ADA MP-1

Stock MP-1 Gain Mod

R. Metzger 8/2003

Introduction:

I wish I would have decided to sit down 12 years ago and do this mod, it would have saved me a lot of time experimenting with buffers, outboard effects pedals, etc. When I got my first MP-1, I was shocked at the quality of the tone it had and how easy it was to get a great sound, but I've always thought in the back of my mind "Man, I could really use a little more gain".

After all my experimenting I settled on a simple device, a **clean-booster** that I placed between my guitar and my MP-1, a **1979 MXR Microamp**. It is beat to hell and has had more beer spilled on it that I would like to admit, but it has never failed me once.

Here is a pic of it, I call it **"Chucky".**

I was able to successfully get the tone I wanted by setting the **OD1 Control Level** on the MP-1 to 5 and adjusting the Microamp's gain control until the **OD1 Clipping LED** blinked occasionally. From there I tweaked the patch.

Here is a quick overview:
This mod not only eliminates the need for a clean-booster to match gain levels but also maxes out the gain on the 2nd tube stage as well, and IMHO, doubles the usable gain.

The goal of this particular mod was to dramatically increase the "shredable" gain and at the same time make the mod as transparent as possible on the stock MP-1 tone. I believe I have done just that.

There are three procedures involved in this mod:
1) Replacing the 2nd tube stage gain resistors on the tube-board.
2) Replacing the OD1 Trimpot that controls the amount of gain passed to the first tube stage.
3) Bypassing the Input FET Buffer Circuit.

Note:
Procedure 3 shown above involves bypassing the **Input FET Buffer Circuit**. This sub-circuit is designed to compensate for impedance mismatches. If you have passive pickups and plan to be able to plug your guitar directly into your MP-1 in the future without an active-buffer, you can safely skip steps 8 & 9. However, if you have active pickups (EMGs) or have passive pickups and use an effect that has a buffered bypass between your guitar and your MP-1, this step is highly recommended. It will significantly help to reduce excess hiss. Please see step 8 for more detail on this.

The positive points about this mod are:

a) There is a minimum number of parts to acquire.
b) It is very easy to perform (even for a newbie!)
c) It should take you no longer than an hour
d) The mod is totally reversible, so it can't hurt to try it. …unless of course you screw something up.

The negative points are:

a) Increased Gain = Increased Noise. We have all lived this. A **Rocktron HUSH** unit is your friend.
b) If you perform the **Input FET Buffer Bypass** (Steps 8 & 9), you will not be able to plug your guitar directly into the MP-1 with passive pickups anymore without experiencing "**Tone-Sucking"**. Active Pickups are NOT affected by this limitation.
c) Geesh, I can't think of anything else… More usable gain in about an hour?! **SIGN ME THE F*CK UP!**

Since this mod requires de-soldering components, I have included an informative write-up with some de-soldering tips.

If this is your first time working with resistors or you just don't understand the value coding system, I have included a write-up in this doc called, yep you guessed it, "**Resistors 101".**

The "Stock MP-1 Gain Mod" involves 10 steps:

1. Acquiring Parts
2. Removing the Top and Bottom Panel
3. Detaching the Tube-Board Stand-offs
4. De-soldering Resistors **R20** and **R21**
5. Installing the replacement resistors for **R20** and **R21** and re-attaching the Tube-Board
6. De-soldering Resistor **R74** and the **OD1 Trimpot (T2)** from the main PCB
7. Soldering a Jumper Wire in place of **R74** and replacing **T2** with a higher value
8. De-soldering Resistors **R90** & **R92** and Cap **C37**
9. Soldering a Jumper Wire in place of **R90** and running the **Input FET Buffer** bypass wire
10. Tweaking the **OD1 Trimpot**

ENJOY!

-HB

Step 1: Acquiring Parts

Surprisingly, this mod has few parts to acquire. **BONUS!**

I won't go into my usual Radio Shack rant this time, but if you do decide to go shopping for parts there, **GOD BLESS YA!** You may be able to find the resistors there, but I know for a fact they don't carry 500k trimpots.

I like to use exact fit replacement parts. It keeps the work looking professional and also keeps the potential for damaging other neighboring components to a minimum, not to mention the main PCB board itself.

The only part listed here that truly needs an exact fit is the **500k Trimpot.** I have included a **Mouser** part number for this if you want to go for the professional approach.

I also included **Mouser** part numbers for the resistors. It is definitely not worth placing an order at **Mouser** for only three parts, but if you do plan on doing other mods to your MP-1, this may just be the time.

Mouser is a great part source. They have a great printed catalog and website, and they also do not charge a per-order minimum. Their prices also blow away **Digi-Key** big time for low quantity items.

Here is their website address if you couldn't have already guessed it:

http://www.mouser.com

This is how you order **1/4W Carbon Film Resistors** from **Mouser**, it is a prefix of "**291-"** followed by the value of the resistor you need:

For example, a **100k 1/4W Carbon Film Resistor** would be: **291-100k**

A **100 Ohm** would be: **291-100**

…and a **22M** (yes, they do exist!) would be: **291-22M**

Parts and Quantities (with some Mouser part numbers):

(1) 1/4W 5% 510k Carbon Film Resistor	**#291-510k**
(1) 1/4W 5% 1M Carbon Film Resistor	**#291-1M**
(1) 500k Horizontal Single-Turn 4.5mm Trimpot	**#32RH505**

At least 2" inches of insulated 24AWG stranded hookup wire (Input FET Bypass Wire)

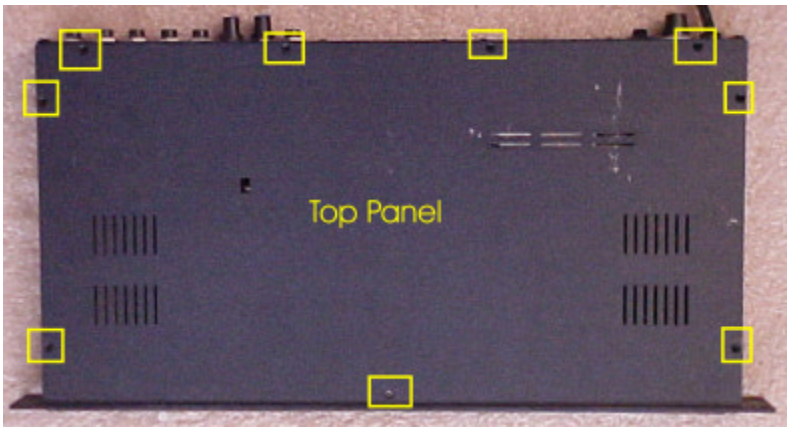
24AWG Pre-tinned Bus Jumper Wire. You can get this at **Rat Shack** if you don't have any extra lying around. It is catalog number: **278-1341.** Alternatively, you can use the excess snipped leads from the resistors.

