

An HF linear amplifier is a major constructional project, but now Linear Amp UK has made it a little easier by bringing out a kit version of its popular Ranger 811 amplifier. However, with voltages in excess of 3kV present, building the kit should only be attempted by those with a good knowledge of electronics and RF construction techniques.

The Linear Amp UK Ranger



The kit, as it arrives from Linear Amp UK.

In March 2004, Linear Amp UK (see 'Web search') released a kit version of its popular Ranger 811H linear amplifier. Linear Amp UK has been making the Ranger for about six years now and after many requests from amateurs at home and abroad the company has finally released the amplifier in a kit form.

The Ranger 811 is a grounded grid amplifier using four of the popular 811A valves which are readily available and which make replacement a relatively cheap option at around £20.00 each. The amplifier can be used on all bands (160 to 10 metres) and will produce 700 to 800 watts output on SSB and CW with 100W drive. There is no waiting for warm up as this amplifier features an instant warm-up facility so you can use it on air straight away after switching on the mains.

SAFETY FIRST

First things first. ***As always when working with high voltages, due care and attention should be observed at all times.*** Be aware that there are voltages present within the Ranger in excess of 3000 volts. You only have to get it wrong once and it will be 'good-night nurse', so it goes without saying ***if you are thinking of buying and***

building this amplifier you should have a good working knowledge of electronics and RF construction techniques.

UNPACKING

The kit arrives packed inside the box that the finished amplifier will be housed in. The instructions come in the form of a suggested order of construction rather than a step-by-step guide. A list of parts is included along with pictures of the finished section, which I found very helpful and used as a constant reference. The order of construction is as follows: 1. Rear panel; 2. Valve bases; 3. Filament choke; 4. Antenna relay; 5. Switch and input board; 6. Control board and mains wiring; 7. Tune and Load capacitors; 8. Fit transformer; 9. PSU board; 10. Fan; 11. PA coils; 12. Valves and anti-parasitic choke (APC); 13. Front panel; 14. Test and calibrate; 15. Put on top and bottom covers; 16. Test on air!

All items are bagged for their relevant section and contain all parts required to complete that part of the construction, each section being finished before pressing on to the next where practicable. The total time for me to complete this project was about two and a half weeks allowing about three hours a night for construction. There is a lot to do in this amplifier and each section requires some careful deliberation before assembly (rather than going at it like a bull in a china shop and thinking later it would have been easier if I had done so and so!) Unpack the bag and plan each section as you go. Once you get going it's nice to see the thing starting to take shape and it's not half as daunting as it seems at first.

REAR PANEL

This involves fitting the 10A fuse holder, two SO239 sockets, a filtered mains socket and two phono sockets for PTT and ALC. A linking bar is used to connect the SO239s and one side of the phono connectors via capacitors to one terminal of the

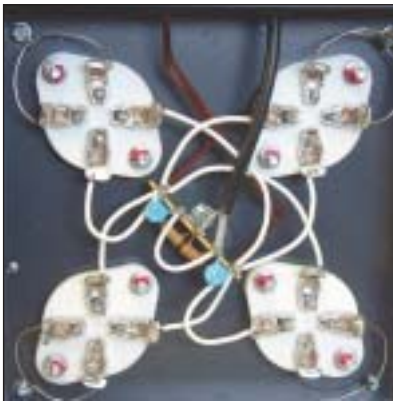
811K kit

mains socket and then to earth.

Two wires are also soldered to the centre connectors of the phonos. All wires are included and also cut roughly to length. The anode choke is also fitted into the valve compartment now, and is fixed from the underside with a tag block, which is to be used later for terminating valve cables.

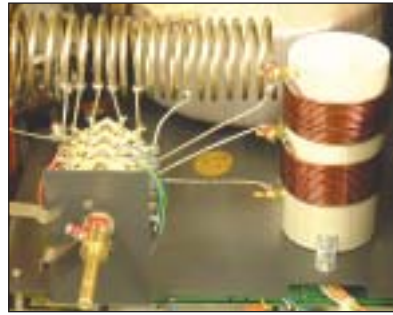
VALVE BASES

Fix in four ceramic valve bases and copy the wiring in the picture. Now is a good time to use the circuit diagram in the manual to check what you are doing. You will find yourself constantly checking the diagram in this project. Make sure to scratch off enough paint to ensure a good earth connection. Terminate some high temp wire with red sleeve and an HT



Close-up of the valve bases assembly.

