

MULTI-SERVOS

POWERFUL-DEPENDABLE
R/C ACTUATORS

*The
Heart of Your
Radio Controlled
Model!*

DeBolt Model Engineering Co.
WILLIAMSVILLE, N. Y.

YOUR INTRODUCTION TO "MULTI-SERVOS"

Multi-Servos are powerful motor driven actuators for operating any control on a model airplane, boat or car through a radio receiver or other device which has a relay. These servos operate with any ordinary radio control equipment and require no special radio gear or accessories. They use both contacts on the regular receiver relay to switch their circuits. They may be used with other types of selectors when desired. The Multi-Servos provide more than ample power to move any model control or mechanism and will withstand any normal abuse. The model 2PN and 3PN Servos provide selective control positions. The servos require the very minimum of batteries and will give exceptionally long battery life. No special mounting is required and they may be fastened to any part of the model. They also may be used in combinations to provide servo operated multi-controls. All Servos are guaranteed against defects in materials and workmanship for a period of 90 days, under normal use and conditions.

Multi-Servos are made in several different models so that you can use them separately or in combinations to perform any work that you may wish. By combining the 3PN servo with either the 2P2N or the 3P, you can have most any action desired. Model 2P2N provides a servo which is self-neutralizing when used with model

3PN, thus, it is especially fitted to controls such as elevators. Model 3P is a positionable type and when used with Model 3PN it is especially suited to engine controls, brakes, etc.

DESCRIPTION OF EACH MODEL SERVO

Model 2PN

This servo is ordinarily used for a single control such as "rudder only" and provides 2 control positions plus one automatic neutral. Control positions are completely selective.

Model 3PN

This is the basic multi-control servo and provides 2 control positions with one automatic neutral. In addition, it has a 3rd position which will close a separate circuit and thus actuate a 2nd servo or any other actuator. Control positions are completely selective.

Model 2P2N

This servo provides 2 control positions and 2 neutral positions and has a sequence to it. It is intended to operate elevator and similar air control surfaces. It is used in conjunction with the Model 3PN or may be used separately if desired.

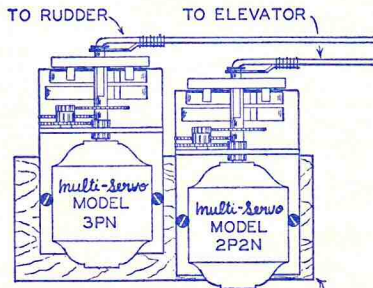
(2)

Model 3P

This servo is the positionable type and is ordinarily left in one position until another is wanted. It provides 3 control positions and is ordinarily used with Model 3PN for engine control, brakes, etc. It may be used with any other selector if desired.

OPERATION REQUIREMENTS

Due to the low battery drain of Multi-Servos, you should never need over 2 pen-



MOUNT SERVOS WITH
1/4"#2 WOOD SCREWS

1/8" X 1 1/4"
PLYWOOD

SERVO MOUNTING

(3)

cells for the 2PN servo, actually, they will operate on only one. The required battery voltage is $1\frac{1}{2}$ volts, never use more. The batteries should be changed at $1\frac{1}{4}$ volts which is the safe operating minimum. Approximately 5000 operations can be expected from 2 pen cells with the 2PN, 4 pen cells with the 3PN combination.

The servos should be mounted on plywood or hardwood using two No. 2 wood screws in the holes provided. Under any reasonable conditions, they do not require shock mounting. See installation diagram.

The servo's operating cam is hooked directly to the control desired by means of a $1/16$ " wire push rod. If the rod is over 12" long, run it through plywood guides to keep it from flexing. Figure No. 1 shows a simple means of attaching the rods so that they are easily removable. Be sure that the spring locks have sufficient tension to hold the rods in place.

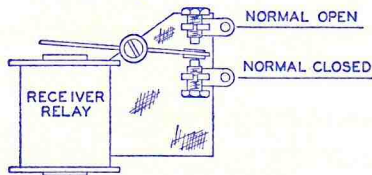


FIGURE NO. 2

(4)

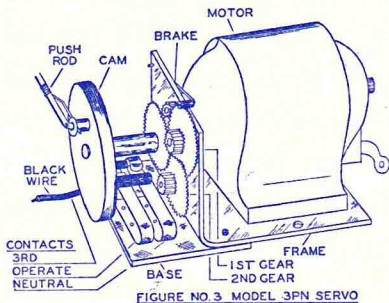
IMPORTANT!

