



# INSTRUMENTS OF THE FUTURE

Electronics  
handbook  
for chaos

ETTA HARBAR & VEERLE PENNOCK

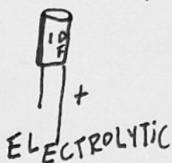
# COMPONENTS: A FEW IMPORTANT COMPONENTS YOU WILL CERTAINLY COME ACROSS

## CAPACITORS

Symbols

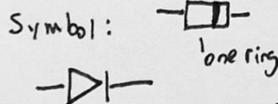
NOT POLARIZED (OFTEN looks like this:)

POLARIZED (check if good with + or -)



## DIODES

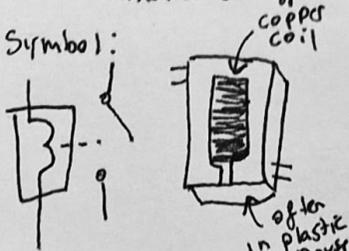
Unidirectional regulator. The current can only leave from one side.



\* the most known Diode is a LED (light emits Diode)

## RELAYS

A controlled or controllable switch or a large machine controlled by a small signal. A large coil controlled on/off



## RESISTORS

Resistors reduce the electrical current! Often used with LEDs often:

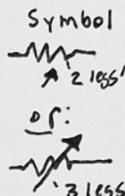
1Ω +11 10Ω

Symbol:



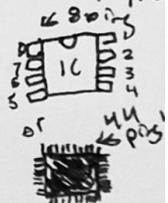
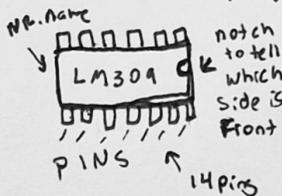
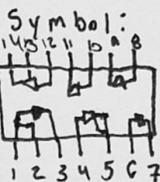
## POTMETERS

Variable resistor where you can choose how much current flows by turning the nob!



## INTEGRATED CIRCUITS (IC):

IC's or "Chips" do all the thinking for electronics. They are the heart & Brain of the circuit. There are many different kinds/types



## BUTTONS

ON/OFF regulators!

When pushed (or flipped) current flows or stops

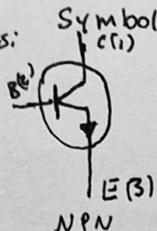
Symbol:

lots and LOTS of different types:



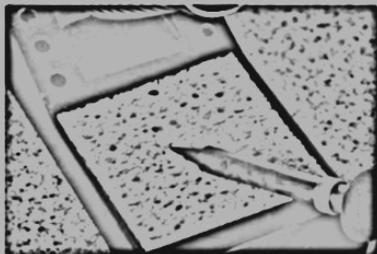
## TRANSISTORS

Also found in IC's, transistors are used for many things but namely to amplify or switch electronic signals. Sort of traffic controller!





# FROM THE ADAFRUIT SOLDERING GUIDE!



## Clean the Iron

Wipe the tip of the hot iron on the damp sponge to clean off any oxidation.

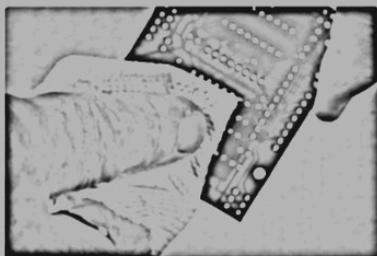
Do not use files or abrasives to clean the tip. It will damage the plating and ruin the tip.



## Tin the Tip

Apply a small amount of solder to the tip and wipe again to tin the tip. You should have a thin, shiny layer of molten solder on the tip of your iron.

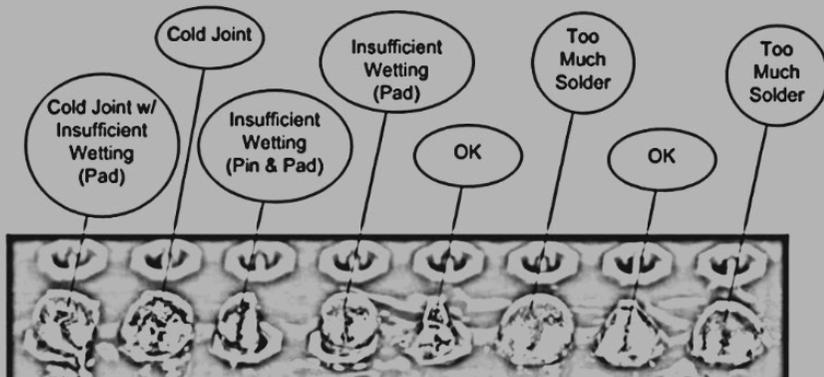
If the tip is badly oxidized and difficult to tin, it can usually be reconditioned with some tip-tinning paste.



