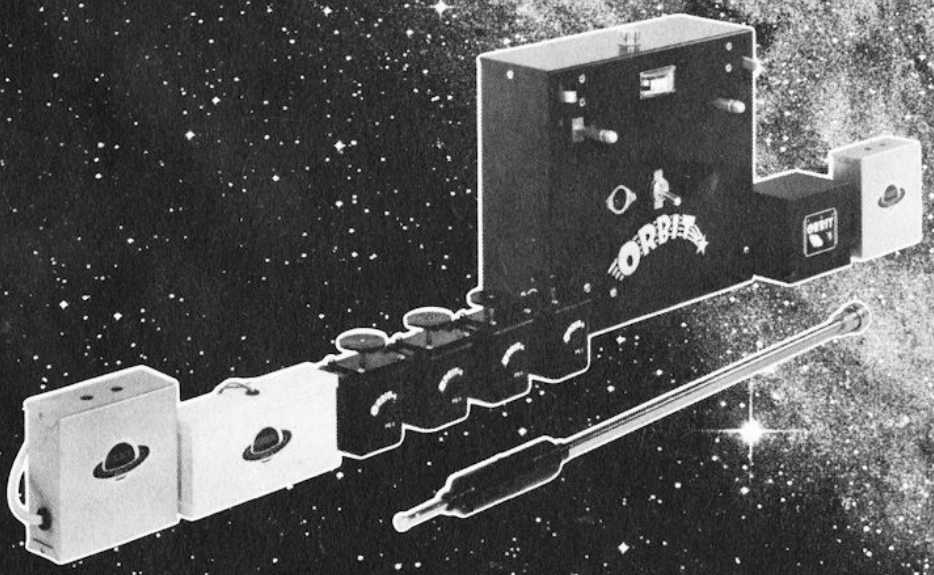
ORBIT PROPORTIONAL SYSTEM



INSTRUCTION MANUAL

INTRODUCTION

In keeping with the high standards of quality control, progressive engineering, and advanced design concepts established by ORBIT ELECTRONICS in preceding years, we introduce the ORBIT PROPORTIONAL SYSTEM. Before proceeding with a description of the individual units comprising the system, a brief resume of circuit operation is presented.

The two primary control functions (aileron and elevator) are operated by two audio tones. These two tones are varied through a relatively small change in frequency above and below the center frequencies of approximately 1750 and 3500 cycles per second. This produces the right and left aileron, and up and down elevator response. These tones are not transmitted simultaneously, but in separate segments. That is, one tone is sent for a short period, and then the other. The amount of *time* involved with the transmission of either tone does not produce an effect on aileron or elevator. These controls are concerned only with the tone frequency.

Rudder control is achieved by varying the amount of time one tone is transmitted with relation to the other. This is referred to as symmetry. Through any given period of time occupied by the high *and* low tones, the symmetry may be varied to a maximum of an 80-20 to 20-80 ratio. That is, 20 per cent of the time may be low tone, with 80 per cent as high tone. This would result in one extreme rudder position. Reversing the symmetry relationship would be the opposite extreme rudder. This symmetry is also infinitely variable with the 20-80 to 80-20 range for proportional rudder action.

Throttle control is achieved by varying the rate at which the two tones are repeated. To explain further; Consider a space of time in which the low tone occupies half the time segment, and the high occupies the other half. If the rate of repetition is increased so that one quarter of the time is low tone, one quarter high, one quarter low, and last quarter high, we have doubled the rate, and the throttle servo moves toward high speed. Slow rate is low speed; high rate is high speed. By considering all the previously mentioned facts, you will see that varying the two audio tone frequencies, the rate of repetition of these tones, and the symmetry relationship produces the quadruple proportional action, and any control may be operated at any time without affecting any of the others.

TRANSMITTER

The command functions on the two stick transmitter from right to left are as follows:

The lever in the upper right hand corner is throttle. Pushing lever up towards the top of transmitter is fast. Pulling down is slow.

The horizontally operated lever on the right with the "Bat Handle" is the aileron control. Moving lever right is right aileron, with left travel producing corresponding left aileron. The black plastic knurled knob just below and slightly to the left of aileron stick is the aileron trim control. Rotation of knob right or left produces a small excursion of aileron servo to right or left of neutral.