Close-up of the four 811A valves in situ.



decoupling capacitor to the bottom of the anode choke. The other leg of the HT capacitor goes to earth.

Terminate the supplied RG58 coax to the five-way tag strip along with the capacitors, again use pictures and circuit diagram to complete.

FILAMENT CHOKE

There is a supplied filament choke. It is basically two enamelled wires wrapped around a ferrite core; one end has a loop and the other ends are open circuit. At this time I suggest cutting the loop end and soldering on some ring terminals which you will find in the transformer pack. These two ends connect to the transformer later. The two free ends are routed into the valve compartment and are soldered to the five-way tag block. Easy!

ANTENNA RELAY

This pack contains a PCB and there is a diagram for mounting the components and a guide for connecting various cables. Route all cables as per the supplied picture and then fix the PCB into the chassis. Solder wires from the relay along with a 470k resistor to the respective SO239 connectors on the back panel.

SWITCH AND INPUT BOARD

This involves fitting a four-pole 12-way ceramic switch to the chassis and soldering wires onto it to connect to the input board. This board gives the correct 50Ω impedance per band when your transceiver looks into the amplifier.

The input board is made on a PCB and you have to wind a coil for each band to give 50Ω impedance. This is adjusted later by inserting a ferrite core into each coil former and setting the SWR to 1:1 on your transceiver. A diagram for winding these coils is supplied, making the task easy. My 20m coil was 1:1 SWR without any adjustment of the ferrite core, so it can't be that difficult and the others did not take much adjustment to bring the SWR down



Completed, with the top cover removed.

to a workable level.

Take care when fixing in the switch and make sure it is the correct way up and looks exactly the same as the one in the picture. A mistake now will be costly and hard to rectify later.

CONTROL BOARD AND MAINS WIRING

The control board PCB involves fitting three relays; quite a large amount of components and a rat's nest of wires to be routed later to various parts of the amplifier. A complete list of which wire goes where is included and makes the task relatively straightforward. Take care when routing the cables, as a squashed cable can cause some confusion when testing the amplifier for the first time, as I will explain later.

Mains cables are routed to the on / off switch and the control board from the input fuse and mains socket, which is clear in the pictures supplied. Also a tip at this stage would be to unpack the fan which is to be mounted on the rear of the amplifier and take the cable supplied and route it to the control board as this is quite difficult to do later.

TUNE AND LOAD CAPACITORS

Fit capacitor module as per diagram. Also fit slow motion drives on to the capacitor module. The slow motion drives protrude through the front panel and will be the Tune and Load controls. Take care at this stage that the front panel looks square when fitted.

Fasten the copper strip to the chassis, taking care to make a good connection. Also a short piece of wire is routed from the capacitor to the input switch. One of the coaxes that you soldered on the antenna relay board earlier is terminated on the wire with the braid to chassis via a ring terminal. Fit a 300pF capacitor to the capacitor module and a spring clip to the input switch spindle, making sure it connects when the switch is in the 160m position. Check the front panel fits again. ♦

TRANSFORMER

This is a seriously heavy piece of kit and supplies all voltages required in the 811. The voltages are 230V, 300V, 6.75V and 12V.

There are 10 wires coming out of the transformer - a blue and brown for 240V primary input, a purple and black for 300V secondary, an orange and grey for 300V secondary, a red twin and a yellow twin for 6.75V heaters and a green and a white for 12V control.

The blue and brown connect to the blue and brown wires from the control board and mains input filter. Join the black and orange secondary wires together and then connect the purple and grey to the PSU board. Put a ring terminal on each red and yellow twin and route to the filament coil where we soldered ring terminals on earlier and join with nuts and bolts. The green and white join to the reds coming from the control board.

PSU BOARD

Make up the PCB with the capacitors, resistors and diodes supplied. Then fix into the chassis of the amplifier. Now solder on the purple and grey wires from the transformer, the white wire with red screen from the anode choke and the black wire from the control board.

