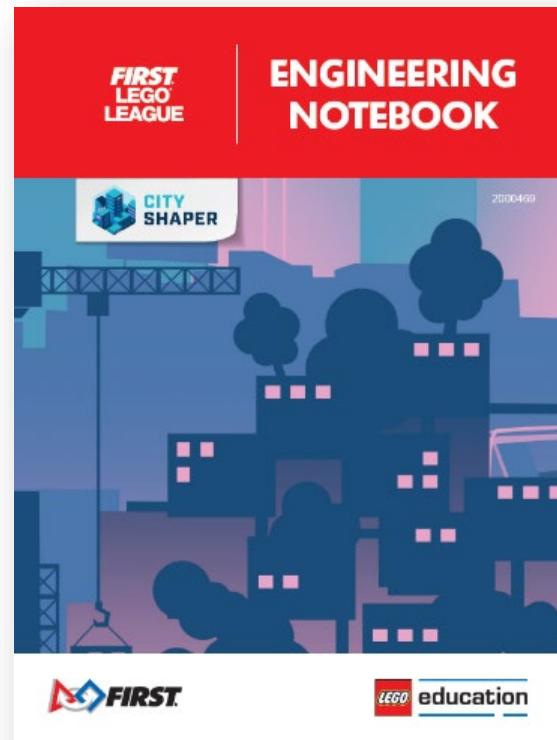


***FIRST*® LEGO® League CITY SHAPERSM Challenge**

Detailed Guidance for Engineering Notebook Robot Lessons



Crane Mission Lesson

If you have not done so already, please complete Robot Lessons 1-6 before attempting the Crane Mission. Lessons 1-6 are found in the CITY SHAPER Engineering Notebook and the [Robot Lessons Poster](#).



The Crane Mission (Mission 2)

Robot Lesson 7
Learn to complete your first FIRST LEGO League mission.

Task 1
Follow the instructions to build the attachments for your robot to solve the Crane Mission.

Task 2
Use the program below to tell your robot how to solve the Crane Mission (Mission 2).

Challenge
Use what you have learned to design a way to drop the Blue Unit into the blue circle.

1

2

C

Where are the building instructions?
You can find a PDF of the building instructions where you found this poster, on the FIRST LEGO League Resources page on firstinspires.org.

Remember to set up your robot in the Launch Area before you press go and run the program.
Look carefully at where the robot should be placed and pointed before launching it.

Practice launching the robot a few times. Modify the program using your knowledge of Curved Move and Tank Move so that it ends in Home.

Can I download the EV3 program?
You can find a file for the Crane Mission program where you found this poster, on the FIRST LEGO League Resources page on firstinspires.org.

This code will drive the robot out of the Launch area, detect and follow the line directly to the crane, and then activate the lever to drop the blue unit. The red blocks are called 'Math' blocks. You can learn more about them in Tutorials > Beyond Basics > Math - Basic.

Do you notice anything about the Crane Mission? How many levers does it have? What does the Crane do when you activate the levers?
Can you rotate the Crane before activating it to drop the building unit?

What if the Crane doesn't work?

- Check the Crane is built correctly and moves as it should.
- Check the Dual Lock and that the Crane is correctly positioned on the mat.
- Reset the Crane after each activation.

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Robot Lesson 7 will help you complete your first FIRST LEGO League mission.



Using the *FIRST* LEGO League [Robot Lessons Poster](#)

Lesson 7 – The Crane Mission

*The directions for **Task 1** of **Robot Lesson 7** on the Robot Lessons Poster are copied below. We'll explain the directions to this lesson in a little more detail.*



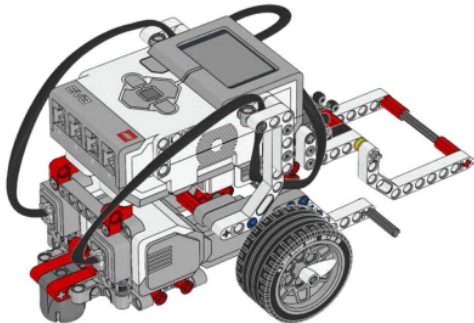
Robot Lesson 7

Learn to complete your first *FIRST* LEGO League mission.

