INSTRUCTION SHEET

DUAL PAK
CATALOGUE NO. 6080

The DUAL PAK is a completely matched and wired set of two spring-centered pulse actuators, 1 Amp. battery, and switch harness,--ready for connection of three wires from your receiver and installation in the airplane.

The DUAL PAK provides three controls: two simultaneous proportional controls and one trimmable control for throttle. Throttle control is provided on the rudder actuator by go-around action. The DUAL PAK operates at high pulse rates for the least dither and is a fail safe system.

The DUAL PAK includes a 1.0 Amp. hour, three cell battery pack, composed of the latest G.E. vented, self-sealing, cylindrical cells. The cells are spot-welded together for added reliability. The battery provides at least one hour flying time.

The DUAL PAK operates with any 3 to 3.6V pulse receiver, however, relay receivers must have the relay disconnected. Some receivers have not been designed for use with pulse systems and may require a reduction in capacity of the output filter capacitor for satisfactory operation. Receivers, which are over sensitive, tend to pass false elevator signals, called glitches. Superregen receivers require decoupling as per instructions.

SPECIFICATIONS:	System Weight:	8 1/2 oz.	Actuator weight:	1 1/4 oz. ea.
			Actuator size:	1 x 1 3/4 x 2 ea.
	Power Supply:	3.6 V	1 Amp. hour (Supplied)	
	Signal Requirements:		Elevator: Neutral	13-16 pps
			Up	9-11 pps
			Down	19-21 pps
			Rudder:	60-40% Width Change
			Motor Control:	Actuators go-around
				Tone 'on' -High motor
				Tone 'off'-Low motor

UNWANTED MOTOR CONTROL WILL OCCUR, IF THESE SIGNAL REQUIREMENTS ARE EXCEEDED.

Understanding How Pulse Proportional Works

Three pulse coded control signals are transmitted to the airplane receiver. The signals are electronically decoded and directed to each actuator.

1. Neutral width is 50% 'on' and 50% 'off'. Varying the width to more 'off' time than 'on' time, causes the actuator motor to turn more in one direction, so that the output assumes an average position to the left. More 'on' time than 'off' provides a right turn.

2. The pulse rate controls the position of the elevator actuator output. Increasing the pulse rate will cause the output to rotate from neutral for 'down' elevator. Decreasing the rate causes rotation in the opposite direction for 'up' elevator.

3. Steady-on tone or steady-off tone causes the actuator crank to turn 360°; five times for full throttle control. Signal 'off' is used for low motor to provide fail-safe operation. The control surfaces move rapidly through their extreme positions, for effective neutral action.

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FIGURE 1.

