Pi Co-op
Raspberry Pi Arduino
Add-on Board

Version 1.02

Welcome

The Pi Co-op is an Arduino compatible microcontroller expansion board for the Raspberry Pi. The Pi Co-op makes it much easier to hook up electronics to the Raspberry Pi than using the GPIO pins directly, and provides a powerful programmable microcontroller that can take care of your low level hardware whilst the Pi focuses on the higher level computation. The Pi Co-op brings the worlds of the Raspberry Pi and the Arduino together, and means that you don't have to make the false choice between an Arduino or a Pi for your next project. Use the best bits of both!

Features

- Atmega328p microcontroller preprogrammed with the Arduino Uno bootloader
- 10bit 8 channel Analog to Digital Converter (ADC)
- Can be programmed directly from the Raspberry Pi using the free Arduino IDE
- Level shifted UART for fast communication between the Pi and Pi Co-op at a baud rate of up to 115200bps
- Atmega328p pins broken out to female headers for easy prototyping, just plug in wires or connect directly to a breadboard.
- Power line incorporates the same type of fuse used on the Pi MicroUSB connector (700mA hold current, 1100mA trip current). This allows the Pi to be safely powered from an external 5V supply attached to the Pi Co-op.
- Standard spacing of 2.54mm between all headers allows expansion boards to be created easily using copper stripboards.

Getting Started Quickly

This part of the manual aims to get you up and running with the Pi Co-op as quickly as possible. We show you how to connect the Pi Co-op and how to use the Arduino IDE to program the Pi Co-op with a simple blinking LED program. Later parts of the manual explain more advanced configuration and programming options for the Pi Co-op.

Connecting the Pi Co-op

Make sure that the power is disconnected from your Raspberry Pi. Then plug your Pi Co-op onto the GPIO header pins of the Raspberry Pi so that the yellow video connection of the Pi fits into the space cut out of the corner of the Pi Co-op. Take care to ensure that the 26-pin connectors of the Pi and Pi Co-op fit together precisely before turning the Pi back on. **Warning:** Failure to perform this step correctly may result in permanent damage to both your Pi, and your Pi Co-op.

Installing the Software

You have a number of options for configuring your Pi and installing the required software in order to be able to program your Pi Co-op.

Option 1 - You can configure an existing installation of Raspbian using the instructions given in the section entitled **Simple Installation Process** below.

Option 2 - You can download an SD card image from our website, and copy it to an SD card, or buy a preloaed SD card from our store. This SD card has Raspbian loaded, and is preconfigured to work with the Pi Co-op.

Option 3 - If you're not using Raspbian, you can follow the more in depth configuration process given in **Appendix A**. This describes all of the configuration steps we perform using a script in the simple installation process, and should hopefully give you the information you need to use the Pi Co-op with your own Linux setup.

Simple Installation Process

We assume that you are following these steps on an installation of Raspbian which boots into a graphical desktop. The instructions make use of a script designed to simplify the configuration process. Please note that this script has only been tested, and confirmed to work on Raspbian. It may cause problems or fail entirely on other Linux distributions.

Open up an LXTerminal window and run the following commands

```
sudo apt-get update
sudo apt-get install arduino git
```

This will install the Arduino IDE and some supporting Python libraries. Now run the following commands

```
git clone https://bitbucket.org/DawnRobotics/pi_co-op.git
cd pi_co-op
sudo python setup_pi_co-op.py install
```

This will alter configuration files to allow us to use the serial port on the GPIO pins of the Pi. Finish the configuration by restarting the Raspberry Pi

```
sudo reboot
```

