

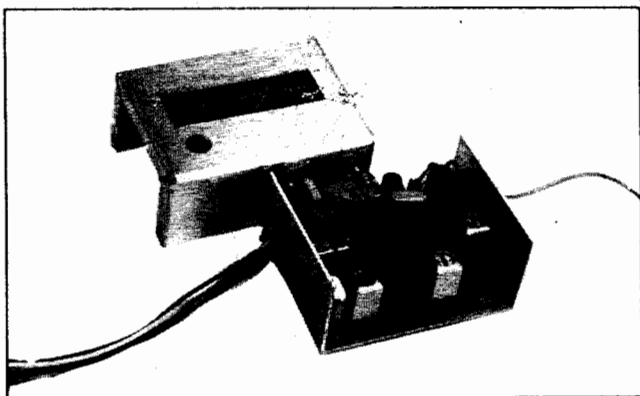
# CONTROLAIRE

Single Channel

Superhet

Receiver

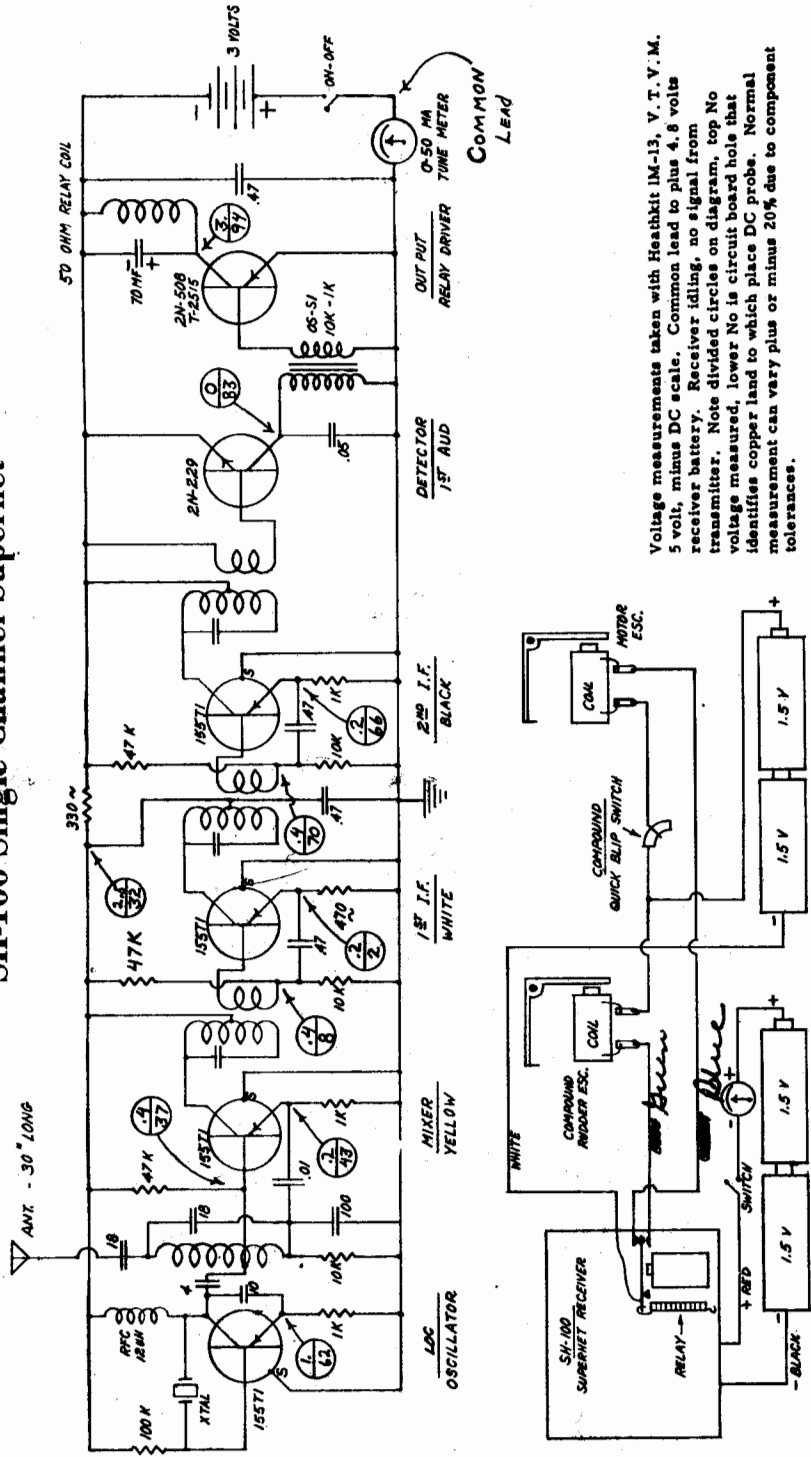
SH-100



## OPERATING INSTRUCTIONS

MADE IN U. S. A.

