

LP-PAN Preamp Kit



Assembly Manual

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TelePost Incorporated
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Introduction...

The LP-PAN preamp was introduced mainly to address the buffer losses in the K3, but may be useful with other rigs. When the rig is a K3, even if it has the N8LP buffer mod or the Elecraft buffer mod, the total conversion gain, ie. antenna input to IF output, is low. The “gain” measures about -7 to -10 dB when the K3 preamp is OFF. Adding further to the losses is the 3dB loss of the hybrid splitter in the P3 if a one is used, which also appears ahead of LP-PAN (or any other device connected to the K3 IF output port). When the K3 preamp is ON the situation is a bit better, since it adds some low noise gain ahead of the lossy elements (filter, mixer and buffer amp), but it’s not as effective as it would be without the losses.

When the K3 preamp is OFF, the overall NF is approximately equal to the NF of LP-PAN plus the losses in the K3/P3. The LP-PAN preamp attempts to minimize the effect of the losses by reducing the NF of LP-PAN. When the K3 preamp is ON, the LP-PAN preamp improves the overall gain distribution to minimize the noise floor while maintaining dynamic range. A front panel 10dB attenuator is provided to provide protection against extremely strong signals as needed.

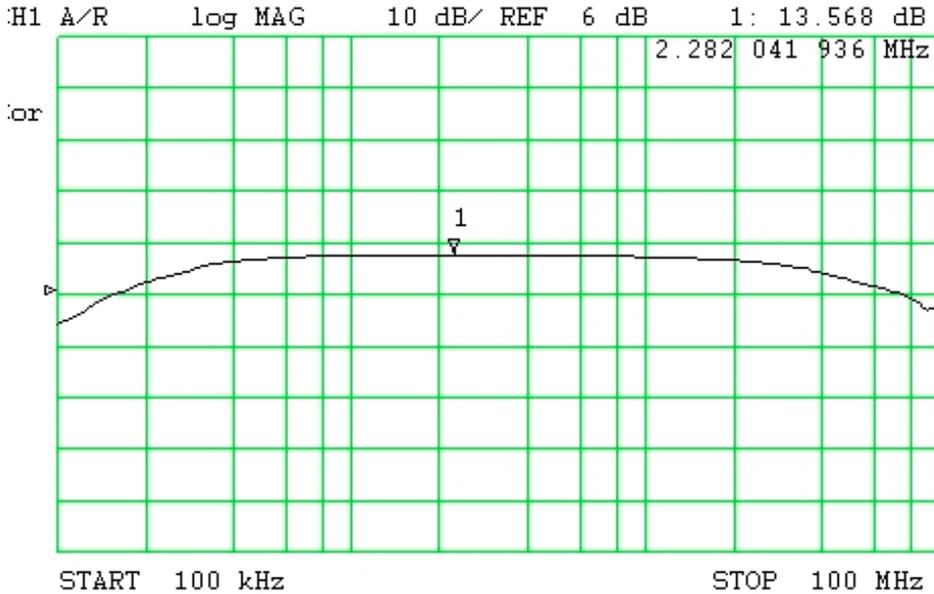
Lowest noise floor is achieved with the LP-PAN preamp installed and LP-PAN gain pot at maximum, but this will reduce dynamic range by about 10dB. Setting the LP-PAN gain pot to minimum will add a couple dB to the noise floor, but improve dynamic range by 10dB. This is the recommended setting, and the setting that LP-PANs with factory installed preamp will use. A stock LP-PAN will have the gain pot set to maximum, so you will have to readjust the control if you wish to set the pot to the minimum position. With this setting, the LP-PAN preamp improves the displayed noise floor by about 6-8dB over a stock LP-PAN when the K3 preamp is ON and 8-10dB when the K3 preamp is OFF.

