

ASSEMBLY INSTRUCTIONS

Controlaire "5" Relayless Super-Regen Tone Receiver

ALL TRANSISTOR 3 VOLT OPERATION

INTRODUCTION:

Again satisfaction on the flying field has prompted the production of another Controlaire receiver in kit form. This time it is the super-regen "5", a single channel relayless type receiver that has proven its worth by the testimonial of hundred of satisfied users. This combined with our own experience of factory assembly of the original units makes the receiver a natural for home construction. We now present the "5" in kit form. Assembly has been engineered to provide all needed information, however, one word of caution. The receiver is small and involves close soldering to a small circuit board. Do not rush the assembly but instead take your time and use common sense on the delicate work. Do so and your "5" will reward you with exacting service.

The instructions are presented in two separate manuals and a small pamphlet titled "Kit Assembly Tips". One manual is the standard "Operating Instructions" as supplied with factory assembled units and the other manual is the "Assembly Instructions" which you are now reading. It is of primary importance that before any assembly work is started that you initially read all three of these items to gain a preliminary understanding of all information involved.

As you study the manual you will notice that assembly is outlined by the step by step procedure and large pictorials which identify all parts and their exact placement to the circuit board. To understand the assembly procedure take notice of the main pictorial, Fig. 2. This is the pictorial about which the assembly text is centered. Notice that this is a top view of the receiver chassis and that all components are assigned specific hole numbers. The shaded area represents the etched copper circuit pattern and although on the underside of the board, the same pattern can be recognized on the receiver board by holding it up to a light source where the pattern will show through. By using the light on the actual receiver board specific holes can be identified by association with the pattern or individual copper lands as

shown in the pictorial.

Assembly of parts to the circuit board is quite conventional. Resistors and most other parts are mounted flush or upright as directed, however, if any specific positioning is required it will be mentioned in the step in which it is installed. As each part is installed bend its leads over slightly to hold it in position and then, after soldering, clip off the excess lead about 1/16", from the circuit copper.

Preliminary Notes

After you have studied the pictorials and initially read all of the instructions, unpack your kit carefully and check each part as identified on the check list. By doing this you will become familiar with parts appearance that will help you during assembly. After the check has been made, group the parts, resistors, in one pile, condensers in another, until parts are generally separated for easy identification.

Occasionally, we may have to substitute a part to allow an even production of kits when a specific part is not available. This is done to prevent a delay in filling your order and in no way will the substitution effect normal operation. If this has been done in your kit a note, "Parts Substitution", will be included for your identification.

The use of the "Ungar Soldering Pencil" equipped with 37½ watt heat element and small chisel pointed tip is considered mandatory in the construction of this kit. Similar irons may be used but none larger and of higher heat. The work on the etched circuit board is somewhat delicate so let a word to the wise be sufficient. If you do not have the small iron it should be purchased at your local radio or hardware store.

Common tools required are a small pair of dykes (wire snippers), long nose pliers, screw driver, penknife, file, pad of steel wool. Other driver, penknife, file, pad of steel wool.

Start construction by referring to the assembly steps. During each step refer to the pictorials for necessary parts location and solder the lead of each part as it is installed. Place a check mark in the space provided after completion of each step. Good luck and may your experience be a pleasant one.

ASSEMBLY INSTRUCTIONS

As parts are installed to the circuit board, bend over the leads only enough to hold the parts in place, then solder, unless otherwise noted in text. Do not flush bend lead to the circuit copper as, if removal is necessary, it cannot be done without damage to the part. After soldering, clip off excess leads about 1/16" from circuit copper.

