



# FIVE CATS PEDALS

## GENERAL BUILD GUIDE

VI.1 – AUG 2022

## General Build Guide

We put this guide together just to help anyone building their own pedals or doing a mod here and there – it's all pretty basic stuff but it's a handy go to guide for help! Feel free to download it and share it with anyone who may need it – we certainly could have used it when we started out!

Please remember this is a guide, not the gospel – measure your own components and always check twice before drilling your enclosure or starting your build on the board, it's better to spend an extra hour checking your plan than a week waiting for a new enclosure or board to arrive cause you've rushed it!

Feel free to share this – just be kind enough to say where you got it ☺

[www.Five-Cats-Pedals.co.uk](http://www.Five-Cats-Pedals.co.uk)

[www.facebook.com/FiveCatsPedals](https://www.facebook.com/FiveCatsPedals)

[www.instagram.com/Five.Cats.Pedals](https://www.instagram.com/Five.Cats.Pedals)

## Potentiometers (pots)

For most pedal building, you will use 16mm potentiometers, however if you're building in a small case such as a 1590A enclosure, or you've got a lot of pots to fit into a case, you may opt for a smaller, 9mm pot.

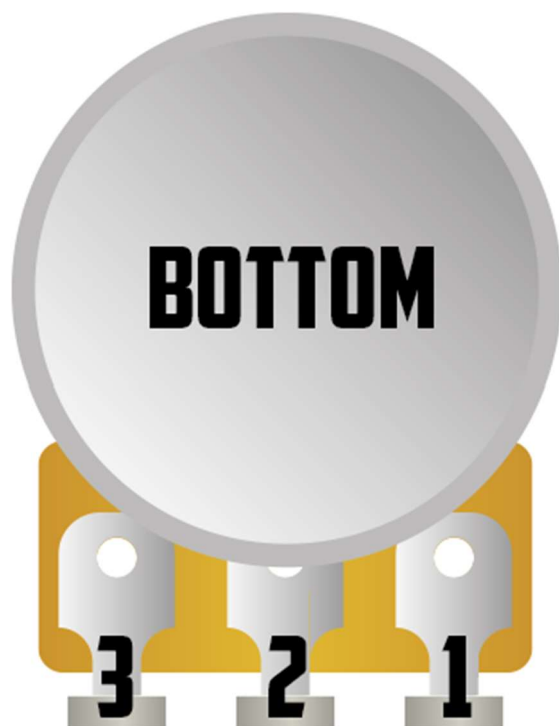
Pots come in a few types but are usually one of three flavours A, B or C.

A = Audio taper / logarithmic

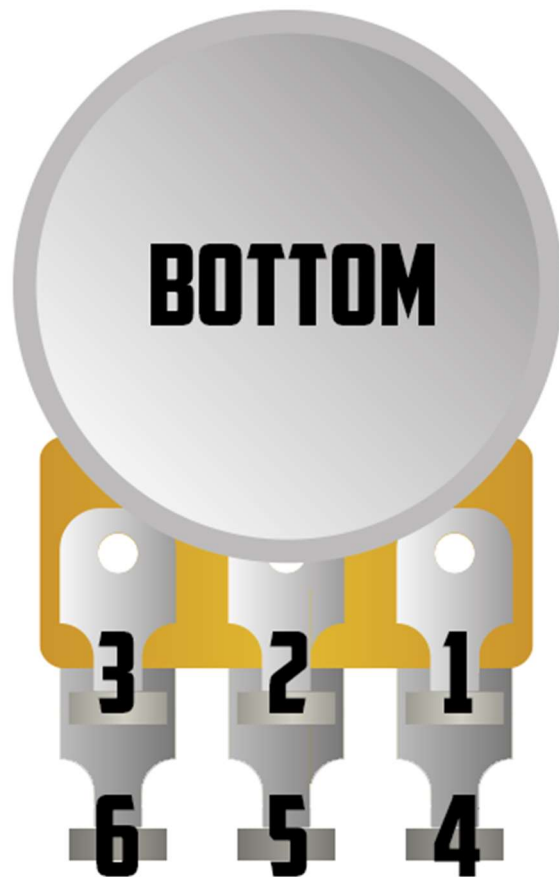
B = Linear taper

C – Reverse Audio taper / Reverse logarithmic

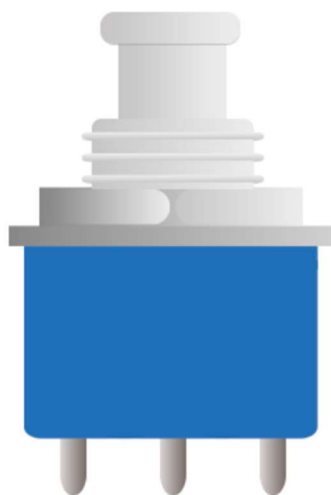
As you look at the pot from the underside (with the shaft pointing away from you) the legs of the pot are number 3 / 2 / 1.



