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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



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

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

IQaudIO user instructions

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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 Linux OS.

You will find several audio applications with pre-configured Micro SD Card images on www.iqaudio.com/downloads we also include quickest images which will help you check that you have the IQaudio sound card installed correctly on your Raspberry Pi.

What output does each IQaudio card support?

Each of the IQaudio sound cards has a specific purpose. Chose the correct sound card for your specific need:

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.

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

IQaudio Card	/boot/config.txt	Quickest img
Pi-DAC+	dtoverlay=iqaudio-dacplus	IQ_0_quickestDAC_DigiAMP_AMP.zip
Pi-DigiAMP+	dtoverlay=iqaudio-dacplus,unmute_amp or dtoverlay=iqaudio-dacplus,auto_mute_amp	IQ_0_quickestDAC_DigiAMP_AMP.zip
Pi-DACZero	dtoverlay=iqaudio-dacplus	IQ_0_quickestDAC_DigiAMP_AMP.zip
Pi-DAC PRO	dtoverlay=iqaudio-dacplus	IQ_0_quickestDAC_DigiAMP_AMP.zip
Pi-Digi+	dtoverlay=iqaudio-digi-wm8804-audio	IQ_0_quickestDigi.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.

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.

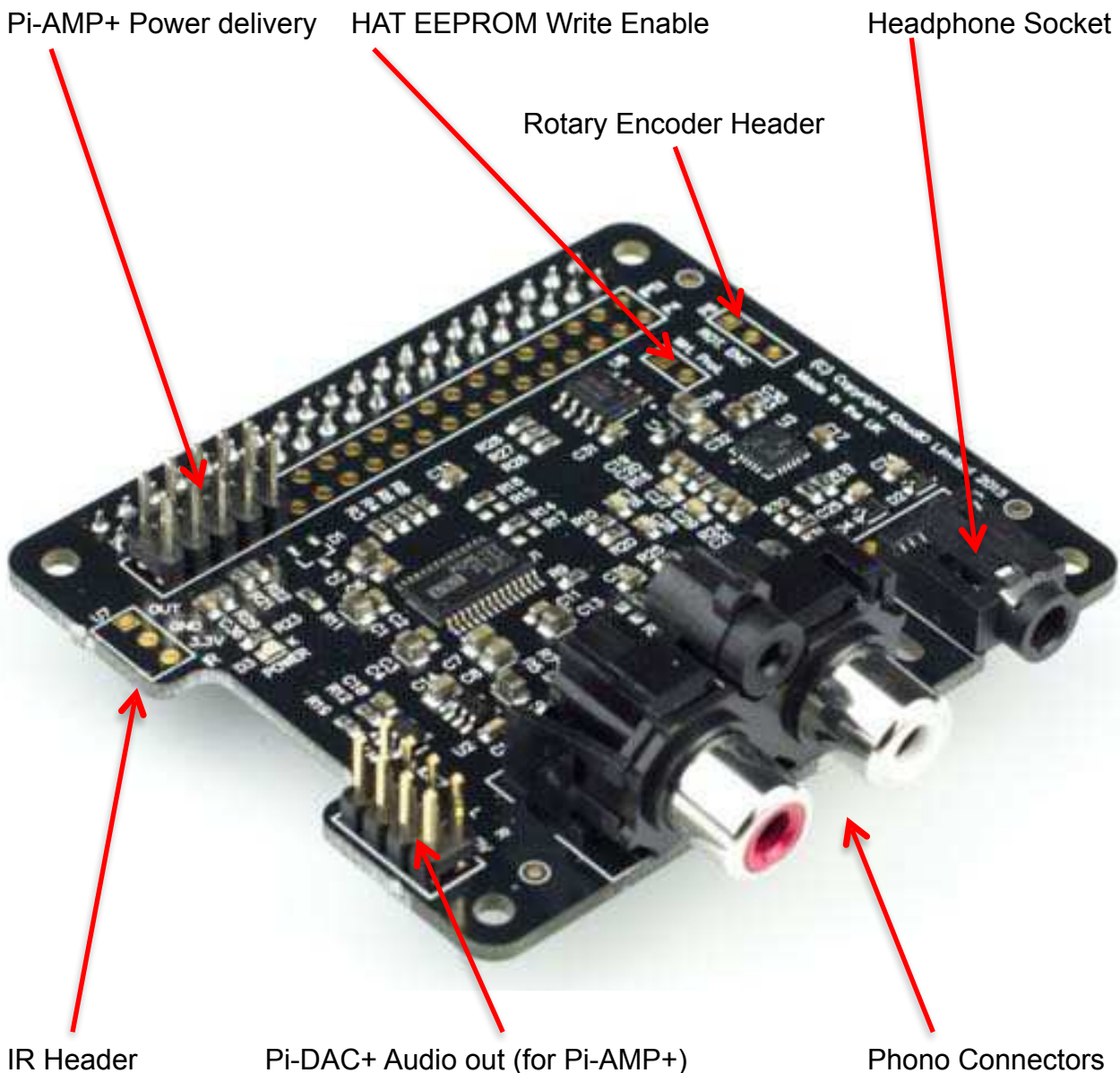
2) The Pi-DAC+

The Pi-DAC+ is a fully HAT compliant add-on accessory for the Raspberry Pi A+/B+/Pi2/Rpi3.

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+.



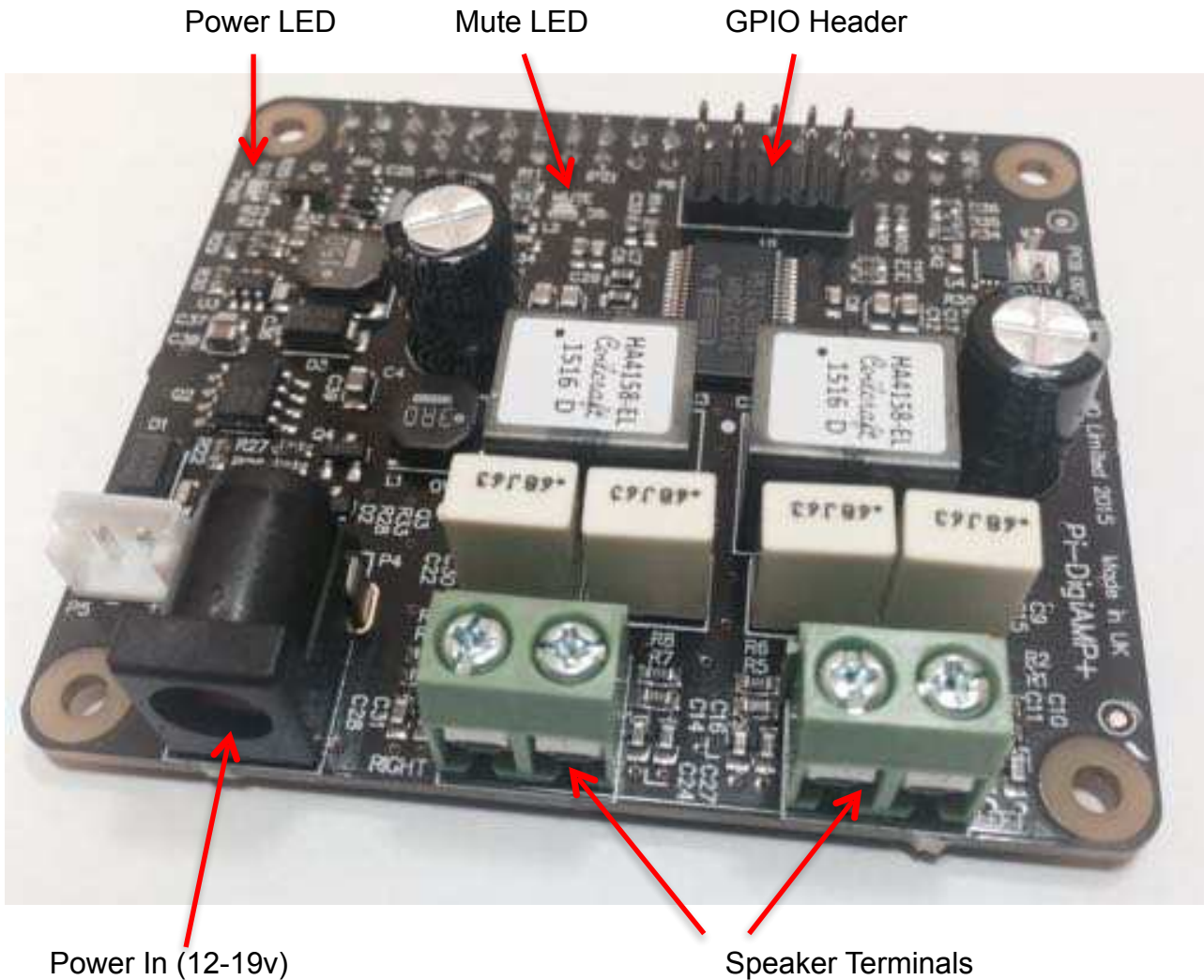
3) The Pi-DigiAMP+

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. Adjustable gain (+20db or +26db) is selectable by a pin header P7 (not shown below). Only remove and set this when NO POWER IS APPLIED.

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 12-19volt power source to operate. Power should be applied via the Pi-DigiAMP+'s standard barrel connector or the two pin JST socket 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 Pi-DigiAMP+ is by default muted at power on (mute LED lit). Mute state / LED is under software control (Raspberry Pi GPIO22). Component selection and track layout have been in the forefront of our design to ensure noise immunity and best possible audio playback / experience with the Pi-DigiAMP+.

