

# IQaudio User Guide

This document covers the installation, software configuration and usage of IQaudio audio cards for the Raspberry Pi.

If you would like to see additional information within this document please email us at [info@iqaudio.com](mailto:info@iqaudio.com)

**For those who simply need the /boot/config.txt details → Just jump to section 1**

# IQaudIO user instructions

## Contents

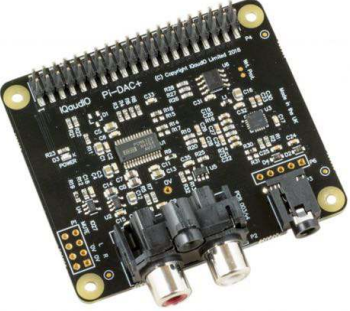



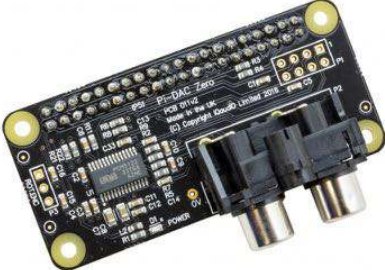

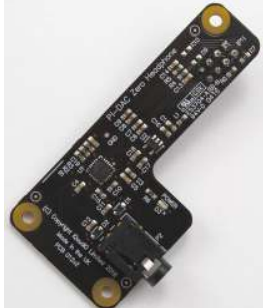
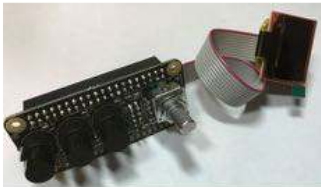

- 1) Getting started
- 2) The NEW Pi-DAC+
- 3) The NEW Pi-DigiAMP+
- 4) The NEW Pi-DAC PRO
- 5) The Pi-AMP+
- 6) The Pi-Digi+
- 7) The Pi-DACZero / ZeroHeadphone
  
- 8) Connecting the Pi-DAC+ to your Raspberry Pi
- 9) Connecting the Pi-DigiAMP+ to your Raspberry Pi
- 10) Connecting the Pi-AMP+ to your Pi-DAC+
  
- 11) Building the Raspberry Pi and IQaudIO sound cards into your Pi-CASE+
- 12) Configuring Linux/Raspbian to include sound card support
- 13) Checking audio is working through the IQaudIO sound card
- 14) Advanced troubleshooting
  
- 15) Controlling the Pi-AMP+ or Pi-DigiAMP+'s Mute / Un-mute
- 16) Common Linux audio distribution configurations
  
- 17) Advanced hardware information
- 18) Adding a Rotary Encoder (Physical volume control)
- 19) Adding an IR (Remote Control) Sensor
  
- 20) Sonic\_Pi and IQaudIO
- 21) Storing alsamixer settings
- 22) Using external USB devices
- 23) MPD based audio with volume control
- 24) Useful data (screw sizes / part numbers / wire gauge size etc.)

## 1) Getting Started

Thank you for choosing an IQaudIO sound card. Next you need to play music, but first you may need to configure the Raspberry Pi's and software package you want to use.

### The IQaudIO product family.

The IQaudIO sound cards are all designed to work with the current Raspberry Pi, those that have a 40way male GPIO pin header. This includes the Pi3, Pi3B+, Pi-Zero etc. Some of our products are full size (HAT) boards for the full size Raspberry Pi, and others are more suited to the Pi-Zero form factor. We also have accessory boards that either act as accessories to our sound cards or can be used standalone (such as the CosmicController).

Pi-DAC+	Pi-DigiAMP+	Pi-DAC PRO
		
Phono (RCA) and headphone output	Speaker output	Phono (RCA), Balanced and headphone output
Pi-Digi+	Pi-DACZero+	Pi-AMP+
		
Optical (Toslink) and SPDIF output	Phono (RCA) output	Speaker output (accessory to the Pi-DAC+ and Pi-DAC PRO)
DACZero Headphones	CosmicController	GPIO Expander
		
Headphone output (accessory for the Pi-DACZero)	3xLED, 3xButtons, Rotary Encoder & 128/64 OLED display	Double the access to the Pi's standard GPIO pins

You will find several audio applications with pre-configured Raspberry Pi SD Card images on [www.iqaudio.com/downloads](http://www.iqaudio.com/downloads) . We also include a quickest images which will help you check that you have the IQaudIO sound card installed correctly on your Raspberry Pi.

Each IQaudIO sound cards has a specific purpose / is designed for specific use cases. Select the board that best integrates with your existing HiFi equipment. If you don't have any existing equipment then simply buy a set of speakers and use the Pi-DigiAMP+.

IQaudio Card	Headphones	Line Out (RCA)	Balanced (XLR)	Speakers	Digital Output
Pi-DAC+	★	★			
Pi-DAC+ / AMP+	★	★		★	
Pi-DigiAMP+				★	
Pi-DACZero		★			
Pi-DACZero Headphones	★				
Pi-DAC PRO	★	★	★		
Pi-DAC PRO / AMP+	★	★	★	★	
Pi-Digi+					★

## Enabling the IQaudio sound card in Raspbian / example SD card images.

By default all our latest full size audio boards include a pre-programmed EEPROM. This allows the Raspberry Pi operating system to auto detect and auto configure itself allowing the IQaudio boards to be plug and play.

If however you are using an older version of our board, or a Pi-Zero type board then you may have to configure the Raspberry Pi operating system yourself. This is done by editing the Pi's configuration file (found at /boot/config.txt) and ensuring the correct device tree overlay is included. This is also how you disable the Pi's onboard audio if it exists.

We've included below the entries needed for the IQaudio boards and also the quickest image that can be downloaded from our website.

The following will help you check your sound card is working and it's configured correctly.

IQaudio Card	/boot/config.txt	Quicktest img
Pi-DAC+	dtoverlay=iqaudio-dacplus	IQ_0_quicktestDAC_DigiAMP_AMP.zip
Pi-DigiAMP+	dtoverlay=iqaudio-dacplus,unmute_amp or dtoverlay=iqaudio-dacplus,auto_mute_amp	IQ_0_quicktestDAC_DigiAMP_AMP.zip
Pi-DACZero	dtoverlay=iqaudio-dacplus	IQ_0_quicktestDAC_DigiAMP_AMP.zip
Pi-DAC PRO	dtoverlay=iqaudio-dacplus	IQ_0_quicktestDAC_DigiAMP_AMP.zip
Pi-Digi+	dtoverlay=iqaudio-digi-wm8804-audio	IQ_0_quicktestDigi.zip

## Disabling the standard Raspberry Pi On-Board Audio

You may want to disable the Raspberry Pi's on-board "low quality" audio card. This is done simply by commenting out the `dtparam=audio=on` device tree parameter in your /boot/config.txt file by placing a # at the start of the line, saving the file and rebooting

```
#dtparam=audio=on
```

## What's Headless?

Many of the software packages used with the Raspberry Pi simply turn the Pi into a Headless end-point. That is to say that it doesn't need to or expect a screen to be attached to the Pi's HDMI socket.

So if there's no screen how do you control it?

Well in some cases you don't need to do anything with the Pi at all. Take the RoonLabs images, these turn the Pi into a Roon Certified end-point. The Pi is then controlled from the RoonLabs PC/ Mac application which connects to and plays music through the IQaudio sound card. No screen needs to be attached to the Pi itself.

This is again similar with the Shairport-sync utility - it turns the Pi into a Apple Airport compatible speaker, music and volume is then controlled from your iPad / iPhone, or iTunes. Below, LivingRoom and Snug are both RaspberryPi running Shairport-sync.



Other “headless” applications install a web server onto the Pi, so to control it you simply open a browser window on your PC / Mac / Tablet or similar and interact with the Pi based application through a web page. Applications such as [MoodeAudio](#), [Volumio](#) and [RuneAudio](#) work this way.



