MULTI-SERVOS

POWERFUL-DEPENDABLE R/C ACTUATORS

The Heart of Your Radio Controlled Model!

INSTRUCTIONS FOR USE WITH MODEL 3PNX, 3P3NX & 2P2NX SERVOS

DeBolt Model Engineering Co.
WILLIAMSVILLE, N. Y.

YOUR INTRODUCTION TO "MULTI-SERVOS"

Multi-Servos are powerful motor driven actuators for operating any control in a model airplane, boat or vehicle. They are operated by any radio receiver which has a STDP relay or with any equivalent switch. These servos operate with ordinary radio control equipment and do not require changes to it, or special gear or accessories. They use both contacts of the regular receiver relay to switch their circuits. They may be used with other types of selectors when desired.

Multi-Servos provide more than ample power, plus reliability, to move any model control or mechanism and will withstand all normal usage. The basic control actuators provide selective control positions, secondary servos use the most useful sequence for their purpose. The servos require a minimum of batteries and will give exceptional battery life. No special mounting is required and they may be fastened to any part of the model. Multi-Servos can be used in combinations to provide more than one control.

GUARANTEE

All Multi-Servos are guaranteed unconditionally against defects in materials and workmanship for a period of 60 days from

purchase when used as described in this booklet and under normal conditions. To take advantage of this guarantee the servo in question should be returned to the factory by the purchaser.

SERVICE

The factory provides a 24 hour repair service for those needing it. The servo should be returned to the factory via insured mail. Inclose $2.00 with the servo to cover the service, if parts are needed you will pay for them on the return of the servo.

Multi-Servo operating characteristics

Multi-Servos are powered by miniature electric motors. These motors only run while the servo is moving to a position, never while in a position. Maximum operating time is .6 sec. from start back to start again, it is only .2 sec. between positions. These motors operate on 3 volts and draw a maximum of 2 to 4 hundred milliamperes while running. They provide a minimum of 2 inch pounds of torque at the output cam of the servo, far more than any model device should require. It can be considered that a battery supply of 4-pen cells will give approximately 5000 operations with one Multi-Servo, the equivalent of 75 to 100 normal model flights.

DESCRIPTION OF THE VARIOUS MODELS

Model 3PNX

This is the basic actuator, it is ordinarily used to operate the rudder of a model plane or boat, it can steer a vehicle. It also has an auxiliary circuit which can be used to operate a secondary actuator for some additional control. Control positions are completely selective by the operator.

Model 3P3NX

This is a secondary servo for operating auxiliary devices such as engine controls, etc. It may be operated from a separate relay or else it can be actuated by a model 3PNX used as a basic actuator. It may also be operated by other types of selectors. This servo has 6 positions and operates through a desirable sequence.

Model 2P2NX

This is a secondary servo for operating auxiliary air controls. In general it is used for elevators or wing flaps. It also is well suited to wheel brakes. It may be operated from a separate relay or else it can be actuated by a model 3PNX used as a basic actuator. It may also be operated by other types of selectors. This servo has 4 positions and operates through a desirable sequence.

MOUNTING THE SERVOS

Before starting to mount the servo in the model refer to diagram No. 5. Notice that the servo is best mounted on hardwood strips using wood screws to hold it in place. These wooden runners should be cemented to balsa wood, usually the model's structure. Two servos may be mounted side by side by running the strips parallel with each other. Because of vibration if the servos are to be mounted on plywood or any other material there should be a thin piece of foam rubber between the base of the servo and the mounting. In any event be sure that nothing presses against the bottom of the contact base so as to bend this base, any pressure there can disturb the timing of the servo's contacts and result in malfunctioning. Also, be sure that the control push rod is installed parallel with the servo's drive cam.

CONNECTING THE CONTROL

To connect the control refer to diagram No. 10. Notice that the servo operates the control with a $\frac{1}{16}$" wire push rod. When operating a model plane or boat rudder it is best to use a control horn on the rudder similar to the one shown. This type of rudder horn gives a faster rudder action and an adjustable "neutral" for the rudder. If an excapement type actuator is being replaced by a servo it is most important that only 50% of the previous rudder

action should be used. Otherwise, you may over control the model, servos are positive in action, there is no blow back or lack of power with a servo.

OPERATING REQUIREMENTS

Model "MX" Multi-Servos operate on 3 VOLTS, never any more. The normal usable battery range is from 3 to 2 volts, the batteries should be replaced as they reach 2 volts UNDER LOAD. 4 pen cell type batteries should be provided for each servo to obtain the most economical battery life, larger and more cells may be used if desired. It is also important that the radio receiver should provide a current change to match the relay used, if this is done there should be no relay contact problems. Most commercial equipment provides this arrangement.

