

KZUGR

INTRODUCTION

Amateur Radio has not kept pace with other consumer electronic products in the application of solid state devices. This lag, in part, was due to the Amateur's insistence on excellence in performance and reliability in design. Early solid state devices and equipment were more expensive and inferior to vacuum tube designs.

In the past several years, however, we have seen the transistor emerge as the universal replacement for the vacuum tube in virtually all applications with the exception of the RF power field. As in the past, this transition will not take place until solid state devices are available that will perform the required functions better than their vacuum tube counterparts, with measurable benefits, and at a cost comparable to them.

Advances in the RF solid state art have progressed to the point where these criteria have been met in the medium power range. It is with pleasure that TEN-TEC offers the first piece of Amateur equipment using these new devices, the Model 405 Linear Amplifier. That it provides definite benefits to you, one of the owners, will become apparent as you unfold a new chapter in Amateur Radio Communications. The broad-band design offers instant band change and eliminates any possibility of mis-tuning. RF power out and SWR are continually monitored with separate meters. Two rugged output transistors deliver 50 watts to the antenna, and are virtually immune to shorted, open or high SWR loads. The extremely light weight and small size make portable and mobile operation a rare pleasure. Yes, the time is now for Amateur Radio to reestablish itself as a leader in the use of new technologies. Your Model 405 Linear is a step in this direction. It should provide a life-time of top performance.

AUX 12 V.D.C.

Twelve volts DC is available to power accessories. This output is not switched from the front panel power switch, nor is it fused.

Fuse

A 10 ampere fast blow fuse is supplied with the unit. Replace only with an identical fuse. Do not use slo-blo fuses.

Input (Exciter)

Connect the linear input to a suitable transmitter or transceiver, such as the TEN-TEC Argonaut, capable of a minimum of one watt output. If an exciter capable of more than 3 watts output is used, an attenuator to limit the input power to this amount is recommended. Coaxial cable such as RG 174 u or RG 58 u should be used. Connect the shield to the shells of the plugs and the center conductor to the pins.

OPERATION

SSB

- 1) Select the desired band.
- 2) Turn on the power.
- 3) Advance the exciter drive until voice peaks reach between 25 and 50 watts on the RF power meter. (Note: A single tone or whistle will register 50 watts output when properly adjusted. Average voice will be somewhat less than 50 watts.)

CW

- 1) Select the desired band.
- 2) Turn on the power.
- 3) Advance the exciter drive to 50 watts output in key-down position.

T/R Delay

The internal RF actuated relay circuit will operate with approximately $\frac{1}{4}$ watt into the linear. When activated, the transmitting antenna is connected to the linear output and the transceiver is connected to the linear input. When the signal is removed, the operation is reversed and the transceiver is connected to the antenna. If the transceiver is to be used without the linear, simply turn off the power switch. This will feed the transceiver directly through to the antenna.

The T/R DELAY control may be set from almost instant changeover to a delay of several seconds before it drops out. The initial turn on will be nearly instant regardless of the amount of delay. In the minimum position, the delay is due only to the mechanical properties of the relay. It is possible to use the minimum setting for complete break-in on CW. The keying characteristics will, however, be very sharp and the characters will be shortened approximately 10% due to the relay inertia. It is recommended that a small delay be used to preserve the keying characteristics of the exciter.

GENERAL

Reverse Voltage Protection

A shunt power diode is connected across the main 12 volt line after the fuse. If the polarity is inadvertently reversed, this diode will blow the fuse and protect the transistors from failure.

Meters

RF WATTS will register the power delivered to the load. This meter is adjusted at the factory for an output of 50 watts into a 50 ohm dummy load. The small printed circuit potentiometer located on the relay board controls the reading. Loads other than 50 ohms will result in a slight inaccuracy in the calibration.

SWR - The same circuit that is used for the RF watts indication is used for the SWR meter. The SWR is calibrated with a fixed resistor and referenced to a reading of 50 watts output with a 50 ohm load. Adjustment of the SWR circuit may be checked by attaching a 50 ohm non-inductive load and adjusting the trimmer capacitor located on the relay board for a null on the meter.

Pilot Lamps

The pilot lamps behind each meter are connected directly to the +12 VDC buss. If the supply voltage is not absolutely constant under varying load, these lights will slightly change in brilliance. Use only #1813 bulbs or equivalents for replacement.

