MULTI-SERVOS

POWERFUL-DEPENDABLE R/C ACTUATORS

The Heart of Your Radio Controlled Model!

INSTRUCTIONS FOR USE WITH MODEL 5PN SERVOS

DeBolt Model Engineering Co.
WILLIAMSVILLE, N. Y.

Your Introduction TO THE MODEL 5PN MULTI-SERVO

This is the improved 5PN Multi-Servo

Use 3 volts for operation wherever $1\frac{1}{2}$ volts are called for in this booklet.

YOUR INTRODUCTION TO THE MODEL 5PN MULTI-SERVO

The model 5PN servo has been developed especially for use with electric motor powered model boats and vehicles. It provides selective steering plus forward, reverse and off motor speeds while using only a simple single channel radio.

Multi-Servos are powerful motor driven actuators for operating the controls of model airplanes, boats and vehicles through a radio receiver or any other device which provides a relay. They come in several different types to provide the special sorts of control action needed with the various models; the 5PN is particularly suited to boats and cars. These servos operate with any ordinary radio control equipment and require no special radio gear or accessories. They operate through a combination of electrical circuits and use both contacts of the radio receiver relay to switch their circuits. They may be used with other types of selectors when desired. All of the Multi-Servos provide more than ample power to move any model control or mechanism and will withstand all normal abuse while maintaining perfect operation. These servos require the very minimum of batteries to operate and yet provide exceptionally long battery life. No special mounting is required, they may be fastened to any part of the model. All Multi-Servos are unconditionally guaranteed

against defects in materials and workmanship for a period of 90 days, under normal use and conditions.

DESCRIPTION OF THE MODEL 5PN MULTI-SERVO . . . .

The parts of the 5PN servo are shown on Diagram No. 1. There are two sections to it, the actuator section and the switch section. Each has a separate motor and set of contacts. The actuator section operates the steering of the craft, it also operates the switching section when it is desired to change the motor speed. The switching section controls the motor used to power the craft.

On the actuator section the neutral contact controls a circuit which causes the servo to neutralize from any position. The motor also runs from position to position through this contact while you are pulsing for the position. The operate contact starts the servo and causes it to stop in the desired position. It also controls the 3rd circuit which causes the switching section to operate.

On the switch section the operate contact is the one which indexes the switch cam. When the 3rd circuit of the actuator section is closed momentarily it causes the switch motor to start, once it is started the switch operate contact closes and it will then run the motor until the next position comes up. At this point the operate switch opens and if the actuator has been allowed to return to neutral the switch motor will stop. The switch contacts

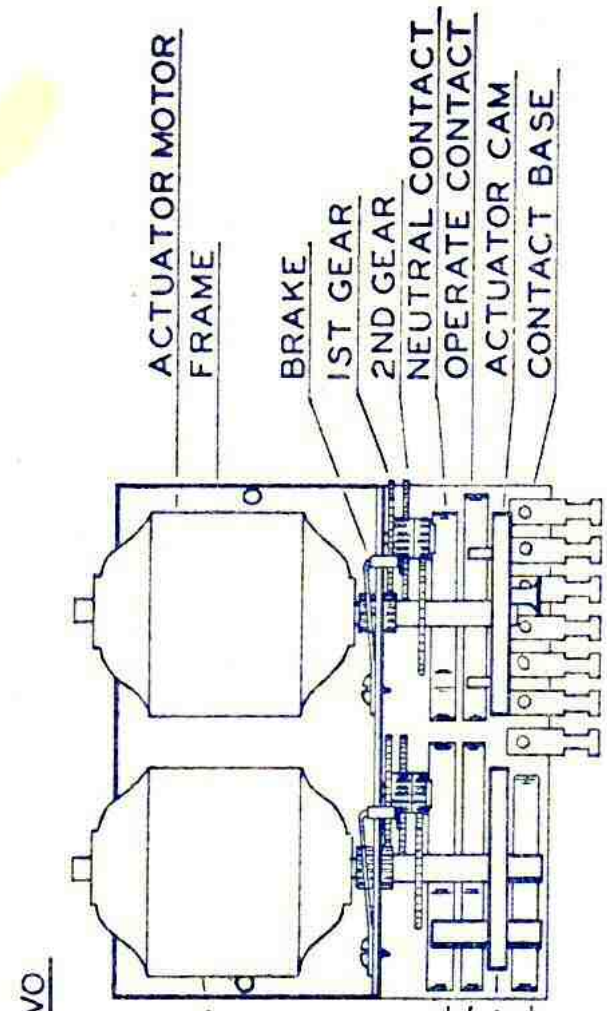


DIAGRAM NO. 1 5PN SERVO

control the direction of the motor used for power. When both contacts are up the motor will run in one direction, when both contacts are down the motor will run in the opposite direction. When one switch contact is down and one is up the motor will stop.