A front panel attenuator switch was added to prevent possible overload in case the user wants to run LP-PAN at maximum gain. The kit can be installed without drilling a hole in the front panel for the switch if desired. In this case, simply don't install the keycap on the switch. The switch, in the no attenuation position will still fit behind the front panel if the keycap is not installed. Most users will probably find that the attenuation is not needed.

Specifications...

Standalone preamp

Impedance.....50 ohms
Gain (attenuator off)..... 12 -14dB
Gain (attenuator on)..... 2 - 4dB
Noise Figure..... 2.7dB
Reverse Isolation..... 35dB
Power consumption.....12VDC / 80mA
Bandwidth, -3dB (see graph below).....300KHz to 35MHz
Current draw.....75mA @ 12VDC



Preamp with LP-PAN

(Measured with E-MU 1212m: 192kHz sampling rate)

Overall Noise Figure..... 7dB
Noise floor in PowerSDR/IF..... -141 dBm
Noise floor improvement over stock LP-PAN..... 8 dB
Clipping point.....-13dBm (same as stock LP-PAN)
Total current draw, LP-PAN + Preamp.....approx. 120mA @ 12VDC

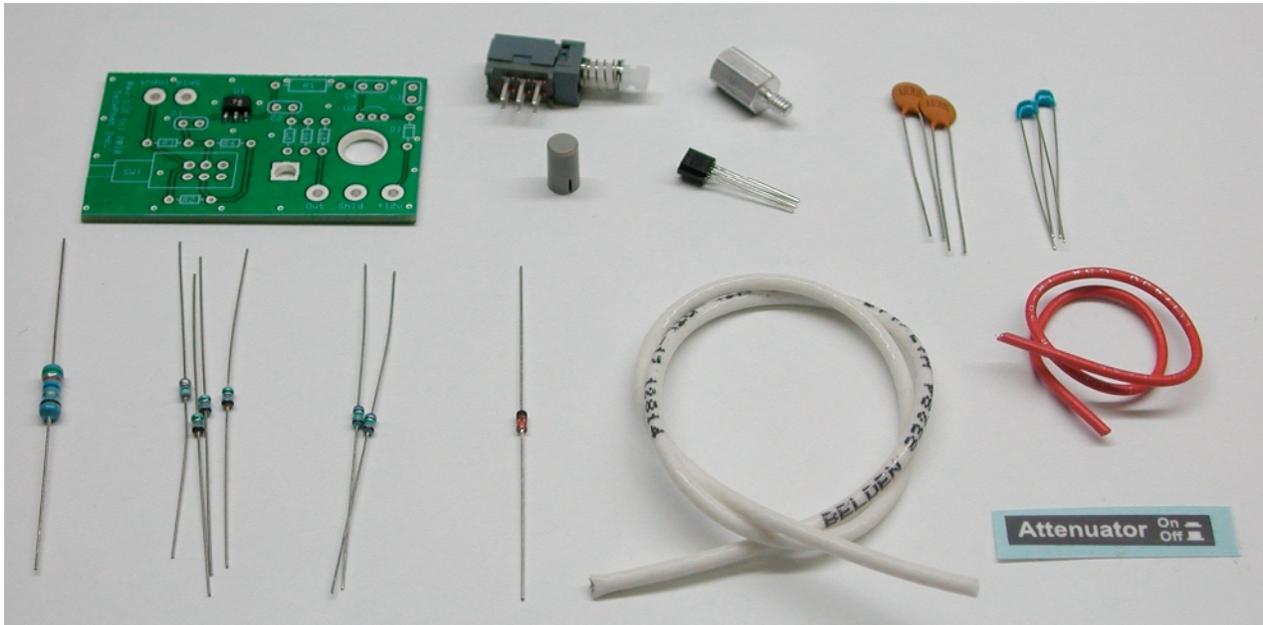
Preamp with LP-PAN and K3

(LP-PAN gain pot set to minimum, E-MU 0202: 96kHz sampling rate, K3 preamp ON)

Overall noise floor..... -143dBm
Clipping point -21dBm

Note: Noise floor improves by approx. 3dB in all cases as sampling rate is halved, ie. noise floor is lowest with 48kHz sampling rate.

