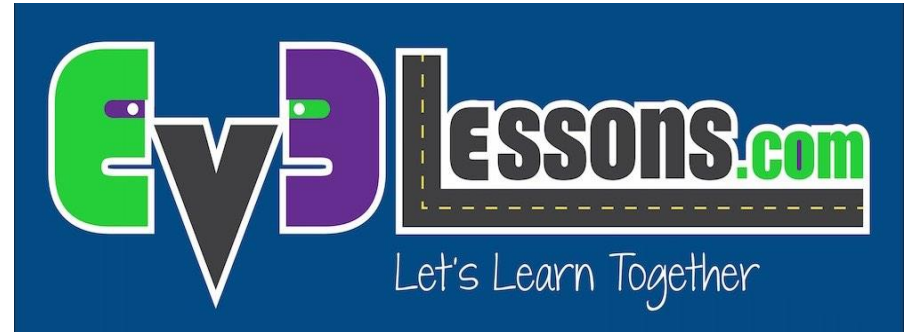
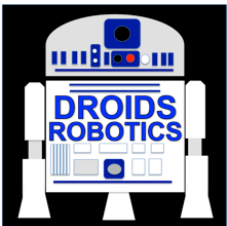


INTERMEDIATE PROGRAMMING LESSON



Move Distance My Block (Move_Inches)



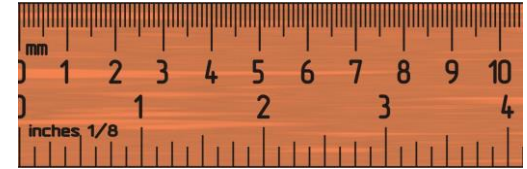
By: Droids Robotics

LESSON OBJECTIVES

1. **Create a useful My Block**
2. **Learn why creating a My Block that takes measurements made with a ruler can be useful**
3. **Practice creating a My Block with Inputs and Outputs**

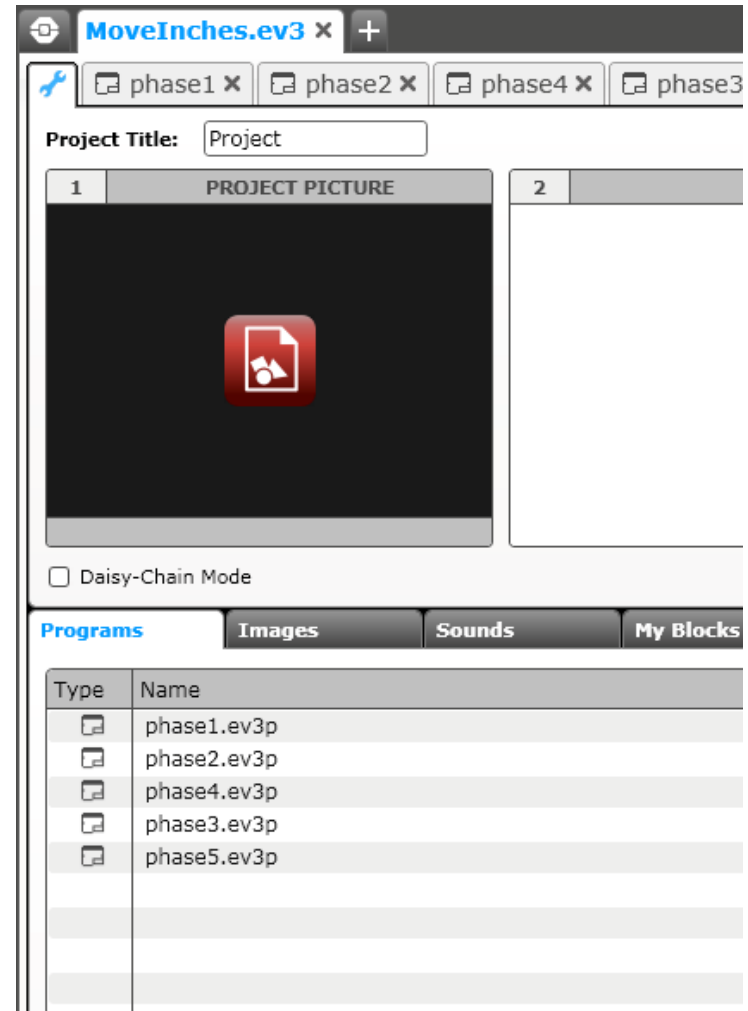
WHY IS A MOVE DISTANCE MY BLOCK A GOOD IDEA

- **Built-in move blocks will not take inputs (values) in centimeters or inches.**
- **Much easier to measure distance with a ruler than degrees or rotations.**
- **If you change your robot design to have bigger or smaller wheels late in the season you don't have to re-measure every movement of your robot**
 - Instead of changing distances in every single program you wrote, just go into your cool Move Distance Block and change the value for how many inches/cm one motor rotation would take.