The brake on the servo's motors is to maintain a constant speed for the servo. It keeps the cam from overrunning and controls the indexing of the cams. This indexing is also controlled by the timing of the contacts opening and closing.

All Muti-Servos come to you completely adjusted and tested, they should require no adjusting by you for at least several hundred thousand operations. If you think that the servo is not operating correctly the first thing to do is to CHECK ALL BATTERIES under a load before you touch anything! Then remember that the servo was operating correctly when it left the factory, recheck everything you have done since obtaining it and if the trouble should persist return it to the factory before anything serious can happen.

The factory provides a 24 hour service for your convenience. If you should return a servo for service inclose $2.00 to cover the service charge and postage. If your trouble is covered by the warranty, your $2 will be returned, if it has been damaged it will be returned in first class condition with an additional charge for all parts used C. O. D.

INSTRUCTIONS FOR USING THE MODEL 5PN MULTI-SERVO . . .

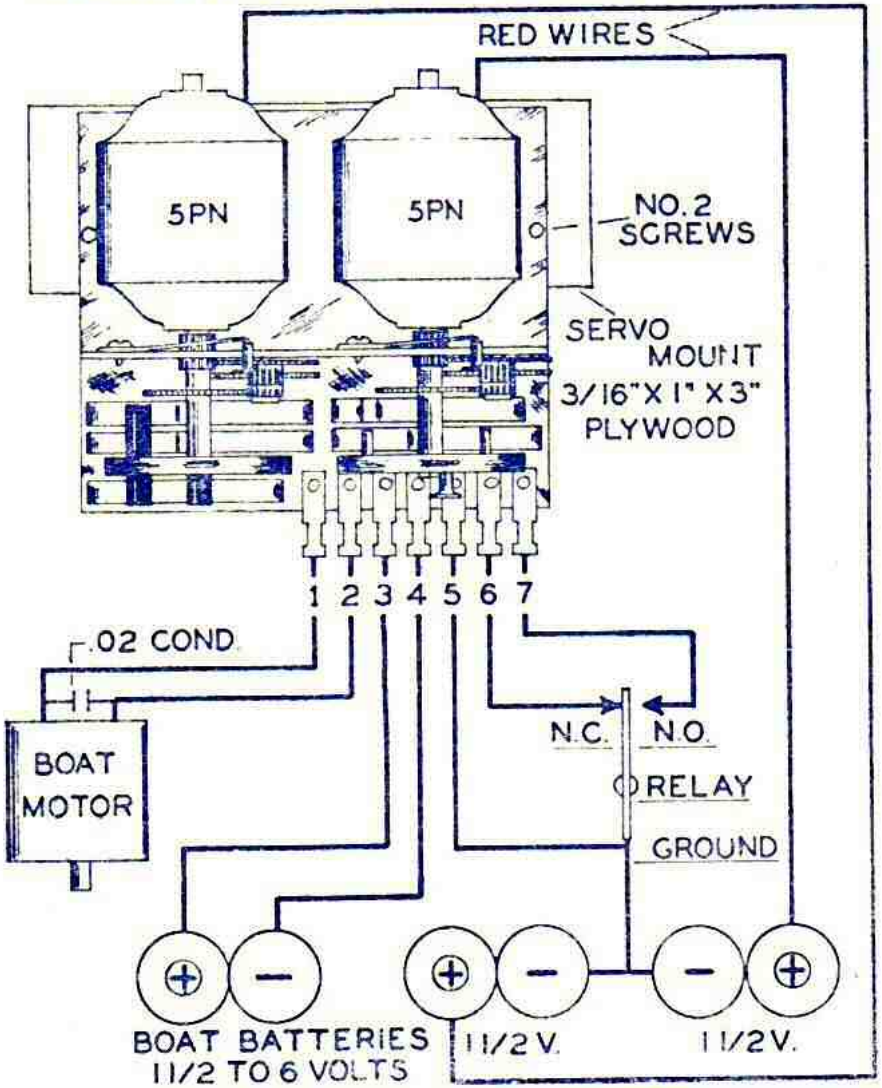
Mounting the Servo . . . . Diagram No. 2

The servo should be mounted on a piece of $\frac{3}{16}$"x1"x3" plywood or hardwood using two No. 2"x$\frac{1}{4}$" wood screws. When mounting be sure that the contact base of the servo does not touch any part of the model which could exert pressure on it. The wooden mount may then be cemented to the most convenient part of the model. With boats particular attention should be used to be sure that the servo is well insulated from water or water spray, moisture can cause malfunctioning of the servo. The actuator cam of the servo is connected to the rudder or wheels through $\frac{1}{16}$" wire push rods and a compensator as shown in Diagram No. 3.

