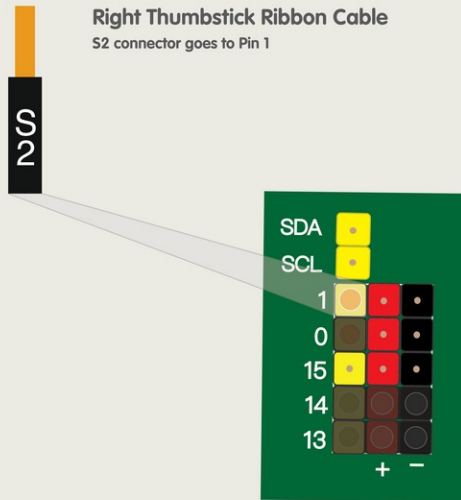
- Next we'll connecting the Right Thumbstick, with the 3-Wire Connector plugging into **Pin 14** this time.
- The **yellow** wire (**S1**) goes into the yellow **Pin 14**.
- The **red** wire (**+**) goes into the red pin next to Pin 14...
- And the **black** wire (**-**) goes into the black pin next to that.
- You should now have both of the 3-Wire Connectors plugged in, with the left going to **Pin 13** and the right going to **Pin 14**.

Step 14 — Attach Left Side S2 Wire



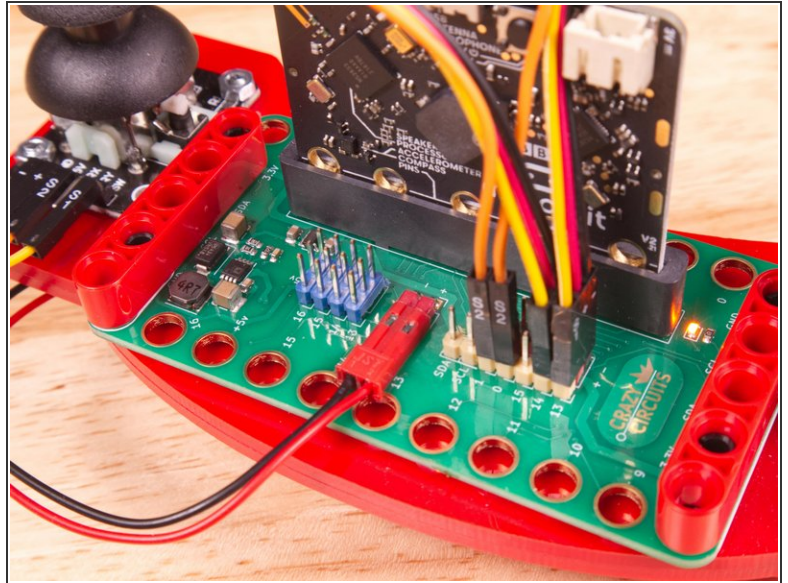
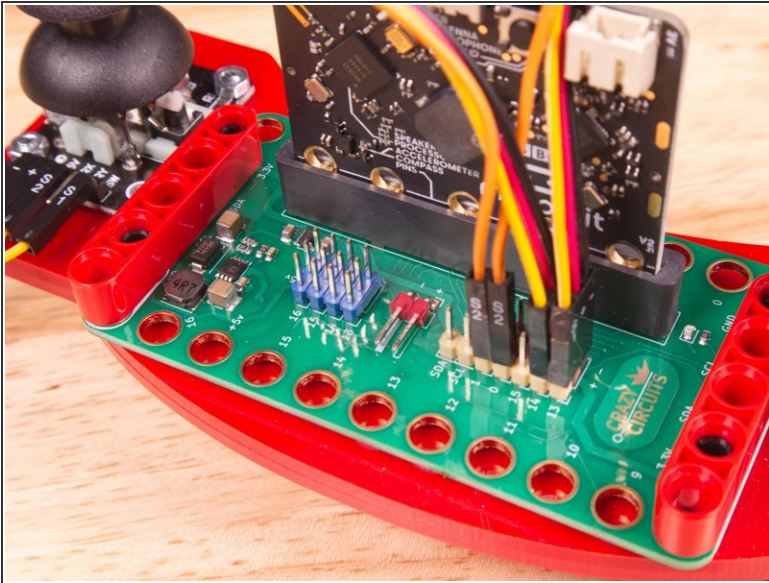
- Back to the Left Thumbstick now...
 - The **orange** wire (**S2**) goes into the yellow **Pin 0**.
- ❗ **Pin 0** is an **analog pin**. We'll plug our Left Thumbstick in here as it will be sending analog data to the micro:bit

