

## Let the Robot Tell You :

### Distances to Degrees Program Tool for *FIRST*®LEGO®League Log degrees: Straight forwards, backwards, left and right spin

These 3 NXT sample programs provide a method of getting the robot to measure the distances it needs to travel for specific distances on the FLL mat for straight lines ( straight lines - motors), left and right turns. Using these programs to work out distances - degrees has a number of benefits over other methods by reducing the number of variables and inaccuracies that result from lifting and replacing the robot on the mat multiple times while attempting to work out distances-degrees for a pathway to/from a mission object.

Attach a long electrical lead to the touch sensor and connect it to Port 1. When you run the robot you will hold the touch sensor in your hand without allowing the lead to drag or interfere with the robots free movement.

Each program provides the operator with the ability to run the robot , either forward, left or right spins and stop the robot in the exact position on the mat by pressing the touch sensor . The NXT screen will then show the number of degrees it takes to get to that position , on its screen ( write it down!). Don't lift the robot off the mat. If you want the robot to turn left after going forward, simply run the LEFT program and press the touch sensor again at the position you require and read the degrees on the NXT screen. This way you can string a number of movements together without lifting the robot off the mat and losing your position. Once you have all the degrees readings you can then go back to your program and put the movements and degrees into your program.

By reducing the number of variables when you run these programs you will get a far more accurate result. Use the actual robot with the actual attachments on it that you will use for that mission. The weight of the robot can influence degrees results even though you would think that it shouldn't!

Place the mat on a hard surface, not carpet . The 'squishyness ' of the running surface can affect degrees results too!

The level of charge in the battery can also effect readings , try to keep this relatively consistent or repeat the degrees testing.

### **Method**

1 Load all 4 programs into the robot.

NOTE – These programs were written in NXT V2 , if you are using NXT V1 there's a good chance that whilst t these programs will look like they will be downloadable in an earlier NXT version, you will be able to view the program but not download it into your NXT brick. If this occurs simply view the program in your version and re-write it on a new screen in your version of the software. To do this you will need to use the



COMPLETE palette in NXT

2 Line up your robot in the desired position in home base and run either the STRAIGHT MOVE, LEFT or RIGHT.rbt programs in the sequence you require to get to the desired position on the mat ( DO NOT LIFT

THE ROBOT UP / MOVE IT BETWEEN MOVES). Use the touch sensor to stop the robot at the various desired positions and write down all the degrees for each movement.

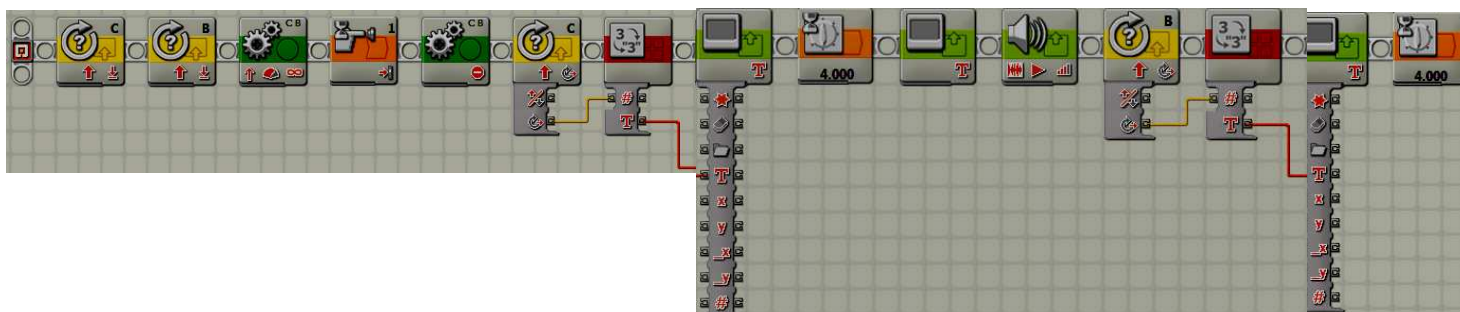
3 Use these in your actual program to program the robot to get to a position by itself.

### VERY STRAIGHT

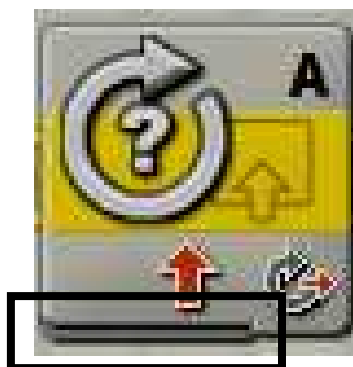
Some robots have a tendency to drift left or right despite being programmed to run straight. The STRAIGHT MOVE.rbt program will give you a clear indication of differences in your motors- the number of degrees should be the same for both motors. If there's a big difference you should try to replace one motor with a motor of more similar performance.

### STRAIGHT MOVE

The program : Motors B and C go straight forward until the touch sensor on port 1 is pressed, then the robot stops and the number of degrees to get this place by motor C will be displayed on the NXT SCREEN for 4 seconds. After a beep then the number of degrees for the B motor to get to this position will be shown on the NXT screen.