# SH-100 Single Channel Superheth



Voltage measurements taken with Heathkit 1M-13, V.T.V.M. 5 volt, minus DC scale. Common lead to plus 4.8 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 lead to which place DC probe. Normal measurement can vary plus or minus 20% due to component tolerances.

SUGGESTED WIRING ~ INDEPENDENT BATTERIES ~ RUDDER & QUICK BLIP MOTOR

## CONTROLAIRE SH-100

### OPERATING INSTRUCTIONS

The SH-100 is an all-transistorized superhet receiver with its output terminated in the use of a S.P.D.T. relay. This feature allows for simple application to pulse or escapement type of control systems. Unlike earlier single channel superhet receivers, the SH-100 exhibits a certain immunity to the R.F. noise interference generated by the electrical control system of your aircraft. This is accomplished by a design feature that allows extreme signal clipping to take place within the receivers I.F. section. By this clipping action noise of reasonable amplitude is eliminated from appearing in the I.F. carrier. If noise does not appear, it cannot be detected as an interference signal to actuate the receivers relay.

No superhet can reject any and all conditions of noise interference, however, the SH-100 presents a definite improvement. Other design features include temperature compensation from 0 degrees to 130 degrees F., a strong protective metal case and 3 volt operation.

Receivers are available in any of the following frequencies. 26.995mc, 27.045mc, 27.095mc, 27.145mc, 27.195mc. Special units on 6 meters at 52 and 53mc are available by special order.

### TRANSMITTER REQUIREMENTS

Due to the extreme clipping action that takes place within the receivers I.F. section, the SH-100 must be operated with a companion transmitter of high modulation percentage. Minimum is 90% and the best 100%. If transmitters of less than 90% are used you may find a nulling or no signal condition exhibited by the receiver at varied distances from the transmitter. For this reason do not attempt to operate the SH-100 with either the Controilaire multi or single channel "Mule" transmitters. These units, while perfect for other Controilaire receivers, have 85% modulation and, in most cases, will not operate the special purpose SH-100. For best results we recommend the new Controilaire "Mark II Mule". This is an all-transistor unit and has been designed specifically for the SH-100. Other transmitter requirements are a radiated RF output in excess of 75 milliwatts and a tone frequency falling between 400 to 1200 C.P.S.

## BATTERY REQUIREMENTS

2.4 to 3.6 volts is required. Factory assembled receivers are adjusted to 3 volts. At 2.4 sensitivity will be slightly reduced and at 3.6 slightly increased. For best results a separate set of batteries, two pen cells, should be used to power the receiver and a separate set used to power your escapement or servo actuator. Batteries should be measured with receiver turned on and actuated with transmitted signal.

## RECEIVER OPERATION

With transmitter turned off, receiver turned on, the receiver should idle at about 2 or 3 ma. This is measured by a 0-50 ma milliammeter as shown installed in the receiver circuit. The reading should be steady except if in your testing area you are bothered with electrical disturbances. This could be noisy fluorescent light, electric motor, etc. In this case the idle may be higher and nervous in action. In any case, the idle should quiet down when your transmitter carrier signal is turned on. Presence of the carrier should bring the idle current to a steady 6 or 7 ma. In operation it is the presence of the transmitted carrier that enables the receiver to reject noise and electrical disturbances. With carrier off you may notice noise pick-up. As you key a transmitted tone signal the receiver current should rise from about 6 ma to about 48 ma. This current change actuates the receiver relay and thus in turn you control escapement or servo actuator.

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 transmitter. A few field tests with your buddy on the adjacent channel will acquaint you with close-in operation limits. For ground operation you might experience interaction if taxiing closer than 20 feet of your buddy's transmitter, however, beyond this distance and in the air, no interference will be noted.

## 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 is 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, point the sub-antenna of your Mark II Mule transmitter, main antenna removed, at the stretched out end of the receiver antenna and key tone signal. If you get good operation out to a distance of 15" all is in order to fly. If not, accomplish the following check. Install tuning meter and note at the 15" distance if current is rising to 40 ma. If so, then relay adjustment or cleanliness is reason for non-operation. If small or no rise is noted, receiver tuning is probably at fault. To retune the receiver, use the following procedure.