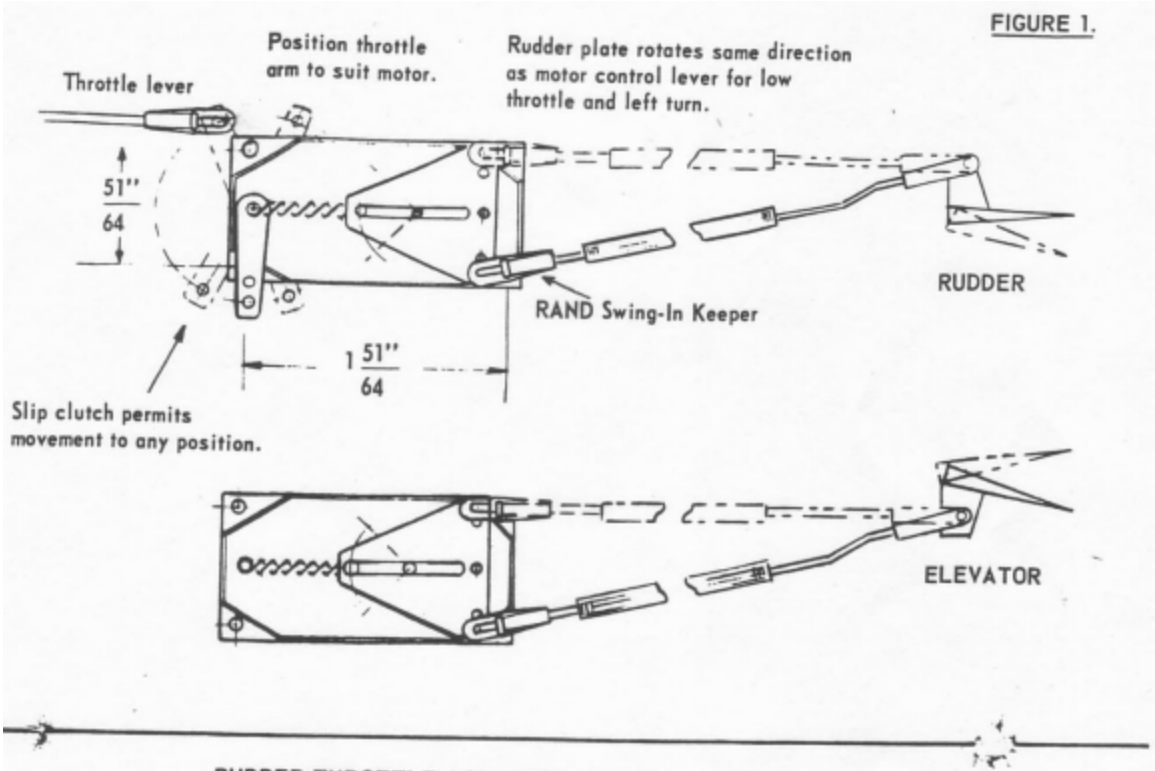
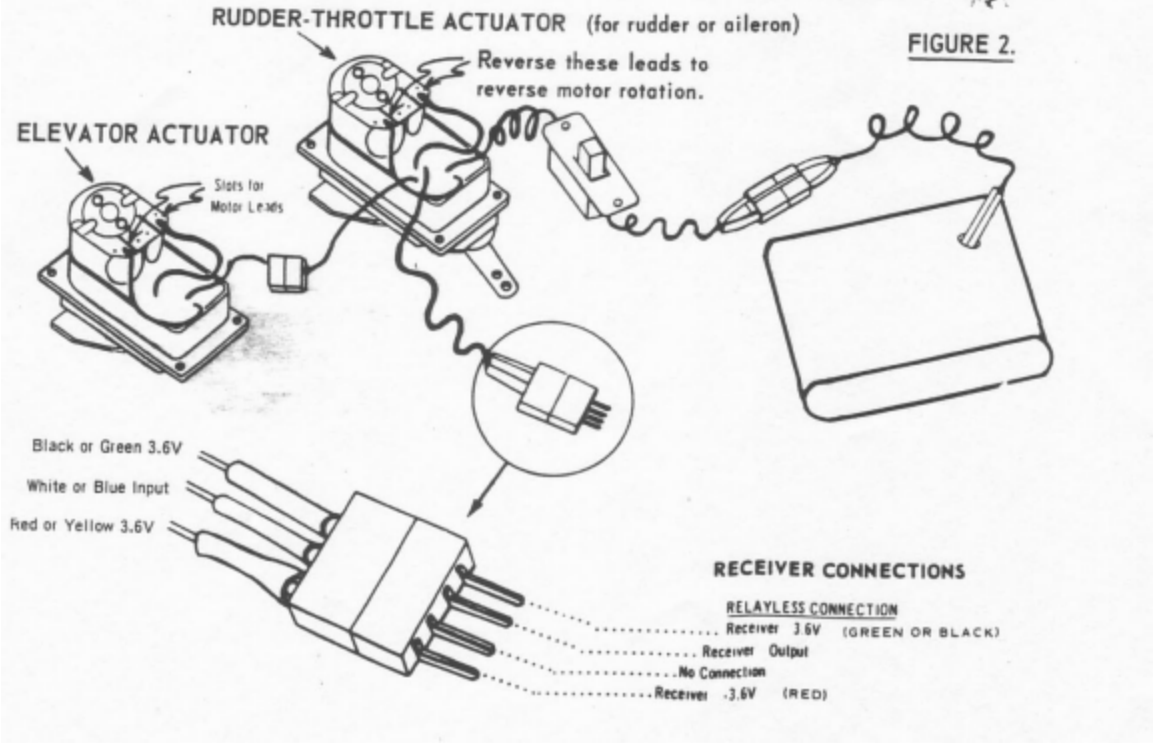


FIGURE 2.



RECEIVER CONNECTION INSTRUCTIONS

Technique for Soldering Wires to Plug:

Strip wire 1/8". Tin the wire and connector ends and place sleeves over the wires. Hold the plug in a vise or tape to the bench. Hold the wire in place and put the point of a freshly tinned iron along side the wire and prong, heating both simultaneously. Quickly remove the iron, holding the wire until the solder is set. The result should be a smooth filled joint.

Instructions for Disconnecting the Relay:

Inspection of the relay and receiver circuit board will reveal that one side of the relay coil is connected to the negative land and the other leg is connected to the output transistor.

