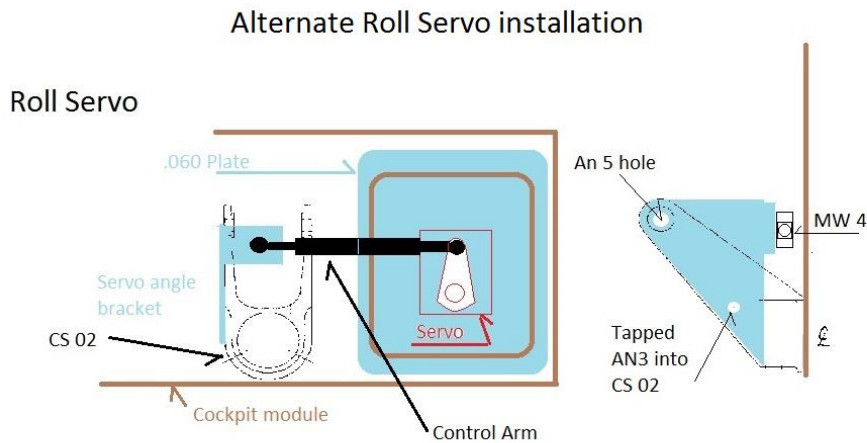


Pitch Autopilot Options done at Custom Flight Creations, Inc.

By Bud Yerly

Autopilot installations have been addressed by Europa Aircraft. These mods (Europa Mod 75 and 76) require replacing the pitch and roll tubes which are difficult to do without ripping out part of the cockpit module. The CFC mods allow installation of pitch and roll autopilots without deconstruction. However, the pitch modification is going to require some gymnastics in some aircraft without proper access holes in the aircraft rear.

1. The roll autopilot is quite easy to install:



Below is a photo of one install using a Trutrak servo.



The roll autopilot installation requires an open area normally used under the pilot or passenger seat. Today's smaller servos fit quite nicely into these holes and installation only requires the fabrication of a plate, a cover to prevent control interference, and a bracket installed on the stick. Note in the photo

above, a couple of pieces of angle allow a fiberglass cover to be manufactured quite easily. The throw of the aileron servo is critical. One must ensure the servo cannot under any circumstances go over center. Limit the throw to a maximum of 45 degrees. This extra servo throw greatly improves the pitch trim servo accuracy. The longer the throw of the servo, the better the operation of the feedback loop.

Caution:

The servo arm throw should be limited to a max of 45 degrees and must be installed so it cannot go over center and jamb the control. Many servo manufacturers supply a limit bracket to prevent this. When any doubt or possibility of an over center condition can exist, install the over center limit bracket!

2. The pitch servo depends on the size and placement of your access holes in the rear of the aircraft.

Those who have the miniature access holes for access to the rear of the aircraft. In the drawings below, are two methods of servo attachment.

The first method is for those who have no access to the pitch tube attachment in the rear of the aircraft. This setup requires one to do the install through the access panel in the rear of the baggage bay. This applies to tri-gear and mono aircraft. I make a block and board support to lay on “comfortably” while doing this mod.

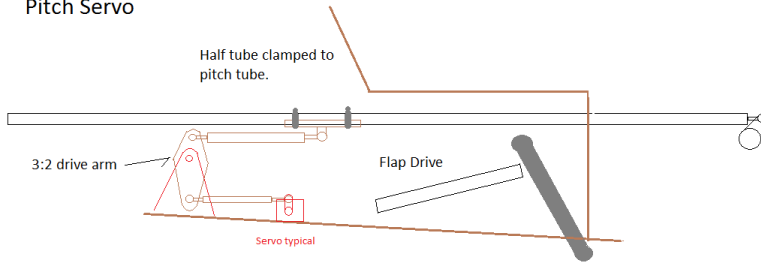
The servo is attached to the floor via a glassed in support. The pitch tube only moves about an inch so a servo would have a very small throw if attached physically to the pitch tube. In this servo attachment setup, the servo arm is centered on the pitch tube and an arm is attached physically to the longitudinal pitch tube through a 3:2 arm to allow the servo to travel nearly 45 degrees from up to down. This extra servo throw greatly improves the pitch trim servo accuracy. The longer the throw of the servo, the better the operation of the feedback loop.