## How do I install software on the Pi?

The Raspberry Pi loads its software from the micro-SD card. Most audio applications assume they are the only thing running on the Pi so most require a dedicated SD card. The applications are normally distributed as a compressed .img file (likely a .zip or .gz file) and this .img file will need to be written to the Pi's SD card to allow the Pi to boot.

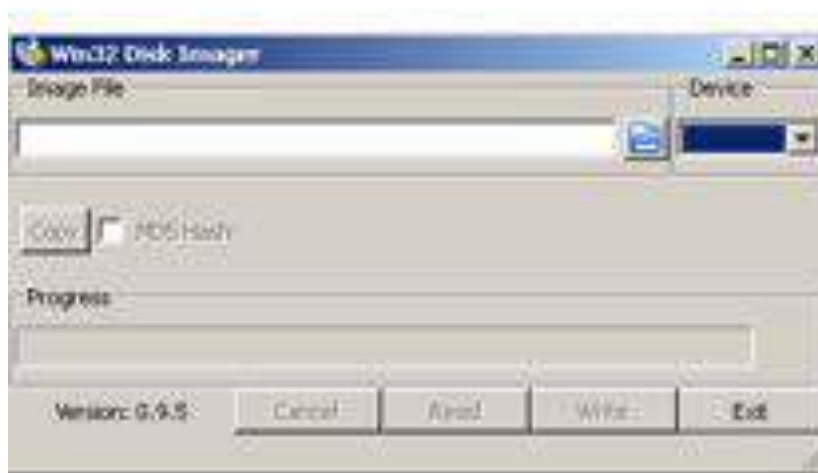
Can't I just copy the .img file over to the Pi?

Err, no. Doing this will just store the .img file on the SD card. The Pi needs the SD card to be formatted in a particular way to allow it to boot / start up and run. Don't worry, there are several ways to do this and some are VERY simple.

Got a Mac? Get ApplePi-Baker - <https://www.tweaking4all.com/>



Use Windows? Use Win32DiskImager - <https://sourceforge.net/projects/win32diskimager/>



Top Tip: Buy a few extra micro SD cards, you'll find it much easier to try things. Also, once you have a working Pi SD card, back it up to your PC/Mac. It's easier to re-write the SD card if things go wrong.



## 2) The NEW Pi-DAC+

The Pi-DAC+ is a fully HAT compliant add-on accessory for the Raspberry Pi A+/B+/Pi2/RPi3/RPi3B+.

The Pi-DAC+ takes the digital audio signals (I2S) from the Raspberry Pi and through the onboard Texas Instruments PCM5122 DAC delivers variable output (hardware volume control) analog audio to the Pi-DAC+'s Phono connectors. The Pi-DAC+ also, via the Texas Instruments TPA6133A headphone amp, supports the direct use of headphones via the Pi-DAC+'s 3.5mm audio jack.

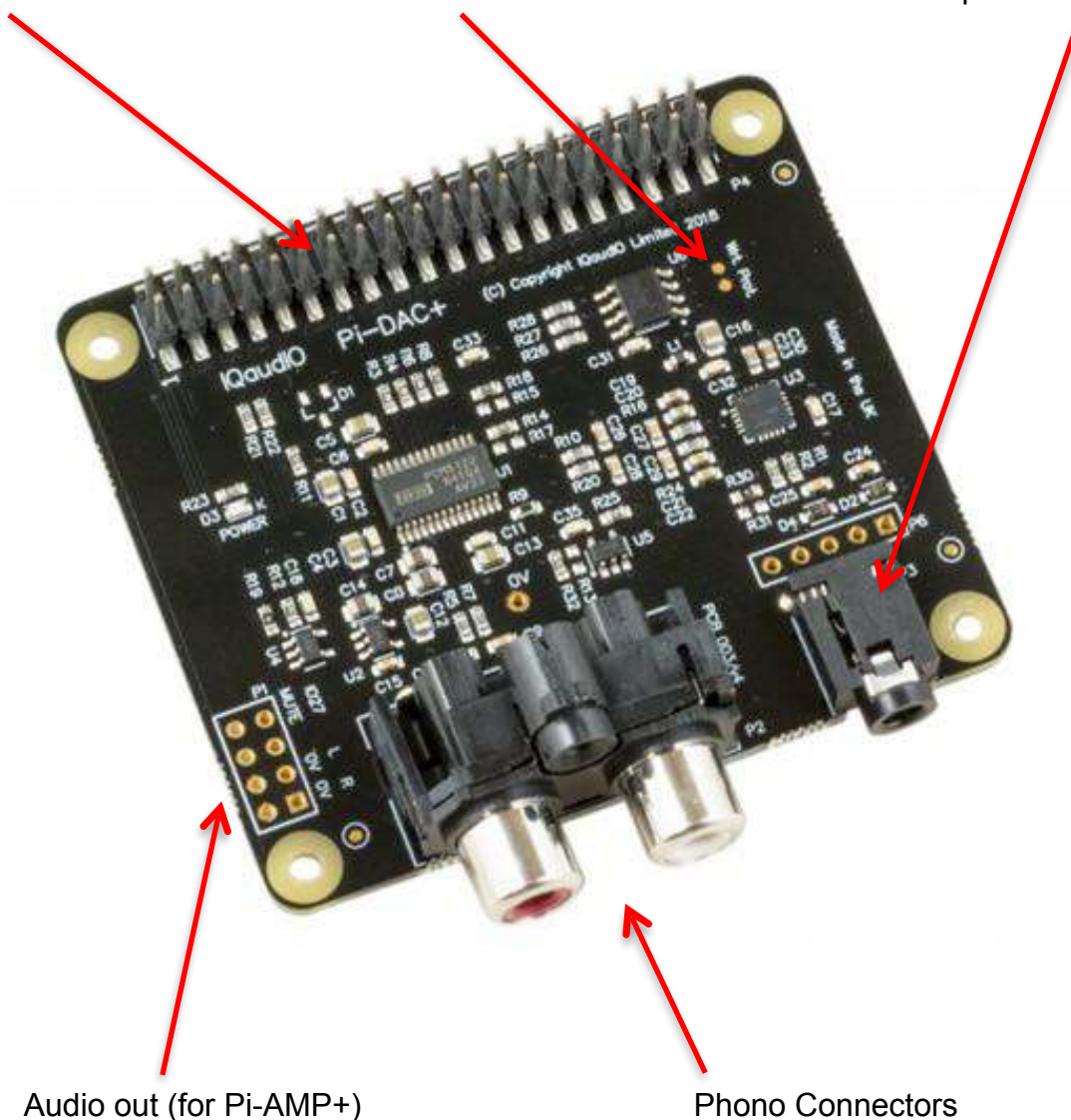
The Pi-DAC+ can be connected to the Raspberry Pi's 40way pin header without any additional soldering.

Component selection and track layout have been in the forefront of our design to ensure noise immunity and best possible audio playback with the Pi-DAC+.

