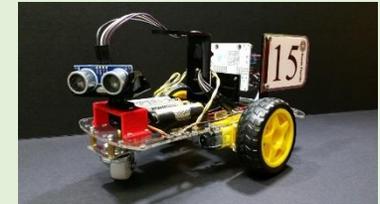


Steering Calibration #2

Objectives:

Modify the Steering Test 1 to generate and collect data about the steering ability of the rover. Graph and analyze.

1. Open the MakeCode Editor. Import the Steer Test 1.
2. The code will be modified to test the steering left and right of the rover.
3. Change the name of the project: Steering Test 2
4. Follow the **what** and **how** directions.



Did You Know? In the Steering Test #2, the LEDs will be programmed much like the LEDs for the Propulsion/Speed Test. For each value of 10, an LED will light up to the right or left of four center vertical placed LEDs. Pressing Button A will increase the increment and add a lit LED as an indicator. Pressing Button B will make the rover move.

What am I doing?	How will I do it?
<p>Modify the On Start block to set Speed to a constant and allow the Steer value to be changed.</p> <ul style="list-style-type: none"> • Set "Speed" to a constant 50% or 50. This will remain a fixed value for the Steer Test. • Create a variable called "SteerLeft" to be able to control whether the rover moves left for right. 	<p>Modify the On Start block:</p> <ol style="list-style-type: none"> 1. Change the set "Speed" to 50 2. Create a "SteerLeft" variable 3. Insert an if/then block: <ol style="list-style-type: none"> a. if "Steer" is great than or equal to (\geq) zero (0) b. set "SteerLeft" to false c. else Set "SteerLeft" to true

```

on start
  play scale up ~ middle ~
  show image icon image ~ at offset 1
  set Speed to 50
  set Steer to -60
  if Speed >= 0 then
    set Forward to true
  else
    set Forward to false
  radio set group 1
  set HeadStraightAt to 97
  servo write pin P15 (write only) to HeadStraightAt ++ Steer ++ 2
  pause (ms) 500
  set Steer to 60
  servo write pin P15 (write only) to HeadStraightAt ++ Steer ++ 2
  pause (ms) 500
  set Steer to 0
  servo write pin P15 (write only) to HeadStraightAt ++ Steer ++ 2
  if Steer >= 0 then
    set SteerLeft to false
  else
    set SteerLeft to true
  
```

Modify the Forever loop to show the Steer value instead of the Speed value as in the Speed/Propulsion Test.

- Change the center indicator LEDs (4) from a horizontal to a vertical position.
- Plot the LEDs to show to the right and left of the vertical line instead up above or below the horizontal line as in the Speed Test. LEDs to the right of the vertical line represent a turn to the right and those on the left, a turn to the left.
- Moving the LEDs will require switching the code from the x-axis LEDs to the y-axis LEDs.

Modify the Forever loop

1. Change the plot x 2 y 2 block to plot x 2 y 1
2. Add another plot block: plot x 2 y 3
3. Change "Speed" variable to "LEDCount" in the for index block
4. Change the "Forward" variable to "SteerLeft" in the second if/then block.
5. Change the plot LED blocks by reversing the values for the x and y axis in the if blocks.
 - a. first plot: change to plot x 3 y index - 1
 - b. second plot: change to plot x 4 y index - 6
 - c. third plot: change to plot x 1 y index - 1
 - d. fourth plot: change to plot x 0 y index - 6

Change the Button A commands to control the Steer function instead of Speed (Forward).

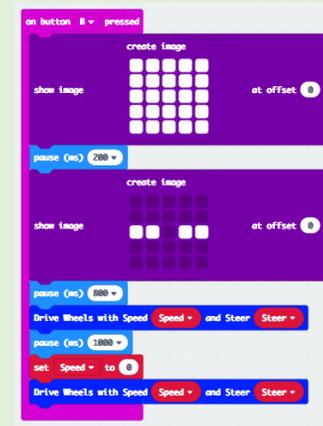
Modify the On Button A block:

1. Add a set "Speed" to 50 at beginning
2. Modify the first if block:
 - a. Change the "Forward" variable to "SteerLeft"
 - b. Change the "Speed" variable in the change to block to "Steer" and set constant to -10
 - c. Change the "Speed" variable in the second change to block to "Steer" and set to 10
3. Modify the second if block:
 - a. change the absolute of "Speed" to "Steer"
 - b. change set "Speed" to zero (0) to "Steer"
 - c. change the set "Forward" to not "Forward" to "SteerLeft" to not "SteerLeft"

Modify the On Button B pressed block to show a horizontal indicator for Steer instead of a vertical.

