ACE R/C, Inc.

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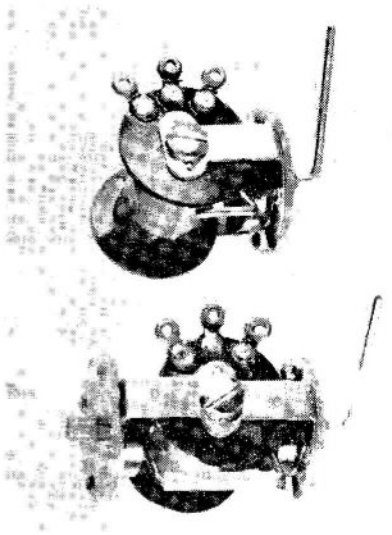
ADAMS MAGNETIC ACTUATORS

**PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:
2,771,572; 3,299,381; 3,304,526. OTHER PATENTS PENDING.**

[ ] No. 14K15—Adams Baby Actuator
[✓] No. 14K58—Adams Baby Twin Actuator
[ ] No. 14K173—Adams Standard Single Actuator (1RLV)
[ ] No. 14K121—Adams Stomper Twin Actuator (2RLV)



I. OPERATIONAL CONCEPTS

Adams Magnetic Actuators offer the greatest versatility of any of the simple rudder actuating devices. They weigh much less than any comparable gear. Being electro-mechanical, they have only one moving part, and "noise"-free. Easy to install and maintain. No electronics to burn out. The design has evolved so that they are probably the most rugged of any device used for moving your airborne surfaces.

The Adams Magnetic Actuators are designed for simple channel, rudder-only, pulse proportional. Two coils are wound together and provide for clockwise and counterwise rotation of the magnetic rotor which, in turn, through the crank, activates the rudder of the aircraft, boat or car.

This rotation occurs when current flows through either of the coils--one direction when it is through one coil and in the opposite direction when it is through the other coil. When hooked up properly, the actuator will bang back and forth from right to left as the transmitter sends a pulsing tone--on and off--to the receiver. Current flows through one coil when the tone is on, and through the other coil when the tone is off. If the tone is on as long as it is off (50/50 width ratio), then the actuator moves equally to the left and to the right, and gives an effective neutral. This should occur when the transmitter stick is in the neutral position. As the transmitter stick is moved to the right or left, this pulse width of 50/50 will vary and thus cause the actuator to drive more in the right or left position, and results in turning the aircraft.

To get the fullest control from your actuator, this pulse width should vary from 5% on/95% off to 95% on/5% off when the control stick is in the extreme left and right positions.

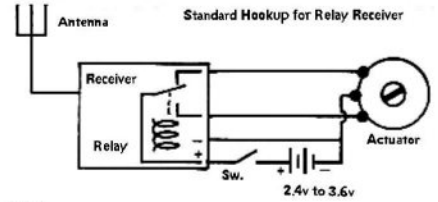
Adjustment may be necessary if your transmitter is a Galloping Ghost transmitter. Check the manufacturer's instructions for adjustment procedures. Some GG transmitters do not have the facility for adjustment. In this case some flyers have used the GG transmitter successfully by using the control stick for straight flying and gentle turns; when a full turn is needed, the motor control push buttons are used to give full tone off or full tone on, thus causing the actuator to be full right or left. This may require repositioning of these full on and full off in the positions you require for left and right.

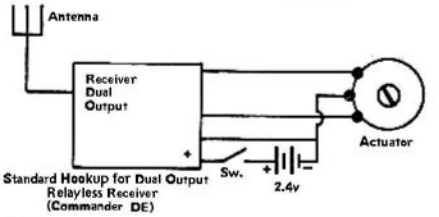
The speed or rate that the pulsing occurs should be fast enough to cause the airplane to fly straight without "wagging". It should be slow enough to allow positive back and forth action of the actuator--this is approximately 3 to 4 pulses per second.