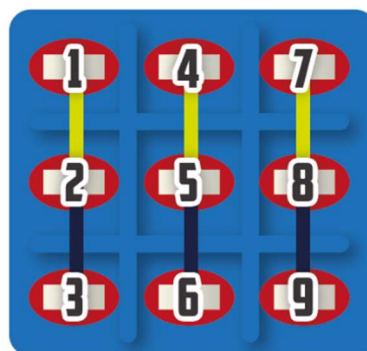
There are also **dual gang** pots. These are essentially 2 pots of the same value in one housing.



### 3PDT Footswitch



**REMEMBER: THE PINS GO HORIZONTAL!**

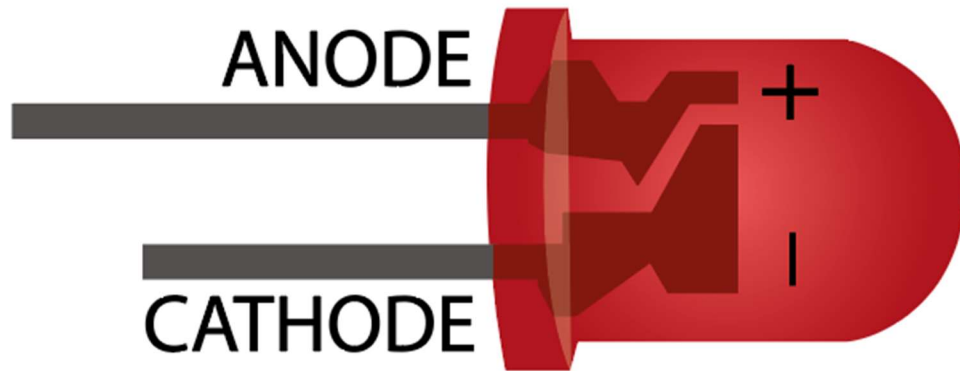


● **THROW 1**  
● **THROW 2**

### Light Emitting Diode - LED

Used to indicate if your circuit is engaged, but also used within the circuit itself for clipping or as part of a setup for use with light dependent resistors. There is a positive (**anode**) and a negative

(*cathode*) side to an LED. If you're using an LED with a daughterboard or wiring manually (see the diagrams below), you'll need to add what's called a current limiting resistor (CLR). This reduces the current that gets to the resistor – if you drop a full 9+ volts at an LED...it's going to go pop – but don't panic...we've all done it and it's part of the learning curve.

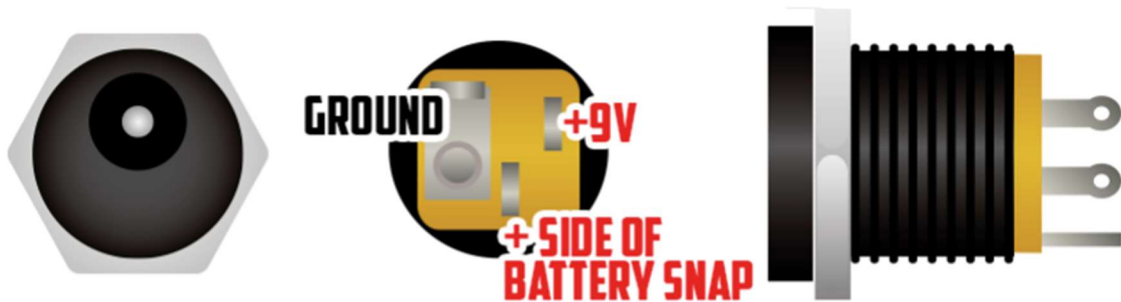


## 2.1mm 9V DC Input Socket

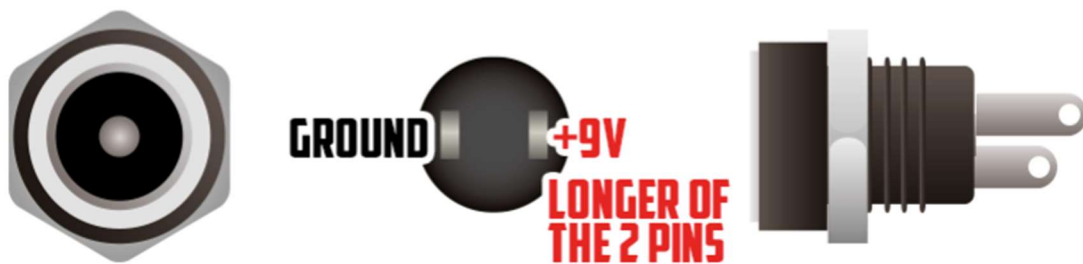
These come in a few options but the two most common styles are listed below – the main thing to note is **do not** buy all metal dc sockets – these will cause you grounding issues.