Task 1

Follow the instructions to build the attachments for your robot to solve the Crane Mission.

1

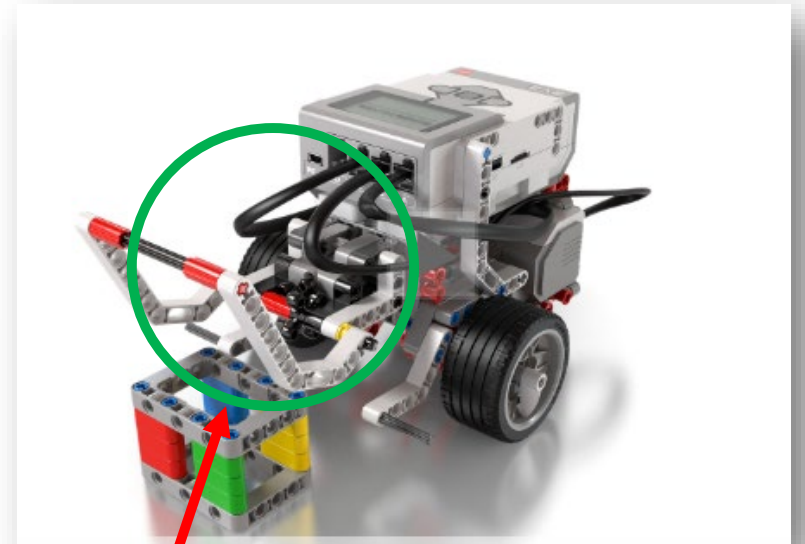


You will need this basic robot to solve the Crane Mission. You can build on the robot and modify the attachments and programs later.

Where are the building instructions?

You can find a PDF of the building instructions where you found this poster, on the *FIRST* LEGO League Resources page on firstinspires.org.

Task 1 directs you to modify the robot with the addition of a color sensor (for line following) and a bumper. **BEFORE** you make these modifications, the robot needs to be configured with an additional motor as it was in **Robot Lesson 4** (Tutorials → Basics → Move Object)



