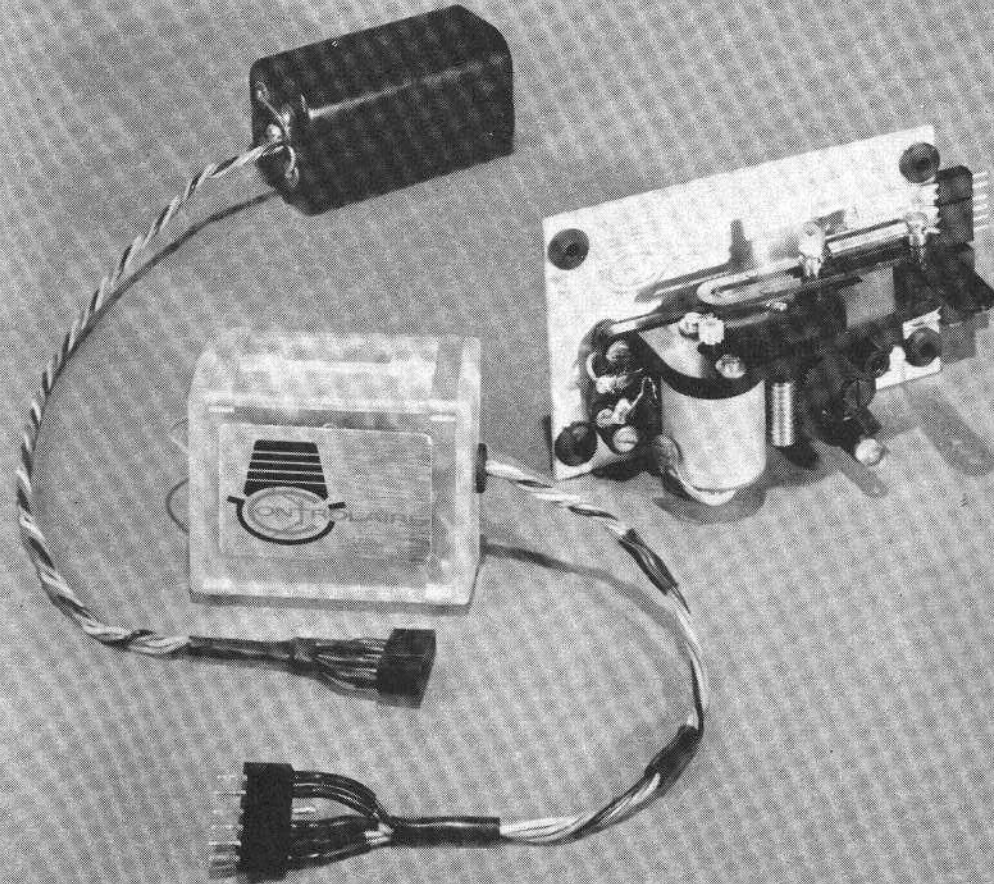




MARK II

# GHOST BOARD & SWITCHER



ASSEMBLY & OPERATING INSTRUCTIONS



*Controlaire Electronic Division*  
**WORLD ENGINES**

INCORPORATED

8960 ROSSASH AVENUE

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# GHOST SWITCHER BOARD ASSEMBLY AND OPERATING INSTRUCTIONS

## INTRODUCTION

The purpose of the Ghost Switcher Board is threefold. (1) It provides a simple, convenient mount for the Ghost Actuator; (2) it includes the well-known NND-1 Switcher (no neutral drift) which allows the system to be flown in rather small airplanes due to low battery weight and, perhaps most important, (3) it accomplishes a majority of the installation wiring via the printed circuit board. World Engines hopes that this product will overcome the complexity of proportional over escapements and, in so doing, allow more modelers to enjoy single channel proportional flying.

## PRELIMINARY NOTES

Unpackage and inspect all parts and compare with the parts list to insure that your kit is complete. Inspect the printed circuit mounting board for flaws or broken circuit lands. After etching, your circuit board was silver plated and sprayed with a clear protective plastic coating. The protective coating can be "soldered through"; that is, it will melt away locally when you solder to the board and wherever it is left intact it will prevent corrosion, keeping your board bright and neat looking. In the event that the coating becomes scratched and corrosion appears, clean the spot locally with steel wool and apply solder to the damaged area.

## ASSEMBLY

Due to the simplicity of this unit, no formal assembly instructions will be given. Refer to fig.#1 and the various photos to determine parts placement. Use a 25 to 40 watt soldering iron and the solder provided during assembly.