WIRING THE SERVOS

Diagram No. 1 shows a typical radio receiver relay. The servos are wired to it for operaton. If your receiver does not have a relay cable coming from it which is clearly coded, it is best to go directly to the relay contacts and wire your servo through a separate cable to them. Study the information given here and that which came with your radio and you will see that this is a very simple operation.

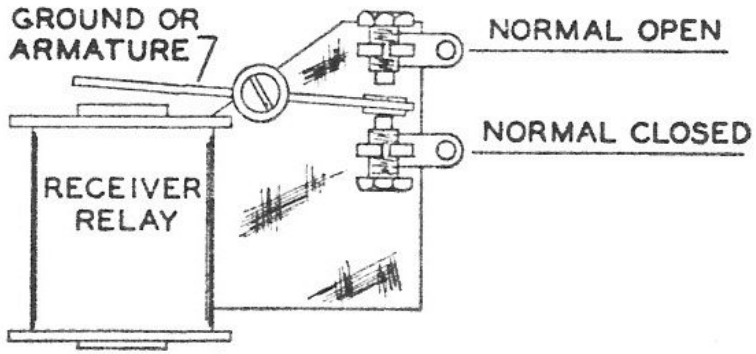


DIAGRAM NO. 1

In wiring the servo to the relay we will consider the relay points or contacts to be normally open and normally closed as labeled. The third connection will be to the relay armature which can be called ground, there is a separate terminal for this.

The normally closed contact is the one which is closed when your receiver is turned on and no signal is being sent to it by the transmitter. It is possible that this same contact may be open when the receiver is OFF. The normally open contact is the one which closes when you send a signal to the receiver with the transmitter. It will be open with the receiver turned on and NO SIGNAL being sent by the transmitter.

As the wiring of all model "MX" Multi-Servos is basically the same you may refer to diagram No. 2 and 3. In number 2 you will see the method of wiring the pen cell batteries into a pack for operating the servo, it requires one of these packs for

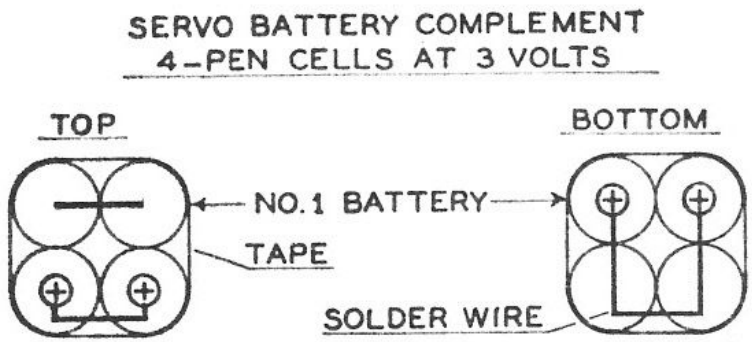


DIAGRAM NO. 2

each actuator. A suitable battery box may also be used in place of this pack if desired. In diagram number 3 a typical model "MX" servo is shown. Each part of the servo is labeled and these parts will be typical throughout the various models of the servo. The operate contact is the one which always starts the servo, it is operated by the normally open contacts of the relay. The neutral contact is the one which always runs the servo back to the starting point, it is operated by the normally closed relay contact. The 3rd position on the 3PNX servo closes a secondary switch which can operate a 2nd actuator, this switch is the operate contact plus another contact. The circuit breaker on the model 3PNX is used to break the neutral circuit of a 2nd servo so that it will not function when it is not needed.