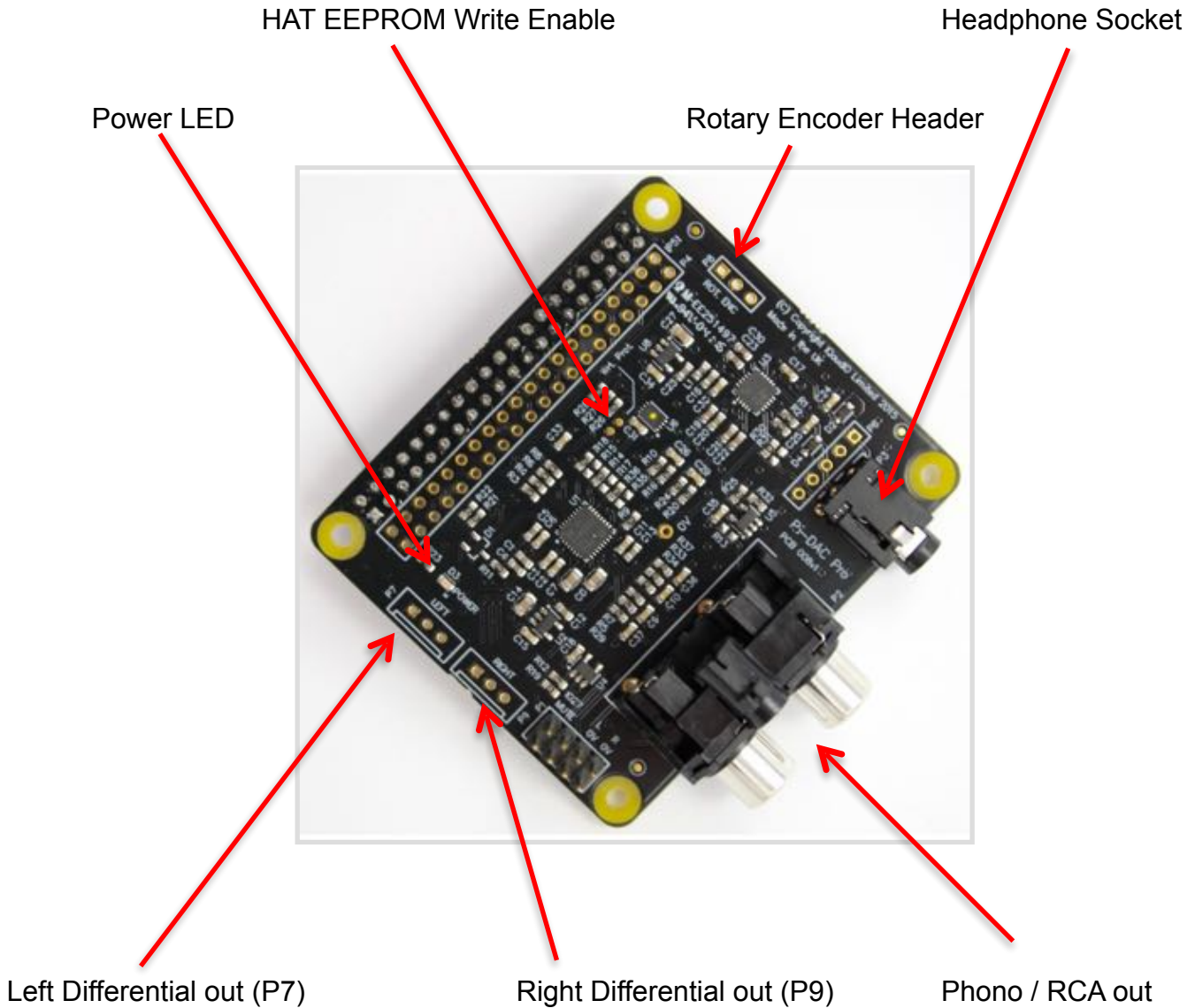


5) The Pi-DAC PRO

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.

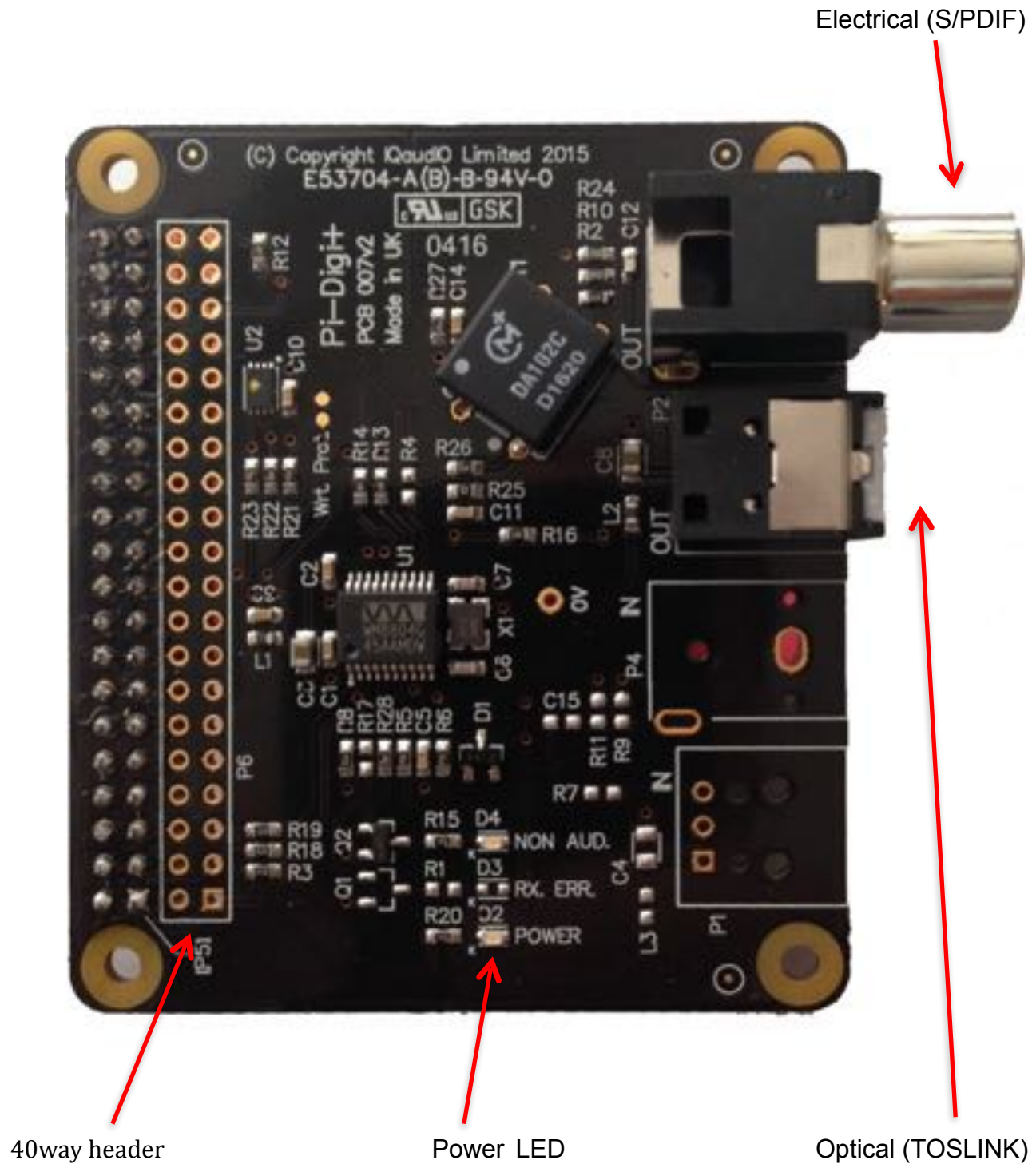


6) Pi-Digi+

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

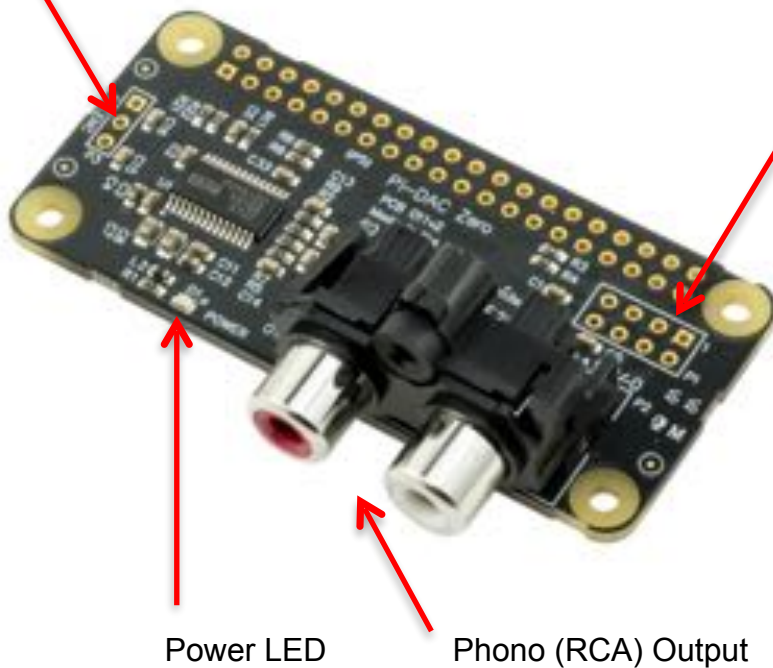
The Pi-DACZero is a smaller version of the IQaudIO Pi-DAC+ which is designed to be used with the Raspberry Pi-Zero.

