USER GUIDE

$F = ma$

$c = 2 \cdot \pi \cdot r$

EV3

COMPUTER SCIENCE · SCIENCE · TECHNOLOGY · ENGINEERING · MATH
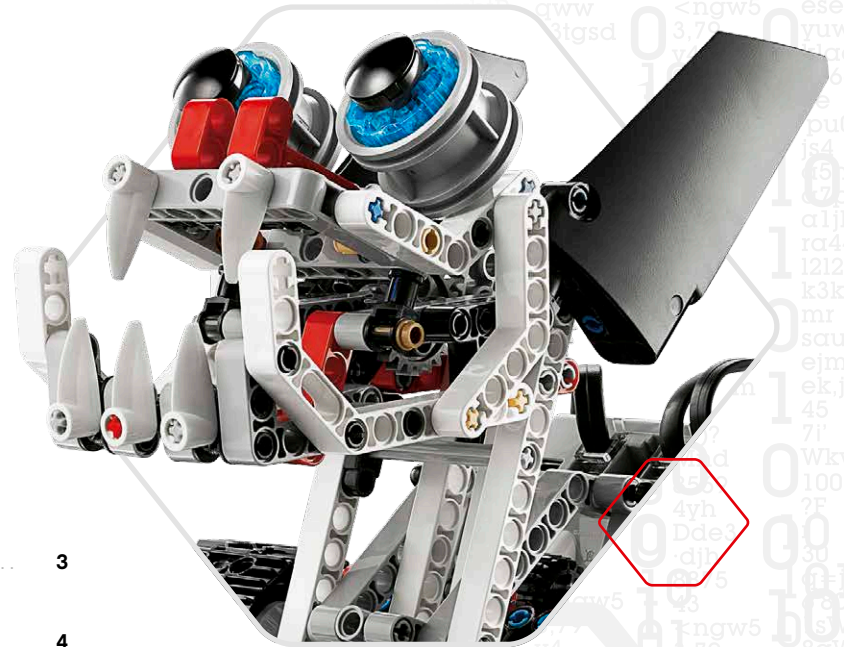
LEGO MINDSTORMS education EV3

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INTRODUCTION

Welcome

LEARNING POWERED BY LEGO® MINDSTORMS® EDUCATION
Since the beginning of this century, LEGO® MINDSTORMS® Education has led the way in STEM (Science, Technology, Engineering, and Math) Education, inspiring users to engage in fun, hands-on learning. The combination of LEGO building systems with the LEGO MINDSTORMS Education EV3 technology is now offering even more ways to learn about robotics and teach the principles of programming, physical science, and mathematics.

The heart of LEGO MINDSTORMS Education is the EV3 Brick, the programmable intelligent brick that controls motors and sensors, as well as providing wireless communication. Choose what motors and sensors you wish to use and build your robot just like you want it to be.

Enter the LEGO MINDSTORMS Education EV3 Software to find everything you need. The EV3 Software Lobby gives you easy access to content, programming, data logging, digital workbooks and more. You can for example choose to follow the Robot Educator and you'll be able to create, program, and run a robot before you know it. The intuitive icon-based programming is full of challenging possibilities and the data logging environment provides a powerful tool for scientific inquiry and experiments.

LEGO Education offers a growing number of EV3-based curriculum packages developed by experienced educators. We are committed to responsive customer support, professional development, and continuing education for teachers using MINDSTORMS robotics in their classrooms.
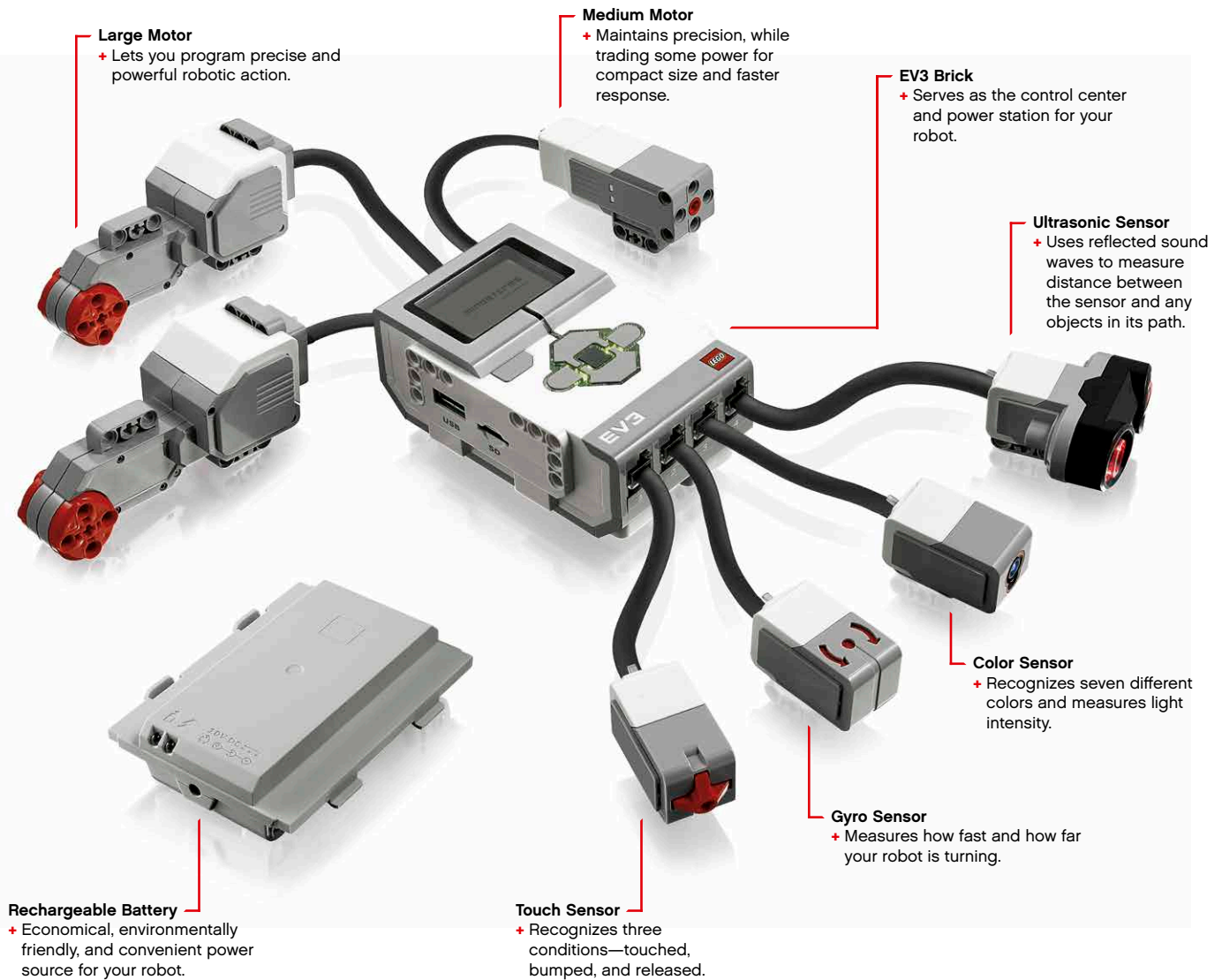
Want to work like real scientists and engineers? Enter the LEGO Education-supported FIRST® LEGO League and World Robot Olympiad—and gain invaluable knowledge, life skills, and increased self-confidence!

We hope you enjoy the journey!

EV3 TECHNOLOGY

Overview

Large Motor
+ Lets you program precise and powerful robotic action.

Medium Motor
+ Maintains precision, while trading some power for compact size and faster response.

EV3 Brick
+ Serves as the control center and power station for your robot.

Ultrasonic Sensor
+ Uses reflected sound waves to measure distance between the sensor and any objects in its path.

Color Sensor
+ Recognizes seven different colors and measures light intensity.

Gyro Sensor
+ Measures how fast and how far your robot is turning.

Rechargeable Battery
+ Economical, environmentally friendly, and convenient power source for your robot.

Touch Sensor
+ Recognizes three conditions—touched, bumped, and released.

EV3 TECHNOLOGY

EV3 Brick

Overview

The **Display** shows you what is going on inside the EV3 Brick and enables you to use the Brick Interface. It also allows you to add text and numerical or graphic responses into your programming or experiments. For example, you might want to program the Display to show a happy face (or a sad face) for a comparison response or to display a number that is the result of a mathematical calculation (learn more about using the **Display Block** in the EV3 Software Help).

The **Brick Buttons** allow you to navigate inside the EV3 Brick Interface. They can also be used as programmable activators. For example, you might program a robot to raise its arms if the Up button is pressed or to lower them if the Down button is pressed (for more information, see **Using the Brick Buttons** in the EV3 Software Help).

Brick Name

USB:
USB connection established to another device

Wireless Connection Status icons *(from the left)*

Bluetooth enabled but not connected or visible to other Bluetooth devices

Bluetooth enabled and visible to other Bluetooth devices

Bluetooth enabled and your EV3 Brick is connected to another Bluetooth device

Bluetooth enabled and visible and your EV3 Brick is connected to another Bluetooth device

Wi-Fi enabled but not connected to a network

Wi-Fi enabled and connected to a network

Battery level

Brick Buttons

1. Back
This button is used to reverse actions, to abort a running program, and to shut down the EV3 Brick.

2. Center
Pressing the Center button says "OK" to various questions—to shut down, to select desired settings, or to select blocks in the Brick Program App. You would, for example, press this button to select a checkbox.

3. Left, Right, Up, Down
These four buttons are used to navigate through the contents of the EV3 Brick.

EV3 TECHNOLOGY

EV3 Brick

The **Brick Status Light** that surrounds the Brick Buttons tells you the current status of the EV3 Brick. It can be green, orange, or red and can pulse. Brick Status Light codes are the following:

+ Red = Startup, Updating, Shutdown
+ Red pulsing = Busy
+ Orange = Alert, Ready
+ Orange pulsing = Alert, Running
+ Green = Ready
+ Green pulsing = Running Program

You can also program the Brick Status Light to show different colors and to pulse when different conditions are met (learn more about using the **Brick Status Light Block** in the EV3 Software Help).

TECHNICAL SPECIFICATIONS FOR THE EV3 BRICK

+ Operating System—LINUX
+ 300 MHz ARM9 controller
+ Flash Memory—16 MB
+ RAM—64 MB
+ Brick Screen Resolution—178 x 128/Black & White
+ USB 2.0 Communication to Host PC—Up to 480 Mbit/sec
+ USB 1.1 Host communication—Up to 12 Mbit/sec
+ Micro SD card—Supports SDHC, Version 2.0, Max 32 GB
+ Motor and Sensor Ports
+ Connectors—RJ12
+ Support Auto ID
+ Power—6 AA batteries/rechargeable

Brick Status Light – Red

Brick Status Light – Orange

Brick Status Light – Green

EV3 TECHNOLOGY

EV3 Brick

PC Port
The Mini-USB PC Port, located next to the D port, is used to connect the EV3 Brick to a computer.

Input Ports
Input Ports 1, 2, 3, and 4 are used to connect sensors to the EV3 Brick.

Output Ports
Output Ports A, B, C, and D are used to connect motors to the EV3 Brick.

Speaker
All sounds from the EV3 Brick come through this speaker—including any sound effects used in programming your robots. When the quality of the sound is important to you, try to leave the speaker uncovered while designing your robot. Check out the cool sound files that can be programmed within the EV3 Software (learn more about using the **Sound Block** in the EV3 Software Help).

USB Host Port
The USB Host Port can be used to add a USB Wi-Fi dongle for connecting to a wireless network, or to connect up to four EV3 Bricks together (daisy chain).

SD Card Port
The SD Card Port increases the available memory for your EV3 Brick with an SD card (maximum 32 GB—not included).

EV3 Brick

Installing Batteries

With LEGO® MINDSTORMS® Education EV3, you have the choice of using normal AA batteries or the EV3 Rechargeable Battery pack included in the LEGO MINDSTORMS Education EV3 Core Set. If you experiment with both, you will find that each option has characteristics to consider when constructing your robots. For instance, six AA batteries weigh more than the Rechargeable Battery, and the EV3 Brick with the Rechargeable Battery installed is slightly larger than the EV3 Brick with six AA batteries.

The **EV3 Rechargeable Battery** is a convenient and economical alternative to using AA batteries. It can be recharged while inbuilt in a model, saving you the trouble of disassembling and reassembling a robot to replace batteries.

To install the Rechargeable Battery on the EV3 Brick, remove the battery cover on the back of the EV3 Brick by pressing the two plastic tabs on the side. If there are batteries in the EV3 Brick, remove them. Insert the Rechargeable Battery in the slots that held the battery cover in place and snap the battery in place. The battery cover is not used.

If it is your first use of the battery—or if the battery is completely drained, let the battery and the EV3 Brick charge together for minimum twenty minutes.

Using the enclosed power adaptor cord, connect the Rechargeable Battery to a wall outlet. Make sure to keep the transformer cord and battery where they will not be tripped over or get wet.

When you plug the uncharged battery into a wall socket, a red indicator light will be lit. When charging is complete, the red light will go out and the green light will be illuminated. The recharging process will generally take three to four hours. If you use the EV3 Brick while the battery is charging, it will take longer. Before you start to use the Rechargeable Battery for the first time, it is recommended that it is fully charged.