3PNX MULTI-SERVO DETAILS

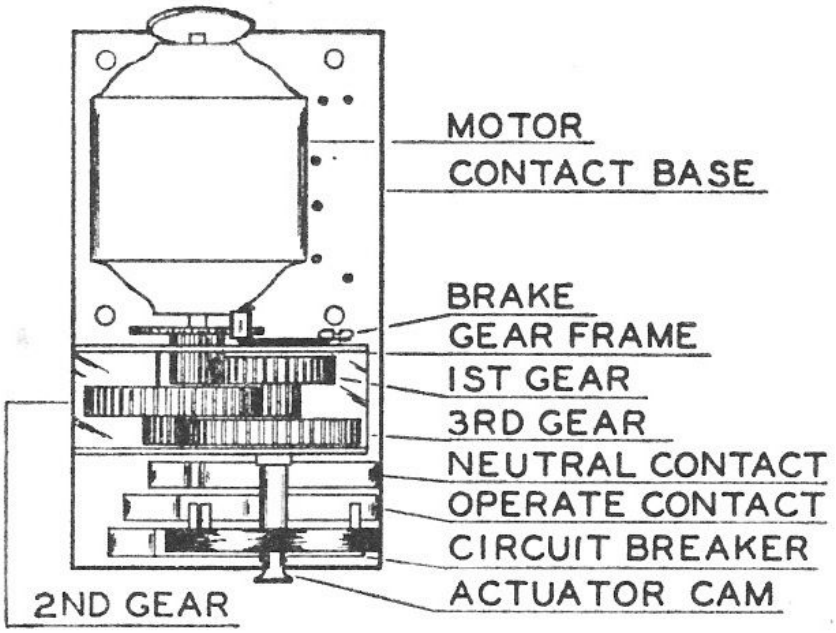


DIAGRAM NO.3

PATENT PEND.

WARNING!

Be sure to check all wiring carefully, improper wiring can damage your servo! BE CAREFUL not to use excessive heat when soldering to a servo. Too much heat can damage the motor by warping the case and it can also damage your printed wiring beyond repair.

WIRING MODEL 3PNX

Refer to diagram No. 7, this shows the servo wired to act as a simple one control actuator. In diagram No. 8 the method of fastening the wires to the servo is shown.

When the 3PNX is to be used with another servo refer to diagram No. 6. This shows the additional wiring required as dotted lines.

When it is desired to operate some other device with a model 3PNX it should be wired as shown in diagram No. 5. If this device has a very heavy battery drain the number of batteries used should be increased.

WIRING MODEL 3P3NX

Model 3P3NX can be used in 2 ways, as a secondary control servo operated by a model **3PNX** or other selector. It may also be operated by its own relay as with multi-channel equipment.

When the 3P3NX is to be operated by its own relay with multi-channel equipment diagram No. 7 should be followed. It can use its own set of 4 pen cells at 3 volts or may be operated from a set that is also used to operate another servo.

If the 3P3NX is to be operated by a model **3PNX** diagram **No. 6** should be followed. In this case a separate set of batteries is required for it. To operate the 3P3NX with a compound type escapement selector diagram No. 9 should be followed.

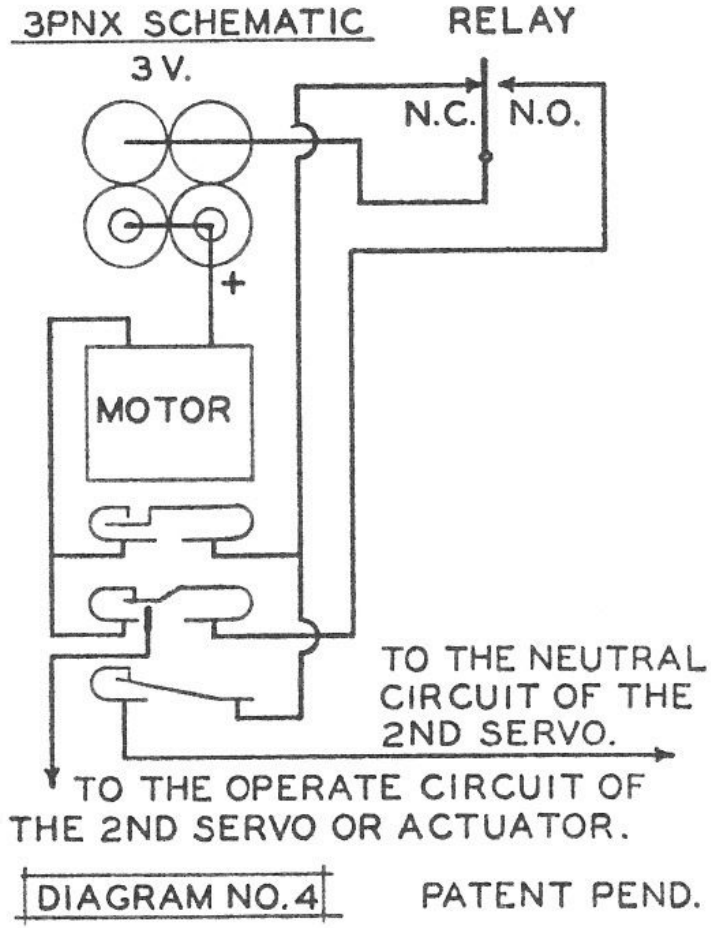
WIRING MODEL 2P2NX

Model 2P2NX can be used in 3 ways, as a secondary control servo operated by a model **3PNX** or other selector. It may also be operated by its own relay with single or multi channel equipment. With single channel equipment it would be the basic actuator and provide steering control with a sequence. When the 2P2NX is to be operated by its own relay with single or multi channel equipment diagram No. 7 should be followed. With multi-channel equipment it can use its own set of 4 pen cells at 3 volts or it may be operated from a set that is also used to operate another servo.

