



What is PiStorms

PiStorms is a shield (or a HAT) designed for the Raspberry Pi to control NXT and EV3 Motors and operate NXT and EV3 Sensors. PiStorms works with Raspberry Pi model A+, model B+, and 2 model B.



Connections and Placement

PiStorms is designed to connect directly with Raspberry Pi board by connecting over its GPIO header pins. You can use it jointly with other hardware that uses GPIO pins, provided there is no conflict between Raspberry Pi pins used by PiStorms. (Refer to 'Raspberry Pi Pins Used by PiStorms' section for details).

Supplying power to your PiStorms

Do NOT supply power to the PiStorms unless you are completely sure the Raspberry Pi GPIO pins are correctly inserted into the PiStorms. Doing so may result in permanent damage to the Raspberry Pi.

The PiStorms has green terminals to connect an external battery; this battery will also supply power to attached Raspberry Pi. You do not need to power the Raspberry Pi with a different power source; however supplying external power to Raspberry Pi (such as through USB) is also ok.



NOTE

**Nominal PiStorms Power requirement: 8 Volts, 1.5 Amps
While using motors, at least 6.8 volts, 1.5 Amps power is needed.**

While connecting external battery, ensure correct polarity.

PiStorms is rated for external power supply of 10.5 volts DC max for sensors and motors (never exceed this voltage limit). Above 9V the touch screen may flicker. Ensure to not exceed this value.

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 the mindsensors.com website.

Rechargeable battery Pack designed for PiStorms. This battery pack comes with a charging adapter.



You can order it here:

<http://www.mindsensors.com/products/174-rechargeable-battery-pack>

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 PiStorms on your contraption

The PiStorms fits directly on to the GPIO header pins of the Raspberry Pi. The PiStorms Frame allows users to connect LEGO parts. The PiStorms Frame has holes that are compatible with LEGO mindstorms products.



[PiStorms Frame Assembly Instructions](#)

Architecture Highlights

- PiStorms 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 and supported NXT Sensors in the sensor ports).
- PiStorms has one button/switch. The button must be pressed once upon start up to establish connection to the Raspberry Pi. You can also shutdown the Raspberry Pi by holding the button for approximately 10 seconds.
- PiStorms is equipped with a 2.4 inch LCD touchscreen.
- PiStorms has 1 LED (located in the corner of bank A for newer models and bank B for older models) that when programming, can be accessed from either bank.

Feature Highlights

The table below lists important features provided by the PiStorms. 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 PiStorms.
Reading from I2C sensors	You can read from various I2C sensors connected to PiStorms.
Reading from EV3 Sensors	You can connect EV3 Sensors to your PiStorms and read from it.
Reading from NXT Analog Sensors	You can connect analog sensors to PiStorms and read from them.

Feature	Description
Note: Old NXT Ultrasonic sensor can not be used with PiStorms.	
2.4" LCD touchscreen	Open programs and interact with the PiStorms with built in 2.4" LCD touchscreen.

Current Characteristics

Average current consumption of this device is about 5.0 mA. PiStorms can deliver up to 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

PiStorms Software Downloads and Upgrades

PiStorms Software is available in three different forms!

1. Pre-configured image - ready for use operating system image.
2. Manual installation - when you already have data on your SD card.
3. Developer Installation - for advanced users that wish to modify and share PiStorms software (GitHub).

PiStorms software will run on a standard Raspbian Operating system (Jessie).

Download the pre-configured PiStorms image at

<http://www.mindsensors.com/largefiles/pistorms.zip>, and write the image to an SD card.

To write this file to your SD card, please follow instructions from following page:

<https://www.raspberrypi.org/documentation/installation/installing-images/>

Basically, you need to download and install Win32DiskImager utility on Windows, and 'Write' the SD card with pistorms iso file. be sure to unzip the downloaded zip file before you do this, (the zip contains the .iso file)

Note: This file is about 1.6GB compressed. To uncompress use a Windows 7 or higher Computer.

If using Windows XP, you may need WinZip or 7-Zip.

If using older Mac, you may need uncompression software, such as:

<https://itunes.apple.com/us/app/the-unarchiver/id425424353?mt=12>

If you already have Jessie installed on your Pi,

Ensure that you have expanded the file system on your SD card.

Open a browser on your computer and visit following url:

<http://www.mindsensors.com/largefiles/updater/>

find the latest release of software from this page and make a note of the filename.

Login to your Pi and issue command:

```
cd /home/pi
wget
http://www.mindsensors.com/largefiles/updater/fileName
```

(use the *fileName* as you noted above)

This will download the latest release on your Pi.

unzip the release file, and install as follows:

```
cd /home/pi
tar -zxvf fileName
cd /home/pi/PiStorms/setup
chmod +x setup.sh
./setup.sh
```

It will take a few minutes to install the software.

PiStorms Developer Software is available on GitHub.

Follow the instructions at the url below to install the developer software.

<https://github.com/mindsensors/PiStorms>

PiStorms Python API Reference

The PiStorms Python API library reference is at following url:

<http://www.mindsensors.com/reference/PiStorms/html>

PiStorms Scratch Reference

The PiStorms Scratch Interface Reference Guide can be found at the following address:

<http://www.mindsensors.com/pdfs/PiStorms%20-%20ScratchProgrammingGuide.pdf>