

STC GROUP LLC
480 RUDDIMAN DRIVE
NORTH MUSKEGON, MICHIGAN 49445-2783

REPORT NO: 1006007
REVISION E

TRIO AUTO PILOT INSTALLATION INSTRUCTIONS
CESSNA MODEL 180F TO 180K AND CESSNA 185

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REFERENCES

The following documents form a part of this report. Unless a specific revision of one of these documents is specified, the revision in effect at the time of original issue of this document shall apply.

STC Group LLC Document Number 1006906 – Cessna 180 / 185 Illustrated Parts Catalog

Industry Specifications and Standards:

1. MMPDS-09 Metallic Materials Properties Development and Standardization
2. AC 43.13-1B Aircraft Inspection, Repair & Alterations

Other Data:

ER1006 – STC GROUP LLC Program Engineering Record.



TOOLS NEEDED

Drills

- Cordless
- 90-degree air drill
- 45-degree air drill
- #40 drill bits
- #40 1/4 x 28 threaded drill bits
- Silver Cleco P Series Temporary Fasteners
- Copper P Series Temporary Fasteners
- Side grip Cleco clamps
- Cleco pliers
- 24" ruler or tape measure
- 6" ruler
- Light
- Foam knee pad



ACRONYMS, ABBREVIATIONS, AND SYMBOLS

<u>ASSY</u>	<u>Assembly</u>
<u>Autopilot</u>	<u>Trio Pro Pilot Autopilot</u>
<u>C.G.</u>	<u>Center of Gravity</u>
<u>ER</u>	<u>Engineering Record</u>
<u>FAA</u>	<u>Federal Aviation Administration</u>
<u>F.S.</u>	<u>Fuselage Station</u>
<u>ICA</u>	<u>Instructions for Continued Airworthiness</u>
<u>INCH</u>	<u>Inches</u>
<u>LH</u>	<u>Left Hand</u>
<u>OEM</u>	<u>Original Equipment Manufacturer</u>
<u>OUTBD</u>	<u>Outboard</u>
<u>PCS</u>	<u>Pilot Controlled Steering</u>
<u>Recover</u>	<u>Recover Button</u>
<u>RH</u>	<u>Right Hand</u>
<u>Servo</u>	<u>Trio Gold Standard Servo</u>
<u>STC</u>	<u>Supplemental Type Certificate</u>
<u>WS</u>	<u>Wing Station</u>



1.0 TRIO PRO PILOT AUTOPILOT INSTALLATION

This installation procedure provides information and data necessary to install bracketry and hardware for mounting the Trio Avionics Pro Pilot Controller along with the Pitch and Roll servos in Cessna Aircraft Model 180F through 180K, Serial Numbers 645, 18051184 through 18053203 and Cessna Aircraft Model 185, Serial Numbers 632, 652, and 185-0001 through 18504448. Please note that some of these aircraft shipped equipped with an ARC (Cessna) Navomatic autopilot. Contact The STC Group LLC if your Cessna 180 or 185 was shipped with a factory installed autopilot.