MY BLOCKS WITH INPUTS AND OUTPUTS (MOVE INCHES)

- The next few slides and the corresponding code file teaches you how to make a specific Move Distance My Block called Move Inches.
- You can easily convert the code to use CM.
- In the code file, start at PHASE 1.
- There is also a corresponding worksheet as well as an automatic calculator that will help you in this lesson.



PHASE 1: MEASURE WHEELS

This is a program that moves 1 inch. The value 67 degrees is based on the size of the wheels on our robot. You will have to compute or measure how many degrees your wheel turns to move 1 inch. Please read our email for instructions to calculate how many degrees are in 1 inch.

This is a first step in making a Move Inches My Block.



HOW TO MEASURE YOUR WHEEL.

There are 2 ways to figure out how many degrees your robot moves in 1 inch:

1) Put your ruler next to your wheel/robot at 0 inches. On the brick, go to the menu where you can view your sensor and motor readings. (Pick PORT VIEW - under the tab with the 6 circles) Roll your robot forward 10 inches making sure your robot does not slip.

Take the degree reading you see on the screen for the motor sensor and divide by 10. The answer will be the number of degrees your robot's wheels turn in 1 inch.

2) Lego usually prints the diameter of the wheel on the side of the tire in mm. If you can't find it printed, lots of internet sites tell you the size of lego parts. Since circumference is $\pi \times \text{diameter}$, you can use the mm printed on the wheel to convert to cms or inches and figure out how much the wheel would travel per 360 degree rotation.

e.g.

The standard big motorcycle wheels in the technic sets are 81.6mm = 3.21inches

$3.21 \times \pi = 10.1$ inches per rotation

1 rotation = 360 degrees

$360 \text{ degrees} / 10.1 \text{ inch} = 35.7 \text{ degrees per inch}$

PHASE 2: MAKING AN INCHES TO DEGREES MY BLOCK

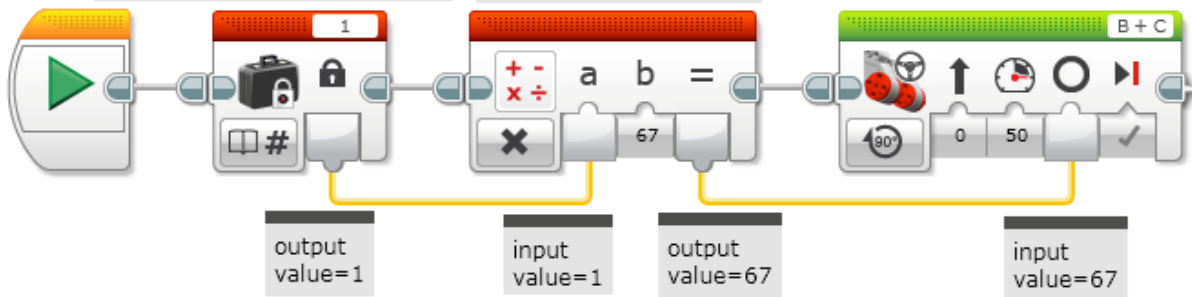
In Phase 1, you could only move your robot 1 inch. This program lets you put in any number of inches you want the robot to move. The number of inches to move is stored in the constant block and connected using a wire to the math block. Remember to change the 67 based on your wheel size.

This block is a constant that can be found in the red tab. The value in the number on the top right corner of the block represents the number inches that the robot will move. This block value can be changed by clicking on . In this program the block is used to create an input for our My Block in the next step of making a My Block.

This math block takes the value inputted and multiplies it by 67 to convert the input number (in inches) to degrees. The output wire sends the result into the degrees input of the move block.

Regular move block that has an input wire. The robot should move 1 inch with the correct wheels

You will need to highlight and pick the math block. Select Tools --> My Block Builder from the menu to create the My Block that you will see in Phase 3.