If the 2P2NX is to be operated by a model **3PNX** diagram No. 6 should be followed. In this case a separate set of batteries is required for it. To operate the 2P2NX with a compound type escapement selector diagram No. 9 should be followed.

WIRING 1½ VOLT SERVOS

When it is desired to operate a 1½ volt servo with a model 3PNX as the main actuator refer to diagram No. 6. These auxiliary servos could be any one of the following, model 3P, 2P2N or 3P3N Multi-Servos. Any of these servos is wired as shown in the diagram for models 3P3NX or 2P2NX, the only difference is that the set of batteries required for the auxiliary servo would be used at 1½ volts instead of 3 volts as shown. The auxiliary servo's



blue wire would connect to the No. 3 terminal of the **3PNX**, the white wire would connect to the No. 4 terminal and the red wire to the 1½ volt battery positive.

SERVO OPERATION

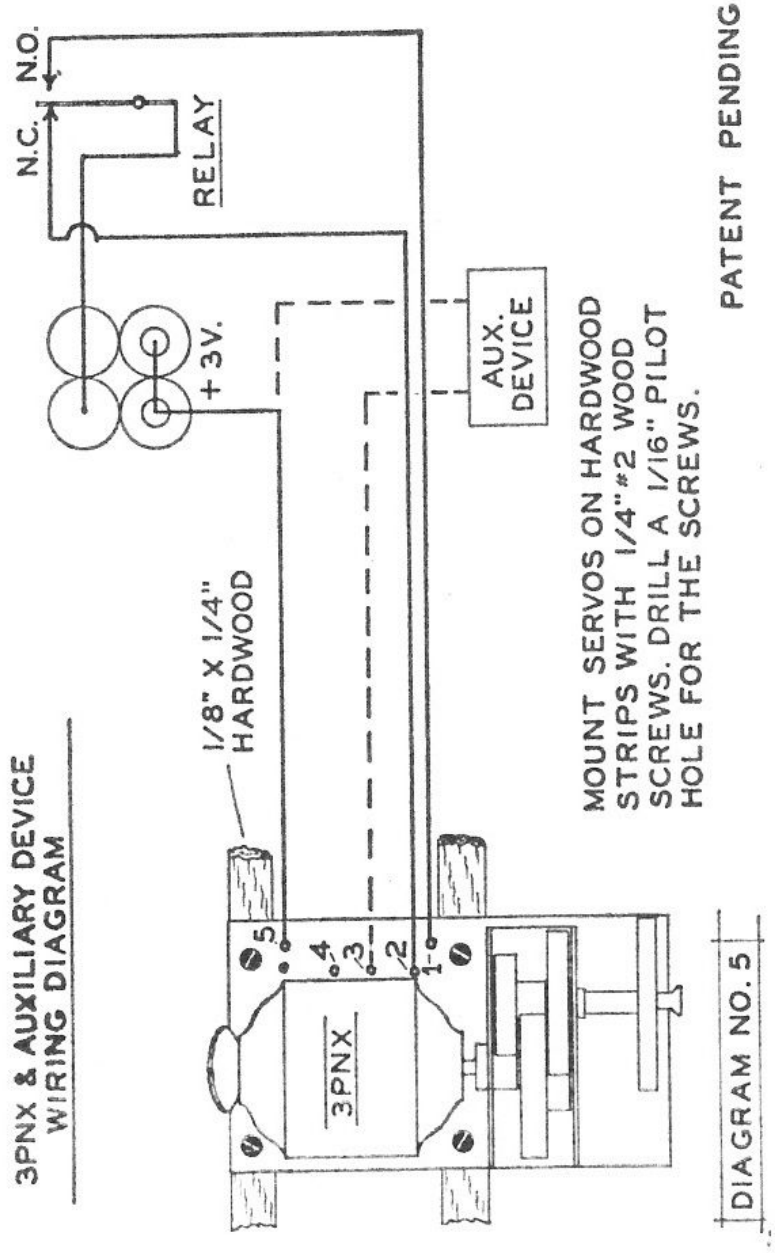
Multi-Servos operate by keying the transmitter with a series of pulses. When no pulses are being sent, the servos automatically neutralize themselves. To hold the control in a selected position simply hold the transmitter's key depressed as long as the control is desired. No battery current is used by the servo when in any position.

