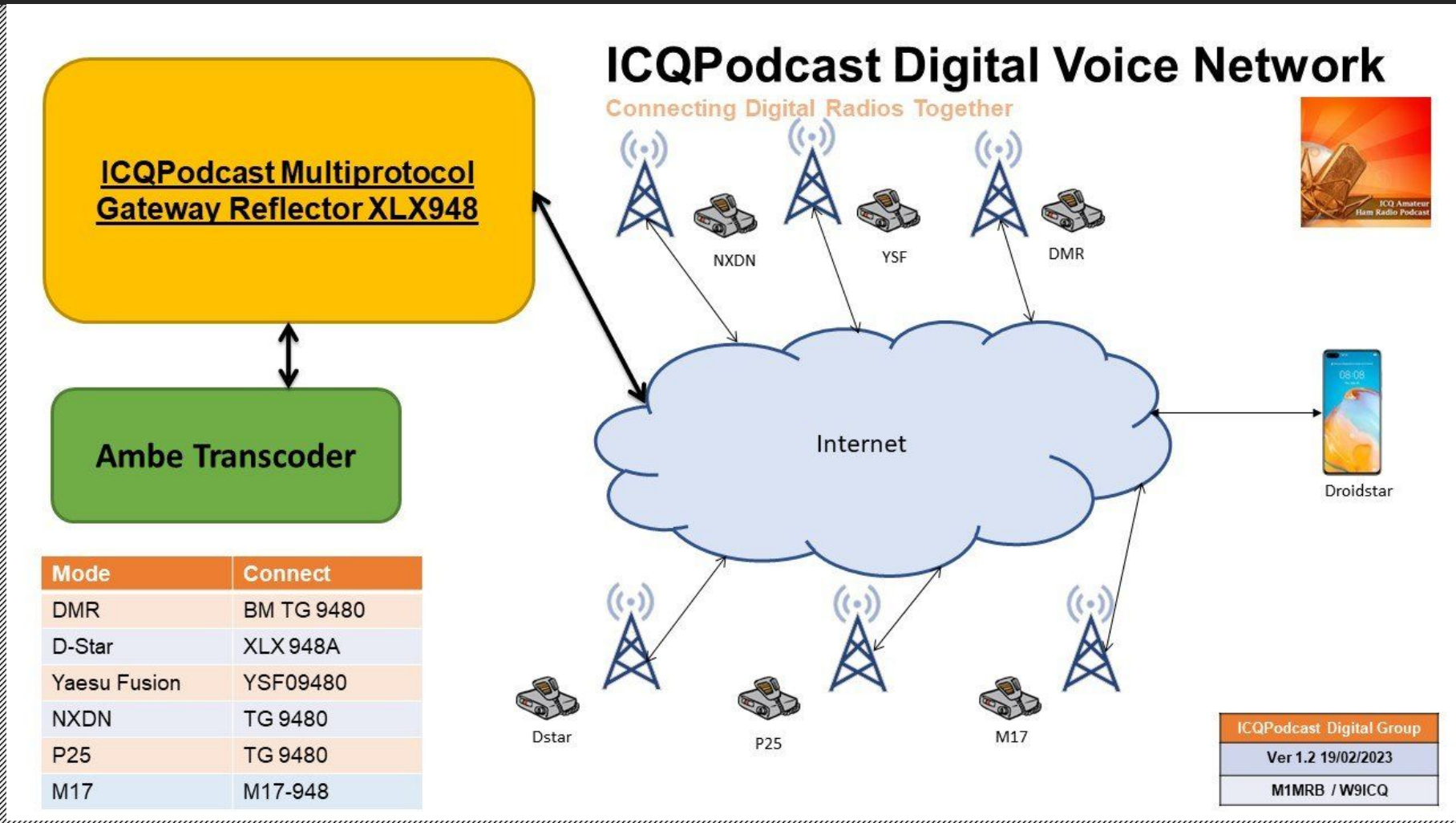
Who am I ?

- My name is Martin Butler
- I hold full callsigns in the UK and USA M1MRB and W9ICQ
- Licenced over 25 years
- Part of the ICQPodcast for over 17 years. 470 plus episodes
- RSGB Registered Trainer and active member of Sutton and Cheam Radio Society.

ICQPodcast



Mode	Connect
DMR	BM TG 9480
D-Star	XLX 948A
Yaesu Fusion	YSF09480
NXDN	TG 9480
P25	TG 9480
M17	M17-948

HAM RADIO OPERATOR

n. *ham ra·dio op·er·a·tor*

1. Someone who solves problems in a way you don't understand.

2. A person who does precision guess work based on unreliable data provided by those of questionable knowledge.

see also; genius, wizard.

Practical Fault Finding

By Martin Butler
M1MRB / W9ICQ

Fault Finding

- I'm a practical person, a fixer rather than a designer. A lot of these tips have come from years of experience gained in the Radio / TV and computer industries.
- ***Any advice or tips given here are given in the spirit of Amateur Radio. It is your responsibility to work safely and not to undertake projects you feel are outside of your skill set. Anything you do, you do so at your own risk***

Fault Finding

- Fault Finding is often a state of mind
- KISS (Keep it simple stupid) NOT KIDS (Keep it Difficult Stupid)
- Don't Pre judge the problem
- Have an open mind

