

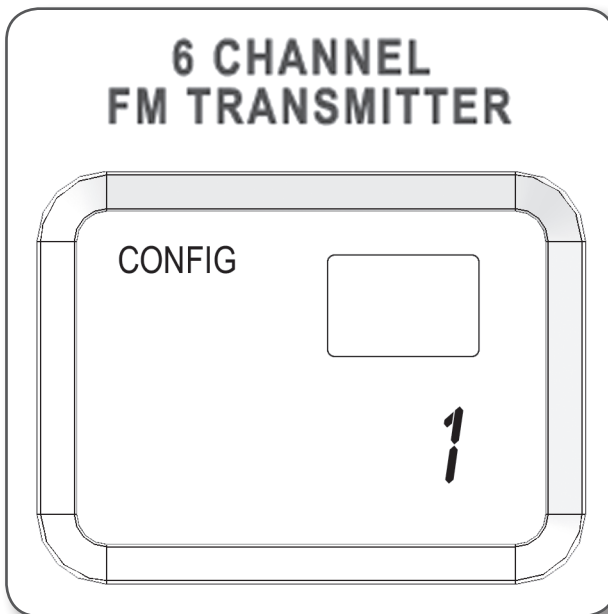
Menus

Advanced Transmitter Features

The Transmitter has a large number of onboard options that can help you refine your control over the robot. Most users will not need the advanced transmitter features described in this section.

To access the advanced feature menus, turn on your transmitter, then hold down the Mode and Select buttons together for two seconds until the menus appear.

Config Menu

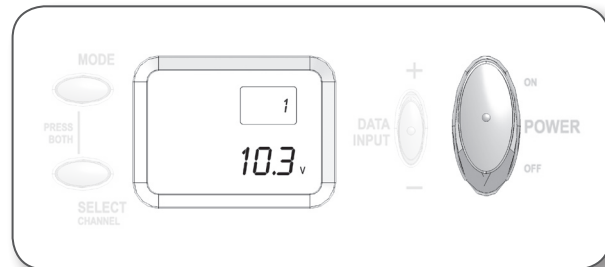


If you design multiple robots or a robot with multiple configurations (removable arm attachments, for example), the VEX Transmitter can store different control settings for each of them. The CONFIG menu allows you to switch between six different control configurations, each of which can be set any way you want for optimal control of a different robot configuration. If you make changes to a configuration and decide later that you would rather restore the defaults for that config, you can also reset them to the factory defaults from this menu.

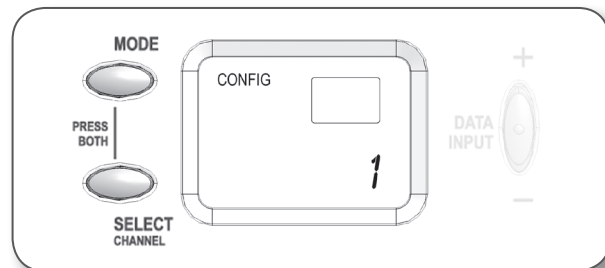
Menus, continued

Config Menu, continued To Select A Configuration:

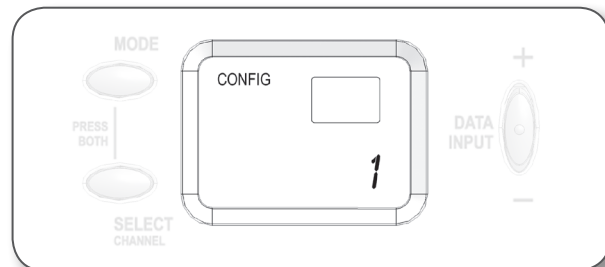
1. Turn on the Transmitter by pushing the power switch to the ON position.



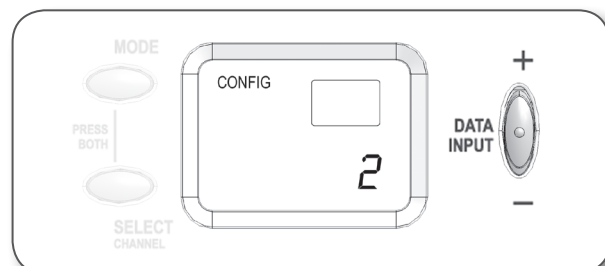
2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.



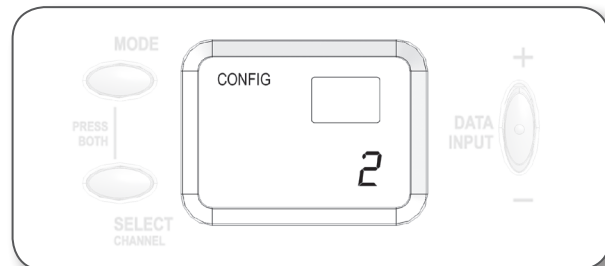
3. CONFIG mode should be open by default. If it is not, then push the Mode button until the word CONFIG appears in the upper-left corner of the display.



4. The number in the lower-right indicates which configuration is currently active. Use + and – on the Data Input button to change the active configuration.



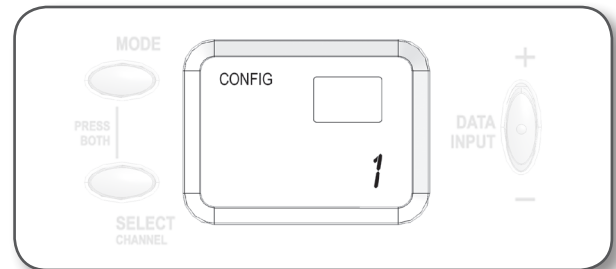
5. Any further programming changes you make in the other menus will now affect the configuration you have chosen. You do not have to confirm your selection with an Enter command. All changes will be stored as the new configuration.



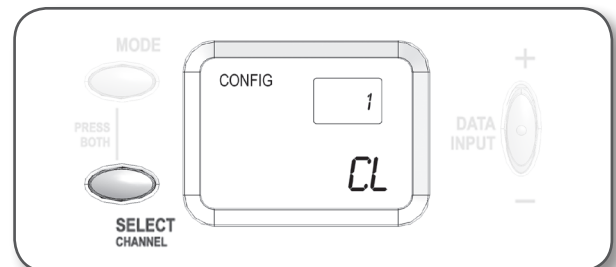
Menus, continued

Config Menu, continued To Reset A Configuration:

1. Enter the CONFIG menu and select the configuration you wish to reset by following the instructions in the section "To select a configuration" on the previous page. Make sure that the number on the screen is the number of the configuration you want to reset.