Raspberry Pi GPIO header

HAT EEPROM Write Enable

Headphone Socket



Audio out (for Pi-AMP+)

Phono Connectors



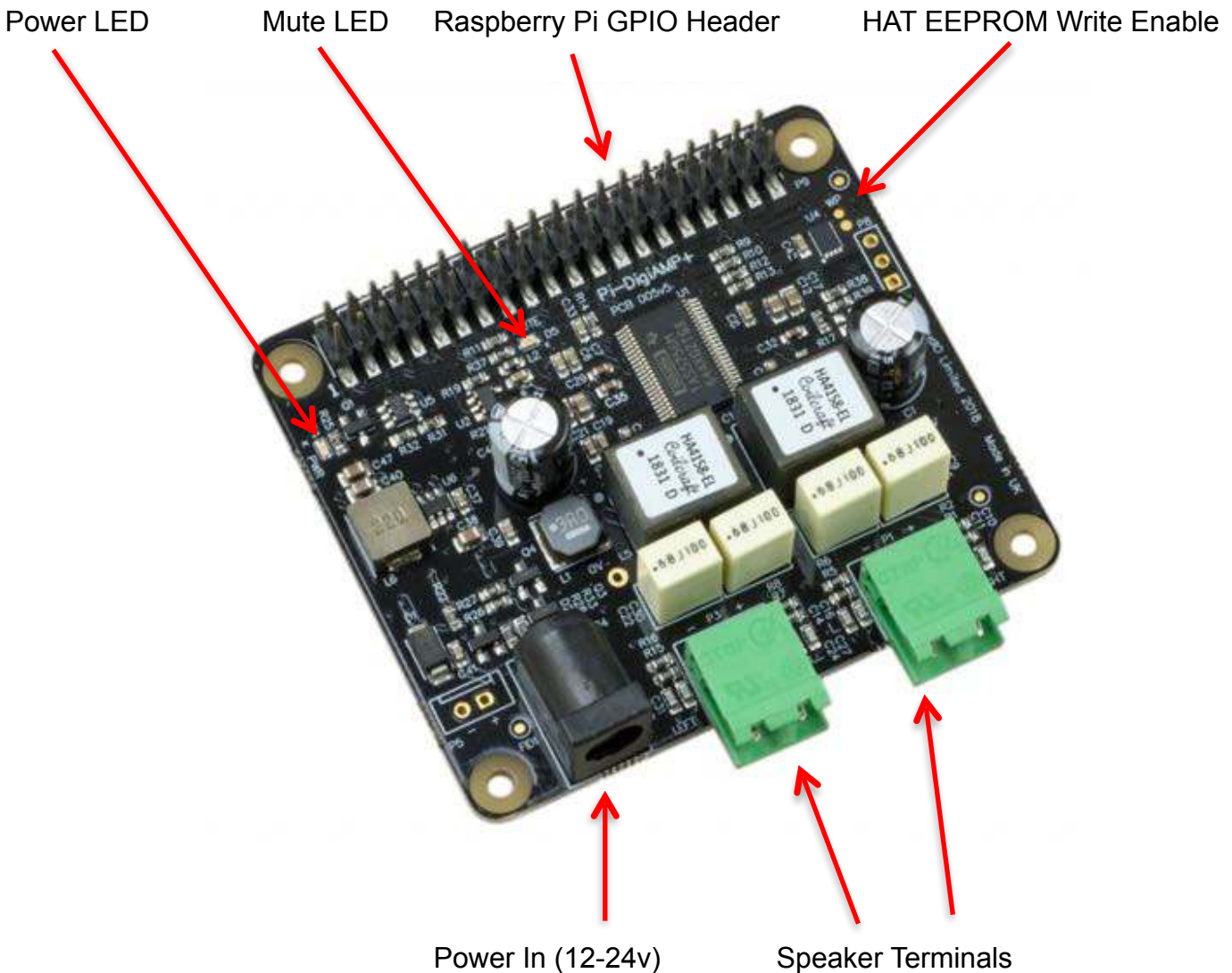
### 3) The New Pi-DigiAMP+

The Pi-DigiAMP+ is a fully HAT compliant add-on accessory for the Raspberry Pi.

The Pi-DigiAMP+ takes the digital audio signals (I2S) from the Raspberry Pi and through the onboard Texas Instruments TAS5756M PowerDAC delivers direct connection to stereo speakers at up to 2x35w with variable output.

The Pi-DigiAMP+ can be connected to the Raspberry Pi A+/B+/RPi2 or RPi3's 40way pin header without any additional soldering. The Pi-DigiAMP+ requires a 12-24 volt power source to operate. Power should be applied via the Pi-DigiAMP+'s standard barrel connector or can be applied via the (no fit) two pin header provided.

The Pi-DigiAMP+, when powered, has been designed to provide power to the Raspberry Pi and Pi-DigiAMP+ combination safely. You can continue to use your Pi devices without risk of damage. The amplifier is by default muted at power on (mute LED lit). Mute state / LED is under software control (Raspberry Pi GPIO22).

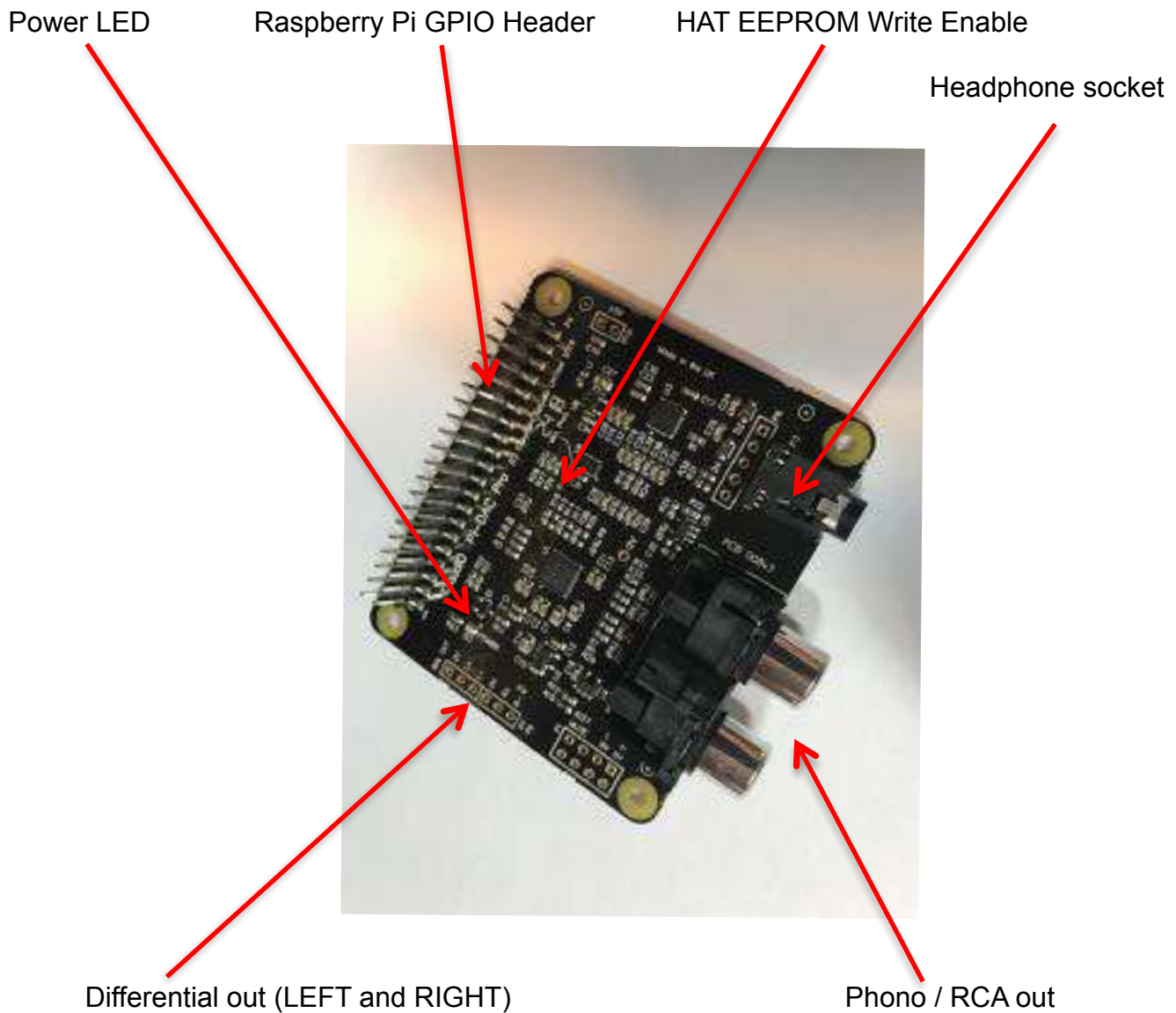


#### 4) The NEW Pi-DAC PRO

The Pi-DAC PRO is a fully HAT compliant add-on accessory for the Raspberry Pi.