## LARGER SOCKETS - WITH BATTERY TAB



## SMALLER SOCKETS - NO BATTERY TAB



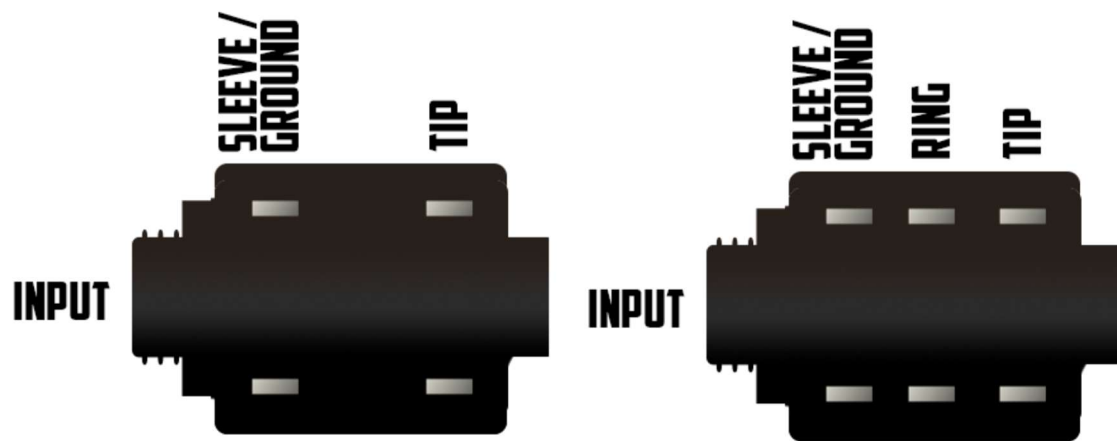
### ¼" Jacks

In the images below, mono jacks are on the left, stereo jacks are on the right – for 99% of your builds you will only need mono jacks.

