CONTROLAIRE

Made in U.S.A.

INSTRUCTIONS

MULTI CHANNEL SIMULTANEOUS TRANSMITTER

MODELS MTT-10A AND UTT-10A

9 VOLT OPERATION

INTRODUCTION

Transmitters, Model MTT-10A and UTT-10A, are one and the same unit except for the alignment or tailoring of their tone channels. The MTT-10A is sold only as part of a matched transmitter and receiver combination and its tone channels have been factory tailored to match the reed bank of the campanion receiver. The UTT-10A is intended for home alignment and is supplied untailored for companion use with the Controlaire kit assembled receivers. Both transmitters are fully assembled and have their RF frequency tuned, to meet requirements of the citizens radio service. Being untailored, the UTT-10A is supplied with no condensers installed on the tone section of the P.C. board.

The transmitter has a man-size wallop in reference to power output. Average radiated power is approximately 150 millawatts with a minimum specification of 100 millawatts before a transmitter is approved. This means it will equal and in most cases surpass the output of the average tube type transmitter used in the past. Efficiency is due to several factors. One, the use of specially graded Silicon, RF transistors, the employment of a series tuned center loaded antenna and, last, the use of collector modulation. Collector modulation is quite important as average power will increase during modulation and not reduce as experienced with grid modulation of older tube type units. The total power input for all stages is approximately 52 ma at 9 volts or about 470 millawatts. Of this power approximately 275 millawatts goes to the RF power amplifier which in turn supplies the antenna. A Class "C" citizens service station license is required to operate this transmitter.

Operation and maintenance is the same on both model transmitters, however, if you have purchased a Model UTT-10A you will be required to tailor its tone channels to match the frequencies of your particular receiver reed bank. The following instructions will show you how to do this.

To provide for either single channel or dual simultaneous operation, the transmitter has two separate tone oscillators. Four channels are assigned to one oscillator and six to the other. As viewed from the front case and identified in the pictorial, lever switches key each channel. The switches on the right hand side are assigned to the low frequency tone oscillator and all switches on the left to the high frequency tone oscillator. On the UTT-10A all lever switches of each tone oscillator emit almost the same tone because they have not as yet been tailored. For each channel there is an adjustment potentiometer that allows only a small frequency adjustment and these are used to fine tune after tailoring has been accomplished. Tailoring is the process of adjusting the output frequency of each channel to be within the pot adjustment (fine tuning) range of operating a particular reed. It is done by adding the proper circuit capacitance or condenser across a channel to control its operating frequency. As supplied, the channels of the UTT-10A will match in sequency the channel functions as listed in the receiver instructions for the Medco 10 channel reed bank. If the transmitter is used with other receivers or reed banks, the channels may require changes.

INDIVIDUAL TAILORING

To help you understand the need of individual tailoring, there are certain facts you should know. In the manufacture of reed banks and other parts making up the entire system, there are component parts tolerances. It is these tolerances that make tailoring a necessity. For example, receiver reed banks vary a little as to their exact operating frequency. The resonant frequency may vary as much as 10 cycles per second for the same reed of different banks. Also, a reed has a very high tuning Q. This means a reed will only vibrate properly at a tolerance of 1 to 2 cycles from its exact tuned frequency. Because of this high Q the transmitter tone oscillators from which the reed is operated must be of a very stable design frequency-wise. This has been accomplished in the UTT-10A by use of toroid inductors and temperature stable capacitors. However, there is one problem - we cannot, from a cost-sell viewpoint, develop a simple frequency control that would allow adjustment of any one channel over a great range of frequency to operate all the reeds of any bank. That is, and still maintain tone frequency stability. Because of this the trim adjustment pots for each channel have only a small "range" of frequency. This is about 50 cps on the highest frequency channel to about 25 cps on the lowest channel.

The facts presented above, such as stability and small frequency control, coupled with the tolerances of reed banks and the tolerances of parts used in the transmitter dictate the need of individual tailoring. We could, by increasing certain costs, eliminate some of these tolerances, but from an overall practical viewpoint, the system we use is the best. To create a perfect match between transmitter and receiver, we employ individual tailoring.