## Make sure that the joint is clean

Dirt, oxidation and oily fingerprints can prevent the solder from wetting the solder-pad to create a solid joint. All Adafruit boards are plated to prevent oxidation, but if your board appears dirty from storage or handling, wipe it down with a little Isopropyl alcohol.

## Common Soldering Problems



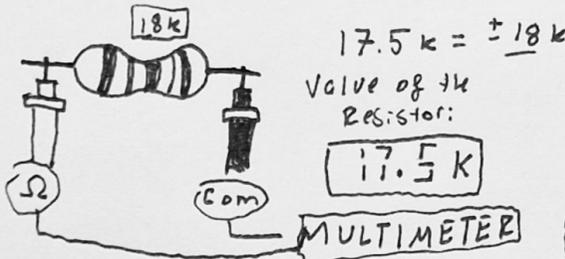
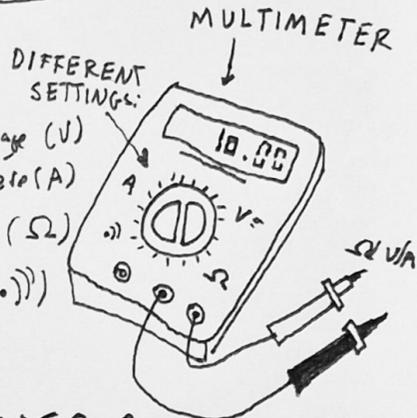
# OHM'S LAW FOR DUMMIES:

OHM's Law is widely used in electronics/projects for electrical calculations. (ie. How much resistance is needed for a LED?)

Often you will use a **MULTIMETER**

## MEASURING RESISTORS:

- Take out your Multimeter and turn it on
- Use the  **$\Omega$  OHM** setting
- Choose the right amount (2000 $\Omega$ , 200 $\Omega$ , 20 $\Omega$ ... etc)
- Place the Resistor between the two meters

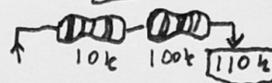


## SERIES & PARALLEL:

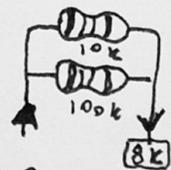
Important difference between components in a series & in a parallel.

**SERIES**

**PARALLEL**



When resistors are in series the result value is the SUM of the value of each resistor.



In Parallel the result value is slightly less than the value of the SMALLEST resistor.

## MEASURING VOLTAGE:

Example on a 9V Battery (NEVER TEST WALL SOCKETS)

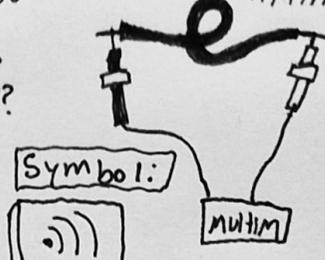
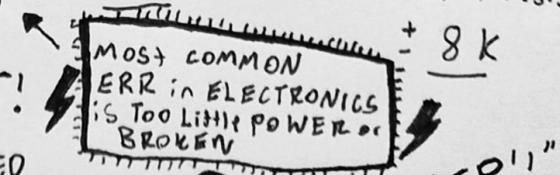


- Plug the black meter in the  $\ominus$  and the red in the  $\oplus$ .
- Read the Voltage with the (V=) option!

## DR. BIBBER TEST!

How can I quickly know if a LED works? if the connection is properly soldered? Broken cable?

Use the **BEEEP!** function on the MULTIMETER



if the connection works you will hear a beep!

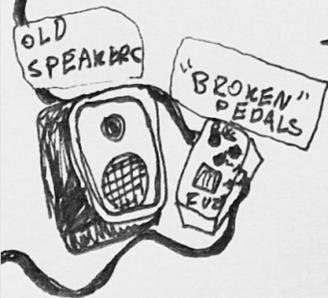
# TIPS FOR SKIP-PING ELECTRONICS!

"SKIPPING" IS ANOTHER WORD FOR DUMPSTER DIVING OR GETTING MATERIALS FOR FREE, ANYTHING THAT HAS BEEN "SKIPPED" OVER.

- Often I find things just on the street, by trash cans, or the collective bins - especially motors!