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

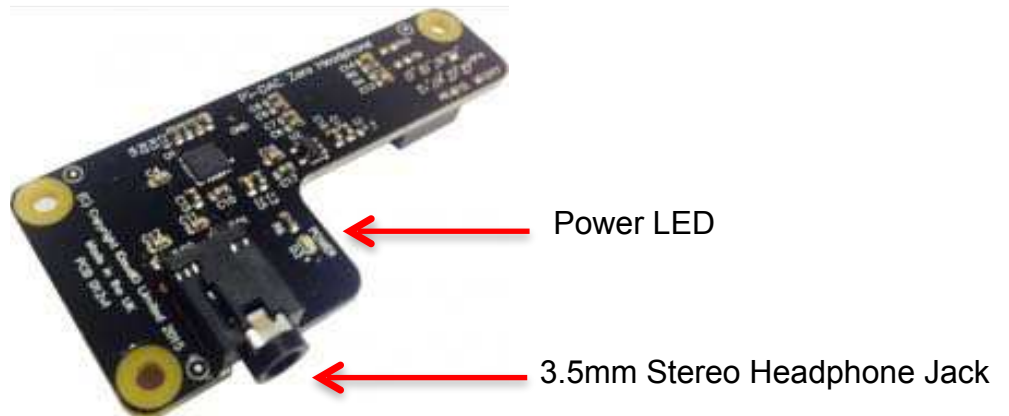
There is an optional Headphone daughter card for the Pi-DACZero which can be mounted above the DACZero to give an amplified headphone output in parallel. The Pi-DACZero and Pi-DACZeroHeadphone boards are powered from the Raspberry Pi-Zero itself.

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

Daughter card header (P1)
See Advanced Hardware Section for details



DACZero Headphone



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

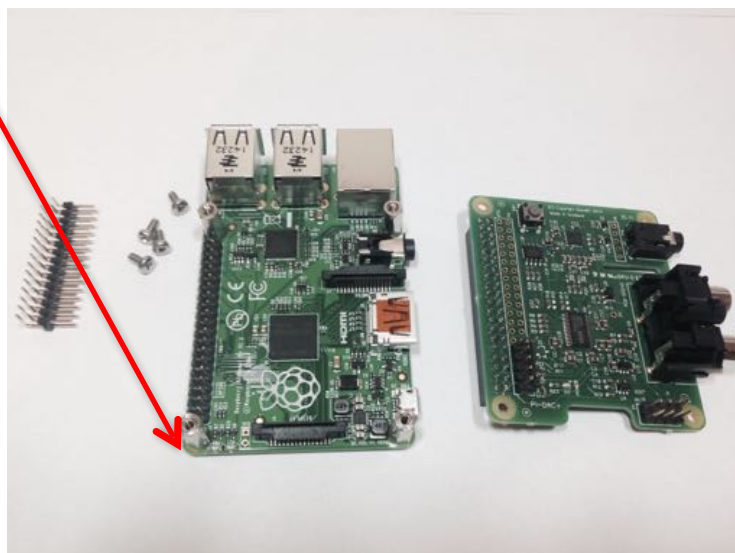
WARNING: PLEASE ENSURE ALL CABLES ARE DISCONNECTED FROM THE Pi-DAC+ AND THE RASPBERRY PI BEFORE ATTEMPTING THIS PROCEDURE.

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

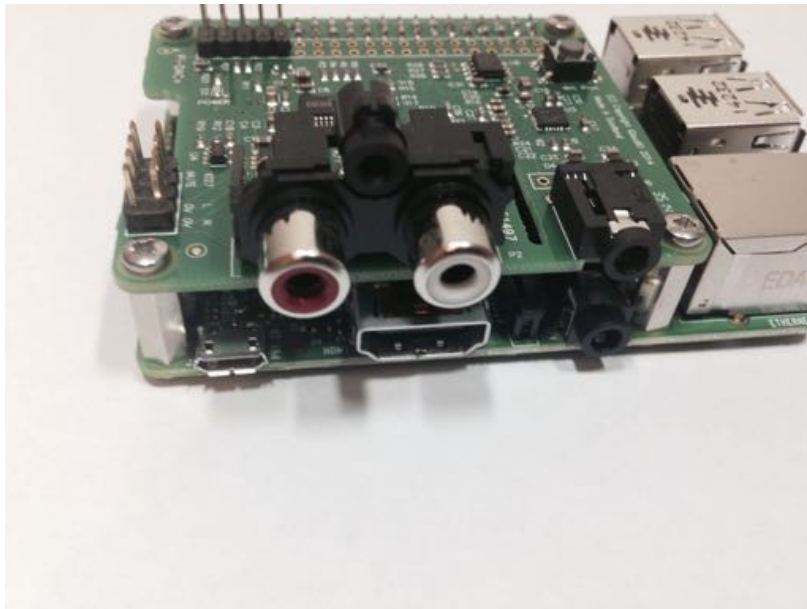
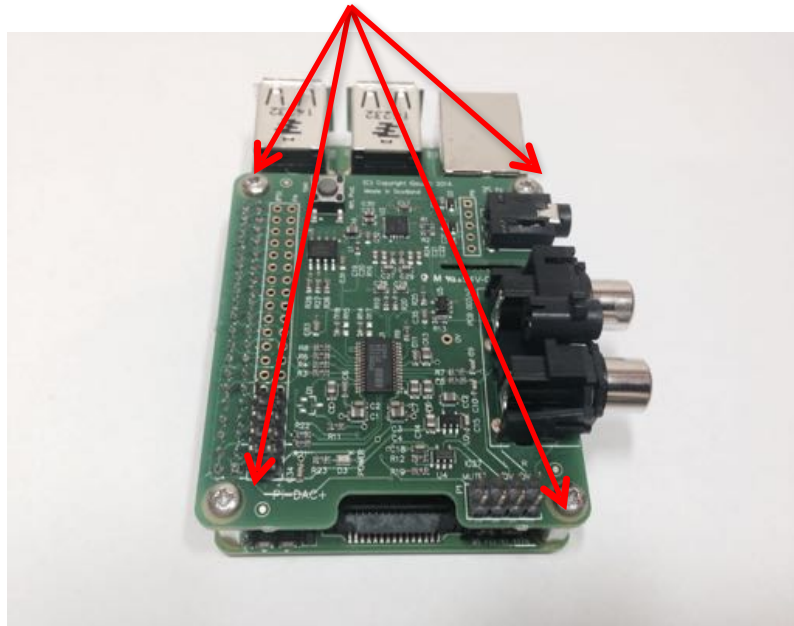
The Pi-DAC+ is normally supplied* along with 4x 12mm PCB spacers and 8x M2.5 screws. You may want to use a 30way right-angled I/O pin header (only needed if you wish to use the exposed Raspberry Pi GPIO).



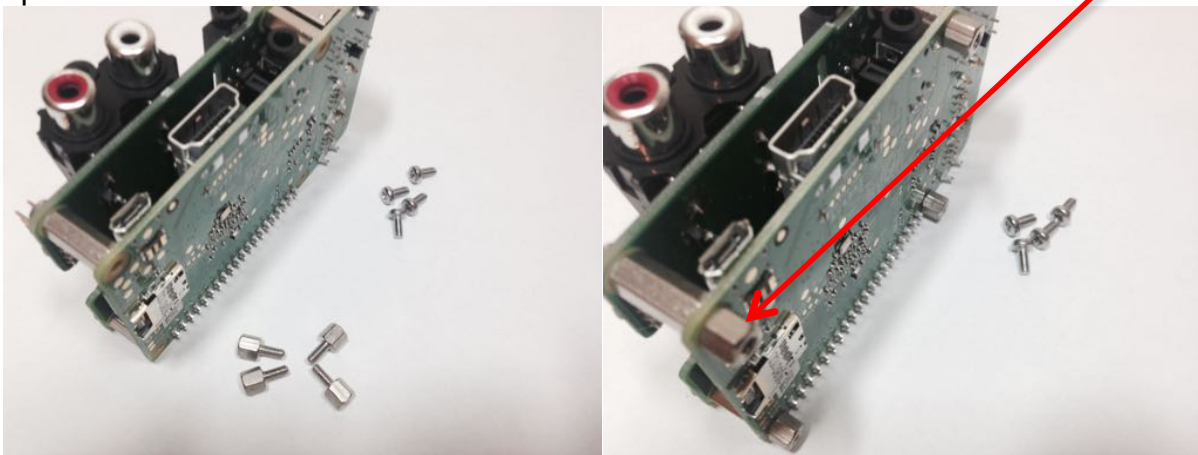
The spacers should be screwed (finger tight only) to the Raspberry Pi before adding the Pi-DAC+.



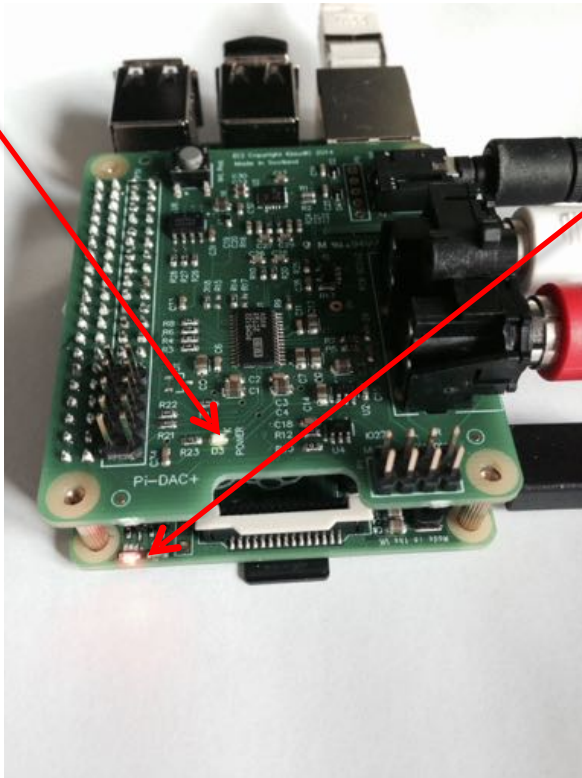
Once the Pi-DAC+ has been fitted the remaining screws can be tightened (finger tight please) as required.