The manner of pulsing will be different between the various models of the servos, this variation provides the code to tell the servo what you desire. It is possible for you 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. You will find that this pace will fit your natural reaction very neatly.

SERVO KEYING PROCEDURE

Model 3PNX

By depressing the transmitter key once and holding the key down the servo will move to the 1st control position. By keying the transmitter once, releasing it and keying again immediately, holding it down this time (2 pulses and hold) you will get the second control position. These procedures may be repeated at will any time the control is desired. When it is desired to operate the auxiliary circuit you key as

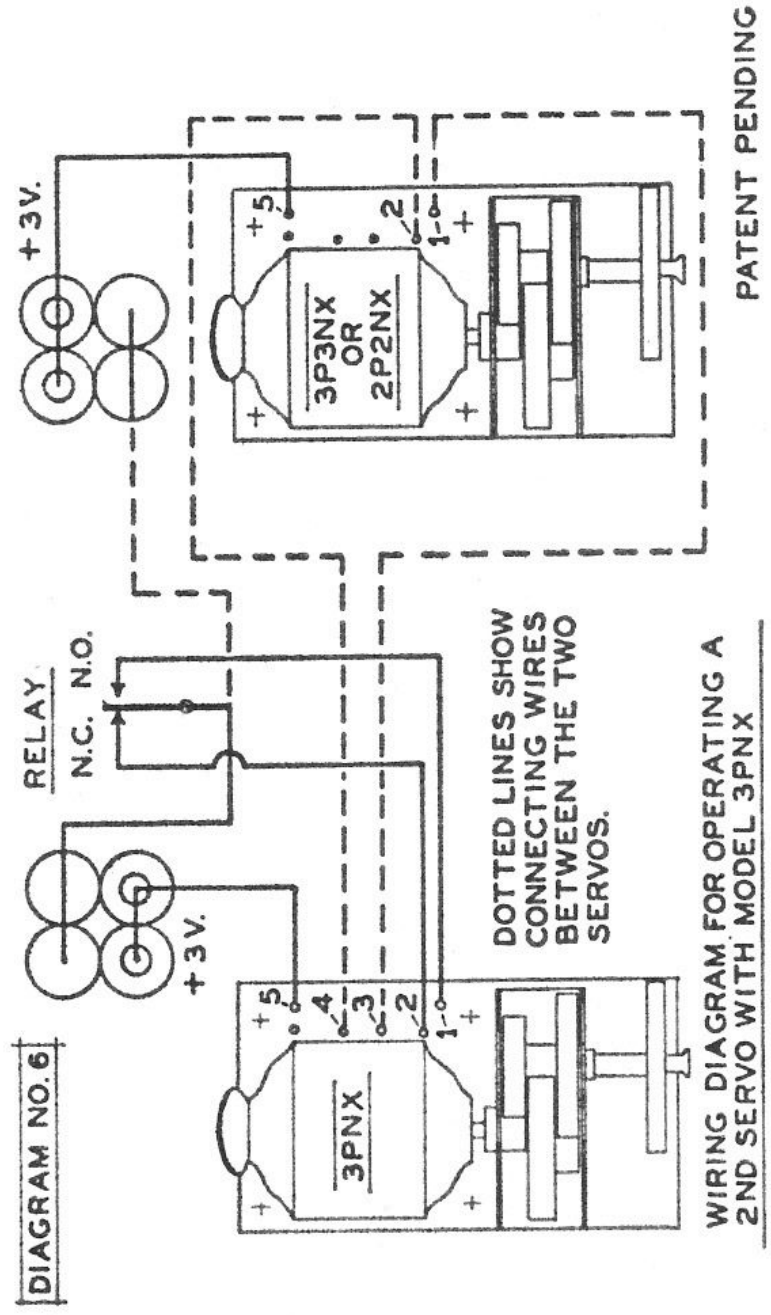


follows: Key once, twice and then hold the key down momentarily after which you release it and key the 3rd time and hold it down. The best thing to remember is to be sure and hesitate on the 2nd pulse, this assures you that the servo has had time to index itself properly for the 3rd pulse. While you hold the 3rd pulse on the 2nd actuator will move to a control position and stay there. If it is a servo it will move to the next position when you release the key. This 2nd actuator will never operate unless you pulse the 3 times as described. You may select any control at anytime by pulsing once, twice or three times as described, the 3PNX always neutralizes itself when you release the key for more than a fraction of a second.

