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Make sure to read the entire Notes section on the website! (Mistakes/anomalies, confusing things, build notes, future improvements, etc.) Your question may be answered there already!

[last update to this file: 2017-12-10.]

[I have added annotations in brackets, like this, in places where I was confused or otherwise needed clarification of the original instructions, which are in black. Bracketed comments in this color apply to the mods in general, or the 720A when specifically noted.]

{Braced comments in this color are more specific to an Akai M7.}

Akai / Roberts Mic Preamp conversion

6/24/2005 Rod Childers

** 3/17/07 Revamped entire document to reflect 2 Preamps in 1 mod. **

3/30/07 Added grounding Notes

The Akai M7 preamp/power amp used for play back has 4 gain stages. The first stage is powered by an EF86 (6267) pentode for the playback head. The next 2 stages are powered by a dual triode 12AX7. The next stage is the power amp centered around a 6BQ5. To make the mic preamps in the following mods we will only be using the EF86 and the 12AX7.

[Note: all four preamps will be polarity-inverted when this mod is performed as written. There are some notes (from Rod and from me) below describing how to fix this for the XLR input of the EF86 stage, but the 12AX7, as well as any 1/4" input for the EF86 stage you might add, will still be polarity inverted.]

[Note: lots of these instructions refer to wire colors – these should not be trusted too much. There is a fair amount of variation between units, even of the same model number, and you must rely first and foremost on the schematic. The color of wires can be a handy way to figure out what's what, but don't rely on it.]

WARNING: This document is for qualified personnel only. If you don't feel safe doing these changes please seek qualified help. This document is provided with no warranties expressed or implied. This is old equipment and all the risks associated with modifying and using old equipment exist with this equipment.

There are dangerous voltages that can KILL you in these units! I am not responsible for any damage or injury caused by performing these changes to your preamps. As with any tube equipment of this age you should inspect each component to insure its reliability, also do not leave it powered up while unattended!

[NOTE: see the website article for a note (and illustrative image) about high voltages being present on the exterior of coated components (e.g. R20) – I found continuity from the coated part of the component to the bare metal leg of the component, thus exposing ~350 VDC on a part of a component that one would usually expect to be isolated and safe. Other components in the amp are presumably the same way, so be careful.]

Generally I remove the 6BQ5 due to heat concerns, if you choose to use the 6BQ5 insure you have **proper ventilation above the tubes. The power tubes get HOT!.

The 6BQ5 circuit can remain in place for these reasons:

- 1) to provide speaker level output
- 2) Continue the use of the VU meters
- 3) provide a bit more “compression” due to power supply sag.
- 4) Use it as a low power tube guitar amp.

If you follow these directions the power section will be fed by the 12ax7 preamp (If there is nothing plugged into the 12ax7 output.) This will be very close to the stock circuit.

The AKAI M7 and M8 (And Roberts 770) are very similar, the M8 has a bit more options for sound on sound and monitoring. The directions I have typed up should get you through both.

The Roberts 770 is very similar to the M8, but does not have a multitap transformer for the AC power (On most models) you can skip the section that details moving the power to the 117 tap.

The EF86 stage is much more detailed in my opinion. It is really only used in the preamp for the tape head. Unless you do these mods the EF86 is not in the preamp circuit. The EF86 stage is transformer coupled and the Volume pot is used for its gain. The 12ax7 stage is not coupled with a transformer. The tone control is removed, this position is used for the 12ax7 gain. I don't normally want to adjust the tone, I like to record as 'Dry' as possible. I also change the input impedance if I plan to use it as a Guitar DI.

Since the 12ax7 stage is a high impedance input, you can use a patch cable to connect the 2 preamps together if you desire more gain. This also gives you 2 gain adjustments.

When complete:

The Microphone jack will be replaced with an XLR jack = (Mic Input) {Labeled "Microphone" on my A7}

The Phono Radio jack (Marked Line on some units) will be the ¼" EF86 stage output. {Labeled "Phono" on my M7}

The Preamp Output jack will be the input of the of the 12AX7 preamp {Labeled "Preamp Output" on my M7}

The Head Output (Phono Playback on some units) jack will be the output of the of the 12AX7 preamp {Labeled "Pick Up" on my M7}

The Volume knob will be the level for the EF86 preamp

The Tone Knob will be the level for the 12AX7 preamp

The Tape speed switch will not be functional (removed when the tone control is changed)

SW1 will be eliminated, cleaning the chassis up a lot.

Basically we are building our own 2 preamp circuits, reusing the most of the old we can, and eliminating a lot of extra components to clean the chassis up.

Some reminders I like to have around while doing the mods:

These instructions cover modifying the Right Amp module. They can be applied to the Left also, I'll try to include references where I remember a difference. Keep in mind the tubes are in different sockets due to the Oscillator tube (V4 6AR5). We will also eliminate a lot of unnecessary components on the Left amp by eliminating this recording circuit. (Covered below)

If you take a look the tubes are arranged:

LEFT Pre- EF86, 12ax7, 6X4, 6BQ5, 6AR5 (V1 V2 V5 V3 V4)

RIGHT Pre- EF86, 12ax7, 6BQ5, 6X4 (V1 V2 V3 V4)

Components marked AK are single package RC networks. They look like a square ceramic capacitor but contain caps and resistors.

References to AK5 - on some models AK5 is discrete components not a single package. I have seen some models where there are no AK components and they are replaced by all discrete resistors and caps.

The 8ohm load resistors look like a strand of wire with cloth braiding on the outside. They are marked 8ohm

Note which jacks are isolated from the chassis with fiber washers/clear tygon washer. The clear tygon washer may stick in the chassis. You will want one of them for the EF86 output stage.

I'm building some now that I add rack ears to each side. This should fit in 3 rack spaces high with about 1/16" extra on top and bottom. For this option I don't drill the faceplate for the XLR jack, I locate the jack on the extra front panel provided by the rack ears. This can make some steps easier and you can skip removal of the front faceplate. I will make notes where this is applicable. **WARNING:** If you plan to rack mount the units make sure the rack is enclosed. There are tons of exposed High voltages in this unit. You may wish to fabricate a metal chassis to cover the whole unit if you can't insure the back will be covered.

Tube In/out connections:

EF86

Input = Pin 9

Output = Pin 6 [also B+, I believe]

12AX7 (Stage 1)

Input = Pin 2

Output = Pin 1 [also B+, I believe]

12AX7 (Stage 2)

Input = Pin 7

Output = Pin 8 (Cathode follower)

[B+ = Pins 1 and 6, I believe]

[Heaters = Pins 4, 5 are line, and 9 is neutral (common terminal for both heaters)]

6BQ5

Input = Pin 1 [actually Pin 2, though Pin 1 is tied... see notes at Beyond Sanity and at lacinato.com]

Suggested Parts list:

Microphone input transformer (I use transformers from a Shure M67 or M68 mixer, see notes at end)

500K ohm audio taper pot [I used 100k for Cinemag transformers] {for Jensen transformers I used 250k pots with 383k resistors in parallel to simulate 150k. See lacinato.com}

Female Panel mount XLR connector

.15 uf orange drop cap (400V) this is the output coupling cap for the EF86 [Rod now recommends .22 uf]

Knobs for 1/4" shaft

3 conductor power cord with grounded plug

Fuse holder and fuse (Or solder in type fuse)

1/8" thick aluminum sheets (4 1/4" X 5") if you choose to add rack ears.

1st Major Step - Remove all unnecessary components, clean up chassis (This is the biggie)

1. Remove all the tubes so they won't get damaged during the process.
2. Remove the metal shield below the Mic Jack to gain access. On some models this shield runs the whole length of the preamp. [this was the case for me.]
3. Remove the Head input jack [is "Head output jack" intended here?] {labeled "pick up" on M7}. Remove the Head input cable, and the gray cable [couldn't remove this yet as it was behind SW1] {clipped it near SW1} going from the head input ["output", i believe] jack (Phono Playback Input on some models [yes on 720A] {"Pick Up" on M7}) to SW1. Remove the black shielded wire going to pin 9 of the EF86 - (Save jack and wire for mods below) [my notes here are bad, but the "black shielded wire" might have been blue in my case.] {was black in M7}
4. Remove the Mic Jack (Save for mods below) and eliminate R1, R2, and R3 these resistors should come out with the Mic Jack. R3 is in a clear plastic tube sleeve behind the Mic Jack connected to a red wire.
5. Remove the Phono Radio Jack (Labeled Line on some models [yes on 720A]) (Save for mods below)
6. Remove JC7 (JC6 for Left Amp) R4, and C8. Just follow all the wires from JC7, R4 and C8 may be in a plastic tube on the end of a yellow wire. This jack is bolted on in older units, it is riveted in newer ones (drill/grind the rivets off). [a yellow wire leads to the location, and they were not hanging off the plug, but on the main strip. I didn't bother taking off the riveted jack.]
7. Remove C1 (Connected between Pin 9 of EF86 and a **3 spot solder strip**) Make note of this strip, we will need it for the EF86 output wiring below. [schematic shows C1 connected to SW3, but Rod's description was accurate. I combined this with step 9.]
8. Remove the Yellow shielded wire running from the tape speed switch (SW3) to where C1 was connected on the **3 spot solder strip**.
9. Remove R5 (100K on Bottom of EF86 connected to Pin 9 and Pin 2/ground) . This is where the input transformer will connect and depending upon what transformer you choose you may have to put a shunt resistor at this location in the circuit. [I don't believe i did this for either of the mods. Don't know if it's important.]
10. Remove C5 (Tone Cap) Maintain the coil of wire around it. ["maintain" means "maintain it in the circuit", NOT "maintain it around C5 and remove it" as I foolishly interpreted this.]
11. Remove C6 (Between AK2 and the slide switch SW1)
12. Remove AK2
13. Looking at the back of the tape speed switch (SW3) one terminal of AK5 is hooked to the same terminal as the white wire. Remove this terminal of AK5 and connect it to ground. You can use the center of the power tube V3 [the

6BQ5] (AK5 is replaced with discrete resistors and caps in some units, in these units follow the same directions but AK5 will be a small 50p cap with long leads **[this was the case for me]**)

14. Remove the Blue and White wires from the Tape speed switch (SW3) and the slide switch (SW1). Note where the Blue wire connects to SW1 there is a black wire also connected that leads to ground, remove this black wire **[some unclear notes: I think I already had cut the ground from SW1. My notes also say "not a black wire but a jumper to the tone pot" and perhaps for the left channel I wrote "light not jack".]** This black wire leads to the **3 spot solder strip**. The **3 spot solder strip** should now have nothing connected to it. **[at this point i cut the leads to the lamp on the right channel and leave the lamp in place]**
15. If you have a model that has a jack labeled record (On the right facing the front) you can leave the jack in place for looks but you should remove the 100 ohm resistor on the red wire going to the meter. Also remove the 100 ohm resistor on the white wire. **[Here I just wrote "nope". Maybe I didn't have these resistors?]** **{M7 right channel had these resistors. they are not on any schematic, as far as i know.}**
16. If there is a "Stereophones" jack **[yes, on right channel]** remove the jack. Remove the resistor leading to the speaker output. Remove the white wire and the 100ohm resistor it leads to **[these resistors also not in any schematic, as far as i know... i think i also removed a plug, here]**. The 2 solder tabs are usually used for the new AC power connections (covered below)
17. If there is a "Push to record" button eliminate the wiring for it, you can leave the button for looks or remove it and cover the hole later. (This is the Left preamp.)
18. Remove the Tone control (This will be replaced with a standard 500K ohm resistor). To remove the knobs use a good Phillips screwdriver. (Small tip but a large handle.) If you use a jeweler's screwdriver you may strip the head. **[Heed this advice! these set screws are of an absolutely unobtainable thread count -- you would have to have them custom made. I looked. Keep any spares from here or other parts of the machine that match.]**
19. If you have a Right preamp with a 4 pin plug that is tied up with the power cord. (Yellow, Green, Black and white wires) Remove it and its associated wires **[left channel had 4 pin plug; black/black/green, was tied to the gray wire from step #3]** **{same with M7 -- it was on the left, though there was no gray tie-in.}**
20. At this point I remove the front panel and use a step drill bit to enlarge the Microphone jack hole to accommodate an XLR jack. Lots of stuff to disconnect, make sure you understand where everything must be resoldered. Install the XLR connector, we will wire it in later. The Preamp out jack should be unscrewed from the front panel because it will be relocated when you reassemble the front panel. **NOTE:** Skip removal of the front pannel if you plan to use rack ears. Drill your rack ears and mount the XLR jack on the left one at this phase. Mount the left ear at this phase so we can wire the XLR below

21. You can remove and disassemble the VU meter if the glass is separated and glue it. [i sheared off one of the meter bolts when removing it, so watch out for that.]
22. This is a good point to do the **Slide Switch Removal** and the **Left Channel additional Items** because you can get to most of the components while the front panel is off much easier.

Slide Switch Removal (SW1)

***NOTE references to AK5 - on some models AK5 is discrete components not a single package**

1. Remove the 2 screws on the bar that slides SW1. Remove the spring and the bar. Bend the tab that the spring connects to down to get it out of the way.
 2. Remove the yellow wire (Pink wire on some units) on Pos 6 of SW1 (Goes to speaker out) {on M7 was yellow on R channel and pink on L} ****IMPORTANT** Connect the 8ohm load resistor R30 to ground (Looks like a white braided wire located on the speaker out jack) [on left channel I tied to the 2-spot solder strip] This resistor acts as a load when no speaker is connected. There is an extra lug [on the main strip] next to the ground that you can bridge with solder to ground and connect R30 to it. [R30 doesn't seem to be on the schematics anywhere. It may possibly be labeled R24 on some schematics. I follow the instructions as written here.] If this is a Roberts, with a pink wire leading to a 2 position solder lug [for me on right channel only, at least for 720A - see "left channel additional items" step for PG2], you can eliminate this lug by soldering the green wire that leads to the hum control to ground [my notes unclear. i wrote: "same spot. Didn't need to bridge."] {notes a tad unclear: M7 L channel had pink wire to 3-spot solder strip; took the 8 ohm off, connected it to ground; the speaker out was not connected}. The white wire will be removed when you eliminate PG2 [this applies to L channel only, i believe].
 3. Remove R24 (Looks like a white braided wire), it goes from the output transformer to the slide switch (Sw1) (this is the 8ohm load, save incase you need for other preamp)
 4. On the back side of the slide switch, the side closest to the chassis, note the Red, White and Green wires. Remove the Red wire. (it should go to C12 and AK5) [see next step: can cut all three wires at once, doesn't need to be done at SW1, but use end of white wire for the jumper]
 5. Cut the Green and White wires close to the switch, replace them with a jumper between AK4 (Connect to side of AK4 NOT connected to transformer) and R14 (connect to side NOT connected to Ground).
- [here my notes say "removed mysterious cap with yellow wires and interconnect" - this might be referring to two 47uF caps in series (not found in any schematics) that connected between the two channels, but might be something else.] {M7 did not have this}
6. Remove the white wire on the end of the switch that connects to R26, Shorten

- and connect this wire to Ground lug right beside R26 [which is also connected to R17 - 150 ohms], (One terminal of R26 should connect to AK3 and the other should connect to Ground).
7. Remove the short jumper that connects to the transformer and the Ground of the SW1, Make sure the transformer is connected to ground by another means. (It should have another wire on this same terminal running to the transformer shield). [on 720A I connected to the near side of R6] {M7 L and R had the other wire}
 8. Remove the shielded wire leading from SW1 to Pin 2 of the V2 (12ax7) (unsolder it from the tube socket).
 9. Remove the Red wire going from SW1 to the Meter, untwist it from the white wire.
 10. Remove/relocate R23 (5K) from the switch, Use this to connect the meter ground using the center lug of the tube closest to the meter. (Where red wire was removed above) [on the right channel, I connected to the ground of 6BQ5 because the nearest tube was the 6x4 and the center lug was not connected to anything] {same on M7 R channel - and the meters were mounted on faceplate so i couldn't connect the resistors to the meters just yet. On M7 L channel i used the 6AR5 tube ground and my notes add "but maintain ground", whatever that meant.}
 11. Eliminate PG3 and all its wires. [called "PG1" on the left channel. I already had done this by now, for both channels. These are connectors – if I recall correctly, PG3 is an RCA-like connector, and PG1 is a round four-pin connector.]

Left Channel additional Items

1. If you have a model with a Monitor button on the right remove all the wires leading to this switch. Leave the button in place for looks if you wish, or remove and cover the hole later. There will be a light green wire leading to a 4 pin connector (From the Monitor button), remove this connector and any wires associated. [here my paltry notes say "confusing... 4 pin connector?". Maybe i didn't have one...] {confusing on M7 also... no 4-pin connector that i see. I use the switch to turn the meter lights on/off, though.}
 2. If there is a record indicator lamp above the monitor button – follow the red wire from this lamp to the back of the unit through a 300K resistor [probably inside a braided insulator]. Here it connects to a solder lug with a shielded wire and a cap. {i had no resistor? or possibly missed it inside the insulator?; went to a lug connected to C21 - .001 uF} [see iacinato.com for a discussion of the indicator lamps and how to use them -- and send them to me if you don't want them!]
1. Remove the red wire and the 300K resistor going from the lamp to the lug
 2. Remove the black wire going to the lamp {went to ground}
 3. Remove the shielded wire on the lug (Leads to a 4 pin plug) [my notes: "confused -- already did this?"] {i had already removed the plug and

shielded wire}

4. Remove the cap [C21]. (and the red wire on the other side of the cap that leads to the oscillator)
3. Eliminate all recording components and extra wires, pretty easy to find using the schematic:
 0. Oscillator Coil [aka L1]
 1. 6AR5 V4 (Just remove it from the socket)
 2. C21 [already gone], C22, C23, C24 (2 of the caps are on the Oscillator Coil) [NOTE: C21 and C24 seemed to be in different places in the 720A vs M7. Look on the labeled photographs from the M8 repair manual included in Rod's instructions -- on the far right of the left channel, just past C15, there are two empty positions. In the 720A these were occupied by C24 (3uF) in the left position and C21 in the right. In the M7 this was reversed. This is true for the L channel, can't remember about the R channel.]
 3. R27, R28
4. Eliminate PG2 [the big 6-pin connector] - **IMPORTANT** Place the Dummy 8ohm load on the output like we did for the Right AMP. (R30 on right amp) [my notes say: "wasn't relevant here for me", so maybe it was in place already, can't remember.] {M7 notes say "yes, already done here", and recall above note that R30 may be labeled R24.}
5. Eliminate PG1 and all its wires. [I had already done this]
6. Eliminate JC5 (Power output) and all its wires. There will be wires running from the transformer and power switch for the right preamp, unsolder them from the transformer. All wires from JC5 should be removed. [For me JC5 was connected to the transformer only.] {Took out power switch in step 4.}

[my notes also say: "right channel - removed power switch and power leads"]
[at this point I wired the "monitor" switch to turn the light on the meter on and off (and repurposed the switch on the right channel in the old "sound on sound" hole for the same purpose.)]

