

INSTRUCTIONS

CONTROLAIRE "MULE" TONE TRANSMITTER

ALL TRANSISTORIZED

9 VOLT OPERATION

The MULE, although small, has a man-size wallop in reference to power output. Average radiated power is approximately 135 millawatts with a minimum specification of 100 millawatts before a transmitter is approved. This means the MULE 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. Modulation or tone frequency is approximately 600 C.P.S. The total power input for all stages is approximately 42 ma at 9v or about 380 millawatts. Of this power approximately 225 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.

PREPARING TRANSMITTER FOR USE

Use care when removing rear case cover as the case assembly screws and cardboard spacers 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 seven inches above the case so generally leave it installed as it should present no transportation or storage problem.

The battery required is one (1) Eveready No. 276, Burgess D6, or Novel 306. It is installed in lower case compartment connecting the red wire snap to plus and black wire snap to minus. Use scrap cardboard or balsa blocks to take up unused space and to provide a tight battery installation.

OPERATING INSTRUCTIONS

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 antennas 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 $4\frac{5}{8}$ " above 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.

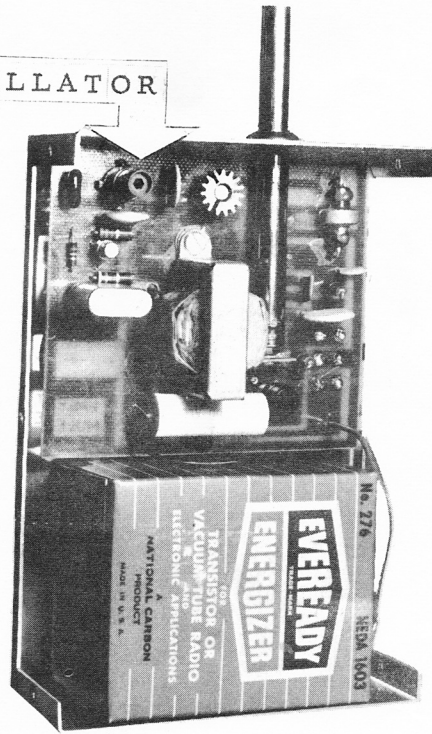
SWITCH

There are two switches on the front of the transmitter. One of these is a push button and the other is a slide switch. First about the operation of the slide switch. This is fundamentally a steady "carrier on" or carrier off" switch. When in the UP position the transmitter is basically off (no carrier), however, when the push button switch is actuated an instantaneous carrier and tone is produced. When the slide switch is in the DOWN position, this turns on a steady or continuous carrier and upon actuation of push button the steady carrier is again modulated with a tone. Normally when the transmitter is not in use the slide switch should be placed in the UP position so there is no drain on the batteries. Now, let's stop to consider this a minute. For the safest flying possible it is best to fly with a carrier on, however, this uses up batteries a little faster than to fly without a carrier on all the time. Flying without a carrier subjects your model airplane to a greater interference gamble than you would be taking by leaving the carrier on so if you feel you are flying in an interference free area you might try flying with the carrier off or with the switch in the UPPER position. Now, there is another advantage to flying without a carrier with some receivers. There are some receivers that have swamping tendencies so if you are flying up close to an airplane containing one of these receivers you should at least fly with your carrier off until your model airplane is far enough away so that it will not swamp and then you can turn the carrier ON switch on.