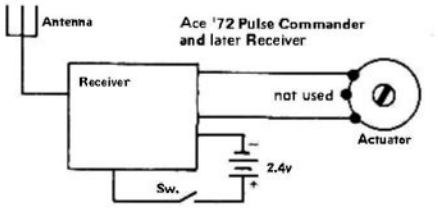
Some people are alarmed at the rudder banging back and forth, but this is nothing to worry about. This is the normal operation of the actuator and is inherent in the concept of pulse proportional with magnetic actuators. When properly adjusted, it doesn't affect the flight of the airplane and is soul satisfying to see and hear the rudder wagging, because you know the system is working properly. Also, if you fly in tall grass, you can't beat the banging as an aid to tracking your airplane by sound if you happen to land it a little far from yourself

II. HOOKUP

The actuator has to receive almost full potential voltage of 2.4V or 3.6V in one coil when the receiver gets a tone and the same in the other coil when the tone is off; or there needs to be an alternating current through both coils. To obtain this, you need either a receiver with a relay, a double ended relayless receiver (Ace Commander DE) or a Pulse Commander receiver equipped with "Drain Brain" circuitry ('72 Pulse Commander and later).







The use of nickel cadmium rechargeable batteries is most highly recommended. Any other types have proven impractical because of the amount of current drain the actuators employ. While they have been used successfully, in most instances they have given problems because they do not have the capacity of the nickel cadmiums, and they require replacement quite frequently and therefore in the long run prove much more expensive.

Be careful when soldering to the lugs on the actuator; excess heat will deform the Delrin header and possibly cause a contact to open. Also, never use a soldering gun--not only is this too large, but the magnetic field induced from the gun may ruin the actuator by demagnetizing the rotor.

Before installing the system in your airplane, hook everything up on the bench and make sure it works properly.

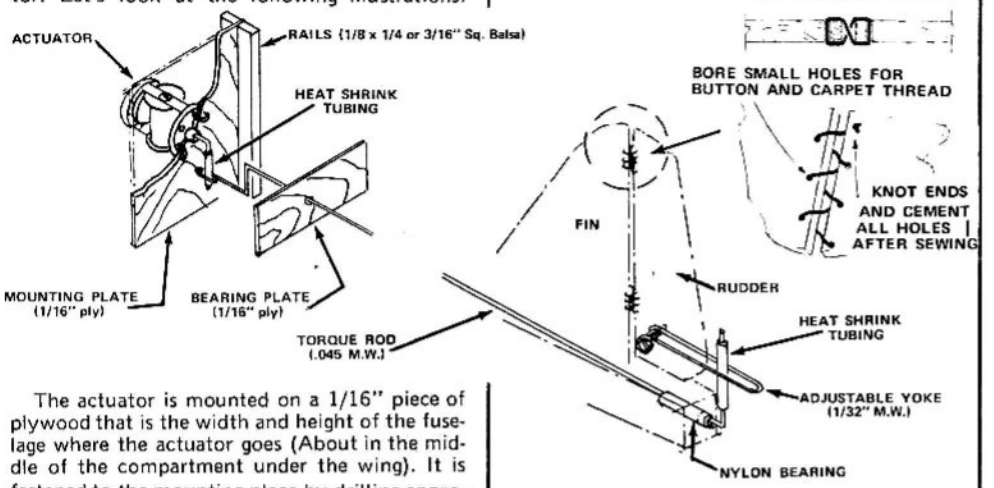
INSTALLATION

The radio installation is a critical part in the construction of a small R/C airplane. Because of the size and weight of a rudder-only pulse system, the power which controls the rudder isn't excessive, but is more than enough to fly the plane. However, not enough to compensate for errors or carelessness in installation. Before installing your R/C equipment, please read the following suggestions carefully so you have the best chance of success.

If you have charged the nicads, installed transmitter battery and antenna, you are ready to analyze the way your rudder-only pulse system works. Turn on the receiver and transmitter. See how the crank on the actuator wags back and forth? Don't worry! This action is a must for the proper operation of the system. Now as your actuator is wagging back and forth, move the control stick on the transmitter slowly to the left Notice that the crank on the actuator dwells more and more to one side as you move the stick--when you push the stick all the way over, the crank barely goes to the other side. Moving the stick the opposite direction produces the opposite result, right? Good. That's the whole principle of pulse proportional radio operation The installation will hook up the rudder so it responds in exactly the same manner. It will wag back and forth vigorously, banging equally from right to left until you move the control stick. Then it will follow your command proportionally—the more you move the stick, the more the rudder will stay to one side or the other until it almost stops at full right or left when the stick is all the way over in those positions.

