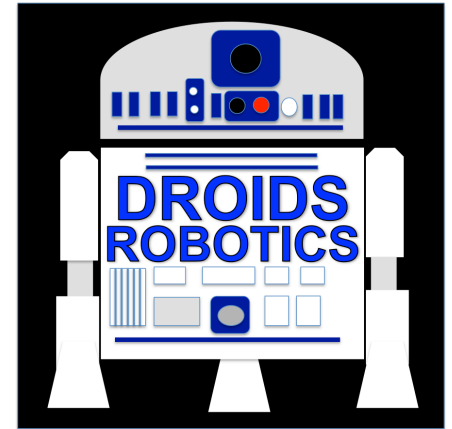# INTERMEDIATE PROGRAMMING LESSON:
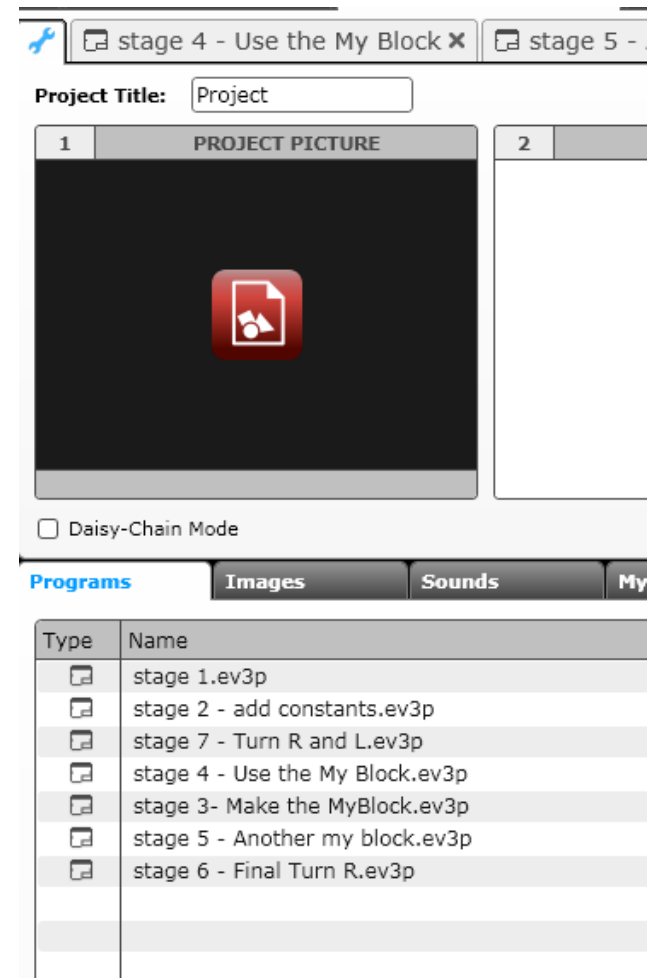
TURN DEGREES MY BLOCK

BY DROIDS ROBOTICS

MY BLOCKS WITH INPUTS AND OUTPUTS (TURN DEGREES)

See the attached EV3 Files for step-by-step instructions and the actual code for you to learn how to make a useful My Block to turn.

Start at the Stage 1 tab and read all the comments in each one. We also show you the final programs.

The project file has instructions for a **Turn Degrees** My Block. Some supplemental information is on the next few slides.

MAKING A TURN MY BLOCK

Just like Move Inches, you can also create a My Block for turns. In Move Inches, we had to figure out how much the robot wheels rotate for one inch on a ruler.

