

## What is EVShield

EVShield is a shield designed for Arduino to control NXT and EV3 Motors and operate NXT and EV3 Sensors.



EVShield works with Arduino Duemilanove, Arduino Uno (or Uno R3) or Arduino clones with similar form factor.

## Connections and Placement

EVShield is designed to connect directly over Arduino board by connecting over it's header pins. You can use it jointly with other shields, provided there is no conflict between Arduino pins used by the two shields. (Refer to 'Arduino Pins Used by EVShield' section for details).

### Supplying power to your EVShield

The EVShield has Green terminals to connect external battery; this battery will also supply power to attached Arduino.

You do not need to power Arduino with different power source; however supplying external power to Arduino (such as through USB) is also ok.



### NOTE

EVShield is rated for external power supply of 10.5 volts DC max. Ensure to not exceed this value. While connecting external battery, ensure correct polarity.

While using motors or servos, at least 6.6 volts power is needed.

### Recommended Battery Options

6AA batteries (rechargeable or non-rechargeable).

To hold and mount these batteries, you can purchase a holder with LEGO mounts as shown here from [openelectrons.com](http://openelectrons.com) website.



8.4 V Li-Ion battery or 9.6Volts Ni-CD or Ni-MH RC rechargeable battery. You can buy such battery and it's charger in local toy store.



### Mounting EVShield on your contraption

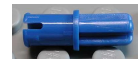
The holes on the EVShield enclosure are designed for tight fit of Technic pins (or axles) with '+' cross section. The holes however are not designed for repeated insertions/removals of these pins.

To mount EVShield on your contraption we suggest that you use two dark gray 'Technic Axle 3 with Stud' as shown.



Insert axles from the top of the device and secure with a bushing on the back or mount it on your contraption directly.

Alternately, you may use blue 'Technic Axle Pin with Friction', as shown.



While disassembling contraption, leave the pins on the device.

### Architecture Highlights

- EVShield has two banks for motor and sensor ports (Bank-A and Bank-B). Each bank has its own I2C address. Each bank has two EV3 motor ports and 2 sensor ports. (Total 4 motors and 4 sensor ports, You can also connect NXT motors in the motor ports).
- EVShield has four switches: Reset switch is connected to Arduino Reset pin and used to reset the program running on Arduino. GO switch is used to wait in the beginning before you run the program. The Left input and Right input switches can be programmed to suit your needs.

### Feature Highlights

Table below lists the important features provided by the EVShield. To use these features in your specific programming environment, please refer to API help file or program header file.

Feature	Description
Timed Control of each motor	Each motor can be run for a specified duration of time.
Encoder control of each motor	Each motor can be run from its current Encoder position to a new position (with or without a specific speed).
Speed control of each motor	Speed of each motor can be controlled in timed run or encoder based run.
Brake Vs Float while stopping the motors	Each motor can be set to Brake (where motor shaft can not be turned easily), Vs Float (where motor shaft is free to rotate by external force).
Holding Encoder position	At the end of run, hold the encoder position (i.e. motor turned by external force is restored to last set encoder position).
Turning motor by degrees	Move it in forward or reverse direction.
Turning motor by rotations	360 degrees makes one rotation.
Running operations asynchronously	While a motor is running other operations may be performed.
Running motors for unlimited duration.	While motors are running, you can also perform other operations. <b>NOTE: When motors are set to run for 'Unlimited Duration', they will continue to run until a Stop command is issued (or power is disconnected). In other words, after starting the motors for 'Unlimited Duration' if your program does something else without stopping the motors, they will continue to run.</b>
Stopping motors abruptly.	
Reading Motor Encoders	You can read the value of each encoder from the EVShield.
Reading from I2C sensors	You can read from various I2C sensors connected to EVShield.
Reading from EV3 Sensors	You can connect EV3 Sensor to your EVShield and read from it.
Reading from NXT Analog Sensors	You can connect analog sensors to EVShield and read from them.
Note: Old NXT Ultrasonic sensor can not be used with EVShield.	

## Programming for EVShield

### Arduino Programming Environment

EVShield uses Arduino Software for programming.

If you have not already, visit following webpage, and download the Arduino Programming environment software for your operating system:

<http://arduino.cc/en/Main/Software>

Follow the instructions at that webpage to install it on your computer.

### EVShield Programming Library

EVShield provides several features which are accessible through C/C++ EVShield library. If you have not already, visit following webpage, and download latest library, example programs and utilities from following location.



<https://github.com/openelectrons/EVShield>

Follow the instructions at that webpage to install it on your computer.

### What this zip Contains -

1) **EVShield library folder** contains library header files and class files. Use these header files in your program. You should refer to these classes and learn from them. If you need to add advanced features to EVShield library, this is where you will have to add them. For normal use you shouldn't have to edit files in this library.

2) **EVShield\_examples folder** contains various example programs. Use these programs as a reference or a starting point for your own programs. Feel free to modify them to suit your needs.

3) **Programming API Guide**: Open the file -

<Your Arduino-folder>\libraries\EVShield\html\index.html in your browser to access the class reference.

## Need Help Programming?

### EVShield Programming API Guide

The latest on-line API guide is available at following url:

<http://www.openelectrons.com/EVShield/html/>

This guide is also available with you when you download and install the library. It will be located at:

<Your Arduino-folder>/libraries/EVShield/html/index.html

Also refer to **EVShield-Library-Tutorial.pdf** from following location.

[http://www.openelectronics.com/index.php?module=documents&JAS\\_DocumentManager\\_op=viewDocument&JAS\\_Document\\_id=25](http://www.openelectronics.com/index.php?module=documents&JAS_DocumentManager_op=viewDocument&JAS_Document_id=25)

#### **More EVShield Resources**

Are available here:

<http://www.openelectronics.com/EVShield>

### **Current Characteristics**

Average current consumption of this device is about 5.0 mA.  
EVShield can deliver upto 1 Amp current per NXT Motor attached.  
Drawing of excessively large current (such as incorrect motors or stalled motors) will result in internal shutdown until the situation is corrected.

### **I2C Bus address**

**Factory Default Address of Bank-A: 0x34**

**Factory Default Address of Bank-B: 0x36**