Parts List - Subject to change without notice.



Parts listed as shown in order... top left to top right, bottom left to bottom right.

QTY	Part No.	Description
1	PCB, U1	PCB with pre-installed Gali-74 MMIC
1	SW1	DPDT Pushbutton Switch & Keycap
1		4-40 Threaded Standoff, Male/Female, 3/8" Long
1	U2	78L09 9V Regulator, TO-92 case
2	C1, 2	0.01uF ceramic disc capacitor (marked 103)
2	C3, 4	0.1uF capacitor (marked 104)
1	R1	53.6 ohms, 1/2W (gr-or-blu-gold-br)
4	R2, 4, 5, 7	95.3 ohms, 1/8W (wh-gr-or-gold-br)
2	R3, 6	71.5 ohms, 1/8W (viol-br-gr-gold-br)
1	D1	1N4148 Diode
1		RG-316/U Teflon Coax Cable , 12" long (30.48 cm)
1		#26 Red Hookup wire, 6" long (15.24 cm)
1		Attenuator Label for Front Panel
1	Not shown	#4 split lockwasher

You should check all parts before starting to allow you to start the process of obtaining replacement parts as soon as possible. It is recommended that you print this manual to allow for easy reference while building, and to allow you to check off the parts as you install them. You can do more than one step at a time, but don't install so many parts that the pigtailed get in the way of soldering other parts.

Make sure your work area is static-free to avoid damage to the parts. It is also advisable to wear an anti-static wrist band. If you have one, a small electronic vise like a PanaVise will prevent the small PCB from "walking around" the assembly table. You will also need a small pair of diagonal cutters, a small needle nose pliers, and medium size Philips head screwdriver, a 20-30W soldering iron / station and solder. The PCB uses RoHS compliant lead-free solder. RoHS refers to the EU "Reduction of Hazardous Substances" initiative. As a kit builder you are allowed to use Sn/Pb alloy solder in most countries. In general, Sn /Pb solder works better and lasts longer.

Assembly

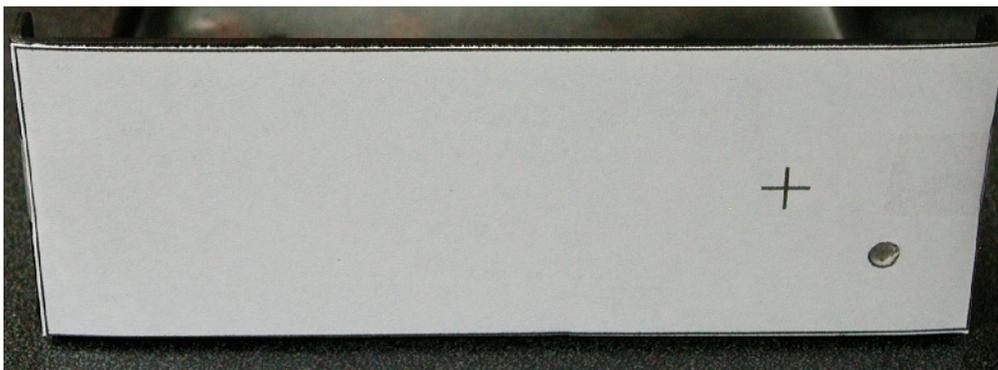
Overview...

You will assemble the PCB first, then make up the two coax cables and the 12V power lead. Before mounting the PCB and connecting it, you have to decide whether you will be drilling the front panel hole for the attenuator switch. The board will fit behind the panel with the attenuator in the OFF position as long as you don't install the keycap. This allows you to try it without the hole to see if you need to use the attenuator at any time.