To make a `Turn Degrees` My Block, you have to figure out how much your rotation sensor on the motor turns for one degree on a protractor

A Turn My Block will be extremely useful to any FLL team because now you can measure your turns using a protractor!!!
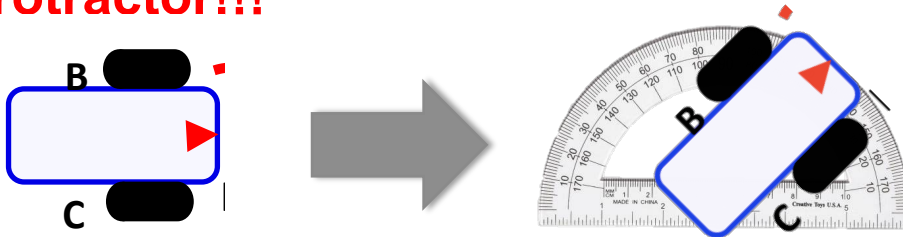
You can use the EV3 to measure how much your wheel turns. **We call this rotation degrees.**

45 degree turn by the robot in the real world can be measured with a protractor. **We call this protractor degrees.**

MEASURING THE ROTATION SENSOR

The EV3 has a Port View Function which lets it display values measured by sensors

In this section, we will show you how to use the port view to measure turns.

Step 1: Go to Port View on your brick. On the EV3, it is on the third menu to the right. Look for the value for one of your drive motors (motors attached to your wheels)

Step 2: Turn the robot 90 degrees (Pivot Turn) yourself – using your hands to turn one wheel. Make sure the wheels don't slip when you do this.

Step 3: Look at the rotation degrees value and write down the number of degrees (n)

Step 4: Divide the number from step 3 (n) by 90 (n/90)

This is the number of how many motor rotation degrees are in 1 protractor degree.

You can now use this information to make a Pivot Turn My Block called `Turn Degrees`. Please see my attached EV3 file. There are Phases marked for you to follow. Once you understand the code, you can modify this code to make a Spin Turn My Block as well.

STAGE 1: MEASURE TURNS

The goal of this program is to turn the robot 90 degrees.

This starts motor B (the left motor if you were facing the same way as the robot)

You need to use the sensor readings on your brick to figure out how many degrees in the rotation sensor it takes if you manually turn your robot 90 degrees right. For our robot, this value is 526.5. See the PDF file for more information on how to do this.

GO TO STAGE 2 after this step. CLICK ON the wrench icon on the top left to pick the next stage. Follow this step at the end of each Stage.

STAGE 2: ADD CONSTANTS

This program is the same as stage 1 except it has two constants to input the degrees and power. We also added a Math block to convert from protractor degrees to motor rotation degrees. We are adding these constants so that it is easy to make the My Blocks.

power constant

protractor degrees constant
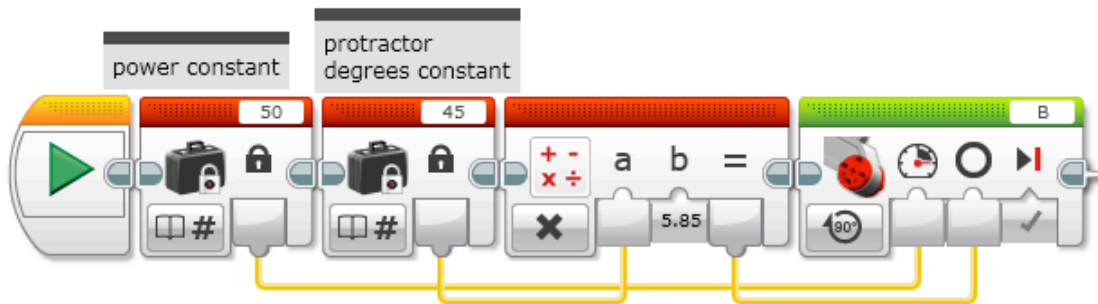
These are constants. A constant is like a variable, but it is set one time and you can change the value somewhere else.

This is a Math Block. It is currently set to convert the protractor degrees to motor degrees. 5.85 is how many degrees on the protractors. See the comment on the far right.

We move the motor for the amount of degrees that was calculated in the previous block using the data wires (yellow lines).

From Stage 1: (you can use the value calculated in stage 1) You need to use the sensor readings on your brick to figure out how many degrees in the rotation sensor it takes if you manually turn your robot 90 degrees right. For our robot, this value is 526.5.