PARTS PACKAGE

Included with your transmitter is a package of alignment condensers. These vary m size from .01 mf to .15 mf and normally will be sufficient to complete the tailoring. However, in cases of extreme mismatch, it is possible that an extra or odd ball size might be needed. If such is the case, the extras may be purchased from your local radio store. The point is to advise you to purchase tubular types because of their stable temperature characteristics. Do not use ceramic disc units. The values you will probably need will be about .005 mf or .01 mf at a voltage not less than 50v.

TONE MONITOR

To help you hear the tones being generated by the transmitter and thus guide you in the tailoring operation an earphone can be attached to your Controlaire superhet in the following manner.

Connect one lead with a .01 mf condenser in series to the minus terminal of the receiver battery. Connect the other lead to the top lead of the 1 mf filter condenser that installs in hole position 63 on the receiver reed bank and a loud tone can be heard. Hearing the tones generated by the transmitter tells you which way to make an adjustment. A separate tone monitoring receiver is better yet, but not always available.

TRANSMITTER ANTENNA

Notice that the antenna is a center loaded unit and includes a coil assembly as part of the antenna. It is of primary importance when the antenna is extended that all slide elements are fully extended and especially that element just above the coil. This particular element, if not

fully extended can short out the coil and power output from transmitter will be reduced 90%. Sometimes on new antenna this one element may not slide freely through coil until it has been extended a few times. If yours appears to stick as it goes through the coil, rotate it slightly and this will free it. When fully extended this element will extend about 4 5/8'' above the coil.

For maximum radiation of signal power the operator should grasp the transmitter case firmly with his bare hands. By doing this the operator becomes part of the antenna system (counterpoise) and maximum efficiency is achieved. Grasping the case loosely or the wearing of thick gloves reduces your body connections as part of the antenna system and power will be reduced. For maximum range to your receiver the antenna should be held vertical with respect to ground. When flying at an extreme distance do not point antenna at aircraft. This is brought to your attention for maximum efficiency - let it guide your operation.

SUB-ANTENNA FOR RECEIVER TEST

Notice the small rubber grommet installed near the center of the rear case cover. Notice also that protruding flush in the gromet is the end of a bare wire that is internally soldered to the circuit board. When removing or installing cover use care so as not to bend this wire as it must be aligned to protrude flush in the grommet when cover is installed. Basically, the wire is soldered to antenna circuit and its purpose is to allow a controlled amount of signal leakage from the transmitter for receiver tuning purposes. As described in your Controlaire receiver instructions, tuning and sensitivity testing is accomplished with transmitter antenna removed so as to create a weak signal condition; however, because of a new case design and other internal RF shielding, the transmitter becomes almost immune to any signal output with its antenna removed. Because of this we have added the Sub-Antenna. With the main antenna removed signal leakage is now controlled and a proper operating receiver should respond at a distance of 18'' to 30'' from the sub-antenna radiation hole. If receiver will not respond at a minimum distance of 18'' it should be considered insensitive or out of tune and it should not be flown.

PREPARING TRANSMITTER FOR USE

Use care when removing rear case cover as the case assembly screws, and other applicable parts are packed inside the case. Remove these items and prepare to install the antenna. Notice the small ''L'' bracket