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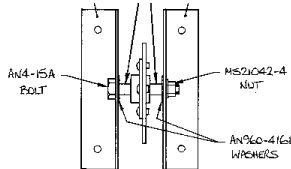
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The installation drawings below shows the basic setup of the pitch trim servo. Some items do not have exact dimension as each owner has a slightly different setup. The 3 to 2 arm has to be designed to fit as one of the Europa Aircraft belcranks. I've used two thin pieces of metal and one solid thick (1/8 inch) arm which changes the dimensions of the servo arm supports. How you get into trouble is not noting in the layout, what the distance is from the fuselage floor to the pitch tube and then designing the components. I start with the half tube and its servo arm attachment. That sets the centerline to swing arm bracket installation. Nominally if 7 inches is available from the tube to the floor, and the pitch tube to the 3:2 arm has to be 1.5 inches lower to clear properly, then the 3:2 arm cannot exceed 4.5 inches. However, the two supports for the 3:2 arm has to be subtracted also. Let's say that is ½ inch so now the servo arm cannot exceed 4 inches. Then one must consider the clearance for assured motion without any possibility of interference of at least ¼ inch on the top to the bottom leaves a servo arm of 4 inches. That is the overall outside of the arm dimension, not the drive tube MW4 attachment points. Typically the arm MW4 drive hole dimensions in this example will be from the pivot nominally 1.5 inch above and 2.25 inches on the lower from the pivot point.

Pitch Servo



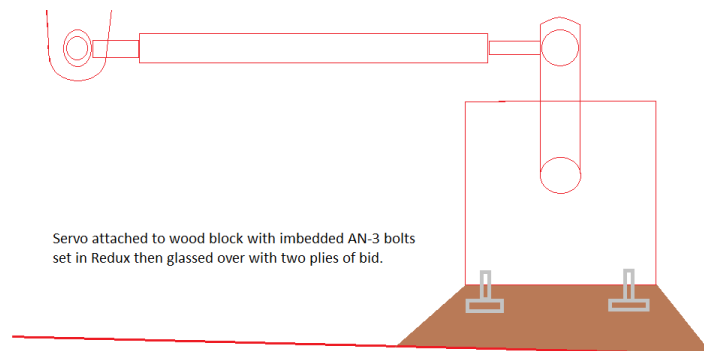
Spacers



Belcrank arm is built up like trim arm at .090 aluminum. Make a 6 inch arm with 5 inch hole centers top and bottom. Put bearing hole two inches from top hole.

Brackets are .040 aluminum using lengths of about 7 inches with flanges of at least 1/2 inch.

Half tube is 2 inch tube cut in half with 1/4 inch bung 1.5 inches long in center. Lay silicone cowl seal glued into tube to cushion against wear and improve traction on tube. Use standard hose clamps to attach half tube.

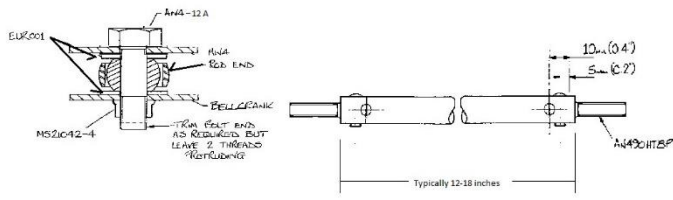
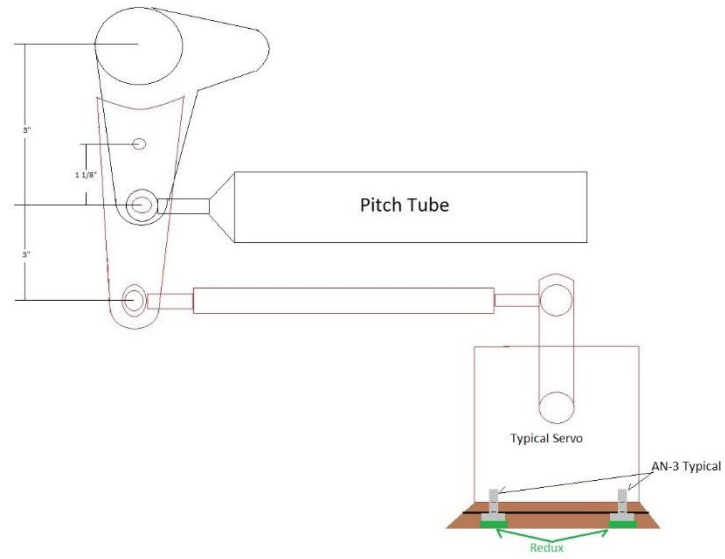


