RV-4 / RV-6 Wingtip Servo Installation Kit

Thank you for purchasing the Trio Avionics Wingtip Servo Installation Kit. This guide provides a general overview for installation of the autopilot servo in Van's RV-4 and RV-6 series aircraft. Specific techniques may be varied by the builder. If you have any questions or suggestions for improvement regarding this Guide, please write to us at info@trioavionics.com

Getting Ready:

Time required to install this kit will vary by aircraft as existing electrical system and existing wire runs determine what needs to be done. In general, you should allocate from 6 to 12 hours and it can typically be done over a weekend.

Techniques may be varied by the builder; this document is only intended to provide a general guide.

AVOID ERRORS – READ THIS GUIDE BEFORE STARTING

Tools:

No special tools are required for this installation; general shop tools are sufficient for completion. Tools that may be helpful are:

- **Small air-powered drill motor**
- **Cable drill**
- **Pin crimper for Molex type connector pins**

Kit contents:

- **One reinforcement PLATE**
- **One reinforcement ANGLE**
- **Push/pull tube (already assembled)**
- **Attachment hardware**
- **Two aileron bellcrank tabs**
- **Installation guide**

Note: **This kit does not contain wire, terminals, or any materials required for the electrical hook-up of the servo. You can easily wire the servo according to the schematics included with your autopilot documentation.**

Trio offers a complete, ready to use, wiring harness for the autopilot servos, image at right. More information can be found at www.trioavionics.com.

Note: **All illustrations and references in this guide show the kit being installed in the RIGHT wing of an RV6. Of course, the servo may just as well be installed in the left wing of the airplane. Procedures for RV4s are identical.**

Step 1: Install tabs on the existing bellcrank to provide for mounting the servo push/pull tube. The image at right shows the finished aileron bellcrank installed in the right wing. Note the visible aluminum tab that has been riveted to the bellcrank that attaches the servo push/pull tube. (There is a similar tab on top of the bellcrank.)

Right Wing
- view looking up and aft into inspection panel

Remove the bellcrank inspection panel from the bottom of the right wing and mark the bellcrank ends with “Aileron” and “Control Stick” as appropriate. (This will help with orientation when working on the bench.) Remove the bellcrank being careful to document the location of all the hardware and spacers..

Step 2: Drill out the two rivets located on the CONTROL STICK END of the bell crank. Align the servo push tube mounting tabs to the bellcrank as shown below. Align the tabs on the CONTROL STICK END of the bellcrank with the tabs extending out from the long side (hypotenuse) of the triangle.

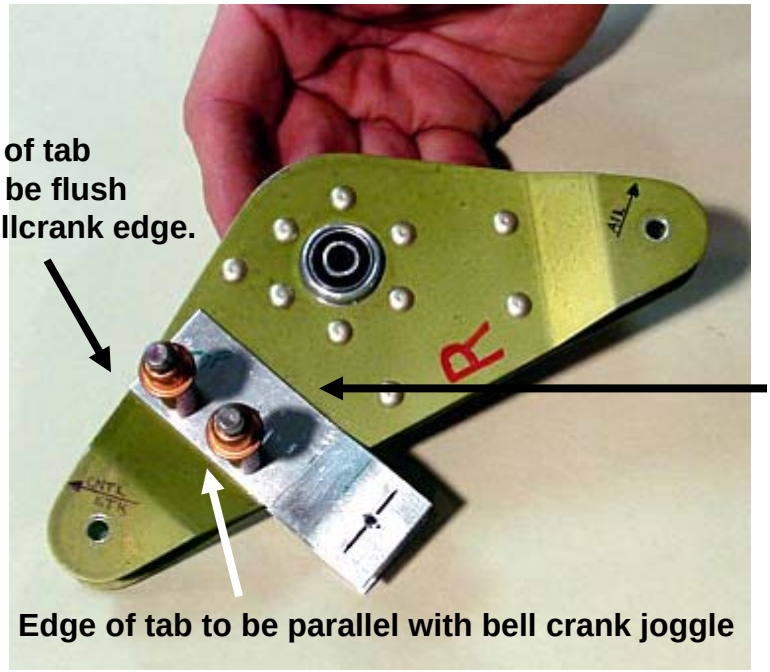


Image below shows bellcrank tabs drilled and cleco'ed in place. Note the third rivet hole just visible behind the cleco. Adding this additional rivet is optional and may require the fabrication of an new spacer to slip between the two halves of the bell crank. (0.063 material is required.)

