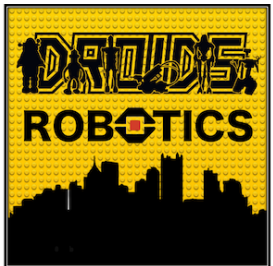# INTERMEDIATE PROGRAMMING LESSON

MOVE DISTANCE MY BLOCK (MOVE_CM)

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. Make a Move_CM My Block

Prerequisites: Move Straight, Port View, My Blocks with Inputs and Outputs, Math Blocks, Data Wires

Why a Move Distance My Block?

Built-in move blocks will not take inputs (values) in centimeters or inches.

It is much easier to measure distance with a ruler than degrees or rotations.

If you change your robot design to have bigger or smaller wheels later on, 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 new Move Distance Block and change the value for how many inches/cm one motor rotation would take.
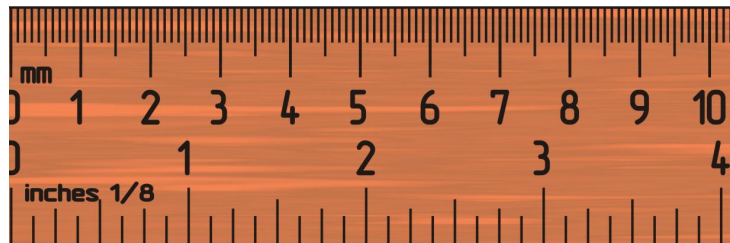
MOVE_CM IN THREE EASY STEPS

STEP 1: Determine how many motor degrees your robot moves in 1cm

     STEP 1A: Wheel Measurement

     STEP 1B: Program the robot to move 1cm

STEP 2: Add a Math Block to convert centimeters to degrees

STEP 3: Create a Move_CM My Block with 2 inputs (power and degrees)

Step 1A: How Many Degrees Does The Robot Move in 1 CM?

Method 1:

1. Look up the wheel size in mm printed on your tire and divide by 10 to convert to cm (because 1cm=10mm)
2. Multiply the answer in step 1 by π (3.1415...) to compute circumference
3. Divide 360 degrees by value from step 2. This computes degrees in 1cm since you travel one circumference in 1 rotation and 1 rotation is 360 degrees

Example calculation using the standard EV3 Edu 45544 set wheels:

1. EV3 EDU (45544) wheels are 56mm = 5.6cm in diameter
2. 5.6cm × π = 17.6cm per rotation
3. 360 degrees ÷ 17.6cm = 20.5 motor degrees per cm

Helpful chart with common LEGO wheels and their diameters.

http://wheels.sariel.pl/

Step 1A: Alternative Method

Alternate Method: Use Port View to find the Motor Degrees value. Use this method if you cannot find the diameter value printed on your wheel.

