

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

## The Collins 30L-1 Amplifier Revisited

In the early 1960s Collins Radio Company introduced the model 30L-1 linear amplifier for amateur HF use. This was a unique design. It boxed a 1 kilowatt PEP amplifier and power supply in the same size cabinet as the popular KWM-2 transceiver. In fact, it was designed as a companion unit to the transceiver.

Production of the 30L-1 ceased some years ago, but the amplifier has remained a favorite on the second-hand market. The few units offered for sale are snapped up at a good price by eager amateur radio operators anxious to have a well-designed, compact amplifier that will work with today's modern transceivers.

Recently, a large contingent of 30L-1 amplifiers hit the market. These were released by the military, who used them in the Desert Storm operation, and also by NATO, who fitted the amplifiers into a transportable communication system.

In general, the newly surplus amplifiers are in good shape, aside from some bangs and dents in the fragile aluminum case. The units were snapped up, some by hams, and others by dealers who resold them to the fellows who were not johnny-on-the-spot when the amplifiers hit the market.

Since the exact use of the amplifiers is unknown (as far as frequency is concerned), and the amount of maintenance questionable, I'm offering some maintenance and adjustments you might consider before your amplifier is put on the air. The following material was gained by putting one of the surplus units on the air myself.

### The 30L-1 Amplifier Circuitry

The 30L-1 amplifier uses four 811A high- $\mu$  triodes in parallel in a grounded grid circuit. The amplifier covers the range of 3.4 to 30 MHz in five bands. It is theoretically possible to operate at any frequency in that range, provided the cathode input circuits are tuned to the operating frequency.

The amplifier power supply is normally connected for 115 volt operation, but the primary connections may be changed for 230 volt operation. Under normal operation, standby plate voltage is 1800, dropping to about 1600 volts under full output.

An antenna changeover/VOX relay is incorporated in the 30L-1 so that it may be controlled from the transceiver. An ALC control circuit is also provided.

Under key-down operation (not recommended) the amplifier draws 600 ma plate current at about 1600 volts anode potential. This equates to a plate input of 960 watts. Some of the drive power is fed through the amplifier, so it actually reaches an input of 1 kW PEP.

The user of a 30L-1 is cautioned that it does not have the overload capability of many mod-



The Collins 30L-1 linear amplifier introduced in the early 1960s.

ern amplifiers. Because of the size and compact design, there is very little margin for tune-up error or overload in either the power supply or the 811A tubes. Don't be greedy and push this amplifier for the last available watt, as it does not have the reserve.

### Preliminary Checks On The Amplifier

Before you turn on the amplifier, there are some checks you should run to ensure proper operation. First, you should check to see if the amplifier is wired for 115 or 230 volt operation. This can be done with an ohmmeter. Measure the resistance between the two blade pins on the power cord. If the amplifier is strapped for 230 volt operation, the resistance will be about 2.2 ohms. The resistance will be about 1 ohm for 115 volt operation.

Next you should remove the 811A tubes and eyeball them. If the glass envelope of a tube is gray instead of clear, it means the tube has many hours of use and its operation is questionable. If there are burned, bright spots on the plate, it indicates the tube has been overloaded. It is prudent to replace such a tube. More on tube selection later.

Once you have removed all tubes, use your ohmmeter to measure the resistance from one filament pin socket (one of the large ones) to ground. It should be near-zero ohms. You are checking out a fuse in the filament return circuit (not shown on the schematic, but mentioned in Section 4.1 of the manual). This fuse is a short length of No. 30 wire in the ground return of the filament winding of the power transformer. It will blow and protect the 811As from excessive current. It is rated at 700 ma steady current and will blow at about 1000 ma. Whether this protects the tubes is questionable. If the four 811As draw 1000 ma even for short period, at least one or more will be ruined. In any event, if the fuse is blown, the amplifier

won't play! The fuse wire is mounted between two outer lugs of a terminal strip located near resistor R11 in the power supply compartment.

You now know the protective fuse is okay and the line voltage for which the amplifier is wired. The next step is to check the 811A tubes. Eyeball them. Look for little pieces of wire bouncing around inside the tube as you rotate it. If such wires are visible, it means that a section of the filament or grid is broken and the tube is useless. Clean the glass of the tube with a damp rag and clean the base pins. I scraped the pins with the blade of a small knife to remove corrosion.

