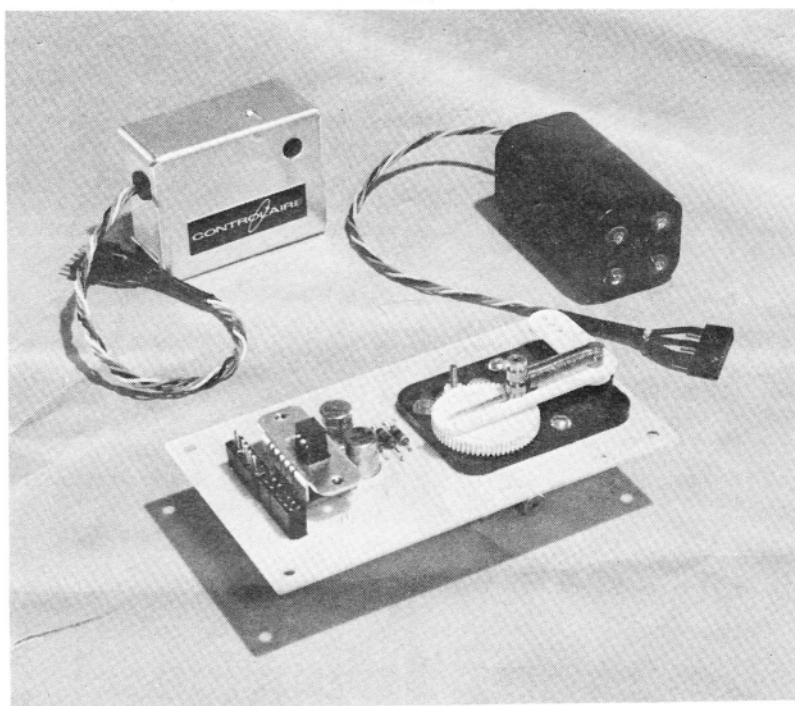


CONTROLAIRE GHOST BOARD & SWITCHER



ASSEMBLY & OPERATING INSTRUCTIONS

AVAILABLE ASSEMBLED OR KIT

Made In U. S. A.

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

Refer to Fig. 1 during the following steps and solder each component in place using the solder provided and a 25 to 40 watt iron.

1. Install the 6-prong plug in holes 1 thru 6, making sure that you insert the correct end of the plug into the holes and that you have the polarizing grooves oriented correctly.
2. Install the 6-prong socket in holes 7 thru 12. Again check the location of the polarizing grooves.
3. Install the double pole-double throw slide switch in holes 13 thru 18.
4. Install the two GC-4008 transistor in holes 19, 20, & 21, and holes 22, 23, & 24. Note the small metal tab on the transistor body and orient these transistors such that the position of tabs corresponds to Fig. 1.
5. Install the two 100 ohm 1/4 watt resistor (brown, black, brown) in holes 25 and 29 and holes 26 and 30. Lay these resistors flat against the board and bend their leads to the correct length.
6. Install a 47 ohm 1/4 watt resistor (yellow, violet, black) in holes 28 and 32 lying flat against the board.
7. Mount the Ghost Actuator in place using two 4-40 x 5/16 screws and nuts. It may be necessary to remove the arc-suppression capacitor mounted on the motor in order to slip the assembly into the cut-out in the board.
8. Refer to Fig. 2 for details of the motor hook-up and install the two wire-wound chokes in holes 28 and 32. Note that these parts are mounted up-right on the foil side of the board.

9. Bend the unattached choke leads over to the motor terminals and cut to length; slip a piece of insulating sleeving over the lead going over the back of the motor and solder the leads to the motor terminals. Reinstall the arc suppression capacitors if they were removed. It might be mentioned that whether you have one capacitor across the motor terminals or two capacitors, one going from each motor terminal to a motor case screw, is unimportant, either method will work. Also, any value of capacitor from .01 to .05 mf will work since this installation has more than adequate arc-suppression for use with any receiver.
10. Refer to Fig. 3 for receiver plug and battery supply wiring. Inspect the receiver plug and make sure you solder the wires to the terminals and not to the plug pins. A square Dubro 4-pencell battery holder is recommended for the supply batteries.