BATTERY REQUIREMENTS FOR THE 5PN MULTI-SERVO . . . .

The 5PN servo operates on 1½ volts, never more. It requires two sets of batteries for its operation at 1½ volts each. The batteries should be changed when the voltage has dropped to minimum of 1¼ volts for either set, the minimum battery supply will give approximately 5000 operations of the servo. The minimum battery supply is 2 sets of 2 pen cells, total 4 pen cells. The servo is divided into two sections, the actuator section and the switching section. One set of batteries is required for each section. If long periods of

DIAGRAM NO. 2 5PN SERVO WIRING



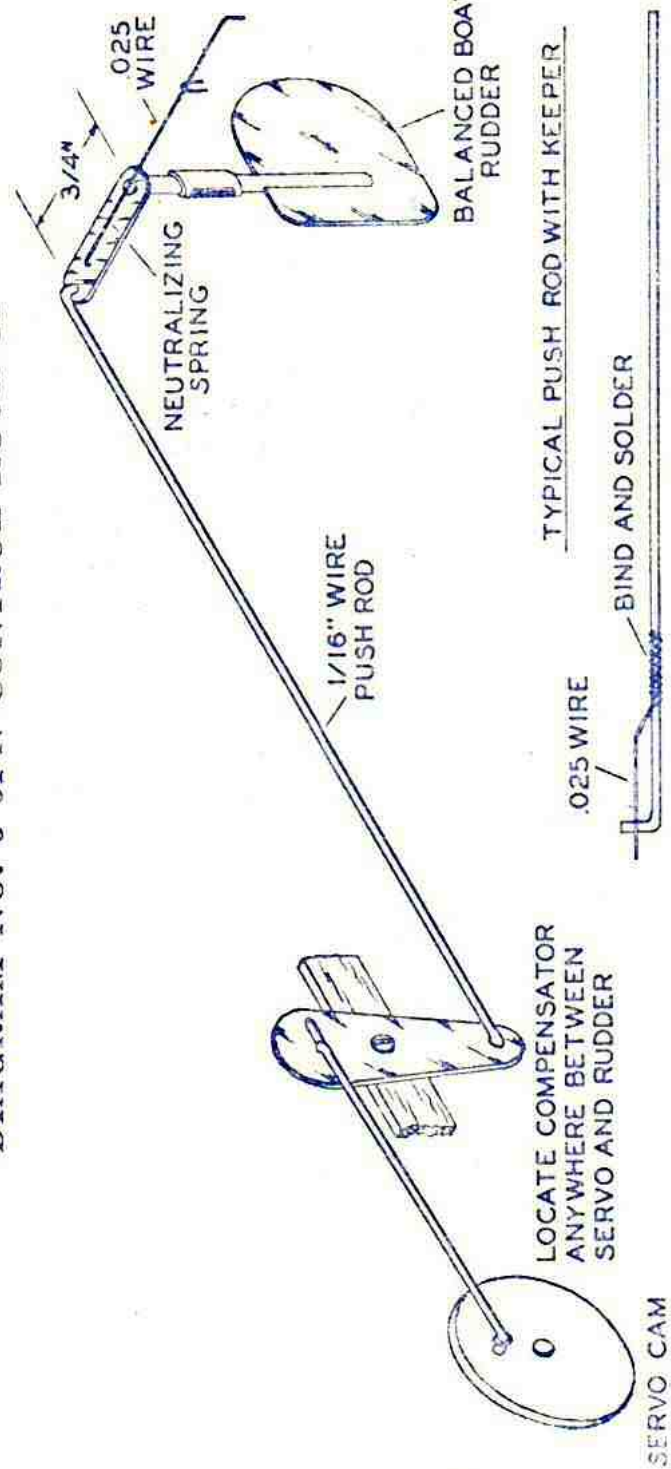
SERVO TERMINAL CONNECTIONS

1. Boat Motor terminal.
2. Boat Motor terminal.
3. Boat Motor battery.
4. Boat Motor battery.
5. Receiver relay ground or common terminal.
6. Receiver relay normally closed contact.
7. Receiver relay normally open contact.

One red wire goes to one set of servo batteries positive.