If you decide to drill the hole, it is best to remove the PCB from the enclosure so that you can stand the enclosure flat on the work surface. To remove the PCB, remove the four top screws holding it in place, slide the board to the rear and lift the front of the board. You will need to carefully pry the LED back to clear the front panel. Use the following template to help position the hole. Make sure you print the template without resizing.



I have included the power LED hole to help with alignment. When aligned properly, a pencil can be pushed through the hole in the chassis to verify alignment, like this...



Once aligned, tape the template in place and use a center punch to mark the hole center. Then use a 7/32" drill or punch set to create the hole. For users in metric countries I would recommend a 5.6mm bit if available, otherwise you could try 5.5mm, although it might be a bit tight and need to be filed. 6mm is probably too loose. Be careful not to scratch the faceplate while drilling / punching the hole. Masking tape helps with this.

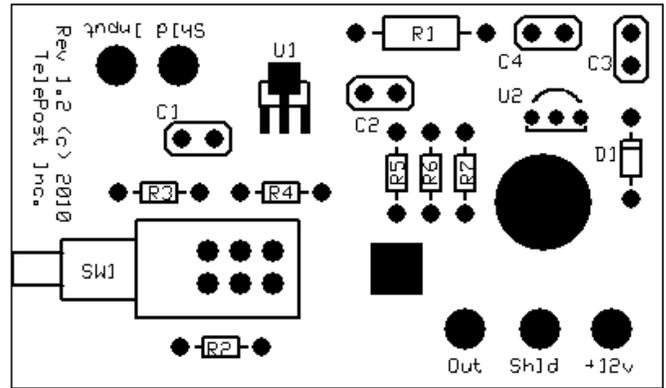
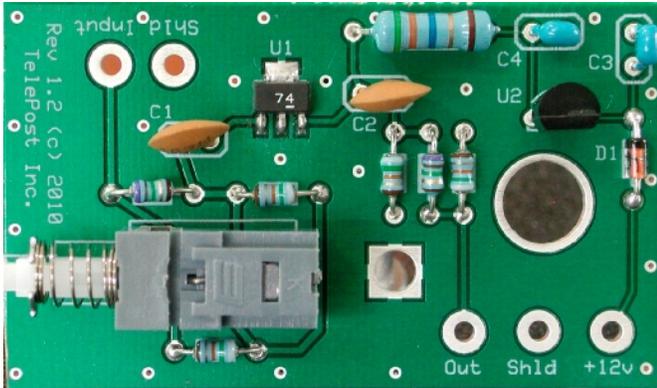


Install the front panel decal next. You can choose to place it either above or below the hole. Just peel it off the blue backing and carefully place it on the front panel. A tweezers might be helpful for this task.

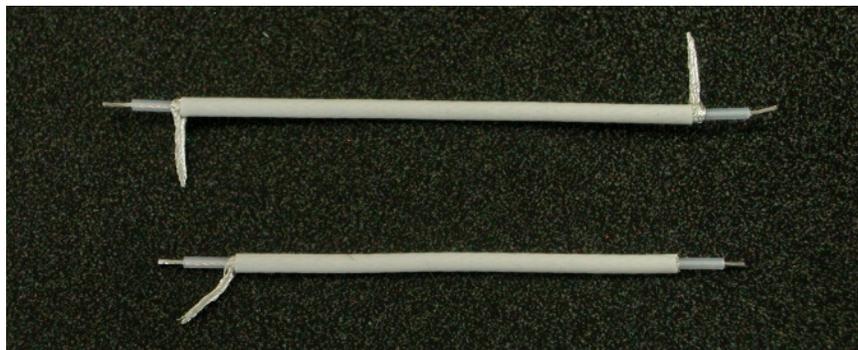
Assembly continued...

PCB Assembly

Now you can assemble the PCB. For reference, here are pictures of the completed board and component layout.