- () 1. Assembly is started by first cleaning the circuit board copper so soldering may be done easily and with the least amount of heat. To do this involves a certain procedure as the board is supplied to you with the tuning coil pre-installed. The best way is to lay the board flat against your work bench with the coil overhanging the edge. Hold board firm then scrub vigorously with steel wool until copper is bright and shiny. After cleaning, blow away any wool residue that may have entered coil form or remaining on circuit board.
- () 2. Sometimes in the factory operation of cementing the coil to the board epoxy cement clogs some of the circuit board holes near the coil. Inspect your board and if any are clogged use a straight pin to clear.
- () 3. Notice that the wire leads on the tuning coil are twisted together for a short length. This is done for shipping purposes and before the leads are inserted into circuit board they must be untwisted and any excess kinks removed. Be careful not to unwind the coil. Insert bottom lead into hole 61 and top lead into hole 60. The coil wire is of a type where the heat of the soldering operation removes the insulation. Soldering will be somewhat stubborn but as the insulation melts away you will note the proper flow of solder on both the wire and circuit copper. Be sure the wires are properly soldered.
- () 4. Inspect the interstage transformers and note that one side is marked with either a RED dot or the letter "S". This means that the leads extending from this side of the transformer are of the secondary winding. Insert one transformer with secondary leads going into holes 50 and 51 and the other two leads into holes 55 and 54. Push transformer flush to circuit board with frame tabs going into holes 52 and 53. Bend tabs to secure transformer but do not solder to circuit copper.
- () 5. Using same procedure to identify secondary leads, insert the remaining transformer with secondary leads going into holes 41 and 42, and other leads into holes 43 and 44. Tabs go into holes 40 and 45 are bent over and again not soldered.
- () 6. Three identical resistors, 1 K ohm (brown, black, red) are installed in this step. One in holes 12 and 15, another in holes 13 and 16 and a third in holes 7 and 8.
- () 7. Install a 100 ohm resistor (brown, black, brown) in holes 32 and 33.
- () 8. Install a 1.5K ohm resistor (brown, green, red) in holes 48 and 49.
- () 9. Install a 15K ohm resistor (brown, green, orange) in holes 46 and 47.
- () 10. Install a 470 ohm resistor (yellow, violet, brown) in holes 2 and 3.
- () 11. Install a 4.7 ohm resistor (yellow, violet, red) in holes 11 and 14.
- () 12. Install the RFC choke in holes 17 and 18. To identify, the RFC choke is a small resistor-like component that is wound with fine wire.
- () 13. Install a 4 MMFD disc condenser in holes 62 and 63.
- () 14. Install a 20 MMFD disc condenser in holes 58 and 59.
- () 15. Install a .01 MF disc condenser in holes 37 and 38.
- () 16. Install a 62 MMFD disc condenser in holes 30 and 31.
- () 17. Install a .02 MF disc condenser in holes 56 and 57.

() 18. Two identical .01 MF disc condensers are installed in this step. One in holes 28 and 29, another in holes 9 and 10.

() 19. Notice the polarity markings on the body of the 15 MF electrolytic condenser. This identifies polarity of leads. Install this condenser with plus lead going into hole 23 and minus lead into hole 24.

() 20. Install the 15 MF electrolytic condenser with plus lead going into hole 20 and minus lead in hole 19.

In the following steps the transistors are installed. To identify the leads, refer to Fig. 3. All transistors should be installed with bottom surface spaced about 3/16" from surface of circuit board. Do not flush mount.

() 21. Identify the leads of the 155-T1 transistor. Install it with the collector going into hole 34, base in hole 35, and emitter in hole 36.

() 22. Install a T-2515 transistor with collector going into hole 25, base in hole 26 and emitter in hole 27.

() 23. Install a T-2515 transistor with collector going into hole 5, base in hole 4 and emitter in hole 6.

() 24. Install a 2N-229 transistor with collector going into hole 22, base in hole 39 and emitter in hole 21.

() 25. Strip 1/8" insulation from one end of a 10" length of white, black and red wire. From the underside, or copper side of the board, solder the white wire to copper land identified by hole 5. Solder the red wire to land at hole 6. Black wire to land at hole 19. After all three wires have been soldered, route them through hole 1 which acts as a strain relief.

() 26. Strip 1/8" insulation from one end of a 30" length of wire (antenna). insert this end of wire through hole 64 so both wire and insulation extend through hole for about 1/4". Bend down bared end of wire and solder it to copper land containing hole 64.

() 27. Screw tuning slug into tuning coil until it is about flush with top of coil form. If slug appears very tight rotate it back and forth to gradually loosen its threads.

At this point assembly of the receiver is complete. To check it out for operation, refer to the "Operating Instructions".

CONTROLAIRE "5"

PARTS CHECK AND PRICE LIST

Wiring

[] 3 ea. 10" length, No. 26 Stranded....	.10
Red, Black, White	
[] 1 ea. 30" length No. 26 Stranded	
(antenna) .....	.05

Resistors

[] 1 ea. 100 ohm (Brown Black, Brown)	.12
[] 1 ea. 470 ohm (Yellow, Violet, Brown)	.12
[] 3 ea. 1K ohm (Brown, Black, Red)	.12
[] 1 ea. 4.7K ohm (Yellow, Violet, Red)	.12
[] 1 ea. 1.5K ohm (Brown, Green, Red)	.12
[] 1 ea. 15K ohm (Brown, Green,	
Orange) .....	.12

Capacitors

[] 1 ea. 4 MMFD Disc .....	.25
[] 1 ea. 20 MMFD Disc .....	.25
[] 1 ea. 62 MMFD Disc .....	.25
[] 3 ea. .01 MF Disc .....	.25
[] 1 ea. .02 MF Disc .....	.25
[] 2 ea. 15 MF Electrolytic .....	.65

Transistors

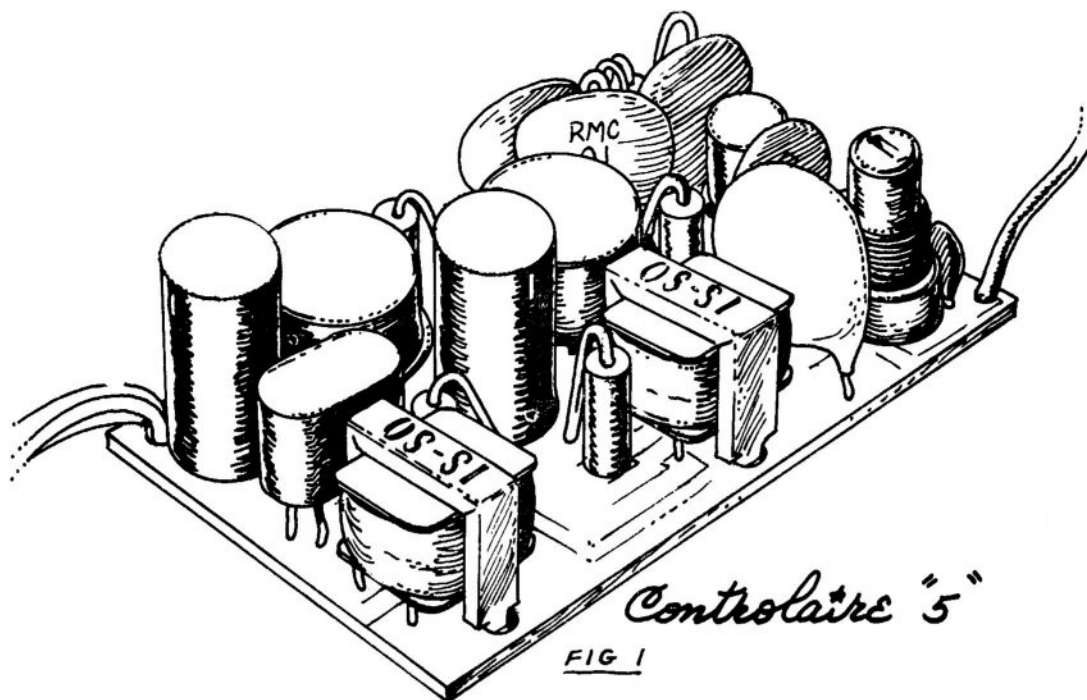
[] 1 ea. 155-T1 RF Detector	1.95
[] 2 ea. T-2515 Audio	1.50
[] 1 ea. 2N-229 Audio .....	.90