Remove the tabs from bellcrank, cleco them together, and pilot drill the bearing hole.

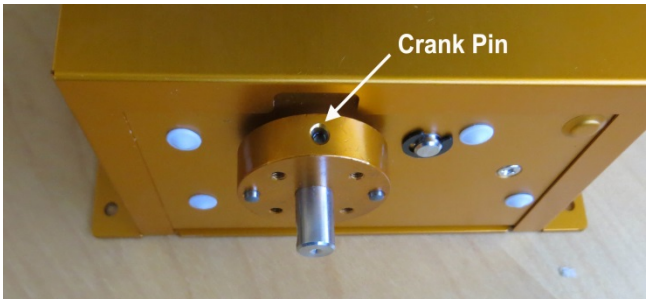
(Left) Tabs have been rounded at the tips and riveted in place. The next step is to drill the hole for the bolt which captures the bearing to final size. (Below)

Use a ½" block, inserted between the tabs, to drill the bearing hole to final size. Try to drill this as "square" as possible. A drill press will help if available.

Step 2 is now complete. Shown to the right is a properly modified bellcrank. The servo push rod is shown in place but should be set aside for now.

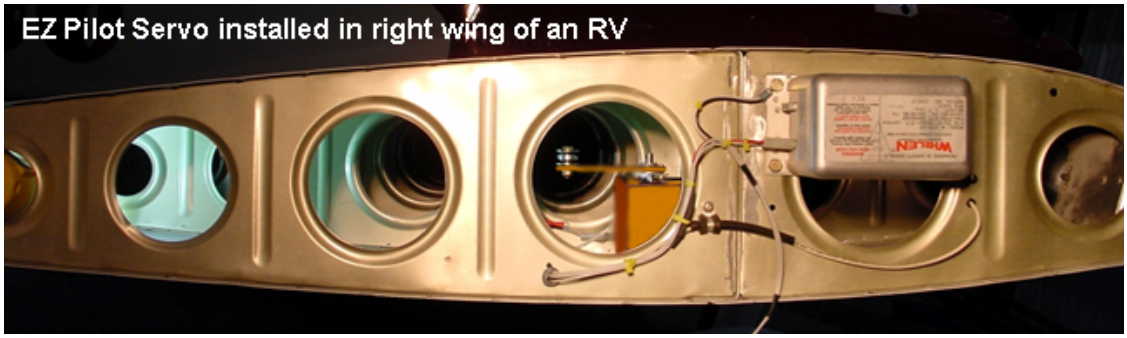
Step 3: Reinstall the bellcrank in the CORRECT orientation. Be sure all spacers and washers are returned to their original position. Use new nylon stop nuts and torque to the appropriate values. Verify bellcrank rotates freely and no bolts interfere with bellcrank mount struts.

Step 4: With the servo hub centered (crank pin in the hub facing straight up), install the crank arm straight up as shown below..



- The screws provided for the Gold Standard servo crank arm are pre-coated with a Loctite compound. These will hold the crank arm securely.
- If you have a Gold Standard servo with the crank arm already installed pointing down, it will have to be removed. To avoid stripping the screws when removing them, heat the area with a heat gun to loosen the Loctite before removing the screws/.
- Once the crank arm is installed, place the washer over the shaft and install the cotter pin as shown.

Step 5: Servo Installation in outer wing bay. (Right wing shown.)



Step 6

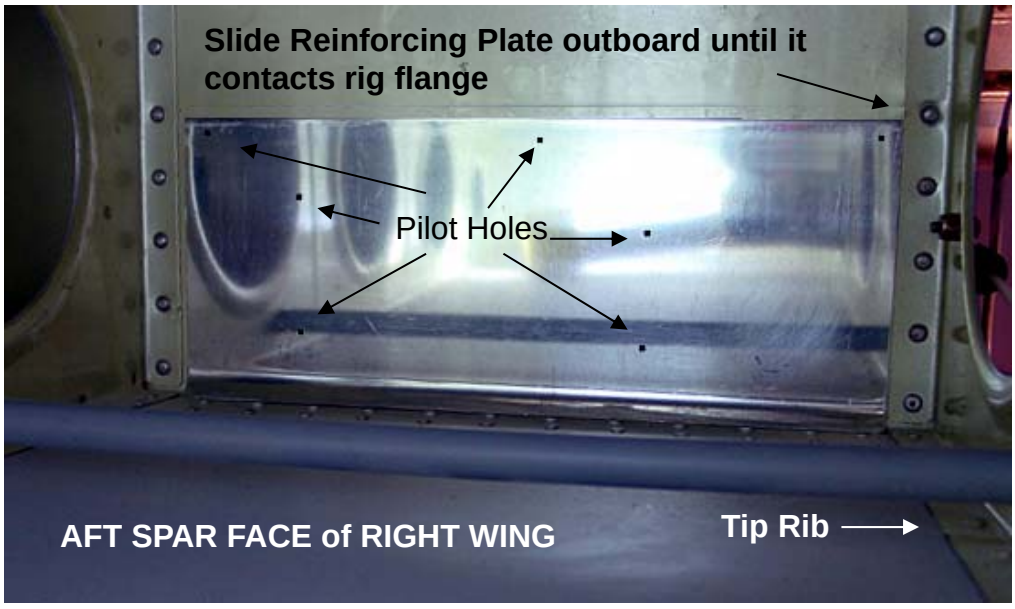
- Remove wingtip to gain access to outer wing bay.