In the center is the ON/OFF switch which is clearly marked.

The lever with "Bat handle" on the left of transmitter in the square hole is elevator and rudder control. Operation of lever horizontally to right and left is rudder function. Likewise, up and down operation produces up and down elevator. Note that this is a gimbal type assembly, and may actually be moved in a full circle for the simultaneous rudder/-elevator commands.

The lever in the upper left hand corner is elevator trim, and works in the same manner as elevator control, but yielding a small amount of servo travel for precise trim adjustments.

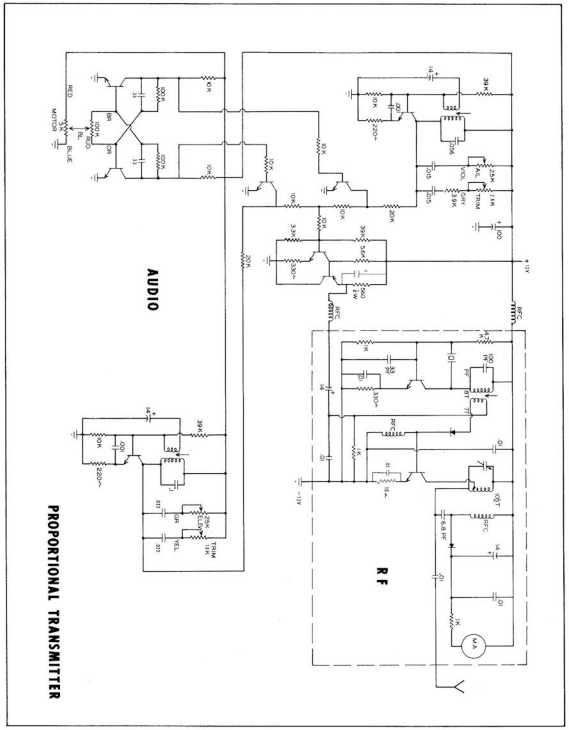
The meter in the center of transmitter at the top, is an R/F indicator. It does not read battery voltage.

Command functions on the single stick unit are as follows:

At the top of the transmitter, on the right hand *side*, are two black knurled knobs. The knob at the front is aileron trim, while the rear knob is elevator trim. Rotation of these knobs produces the same small degree of servo travel for trim adjustments, as the two trim controls on the two stick transmitter.

The lever jutting out the side of the transmitter just below the two trim knobs, is the throttle control. This lever operates through a horizontal plane with push towards the front of the can as fast, and pull to the rear as slow.

TRANSMITTER (cont.)



The single stick on the front of the transmitter contains all the primary control functions; rudder, aileron and elevator. Horizontal movement to right and left is aileron. Up and down motion is elevator, and rotation of knob on the top of the stick is rudder. This is also a gimbal assembly, and may be moved full circle for simultaneous aileron/elevator, with rotation of knob for rudder available at any time.