The other red wire goes to the 2nd set of servo batteries positive.

DIAGRAM NO. 3 5PN CONTROL HOOK-UP



It is not absolutely necessary that a compensator must be used. However the compensator reduces the rudder action, the rudder moves only when the servo reaches its maximum operate positions. It gives an absolute neutral at all other times.

Note: The 5PN control cam eyelet does not stop in a vertical position for neutral.

operation are desired heavier batteries may be used of course, the more batteries you use the longer the life and the better will be your servos operation.

WIRING THE MODEL 5PN MULTI-SERVO, DIAGRAM NO. 2 . . . .

In figure No. 4, a typical receiver relay is shown. The servo is wired to it for operation. In wiring the servo we will consider the relay points to be normally open and normally closed, as labeled. With your radio the normally closed relay point is the one which is closed with the receiver turned on and while no signal is being sent by the transmitter. The normally open point is the one which closes when you signal with the transmitter. You may refer to diagram No. 2 for the servo wiring.

1. Take 2 pen cells and connect them together, positive to positive and negative to negative, you will have 1½ volts. A second set of batteries exactly the same is also needed.
2. Connect the negative side of both sets of batteries together.
3. Connect this common negative to the ground or armature connection of your relay.
4. Connect the red wire from the motor on the actuator section of the servo to one set of batteries positive.
5. Connect the red wire from the motor on the switch section of the servo to the remaining set of batteries positive.

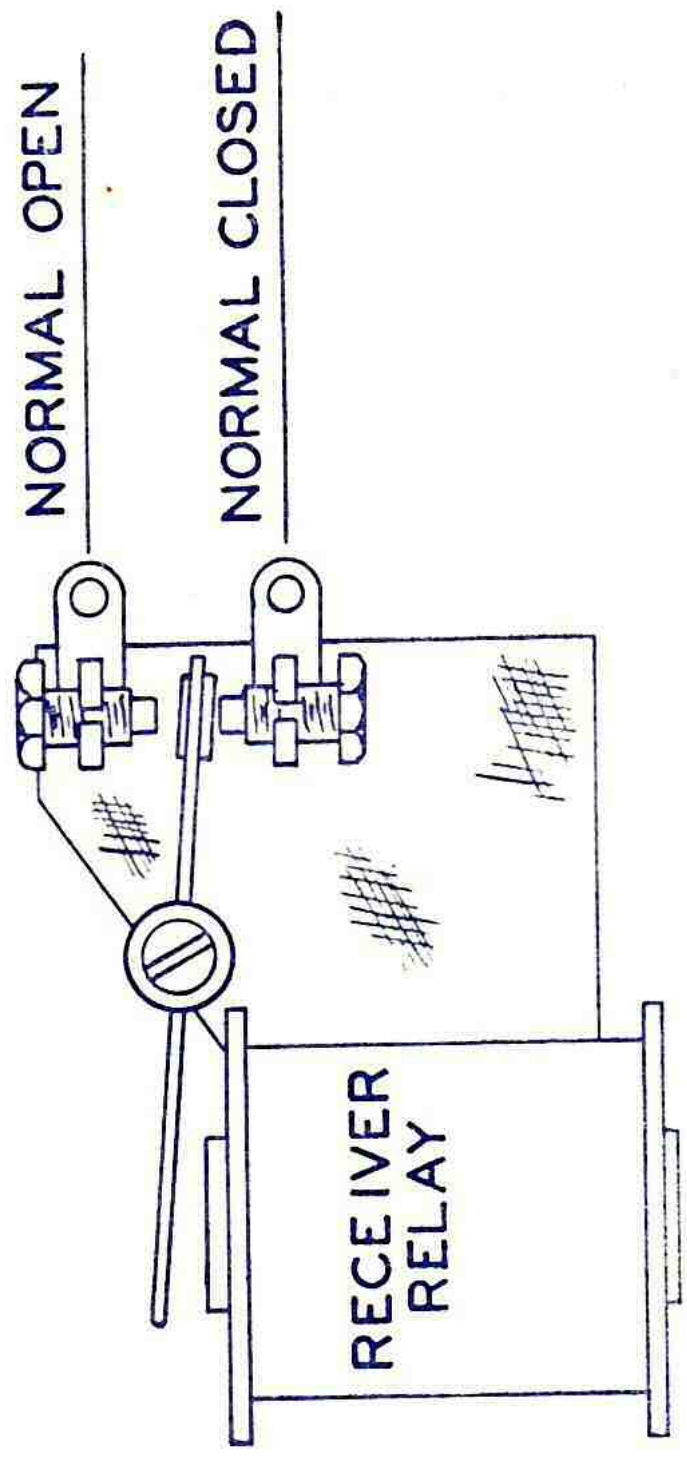


FIGURE NO. 4

6. Connect terminal No. 5 on the servo contact base to the ground or armature terminal of your relay, same terminal as in step No. 3.
7. Connect terminal No. 6 on the servo contact base to the normally closed relay contact.
8. Connect terminal No. 7 on the servo contact base to the normally open relay contact.