EV3 Rechargeable Battery

1

2

7.4V Rechargeable

3

4
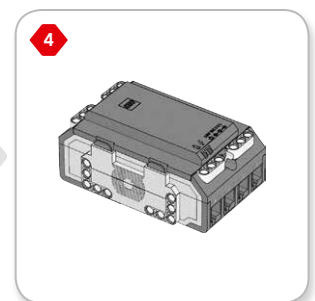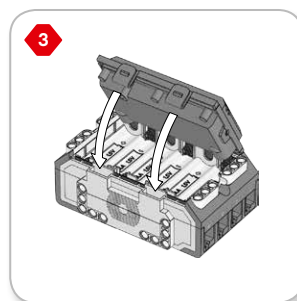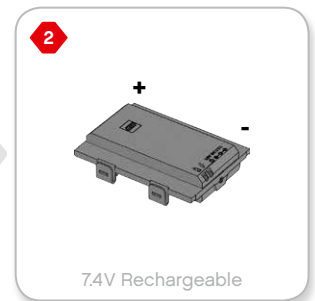
EV3 TECHNOLOGY

EV3 Brick

The EV3 Brick requires **six AA/LR6 batteries** if the EV3 Rechargeable Battery is not used. Alkaline or rechargeable Lithium Ion AA batteries are recommended. The AA batteries option is a good choice when a little more weight is desirable in your robot.

To install the AA batteries, remove the battery cover on the back of the EV3 Brick by pressing the two plastic tabs on the side. After you have inserted the six AA batteries, attach the battery cover again.

SOME IMPORTANT INFORMATION ABOUT BATTERIES:

+ Never use different kinds of batteries together (including mixing old and new).
+ Remove batteries from the EV3 Brick when not in use.
+ Never use damaged batteries.
+ Use the correct battery charger under the supervision of an adult.
+ Never attempt to recharge batteries that are not rechargeable.

Note: If your batteries are weak, the Brick Status Light may stay red after you press the Start button, while the Display continues to say "Starting."

POWER-SAVING PRACTICES

+ Remove batteries between use.
  Remember to keep each set of batteries in its own storage container so they can be used together.
+ Reduce Volume.
+ Adjust Sleep Setting.
+ Turn off Bluetooth and Wi-Fi when not in use.
+ Avoid unnecessary wear on the motors.

AA, 1.5V x 6
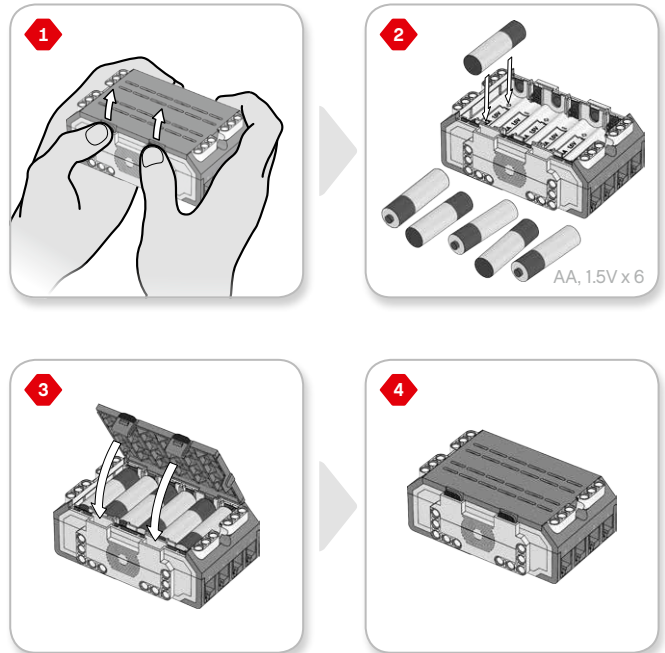
Low Battery Power Indicator

EV3 TECHNOLOGY

EV3 Brick

Turning On the EV3 Brick

To turn on the EV3 Brick, press the Center button. After you press the button, the Brick Status Light will turn red and the Starting screen will be displayed.

When the light changes to green, your EV3 Brick is ready.

To turn the EV3 Brick off, press the Back button until you see the Shut Down screen.

The Abort X will already be selected. Use the Right button to select the Accept check mark, then press the Center button for OK. Your EV3 Brick is now turned off. If you press OK while the X is selected, you will return to the Run Recent screen.

Starting screen

Shut Down screen

EV3 TECHNOLOGY

EV3 Motors

Large Motor

Large Motor

The Large Motor is a powerful "smart" motor. It has a built-in Rotation Sensor with 1-degree resolution for precise control. The Large Motor is optimized to be the driving base on your robots.

By using the Move Steering or Move Tank programming block in the EV3 Software, the Large Motors will coordinate the action simultaneously.

Medium Motor

The Medium Motor also includes a built-in Rotation Sensor (with 1-degree resolution), but it is smaller and lighter than the Large Motor. That means it is able to respond more quickly than the Large Motor.

The Medium Motor can be programmed to turn on or off, control its power level, or to run for a specified amount of time or rotations.

Medium Motor

COMPARE THE TWO MOTORS:

+ The Large Motor runs at 160–170 rpm, with a running torque of 20 Ncm and a stall torque of 40 Ncm (slower, but stronger).
+ The Medium Motor runs at 240–250 rpm, with a running torque of 8 Ncm and a stall torque of 12 Ncm (faster, but less powerful).
+ Both motors are Auto ID supported.

For more information on using the Rotation Sensor in your programming, see **Using the Motor Rotation Sensor** in the EV3 Software Help.

EV3 TECHNOLOGY

EV3 Sensors

Color Sensor

The Color Sensor is a digital sensor that can detect the color or intensity of light that enters the small window on the face of the sensor. This sensor can be used in three different modes: Color Mode, Reflected Light Intensity Mode, and Ambient Light Intensity Mode.

In **Color Mode**, the Color Sensor recognizes seven colors—black, blue, green, yellow, red, white, and brown—plus No Color. This ability to differentiate between colors means your robot might be programmed to sort colored balls or blocks, speak the names of colors as they are detected, or stop action when it sees red.

In **Reflected Light Intensity Mode**, the Color Sensor measures the intensity of light reflected back from a red light–emitting lamp. The sensor uses a scale of 0 (very dark) to 100 (very light). This means your robot might be programmed to move around on a white surface until a black line is detected, or to interpret a color-coded identification card.

In **Ambient Light Intensity Mode**, the Color Sensor measures the strength of light that enters the window from its environment, such as sunlight or the beam of a flashlight. The sensor uses a scale of 0 (very dark) to 100 (very light). This means your robot might be programmed to set off an alarm when the sun rises in the morning, or stop action if the lights go out.

The sample rate of the Color Sensor is 1 kHz/sec.

For the best accuracy, when in Color Mode or Reflected Light Intensity Mode, the sensor must be held at a right angle, close to—but not touching—the surface it is examining.

For more information, see **Using the Color Sensor** in the EV3 Software Help.

Color Sensor

Color Mode

Reflected Light Intensity Mode

Ambient Light Intensity Mode

EV3 TECHNOLOGY

Gyro Sensor

EV3 Sensors

Gyro Sensor

The Gyro Sensor is a digital sensor that detects rotational motion on a single axis. If you rotate the Gyro Sensor in the direction of the arrows on the case of the sensor, the sensor can detect the rate of rotation in degrees per second. (The sensor can measure a maximum rate of spin of 440 degrees per second.) You can then use the rotation rate to detect, for example, when a part of your robot is turning, or when your robot is falling over.

In addition, the Gyro Sensor keeps track of the total rotation angle in degrees. You can use this rotation angle to detect, for example, how far your robot has turned. This feature means you are able to program turns (on the axis the Gyro Sensor is measuring) with an accuracy of +/- 3 degrees for a 90-degree turn.

Note: The sensor must be completely motionless while being plugged into the EV3 Brick. If the Gyro Sensor is attached to a robot, the robot should be held motionless in its starting position as the Gyro Sensor is plugged into the EV3 Brick.

CONNECTING THE GYRO SENSOR
On the EV3 Brick, go to the Brick App screen (third tab) and use the Center button to select Port View.

Using a flat black Connector Cable, connect the Gyro Sensor to the EV3 Brick on Port 2. Make sure to hold the sensor very still while you do this. On the EV3 Brick display, the Port View app should show a "0" reading in the second small bottom window from the left, which is the window representing input values from Port 2.

Still without moving the sensor, observe the display for a few seconds. It should continue to display "0" for Port 2 with the Gyro Sensor. In case the Gyro Sensor readings do not constantly display "0" during the connection process, unplug the sensor and repeat the procedure.

When the screen consistently displays "0" for a few seconds, experiment with rotating the sensor and observe how the angle reading changes. Remember, the Gyro Sensor measures the angle of change on only one axis.

For more information, see **Using the Gyro Sensor** in the EV3 Software Help.
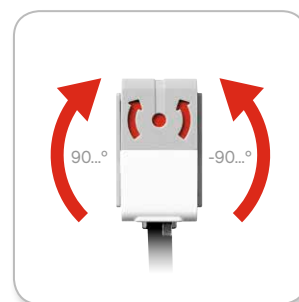
Single axis rotation

Brick App screen

Port View with Gyro Sensor
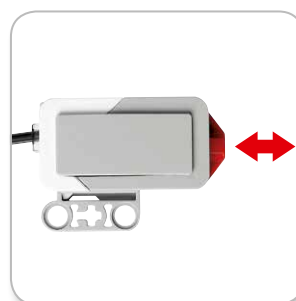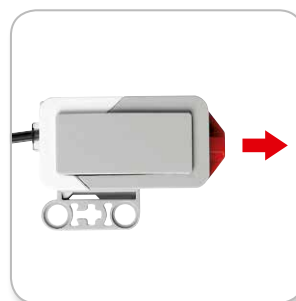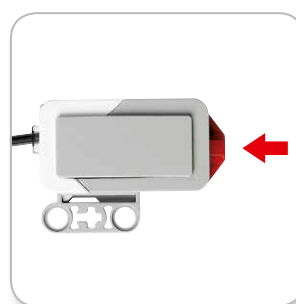
EV3 TECHNOLOGY

EV3 Sensors

Touch Sensor

The Touch Sensor is an analog sensor that can detect when the sensor's red button has been pressed and when it is released. That means the Touch Sensor can be programmed to action using three conditions—pressed, released, or bumped (both pressed and released).

Using input from the Touch Sensor, a robot can be programmed to see the world as a blind person might, reaching a hand out and responding when it touches something (pressed).

You might build a robot with a Touch Sensor pressed against the surface beneath it. You might then program the robot to respond (Stop!) when your robot is about to drive off the edge of a table (when the sensor is released).

A fighting robot might be programmed to keep pushing forward against its challenger until the challenger retreats. That pair of actions—pressed, then released—would constitute bumped.

For more information, see **Using the Touch Sensor** in the EV3 Software Help.

Touch Sensor

Pressed

Released

Bumped

EV3 TECHNOLOGY

EV3 Sensors

Ultrasonic Sensor

The Ultrasonic Sensor is a digital sensor that can measure the distance to an object in front of it. It does this by sending out high-frequency sound waves and measuring how long it takes the sound to reflect back to the sensor. The sound frequency is too high for you to hear.

Distance to an object can be measured in either inches or centimeters. This allows you to program your robot to stop a certain distance from a wall.

When using centimeter units, the detectable distance is between 3 and 250 centimeters (with an accuracy of +/- 1 centimeters). When using inch units, the measurable distance is between 1 and 99 inches (with an accuracy of +/- 0.394 inches). A value of 255 centimeters or 100 inches means the sensor is not able to detect any object in front of it.

A steady light around the sensor eyes tells you that the sensor is in Measure Mode. A blinking light tells you that it is in Presence Mode.

In Presence Mode, this sensor can detect another Ultrasonic Sensor operating nearby. When listening for presence, the sensor detects sound signals but does not send them.

The Ultrasonic Sensor can help your robots avoid furniture, track a moving target, detect an intruder in your room, or "ping" with increasing volume or frequency as an object gets closer to the sensor.

For more information, see **Using the Ultrasonic Sensor** in the EV3 Software Help.

Ultrasonic Sensor

250 cm / 99 inch
Detectable distance

NOTE:

Since the Ultrasonic Sensor depends on reflection of the sound waves it may be ineffective at detecting surfaces that are textured or objects that are rounded. It is also possible for an object to be too small for the Ultrasonic Sensor to detect it.

EV3 TECHNOLOGY

EV3 Sensors

Infrared Sensor and Remote Infrared Beacon

The Infrared Sensor is a digital sensor that can detect infrared light reflected from solid objects. It can also detect infrared light signals sent from the Remote Infrared Beacon.

The Infrared Sensor can be used in three different modes: Proximity Mode, Beacon Mode, and Remote Mode.

PROXIMITY MODE
In Proximity Mode, the Infrared Sensor uses the light waves reflected back from an object to estimate the distance between the sensor and that object. It reports the distance using values between 0 (very close) to 100 (far away), not as a specific number of centimeters or inches. The sensor can detect objects up to 70 cm away, depending on the size and shape of the object.

For more information, see **Using the Infrared Sensor Proximity Mode** in the EV3 Help files.