Transformers, Coils, Chokes

[] 1 ea. 12 Micro Henry RF choke.....	.35
[] 1 ea. RF Coil Assembly and	
Tuning Slug .....	.90
[] 2 ea. Interstage, 10K to 1K	
Transformers	1.20

Misc. Parts

[] 1 ea. Etched Circuit Board	1.95
[] 1 ea. Kit Assembly Tips .....	.10
[] 1 ea. Assembly Instructions .....	.25
[] 1 ea. Operating Instructions .....	.15
[] 1 ea. 24" length 60/40 Solder .....	.10



TROUBLE-SHOOTING TIPS

Occasionally, someone experiences trouble in the completion of his receiver. Whatever your problem, first review your assembly steps to insure proper assembly. Secondly, check all solder joints and the board for possible solder shorts between copper lands. If this reveals no mistake, the following procedure can be applied to isolate the trouble to a particular stage.

The receiver involves four stages. One, a super-regen detector, followed by three stages of audio amplification. When operating properly at idle, the detector 155-T₁ generates a noise signal commonly referred to as super-regen "hiss". The hiss is then fed by transformer coupling to the first audio stage (T-2515) where it is amplified. From here by means of transformer coupling to the second audio (2N-299) where it again is amplified but changed in the output of this stage from an AC noise signal to a DC current level. This is done by the 15MF filter capacitor. From here the DC current level is direct coupled to the fourth stage (T-2515) where it is amplified as a DC level only to actuate the escapement.

The idle hiss as described above and directed through the stages, is of a very low amplitude. As a simple means of isolating trouble a common high impedance earphone can be used to listen to the signal. To use the earphone as well as other equipment you might have, oscilloscope, etc., connect one lead to the negative battery connection and with a .01 to .05 MF condenser in series with the other lead touch it to the following points. First, to copper land containing hole 60. See Fig. 4 circuit diagram and note this is output point for the 155-T₁ detector stage. A very slight hiss should be heard. If not, it indicates detector is inoperative. If OK, next touch probe lead to land hole position 25. This is output of first audio (T-2515) and hiss should be substantially louder. Next to land hole position 22. This is output of second audio (2N-229). This time the noise will be weaker but still audible due to filtering of the 15 MF capacitor. As to hiss in last stage as touched to land hole position 5, there is barely an audible sound due to filter action of this stage. Actually, if any problem was involved in last stage it could be only a defective transistor or open or shorted escapement as these are the only two components involved. The point in the earphone test was tracing the hiss noise from its origin, the detector through the stages to determine proper operation of the stages. If not present at detector, stop and check components of this stage. Probable cause aside from assembly mistakes, is 155-T₁ transistor or open or shorted coils, choke or transformer. The same would apply if hiss disappeared at a succeeding stage. From this point in trouble-shooting location of an exact cause of trouble may involve use of V.T.V.M. measuring the voltage points as shown on the circuit diagram. If you have such an instrument you probably know how to use to isolate a component trouble. One last point. Sensitivity of the detector 155-T₁ is controlled by value of resistor installed in hole 13 and hole 16. To increase sensitivity, decrease value no more than 30% and vice versa.