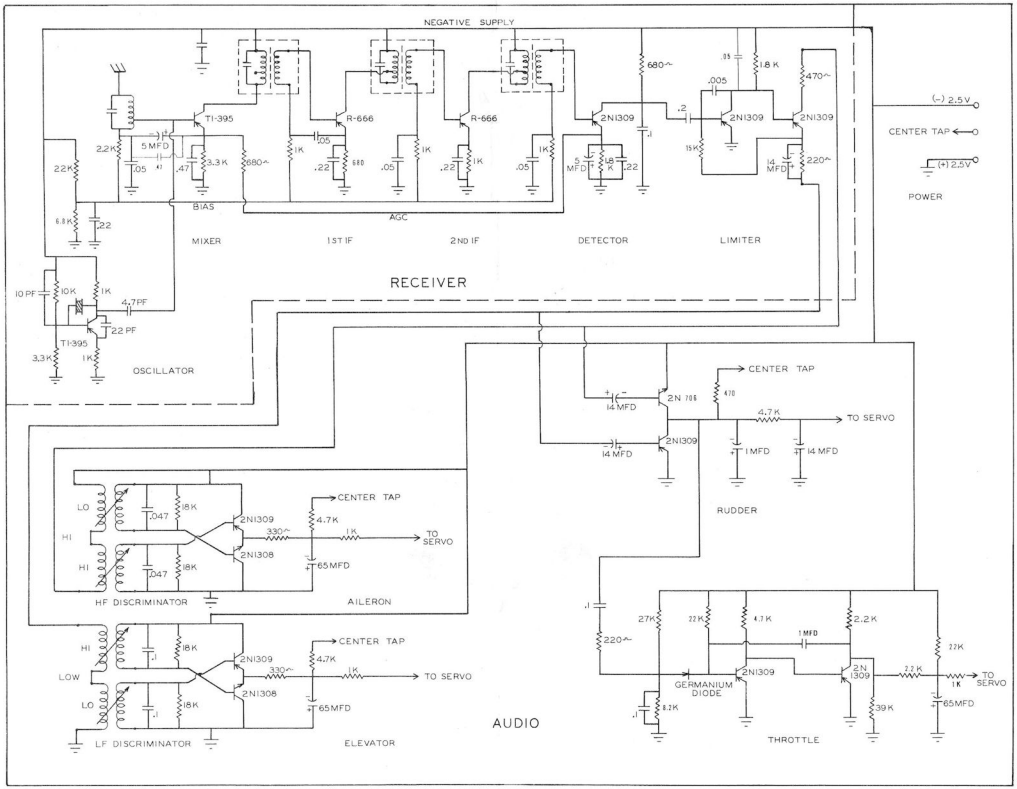
ON/OFF switch, and meter function are the same as on the two stick transmitter.

Note that both transmitters have a three pin socket mounted flush in the face of the transmitter. This mates to the male plug on the charger for recharge of the built-in nickle-cadmium batteries. Always allow a full 24 hour initial period. Thereafter, the batteries may be brought up to peak with a charge period approximately twice that of the previous period of operation. Extended periods of charging will not harm the cells, but avoid any longer than 36 hours. The ON/OFF switch *must* be in the OFF position to charge batteries. The circuit is so wired that the charger is disconnected from cells when the switch is in the ON position. In any case, always check to see that the light in the charger is glowing while attempting to charge.

Both transmitters feature all-transistor circuitry of advanced design, and incorporate very high quality components. Transmitter output is well in excess of necessary power, and should produce adequate range in the air with antenna fully collapsed. However, extended periods of operation with antenna retracted should be avoided.

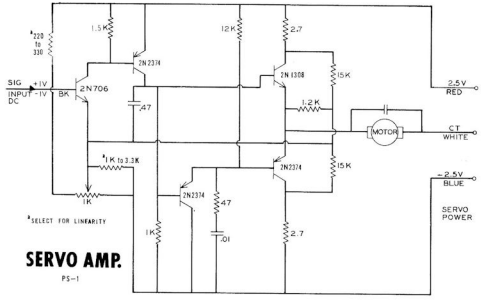
RECEIVER

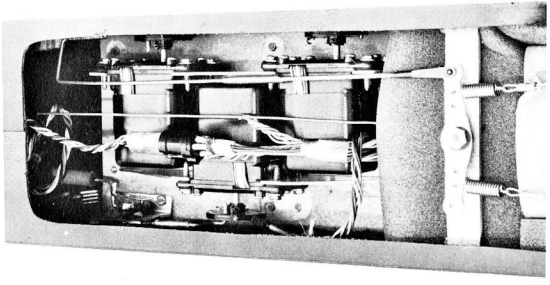
The proportional receiver incorporates "twin-deck" type construction for minimum size and weight with a maximum of strength. The R/F section is a superheterodyne circuit assuring high sensitivity with maximum interference rejection. No adjustments are necessary, or in fact, desirable. Special test equipment is required to properly align this receiver, so "field" adjustments must *not* be attempted. The receiver operates off the same battery that supplies servo power.



SERVOS

The proportional servos incorporate a built-in feed-back potentiometer for true "closed-loop" operation. These units are based on a tried and proven mechanical design with more than adequate power for surface control on the largest models. The very high efficiency motor used will start and run on as little as 12 to 15 milliamperes of current. The five transistor amplifier employs selected germanium and silicon semi-conductors for stable operation under extremes of temperature. Servo transit time is half a second from maximum to maximum.





