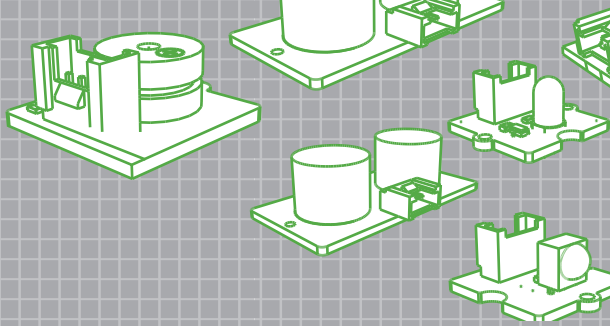

Getting Started with the GrovePi+ Starter Kit

Grove

User Manual

seeed studio

DEXTER INDUSTRIES

About Grove

Grove is a modular, plug-n-play technology platform developed by SeeedStudio. Much like Lego, it takes a building block approach and applies it to assembling electronics. The Grove system consists of a base shield and various modules and sensors with standardized connectors. The base shield allows you to easily connect any microprocessor input or output from the Grove modules, each with their own function. Grove modules and sensors range from simple buttons to complex heart rate sensors. Each one comes with clear documentation and demo code to help you get started quickly.

About GrovePi+

GrovePi+ enables you to use Grove sensors with the Raspberry Pi. GrovePi+ is compatible with the Raspberry Pi model B, B+, A+ and 2. The GrovePi+ was designed & developed by an American robotics education company, Dexter Industries.

About SeeedStudio

Seeed is the leading open source hardware innovation platform for makers and inventors to grow their inspirations into unique products. Working closely with our technology partners, Seeed's in-house engineers, supply chain managers and agile manufacturing plant enables us to produce anywhere from 1 to 1,000 pcs with high quality & speed, at a competitive cost.

www.seeed.cc

About Dexter Industries

Dexter Industries is an American educational robotics company that designs & develops robot kits to make learning how to program accessible & fun for everyone. Other kits include the GoPiGo & BrickPi & Arduberry
www.dexterindustries.com

Questions & Support

Documentation, support material, and example projects can be found on our website:
www.dexterindustries.com/GrovePi

Technology support forums & contact information:
www.seeedstudio.com/forum
www.dexterindustries.com/forum/?forum=grovepi

GrovePi+

Product information, specifications, documentation, and example projects:
www.seeed.cc/grovepi
www.dexterindustries.com/GrovePi

Open source software resources:
https://github.com/DexterInd/GrovePi

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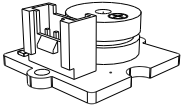
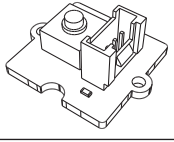
Grove Sensors Quickguide

Grove - Buzzer



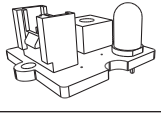
What have we got here?
This is a simple yet enjoyable twig to use. The piezo can be connected to digital outputs, and will emit a tone when the output is high. Alternatively it can be connected to an analog pulse-width modulation output to generate various tones and effects.
How to work:
One digital input pin.
More details:
http://www.seeedstudio.com/depot/Grove-Buzzer-p-768.html

Grove - Button



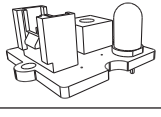
What have we got here?
This product is a momentary push button. It contains one independent "momentary on/off" button. "Momentary" means that the button rebounds on its own after it is released. The button outputs a HIGH signal when pressed, and LOW when released.
How to work:
One input
More details:
http://www.seeedstudio.com/depot/Grove-Button-p-766.html

Grove - Red LED



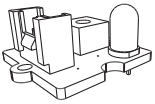
What have we got here?
This is a Red LED designed to monitor controls from digital ports. It can easily be mounted to the surface of a box or desk to be used as a pilot lamp for power or signal. Its brightness can be adjusted by the knob on the sensor.
How to work:
One digital input pin
More details:
http://www.seeedstudio.com/depot/Grove-Red-LED-p-1142.html

Grove - Green LED



What have we got here?
This is a Green LED designed to monitor controls from digital ports. It can easily be mounted to the surface of a box or desk to be used as a pilot lamp for power or signal. Its brightness can be adjusted by the knob on the sensor.
How to work:
One digital input pin
More details:
http://www.seeedstudio.com/depot/Grove-Green-LED-p-1144.html

Grove - Blue LED



What have we got here?

This is a Blue LED designed to monitor controls from digital ports. It can easily be mounted to the surface of a box or desk to be used as a pilot lamp for power or signal. Its brightness can be adjusted by the knob on the sensor.

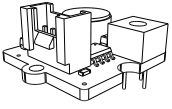
How to work:

One digital input pin

More details:

http://www.seeedstudio.com/depot/Grove-Blue-LED-p-1139.html

Grove - Sound Sensor



What have we got here?

The Sound sensor module is a simple microphone. It can be used to detect the sound strength of the environment. The resistance of the sensor decreases when the sound intensity of the environment increases. The value of the output can be adjusted by the knob on the sensor.

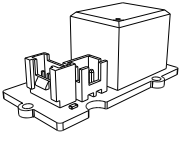
How to work :

One analog output pin.

More details:

http://www.seeedstudio.com/depot/Grove-Sound-Sensor-p-752.html

Grove - Relay



What have we got here?

The Relay is a digital switch that is capable of switching much higher voltages and currents than the normal Launchpad boards. The default is for the relay to be in the open position. When set to HIGH, the LED will light up and the relay will close to allow currents to flow. The peak voltage capability is 250V at 10 amps.

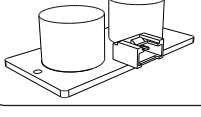
How to work:

One digital input pin.

More details:

http://www.seeedstudio.com/depot/Grove-Relay-p-769.html

Grove - Ultrasonic Ranger Sensor



What have we got here?

This Grove Ultrasonic sensor detects distance through ultrasonic technology, so it doesn't need to touch an object to detect that it is there.

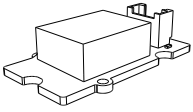
How to work:

One digital output pin.

More details:

http://www.seeedstudio.com/depot/BackorderGrove-Ultrasonic-Ranger-p-960.html?cPath=25_31

Grove - Temperature Humidity Sensor

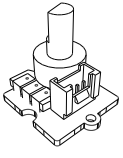


What have we got here?
This sensor measures temperature and humidity of the environment. IT consists of a capacitive sensor element used for measuring relative humidity and a negative temperature coefficient (NTC) thermistor used for measuring temperature.

How to work:
One analog input pin

More details:
http://www.seeedstudio.com/depot/Grove-TemperatureHumidity-Sensor-Pro-p-838.html?cPath=25_125

Grove - Rotary Angle Sensor

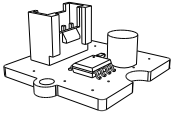


What have we got here?
This is a knob that you can turn to control how much voltage is delivered to a pin on the GrovePi+ board. You can write a program for the GrovePi+ telling it how to use that measurement to control how much voltage is being delivered to another sensor connected to the board. A classic example is to use this knob to increase or decrease the voltage sent to a LED to make it brighter or dimmer. More specifically, this variable resistor produces an analog output between 0 and Vcc (total voltage coming through the D1 connector on the GrovePi+ board) as it turns. It can rotate up to 300 degrees with a linear change in value and is a simple way to increase or decrease the amount of voltage passing through it.

How to work:
One analog input pin

More details:
http://www.seeedstudio.com/depot/Grove-Rotary-Angle-Sensor-p-770.html?cPath=85_52

Grove - Light Sensor

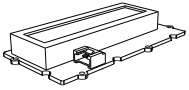


What have we got here?
The Grove - Light Sensor v1.2 is updated version of Grove - Light Sensor 1.0 which is aimed at measuring light levels. It is an analog module and output various electrical signals which can be converted to different ranges (that depends on the Analog-to-Digital-Converter on your controller board. For example, it will output 0-255 for an 8-bit ADC). It integrates a high-sensitive and reliable photoresistor, and is interfaced with Grove port which will save you a lot of work in the wiring. This module can be used in various smart-lighting device or facilities.

How to work:
One analog input pin

More details:
http://www.seeedstudio.com/wiki/Grove_-_Light_Sensor_v1.2

Grove - RGB Backlit LCD



What have we got here?
This screen can be programed to display any color or character you want. Want to display a shape or your name? You can design it to show anything that you can think of.
How to work:
I2C Connector
More details:
http://www.seeedstudio.com/depot/Grove-LCD-RGB-Backlight-p-1643.html

Setting up the SD card for the Raspberry Pi

Before you get started with the Grove Pi+, you need a working SD Card to use with the Raspberry Pi.