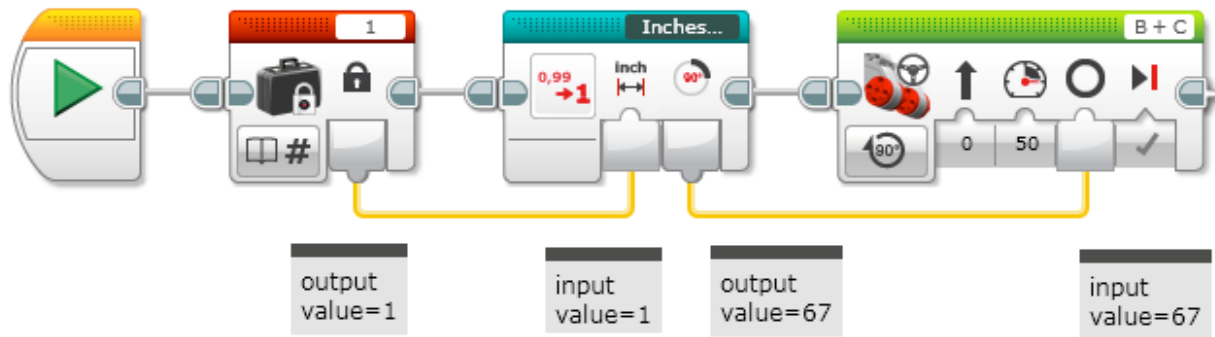


These yellow lines are data wires. You use them to send inputs and outputs from one block to another.

PHASE 3: USING THE INCHES TO DEGREES MY BLOCK

This program is the same as phase2 but instead of having a math block to convert inches to degrees, we have a My Block with the math block inside it. As you can see, this My Block has an input and an output. Even though it is only long, we still made this a My Block because we reuse this code over and over again. For instance, we use it in a Wall Follow Inches My Block and in our Line Follower for Inches programs. If we change the wheels on the robot, we would only have to change this 1 My Block and everything would update.

The math block from phase 2 has been made into a My block.



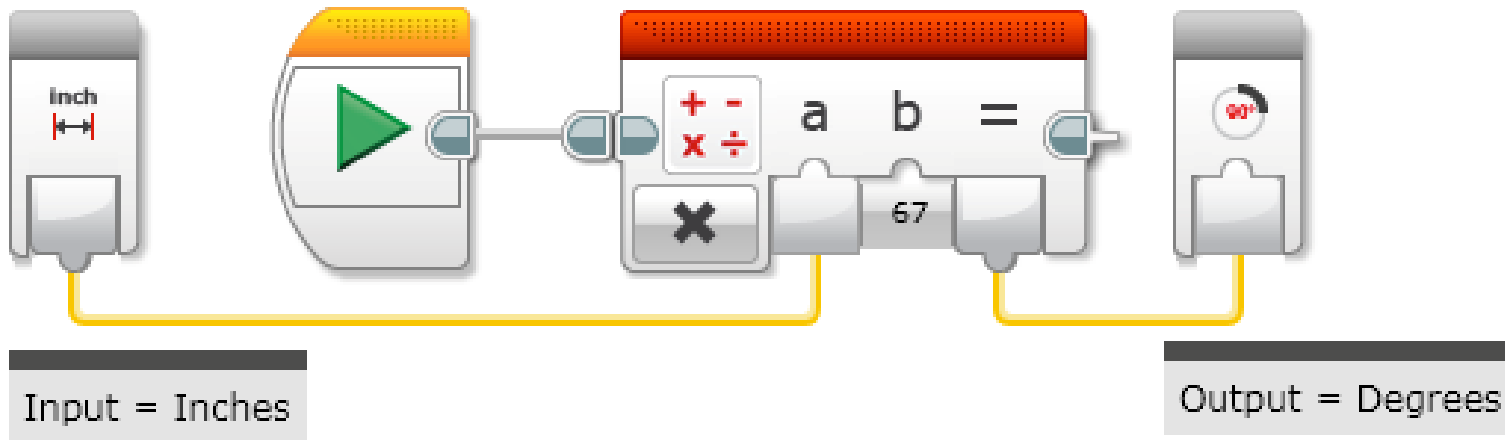
These yellow lines are data wires. You use them to send inputs and outputs from one block to another.

The My Block in this program was made by highlighting the math block and then clicking on Tools ---> My Block Builder.

All My Blocks you make will appear in the green tab at the bottom of the screen for you to reuse.