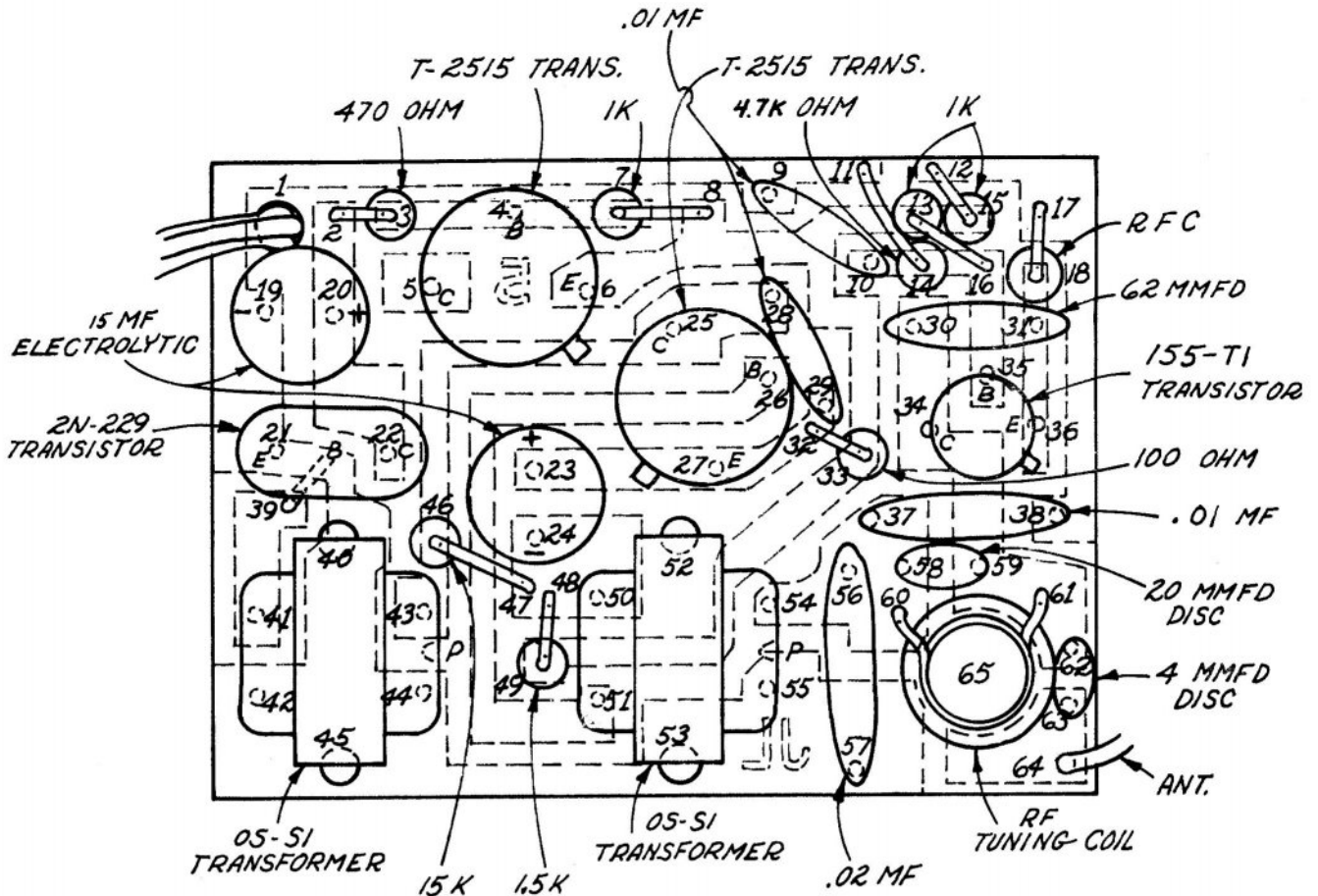
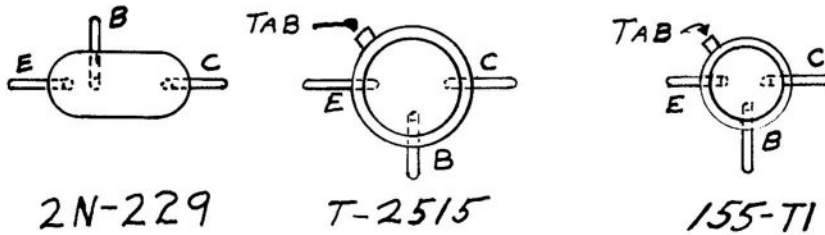