1. Put your ruler next to your wheel/robot at 0 centimeters (whatever part of the robot you use to align with 0, you should use to use to measure distance in step 2)
2. Roll your robot forward any amount of centimeters, making sure your robot does not slip.
3. Take the degree reading you see on the screen for the motor sensor and divide by the amount of centimeters you moved.
4. The answer will be the number of degrees your robot's wheels turn in 1 centimeter.
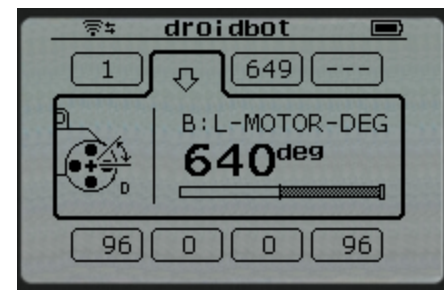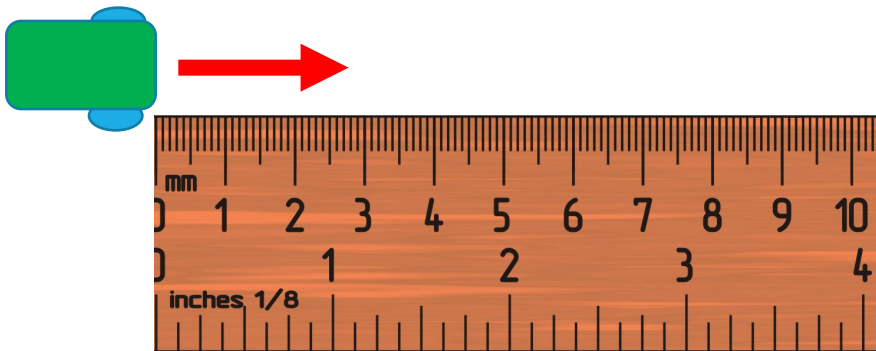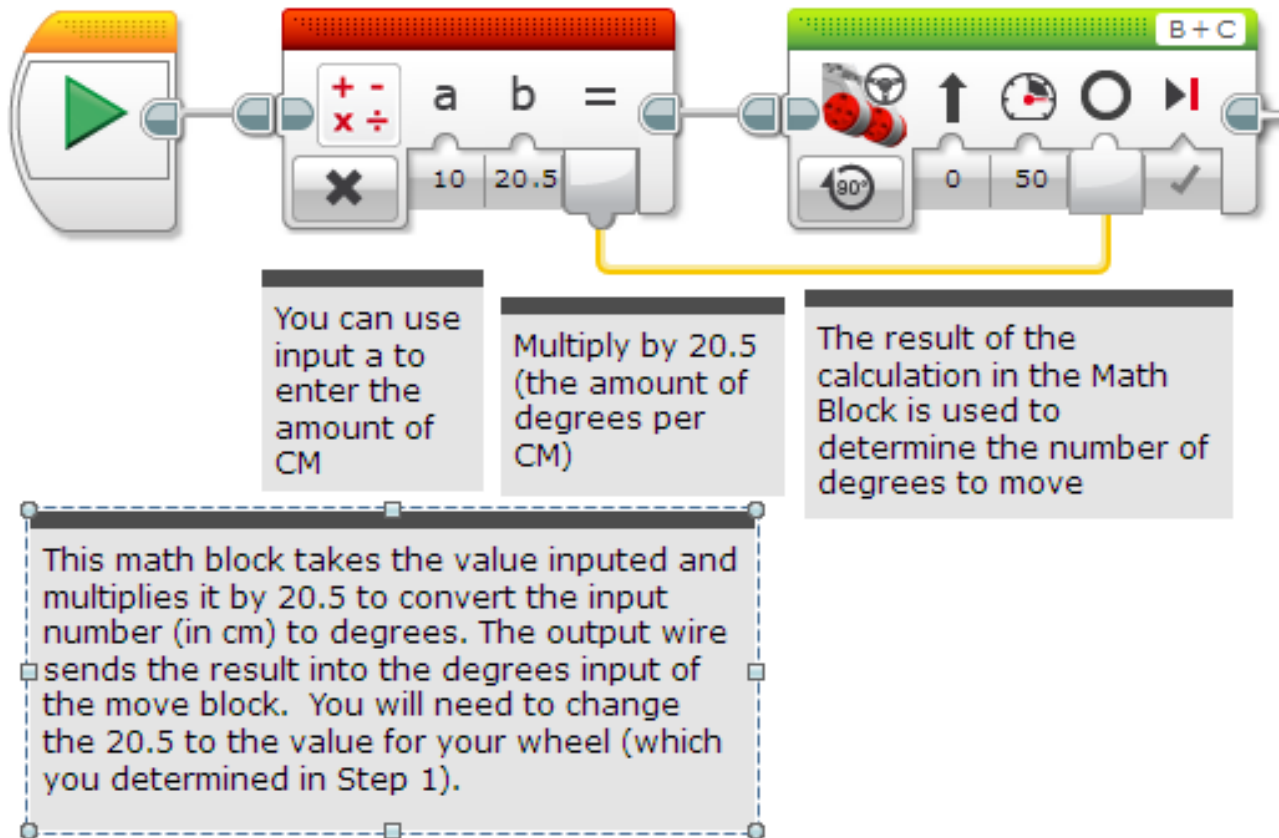
Step 1B: Program Move 1CM