BEACON MODE
Choose one of the Remote Infrared Beacon's four channels from the red Channel Selector. The Infrared Sensor will detect a beacon signal matching the channel that you specify in your program up to a distance of approximately 200 cm in the direction it is facing.

Once detected, the sensor can estimate the general direction (heading) of and the distance (proximity) to the beacon. With this information, you can program a robot to play hide-and-seek, using the Remote Infrared Beacon as the target of its search. The heading will be a value of between -25 and 25, with 0 indicating that the beacon is directly in front of the Infrared Sensor. The proximity will be values between 0 and 100.

For more information, see **Using the Infrared Sensor Beacon Mode** in the EV3 Help files.

Infrared Sensor

70 cm / 27 inch
Proximity Mode

200 cm / 79 inch
Beacon Mode

EV3 TECHNOLOGY

Remote Infrared Beacon

EV3 Sensors

The Remote Infrared Beacon is a separate device that can be handheld or built into another LEGO® model. It requires two AAA alkaline batteries. To turn the Remote Infrared Beacon on, press the big Beacon Mode button on the top of the device. A green LED Indicator will turn on, indicating the device is active and transmitting continuously. Another press on the Beacon Mode button will turn it off (after one hour of inactivity, the beacon will automatically turn itself off).

REMOTE MODE
You can also use the Remote Infrared Beacon as a remote control for your robot. When in Remote Mode, the Infrared Sensor can detect which button (or combination of buttons) on the beacon is pressed. There are a total of eleven possible button combinations:

Remote Mode

 0 = No button (and Beacon Mode is off)
 1 = Button 1
 2 = Button 2
 3 = Button 3
 4 = Button 4
 5 = Both Button 1 and Button 3
 6 = Both Button 1 and Button 4
 7 = Both Button 2 and Button 3
 8 = Both Button 2 and Button 4
 9 = Beacon Mode is on
10 = Both Button 1 and Button 2
11 = Both Button 3 and Button 4

For more information, see **Using the Infrared Sensor Remote Mode** in the EV3 Help files.
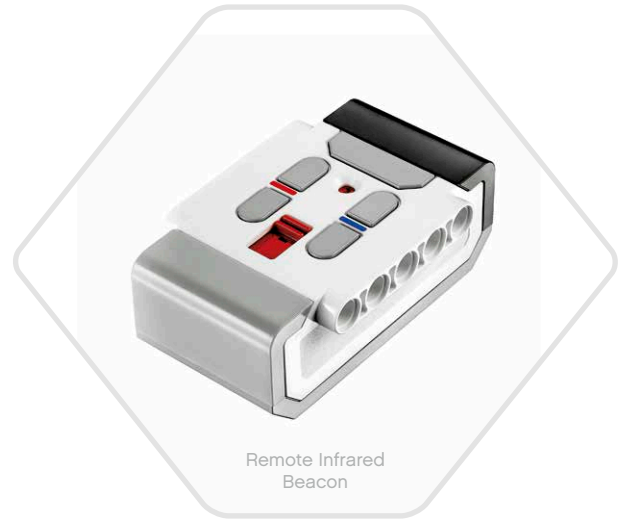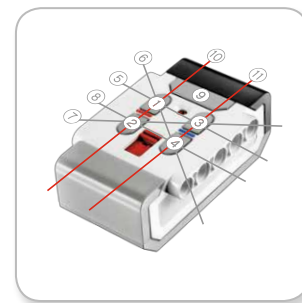
> **NOTE:**
> The Infrared Sensor and Remote Infrared Beacon are not part of the LEGO® MINDSTORMS® Education EV3 Core Set but can be acquired as accessories.

EV3 TECHNOLOGY

EV3 Sensors

Temperature Sensor

The Temperature Sensor is a digital sensor that measures the temperature at the tip of its metal probe. The sensor measures in Celsius (-20°C to 120°C) and Fahrenheit (-4°F to 248°F) with an accuracy of 0.1°C.

The Temperature Sensor is most commonly used to collect data for heat-related data logging projects. With a 50 cm–long Connector Cable and a 6.4 cm metal probe, the sensor makes it easy to measure hot liquids away from the EV3 Brick and other electronics.

For more information, see **Using the Temperature Sensor** in the EV3 Software Help.

Temperature
Sensor

NOTE:

The Temperature Sensor is not part of the LEGO® MINDSTORMS® Education EV3 Core Set but can be acquired as accessory.

EV3 TECHNOLOGY

Connecting the EV3 Technology

Connecting Sensors and Motors

In order to function, motors and sensors must be connected to the EV3 Brick.

Using the flat black Connector Cables, link sensors to the EV3 Brick using Input ports 1, 2, 3, and 4.

If you create programs while the EV3 Brick is not connected to your computer, the software will assign sensors to default ports. Those default port assignments are:

+ Port 1: Touch Sensor
+ Port 2: Gyro Sensor/Temperature Sensor
+ Port 3: Color Sensor
+ Port 4: Ultrasonic Sensor/Infrared Sensor

If the EV3 Brick is connected to your computer while you program, the software will automatically identify which port is being used for each sensor or motor.

Using the flat black Connector Cables, link motors to the EV3 Brick using Output ports A, B, C, and D.

As with the sensors, if the EV3 Brick is not connected when you are writing a program, each motor will be assigned to a default port. Default port assignments are:

+ Port A: Medium Motor
+ Port B & C: Two Large Motors
+ Port D: Large Motor

If the EV3 Brick is connected to the computer when you are programming, the software will automatically assign the correct port in your programs.

Connecting Sensors

Connecting Motors

NOTE:
The software cannot distinguish between two or more identical sensors or motors.

EV3 TECHNOLOGY

Connecting the EV3 Technology

Connecting the EV3 Brick to Your Computer

Connect the EV3 Brick to your computer by USB Cable or wirelessly using either Bluetooth or Wi-Fi.

USB CABLE
Using the USB Cable, plug the Mini-USB end into the EV3 Brick's PC port (located next to Port D). Plug the USB end into your computer.

USB Cable connection

EV3 TECHNOLOGY

Connecting the EV3 Technology

WIRELESS—BLUETOOTH
If your computer is not Bluetooth-enabled, you will need a Bluetooth USB dongle for your computer.

Making a Bluetooth connection to the computer
Before you can make a Bluetooth connection between the EV3 Brick and the computer running the EV3 Software, you will need to enable Bluetooth on the EV3 Brick. Directions for this can be found on page 33.

Once you have enabled Bluetooth on the EV3 Brick, it can now be connected to the computer and EV3 Software.

1. First, confirm that the EV3 Brick is turned on.
2. Open a new or existing program in the EV3 Software (see the **EV3 Software** chapter on page 37 for directions on how to do this).
3. Go to the Hardware Page at the lower right of the screen— expand the window if collapsed (learn more about the Hardware Page on page 46).
4. Click on the Available Bricks tab. If your EV3 Brick is not already listed, click the Refresh button to locate the EV3 Brick and check the Bluetooth box that will appear.
5. Accept the connection on your EV3 Brick manually, then enter the passkey and press the Center button for OK. The default is 1234. Repeat this in the EV3 Software.
6. The connection is now established and a "<>" symbol is shown on the top left of the EV3 Brick Display (next to the Bluetooth icon) to confirm the connection.

To disconnect the EV3 Brick from the computer, click on the Disconnect button next to the Refresh button in the Hardware Page.

More information about Bluetooth settings on the EV3 Brick can be found on page 33.

Wireless connection

EV3 TECHNOLOGY

Connecting the EV3 Technology

WIRELESS—WI-FI
Your first step in connecting to Wi-Fi is to acquire a Wi-Fi USB dongle. For a list of compatible dongles, ask your local LEGO® Education provider or go to the official LEGO® MINDSTORMS® Education website (www.LEGOeducation.com/MINDSTORMS).

To begin the setup, you must have access to a wireless network, and know the network's name and its password.

If the EV3 Software is open, close it and insert your Wi-Fi dongle into the EV3 Brick using the USB Host port.

Before you can connect the EV3 Brick to a network, you will need to enable Wi-Fi on the EV3 Brick. Directions for this can be found on page 35.

Settings screen

NOTE:
Because of keyboard limitations, the password for the network must be made up of numbers, capital letters, and lowercase letters. You will not be able to use some symbols, such as the # sign, or letters and symbols from non-Latin alphabets.

NOTE:
The EV3 Brick only supports the following network encryption modes: None and WPA2.

EV3 TECHNOLOGY

Connecting the EV3 Technology

Connecting the EV3 Brick to a network
After selecting Wi-Fi on the Settings screen, use the Up and Down buttons to select Connections and press the Center button for OK. The EV3 Brick will now search for and list available Wi-Fi networks.

Using the Up and Down buttons for navigation, find your network on the list. If the EV3 Brick is not already connected to your network (indicated by a check mark), select your network using the Center button.

In the Network dialog box that appears, select Connect and press OK with the Center button. You will now be asked to enter the encryption type and the network password using the Left, Right, Up, and Down buttons to navigate (upper and lower cases do matter here).

Once you have entered the correct password, press the check mark for OK. You will now be connected to the network.

If the EV3 Brick does not find your network in its search, the network may be hidden. To connect to a hidden network, select "Add hidden."

You will then be asked to enter the name, encryption type, and password for the hidden network you wish to add (upper and lower cases do matter here). Once done, the EV3 Brick will be connected to the hidden network and the network will be included in the network list.

Network list

Connect to network

Network password

Add hidden network

NOTE:
Once you have connected to a network using its password, the EV3 Brick will remember the password for future connections. Known networks are indicated in the list with an "*".

EV3 TECHNOLOGY

Connecting the EV3 Technology

Making a Wi-Fi connection from the computer to the EV3 Brick
Using the USB Cable, connect the EV3 Brick to the computer.

Open an EV3 Software program. Access the Wireless Setup tool in the Hardware Window (at the bottom right of the screen), or select Wireless Setup from the Tools Menu.

The computer will display which networks it detects.

Select the network you want to connect to and click on "Connect" to configure the connection. To add a network that is not broadcasting its Network Name (SSID), click "Add."

To edit the settings of a previously configured network, click Edit.

Click OK to establish a Wi-Fi connection. Once the connection is established, you can unplug the USB Cable.
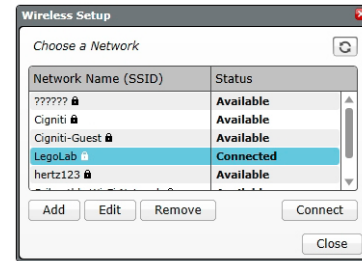
Wireless Setup tool

EV3 TECHNOLOGY

EV3 Brick Interface

The EV3 Brick is the control center for bringing your robots to life. Using the Display and the Brick Buttons, the EV3 Brick Interface contains four basic screens that give you access to an amazing array of functions unique to the EV3 Brick. It can be something as simple as starting and stopping a program, or something as complicated as writing the program itself.

Run Recent screen

Run Recent

This screen will be blank until you begin to download and run programs. It is the most recently run programs that will be displayed on this screen. The program at the top of the list which is selected by default is the latest program run.

File Navigation

This screen is where you will access and manage all the files on your EV3 Brick, including files stored on a SD Card.

Files are organized in project folders, which in addition to the actual program files also contain sounds and images used in each project. In the File Navigator, files can be moved or deleted. Programs created using the Brick Program and Brick Datalog apps are stored separately in the BrkProg_SAVE and BrkDL_SAVE folders.

File Navigation screen

Open folder in File Navigation

EV3 TECHNOLOGY

EV3 Brick Interface

Brick Apps

The EV3 Brick comes with five brick applications preinstalled and ready to use. In addition, you can also make your own apps in the EV3 Software. Once downloaded to the EV3 Brick, the homemade apps will be displayed here.

The five preinstalled apps are the following:

PORT VIEW

On the first screen in the Port View, you will see, at a glance, which ports have sensors or motors attached. Use the EV3 Brick Buttons to navigate to one of the occupied ports and you will see the current readings returned from the sensor or motor. Attach some sensors and motors and experiment with the different settings. Press the Center button to see or change the current settings for the attached motors and sensors. Press the Back button to get back to the Brick Apps main screen.

MOTOR CONTROL

Control the forward and reverse movement of any motor connected to one of the four output ports. There are two different modes. In one mode, you will be able to control motors connected to Port A (using the Up and Down buttons) and to Port D (using the Left and Right buttons). In the other mode, it is motors connected to Port B (using the Up and Down buttons) and Port C (using the Left and Right buttons) that you control. Use the Center button to toggle between the two modes. Press the Back button to get back to the Brick Apps main screen.

Brick Apps screen

Port View app
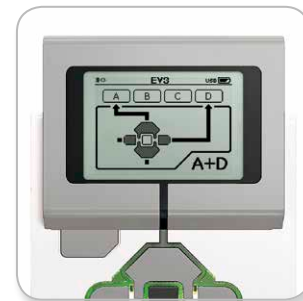
Motor Control app

EV3 TECHNOLOGY

EV3 Brick Interface

IR CONTROL

Control the forward and reverse motion of any motor connected to one of the four output ports using the Remote Infrared Beacon as remote control and the Infrared Sensor as receiver (the Infrared Sensor must be connected to Port 4 in the EV3 Brick). There are two different modes. In one mode, you will be using Channels 1 and 2 on the Remote Infrared Beacon. On Channel 1, you will be able to control motors connected to Port B (using Buttons 1 and 2 on the Remote Infrared Beacon) and to Port C (using Buttons 3 and 4 on the Remote Infrared Beacon). On Channel 2, you will be able to control motors connected to Port A (using Buttons 1 and 2) and to Port D (using Buttons 3 and 4). In the other mode, you can control your motors in the exact same way by using Channels 3 and 4 on the Remote Infrared Beacon instead. Use the Center button to toggle between the two modes. Press the Back button to get back to the Brick Apps main screen.