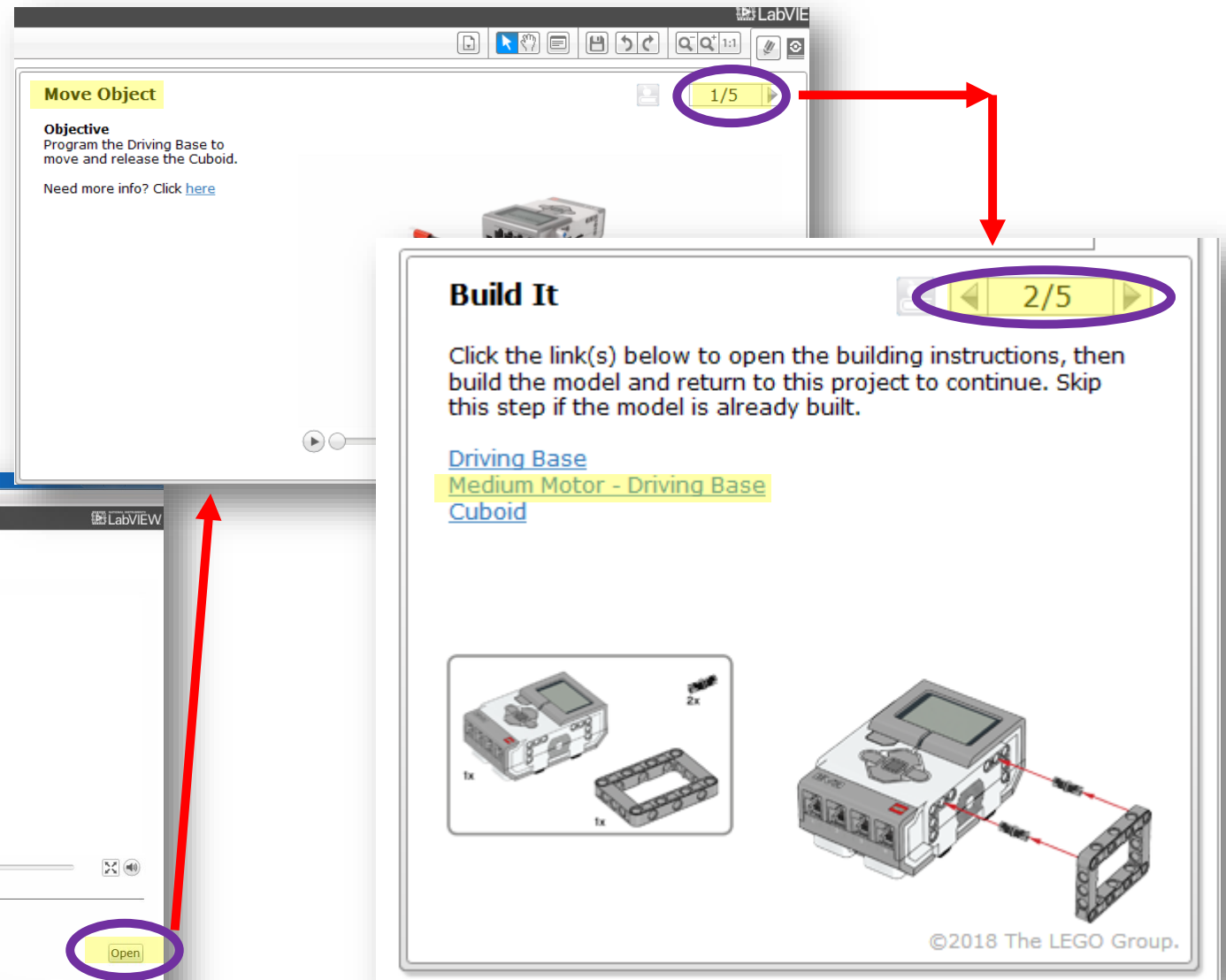
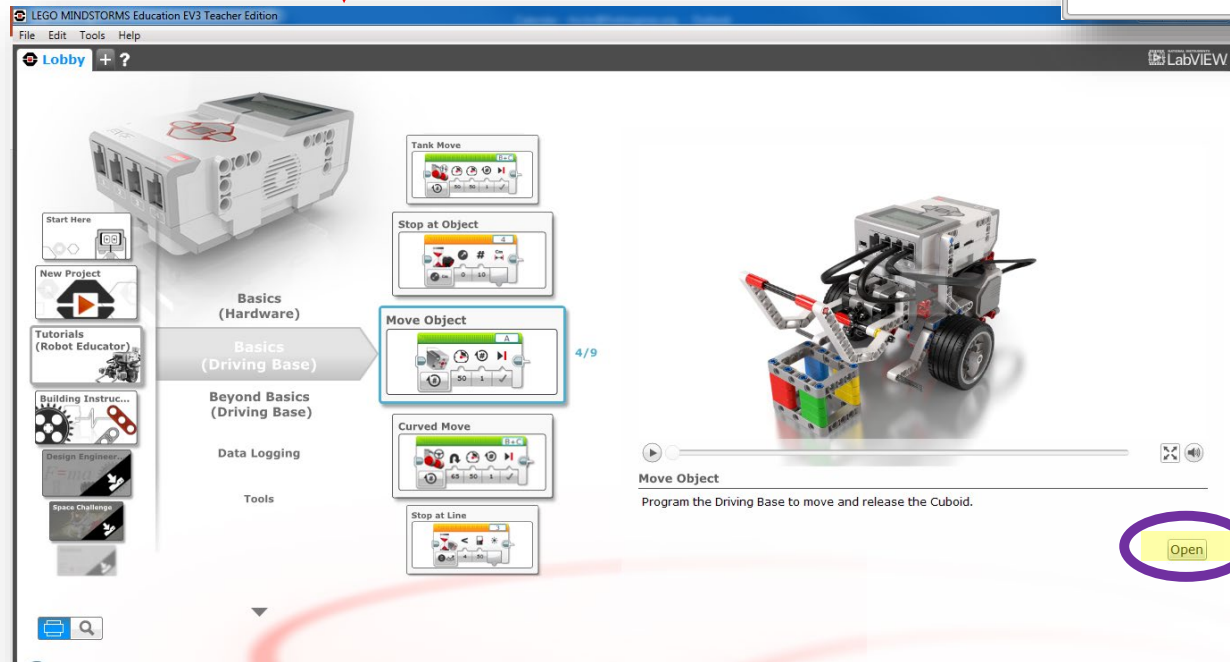
Extra motor and “end effector” attachment.