- Insert the plate through the large lightening hole AFT of the main spar. Place the bent flange along the bottom of the spar. Note: The image below shows a prototype reinforcement plate. Your plate will have relief holes and may vary slightly from the prototype.
- The reinforcement plate should slide OUTBOARD until making contact with the tip rib flange.
- Hold the plate in this position, drill though the spar, using the 7 small pilot holes as a guide, with a # 30 drill bit. Cleco as you go to maintain alignment. Disassemble and debur all holes.
- On the workbench, clamp the reinforcement ANGLE to the back of the reinforcement PLATE as show in the image below. The top and sides of the angle should be flush with the top and ends of the plate. The angle flange should be down. Using the three holes drilled in the top of the plate as a guide, back drill into the angle. (See image next page)
- Cleco the reinforcement PLATE, SERVO, and reinforcement ANGLE in position (it's easier if the clecos are on the front side of the spar) and drill through the four servo mounting that match the pilot holes in the reinforcement plate, and spar using a #26 drill bit. Temporarily install the 6/32" screws in each hole as you go to maintain alignment. Now drill the three holes across the top of the reinforcement plate. Once all seven holes are drilled, disassemble, debur, and prime (priming is optional).

NOTE:

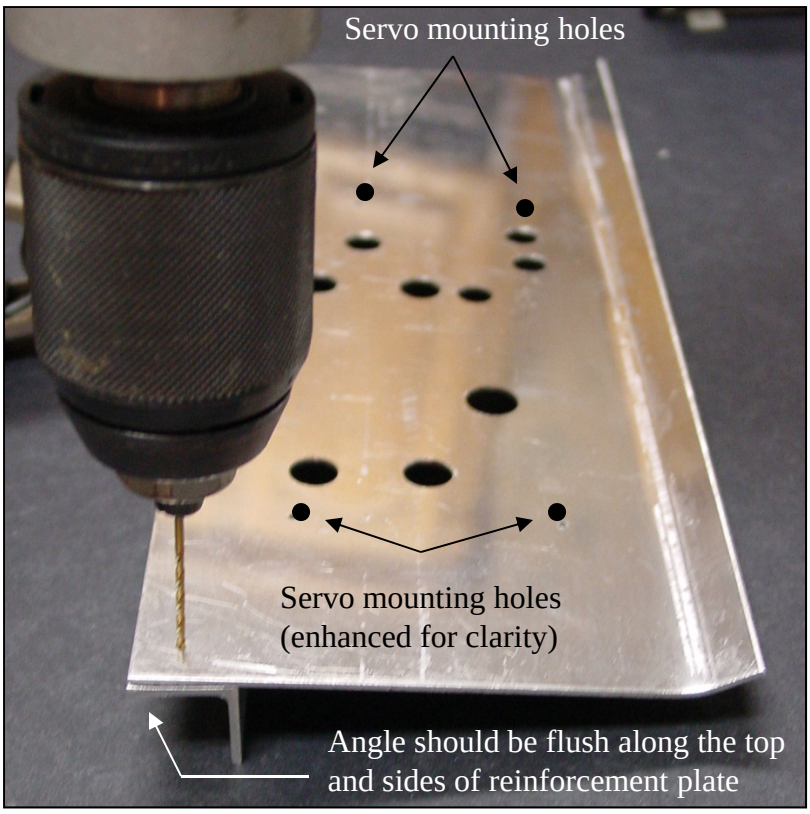
If installing in the left wing, plate positioning is the same. ALWAYS slide reinforcement plate to the OUTBOARD rib flange. Should you need to trim the reinforcement plate, always remove material from the inboard edge.