FIG 2

Controlaire "5" RELAYLESS RECEIVER

NOTICE

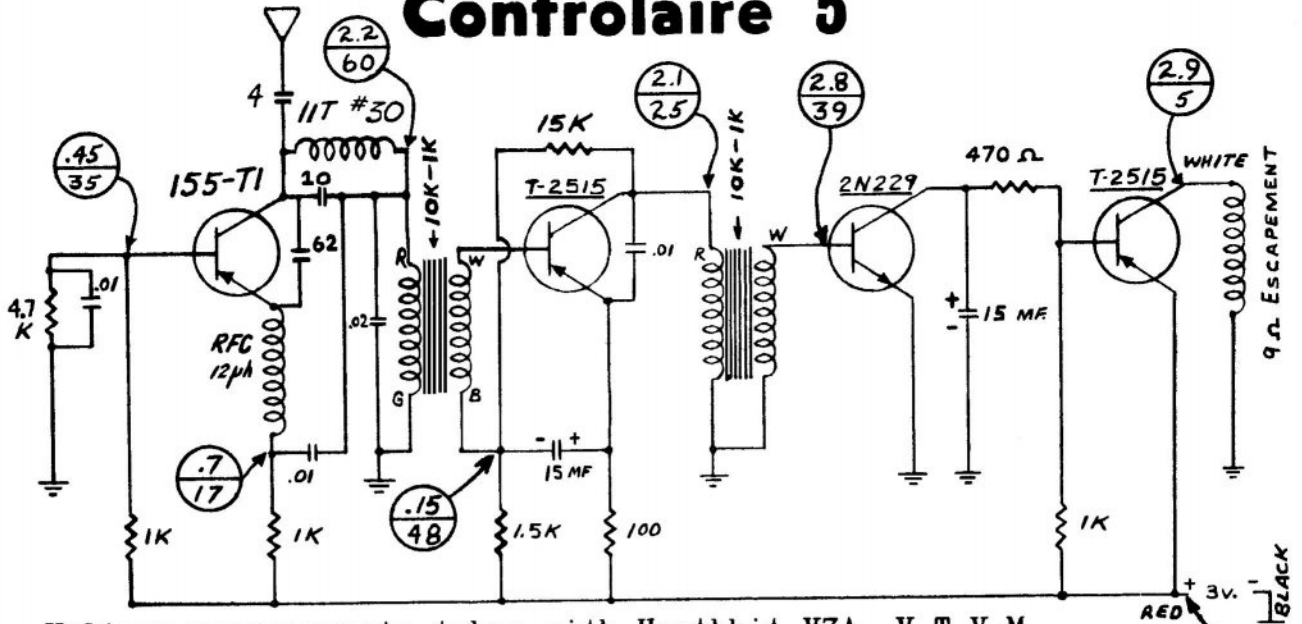
A new circuit board with rounded copper lands has been supplied with this kit. This is brought to your attention as the board does not exactly match the squared appearance of lands as shown in Fig. 2. It is the correct board for this kit and no trouble in identification of lands or holes should be encountered as layout is identical. For those who would question this minor change it is brought to your attention. This is the correct circuit board for this kit and will not change assembly or operation of the receiver.