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.

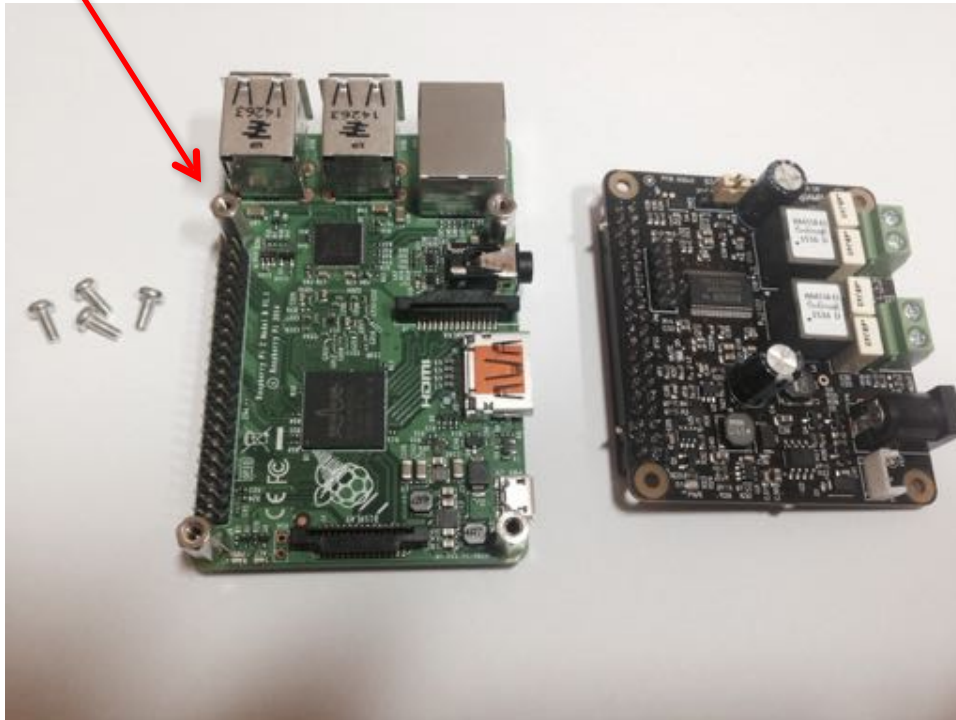
9) Connecting the Pi-DigiAMP+ to your Raspberry Pi

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

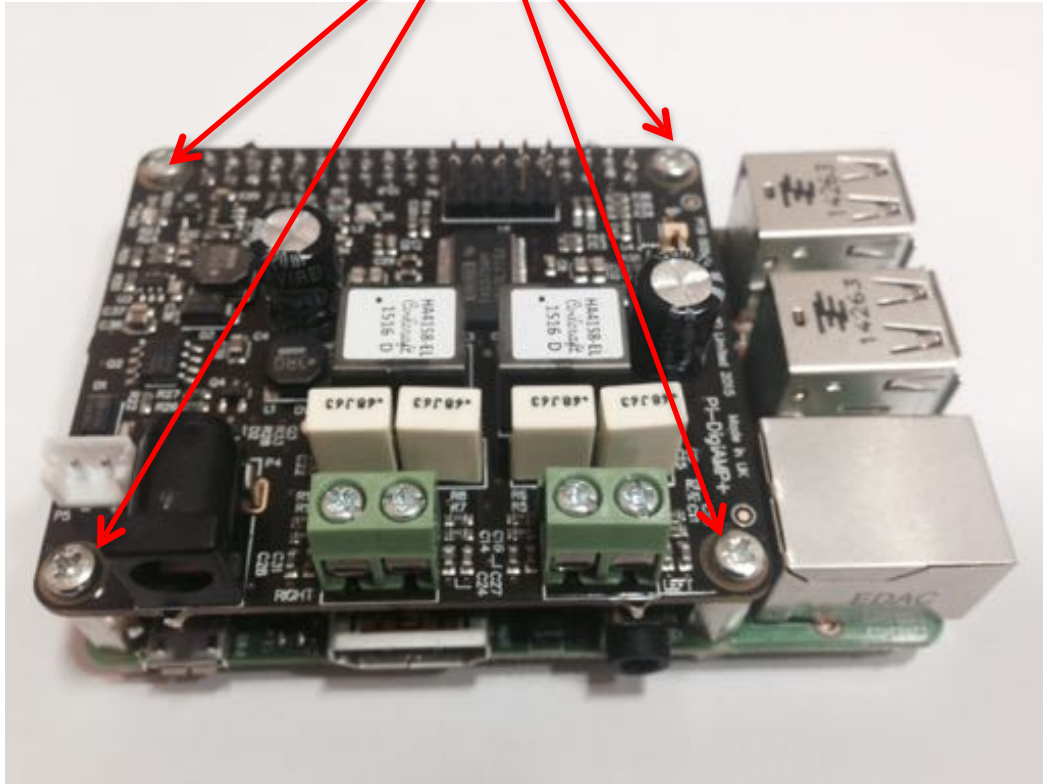
The Pi-DigiAMP+ can be connected to the Raspberry Pi's 40way pin header without any additional soldering.

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

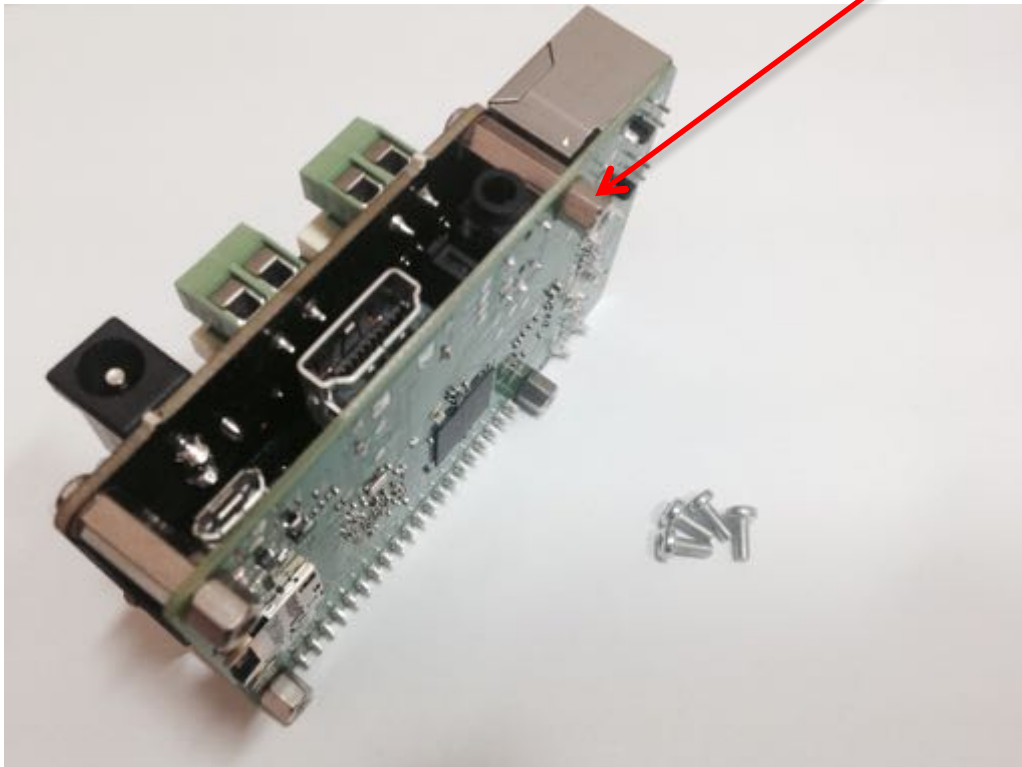
The spacers should be screwed (finger tight only) to the Raspberry Pi before adding the Pi-DigiAMP+.