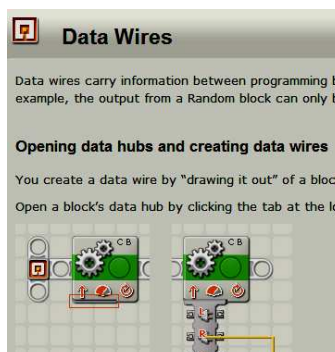
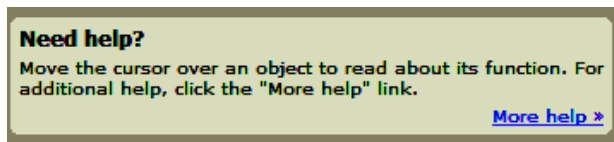


### Data Hubs










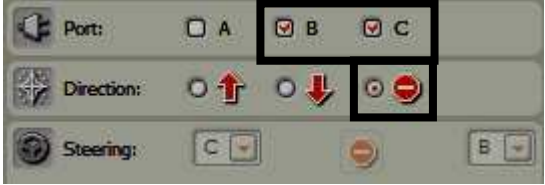







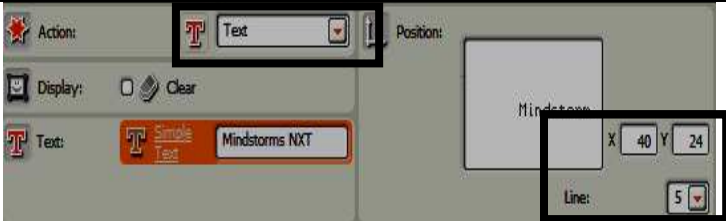
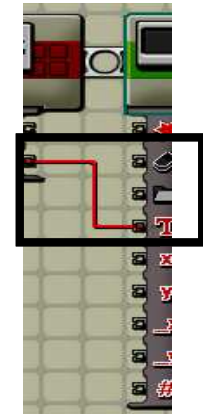





This program is written using the COMPLETE palette and utilizes data hubs ( you can download my article on data hubs from my website) Open a data hub by left mouse clicking on the shaded border on the lower left border of the icon. ( you close the data hub the same way). This drops down a range of data ports where you can connect different types of 'live ' data from other sensors ( left click on the 'out' port then left click on the 'in' port on the other data hub. For more information on this









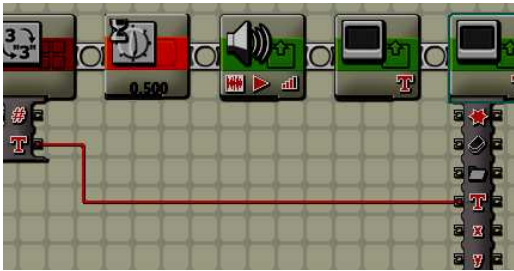

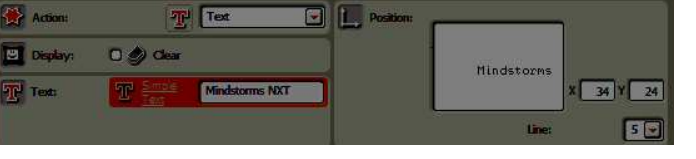
feature use the help menu in the NXT g software itself.



## Programming this

No	Icon	Configuration	Explanation
1			Reset rotation sensor on motor C to '0'
2			Reset rotation sensor on motor C to '0'
3			Move motors B & C forward , unlimited duration ( any power level is OK)
4			Until the touch sensor on port 1 is pressed
5			Then stop motors B and C
6			Read the rotation sensor on motor C. Left click data wire on Degrees output hub to send this reading to the next icon

7			<p>Connect the data wire from rotation sensor degrees output hub to the number input port on the number to text data hub</p> <p>Convert number ( of degrees) to text so that it can be shown on the NXT screen.</p>
8		  <p>Data wire from 'Number to Text' TEXT output hub connects with TEXT input hub on the display icon</p>	<p>Show the TEXT( number of degrees for motor C ) on the NXT screen in the middle of the screen. X position 40 Y position 24 Line 5 ( make sure Clear is NOT selected)</p>
9			<p>Show the text for 4 seconds... then</p>
10			<p>Then read the degrees for the rotation sensor in motor B.</p>
11		<p>Connect the degrees data wire to the number to text number hub</p>	<p>Convert number ( of degrees) to text so that it can be shown on the NXT screen</p>

12			Wait for 0.5 of a second
13			Then play a warning sound to alert you that the reading will change
14			Clear the text ( degrees from motor C0 from the NXT screen
15		  <p>ie Text output data wire from the convert text icon to the display – text input hub</p>	<p>Show the TEXT( number of degrees for motor B ) on the NXT screen in the middle of the screen. X position 34 Y position 24 Line 5 ( make sure Clear is NOT selected)</p>
16			Show the text for 4 seconds

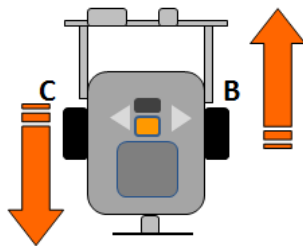
## Backwards- Log Degrees

To write the log degrees for backwards simply reverse the direction for the move icon ( no 3 above)

## Left / Right - Log Degrees

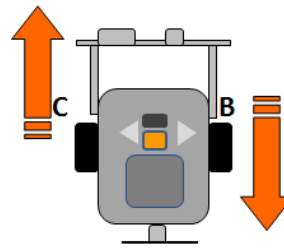
For turning left/right we'll use 'spin' type turns in the program instead of go forward/go backwards straight. Spin type turns take less physical room for the robot to execute. We'll only log the degrees for the forward moving wheel. In a spin turn the opposite wheel moves in the opposite direction at the same time and for the same number of degrees.