Fault Finding

Fault Finding

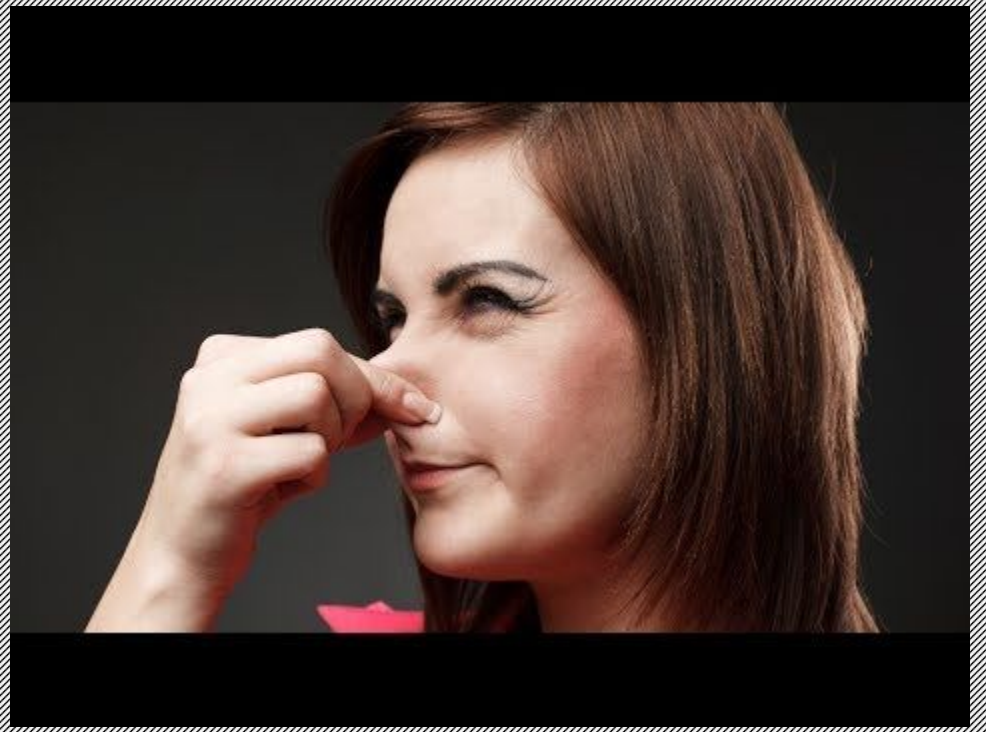
- Have a good look round
- Is there any physical damage?
- Are there any burnt components?
- Are there any stressed components?
- Are there any error codes?

Fault Finding

Fault Finding

- **Listen to what the user is telling you**
  - Did the device make any noise?
  - Is there any arcing?
  - Are Hard Disk spinning up and completing there diagnostics?
  - Are Motors working or making a noise?
  - Any Hum or Pops from the loudspeaker?

Fault Finding



Fault Finding

Fault Finding

- Are there any log files?
- Is there any service history / reports from other engineers?

Fault Finding

Fault Finding

- With an open mind and a can do attitude, review all the information to make sure you understand what the fault is.
- Is this something in your skill set you feel comfortable undertaking?
- Are spares available?
- Is it worth repairing?

Fault Finding

- Man Made Faults are harder to find than a failure.
- They don't obey logic ©
- Look for signs of other repairs and modifications
- You can always ask for help if you are unsure on something but don't expect your helper to do the work for you.

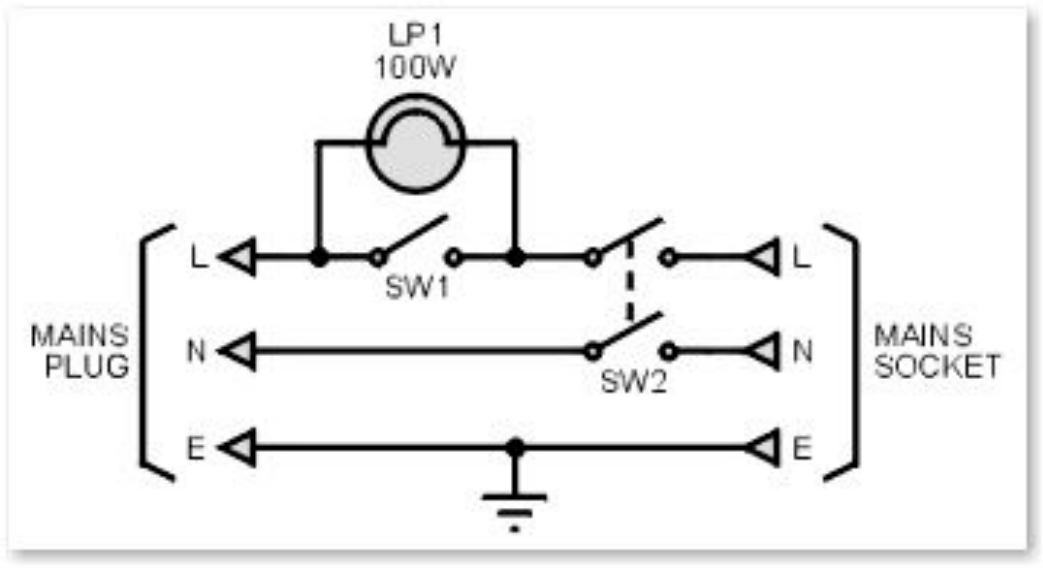
Using a Circuit

- Circuits and Manuals, often downloadable from the internet.
- If you have a Computer Scanner you can scan and enlarge the part of the circuit you are interested in.
- Stock faults for the device being repaired
- Generic Stock faults