You are probably wondering how the plane can fly straight and make gentle turns with its tail bumping like a Go Go dancer. Luckily, there's a difference between airplanes and people, an airplane doesn't care whether its tail is wagging or not. If the rudder is wagging equally from right to left all it knows how to do is fly straight Because it has such a big wing in relation to its little rudder, a bit of wagging doesn't bother it at all. When the rudder starts to wag more to the right than to the left, the plane has no choice but to start to turn to the right--the more the rudder dwells to the right, the harder the turn. This is what the pulse system does. It moves the rudder either equally right to left or more to the right or left, depending on how you, the pilot, move the control stick. So, what we will show is how to hook the rudder up to the actuator so it does exactly what it is supposed to do; and find a place in the airplane for the other stuff such as the receiver, batteries, antenna, and switch.

The first and hardest part of the installation is hooking up the actuator to the rudder. Since the actuator weighs too much it can't be mounted at the tail of the plane where the rudder is, so it has to be connected to the rudder by some form of linkage. Because the actuator and rudder are constantly in motion, this linkage has to be very free and efficient otherwise the power of the actuator is lost. The most efficient method is by use of a torque rod to connect the rudder and actuator. Let's look at the following illustrations:



The actuator is mounted on a 1/16" piece of plywood that is the width and height of the fuselage where the actuator goes (About in the middle of the compartment under the wing). It is fastened to the mounting place by drilling appropriate holes and sewing with "button and carpet" thread or copper wire--don't use steel wire because this will disturb the magnetic field. To secure the actuator mounting plate in the fuselage, rails are made from 1/8 or 1/4 or 3/16" square balsa pieces which are glued to the fuselage side to act as slides or rails so that the plate can be slid in and out for easy removal. Make this a snug fit between the balsa rails and the plywood actuator plate.

The rudder is hinged at two points using heavy thread (button and carpet preferred) sewn in a figure 8 manner and glued. Use glue sparingly so you don't get it on the hinge portion--the rudder should flap easily back and forth with no resistance.

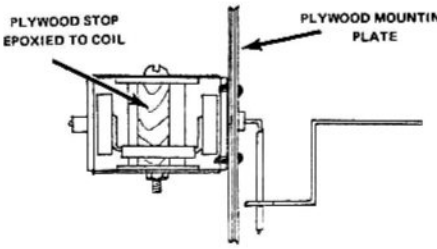
With needle nose pliers the front post of the torque rod is bent (out of .045 music wire) in the manner shown. It passes through two bearings: the front bearing is made of 1/16" plywood with a slightly oversize hole and a piece of nylon tubing is used at the rear. Make sure the torque rod is a straight line from the center of the actuator to the rear, touching nothing but the bearing points--no bind or rub should occur anywhere. It will be necessary in most instances to drill a hole through the rudder post for the torque rod to slide through. With the front plywood bearing loose, the torque rod can be slid in before the rear bend is made. Then when you are absolutely sure you have no binds, the rear bend is made straight up and down when the actuator crank is in the "neutral" or half way between its amount of travel. Then glue the ply bearing plate and make sure it does not shift. Also make sure you get no glue on any bearing points.

A yoke is used to connect the rudder to the torque rod. Paper clip wire or 1/32" music wire works well here. Bend in the manner shown and use a small nut and bolt to fasten it to the rudder; this allows it to be adjustable--move it up and you get more rudder movement, down and you get less. There should be absolutely no bind in the system when the actuator moves from right to left, especially at the extremes. In order to accomplish this, it is necessary to have some slop in the linkage when it is in neutral--don't worry! The plane doesn't care.

Where wire touches wire small heat shrink tubing is used to prevent electrical noise--something that can really screw up your receiver. Simply slip the tubing over the wire, position it where you want, and apply heat. It will shrink up around the wire very tightly and stay there. Heat can be applied with a soldering iron or a match. If you use a match be careful not to burn the plane.

Before going any further, again turn on the system and check the operation. The rudder should bang back and forth equally right to left when the control stick is in neutral and follow your command when you move the stick. It should do this with the plane in any attitude: upside down, straight up, or its side, etc. If it doesn't, you've got bind in the linkage so check your work carefully.

If the rudder still pulses unevenly while the plane is on its side and you are sure there is no bind, a modification to the actuator is recommended. Simply cut a piece of 3/32" plywood 1/4" wide, and long enough to fit snugly against the coil between the plastic discs of the actuator (see illustration). Carefully epoxy this stop to the coil. This restricts the deflection or throw of the actuator, since the torque effect is weakest at the extremes of the actuator travel. The lost throw can be regained by moving the yoke at the rudder upward slightly.