Open / skeleton style



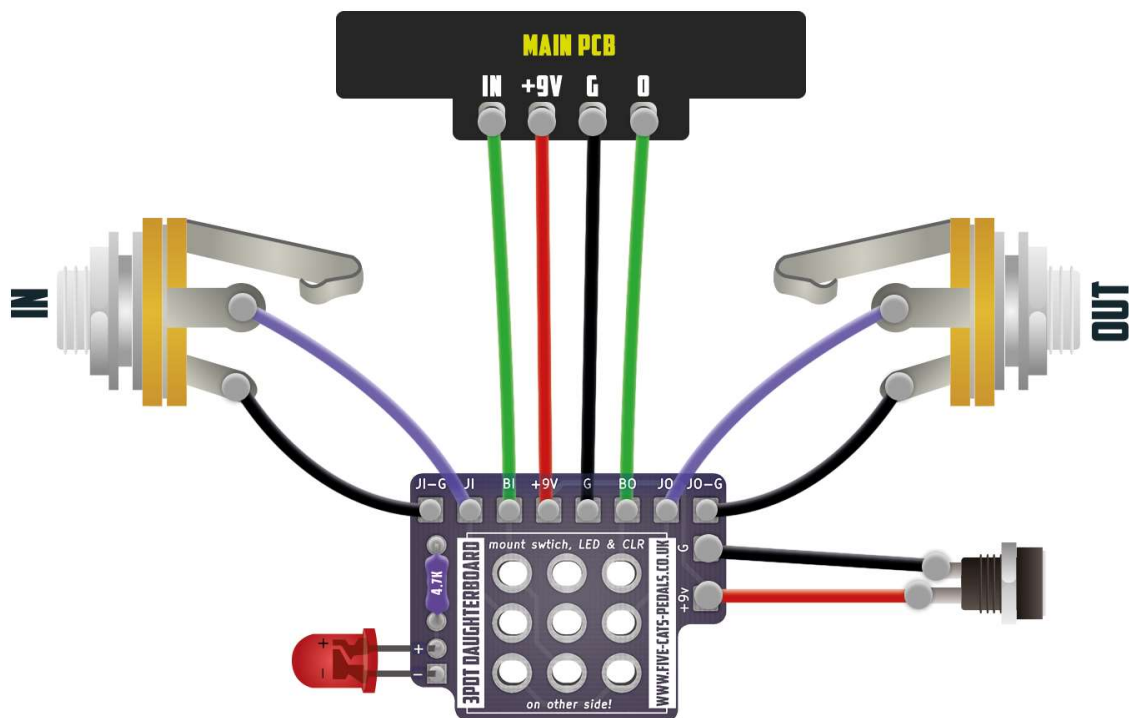
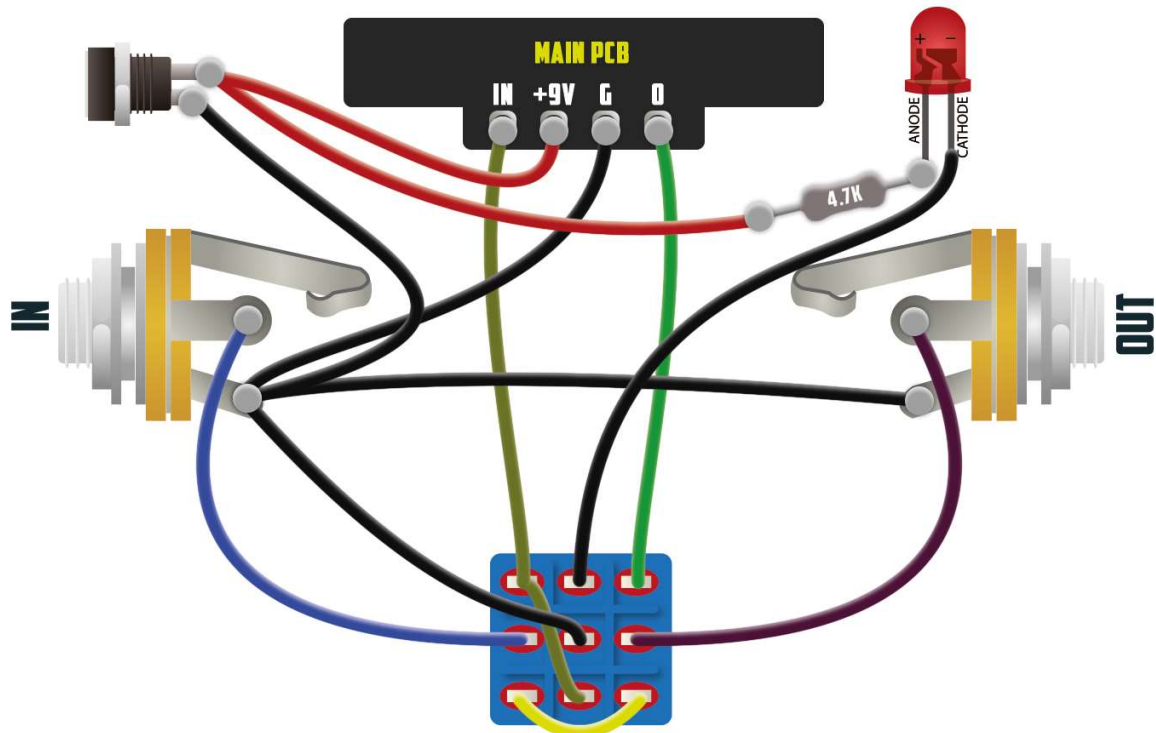
Plastic / enclosed style





## Wiring up your effects PCB to all the external components

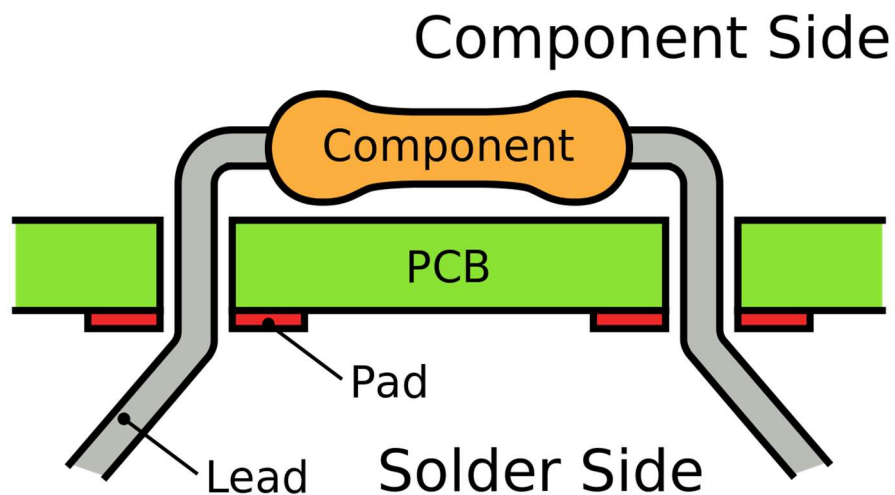
This has never failed us! 3PDT, LED, No Battery and star grounding to input to avoid a ground loop – by far the easiest diagram around! There are two options below – one using our daughter board, and another for manually wiring things up.