RF Drive

The RF drive to the Linear should not exceed that amount of drive which produces 50 watts output. Overdrive will produce excessive current in the output transistors, increase heat dissipation and greatly increase harmonic output.

Bandswitch

Be certain to place the bandswitch in the proper position for the frequency of operation. If the operating frequency is below the band selected, the harmonics will not be attenuated properly. If the frequency is above the band selected, all of the output will be reflected back into the output transistors and will cause overheating. There will be no indication of output power on the RF WATTS meter if the operating frequency is above the band selected.

OPERATION

Power Source

The Model 405 is designed for a nominal 12 VDC power source. It will operate satisfactorily from a 12 volt automobile battery or AC power supply such as the TEN-TEC Model 250. The supply should be well filtered and regulated to 15% with an 8 ampere load. Maximum voltage should be kept under 16 VDC. Connect the positive lead to Pin 3 and the negative lead to Pin 1 of the Jones plug.

Antenna

Any matched antenna presenting 50-75 ohms will work satisfactorily. Random length antennas or open wire feed systems will require a matching network. Any of the popular mobile antennas will operate without any special matching. The Model 405 is designed for an unbalanced feed system. The coax shield should be connected to the shell and the center conductor to the pin of the PL239 connector.

THEORY OF OPERATION

The Model 405 Linear Amplifier utilizes the latest transistor technology and broadband ferrite transformers to produce 50 watts to the antenna. The basic design is the utmost in simplicity. The amplifier is push-pull and has one transformer to match the transistor input to 50 ohms and one transformer to match the output to 50 ohms.

The amplifier will operate over a frequency range of 3.5 to 30.0 MHz without any tuning or adjustment. The output does however, contain harmonics of the fundamental frequency. The push-pull design reduces the even harmonics to better than 40dB. The odd harmonics must be removed by a simple low pass filter. In the Model 405, four low pass filters are used to cover the range of 3.5 to 30.0 MHz.

The highest frequency filter covers both the 15 and 10 meter Amateur bands. The cutoff frequency is 34 MHz and this filter is in the circuit at all times. Other filters are selected by the front panel switch for 80, 40 and 20 meters. The low pass filters will allow any frequency up to the cutoff point to be passed without attenuation.

TABLE 1 shows the relationship between the bands and the upper frequency limits.

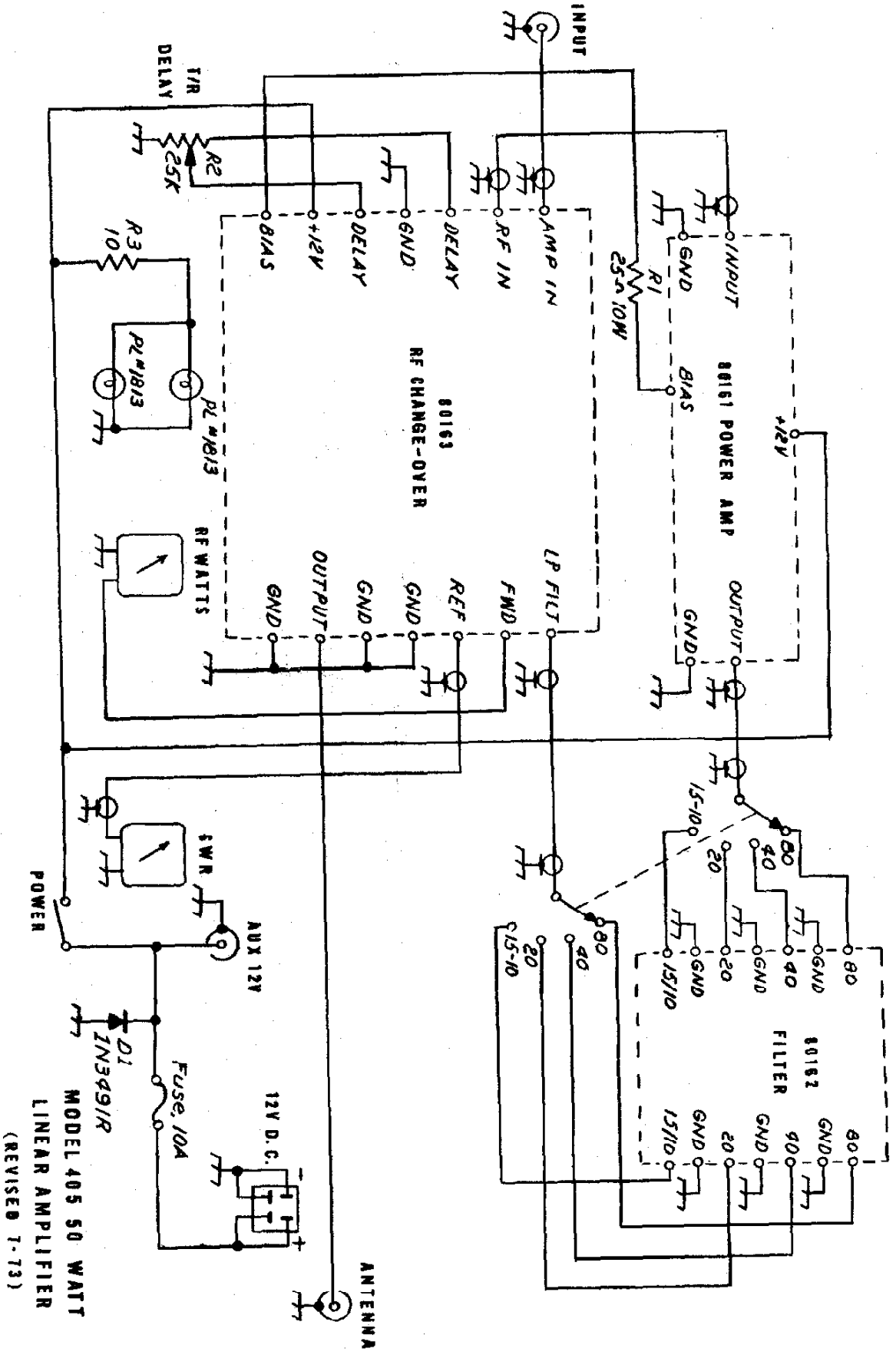
<u>BAND</u>	<u>UPPER LIMIT</u>
80	4.5 MHz
40	8.3 MHz
20	17 MHz
15-10	34 MHz