The Pi-DAC PRO uses the Texas Instruments PCM5242 to deliver outstanding Signal to Noise Ratio and supports Balanced / Differential out in parallel to Phono / RCA line level output. It also includes the IQaudIO Headphone amp.

The Pi-DAC PRO can be connected to the Raspberry Pi A+/B+/RPi2 or RPi3's 40way pin header without any additional soldering. The Pi-DAC PRO is powered from the Raspberry Pi.



## 5) The Pi-AMP+ (Legacy product)

The Pi-AMP+ is an add-on accessory for the Legacy Pi-DAC+ / Pi-DAC PRO and Raspberry Pi.

The Pi-AMP+ takes the variable output analog audio from the Pi-DAC+ and through the onboard Texas Instruments TPA3118D2 Class D amplifier delivers audio to the Pi-AMP+'s speaker terminals delivering up to 2x35w@19v input.

The Pi-AMP+ requires a 12–19volt power source to operate. Power should be applied via the Pi-AMP+'s standard barrel connector or the two pin JST socket provided.

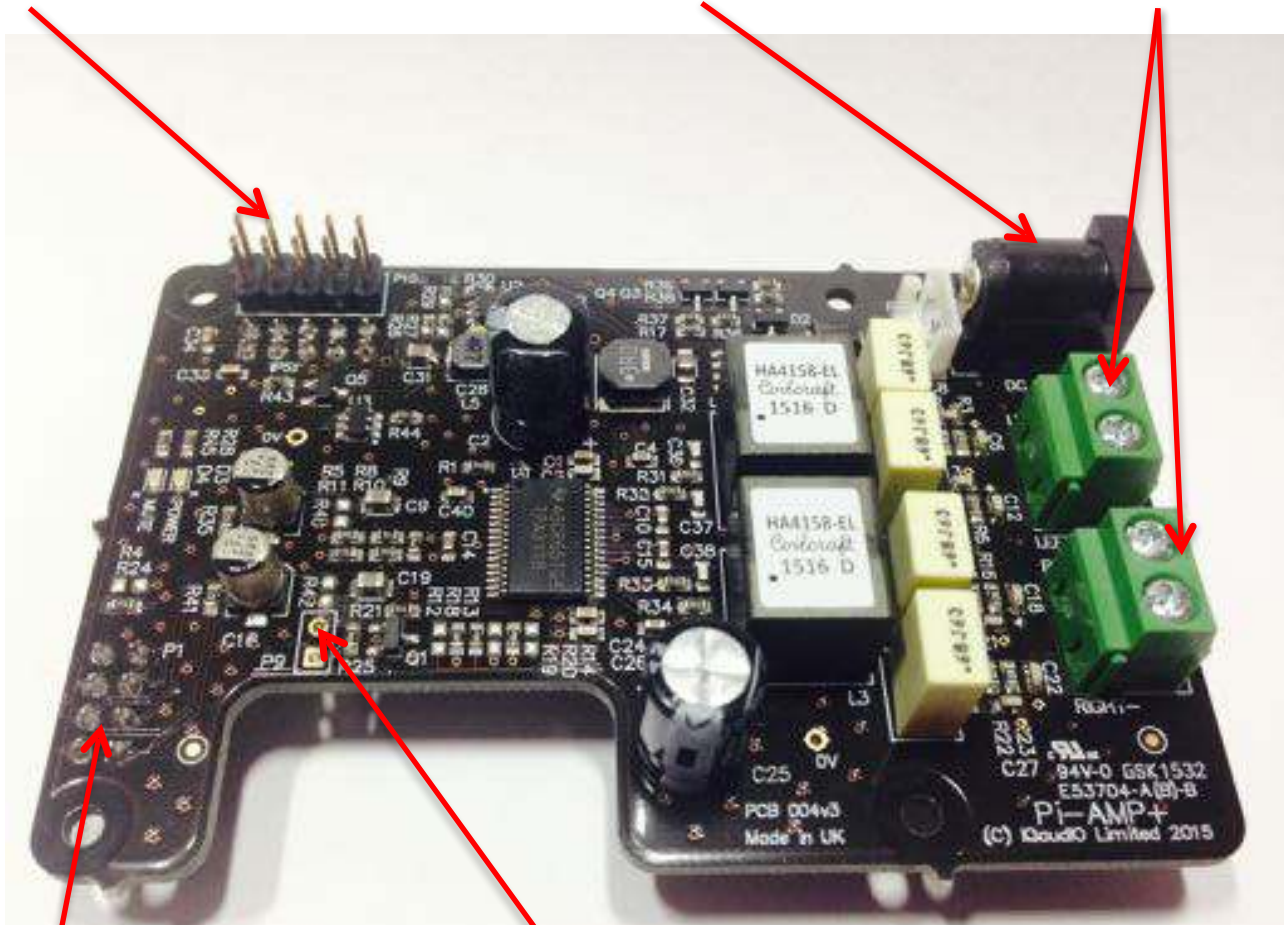
The Pi-AMP+, when powered, has been designed to provide power to the Raspberry Pi / Pi-DAC+ and Pi-AMP+ combination safely. You can continue to use your Pi devices without risk of damage. As with the Pi-DAC+, we've focused on the components selected and the attention to audio performance during PCB layout when developing the Pi-AMP+.

The Pi-AMP+ is by default muted at power on (mute LED lit). Mute state / LED is under software control (Raspberry Pi GPIO22) but mute may be overridden by shorting the Pi-AMP+'s P9 pins with a suitable jumper – note the mute LED will remain lit if P9 is shorted.

Pi Power out

12v-19v Power In

Speaker Terminals



Audio In (from Pi-DAC+)

Mute Override (P9)