The servo mounting plate provides reinforcement for the spar at the attachment location and also serves as a drilling template during installation. In the image below, "you" are inside the outboard wing bay (right wing), looking forward at the aft face of the spar. The main tip rib is to your right.

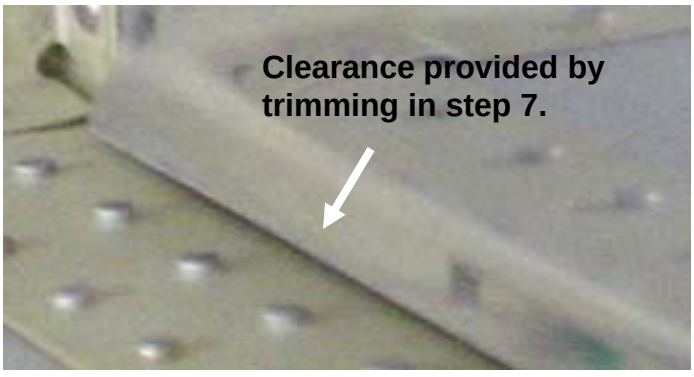


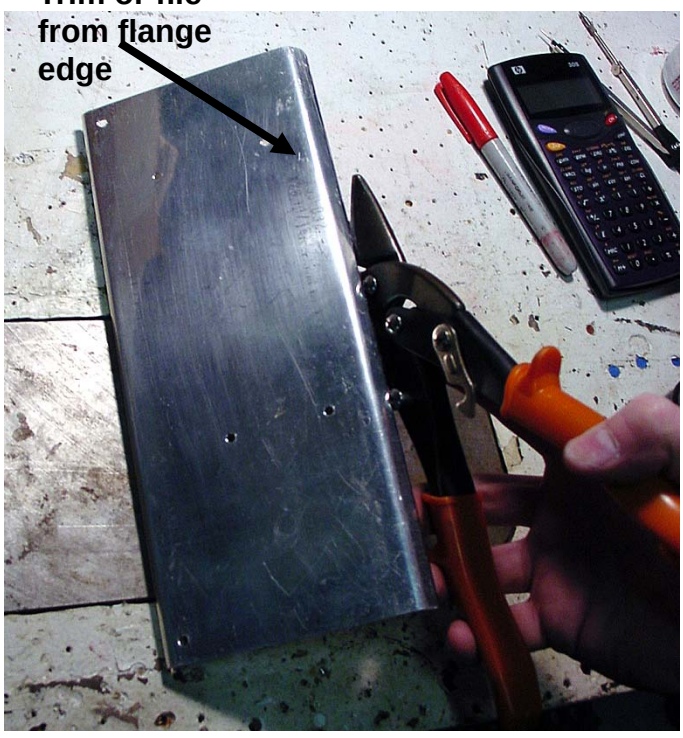
Your reinforcement plate may have up to nine large (.375”) holes drilled (as shown below) in it to allow the servo to mount flush against the reinforcement plate. **ONLY THE SEVEN SMALL PILOT HOLES WILL BE DRILLED THROUGH THE SPAR**. Four that attach the servo and three across the top of the reinforcement plate. The three across the top of the plate also secures the reinforcement angle on the front side of the spar. (See images on next page)

Back drilling of reinforcement Angle as described in STEP 6E.



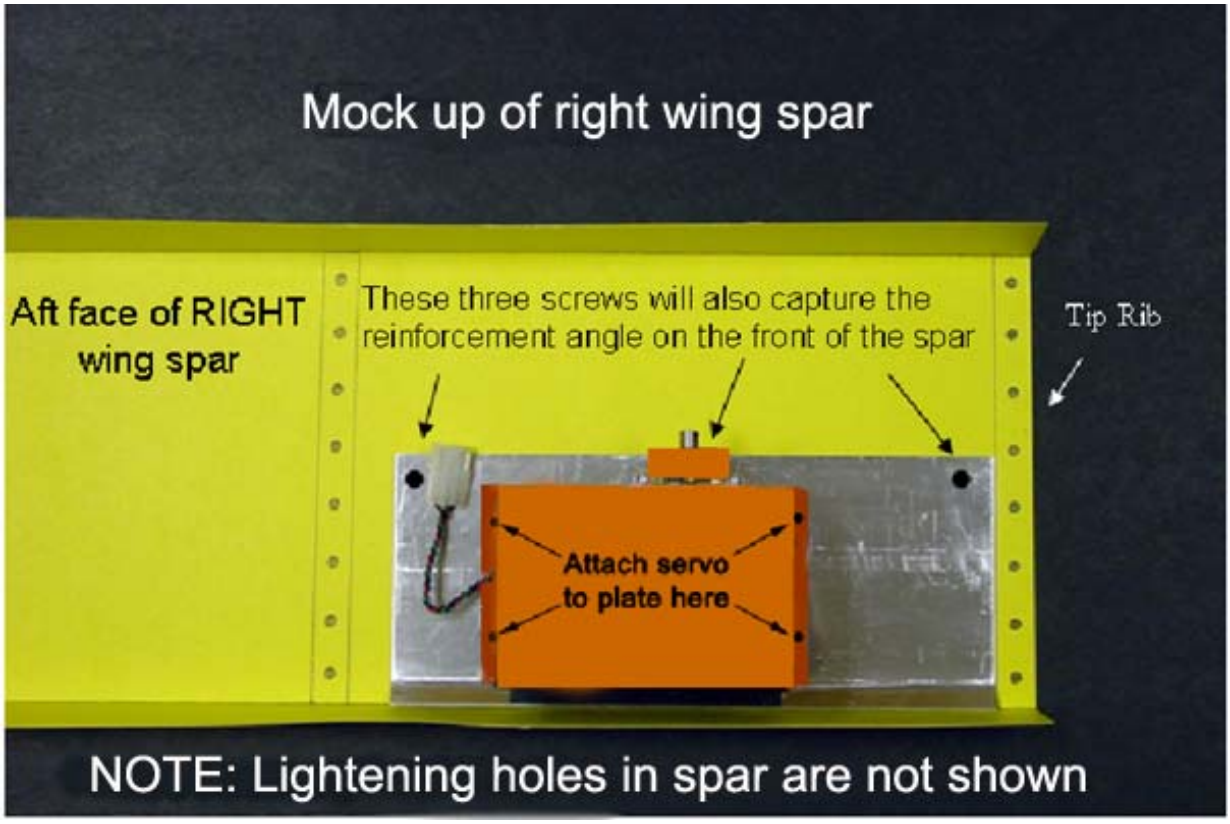
STEP 7: Trim or file a small amount, approximately 1/16th-1/8th inch, from the (30 degree) flange on the bottom of the plate. Once installed, no contact with the spar flange will be possible, eliminating any chance for wear or corrosion.

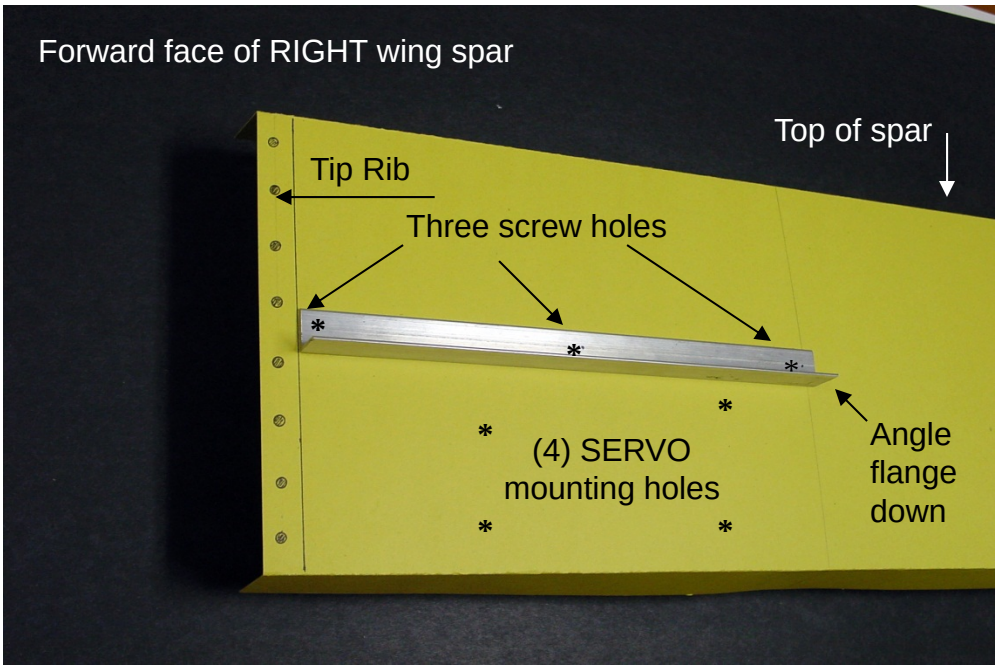




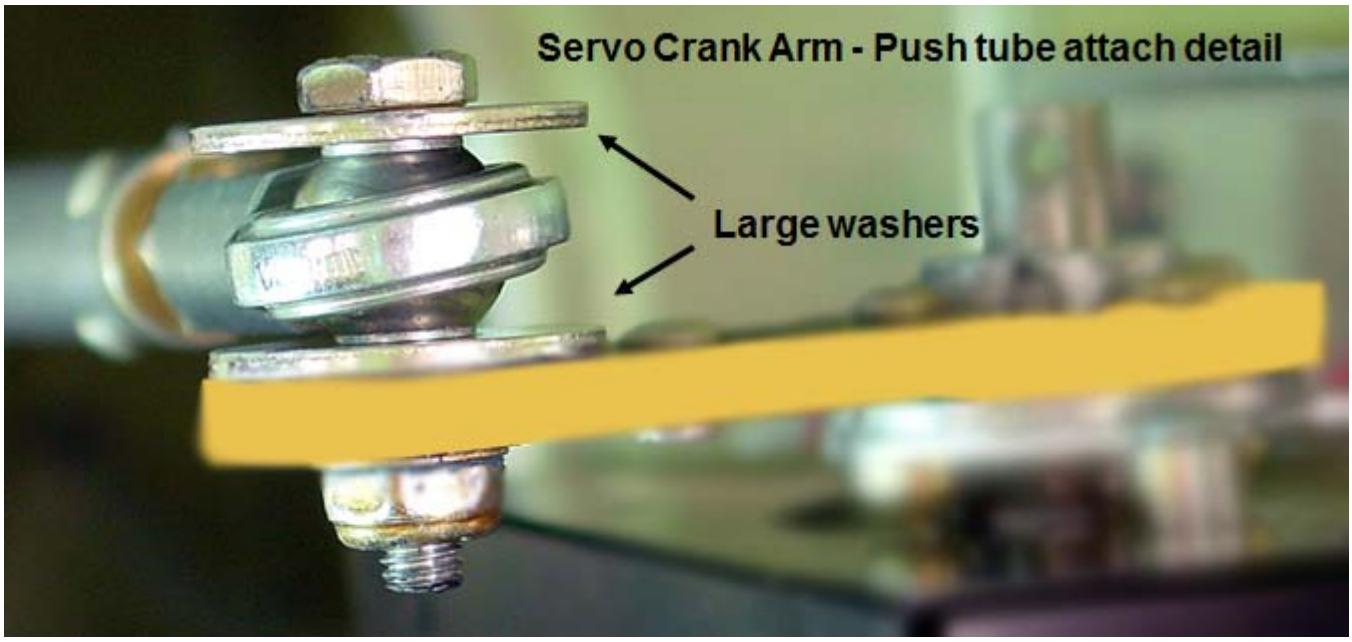
Step 8:.

- Install the reinforcing SERVO, reinforcement PLATE, and reinforcement ANGLE using the seven sets of 6/32” screws, washers, and lock nuts provided. Below is a conceptual mock up that should help clarify the objective.