## Components

Most pedal board builds will use through hole components (there are some exceptions). Through hole components are just how they sound – there's a hole in the PCB and the legs of the components go through them. SMD (surface mount) components are becoming more widely used, however these require some extra skill to solder!

How through hole components go into the board:





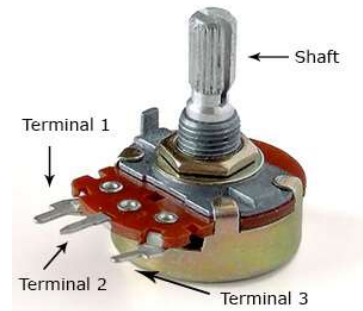
## Common Components You Will Come Across

You can read far more in depth about each component online, but the basics are here with a handy picture to help you know what it is you're looking for in that big bag of bits that's arrived with your kit!

### Potentiometer (Pots)

Potentiometer (*these can be mounted directly to the board, or off board – depends on design*). Used for controlling things such as volume, gain, fuzz etc etc.

- ++++ Pot A – Audio Taper / Log
- ++++ Pot B – Linear
- ++++ Pot C – Reverse Audio Taper / Log



### SPST

Single Pole, Single Throw  
The simplest of all toggle switches – On/Off.

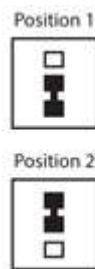
One input.  
One output.



### SPDT

Single Pole, Double Throw

One input. Two outputs.



### DPDT

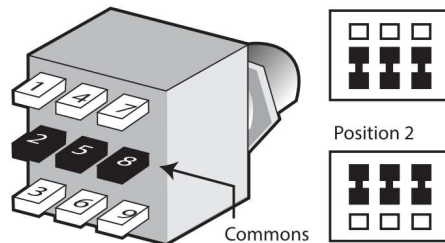
Double Pole, Double Throw



## 3PDT

3 Pole / Double Throw switch (*the most common for footswitches in pedals*). When wiring up, make sure the pins sit horizontally, not vertically!

Lug map and throws



## Enclosures

The case in which your pedal will live – common among the community are HAMMOND brand, these are high quality cases – don't be tempted with a 99p case from Alibaba! Hammond enclosures come in various colours and sizes too.



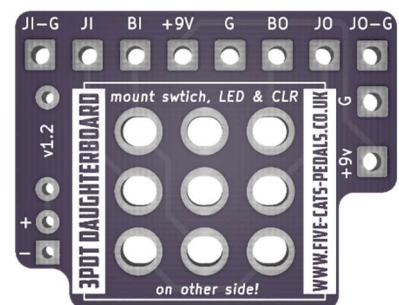
## PCBs

Printed circuit board, usually just one main board that your components are soldered too, however in larger more complex projects there could be more!



## Daughterboards

Some components (like the 3PDT) can use a daughterboard to make it easier to wire



## Resistors

Measured in: **Ohms**

**Ohms (R)**

*Kilo ohms (K -000's)*

*Mega ohms (M -000000's)*

*1k ohm = 1,000 ohms*

*1M ohm = 1,000,000 ohms*

**Type: Carbon Film**

Usually a 5% tolerance (which means 5% either way of the stated value).

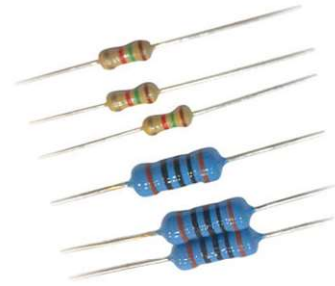
**Sizes / Rating:** ¼ or 0.25 watt is generally the most used in pedal building, however some instances (such as the KLON) will require a 1/8 size.

**Type: Metal Film**

Usually a 1% tolerance and can withstand more heat.

**Type: Light Dependant (LDR)**

Special resistors which means the resistance offered by them changes based on the light they receive.