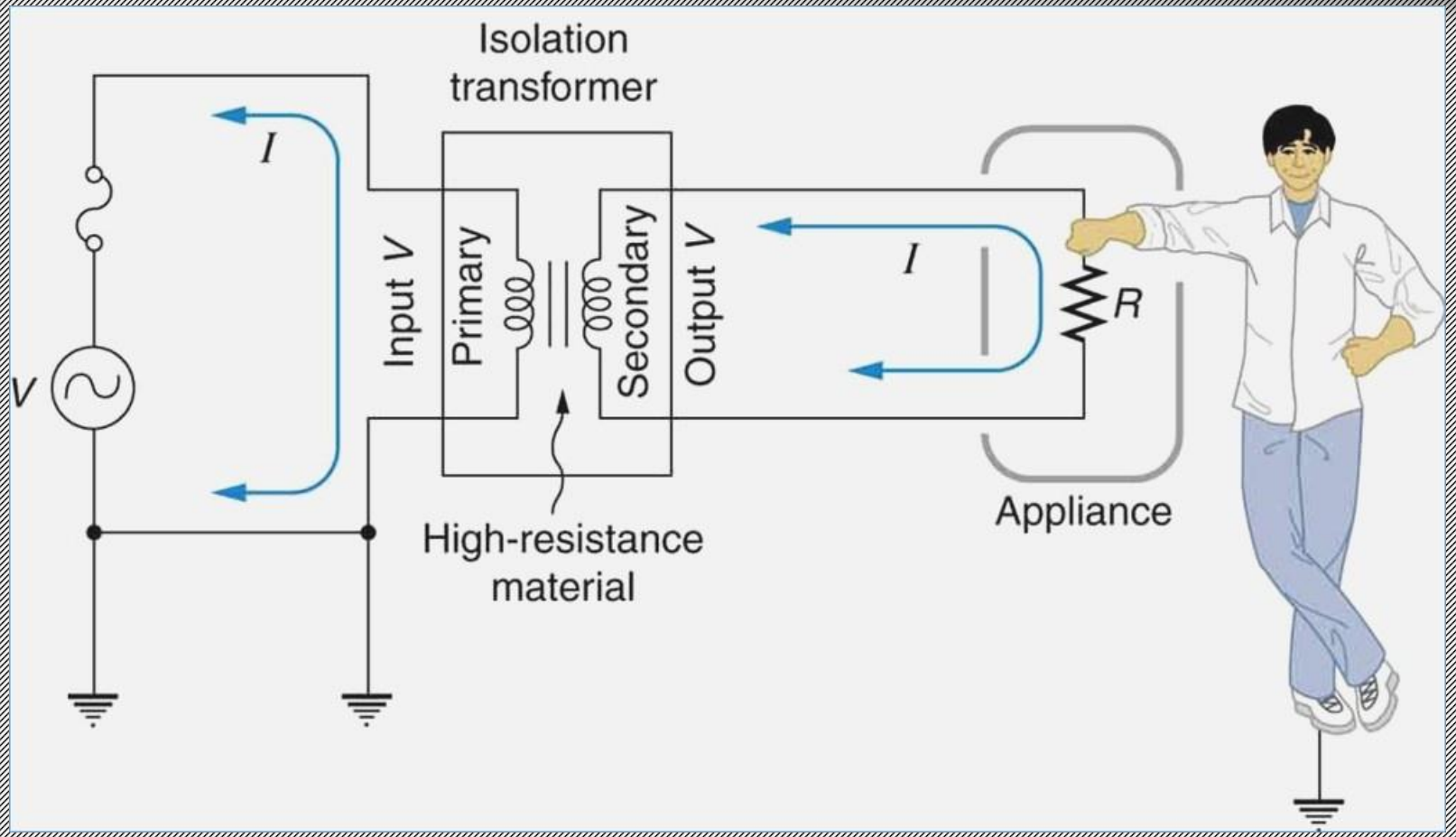
High Voltage Safety

- Remember, a fuse is fitted to protect the equipment **NOT YOU**.
- Try to work one handed.
- If possible use an **ISOLATING TRANSFORMER**, a **CURRENT LIMITER** and **VARIAC**

CURRENT LIMITER



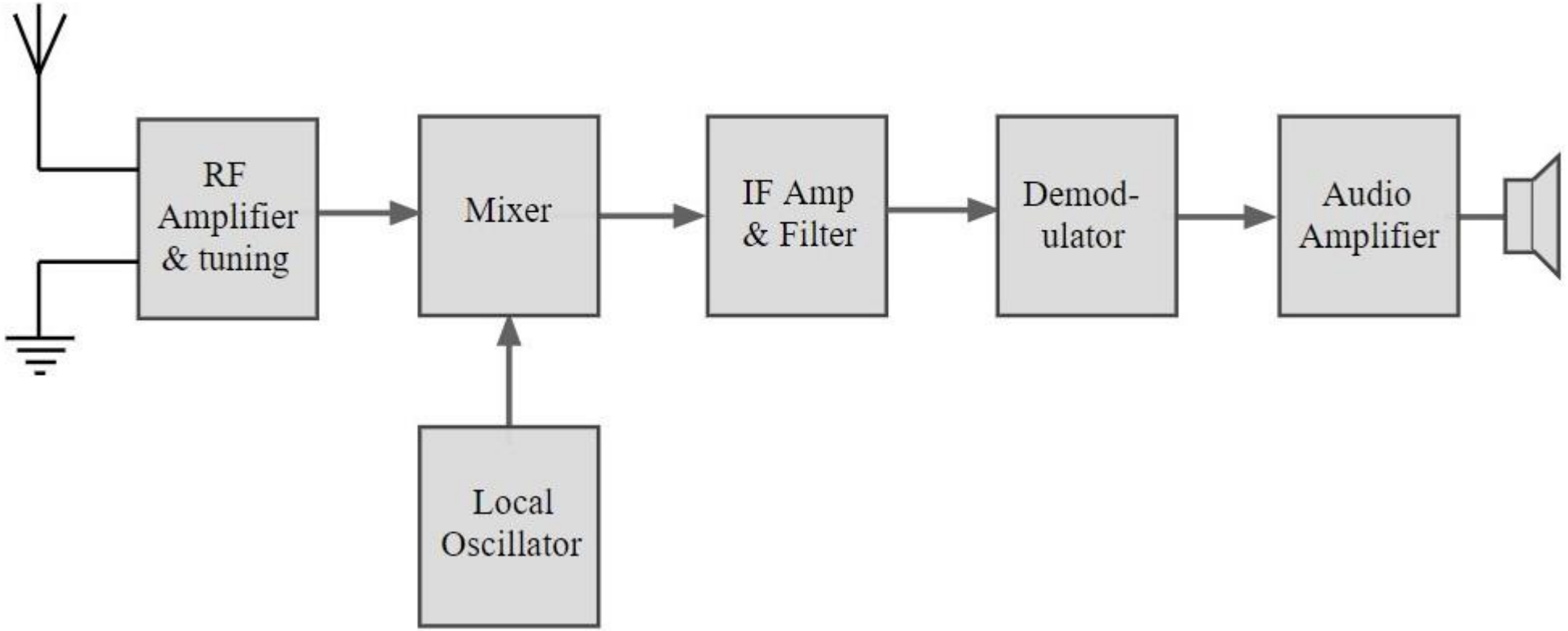
ISOLATING TRANSFORMER



VARIAC

- A Variac is NOT an Isolation Transfomer
  - It is used to bring the mains voltage up slowly
  - Check the rating of the device.