BABCOCK MODEL BCR-3 SINGLE CHANNEL RECEIVER . . . .

These are special instructions for using the model 5PN Multi-Servo with the Babcock BCR-3 receiver. These instructions have been furnished by Babcock Radio Engineering.

Remove the case of the receiver. A wire is then soldered to terminal No. 5 of the relay socket and brought out of the receiver through a new hole with a grommet to prevent chafe. This wire is then the normally closed contact of the relay. Pin No. 6 of the CONNECTOR PLUG is the normally open contact of the relay. Pin No. 7 of the CONNECTOR PLUG is the armature of the relay or relay ground. With this information the regular servo wiring instructions may be followed.

The servo is now ready to operate. Terminals 1 thru 4 on the servo contact base are the boat motor and its battery connections.

9. A .02 ceramic condenser should be used across the brush terminals of your boat motor to reduce radio interference.

10. Connect the two wires coming from your boat motor to terminals No. 1 and 2 on the servo contact base, it makes no difference which wire goes to which terminal.
11. Connect the positive boat battery wire to terminal No. 3 on the servo contact base.
12. Connect the negative boat battery wire to terminal No. 4 on the servo contact base.

When you have operated the servo and checked the switching, if your boat motor should run in reverse when you switch from off to forward speed the battery connections at terminals No. 3 and 4 must be reversed to obtain the proper polarity for your particular motor.

A good quality No. 22 insulated stranded hook up wire should be used for all servo connections. Be sure to check all wiring carefully, improper wiring may damage your servo! Under no circumstances should you turn the servo's cams by hand! You may damage the cam or the servo contacts causing the servo to malfunction!

OPERATING THE MODEL 5PN MULTI-SERVO . . . .

Multi-Servos operate by keying the transmitter with a series of pulses. When no pulses are being sent, the servo automatically neutralizes itself. To hold the control position selected, it is only necessary to keep the transmitter key depressed.

The servo uses no battery current while in any control position, it uses current only while running from position to position. It is possible to key the transmitter **too fast** but almost impossible to key it too slowly, hence, it is advisable to key slowly until you have become familiar with the pulse pace required. You will find this pace to be normal to your physical reactions and very simple to follow.

To control the direction of the craft you depress the transmitter key once and hold it depressed. Upon release the servo will neutralize the control. Anytime that you key once and hold you will get the same action. To get the opposite control direction you depress the key once, release and depress it again holding it down this time. Thus anytime that you key or pulse twice holding the key down on the second pulse you will get this same control direction.

To start the craft's motor or to change it, you use a similar pulse sequence, but with a 3rd pulse added. Thus if you key once, release, key again and hold momentarily and follow this 2nd release with a short pulse, the switch will change. In other words you should pulse twice, hold, then release and pulse quickly again without holding.

Considering that the motor is in the off position, the first time that you signal for a change, the motor will start in a forward direction and run until you signal for a change. The next change will be to the reverse direction where it will continue

to run as before. The next change is to the off motor position. The motor will not change from the position it is in unless you definitely signal for it with the series of 3 pulses as described.

It is of course advisable that you should practise the pulsing of the servo at home before actually operating your craft, a little bit of familiarity with the system can be a great help and of course make your sport that much more enjoyable.

MODEL 5PN MULTI-SERVO PARTS AND PRICE LIST

Part No.	Description	Price
MS-1	—Servo motor with condenser and pinion gear	$2.75
MS-2	—Servo motor condenser	.50
MS-4	—First gear and pinion	.25
MS-5	—2nd gear and pinion	.25
MS-6	—First pinion shaft	.25
MS-7	—2nd pinion shaft	.25
MS-9	—Actuator cam and main shaft with gear	4.00
MS-20	—Switch cam and main shaft with gear	4.00
MS-12	—Main inner cam shaft	.35
MS-13	—Brake assembly	.25
MS-21	—Set of servo screws	.50
MS-22	—Servo frame	4.00
MS-23	—Contact base with contacts and terminals	9.75
MS-24	—Servo instruction booklet	.75