Step 15 — Attach Right Side S2 Wire



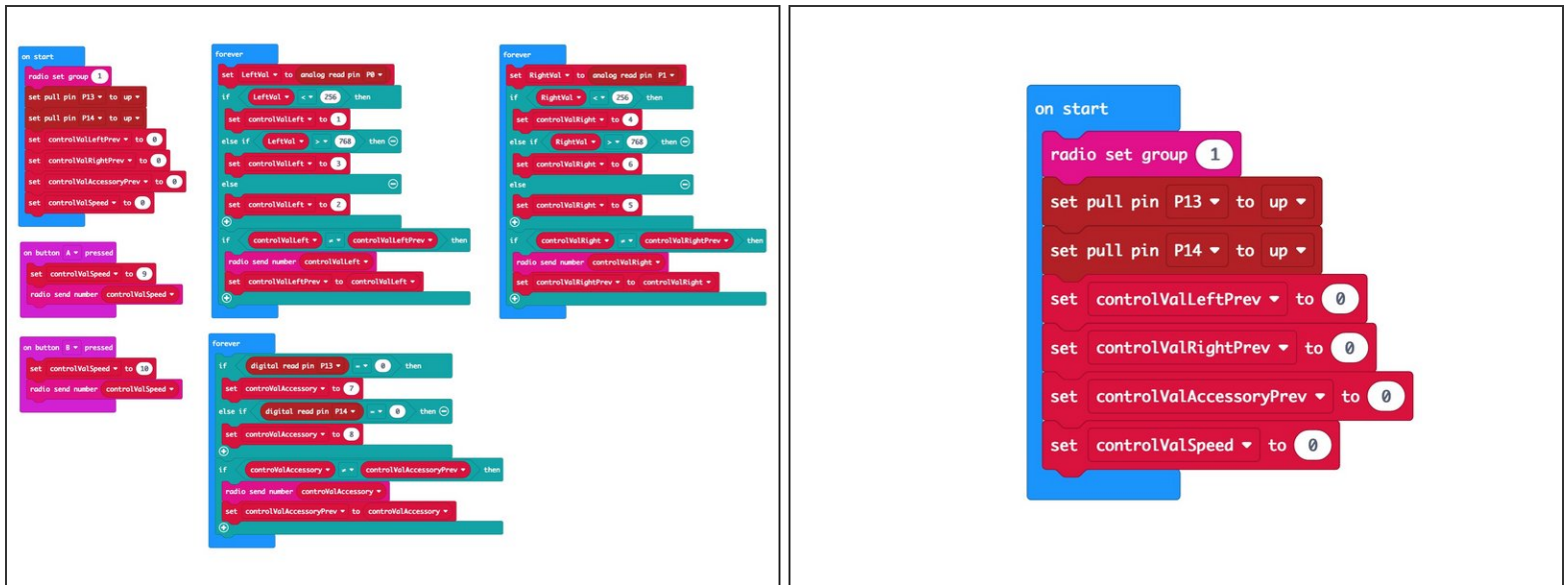
- Finally, we'll finish with the Right Thumbstick...
- The **orange** wire (**S2**) goes into the yellow **Pin 1**.
- ① **Pin 1** is an **analog pin**. We'll plug our Right Thumbstick in here as it will be sending analog data to the micro:bit

Step 16 — Add micro:bit to Bit Board



- Once you've got all the wiring completed you can plug the micro:bit back in so we can load the code!
- ① You can plug in the battery pack now, or wait until after you load the code.

