INSTRUCTIONS

CONTROLAIRE 10

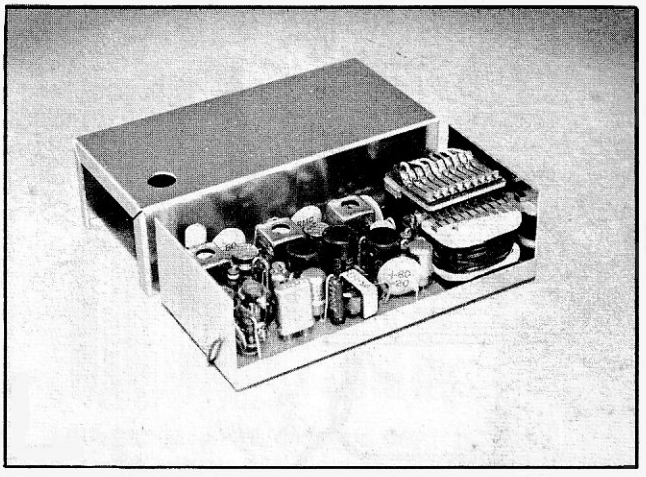
4.5 V SUPERHET RELAYLESS RECEIVER

Physical Size 1 1/8" X 1 3/4 X 3 3/4, weight 4 3/4 ounces

Manufactured by

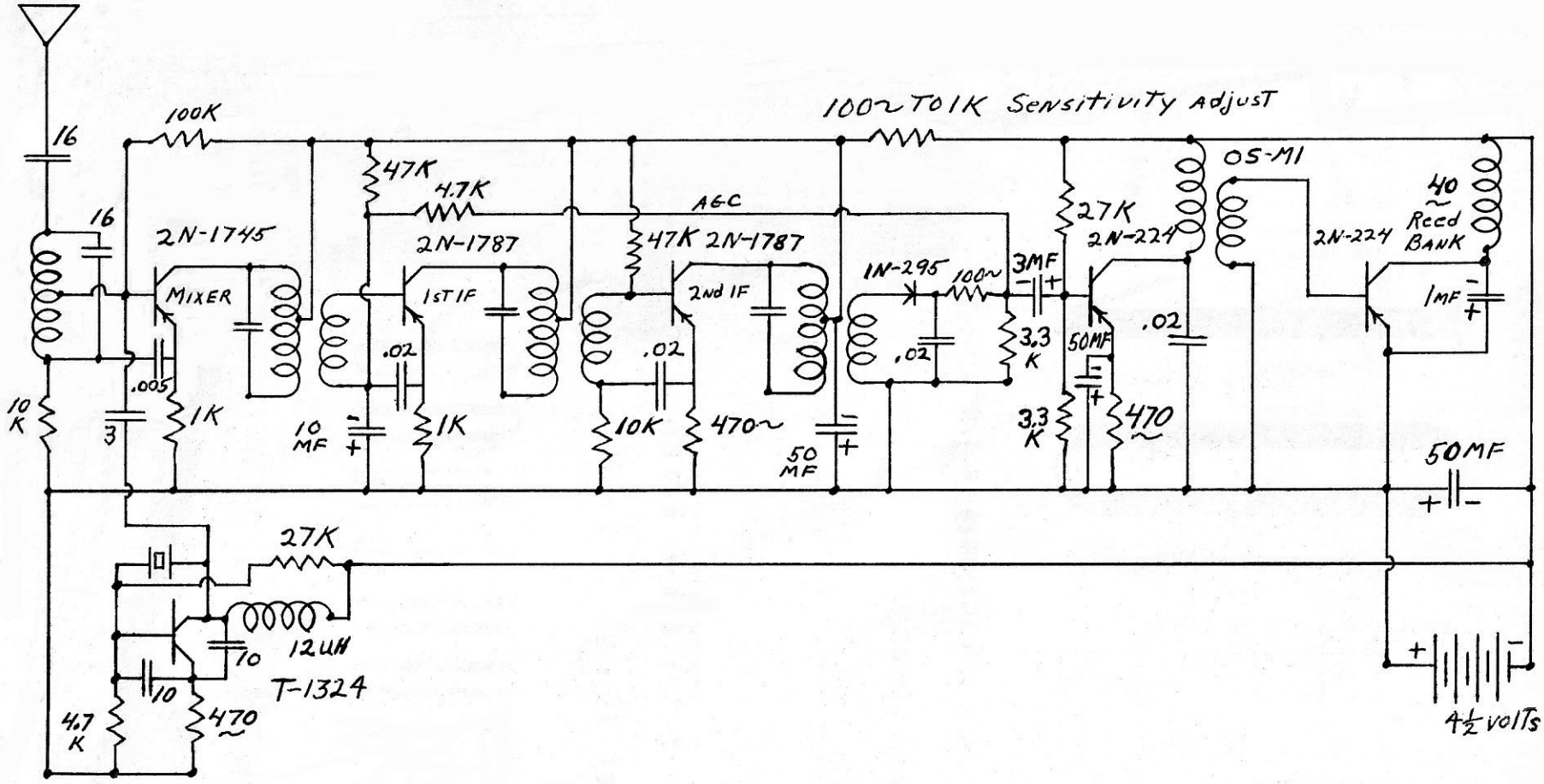
Controlaire Electronics . Box 345 . Fairborn, Ohio