A standard installation of "wheezy" or Raspbian will not work with the GrovePi; there are some specific modifications that must be made to successfully operate the GrovePi. We have listed some options below :

Option 1: Configure your own SD card image

Before beginning your Raspberry Pi must be connected to the internet.

Steps:

1). Clone the Github repository at an appropriate location

```
git clone https://github.com/DexterInd/GrovePi.git
```

2). Run the bash script in the Scripts folder to configure the Raspbian.

3). Change directory to the Scripts folder in the GrovePi folder.

```
cd GrovePi/Script
```

4). Make the install.sh bash script as executable. We do this by modifying the permissions of the script:

```
sudo chmod +x install.sh
```

5). Start the script. You must be the root user, so be sure to include "sudo".

```
sudo ./install.sh
```

6). Press "Enter" to start when you are prompted.

7). The script will download packages from the internet which are used by the GrovePi+. Press "y" when the terminal prompts and asks for permission to start the download.

8). Restart the Raspberry Pi:

```
sudo reboot
```

Option 2: Download our custom "Raspbian for Robots" image

If you want to download and use our modified "wheezy" image on a dedicated SD card you can download it from the following locations:
(http://sourceforge.net/projects/dexterindustriesraspbianflavor)

You will need a minimum 4 GB card to install this image.

We highly recommend you visit the elinux.org website and read through their RPi Easy SD Card Setup before installing an image here
(http://elinux.org/RPi_Easy_SD_Card_Setup).

Steps:

1). Download the latest image from Sourceforge:
(http://sourceforge.net/projects/dexterindustriesraspbianflavor/).

2). Download and install Win32DiskImager
(http://sourceforge.net/projects/win32diskimager/).

3). Unzip the image file you downloaded.

4). Install the image on your SD card. **Be careful to select the SD Card Drive!! If you select the wrong drive you can destroy your computer's hard disk or other information!**

Note that you can expand to the full size of your SD Card by running the command

```
sudo raspi-config
```

And expanding the rootfs to use all available space on the SD Card. You can update your configuration and hardware profiles by running:

```
sudo apt-get update
sudo apt-get upgrade
```

when connected to the internet.

Option 3: Use an SD card from Dexter Industries

If you purchased a Dexter Industries SD card for your GrovePi+ (http://www.dexterindustries.com/site/?product=sd-card-raspbian-wheezy-image-for-raspberry-pi), you can skip this step: your SD card is already configured!

Note you can expand your Dexter Industries SD Card by running the command:

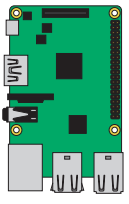
```
sudo raspi-config
```

You can buy the SD card from Dexter Industries
(http://www.dexterindustries.com/site/?product=sd-card-raspbian-wheezy-image-for-raspberry-pi).

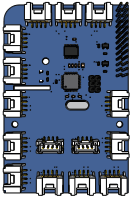
Hardware connection for GrovePi+

Connecting the GrovePi+ to the Raspberry Pi

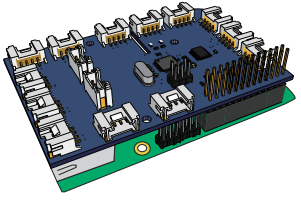
First, mount your GrovePi+ on the Raspberry Pi. The GrovePi+ slides over top of the Raspberry Pi as shown in the picture below.



Raspberry Pi



GrovePi+



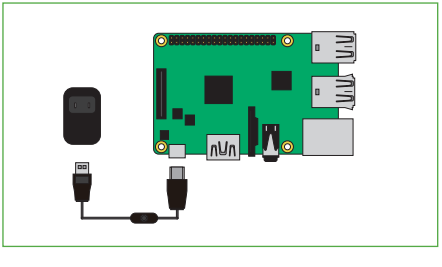
Ensure that the pins are properly aligned when stacking the GrovePi+.

Powering up the Raspberry Pi

To power the GrovePi+ and the Raspberry Pi, you can use the micro USB power port on the Raspberry Pi.

Remember to use a good power adapter capable of supplying 1A at 5V and you should be fine with the power.

If you want to run the GrovePi+ in a standalone configuration, then you might find a USB power bank.



Access to GrovePi+

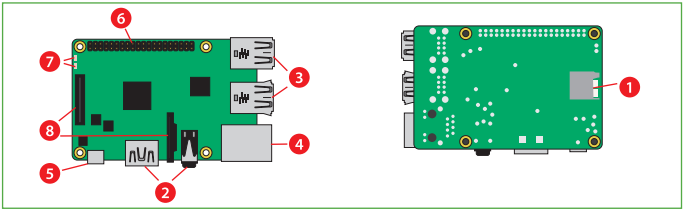
With some of your projects, hooking up a monitor and micro USB cable power supply might be impractical. We have developed extra options to make network configuration quick with the GrovePi+.

Here we explain the options we have worked into the GrovePi+ Image for Network Configuration here and offer some hints on how to get started using the GrovePi+.

These are "run once" operations. To setup, you can make these changes, and you should only have to make these changes once.

The last two options are for controlling your Raspberry Pi; once you have a connection setup, you can use the Raspberry Pi command line or VNC to start programming.

Option 1: Access as Desktop



1. MicroSD Slot
2. HDMI and Audio output
3. 4 USB2.0 ports
4. Ethernet port
5. Micro USB port, USB power port
6. GPIO ports
7. LED indicator
8. DSI/CSI， Camera Module and Display Module interface.

Using a monitor, mouse, keyboard: the bullet-proof option. The GrovePi+ case is designed to allow space for a keyboard, monitor, and mouse.

You may find that you need a USB hub to add a WIFI device to the GrovePi. The advantage of this configuration is that you don't have to configure the WIFI on the Raspberry Pi, or login remotely on the computer.

For more information on this, we recommend browsing the Raspberry Pi Foundations Quickstart Guide here (http://www.raspberrypi.org/quick-start-guide).

Option 2: Access via Ethernet Cable

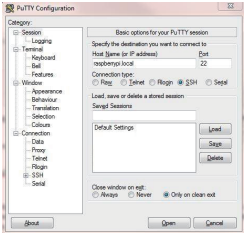
The Dexter Industries SD card comes configured with Bonjour which allows you to get the networking up and running with zero configuration.

- If you are using Windows and don't have iTunes installed, download Bonjour from here (http://support.apple.com/kb/dl999) and install it.
- If you are on a Mac or already have iTunes installed skip this step.
- If you are using your own image, just install avahi-daemon in you Raspbain image:

```
sudo apt-get update
sudo apt-get install libnss-mdns
```

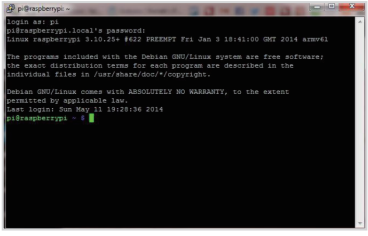
Windows

Open **Putty** and enter the **Host Name** as **raspberrypi.local** and press open.



If everything goes right, then you'll be prompted with a security prompt. Press "**Yes**"

This will open a terminal and ask for a Username and Password. The username is "**pi**" and the password is "**raspberry**". After entering the credentials, you'll get logged on to the Raspberry Pi terminal.



Mac

You can log into your Raspberry Pi using Bash on your Mac.
Again, we'll open up a new terminal: Press "**Command Space**", which opens Spotlight.

Type "**Terminal**" and the terminal will come to the top.

Click on the terminal icon. In Bash, type:

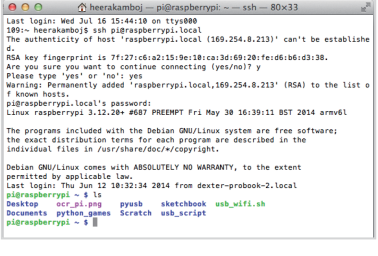
```
ssh pi@raspberrypi.local
```

You'll be prompted to verify you're trying to login to the Raspberry Pi.

Type "**yes**" and press return.

Type the password. The default password for the BrickPi image is "**raspberry**". Type "**raspberry**" and press return.

Boom! You're logged into your Raspberry Pi and ready to start programming the GrovePi!



Option 3: Access via WiFi

The most autonomous way to connect to your GrovePi+ is through a WiFi dongle. The most reliable way to set the GrovePi+ up on your local WiFi network is to use Option 1 or Option 2, and change your wifi setting on the Raspberry Pi.
You can setup WiFi on the GrovePi using the command line. Below are step-by-step instructions and some troubleshooting tips for setting up WiFi on the GrovePi+.