If you can lay your hands on a tube tester, check the tube. I used a surplus TV-7 transconductance checker for my tubes. They all should give approximately the same reading on the checker.

Finally, check the line fuses and lubricate the blower motor bearings with a few drops of machine oil.

### Primary Power For The 30L-1

The amplifier operates from a 115/230 volt, 60 Hz power line. For best regulation, it should be run on a 230 volt circuit.

Over the years, since the 30L-1 was designed, the utility companies in the U.S. have gradually been boosting line voltage to accommodate increased loads on existing circuits. In my home, for example, I measure 122/244 volts most of the day. This results in overage of 7 volts on the 115 volt amplifier primary circuit, or 14 volts on the 230 volt circuit.

No big deal, you might say. However, the situation is otherwise. The 30L-1 is designed with little tolerance for tuning error. In addition, the power transformer, filter capacitors, and 811A tubes are working at their maximum intermittent rating at the designated voltages. Running the amplifier at my line potential subjects the amplifier components to a 7 percent

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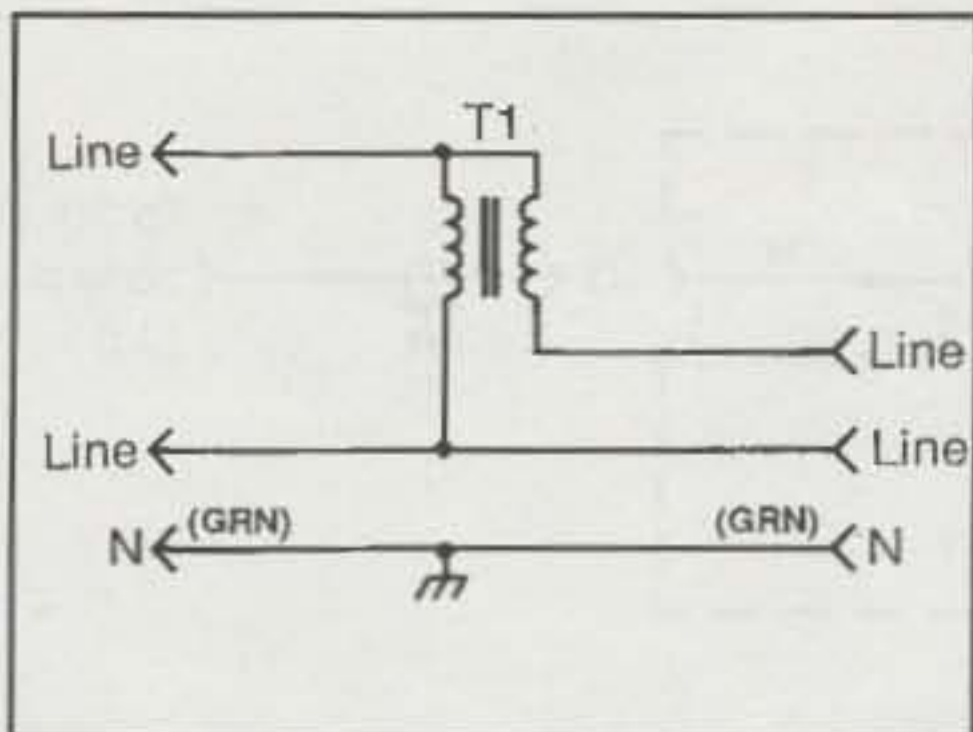


Fig. 1—Primary autoformer is a filament transformer wired so as to buck the line voltage down to the proper value. Secondary of the transformer is in series with one side of the line.

overload. This exceeds the voltage tolerance limits on the tube filaments and capacitors, besides making the power transformer run very hot. The amplifier runs hot enough as it is, so stressing it further is a risky operation. I don't recommend it.

### A Primary Autoformer

It is a good idea to reduce line voltage to the 115/230 volt rating. This can be accomplished with an autoformer. A filament transformer can be used, provided the secondary can pass the line current. This transformer is connected so as to buck the line voltage (fig. 1). In my case, I used a 7.5 volt, 10 amp transformer. This reduced my line voltage to about 114.5.