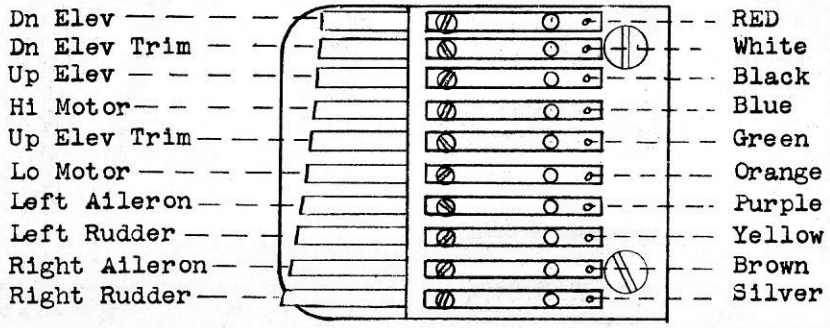
10



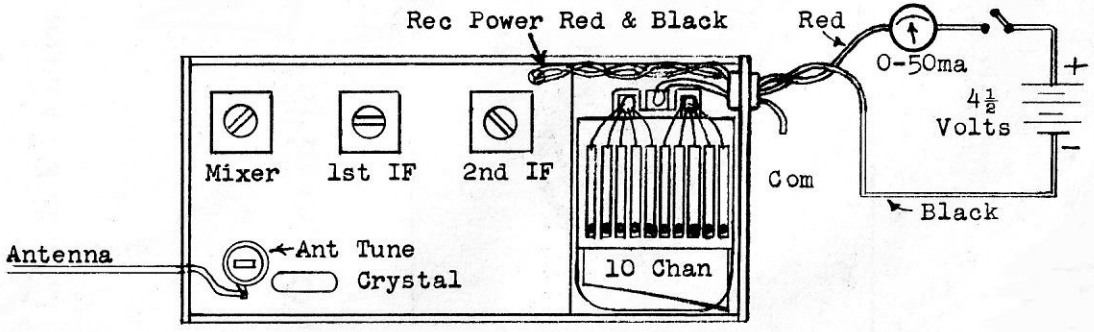
DISTRIBUTED BY WORLD ENGINES INC.

8206 BLUE ASH ROAD – CINCINNATI 36, OHIO

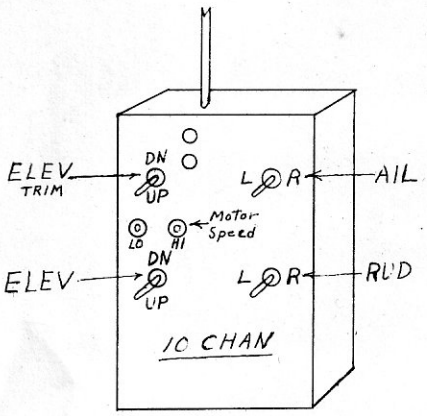




10 Channel Reed Bank



Top View



Eight Channel has motor switches omitted and elev trim used for motor control.