IR Control app

NOTE:

The Remote IR Beacon and Infrared Sensor are not part of the LEGO® MINDSTORMS® Education EV3 Core Set but can be acquired as accessories.

EV3 Brick Interface

BRICK PROGRAM
The EV3 Brick comes with an on-brick programming application similar to the software installed on your computer. These instructions provide you with the basic information you will need to get started.

Create program
Open up your Brick Program App.

The Start screen provides you with a Start and a Loop block that are connected via a Sequence Wire. The vertical broken Add Block line in the middle indicates that you can add more blocks to your program. Press the Up button to add a new block from the Block Palette.

In the Block Palette, you can choose which new block to add by navigating using the Left, Right, Up, and Down buttons. Navigating farther up, additional blocks will show. Navigating all the way down will take you back to your program. Generally, there are two types of blocks—Action and Wait. The Action Block Indicator is a small arrow at the top right on the block. The Wait Block Indicator is a small hourglass. In total, there are six different Action blocks and eleven different Wait blocks to choose from.

When you find the block you want, navigate to it and press the Center button. You will be taken back to your program.

In your program, you can navigate between the blocks using the Left and Right buttons. Press the Center button to change the settings of the highlighted block (always the block in the middle of the screen) or to add a new block when the Sequence Wire is highlighted and the Add Block line is visible.

On each programming block, you can change one setting using the Up and Down buttons. For example, on the Action Move Steering block, you can change the direction of your robot's path. When you have chosen the setting you want, press the Center button.

Start screen

Block Palette

New block added

Adjust block setting
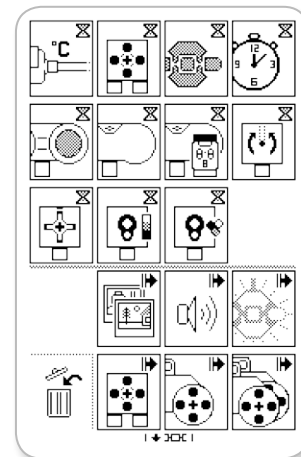
Full Block Palette

EV3 TECHNOLOGY

EV3 Brick Interface

Delete blocks
If you want to delete a block from a program, highlight the block you want to delete and press the Up button to go to the Block Palette.

In the Block Palette, navigate to the trashcan on the far left and press the Center button. The block is now deleted.

Run program
To run your program, use the Left button to navigate to the Start block at the very beginning of the program. Press the Center button and your program will run.

Save and open program
To save your program, navigate to the Save icon on the far left of your program. When clicking on the Save icon, you will be asked to name your program or accept the default name. Once you are done, click OK and your program is now saved in the BrkProg_SAVE folder that can be accessed from the File Navigation screen (see page 25).

You can also open any existing EV3 Brick Program by clicking on the Open icon located above the Save icon. Use the Up and Down buttons to toggle between those two icons.

Delete block

Run program

Save program

EV3 TECHNOLOGY

EV3 Brick Interface

BRICK DATALOG
The EV3 Brick comes with a simple-to-use, on-brick data logging application. These instructions provide you with the basic information you will need to get started.

Main screen
When you open the EV3 Brick Datalog app, you will see to the left a Graph Area. If a sensor or motor is connected to the EV3 Brick, a graph will show live readings from one of the sensors like an oscilloscope (if a motor is connected, it is readings from the in-build rotation sensor).

To the right of the graph, the following numbers are displayed (from the top): actual reading, duration, highest reading, lowest reading, and average reading. Duration will only be shown when running an experiment—not when in Oscilloscope Mode.

Underneath, a small window will indicate what port the values are currently read from (Input Port 1, 2, 3, or 4, or Output Port A, B, C, or D). To change the port, use the Left and Right buttons to click through the available ports.

Main screen

NOTE:
Only ports with a sensor or motor connected will be displayed!

EV3 TECHNOLOGY

EV3 Brick Interface

Set up and run experiment
If you wish to set up and run an experiment, start by clicking on the Brick Datalog Settings button in the bottom right corner symbolized by a wrench. Use the Down and Right buttons to navigate to it and the Center button to click OK.

You can now decide the sample rate of your experiment, ranging from one sample per minute to a thousand samples per second. Use the Up and Down buttons to highlight Rate, then use the Left and Right buttons to select the sample rate you wish to use for your experiment.

Next, you can choose what sensor to use for your experiment. Highlight Sensor Setup and click OK with the Center button.

You will now get a list of sensors connected to your EV3 Brick. Use the Up and Down buttons to highlight the sensor you want to use. When a sensor is highlighted, use the Left and Right buttons to select sensor mode (for example, if the Color Sensor should measure color or ambient light). Once you have found the correct sensor mode, use the Center button to click OK and you will be taken back to the Settings screen. On the Settings screen, click the check mark button and you are now back at the main EV3 Brick Datalog screen.

To run your experiment, select and click on the Record button (next to the Settings button with the wrench).

A live graph will now show the incoming values from the selected sensor. To the right you can see the statistics of your experiment, including duration. The flashing Record button and pulsing green EV3 Brick Buttons Light indicate that your experiment is running. To stop your experiment, click the Center button.

When stopping your experiment, you will be asked to name your experiment or accept the default name. Once you are done, click OK and your experiment is now saved in the BrkDL__SAVE folder that can be accessed from the File Navigation screen (see page 25).

Sample rate

Sensor setup

Run experiment

NOTE:
The live graph is not supported when logging data at higher rates than ten samples per seconds. The incoming values will then only be shown as numbers.

EV3 TECHNOLOGY

EV3 Brick Interface

Settings

This screen will enable you to see and adjust various general settings on the EV3 Brick.

VOLUME

There may be occasions when you will want to adjust the volume of the sound coming from the EV3 Brick Speaker. To change the speaker volume, go to the Settings screen. As the top menu, Volume will already be highlighted. Press the Center button.

Use the Right and Left buttons to change the volume setting, which can be intervals from 0% to 100%. Press the Center button to accept. This will return you to the Settings screen.

SLEEP

To change the amount of inactive time that passes before the EV3 Brick goes into Sleep Mode, go to the Settings screen and navigate to the Sleep menu using the Down button. Press the Center button.

Use the Right and Left buttons to select a lower or higher time period, which can be intervals from 2 minutes to never. Press the Center button to accept. This will return you to the Settings screen.

Settings screen

Adjust volume

Adjust sleep

EV3 TECHNOLOGY

EV3 Brick Interface

BLUETOOTH
This is where Bluetooth is enabled on the EV3 Brick, and where you can choose some specific privacy and Apple iOS settings. Here you can also connect to other Bluetooth devices such as another EV3 Brick.

When you select Bluetooth on the Settings page, there are four options presented—Connections, Visibility, Bluetooth, and iPhone/iPad/iPod. To go back to the main Settings screen, press the Down button until the check mark at the bottom of the screen is highlighted, then press the Center button for OK.

Bluetooth
It is here that you enable standard Bluetooth on the EV3 Brick. Using the Up and Down buttons, select the word "Bluetooth," then press the Center button for OK. A check mark will appear in the Bluetooth box. Bluetooth is now enabled on your EV3 Brick, and a Bluetooth icon will be shown in the top left of the EV3 Brick Display.

Note: This setting will not allow you to connect to an iOS device. For this, you will need to select the iPhone/iPad/iPod setting (see below)!

To disable Bluetooth, repeat the above procedure, this time unchecking the Bluetooth box.

iPhone/iPad/iPod
Select this setting only if you specifically want your EV3 Brick to connect with Apple iOS devices—iPhones, iPads, and iPods—using Bluetooth (make sure Bluetooth is enabled on your iOS device).

Note: Using this setting will not allow you to communicate with other Bluetooth devices, including computers and other EV3 Bricks!

You cannot choose to enable both standard Bluetooth and Bluetooth communication for Apple iOS devices at the same time.

To enable and disable Bluetooth communication for iOS devices, use the Up and Down buttons to select "iPhone/iPad/iPod," then press the Center button for OK. A Bluetooth icon will be shown on the top left of the EV3 Brick Display.

Enable Bluetooth

NOTE:
Your EV3 Brick will run more efficiently if you disable the Bluetooth setting when it is not in use.

EV3 TECHNOLOGY

EV3 Brick Interface

Connections

This option allows you to discover and choose other available Bluetooth devices (make sure Bluetooth is enabled). If you click on "Connections," you will be taken to a Favorites screen, where the devices you trust are displayed and identified with a check mark. No passkeys are needed for your trusted devices. Using the check boxes, you can manage which devices you wish to have as Favorites.

If you then click on "Search," the EV3 Brick will scan the area for all detectable Bluetooth-emitting devices—including other EV3 Bricks. Your favorite devices will be shown with an asterisk "*" symbol.

Use the Up and Down buttons to select the device on the list you wish to connect to. Press the Center button for OK. If you choose to connect to a device not yet marked as a Favorite, you will be asked to enter the passkey to establish the connection. Once the other device verifies the passkey, you are automatically connected to the device.

Visibility

If the Visibility setting is selected, other Bluetooth devices (including other EV3 Bricks) will be able to discover and connect to your EV3 Brick. If Visibility is unchecked, the EV3 Brick will not respond to search commands from other Bluetooth devices.

Favorites list

Device list

EV3 TECHNOLOGY

EV3 Brick Interface

WI-FI

This is where you enable Wi-Fi communication on the EV3 Brick and connect to a wireless network. After selecting Wi-Fi on the Settings screen, use the Up and Down buttons to select the word "WiFi" and press the Center button for OK. A check mark will appear in the WiFi box. Wi-Fi is now enabled on your EV3 Brick, and a Wi-Fi icon will be shown in the top left of the EV3 Brick Display.

To go back to the main Settings screen, press the Down button until the check mark at the bottom of the screen is highlighted, then press the Center button for OK.

For information on how to connect your EV3 Brick to a wireless network, see the Connecting the **EV3 Brick to Your Computer** section on page 22.

BRICK INFO

When you need to know the current technical specifications of your EV3 Brick, such as hardware and firmware version and EV3 Brick OS build, this is where you will find that information. This is also where you can find out how much free memory you have available.

Enable Wi-Fi

Brick Info

EV3 SOFTWARE

While building robots is fun, the heart of robotics is bringing them to life—making them move and accomplish tasks. You will find the LEGO® MINDSTORMS® Education EV3 Software to be:

+ A visual and intuitive introduction to programming
+ A helpful and comprehensive data logging tool
+ A digital workbook where instructions are given and findings documented
+ A natural opportunity to inspire and show interest in the fields of science, technology, engineering, and mathematics.

Installing the Software

Once you have confirmed that your computer meets the minimum system requirements, you are ready to install the software. Close all other programs, then double-click on the installation file in the EV3 Software application folder. Installation will now begin.

TEACHER AND STUDENT EDITION
During the installation process you will be asked if you want to install the Teacher or Student Edition of the EV3 Software. On Macintosh, Teacher Edition can be selected when choosing Customized installation.

In the Teacher Edition you will find additional information and resources that can be useful in a classroom setting and in other teaching situations. You will also have extended Content Editor capabilities to access, create, and manage content used for teaching: for example, by making programs inaccessible to students. It is recommended that all educators install the Teacher Edition.

MINIMUM SYSTEM REQUIREMENTS

Prerequisites:
+ Silverlight 5.0 or newer
+ Microsoft Dot Net 4.0 or newer

Operating systems:
+ Windows: Windows XP, Vista, Windows 7, and Windows 8 (excluding Win RT) (32/64 bit) with the latest service packs
+ Macintosh: Mac 10.6, 10.7, and 10.8 with the latest service packs

System requirements:
+ 2 GB of RAM or more
+ 1.5 GHz processor or faster
+ Minimal supported screen resolution—1024*600

LEGO® MINDSTORMS® Education EV3 does not support tablets or certain netbooks with hardware that does not meet the above requirements.

EV3 SOFTWARE

Lobby

Every time you open the EV3 Software, you will automatically start out in the Lobby area. The Lobby makes it easy to locate and work with the software and gives you access to everything you need.

In the Lobby you will find the following options and resources:

1. **Lobby Tab**—This button always returns you to the Lobby.

2. **Activity Overview**—Here you can access, organize, and preview content and get started with a project.

   + Building instructions for the Core Models
   + Quick Start resources such as a small introduction video and the EV3 User Guide
   + File management, where you can start a new project or open an existing one
   + Robot Educator, with forty-eight step-by-step tutorials that explain how to use the EV3 Software and Hardware

3. **View**—This button takes you back to the Activity Overview.

4. **Search**—Find projects with specific content using different filter options

5. **www.LEGOeducation.com/MINDSTORMS**—A link to the official LEGO® MINDSTORMS® Education website.

