



How to Use EV3 Lessons




OVERALL STRUCTURE

- **Beginner Lessons**: These lessons will teach you to move and turn the robot, use the sensors, and use loops and switches.
- **Intermediate Lessons**: These lessons introduce more advanced programming techniques such as My Blocks, variables, parallel beams, calibration and math/logic blocks.
- **Advanced Lessons**: These lessons assume that you are comfortable using all the blocks in the EV3 environment. The advanced lessons teach you to more sophisticated programs such as menu systems, proportional line followers, squaring on lines and stall detection techniques.
- Beginner Lessons are designed to be done in order. Intermediate and Advanced Lessons may be done out of order. Lessons usually mention specific pre-requisites when needed.

LESSON STRUCTURE

- 1. Each lesson starts with a list of objectives and ends with a challenge**
- 2. In most lessons, we provide hints in the form of Pseudocode. Students who need a hint should look at the Pseudocode.**
- 3. We provide a challenge solution as well (both as a screenshot as well as in EV3 Code)**
- 4. A discussion guide is included after the challenge that will help understand the main objectives**
- 5. Many lessons have companion worksheets for students. More will be added over time.**


PROGRAMMING LESSONS

Beginner 	Intermediate 	Advanced 
<ul style="list-style-type: none">• Build a Base Robot• Introduction to Brick/Software• Moving Straight• Pseudocode• Turning• Displaying Text and Graphics• Touch Sensor• Color Sensor• Loops• Switches• Ultrasonic Sensor• Basic Line Follower• Basic Sequencer• Final Challenge	<ul style="list-style-type: none">• My Blocks with Inputs and Outputs• Moving with My Blocks• Turning with My Blocks• Color Line Follower with My Blocks• Infrared Sensor• Debugging• Move Blocks• Reliability• Intermediate Menu System• Color Sensor Calibration• Variables• Parallel Beams	<ul style="list-style-type: none">• Parallel Beams Sync• Arrays• Proportional Control• Proportional Line Follower• Proportional 2 Color Line Follower• Ramping Up• Gyro Sensor• Gyro Sensor Turns• Squaring on Lines• Gyro Sensor: Move Straight and Wall Follow• Squaring on Lines• Stall Detection• Menu System

QUICK GUIDES IN RESOURCES

These provide quick responses to important topics and questions that are common.

Use them as you need – as handouts, as discussion guides



MY BLOCKS

By Droids Robotics, 2015

What is a My Block?

My Blocks are a combination of one or more blocks that you create that can be grouped into a single block. Once this custom block is created, you can use it in multiple programs.

Every programming language has something like a My Block (e.g. functions, procedures, or methods). If you are looking to improve your programming style, you should learn to use My Blocks.

My Blocks are great programming tools. When used correctly, they can be very useful. They can have inputs and outputs (parameters).

When should you use a My Block?


- When your robot is going to repeat an action inside your program
- When your code is repeated in a different program
- To organize and simplify your code

What does it do?

Moves the robot 2 inches

You can enter the number of inches the power you want your robot to n

You can pick numerous parameter (inputs) such as inches, power, an



NXT AND EV3: WORKING TOGETHER

By Droids Robotics, 2015

Using the NXT brick with EV3 software

1. Space is a challenge - the NXT has very little storage and a few programs with the new software fill it up "very" quickly.

2. Sensor support is limited - you need to deal with issues such as light level calibration on your own. Some sensors use odd interfaces (e.g. light uses the sound block).


3. Some blocks don't work as advertised. Move steering/tank blocks don't synchronize motors well, therefore, making turns difficult. Built-in graphics don't fit on NXT screen. Advanced Math Blocks cannot be used on the NXT.

Using NXT peripherals (sensors and motors) with the EV3 brick:

- 1) Auto recognition is limited - sometimes, the EV3 brick does not automatically recognize when an NXT part is connected
- 2) The NXT color sensor is not as accurate as the EV3 color sensor

Description	EV3 Brick	NXT Brick
Hardware (EV3)		
EV3 Large motor	Yes	Yes
EV3 Medium motor	Yes	Yes
EV3 Touch sensor	Yes	No
EV3 Light sensor	Yes	No
EV3 Ultrasonic sensor	Yes	No
EV3 Color sensor	Yes	No
EV3 IR sensor	Yes	No
Hardware (NXT)		
NXT Large motor	Yes	Yes
NXT Touch sensor	Yes	Yes
NXT Light sensor	Yes (as Colour)	Yes (as Sound)*
NXT Sound sensor	Yes	Yes
NXT Ultrasonic sensor	Yes	Yes
NXT Color sensor	Yes	Yes
NXT Temperature sensor	Yes	Yes
Program		
Display	Yes (but best made is odd)	Yes (but some images don't display correctly)
Arithmetic	Yes	Yes (but not Exponent or Advanced)
Disabling block	Yes	No
Invert motor	Yes	No
Experiment	Experiment (Debugging)	Yes
Distance mode	Yes	No
Graph programming	Yes	No
Other		
Auto ID	Yes	No
Bluetooth (PC - Brick)	Yes	Yes (internal setup)
Bluetooth (Brick - Brick)	Yes	Yes?
Bluetooth (Brick - Brick)	Yes	No

Source: legoengineering.com



FLL ROBOT BUILD GUIDE

By Droids Robotics, 2015

Impetion robot involves a lot of a often get asked if Droid Bot would build. Droid Bot was designed with To use only the elements in the EV3 robot that could be used to complete on EV3Lessons.com and 3) Have building that students could learn from own designs built for any year of any particular elements worth

1 features you like id build your own.

Droid Bot 2.0 F.

- Good weight
- A strong oute
- Color sensors apart from ea the wheels
- A compact de
- Small wheels
- SNAP attach

To build a robot the questions b each option.

Factors

Tall wheels can add height, but give upside down to reduce the height. Small wheels can give you more per Firmer tires won't become out of the Back wheels/skids need to be able t same height as the front wheels. If the robot has to go over obstacles even tracks. (e.g. Nature's Fury)

Other than base height restrictions, it might get.

The width of the robot depends on b much space there is on the competi missions and walls.)


The robot should not be weighed to If it does, your moves will be unreali Once you add the weight of the attac

Color sensors need to be a good dist Sometimes placing them too close to follower.

The gyro can be placed anywhere (b be used to measure turns) (ie, not pc The other sensors need to be placed of the robot where you will use them

If you are using the EV3, you can use need to decide if you like the Medium Where you place them depends on it willing to add gears to your attachme

Planning to ride on walls? Consider a robot.



CABLE MANAGEMENT TECHNIQUES

By Droids Robotics, 2015

"Those wires are always in the way! What do I do?"

EV3 and NXT cables are necessary, but always seem to get in the way.

Tips for cable management:

Use the cable that is the most appropriate length first. In the EV3 Core Set you get the following length cables: 4 x 25 cm/10 in. cables, 2 x 35 cm/14 in. cables, and 1 x 50 cm/20 in. cables.

Some cables will be too long. Wrap cables around beams to shorten them and keep them out of the way.

Adding LEGO "cable guides" to the wires can help to keep them in place, identify what they are (use different colors) and even keep them together (in case you want to quickly detach two or more at the same time)

If you break the tip on the cables or you need extra wires, you can buy replacements from LEGO: <http://shop.lego.com/en-US/EV3-Cable-Pack-45514>

Have another idea of how manage your cables? Please share it with EV3Lessons.com.

You can even gently knot cables to shorten them.

The cables can get in the way of the attachments, motors, etc. Secure cables by creating different cable holders/guides out of LEGO. Here are some examples: