

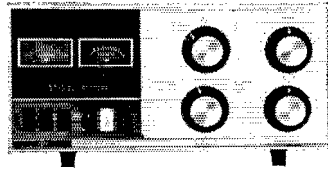
• Recent Equipment —

The NCL-2000 Linear Amplifier

THE NCL-2000 is National Company's new linear amplifier, capable of power inputs of 2 kw. p.e.p. on s.s.b., and 1 kw. for c.w., a.m., or RTTY. The amplifier is completely self-contained, with power supply and r.f. circuits in a compact package measuring approximately 8 by 17 by 13 inches. Frequency coverage includes five bands, 80 through 10 meters. Two RCA type 8122 ceramic tetrodes, with a total plate dissipation of 800 watts, are connected in parallel and operated in Class AB₂. Any exciter with 20 to 200 watts peak output will drive the NCL-2000 to full input.

The input circuit of the amplifier is untuned, utilizing a resistor divider network for developing the required driving voltage for the amplifier tubes. An added feature of the amplifier is that the resistor network can also be used as a 50-ohm dummy load for tuning up the exciter, without plate voltage being applied to the amplifier tube.

An unusual feature of the amplifier is the grid-bias supply. The essentials of the grid-bias regulator circuit, on which a patent is pending, are shown in Fig. 1. In order to operate the amplifier in AB₂, with low values of grid current, the regulator circuit is designed to hold the grid-bias voltage constant at normal driving levels. However, when the grid current exceeds 15 ma. the grid bias automatically increases. Output from the bias supply, approximately -80 volts, is fed to the collector of Q₁, a series-regulator transistor. Operating bias for the amplifier tubes is obtained from the emitter of Q₁. The resistor network R₄₀R₄₁R₄₂ carries a bleed current of 15 ma., and a sample of the output voltage is taken from the bleed network and applied to the base of the control transistor, Q₂. The collector of the control transistor is fed from the -80-volt source through R₃₉. The emitter of Q₂ is returned to ground through CR₉, a Zener diode. The Zener diode is



kept in its regulating range by the current through R₃₉ from the negative supply. When the 8122 grids start to draw grid current, the bias voltage will tend to go more negative. This makes the base of Q₂ more negative and more current flows through the transistor, causing the base of Q₁ to go more positive, reducing the current through the regulator transistor. This tends to maintain the bleed current at 15 ma. and cancel any change in bias on the grids. When the grid current exceeds 15 ma. the regulator can no longer function and R₄₀, R₄₁, and R₄₂ act as a simple grid leak. Thus, if the amplifier is driven past the point of regulation, the tubes will be protected because the increasing grid current increases the grid bias. (This is, of course, accompanied by nonlinearity on s.s.b., and is not an s.s.b. operating condition.)

In addition to the points already mentioned, the grid circuit also provides a.l.c. output. When excessive drive is applied to the final, modulation peaks resulting in more than 15 ma. of grid current will cause an audio voltage to appear on the bias circuit. This voltage is rectified by a voltage doubler and is then available to control the exciter gain automatically.

A pi-network tank is used in the output side of the 8122s. In order to maintain the proper LC ratios for working into a design-figure load of 40 to 60 ohms, additional capacitance is switched into the pi on both the input and output sides of the inductor on 40 and 80 meters.

The inductor is a tapped coil, the proper taps being selected by the band switch.

Plate voltage for the amplifier tubes is obtained through a voltage-doubler circuit using silicon rectifiers. In fact, all the supplies in the NCL-2000 use solid-state rectifiers. The screen voltage is developed from a full-wave bridge circuit.

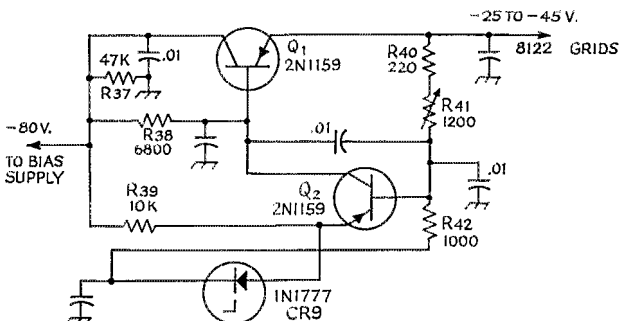
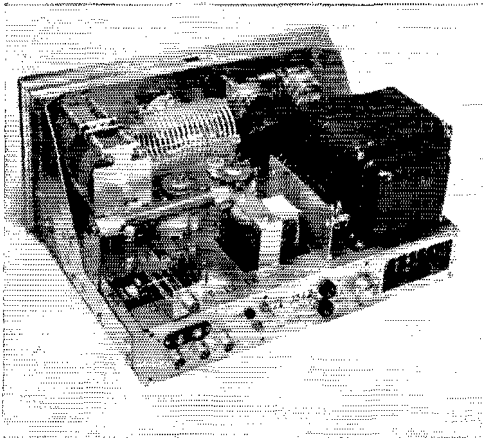


Fig. 1—The grid-bias regulator circuit.