Lobby overview
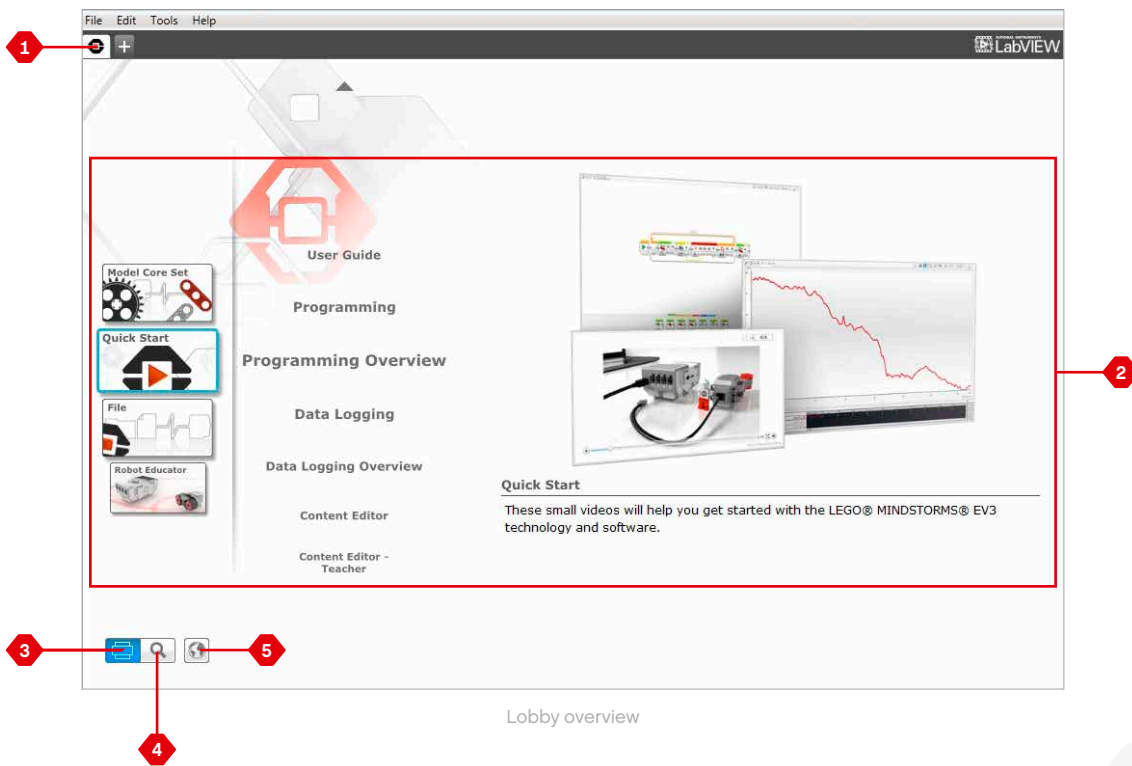
EV3 SOFTWARE

Project Properties and Structure

When you open a new program or experiment, it will automatically create a project folder file. All programs, experiments, images, sounds, videos, instructions, and other assets that are used within a project will automatically be stored in this project folder. This makes it easy to store your project and share it with others.

Each project will be displayed in the form of a tab at the top of the screen. Underneath, you will see tabs for the Programs and Experiments that belong to the selected Project. You can add a new Project, Program, or Experiment by clicking on the + button to the right of the other tabs. Clicking on an X will close the tab.

PROJECT PROPERTIES PAGE
If you click on the tab with the wrench to the far left of the Program and Experiment tabs, you will be taken to the Project Properties page. This page gives you an orderly display for the project that is currently selected, including all programs and experiments, images, sound, and other assets. Here you can describe your project with text, images, and video that will determine how the project shows up in the Lobby. In the Teacher version of the EV3 Software, the Project Properties page also allows you to restrict access to selected programs and other assets in your project.
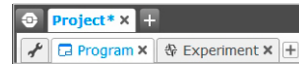
Project, Program and Experiment tabs

EV3 SOFTWARE

Project Properties and Structure

Project Properties displayed include:

1. **Project Description**—Give your project a title, describe it, and insert any images and video you would like to appear in the Lobby when the project is previewed.

2. **Project Content Overview**—Here you will find all assets included in the project: for example, programs, experiments, images, sounds, and My Blocks.

3. **Daisy Chain Mode**—This check box enables the Daisy Chain Mode, so you can program up to four connected EV3 Bricks.
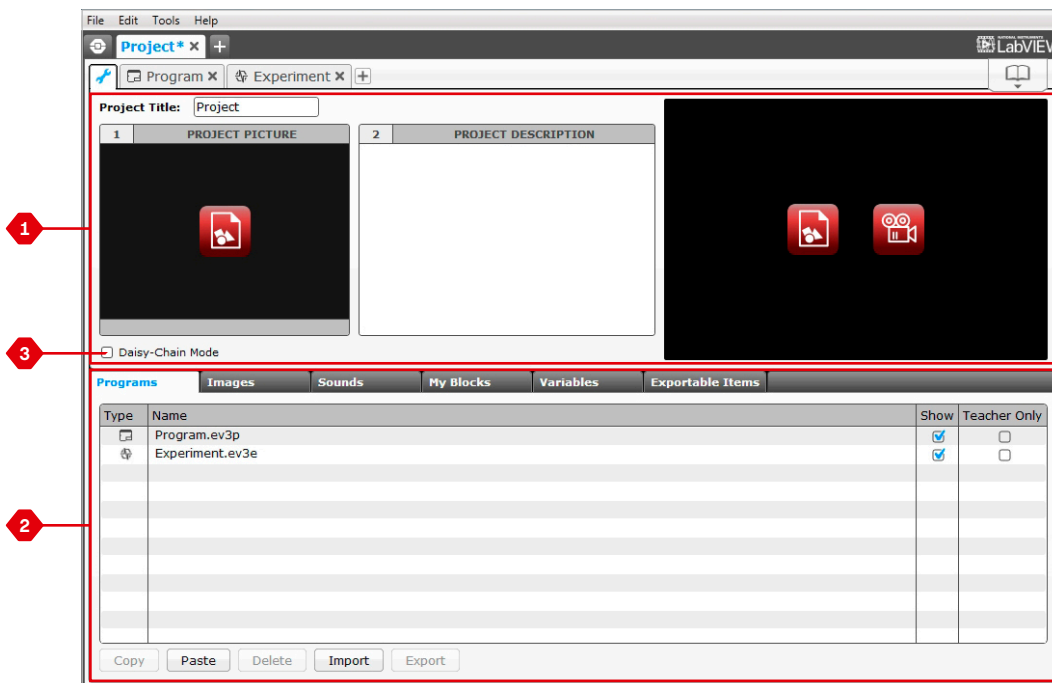
Project Properties page

EV3 SOFTWARE

Robot Educator

Robot Educator is the name of both the basic robot and the tutorials you will find in the EV3 Software. The Robot Educator learning tool is designed to take you through the essentials of programming, data logging, and hardware.

Robot Educator consists of forty-eight tutorials divided into the following categories: Basics, Beyond Basics, Hardware, Data Logging, and Tools. Each tutorial is structured in the following way:

+ Understanding the objective
+ Build and program your robot
+ Test it
+ Modify it

In the Robot Educator section in the Lobby, you can also find all related building instructions and a Teacher's Guide (only available in the Teacher version of the EV3 Software).
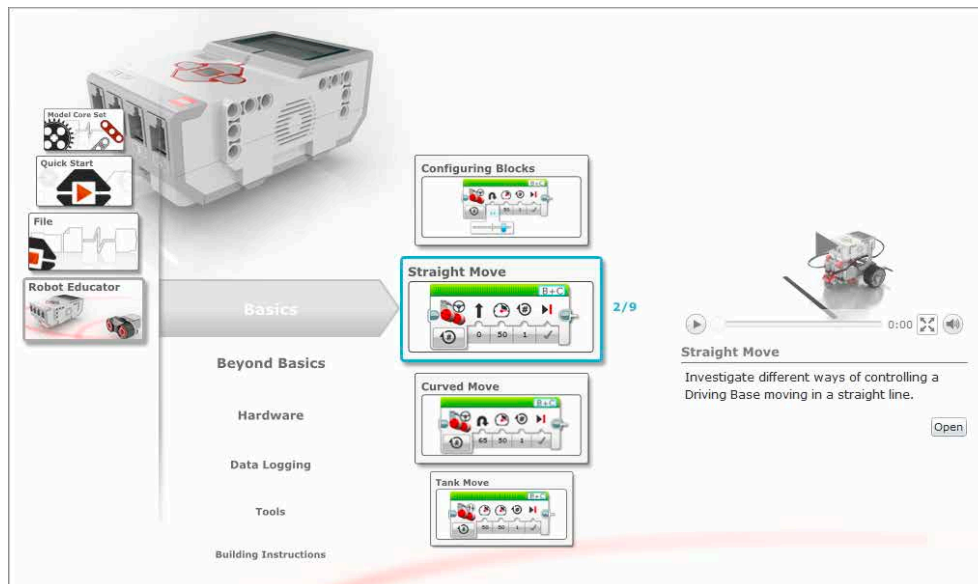
Robot Educator

EV3 SOFTWARE

Programming

Without a program, a robot is just a statue. It may be a cool statue, but it's still a statue. When you program a robot you give it abilities—to move, to follow lines, to avoid objects, to make mathematical calculations, and much more. The EV3 Software has an intuitive, graphics-based format that users from 10 to 100 years of age can quickly learn and successfully use.

The EV3 Programming environment consists of the following main areas:

1. **Programming Canvas**—Lay out your program here.
2. **Programming Palettes**—Find the building blocks for your program here.

3. **Hardware Page**—Establish and manage your communication with the EV3 Brick here and see what motors and sensors are connected where. This is also where you download programs to the EV3 Brick.
4. **Content Editor**—A digital workbook integrated into the software. Get instructions or document your project using text, images, and videos.
5. **Programming Toolbar**—Find basic tools for working with your program here. Learn more about these tools in the **EV3 Software Help**.
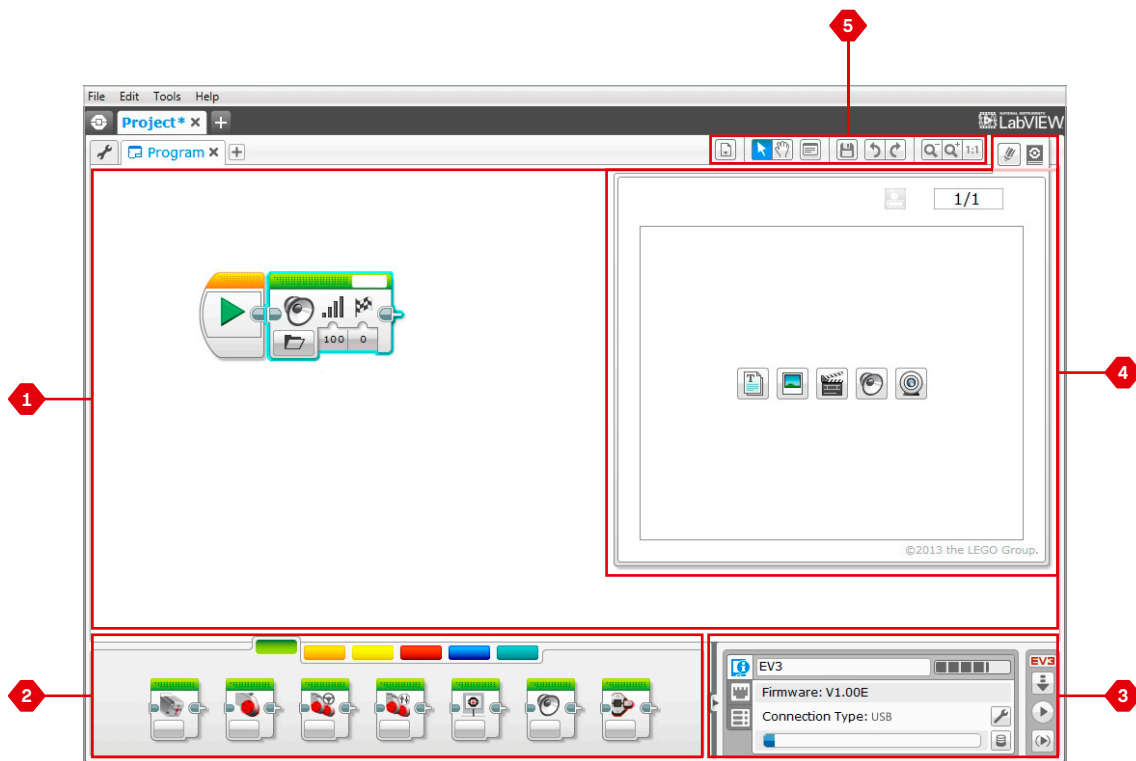
Programming environment

EV3 SOFTWARE

Programming Blocks and Palettes

All the programming blocks that are used for controlling your robot are located in Programming Palettes at the bottom of the Programming environment underneath the Programming Canvas. The Programming blocks are divided into categories according to type and nature, making it easy to find the block you need.

To learn more about the EV3 Programming environment and see how you can get started with your first program, see the **Programming** and **Programming Overview** videos in the Quick Start section of the Lobby.

You can also find more information about how to program in the **EV3 Software Help**.