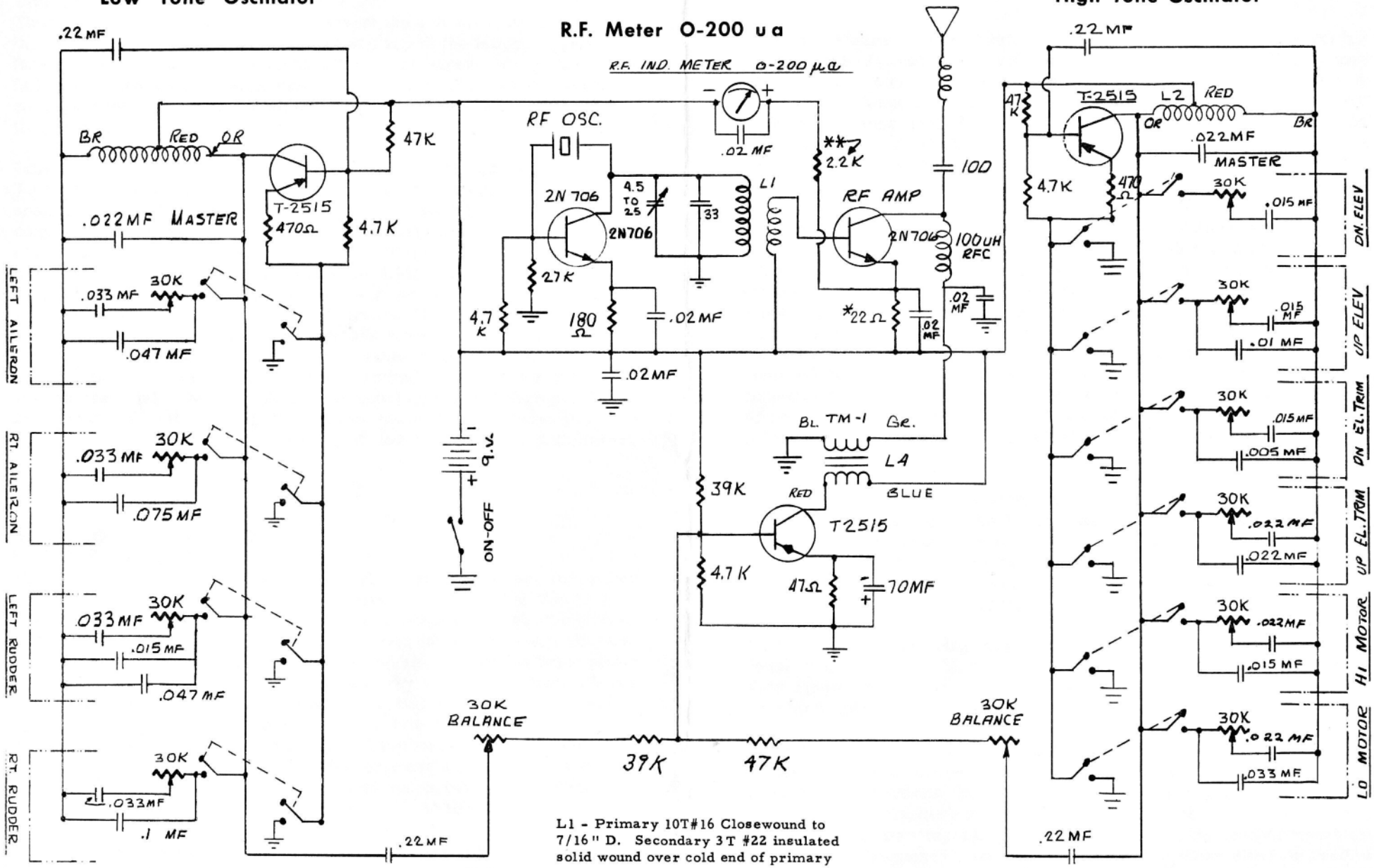
with attaching screw near the lower section of etched circuit board. This is the antenna attaching point. Insert the antenna carefully through the rubber grommet so as not to damage any of the internal parts then thread it firmly onto the antenna attachment screw. Notice that when fully collapsed your antenna only extends about four inches above the case so generally leave it installed as it should present no transportation or storage problem.

Only one Eveready No. 276 or Burgess D6, 9 volt battery is required. This is installed in lower case compartment connecting the red wire snap to plus and black wire snap to minus. Two batteries may be used connected in parralel for increased battery life. If nickel cadmium rechargeable batteries are desired we recommend the 8.4 volt 500 mah Controlaire power pack with charger ($24.95). This will allow approximately 9 hours continuous operation from a full charge condition. A charge jack is installed on all transmitters. If your transmitter was purchased with nickel cadmium pack, merely plug in charger for a 10 to 12 hour charge period before each flying session. Polarity of charge jack is minus for center terminal and plus for outside or ground terminal. The jack is not connected on transmitters purchased for standard battery use. Use scrap cardboard or balsa to fill up unused space in battery compartment for tight battery installation.