Divide and Conquer



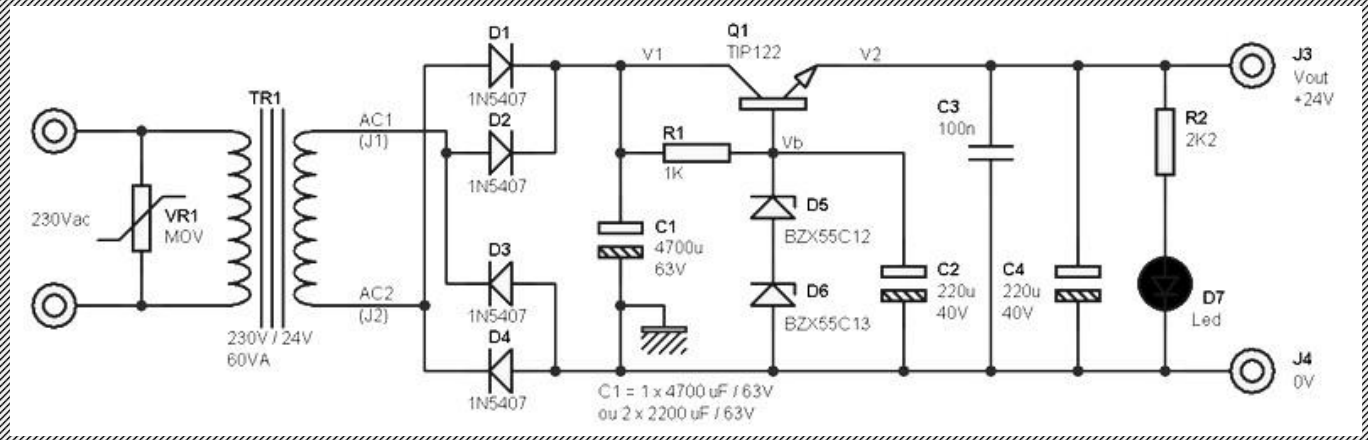
Simple Test Gear

- Multimeters
- Power supply
- Audio generator
- RF generator
- RF probe for multimeters
- Simple audio amplifier and loudspeaker
- Oscilloscope
- Capacitor discharger

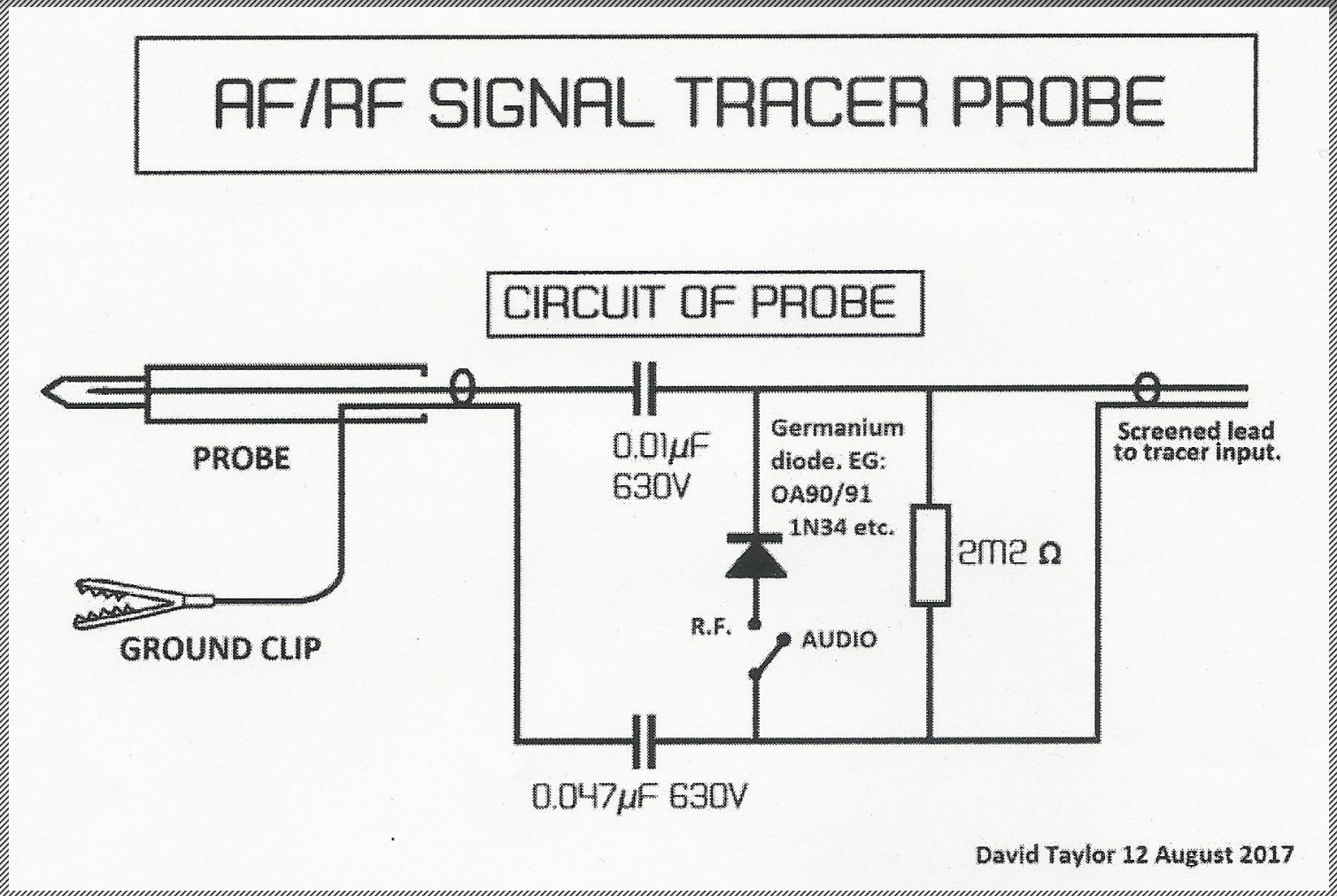
Power Supplies

- Simple PSUs can either be made or purchase and are worth their weight in gold.
- They can be built with discreate components or with a IC regulator.