Note:
If you do decide to substitute parts, I can not guarantee that they will have the same affect on the final result of this mod, nor can I guarantee that the parts will physically fit as replacements.

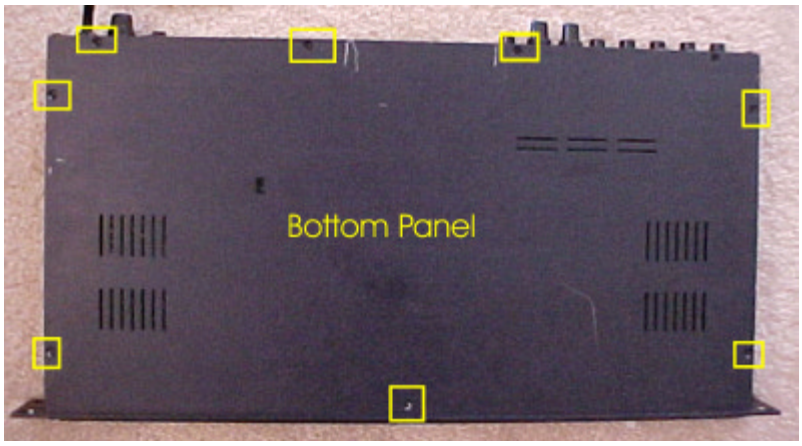
Step 2: Removing the Top and Bottom Panel

There are 9 counter-sunk machine screws on both the top and bottom panels that must be removed.

Top Panel screw locations



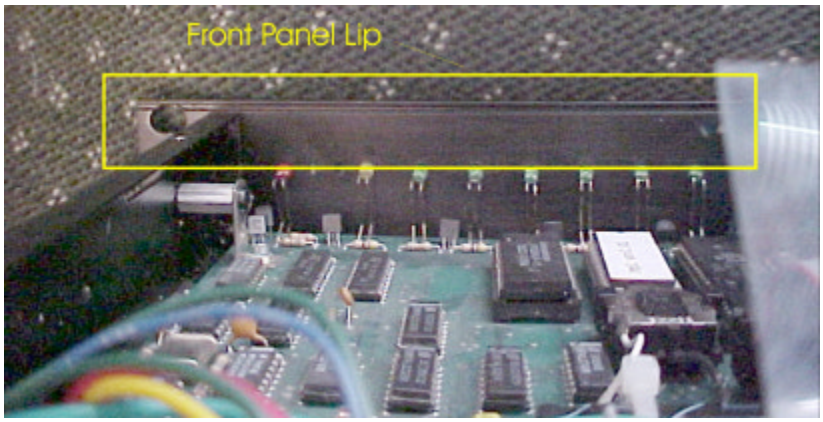
Bottom Panel Screw Locations



Be careful taking the panels off because there is a lip on both the top and bottom of the front panel that helps keep all the panels flush. Pull the panels out from the back of the unit, don't lift them out.

When re-attaching both panels, be sure to slide the panels into the lip and confirm all screw holes are in the correct locations. Be forewarned, these panel screws strip easily, especially if you accidentally cross-thread one.

Here is a pic of the front panel lip



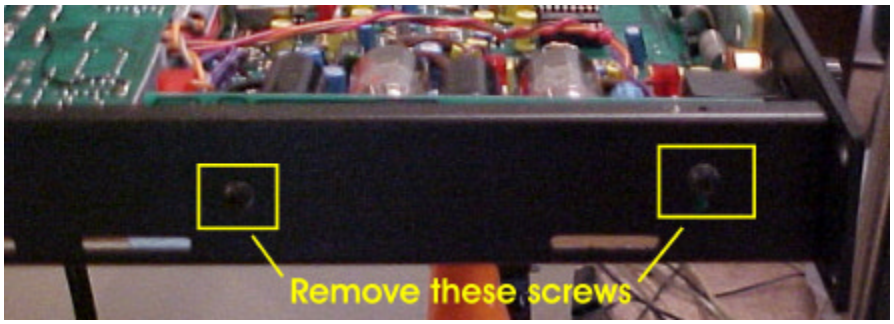
After removing the top panel, **REMOVE THE TUBES!**

This will avoid any incidental damage and will also give you more room to work with.

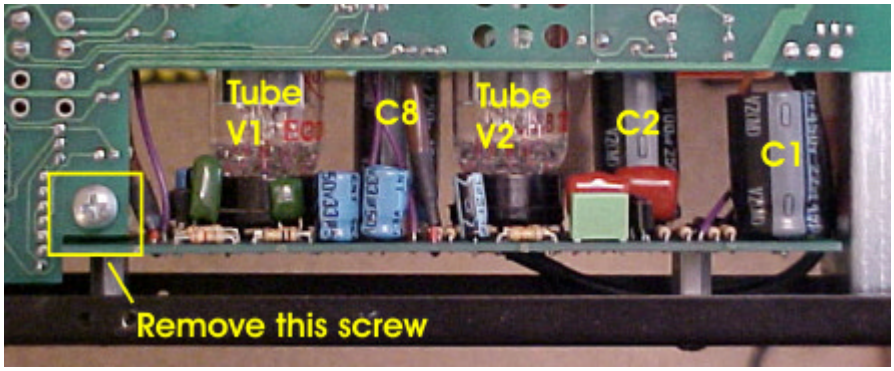
Step 3: Detaching the Tube-Board Stand-offs

Detaching the Tube-Board requires you to remove three screws. Once the Tube-Board is detached, you can flip the board up and work on it from there. You don't have to worry too much about breaking a wire off from a solder-pad, they are all attached pretty securely.

Remove these screws from the left side of the unit



Remove this screw from the underside of the unit

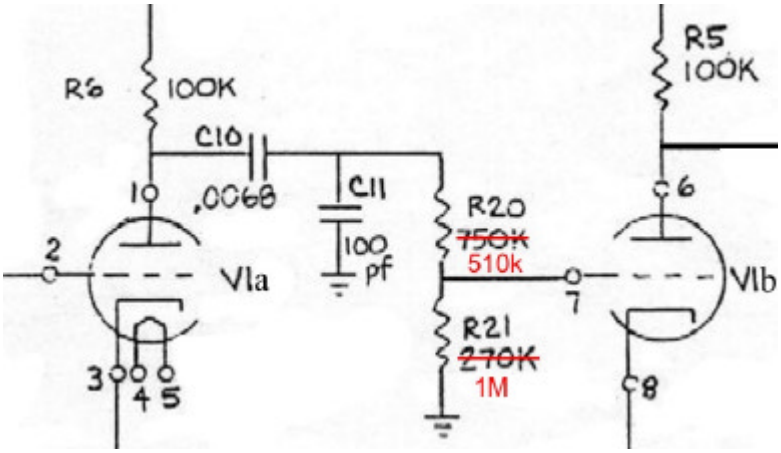


From here, you should be able to orient the Tube-Board so you can work on it comfortably.

Step 4: De-soldering Resistors R20 and R21

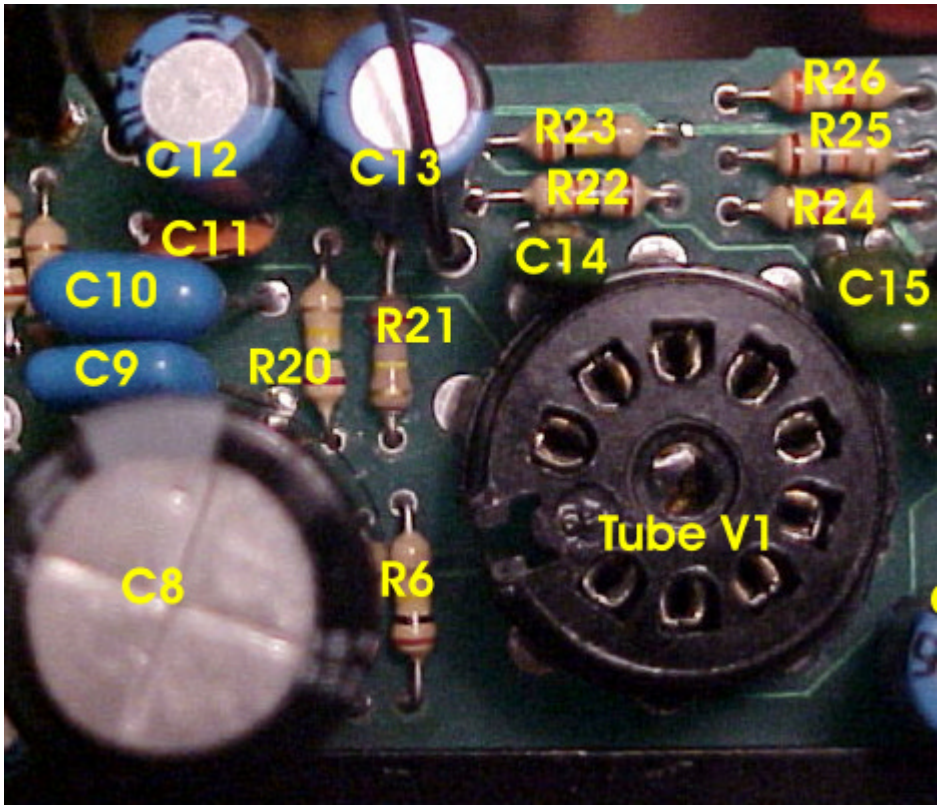
The following two steps of the mod involve replacing the resistors that control the amount of gain fed into the 2nd tube stage (V1b). This configuration pretty much maxes out all the usable gain for this tube stage.

Schematic of the 1st and 2nd Tube Stages showing the replacement resistors for **R20** and **R21**

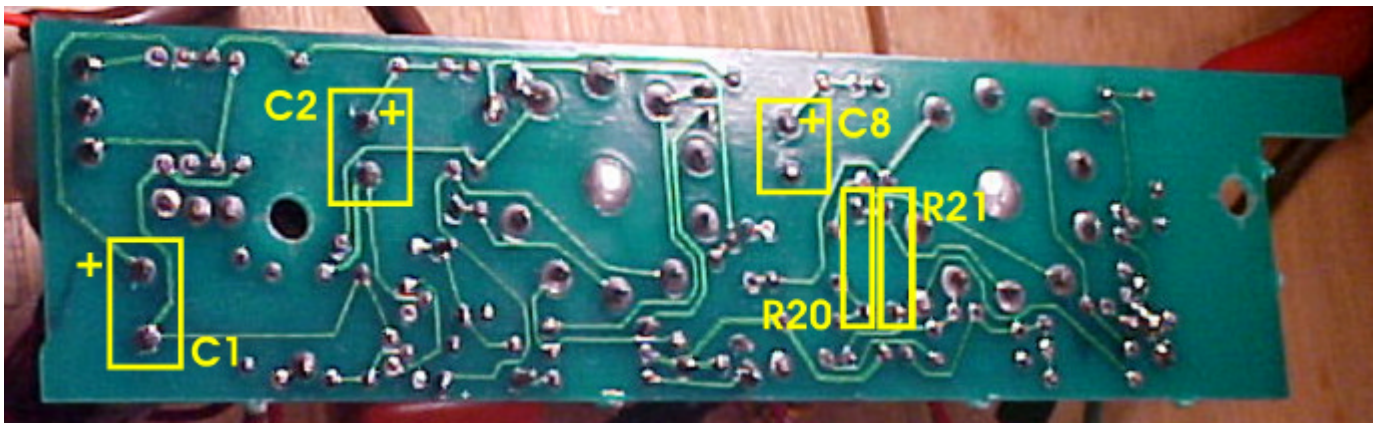


After a good clean de-soldering of both leads of each resistor, you should be able to lift them off the Tube-Board with little or no effort. Keep using the de-soldering wick (braid) on each lead until it literally falls out. Be careful not to melt or score the surrounding PCB area. Also watch for pads lifting off the PCB. If you see a pad starting to lift, STOP! Your iron has too high of wattage for this application. Buy or borrow another one. Patience is a virtue here. If you continue with lifted pads, you risk breaking traces. If this does happen to you I have included some repair tips in the **"Good Desoldering Practices"** section.

Pic of the un-modded component-side of a **Stock MP-1** Tube-Board with surrounding components labeled for reference.

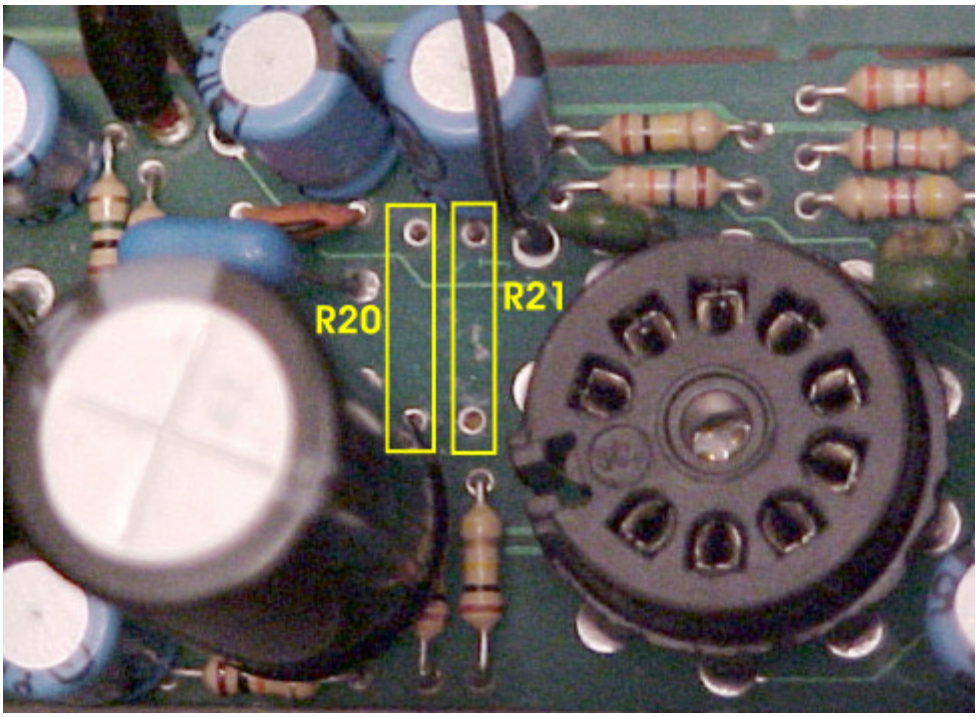


Here is a pic of the solder-side of the Tube-Board with the location of **R20** and **R21**. The filter cap locations shown in this pic are included for reference.



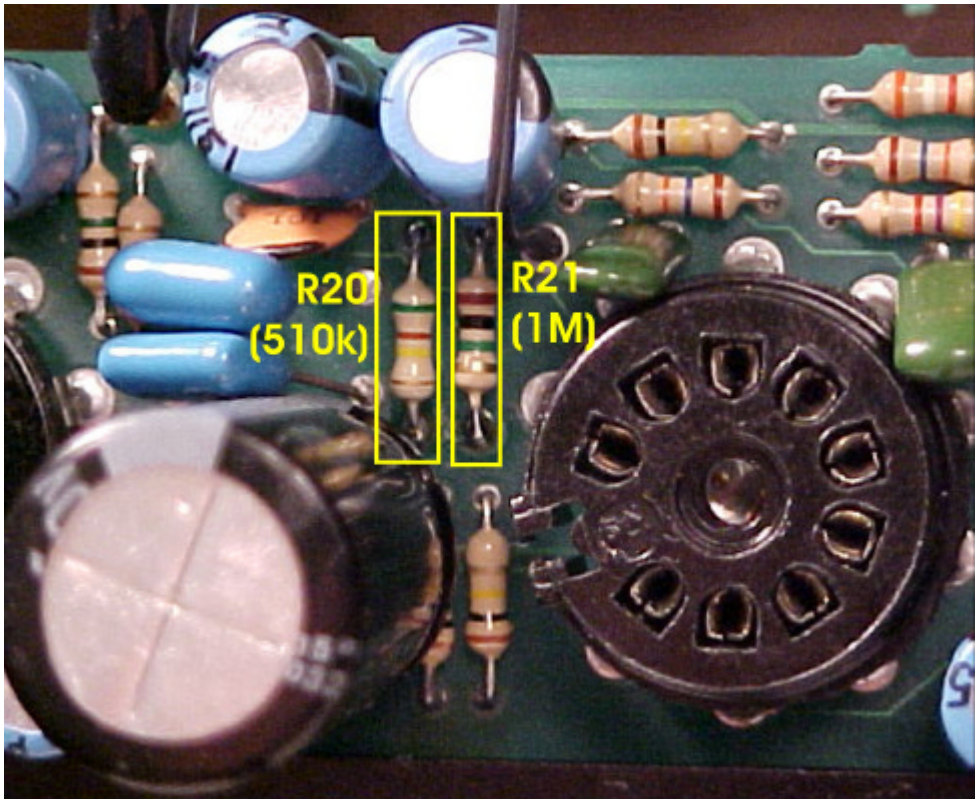
Step 5: Installing the replacement resistors for R20 and R21 and re-attaching the Tube-Board

Pic of the un-populated locations of **R20** and **R21**



Pic of finished job.

My high-school shop teacher would be proud.



When you are done soldering the replacement resistors onto the Tube-Board, clean up the excess soldering flux on the underside of the PCB with a toothbrush and some **Zippo Lighter Fluid** (naptha).

Go ahead and re-attach the Tube-Board stand-offs to the chassis. Do **NOT** reinstall the tubes just yet.

Step 6: De-soldering Resistor R74 and the OD1 Trimpot (T2) from the main PCB

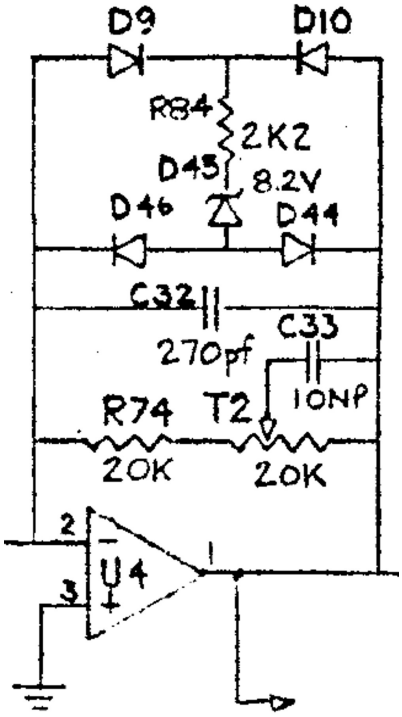
This next part of the mod involves replacing the **OD1 Trimpot (T2)** with a higher value and jumpering the location of **R74**. This part of the circuit is based around an Op-amp gain stage that directly pushes the first tube stage. As well as a gain match/boost circuit, there is also a limiter (or “clamp”, or sometimes “chaff”) circuit that is designed to keep the Op-amp from distorting.

Here is another great post by **Mark Howell** from the **ADA Depot Forum**.

I have also included a schematic of Op-amp U4’s feedback loop with the Clamp Circuit included for all you geeks to analyze:

“Yep, it's a clamping/limiting circuit, and you can consider it separate from the basic inverting op-amp that it's attached to. It's a full wave clamp circuit, and starts limiting around 9.6V peak (8.2V zener + 2 .7V diode drops). The resistor above the zener is to prevent it from clamping hard, easing the transition from sine wave to square wave. So OD1 is limited to a 19.2V swing. If you up the zener, you can have it limit right near the supply rails, and the first tube stage will get hit harder.”

- M. Howell



WoW, I couldn’t have technically explained it better… Really though, I couldn’t have!

Well, with that said, I’m not sure if increasing the value of the Zener Diode in this case would actually yield more usable gain or just more noise. Most likely you would lose that sweet compressed tone that the stock MP-1 is known for.

Back to the actual mod:

What we will be doing here is removing the gain minimizing resistor **R74** and increasing the **OD1 Trimpot’s** value from 20k to 500k.

Aside from the Clamp Circuit, this is essentially an Inverting Op-amp stage with variable gain. I won’t get too technical here into Op-amp theory, but simply stated, the more resistance in an inverting Op-amp feedback loop, the greater the gain (up to a certain point).

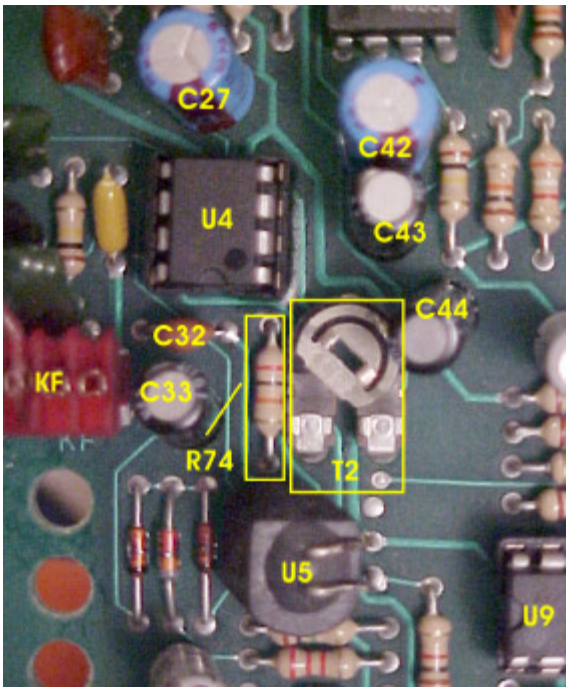
This does two things. First, it allows us to increase the resistance in the feedback loop almost 20 times, hence a higher gain signal will get fed to the first tube-stage. Second, with the minimizing resistor gone, we can now *“dial-down”* the gain if this stage already has adequate gain and is causing clipping issues.

…**onto the good stuff:**

OD1 Trimpot T2 and Resistor **R74** are to be removed from the main PCB.

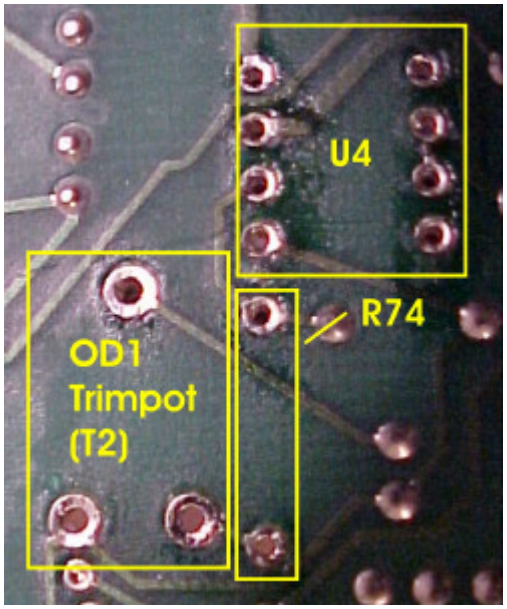
Pic of **T2** and **R74** to be removed.

The surrounding components labeled for reference.



Pic of solder (under) side of the main PCB with components labeled.

No, it is not your imagination. U4 has been removed in this pic. I was installing the **"Noise-Mod"** on this MP-1 at the same time I was documenting the mod.



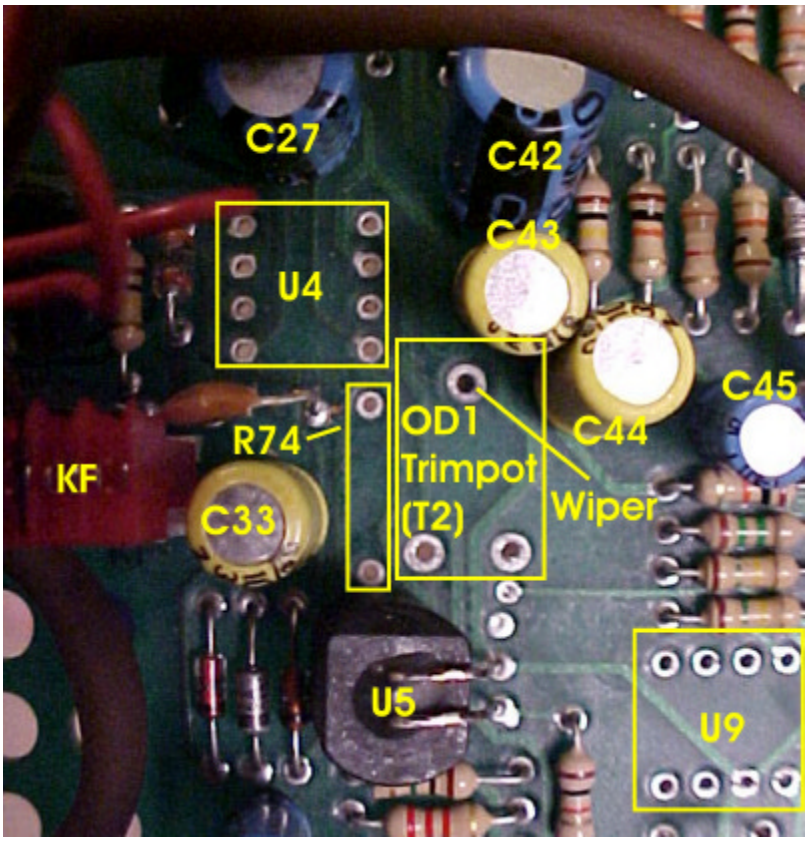
After the components are removed from the main PCB, continue using the solder-sucker and de-soldering braid to completely open and clean-up the through-holes of any excess solder. Do this on both the component side and the solder side of the main PCB and you will get great results.

Step 7: Soldering a Jumper Wire in place of R74 and replacing T2 with a higher value

Pic of unpopulated PCB locations for **R74** and **T2.**

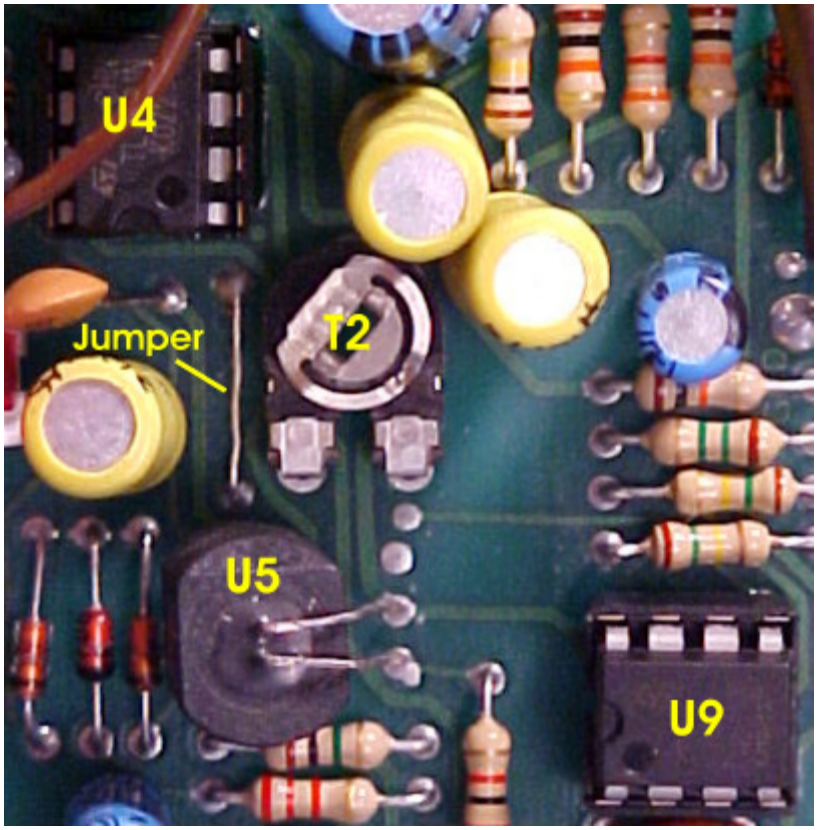
Surrounding components are labeled for reference.