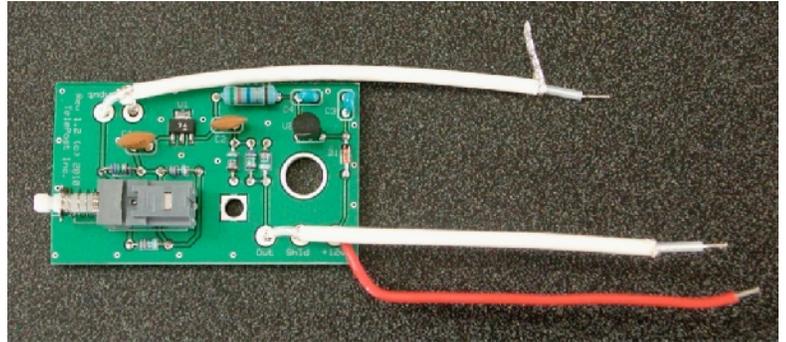
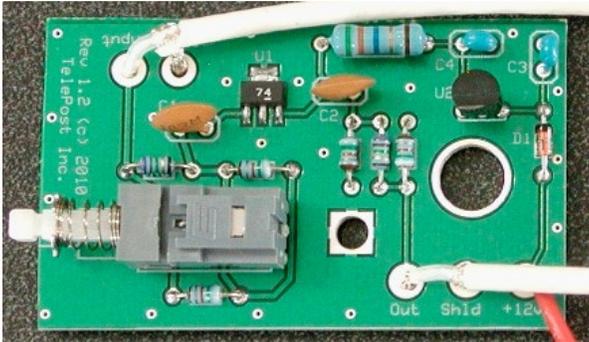


- q Install the two 0.01uF capacitors (marked 103) at C1 & C2.
- q Install the two 0.1uF capacitors (marked 104) at C3 & C4.
- q Install the 53.6 ohm 1/2W resistor (gr-or-blu-gold-br) at R1. Bend the leads as shown and leave about 1/8" clearance between the resistor and PCB to allow for air circulation. 
- q Install the four 95.3 ohm resistors (wh-gr-or-gold-br) at R2, R4, R5 & R7. Use an ohmmeter to verify the values, since it's difficult to see the color markings on these resistors.
- q Install the two 71.5 ohm resistors (viol-br-gr-gold-br) at R3 & R6. Use an ohmmeter to verify the values, since it's difficult to see the color markings on these resistors.
- q Install the 1N4148 diode at D1.
- q Install SW1. Make sure that the switch is flat against the PCB and that the switch is parallel to the side of the board so that it lines up with the front panel hole.
- q Install the 78L09 regulator at U2 with the flat side matching the silk-screen.
- q Prepare the two pieces of RG-316/U Teflon coax as shown. The pictures are full size to make preparation easier. The lengths are 3.25" (8.26 cm) and 3.75" (9.53 cm). The longer cable is for the input to the preamp, and the shorter one is for the output. Note that the shorter cable only has a shield on one end. This is the end which connects to the main PCB. I have found that rolling the cable under a razor blade or X-acto knife allows you to control the depth of the cut. I work at the edge of my table to allow clearance for the shield when I'm working on the center conductor. I have provided extra wire just in case.