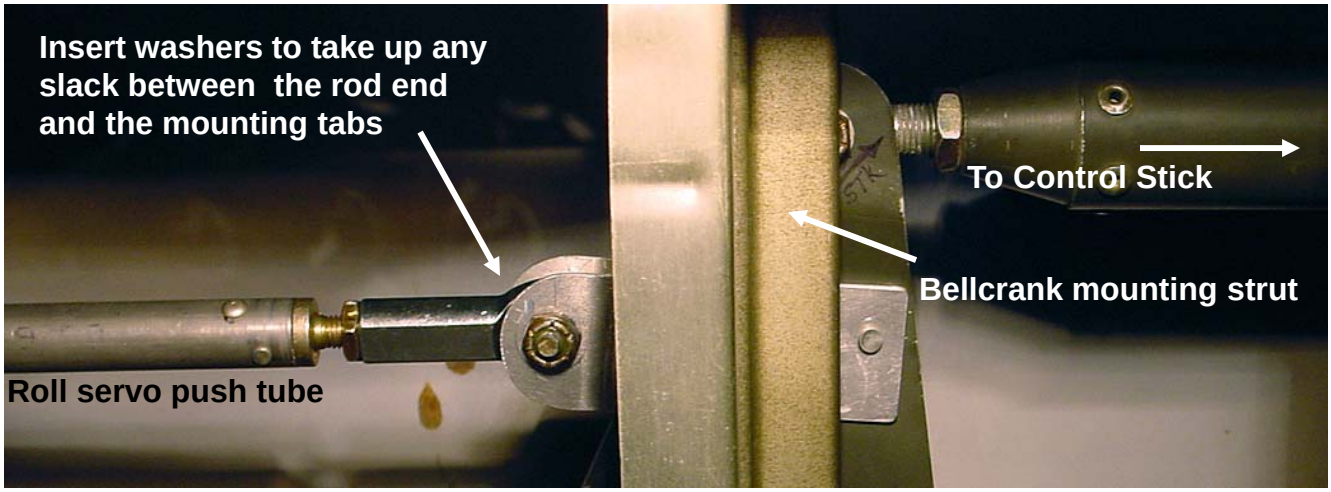




Step 9: Attach the push/pull tube to the servo crank arm. The rod-end bearing should be **ON TOP** of the crank arm and the hardware installed as shown in image below.

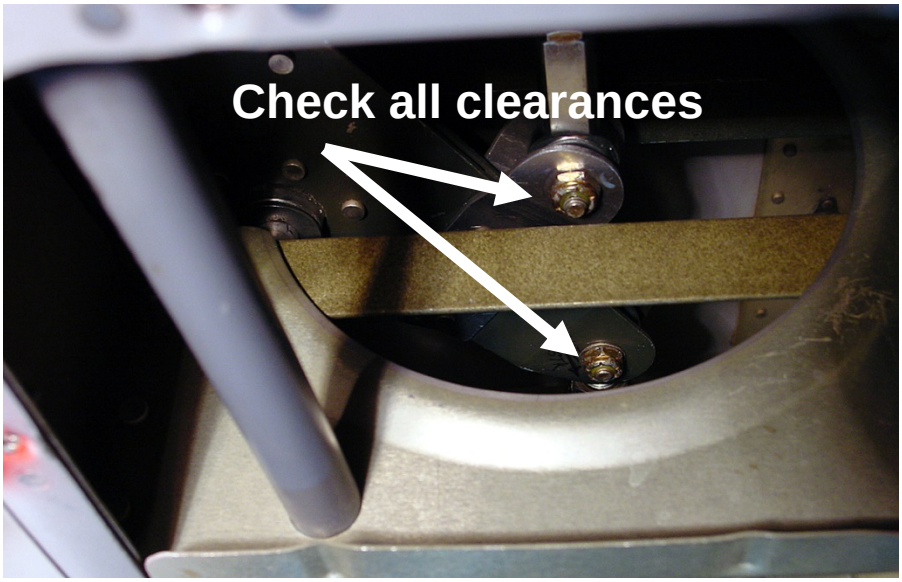


Step 10: Attach servo push/pull tube to aileron bell crank. Note: Your kit contains hardware for attaching the push/pull tube to the bell crank. We have provided a variety of washers (spacers) for the installation.



WARNING

Verify bellcrank freely rotates throughout its entire range*. Ensure all hardware has sufficient clearance from bellcrank mounting struts and all other wing structure as shown in image below. Verify that no “over center” conditions are possible. Confirm the servo push/pull tube doesn’t bind as the controls are moved throughout their entire range.

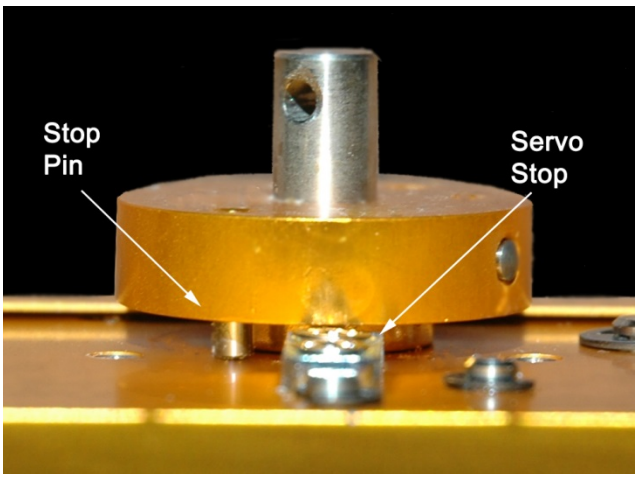


* Aileron control travel limits are defined by Van’s. Limits are set by mechanical stops that are attached to the airframe. Following installation, verify aileron travel is limited by the mechanical stops on the airframe, NOT BY THE ROTATIONAL LIMITS OF THE SERVO. If you do not have experience working with aircraft control rigging, please seek the advice of an EAA Technical Counselor or someone else with appropriate skills and experience.