[i also wired up the switch for the heater and B+ cutoffs for the 6BQ5]

[i also wired up the impedance switch for the mic input transformer] {not needed on M7, as i used a different mic input transformer with no alternate impedance options}

2nd Major step - Build the 12ax7 preamp

Now that we are done cleaning things up the chassis should look much neater and have some extra room for our new circuit components. This is also where you may want change things a bit if you are going to experiment with some of your own input/output options.

1. Reassemble the front panel but do not reconnect the Volume pot, these connections will be relocated. Also note in the next step the preamp out jack has a new position. [careful not to shear off the bolt on the meter like I did]

2. Move the old Preamp Output jack to the Head output jack position (labeled Phono Playback Input on some models [yes for 720A] {"Pick Up" on M7}). This jack is the output of the 12ax7 preamp and should be unmodified. (A green and yellow wire should be connected to the jack) {unclear notes for this step, or perhaps the next: "L is cap, C in yellow to pin 7, R to ground"}
3. Mount the new 500K pot in the Tone pot position. This is now the level control for the 12ax7. [i used the old 500k pot for this position, because i didn't use a new 500k given the input transformers being used.]
4. Relocate all the connections that were on the Volume pot to the new pot installed above. You may have to use longer wires. Twist the 2 wires a bit to reduce noise. If you extend the cap leads you should insulate them.
5. Wire the 12ax7 input. You have 2 options here, leave it stock, (High impedance Mic input) or make it more like a guitar amp input (I suggest this option if you plan to use the 12ax7 as a DI or a guitar amp with the power section). The stock position will still work for a DI, the impedance will just be a bit too low for my taste. Start by mounting the ¼" jack in the Preamp output position, (This will now be the 12ax7 input) Use shielded cable for the connections below. I like to use one of the jacks that is grounded (not isolated from the chassis) for this input. I lift the ground on the jack end to prevent ground loops. [might be wise to confirm that your input jacks are not connecting to the switched conductors of the jack.]

Mic input (Stock):

Connect a 3.3 Uf cap the input jack + and run the other end to Pin 2 of the 12ax7. Note this cap is optional and can be replaced with a jumper. Leave R10 (500K) in place.

Guitar input

Connect a 68K resistor input jack + and run the other end to Pin 2 of the 12ax7. Then change R10 from 500K to 1Meg. This resistor is a Grey old style resistor that will be on the bottom of the 12ax7 tube socket.

An **additional modification** that you may consider is to replace R10 with an audio-taper pot of the same value (500K for the "mic input" version, 1M for the "guitar input" version). The signal from the 12AX7 input jack (after the 3.3uF cap or the 68k resistor) goes to one side of the pot. The center wiper of the pot goes to the grid of the 12AX7 tube (pin 2, where the signal wire and R10 used to connect), and the remaining lug of the pot goes to ground (I used the center post of the tube socket.) This is useful to set the input gain of the 12AX7, but the main motivation relates to chaining the two stages together: when you chain them, you can turn the gain of the EF86 stage to maximum, and then set the appropriate input level to the 12AX7 using this additional pot. This allows for minimal amp hiss: there is a fixed minimum amount of noise coming from the EF86 regardless of the level of the EF86 input pot (due to thermal noise, and perhaps other sources); as a result, the higher the EF86 pot level, the better the SNR of the EF86 stage, but with no pot in between the EF86 and 12AX7 you can't control

the level going into the 12AX7 and it will distort, which isn't always desired. This additional pot lets you have a clean signal or a distorted signal with minimal hiss. It reduces the hiss by perhaps 3 to 6 dB, and takes the amp from borderline-unusably-noisy (speaking only of the chained configuration) to a very reasonable quiet background hiss. I recommend doing it if you intend to chain the stages. I used a couple of the leftover knobs from the conversion, and put the pot between the two main pots, which is both a logical and aesthetically appropriate location. You can see a picture of the added knobs on a 720A on the main website linked in the "further improvements/ideas" section.