Using the *FIRST* LEGO League [Robot Lessons Poster](#)

Lesson 7 – The Crane Mission

*If your robot is not configured with the extra motor, return to **Robot Lesson 4** (Tutorials → Basics → Move Object) and add the motor. (If your robot **does** have the extra motor and end effector already installed, you may skip to **slide 6** of this tutorial.)*

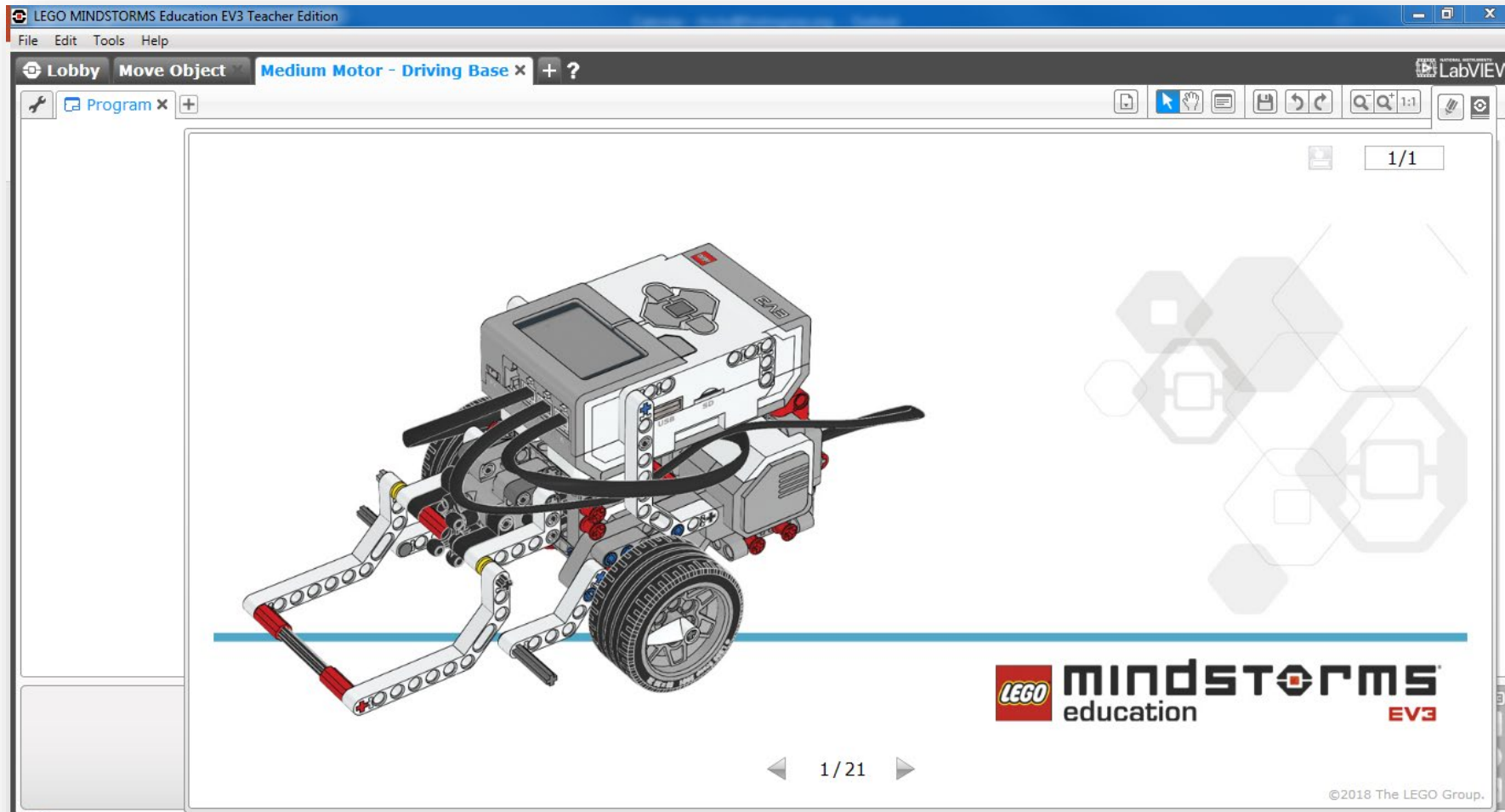
Page 2 of the **Move Object** lesson contains the building instructions for “Medium Motor – Driving Base.”