Multi-Servos give positive rudder displacement, there is no lack of power or rudder blow-back. Because of this it will be necessary to use approximately 50% of the *area and movement* that would be used with a rubber powered actuator to obtain equal rudder reaction. This is especially important to watch when replacing an escapement with a servo, otherwise you can over control your model!

(5)

WIRING THE SERVOS TO THE RADIO RECEIVER

In figure No. 2, a typical receiver relay is shown. The servos are wired to it for operation. In wiring the servos, we will consider the relay points to be normally open or normally closed as labeled. The normally closed point is the one which is closed when your receiver is turned on and no signal is being sent to it by the transmitter.



(6)

The normally open point is the one which closes when you send a signal to the receiver with the transmitter. As all servos are basically the same, you may refer to figure No. 3 which has each part labeled and it will help you to understand the wiring as well as the operation of the servos. In the wiring diagrams, dotted lines indicate wires used to connect two servos together for multiple controls.

* * *

Special instructions for the use of Multi-Servos with Babcock products, these instructions furnished by Babcock Radio Engineering.

BCR-3 Single channel receiver

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 separately through a grommet to prevent chafe. This wire is the normally closed contact of the relay. Pin No. 6 of the connector plug is the normally closed contact of the relay. Pin No. 7 of the plug is the center arm of the relay or servo battery negative in all cases. With this information the wiring instructions for each model servo may be applied.

BCR-4 Three channel receiver

Babcock recommends the use of servos with the rudder relay only, if you use them with any of the other relays you are on your own. The rudder relay is the one nearest the center of the receiver and after removing the receiver cover the changes are made to it. Remove the wire from ter-

(7)

minal No. 4 of the relay socket. Separate wires are than attached to terminals 4 and 5 and brought out of the case through a grommet. The No. 4 terminal wire is the normally open relay contact. The No. 5 terminal wire is the normally closed relay contact. Pin No. 7 of the power connector plug is the center arm of the relay or servo battery negative in all cases. With this information the wiring instructions for each model servo may be applied.

BE SURE TO CHECK ALL WIRING CAREFULLY, IMPROPER WIRING CAN DAMAGE YOUR SERVO!

Model 2PN, diagram No. 4

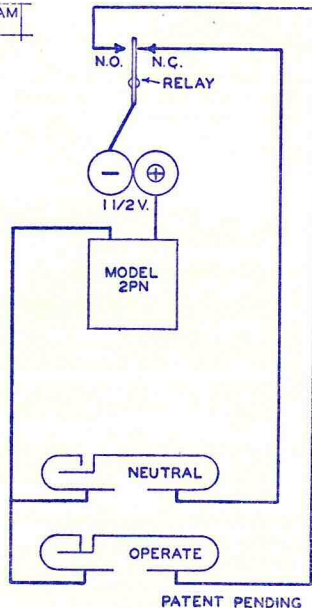
1. The red wire from the servo motor is connected to the servo battery positive.
2. Connect a wire from servo battery negative to the relay ground connection.
3. Connect the servo operate contact blue wire to the normally open point on your relay.
4. Connect the servo neutral contact white wire to the normally closed point on your relay.

Model 3PN, diagram No. 5

1. The red wire from the servo motor is connected to the servo battery positive.
2. Connect a wire from servo battery negative to the relay ground connection.

(8)

DIAGRAM
NO.4



(9)

3. Connect the servo operate contact blue wire to the normally open point on your relay.
4. Connect the servo neutral contact white wire to the normally closed point on your relay.

When the 3rd contact is used to close a 2nd circuit of any nature that circuit is wired according to the dotted lines in diagram No. 5 as follows:

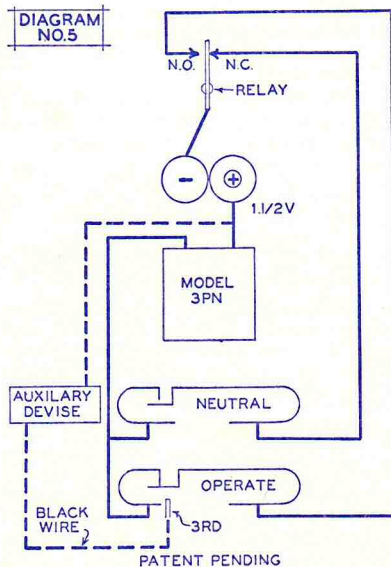
1. Connect the black wire from the 3rd contact on the servo to the device, this will be the negative connection.
2. The other connection of the device is wired to the servo battery positive.

If the device has a high battery drain, larger capacity batteries should be used with the servo. In wiring other Multi-Servos to the Model 3PN, follow the directions given for the model that is to be used.