## Capacitors

Measured in: **Farads** and fractions of a Farad:

**Picofarad pF** (trillionth)

**Nanofarad nF** (billionth)

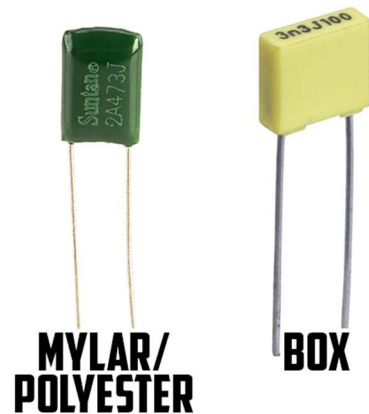
**Microfarad uF** (millionth)

**Type: Ceramic (pF):** Measured in **pF (Picofarad)** and lower **nF (Nanofarad)** for small / medium values. Almost all have a number code printed on the body e.g. 101 = 10 + 1 zero = 100 pF



**Ceramic**

**Type: Mylar / Polyester & Box (nF):** Measured in **nF (NanoFarad.)** for medium values and lower uF. A note here – most people call these Mylar...however that is the brand name, so if you see polyester instead – it's the same!



**MYLAR/  
POLYESTER**

**BOX**

### Type: Multi Layered Ceramic Capacitor (MLCC)

These come in all measurements from PF to UF, they become very popular in recent years, have less fluctuations at higher temps and are cheap! (you can get multi value boxes on places like eBay/Amazon).



MLCC

**Type: Electrolytic (uF):** Measured in **uF (Microfarad)** for larger values polarized with small minus signs down the negative side and the positive lead is usually longer. **Be sure to get the polarity correct** when using these.

Be aware there are also non-polarised versions of electrolytic capacitors, so check your build guides!

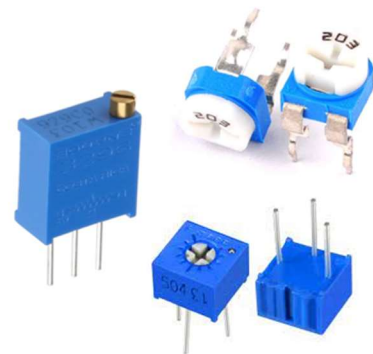


Electrolytic

### Trimmers

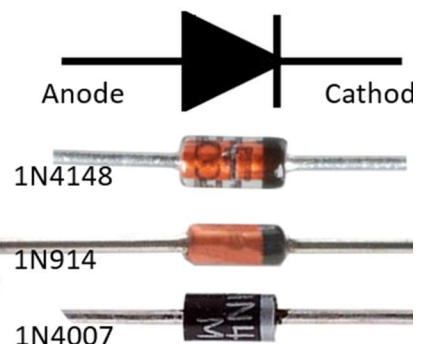
Variable resistors that can be adjusted with a small screwdriver to vary the resistance of the current passing through them – these come in a variety of values, sizes and types.

Once set they are usually left alone – *you can however replace them with an off-board pot to adjust if you wish.*



### Diodes

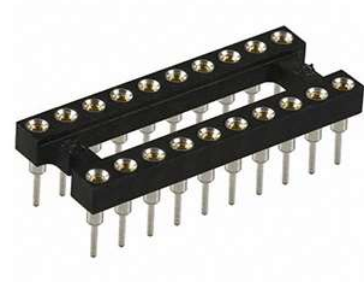
Used primarily in circuit protection, regulating voltage and clipping stages. Pay attention to the markings on the diode as they are polarised – so make sure it goes in the right way!



### IC Socket / DIP (dual inline package)

IC chips can be very sensitive to heat and soldering one with say...16 legs to the board and realising it's the wrong one...is a massive pain!

Thus...use sockets! These cheap, super handy sockets get solder into the board, and the IC chip simply clips into the top allowing you to swap / replace the chip without any desoldering of tiny legs!



### IC Chip (integrated circuit)

An integrated circuit (IC), is small chip that can function as an amplifier, oscillator, timer, microprocessor etc.

They come in various configurations – 8/14/16/32 legs etc.

Use them with the sockets mentioned above!



### Transistors

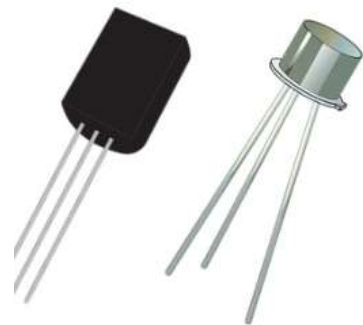
Are used to amplify or switch a signal. They generally contain three pins and come in a few varieties. This is a field of discussion on its own, so for the sake of this brief guide, we'll just use an overview.