- Unsolder the short wires connecting the relay to the P.C. board and remove it.
- Solder a blue or white wire in place of the short wire, which had connected the relay to the output transistor.
- Twist the three receiver wires (positive, negative and receiver output) together and connect to the receiver plug as shown in Figure 2.

INSTALLATION OF THE DUAL PAK

Prior to installation in the airplane, connect the battery and receiver to the harness and position the actuators on the bench in their relative positions in the airplane. Place the rudder actuator on the side most convenient for operation of the glow motor throttle. Turn on the transmitter and receiver and note the operation. Proceed as follows:

Transmitter Adjustments for Neutral Pulse Rate:

The DUAL PAK system is set for a 14-16 PPS neutral pulse rate. If the transmitter has not been set to this rate, the elevator actuator will go around as if failsafing. Follow the transmitter manufacturer's instructions and adjust the elevator pot until the actuator is pulsing in the neutral position.

Move the control stick to the stops for 'up' and 'down' elevator. The actuator output should deflect about 30°. If it goes around before the stick hits the stops, note the excess travel. If the transmitter has a rate ratio adjustment, follow the maker's instructions and reduce the rate range until the stick can be moved in both directions to the extremes without the output going around. Some GG transmitters, when set to this rate, become very nonlinear and the pulse rate change in the down direction will be excessive. If there is no rate range adjustment or it is insufficient, then a plywood mask must be cut and attached to the transmitter to limit the stick travel and prevent the go-around action.

At this point the limitations of some relayless receivers may become apparent. If the control stick is moved to the full 'down' position, it will be noticed that rudder will drift and the control stick will have to be moved to the left to neutralize it. Unless the amount is quite severe, this will not unduly limit your flying. A reduction in the capacity of the output filter capacitor will improve this condition.

Determining Direction of Rotation of Rudder Actuator Motor:

Signal for low motor on the transmitter and note the direction of rotation of motor control lever on the actuator. Note: the motor control arm on the actuator can be moved to either side to suit the throttle position. If the throttle arm does not move in the direction required to close the throttle, the direction of rotation of the actuator motor will have to be reversed. This is accomplished with reference to Figure 2. The blue (or white) and green (or black) wires are soldered in slots in the P.C. board holding the suppression circuit to the actuator motor. Carefully unsolder them and reverse their position.

Connection for Rudder:

With transmitter signaling left turn, note position of rudder plate. Connect rudder pushrod to appropriate side to give 'left' rudder. Then adjust pushrod length so the rudder and actuator will both be in a neutral position.

Connection for Elevator:

With transmitter signaling 'down', note position of elevator plate. Connect elevator push rod to appropriate side to give 'down' elevator or reverse motor direction so the push rod can be connected to a particular side. Then, adjust push rod length for neutral.

For Motor Control:

Be sure all control linkages are free. Watch for binding of quick-links on control horns caused by too much tension, keepers that are too tight and misalignment. Be sure voltage under load is at least 3.6 V. (For best results, use RAND HINGES)

Mounting Plate: USE YOUR PACKAGE INSERT FOR A TEMPLATE.

Recommend mounting actuators on 3/32" plywood plate with #2-56 blind mounting nuts or self-tapping screws (RAND Cat. No. 1014, #2-Self-Tapping Servo Mtg. Screws). Attach the plate with rubber grommets to 1/4" square rails glued to sides of fuselage.

CARE OF BATTERY

Carefully measure your battery voltage prior to each day's flying. This can easily be accomplished by pulling the plug far enough apart to insert the probes from your meter. It should measure at least 3.6 V with the system in operation. It is wise to make a battery check at least once each half hour of flying time. The G.E. cells have been tested for 1 hour of constant pulsing on the bench. In normal operation with some rest time between flights, they will give this much time or more.

Charging should be at a rate of 90-100 maH for at least 16 hours prior to each day's flying. Note: These batteries may not be fully charged when received. No damage will result, if these batteries are left on the charger over 16 hours. However, it would be advisable to remove them after 24 hours. Batteries are considered to be discharged when they have reached 1.1 V per cell or 3.3 V for the battery.

Depending on the receiver used, this system will function below 3 V. The limiting voltage being that at which the receiver will no longer operate. Therefore, it is possible to discharge these cells because of prolonged use, below the recommended 3.3 V. The action of the actuator and its motor control will be noticeably affected at approximately 3 V. Serious damage to the batteries can result, if discharged completely. Sometimes a low battery will be indicated by a missed signal or glitch. For safe operation of your aircraft and protection of your equipment, it will be your responsibility to land your airplane and measure the battery voltage. Do not fly with voltage below 3.4 V, with the system in operation.