This completes the assembly of the unit. 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 Controlaire "4" is used. To check the operation of the unit first make sure the slide switch is off (handle moved toward holes 17 and 18) 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.

Looking down on the unit while it is operating, you will notice that the elevator control take-off point (the brass fitting mounted to the large gear) is traversing an arc. Note that as the rudder control at the transmitter is moved to the left or right, the arc moves to one side or the other of the center line of the actuator. Adjust the rudder neutral at the transmitter in accordance with the manufacturer's instructions until the arc is centered with the centerline of the actuator. Note that the arc grows longer if the pulse rate is slowed down at the transmitter (up elevator) and shorter if the pulsing is speeded up (down elevator). Adjust the neutral elevator pulse rate at the transmitter until the arc length corresponds to that shown on Fig. 1. With the settings outlined above the elevator and rudder push rods installed, the unit should have no tendency to cycle through during normal control functions.

A steady tone or steady carrier transmitted will cause the unit to cycle through and, in this manner, motor control is achieved from the sector gear on the bottom of the unit near the motor. Note that the V-link connector can be placed at either of two locations on the sector gear. With the unit operating, turn the transmitter off long enough for the sector gear to run to the limit and choose the connector location which will give low motor. In this manner "fail-safe" is achieved; that is, upon loss of transmitted signal, the motor will go to idle and the surfaces will cycle through.

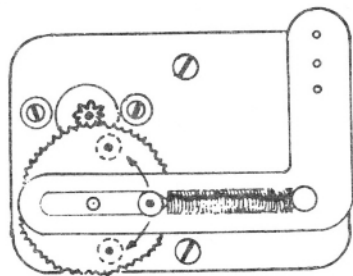


FIG. 1.

NEUTRAL CONTROL PULSE ARC.