Step 17 — Load the Code - Remote



⚠ If you've never used a micro:bit before you'll want to check out this guide: [Bit Board V2 Setup and Use](#)

- Let's load the code onto the Remote's micro:bit so it can function as a transmitter and send control signals to the micro:bit on the Rover.
- Load the following code: **Rover Thumb Remote TX** program:
https://makecode.microbit.org/_afEWzu5TX...
- ① Note that we've set the **radio group** to 1. You can choose any number you want as long as the two micro:bits use the same number. For a classroom setting with multiple pairs you'll want each set to have a different number.
- ① The **TX** stands for "Transmitter". For the code on the other micro:bit you'll see **RX** which stands for "Receiver".

Step 18 — Load the Code - Rover



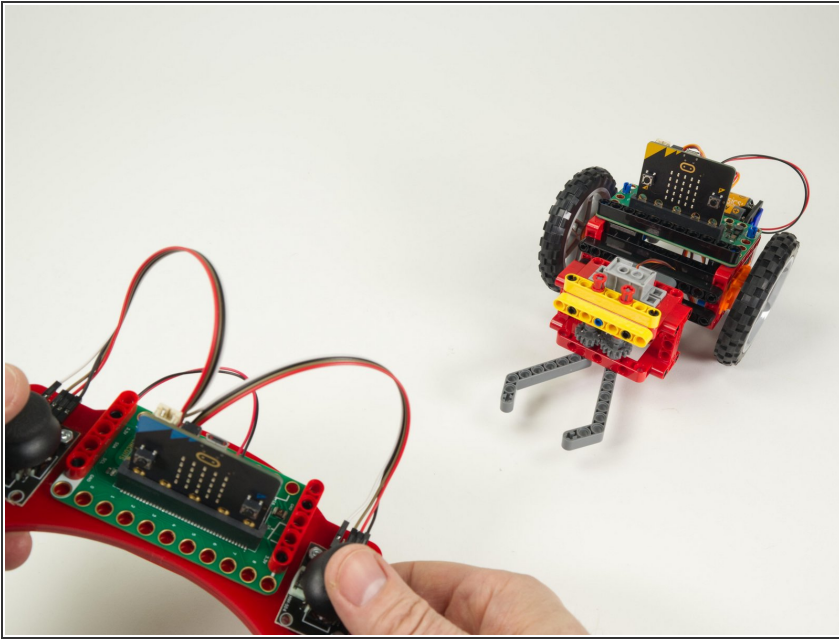
```

on start
  radio set group 1
  set speed to 0
  change angleOpen by 185
  change angleClosed by 135
  servo write pin P15 (write only) to angleOpen

on radio received: receivedNumber
  if receivedNumber == 1 then
    spin one way pin P13 (write only) with speed speed
  else if receivedNumber == 3 then
    spin other way pin P13 (write only) with speed speed
  else if receivedNumber == 2 then
    turn off motor at pin P13
  if receivedNumber == 4 then
    spin other way pin P14 (write only) with speed speed
  else if receivedNumber == 6 then
    spin one way pin P14 (write only) with speed speed
  else if receivedNumber == 5 then
    turn off motor at pin P14
  if receivedNumber == 7 then
    servo write pin P15 (write only) to angleOpen
  else if receivedNumber == 8 then
    servo write pin P15 (write only) to angleClosed
  if receivedNumber == 9 then
    change speed by 18
    set speed to constrain speed between 0 and 100
  else if receivedNumber == 10 then
    change speed by 18
    set speed to constrain speed between 0 and 100
  