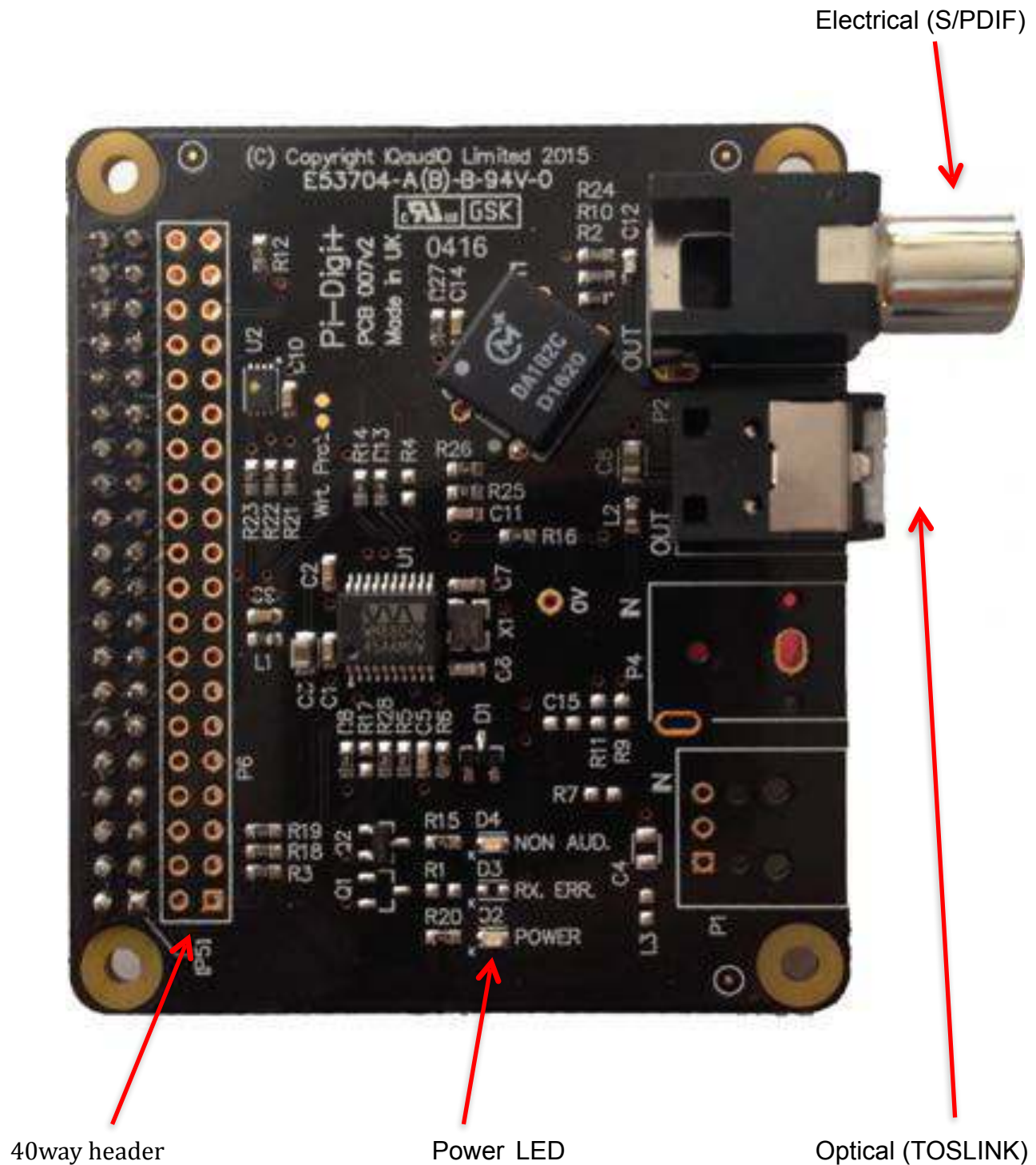


## 6) Pi-Digi+

The Pi-Digi+ is a fully HAT compliant add-on accessory for the Raspberry Pi.

The Pi-Digi+ takes the digital audio signals (I2S) from the Raspberry Pi and through the onboard Wolfson / Cirrus Logic WM8804 delivers Optical TOSLINK and isolated electrical SPDIF connection to an external DAC.

The Pi-Digi+ can be connected to the Raspberry Pi A+/B+/RPi2 or RPi3's 40way pin header without any additional soldering. The Pi-Digi+ is powered from the Raspberry Pi.



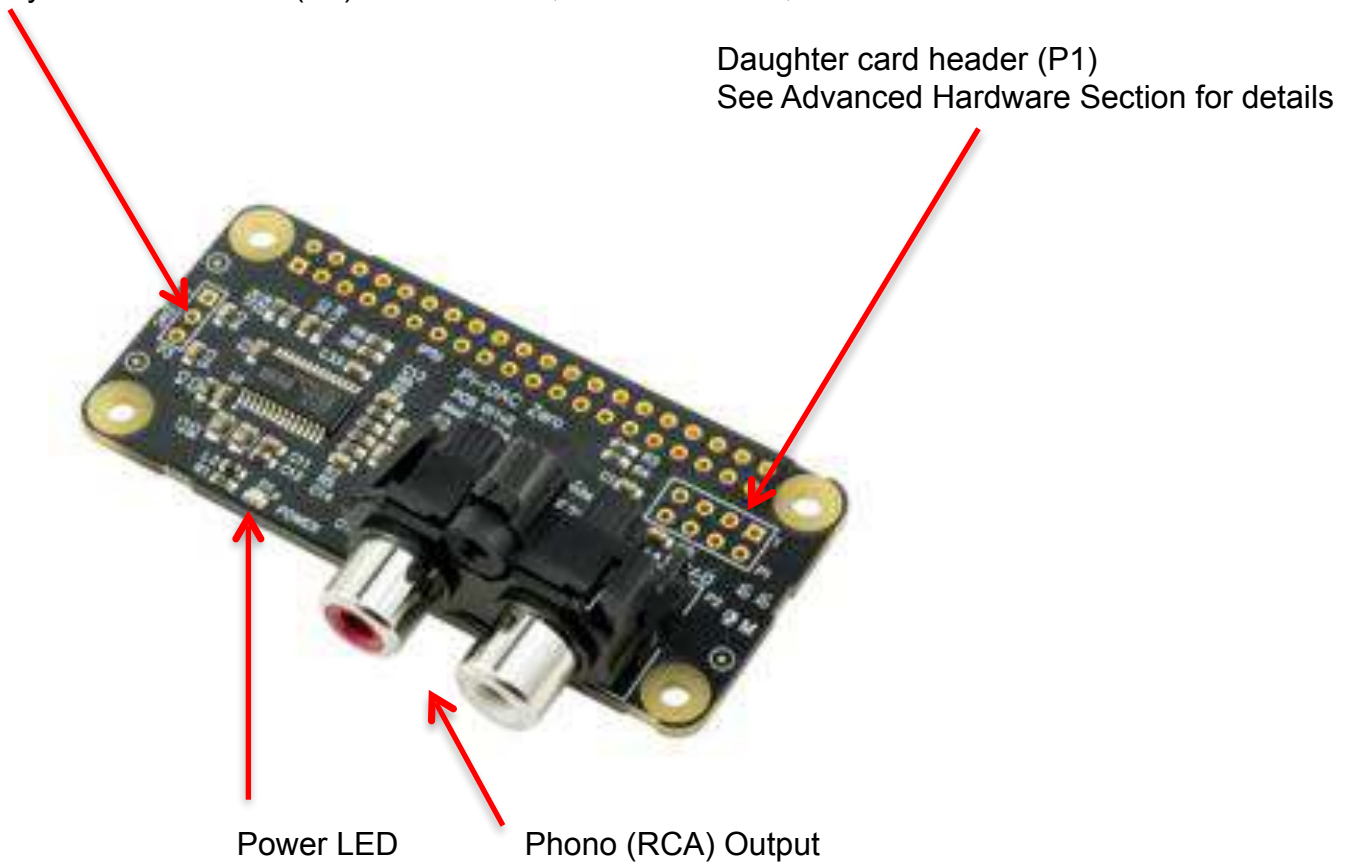
## 7) The Pi-DACZero / DACZeroHeadphone

The Pi-DACZero is a smaller version of the IQaudIO Pi-DAC+ which is designed to be used with the Raspberry Pi-Zero.

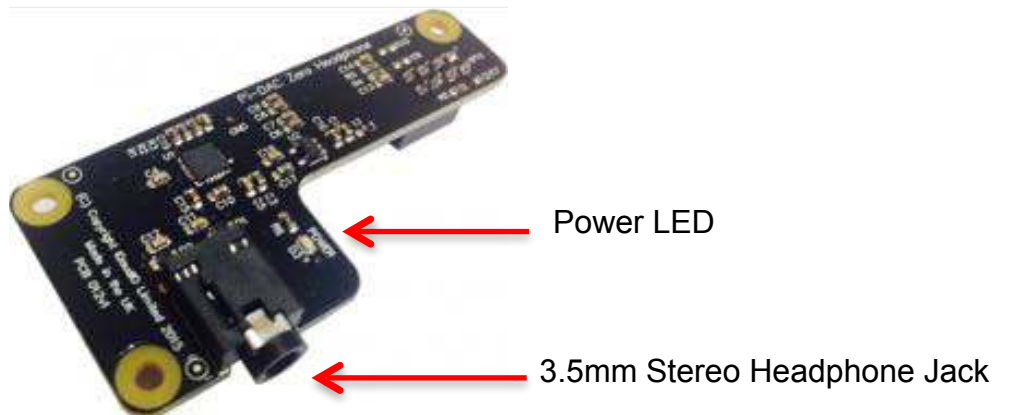
The Pi-DACZero delivers audio Line Out and uses the same Linux drivers as the Pi-DAC+.

