
PA-100 POWER AMPLIFIER

OPERATING MANUAL



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MICRO CONTROL SPECIALTIES

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1. GENERAL

The PA-100 RF Power Amplifier is designed for use in repeater and base station applications which demand dependable performance with continuous operation. Generous heat sinking plus fan cooling enable the PA-100 to deliver 100 watts output with a 100% duty cycle. The amplifier is arranged for convenient rack mounting and connection to any repeater or base station transitter.

2. UNPACKING

Remove the PA-100 from its shipping carton and carefully examine the unit for any sign of damage. Your unit has been insured for full value. In the event of damage save all packing material and notify the transportation carrier immediately. Do not attempt to repair any damage without written permission of the carrier.

3. SPECIFICATIONS

Three models of the PA-100 are available to serve the popular repeater frequencies:

Model	Frequency
PA-100-144	144-174 MHz
PA-100-220	220-250 MHz
PA-100-450	420-470 MHz

The following specifications apply to all three models.

AC Power Requirements -- 105 to 125 volts, 50-60 Hz, 200 watts

Auxiliary DC Power Input -- 13.6 volts (nominal), 5 Amperes

RF Drive Power -- 10 to 15 watts

RF Power Output (AC Operation):

Drive Power	Ouptut
5 watts	40 watts
10 watts	75 watts
15 watts	100 watts*1?

Duty Cycle -- 100% (Continuous) at full output

RF Power Output (DC Operation) -- approx. 40 watts

Ambient Temperature -- -20 to + 50 degrees Celsius

Cooling -- 168 square-inch finned heat sink area plus 20 CFM axial fan

Metering -- DC current, 0 to 10 Ampere scale

Size -- 17" W x 5 1/4" H x 12 1/2" D. Flanges extend overall width to 19" for mounting in standard equipment rack.

Weight -- 22 pounds

4. INITIAL OPERATION

Whenever an operating frequency is specified by the customer at the time of purchase the PA-100 is factory tuned to the specified frequency prior to shipment and no tuning should be required before placing the amplifier into service. The step-by-step procedure given below applies to amplifiers which have been factory tuned. Section xx of this manual describes the procedure for alignment where the operating frequency was unspecified at the time of purchase.

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1. The PA-100 amplifier is arranged for mounting in a standard 19-inch rack. Select a location for the amplifier which will avoid temperature extremes and will permit air circulation. When mounting the PA-100 in a rack with other equipment position the PA-100 so that it is not subject to excessive heat from other equipment and dress all cabling away from the axial fan intake.

2. After mounting the amplifier, observe that the front panel meter pointer indicates zero amperes. If the meter indication is not zero use a fine bladed screwdriver to adjust the mechanical zero set on the meter cover to obtain a reading of zero.

3. Connect the PA-100 power cable to a source of 120 volt 50-60 Hz AC power. Observe that the front panel pilot lamp lights indicating that AC power is applied to the unit. Also observe that the axial fan is operating. The PA-100 uses a 3-wire power cable to ground the amplifier chassis; therefore, connection should be made only to a compatible 3-wire electrical service.

If there is any question about the integrity of the ground provided by the electrical service then a separate ground strap should be connected from the PA-100 chassis to a good electrical ground.

4. Connect a 50 Ohm resistive dummy load or antenna to the RF OUT coaxial connector on the rear of the PA-100 chassis. If a duplexer is used as part of the antenna system the duplexer should be pretuned before connecting it to the PA-100 to insure that the load impedance presented to the amplifier is correct. For proper operation the load connected to the amplifier should have an SWR below 1.3:1.

5. Connect a 10 to 15 watt exciter to the RF IN coaxial jack on the rear of the PA-100 chassis. The exciter should be pretuned to operate into a 50 Ohm load.

6. Operate the exciter to apply drive power to the amplifier and observe that the front panel meter indicates a current of between 5 and 8 Amperes. If the current exceeds 8 Amperes the drive power is excessive and must be reduced or the amplifier will be damaged.

7. If the current is within the 5 to 8 Ampere range the amplifier is ready for use. It is suggested that whenever possible an in-line power meter (Bird model 43, or equivalent) be used to verify proper performance. This can be done by alternately connecting the power meter in series with the amplifier input and output and measuring forward and reflected power. Output power should be 100 watts and input power should not exceed 15 watts. The SWR at both the input and output should be below 1.3:1.

5. REPEATER CONSIDERATIONS

In repeater installations it is essential that the receiver be isolated from transmitter output energy to prevent desensing of the repeater receiver. This isolation is normally provided by carefully shielding the receiver, by using high quality coaxial cables, and by using a duplexer. Because the addition of a PA-100, or any other amplifier, to a repeater increases the effective transmitter output power it also increases the need for isolation.