INSTRUCTIONS: Superhet Relay-less Receivers

INTRODUCTION:

The equipment you have purchased has been painstakingly factory adjusted. Please read this manual before you tinker with it. The receiver is of rugged design, however certain knowledge and maintenance attention must be exercised to keep it in top order. RC flying is full of hard knocks and for this reason we have prepared this set of instructions. Read and digest its contents before any attempt is made to install or operate your unit.

For best results both a transmitter and receiver should have been purchased as a matched pair. Matched units are factory adjusted for both RF, (radio frequency) and tone frequency to insure proper channel operation. If your receiver was purchased separately it will be your responsibility to effect proper tone match to your transmitter. Receivers are supplied at any of the six spot frequencies for radio control use. Operating frequency is stamped on top of lacal oscillator crystal in receiver. RF output from transmitter must match this frequency. All receivers are intended for relay less operation and employ the "COMMON" type reed plate in the reed bank. Because of this the BONNER TRANSMITE or similar transitorised servos must be used. Relay packs may be offered as separate units for those who want standard servo operation.

CIRCUIT DESCRIPTION: THEORY OF OPERATION

There is a great differenct between the Superhet and the superregen type receivers used in radio control. The superhet is superior in channel selection (selectivity) and is less affected by noises created by servos and other sources. Inherent internal noises also are not a problem. Selectivity of a superhet is attained by use of more tuned circuits known as intermediate frequency amplifiers.(IF'T coils). Where the standard super-regen receiver used only one tuned circuit to select operating frequency your superhet uses four. The super-regen was broad tuning, but the superhet, with its increased efficiency of four tuned circuits, has very narrow bandpass characteristics and tuning is very sharp. Because of this, it is very selective, and can reject the unwanted signals of others operating on the citizens band.

In operation the transmitted carrier signal is picked up by the receiver antenna, fed to antenna tuned circuit, and thus to base of the mixed IF stage. This input signal is combined with a signal from the receivers local oscillator, which is crystal controlled, and through the process of mixing the two signals a third is created for use in the intermediate frequency amplifiers. In this case we have controlled the frequencies of the input signals to produce a third or 455KC IF frequency. The reason to effect a change to a lower frequency, for IF amplification, is that greater efficienty can be obtained in the tuned circuits. Since the IF amplifiers are tuned to pass and amplify only the 455kc signal, the two original signals disappear. From the mixer and through the first and second IF stages we have great amplification of our IF

signal but it is still only an RF carrier with no tone information. The tone signal originated in the transmitter when it is keyed and is known as amplitude modulation of basic carrier. Amplitude modulation is process of varying the strength of the carrier at an autio tone frequency and in turn it is presented to mixer of receiver. If the input to the mixer is amplitude modulated so will the resultant IF carrier be modulated. From here, and at last the IF stage, we detect the audio tone with a diode and discard the IF carrier. The tone is presented to the input of two stages of audio amplification and the total gain is such that is turns power on and off at reed bank at an amplitude to drive the reeds. If the tone frequency matches that of any particular reed, it vibrates and such that signal is introduced to servo transistor amplifier and the servo operates. Separate channel selection is attained by use of tuned metal reeds, each of which are tuned to vibrate at a specific audio tone frequency. Although brief, this would complete description except for one very important addition, what is AUTOMATIC GAIN CONTROL, or abbreviated, AGC.

AGC is the heart of a good operating superhet. It is needed because the total gain through the IF amplifiers is not self limiting. The stronger the input signal from the transmitter the stronger the total gain at the IF coils, such that when using any transmitter with less than 100% modulation a condition of clipping and signal distortion takes place to the point of elimination of modulated or tone signal within the IF's. This is called "OVERLOADING" and can prevent operation of the receiver. Good simultaneous operation is dependent on linear amplifier response (no clipping) throughout all stages. If overloading is present, distortion and harmonics are generated that distroy good reed bank operation. Because of this AGC is introduced to limit the total overall gain proportional to amount of input signal received. This is accomplished by rectifying part of the IF signal at last IF stage and presenting it as a DC bias to input of 1st IF. In effect when the IF carrier reaches a dangerous amplitude in the 2nd IF which could cause overloading and clipping enough reverse bias is presented to 1st IF to reduce its gain and control overall response. In a nutshell this is how a superhet operates, although brief, possibly we have planted a seed for future learning.

INSTALLATION NOTES

Installation of the receiver in your aircraft will vary with room available, however one very important item. The (long axis of the) reeds should lie in a parallel to the axis of your engines piston. For a normal up right engine installation you should lay your receiver in the fuselage on its long narrow edge.

To protect the unit from shock or crash damage, it should be mounted by sponge rubber or better still incased in sponge in its fuselage compartment. Mounting should be firm, however not so rigid that engine vibration can be transmitted to the reeds and cause unwanted operation. If you experience this, either the tension of mounting is too firm or you have excessive engine vibration. The latter is most often the case, so try balancing the propeller or change prop pitch or size to peak engine at different speeds. The reed bank used is not prone to vibration troubles, but there are limits.

Poorly planned wiring, bad solder joints, defective socket combinations, open type slide switches and loose battery boxes are major causes of RC failures. Less than 5% can be attributed to basic radio malfunction and some of this to improper tuning. Take your time and plan your installation. Wiring should be harnessed together and tied down to fuselage structure. No wire should be left to mercy of engine vibration. If it is, it will fatigue and break, especially at a connection. Disconnect plugs and sockets should be chosen for firmness of contact. The best we can recommend are those made by CANNON or AMPHENOL. All solder joints should be secure and shiny (not grainy) and covered with insulated sleeving to add protection and strength to the connection. Any frosted appearing solder joint should be remade as this denotes a possible cold solder joint which can fail or become electrically resistive. Use only rosin core or radio type solders and remember to solder any joint correctly the flux or rosin is equally important at the joint as solder and heat. Flux cleanses the joint and allows solder adhesion. Do not use slide switches for aircraft installations, instead select a good grade toggle type. Battery boxes should be chosed with care. The HILLCREST line, Mfg. by Model Plastic Products of Los Angeles, California are very good. Your hobby dealer can show you a selection availibility. Since most installations will use a total of 8 pencells, 3 for receiver power, 1 for servo bias, and 4 to operate servos, two of the 4 pencell type battery boxes will work fine. Battery box spring contact tension and contact cleanliness should be inspected whenever batteries are installed Second but equally important, excess room within the box should be blocked with balsa scrap to insure tight installation. Engine vibration can take its toll, don't let it happen in the battery box. Batteries are a constant source of trouble and should be purchased at a source that has a constant turnover of stock to insure freshness. Do not assume that since you just purchased battery it is good. Here are a few items that have caused failures: Dry batteries (Flashlight types), all have a zinc metal base outer shell. Some of the newer leakproof types have, in addition, a steel cover or base metal caps at the bottom. They have been known, due to long storage, to oxidise between basic shell and outer cover, especially at bottom cap. As a result, under the riggers of engine vibration combined with insufficient battery box contact tension, the battery fails due to intermittent connection. The best type batteries are the ones that have the zinc outer shell exposed. However, these too can oxidise, but at least it can be seen, so when installing any battery, inspect and clean its contents with fine sandpaper. This rule is mandatory for R/C enthusiasts. Most installations will require that four separate connections be switched off. Three in servo circuit and one for receiver. A four pole, single throw switch is hard to find. Our recommendation is tc procure two double pole single throw units and mount them side by side. Toggle switches are best.

Serious troubles can be experienced if the radio gear is not protected from balsa dust infiltration, during the building of your aircraft. Balsa dust or any foreign matter in the reed or servo contacts or servo geering can cause malfunction. So many inexperienced model builders have crashed airplanes because of this we feel it worth mentioning. If possible before installation of RC gear, use air blast to rid your fuselage of duct and shavings.

RECEIVER WIRING

The desired operating voltage is 4.5 volts, Maximum 5.0 and Minimum 3.5. Of primary importance though, is that a separate set of batteries be used to power the receiver. Do not hook power wires into servo batteries for receiver power. Basic receiver wiring and batteries should be isolated from any connection into servos or batteries thereof. To disregard this can invite trouble as voltage drop pulses caused by operating servos and general servo motor noise can bother the receiver. Three common pencells connected in series for 4.5 volts is best recommended for receiver power. These are good on the average, for about 25 to 40 flights. Nicads can be used if desired, however, average voltage should be limited to 4.8. To wire the receiver, refer to pictorial for proper connection. The small twisted red and black wires are for receiver power. Red is Plus and Black minus. Make provisions in the red plus lead to install a tuning meter disconnect jack, and on-off switch. A 0-50 ma meter (moving coil type) is used to measure current flow during the tuning and adjustment or trouble-shooting operation. When not in use, a shorting plug is installed in disconnect jack. The jack should be mounted for easy access and meter leads should not exceed 5 inches in length.

SERVO WIRING.

For relay-less operation of the servos, there are two systems in general use today. One is known as the "COMMON REED PLATE" system and the other "SPLIT REED PLATE". Operation of the two systems are similar. However, each requires a specific type of servo to match the system. Controlaire receivers are equipped with the "COMMON" reed plate, so in selecting your servos, insure that they operate on the Common system. The "BONNER TRANSMITE" is one example of the proper servo. Transmites are supplied either in the neutralising or trim types. Other manufacturers such as DON STEEB, INC., ANNCO, produce very fine servos.

Because there are varied designs of servos operating on the COMMON system, we supply no wiring diagram to show hook-up from receiver to servo. Each servo manufacturer supplies this information as applied to his product. With reference to the receiver, the basic reed bank wiring is installed and terminated at the end of a 9 inch color coded cable. Note there is one large diameter red wire. If traced, you will see it attached to solder lug on body of reed bank. This supplies a common connection to all reeds. Note also that there are 10 color coded wires attached to top of reed contact plate. Each color denotes the function of its contacting reed. For example Red is down elevator and silver is right rudder. This function color coding matches the channels of your Controlaire transmitter and denotes which reed is supposed to function when a particular channel is keyed. The point in wiring to the servos is to know which wire is the common reed plate wire and which color denotes which function. From here, the servos Mfg. hookup can be used.

RECEIVER OPERATION

To check operation, temporarily install the tuning meter and turn receiver on. With no carrier or signal from transmitter the unit should idle at approximately 4 to 6 ma, and have a rather steady needle reading. Some units when operation at max voltage input may be slightly nervous, but again is normal due to increased sensitivity and atmospheric noises. Turn transmitter on and key the different channels. Note when keying the down elevator channel (highest tone) the current rises to about 15 ma and with right rudder to about 20 ma. These values are approximate and will vary with input voltage. As each channel is keyed, assuming transmitter tone pots to be in tune, each corresponding reed should vibrate and if turned on, the servo should operate. Needle nervousness, if present, will disappear when transmitter carrier is turned on. For close in bench operation, do not expect best simul operation. Operation of the superhet can be quite different with transmitter carrier off than when on. Especially on the workbench and in a confined area that has a lot of electrical noise present. The reason for this is that the receiver is in its most sensitive state when no carrier is on. With carrier on AGC is supplied and operation should be normal.

It might be noted during very close-in ground operation your receiver may be affected by an adjacent channel operator if you are close in to his transmitter. This will be more pronounced if your transmitter carrier is off. With transmitter carrier on, your receiver will tend to reject the adjacent channel, however do not purposely operate right on top of an adjacent channel transmitter. A few field tests with your buddie on the adjacent channel, will acquaint you with close in operation limits. For ground operation, you might experience interaction if taxiing closer than 10 feet of your buddies transmitter. However, beyond this distance and in the air, no interference will be noted.

When adjusting your tone pots for best simul operation, do so with your aircraft placed about 10 feet from transmitter antenna. Simul operation closer than 10 feet may be affected due to overloading the receiver with powerful signal. This causes distortion of the mixed tones within the IF section and good simul is hard to obtain. Beyond the approximate 10 foot distance, simul operation will not be affected by over-loading.

While flying with your buddie on the adjacent or any channel, do not get too close to him in the excitement. Keep your transmitter antennas separated by at least 5 feet. The meaning behind this, is that another transmitter, if close enough can plate modulate your carrier signal by pick up of his modulated RF power by your antenna. This can modulate your carrier by his tone, up to a point of about 1 to 5%. The superhet can pick up this low percentage within reasonable range, so use care. Tests show no problem at 5 foot, however, some flyers have bumped antennas in the excitement.