There is an optional Headphone daughter card for the Pi-DACZero which can be mounted above the DACZero to give an amplified headphone output in parallel. The Pi-DACZero and Pi-DACZeroHeadphone boards are powered from the Raspberry Pi-Zero itself.

Rotary Encoder Header (P3) Pin1:GPIO23, Pin2:GROUND, Pin3:GPIO24



### DACZero Headphone



## 8) Connecting the Pi-DAC+ to your Raspberry Pi

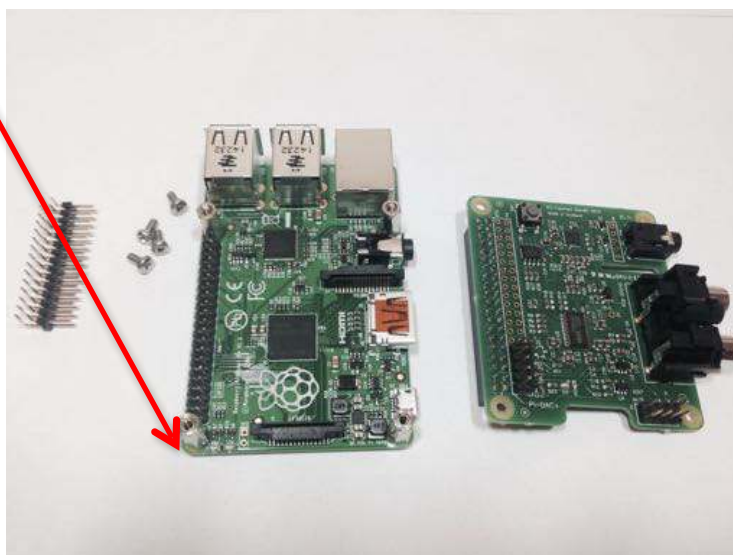
**WARNING: PLEASE ENSURE ALL CABLES ARE DISCONNECTED FROM THE Pi-DAC+ AND THE RASPBERRY PI BEFORE ATTEMPTING THIS PROCEDURE.**

The Pi-DAC+ can be connected to the Raspberry Pi's 40way pin header without any additional soldering.

The Pi-DAC+ is normally supplied\* along with 4x 12mm PCB spacers and 8x M2.5 screws. You may want to use a 30way right-angled I/O pin header (only needed if you wish to use the exposed Raspberry Pi GPIO).

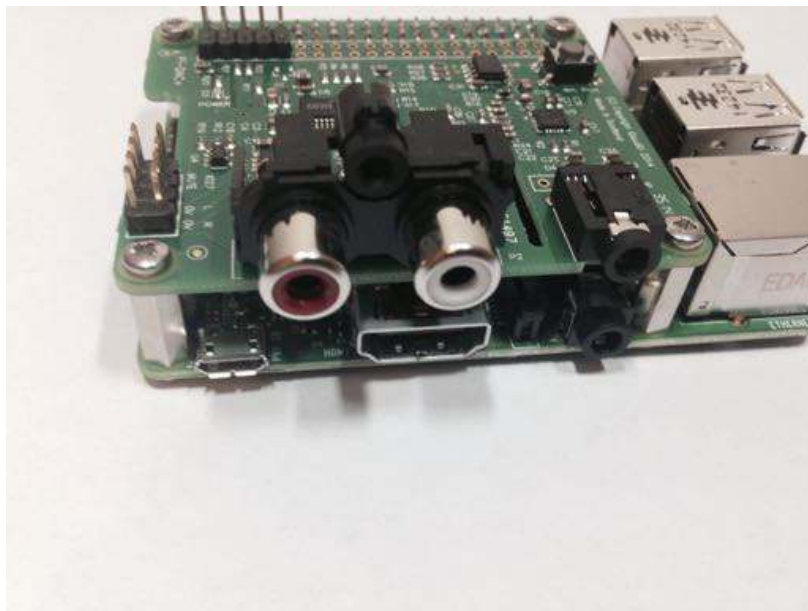
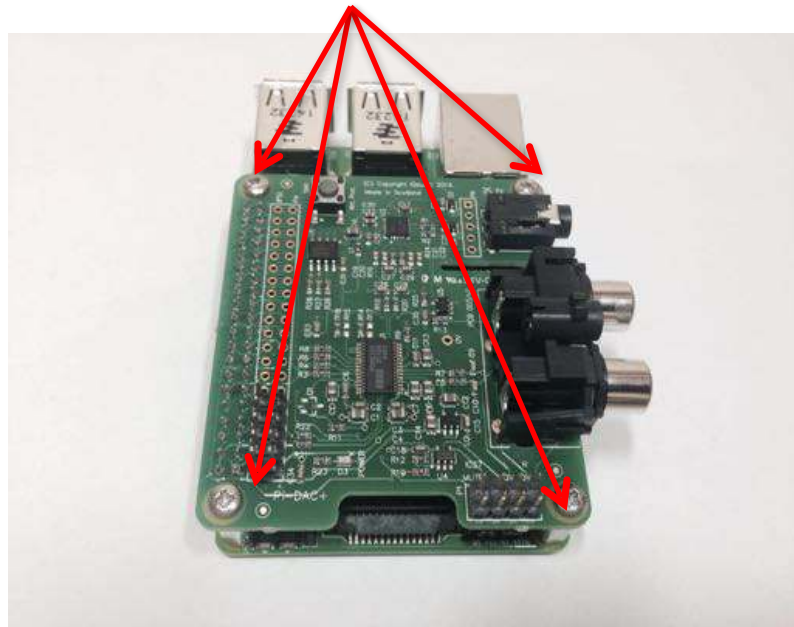


The spacers should be screwed (finger tight only) to the Raspberry Pi before adding the Pi-DAC+.