- Ask second hand stores if they are throwing away any electronics, I got TONS of cables this way, also for "broken" parts they can't sell but YOU CAN USE!



- Very sneakily reach in (or just look in) the electronic disposal bins. Mostly found by stores like the GAMMA. This is very frowned upon so be discrete BUT lots of good things.

- Ask friends / acquaintances if they have any broken or ~~old~~ extra electronics they want to get rid of, often people do!



- Look in your networks / Ask local businesses look in trash cans or on construction sites :)



HAPPY SKIPPING!



**PIEZO'S**



**HUMBUCKER GUITAR  
PICKUP ELEMENT**

# THE PIEZO PAGE:

PIEZO'S ARE CONTACT MICROPHONES MADE FROM THIN CRYSTAL & BRASS. THEY ARE SUPER COMMON!

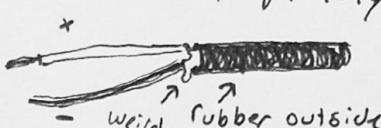
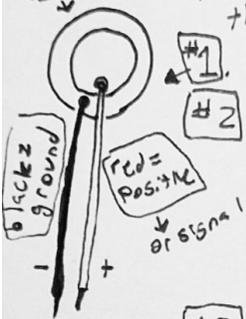
## HOW TO SOLDER:

PIEZO

\* It's easiest to buy the piezo disk that already has the two wires soldered on the disk.

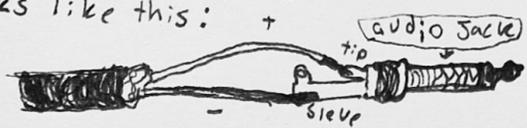
#1. Get Piezo disk (very cheap online)

#2. get audio (preferably microphone cable) cable



#3. HEAT up your soldering iron, and solder the red to red from the audio cable to piezo (and black to the wires, ground)

#4. Solder an audio jack to other side of cable  
Looks like this:



\* the red or signal part goes into the "tip"  
\* the black or ground goes into the sleeve.

## FUN USES: (A FEW NOT ALL!!)

- Put it through some effect pedals to find strange (noisy) sounds!

USE IT to amplify handmade instruments



- like noise boxes,

handmade string instruments... experiment to see how you get the best sound

USE YOUR BODY as an instrument,

Piezo can be tapped, stamped and can pick up breathing and your heart beat!



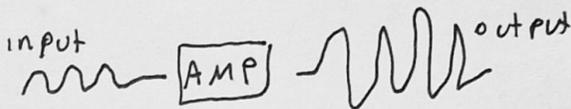
TIP: try on velcro!

# AMPLIFIERS: (AMPS)

RAISING THE INPUT SIGNAL, OFTEN USED FOR BOOSTING AUDIO OR SENSOR DATA!

## SIMPLE:

Connect some input  
(like a jack from your  
telephone / and speaker  
as output.)



Do you hear the  
difference in volume?

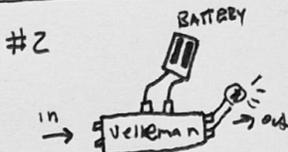
The signal gets  
→ "louder" →

## HOW DO I FIND AMPS?



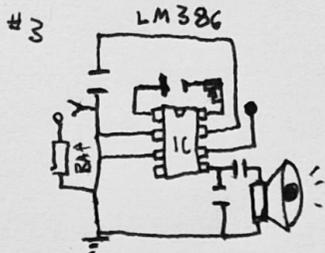
### SPEAKERS: OLD / 2<sup>nd</sup> HAND

WATCH OUT! Make  
sure that it is  
an **ACTIVE**  
speaker (works with  
power) and not a  
**PASSIVE** speaker,  
cut the      V  
cabel and use  
only 5/12 V



### KITS: VEHEMAN/INTERNET

Different kits are available  
that you can connect  
in your own way at  
home. You can order  
those kits online or  
at some electronics  
stores!