3rd Major step - Build the EF86 preamp

1. Install a ¼" jack in the Phono Radio jack (Marked "Line" on some units [yes on 720A]) this will be the EF86 stage output. I like to use one of the isolated jacks for this position. You may have to replace the clear tygon insulator with some black tape if the jack will not fit in the hole. Make sure you use the fiber washers on each side as well.
2. Wire the EF86 output.
 4. Run a shielded wire from the output jack mounted above to the **3 spot solder strip**. Connect the shield to the grounded lug of the strip and the center wire to one of the free spots. Connect the shield at both ends if you use the isolated jack. You may want to run a good ground wire from the center of the EF86 tube ground to the center lug of the **3 spot solder strip**.
 5. On this same **3 spot solder strip** connection, connect one leg of the output coupling cap [to the same spot as the center wire of the cable running to the jack, not to ground/shield]. (.15 uf orange drop) [Rod now recommends .22 uf instead of .15]
 6. Connect the other end of the .15 uf [.22] cap to the end of R7 that is connected to Pin 6 of the EF86. Follow the red wire from pin 6 to the solder tab, connect the cap to this solder tab not the tube pin.
3. Wire the EF86 input

[As mentioned above, if you follow the original instructions below as written, all the stages of these preamps are polarity reversed (meaning, the signal fed in comes out the other end with opposite polarity.) Here you have the choice to intentionally invert the polarity for the XLR input, if you so choose, to counteract this. **The color codes for the Cinemag and Jensen transformers are shown below in this way: the polarity will be intentionally flipped to create the end result of the XLR-in-to-1/4"-out of the EF86 stage being normal polarity.** This is accomplished by switching the colors of the wires on the secondary side of the transformer to the opposite of what is described in the instructions below (and opposite of what you would find on the transformer spec sheets). Using the 1/4" jack for the

EF86 in (if you have one) will still result in a polarity inversion, as will the 12AX7 stage. According to Rod, there isn't any simple way around the 1/4"-route inversions, since they are unbalanced jacks. This inversion is apparently a normal part of some tube amplification circuits.]

[for these I show the Cinemag CMMI-10C wire colors in brackets]
{and the Jensen JT-115K-E in braces}

7. Mount the input transformer in the empty space behind the EF86 tube. (Other side of chassis) You may have to extend the wire leads on the transformer. Twist the wires where appropriate to reduce noise.
8. Connect Pin 3 of the XLR jack to the – of the transformer input (Primary Side). [Orange] {Brown}
9. Connect Pin 2 of the XLR jack to the + of the transformer input (Primary Side). [switched Brown or Red, depending on impedance; Brown is higher, Red is middle tap] {Red}
10. Connect Pin 1 to Ground. Use the ground created above on the center tab of the **3 spot solder strip**. [also should use short jumper to tie shield of 1/4" combo jack to ground, if using one, as far as i know.]
11. Connect the shield wire of the transformer to ground. [I connected Black and White to ground] {same with Jensen}
12. Connect the – of the transformer output to ground (Secondary side) [Yellow] {Yellow}
13. Connect the + of the transformer output (Secondary side) to the volume pot. (Far right connection on the pot if you are looking at the rear. [on the far right if you are looking from the rear to the front] [Green] {Orange} [also connect tip of 1/4" combo jack to pot using shielded wire tied to ground at the jack only]
14. Connect the wiper (Center connection) of the Volume pot to Pin 9 of the EF86 (grid). [the volume pot was the 100k] {in M7 it was a 250k with a 383k resistor in parallel to simulate 150k} [i waited until things were closed up to make this connection -- perhaps it is noisy if it's too long?]
15. Connect the remaining lug on the Volume pot (Far left as you look at the rear) to Ground. You can use the center pin of the EF86 socket.

