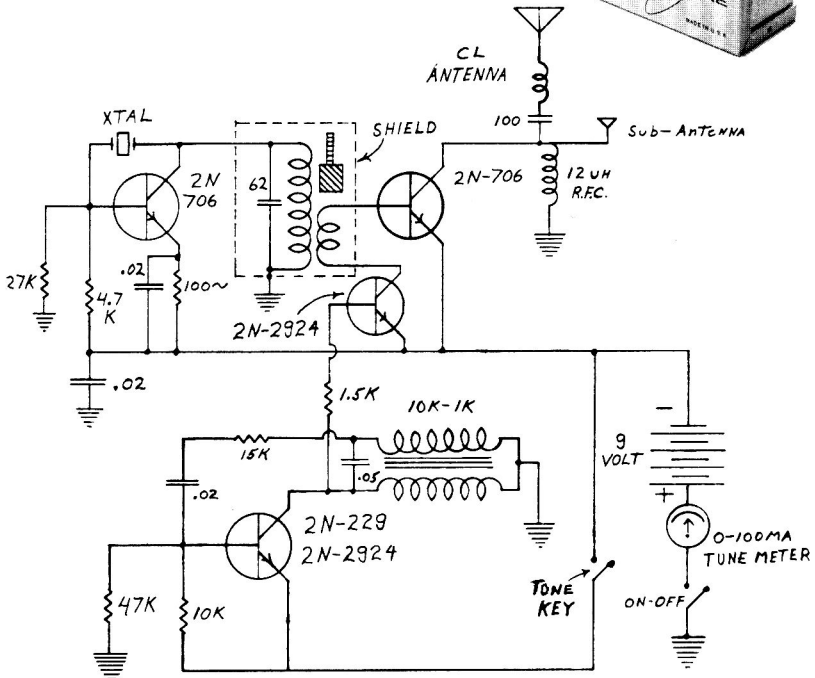


CONTROLAIRE

MARK II MULE

SINGLE CHANNEL TONE TRANSMITTER

OPERATING INSTRUCTIONS



Controlaire Electronics Division — World Engines, Inc.

8206 BLUE ASH ROAD - CINCINNATI 36, OHIO

MADE IN U. S. A.

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MARK II MULE TONE TRANSMITTER

9 VOLT OPERATION

The Mark II Mule is the newest from Controlaire in single channel transmitters. Although it was specifically designed to operate our SH-100 receiver, it will operate all other Controlaire single channel receivers with equal results. Design improvements involve an increased radiated power output and a tone modulation percentage of 97%. Average radiated power is approximately 175 milliwatts with a minimum of 150 milliwatts before a transmitter is approved. This means the Mark II will equal or surpass the output of the average tube type transmitter used in the past. Efficiency is due to several factors. One, the use of special graded silicon R.F. transistors, the employment of a series tuned center loaded antenna and last, the correct matching of this antenna to a special design R.F. amplifier stage. Other features include the ability for pulse application up to about 100 C.P.S., a tone modulation frequency of about 600 C.P.S. and a new sub-antenna system for precision receiver tuning. This latter feature eliminates the necessity of a distance check for positive transmitter-receiver tuning checks. In all, the Mark II Mule is loaded with features. Average total power input to all stages is about 45 ma at 9 volts or about 400 milliwatts. Of this power about 275 milliwatts goes to the RF amplifier which in turn supplies the antenna. A Class "C" citizens service station license is required to operate this transmitter.

PREPARING TRANSMITTER FOR USE

When removing rear case cover use a certain care so as not to bend sub-antenna or accidentally lose the case assembly screws that are packaged inside transmitter case. Remove the case assembly screws and prepare to install antenna and battery. In reference to antenna notice the small "L" bracket with attaching screw near the lower section of the 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 the antenna is installed and collapsed it 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 or 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 sheet on each side of the battery to insulate terminals from case and to provide a tight battery installation.

ANTENNA INFORMATION

Notice that the main 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 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 a 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

As an added convenience the transmitter is equipped with a new sub-antenna system. This is the small bare wire that internally is soldered to the transmitter's antenna circuit which, in turn, protrudes flush in the small rubber grommet located on the rear case cover. One word of caution - when installing the rear cover use care to guide the wire into the grommet. Generally, it is to fit just flush through the grommet and not protrude over 1/32". The purpose of the sub-antenna is to allow a controlled amount of weak signal radiation from the transmitter when main antenna is removed. This controlled amount of weak signal is used for receiver tuning and sensitivity check purposes. As described in the Controlaire receiver instructions, a proper operating receiver should respond at a distance of 15" to 30" from the sub-antenna radiation hole. If the receiver will not respond at a minimum distance of 15" it should be considered insensitive or out of tune and should not be flown. Response at the 15" distance is equivalent to about 3/4 mile range in the air. Whenever you are in doubt about receiver sensitivity check it with your sub-antenna system. Make this a before the first flight of the day preflight check.

TRANSMITTER OPERATION

After the rear case cover has been installed the trans-

mitter is ready for operation. To operate, turn the "On-Off" slide switch to the "On" position then depress the push button to generate a tone. When the slide switch is in the "Off" position no signal will be radiated. Be sure after your flight that the transmitter is turned off. If not, your steady carrier may interfere with the next flyer.

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 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 a 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 "On" 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 35 to 45 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 35 to 45 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 of RF section of transmitter. To check operation of tone generator-modulator, depress push button switch and note if there is some current change indicated on the meter. Normally this will be only 1 to 5 ma, either up or down scale, but does indicate a tone is being generated. If a monitor receiver is available, the tone should be heard.