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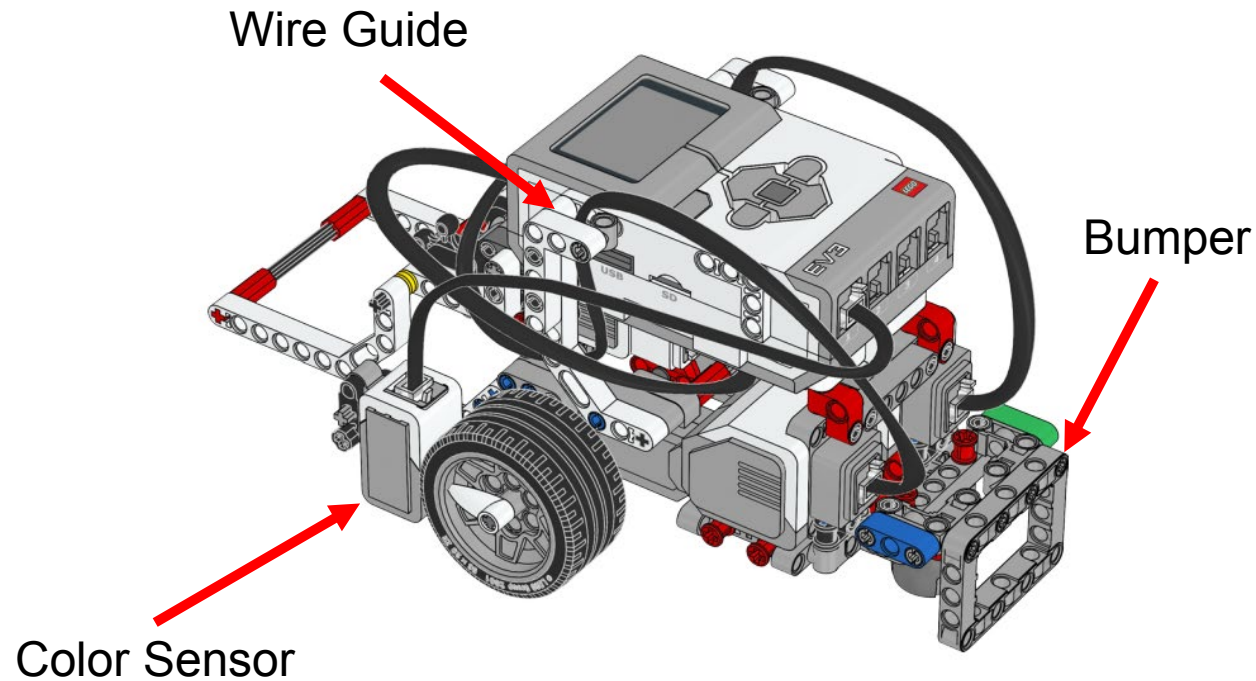
Lesson 7 – The Crane Mission

Complete the building instructions for the Medium Motor – Driving Base to add the motor and end effector to the robot.