It can be seen that it is especially wise to have the number one control position to be just the opposite control from the natural turning tendency of the model. This gives you corrective control in the fastest possible manner.

Model 3P3NX

The model 3P3NX servo is especially suited for auxiliary controls such as engine throttles, etc. The 3P3NX gives 6 control positions, 3 "operate" and 3 "neutral" positions. In other words, 3 positions when a signal is being sent to it and three different ones staggered in between the 1st ones when no signal is being sent. It operates in a sequence from one "off" position to an "on" position and then to a "off"



position around the cycle. Any of the desired positions may be held at will.

When the 3P3NX is used as a basic servo (as with multi-channel) it is keyed as follows: One pulse and hold will move the servo to the 1st position, upon releasing this pulse the servo will move to the next position. Repeating this procedure will move the servo around the cycle as desired. The procedure may be started from any position in the cycle.

If the 3P3NX is operated by another actuator such as a **3PNX** basically the same procedure is followed. The only difference is that the pulses are sent to it by the master actuator. Therefore, you must key the master actuator so as to close its auxiliary circuit, then the 3P3NX will respond. In the case of a **3PNX** three pulses and hold as described in the **3PNX** keying procedure will cause the 3P3NX to index one position, releasing the key will cause the 3P3NX servo to index one more position.

Model 2P2NX

The model 2P2NX is especially suited to auxiliary controls such as wing flaps, brakes, elevators, etc. The 2P2NX gives 2 control positions and 2 neutral positions, 2 different positions when the key is held down and 2 which are similar to each other when the key is released. It operates in a sequence from one neutral position to a operate position and then to a second neutral position. From the second neutral

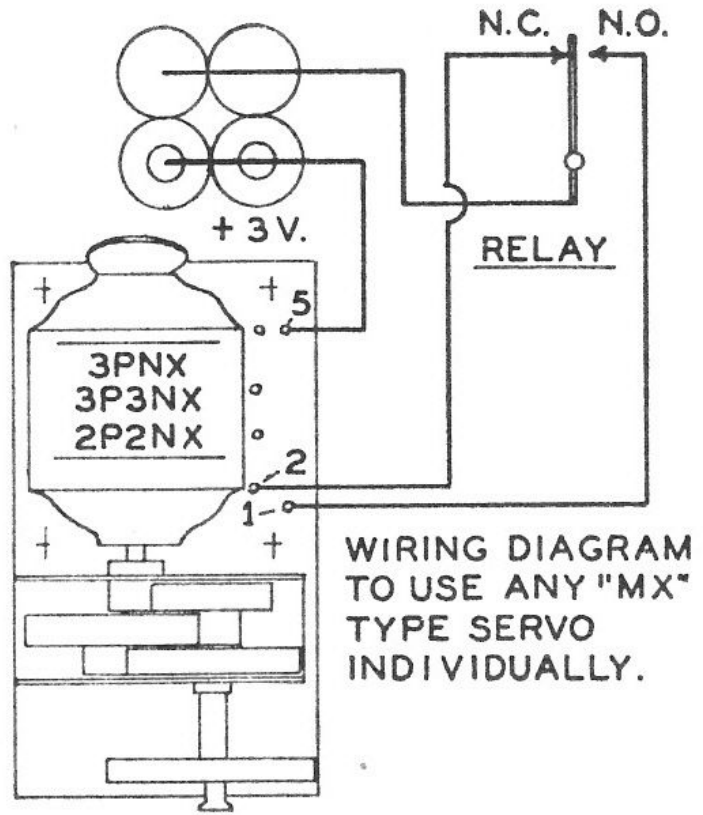


DIAGRAM NO. 7

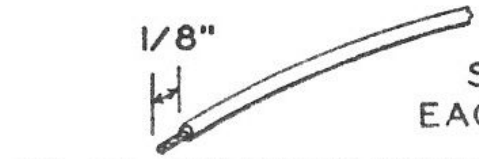
PATENT PEND.

position it moves to a second operate position and then back to the first neutral position. This procedure may be repeated at will, the servo operates in a continuous cycle following this sequence. Any of the positions may be held as desired. When the 2P2NX is used as a basic servo as with single channel it is keyed as follows: Considering that the servo is operating a

rudder the servo will be in a neutral position and so will the rudder. One pulse and hold will move the servo to the 1st operate position and the rudder is in a turn. Releasing the key the servo will return to the 2nd neutral position and the rudder will return to neutral. One more pulse and hold will move the servo to the 2nd operate position and the rudder will move to the opposite direction, release the key and the servo will return to the 1st neutral position and the rudder will be in neutral once again. This procedure may be repeated as long as desired.