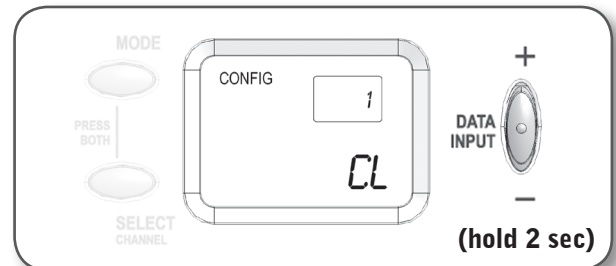


2. Press the Select button. The letters CL (for "clear") should appear.



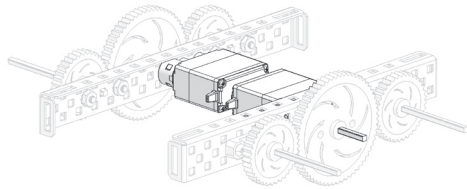
3. Hold either the + or – on the Data Input button for 2 seconds to reset the controls for the selected config number.

The Transmitter will beep twice quickly to indicate that the reset was successful.

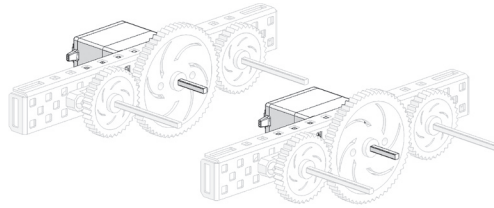


Menus, continued

Reverse Menu



Motors Back-to-Back



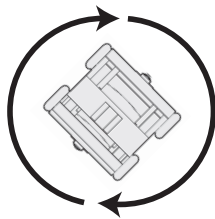
Motors Side-by-Side

Sometimes, you will want to mount motors in a different orientation than the simple back-to-back configuration. Perhaps you would prefer to run the robot using the side-by-side motor configuration shown above. This seems like a straightforward thing to do, but there is a catch.

Left stick



Right stick

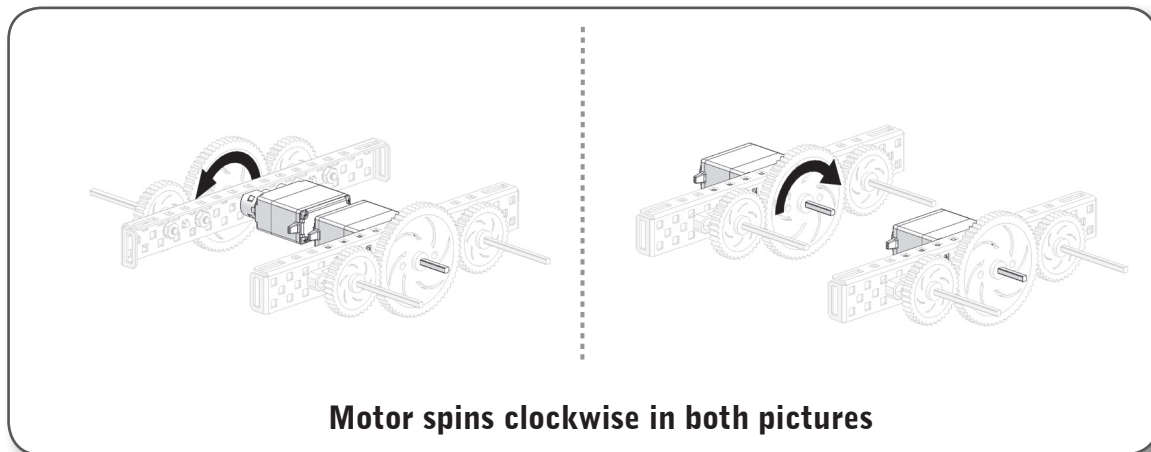


Not Forward!

In a side-by-side configuration, both motors need to spin the same direction in order to make the robot run forward, whereas the back-to-back configuration has the motors spinning in opposite directions to go forward. If you build a robot with the side-by-side configuration shown, the right side will run backwards when you push up on the stick causing you to turn/spin.

Menus, continued

Reverse Menu, continued



This is not because of a flaw in the design of the motor or the robot. The “problem” is that the motor is doing the exact same thing it was doing with the back-to-back positioning: it spins clockwise when you push up on the stick, and counterclockwise when you push down. The trouble here is that spinning in the clockwise direction used to equal forward movement, but now a clockwise spin equals backward movement for that side of the robot!

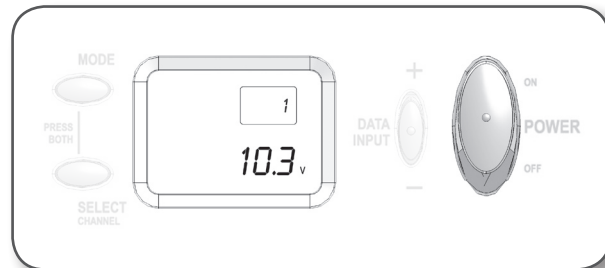
There are several ways to fix this problem, like adding an idler gear (see the Motion Subsystem Background Information), but the easiest solution is to change the settings on your transmitter to reverse the commands sent for the joystick axis that controls that motor. The combination of two reversals will give you normal control once again.

In general, you will find that the controls on the Transmitter are configured for designs using the back-to-back motor configuration. With the Reverse menu, however, you can reconfigure the controls to support any drive train orientation you may need.

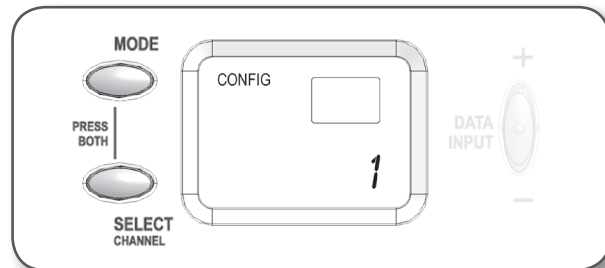
Menus, continued

Reverse Menu, continued To Reverse (Or Un-Reverse) An Axis:

1. Turn on the Transmitter by pushing the power switch to the ON position.

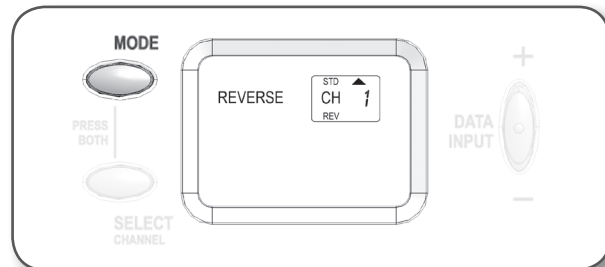


2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.