INITIAL OPERATING TEST

For the identification of each channel lever switch and its proper adjustment potentiometer refer to Figures 2 and 3. After this is considered and understood, extend antenna to its full length and then turn transmitter on. Notice the RF meter on the front case. Indication should be near or at the maximum level and signify that the transmitter is emiting a steady carrier signal. Now, key each of the channel lever switches and note through the monitor that a tone is being generated. Again, key each channel and this time rotate the adjustment for each particular channel and note the swing in frequency response. Next, after you are generally acquainted key for example right rudder and down elevator and note the odd simultaneous tones being generated. If all looks and sounds well, turn transmitter off. At this point consult your receiver instructions and proceed to fine tune the receiver RF frequency to match the exact frequency of your transmitter. Install back cover on transmitter to accomplish this tuning operation, otherwise results will be improper.

CONTROLAIRE MTT-10 or UTT-10 TRANSMITTER



* May vary between 10 and 22 ohms - Adjust to give maximum RF output & modulation percentage.

* Adjust to give full scale meter reading.

L1 - Primary 10T#16 Closewound to 7/16" D. Secondary 3T #22 insulated solid wound over cold end of primary

L2 & L3 - 2 Henry Controlaire Toroid tapped 1/3 DC Resistance.

L4 - TM-1 Controlaire modulation transformer, primary 500 ohm, secondary 200 ohms.

NOTE: Tone alignment condensers shown match Medco 10 channel reed bank. Reed frequency of 350 to 650 C.P.S.

TAILORING

Refer to Figure 1 and notice between which copper lands or solder points the individual alignment condensers are installed. Notice that there are two common lands, A and B, and between each of these and other solder lands are illustrated condenser attach points. The attachment point other than the common land is a copper land adjacent to the center terminal of each adjustment pot. Although the pots have been eliminated for clarity, the center terminal lands of each pot can easily be identified if you compare Figure 1 to your actual transmitter P.C. board. For example, between connom A and the center terminal land of the up elevator pot is installed a .01 mf condenser. This condenser controls only the frequency of up elevator and will not effect others. Likewise, each individual dondenser controls only the alignment frequency of the particular channel to which it is attached. Each condenser is installed between a common land and a pot center terminal land. If you have identified the adjustment pot (see Fig. 2) you now have identified the condenser attaching points that control frequency alignment of that channel. Land A is common for the high tone oscillator channels and Land B is common for the low tone oscillator channels. After you have satisfied yourself that you understand between which solder points a condenser is installed you may proceed to solder in the proper condensers.

In most cases, the values shown in Fig. 1 are common to produce the proper frequencies for the 10 channel Medco reed bank, so note the value on each channel, select from those supplied and solder into place. Use only rosin core or radio solder and do not overheat during soldering. The condenser leads are bent and cut to position the condenser body about 1/4'' above board so no short can exist.

On the channels requiring large values or odd total capacitances, condensers may be added in pairs or parallel to produce the proper value. Note there is no condenser initially installed at the DE position but may be required later.

After the condensers are installed you are now ready to test and see if they produce the proper frequency for each reed of your bank. Consult Receiver Instructions for proper locations of reeds. With antenna installed but collapsed, start alignment by keying Down Elevator and note if, when rotating the pot for that channel, the frequency swings through the frequency required to operate the down elevator reed of your bank. If the reed does vibrate and such that pot adjustment from one extreme to the other both starts and stops reed vibration, your tuning is O.K. The point in tailoring is to add the necessary capacitance

to a channel to basically preset its frequency so the range afforded by pot adjustment allows tuning in a reed. As you continue on checking each channel, you may note that one or more may not tune in. If the frequency will not go low enough then add capacitance to that channel to lower its overall basic frequency. Decrease capacitance if it is necessary to increase its frequency. In most cases, on the high frequency channels, capacitance is added or subtracted in amounts of about .01 mf for each try and about .02 on the low channels.

If you experience a condition of all channels of an oscillator being either too high or too low in frequency to match your particular reed bank you can minimize individual channel tailoring by adjusting the master capacitance of the affected oscillator. To increase the frequency of all channels of an oscillator the master capacitance is reduced and to lower frequency the master is increased. Master capacitor location is at the lower end of common land A or B of the affected oscillator.

As stated earlier, pot adjustment allows about a 50 cycle swing on the highest frequency channel and down to about 25 cycles on the lowest. You may note when adjusting the down elevator pot that two or more reeds can be tuned in. This is normal because it is the highest frequency channel and has greatest swing. As you progressively go to the lower frequency channels, channel alignment becomes more critical.