ACTION BLOCKS
(In order from left to right)
+ Medium Motor
+ Large Motor
+ Move Steering
+ Move Tank
+ Display
+ Sound
+ Brick Status Light
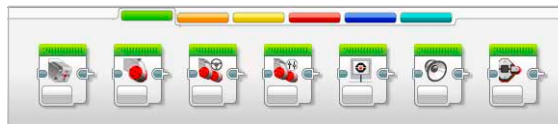
FLOW BLOCKS
(In order from left to right)
+ Start
+ Wait
+ Loop
+ Switch
+ Loop Interrupt

SENSOR BLOCKS
(In order from left to right)
+ Brick Buttons
+ Color Sensor
+ Gyro Sensor
+ Infrared Sensor
+ Motor Rotation
+ Temperature Sensor
+ Timer
+ Touch Sensor
+ Ultrasonic Sensor
+ Energy Meter
+ NXT Sound Sensor

EV3 SOFTWARE
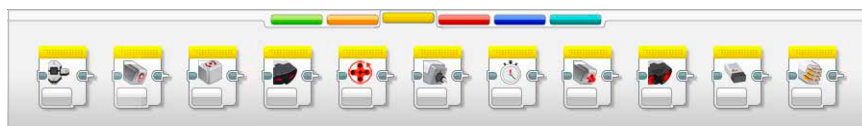
Programming Blocks and Palettes

DATA BLOCKS
(In order from left to right)
+ Variable
+ Constant
+ Array Operations
+ Logic Operations
+ Math
+ Round
+ Compare
+ Range
+ Text
+ Random
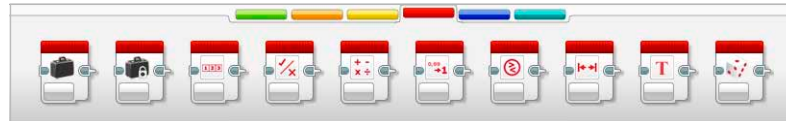
ADVANCED BLOCKS
(In order from left to right)
+ File Access
+ Data Logging
+ Messaging
+ Bluetooth Connection
+ Keep Awake
+ Raw Sensor Value
+ Unregulated Motor
+ Invert Motor
+ Stop Program
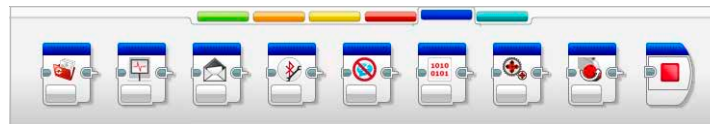
MY BLOCKS
When you are repeatedly using the same segment of a program in many programs, that is a good time to create a My Block. Once your My Block is created, you can simply insert that single block into future programs within the same project.

EV3 SOFTWARE

Data Logging

To data log is to collect information for analysis. For example, a weatherperson might collect temperature readings throughout the day, and then analyze it for a report on the evening news. Or a zookeeper might collect data on where visitors are spending their time at the zoo. The EV3 Software cannot only record data, it can help you to organize and analyze it.

The EV3 Data Logging environment consists of the following main areas:

1. **Graph Area**—This is where you see and analyze your data plots.
2. **Configuration Panel**—Here you set up your experiment, manage your dataset, and get access to Dataset Calculation and Graph Programming, special data logging functionalities.

3. **Hardware Page**—Establish and manage your communication with the EV3 Brick here and see what sensors are connected where. This is also where you download experiments to the EV3 Brick and upload data to the software.
4. **Content Editor**—A digital workbook integrated into the software. Get instructions or document your project using text, images, and videos.
5. **Data Logging Toolbar**—Find basic tools for working with your graph and experiment here. Learn more about these tools in the **EV3 Software Help**.
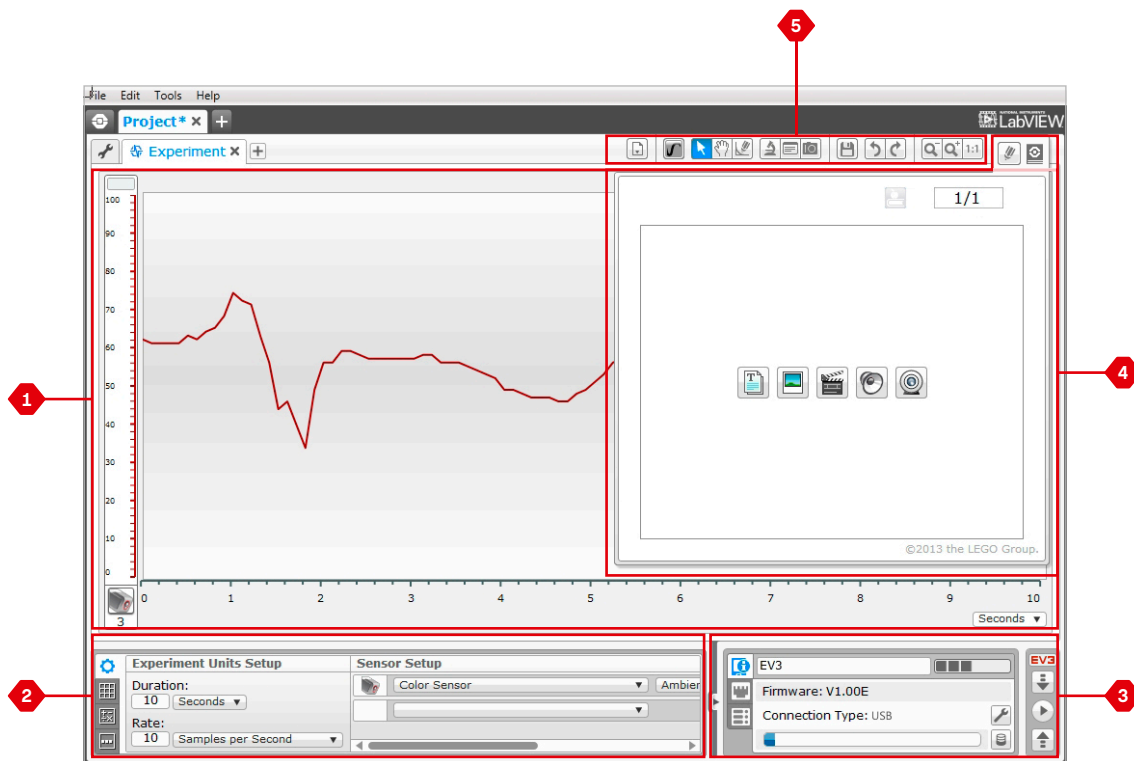
Data Logging environment

EV3 SOFTWARE

Data Logging

Configuration Panel

In the Configuration Panel, you will find four different tabs that will help you prepare, manage, and analyze your experiments. Some of the tabs are dynamic: they will automatically be shown when relevant. You will always be able to switch between tabs manually.

EXPERIMENT CONFIGURATION

Here you set up your experiment by selecting the sample duration and rate and choosing what sensors to collect data from. For each sensor, you also have to select sensor mode, since most sensors can provide different types of data.

DATASET TABLE

In addition to displaying the collected data in the graph area, a dataset will be shown in the Dataset Table. Here you can also rename the dataset, delete or hide it, and change plot style and color of the graphs.

DATASET CALCULATION

Here you can manipulate datasets and graphs by doing various calculations using numbers, functions, and other datasets. The output result will be displayed as both graph and dataset values.

GRAPH PROGRAMMING

By dividing your graph area in different zones, you can enable your sensor input to trigger or activate an output: for example, a motor or a sound from the EV3 Brick when the sensor values reach a certain level or threshold.

To learn more about the EV3 data logging environment and see how you can get started with your first experiment, see the **Data Logging** and **Data Logging Overview** videos in the Quick Start section of the Lobby.

You can also find more information about how to data log in the **EV3 Software Help**.

Experiment Configuration panel

Dataset Table panel

Dataset Calculation panel

Graph Programming panel

Hardware Page

The Hardware Page provides a range of information about your EV3 Brick. It is always located in the lower right-hand corner when working with both Programs and Experiments and can be collapsed when needed using the Expand/Collapse tab. Even when collapsed, the Hardware Page Controller will be visible, allowing you to download your program or experiment.

The different Hardware Page Controller buttons have the following functionality:

1. **Download**—Downloads the Program or Experiment to the EV3 Brick
2. **Download and Run**—Downloads the Program or Experiment to the EV3 Brick and runs it immediately
3. **Download and Run Selected**—Downloads only the highlighted blocks to the EV3 Brick and runs them immediately
4. **Upload**—Uploads your collected datasets from the EV3 Brick to your Experiment

The EV3 text in the small window at the top will turn red when an EV3 Brick is connected to your computer.
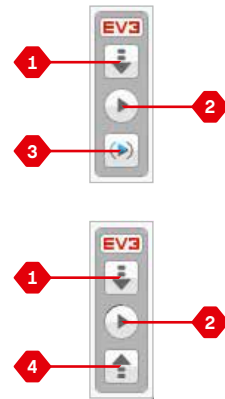
Hardware Page Controllers

EV3 SOFTWARE

Hardware Page

BRICK INFORMATION
The Brick Information tab displays important information about the EV3 Brick that is currently connected, such as EV3 Brick name, battery level, firmware version, connection type, and memory bar. It also gives you access to the Memory Browser and Wireless Setup tools.

Brick Information tab

PORT VIEW
The Port View tab displays information about the sensors and motors connected to the EV3 Brick. When your EV3 Brick is connected to the computer, this information is automatically identified and you will be able to see the live values. If your EV3 Brick is not connected, you can still set up the Port View tab manually. Select a port, then select the appropriate sensor or motor from the list.

Port View tab

AVAILABLE BRICKS
The Available Bricks tab shows the EV3 Bricks that are currently available for connection. You are able to choose which EV3 Brick you want to connect to and the type of communication. Also, you can disconnect an existing EV3 Brick connection.

You can find more information about how to use the Hardware Page in the **EV3 Software Help**.

Available Bricks tab

Content Editor

The Content Editor offers a convenient way for users to document the purpose, process, and analysis of their projects. You can include text, images, videos, sound effects, and even building instructions. It is also a convenient, paperless way for educators to monitor and evaluate student projects. Content Editor is also the place where already-made content—for example, Robot Educator tutorials and purchased LEGO® Education activity packs—is displayed and used.

Each page can be customized with different layouts and can automatically perform a range of actions, such as opening specific programs or highlighting a particular programming block.

The Content Editor is located in the top right corner of the EV3 Software and is available whether you are working with a Program or an Experiment. You open the Content Editor using the large button with the book icon. Once open, you will be able to see whatever content has been made for the project: for example, a Robot Educator tutorial.

The Content Editor consists of the following main areas and features:

1. **Open/Close Content Editor**—Here you open and close the Content Editor.

2. **Edit/View Mode**—Allows you to view or edit your pages.

3. **Page Navigation**—Go to the next or previous page.

4. **Teacher/Student Toggle**—Switch between the Student Page and Teacher Notes while viewing the content. This functionality is only available in the Teacher version of the EV3 Software.

5. **Page Title**—Add a title to your page.

6. **Page Area**—This is where the main content is shown and edited.

7. **Media Icons**—Select what content type you wish to add to the page area.

8. **Page Thumbnails**—Go to a specific page using the thumbnail images. In the Teacher version of the EV3 Software, Teacher Notes will also be available.

9. **Add/Delete Page**—When adding a page, you get to choose from fourteen different templates.

10. **Page Setup**—Make special settings for each page, such as format, page action, and navigation to the next page.

You can find more information about how to use the Content Editor in the **EV3 Software Help**.

Content Editor
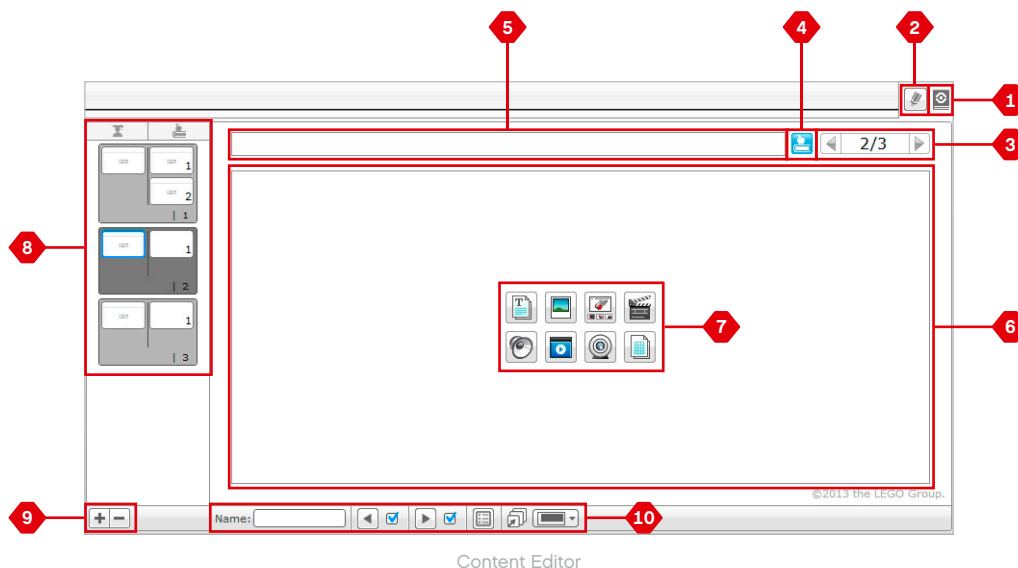
EV3 SOFTWARE

Tools

In the top menu bar of the EV3 Software you will find a number of small Tools that can add extra functionality and support to your EV3 Software experience.