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+



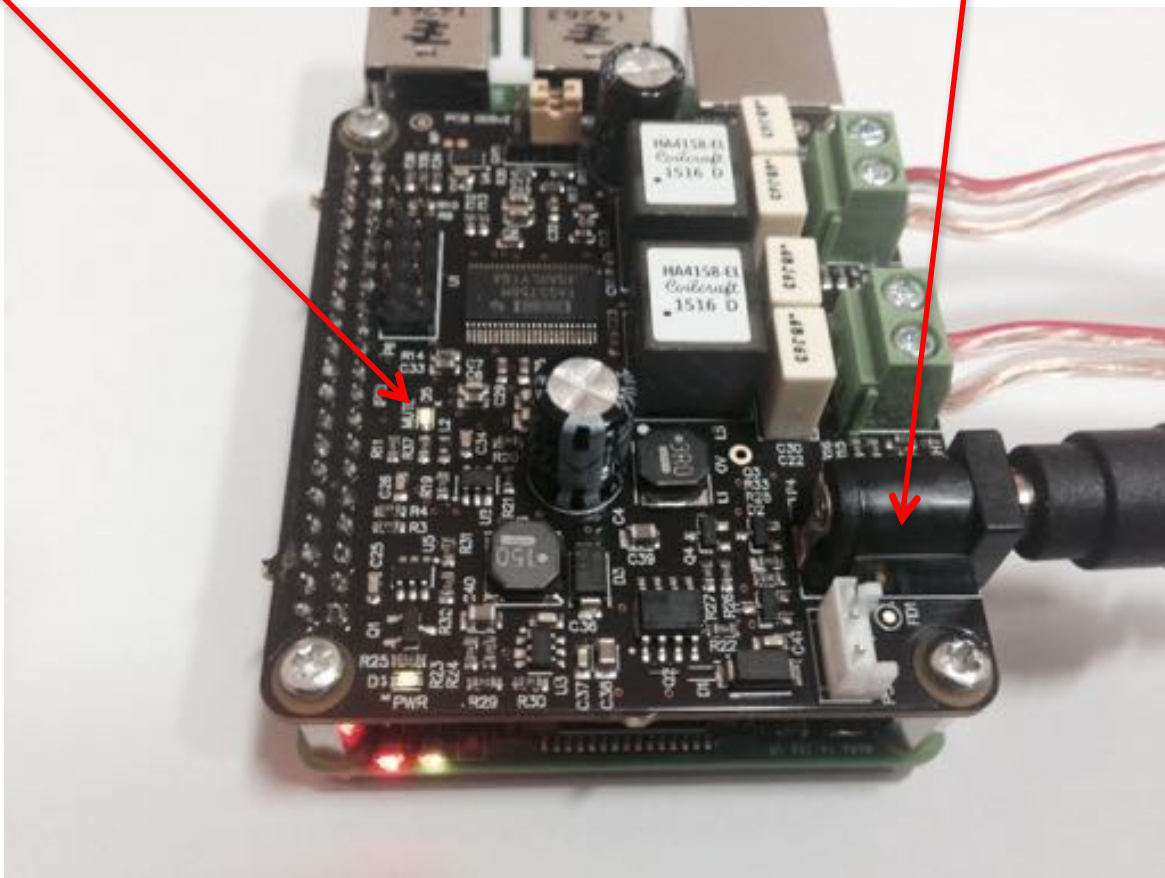
DO NOT APPLY POWER TO YOUR RASPBERRY PI VIA THE PI'S MICRO USB SOCKET.

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.

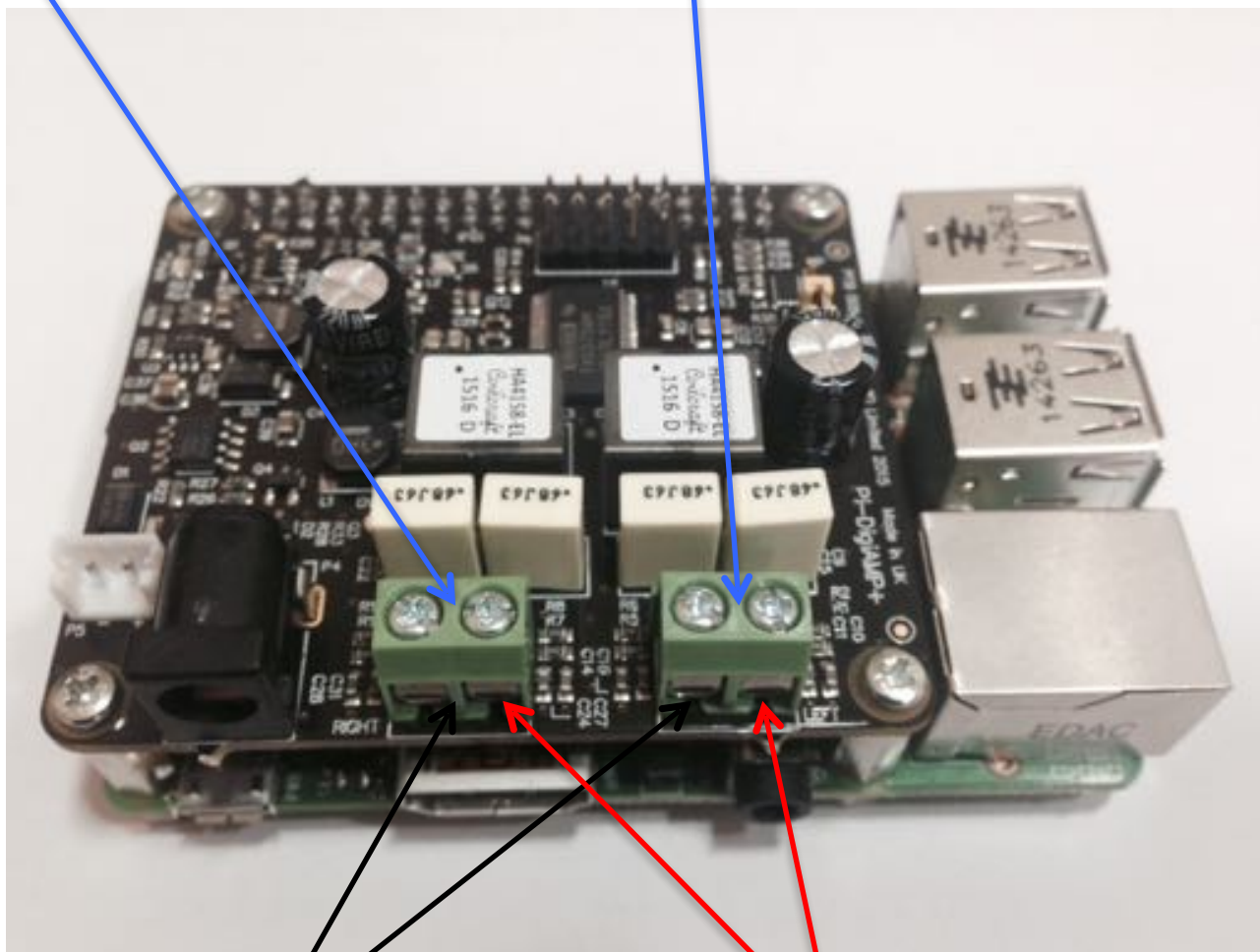


You can now remove power and reconnect any necessary peripherals, install in case etc.

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

P3 is for connecting the RIGHT speaker

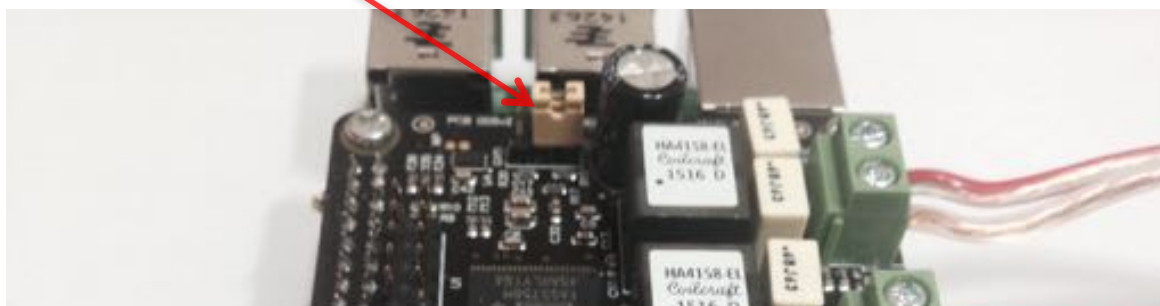
P1 is for connecting the LEFT speaker



Attach the speaker -ve terminal (often black) to the - on the amplifier output

Attach the speaker +ve terminal (often red) to the + on the amplifier output

Now select the output gain +20db or +26db by selecting the appropriate pin header position on P7. Selecting +26db will result in louder volume overall but it also slightly increases the THD+N (Total Harmonic Distortion plus Noise) figure and noise floor. **DO NOT MOVE THIS PIN WHEN POWER IS APPLIED.**