TABLE 1

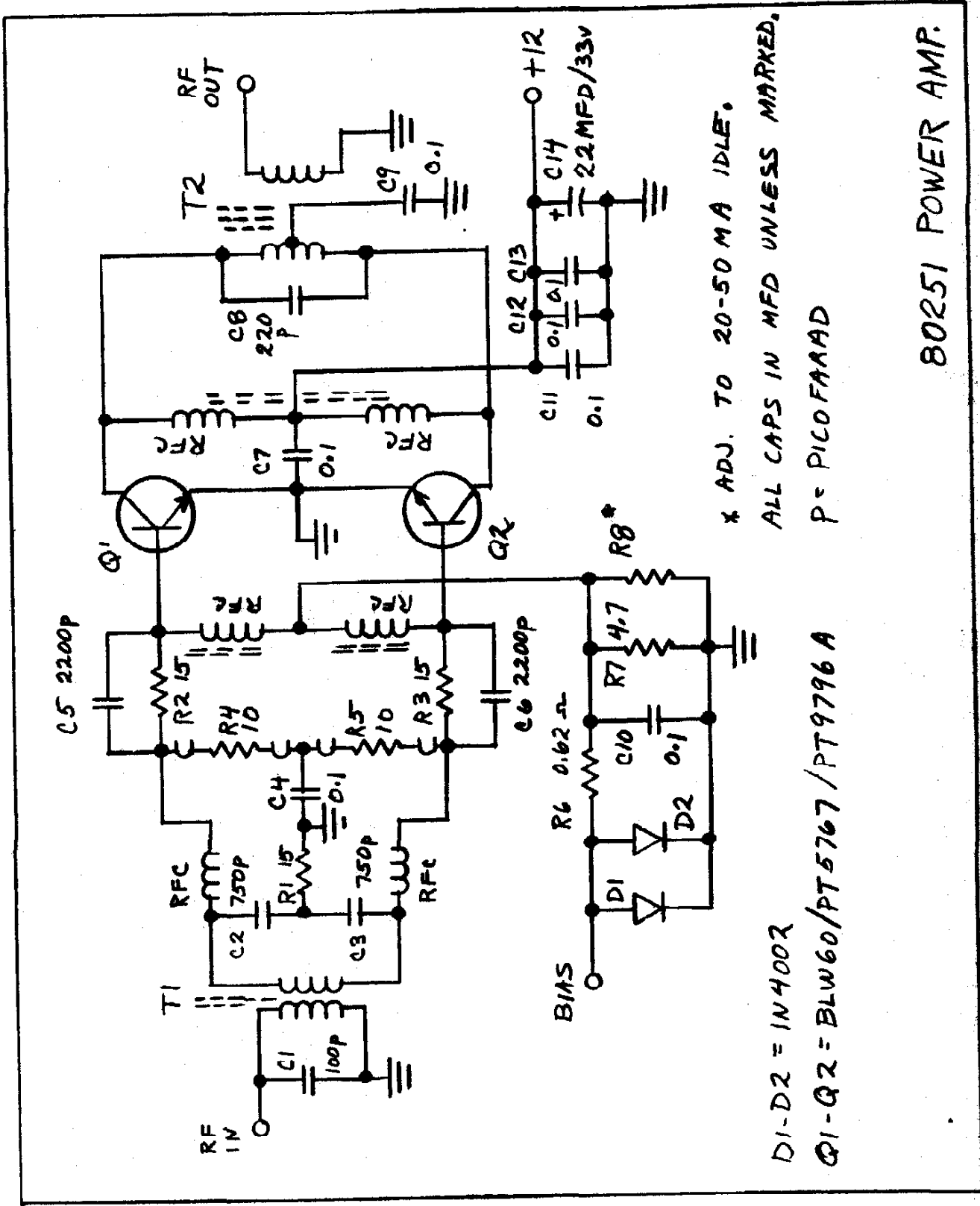
A two pole relay system, actuated by the exciter RF input, is included to switch the antenna from the transceiver input to the linear output, and to switch the transceiver output from the antenna to the linear input. An adjustable release time is provided for VOX operation or semi break-in for CW.