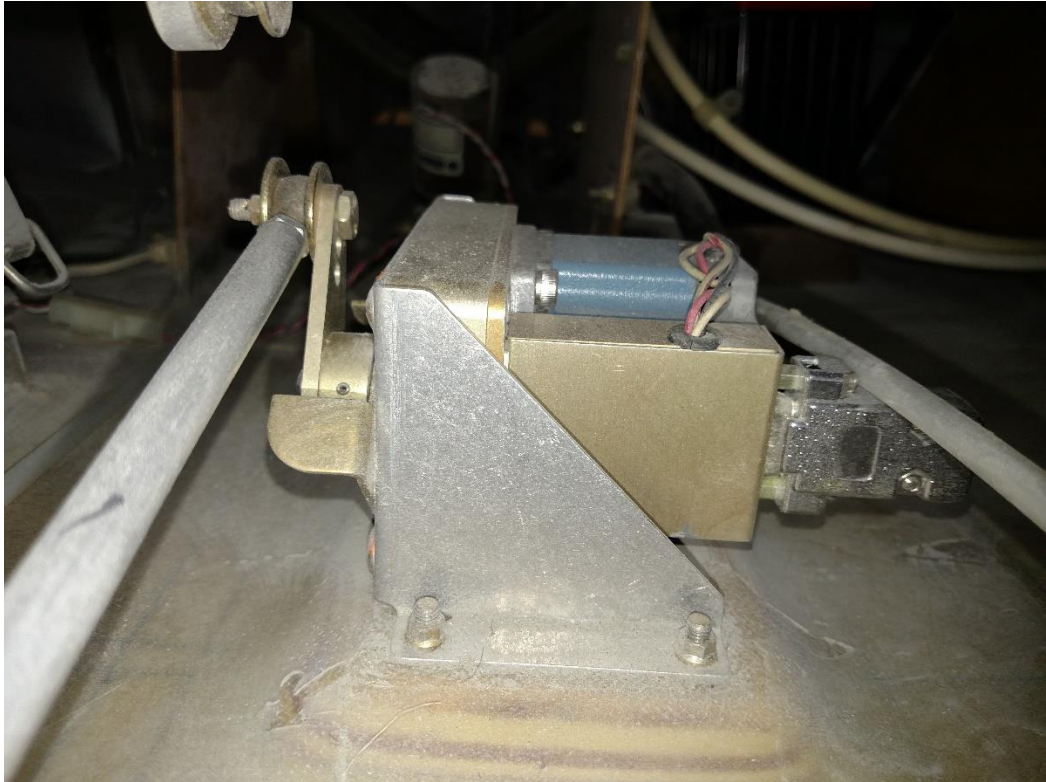
The second method of pitch servo installation is dependent on the access the owner/builder has to the stab pitch tube and tower area. Should the installer have adequate access to the actual pitch tube, I prefer to extend the pitch tube attachment via two pieces of steel sheet to allow a rear mounted direct servo to pitch tube attachment.

This is a very direct drive setup. Using two arms attached to the existing stab tube that extend the arm allowing extra throw for proper autopilot servo drive. The problem comes in to installing the servo. Normally I install the servo level and directly to the fuselage floor. The access hole must be large enough for the installer to work in to install the servo attachment block. In the event that the access hole is large enough, with some preinstallation planning the servo can be attached quickly and easily. I show a wood block but I have also made an aluminum bracket bolted and Reduxed to the floor through the fuselage. I do not have drawings of this at this time. Pretty straight forward though. I lay glass to the floor for reinforcement (two extra layers of 8 oz bid). Then I fabricate the servo mount which is angled and is predrilled to conform to assure a centered servo arm with a rigid bracket supporting the servo. I counter sink the belly for the screws holding the support bracket. Some times the wood is easier to fabricate and then simply plop in some redux, then glass over with a tape. Either is easy to plan but a tough to do in place.

See drawing below:

Alternate Pitch Servo







No installation is without effort and to many, not worth the time. The mono makes installation to the pitch tube very difficult, and rear access panel size are the factors which affect the installation type. For most mono owners putting the pitch servo just behind the baggage bay bulkhead on the floor is required.

I highly recommend the installer build the unit on the bench and get the nuts and bolts all ironed out prior to installation of the supports. Make sure the supports are placed so as, to keep components/servos installed exactly where they must be.