Note Op-amp locations **U4** and **U9** are currently unpopulated also, due to another mod being performed at the same time.



Pic of finished job.

Booya!



Step 8: De-soldering Resistors R90 & R92 and Cap C37

The last two steps of the mod involve bypassing the Input FET (Q7) Buffer Circuit.

A **"buffer"** or **"unity-gain amplifier"** is designed to compensate for impedance mismatches. Simply stated in this case, it is supposed to eliminate "**Tone-sucking".**

"Tone-sucking" occurs when there is a load on a source that the source cannot handle. The source in this case being the passive pickups. Since passive pickups are not powered by an active circuit, it can not compensate for increased resistance and thus capacitance occurs. Generally speaking, some high frequencies get "sucked" out of the circuit. The result is a dull, blatty tone that is devoid of any "presence".

Active pickups are designed in such a way that the active boost circuit is placed inside the guitar's cavity and is powered by batteries. It is already "buffered" by design.

Passive Pickups are another story with the Input FET Buffer bypassed. Without an active-buffer placed before the MP-1, you will get mass amounts of sucking similar to a $5 South Hollywood whore.

Using a clean-booster in front of the MP-1 with passive pickups is essentially like using active pickups but with another 10-20dB of preamp gain (depending on the type of booster unit).

The whole idea of this section of the mod is to eliminate an unneeded gain stage.

This is a good rule of thumb: **More Gain (or Buffer) Stages = More Unwanted Noise**

If you already have the buffering stage covered by another effect (or active pickups), you can safely bypass this gain stage and reduce the overall noise level.

Here are some examples of floor effects (stomp-boxes) that are either designed to be a buffer/booster or have a "buffered bypass".

*** MXR Microamp.** This is an excellent transparent clean-booster and with the gain control set extreme counter-clockwise it acts as a simple active-buffer. **BONUS!**
*** BOSS GE-7 Graphic EQ**
*** Newer Dunlop CryBaby Wah Pedals.** Older CryBabys suffered horribly from "tone-sucking" while in bypass mode. Dunlop addressed this issue on later models and put a buffer in the bypass circuit.
* Generally speaking, most (or all?) **BOSS stomp-boxes** have a buffered bypass.

…the list goes on and on, you get the idea. Check out your effect's manual for more detail.

Keep in mind, a powered stomp-box with the effect engaged is essentially an active buffer by design.

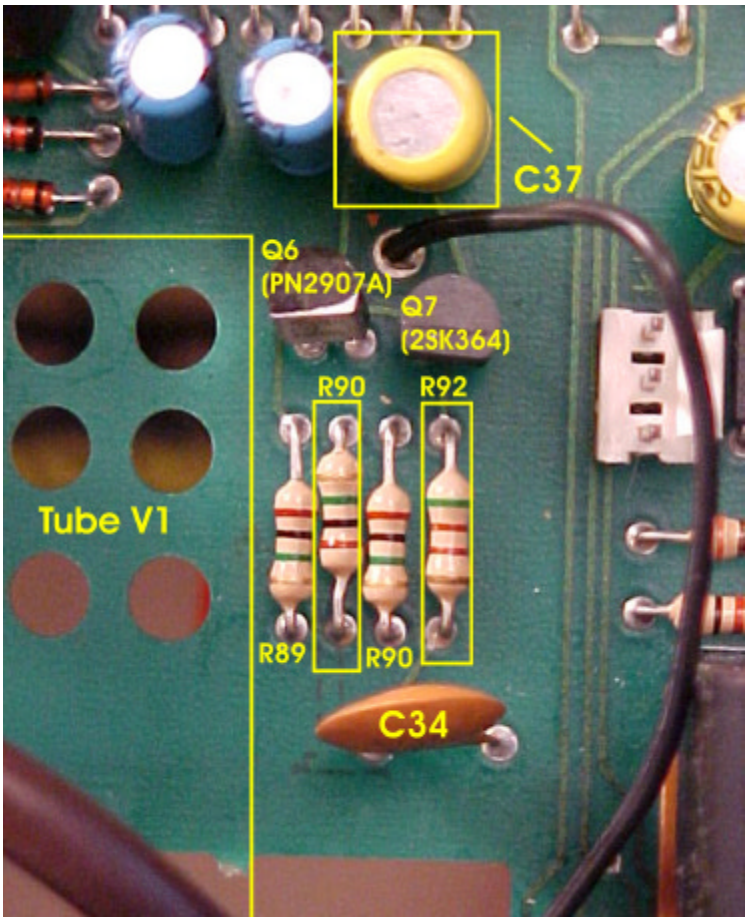
<u>Wireless Units:</u>
If you use a wireless unit, it will provide a more than adequate active buffer (with or without passive pickups).

The Input FET Buffer Bypass mod is totally reversible too, if you ever decide it's not for you.

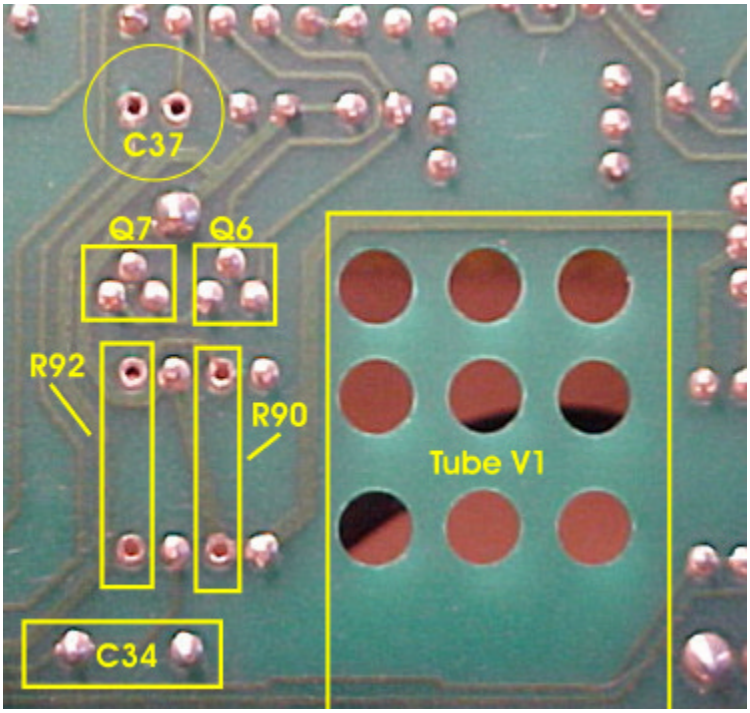
The upside of the FET bypass is that it really cuts down on the amount of hiss because you are essentially eliminating an unneeded gain stage. The downside is, well, you know, Hollywood Hookers...