2N-229 T-2515 155-T1
TRANSISTORS VIEWED FROM
TOP WITH LEADS EXTENDING DOWN

FIG 3

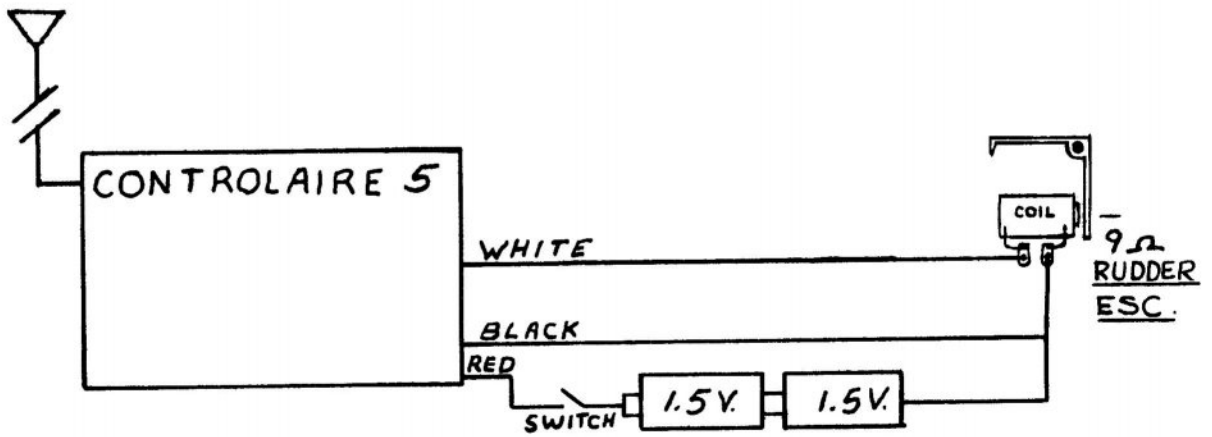
Controlaire 5



Voltage measurements taken with Heathkit V7A, V.T.V.M. 5 volt, minus DC scale. Common lead to plus 2.9 volts receiver battery. Receiver idling, no signal from transmitter. Note divided circles on diagram, top No voltage measured, lower No is circuit board hole that identifies copper land to which place DC probe. Normal measurement can vary plus or minus 20% due to component tolerances.

FIG. 4

Common Lead V.T.V.M. 2.9v



Pencells Shown - For Ni-Cad Operation Use 3.6 Volts

FIG. 5



World Engines Inc.

Controlaire Division

8206 BLUE ASH ROAD

CINCINNATI 36, OHIO

CHANGE NOTICE - CONTROLAIRE 5

Due to tolerances involved in the supply of 155 T1, detector transistor, it is necessary that the condenser installed in holes 37 and 38 of step 15, be varied in actual capacitance value to match the particular transistor that is supplied in this kit. Since the capacitance will vary we have identified this condenser by painting a red mark on the body of the condenser. Its actual size will vary from .002 mf to .01 mf. However, this one has been selected for the 155 T1 supplied in this particular kit. Do not misconstrue this notice as a possible trouble point in earlier receivers as we select condensers to match any given batch of transistors.

THIS IS A CUSTOM CONTROLAIRE SERVICE TO THE KIT BUILDERS

SUBSTITUTION NOTICE

CONTROLAIRE 5 RECEIVER KIT

1. A combination pair of (1) each 2N-508 and (1) each GC-4008 transistor may be substituted in your kit for the (2) each T-2515 transistors as called for by the instructions. If this has been done in your kit the 2N-508 installs in holes 25-26-27 as described by Step 22 and the GC-4008 installs in holes 4-5-6 as described by Step 23. Lead identification is the same as shown for the T-2515.
2. An 18 mmfd or 22 mmfd disc condenser may be substituted for the 20 mmfd disc condenser as called for by Step 14.
3. To increase the efficiency of the output transistor, install a 100 ohm resistor (Brown, Black, Brown) in holes 2 and 3 instead of the 470 ohm resistor as described in step 10. This is a design change and is not shown on the standard assembly instructions. Correct step 10, your circuit diagram, and kit parts list to show this change. No 470 ohm resistor is now used in this kit.

These substitutions will not effect operation of your completed receiver. It is done to allow an even production of kits when a specific part is not available and, therefore, make delivery to you