If the 2P2NX servo is operated with multi-channel equipment the same sort of keying procedure is used as the single channel requires.

When the 2P2NX is operated by another actuator such as a **3PNX** basically the same procedure is followed. The only difference is that the pulses are sent to it by the master actuator. Therefore, you must key the master actuator so as to close its auxiliary circuit, then the 2P2NX will respond. In the case of a **3PNX** three pulses and hold as described in the **3PNX** keying procedure will cause the 2P2NX to move to the 1st operate position, release the key and both servos will return to a neutral condition. The next time you pulse the **3PNX** three times as described the 2P2NX will move to its second operate position and then back to neutral upon release of the key.



NO. 22 STRANDED WIRE

SOLDERING PRINTED WIRING

USE A HOT 30 WATT SOLDERING IRON AND MULTI-CORE SOLDER. INSERT WIRE THRU CIRCUIT BOARD. APPLY TO WIRE & CIRCUIT QUICKLY, DO NOT OVER HEAT THE PRINTED WIRING!

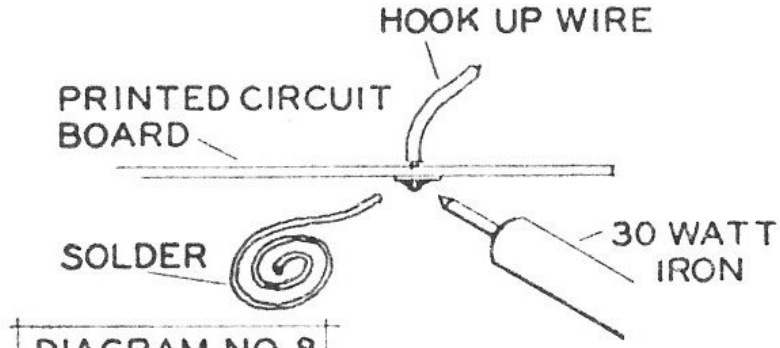


DIAGRAM NO. 8

ADJUSTMENTS

Multi-Servos receive a very thorough testing at the factory. They come to you completely adjusted and tested ready for use, they have already been operated on test just as you will be using them. There is nothing which you can do to them which will improve their operation. There should

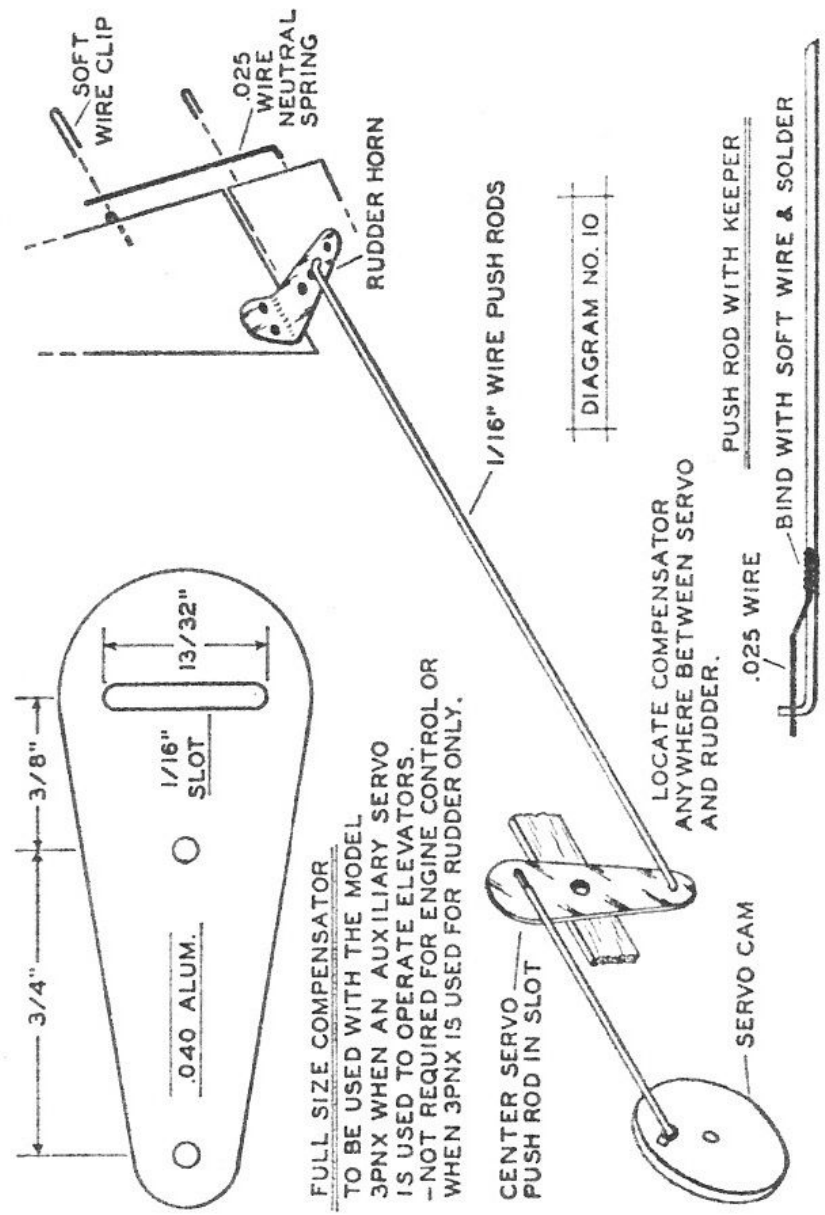
For your information the following factors control servo operation.