### HERE ARE SOME POINTS TO WATCH:

- (1) Soldering the deans plugs to the board will be somewhat easier if both the plug terminals and the circuit board are pretinned. Take care not to tin the male plug contacts instead of it's terminal pins. After tinning, place the plug in position and solder one terminal to the circuit board. When you're satisfied with the plug position, solder the remaining terminals.
- (2) Mount all electronic parts flush with the board. The 47 ohm resistor is color coded yellow-violet-black and the 100 ohm resistors are coded brown-black-brown.
- (3) Before mounting the Ghost Actuator to the board, install the flexible leads to the terminal lugs and route the wires under the actuator. Mount the Actuator on the circuit side of the board using the #4 self tap screws with 3/16 rubber grommets between the actuator and the board. Solder the remaining ends of the flexible wires to the circuit board as shown in the photo.

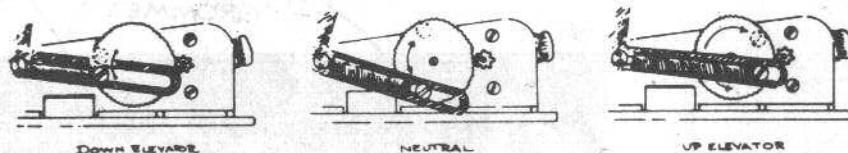
After assembly and before making an operational check, go over your work to make sure you have not created any short circuits during soldering either on the board or at the plugs. In particular, check the wiring to the receiver and battery plugs. An extra minute or two spent here might catch a mistake and save a repair bill.

## OPERATION

Two 1.2 volt nickel cadmium (500 MAH or larger) are recommended for servo power and two 1.5 volt pen cells for receiver power if an SH-100 or Contro-laire "4" is used. To check the operation of the unit, first make sure the slide switch is off and plug the receiver and batteries in. With the transmitter turned on, move the slide switch to the "ON" position and the actuator will begin pulsing. If the unit did not operate in the normal manner, check your wiring and refer to the troubleshooting section.

## TRANSMITTER ADJUSTMENTS

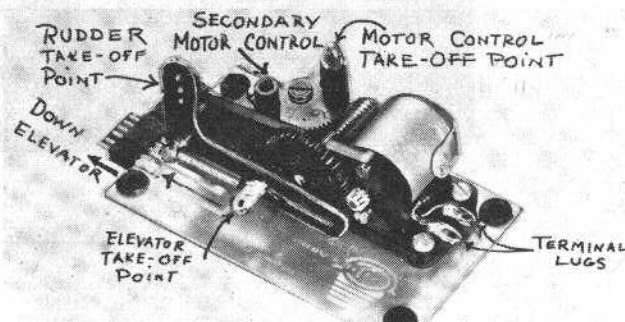
Note the three sketches illustrating the (neutral rudder) elevator pulse arcs. adjust the transmitter control stick pots until the actuator is pulsing symmetrically, similar to the neutral elevator sketch. Try all four control stick extremes (full up, down, left and right). Correct any over travel or cycling-thru by reducing control stick sensitivity in accordance with the transmitter manufacturer's instructions. A correctly adjusted transmitter does not cause cycling-thru when full rudder is given with full up elevator.



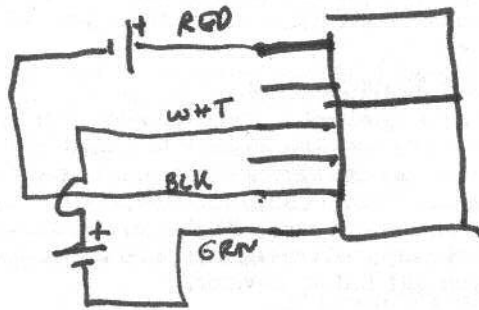
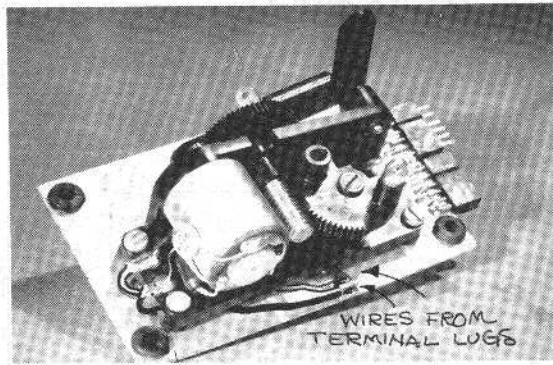
## GENERAL NOTES

Rudder control may be reversed by simply switching the actuator wires at the terminal lugs. This does not change the direction of elevator travel, which must be provided for by proper orientation of the servo according to whether the elevator control horn is located on the top or bottom of that surface. Note that a secondary motor control take-off point is provided. Check to see that the motor control fail-safes in the correct direction, that is, turning off the transmitter causes the motor control to close the throttle. In the event it goes the wrong direction, remove the snap ring and move the motor control take-off to the secondary position. Normal operating voltage is 2.4 volts; 3.6 volts may be used but some cycling-thru problems may arise. Keep all linkages free to the point of being sloppy. It is particularly important that the motor control linkage be bind-free since in order to cycle-thru the servo has to overcome the centering spring and all air loads as well as any load from the motor control linkage.