#### Terms and types

Bipolar junction transistors (BJTs)

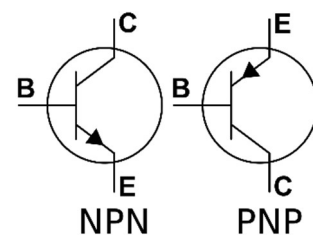
Field effect transistors (FETs)

- Germanium PNP / NPN
- Germanium NPN
- Silicon PNP / NPN
- JFET
- MOSFET



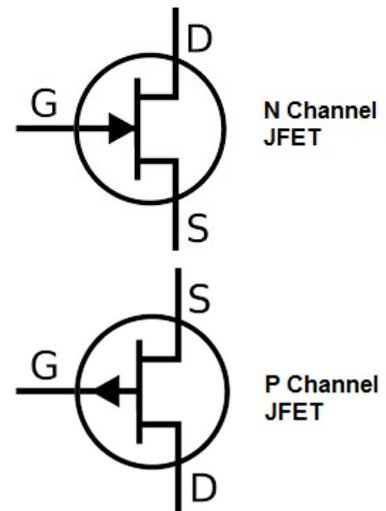
#### Leg Identification and Schematic Symbols

B= Base  
E = Emitter  
C = Collector



D = Drain  
S = Source  
G = Gate

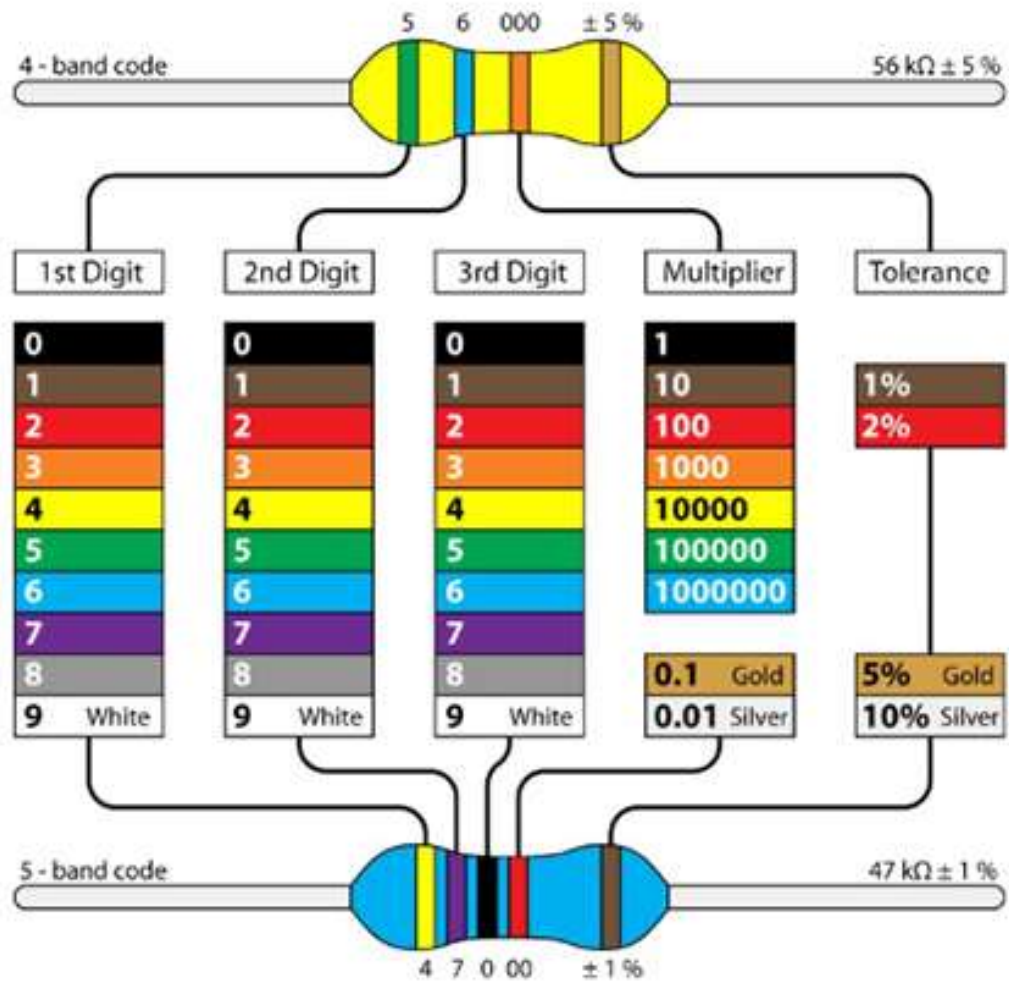
these can differ from manufacturer to manufacturer, so always check the data sheets!