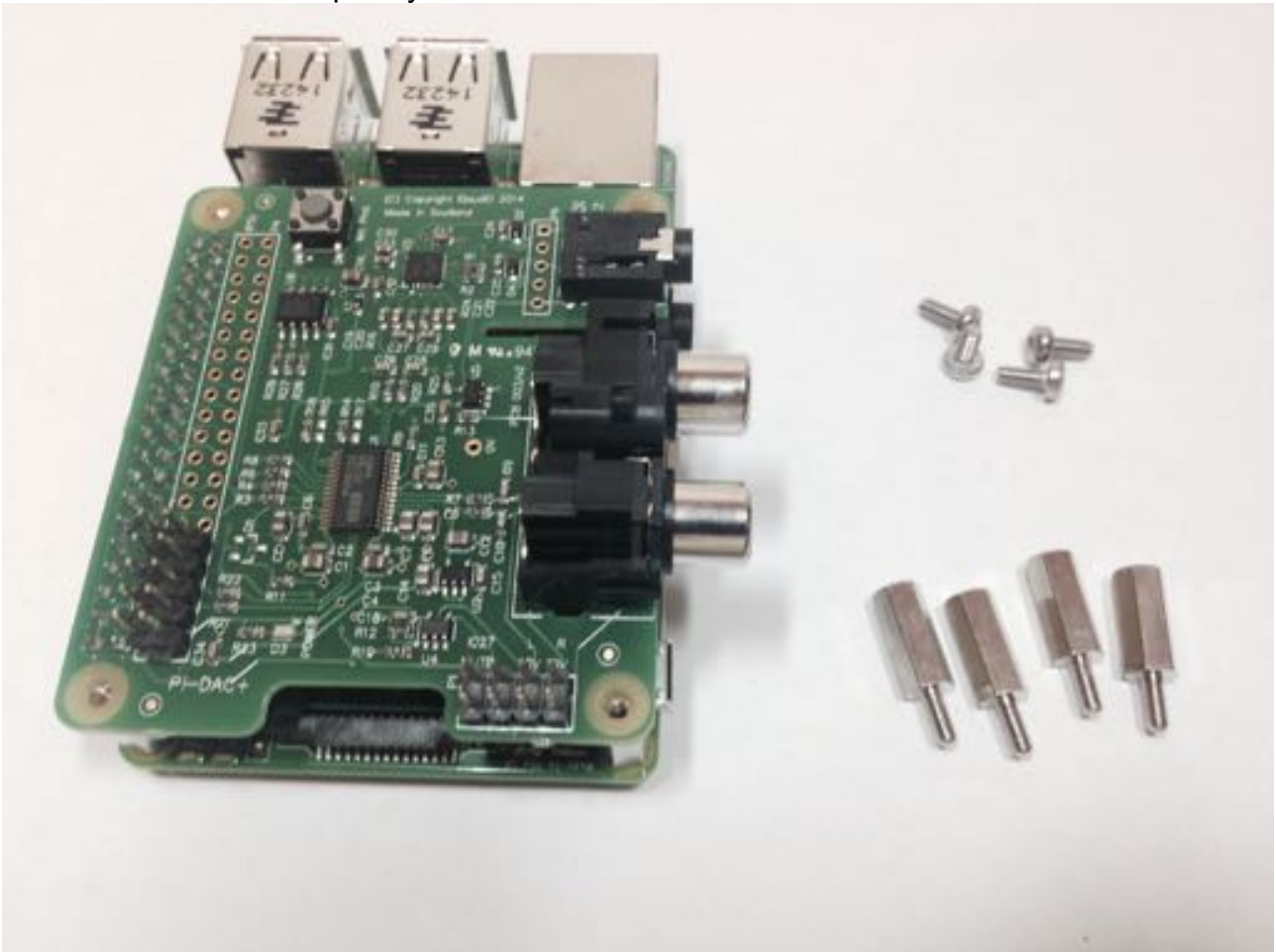
10) Connecting the Pi-AMP+ to your Pi-DAC+

WARNING: ENSURE YOU HAVE DISCONNECTED ALL POWER BEFORE ATTEMPTING THIS PROCEDURE

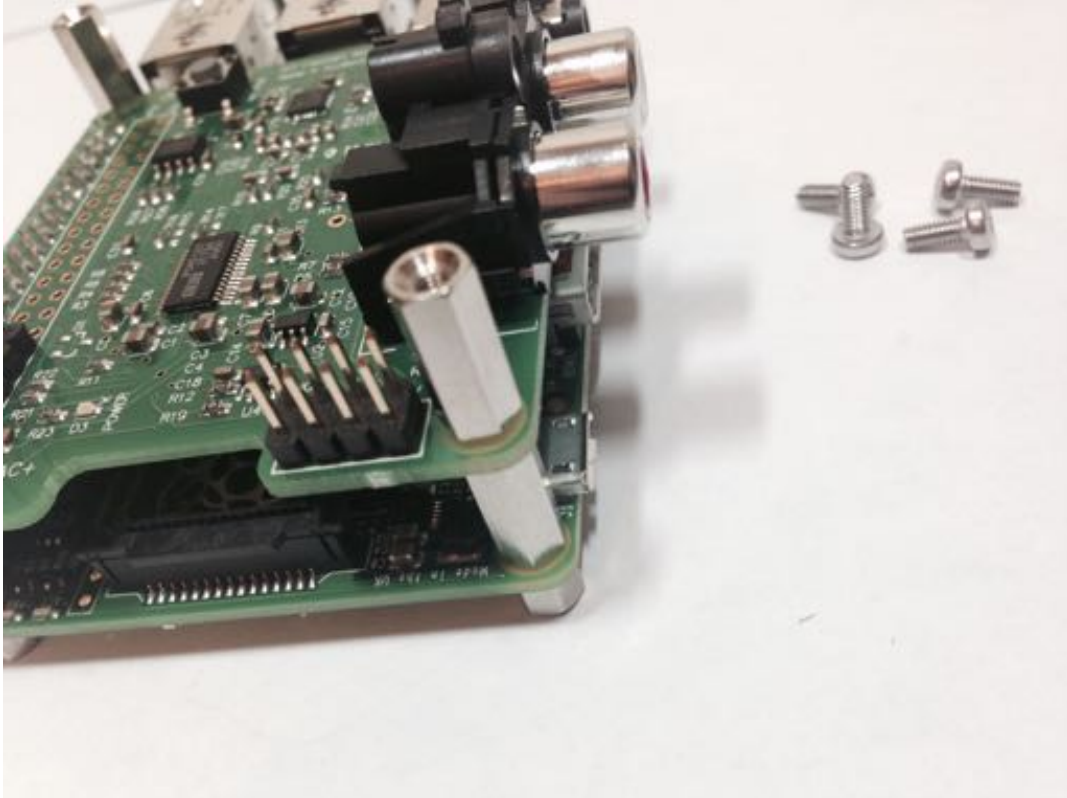
The Pi-AMP+ connects to the Pi-DAC+ through both Pi-DAC+'s two pin headers (the 2x4 audio pin header, and the 2x5 power header).

NOTE: Older Pi-DAC+ may not have the 2x5 power header fitted. Please see Section 10 for details on how to solder this to the Pi-DAC+ before continuing.

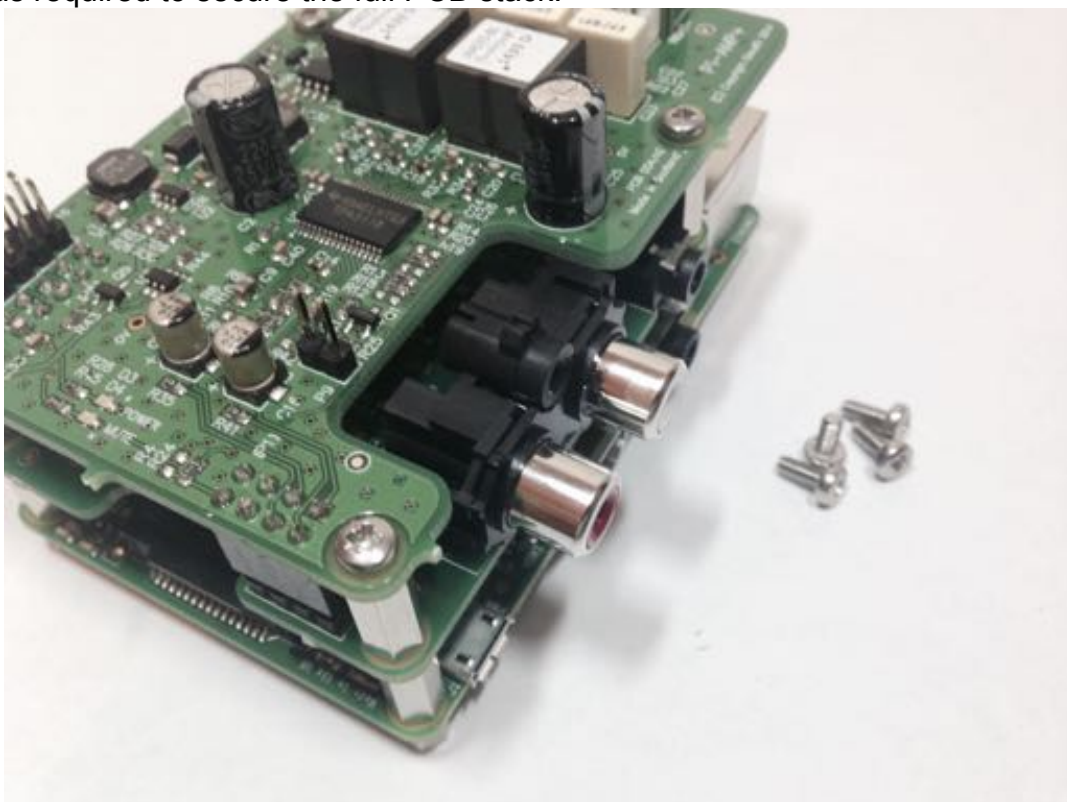
The Pi-AMP+ is supplied* with 4x male/female 12mm M2.5 PCB spacers. Use these spacers to attach the Pi-DAC+ to the Raspberry Pi.



The male/female spacers should replace the 4 screws (these should be retained) previously used to secure the Pi-DAC+ to the Raspberry Pi.



Once the Pi-AMP+ has been fitted the remaining screws (from the Pi-DAC+) can be tightened (finger tight is fine) as required to secure the full PCB stack.