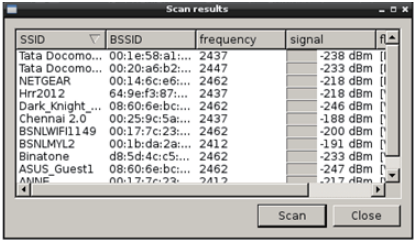
1. A static IP
We DO NOT recommend that you use a static IP for wifi interface with the GrovePi+. The latest version of the GrovePi+ Raspbian comes with Bonjour. In short, this means that instead of using an IP address, you can connect using "**raspberrypi.local**". The Pi can be accessed over the network (via VNC or SSH) by any computer that has Bonjour installed.

- **Mac**: If you have a Mac, Bonjour is installed.
- **Linux**: If you have a computer with iTunes installed, Bonjour is installed.
- **Windows**: If you need to install Bonjour, you can find it on Apple's website here (http://support.apple.com/kb/DL999).

2. Insert Wifi Dongle
Boot the Raspberry Pi with the Wifi dongle plugged in, and open a terminal session in the Raspberry Pi.

3. With the GUI
If you want to setup Wifi using the GUI, login to the Raspberry Pi.

3.1 Click on WiFi Config
The icon on the desktop labeled "**WiFi Config**". Click on it. Change tabs to "**Manage Networks**" and click "**Scan**". Clicking "**Scan**" reveals the wifi networks available. Click the network you want to connect to.



3.2 Enter your wifi information

Enter in your wifi information and click "**Add**". Your Raspberry Pi should connect automatically to the WiFi network.

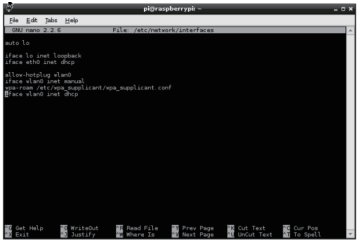
4. With the Command Line

If you want to setup wifi using the terminal or SSH, In the terminal, open your interfaces file for editing with the following command:

```
sudo nano /etc/network/interfaces
```

4.1 Interfaces File

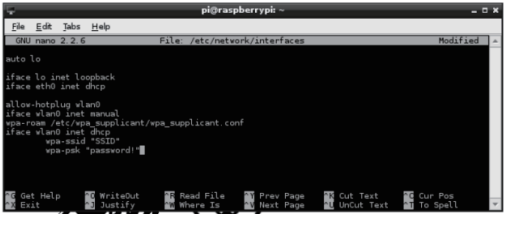
Your interfaces file should look like this:



4.2 Edit the File

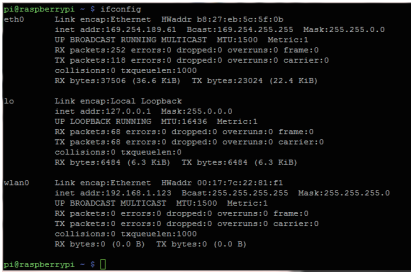
Edit the file by adding the network configuration information, and your **network's SSID** and **passphrase** below the last line. Indent one tab!.

```
wpa-ssid "ssid"
wpa-psk "password"
```



4.3 Test your Wifi Adapter

After adding your information, save and exit by typing "**Ctrl-x**" and choosing to save the file. And then reboot your raspberry pi. After reboot success, test that your Pi recognizes the WiFi Adapter. You can test by typing "**ifconfig**" in the terminal of the GrovePi+. If "**wlan0**" is showing, the wifi dongle is recognized.

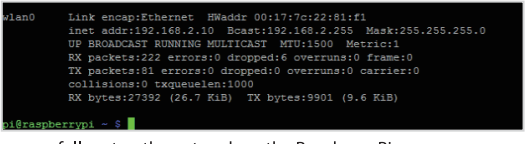


5. Check for a Connection

Check that you are successfully connected to the network. In the command line, type:

```
ifconfig
```

When RX and TX are showing 0 bytes, no data has been exchanged. Below is a successfully connected Raspberry Pi to a wifi network.



You have successfully setup the network on the Raspberry Pi.

Running Examples of GrovePi+

Here we have a list of example projects that show just how easy it is to start a project with the GrovePi+. These GrovePi projects combine easy-to-use Grove sensors with the powerful Raspberry Pi.

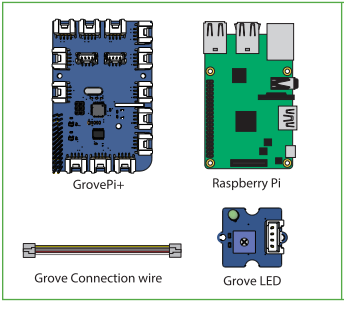
Example Project: LED Blink

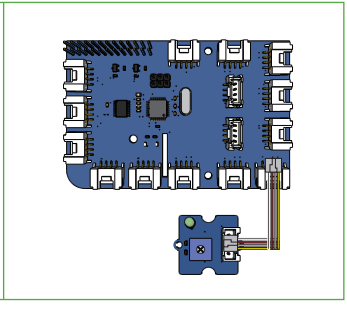
This tutorial shows the simplest thing that you can do with the GrovePi: Blink a LED. This is a great first project to learn how to connect hardware to the Raspberry Pi. The blinking LED is the hardware version of the software world's "**Hello World**" program.

Once mastered, you can move on to more complicated projects like connecting a display or other sensors to the Raspberry Pi. This example is meant to be your first project with the GrovePi+. All the parts used in this project are available in the GrovePi+ Starter Kit.

Hardware for This Tutorial

All of the hardware comes with the GrovePi+ starter kit. Specifically, for the Raspberry Pi LED Tutorial, you'll need:





Hardware Setup: Connecting the LED to the Raspberry Pi
Connect the **LED to Port D4** and power on the Raspberry Pi, using the Grove wire connector.

Running the Program
The example program for this project is shown below. To run the program, change directory on your Raspberry Pi to the **GrovePi+/Software/Python** folder.

```
cd /GrovePi/Softwave/Python
```

Run the grove_led_blink.py python program:

```
sudo python grove_led_blink.py
```

The Grove LED will start blinking.

Source Code
The source code for the example can be found here:
https://github.com/DexterInd/GrovePi/blob/master/Software/Python/grove_led_blink.py

```
# GrovePi LED Blink example
# http://www.seeedstudio.com/wiki/Grove_-_LED_Socket_Kit

import time
from grovepi import *

# Connect the Grove LED to digital port D4
led = 4

pinMode(led,"OUTPUT")
time.sleep(1)
while True:
    try:
        #Blink the LED
        digitalWrite(led,1)             # Send HIGH to switch on LED
        time.sleep(1)

        digitalWrite(led,0)             # Send LOW to switch off LED
        time.sleep(1)

    except KeyboardInterrupt:           # Turn LED off before stopping
        digitalWrite(led,0)
        break
    except IOError:              # Print "Error" if communication error encountered
        print "Error"
```

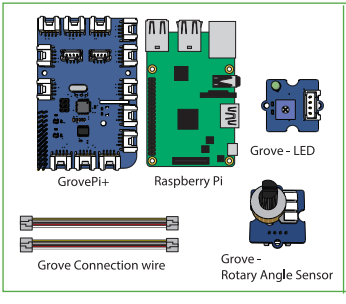
Outcome
This project is very straightforward: you should see the LED blink on and off at a 1 second interval.

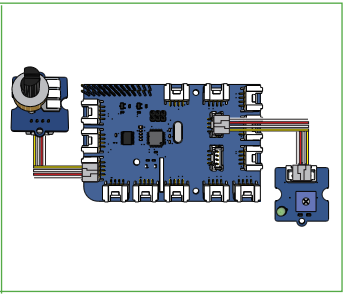
Example Project: LED Fade

This project shows how to fade an led with the Raspberry Pi.
A rotary angle sensor (a fancy name for a potentiometer) is used to get the analog values and the Raspberry Pi sends commands to the Grove Pi to set the LED's intensity.

Setting Up The Hardware

Simply plug the LED Module in **Port D5** and the Rotary encoder in **Port A0**. That's it.