Step 11: Adjusting the push/pull tube. The linear movement of the servo push/pull tube (from the neutral position) is not the same in both directions. (Van designed it this way.) Therefore, the neutral position of the crank arm is NOT perpendicular to the wing spar when the ailerons are pinned or clamped in neutral.

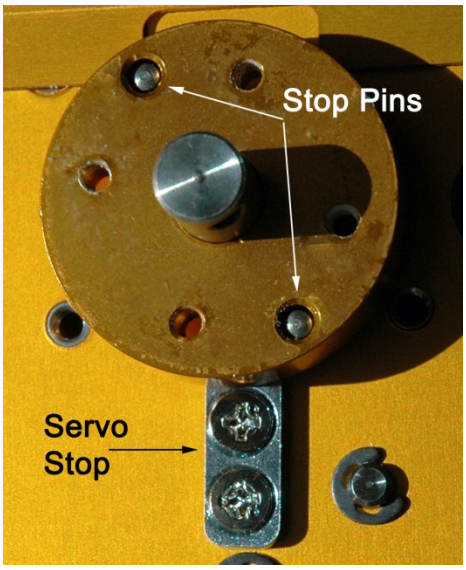
The installation kit has been designed so that, when installed properly, the servo bellcrank will be very close to the proper neutral position when the push/pull tube is installed.

You MUST have a gap (clearance) at the servo "stops" when the ailerons are fully deflected. A gap verifies the servo is not limiting the aileron travel. Equal gaps (between full left and full right deflection) indicates the servo crank arm is in the mechanically neutral position. It is not necessary for the gaps to be equal, only that gaps exist. Lengthening the servo push tube (via the threaded rod ends) will increase the gap on one side and reduce it on the other. The reverse is true when shortening the servo push tube.



The images at right are of the servo crank arm (viewed through a mirror) with full left and full right aileron deflection.

(*Crank arm removed for clarity*)

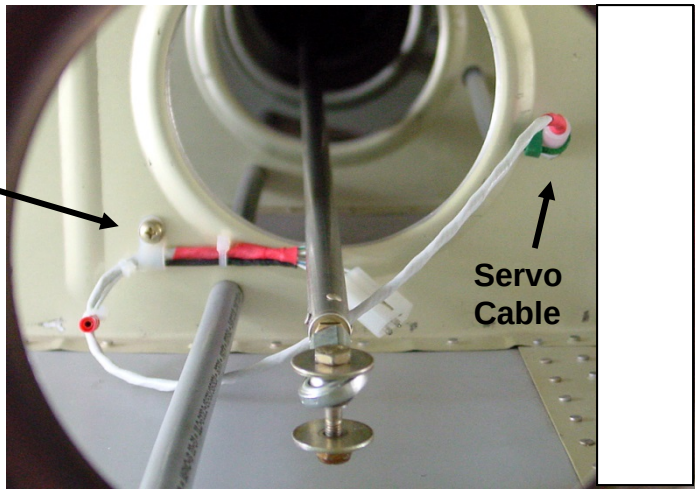


Step 12: Wiring the servo. The servo should be wired according to the wiring schematic provided with the servo documentation. We recommend using a shielded, multi-conductor (3 minimum) cable for the electrical interface between the servo and autopilot head.

The wiring harness should be installed with the servo cable run to the outer wing bay (just aft of the main spar) where the servo will be installed. Be sure to install conduit and/or snap bushings to protect the cable. Make certain the cable is secure and cannot foul the controls. Depending on your installation, it may be easier to run the cable before installing the servo and push tube.

Ready to install installation harnesses are available from Trio.
www.trioavionics.com

Secure servo cable in a manner that will not allow controls to be fouled.



Step 13: Refer to your owners manual for initial power up, set up, and operating instructions. **THIS IS A CRITICAL STEP IN THE SUCCESSFUL INSTALLATION AND OPERATION OF YOUR AUTOPILOT. READ THE MANUAL!**

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Congratulations !

You've just completed the installation of your Trio Servo.