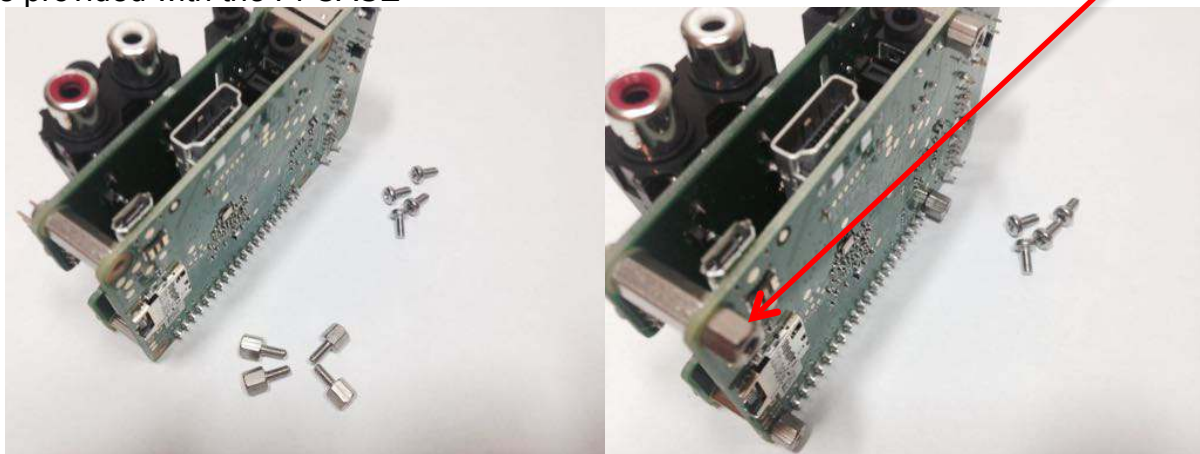




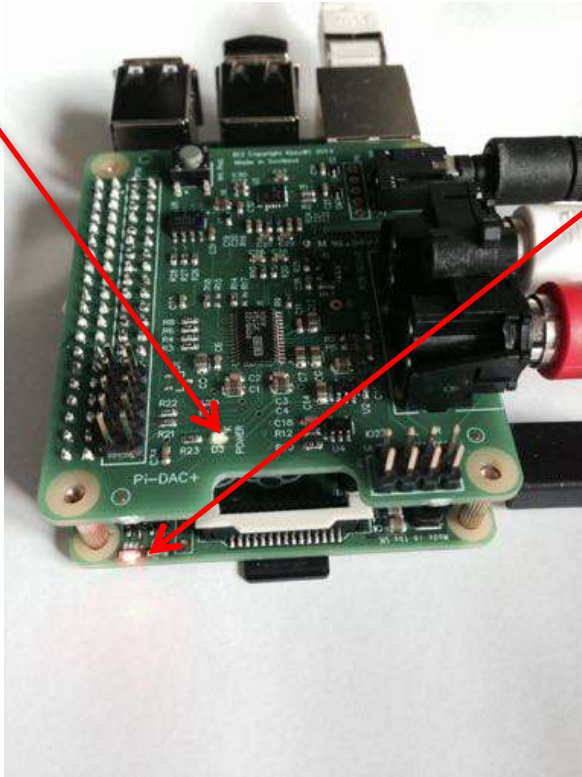
Once the Pi-DAC+ has been fitted the remaining screws can be tightened (finger tight please) as required.



If you are using the Pi-CASE+ then replace the 4x screws beneath the Pi with the 4x 5mm PCB standoffs provided with the Pi-CASE+



Apply power to your Raspberry Pi in the normal way. You should see that the Raspberry Pi and the Pi-DAC+ both have power LEDs – this indicates that the power is successfully being applied to the Pi-DAC+.



You can now remove power and reconnect any necessary peripherals.

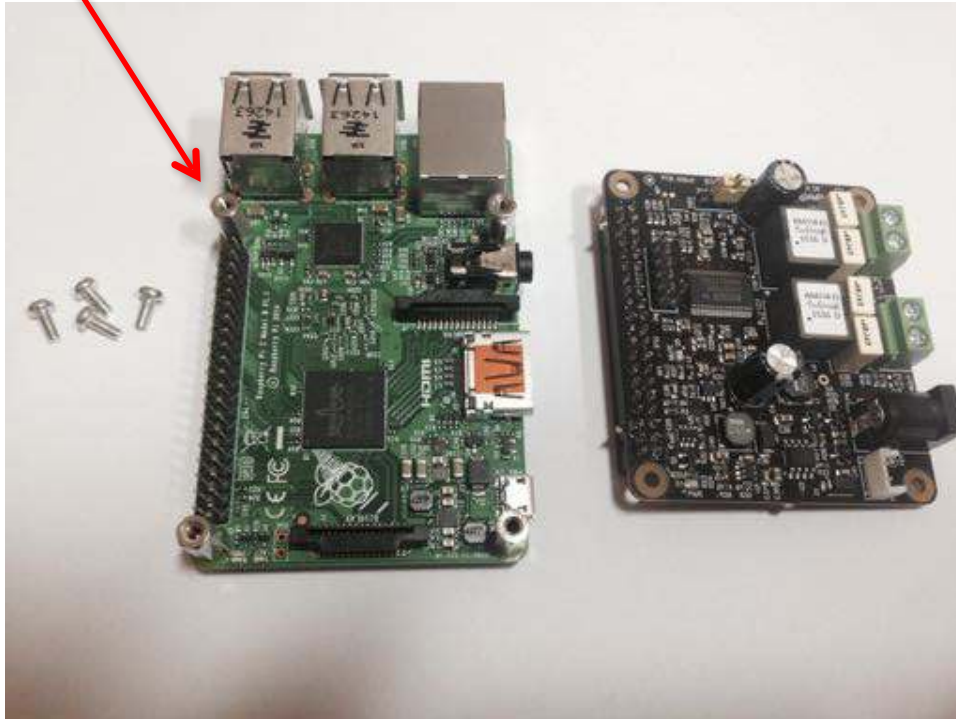
## 9) Connecting the Pi-DigiAMP+ to your Raspberry Pi (Pictures are of LEGACY product)

**WARNING: PLEASE ENSURE ALL CABLES ARE DISCONNECTED FROM THE Pi-DigiAMP+ AND THE RASPBERRY PI BEFORE ATTEMPTING THIS PROCEDURE.**

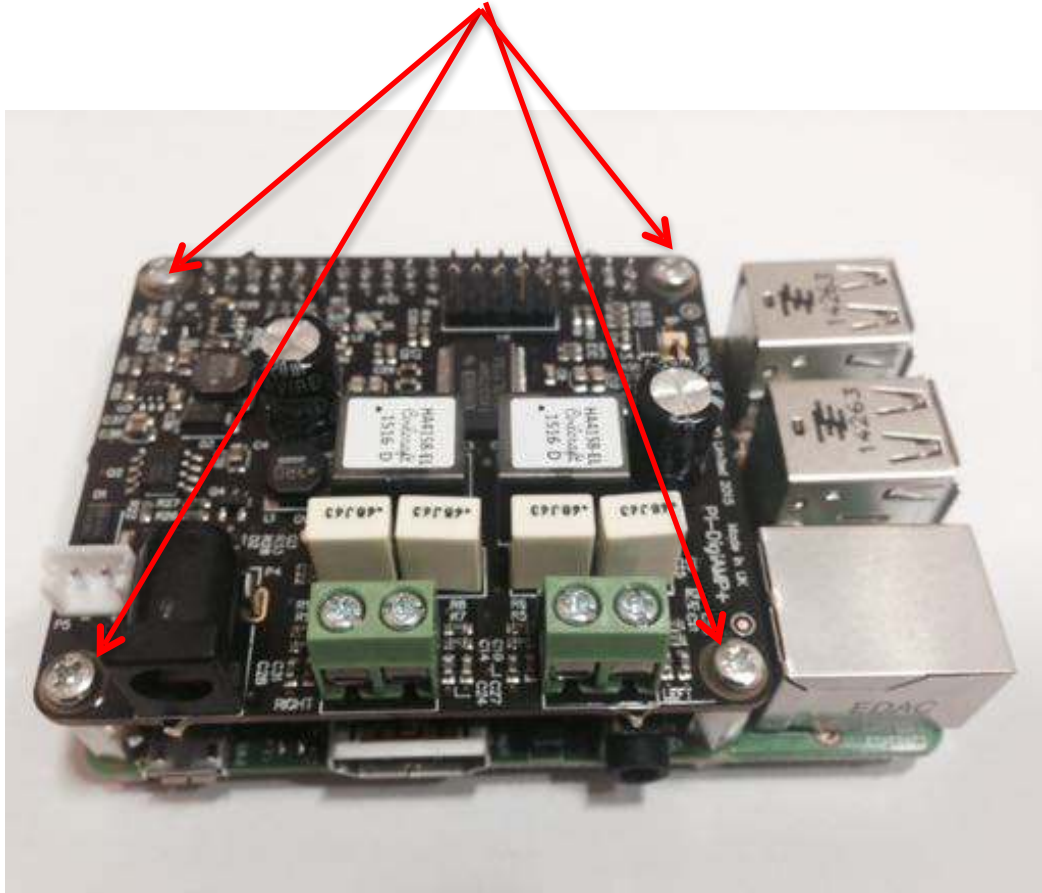
The Pi-DigiAMP+ can be connected to the Raspberry Pi's 40way pin header without any additional soldering.

The Pi-DigiAMP+ is supplied\* along with 4x 12mm PCB spacers and 8x M2.5 screws.