The primary of the transformer is connected across the line, and the secondary is in series with the line. If the secondary connections are incorrect, the line voltage will be boosted by 7.5 volts. You have a 50-50 chance of hitting it right the first time.

If you are wired for 230 volt operation, and your line voltage is 244 as mine is, a 10 volt, 5 amp transformer will buck the voltage down to 234 volts. Close enough. For 230 volt service, you'll need a transformer with a 220 volt primary. That may be a sticky wicket. Check the surplus outfits.

### Amplifier VOX Circuitry

The 30L-1 has an internal relay that controls antenna changeover and standby circuitry. That relay can be activated by the "Remote" or "VOX" circuit of the transceiver. The relay in the 30L-1 obtains its voltage from the -170 volt bias supply. The relay coil draws about 85 ma current.

It may be risky to key this relay directly from the transceiver. Some makes of transceivers use a power transistor to actuate the amplifier's changeover relay, while others use a small mechanical relay the contacts of which are not rated for the voltage and current required by the 30L-1 circuit.

It is best, therefore, to make up an intermediate relay that can be safely driven by the transceiver, regardless of whether that unit uses a transistor or a relay as a VOX driver. A suitable circuit is shown in fig. 2. A small relay with a 9 volt, 18 ma coil (Radio Shack 275-005) is activated by the transceiver circuit, and this

secondary relay activates the VOX circuit in the 30L-1. The relay and a 9 volt battery are placed in a small aluminum box (Radio Shack 270-235) measuring  $2\frac{3}{4} \times 2\frac{1}{8} \times 1\frac{5}{8}$ ". A phono input plug and an output cable complete the simple installation, which may be held to the rear case of the amplifier by stickum tape. Now there is no danger of damaging the receiver circuitry by the relatively high voltage and current drawn by the amplifier relay.

### The 811A High-mu Power Triode

The 811 triode was brought to the market in the late 1930s. It was designed mainly for class B audio service. The tube suffered from low plate dissipation rating, and a few years later RCA (the designer of the tube) brought out the 811A, which was the same tube, but with small cooling fins added to the anode to boost the plate dissipation rating a bit.

The 811A has a maximum dissipation rating of 65 watts. At this level the anode will just show a dull red color when observed in a dark room. Four 811As, of course, have four times this dissipation rating, or 260 watts when they are properly ventilated.

### Problems With The 811A Tube

The early 811A tubes with the old RCA logo on the base were beautiful examples of tube design and manufacturing. However, during the last, sad days of RCA when the transistor was shooting the vacuum tube out of the sad-

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dle, RCA succumbed to the lure of letting the cost accountants, rather than the tube engineers, dictate the manufacturing processes—or so it seems. Late productions of the 811A were unhappy knock-offs of the early design. Ceramic plate supports on the vertical anode rods were removed, the mica support at the top of the tube anode disappeared, and the plate lead from the anode strap to the top cap was butt-welded to a thin wire, instead of being welded to a sturdy strap.

The "improved" 811A seems to work about as well as the older configuration, but the internal structure is fragile and subject to vibration damage.

In any event, the 811A works to its maximum capacity in the 30L-1, so every attempt should be made to get good tubes. My experience has been that some of the 811As in the surplus amplifiers have been cooked at one time or another, so this is a major problem for the owner of one of these.

### A New Version of The 811A

Some years ago power tube engineers had the opportunity to examine some transmitting tubes brought back from the USSR by an amateur who visited that country. Visually, the tubes seemed excellent, and first-class assembly techniques were obvious. The tubes were tested and the results were mixed. The pumping and aging techniques used in the USSR at that time were not up to the attractive mechanical quality of the tubes.