The pi-network input capacitor and inductor are in the upper left in this view. Just below the inductor are the amplifier tubes. The antenna relay is visible through the opening in the chassis top at the left rear. Near the rear center is the blower motor and to its right is the plate transformer.

Metering of the amplifier is taken care of by two meters, one of which is switched. The plate-current meter (not switched) has a full-scale reading of 1 amp. The other meter can be switched to read plate voltage (full scale 5000 volts), screen current up to 50 ma., grid current 50 ma. full scale, and exciter tune, in which position the meter again reads grid current but with the antenna relay switched to the transmit position. This permits exciter adjustment with the amplifier plate and screen voltage off.

The amplifier is set up so that either 115-volt, 2-wire, or 230-volt, 3-wire input can be used. When the a.c. panel switch is turned on, power is applied to the bias supply and the 8122 heaters, and also to a squirrel-cage blower which cools the 8122s. A green dial lamp comes on with the a.c. switch and after approximately one minute warm-up time, another dial light marked "ready" comes on. This indicates that a time-delay relay has closed. This relay prevents the plate voltage from being turned on before the amplifier tubes have a chance to warm up. When the plate switch is closed, another dial lamp comes on. The plate switch is connected to a relay which controls the primary of the transformer for the plate and screen supplies.

The remaining panel switch is used for changing from c.w. to s.s.b. operation. In the c.w. position the plate and screen voltages on the amplifier are 1800 and 290 volts, respectively. This is determined by a tap on the plate and screen transformer primary. In the s.s.b. position the tap is changed and the plate and screen voltages are 2500 and 400 volts.

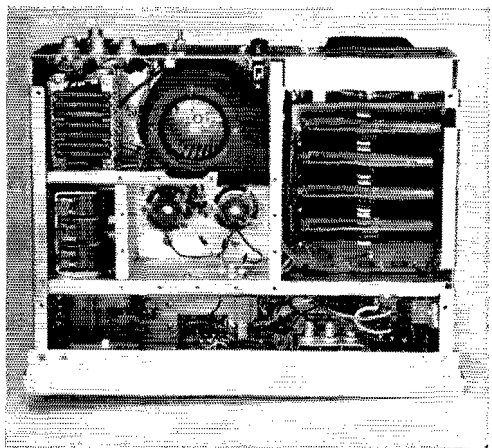
The amplifier is designed for a peak input of 2 kw., which means running the tubes at 2500 volts and 800 ma. With an efficiency on the order of 60 per cent, the output is approximately 1400 watts peak. When going to c.w., 1-kw. input is 1500 volts at 550 ma. The NCL-2000 is

designed so that when the amplifier is tuned up with a 50-ohm load to a c.w. input of 1 kw., all you need do is switch to the s.s.b. position and you are properly tuned up for s.s.b.

Control circuits in the amplifier include a built-in antenna relay, which is opened or closed by the plate switch when two external terminals are shorted. These two terminals can be controlled by the exciter send-receive switch or VOX. If the exciter is a transceiver, all you need do to operate "barefoot" is to turn off the amplifier plate supply and make sure that the multi-meter switch is not in the exciter-tune position.

An additional contact on the antenna relay is used to open the ground return of the screen supply since the idling current of the 8122s is 250 ma., which would cause considerable noise generation. Opening the screen supply eliminates this problem.

The instruction manual is complete with detailed tune-up instructions and trouble-shooting



The resistor network for grid-input circuit is in the upper left corner. Just below the bank of resistors is the pi-network output capacitor. A bottom plate which seals off the tube compartment has been removed for the photograph; the tube sockets are visible in this compartment. At the right are the electrolytics used in the plate power supply.

information. Top- and bottom-view photographs are included with all components clearly identified, a feature we heartily approve of. A chart of voltage and resistance checks is also included. — W1ICP. QST

National NCL-2000 Linear Amplifier

Height: 7⁵/₈ inches.

Width: 16³/₄ inches.

Depth: 12³/₄ inches.

Power Requirements: 110/120 volts
50/60 cycles, 220/230 volts 50/60
cycles.

Price class: \$585.00.

Manufacturer: National Company,
37 Washington St., Melrose, Mass.