Model 2P2N, diagram No. 6

If model 2P2N is to be used separately by itself, it is wired in the same manner as the model 2PN, see diagram No. 4 and the instructions for model 2PN. When model 2P2N is to be used for a 2nd control in conjunction with model 3PN, it is wired as in diagram No. 6.

(10)



(11)

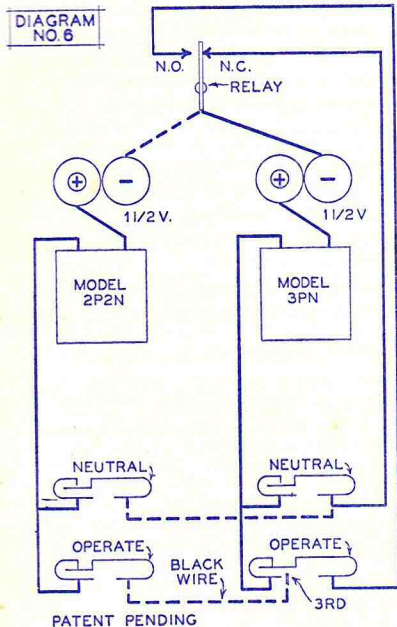
1. Use 4 pen cells with the 3PN servo instead of 2. A second set of batteries is required for the 2P2N servo, 2 pen cells.
2. Connect a wire from the 2P2N servo batteries negative to the negative of the 3PN servo batteries.
3. Connect the 2P2N servo red wire to its servo batteries positive.
4. Connect the 2P2N neutral contact white wire to the 3PN neutral contact white wire.
5. Connect the 2P2N operate contact blue wire to the 3PN 3rd contact black wire.

Model 3P, diagram No. 7 and No. 8

The model 3P servo may be used separately or in conjunction with the model 3PN servo. If it is used separately, use diagram No. 7 as follows:

1. Connect the servo motor red wire to the servo battery positive.
2. Connect the relay ground to the servo battery negative.
3. Connect a wire from the black terminal of the servo motor to the normal open contact of the relay.

(12)



(13)

4. Connect the movable servo operate contact blue wire to the relay ground.

When model 3P is used in conjunction with model 3PN, follow diagram No. 8.

1. Use 4 pen cells with the 3PN servo instead of 2. A second set of batteries is required for the 3P servo, 2 pen cells.
2. Connect a wire from the 3P servo batteries negative to the negative of the 3PN servo batteries.
3. Connect the 3P servo red wire to its servo batteries positive.
4. Connect the 3PN 3rd contact black wire to the stationary operate contact of the 3P servo, or to the black terminal of the 3P motor.

SERVO OPERATION

Multi-Servos operate by keying the transmitter with a series of pulses. When no pulses are being sent, the servos automatically neutralize themselves. To hold the control position selected, it is only necessary to keep the transmitter key depressed, no battery current is being used while the control is in 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 become familiar with the pulse pace.

(14)

DIAGRAM
NO. 7

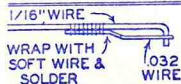
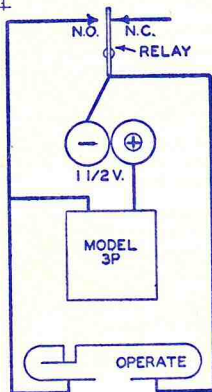
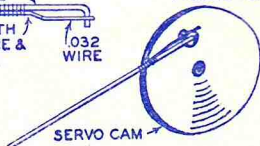


FIGURE NO. 1



(15)

SERVO KEYING PROCEDURE

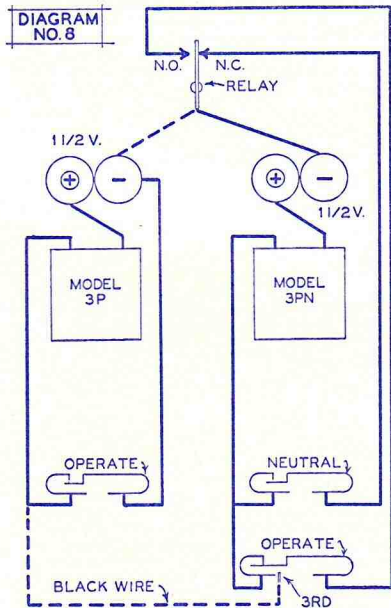
Model 2PN

By depressing the transmitter key once and holding it there, you get one control position. By keying once, releasing and keying again, holding it this time (2 pulses & hold) you will get the second control position. You may select either control position at anytime, simply by pulsing once or twice as desired. The servo will self-neutralize from any control position. It is best to arrange the rudder horn and push rod so that the first control position that the servo gives you is *opposite* to any natural turning tendency of the model, then corrective control can be applied extremely fast.