Recently, the tube engineers had the opportunity to examine and test transmitting tubes made in the new Russia and also the People's Republic of China. It was immediately obvious that the Russians had made great strides in quality control, and that the Chinese tubes were in the questionable category occupied by the tubes of the defunct USSR. Over a dozen factories in China make transmitting tubes. Some are good; some are not. And the unfortunate purchaser doesn't know from

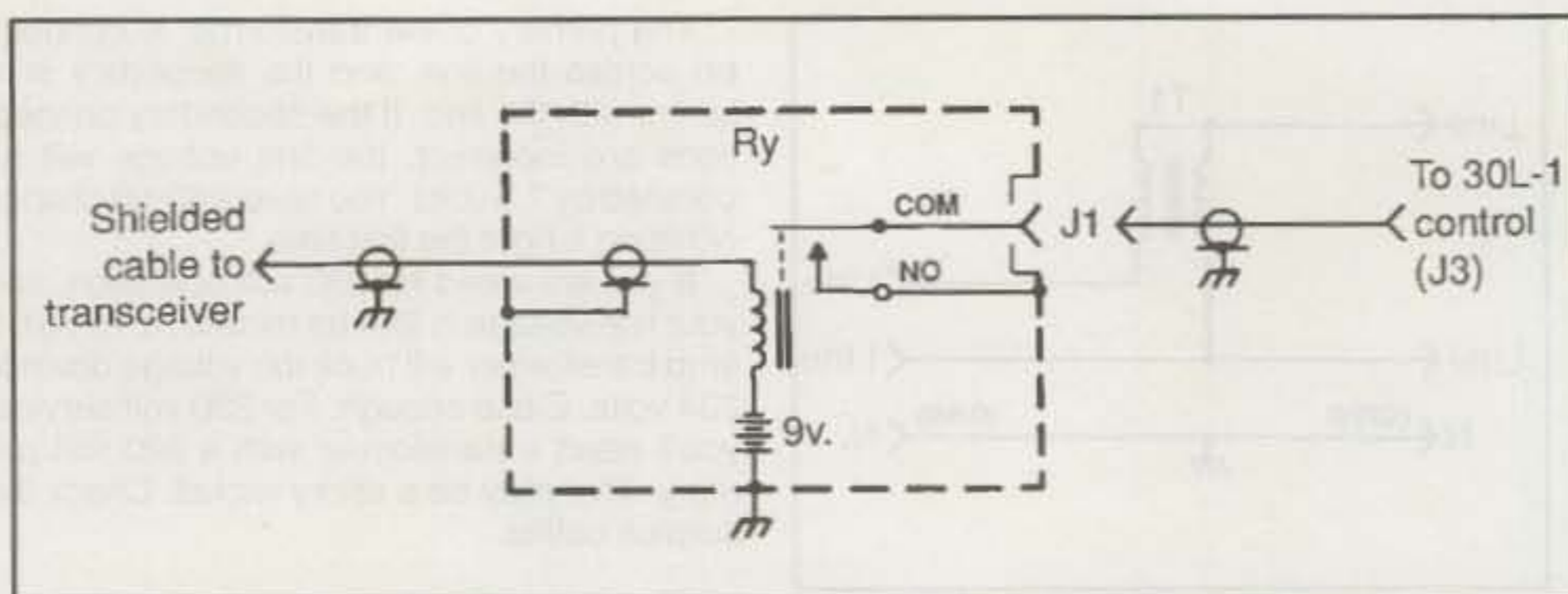


Fig. 2—Intermediate control relay circuit. (Ry = Radio Shack 275-005 relay.)

which factory his tubes came! The 6146 is a good example. Some Chinese 6146s are so out-of-spec that they didn't fit into the amplifier enclosure of a TS-830. They are too tall. Others are gassy, or have poor gain.

In the last few years, assisted by American expertise, the Russians are turning out first-class tubes, including 811As. The Russian 811A looks like the good old RCA job, but with the addition of a ceramic base, and a ceramic insulator under the plate cap to protect the glass envelope from electrolysis. In addition, a hard glass envelope is used, specifically intended for transmitting tubes, instead of the soft glass envelope of the RCA 811A.

Four Svetlana 811As (from Svetlana Electron Devices, 3000 Alpine Road, Portola Valley, CA 94028; phone 415-233-0429) are running in my 30L-1 amplifier. Operation is uneventful, the results equalling those achieved with the early RCA tubes. The four tubes seem evenly matched, as all run at approximately the same temperature.