In this stage you have to divide the above value of motor degrees in 90 protractor degrees by 90 degrees to calculate to get how many motor degrees are in one protractor degrees. For our robot, this is 5.85.

You should read our PDF document if you need more explanation for what we just did in this step.

MOVE TO STAGE 3

STAGE 3: MAKE MY BLOCK
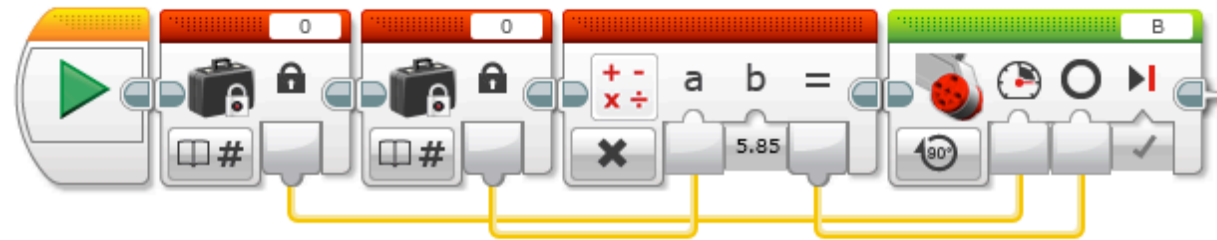
This is the Math Block you need to make into a My Block BEFORE you move to stage 4.

This program is the same as stage 2 except you will make a My Block. Click on the Math Block on the right and click on the Tools Menu. Choose My Block Builder. Customize the My Block and choose finish. We found that the My Block builder does not let you pick a long name. To make a long name, I saved the My Block and renamed it named "turndegrees_to_mtr_degrees". You can rename a my block or program by opening the program and then double clicking on the program tab at the top of the screen. For example, you can double click on "stage 3" at the top of the screen to rename this program.

In general, you should name your My Block something useful so that you can easily remember what it does.

Once you make My Blocks, they show up in the darker green tab at the end. It will show you the name of the My Block if you hover over it. Now you can use the new My Block over and over again.
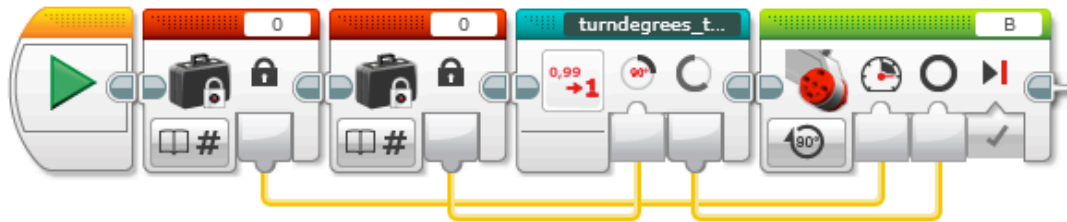
MOVE TO STAGE 4

STAGE 4: USE MY BLOCK

This program is the same as stage 3 except it now uses a My Block called turndegrees_to_motor_degrees which you would have created in Stage 3.

This is a My block we made. It converts protractor degrees to motor degrees.
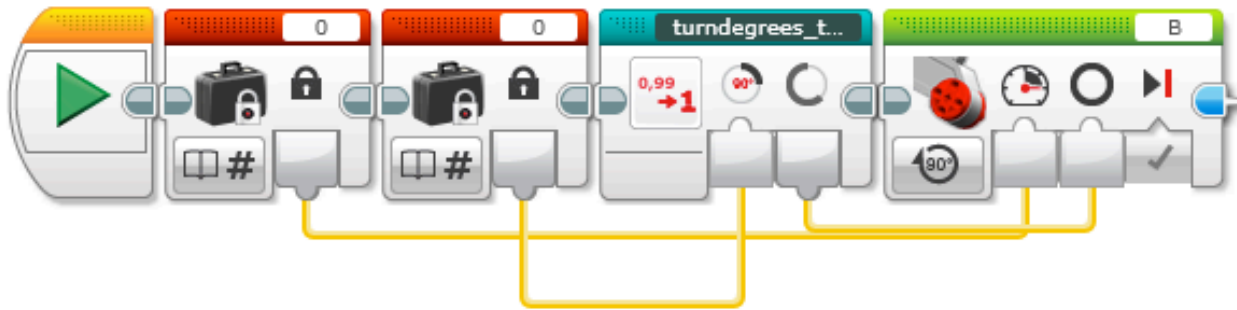
MOVE TO STAGE 5 once you have inserted your My Block