SPECIFICATIONS

RF Power Output: 50 Watts
D.C. Power Input: 100 Watts
Power Required: 12-14 VDC @ 8A
Output Impedance: 50-75 Ohms-unbalanced
Drive Required: 1 Watt
Input Impedance: Nominally 50 Ohms
Frequency Coverage: 80 through 10 meters
Distortion Products: Better than -30dB
Harmonic Attenuation: Greater than -50dB
Cabinet Dimensions: H.W.D. 4½" x 7" x 7½"
Construction: Case, Aluminum; Side-panels, Cycloc
Net Weight: 2½ lbs.



**MODEL 405 50 WATT
 LINEAR AMPLIFIER
 (REVISED 7-73)**



D1-D2 = 1N4002

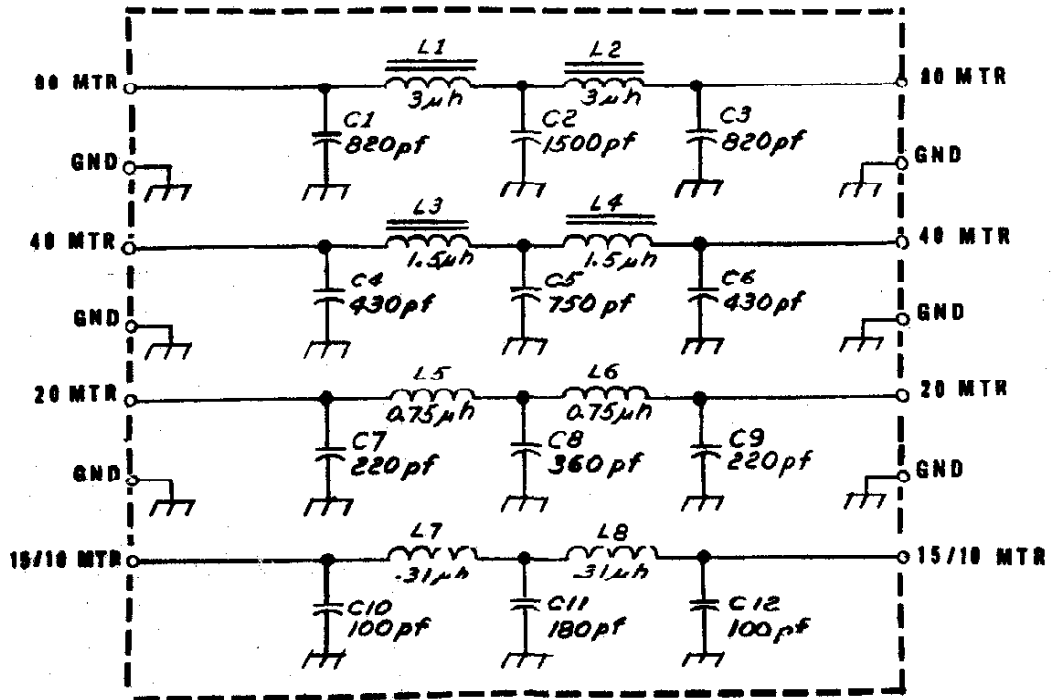
Q1-Q2 = 80251

* ADJ. TO 20-50 MA IDLE.