Running the Program

The example program for this project is shown below. To run the program, change directory on your Raspberry Pi to the **GrovePi+/Projects/LED** fade folder.

```
cd /GrovePi/Projects/LED_Fade
```

Run the led_fade.py python program:

```
sudo python led_fade.py
```

Source Code

Below is the code for running this example. You can access the code here:
https://github.com/DexterInd/GrovePi/blob/master/Projects/LED%20Fade/led_fade.py

```
# Adjust LED brightness by rotating Potentiometer

# GrovePi + Rotary Angle Sensor (Potentiometer) + LED
# http://www.seeedstudio.com/wiki/Grove_-_Rotary_Angle_Sensor
# http://www.seeedstudio.com/wiki/Grove_-_LED_Socket_Kit

import time
import grovepi

# Connect the Rotary Angle Sensor to analog port A2
potentiometer = 2

# Connect the LED to digital port D5
led = 5

grovepi.pinMode(led,"OUTPUT")
time.sleep(1)
i = 0

while True:
    try:
        # Read resistance from Potentiometer
        i = grovepi.analogRead(potentiometer)
        print i

        # Send PWM signal to LED
        grovepi.analogWrite(led,i/4)

    except IOError:
        print "Error"
```

Outcome

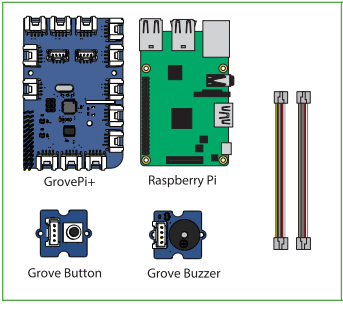
This project, like the previous project, has a straightforward outcome: as you turn the potentiometer back and forth, you should see the LED increase and decrease in strength. In your Raspberry Pi terminal, you will see a number printing, which represents the position of the potentiometer.

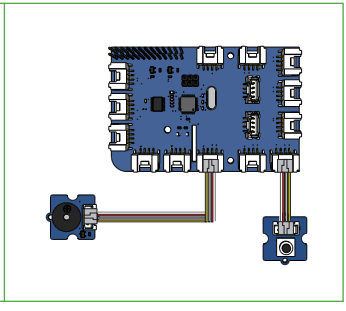
Example Project: Button And Buzzer

In this project, we connect a Grove Button and a Buzzer to the Raspberry Pi.

Setting Up The Hardware

Simply plug the Buzzer Module to Port D2， the Rotary to Port A0. That's it.





Running the Program

The example program for this project is shown below. To run the program, change directory on your Raspberry Pi to the **GrovePi/Projects/LED** fade folder.

```
cd /GrovePi/Projects/Button_And_Buzzer
```

Run the grove_led_blink.py python program:

```
sudo python Button_And_Buzzer.py
```

Source Code

The source code for the example can be found here:
https://github.com/DexterInd/GrovePi/blob/master/Projects/Button_And_Buzzer/Button_And_Buzzer.py

```
# button_buzzer.py
#
# This is an project using the Grove Button, Buzzer from the GrovePi starter kit
#
# In this project, the buzzer starts making a sound when the the button is hold

import time
from grovepi import *
import math

buzzer_pin = 2          #Port for buzzer
button = 4              #Port for Button

pinMode(buzzer_pin,"OUTPUT")        # Assign mode for buzzer as output
pinMode(button,"INPUT")             # Assign mode for Button as input
while True:
    try:
        button_status= digitalRead(button)  #Read the Button status
        if button_status:  #If the Button is in HIGH position, run the program
            digitalWrite(buzzer_pin,1)
            # print "\tBuzzing"
        else:  #If Button is in Off position, print "Off" on the screen
            digitalWrite(buzzer_pin,0)
            # print "Off"
    except KeyboardInterrupt:  # Stop the buzzer before stopping
            digitalWrite(buzzer_pin,0)
            break
    except (IOError,TypeError) as e:
            print "Error"
```

Outcome

The outcome of this project will show up on the Raspbery Pi terminal, and with the sound of the buzzer making noise.

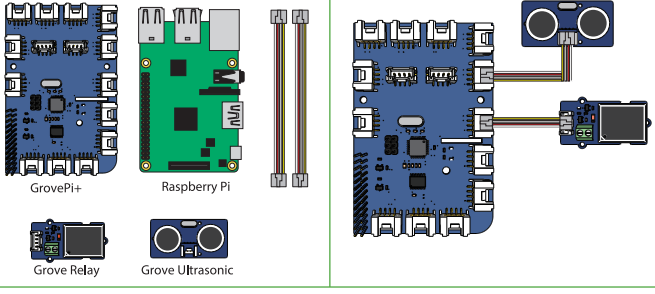
Example Project: Ultrasonic And Relay

In this project, we connect a Grove Ultrasonic and a Relay to the Raspberry Pi .

You can use this project to detect distance of any object in the front of your machine, it can be a counterguard robot or a auto-open door.

Setting Up The Hardware

Simply plug the Buzzer Module to **Port D2** , the Rotary to **Port A0**. That's it.



Running the Program

The example program for this project is shown below. To run the program, change directory on your Raspberry Pi to the **GrovePi/Projects/LED** fade folder.

```
cd /GrovePi/Projects/Ultrasonic_And_Relay
```

Run the grove_led_blink.py python program:

```
sudo python Ultrasonic_And_Relay.py
```

Source Code

The source code for the example can be found here: https://github.com/DexterInd/GrovePi/blob/master/Projects/Ultrasonic_And_Relay/Ultrasonic_And_Relay.py

```
# GrovePi + Grove Ultrasonic Ranger
# http://www.seeedstudio.com/wiki/Grove_-_Ultrasonic_Ranger

# This is an project using the Grove Ultrasonic Ranger and Relay from GrovePi start
# kit

# In this project, the ultrasonic can figure out the distance of object in front,
# when object close to it within 10cm, the relay will turn on

from grovepi import *

# Connect the Grove Ultrasonic Ranger to digital port D4
# SIG,NC,VCC,GND

ultrasonic_ranger = 4
Relay_pin = 2

pinMode(Relay_pin,"OUTPUT")

while True:
    try:
        # Read distance value from Ultrasonic
        distant = ultrasonicRead(ultrasonic_ranger)
        print distant,'cm'
        if distant <= 10:
            digitalWrite(Relay_pin,1)
        else:
            digitalWrite(Relay_pin,0)

    except TypeError:
        print "Error"
    except IOError:
        print "Error"
```

Outcome

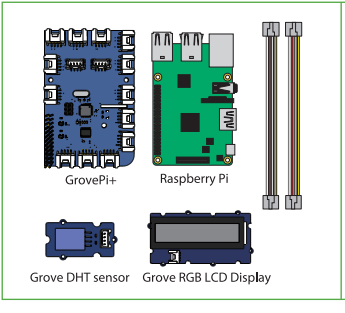
The outcome of this project will show up on the Raspbery Pi terminal, and you can put your hand close to the ultrasonic to see, will the relay turn on within about 10cm and turn off without about 10cm.

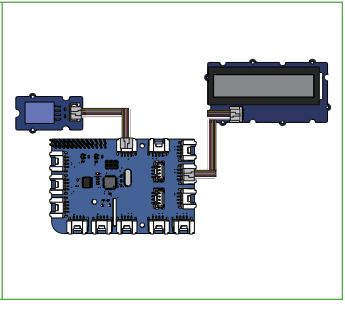
Example Project: Home Weather Display

In this project, we use a **Grove DHT (Digital Humidity and Temperature) sensor** as a Raspberry Pi temperature sensor. This project uses a **Grove RGB LCD display**, connected to the Raspberry Pi, to show the temperature and humidity. You can use this project as designed: a simple weather station for your home.

Connecting the Raspberry Pi temperature sensor

Connect the DHT sensor to **Port 7** and the RGB LCD display to any of the **I2C** ports. Now power on the Raspberry Pi.





Running the Program

Run the home_temp_hum_display program:

```
sudo python GrovePi_LCD_DHT.py
```

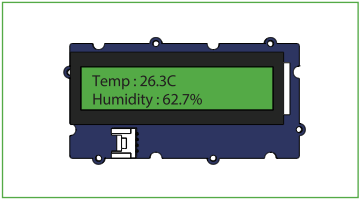
Source Code

The source code for the example can be found here:
https://github.com/DexterInd/GrovePi/blob/master/Projects/Home_Weather_Display/Home_Weather_Display.py

```
# grovepi_lcd_dht.py
#
# This is an project for using the Grove OLED Display and the Grove DHT Sensor from
# the GrovePi starter kit

# In this project, the Temperature and humidity from the DHT sensor is printed on
  the DHT sensor

from grovepi import *
from grove_rgb_lcd import *

dht_sensor_port = 7                 # Connect the DHt sensor to port 7

while True:
    try:
        [ temp,hum ] = dht(dht_sensor_port,1)  #Get the temperature
                                               #and Humidity from the DHT sensor
        print "temp =", temp, "C\thumadity =", hum,"%"
        t = str(temp)
        h = str(hum)

        setRGB(0,128,64)
        setRGB(0,255,0)
        setText("Temp:" + t + "C       " + "Humidity :" + h + "%")

    except (IOError,TypeError) as e:
        print "Error"
```

Outcome

The outcome of the project should show up on your Raspberry Pi and the screen. Below you can see the temperature printed on the Raspberry Pi terminal. Further down, you can see the same information printed on the attached display.The LCD display will start showing the live temperature data and humidity data from the DHT sensor.