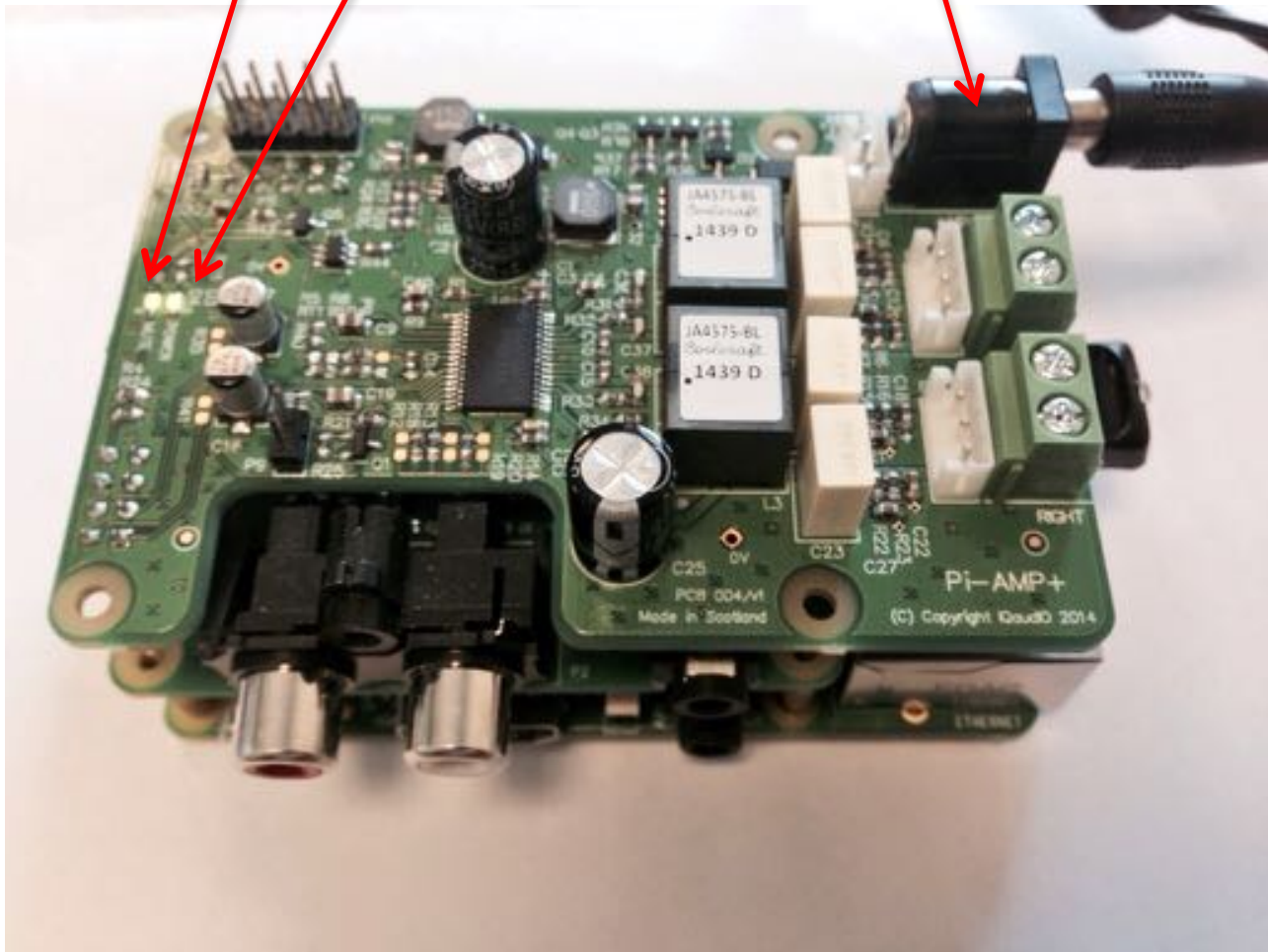


DO NOT APPLY POWER TO YOUR RASPBERRY PI VIA THE PI'S MICRO USB SOCKET.

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

The Pi-AMP+ combination is designed to be powered by the recommended XP Power DC supply. The Power supply's output connector should be inserted into the Pi-AMP+'s DC input terminal (marked "+15V power"). Only then should the Power supply's AC input be plugged into the mains.

Once power is applied via the Pi-AMP+ you should see that the Raspberry Pi the Pi-DAC+ and the Pi-AMP+ have their power LEDs illuminated – this indicates that the power is successfully being applied to each board as expected. The Pi-AMP+'s Mute LED will also be lit.



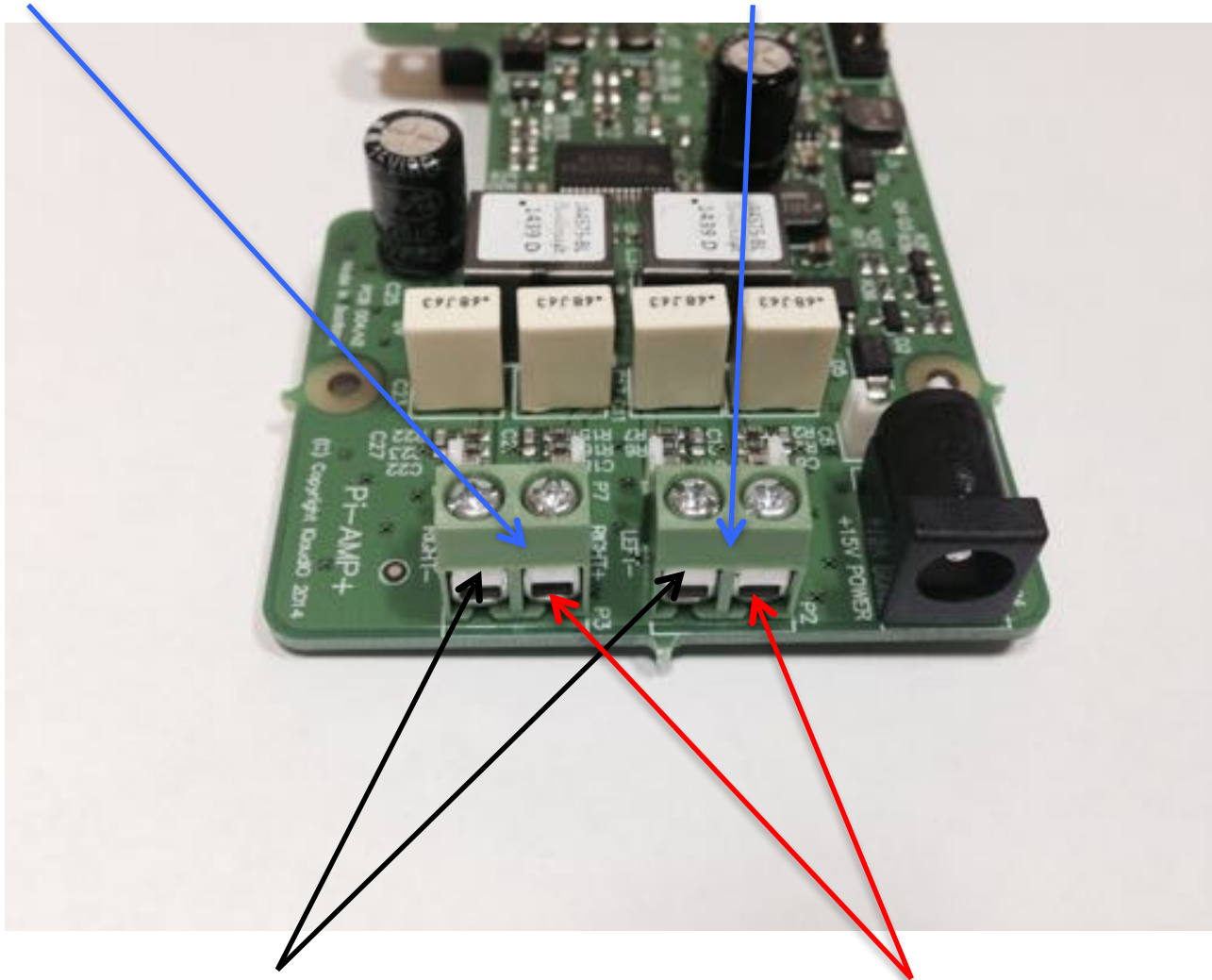
You can now remove power and reconnect any necessary peripherals you may need, including speakers.