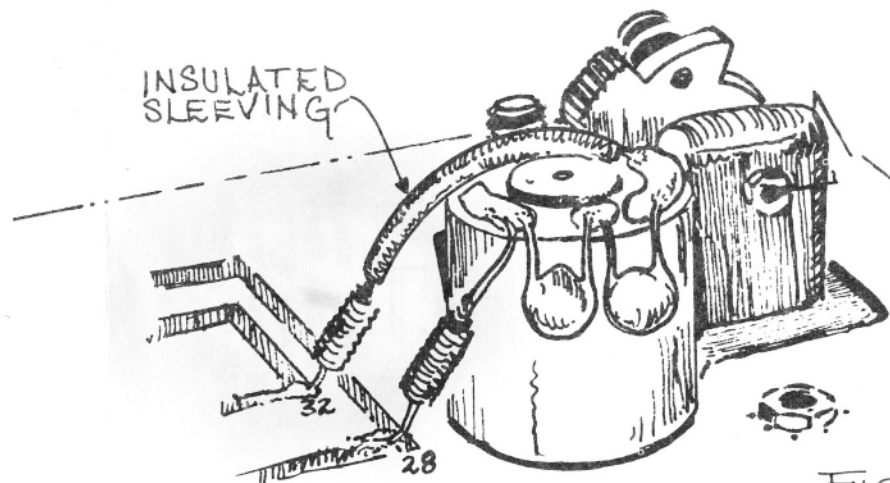
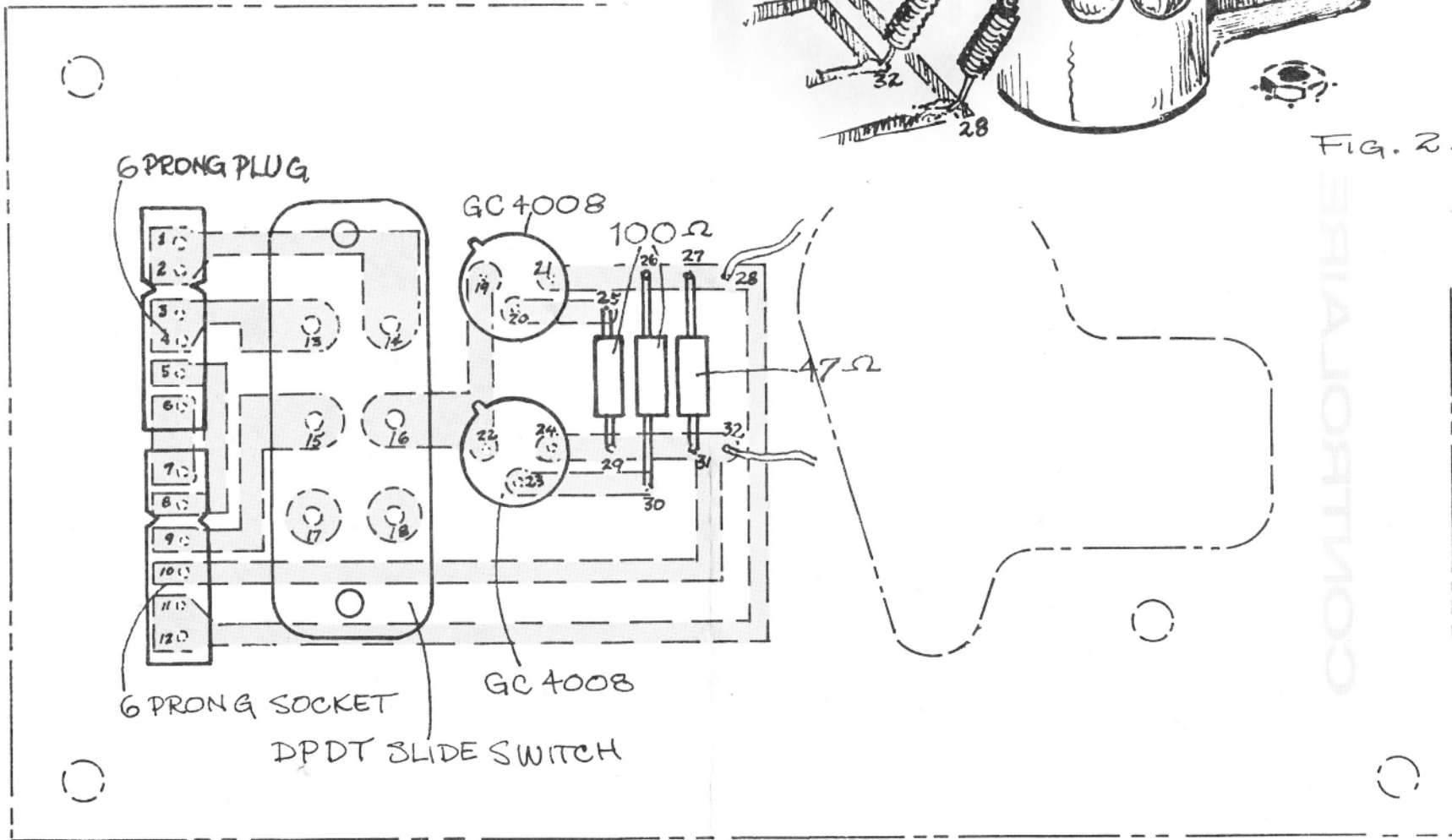
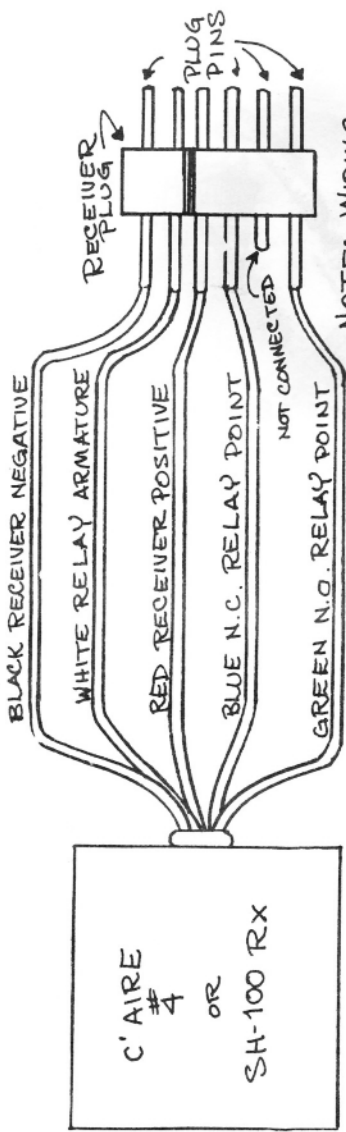
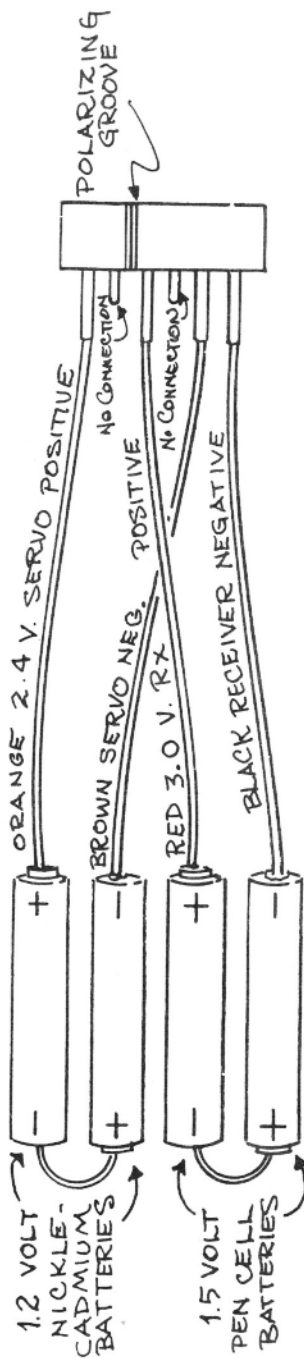