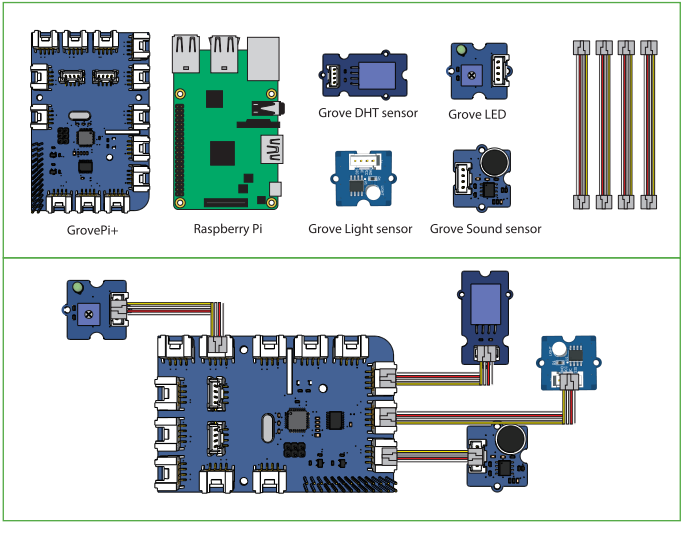


Example Project: Sensor Twitter Feed

In this example we tweet the temperature, light, and sound levels with our Raspberry Pi. The data is taken by the GrovePi and pushed to our Twitter feed with the Raspberry Pi.

Hardware Setup

This example uses a sound sensor, a light sensor, and temperature sensor connected with the GrovePi's Analog Ports(Port A2,A1 and A0 respectively). An LED connected to a PWM channel (Port D3) and responds to light conditions.



Running the Program

In the Raspberry Pi terminal, change directory to GrovePi/Projects/Sensor Twitter Feed:

```
cd /GrovePi/Projects/Sensor Twitter Feed
```

In the directory, Run the wifi_twit.py:

```
sudo python wifi_twit.py
```

Source Code

The source code for the example can be found here:

https://github.com/DexterInd/GrovePi/blob/master/Projects/Sensor%20Twitter%20Feed/wifi_twit.py

```
# Tweet the temperature, light, and sound levels with our Raspberry Pi
# http://dexterindustries.com/GrovePi/projects-for-the-raspberry-pi/sensor-twitter
  -feed/

# GrovePi + Sound Sensor + Light Sensor + Temperature Sensor + LED
# http://www.seeedstudio.com/wiki/Grove_-_Sound_Sensor
# http://www.seeedstudio.com/wiki/Grove_-_Light_Sensor_v1.2
# http://www.seeedstudio.com/wiki/Grove_-_Temperature_and_Humidity_Sensor_Pro
# http://www.seeedstudio.com/wiki/Grove_-_LED_Socket_Kit

import twitter
import time
import grovepi
import math

# Connections
sound_sensor = 0        # port A0
light_sensor = 1        # port A1
temperature_sensor = 4  # port D4
led = 3                 # port D3

# Connect to Twitter
api = twitter.Api(consumer_key='YourKey',consumer_secret='YourKey',access_token_
key='YourKey',access_token_secret='YourKey')
print "Twitter Connected"

grovepi.pinMode(led,"OUTPUT")

last_sound = 0

while True:
    # Error handling in case of problems communicating with the GrovePi
    try:
        # Get value from temperature sensor
        [temp,humidity] = grovepi.dht(temperature_sensor,1)
        t=temp

        # Get value from light sensor
        light_intensity = grovepi.analogRead(light_sensor)

        # Give PWM output to LED
        grovepi.analogWrite(led,light_intensity/4)

        # Get sound level
        sound_level = grovepi.analogRead(sound_sensor)
        if sound_level > 0:
            last_sound = sound_level
```

```
        # Post a tweet
        print ("DI Lab's Temp: %.2f, Light: %d, Sound: %d" %(t,light_intensity/
        10,last_sound))
        api.PostUpdate("DI Lab's Temp: %.2f, Light: %d, Sound: %d" %(t,light_
        intensity/10,last_sound))
        time.sleep(3)
    except IOError:
        print "Error"
    except:
        print "Duplicate Tweet"
```

Outcome

You should see two outcomes. The first is output on your terminal screen, shown below. You should see "Twitter Connected" if the connection is made succesfully. Then a series of Temperature, Light, and Sound values.

```
Twitter Connected
DI Lab's Temp: 24.35, Light: 69, Sound: 0
DI Lab's Temp: 24.35, Light: 67, Sound: 0
DI Lab's Temp: 24.43, Light: 70, Sound: 0
DI Lab's Temp: 24.43, Light: 70, Sound: 0
```

You should also see your Twitter stream start to update. It might take a few minutes for Twitter to update.

For Windows IOT Users

1. Set up your PC

1.1 Download Windows 10 and Install Visual Studio 2015

To set up your Windows 10 IoT Core development PC, you first need to install the following:

- **Make sure you are running the public release of Windows 10 (version 10.0.10240) or Newer.** You can upgrade from http://www.microsoft.com/en-us/software-download/windows10. If you are already running Windows 10, you can find your current build number by clicking the start button, typing "winver", and hitting enter.

- **Install Visual Studio 2015**

a. We recommend Visual Studio Community Edition, but Visual Studio Professional 2015 and Visual Studio Enterprise 2015 will work as well (available https://www.visualstudio.com/vs-2015-product-editions).

b. If you have to install Visual Studio, make sure to do a Custom install and select the checkbox Universal Windows App Development Tools -> Tools and Windows SDK.

c. If you already have Visual Studio, you will be prompted to download the needed tools when attempting to run our solution in the next part of the tutorial.

- **Install Windows IoT Core Project Templates from** https://visualstudiogallery.msdn.microsof.com/06507e74-41cf-47b2-b7fe-8a2624202d36.
Alternatively, the templates can be found by searching for Windows IoT Core Project Templates in the Visual Studio Gallery or directly from Visual Studio in the Extension and Updates dialog (Tools > Extensions and Updates > Online).

- **Enable developer mode** on your Windows 10 device by following https://msdn.microsoft.com/library/windows/apps/xaml/dn706236.aspx. The relevant portion of the linked instructions is the "Windows 10 Desktops/tablets" section, as you should be attempting setup with one of these devices.
Open Visual Studio 2015 and create a Universal Windows Platform (UWP) App by selecting 'File > New > Project > Visual C# > Windows > Universal > Blank App (Universal Windows)'. This is required to ensure that the framework dependencies are available for our samples to build.

2. Set up your Raspberry Pi

Before you get started with the GrovePi +, you need a SD Card which is running the win10 for IoT core.

2.1 What you need

- A PC running Windows 10 - as prepared in the previous steps
- Raspberry Pi 2
  http://www.seeedstudio.com/depot/Raspberry-Pi-2-Moel-B-w-ARMv7-Quad-Core-1GB-RAM-p-2289.html?cPath=122_154_159
- 5V Micro USB power supply - with at least 1.0A current. If you plan on using several power-hungry USB peripherals, use a higher current power supply instead (>2.0A)
- 8GB micro SD card - class 10 or better.
- HDMI cable and monitor
- Ethernet cable
- Micro SD card reader - due to an issue with most internal SD card readers
- Install the Windows 10 IoT Core tools

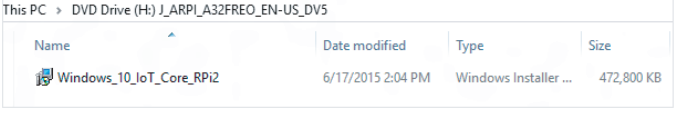
You can also buy Quick Starter Kit for Raspberry Pi 2 Model B from http://www.seeedstudio.com/depot/Quick-Starter-Kit-for-Raspberry-Pi-2-Model-B-p-2364.html?cPath=122_154_151，it include:

- 1x 8GB SD card preinstalled Raspbian OS
- 1x Raspberry Pi Black Enclosure
- 1x 5V 2.1A USB Power Adapter
- 1x Micro USB Cable with Switch
- 1x HDMI Cable - 3.2"(1 meter)
- 1x USB to TTL Serial Cable
- 1x Ethernet Cable - 3.2"(1 meter)
- 1x 802.11b/g/n Wireless USB Adapter

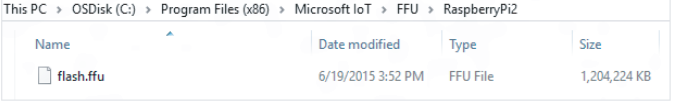
2.2 Install the Windows 10 IoT Core tools

- Download a Windows 10 IoT Core image from the http://ms-iot.github.io/content/en-US/Downloads.htm. Save the ISO to a local folder.