1. Inertia or coasting of the servo is controlled by the brake, increasing the brake tension slows down the servo and causes it to stop quicker at all points. Reducing brake tension speeds the servo up and causes it to stop at a later point. There should be no appreciable loss of servo speed over the full battery range when the brake is correctly adjusted, the tension is set at the factory and should not be altered.

2. The operate contact runs the servo to an operate or control position and when it opens it breaks the operate circuit through the relay causing the servo to stop in the correct position. The adjustment of this contact and the brake tension indexes the servo to the correct operate positions.

3. The neutral contact runs the servo back to neutral and at anytime when the operate contact is open. The adjustment of this contact and the brake controls the location of the neutral position on the SERVO. The push rod to the control must be adjusted to neutralize the control itself.

4. The operate contact also serves as one half of the auxiliary circuit switch. When it is depressed farther than nor-



mal by the 3rd position cam it makes contact with another point which completes the auxiliary circuit. The adjustment of the operate contact also controls the opening and closing of the auxiliary control switch. In turn the operation of the 2nd servo is affected by these adjustments.

5. On the model 3PNX there is also a circuit breaker. This serves to separate the circuits of the two servos when a 2nd servo is operated by the 3PNX. This circuit breaker opens whenever the 3PNX is in its 3rd position and closes before the 3PNX returns to neutral. In effect it opens the neutralizing circuit of the 2nd servo and holds the servo in an operate position until you wish it to neutralize.

We do not recommend that anyone other than the factory should adjust the servo contacts, except in the case of damage there should be no reason for it under normal circumstances.

It should be noted that the contacts are designed so that normal dust and dirt will not trouble them. Once adjusted they will hold their settings for the life of the servo unless they are abused or damaged. Use normal care and keep them clean and the contacts will operate perfectly.

MODEL "MX" MULTI-SERVO PARTS AND PRICE LIST

Part No.	Description	Price
MX:1	—Servo motor with condenser and pinion gear	$2.75
MX:2	—Servo motor condenser	.50
MX:3	—Gear train frame, all models	2.50
MX:4	—1st gear and pinion	.75
MX:5	—2nd gear and pinion	.90
MX:6	—3rd gear and bushing	.75
MX:7	—2nd gear pinion carrier shaft	.35
MX:8	—Main inner cam shaft	.40
MX:9	—Main outer cam shaft tube	.35
MX:10	—3PNX cam disc	3.50
MX:11	—2P2NX cam disc	3.00
MX:12	—3P3NX cam disc	3.50
MX:13	—3PNX contact base with contacts	5.00
MX:14	—2P2NX contact base with contacts	4.50
MX:15	—3P3NX contact base with contacts	4.50
MX:16	—Brake assembly	.35
MX:17	—Set of servo screws	.50
MX:18	—Instruction booklet	.75

Prices include handling and postage.
Remit with order please.

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To suit the special needs of radio control flying dmeco offers Positive Flow fuel tanks with the internal swivel.

Model A2oz:—.09 to .19 engines $1.59

Model B4oz:—.19 to .35 engines $1.69

Specialized rubber bands for R/C models, pure gum rubber that is not affected by fuel, heat or cold.

No. 16 size—For ½A models and common uses ..... $1.25 per ¼ lb. box

No. 62 size— For average R/C model stabilizers ..... $1.25 per ¼ lb. box

No. 64 size—For average R/C model wings ..... $1.25 per ¼ lb. box