FIG. 2.





NOTE: WIRING DIAGRAM FOR C' AIRE #4 / BLUE AND GREEN WIRES REVERSED FOR SH-100

FIG. 3.

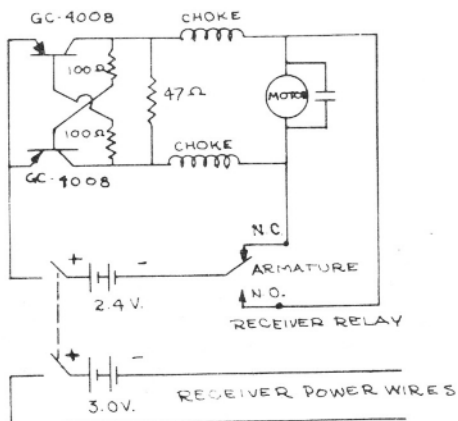
INSTALLATION

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.

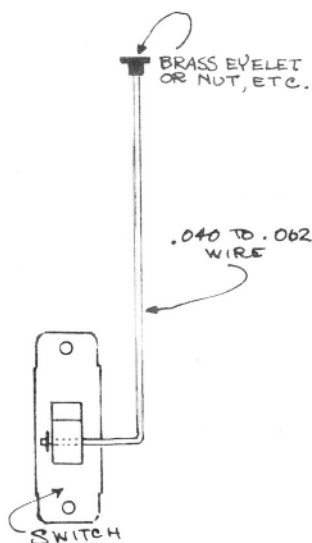
If you find that the rudder moves the wrong way as compared with the transmitter stick movement, this can be corrected by reversing the positions of the blue and green wires at the receiver plug and switching the motor control take-off to the other position on the sector gear. Assuming that you mount 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

<u>Condition</u>	<u>Possible cause and cure</u>
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 <u>not</u> pulsing, actuator cycling through continuously	(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
- (2) Wirebound chokes
- (2) 4-40X5/16 screws and nuts
- (1) Piece insulating sleeving
- (1) LPDT slide switch
- (2) 6 pin Deans plugs
- (1) Length of solder
- (1) Printed circuit mounting board



WORLD ENGINES

I N C O R P O R A T E D

8208 BLUE ASH ROAD

CINCINNATI, OHIO 45236