- Double click on the ISO (IoT Core RPi.iso). It will automatically mount itself as a virtual drive so you can access the contents.



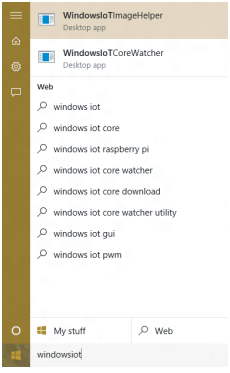
- Install Windows_10_IoT_Core_RPi2.msi. When installation is complete, flash.ffu will be located at C:\Program Files (x86)\Microsoft IoT\FFU\RaspberryPi2.



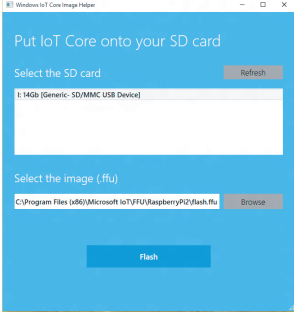
- Eject the Virtual CD when installation is complete - this can be done by navigating to the top folder of File Explorer, right clicking on the virtual drive, and selecting “Eject”.

2.3 Put the Windows 10 IoT Core image on your SD card

- Insert a micro SD card into your SD card reader.
- Use IoTCoreImageHelper.exe to flash the SD card. Search for “WindowsIoT” from start menu and select the shortcut “WindowsIoTImageHelper”.



- The tool will enumerate devices as shown. Select the SD card you want to flash, and then provide the location of the ffu to flash the image.

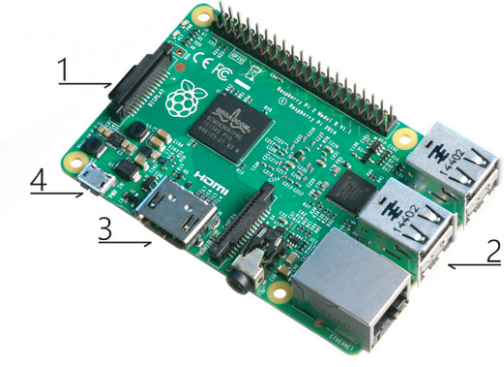


NOTE: IoTCoreImageHelper.exe is the recommended tool to flash the SD card. However, instructions are available for using DISM command line tool directly.

- Safely remove your USB SD card reader by clicking on “Safely Remove Hardware” in your task tray, or by finding the USB device in File Explorer, right clicking, and choosing “Eject”. Failing to do this can cause corruption of the image.

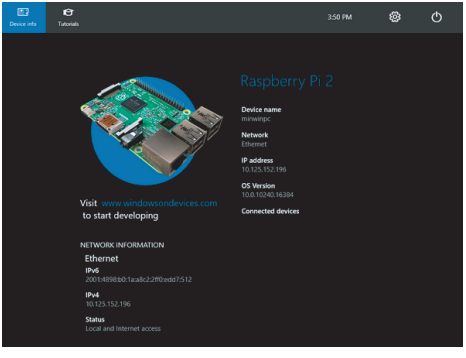
2.4 Hook up your board

1. Insert the micro SD card you prepared into your Raspberry Pi 2 (the slot is indicated by arrow #1 in the image below).
2. Connect a network cable from your local network to the Ethernet port on the board. Make sure your development PC is on the same network.
3. Connect an HDMI monitor to the HDMI port on the board.
4. Connect the power supply to the micro USB port on the board.



2.5 Boot Windows 10 IoT Core

● Windows 10 IoT Core will boot automatically after connecting the power supply. This process will take a few minutes. After seeing the Windows logo, your screen may go black for about a minute - don't worry, this is normal for boot up. You may also see a screen prompting you to choose a language for your Windows 10 IoT Core device - either connect a mouse and choose your option, or wait about a 1-2 minutes for the screen to disappear.
● Once the device has booted, the DefaultApp will launch and display the IP address of your RPi2.



● Follow the PowerShell documentation http://ms-iot.github.io/content/en-US/win10/samples/PowerShell.htm to use PowerShell to connect to your running device. You can also follow the instructions http://ms-iot.github.io/content/en-US/win10/samples/SSH.htm to use SSH to connect to your device.
● It is highly recommended that you update the default password for the Administrator account. To do this, issue the following commands in your PowerShell connection:
● Replace [new password] with a strong password:

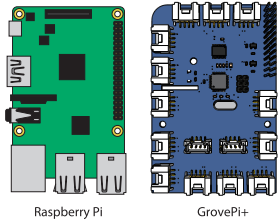
```
net user Administrator [new password]
```

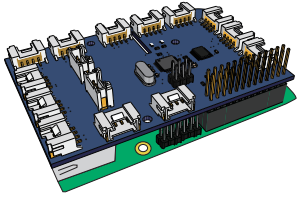
Once this is done, you'll need to re-establish the current session using enable-psSession with the new credentials.

3. Hardware connection for GrovePi+

3.1 Connecting the GrovePi+ to the Raspberry Pi

First, mount your GrovePi+ on the Raspberry Pi. The GrovePi+ slides over top of the Raspberry Pi as shown in the picture below.

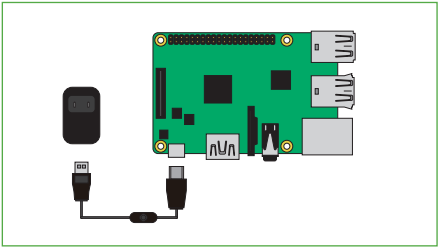




Ensure that the pins are properly aligned when stacking the GrovePi+.

3.2 Powering up the Raspberry Pi

To power the GrovePi+ and the Raspberry Pi, you can use the micro USB power port on the Raspberry Pi.
Remember to use a good power adapter capable of supplying 1A at 5V. If you want to run the GrovePi+ in a standalone configuration, then you might find a USB power bank.



4. Install GrovePi C# library for Raspberry Pi

The GrovePi can be programed in C#, but first you should install the Windows 10 IoT C# driver library for GrovePi, There're two ways to do this.
All supported sensors are available through the DeviceFactory class.
Supported sensors include:

- Grove - Relay
- Grove - Led
- Grove – Temperature&Humidity Sensor
- Grove – Ultrasonic Sensor
- Grove – Accelerometer Sensor
- Grove – Real Time Clock
- Grove – Build Led Bar
- Grove – Four Digit Display
- Grove – Chainable RGB LED
- Grove – Rotary Angle Sensor
- Grove - Buzzer
- Grove – Sound Sensor
- Grove – Light Sensor
- Grove - Button
- Grove – RGB LCD Display

Examples

Below are some simple examples of how to use the library.

- Measure Distance

```
Ultrasonic sensor plugged into digital pin 2 (D2)
var distance = DeviceFactory.Build.UltraSonicSensor(Pin.DigitalPin2).Measure-
InCentimeters();
```

- Display Hello World

```
DeviceFactory.Build.RgbLcdDisplay().SetText("Hello World").SetBacklightRgb(0, 255,
255);
```

- Sound the buzzer

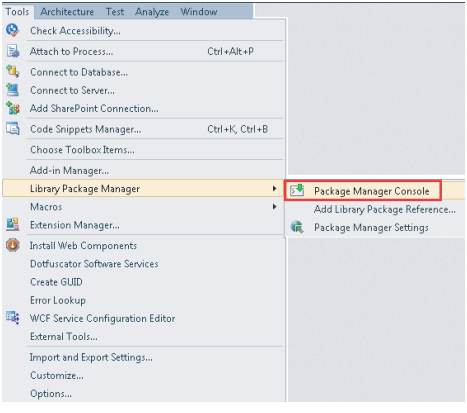
  Sound the buzzer plugged into digital pin 2 (D2).

```
DeviceFactory.Build.Buzzer(Pin.DigitalPin2).ChangeState(SensorStatus.On);
```

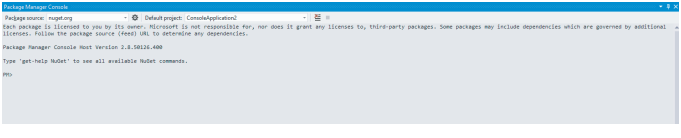
4.1 Install the NuGet package

The GrovePi NuGet package for the current release is available. More details https://www.nuget.org/packages/GrovePi/.
To install GrovePi for Windows IoT follow the following steps.

- Step1: From the Tools menu, select Library Package Manager and then click Package Manager Console.