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 (yellow slug) and slowly adjust slug for highest reading on meter. As the slug is peaked and current rises to the maximum level of about 48 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 the first IF (white slug) and repeat the above. In sequence, back away transmitter and weaken signal each time adjustment brings current level to saturation. In same manner, peak the second IF (~~yellow~~ slug) 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. You will note while tuning that adjustments to the mixer and first IF are somewhat critical but tends to broaden out at the second IF and antenna coil. This is normal. When tuning is finished you should get at least a 40 ma reading at the minimum 15" distance. The average will be about 24". This completes the tuning adjustment.

BLACK

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 15" operation, ground range (receiver held head height) will be in excess of one-half 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 distance as expressed above are for companion use with the Controilaire Mark II Mule transmitter only. Other transmitters may give varied distances due to varied output less antenna, etc. Remember, for proper operation of the SH-100 it requires a transmitter capable of 90% or more modulation.

### RELAY CONTACTS

Occasionally, clean the relay contacts with a contact burnisher or real fine emery paper. Dust or dirt in the contacts can really bug you so use common sense with respect to cleanliness.

### RELAY ADJUSTMENT

As supplied, the 50 ohm relay has been adjusted to pull in at about 35 ma and drop out about 20 ma. Under normal conditions it should remain in adjustment, however, after a hard knock you may have to readjust assuming operation is affected. In practice the relay is first adjusted by bending armature contact so a condition of pull-in allows the armature contact to strike the lower fixed contact before the main armature contacts the coil pole piece. In practice actuate the armature lightly with your finger or small tool and notice that when the contacts are just closing that a small air gap is visible—about .001 between main armature and coil pole piece. After this is adjusted lightly hold the relay in a pulled-in condition and adjust clearance between moving contact and upper contact to be about .003". This is done by bending upper contact. Generally, after these fixed adjustments are made the actual pull-in and drop out can be adjusted by increasing or decreasing armature coil spring tension. Increase tension to increase pull-in point and vice versa.

### NOISE SUPPRESSION

As expressed earlier, the SH-100 is a special purpose unit that has a certain immunity to noise reception, however, in any receiver there is a limit as to the amount the receiver can reject. To guide you in the assembly of a clean installation we pass on to you the following information.

Just what is a noise condition and how will it affect the

receiver? First, the effect is a chattering or unwanted intermittent operation of the receiver. This is caused by noise signals generated within the aircraft. One noise condition is the RF signal generated by the sparking of an electric servo motor. This is best eliminated or minimized by use of an .05 to .1 mf condenser installed across the motor brush terminals. One other condition is the antenna effect noise created by use of long metal torque rods to operate control surfaces.

ANTENNA EFFECT FROM METAL TORQUE RODS. This is tricky to explain. We could just say "use wooden torque rods" - but we know that you might use metal rods anyway unless we explained it - or at least tried to. A metal torque rod adds to the antenna length intermittently. Say the antenna would normally give the receiver a 1/4 volt signal. Then the torque rod (shorting through the escapement momentarily as it revolves) gives added antenna effect. This increases the voltage to, say, 1/2 volt. Seen on an oscilloscope this varying antenna voltage appears as a tone blip or an audio signal. This fires the receiver again. The escapement revolves again - the cycle continues and we have what is called "motor boating" or a relay chattering situation. This "antenna effect" condition is most noticeable (and bothersome) where the transmitter is close to the receiver. This is a clue in the recognition of this problem - operate the system with the transmitter close to the plane and watch for "motor boating"

To conclude, after all this explanation, we again advise that you do not use all metal torque rods. Use wooden rods with small metal end fittings as necessary but minimize the metal length.

Other sources of noise are intermittent battery box connections and switch contacts.

### WARRANTY

Guarantee is extended that factory assembled receivers, not kits, 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 within scope of instructions presented and used with a companion CONTROLAIRE MARK II MULE transmitter. 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 this fact, along with full particulars of why you think unit is defective. Enclose particulars in carton, pack well, and send direct to Controlaire Division, World Engines, Inc. Do not return to your dealer as in most cases details and particulars are omitted and misunderstandings result.

### SERVICE

The minimum fee for inspection and repair is \$4.50. 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 and costs to you. Parts are quoted net and no dealers discount is offered. 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 receipt, repair and return. Send repair work to CONTROLAIRE DIVISION, WORLD ENGINES, INC. 8206 Blue Ash Road, Cincinnati, Ohio 45236. Do not return repair work to your dealer.

The Mark II Mule is recommended for best results

\$ 29.95

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