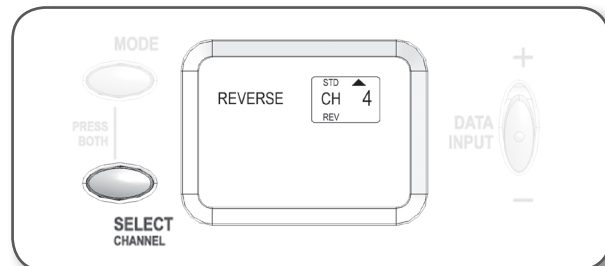


3. Push the Mode button until the word REVERSE appears on the left-hand side of the display.

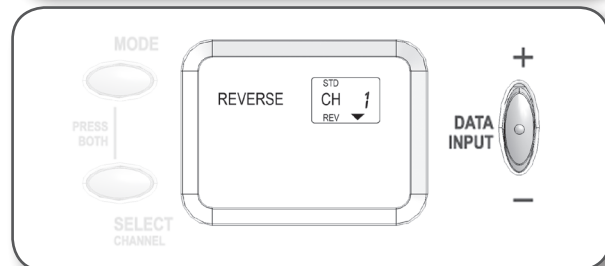
The number in the upper-right indicates which control channel (axis) you are currently viewing. The small arrow to the left of the number indicates whether the axis is currently set to operate with standard (STD) or reversed (REV) directions.



4a. Use the Select button to cycle through channels (axes).



4b. Use + and – on the Data Input button to the right of the display screen to switch between standard or reversed directional controls for the displayed axis.



5. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if they have fixed the problem.

Menus, continued

Scale Menu

The default controls are often not comfortable for a human operator. Sometimes they feel too sensitive, other times they are not sensitive enough. There are two distinct types of adjustments that can be made in this menu. The first series of adjustments controls the "linear scaling" of the controls, and can be used to make coarse adjustments to the overall range of motion that the transmitter will generate on the motors. The second series of adjustments sets the "exponential scaling" of the controls, which allows you to tweak the controls to make them "softer" or "firmer". These can only be applied to the first two axes (1 and 2, on the right stick), so scaling is only recommended for users of the "12" DRIVE mode (see Basic Transmitter Operation in the Control Subsystem chapter, or Appendix E for full details).

Scale vs. Edit Points

The easiest way to decide whether you want to use SCALE versus EDIT PT to adjust your controls is to first check whether you will need to adjust settings for axes other than 1 or 2. If so, you will need to use EDIT PT, because SCALE can only adjust settings for axes 1 and 2.

After that, it helps to organize your changes into optimizations that are designed to make the robot run better, versus optimizations that are intended to help the human operator. The main strength of the SCALE functions are the exponential controls, which help to give the operator more comfortable response ranges from the joysticks. It makes sense, then, that you should try to use the SCALE menu to help the human operator achieve a comfortable control setup, and the EDIT PT menu for necessary changes to the robot to coordinate better functionality within its own systems (see the EDIT PT section for more information and examples).

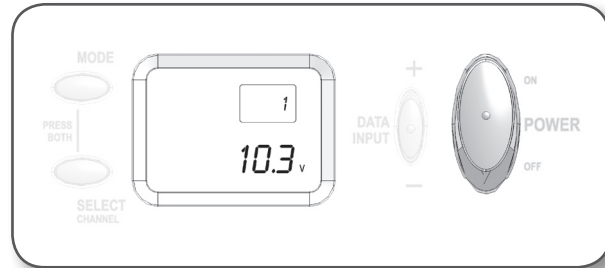
Note: If you plan to use both Scaling and End Points to optimize your robot's performance and control handling, you must adjust the End Points using the EDIT PT menu first. If you change the End Points after you set scaling, the scaling info will also be changed. See the EDIT PT menu section below for details on End Points.

Menus, continued

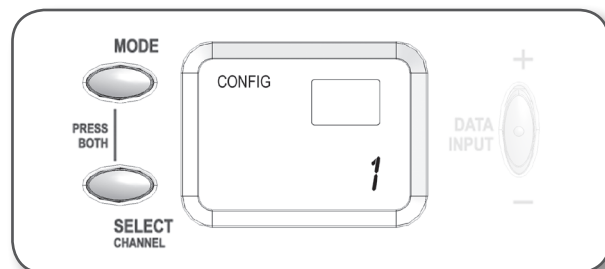
Scale Menu, continued

To Adjust Linear Scaling For An Axis:

1. Turn on the Transmitter by pushing the power switch to the ON position.

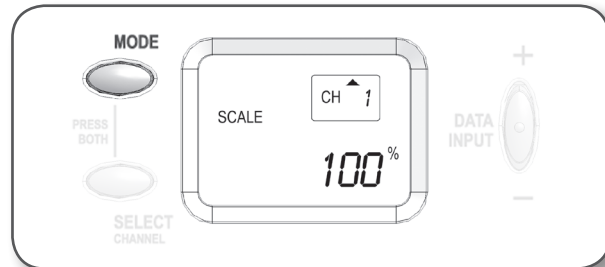


2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.

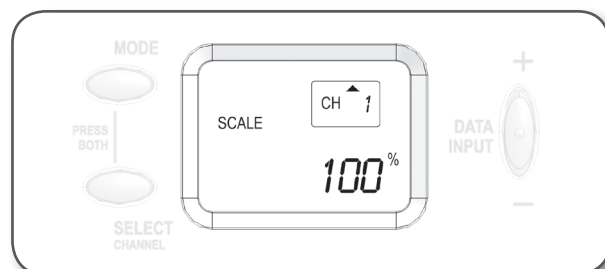


3. Push the Mode button until the word SCALE appears on the left-hand side of the display.

The number in the upper-right indicates which control channel (axis) you are currently viewing. The large number in the lower right indicates the current linear scaling value for the displayed channel.



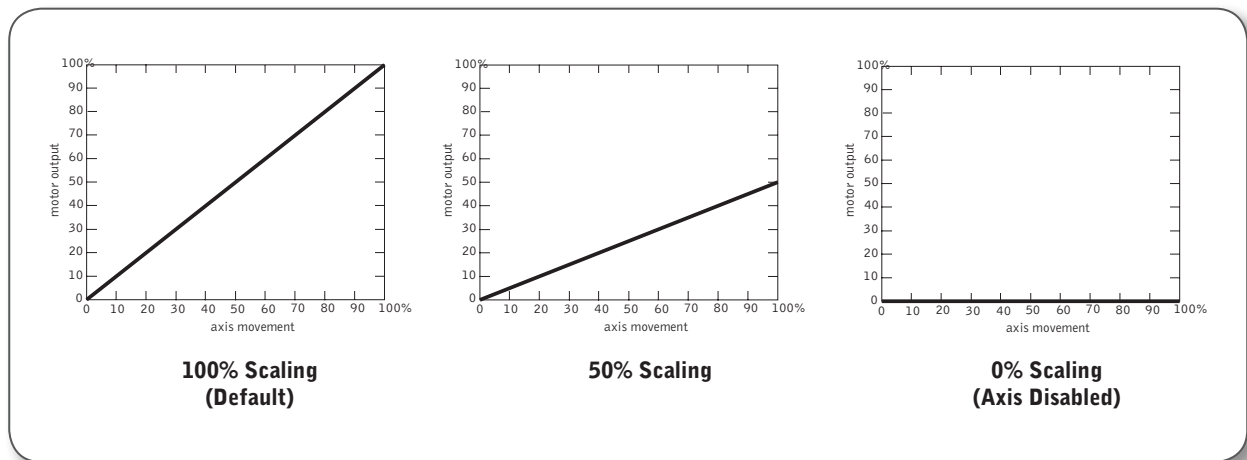
4. Make sure there is no + or – sign in front of the large number in the lower-right. If you see a + or – (or both), you are in the exponential mode, and you should push Select until you see a number without the + or – signs.