### Capacitor Conversion Table - $\mu\text{F}$ / nF / pF

Capacitor Value Conversion Chart pF to nF, $\mu$ to nF, etc . .		
microfarads ( $\mu\text{F}$ )	Nanofarads (nF)	Picofarads (pF)
0.000001	0.001	1
0.00001	0.01	10
0.0001	0.1	100
0.001	1	1000
0.01	10	10000
0.1	100	100000
1	1000	1000000
10	10000	10000000
100	100000	100000000

## Resistor Colour Codes





## Basic Kit Suggestions

Here's just some items we've found make for a good base kit when you start out in pedal building/modding pedals.

### Soldering Iron



Don't buy a £3 soldering iron and expect it to be great. It won't be. You also don't need to spend £150 on a [Hakko FX-888D](#). There's a lot of options around, but we've used one called the [Hanmatek SD1](#) available on amazon and it's done us just fine, it also takes standard Hakko t-18 tips!!

### Solder



Some people will argue that you need old school lead filled solder...others will say you don't. We use a [Lead Free Rosin Core wire from Tabiger](#) - again, this is our choice, you may find you prefer a different type or brand.

### Side Snips



Side snips help you trim off the excess legs from your components or cut wire. [You can get 2 pairs for about a fiver](#)- they won't last forever and if you decide to upgrade to some Knipex branded ones when you're getting into the swing of things - why not!

### Solder Sucker



There's a few options available for removing solder - you will at some point, solder in the wrong part or need to remove a broken part - without a solder sucker that can be a real pain. We've tried a few different options, de-solder braid and cheap pumps - but it's worth investing a little more (about £20) in the [ENGINEER solder sucker](#) - it really does make removing solder a breeze.

## Wire



You have two choices of wire type - stranded or solid core, usually around 24AWG size. [Stranded](#) has lot of little wires inside that carry the signal, this wire lends itself more to being a bit flexible. [Solid core](#), as the name suggests, has just one metal wire inside it. It doesn't like to be bent over and over, but it does hold it's shape well if you want a tidy layout inside your pedal. You can also get [silicon coated wire](#), this is heat resistant so when you solder the ends, the sheathing doesn't shrink - but it's can also be more expensive!

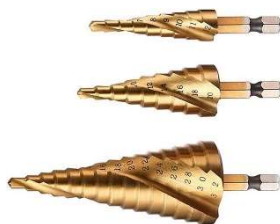
## Enclosure related:

### Automatic Center Punch



When you come to marking up your enclosure to drill it - you'll need to make a small dent in the metal to stop the drill from slipping - in comes the [Automatic Center Punch](#)! Another cheap bit of kit that will help you a lot.

### Step Drill Bits



Whether you're drilling your cases with a hand drill or a pillar drill (pillar drill is easier!) you'll need to slowly widen the holes for your pots/jacks/led's from a couple of mm and progress upwards. Trying to drill a 12mm hole straight away will give you sore arms and a shoddy hole! [Step drill bits](#) are just like they suggest. They slowly step up in size from around 4mm all the way up to 32mm for example. They also debur the hole whilst they are at it.

### Taper Hole Reamer



The step drill bit is great - but you'll find some components like potentiometers can measure 6.4mm diameter - you could drill a 7mm hole...or you could drill a 6mm hole and open than drill hole up a little at a time with a [Metal Reamer](#). Insert it into the hole and twist clockwise slowly, and keep checking until you have the desired size - remember if you're adding paint and/or clearcoat to your enclosure to allow some extra room in the hole for the clearcoat/paint that will sit at the edge.

## Masking Tape



You've probably got some of this kicking around somewhere but if not [any brand will do](#) - just avoid blue...as it's really hard to see the marks, we prefer yellow! - Super handy to put on your enclosure to mark it up and also protects it a little when you're drilling.

## Rocket Sockets



[These are genius](#). Made by Pepers Pedals in New Zealand and sold by us - they come in a pack with a whole range of sizes and are made from tough injection moulded plastic and allow you to tighten the nuts on your pedal without damaging the finish. A go to tool for all the DIY community .

## Drill Templates



A nice bonus to have is [some drill templates](#). These make laying out and marking your enclosure easier. We currently sell a set for 1590A & 1590B size enclosures that have holes big enough to fit an automatic center punch through!

**Remember to check everything twice – it's easier to check twice than patch a wrong size drill hole or de-solder some tiny component! Don't rush it, take your time, you will make mistakes – but learning from those mistakes is exactly what makes you learn.**

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<https://www.five-cats-pedals.co.uk>