ALL CAPS IN MFD UNLESS MARKED.

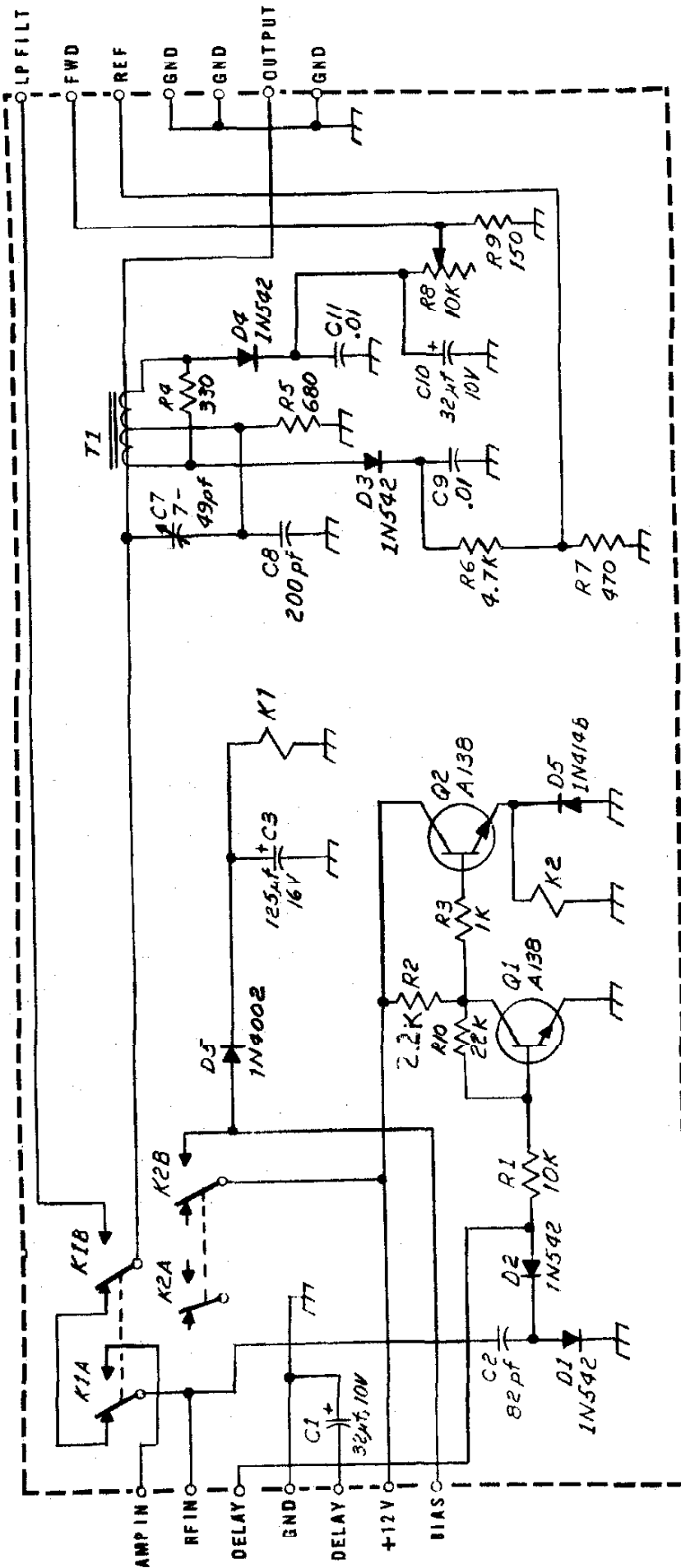
P = PICOFARAD

80251 POWER AMP.



*Pins viewed from top of board.
Air core coils toward the front.*

80162 FILTER S/A
(REVISED 7-73)



Pins viewed from top of board

80163 RF CHANGE-OVER S/A
(REVISED 7-73)