STAGE 5: ANOTHER MY BLOCK

Select these two blocks (use shift click or select area to select multiple blocks)

This program is the same as stage 4 except you will make another My Block. Highlight both the turndegrees_to_mtr_degrees and the Move Motor B blocks (use shift click or select area to select multiple blocks) and click on the Tools Menu. Choose My Block Builder. Customize the My Block and choose finish.

The My Block builder did not let me pick a long name. I saved the My Block and renamed it named "turn_degrees_right". Follow the same instructions as before.

MOVE TO STAGE 6

STAGE 6: TURN DEGREES RIGHT

This program is the same as stage 5 except it now uses a My Block called Turn_Degrees_Right. This block will let you turn the robot any number of degrees to the right.
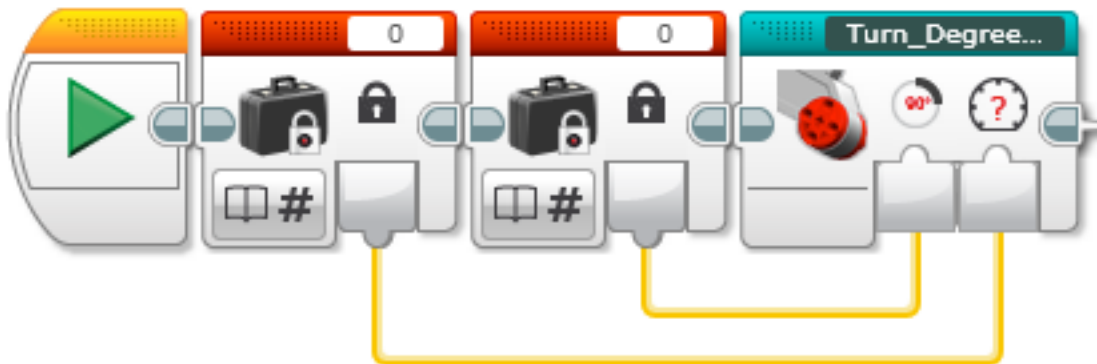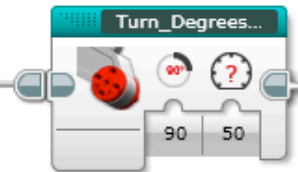

MOVE TO STAGE 7

STAGE 7: FINAL TURN DEGREES

This is the final Turn Degrees Right program. It does Pivot Turns RIGHT

Using the same technique, I made a Turn Degrees Left. You can look at it here.

These are the final two my blocks for turning right and turning left. You can double click on any my block to look inside and see the contents. You can try combining this with the move_inches my blocks from the earlier lesson to move around the FLL table easily.

You can add these my blocks to any of your progams from the darker green tab at the bottom of the screen (the far right one in the set of tabs).

Turn_Degree...

90   50

This block turns the robot right.

The my block we made has two inputs: power and degrees.

Turn_Degrees...

90   50

This block turns the robot left.

CREDITS

- These slides and the corresponding EV3 project files were made by Sanjay Seshan and Arvind Seshan from FLL Team: Not the Droids You Are Looking For.

- They are free to use and distribute. Please just give credit to the team and send a thank you note if you can.

- You can reach the Droids at: team@droidsrobotics.org

- Calculator for converting CM/IN into degrees: www.ev3lessons.com/resources.html

- More lessons: www.ev3lessons.com