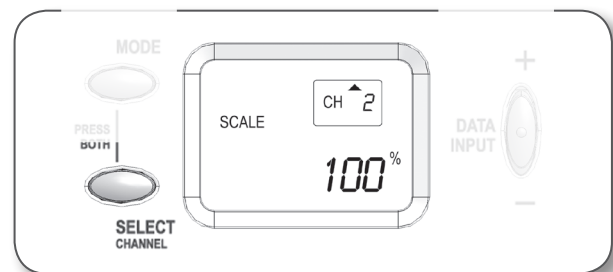
Menus, continued

Scale Menu, continued

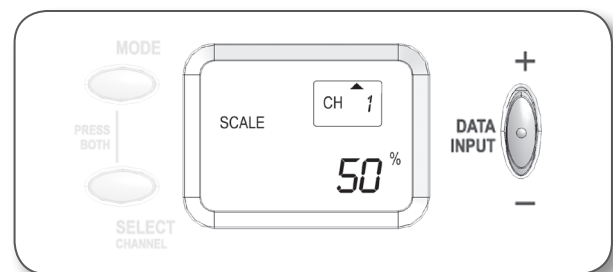
To Adjust Linear Scaling For An Axis, continued:



5a. Use the Select button to cycle through channels (axes).



5b. Use + and – on the Data Input button to the right of the display screen to increase or decrease the scaling value for the displayed axis. Higher values (up to the maximum of 100%) cause the motors to move to a fuller extent of their capabilities, while lower values allow you more control, but at the cost of not being able to reach full speed.



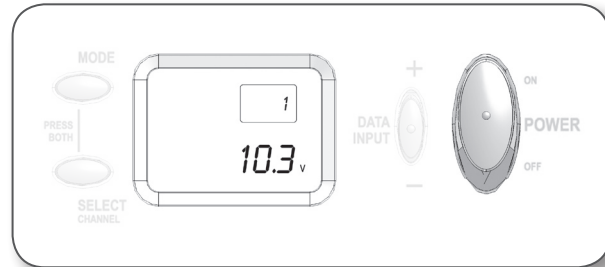
6. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if the controls are more comfortable now.

Menus, continued

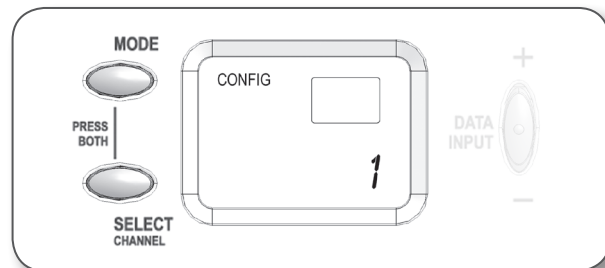
Scale Menu, continued

To Adjust Exponential Scaling For An Axis:

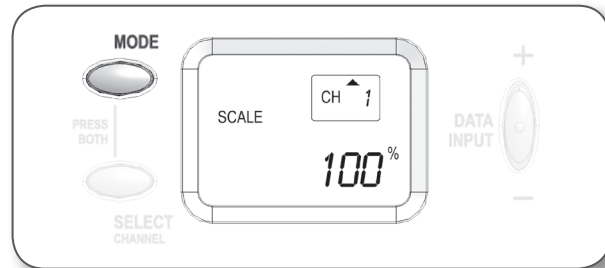
1. Turn on the Transmitter by pushing the power switch to the ON position.



2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.

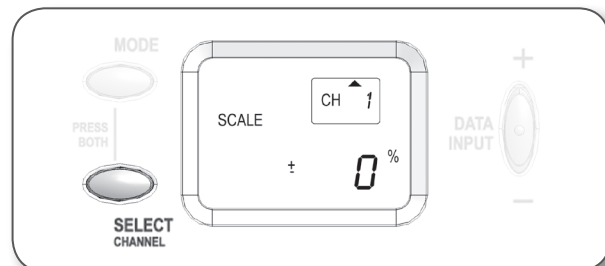


3. Push the Mode button until the word SCALE appears on the left-hand side of the display.



4. Press the Select button to skip through the Linear Scaling menus, until you see a +/-0% appear.

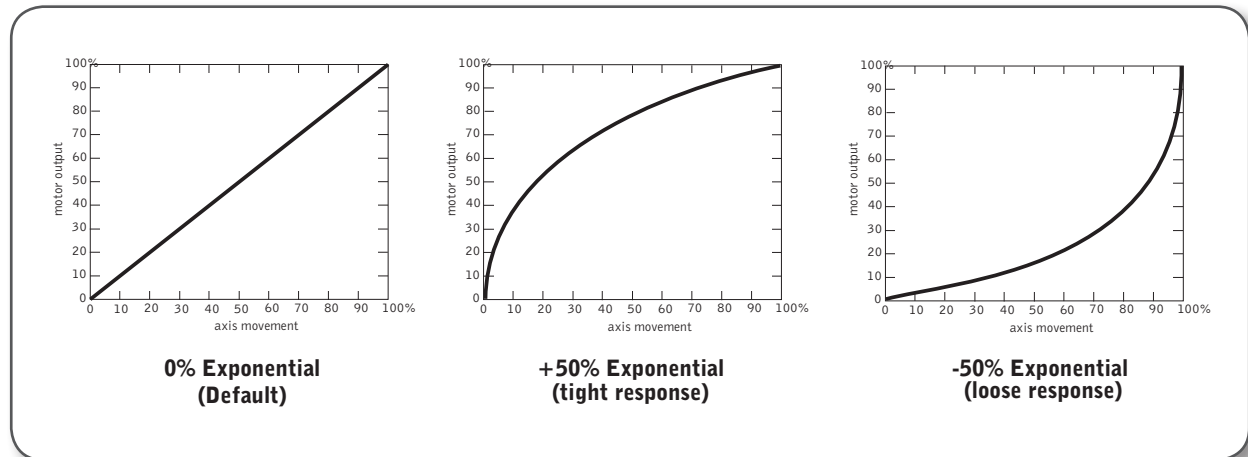
The number in the upper-right indicates which control channel (axis) you are currently viewing. The large number in the lower right indicates the current exponential scaling value for the displayed channel.