For best keying and starting characteristics, reeds should be tuned slightly on the low frequency side of maximum drive. The best procedure is to swing the transmitted tone from high frequency to low, noting the point where the reed started, then going slightly lower for best reliability. For information regarding specific reed bank adjustments, refer to your receiver instructions.

BALANCE CONTROL

Tone signal power distribution for simultaneous operation is adjustable by use of the dual balance control. As illustrated in Figure 2, there is a separate control for each tone oscillator in the transmitter. A low tone adjustment and high tone adjustment. Initially, both controls should be set to their midrange position. Now, adjust the tone pots on the transmitter for best simultaneous operation (see receiver instructions for reed bank adjustment). If the low frequency (long) reeds seem to drive equally as hard as the high frequency reeds and the balance control is O.K. - do not adjust it further. Let's suppose, for example, that the low tone reeds are not driving as hard as the high tone reeds. In this case you turn the low tone pot on the balance control clockwise and the

high tone pot counter-clockwise - this should balance the drive. If the high tone reeds are not driving as hard as the low tone reeds you would turn the high tone pot clockwise and the low tone pot counter-clockwise.

TUNING - Only to be accomplished by persons having 1st or 2nd Class commercial F.C.C. license.

Your transmitter has been factory tuned for maximum output and barring any physical damage should remain tune indefinitely. Do not attempt to retune unless you are positive the tuning is at fault then be sure you understand the procedure. Equipment involved is a sensitive field strength meter, insulated tuning tool and 0-100 ma meter to measure the current drain from the batteries. Procedure is to place field strength meter at a point from the transmitter where a reading can be obtained. Actual distance will depend on sensitivity of meter. Install the 0-100 ma meter in the (plus) lead from the batteries. Grasp transmitter case firmly and fully extend antenna - remember you are the counterpoise antenna. With transmitter turned on, notice the readings on the field strength meter, also the reading on the 0-100 ma meter. The field strength meter should indicate, however, its reading will be arbitrary. Current flow on the 0-100 ma meter should be approximately 40 to 55 ma. To repeak or check transmitter tuning, initially set oscillator trimmer capacitor at full minimum capacitance. There should be no output indicated on field strength meter and current flow should drop to about the 20 ma level. Now, slowly adjust trimmer towards maximum capacitance until exact point is noted where current suddently jumps to the 40 to 50 ma level. After this point is located which is the point where oscillator started, slightly adjust further towards maximum capacitance allowing about an additional 4 ma in current flow. Total finalized current flow will vary between 40 and 55 ma on different transmitters but is normal due to componant tolerances. This completes the RF tuning adjustment. There is no tuning adjustment to the RF amplifier section of the transmitter as this is fixed tuned for best efficiency.

MAINTENANCE NOTES

The nylon rub lelement of the switch was initially lubricated at the factory to insure a smooth, non-sticking key switch action. Possibly in the future this may require relubrication. If so, use VASELINE, but only a small amount at the point where rub element contacts the springs. Over-lubrication will invite trouble due to dirt collection. Also, periodically inspect electrical contact points for dust and foreign matter. If they appear dirty, clean with contact burnishing tool.

Battery should be replaced when the voltage is less than 7 volts. Measure the voltage with transmitter turned on to create proper load.