4th Major step - AC power

The first step is to add a power cord to the transformer. Since the preamp is normally isolated from the main AC power via the selectable transformer, the tap will be on 100V MAKE SURE YOU USE THE 117V tap if you are using 120V AC. If you are plugging the preamp directly into the wall you may want to add a fuse at this point. If you are modifying a unit that does not include a selectable power voltage, you may be able to skip this step. Make sure the transformer is wired for 117 or 120 V. (Many Roberts models were only designed for 120V) I also replace the cord with a grounded cord and ground it properly. The power switch

should be wired at this stage to switch the power to the primary of the transformer. The Right preamp is pretty simple, the Left has a SPDT switch that you can rewire, I use the top position for on, middle and down will be off. **(If you don't understand this phase, please seek help. The grounding and fusing is very important to safety)**

Finishing up:

1. Replace the metal shield below the Mic Jack.
2. Last but not least, put the EF86, the 12ax7 and the 6X4 back in place. If you want to use the power section replace the 6BQ5 as well. Leave the 6AR5 tube out, (Oscillator tube) it is no longer needed.
3. You should now be able to put some knobs on of your choice and try it out.
4. When you are finished check the phase of the EF86 preamp against one that you know is correct to insure you wired the input transformer properly.

Grounding notes

I have seen a couple of preamps that had the ground wires ran differently. After you complete the mods check these ground wires:

1. The center of the EF86 and 12ax7, check it with a meter, make sure it is grounded with a good wire running to the main ground point on the opposite side of the board. If you do not isolate the jacks I suggested the only source of ground may be the shield of the jack wires.
2. Junction of R6 & C2. If you have the preamp upside down, and you are looking at the back. This is the resistor and Cap all the way to the right. **[if you are looking from the back towards the front they are on the left side.]** The solder tabs facing you should be tied together and to ground. If not, run you a good ground wire to the center of the EF86 tube.

Other Mods I have tried & stuff left here for history:

****3/1/2006 Update:** I found an input transformer that provides the gain/sound I have been looking for to complete this mod. I believe this is the best configuration. The EF86 stage sounds great with the input transformer, and I still like the 12AX7 without the transformer. **3/7/2006:** I also eliminated AK2 and replaced it with a .15uf cap (200V). I believe the 12AX7 in this setup will make a great instrument DI as well. (I used a transformer out of a Shure M67 mixer, I hate to rob from one to fix another, but I have some that are in pretty bad shape.) I'll call this mod the **2 Preamps in one mod**. There is a schematic available.

12/03/2006 Better input if you use 12ax7 as DI

I have been trying out a different resistor stage for the input stage of my M7/M8 preamps. It makes it like the input stage of many guitar preamps. I have been using mine for Guitar DI more and more. You may want to change yours, it's a pretty easy change. If you look at the schematic there is a 3.3 Uf cap in the input. (This should be a blue electrolytic going from the positive terminal of the input jack to the 12ax7) Replace this cap with a 68K resistor. Then I change R10 from 500K to 1Meg. This resistor is a grey old style resistor that will be on the bottom of the 12ax7 tube socket. It connects to the same point the 3.3Uf cap connects, and then to the center post (Ground) It does seem to have a bit better bass response and doesn't distort as easy. Depending upon the tube, I get about -12db out of it at half volume without any distortion. (This is a bit hotter than I like to record DI guitar or bass so it seems to have enough headroom.)

Things I would like to try

I would like to remove the power tube and place another EF86 in its place. This would give me the ability to have 2 EF86 preamps. This would give me a nice 3 channel preamp.

The cathode resistor bypass capacitors in these old preamps were pretty small (I think due to space/cost) Replacing them with larger values should reduce the amount of compression seen while using these preamps.

I would like to get the VU meters to work at lower levels. Currently you have to maintain speaker level output to get them to work properly. I like to remove the power tubes while using the preamp to reduce the power supply sag and the compression created. (See Notes of Operation below) The meter probably has a shunt resistor inside that could be changed to allow the meter to operate at lower voltages. **Update:** Tried this, even with the shunt resistor removed/changed the signal is too low for the VU and the signal is degraded. You would prob have to build a small op amp circuit to get it to work without signal loss.