

What is NXShield

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

There are different models of NXShield, designed to work with different Arduino boards as follows:



Model Name	Supported Arduino boards
NXShield (or NXShield-D)	Arduino Duemilanove Arduino Uno (or clones with similar form factor)
NXShield-M	Arduino Mega2560 Android ADK

Connections and Placement

NXShield is designed to connect directly over Arduino board by connecting over its 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 NXShield' section for details).

Supplying power to your NXShield

The NXShield 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

NXShield 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 NXT mounts as shown here from Mindsensors.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 NXShield on your contraption

The holes on the NXShield 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 NXShield 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

- NXShield has two banks for motor and sensor ports (Bank-A and Bank-B). Each bank has its own I2C address. Each bank has two NXT motors and 2 sensor ports. (Total 4 motors and 4 sensor ports).
- NXShield 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.
- The NXShield supports two variants of I2C protocol - Hardware I2C and Software I2C. The protocol is chosen in your sketch.

Feature Highlights

Table below lists the important features provided by the NXShield. 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. 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.
Stopping motors abruptly.	
Reading Motor Encoders	You can read the value of each encoder from the NXShield.
Reading from NXT I2C sensors	You can read from various I2C sensors connected to NXShield.

Feature	Description
Reading from NXT Ultrasonic Sensor	You can connect one NXT Ultrasonic Sensor to your NXShield and read from it.
Reading from NXT Analog Sensors	You can connect analog sensors to NXShield and read from them.

Programming for NXShield

Arduino Programming Environment

NXShield uses Arduino Software for programming.

If you have not already, visit following webpage, and download the Arduino Programming environment software for your operating system (as of this writing, the software version is 0022):

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

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

NXShield Programming Library

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



<http://sourceforge.net/projects/nxshield/files/AVR/>

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

What this zip Contains -

NXShield_AVR 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 NXShield library, this is where you will have to add them. For normal use you shouldn't have to edit files in this library.

NXShield_AVR_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.

Need Help Programming?

NXShield Programming API Guide for AVR Arduinos

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

http://nxshield.svn.sourceforge.net/viewvc/nxshield/NXShield_AVR/html/index.html

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

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

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

http://www.openelectrons.com/index.php?module=documents&JAS_DocumentManager_op=viewDocument&JAS_Document_id=1

More NXShield Resources

Are available here:

http://www.openelectrons.com/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=7

Current Characteristics

Average current consumption of this device is about 5.0 mA.
NXShield 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: 0x06

Factory Default Address of Bank-B: 0x08