Receiver operating frequency is determined by frequency of crystal in local oscillator. It is a third overtone type and cut to a frequency of 455KC lower than receiver input operating signal. Replacement should be of the same type and are available from the Controlaire or World Engines at $4.95 each, net.

When ordering, specify RC spot frequency desired, -- 26.995 mc, 27.045, 27.095, 27.145, 27.195, or 27.255. To replace crystal in receiver, involves soldering into place. Use care and do not overheat. After replacement, receiver tuning and sensitivity should be checked and readjusted if necessary, as outlined under "RECEIVER TUNING".

RECEIVER TUNING

The receiver was tuned at the factory and assuming no shipping or handling abuse, should still be in perfect order. However, before flying it's best to check. Tuning and sensitivity is checked by operating receiver with antenna-less transmitter and noting the maximum distance operation can be obtained. To do this, the antenna end of the transmitter is pointed at the stretched out end of receiver antenna and tone keyed. If you get good operation out to a distance of at least two feet, all is in order to fly. If not, accomplish the following check. Install tuning meter and note at the two foot distance if current is rising to at least 10 to 12 ma. If so, then reason for non-operation is mistuned tone pots. If small or no rise is noted, receiver tuning is probably at fault. The tuning tool should be insulated and fabricated to fit slots of both the antenna, coil and IF cans. Do not use metal screwdriver or metal tipped tools. Again, operate receiver with antenna-less transmitter, bringing it close enough to receiver antenna to get a small reading. Start at the mixer IF can and slowly adjust slug for highest reading on meter. As the slug is peaked and current rises to the max level of about 15 ma, back transmitter away to drop the current so an exact peak can be obtained. Do not try to peak any adjustment with receiver current at saturation level, back transmitter away to weaken input signal so peak can be obtained. After the mixer has been peaked, go to the 1st IF and repeat the above. In turn, back and weaken transmitted signal each time adjustment beings current level to saturation. In same manner, peak the 2nd IF and last, with receiver lid on, peak slug of antenna coil. Presence of receiver lid will not affect IF tuning, on or off. However, it does affect the antenna coil. While tuning, you will note that adjustment to the mixer and IF are somewhat critical but tends to broaden out at the 2nd IF and antenna coil. This is normal. When finished, you should get at least 10 to 12 ma reading at the minimum 2 foot distance. The average will be about 3 foot.

During the above sensitivity check, it will be noted that the high frequency tone channels operate at a slightly further distance than do the low channels. The 2 foot minimum distance is in reference to the high channel. Assuming tones to be in tune, simul will operate, but not at maximum distance.

Do not attempt tuning by the distance check method, it cannot be done. You may try a ground distance check for personal satisfaction if desired. If properly tuned as described above with minimum of 2 foot operation, ground range (receiver head height) will be in excess of 1/2 mile in open country.

If you experience trouble and cannot get operation at the minimum distance, check transmitter for proper output and battery condition. The distances expressed above are for companion use with Controlaire transmitters only.

Other transmitters will give varied distances due to varied output, less antenna, etc.

TRANSMITTER TONE ADJUSTMENT

Tone channels of the Controlaire transmitters are adjustable through a small frequency range for each channel. If you find some of the channels do not operate the intended reed properly, these channels must be retuned. Remove back cover from transmitter to gain access to tone adjustment pots. The correct pot for a particular channel is identified by the channel abbreviation etched either above or below pot on tone PC board.

With fair transmitted signal (antenna installed, but collapsed) start keying each channel separately and in the following manner, swing the tone slowly from high frequency to low noting the point where the reed started, then going slightly lower for best reliability. For fast keying and starting characteristics, reeds should be tuned slightly on the low frequency side of maximum drive. On each pot, the tone is at its highest frequency with full counter-clockwise. Start at this point and rotate pot clockwise to swing frequency from high to low. For simul operation, each channel may require more exact adjustment. The point is to key both channels and tough up as necessary. Remember, for best simul the aircraft should be at least 10 feet from transmitter to prevent overloading. Adjust by noting operation of control surfaces.