Modify the On Button B Pressed block:

1. Change the second create image block to four LEDs in the center horizontally instead of vertically.

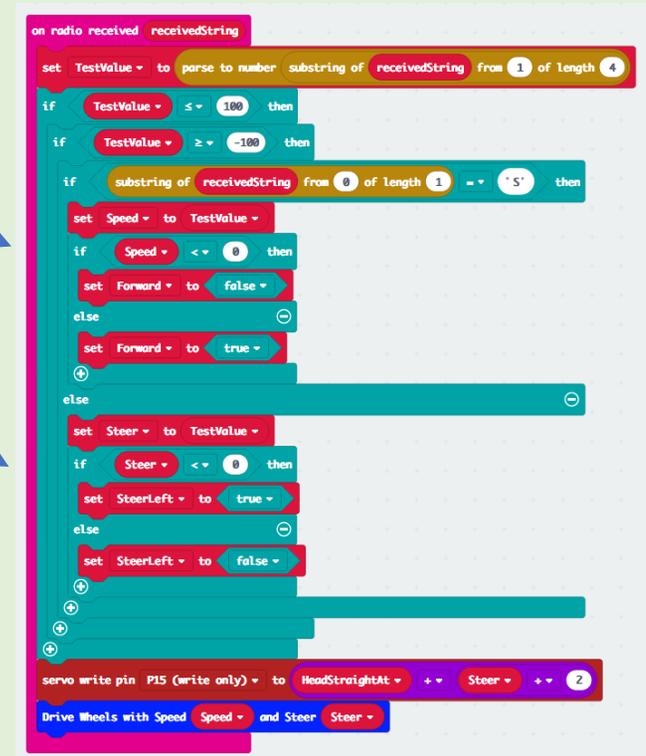


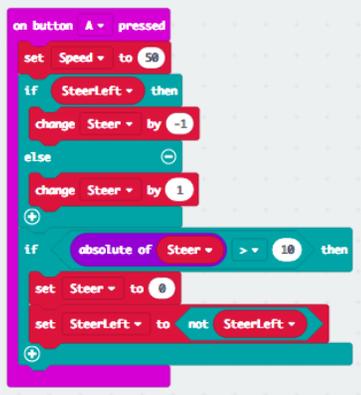
Change the code on the radio received "receivedString" to indicate the steering direction when the remote is used.

- The remote will not be used for this test but the rover needs to be coded for the correct display when the remote is used for steering later in the program.

Modify On Radio Received block:

1. Duplicate the fourth if block: if "Speed" is less than zero
2. Insert the duplicated block below the set "Steer" to "TestValue" block
3. Modify this duplicated block:
 1. change if "Speed" is less than zero to "Steer" is less than zero
 2. change the set "Forward" to true to "SteerLeft" to true
 3. change the set "Forward" to false to "SteerLeft" to false