Using the *FIRST* LEGO League
[Robot Lessons Poster](#)

Lesson 7 – The Crane Mission

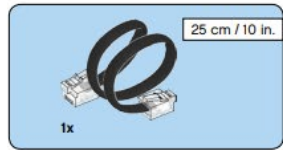


After you have verified your robot has a medium motor and end effector installed, you may begin Task 1 of Lesson 7. Task 1 directs you to modify the robot with the addition of a color sensor (for line following), some wire guides and a bumper. The building instructions to do this are found [here](#).

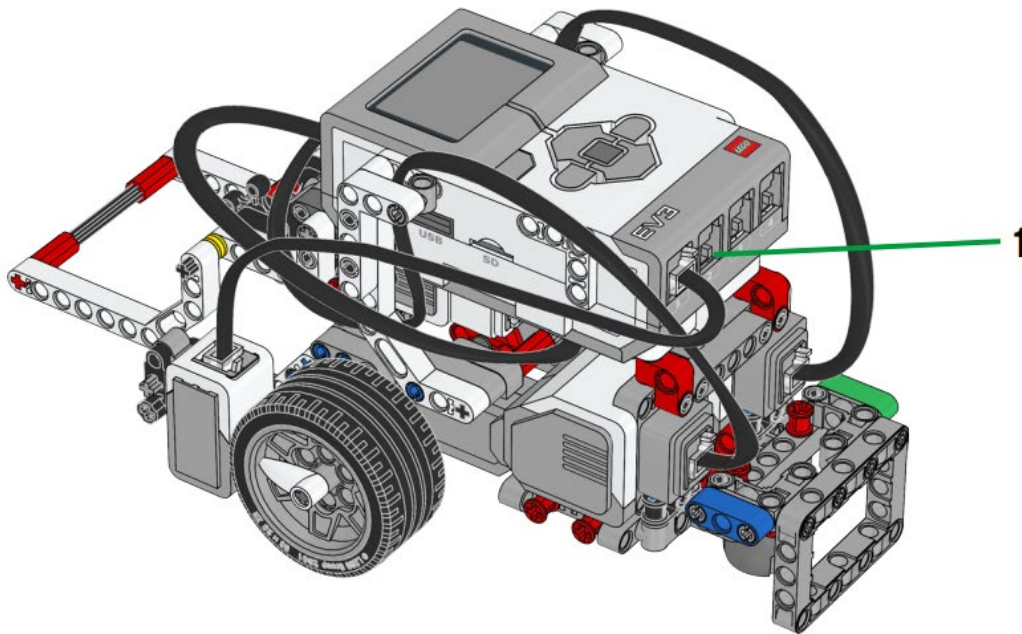
The first page of the building instructions shows how your robot will look once the modifications for the crane mission have been finished.

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Lesson 7 – The Crane Mission



18



Follow these building instructions until you have modified your robot with the color sensor, the wire guides and the bumper.

Hint: Be sure your color sensor and motors are plugged into the following ports on the EV3 brick:

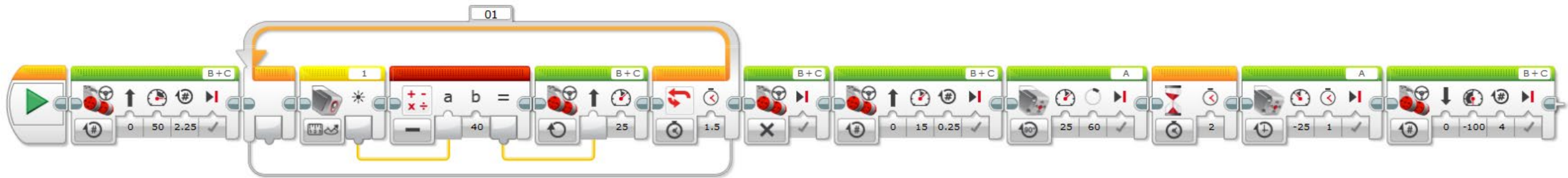
*Color Sensor = **Port 1***

*Medium Motor = **Port A**
(end-effector)*

*Left (Drive) Motor = **Port B**
Right (Drive) Motor = **Port C***

Using the *FIRST* LEGO League Robot Lessons Poster **Lesson 7 – The Crane Mission**