Simple PSU

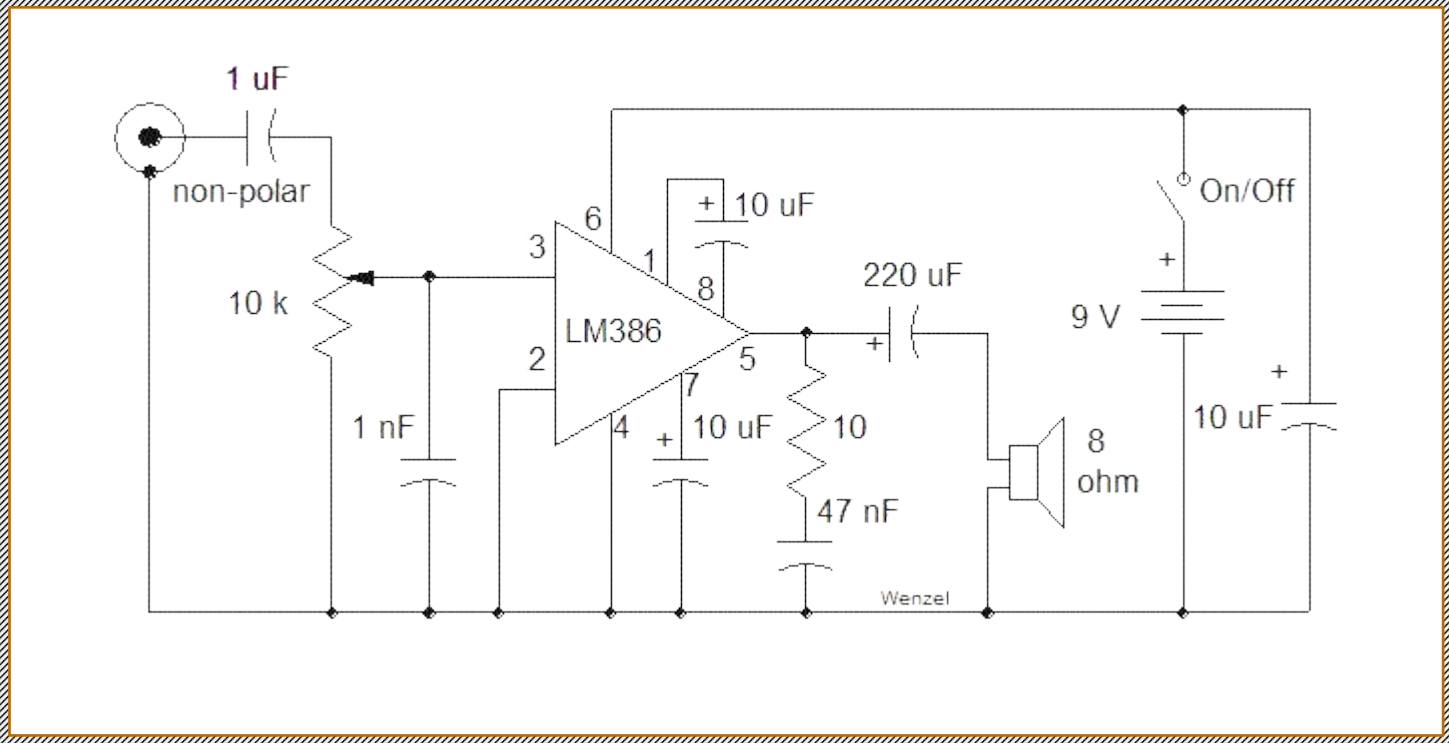


Simple AF / RF Probe



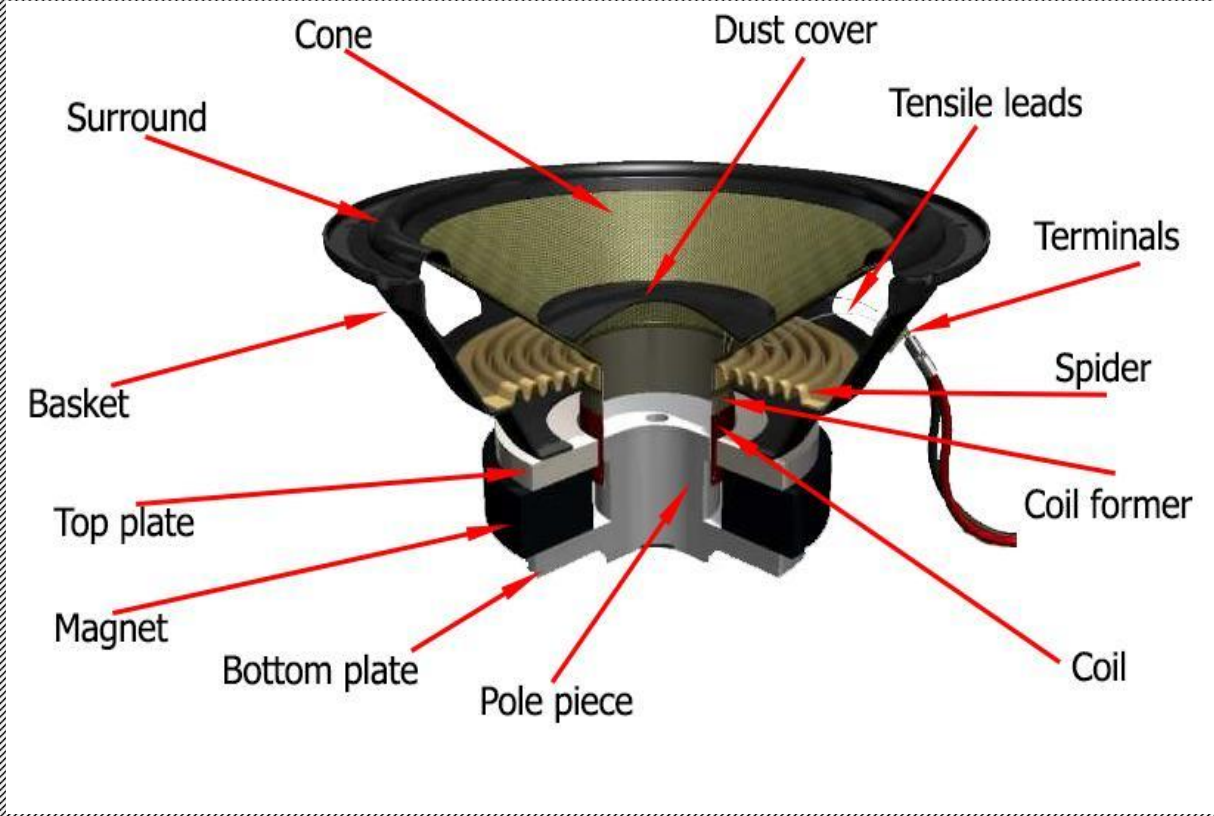
Audio Amplifiers

- Something like this or an old set of powered computer speakers



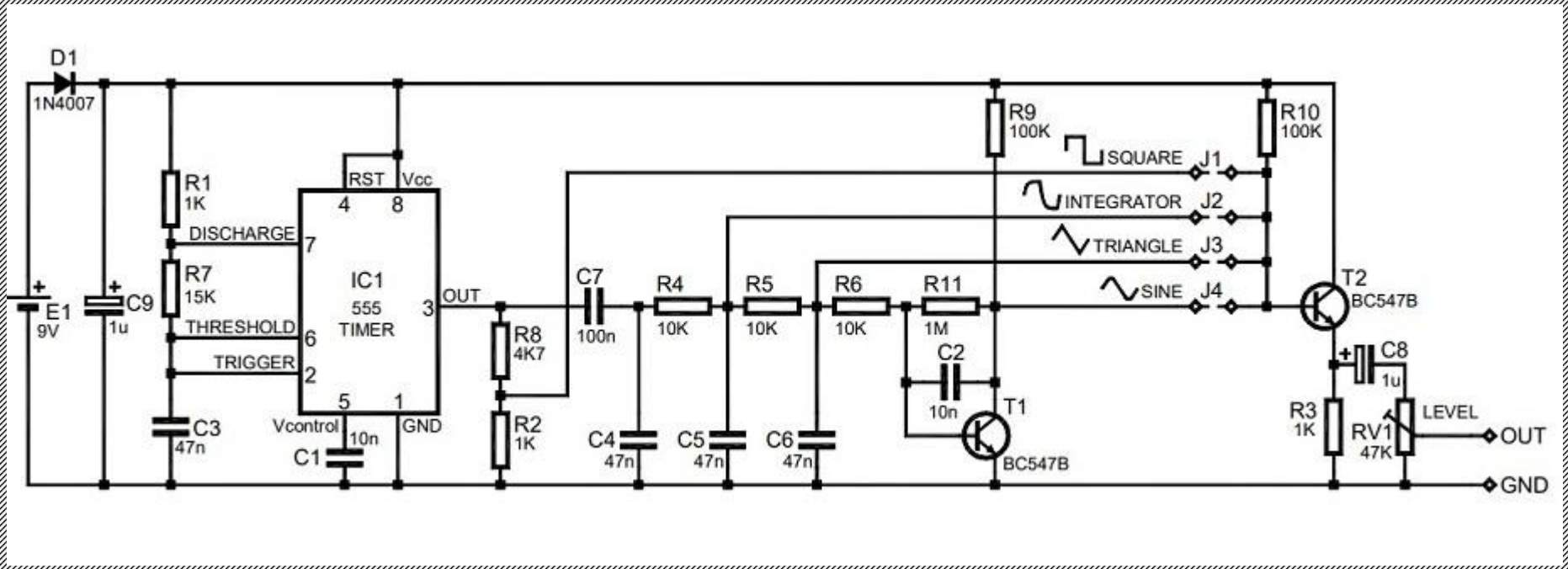
Loudspeakers

- Remember an 8 ohm loudspeaker will not measure 8 ohms on a multimeter
- Meauring a Loudspeaker with a multimeter can damage it.
- Distorted sound / off centre cone



Oscillators

- A test AF oscillator (about 1KHz)