Bypassing the Input FET Buffer Circuit:

Capacitor **C37** and Resistors **R90** & **R92** need to be removed from the main PCB.



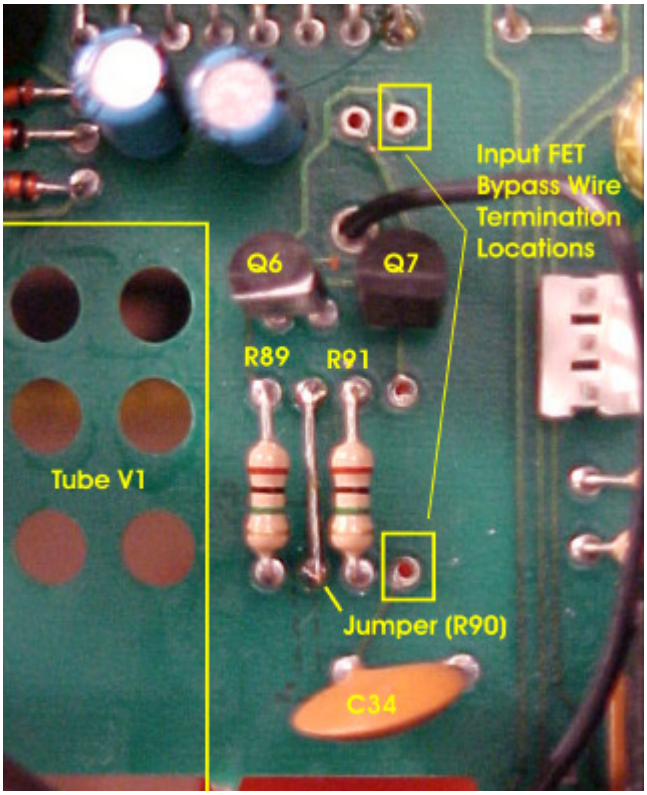
Pic of the solder-side on the main PCB where **C37**, **R90**, and **R92** are located.



Use the same de-soldering procedure you used for the previous two procedures.

Make sure to keep an open eye for pads starting to lift!

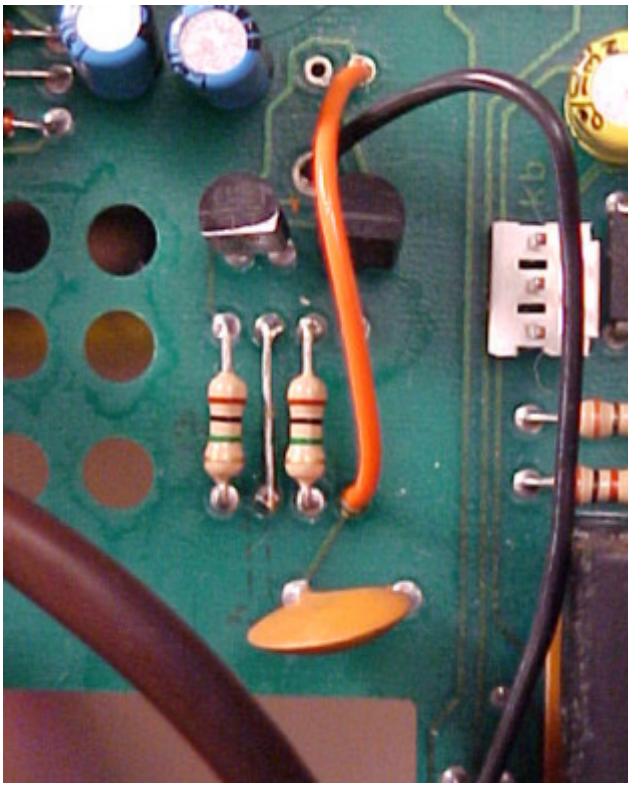
Step 9: Soldering a Jumper Wire in place of R90 and running the Input FET Buffer bypass wire



We will be soldering a jumper in place of **R90**, and running a bypass wire from the **R92** trace pad of **C34** to the **C37** trace pad of **R89** as shown by the illustration on the right.

This will short any stray signal to ground that is being fed into the now unused FET Buffer Circuit. This will keep the circuit as quiet as possible and prevent it from adding any excess noise into the circuit.

Technically speaking, it shunts the Gate of FET **Q7** to ground.



Pic of finished FET bypass procedure.

Make sure you use an insulated stranded hookup wire of *at least* 24AWG.

Also, please be sure you use wire with an insulation that has a cool color. Like orange for example. You wouldn't want to be showing off your work to your best friend and have him see a wire with a gay powder-blue insulation on it, would you?! It would just kill the moment.

When you are finished here, use the toothbrush/naptha technique to clean off the solder flux from the bottom of the PCB.

YOU ARE ALMOST DONE! Re-install your tubes as well as the bottom panel. Do NOT re-install the top panel just yet.

Step 10: Tweaking the OD1 Trimpot

Here is how to set the input stage gain-trim:

1) Plug your MP-1 back into your rack, make sure you have ample access to the top of the unit.

2) Locate the **OD1 Trimpot** you replaced in steps 6 & 7.

3) Dial-up your favorite high-gain patch.

4) Grab your main axe, plug it in, and switch to your bridge pickup.

5) Set the **OD1 Level Control** to **5.0** or **6.0** (or **7.0** depending on your pickups). You will have to play around with this setting until you are happy with how the other channels sound, especially the Clean-Tube channel. I wouldn't let this setting get above 8.0, it may get too muddy or noisy.

6) While you are doing palm mutes and/or heavy open chords ("**Pull Me Under**" is a good riff to test with BTW), have your little brother turn the trimpot dial with a little miniature screwdriver until the **OD1 Clipping LED** lights up frequently on downstrokes, but doesn't stay lit all the time.

THAT'S IT!

Re-install the top panel and you are good to go!

Now, crank up the bitch and scare away all the small furry animals in the near vicinity!