After making the modifications, program the robot using the code string below. You may also simply download the program [here](#).



This code will drive the robot out of the Launch area, detect and follow the line directly to the crane, and then activate the lever to drop the blue unit. The red blocks are called 'Math' blocks. You can learn more about them in [Tutorials > Beyond Basics > Math - Basic](#).

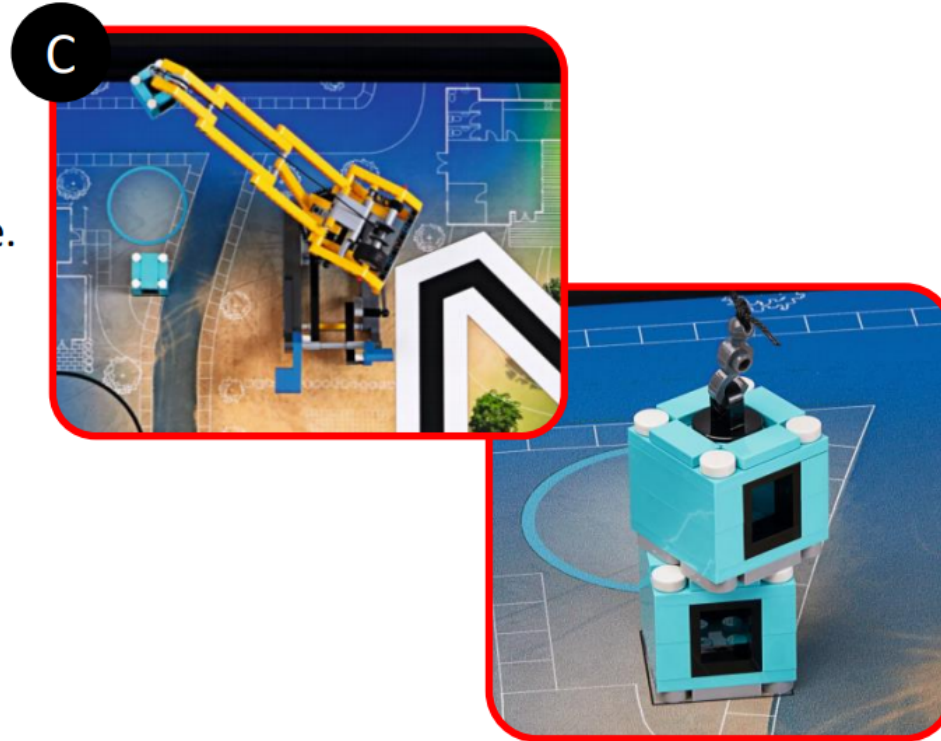
Using the *FIRST* LEGO League [Robot Lessons Poster](#)

Lesson 7 – The Crane Mission

After you have programmed your robot, move to the CITY SHAPER robot game field and try it out! Change or modify the program if needed, and adjust the placement of the robot when starting from the Launch Area in order to consistently complete the mission.

Challenge

Use what you have learned to design a way to drop the Blue Unit into the blue circle.



Do you notice anything about the Crane Mission? How many levers does it have? What does the Crane do when you activate the levers?

Can you rotate the Crane before activating it to drop the building unit?

What if the Crane doesn't work?

- Check the Crane is built correctly and moves as it should.
- Check the Dual Lock and that the Crane is correctly positioned on the mat.
- Reset the Crane after each activation.

Congratulations! You've just completed a FIRST LEGO League robot game mission!