If everything goes well, then you will now be ready to start programming the Pi Co-op. If you have problems, then please check out the Dawn Robotics support forum for possible solutions.
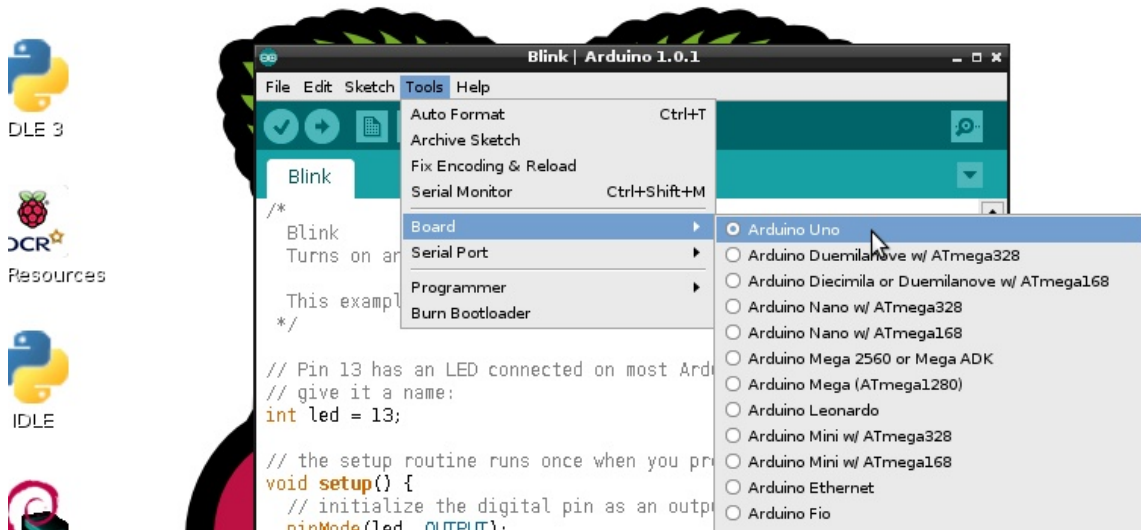
Programming the Pi Co-op

Start up the Arduino IDE. This can either be done by choosing it from the desktop start menu (**Programming > Arduino IDE**), or by opening up a terminal window and typing in
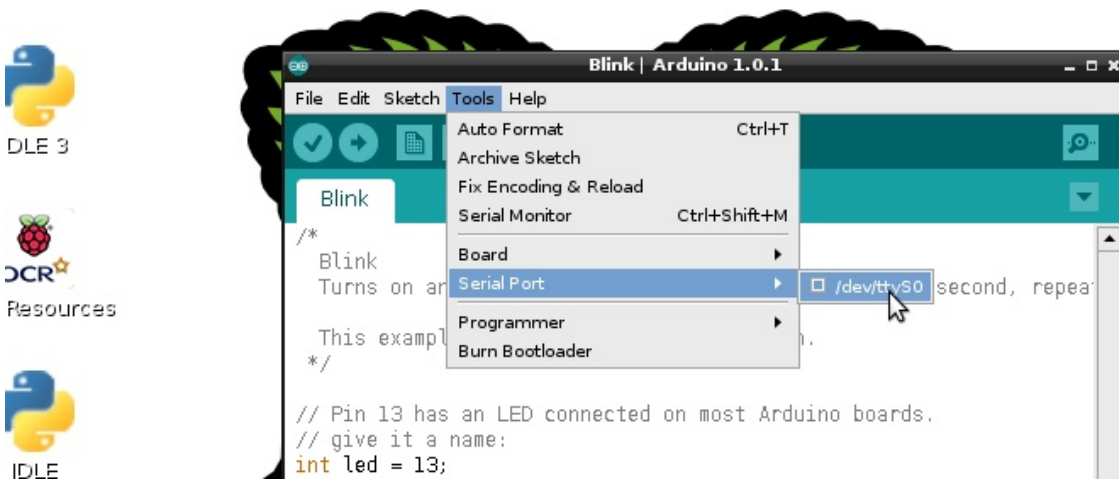
```
arduino
```

When the IDE has loaded, open up the Blink example by selecting **File > Examples > 01.Basics > Blink**
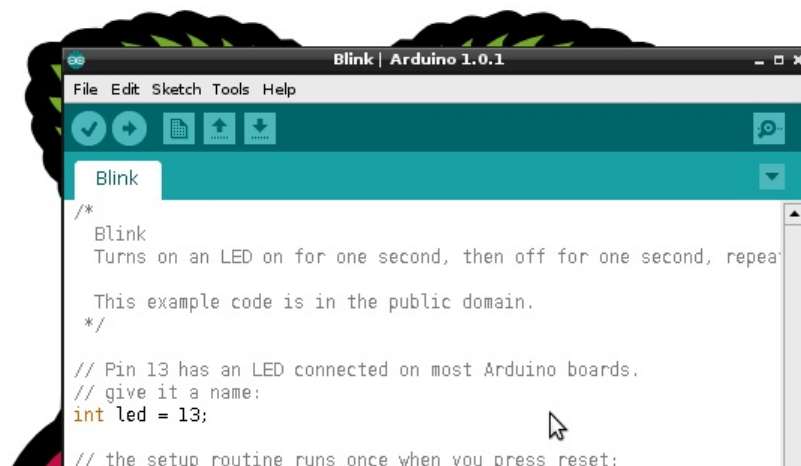
Tell the IDE what kind of Arduino board you're programming (the Pi Co-op is compatible with the Arduino Uno) by selecting **Tools > Board > Arduino Uno**.

