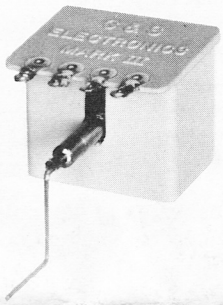
C&S ELECTRONICS

13400-12 SATICOY STREET, NORTH HOLLYWOOD, CALIFORNIA

Operating Instructions



for the "Septalette"

PROPORTIONAL ACTUATOR

(MODEL CS-506)

Mark III Mark V

DESCRIPTION

Instructions contained herein apply to both the Mark III and Mark V "Septalette" actuators. Except for physical size and power output, these units are identical.

The "Septalette" actuator is basically a permanent magnet free to rotate within a dual field winding. A high impact plastic case protects the mechanism. An output shaft and crank serve to transmit the actuator motion to the flight control surface. Electrical connections are made to terminals on the plastic case top.

When current flows through one winding the magnet rotates and turns the attached output shaft towards one extreme position. Application of this current to the second coil, but in reverse direction, turns the magnet and shaft towards the opposite position. When currents between both windings are switched (pulsed) at a high rate, the magnet tends to rotate alternately in either direction but actually very little movement appears at the output shaft. Relative position of the output shaft is determined by the percentage of time current flows through one winding or the other.

In a control system using the "Pulsi-Tran" pulser and a radio control receiver (CS-503A, CS-505A or CS-507S), variation of the "PULSE WIDTH" control setting will cause a corresponding change in the average position of the actuator output shaft. By proper coupling, this shaft movement can be used to produce any desired position of a model aircraft rudder. Direction and degree of rudder movement will be proportional to the rotation of the "PULSE WIDTH" control knob.

INSTALLATION

Permanently mount actuator in airframe as follows:

a. Make rudder torque rod either of solid music wire or dowel with wire end fittings. Be certain rod is stiff and absolutely straight.

b. Forward yoke in torque rod wire must accommodate actuator crank without excessive side play. Solder open end of yoke to maintain wire alignment.

c. Install torque rod in fuselage. Use bulkhead bearings if possible. Solder brass washer to each end of torque rod to prevent end play. Bend rudder control wire at exactly 180° to forward yoke.

d. Adjust position of rudder yoke to obtain desired rudder throw with approximately 75° torque rod rotation. Install sponge plastic stops in fuselage to limit travel of torque rod forward yoke to 75° maximum.

e. Be absolutely certain that control system works with complete freedom. Rudder hinges must not bind. Work entire system by hand several times to obtain smooth operation.

f. Using thread, bind and glue actuator unit to a 1/16 or 1/8-inch thick hard balsa platform.

g. Cement platform in fuselage with actuator output shaft facing aft and aligned with torque rod front bearing. Fit actuator crank into torque rod yoke. Be sure alignment is maintained.

SPECIFICATIONS

Size	3/4 x 3/4 x 1 inch (Mark III) 1 x 1x1 5/16 inch (Mark V)
Weight	5/8 oz (Mark III) 1 oz (Mark V)
Resistance (per coil)	15 ohms
Current Drain (at 3V)	200 ma
Aircraft Application	.010-.020 (Mark III) .020-.049 (Mark V)
Recommended Receiver	CS-503A (Relay) CS-505A (Relayless)
Recommended Pulser	CS-504 "Pulsi-Tran"
Recommended Transmitter	CS-502 or CS-509

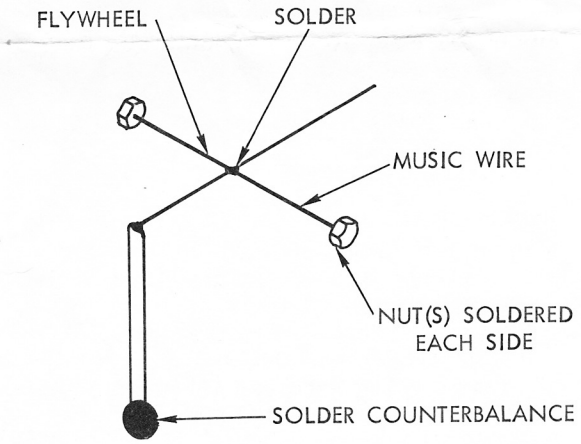
NOTE

It is absolutely imperative that actuator output shaft and torque rod bearing be aligned in both dimensions, or improper proportional operation will result.