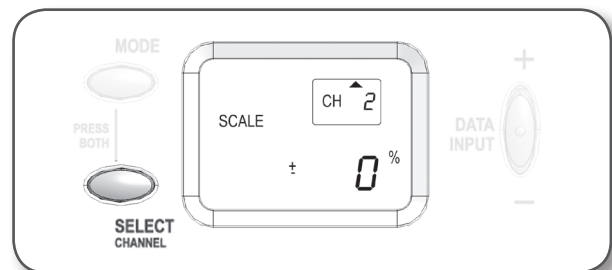
Menus, continued

Scale Menu, continued

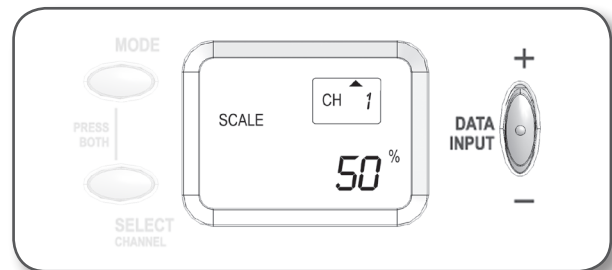
To Adjust Exponential Scaling For An Axis, continued:



5a. Use the Select button to cycle through channels (axes). Be sure you select an option with the + or - sign showing, otherwise you will be adjusting linear scaling rather than exponential.



5b. Use + and - on the Data Input button to the right of the display screen to increase or decrease the exponential value for the displayed axis. Higher values make the controls more sensitive to small pushes on the joystick, lower values make the controls "softer" and allow finer control at low motor speeds.

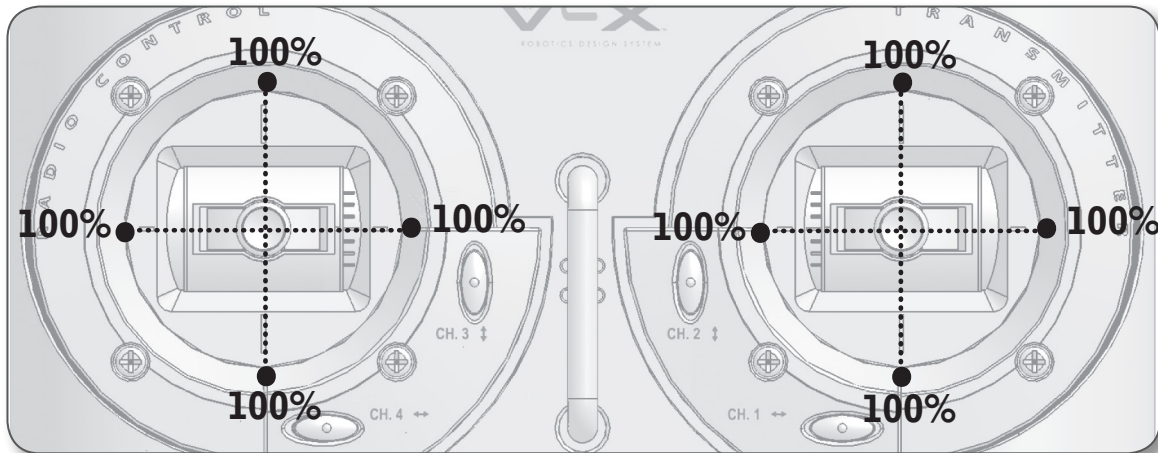


6. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if the controls are more comfortable now.

Menus, continued

Edit Points Menu

The primary purpose of EDIT PT mode is to allow small tweaks to optimize the coordination between the Radio Transmitter and the robot's motors. We recommend using EDIT PT to smooth out the interactions between the Transmitter and the motors, and using the SCALE menu to adjust the "feel" of the controls to the human operator's liking.



Compensating for Motor Variance

Not all motors are created equal. At 100% power, no two motors will spin at the exact same speed with the exact same torque, due to tiny variations between individual units in manufacturing. If you order both the left and right motors on the robot to go full power forward, the robot will not travel straight ahead (try it!). Rather, it will go straight and somewhat to one side because one motor will spin faster than the other, causing that side of the robot to get ahead of the slower side.

The solution to this problem is to limit the amount of power that the stronger motor will output at "full stick" (i.e. when the joystick is pushed all the way to the end of its movement range). If the stronger motor were set to output, say, 95% power when its joystick is pushed to full, while the weaker motor runs at 100% when its joystick is at full, the net result would be a robot that moves straight ahead when both sticks are pushed all the way.

The EDIT PT menu allows you to do this by editing the "end point values" of each joystick axis. Setting an end point value to 80%, for instance, would mean that you would only get 80% of a motor's maximum speed when the stick is pushed all the way in that direction.

Furthermore, the EDIT PT menu lets you edit the two endpoints of each axis (up vs. down on the Y-axis, for instance) independently, to account for the fact that a motor will usually not spin with identical power forward and backward either.

These small but significant changes in speed and power can happen any time you make a change to the robot's drive train. You may need to revisit this menu to retune your controls each time you modify your robot.

Menus, continued

Edit Points Menu, continued Compensating For Transmitter Joystick Variance

Ideally, the joystick's physical stopping point at the edge of the controller would match up with the point where it sends its highest power command (either forward or reverse). This is not always the case, due to manufacturing variance, and sometimes the maximum power point actually resides under the plastic cover, out of reach of the joystick.

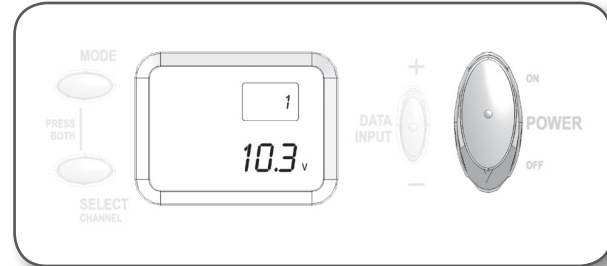
EDIT PT allows you to set values "above 100%" power (up to 120%) in order to coax out this little bit of extra signal range from your Transmitter. Setting the endpoint past 100% doesn't actually make the motors run faster than 100%. Instead, it makes the joystick behave as if the 100% point were closer to the center than the actual edge of the device. Since the "electrical endpoint" may be outside the physical range, this lets you move the 100% power point back into the joystick's physical reach.

Pushing the joystick past the 100% point (if you move the 100% point too far in) will result in a 100% power signal being sent.