NOTE: **ALWAYS** remove power **BEFORE** connecting speaker cable to the Pi-AMP+

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

P3 is for connecting the RIGHT speaker

P2 is for connecting the LEFT speaker



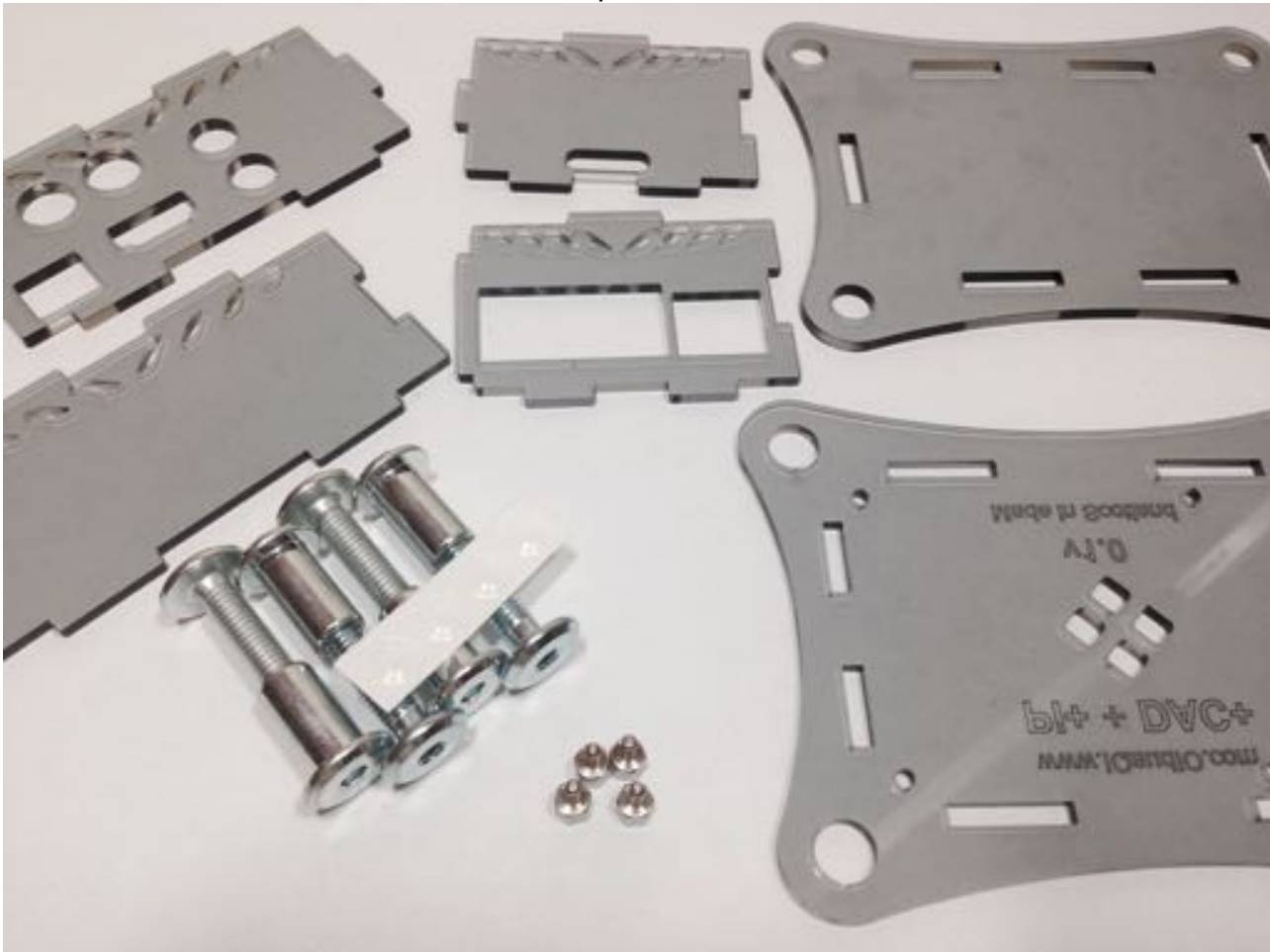
Attach the speaker -ve terminal (often black) to the - on the amplifier output
Attach the speaker +ve terminal (often red) to + on the amplifier output

11) Building the Raspberry Pi and IQaudIO sound cards into your Pi-CASE+

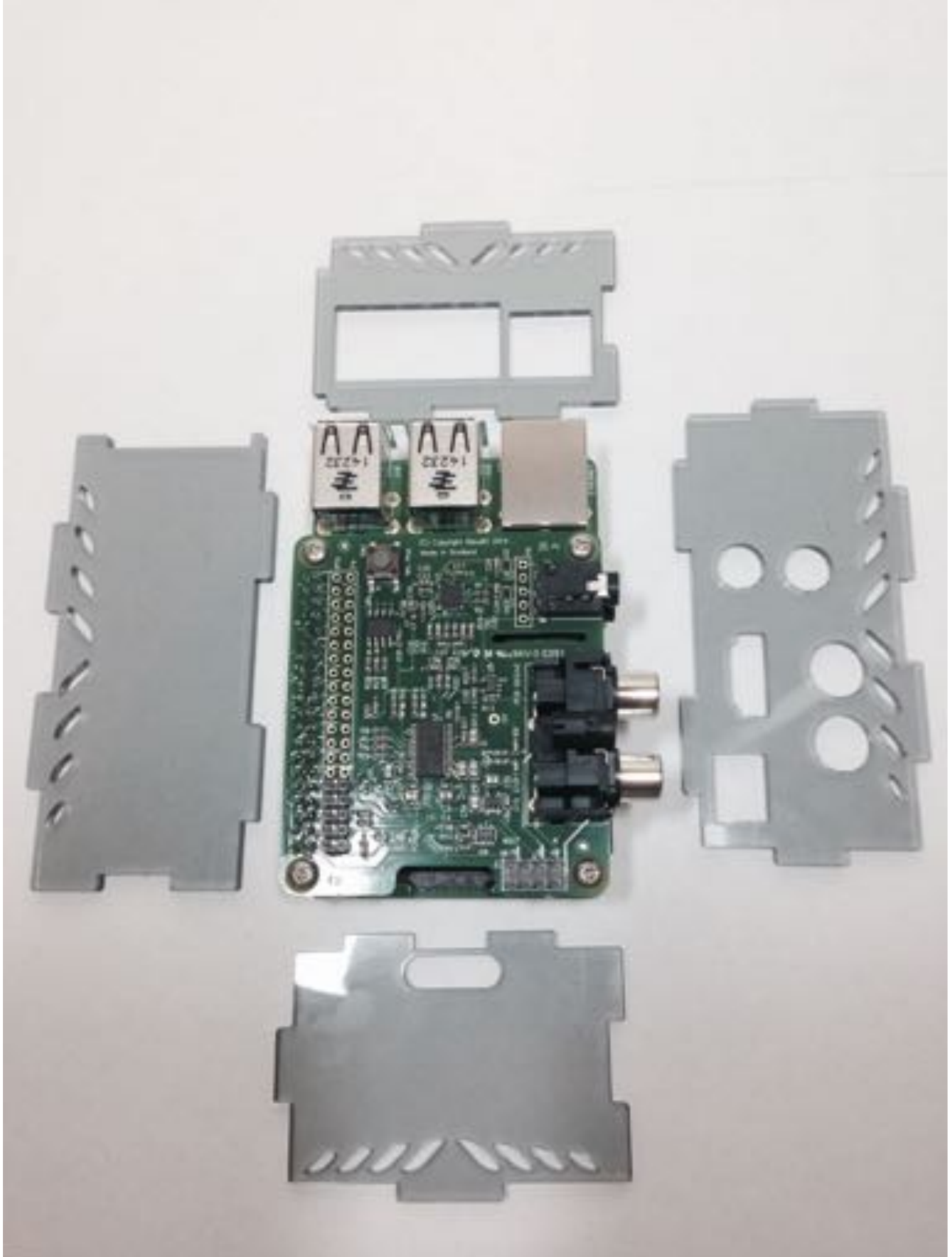
The following may prove helpful when building your Raspberry Pi and IQaudIO sounds card into the appropriate Pi-CASE+.

All acrylic CASE+ installations follow the same process:

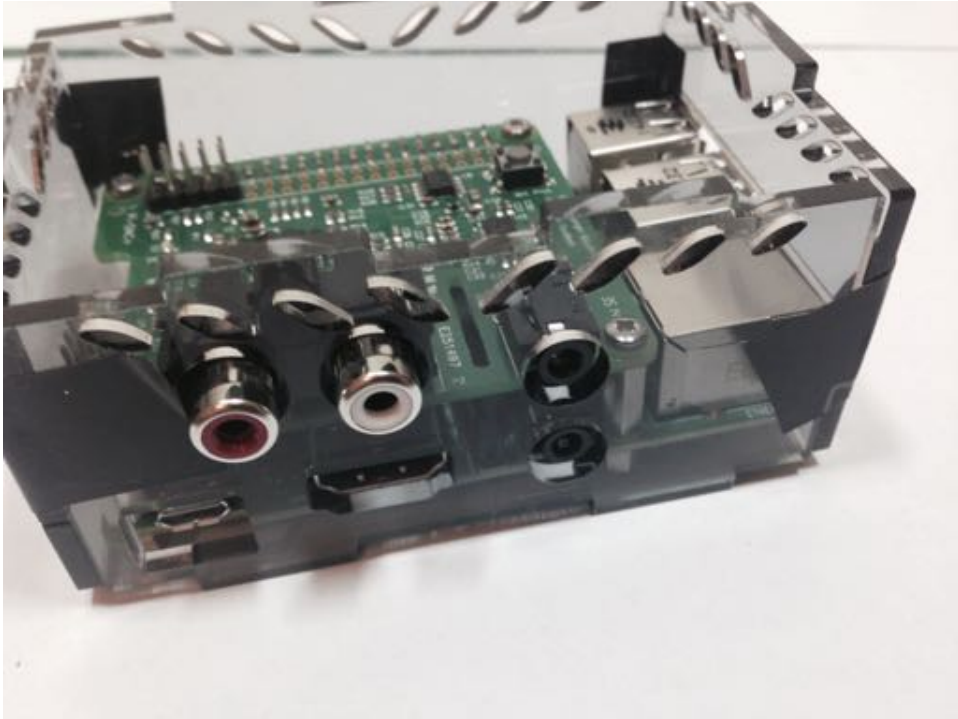
- **If there is a protective film applied to either side of your acrylic, remove it now.** If you build the CASE+ whilst retaining the protective film you may find that the finished look is spoilt or for transparent cases, the result may be opaque.
- Bolt the PCBs together before attempting to install the bundle in the case. Make sure the small 5mm female/male spacers are fitted to the bottom of the Raspberry Pi
- Build the case sides around the PCB first (tip: use tape on each corner during the build process)
- Add the bottom and top
- Add the bolts and small rubber bumper stickers



a) Lay out the CASE+ sides corresponding to the Raspberry Pi / Pi-DAC+ / Pi-DigiAMP+ / Pi-AMP+



b) Then, build the sides up around the Raspberry Pi. Use sticky tape at each corner to make things simpler to assemble.



c) Add the base (with text outwards) and screw the case to the Raspberry Pi