You can learn more about most of the Tools in the **EV3 Software Help**.

SOUND EDITOR
Create your own sound effects or customize one from our selection of official EV3 Sound files. The sounds can then be used for programming your robot by use of the Sound Programming Block.

IMAGE EDITOR
Make creative use of the EV3 Brick Display by designing original images or customizing existing images. The images can then be used for programming your robot by the use of the Display Programming Block.

MY BLOCK BUILDER
Sometimes you make a great miniprogram that you want to use again in another project or program. My Block Builder helps you take this miniprogram and create a unique My Block where you define the name, icon, and parameters that are relevant for you. My Blocks will automatically be archived in the My Block Programming Palette.

FIRMWARE UPDATE
Periodically, updated firmware will become available for your EV3 Brick. We recommend that you install new versions as they become available. This tool will tell you if there is a new firmware version available and help you update it on your EV3 Brick.

WIRELESS SETUP
In case you wish your EV3 Software to communicate with your EV3 Brick using Wi-Fi, this tool will help set up the wireless connection. To do so, you will need to acquire a Wi-Fi USB dongle for the EV3 Brick and enable Wi-Fi communication on the EV3 Brick.

BLOCK IMPORT
Add new blocks to your Programming Palettes. This can be new LEGO® Programming Blocks or blocks developed by other manufacturers: for example, in relation to a third-party sensor. These Blocks first need to be downloaded to your computer—then you can import them into your EV3 Software using this tool.

MEMORY BROWSER
It is easy to lose track of what you have stored on your EV3 Brick. The Memory Browser provides an overview of memory use on your EV3 Brick (including an SD card if you have it inserted). You can use the Memory Browser to transfer programs, sounds, graphics, and other files between your EV3 Brick and a computer, and copy and delete files that are already on your EV3 Brick.

Tools

DOWNLOAD AS APP

Advanced users may enjoy the challenge of creating applications for generic tasks on the EV3 Brick. An EV3 Brick app is made as a normal EV3 program, but when downloaded to the EV3 Brick using this tool, it will show up as a new app in the Brick Apps screen, together with the default apps such as Brick Programming and Port View.

IMPORT BRICK PROGRAM

This tool will enable you to import a program made in the Brick Program App on the EV3 Brick to the EV3 Software programming environment. Your program can then be further refined using the full functionality of the EV3 Software.

DATA LOG FILE MANAGER

Use this tool to view, manage, and import datasets created by an experiment into your EV3 Software. This is used when collecting data remotely on the EV3 Brick. The Data Log File Manager can import datasets from the EV3 Brick, an SD card, or your computer.

REMOVE VALUES FROM DATASET

When collecting data from your sensors, you may later wish to remove certain values from a dataset. This might be done to narrow the range of sensor values you wish to further analyze or because your dataset contains sporadically invalid values generated by a sensor returning a default value when a real value cannot be measured.

CREATE DATA LOGGING PROGRAM

If you have an experiment that you would like to integrate into a program, this tool will help you. Rather than collecting data at the same place all the time, you may wish to program a robot to collect data from different areas in a room. This tool will transform your experiment into a Data Logging Programming Block on the Programming Canvas. You can now build your program.

EXPORT DATASETS

If you wish to work further with your dataset in another software tool (for example, Microsoft Excel), you can export any EV3 dataset to a comma-separated value (CSV) file format and save it on your computer. The CSV file can then be opened from within the chosen software. Make sure the software supports the CSV file format.

TROUBLESHOOTING

EV3 Software Help

Under Help at the top menu bar of the EV3 Software, you will find access to the EV3 Help section. The help section is a comprehensive and structured resource that provides helpful information about and guidance with all of the EV3 Software, including how to best use and program with sensors and motors. This is the first place to look if you need help or more information on how to use the EV3 Software.

Software Updates

Under Help at the top menu bar of the EV3 Software, you can enable the EV3 Software to automatically check for software updates. By clicking **Check for Software Updates**, a check mark will appear and the software will regularly check for software updates (this requires an Internet connection). If a relevant update is available, you will be notified by the software. If you wish to install this software update, you will be taken to a website where you can download the update file. Once downloaded, you can install the update. Make sure you have closed down your EV3 Software during installation.

TROUBLESHOOTING

Firmware Update

Firmware is the software that is inside the EV3 Brick. Without its firmware, the EV3 Brick will not work. Occasionally, the LEGO Group may release new versions of the firmware that add enhanced functions or fix software bugs.

To update the firmware, you need a USB connection from your computer to your EV3 Brick. Your computer must also be connected to the Internet.

1. Turn your EV3 Brick on and connect it to your computer.
2. Select Firmware Update in the Tools menu.
3. Click the Check button to see if new firmware updates are available.
4. Select the most recent firmware version from the Available firmware files.
5. If you want to use a firmware version located on your computer instead, use the Browse button to find and select the correct firmware file.
6. Click the Download button to download the new firmware to your EV3 Brick. The progress bars at the bottom of the Firmware Update dialog box will show you how the firmware update is proceeding. Once complete, your EV3 Brick will restart itself.

If for some reason your EV3 Brick stops working during the firmware update process, you will need to manually update the firmware by doing the following (the EV3 Brick still needs a USB connection to your computer):

1. Hold down the **Back**, **Center**, and **Right** buttons on the EV3 Brick.
2. When the EV3 Brick restarts, release the **Back** button.
3. When the screen says "Updating," release the **Center** and **Right** buttons and click the Download button in the Firmware Update tool. The firmware will be downloaded to your EV3 Brick, which will restart itself.

If the manual firmware update does not make your EV3 Brick work the first time, repeat the manual update process.
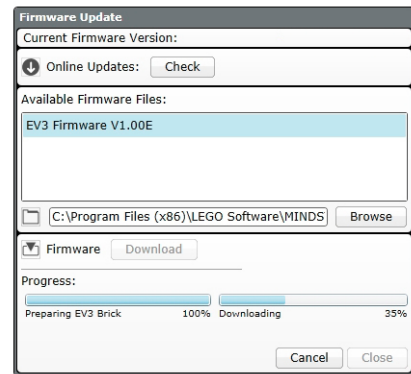
Firmware Update tool

NOTE:
Updating firmware will delete all existing files and projects in the EV3 Brick memory!

NOTE:
Check your EV3 Brick batteries before repeating manual firmware updates. The problem may simply be due to worn-down batteries!

TROUBLESHOOTING

Resetting the EV3 Brick

If your EV3 Brick suddenly stops working and cannot be shut down through the normal process, you will need to reset your EV3 Brick. Resetting the EV3 Brick does not delete existing files and projects from previous sessions in the EV3 Brick memory. Files and projects from the existing session will be lost.

1. Make sure that the EV3 Brick is turned on.
2. Hold down the **Back**, **Center**, and **Left** buttons on the EV3 Brick.
3. When the screen goes blank, release the **Back** button.
4. When the screen says "Starting," release the **Center** and **Left** buttons.

NOTE:
Check your EV3 Brick batteries before reinstalling firmware. Problems may simply be due to worn-down batteries!

USEFUL INFORMATION

Sound File List

ANIMALS

Cat purr	Dog whine	Snake hiss
Dog bark 1	Elephant call	Snake rattle
Dog bark 2	Insect buzz 1	T-rex roar
Dog growl	Insect buzz 2	
Dog sniff	Insect chirp	

COLORS

Black	White
Blue	Yellow
Brown	
Green	
Red	

USEFUL INFORMATION

Sound File List

COMMUNICATION

Bravo

EV3

Fantastic

Game over

Go

Good job

Good

Goodbye

Hello

Hi

LEGO

MINDSTORMS

Morning

No

Okay

Okey-dokey

Sorry

Thank you

Yes

EXPRESSIONS

Boing

Boo

Cheering

Crunching

Crying

Fanfare

Kung fu

Laughing 1

Laughing 2

Magic wand

Ouch

Shouting

Smack

Sneezing

Snoring

Uh-oh

USEFUL INFORMATION

Sound File List

INFORMATION

Activate	Error	Start
Analyze	Flashing	Stop
Backwards	Forward	Touch
Color	Left	Turn
Detected	Object	Up
Down	Right	
Error alarm	Searching	

MECHANICAL

Air release	Blip 4	Motor stop
Airbrake	Horn 1	Ratchet
Backing alert	Horn 2	Sonar
Blip 1	Laser	Tick tack
Blip 2	Motor idle	Walk
Blip 3	Motor start	

USEFUL INFORMATION

Sound File List

MOVEMENTS

Arm 1	Servo 1	Speed down
Arm 2	Servo 2	Speed idle
Arm 3	Servo 3	Speed up
Arm 4	Servo 4	Speeding
Drop load	Slide load	
Lift load	Snap	

NUMBERS

Eight	One	Three
Five	Seven	Two
Four	Six	Zero
Nine	Ten	

USEFUL INFORMATION

Sound File List

SYSTEM

Click

Overpower

Confirm

Power down

Connect

Ready

Download

Start up

General alert

USEFUL INFORMATION

Image File List

EXPRESSIONS

Big smile	Sad
Heart large	Sick
Heart small	Smile
Mouth 1 open	Swearing
Mouth 1 shut	Talking
Mouth 2 open	Wink
Mouth 2 shut	ZZZ
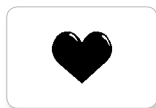
EYES

Angry	Dizzy	Neutral	Tired left
Awake	Down	Nuclear	Tired middle
Black eye	Evil	Pinch left	Tired right
Bottom left	Hurt	Pinch middle	Toxic
Bottom right	Knocked out	Pinch right	Up
Crazy 1	Love	Sleeping	Winking
Crazy 2	Middle left	Tear	
Disappointed	Middle right		
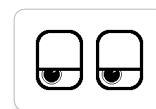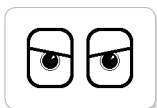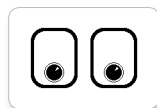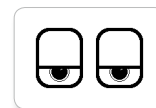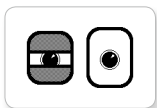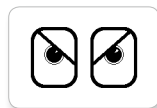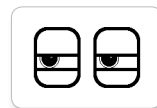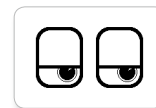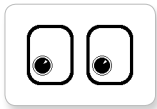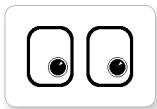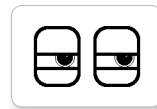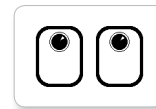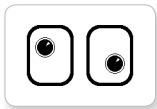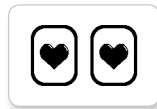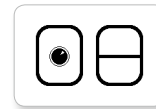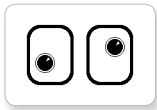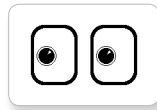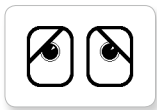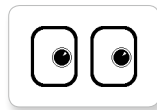
USEFUL INFORMATION

Image File List

INFORMATION

Accept	No go	Thumbs down
Backward	Question mark	Thumbs up
Decline	Right	Warning
Forward	Stop 1	
Left	Stop 2	

LEGO
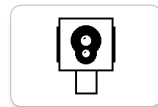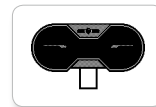
Color sensor	IR sensor	Sound sensor
EV3 icon	Large motor	Temp. sensor
EV3	LEGO	Touch sensor
Gyro sensor	Medium motor	US sensor
IR beacon	MINDSTORMS	
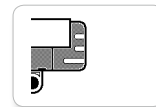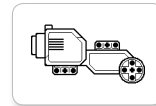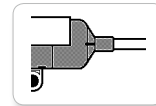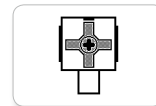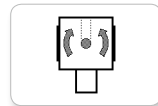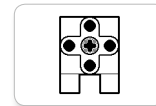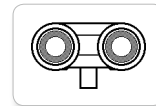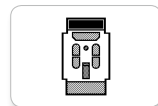
USEFUL INFORMATION

Image File List

OBJECTS

Bomb	Lightning
Boom	Night
Fire	Pirate
Flowers	Snow
Forest	Target
Light off	
Light on	
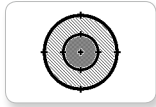
PROGRESS
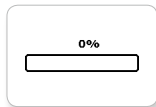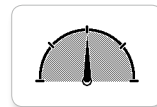
0% **Bar 0**	Dial 2	Hourglass 0	Timer 4
25% Bar 1	Dial 3	Hourglass 1	Water level 0
50% Bar 2	Dial 4	Hourglass 2	Water level 1
75% Bar 3	Dots 0	Timer 0	Water level 2
100% Bar 4	Dots 1	Timer 1	Water level 3
Dial 0	Dots 2	Timer 2	
Dial 1	Dots 3	Timer 3	
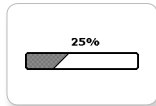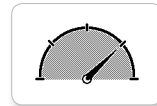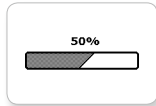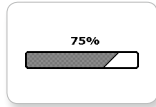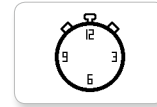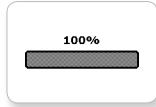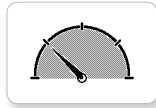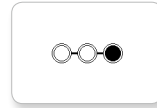
USEFUL INFORMATION