### LEFT SPIN SETTING

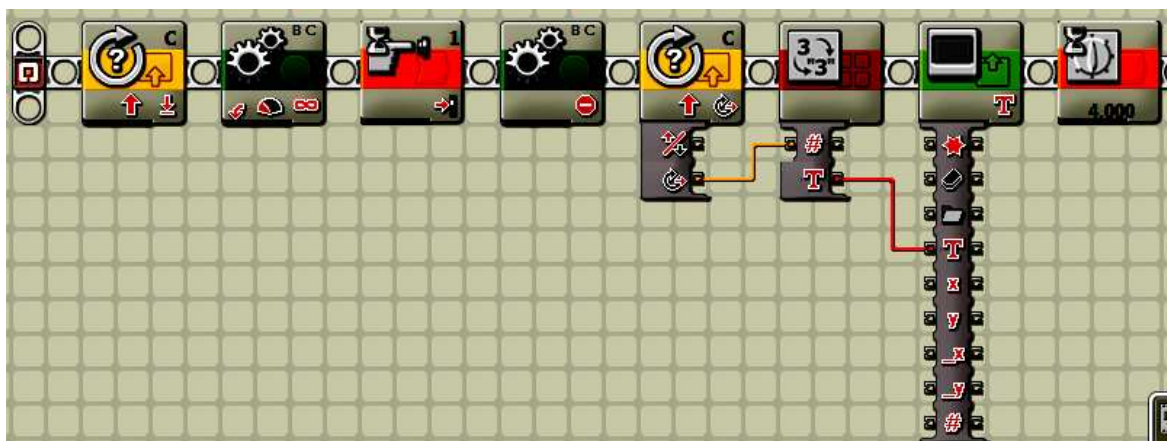
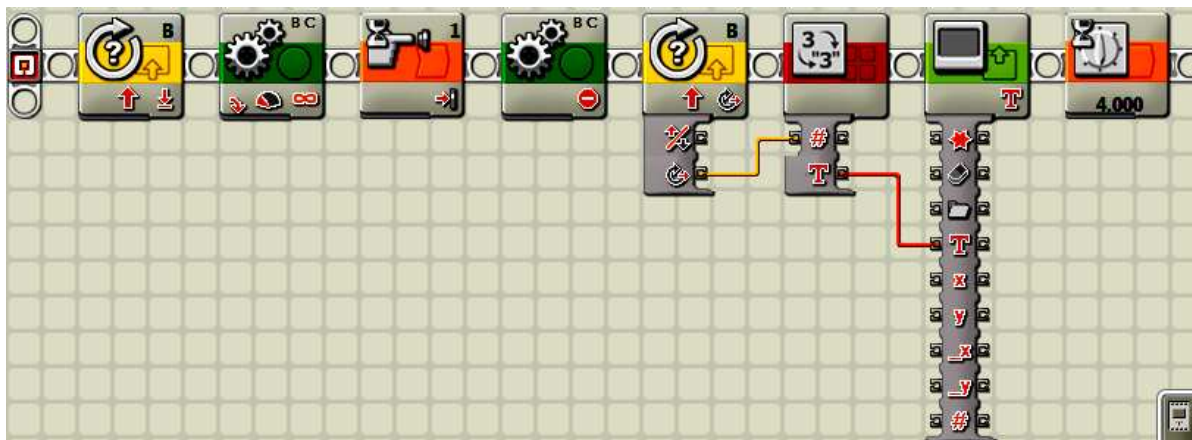
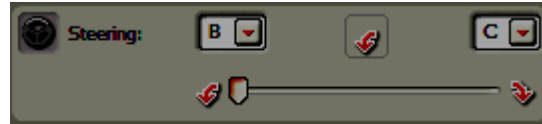


Log B wheel

### RIGHT SPIN SETTING

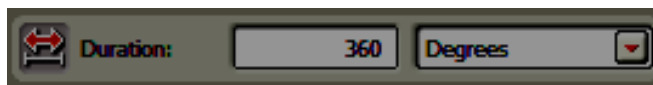


Log C wheel



## Use The Degrees You Have Discovered

By using these programs you will know the exact number of degrees that the robot takes to travel any distance. Now use the degrees you have logged in your programs for the duration setting.



### Repeating Code

In these four programs you will be re using several icons in the same sequence. You could create a 'My Block', this will package the icons into one icon and you can re-use it whenever you wish



Download the 'Creating A My Block ' instructions from my website:

<http://www.techellenttraining.com.au>