FAN

This is an easy one. Just fix the fan and the safety grill to the rear of the unit with the supplied nuts and bolts and connect the wire we routed from the control board earlier. Check the direction of air flow: air blows *out* of the unit.

PA COILS

There is a pre-formed coil for 10 to 40m which connects to the input switch, the tune and load capacitors and the other end connects to the 80 to 160m coil via three connecting wires. There is also a 68pF capacitor to connect between the 80 and 160m connecting wires.

Take your time doing this part as fitting the PA coil to the input switch is quite a tricky exercise, but with time and patience it will fit.

VALVES AND ANTI PARASITIC CHOKE

This is the assembly that connects the valve anodes to the PA coils, anode filament and the Tune / Load capacitors. This involves making four coils, each with three resistors inserted, with clips on each end to connect to the valve anodes. Then solder the whole assembly to the top of the anode filament and connect the other end via a 1000pF blocking capacitor to the Tune / Load capacitors. Refer to the supplied picture for a better understanding. It's easy to make but not easy to describe!

FRONT PANEL

Fix in the two meters with a small amount of silicon bathroom sealer on the front part of the meter. Then seal all the way around the edge on the inside of the panel. Don't use too much as it will leak on to the front panel and it's very difficult to remove.

Now fit all the other switches and pots. There are also two LEDs to be fitted. Pay attention to the polarity of these and make sure they are in the right place on the panel. Terminate the mains wiring on the On / Off switch and connect all other cables as shown in the diagram. Now slide on the front panel and make sure it is square. Cut the spindles on each switch to length and put on the control knobs. Take your time here and make sure that the controls rotate freely. A little bit of oil makes the switches run better and can also be applied to the band switch to make it rotate freely.



Underside view, completed.

TEST AND CALIBRATE

According to Linear Amp UK's website they will give you back up and help you make a good working amplifier. I had to call them once or twice during the building of this amplifier and found them to be true to their word. With that in mind, now comes the time to switch on and see what happens!

After checking every connection two or three times, all seemed OK, so I switched on. The panel lights came on immediately and after about a second delay the red 'Ready' led came on. Bingo! So at this stage all looked good.

Next I pressed the standby operate switch and strangely the amplifier went straight into transmit so I quickly switched back. "It shouldn't do that", I thought, so I switched off and checked the circuit diagram to see how the switch should be wired. All checked out as per the diagram. What should happen is the PTT jack on the rear of the unit switches in an earth via the standby / operate switch. This earth is supplied by your transceiver so when you key your mic the transceiver sends a earth to the amplifier and sends it

into transmit. So I connected my multimeter to the standby switch with everything disconnected and the power switched off. There seemed to be an earth connection on the switch. It transpired that I had pinched one of the wires to the switch under the switch-input board, thus earthing it and subsequently sending the amplifier into transmit. This earth connection was removed and the standby / operate switch operated correctly.

Next the input coils were adjusted for a good SWR at the transceiver and the meters were calibrated. Now was the time to try the amplifier on the air. It tuned up OK and 700 to 800 watts were measured into a dummy load on all bands. The amp on air will loaf along at the UK legal limit and showed no signs of any fault. My first contact on air was into the Bahamas with a 59+ report.

Not long after I managed to work T33C on 20m and also 7Q7MM [see RadCom July 2004 pages 45 and 42 - Ed.] So things are working great! Hopefully this article will give a good insight to making this amplifier and maybe inspire one or two to have a go at the kit.

The amplifier was a really enjoyable project and would be a great idea for a club station where someone with electronic and RF experience oversees club members' activities on the amp, checking things as they go. At the end of the project the club would finish up with a really nice home-constructed amplifier and club members would have gained some experience in RF / electronic construction.

The kit is available from Linear Amp UK at £695.00. The Ranger 811H is available ready built for £945.00. My thanks go to all at Linear Amp UK for their help and assistance during the building of this kit. Now, I'm off to 20m to see if there is any DX about. ♦

Completed, in all its glory!



WEB SEARCH

Linear Amp UK

www.linamp.co.uk