COUNTERBALANCE AND FLYWHEEL

For smoother operation of your pulse system, we recommend addition of a counterbalance weight to offset the rudder mass. A small amount of solder at bottom end of torque rod yoke will serve this purpose. Do not use too much solder.

If greater smoothness is desired, a "flywheel" soldered to the torque rod will also help.



WIRING

a. Follow appropriate wiring diagram for type of receiver being used.

b. Use No. 26 or 24 flexible multi-strand plastic covered wire for connections.

c. When soldering wires to "Septalette" actuator terminals use extreme care and as little heat as possible to avoid melting plastic case.

d. Dress wires away from operating mechanism.

GENERAL OPERATING NOTES

a. The "Septalette" operates at any pulse rate, higher rates giving smoother control surface operation.

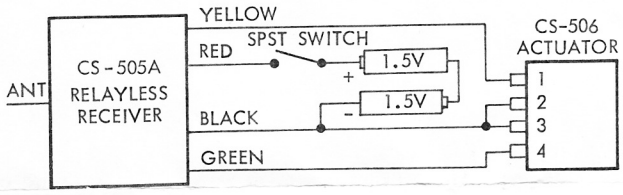
b. Use heavy duty batteries such as Eveready E-91 Alkaline Energizers, larger batteries if possible, for longer life.

c. After installation, check system for full proportional operation, control movement and correct neutral.

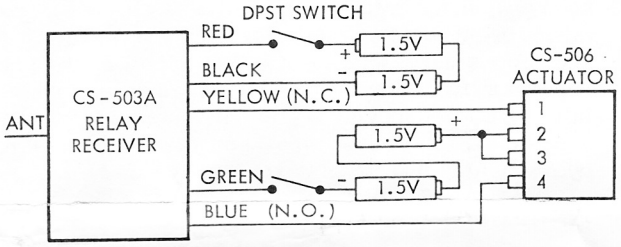
d. If off-center control operation exists, check pulser, transmitter, possible overloading of receiver by proximity of transmitter, and possibility of unbalanced output (relayless receiver).

e. At extremely high pulse rates, an unbalanced output may be obtained from a relayless pulse receiver.

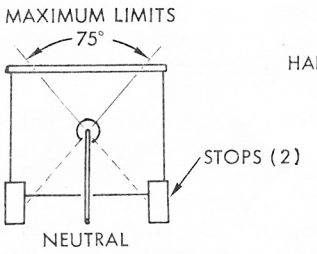
Transistor unbalance can be cured by inserting a small resistor (2 to 10 ohms) in series with either terminal 1 or terminal 4 of the actuator. Place resistor in series with the coil carrying the greater current.



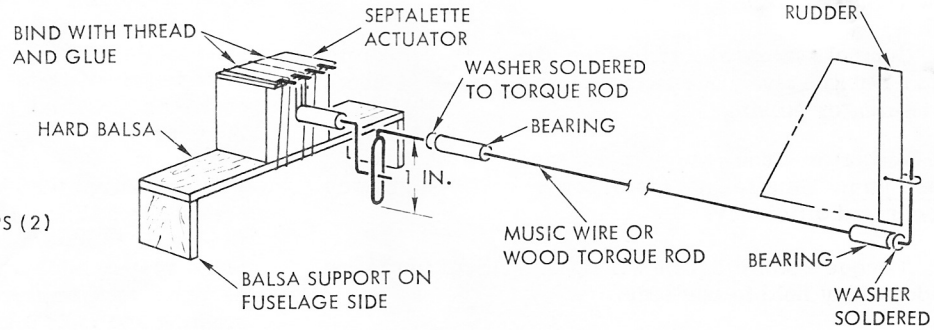
WIRING DIAGRAM- CS-505A RELAYLESS RECEIVER



WIRING DIAGRAM - CS-503A RALAY RECEIVER



TRAVEL LIMITS OF CRANK



ACTUATOR INSTALLATION IN AIRCRAFT

Installation and Adjustment of the C&S Electronics Proportional Control System

WHAT IS PROPORTIONAL CONTROL?