Select the GPIO serial port by selecting **Tools > Serial Port > ttyS0**

The Blink example program is a very simple program that shows you how to blink an LED attached to one of the Pi Co-op's pins. Nearly all Arduino compatibles have an LED attached to pin 13, and the Pi Co-op is no exception. Program the Pi Co-op with the Blink example by clicking the Upload button
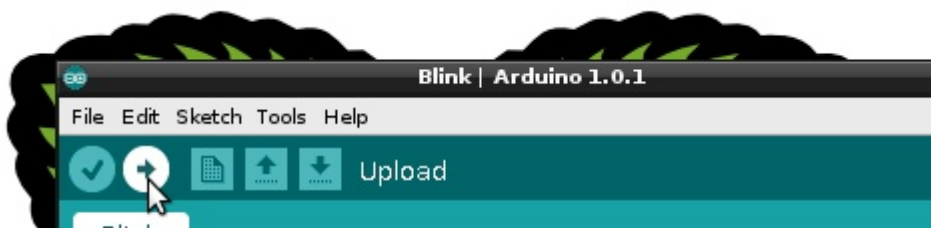
There will be a delay as the program is first compiled and then uploaded to the Pi Co-op. Then if all is working well, you should see a flasing light on the Pi Co-op. Congratulations, you have just programmed your Pi Co-op!

Taking Things Further

The Arduino IDE contains a lot of examples showing things that you can do with your Pi Co-op. Have a look through the **File > Examples** menu for lots of useful code samples.

The great thing about the Arduino platform is that it provides a remarkably versatile foundation for a whole host of projects. Full documentation for the Arduino libraries along with ideas for projects can be found on the Arduino website.

Please Note: Dawn Robotics, and the Pi Co-op is in no way associated with the Arduino foundation. We just make use of the open source software that has been created as part of the Arduino project. Therefore, whilst you can ask questions about the Arduino software and libraries on the Arduino forum. You should ask questions about the Pi Co-op directly on the Dawn Robotics Forum.

Appendix A - Detailed Installation Process

You should only need to read this section if the installation script used for the simple installation process doesn't work on your distribution of Linux.

These are the steps needed to get the Pi Co-op working on a Raspberry Pi. The specific details of each step may vary depending upon the Linux distribution you're using.

1. Install the Arduino IDE - This may be in your package repository, or else you may be able to use the IDE from the Arduino website

2. Enable the serial port on the GPIO pins of the Pi. This is done by

    a) Remove the "console=ttyAMA0,115200" and "kgdboc=ttyAMA0,115200" configuration parameters from the "/boot/cmdline.txt" configuration file

    b) Comment out the last line of the /etc/inittab file. This is the line that reads "T0:23:respawn:/sbin/getty -L ttyAMA0 115200 vt100"

3. The Arduino IDE only recognises certain serial port names. It won't currently recognise the GPIO serial port's name which is /dev/ttyAMA0. To get round this we create a link to /dev/ttyAMA0 called /dev/ttyS0. One way to make this permanent is to create a udev rules file called /etc/udev/rules.d/99-pi_co-op_tty.rules and put in the following lines

    ```
    KERNEL=="ttyAMA0",SYMLINK+="ttyS0" GROUP="dialout"
    KERNEL=="ttyACM0",SYMLINK+="ttyS1" GROUP="dialout"
    ```

4. Move avrdude to one side

    ```
    sudo mv /usr/bin/avrdude /usr/bin/avrdude-original
    ```

5. Copy the files autoreset and avrdude-autoreset from [here](#) to /usr/bin

6. Put the new avrdude in place

    ```
    sudo ln -s /usr/bin/avrdude-autoreset /usr/bin/avrdude
    ```

7. Reboot your Pi and enjoy!