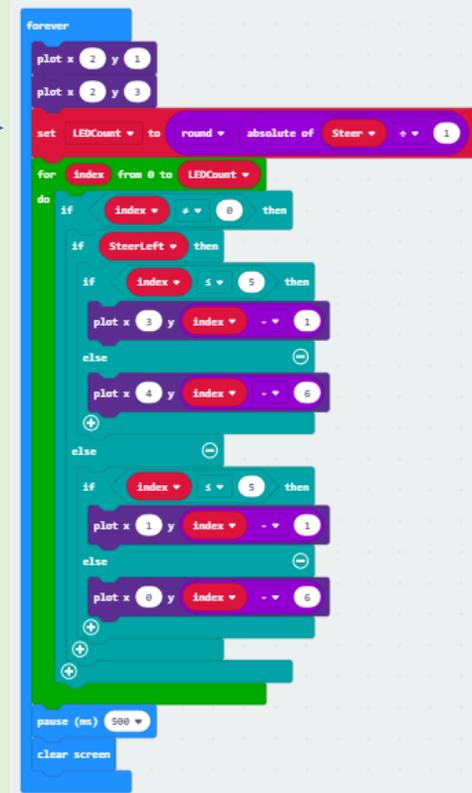
<p>Download the code to the Rover micro:bit and test.</p>	<p>Press Button A to change the Steer value then press the Button B to make the rover move. Continue the process of pressing A then B to see the full range of motion. Pay attention to the LEDs.</p> <ol style="list-style-type: none"> 1. Which direction does it turn first? 2. Does the rover spin?
<p>Conduct a Steering calibration test.</p> <ul style="list-style-type: none"> • Materials needed: masking tape, a ruler or measuring tape • Make a straight line about 20 inches long on the floor using the masking tape. • Use the Steering Test Data Table 1 in the Student Journal to record your data/measurements. 	<ol style="list-style-type: none"> 1. Set the rover on the floor next to the masking tape with the outside of the (rear)right wheel touching the left side of the beginning of the masking tape. 2. Turn the rover on. 3. Press Button B. Observe the LEDs and rover motion. On Start, the Steer should equal zero and the rover should go relatively straight. 4. Measure the distance from the outside rear right wheel to the left side of the masking tape. 5. Move the rover back to starting position and press Button A to increase the Steer value by 10. 6. Measure the distance from tape. 7. Continue this process, pressing Button A to increase Steer value, then Button B and measure the distance from the masking tape. The larger the positive number for Steer, the sharper the rover should turn. Eventually it will not make sense to take a measurement when the turn becomes so sharp. When this happens stop. 8. Then press Button A until Steer is zero (the only LEDs that should be lit are the four center ones). 9. Now place the rover on the right side of the masking tape with the outside edge of the left wheel touching the masking tape. 10. Press Button A again. This should set the Steer value at -10 and a LED on the right of the center LEDs should come on. 11. Press Button B and observe the movement of the rover. Measure the distance from the outside left wheel to the right side of the masking tape. 12. Continue this process, pressing Button A, then Button B and measuring until the rover begins to spin. 13. Create a graph of your measurements on the graph provided in the Student Journal.
<p>Can the rover be programmed to turn left or right in smaller or finer increments?</p> <ul style="list-style-type: none"> • Change the values in of Steer to make finer turns. Decrease each constant to one tenth of its original value. 	<p>Modify the On Button A pressed block:</p> <ol style="list-style-type: none"> 1. Modify the first if block: <ol style="list-style-type: none"> a. change "Steer" by 10 to 1 b. change "Steer" by -10 to -1 2. Modify the second if block: <ol style="list-style-type: none"> a. change the absolute of "Steer" greater than 100 to greater than 10  <p>The image shows a Scratch code block for 'on button A pressed'. It contains the following logic: <ul style="list-style-type: none"> set Speed to 50 if SteerLeft is true, then change Steer by -1 else, change Steer by 1 if the absolute value of Steer is greater than 10, then set Steer to 0 and set SteerLeft to the opposite of its current value. Blue arrows point from the text instructions to the corresponding code blocks in the image.</p>

Modify the LEDs display to work with the finer increments.

- The LED display needs to be decreased to one tenth its original value.

Modify the Forever Loop

- Change the set "LEDCount" to round absolute of "Steer" divided (\div) by 10 to one (1).



```
forever loop
  plot x 2 y 1
  plot x 2 y 3
  set LEDCount to round absolute of Steer / 10
  for index from 0 to LEDCount
  do
    if index = 0 then
      if SteerLeft then
        if index <= 5 then
          plot x 3 y index - 1
        else
          plot x 4 y index - 6
        +
      else
        if index <= 5 then
          plot x 1 y index - 1
        else
          plot x 0 y index - 6
        +
    +
  pause (ms) 500
  clear screen
```

Download the code to the Rover micro:bit and retest.

- Use Steering Test Data Table 2 in the Student Journal.
- Because the rover is using finer turning increments, measure the rover through all 21 possibilities.
- Create a graph of the measurements in the data table on the graph provided in the Student Journal.

Use the same procedures as in the first Steering Test.