Step 1: This is a program that moves 1 centimeter. The value 20.5 degrees is based on the size of the wheels on DroidBot 2.0. It is the number of motor degrees your robot turns for 1 CM. This was determined in Step 1A of the powerpoint file. You will need to customize this number for your robot/wheels.

Use the Motor Degrees value you obtained for your robot in slides 5 or 6

Step 2: Degree to CM Conversion

Create the Calculator that coverts degrees to centimeters

You can use input a to enter the amount of CM

Multiply by 20.5 (the amount of degrees per CM)

The result of the calculation in the Math Block is used to determine the number of degrees to move

This math block takes the value inputed and multiplies it by 20.5 to convert the input number (in cm) to degrees. The output wire sends the result into the degrees input of the move block. You will need to change the 20.5 to the value for your wheel (which you determined in Step 1).
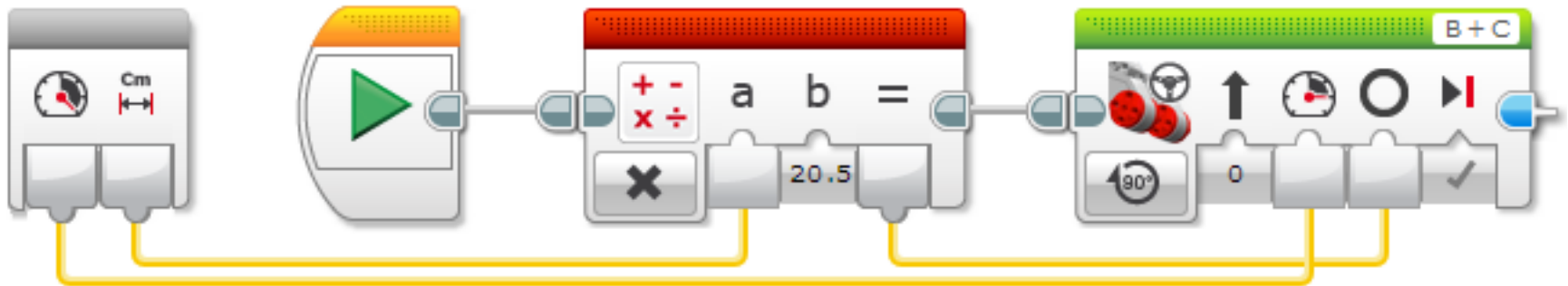
Step 3a: SETUP the My Block

- A. Highlight the two blocks in Step 2 and go to My Block Builder

- B. Add two inputs: Power and Centimeters and complete the setup process.