Image File List

SYSTEM

Accept 1	Dot empty	Slider 0	Slider 6
Accept 2	Dot full	Slider 1	Slider 7
Alert	EV3 small	Slider 2	Slider 8
Box	Busy 0	Slider 3	
Decline 1	Busy 1	Slider 4	
Decline 2	Play	Slider 5	
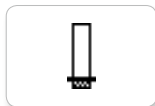
USEFUL INFORMATION

Brick Program App–Assets List

SOUNDS

1. Hello

7. Object

2. Goodbye

8. Ouch

3. Fanfare

9. Blip 3

4. Error alarm

10. Arm 1

5. Start

11. Snap

6. Stop

12. Laser

IMAGES
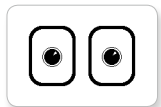
1. Neutral

7. Question mark
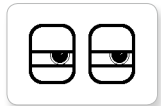
2. Pinch right

8. Warning
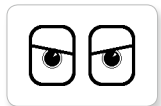
3. Awake

9. Stop 1

4. Hurt

10. Pirate

5. Accept

11. Boom

6. Decline

12. EV3 icon

Element List

10x
Bushing, ½-module, yellow
4239601

10x
Bushing, 1-module, gray
4211622

60x
Connector peg with friction,
2-module, black
4121715

10x
Connector peg,
2-module, gray
4211807

8x
Connector peg with axle,
2-module, beige
4666579

6x
Connector peg,
3-module, beige
4514554

20x
Connector peg with friction/axle,
2-module, blue
4206482

30x
Connector peg with friction,
3-module, blue
4514553

22x
Connector peg with bushing,
3-module, red
4140806

2x
Axle with stud,
3-module,dark beige
6031821
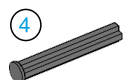
4
2x
Axle with stop,
4-module, dark gray
4560177
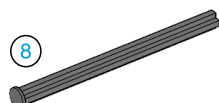
8
2x
Axle with stop,
8-module, dark gray
4499858

10x
Axle, 2-module, red
4142865

3
14x
Axle, 3-module, gray
4211815

4
4x
Axle, 4-module, black
370526
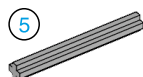
5
6x
Axle, 5-module, gray
4211639

6
4x
Axle, 6-module, black
370626
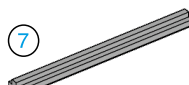
7
5x
Axle, 7-module, gray
4211805

8
2x
Axle, 8-module, black
370726
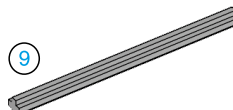
9
2x
Axle, 9-module, gray
4535768

10
2x
Axle, 10-module, black
373726
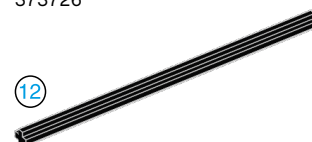
12
2x
Axle, 12-module, black
370826

4x
Pointer, 3-module, white
4173941

4x
T-Beam, 3x3-module, black
4552347

4x
Beam with crosshole,
2-module, black
6006140

2x
Beam, 3-module, black
4142822

USEFUL INFORMATION

4x
Beam, 3-module, green
6007973

4x
Beam, 3-module, red
4153718

4x
Beam, 3-module, blue
4509376

4x
Beam, 3-module, yellow
4153707
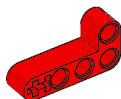
6x
Angular beam,
2x4-module, red
4141270
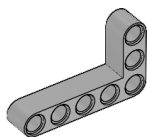
2x
Angular beam,
3x5-module, gray
4211713
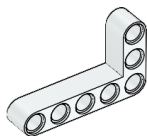
4x
Angular beam,
3x5-module, white
4585040
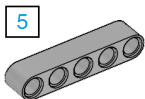
5

4x
Beam, 5-module, gray
4211651
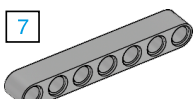
7

4x
Beam, 7-module, gray
4495930
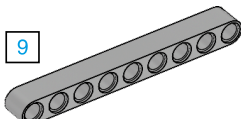
9

6x
Beam, 9-module, gray
4211866
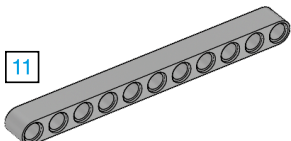
11

4x
Beam, 11-module, gray
4611705
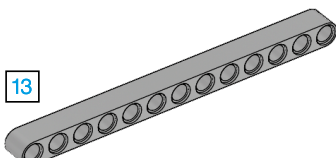
13

6x
Beam, 13-module, gray
4522934
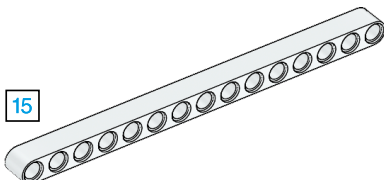
15

6x
Beam, 15-module, white
4542578
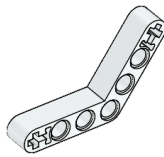
6x
Angular beam,
4x4-module, white
4509912
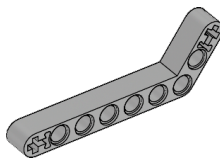
4x
Angular beam,
3x7-module, gray
4211624
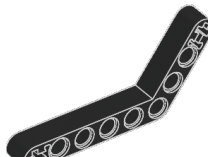
4x
Angular beam,
4x6-module, black
4112282
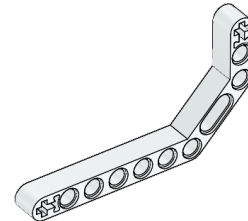
4x
Double angular beam,
3x7-module, white
4495412
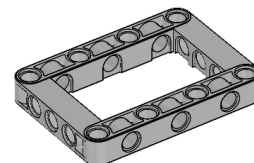
3x
Frame,
5x7-module, gray
4539880
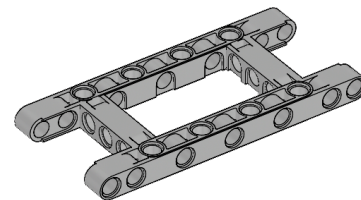
1x
Frame,
5x11-module, gray
4540797

USEFUL INFORMATION

4x
Double connector peg,
3-module, gray
4560175

6x
Double connector peg,
3x3-module, gray
4225033

4x
Angular connector peg,
3x3-module, gray
4296059

8x
Cross block,
2-module, gray
4211775

8x
Cross block,
3-module, dark gray
4210857

6x
Cross block,
3x2-module, gray
4538007

8x
Double cross block,
3-module, black
4121667

4x
Cross block fork,
2x2-module, black
4162857

4x
Cross block,
2x2-module, black
4140430

2x
Cross beam,
2x1-module, red
6008527

2x
Connector peg with handle,
3-module, black
4563044

2x
½ beam,
4-module, black
4142236

4x
½ triangle beam,
5x3-module, gray
6009019

2x
3-spoke angular block,
3x120°, gray
4502595

4x
Tube, 2-module, gray
4526985

6x
Bushing/axle extender,
2-module, red
4513174

4x
Angular block 1, 0°,
black
4107085

4x
Angular block 2, 180°,
black
4107783

2x
Angular block, 6 (90°), black
4107767

4x
Rubber beam with crossholes,
2-module, black
4198367

4x
Gear, 8-tooth, dark gray
4514559

2x
Bevel gear, 12-tooth, beige
4565452

4x
Gear, 16-tooth, gray
4640536

4x
Gear, 24-tooth, dark gray
4514558

USEFUL INFORMATION
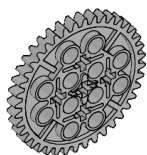
2x
Gear, 40-tooth, gray
4285634

2x
Double bevel gear,
12-tooth, black
4177431

2x
Double bevel gear,
20-tooth, black
4177430

2x
Double bevel gear,
36-tooth, black
4255563

2x
Worm gear, gray
4211510

4x
Gear, 4-tooth, black
4248204

2x
Turntable bottom,
28-tooth, gray
4652235

2x
Turntable top,
28-tooth, black
4652236

4x
Sprocket,
40.7x15 mm, black
4582792
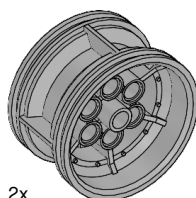
2x
Hub,
43.2x26 mm, gray
4634091
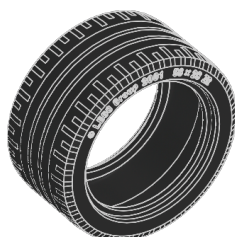
2x
Low profile tire,
56x28 mm, black
6035364

4x
Tire, 30.4x4 mm, black
6028041

4x
Hub, 24x4 mm, dark gray
4587275

1x
Steel Ball, silver metalic
6023956

1x
Ball bearing, dark gray
4610380

54x
Track, 5x1,5-module, black
6014648

1x
Left curved panel,
3x5-module, black
4566251

1x
Right curved panel,
3x5-module, black
4566249

1x
Right curved panel,
5x11-module, black
4543490

1x
Left curved panel,
5x11-module, black
4541326

USEFUL INFORMATION
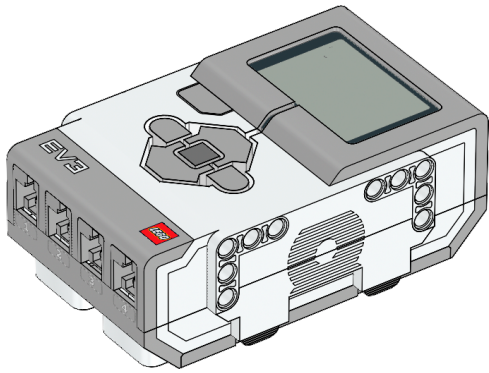
1x
EV3 Brick
6009996
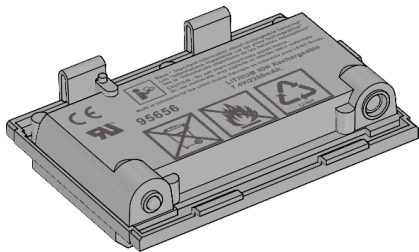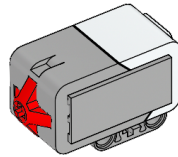
1x
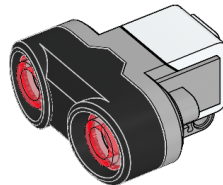Rechargeable Battery
6012820
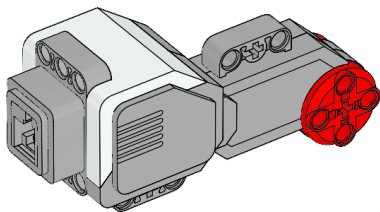
2x
Large Motor
6009430
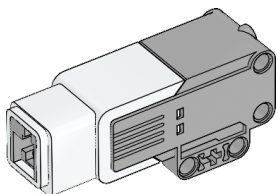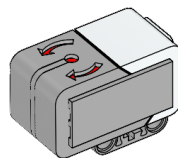
1x
Medium Motor
6008577
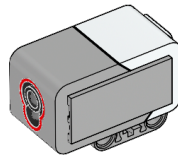
1x
Color Sensor
6008919

2x
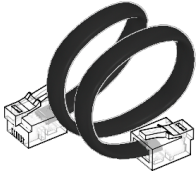Touch Sensor
6008472

1x
Ultrasonic Sensor
6008924

1x
Gyro Sensor
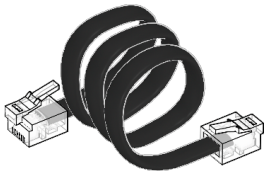6008916

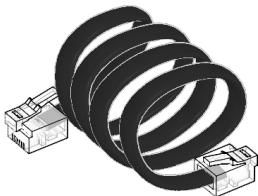# USEFUL INFORMATION

25 cm / 10 in.

4x
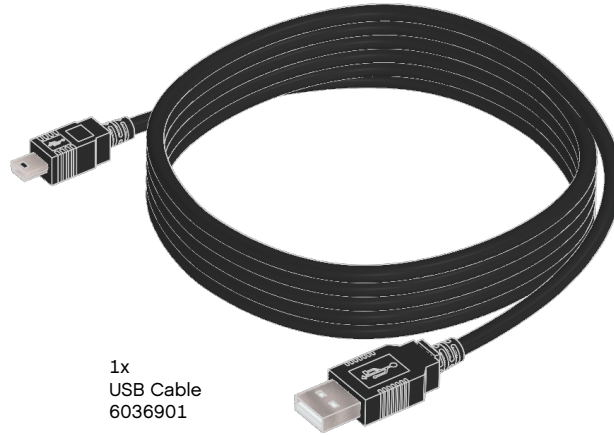Cable, 25 cm / 10 in.
6024581

35 cm / 14 in.

2x
Cable, 35 cm / 14 in.
6024583

50 cm / 20 in.

1x
Cable, 50 cm / 20 in.
6024585

1x
USB Cable
6036901

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iPod Touch (4th gen.)   iPad 1
iPhone 4   iPad 2
iPhone 4S   iPad 3 (3rd gen.)