

This worksheet is to be used with Squarebot, and should not be attempted before completion of the first transmitter lesson.

Using the Edit Points Option

1. You only need two motors for these exercises. To begin, they should be plugged into motor ports 2 and 3. There should not be any jumper clips in the microcontroller.
2. Reset your transmitter to its default settings.
3. Hold down the Mode and Select buttons and then press Mode until you see EDIT PT appear on the screen.
4. Press the select button to get to channel 2.
5. Press down on the Data Input button to change the numeric value to 25%.
6. Press the right joystick down only part of the way, and observe the behavior of the motor. Try pressing the joystick down to varying degrees. Pay close attention to the motor's response. (You may need to lift Squarebot off the ground.)
7. Press up on the joystick and observe the motor's response.
8. Does the joystick seem to be eliciting equal responses in both the up and down directions?
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9. Press up on the Data Input button to change the numeric value to 120%.
10. Press the joystick down to varying degrees and observe the behavior of the motor.
11. Press up on the joystick and observe the motor's response.
12. Does the joystick seem to be eliciting equal responses in both the up and down directions?
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13. Turn the Vex controller off for a moment. While keeping your eye on the small arrow in the transmitter screen, press the right joystick up. Now, while holding the right joystick up, use the Data Input button to change the numeric value to 120%.
14. Turn the Vex controller back on, push the joystick in both the up and down directions to varying degrees, and observe the behavior of the motor.
15. Does the joystick seem to be eliciting equal responses in both directions?
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16. Using proper terminology, describe how to program the transmitter to change the edit points value on the left joystick.
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17. Have another student follow the directions that you just wrote. Did you accurately describe how to operate in the edit points menu?

At this point, the edit pt option might seem to be identical to the scaling option. These two options are very similar, but they are not exactly the same. Basically, the edit pt menu allows you to choose the amount of motor power elicited from the transmitter when the joystick is pushed to its maximum position. So, if you entered 50% for a certain axis under this menu, the transmitter would be calling for half of the motor's power when the joystick was pressed to the maximum position of its physical reach. However, it should

be noted that entering 120% will not call for more power than could be reached under default conditions. Entering a value above 100% will only cause the motor to reach its maximum value before the joystick is pushed to its maximum position.

18. How many different channels can be edited with the scaling menu?

19. How many different channels can be edited with the edit pt menu?

20. Let's imagine Squarebot has three motors and you would like to adjust the maximum power output for each one of these motors. Which menu (scaling or edit pt) should you use? Why?

21. Sometimes, transmitters are manufactured improperly, and the point on the joystick axis that calls for maximum power output is actually beyond the joystick's physical reach. How could you use the edit pt menu to correct for this manufacturing error?

22. No two motors are exactly the same. If Squarebot's right motor is significantly stronger than its left motor, it will not move straight when the joysticks are both pushed to their maximum positions. How could you use the edit pt menu to solve this problem?

23. Reset your transmitter settings when you are done experimenting.
24. Hold down Mode and Select simultaneously to exit the transmitter menu.

Using the Trim Option

25. Hold down Mode and Select simultaneously to enter the transmitter menu.
26. Press Mode until the word TRIM appears on the transmitter screen.
27. The select button allows you to choose the channel that you wish to edit. Let's work with channel 3. Which joystick axis corresponds to channel 3?

28. Press the Data Input button in the positive direction and change the numeric value to +100. Record the behavior of the motors.

29. Press the left joystick up only a small amount. What happened?

30. Allow the left joystick to return to its resting position. Slowly push the joystick up and note the speed and direction of the motor from the resting position all the way to the joystick's maximum upward reach.

31. Press the Data Input button in the negative direction and change the numeric value to -100. Record the behavior of the motors.