- If you need help in the My Block Builder, refer to the My Block with Inputs and Outputs Lesson in Intermediate
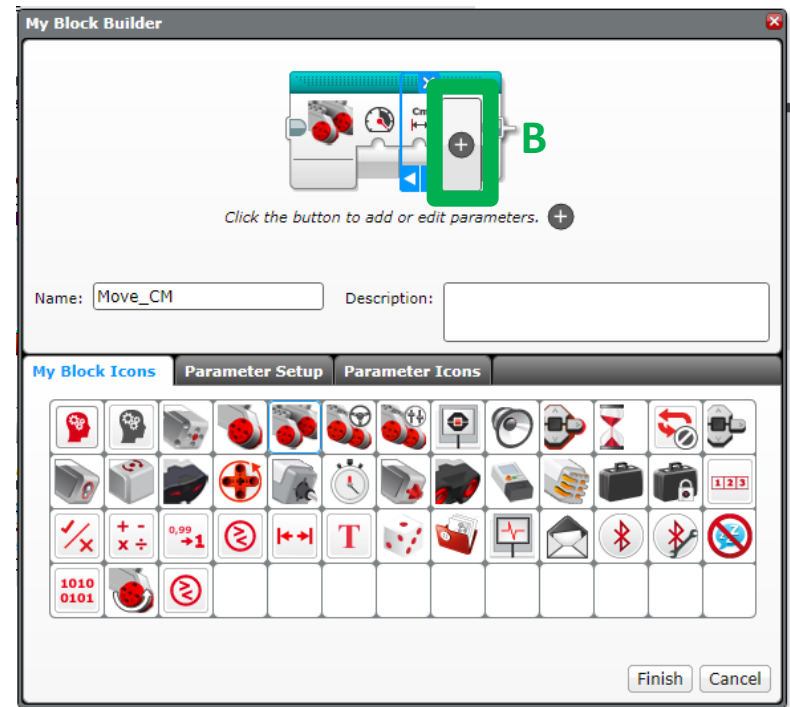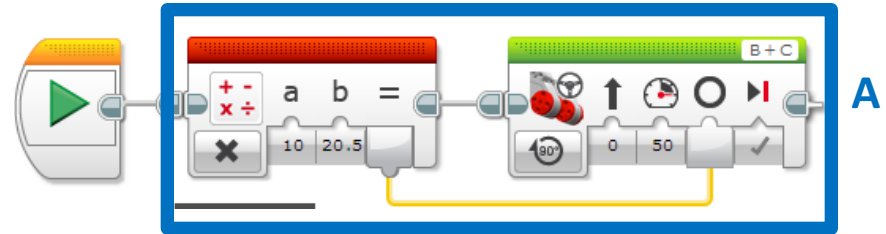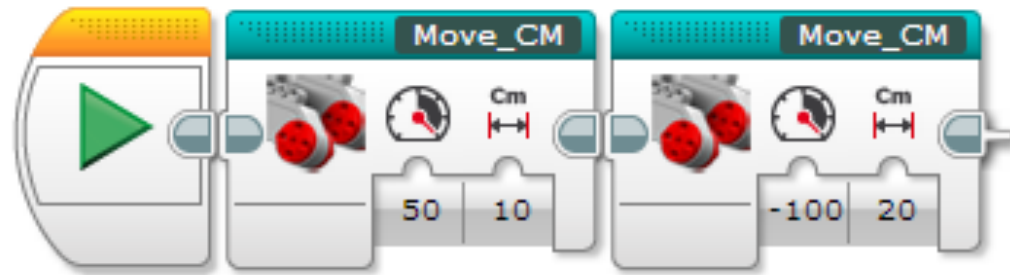
STEP 3A: Wire the My BLOCK

C. Wire the inputs in the grey block. The centimeters input connects to the Math Block. The power goes into the Move Steering Block's power input. The result of the Math Block is wired into the degrees input in the Move Steering Block.

Step 3b: Completed `Move_CM`

This is Step 2 converted into a My Block. We call it Move_CM. It was made with two inputs added: Power and Centimeters. These were added using Tools-->My Block Builder

The same My Block is used for two different moves. One moves 10cm forward at 50 power. The other moves backwards for 20cm at 100 power. By changing the inputs, we can reuse the My Block.

Discussion

Why is a Move_CM My Block useful?
◦ You can measure distances in centimeters and input this number into your block instead of programming in degrees or rotations

Will changing the inputs in one copy of Move_CM impact another copy of it?
◦ No. That is exactly why a My Block is useful. You can use the same block multiple times, each time using a different number for power and centimeters (or any other parameter you set up).

Can you alter a My Block after it is made?
◦ You can change any of the contents, but not the grey blocks (input and output parameters). If you need to make changes to the parameters, you must remake your My Block.

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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