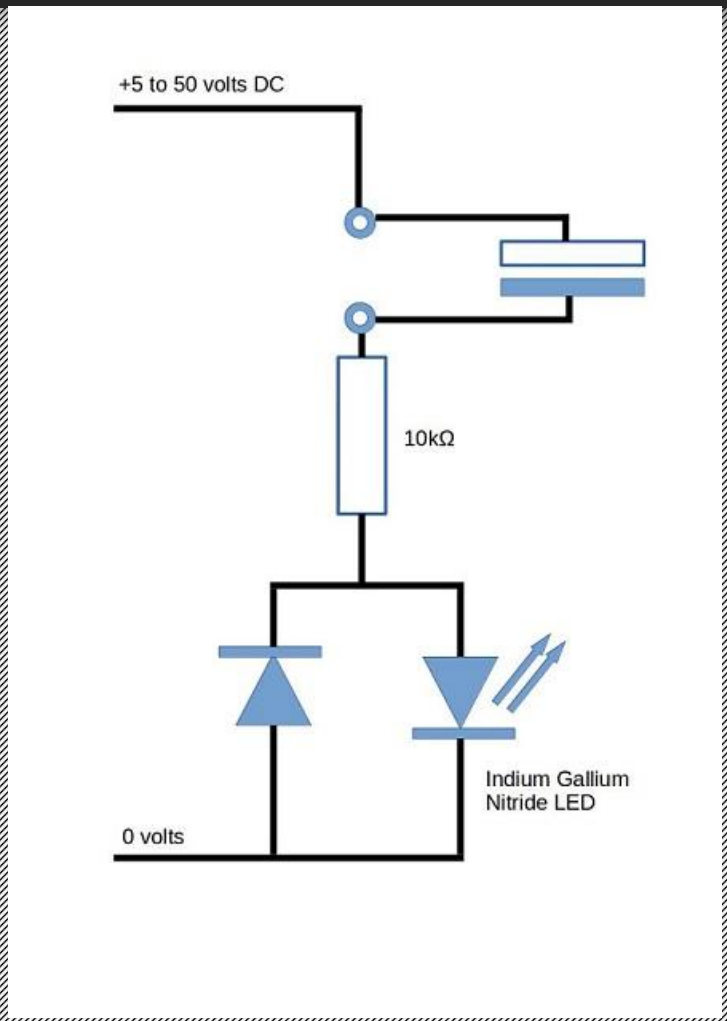


RF Signal Generator

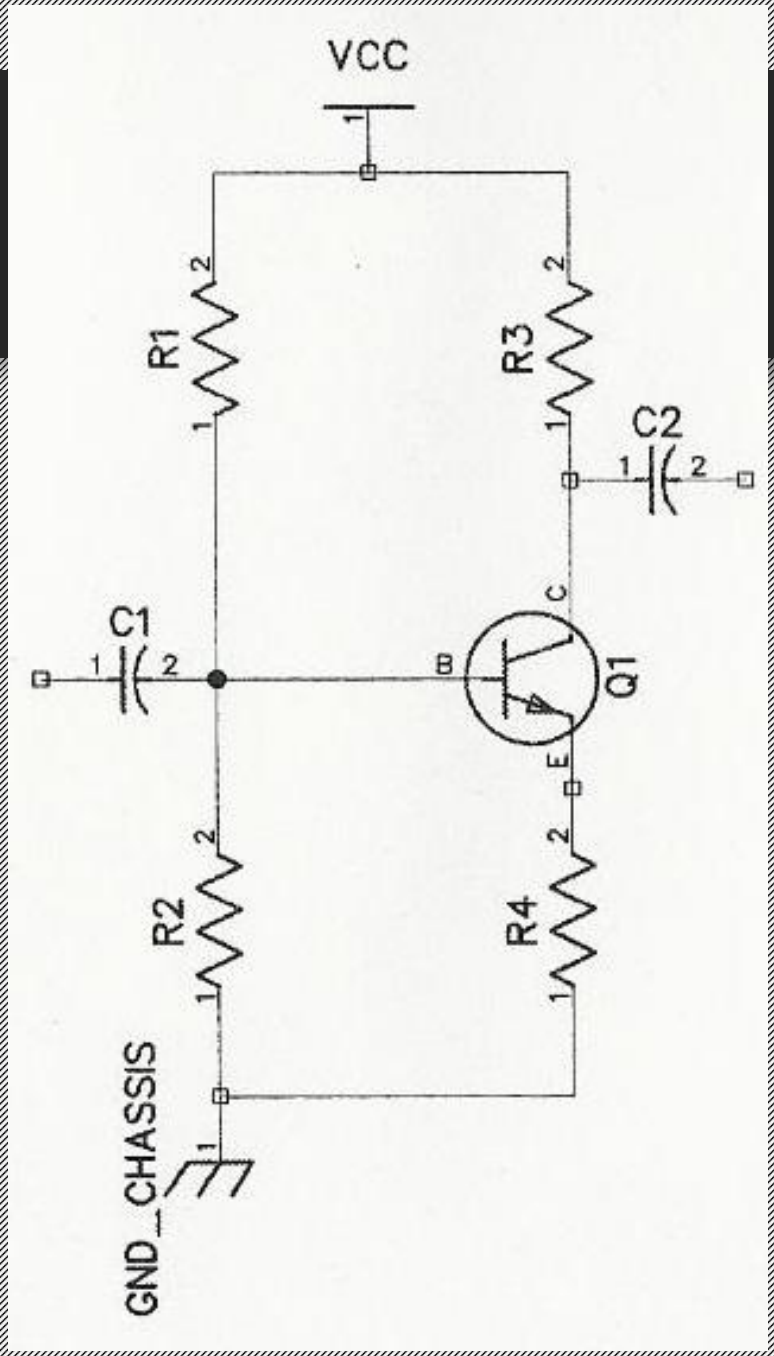
Dummy Loads

- Dummy Loads are not just for RF
- Dummy Loads can replace Loudspeakers
- Dummy Loads can be used to load a power supply

Simple Electrolytic Capacitor Tester



Transistor quick test



Killer Oscilloscopes

- Oscilloscopes have switched inputs
- They can be used in DC or AC mode
- When used in AC mode there is a coupling capacitor in series with the probe.
- This can become charged up and may hold a charge that can kill semiconductors
- Solution, always short / ground you probe before taking AC measurements.

Correct way to fit a Capacitor

- Electrolytic Capacitors must be fitted the correct way round or damage will occur.
- Non-Electrolytic Capacitors also have a right and wrong way to fit them. If fitted incorrectly they will not get damaged but the device will be degraded.

Screws and Screwdrivers

- What is a Japanese industrial standard screwdriver?
- JIS - or Japanese Industry Standard - is a Pacific Rim standard used for "Philips" (cross) type screwdrivers.
- Sometimes a dot will let you know you're dealing with a JIS head. But not always..
- Refitting self tapping screws.