Proportional control as used in R/C model aircraft implies a control system which will permit movement of a flight control surface in any direction or degree that the operator might desire. Unlike escapement systems, the flight surface is positionable in any direction without going through a control cycle. However, the major advantage of proportional control lies in its ability to provide smooth turns, precise control and a true flying "feel" for the pilot.

PROPORTIONAL CONTROL WITH THE SEPTALETTE

The new C & S control system provides simple proportional rudder-only control for small .010 - .049 powered R/C models. A lightweight radio receiver, either relay or relayless, controls operation of the "Septalette" magnetic actuator which moves the rudder. Two pencells (or 3 nickel-cadmium batteries) supply all power needed by the "Finch" relayless receiver and the actuator. Total weight is less than 3 ounces.

NOTE

A conventional single-ended relayless receiver will not operate the "Septalette" actuator.

A control transmitter and pulser are required for ground control of the aircraft. Pulser rate should be 6-20 pps, signal ratio a minimum of 30-70-30%. Transmitter must be of sufficient power, correct frequency and, above all, capable of being keyed at the pulser repetition rate. Be certain your transmitter provides full modulation at fast keying rates. If not, modify as necessary. Of course, the receiver being used must pulse cleanly at the pulse frequency selected.

EQUIPMENT INSTALLATION

Instruction sheets with the "Finch II" and "Lark II" receivers and "Septalette" actuators provide detailed instructions for installation and wiring. Here are a few additional tips:

a. Control system should be free but not loose. Cloth rudder hinges give just enough damping action to smooth out actuator pulsing.

b. Actuator crank movement must be held to 75° maximum. Smaller angles of travel produce greater power and efficiency.

c. Torque rods must be straight, without binds, or rudder may hold to one side.

d. For mounting variation, "Septalette" could be installed sideways to give push-pull rudder action.

e. Actuator output shaft and torque rod forward bearing must be in alignment, both horizontally and vertically.

f. Smoother operation will be achieved by use of counterbalance weight and weighted "flywheel".

BATTERIES

Because of power requirements, use heaviest duty batteries your aircraft can carry. Pencells with less capacity than Eveready E-91 Energizers should not be used. Nickel cadmiums must have a minimum capacity of 225 mah, preferably sintered. Before flying, be certain that battery voltages under load are well above minimums specified, and batteries are fully charged. Do not fly equipment with low batteries.

SYSTEM OPERATION

With equipment operating, and pulser control knob in neutral, the "Septalette" output crank and attached rudder should oscillate back and forth at the "Pulsi-Tran" pulse rate. As pulse rate increases, mass and inertia reduce the actual travel distance of crank arm and rudder. At 15-20 pps motion is restricted to a slight quiver, giving smooth rudder action. Operation at extremely high rates is not always practical because of transmitter - receiver - pulser limitations and range reduction caused by slow rise time in transmitter audio, resulting in under-modulation. In each case, experimentation may be necessary to determine best pulse rate for your own equipment. Select a pulse rate to give:

a. Smooth and positive rudder response, with solid neutral and full rudder travel in each direction.

b. Minimum rudder oscillation consistent with adequate transmitter range.

c. Continued operation of pulser in extreme control positions (low value rate control resistor in "Pulsi-Tran" can stop pulsing).

Rotation of "Pulsi-Tran" control knob should cause the rudder to follow accordingly. Average rudder position should be relatively stable at any setting of control knob, becoming smoother towards control limits. Pulser "FULL OFF" and "FULL ON" buttons provide for instantaneous full left and full right rudder positions. Rudder throw may be slightly more than is obtained at control knob extremes.