TRIMMING AND FLYING

Prior to flying this system, receiver range should be ground checked and receiver tuned in the manner prescribed by the receiver manufacturer.

Note position of control stick or trim levers to maintain straight and level flight. Adjust pushrods accordingly.

For the least flight disturbance, signal motor control with short blips.

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CHART OF MODIFICATIONS TO RECEIVERS

Receiver	Operation for 3 V Receivers on 3.6 V.	Decoupling of Superregen Receivers	Correcting Distortion of Output Waveshape	Misc. Notes
Min-X 1200 Superhet	Connect negative to green wire.	———	No modification required.	
Min-X SH 1 Superhet	Connect negative to green wire.	———	No modification required.	
Min-X Capri Superregen	———	470 OHM resistor in negative line. 20 MFD capacitor across the line.	No modification required.	
Controlaire SH 100 Relay	Will operate at 3.6 V. Some will require dropping the voltage as per Explanation I. (other side)	———	Replace 70 MFD with 20 MFD capacitor.	
Controlaire SH 100 Relayless	Will operate at 3.6 V. Some will require dropping the voltage as per Explanation I. (other side)	———	Replace 70 MFD with 10 MFD capacitor.	
Controlaire 4 Relay Superregen	———	330 OHM resistor in the negative line. 70 MFD capacitor across the line.	No modification required.	
Controlaire 5 Relayless Superregen	———	330 OHM resistor in the negative line. 30 MFD capacitor across the line.	No modification required.	Footnote 1
Citizenship SSH Relayless Superhet	Connect negative to black wire.	———	Remove 90 MFD capacitor from the output and replace with 5 to 15 MFD.	Footnote 2
F & M Vanguard Relay Superhet	Connect negative to brown wire. Will operate at 3.6 V. Some will require dropping the voltage as per Explanation I. (other side)	———	No modification required.	Footnote 3

Footnotes:

1 - Audio filter time constant modification is required. Replace 15 MFD capacitor with 3 MFD, and 100 OHM resistor with 470 OHM. Makes circuit identical to Controlaire 4 receiver.

2 - Dual capacitor with proper value is available from Citizenship.

3 - Load is between emitter and negative instead of the familiar collector to positive. As a result, the 100 OHM resistor in the RAND switcher must be disabled by clipping the lead at the top of the 100 OHM resistor. Put a 100 OHM resistor in the receiver in place of the relay. A 30 MFD capacitor must be added in parallel to the load resistor.

Receiver Modifications for Use with the RAND GG PAK and DUAL PAK

The following suggestions are offered to the modeler as a guide in the adaptation of receivers for relayless operation of the RAND pulse systems. We have tried all of these changes but cannot guarantee that every receiver will respond satisfactorily. In many instances, variations in suggested values will have to be tried.

Not all receivers avail ble today are of equal ability to faithfully reproduce pulse signals. Some are limited in range, some are limited in noise rejection, some are temperature sensitive and some distort the signal at increased pulse rates.

We are offering the following notes as suggestions only. We are unable to accept responsibility for the performance of any particular receiver.

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There are three areas requiring modification for relayless operation. However, not all will apply to all receivers.

I. Provision for operation for 3V receivers on 3.6V.
II. Decoupling of superregen receivers from the power supply.
III. Correcting the distortion of the output wave shape or signal.

Explanation for I:

Some superhet receivers will not work well at 3.6V. They were designed for 3V. A resister in series with the negative lead and a 3V Zener diode (IN703) across the receiver will cure the trouble. A simpler method is to install a silicon diode in series with the negative (such as #SD05 or IN456A). This type of diode should have a forward voltage drop of about .4V @ 25° C. This will reduce the receiver voltage to about 3.1V, which is generally satisfactory. A low cost general purpose silicon diode can be used. Some receivers, such as the Min-X SH-1 and 1200, have this diode built in. It is in series with the green lead.

Explanation for III:

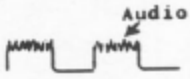
A word of explanation about the signal wave shape. The desired output wave shape is a square shape that looks like this:

One of the basic problems in receiver design is that of removing the audio tone component. Generally, it is done with a large capacitor at the output to ground or at the output stage base to ground.

For rudder only operation, the capacitor is chosen large enough to completely remove all traces of audio. This usually has the effect of distorting the square edge of the desired pulse width shape. In rudder operation, this distortion can be easily compensated for with trim and causes little trouble. As this distortion remains constant in width as the rate is increased or decreased, it causes an interaction in GG systems.

The filtered wave shape looks like this:

We are suggesting the reduction of the output capacitor size to reduce the interaction to an acceptable level or eliminate it. The shape will look like this:



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