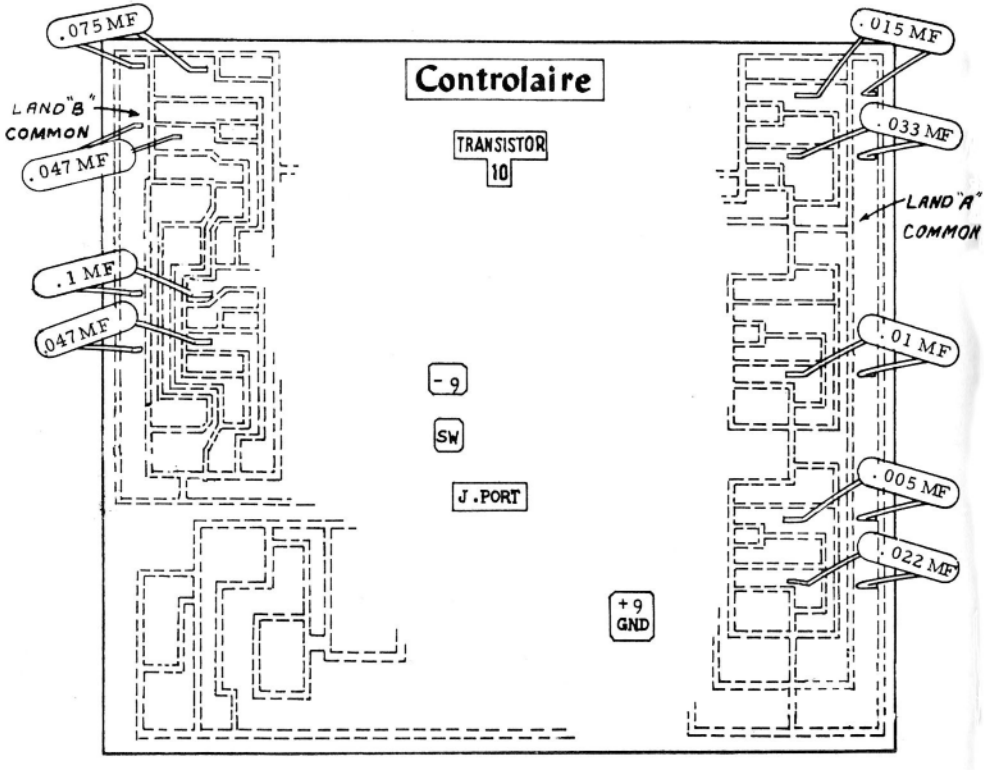


Fig. 1 TONE ALIGNMENT CONDENSER PLACEMENT

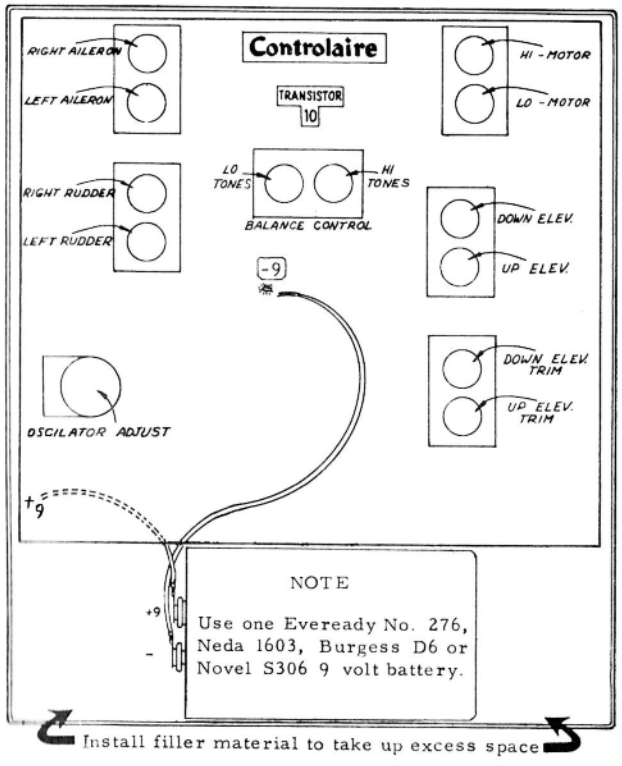


Fig. 2

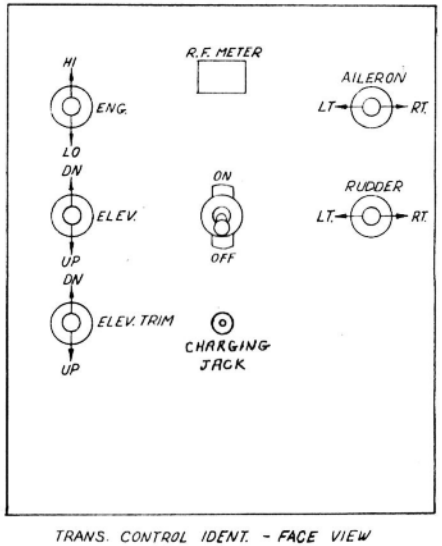


Fig. 3

TRANS. CONTROL IDENT. - FACE VIEW

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