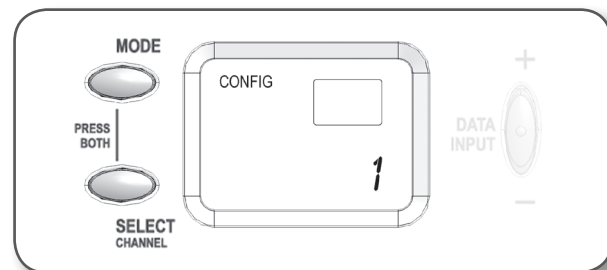
Menus, continued

Edit Points Menu, continued To Adjust An End Point:

1. Turn on the Transmitter by pushing the power switch to the ON position.

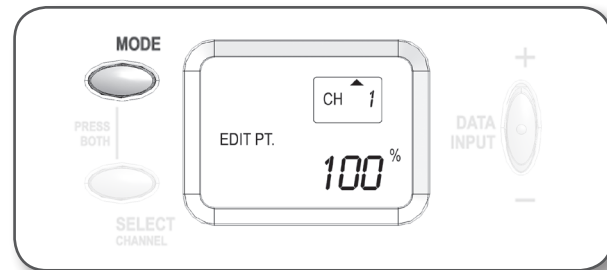


2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.



3. Push the Mode button until EDIT PT appears on the left-hand side of the display.

The number in the upper-right indicates which control channel (axis) you are currently viewing. The small arrow to the left of the number indicates which half of the axis you are modifying the end point for. The large number in the lower right indicates the current end point power value for that direction of the displayed channel.

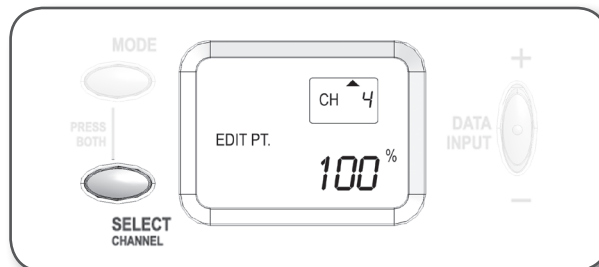


Menus, continued

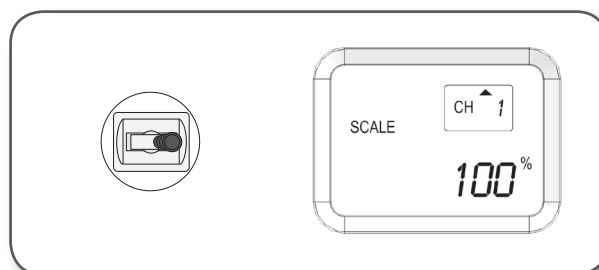
Edit Points Menu, continued

To Adjust An End Point, continued:

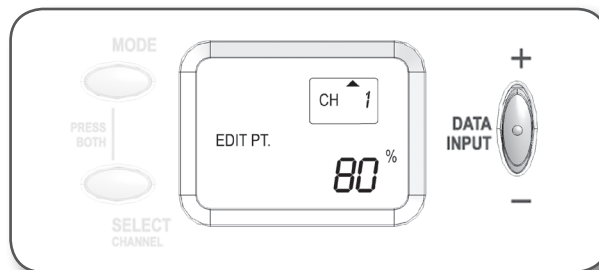
4a. Use the Select button to cycle through channels (axes).



4b. Every axis has two end points (one for each direction the stick can go from center along that axis). Push the stick toward the end point for the selected channel you want to adjust.



4c. Use + and – on the Data Input button to the right of the display screen to increase or decrease the end point (maximum power) for the displayed half of the axis. You cannot go below 70% or above 120% of the default amount. Consider revising your design or checking your components for possible malfunction if you need more adjustment than this range provides.



5. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if they improved your robot's performance.

Menus, continued

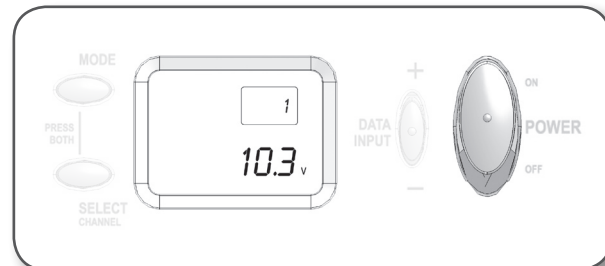
Trim Menu

Generally, you will not need to visit the TRIM menu much, because you can center ("trim") the joysticks using the channel trim buttons located directly on the controller.

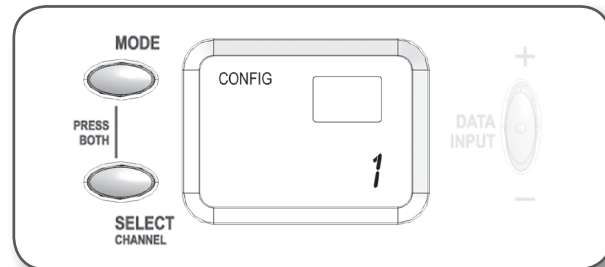
However, the trim buttons make adjustments in increments of 5 trim units, and sometimes you need to make finer changes. In those cases, you can use the TRIM menu to change the trim settings one point at a time.

To Make Fine Adjustments To The Sticks:

1. Turn on the Transmitter by pushing the power switch to the ON position.

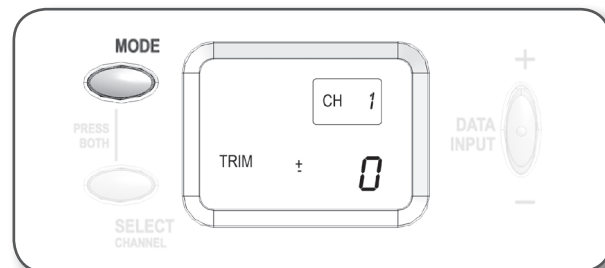


2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.



3. Push the Mode button until TRIM appears on the left-hand side of the display.

The number in the upper-right indicates which control channel (axis) you are currently viewing. The large number in the lower right indicates the current amount of trim for the displayed channel.