MAINTENANCE NOTES

Periodically inspect the reed bank for general condition. Look for dirt residue that tends to collect because of exhaust fume oil contamination. Inspect the reeds for oxidation or rust, connections for firmness, bent frame or uneven reed spacing and last, if doubtful about contact cleanliness, burnish lightly with contact burnishing tool. However, other than the inspection and necessary cleaning, do not attempt specific adjustment unless malfunctioning is evident. In other words, don't fiddle. Aside from shipping and handling abuse, the reed bank can be knocked out of adjustment by the rigors of general RC flying. To allow you to make touch up adjustments, the following information is presented in its entirety. Make sure you understand the principles before any part or complete adjustment is started. To prevent damage to servos, on any major adjustments insure that power is off.

The reed plate to coil pole piece clearance should be initially set to about 3/64 inch. This means each reed should be positioned above the magnetic pole piece this measurement. If any reed is closer, its drive will be greater and vice versa. To accomplish this, first back off the reed contact screw so it is flush with micarta board, then with small blunt tool, apply pressure at base of reed to bend it either up or down to get the 3/64 measurement.

With fair transmitted signal (antenna installed, but collapsed) operate each channel and note the drive of each reed as it begins to vibrate. Adjust each reed contact screw to limit the arc of vibration to about 1/16 inch on highest frequency reed and increasing this arc up to 5/64 on lowest frequency reed. This

is the arc created by the reed tip while it is vibrating. Transmitter tone pot adjustment will need touch up as each reed is adjusted. Remember to swing the frequency from high to low slowly, noting point where reed first started, then going slightly lower to guarantee good starting and fast keying. Never tune a reed at point of maximum drive.

After this adjustment, you should get good single channel operation, however, inspect closely as each channel is keyed and note if the adjacent reeds are being tickled. Note this at instant of keying action and during sustained vibration.

A slight action of the adjacent reed or reeds can be tolerated, but not to the extent of operating, even momentarily, the unwanted channel. At the above adjustment clearances, you should not experience this, but if you do, increase the reed plate to pole piece clearance to lessen drive.

Reed bank drive and adjustment for single channel operation is somewhat a minor problem; however, for dual simultaneous, certain facts should be understood. The first is that, during simul, the signal power available in reed coil divides between the two reeds and only half as much power is available for each reed as compared to single reed operation. This means each reed has reduced drive and because of this, becomes more critical to its exact tuned frequency. Second, adjustment clearances and contact cleanliness become more important. Reed drive is a product of the signal power available in reed coil and the reed to pole piece clearance. This initially was set to about 3/64 inch. If set closer, drive increases and vice versa.

Start by keying both the elevator down channel (highest frequency reed) and right rudder (lowest frequency reed). Note the drive of each reed and adjust the fine tuning of the reed that appears weak; this may be just one or both, but the point is to peak tuning on both reeds where each will drive simultaneously with the other. Note if corresponding surfaces are operating; if not, it might be necessary to close in the reed contact screw slightly. Continue by again keying down elevator and this time left rudder; adjust fine tuning and contact screw if necessary, then alternate the keying while holding down elevator between right and left rudder. This time, key up elevator and alternately right and left rudder, adjusting fine tuning as necessary. Continue the test until up and down elevator is working simultaneously with right and left rudder and left aileron. There is no point in attempting simultaneous engine speed with rudder or aileron. On the Controlaire transmitter, up and down elevator and elevator trim plus low and high engine speed is on one tone generator, and rudder and aileron are on the other tone generator. The procedure you must follow when adjusting a reed bank for simul depends upon the results that you get as you pursue the adjustment. If the drive on a reed appears to be limited, you then decrease the reed to pole piece clearance. Be careful that you do not decrease this clearance to the extent that, when operating on single channel, you get interaction between this reed and others. If a reed appears to be driving properly, but surface does not operate, check the contact clearance in the reed bank, and also the contact cleanliness. Use a burnishing tool to clean these contacts.

In extreme cases, it may be necessary to change the frequency of a particular reed. You can recognize this if a reed seems to be affected by a beat note during simultaneous operation. These beat notes are developed by multiples of sums and differences between the frequencies, and occasionally you will get a troublesome beat note that just cannot be tuned out. There are numerous beat notes; however, most of them are of extreme low power. The troublesome ones are from 1-5 cycles per second, and this will cause a reed to drive in and out and will create the same intermittent effect upon the control surface. To change a reed frequency, you can place a tiny spot of solder on the reed to lower its frequency, or you can clip the reed to increase its frequency.