In a well engineered repeater installation coaxial cables should be double shielded or have a solid outer conductor, and the duplexer

The amount of additional filtering which will be needed when an amplifier is added will depend greatly upon the characteristics of the repeater receiver. In some cases it may be necessary to use additional duplexer cavities. In many cases a high-Q tuned filter, such as the Micro Control Specialties FL-1 six section prefilter, can be used as a low cost alternative to additional cavities. The FL-1 prefilter is standard in Micro Control Specialties Mark 3CR and LR-1 repeaters so additional receiver filtering should not be required in these repeaters when an amplifier is used.

6. FUSING

Three front panel mounted fuses isolate Ac power input (LINE), DC power input (BAT), and RF output transistor current (PA). All three are type 3AGC fast acting glass fuses. Slow acting fuses should not be used. Fuse ratings are as follows:

PA	10 Amperes
LINE	2 Amperes
BAT	5 Amperes

7. EMERGENCY POWER

Terminals are provided on the rear of the main chassis of the PA-100 for the input of a standby, or emergency, DC power source. The standby power source may be continuously connected to the PA-100. When this is done power will be taken from the internal AC power supply under normal circumstances, and in the event of failure of the AC power source the PA-100 will automatically draw power from the DC source.

The external DC supply should be a nominal 13.6 volts and must be capable of supplying 7 Amperes. A lead-acid storage battery is a suitable source. The positive input from the DC supply should be connected to the amplifier red binding post terminal and the negative (ground) input from the supply should be connected to the amplifier black binding post terminal. Wiring from the power source to the amplifier should be kept as short as possible and should be heavy enough to keep the voltage drop in the wiring to one-half volt or less. The front panel pilot lamp will not light when operating from a DC power source.*pn

The internal AC power supply of the PA-100 provides 24 volts during normal operation; therefore, when operating from a 13.6 volt DC power source the available voltage will be lower and the resultant amplifier power output will be correspondingly reduced. This power reduction is necessary to maintain continuous duty performance without the fan cooling.

8. TROUBLE ISOLATION

The following guide may be helpful in determining the cause of improper operation.

No Pilot Lamp Indication, Fan Not Operating

Assure that AC power is being applied to the unit. Replace the front panel LINE fuse.

No Power Output, No Meter Current Indication

Check the PA fuse. Measure the voltage at the standoff on the side of the RF enclosure. Normal voltage should be 26 to 30 volts. If no voltage is present the power supply bridge rectifier should be checked. If normal voltage is present the RF power transistor(s) should be checked or replaced.

Low Power Output

Check the voltage at the standoff on the side of the RF enclosure. Normal voltage is 26 to 30 volts. Low voltage indicates a faulty power supply bridge rectifier or filter capacitor.

Occasional PA fuse failure

Observe DC meter current. If current is greater than 8 Amperes reduce drive power. *

9. ALIGNMENT

Initial alignment is not required on amplifiers which have been factory tuned. The alignment procedure given here should be used whenever the amplifier operating frequency is changed by more than 1.5 MHz. Review all steps in the procedure before attempting to tune the amplifier.

1. To gain access to the adjustments remove the six screws holding the RF chassis top cover and remove the cover.

2. Connect a 50 Ohm resistive dummy load to the amplifier output.

3. Connect an inline power meter (Bird model 43, or equivalent) between the exciter and the amplifier input. The exciter should be pretuned into a 50 Ohm resistive load at the operating frequency and should be capable of delivering 10 to 15 watts of drive to the amplifier. adjust bias pot r1 for a voltage of 2-3 volts at the junction of r1 and r2.

4. Using a non-metallic tool, tune capacitors C1 and C2 for minimum reflected power. Some interaction exists between the tuning of the two capacitors so repeat the adjustments as necessary until reflected power is minimized. While making these adjustments observe the front panel current meter. If the current exceeds 8 Amperes the drive power is excessive and must be reduced or the amplifier will be damaged.

5. Connect the power meter between the amplifier output and dummy load.

6. Alternately tune C3 and C4 to obtain maximum output and best efficiency. Tuning to achieve both of these conditions simultaneously may take some practice. At low output levels the tuning of C3 and C4 will cause both power output and DC current to increase proportionately. As the power output reaches 100 watts (slightly less for 220 mhz) further tuning will increase the DC current without a corresponding increase in output power. When properly tuned to 100 watts output the DC current should be in the range 5 to 8 Amperes. In no case should the DC current exceed 8 Amperes.

7. This completes the tuning procedure and an antenna may now be connected to the amplifier output. For proper operation the antenna SWR should be below 1.3:1. If the antenna impedance is correct it will not be necessary to retune the amplifier into the antenna.*

In repeater operation when a duplexer is used the duplexer should be tuned to the operating frequency before connecting it to the amplifier.