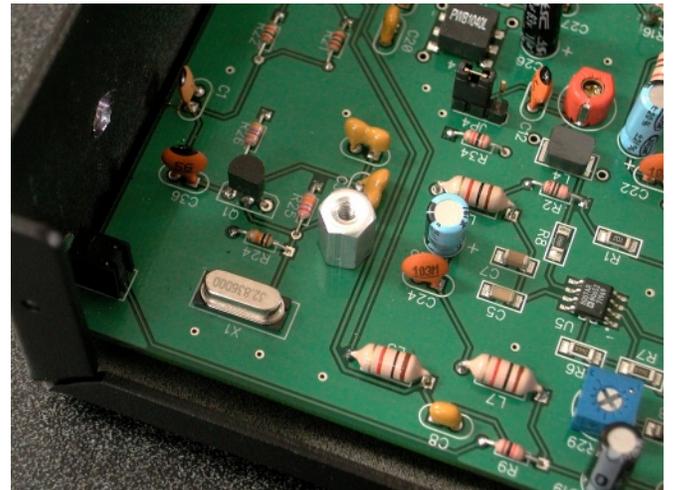
Assembly Cont'd

- q Solder one end of the longer coax cable to the preamp PCB as shown with the center conductor going to the "Input" pad and the shield going to the "Shld" pad next to it. The other end will be connected shortly.
- q Solder the shorter coax cable to the preamp PCB. Use the end with both center and shield leads, and solder them to the "Out" and "Shld" pads as shown. The other end will be connected shortly.
- q Cut a 3" (7.62 cm) length of red hookup wire and strip both ends. Solder one end to the pad labelled "+12v" on the preamp PCB. The other end will be connectd shortly.

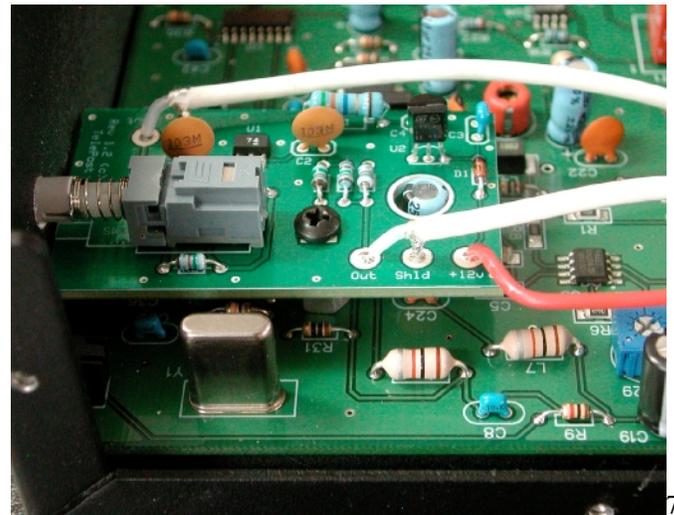


- q If you decided earlier to drill the hole for the attenuator switch, install the keycap on the shaft of the switch now. If you aren't going to use the attenuator, don't install the keycap.