There might be a chance that the rudder follows the command backwards--that is, when you command right, the rudder moves to the left. If so, very carefully unsolder and reverse the brown and blue leads on the outer lugs of the actuator. Resolder carefully and securely. Do not use too much heat or you'll melt the nylon header.

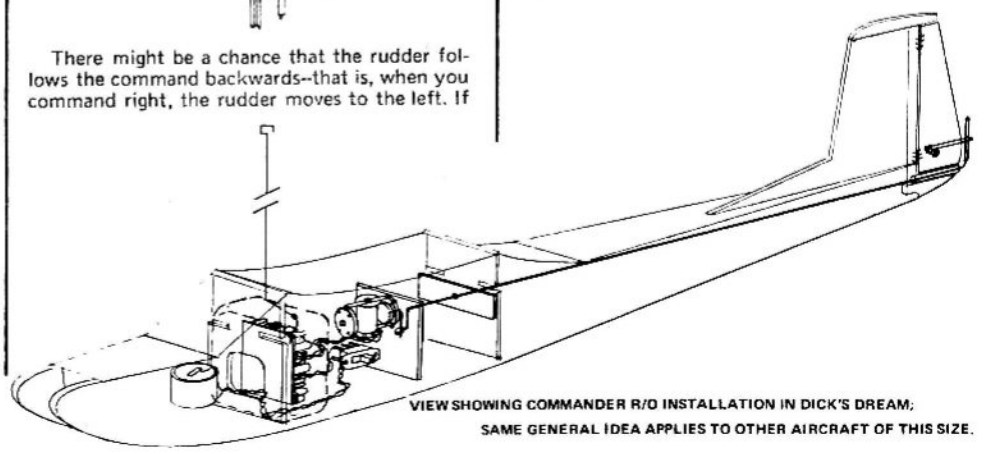
Now it is the time to put the rest of the stuff in the plane. Shown is a typical installation for "Dick's Dream"; same pattern should be followed for other small planes--fine for large ones too.

Notice that the receiver is in front of actuator and batteries are in front of receiver. Always maintain this relationship when installing equipment; otherwise you are going to have pulverized transistors if you have a hard landing or crash. Also, ALWAYS WRAP THE RECEIVER AND THE BATTERIES (SEPARATELY) IN A GOOD QUALITY OF LATEX FOAM RUBBER--to protect them from damage and also dampen vibration from the engine. Receiver is completely wrapped in foam so that it will stay in place but not under too much pressure so that it does have room to absorb vibration. Make sure it clears actuator enough so that under flying conditions it can't shift rearward and jam actuator. Batteries are wrapped completely in latex foam--the rest of the forward compartment is filled with additional foam pieces. Make sure batteries can not shift around in your final installation. When checking the balance of your model, you can move batteries forward or backward so that you have the proper balance point. NOTE: Unless you use latex rubber, the receiver crystal is subject to damage and all warranties on the crystal are void.

Mount the switch in a convenient spot on the fuselage side so it is not in anything's way. Cut a rectangular hole and drill two holes in the proper spot - use two 2-56 bolts and nuts to secure the switch. (Switch guard is available).

You may run the attached antenna to the rear of the plane on the outside to the top of the rudder or any convenient location. ALWAYS keep the antenna separate from other wires and do not run near any metal object such as the torque rod. If you experience glitching, or are flying in a high interference area, you can eliminate a lot of this by going to a whip antenna. A vertical whip is made out of .020 or 1/32" music wire so that the total length between the receiver and the top of the antenna is the length of the original antenna (24"). Securely mount antenna on fuselage, and cut the original receiver antenna so it runs in straight line between the receiver and the vertical antenna, but do leave some slack. Solder this wire to the music wire securely. Use a piece of slit fuel line over this joint for strain relief.

After installation is complete, make sure all your wires are neatly cabled and can't possibly get in the actuator. A nice, neat installation is always desirable - it seems to work better because it looks better; it is also easier to spot any problems that might happen after a number of flights.



VIEW SHOWING COMMANDER R/D INSTALLATION IN DICK'S DREAM; SAME GENERAL IDEA APPLIES TO OTHER AIRCRAFT OF THIS SIZE.