Pulser control buttons will override pulser action to provide an additional safety and control factor in pulse flying. If it should become obvious in flight that the pulse system is operating incorrectly, the buttons may be used to complete the flight. They also permit stunting and violent maneuvers of your pulse aircraft. In addition, the "FULL ON" button allows transmitter keying (pulser off) when flying escapement aircraft.

Litho in U.S.A.

Thus, the C & S proportional equipment becomes a simple, effective system which gives you constant control of flight attitude and develops a real flying "feel". Satisfaction derived from this type of flying far surpasses that obtained from escapement models.

SYSTEM CHECK

Correct adjustment of receiver-actuator installation in the aircraft is the most important factor contributing to satisfactory flight performance. Proceed with the following checks.

a. Check operation of pulser and transmitter carefully before proceeding further. Be certain transmitter is providing adequate pulse range (see System Adjustment below).

b. Turn on equipment in aircraft. Rudder should move to full left position.

c. Turn on transmitter (antenna removed) and hold it close to receiver. Press "FULL ON" button on pulser. If receiver is tuned, rudder should move sharply to full right position.

d. Receiver can be tuned either with pulser off or on. With pulser off, depress "FULL ON" button and tune for right rudder signal at greatest separation distance between receiver and transmitter (antenna still off). With pulser on and in neutral, tune for maximum right rudder at greatest distance. Tuning points should be the same.

e. Turn pulser on, set control knobs to neutral, and operate transmitter (no antenna) within 3 feet of receiver. Equipment should pulse cleanly and, especially with relayless receiver, a definite right rudder condition should exist. Slowly move away from aircraft. Using relayless receiver, as distance increases right rudder will gradually decrease until at 8-12 feet a true neutral rudder is obtained. At this distance pulser should provide full rudder control in both directions, plus correct neutral. If not, system must be adjusted to obtain this operation, or flight performance will not be satisfactory.

SYSTEM ADJUSTMENTS

Possible causes of improper operation are, in order of probability and importance:

a. Loss of transmitter range at high pulse rate, caused by slow rise time of audio signal and resulting low modulation percentage. This can be determined by comparing operating range with pulser on against that with pulser off (keying with "FULL ON" button). If pulsing range is appreciably less, transmitter is at fault. However, some range reduction with pulse is normal.

If transmitter range seems inadequate, check unit carefully for proper operation.

b. System unbalance, causing improper neutral and unequal rudder travel. In relay receivers, adjust relay contact positions and spring tension. However, the "Finch II" relayless receiver outputs are fixed and adjustments must be made by installing a resistor of proper value in series with one of the actuator windings. To add right rudder, solder the resistor in the receiver green lead; for left rudder, in the yellow lead. Use a 1/4 or 1/2 watt resistor. Select a value between 2 and 15 ohms which will provide correct rudder neutral. The larger values will give greater rudder displacement.

c. Low receiver sensitivity will have some effect on rudder position, especially with relayless receivers. Check receiver range with a transmitter of known performance, using manual keying. If receiver sensitivity does not seem adequate, locate source of trouble before attempting controlled flight.

FINAL TEST

a. Recheck system operation with transmitter antenna removed. Be sure controls operate smoothly, neutral is O.K. and range is sufficient.

b. With transmitter antenna installed and extended, ground check for maximum range.

c. Check close-up operation for receiver blocking and overloading. With relayless receivers a heavy right rudder condition at close range is normal.

WARRANTY

This equipment is warranted to be free of defects in material and workmanship. We assume no liability for defects caused by misuse, crashes, over-voltage or abuse by the user. In case of trouble return your unit to C & S Electronics Repair Station NOT TO THE DEALER.

Include return postage with equipment sent in for service. Equipment will not be serviced or returned without this remittance. Be sure and indicate type of trouble encountered. Repair charges will be as reasonable as possible. Where damage is too great to repair, a new unit will be substituted at a cost equal to 66-2/3% of the original retail price. In event repair charges are incurred, you will be notified by mail. No C.O.D.'s or credit on service.

C & S Electronics Repair Station
13400-12 Saticoy Street
North Hollywood, Calif.