BATTERY PACK

The air-borne battery pack provided with this system is a very high capacity (1.25 ampere hour) pack of four cells selected as maximum capacity with minimum amount of weight. This pack will yield an aggragate flight time in excess of three hours. *ALWAYS* charge this pack overnight before an intended session of operation. The charger provided is adjusted to charge slightly below the maximum allowable rate for these cells, so extended periods of charge will not harm the battery. The switch in the power leads must be "ON" to charge. *Always* be certain the light in the charger is glowing which indicates circuit is complete and cells are being charged.

TO PLACE UNIT INTO OPERATION

Both transmitter and receiver battery pack should be given a twenty-four hour charge before any extended period of operation is attempted. There is sufficient activity in batteries as supplied to operate system for a short while, but do not depend on neutral positions indicated with discharged batteries.

Note that all servo leads are color-coded with plastic sleeving over wires to mate with appropriate "pig-tails" from receiver like-wise color-coded. Control functions by color are:

Yellow – Elevator
Brown – Aileron
Green – Motor
Orange – Rudder

The four pin plugs (servo) and sockets (pig-tail) are keyed to prevent plugging in backwards, but always check visually as this operation is performed. It is possible to gain partial engagement of plug backwards by forcing pins. This condition will cause servo to run in a continuous circle as power is applied. Mate all corresponding servo plugs and sockets, and six pin power plug from receiver into mating socket from power-pack. Apply power by turning on the switch that is wired in power leads from battery pack. At this time, servos will all seek neutral, and motor control servo will run to slow speed condition. This is referred to as the "Fail-Safe condition. Now switch transmitter ON. Some small change in servo position may now be noted, depending upon the position of elevator and aileron trim controls, and position of throttle selector lever. At this time you may observe servo response and travel by operating appropriate controls on transmitter.

INSTALLATION

Servo mounting is self-explanatory, and in any case is an individual problem depending entirely upon the physical characteristics of the vehicle. Servos may be mounted in any position, utilizing the four mounting holes equipped with rubber grommets, on the servo flanges. 3/32 or ⅛ inch plywood is an adequate servo platform, using No. 4 or No. 6 flat washer between the head of the screw and grommet. Do not over tighten screws, but rather pull snug to grommet, and then "set" the screws in place with a small dab of Walthers "GOO", or any contact cement. Model cement may be used, but remember that this tends to crack loose fairly readily.

It must be stressed that minimum friction and bind in control surface hinging, and linkages is very important. Try to adjust all surfaces complete with linkage with servo disconnected so they will fall freely from side to side of their own weight. In severe cases, binding surfaces will cause higher than necessary current drain, and could result in "jerky" response. ALSO, *ALWAYS ADJUST NEUTRAL POSITION OF CONTROL SURFACES TO AGREE WITH "FAIL-SAFE" NEUTRAL.* That is, with the servo neutral provided with power on, but transmitter off.

Note that direction of servo travel is non-reversible. That is, it is not possible to reverse direction of servo rotation by switching wires. If control is backwards, it is only necessary to shift pushrod to opposite side of control wheel. It is also necessary to provide a slight spring tension for the motor control servo to work against. The full low speed position with transmitter ON is not the same as "fail-safe" low speed. With transmitter OFF, motor speed servo will rotate approximately twenty degrees farther than full closed position of throttle with transmitter ON. It is for this reason you must avoid a solid bind in motor control linkage. One good method is to use .040 wire for the pushrod with a small "V" somewhere in its' length to act as a spring.

The receiver is not subject to vibration in the same manner as a reed receiver, but adequate padding should be provided for vibration absorption to prevent any possibility of mechanical failure.

This system is guaranteed free from defective parts and workmanship for a period of ninety days from date of purchase. If system fails to function according to, and after following instructions, return directly to factory for service. DO NOT RETURN UNIT TO YOUR DEALER. *Any evidence of unnecessary abuse, alterations, or additions, will void this guarantee.* Guarantee must be on file promptly, and dealer *must* certify date of purchase. This guarantee does not extend to vacuum tubes or crystals.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