Model 3PN

By depressing the transmitter key once and holding it there, you get one control position. By keying once, releasing and keying again, holding it this time (2 pulses and hold) you will get the second control position. By keying once, twice, three times and holding it (3 pulses and hold) you will close the 2nd circuit to operate your additional actuator. This position comes the easiest when you hesitate with the 2nd pulse and then pulse the 3rd time quickly and hold it. The additional actuator will never operate unless the 3rd pulse is held as the circuit is always open except when the 3rd position is held. You may select any control at anytime simply by pulsing once, twice or three times as desired. The servo self-neutralizes from any position.

(16)



(17)

When the 2P2N servo is used with the 3PN servo you will notice that the 3PN servo "jogs" towards the neutral position when the 2P2N servo operates. This is so that you will have practically a neutral position with the 3PN servo while using the second control.

Model 2P2N

This servo provides a sequence. It has two control positions and two neutral positions. In operation, keying the transmitter once and holding will give one control position, release the key and the servo neutralizes. Keying it once again and holding will give the opposite control, release the key and you are back to neutral again. The cycle then repeats itself. When used in conjunction with the model 3PN servo, the 2P2N servo operates just as it does when used separately, except that you replace the single pulses with 3 pulses as required to close the 2nd circuit of the 3PN servo. Both servos will self-neutralize themselves automatically.

Model 3P

This is the positionable servo, it stays in position until you signal for a change. It does not self-neutralize. It operates by keying the transmitter and releasing quickly. Each keying and releasing will cause it to move from one position to another. It has three positions, No. 1 can be a control position, No. 2 a neutral and No. 3 a 2nd and opposite control position. It runs in

a cycle and will follow this sequence repeatedly. When used as an engine servo, it can give high speed, low speed and engine cut off using any of the common devises for accomplishing this job. When used for a 2nd control in conjunction with the 3PN servo, it is operated in the same manner by replacing the single pulses with 3 as required to close the 2nd circuit of the 3PN servo.

ADJUSTMENTS

Multi-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 they are not operating correctly, *check your batteries* under a load before you touch anything! If the batteries are below $1\frac{1}{4}$ volts, under a load the servos can malfunction. If the servo should be damaged in any way, the factory provides a complete adjusting and testing service for a nominal fee of \$1.50 each, plus the cost of any parts. 24 hour post-paid service is rendered. For your information, the following factors control servo operation.

1. Inertia or coasting of the servo is controlled by the brake. Increasing brake tension slows down the servo's action, reducing brake tension speeds up the servo's action. There should be no appreciable loss of servo speed over a

range of battery voltages from 1.5 volts down to 1.2 volts when the brake tension is correct. This tension is set at the factory and should not be altered unless the servo should malfunction because of it.

2. Location of the control positions in the cycle is governed by the brake tension and the point where the operate contact opens. Any contact adjustments should be made at the factory.
3. The neutral positions are governed by the brake and the point where the neutral contact opens.
4. The 3rd position on the 3PN servo is governed in the same manner. It also closes the 2nd circuit and the timing of the opening and the closing of the 3rd position contacts governs the operation of the servo which is connected to them (2nd servo). Adjustment of these contacts should only be done at the factory.
5. The 3P servo's operation is governed by the brake only, contact adjustments should not be required.

It should be noted here that the contacts are designed so that normal dust or dirt will not bother them. Once adjusted, they hold their position for the life of the servo, hence, they should never require adjusting unless they are abused or damaged. Use normal care and the contacts will never need to be touched.

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 condenser50
MS 3:	Servo frame all models	2.00
MS 4:	First gear and pinion25
MS 5:	Second gear and pinion25
MS 6:	First pinion shaft25
MS 7:	Second pinion shaft25
MS 8:	2PN cam and main shaft with gear	3.00
MS 9:	3PN cam and main shaft with gear	4.00
MS 10:	2P2N cam and main shaft with gear	4.00
MS 11:	3P cam and main shaft with gear	3.00
MS 12:	Main inner cam shaft all models35
MS 13:	Brake assembly25
MS 14:	2PN contact base with contacts	3.50
MS 15:	2P2N contact base with contacts	3.50
MS 16:	3P contact base with contacts	3.00
MS 17:	3PN contact base with contacts	4.00
MS 18:	Set of servo screws50
MS 19:	Instruction booklet75

Prices include handling and postage.

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(22)