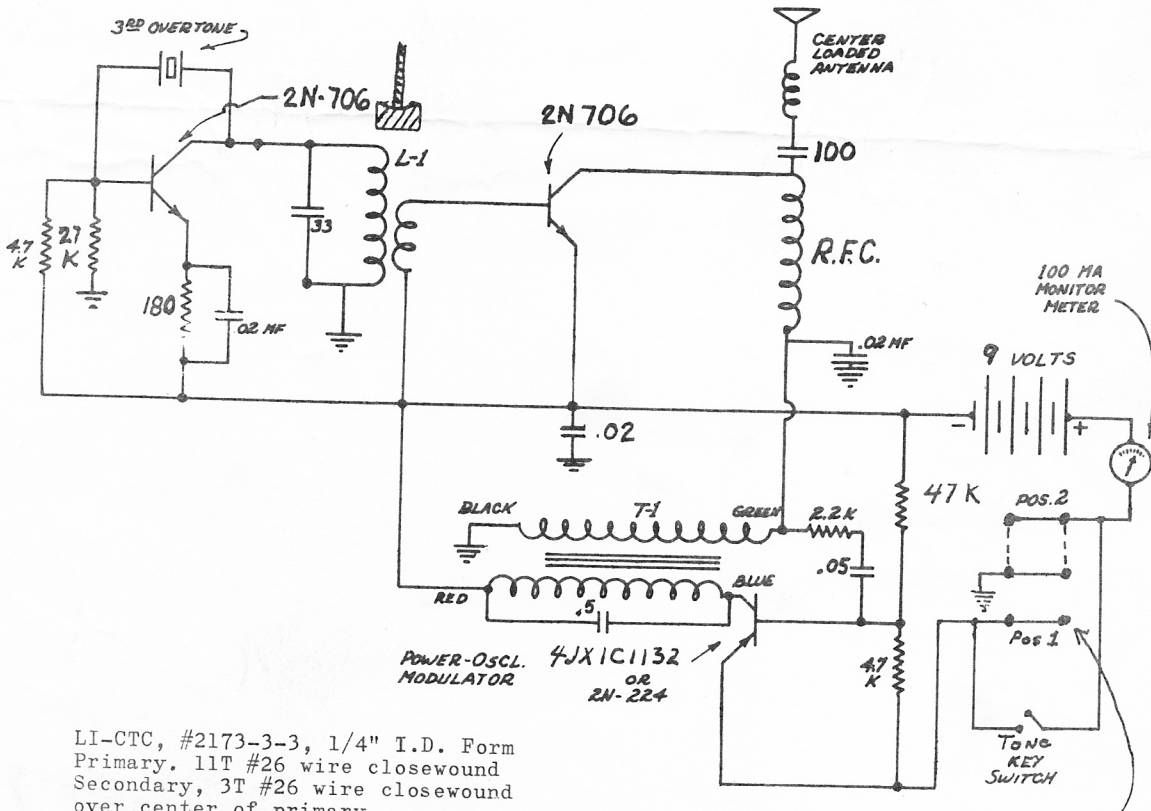
TUNING - only to be accomplished by persons having 1st or 2nd class commercial F.C.C. License.

Factory assembled transmitters have been tuned for maximum output and barring any physical damage should remain in tune indefinitely. Do not attempt to re-tune 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 (+) lead from the batteries. Grasp transmitter case firmly and fully extend antenna - remember you are the counterpoise antenna. With slide switch in DOWN position (carrier on) notice the readings on the field strength meter and 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 30 to 40 ma. To check the tuning only one adjustment is involved. This is to the oscillator tuning slug and is one of adjusting the oscillator for best efficiency. There is no adjustment to the RF power amplifier as this is fixed tuned. To adjust the oscillator first unscrew the tuning slug so it is about halfway out of the coil. At this point the oscillator should be inoperative and no indication should be noted on field strength meter. Current flow on meter should be less than 10 ma. Starting with the slug at the halfway point of the coil, slowly readjust it into the coil and notice the exact point of adjustment where the current suddenly jumps to the 30 to 40 ma level. The essence of proper oscillator adjustment is one of locating exact point where oscillator started or current suddenly increased, then pre-load the oscillator by turning slug one full turn more into the coil. This will allow current to rise about 4 ma above point of sudden increase and will insure oscillator starting every time it is keyed. At this point the oscillator should be operating properly and an indication should be noted on field strength meter. This completes adjustment to RF section of transmitter. To check operation of tone generator-modulator, depress push button switch and note if an increase of from 8 to 10 ma is registered on ma meter. If proper current use is noted a tone will be generated. It may be noted that the tone frequency of the transmitter may vary slightly as transmitter loading varies in operation. This is normal and will create no operational fault to your receiver.

OSCILLATOR



CONTROLAIRE ALL TRANSISTOR "MULE"



LI-CTC, #2173-3-3, 1/4" I.D. Form
 Primary. 11T #26 wire closewound
 Secondary, 3T #26 wire closewound
 over center of primary.

T-1 - MODULATION TRANSFORMER
 PRIMARY 500 OHM. SEC. 200 OHM.
 CONTROLAIRE T-1

2N-706 - RF TRANSISTORS SELECTED.

D.P.D.T. FUNCTION SWITCH. WHEN
 CONNECTED TO POSITION 1 - BOTH CAR-
 RIER & TONE ARE KEYED BY DEPRESS-
 ING TONE KEY SWITCH. WHEN IN
 POSITION 2 - STEADY CARRIER IS
 OMITTED AND TONE ONLY KEYED BY
 TONE KEY SWITCH.