The Package Manager Console window is displayed.



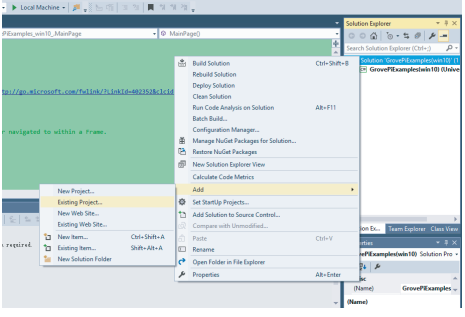
- Step2: Run the following command in the Package Manager Console.

PM> Install-Package GrovePi

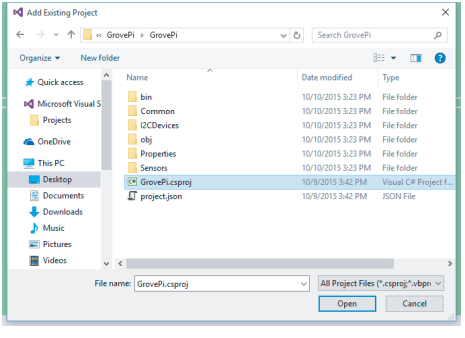
4.2 Use the GrovePi C# library code

If you're a senior programmer or you can't install the GrovePi NuGet package successfully, you can download the library code by click this https://github.com/DexterInd/GrovePi/tree/master/Software/CSharp.

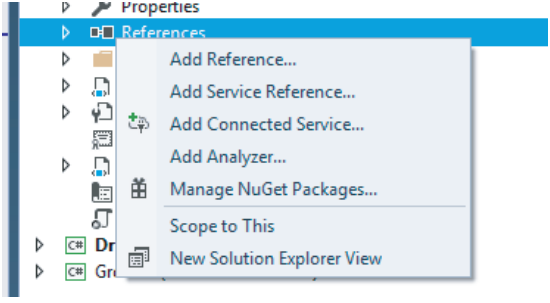
- Step1: Move the two C# library projects "GrovePi" and "Driver" to the folder where your project resides. And add them to your project in Solution Explorer.
For example, right click the Solution "GrovePiExamples ", Add | Existing Project, as below shows.



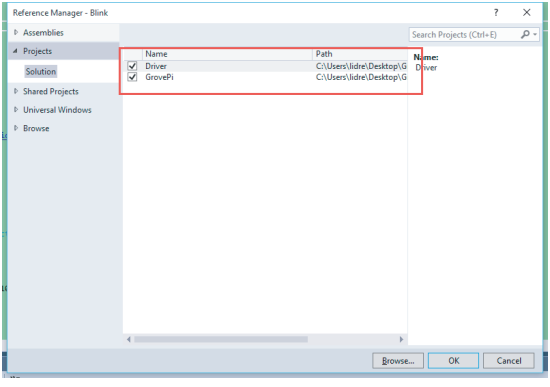
Then add "GrovePi" and "Driver" to the Solution Explorer.



- Step2: Set the C# library as the reference projects.
  Right click References and click Add References



Click Projects | Solution, and check box as shown in the red box below. Then click OK.



Now, you have already install the GrovePi C# library successfully.

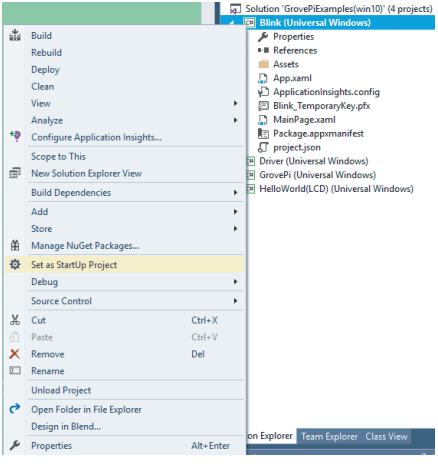
5. Running Examples of GrovePi+ on Win10 for IoT core

Here we have a list of example projects that show just how easy it is to start a project with the Raspberry Pi. These Raspberry Pi projects combine easy-to-use Grove sensors with the powerful Raspberry Pi.
You can click https://github.com/Seeed-Studio/GrovePiExamples_win10 to download the GrovePi Example code for win10.

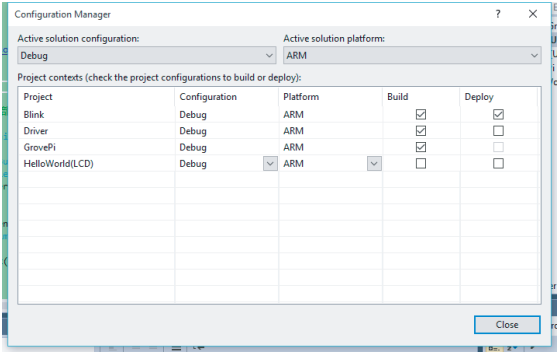
5.1 Blink

Once mastered, you can move on to more complicated projects like connecting a display or other sensors to the Raspberry Pi. This example is meant to be your first project with the GrovePi+. All the parts used in this project are available in the GrovePi+ Starter Kit.
Take the Blink project as an example.

- Step1: Open the GrovePiExamples(win10).sln.
- Step2: Set the Blink project as StartUp Project.
  Right click the Blink project in the Solution Explorer, and click Set as StartUp Project

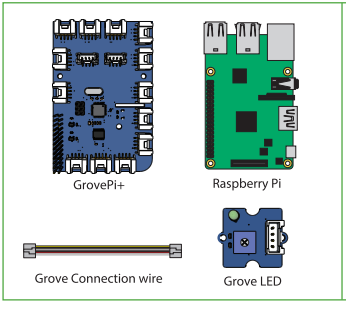


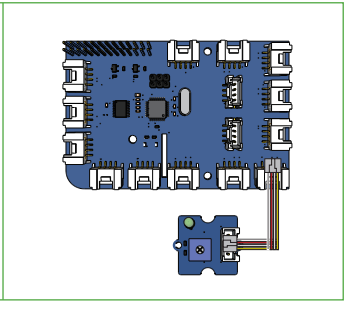
- Step3: Click Build | Configuration Manager. Check the box as below shows.



- Step4: Hardware connection.

All of the hardware comes with the GrovePi+ starter kit. Specially, for the Raspberry Pi LED Blink, you'll need:



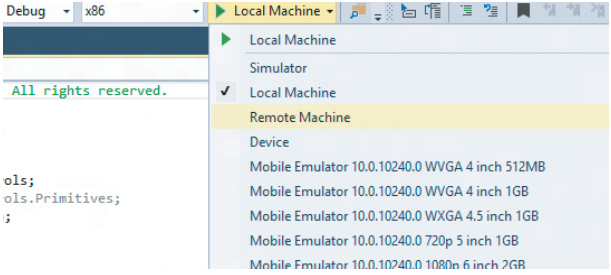


Then connect the LED to Port D4 and power on the Raspberry Pi using the Grove wire connector.

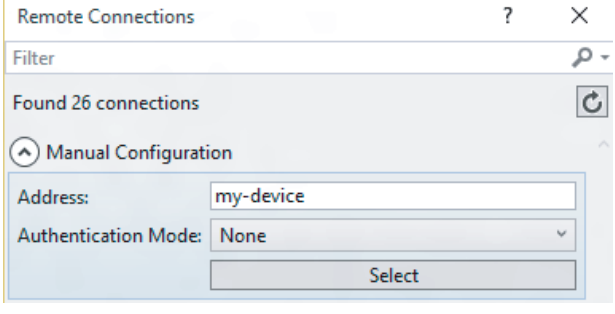
- Step5: Deploy your app.

a) With the application open in Visual Studio, set the architecture in the toolbar dropdown. Select ARM.

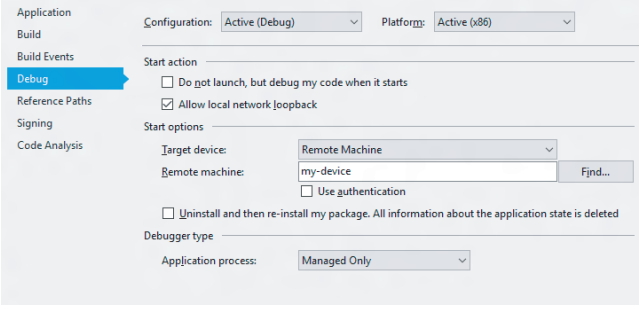
b) Next, in the Visual Studio toolbar, click on the Local Machine dropdown and select Remote Machine.



c) At this point, Visual Studio will present the Remote Connections dialog. If you previously used PowerShell to set a unique name for your device, you can enter it here (in this example, we're using my-device). Otherwise, use the IP address of your Windows IoT Core device. After entering the device name/IP select None for Windows Authentication, then click Select.



d) You can verify or modify these values by navigating to the project properties (select Properties in the Solution Explorer) and choosing the Debug tab on the left:

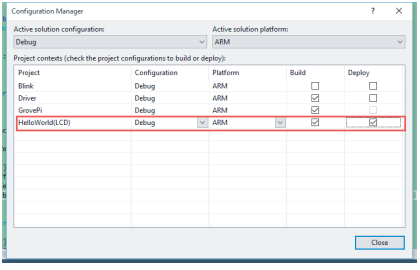


When everything is set up, you should be able to press F5 from Visual Studio. If there are any missing packages that you did not install during setup, Visual Studio may prompt you to acquire those now. The Blink app will deploy and start on the Windows IoT device, and you should see the LED blink.