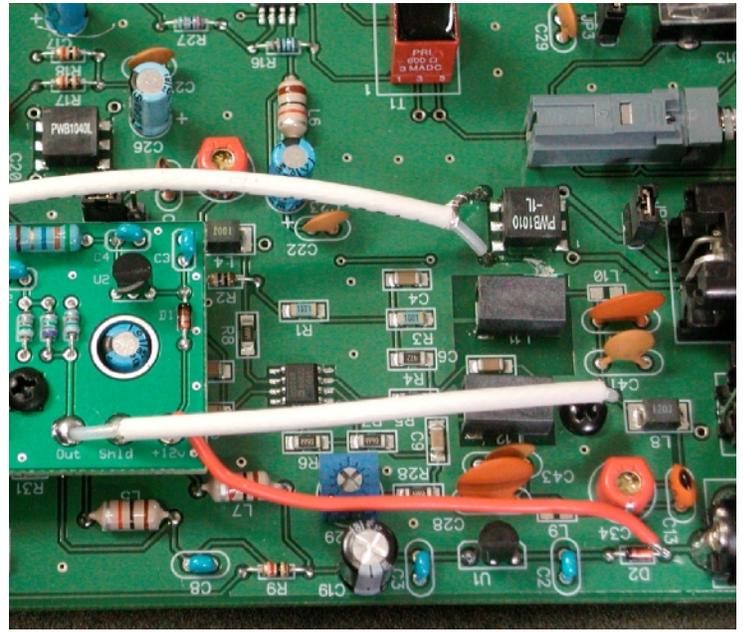
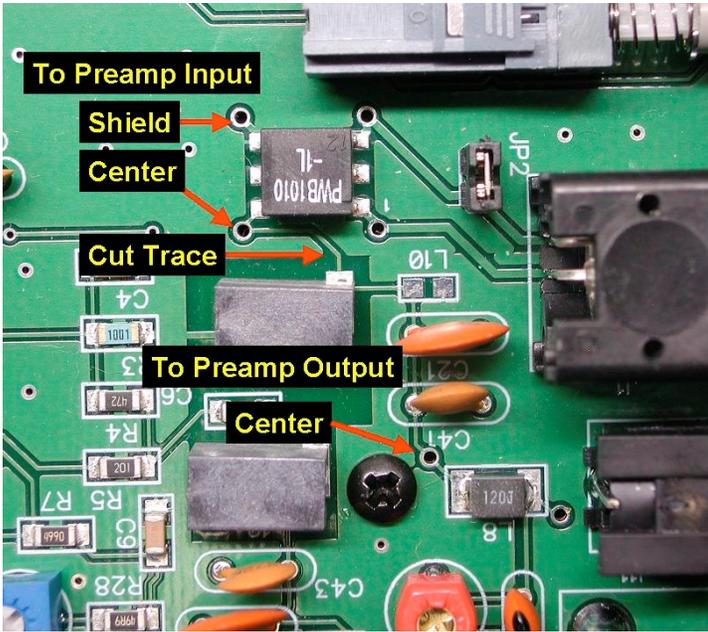
- q If you removed the PCB to facilitate adding the front panel hole, reinstall the PCB now, but use the 4-40 M/F standoff instead of the original screw for the mounting hole that's near the crystal and LED. If you didn't remove the PCB, then replace the screw near the crystal and LED with the standoff. **NOTE: It's possible that the standoff will bottom out against the screw which holds the main PCB in place. To avoid this, you can place the split lockwasher that is supplied with this kit between the underside of the chassis and the screw which holds the standoff that the main PCB mounts with. The thickness of the lockwasher will limit how far the bottom screw will penetrate the standoff from the bottom, so that the M/F standoff has more room to penetrate from the top, without contacting the bottom screw.**



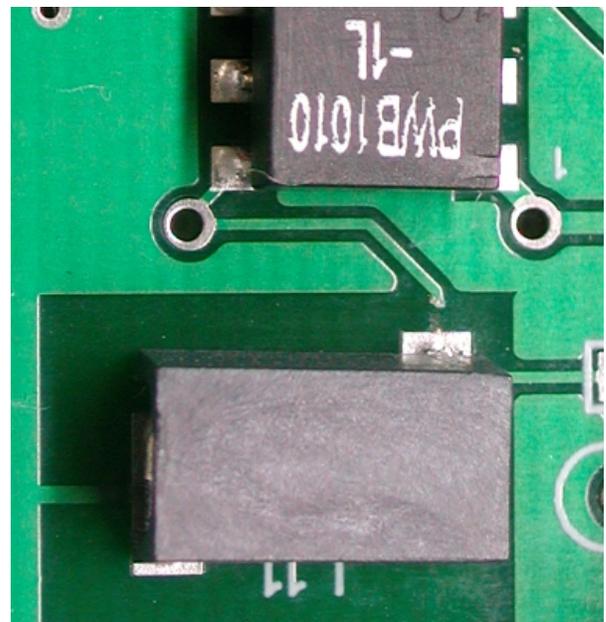
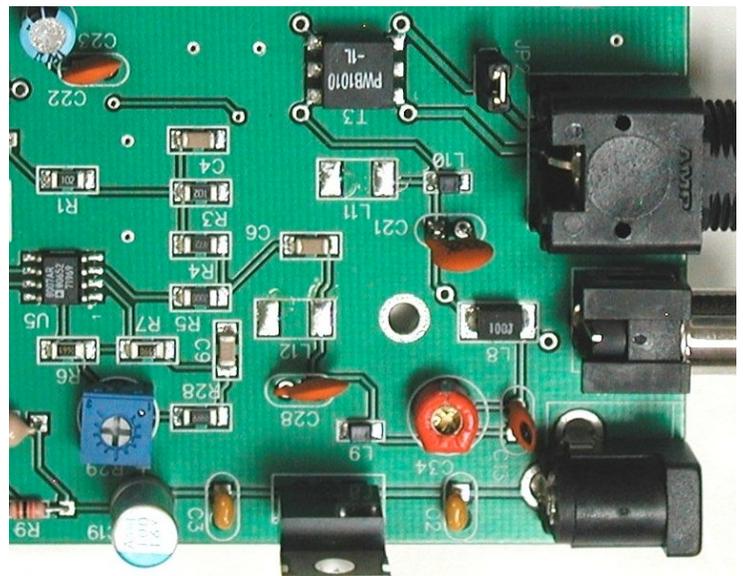
- q Carefully place the preamp PCB over the standoff so that the switch keycap lines up with the hole drilled earlier if you drilled one. If you didn't drill the hole, make sure that the switch is in the extended (OFF) position. Also, line up the hole in the preamp PCB so that the electrolytic cap on the main PCB is centered in the hole. Note: Not all PCB versions had the electrolytic cap. Mount the preamp PCB to the standoff using the screw removed a couple steps ago.