32. Slowly push the left joystick down and note the speed and direction of the wheel assembly from the resting position of the joystick all the way to the joystick's maximum downward reach.
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33. Plug one of the motors into motor port 1.
34. Use the Trim menu to edit the settings for channel 1. Experiment with the right joystick's horizontal axis, and observe the motor's response.
35. Can you guess the function of the TRIM menu? It may be hard to tell at this point.
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36. Reset the transmitter to its default settings.
37. Hold down Mode and Select simultaneously to exit the transmitter menu.
38. Return your motors to motor ports 2 and 3.
39. Find the four buttons on the transmitter that are closest to the joysticks. They should be labeled CH.1, CH.2, CH. 3, and CH. 4.
40. Press the CH. 3 button and hold it down in either direction. What happens on the transmitter screen? What happens to the motors?
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41. Each press of the button changes the value of the trim menu by a certain increment. Within the TRIM feature of the transmitter menu, by what increment does each press of the Data Input button change the numeric value?
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42. When using the buttons near the joysticks, by what increment does each button press change the numeric value?
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43. Which method allows for finer control?
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The TRIM menu allows the user to select the center point of the joysticks, which is the location that will call for zero output from the motors. In most cases, you will want the joysticks' resting positions to be the center points, so that your robot will not be moving when you aren't touching the joystick.

44. Imagine you purchased a faulty transmitter that caused Squarebot to move even when you were not pressing the joysticks. In technical terms, describe how you would use the transmitter's menu options to attempt to solve the problem.
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45. Now, assume you have a transmitter that works correctly. Describe a robot, task, or situation where it would be helpful to set the center point as something other than the joystick's resting position. You may have to be creative!
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46. Reset your transmitter settings when you are done experimenting.
47. Hold down Mode and Select simultaneously to exit the transmitter menu.

Using the P. Mix Option

48. Hold down the Mode and Select buttons simultaneously to enter the transmitter menu.
49. Press Mode until the word P.Mix appears on the transmitter screen.
50. The letters “Inh” should be flashing on the screen. They stand for inhibited, which means that the P. Mix mode is not in use. Press the Data Input button in the positive direction once. The word “on” should now appear on the screen, indicating that P. Mix mode is enabled.
51. Press the Select button to scroll through your options. In the first option, you should see a number with a percentage sign. In the second option, you should see a channel number with a small arrow pointing up. In the third option, you should see another channel number, but with the small arrow pointing down. Pressing select one more time should return you to the on/Inh option screen.
52. Go to the screen that has the channel number and an arrow pointing up. The up arrow indicates that you are selecting the “master” channel. We will use channel 2 as the master channel; press the Data Input button to make this change.
53. Now, go to the screen that has the channel number and an arrow pointing down. The down arrow indicates that you are selecting the “slave” channel. We will use channel 3 as the slave channel; press the Data Input button to make this change.
54. Press Select two times to reach the numeric value with the percentage sign. This screen allows you to adjust the “mix rate.”
55. Start with a value of 0%. Record the action of the left and right wheels, including direction of rotation, when the right joystick is pushed up and when the right joystick is pushed down.

56. Use the Data Input button to change the value to +50%. Again, record the action of both sets of wheels, including direction of rotation, when the right joystick is pushed up and when the right joystick is pushed down.

57. Experiment with the left joystick as well. What happens?

58. Use the Data Input button to change the value to +100%. Again, record the action of both sets of wheels, including direction of rotation, when the right joystick is pushed up and when the right joystick is pushed down. Again, experiment with the left joystick as well.

59. Repeat this step with values of –50% and –100%.
60. Recall that channel 2 was selected as the master channel and that channel 3 was selected as the slave channel. When using the joystick to control the master channel, what happens to the slave channel?

61. When using the joystick to control the slave channel, does there seem to be any effect on the master channel?

62. The menu allows you to select either positive or negative values for the percentage. What is the relationship between the master and slave channel when you choose a positive value?
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63. What is the relationship between the master and slave channel when you choose a negative value?
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64. Let's say you want to set your transmitter such that pushing the right joystick up would cause both sets of wheels to move forwards. What would you choose as the master channel, slave channel, and mix rate? Feel free to experiment with the transmitter to find the correct answer.
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65. Reset your transmitter settings when you are done experimenting.
66. Hold down Mode and Select simultaneously to exit the transmitter menu.