This worksheet is to be used with Squarebot. If you do not already have one assembled, you can find building instructions in the “Build Squarebot” link under “Overview”.

Using the Transmitter

Default Transmitter Settings

You have the ability to adjust several settings on the Vex transmitter. We will begin by ensuring that we are working with the default settings.

1. Turn the transmitter on, and then hold down Mode and Select simultaneously until the transmitter beeps. The word CONFIG should appear on the screen. If you see a different word, press mode until you reach the config option.
2. Press select once. You should see the letters CL flashing on the screen.
3. Hold down the Data Input button in either direction for about two seconds. The transmitter will beep to indicate that it has been returned to default settings.
4. Hold down Mode and Select again to exit the menu.

We are now ready to begin experimenting with the transmitter.

5. Make sure that the number of the crystal in the transmitter matches that of the crystal in the receiver.
6. Turn on the Vex controller.
7. Perform the following actions and write down Squarebot’s response. Be sure to record both the action of the individual wheels and the action of Squarebot as a whole. (It might help to lift the robot off the ground.)
    a. Push the right joystick up _____
    b. Push the right joystick down _____
    c. Push the right joystick to the right _____
    d. Push the right joystick to the left _____
    e. Push the left joystick up _____
    f. Push the left joystick down _____
    g. Push the left joystick to the right _____
    h. Push the left joystick to the left _____
    i. Push both joysticks up. _____
    j. Push both joysticks down. _____
    k. Push one joystick up while pushing the other joystick down. _____

Before learning about the transmitter options, it is important to understand the naming system of the joystick axes. As described in the following list, each joystick axis is labeled as a channel. When you are editing a channel within the transmitter menu, think of it as editing the settings for the movement of a joystick in a particular direction.

Right joystick, horizontal axis: Channel 1
Right joystick, vertical axis: Channel 2

Left joystick, vertical axis; Channel 3
Left joystick, horizontal axis; Channel 4
Buttons on reverse side of transmitter; Channels 5 and 6

8. What motor port seems to be affected when you manipulate channel 2?
   _____
9. What motor port seems to be affected when you manipulate channel 3?
   _____
10. Do you see a pattern with the last two responses?
    _____
11. What happens when you manipulate channel 4?
    _____
12. Remove the left motor from port 3 and plug it into port 4.
13. Manipulate joystick channel 3. What happens?
    _____
14. Try manipulating channel 4 again. What happens this time?
    _____
15. What is the relationship between the joystick channels and the response of the motor ports?
    _____

Using the Reverse Option

16. You may have moved the motor plugs around in the last part of the exercise, but let's return them to their original positions. The left motor should be plugged into motor port 3 and the right motor should be plugged into motor port 2.
17. Let's begin by entering the transmitter menu. Find the Mode and Select buttons on the transmitter, and hold them down simultaneously until the transmitter beeps. Press the Mode button until the word "REVERSE" appears on the screen.
18. Now, let's edit the settings for channel 2, which is the vertical axis of the right joystick. Press Select once. The number 2 should be flashing next to the "CH" on the screen. If there is a number other than 2, continue pressing select until you get to the 2.
19. There should be a small arrow beside the letters "STD." Press the Data Input button in the minus direction to make the small arrow move next to the letters "REV."
20. Perform the following actions and write down Squarebot's response. Be sure to record the action of the individual wheels.
    a. Push both joysticks up
       _____
    b. Push the right joystick down
       _____
    c. Push the right joystick down while pushing the left joystick up
       _____
    d. Push the right joystick up while pushing the left joystick down
       _____

21. Did any of the results differ from step 7? What do you think the Reverse menu does?

    _____

22. Using proper terminology, describe how to program the transmitter to use the reverse option.

    _____

    _____

23. Have another student follow the directions that you just wrote. Did you accurately describe how to program the transmitter?
24. When you are done experimenting, reset the transmitter to its default settings and exit the transmitter options menu.

Using the Scale Option

25. Enter the transmitter menu and press Mode until the word SCALE appears on the screen.

There are two types of scaling: linear and exponential. We will work with linear scaling first.

26. Press Select until you get to channel 2. Look at the large number on the lower portion of the screen. There should not be a plus or minus sign in front of the number. If you see either (or both,) press the select button until you reach channel 2 without the sign(s).
27. Before actually changing anything, press the right joystick up and observe the Squarebot's response.
28. Press down on the Data Input button until the percentage on the screen reaches 70.
29. Press the right joystick up and observe Squarebot's response. (You may want to lift the robot off the ground.
30. Press down on the Data Input again. This time, stop when the percentage on the screen reaches 30.
31. Press the right joystick up and observe Squarebot's response.
32. What do you think linear scaling does?

    _____

33. The select button allows you to cycle through the channels and between linear and exponential scaling. To get a feel for the options that are available to you, press the select button several times to scroll through your choices.
34. As you may have noticed, you cannot change the scaling value for channels 3, 4, 5, or 6. What changes would you have to make to Squarebot if you wanted to edit the linear scaling values for both motors?

    _____

35. When you are done, return the transmitter to its default settings.
36. Now, let's work with exponential scaling. Navigate to the Scale menu again and press select until you get to channel 2 with the plus/minus sign(s) appearing in front of the large number.

37. Press the Data Input button down until the value reaches -65%.
38. Press the right joystick all the way up. Is there any noticeable difference from standard settings?

    _____
39. Try pushing the right joystick just part of the way up. Note your observations.

    _____
40. Now, press the Data Input button up until the exponential scaling value reaches +65%.
41. Press the right joystick all the way up. Is there any noticeable difference from standard settings?

    _____
42. Try pushing the right joystick just part of the way up. Note your observations.

    _____
43. What do you think exponential scaling does?

    _____
44. Exponential scaling certainly seems to change the motor's response, but does it have any effect on the maximum motor output?

    _____
45. Reset your transmitter settings when you are done experimenting.

Using the Drive Option

46. Looking back at the lesson on default transmitter settings (questions 1-15), what is the relationship between the number of the joystick channel and the number of the motor port that it controls?

    _____
47. Considering this relationship, is it possible to move two motors at once when only one joystick channel is being manipulated?

    _____
48. Enter the transmitter menu, and press Mode until the word DRIVE appears on the screen. You should see the number 23 flashing.
49. Press the Data Input button up to switch the number to 12. Notice that there are only two options in the drive menu. All of the previous exercises were done in mode 23.
50. The right motor should now be plugged into motor port 1, rather than motor port 3. If you do not make this change, Squarebot will not operate correctly.
51. Perform the following actions and write down the Squarebot's response.
    a. Push the right joystick up _____
    b. Push the right joystick down _____
    c. Push the right joystick to the right _____
    d. Push the right joystick to the left _____
    e. Push the left joystick up _____
    f. Push the left joystick down _____
    g. Push the left joystick to the right _____
    h. Push the left joystick to the left _____
52. Describe the difference between controlling Squarebot in the two Drive modes.

_____

53. Which drive mode do you prefer?

_____

54. How many motors are affected when only one of the axes on the right joystick is manipulated in Drive Mode 12?

_____

55. How many motors were affected when only one of the axes on the right joystick was manipulated in Drive Mode 23?

_____

56. Think of a situation where it would be beneficial for only one motor to be affected by each joystick axis.

_____

57. Reset your transmitter settings when you are done experimenting.