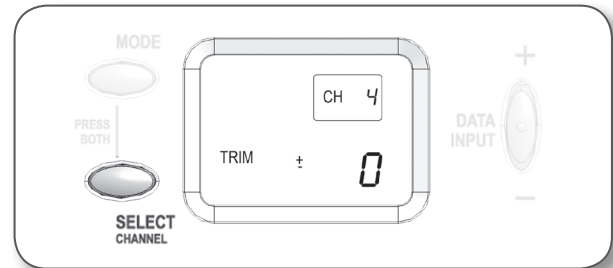


Menus, continued

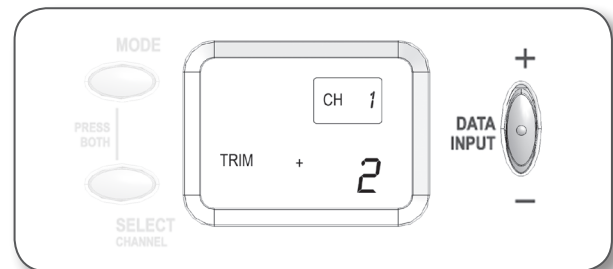
Trim Menu, continued

To Make Fine Adjustments To The Sticks, continued:

4a. Use the Select button to cycle through channels (axes).



b. Use + and – on the Data Input button to the right of the display screen to make adjustments to the amount of trim being applied to that axis. This will allow you to adjust the “center” point on the stick until it matches with the actual stick. See also “Controller Trim” in the Radio Subsystem chapter.



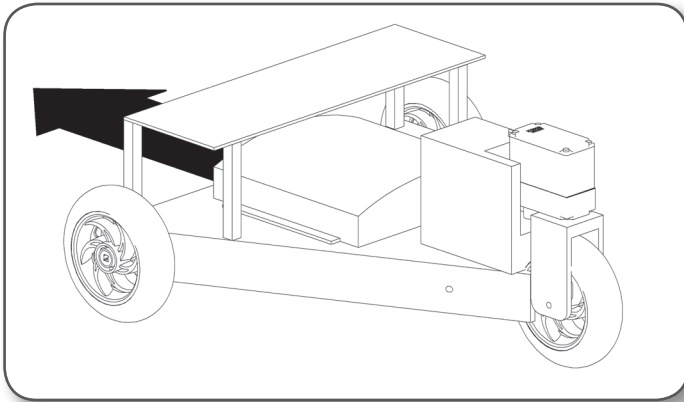
5. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if they have fixed the problem.

Menus, continued

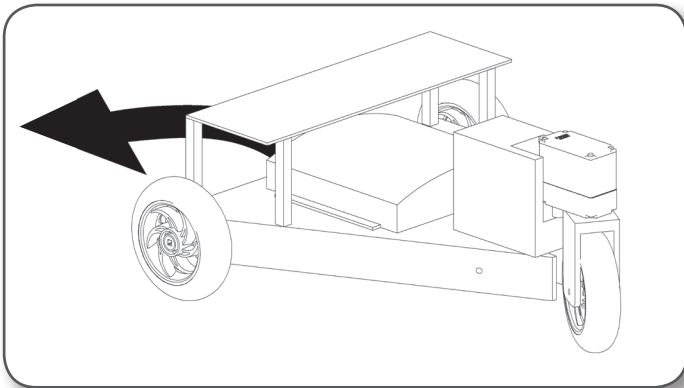
Programmable Mix Menu

P.Mix is short for Programmable Control Mixer. This menu allows you to program one axis "mix" into your controls, so that moving a single joystick axis can control more than one output channel.

In a Programmed Mix, there are three components: the master channel, the slave channel, and the mixing rate. The relationship is simple: the slave channel gets a portion of the master channel's distance-from-center value added to it. The portion is the mixing rate.



You may want to do this, for instance, if you construct a three-wheeled robot with a steerable back wheel, and want to drive it using the arcade-style controls (see Basic Transmitter Operation in the Control Subsystem chapter). As you turn left or right, you want the rear wheel to assist in turning by turning to face slightly in the direction opposite the turn.



In order to do this, you need the servomotor controlling the direction of the rear wheel to turn in conjunction with the left or right turning commands on the joystick.

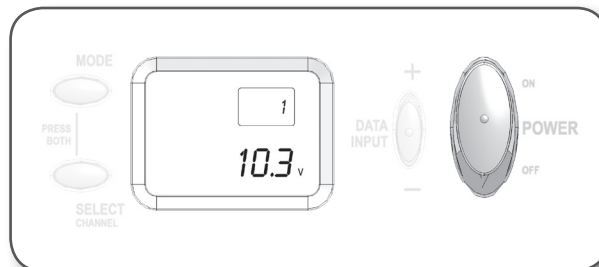
A Programmable Mix can do this:

Master Ch.1, Slave Ch.3, Rate -80% = Pushing the stick left causes the two driving wheels to turn as they normally would for the amount you push, but the servomotor on channel 3 will turn to the right (because the direction is reversed by the - sign) as if you had pushed the channel 3 stick 80% of that distance, thus assisting the robot in its turn.

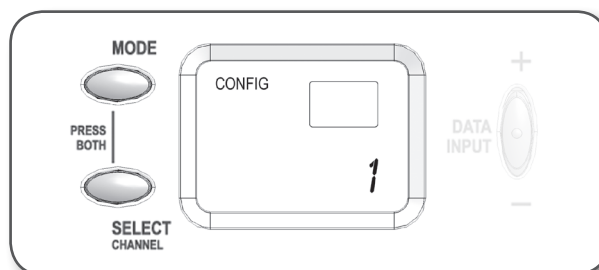
Menus, continued

Programmable Mix Menu, continued To Set Up The Programmable Mix:

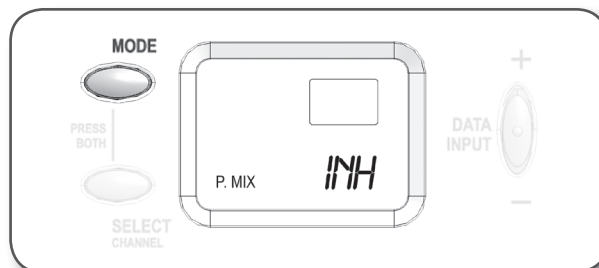
1. Turn on the Transmitter by pushing the power switch to the ON position.



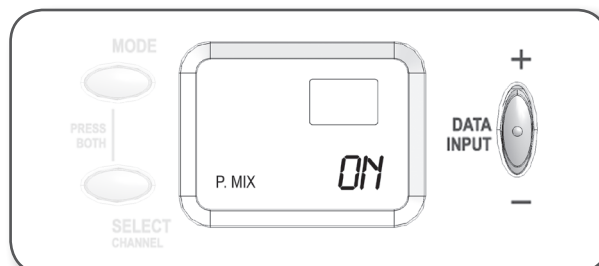
2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.



3. Push the Mode button until PMIX appears in the lower-left part of the display.



4. The Programmable Mixer mode will read "Inh" ("Inhibited") if it is disabled, or "on" if it is enabled. Press either + or - on the Data Input button to change it to "on" if it is not already on.