### A Word of Warning

Regardless of the brand of 811A you use, you might find that you can get the tubes into the

amplifier sockets, but you can't get them out! The bayonet pin on the tube base snags against the aluminum chassis. Most embarrassing. I eliminated this annoying problem by filing off the pin before I put the tube in the amplifier.

### Amplifier Input Circuits

Individual pi-network circuits are used for each frequency range of the 30L-1. They are changed by the main bandswitch. Since the surplus amplifiers arriving on the market probably were used on frequencies outside the amateur bands, it is a good assumption that these circuits were retuned to an out-of-band frequency at some time. I checked the input circuits in my amplifier and found they were tuned to 3.8, 8.6, 16.6, 24.1, and 30.1 MHz. The Collins manual provides tuning information for these circuits. Operation with the input circuits mistuned results in unusual plate circuit tuning and, in extreme circumstances, amplifier oscillation.

### A Heartfelt "Thank You!"

I really appreciate the friendly letters I have received urging me to continue this column. Thank you all. I'll do the best I can, perhaps on a bimonthly basis. We shall see. To the following, my 73 and gratitude: Mel Schaefer, WB2KFN; Thomas Hart, AD1B; Martin Wincott, K2BRY; Andrew Pfeiffer, K1LKO; Paul Scholtz, W6PYK; Anthony Musero, K3UKW; Brian Beezley, K6STI; Robert Lorenz, AB6MA; Rod Newkirk, W9BRD; Ed Gilner, W6ZZN; Ronald Renaud, W8FEU; Richard Harmon, KK5BR; Irving Morris, W2GMT; Jack Bennett, W8NEN; Jack O'Brien, W2YYI; Fred Linn, W9NZF; George Papalias, W6GBA; Bill Hadguis, N5FIH; Robert Boehmig, W4SJS; Rod Hotz, K5BGB; Brad Williams, KE7IP; Phil DeJarlais, W0JHS; Wayne Rhine, ex-DL4AC; Bill Byron, W7DHD; Harold Ort, N2RLL; Paul Vaughn, WA4FST; John Clark, WF3Y; Doug DeMaw, W1FB; Harry Johnson, NV7K; Willard Waite, W8GDO; George Purcell, WA3IND; Phil Sonderman, WA6IPT; Oscar Clinton, N5ZIH; John Monroe, W7KCN; Rex Pealer, KB8HZH; Al Bry, W2MEL; Byron Weaver, WU2J; Ray Gregson, W6EMT; Steve McDonald, VE7SL; John Chapman, WA1KYH; Bill Ryder, W1KL; Jerry Sevick, W2FMI; Bob Wheaton, W5XW; Vince Bashore, ex-W2IDN; Charles Kitchin, N1TEV; Art Roshon, N7ABH; Wayne Cooper, AG4R; Gary Breed, K9AY; Greg Sparacino, N6PUG; Frank Witt, A11H; and Dennis Bernier, WA1WIA. 73, Bill, W6SAI

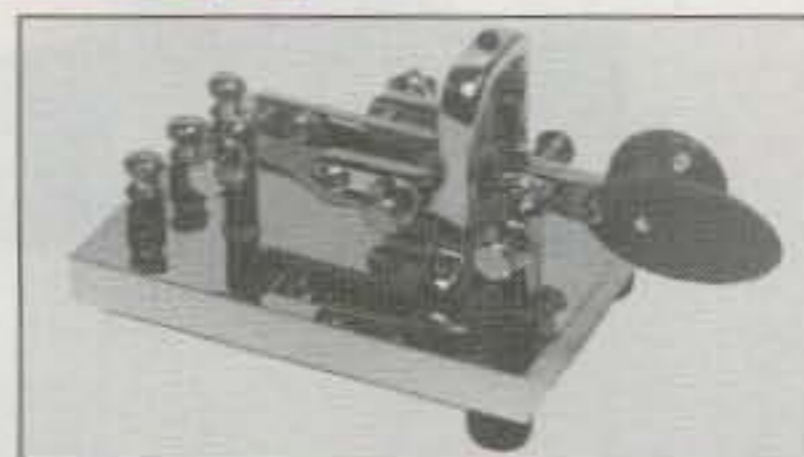


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