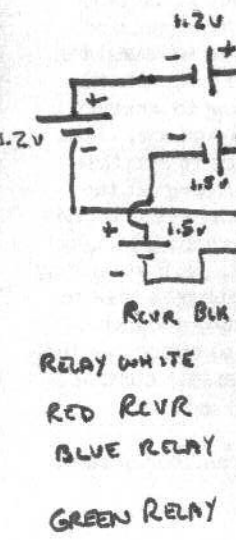
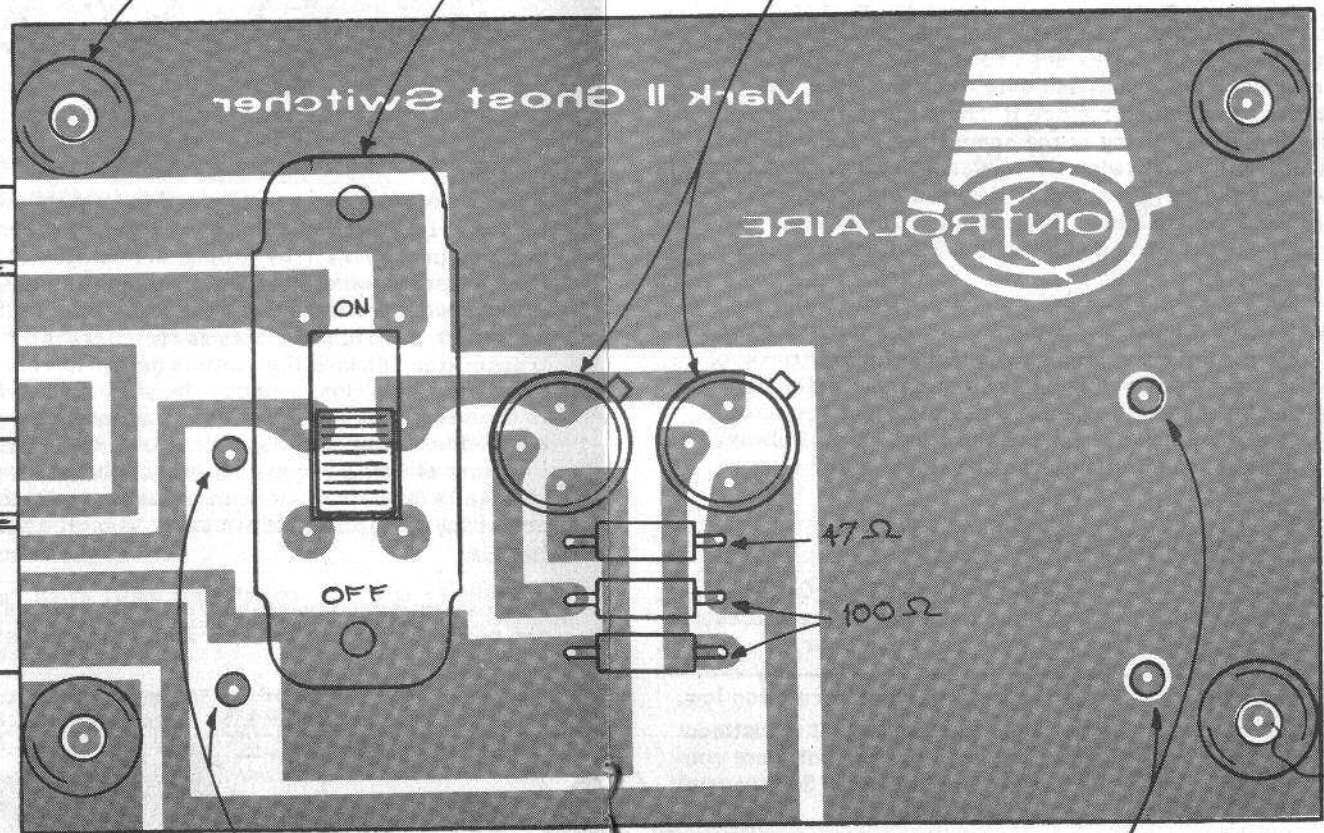
For extremely noise-sensitive receivers, a 47 ohm, 1/4 watt resistor across the motor terminals will add a bit more arc suppression.







