

INTERMEDIATE PROGRAMMING LESSON



ADJUSTING MOTORS FOR LAUNCH

By Sanjay and Arvind Seshan



Lesson Objectives

1. Learn how to make your robot more reliable
2. Learn about common problems you might face
3. Learn some possible solutions

Note: This lesson focuses on reliability issues faced by FIRST LEGO League teams. Many concepts are applicable to non-competition situations, but the terminology in the lesson and the main focus is for competition robots.

Sources of Problems

Problem	Impact
Adjusting motors/attachments in base	First move out of Launch Area may behave differently each time. Attachments don't work the same each time

Adjusting Attachments for Launch

Just like the robot body, you need to set up your attachments in the same way each time for improving reliability

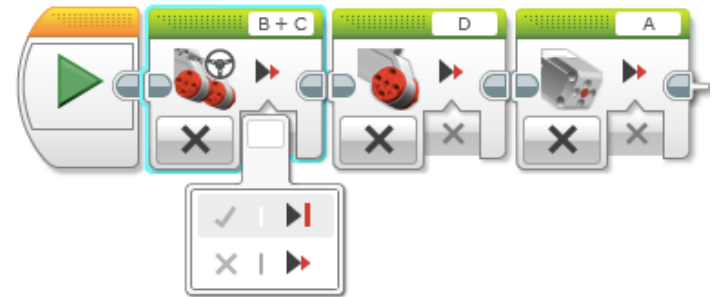
- Jigs that allow the attachment arm to only move to a certain level to make sure the arm is set the same way each time
 - In Senior Solutions, we used a jig to make sure the arm that picked up the pill box always started at the right level
- Indicators on the robot (e.g. bright peg) might help you remember where to reset the arm to
 - In Food Factor, we had a red peg in a hole to remember how far back to move the arm
- You can use a touch sensor to detect the position of an attachment at the start of a run

Adjusting Motors in Launch Area

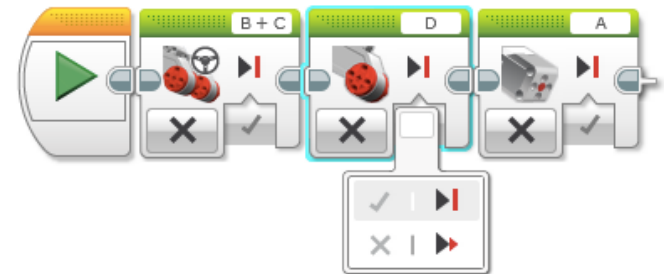
Moving attachments or wheels

- When the program is stopped you can move wheels and attachments easily and it has no impact
- If a program is running, there are multiple steps
 - You need to put the motors into “coast” mode
 - If you move the motors in coast mode, the motors will move back to the original position on the first move!
 - You need to “reset” the motor after an adjustment and before you start your run

1) Put all the motors you use on coast so you can move the motors by hand to adjust



2) Now you have to “reset” the motors




Using Coast

This set puts all the motors in coast mode. You should be able to freely move your motors by hand without any resistance.

When you are ready to start your mission, hit the middle button

We tell motor Arm "A" to move 10 degrees. It will move 10 degrees from where it was when the program last started and not where you moved it to by hand earlier




The image shows a sequence of six code blocks in the LEGO Mindstorms EV3 software. The first block is a 'Start' block with a green play button. The second block is a 'Motor On' block for ports B+C, with a red arrow icon and a 'Coast' mode icon. The third block is a 'Motor On' block for port D, with a red arrow icon and a 'Coast' mode icon. The fourth block is a 'Motor On' block for port A, with a red arrow icon and a 'Coast' mode icon. The fifth block is a 'Motor On' block for port A, with a red arrow icon, a 'Coast' mode icon, and a 'Move to Position' sub-block. The sub-block has a '90°' icon, a '20' value, a '10' value, and a checkmark icon. The sixth block is a 'Motor On' block for port A, with a red arrow icon, a 'Coast' mode icon, and a 'Move to Position' sub-block. The sub-block has a '90°' icon, a '[2]' value, a '2' value, and a checkmark icon.

This code shows that the motor arm (A) will not be predictable no matter how much you reset the arm by hand. It's movement is based on where the arm last was. Move the arm by hand at least 90 degrees to see the difference.

Doesn't work well. Not as reliable!

Using Coast & Reset



The image shows a sequence of LEGO Mindstorms blocks. It starts with a 'Start' block (green play button). This is followed by three 'Coast' blocks (orange top) for motors B+C, D, and A. Each 'Coast' block has a 'Reset' button (middle) and a 'Stop' button (right). Below the first 'Coast' block is a text box: "This set puts all the motors in coast mode. You should be able to freely move your motors by hand without any resistance." Below the second 'Coast' block is a text box: "When you are ready to start your mission, hit the middle button". Below the third 'Coast' block is a text box: "Here, we added a 'reset' step." This is followed by three 'Move' blocks (green top) for motors B+C, D, and A. Each 'Move' block has a 'Reset' button (middle) and a 'Stop' button (right). Below the first 'Move' block is a text box: "This code shows that the motor arm (A) will be more predictable because you are able to set a starting position for the arm in base. Move the arm by hand at least 90 degrees to see the difference." This is followed by three 'Coast' blocks (orange top) for motors B+C, D, and A. Below the first 'Coast' block is a text box: "Now when you ask the attachment arm 'A' to move 10 degrees, it will move 10 degrees from where you manually moved the arm when it was in base." The sequence ends with a 'Stop' block (grey).

This set puts all the motors in coast mode. You should be able to freely move your motors by hand without any resistance.

When you are ready to start your mission, hit the middle button

Here, we added a "reset" step.

This code shows that the motor arm (A) will be more predictable because you are able to set a starting position for the arm in base. Move the arm by hand at least 90 degrees to see the difference.

Now when you ask the attachment arm "A" to move 10 degrees, it will move 10 degrees from where you manually moved the arm when it was in base.

More reliable!

Credits

This lesson was written by Sanjay and Arvind Seshan

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