Batteries should be replaced when voltage under load is less than 3.8 volts. Operation is possible down to 3 volts, however, sensitivity and range will be reduced. Simultaneous below 3.8 may be erratic and at voltages in excess of 4.8, you may overdrive reed bank. Each receiver varies slightly, so let the above be your guide to determine battery replacement and operation above 4.5 as recommended (3 pencells).

Temperature operating range is conservative when expressed as from 0-120°F. However, do not intentionally allow your aircraft exposure to excess sun and heat if shade can be provided. In 90° sunny weather, it is possible for temperature to exceed 150° in cabin of aircraft. This is due to radiation absorption and poor ventilation. If you must operate continually above the 120°F point, then try a heat soak test in your aircraft and recheck operation and sensitivity. If, at the higher temperatures, sensitivity is reduced to less than 2 feet, retune RF and IF stages to operate at higher temperatures.

In the event of severe shock, it is possible to fracture the local oscillator crystal. If your receiver appears inoperative, crystal condition can be checked simply by touching the top of the RF choke with a moist finger. If meter current drops approximately 1 ma at idle, the crystal is O.K., if not, crystal is inoperative.

PREFLIGHT TEST

Before the first flight of the day or any time you would suspect improper operation as a result of hard landing or crash, complete the sensitivity test. In other words, operate receiver with antenna-less transmitter and note the maximum distance of operation. This should be the same distance as you determined on your initial receiver tuning test. (At least 2 feet and possibly greater as receivers will vary slightly.) Basically, it tells you your receiver is operating as before, that batteries are O.K. and that tuning is O.K. If distance changes drastically, or a particular channel does not operate properly, then something is wrong. It requires just two minutes time and will prevent flying with a malfunction.

DO'S AND DONT'S

Do your best to make a secure and neat installation, with attention to solder joints and harnessed wiring. Don't be in a hurry.

Don't use slide switches, instead select a good toggle type.

Do use a separate set of batteries to power receiver, don't tap into servo power.

Don't change antenna length unless you repeak antenna coil and do so with receiver lid on. Desired antenna length is 24 to 36 inches.

Do use insulated tuning tools, don't use screwdriver or metal tools.

Don't use tuning meter lead length in excess of 5 inches.

Do use a moving coil type tuning meter, 0-50 ma. Vane types can give inaccurate readings.

Don't expect perfect simultaneous with transmitter on top of receiver, separate by at least 10 feet.

Do perform the preflight sensitivity and operational check before first flight of day, two minutes time is worth cost of aircraft.

Don't hug your buddy while flying, remember powerful transmitters can modulate one another.

Don't fiddle with reed bank unless malfunction is evident, then understand adjustment before attempting same.

WARRANTY

Guarantee is extended that unit be free of workmanship and parts defect for a period of 60 days from date of purchase. This is valid only if receiver is operated by CONTROLAIRE transmitter or one approved by Controlaire Electronics. We reserve the right of inspection to determine abuse or improper operation and if evident in our opinion, guarantee is void. No responsibility is assumed for damage inflicted by shipping or handling organizations. When returning a receiver for guarantee service, state full symptoms of malfunction and make of transmitter used. Print name and address and include return postage. Pack well and send direct to Controlaire Electronics. Do not return unit to your local dealer.

SERVICE

The minimum fee for inspection and repair is $6.50, include this amount with receiver. If inspection reveals charges to be in excess of $10.00 you will be notified for approval of intended repair. Include all symptoms of malfunction

to lessen our troubleshooting time. Parts are quoted net and no dealer's discount is offered. Do not return unit to your dealer as he is busy. By additional handling, important symptoms and other particulars are forgotten. In no case will repair exceed 50% of the original selling price. Print name and address, pack well, and attach or enclose letter of particulars in return carton. Allow two weeks for our receipt, repair and return. Send repair work to CONTROLAIRE ELECTRONICS, BOX 345 FAIRBORN, OHIO.