1/4" RUBBER GROMMET  
DPDT SLIDE SWITCH  
GC 4008



ACTUATOR MOUNTING HOLES

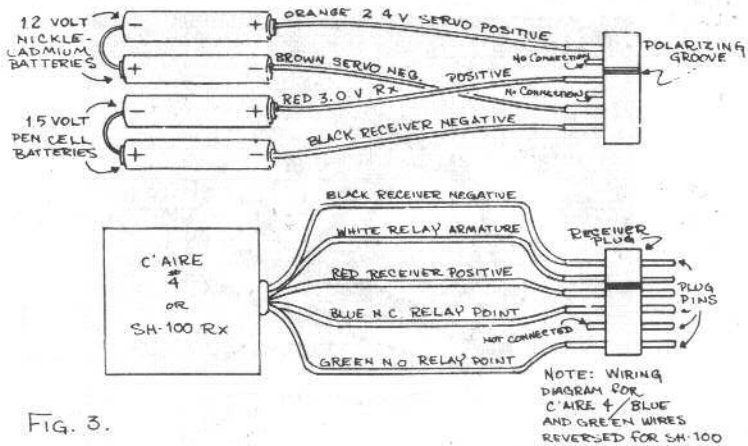


FIG. 3.

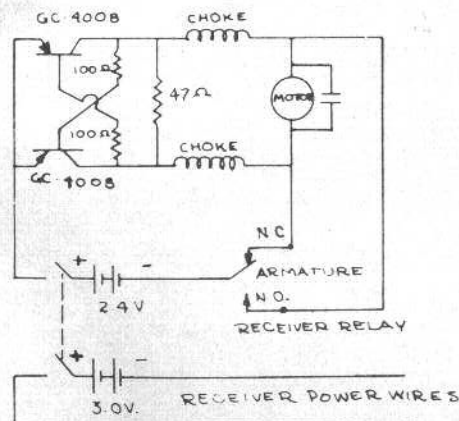
### INSTALLATION

On any type of proportional installation it is important that all linkages be very free and smooth working. Avoid heavy push rods and stiff hinges. In particular, make the motor control smooth and drag-free as this is the hardest mode of operation for the actuator since it has to move the motor control and overcome the centering spring at the same time. You will find that you get the best results with about twice the moveable rudder area that you would use for escapement flying with about 20 degrees of throw each side of neutral. Elevator surfaces should be kept small. One quarter to 1/2 inch wide elevators will usually provide adequate control even on large airplanes.

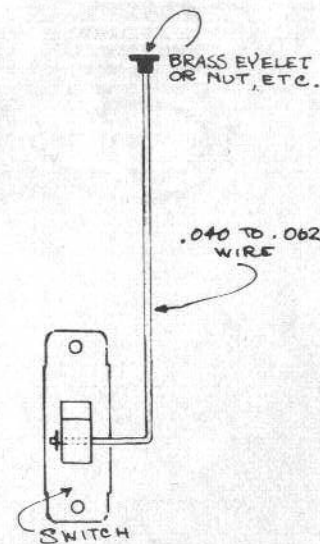
If you find that the rudder moves the wrong way as compared with the transmitter stick movement, this can be corrected by reversing the positions of the blue and green wires at the receiver plug and switching the motor control take-off to the other position on the sector gear. Assuming that you mount the unit in the plane such that the plugs are toward the front, it will always be necessary to mount the control horn on the top and the elevator for correct action.

### TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE & CURE
Receiver relay pulsing, actuator inoperative	No actuator voltage, trace and check supply voltage to switcher.
Receiver relay pulsing, actuator cycling through continually	(1a) Transmitter pulse rate too low. (1b) Transmitter neutral adjustment on rudder (pulse width) not correct - too far out. See transmitter instructions. (1c) Defective or blown out GC-4008 transistor.
Receiver relay not pulsing, actuator cycling through continually.	(1) No Voltage to receiver (2) Receiver voltage polarity reversed (3) Inoperative receiver



- ✕ 2 100 ohm 1/4 watt resistors (brown, black, brown)
- ✕ 1 47 ohm 1/4 watt resistor (yellow, violet, black)
- ✕ 2 GC-4008 transistors
- ✕ 1 DPDT slide switch
- ✕ 2 6 pin Deans plugs
- ✕ 1 Length of solder
- ✕ 1 Printed circuit mounting board
- ✕ 4 1/4" Grommets
- ✕ 4 #4x3/8 self-tap screws
- ✕ 4 3/16" Grommets
- ✕ 1 6" length flex wire



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