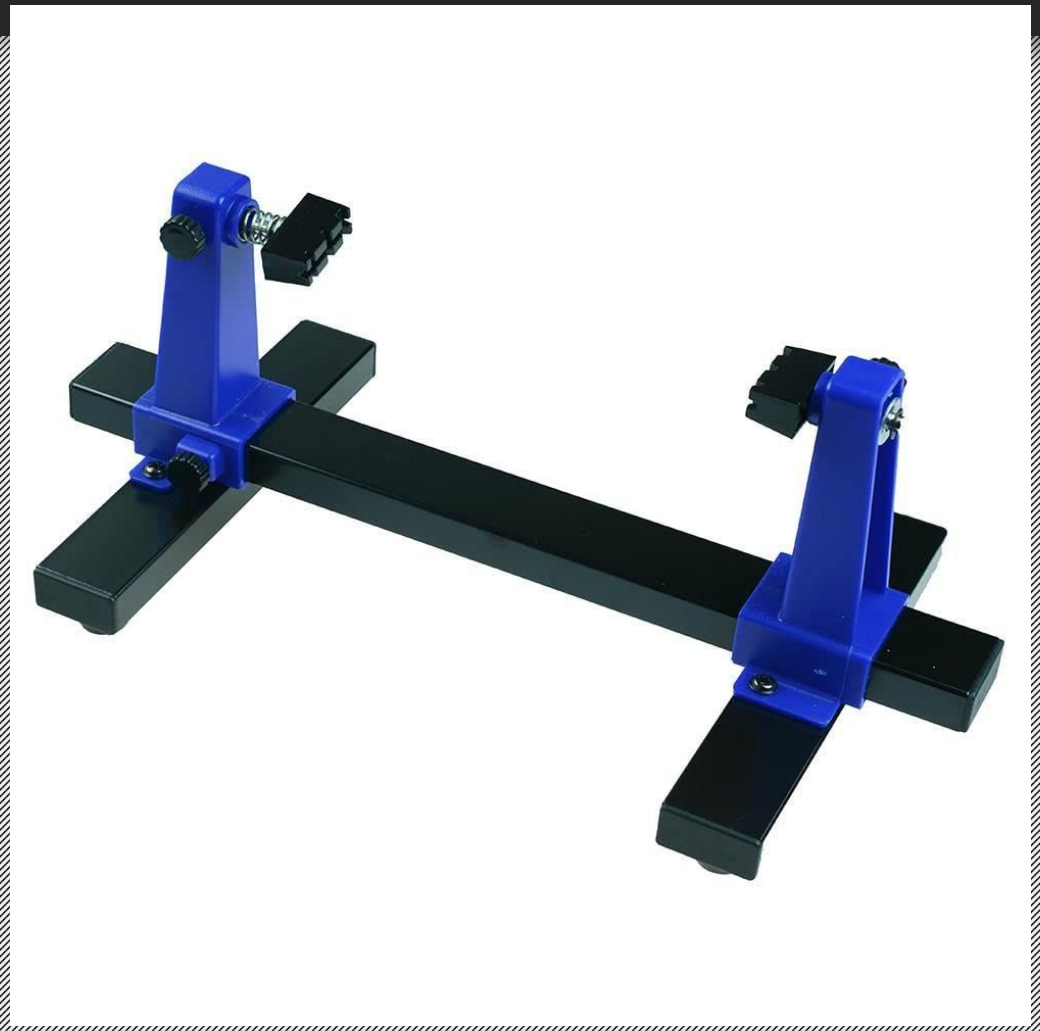
Torx Screws


HOLLOW HEXAGONAL PLUM BLOSSOM SCREWDRIVER HEAD
All kinds of specifications,
sizes of screw holes anastomosed


1/4
Hex Shank
S2 TT30
50mm/2in


T08 T10 T15 T20 T25 T27 T30 T40

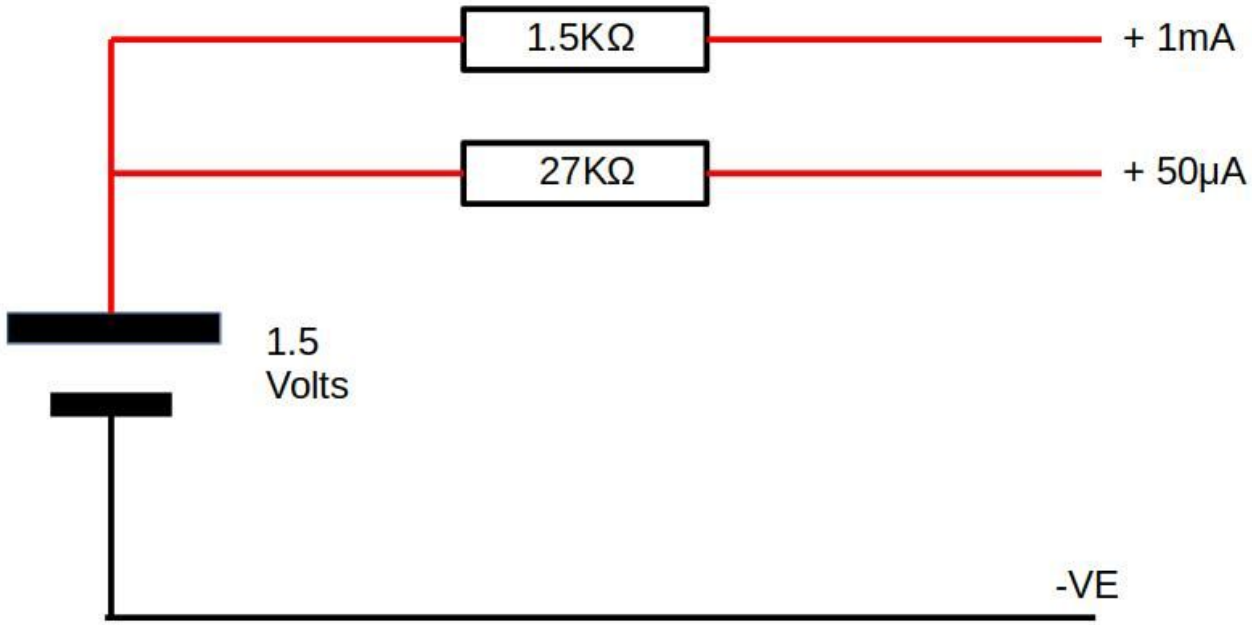
PCB Holder / 3rd Hand



Static charge build up

- Often Analog meters will not zero and the movement changes when you touch it.
- Enter a very simple fix
- Washing up liquid

A very simple device for testing moving coil meters



A very simple circuit for testing moving coil meters at home or at Hamfests.

By Rev George Dobbs G3RJV

Multimeter current on Ohms

- On older analog mulitmeters of low ohms per volt type, there can be higher current when measuring resistance.
- This may blow milliamp fuses when testing.

Fuse Testing with a Smart Phone

- A very useful way of testing fuses when you don't have a multimeter with you.
- A great way to test low milliamp fuses without blowing them.

Removing Components from Lead Free Solder.

- Unsoldering Components will often damage the Component and or the PCB Tracks.
- A Safer way to remove these components is to cut their leads. Heat the joint and pull the pin out.
- You are then left with a blocked hole. Hand solder pumps and braid fail most of the time because the solder solidifys too quickly.

Removing Components from Lead Free Solder.

- A very simple way of unblocking these holes, is to heat the joint up and tap it quickly on the bench.
- Gravity takes over and you end up with a clean hole for the new component.

Most likely faults

- On old valve equipment
  - Electrolytic Capacitors
  - Wax Capacitors
  - Resistors changing value
  - Heater cathode short circuit causing Hum
  - Cleaning of Switches and controls
  - Lastly Alignment
- This equipment will be running on High Voltages, Working on High Voltages, you do so at your own risk.

Most likely faults

- **Low Voltage**
  - Electrolytic Capacitors
  - Tantalum Capacitors going Short Circuit / Going up in Smoke
  - Resistors changing value
  - Interconnecting leads
  - Dead semiconductors
  - Cleaning of Switches and controls
  - Lastly Alignment

The End

- Any Questions
- Thank You