"Resistors 101" (Renamed from **"What to Know that Really Impresses the Chicks"**)

For our quick overview on the basics of resistors, we will focus on the most important characteristics to know:

- **Size (Wattage)**
- **Composition**
- **Tolerance**
- **Value**

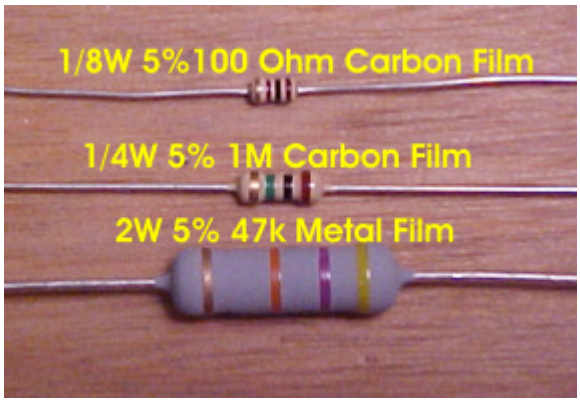
I have found some great write-ups from various sources on the Internet and compiled them here. **ENJOY!**

Size (Wattage):

Generally speaking, for our purposes here, the higher the **wattage** rating of the **resistor,** the larger the physical size.

The most common wattage resistors you will see are **1/4W.**

These are popular because of their modest size and endurance in audio applications.

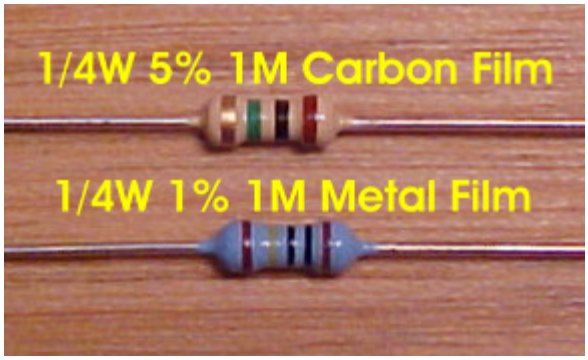


Composition:

The two most popular types of resistor compositions are Carbon Film and Metal Oxide Film.

Again, generally speaking, Metal Film resistors are better quality and can achieve a very low tolerance level. They are also more expensive and have an extra band in their value rating system.

Metal Film resistor values are also available in 1% increments where Carbon Films are only available in 5% increments.



Value (5% Tolerance):

Look for the gold or silver tolerance band and rotate the resistor as in the example on the right. The tolerance band is positioned on the right in this representation.

Look at the 1st color band and determine it's color. Now look at the chart on the next page and match the 1st & 2nd color band color to the "Digit it represents" column.

The 3rd color band is the number you will multiply the result by. Match the 3rd color band with the chart under "Multiplier". This is the number you will multiply the other 2 numbers by. Refer to the example on the right.

I will not get into too much detail about the coding system for **1% tolerance** resistors. It is very similar but uses 5 color codes to identify itself. The first 3 colors represent the significant digits and the 4th represents the multiplier. The 5th color code represents the tolerance. The color code to digit matching scheme is still the same, however.

Example:

= 200,000 Ohms = 200KΩ

- First color is red which is 2
- Second color is black which is 0
- third color is yellow which is 10,000
- Tolerance is silver which is 10%

Therefore the equation is:
2 0 x 10,000 = 200,000 Ohms
or simply **"200k"**

Check out this sweet resistor color code reference chart!

1st. & 2nd Color Band	Digit it Represents	-----Multiplier-----
BLACK	0	X1
BROWN	1	X10
RED	2	X100
ORANGE	3	X1,000 or 1K
YELLOW	4	X10,000 or 10K
GREEN	5	X100,000 or 100K
BLUE	6	X1,000,000 or 1M
VIOLET	7	Silver is divide by 100
GRAY	8	Gold is divide by 10
WHITE	9	Tolerances: • Gold= 5% • Silver=10% • None=20%

Tolerance:

Resistors are never the exact value that the color codes indicate, therefore manufacturers place a tolerance color band on the resistor to tell you just how accurate this resistor is made. It is simply a measurement of the imperfections. **Gold** means the resistor is within **5%** of being dead-on accurate**. Silver** being within **10%** and **no color band** being within **20%**. To determine the exact range that the resistor may be, take the value of the resistor and multiply it by 5, 10, or 20%. This is the number that the resistor's value may go either way.

Example:
A 1,000 Ohm resistor with a gold band maybe any value between 950 to 1050 Ohms.

Another Example:
A 22,000 Ohm resistor with a silver band maybe any value between 19,800 and 24,200 Ohms.

Good Desoldering Practices:

Just as soldering requires practice to get right, so does desoldering. If you have never desoldered before (or have never been that successful at it), I have included some tips for you here that may help you along the way.

There are two types of desoldering tools I use:

The ***"desoldering pump"***  and the ***"desoldering braid"*** 

I use the desoldering (vacuum) pump initially to suck up all the excess solder and then use the soldering braid to thoroughly clean the pads. This method will produce excellent results if you do it right. No broken traces, no lifted pads, and a clean surface to be resoldered. You should also be able to lift desoldered components out with little or no effort if it is done right.

Notes on the Desoldering Braid:

Desoldering Braids remove the solder by ***capillary action***. Simple to use.

1. Place the desoldering braid on the solder joint.
2. Apply the hot soldering iron to the desoldering braid for a second.
3. Remove the desoldering braid and the iron at the same time. The solder will be drawn up into the desoldering braid. Use a wire cutter to clip off the used portion of the braid when you are finished.

Soldering Irons:

I personally use a pencil tip iron with a switchable heat setting (I think I got it at Radio Shack). The heat setting let's you switch from 15W to 30W. For standard PCB soldering I use the 15W setting. For desoldering purposes I use the 30W setting. It seems to work pretty well.

Lifted Traces and/or Pads:

For soldering and desoldering purposes here I would not use over a 30W iron. Anything more than this and you risk lifting PCB traces or pads. If this happens, you must clean the surrounding area thoroughly with acetone or naptha, and use clear epoxy to re-attach the pad/trace to the PCB. After letting the epoxy fully cure, use an X-Acto knife with a small blade (#11) and ***carefully*** scrape the epoxy from the top of the pad. This will allow you to re-tin the pad so that the solder will stick. You may also need to re-drill the through-hole if the epoxy has plugged it. Use a high-speed Dremel tool with a 1/32" (very small) drill bit to ream the hole. Any bit thicker than a 1/32" and you'll risk lifting the pad again.

Broken Traces: DON'T PANIC! It happens to the best of us!

Scrape the two broken edges of the trace ***carefully*** to reveal the copper. Tin, then use bus jumper wire to make a "bridge". If the broken part of the trace is longer then 1", you may want run a line of epoxy along the jumper wire after it has been soldered to keep it from lifting the trace further.

Radio Shack carries this jumper wire, it is catalog #278-1341.