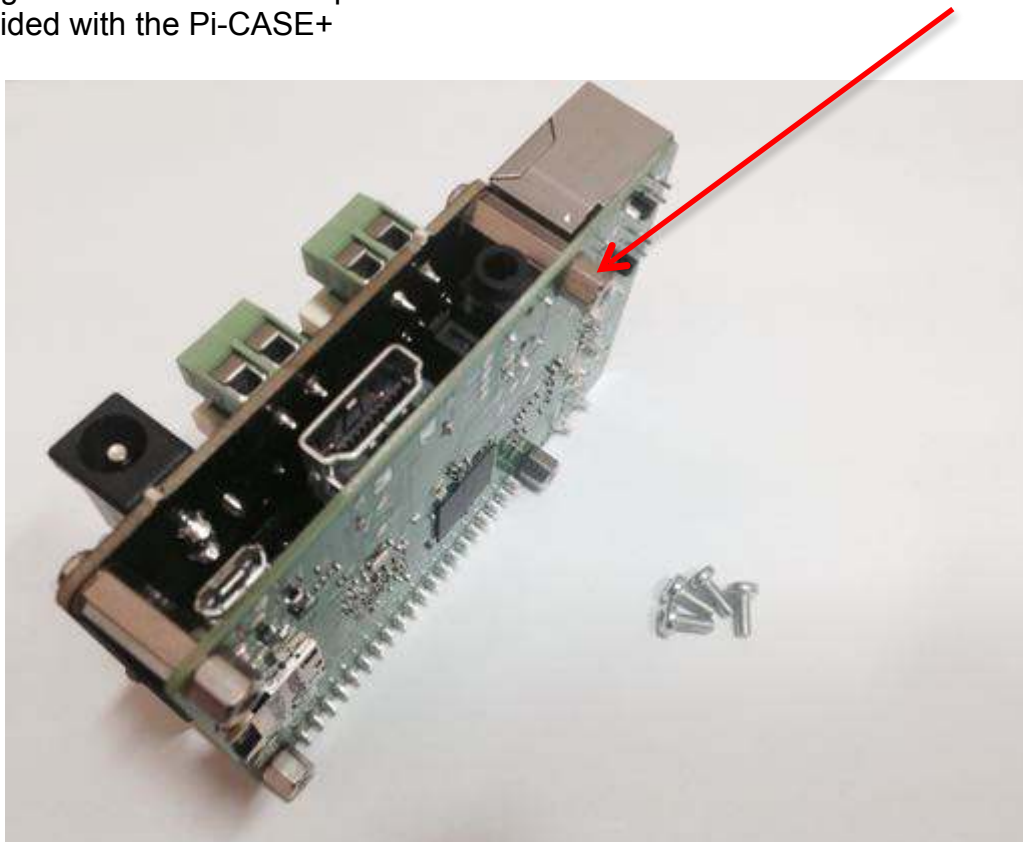
The spacers should be screwed (finger tight only) to the Raspberry Pi before adding the Pi-DigiAMP+.



Once the Pi-DigiAMP+ has been fitted the remaining screws can be tightened (finger tight please) as require



If you are using the Pi-CASE+ then replace the 4x screws beneath the Pi with the 4x 5mm PCB standoffs provided with the Pi-CASE+





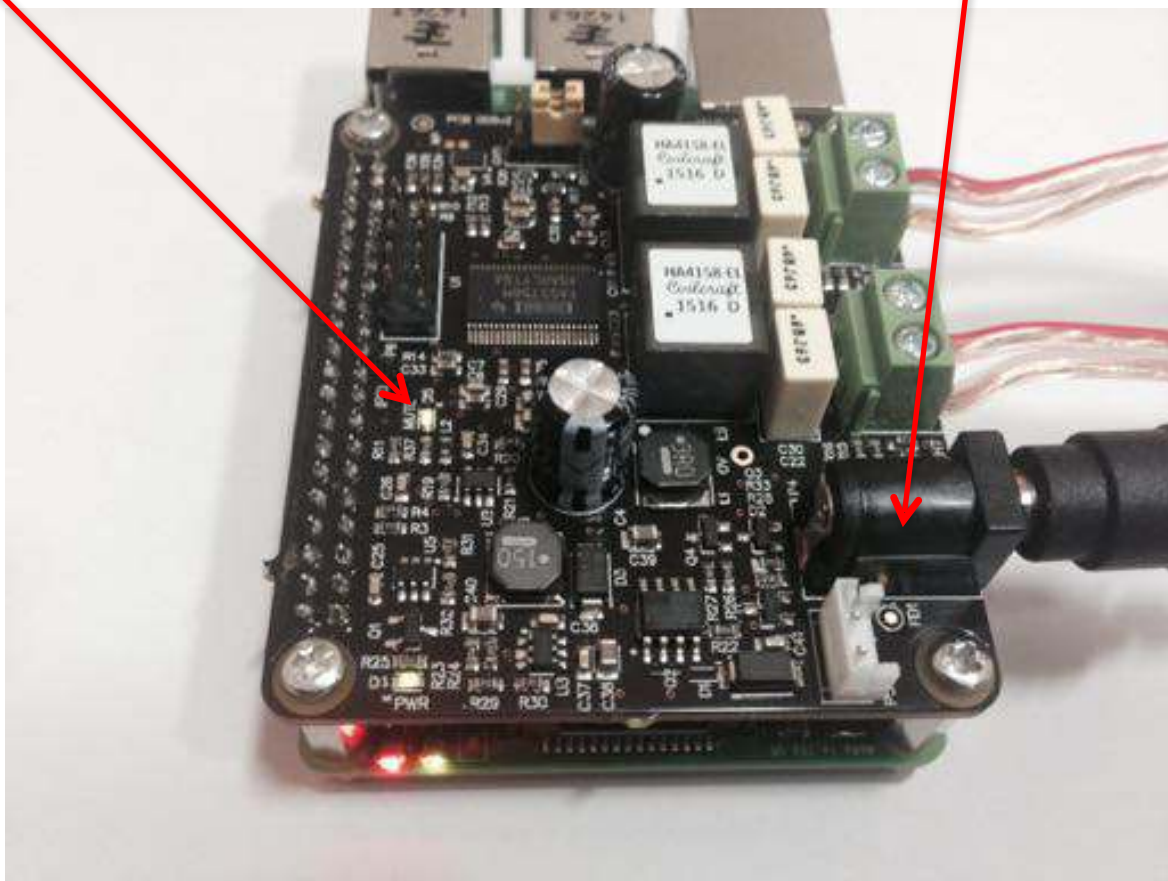
## DO NOT APPLY POWER TO YOUR RASPBERRY PI VIA THE PI'S MICRO USB SOCKET.

The Pi/Pi-DigiAMP+ combination **MUST** be powered via the Pi-DigiAMP+, not the Raspberry Pi. Once you are happy with that the Raspberry Pi and Pi-DigiAMP+ are connected correctly you are nearly ready to apply power.

Power should only be applied to the Pi-DigiAMP+ once speakers have been attached. Powering the Pi-DigiAMP+ without speakers attached may damage the device.

The Pi-DigiAMP+ has been designed to be powered by the recommended XP Power DC supply. The Power supply's output connector should be inserted into the Pi-DigiAMP+'s DC input terminal (marked P4). Only then should the Power supply's AC input be plugged into the mains.

When power has been applied to the Pi-DigiAMP+ it will also provide power to the Raspberry Pi. You should see that the Raspberry Pi and the Pi-DigiAMP+ both have power LEDs – when both are lit it indicates that the power is successfully being applied to the Pi-DigiAMP+ and Pi. The Pi-DigiAMP+'s Mute LED will also be lit.



You can now remove power and reconnect any necessary peripherals, install in case etc.

For accurate performance, your loudspeakers must be connected in phase. For both left and right loudspeakers.