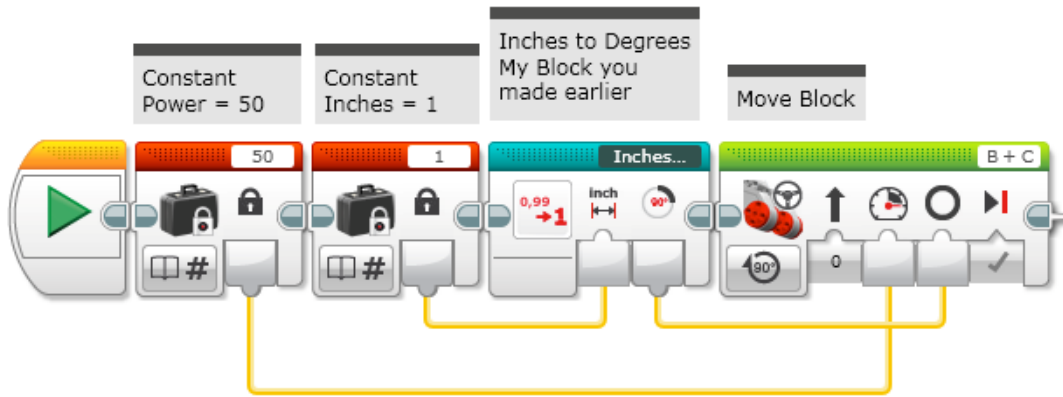
A LOOK INSIDE INCHES TO DEGREES

This is what Inches to Degrees looks like inside if you double click on the My Block. The input on the left is the amount of inches inputted and the output on the right is the amount of degrees. The program changed the wires to look like the 2 blocks you see below.



PHASE 4: ADDING INPUTS

This program adds a power constant to allow you to alter the power. This is the first step in making a My Block with multiple inputs - in this case, we are using POWER and INCHES.



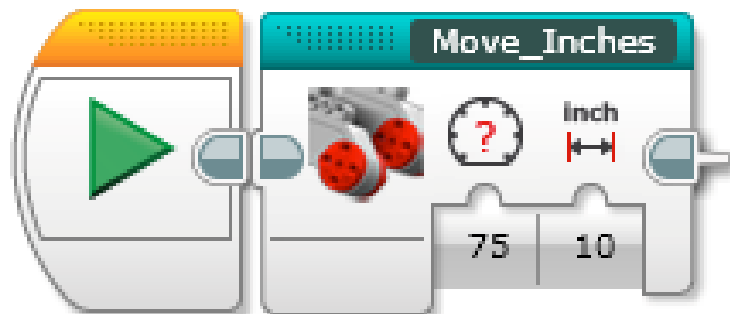
Inputs and Outputs using data wires

In this step, you will need to highlight and select both the Inches to Degrees My Block and the Move Block. Don't select the 2 constants. You will be making this into another My Block by selecting TOOLS --> My Blocks Builder from the menu.

That is what you will see in phase 5.

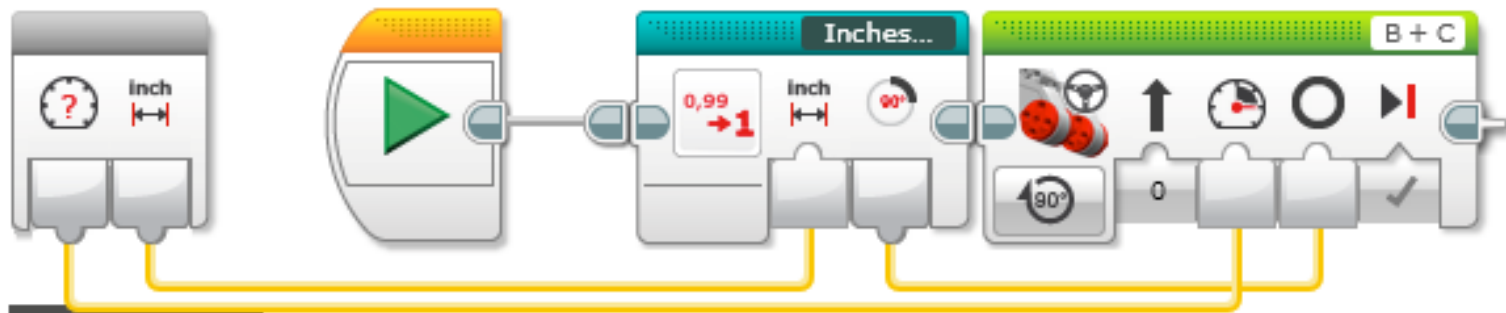
PHASE 5: COMPLETED MOVE INCHES MY BLOCK

This is phase4 converted into a My Block. We call it Move Inches. It has 2 inputs now = POWER and INCHES. You can double click on any My Block to see what is inside it or make certain changes to it. Move Inches is a My Block that you can use frequently in FLL. When you program, just use a ruler and measure how far you want your robot to move to get to a certain mission model.



A LOOK INSIDE MOVE INCHES

This is what the Move Inches My Block looks like inside if you double click on it. This program looks a little different from phase4. You remember that when we made the My Block, we did not select the constant to be part of the My Block. The program automatically converted the two wires that go into the My Block (Power and Inches) into the special block on the left.



Power and Inches input converted from wires.

CREDITS

This tutorial was created by Sanjay Seshan and Arvind Seshan from Droids Robotics.

More lessons are available at www.ev3lessons.com

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