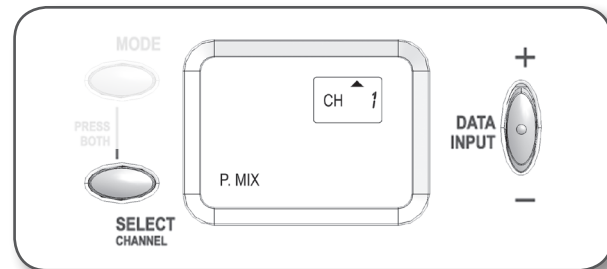
Menus, continued

Programmable Mix Menu, continued

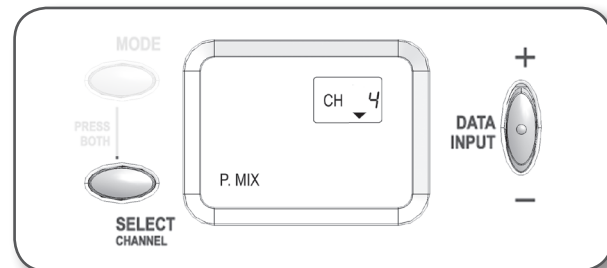
To Set Up The Programmable Mix, continued:

Select a Master Channel, a Slave Channel, and a Mix Rate. The arrow in the upper-right corner indicates which of the three you are setting. When the arrow faces upward, you are selecting a Master Channel. When the arrow points downward, you are selecting the Slave Channel. When there is no arrow, but a large number and % sign appear in the lower-right, you are selecting the Mix Rate.

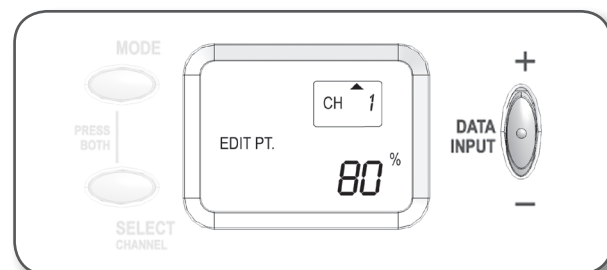
5a. Set the Master Channel by pressing Select until the upward arrow appears next to the channel number in the upper right part of the display. Change the Master Channel number by pressing the + or – on the Data Input button.



5b. Set the Slave Channel by pressing Select until the downward arrow appears next to the channel number (it should only take one press from the Master Channel screen). Change the Slave Channel number by pressing the + or – on the Data Input button.



5c. Set the Mix Rate by pressing Select until the large number and % sign appear in the lower right (two presses from the Slave Channel screen). Press or hold the + side of the Data Input button to increase the mix rate; press or hold the – side of the Data Input button to decrease the mix rate.



Numbers above 0 will make the slave channel move in the same direction as the master channel; numbers below 0 will make the slave channel move in the opposite direction.

6. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if the controls are working the way you want them to now.

Menus, continued

Driving Mode Menu

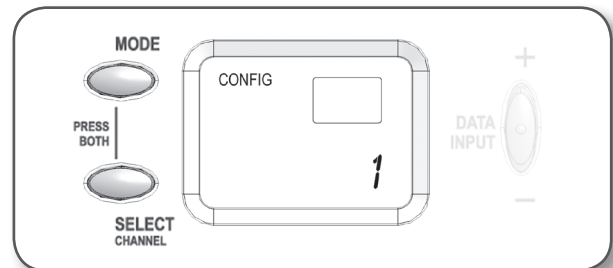
The DRIVE menu allows you to select your driving mode. By default, each axis of the Transmitter controls one motor port on the Micro Controller (this is called "23" mode, because the main motors are controlled by axes 2 and 3). You can change this to "12" driving mode where the right joystick (axes 1 and 2 = "12") controls both forward/reverse and turning motion.

To change driving control modes:

1. Turn on the Transmitter by pushing the power switch to the ON position.

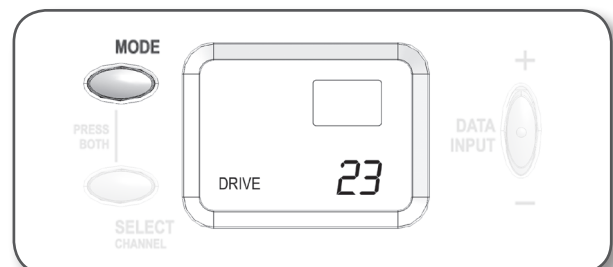


2. Enter the menu on the transmitter by holding down both the Mode and Select buttons next to the display until the menu opens.

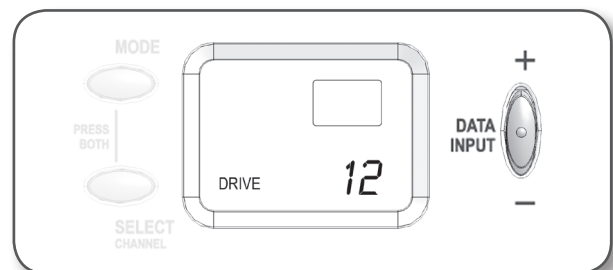


3. Enter DRIVE mode by pressing the Mode button until DRIVE is displayed on the left side (it's the last mode).

The current driving mode is displayed. This will be either "23" or "12".



4. Press the + or – on the data input button on the right side of the display to switch between these two modes. For more information on the difference between "23" and "12" modes, see Basic Controller Operation in the Control Subsystem chapter.



5. Your changes take effect immediately. You do not have to confirm your selection with an Enter command. You can turn on your robot and test your changes now to see if the controls are working the way you want them to now.

Menus, continued

Driving Mode Menu, continued

Additional Notes On Driving Modes:

“23 mode” is the equivalent of having every joystick axis send its signal directly to the motor on the same-numbered port on the Robot Controller. This is the mode you may want to stick with if you are controlling a design where control of individual motor ports is important.

“12 mode” is actually a “mix” mode, where the output commands sent to ports 1 and 2 do not represent the input from a single joystick axis. The actual equations used are:

Motor Port 1 = 50% of stick 1 + 50% of stick 2

Motor Port 2 = 50% of stick 2 – 50% of stick 1

As you can see, this automatically allows you to go to the 100% motor power if you push the stick to the corners. However, it also means that the robot will only move at 50% of maximum motor power straight forward (stick axis 2 at max * 50%, and no contribution from stick axis 1).

Extra Info About Mixes And The Drive 12 Mode:

Motor Port 1 = 50% of stick 1 + 50% of stick 2
= 50% * (stick 1 + 100% of stick 2)

Motor Port 2 = 50% of stick 2 – 50% of stick 1
= 50% * (stick 2 – 100% of stick 1)

You can think of this as a pair of “mixes”, as if you had set them in the P.Mix section (although P.Mix on the VEX Transmitter only allows one mix, so you could not quite duplicate this functionality through the P.Mix mode here). Channel 1 would have a -100% mix on Channel 2, and Channel 2 would have a +100% mix on Channel 1; both axes would then be scaled to 50% as if you had set that option in the SCALE menu.