```

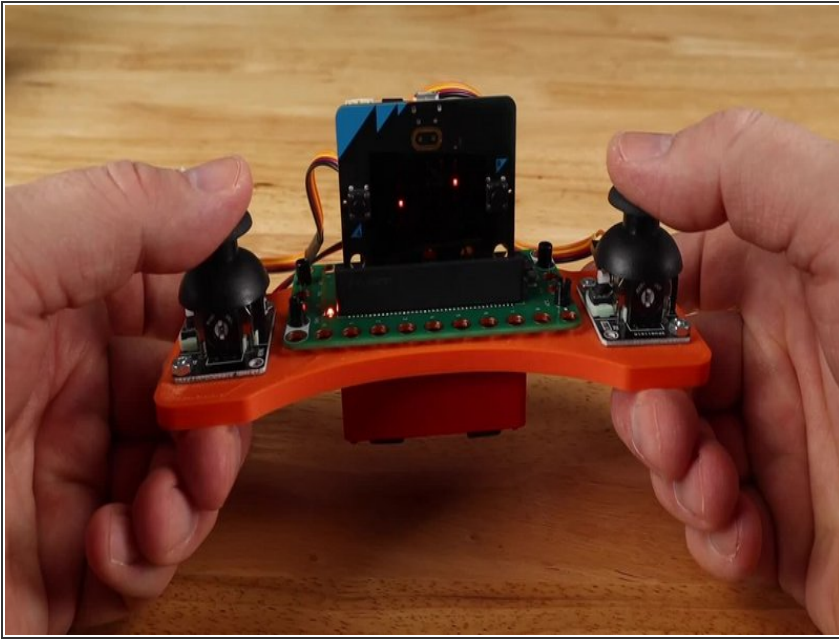
- If you've never used a micro:bit before you'll want to check out this guide: [Bit Board V2 Setup and Use](#)
- We're going to load the following code for our **Rover Thumb Remote RX** program: https://makecode.microbit.org/_T3bLW80qH...
- Once you load the code it won't do anything. Since the code turns the micro:bit into a **receiver** it will *wait* until a transmitter sends data before it does something.
- If you look at the code you'll notice the numbers 1 through 3, and 4 through 6, which we referenced in Step 1. Those are the numbers the transmitter will send to the receiver.
- You may also notice the numbers 7 and 8, which are used to control the Gripper if you have it attached to your Rover.
- Finally numbers 9 and 10 are used to change the speed of the Rover.

Step 19 — Test it Out!



- Once you've got code loaded on both micro:bits you can test using the remote control with your Rover.
- The left thumbstick should make the left wheel turn, and the right joystick should make the right wheel turn.
- Note that we consider the "left" wheel to be the one on your left side if you were standing **behind** the Rover, not facing the Rover.
- The thumbsticks are also buttons that can be pressed. Pressing each should open and close the fingers of the Gripper.
- If you want the Rover to move slower or faster press the **A** or **B** button on the micro:bit located on the Remote Control.

Step 20 — Troubleshooting



- If you have issues getting the Remote to control the Rover we've written code to test the components and wiring of the Remote.
- We're going to load the following code for our **Thumbstick Remote Tester** program:
https://makecode.microbit.org/_3iYMChX7y...
- Once the code is loaded it should behave like the Remote shown in the video.
- The left thumbstick should move a pixel on the LED matrix on the left side up and down when you move the thumbstick, matching the movement direction.
- You should see the same behavior on the right side of the LED matrix when you use the right thumbstick. (You can also test the button presses of each thumbstick)
- **Note:** *Don't worry if the pixel is not centered when you release the thumbstick. This is due to mapping a large scale onto a small scale.*
- If you are **not** seeing this behavior please double check your wiring, starting at [Step 10](#).

- If everything seems to work properly, your Remote is wired correctly and the thumbsticks are working as intended. You can now go back to [Step 17](#) and reload the code for the Remote.
-