10. SERVICING

10.1 TRANSISTOR REPLACEMENT (PA-100-144)

The PA-100-144 amplifier uses one mrf 174 transistor . The procedure given below should be followed when replacing these transistors. Should a transistor fail during the warranty period the entire amplifier should be returned to the factory for repair. Replacement of the transistors by the customer will invalidate the warranty.

1. Remove the exciter and antenna coaxial connections and unplug the amplifier from its AC power source. If a DC power source is being used disconnect these connections also.
2. Remove the PA fuse from the front panel fuse holder.
3. Remove the nuts from the two transistor studs which project from the midsection of the finned heat sink on the underside of the amplifier.
4. Remove the six screws holding the RF chassis top cover and remove the cover.
5. Note the placement of all components which are attached to the transistor tabs and then unsolder these components.
6. Unsolder the four tabs of each transistor and gently lift the transistors to remove them from the circuit.
7. Clean any excess solder from the circuit board areas around the transistor locations.
8. Apply a THIN layer of thermal compound to the surfaces where the transistors mate with the heat sink.*

8. Apply a THIN layer of thermal compound to the surfaces where the transistors mate with the heat sink.
9. Insert the new transistors, properly orient the tabs to align with the correct circuit board pads, and replace the stud nuts. The stud nuts should be tightened to 6 in-lb of torque. Do not overtighten.
10. Replace the components which were removed in step 5.
11. Replace the front panel PA fuse.

The exciter, antenna, and power may now be reconnected to the amplifier, and the amplifier should be tuned as described in section 9 of this manual.

10.3 RECTIFIER REPLACEMENT

Access to the bridge rectifier and power supply components under the main chassis may be gained by removing the front panel. Before servicing the power supply disconnect all wiring to the amplifier and discharge any residual power supply voltage by temporarily connecting a bleeder resistor from the standoff at the side of the RF enclosure to chassis ground. The front panel can be detached by removing the four screws (two at each end of the panel) opposite the handles. Remove the panel carefully to avoid straining the front panel wiring.*o

LIMITED WARRANTY

Micro Control Specialties warrants to the original purchaser that this product shall be free of defects in material and workmanship for ninety days from the original date of purchase.

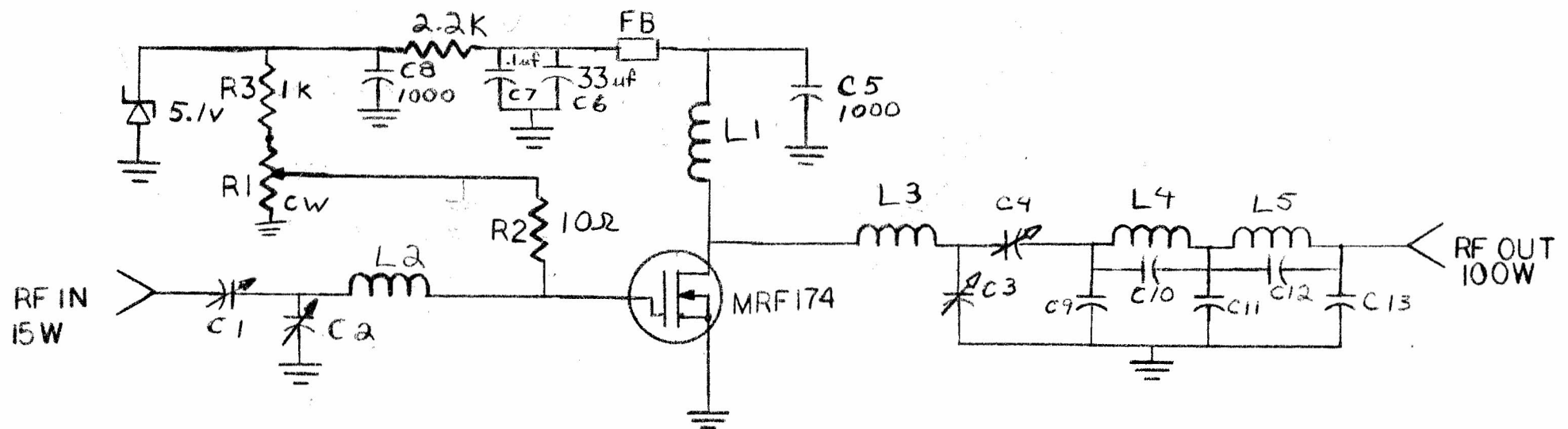
During the warranty period Micro Control Specialties will provide both parts and labor necessary to correct said defects provided the unit is delivered by the original owner intact to us for our examination with all transportation charges prepaid and provided that our examination discloses that the unit is defective.

This warranty does not apply to any unit which has been subjected to misuse, neglect, accident, improper installation, incorrect maintenance, or use in violation of instructions furnished by us, nor to any unit where the serial number has been removed, defaced, or changed, nor to any unit which has been modified or used with accessories not recommended by us.

The foregoing constitutes Micro Control Specialties entire obligation with respect to this product and no employee or officer of Micro Control Specialties or Kendecom Inc. or their dealers or distributors shall have authority to extend this warranty. The buyer agrees that no other remedy for incidental or consequential damages, injury to person or property, or any other loss shall be available to him (her). Some states do not allow limitations on how long an implied warranty lasts or on consequential damages so the above limitations may not apply to you.

Micro Control Specialties reserves the right to make changes and improvements to its products without obligation to install such changes in its previously sold products.

	135-174 MHz	220-250 MHz
C9	10 PF	6.8 PF
C10	10 PF	6.8 PF
C11	15 PF	10 PF
C12	10 PF	6.8 PF
C13	10 PF	6.8 PF



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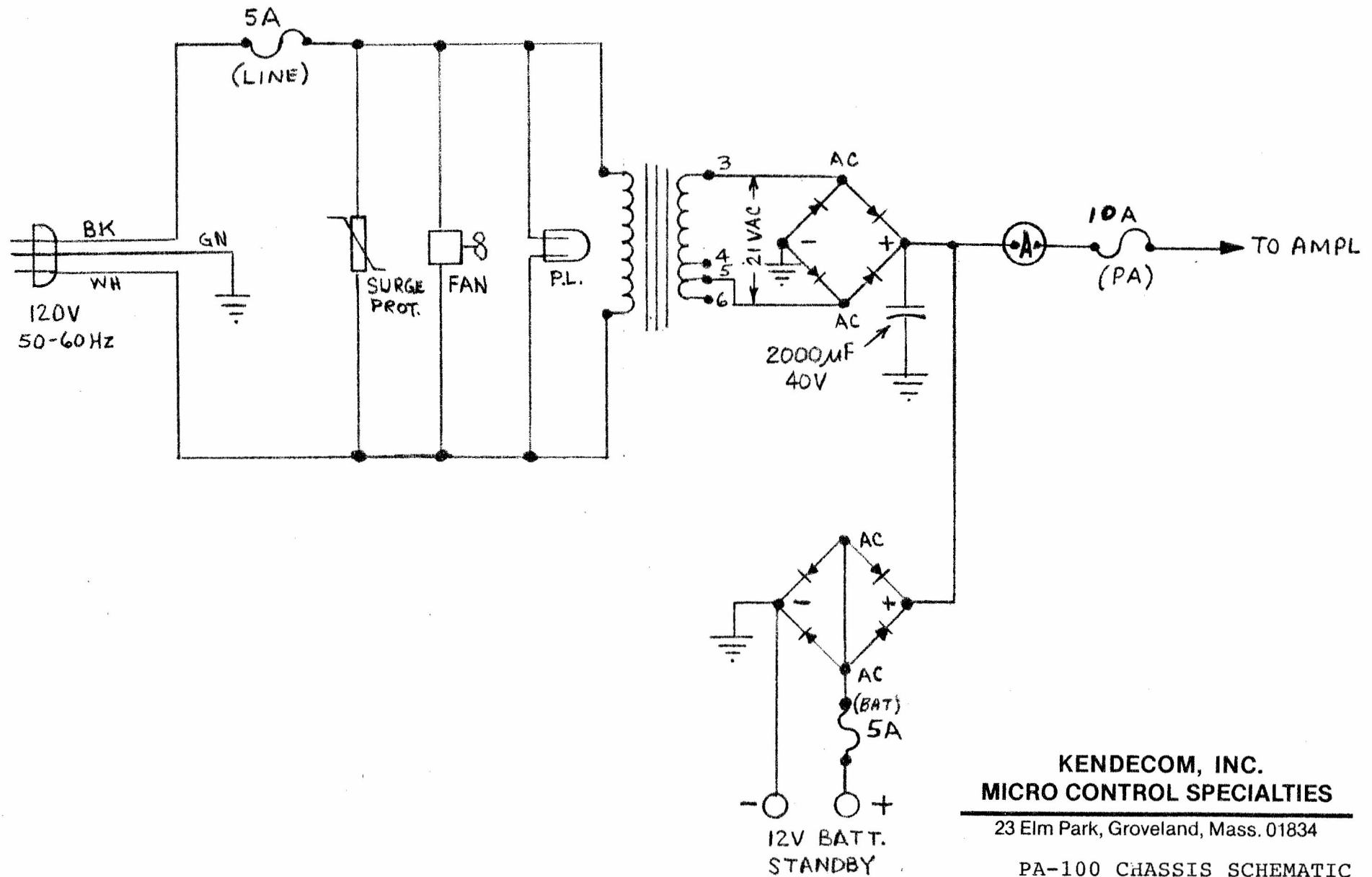
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