5.2 Hello World from RGB LCD

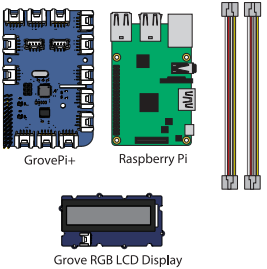
This example is the same use as Blink.

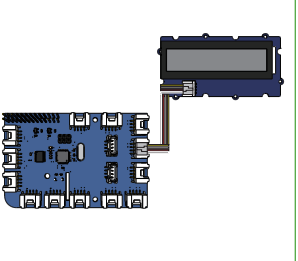
- Step1: Open the GrovePiExamples(win10).sln.
- Step2: Set the HelloWorld(win10) project as StartUp Project.
- Step3: Click Build | Configuration Manager. Check the box as below shows.



- Step4: Hardware connection.

Connect the RGB LCD to Port I2C and power on the Raspberry Pi using the Grove wire connector.





- Step5: Deploy your app. Refer to the Blink example of Step5.

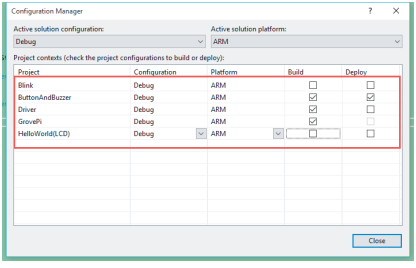
When everything is set up, you should be able to press F5 from Visual Studio. If there are any missing packages that you did not install during setup, Visual Studio may prompt you to acquire those now.

The HelloWorld app will deploy and start on the Windows IoT device, and you will see the HelloWorld form the Grove RGB LCD.

5.3 Button and Buzzer

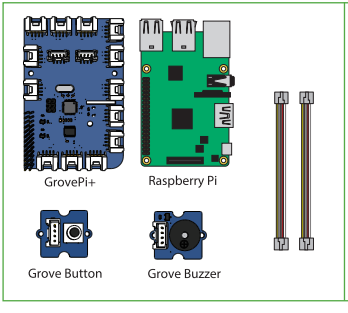
This example is the same use as Blink.

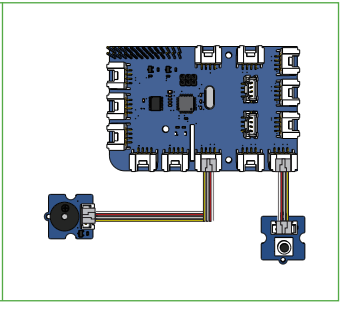
- Step1: Open the GrovePiExamples(win10).sln.
- Step2: Set the ButtonAndBuzzer project as StartUp Project.
- Step3: Click Build | Configuration Manager. Check the box as below shows.



- Step4: Hardware connection.

Connect the Grove Buzzer to Port D2, Grove Button to Port D4 using the Grove wire connector, and power on the Raspberry Pi.





- Step5: Deploy your app. Refer to the Blink example of Step5.

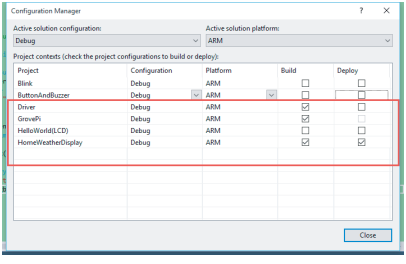
When everything is set up, you should be able to press F5 from Visual Studio. If there are any missing packages that you did not install during setup, Visual Studio may prompt you to acquire those now.

The BuzzerAndButton app will deploy and start on the Windows IoT device, and you press the Grove Button the Grove Buzzer will ring.

5.4 Home Weather Display

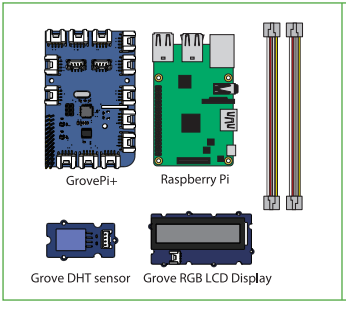
This example is the same use as Blink.

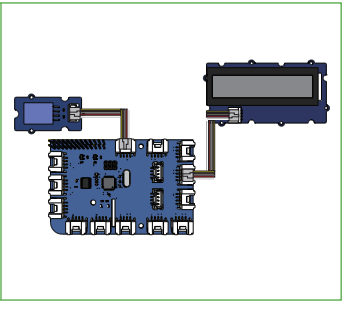
- Step1: Open the GrovePiExamples(win10).sln.
- Step2: Set the HomeWeatherDisplay project as StartUp Project.
- Step3: Click Build | Configuration Manager. Check the box as below shows.



- Step4: Hardware connection.

Connect the Grove Temperature Sensor to Port A1, RGB LCD to Port I2C using the Grove wire connector, and power on the Raspberry Pi.





- Step5: Deploy your app. Refer to the Blink example of Step5.

When everything is set up, you should be able to press F5 from Visual Studio. If there are any missing packages that you did not install during setup, Visual Studio may prompt you to acquire those now.

The Home Weather Display app will deploy and start on the Windows IoT device, and you can view the info. by the RGB LCD.

6. See also

- Windows Dev Center
  https://dev.windows.com/en-us/iot

- GrovePi C# Library Code
  https://github.com/DexterInd/GrovePi/tree/master/Software/CSharp

- Example Code
  https://github.com/Seeed-Studio/GrovePiExamples_win10

FAQ's, Troubleshooting & Getting Help

Q. What languages are supported by GrovePi+?
We officially support C, Python, C# and Scratch, but there is no reason why it should not run in any other language. There are people trying to make it work with Go and Node.js and we have the code up on the Github repository (https://github.com/DexterInd/GrovePi/tree/master/Software).

We'll love to support more languages. If you are interested in porting the GrovePi+ to other language we'll love to hear more from you.

Q. Which port on GrovePi+ does what?
Please check out the port description here: http://www.dexterindustries.com/GrovePi/engineering/port-description/.

Q. How are the ports connected and where is the schematic?
Please check the GrovePi Schematic. GrovePi is open source and you can check out the hardware files here:
https://github.com/DexterInd/GrovePi/tree/master/Hardware. You can open them in Eagle or if you just want to take a look at the schematic, it's available in PDF too.

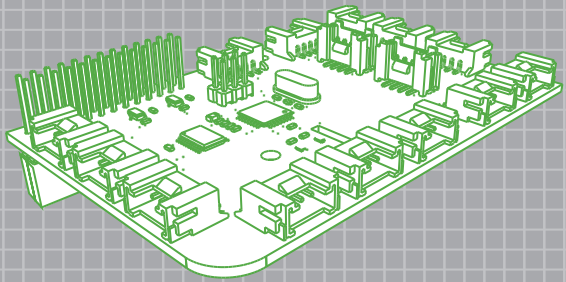
Q. Would my sensor work with the GrovePi+?
Please check the supported sensors page here: http://www.dexterindustries.com/GrovePi/sensors/supported-sensors/ to see if your sensor is officially supported. If it is not just the next question should help you figure out how to get it to work with the GrovePi+.

Q. I just got a Grove sensor I can't get get it to work with the GrovePi+.
First check if your sensor is officially supported by GrovePi+ here: http://www.dexterindustries.com/GrovePi/sensors/supported-sensors/.

If it is then you might need a software and firmware update, here's the guide:
http://www.dexterindustries.com/GrovePi/get-started-with-the-grovepi/updating-firmware/ .

Forum

If you have any other problems or suggestions post them on our forum: http://www.dexterindustries.com/forum/?forum=grovepi .



ATTENTION

Best to keep away from fire.

open source hardware

Innovate with China

http://www.seeed.cc
http://www.dexterindustries.com

For more information, please visit
seeed.cc/grovepi-kit