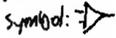
### CIRCUIT: BUILD IT YOURSELF

Design/recreate  
your own circuit  
from scrap!  
Often used with  
LM386 chip or  
TRANSISTORS

# SUPER SIMPEL AMPLIFIER

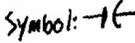
LM386



Symbol: 

Capacitor



Symbol: 

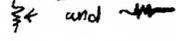
potentiometer



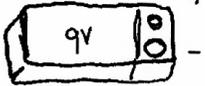
Symbol:  and 

Resistor



Symbol: 

9V Battery:



Speaker

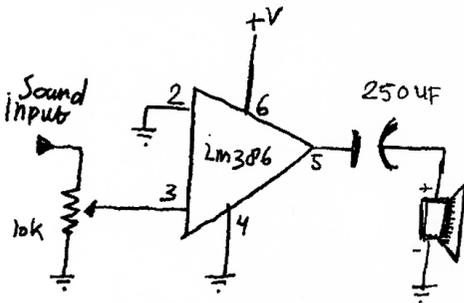
Symbol: 



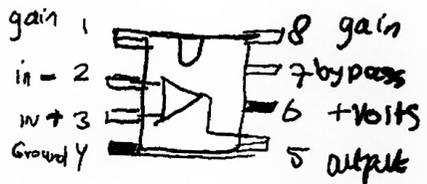
Jack Socket



SCHEMATIC:

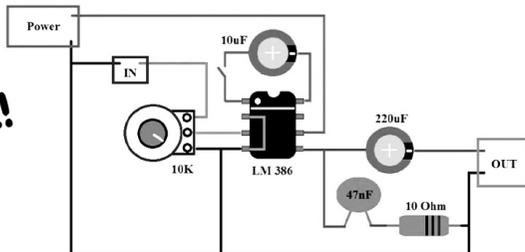


LM 386 pinout:



LM 386 Headphone Amplifier

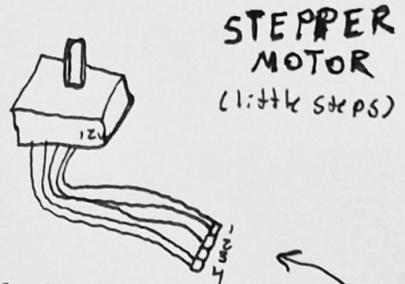
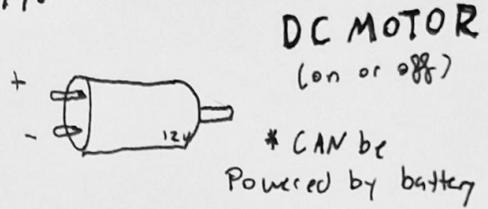
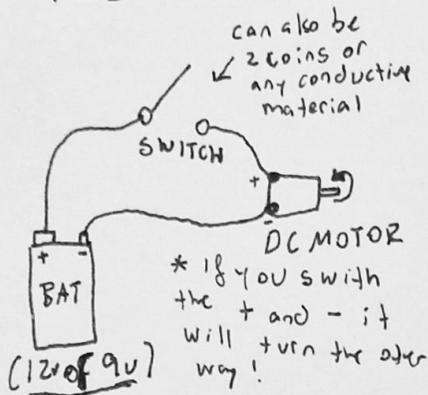
**UPGRADE!**



**CIRCUIT BY NICOLAS COLLINS**

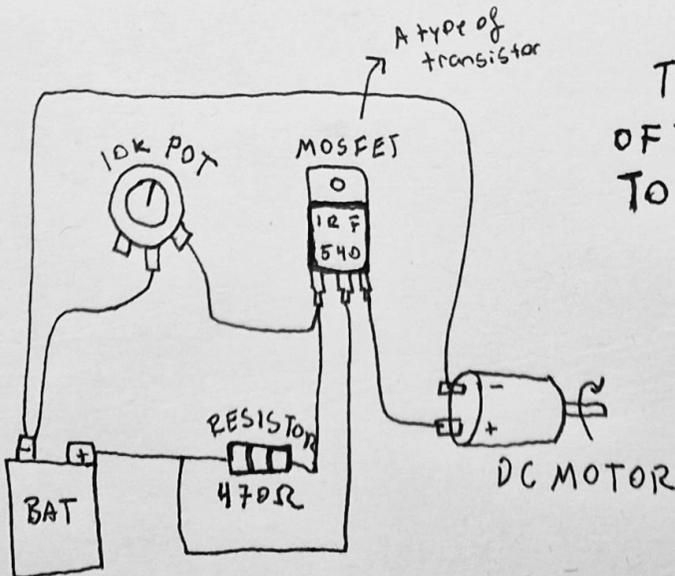
# MOTOR CONTROL:

## SIMPLE DC MOTOR CIRCUIT:



Can only be controlled with a DRIVER

## SPEED CONTROL CIRCUIT:



TURN THE HEAD OF THE POTMETER TO CONTROL THE SPEED!

WORKS FOR 9V/12V

(and also 1.5/3V)





**CRAFT**

**SOME**

**CRAZY**

**STUFF**

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