Assembly Cont'd



- q Review the graphic and picture above and right. These show before and after representations of the preamp connections. Also shown is a trace that has to be cut. The board to the right is the original (v1.1), while the closeup below it is the current board. In all cases, the trace to cut is between T3 and either L10 or L11. L11 has changed a little from board to board, but it is marked in the silk-screening.
- q Cut the trace using an Xacto knife as shown in the closeup. It is easiest to cut the section that's not surrounded by the ground plane, if possible. This also minimizes the risk of shorting the remaining part of the trace to ground. To be sure, you can make two cuts and peel away the trace between them.
- q Solder the coax center and shield from the preamp input to the two pads near the transformer as shown. For convenience, the soldering can be done from the top.
- q Solder the center conductor of the coax from the preamp output to the pad near L8 as shown.
- q Solder the red wire from the preamp to the diode D2. The connection should be on the connector side of the diode, as shown.



Checkout

- q Total current draw for LP-PAN + preamp should be roughly 120mA at nominal 12VDC
- q Before reinstalling the enclosure top, temporarily reconnect LP-PAN to your system. If you added the hole for the preamp switch, verify that the noise floor in the software varies as you turn the attenuator on and off. It should normally be left off.
- q R29 on the main PCB can be adjusted to suit your needs. It has a range of about 10dB, and is normally shipped from the factory set to maximum gain. This may not be suitable with the addition of the preamp, because the preamp adds considerable gain. It makes sense to set the pot for minimum gain. On most LP-PANs, clockwise rotation increases gain, but on some units it works in reverse, due to parts availability at the time of production. Also, some LP-PANs may have a 200 ohm part (marked 201), while some may have a 500 ohm part (marked 501), which changes the minimum gain value a bit, but does not affect the maximum gain value. Adjust R29 for maximum signal on the panadapter display, then back off the pot to lower the signal by 10dB. This value will occur with a setting near minimum pot rotation for the 200 ohm part, and mid-rotation with the 500 ohm part. If you decide that you want more gain later, you can increase the gain, but be careful to watch for overload on strong signals, such as those found in Europe on the 40m band. Of course, you can also use the attenuator to avoid overload if it only occurs occasionally, which will allow a higher gain setting for most operating. If the checkout is successful, you can now reinstall the enclosure cover to complete the installation.
- q If the checkout is not successful, contact us by email, phone for help or visit the LP-PAN User Group.

Schematic...