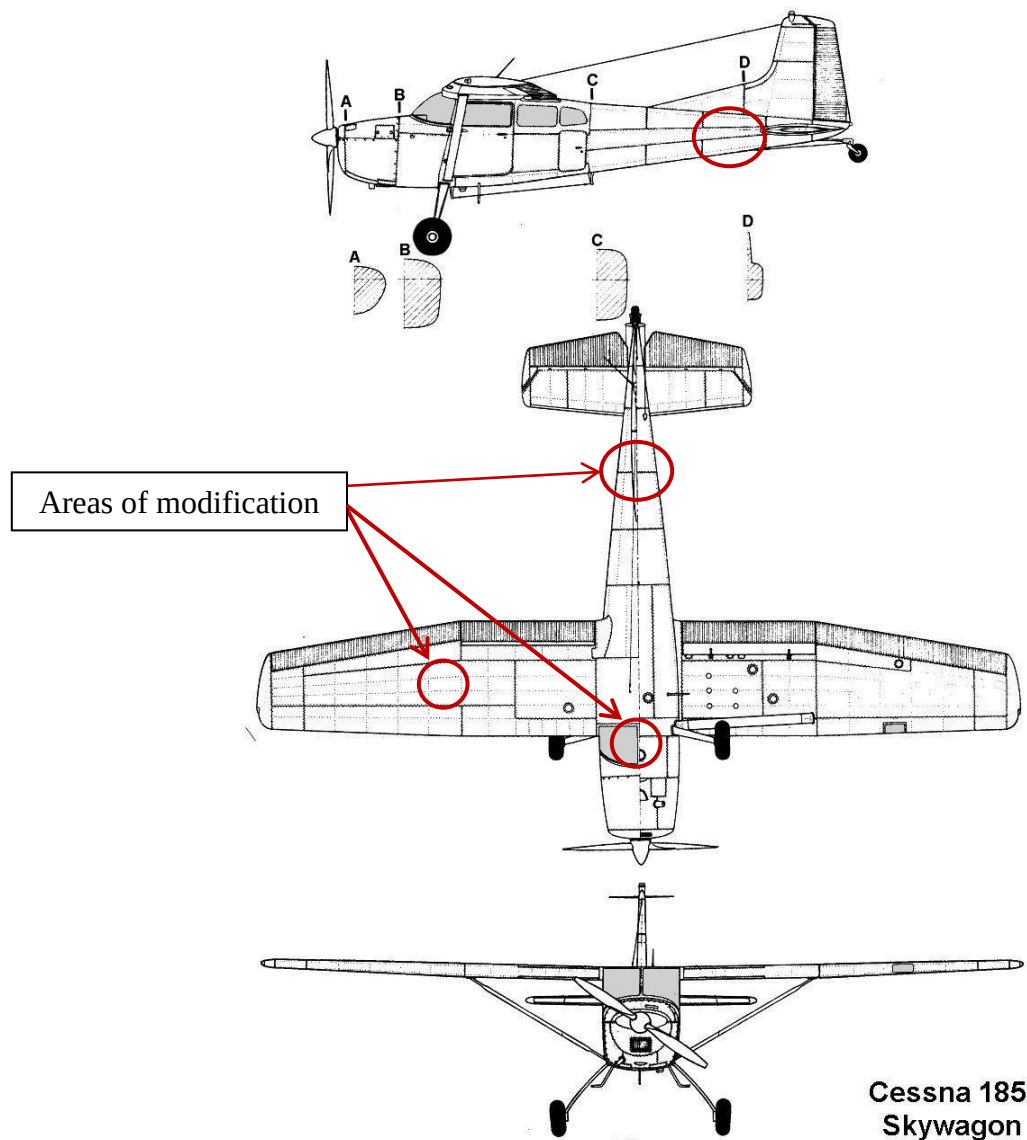


FIGURE 1-1 AUTOPILOT INSTALLATION



2.0 GENERAL

Thank you for your purchase of the TRIO Pro Pilot Autopilot for your aircraft. This document is written to ensure your installation is simple, safe, and professionally completed. Before you begin: Read All Instructions!

This installation procedure provides information and data necessary to install the Trio Auto Pilot Controller along with the Pitch and Roll servos in a Cessna 180F through 180K and 185 through A185F aircraft.

Check all items included in the kit to ensure all parts are accounted for. You may compare the contents of the kit with the Illustrated Parts Catalog. Please contact us if there are missing items.

The STC Group Technical Support is available 0800 to 1700 Monday through Friday Pacific Time:

+1 (231) 220-9296

+1 (888) 350-2998

Trio Avionics may be reached Monday through Saturday at +1 (619) 448-4619

NOTE:

Care should always be taken to avoid marring or scratching of any surfaces of autopilot assemblies including anodized surfaces. Painters tape may be used to prevent damaging hardware surfaces. Remove any previously installed autopilot and related servos, and harnesses. Record the station position of each component removed and weigh each component. This information will be used to update Weight & Balance data.

The STC Group LLC recommends that a flight test of the subject aircraft be conducted to assess aircraft rigging and handling characteristics prior to autopilot installation. Use Test 4 of The STC Group LLC Flight Test Cards, document F-1006-43. Documents can be found at The STC Group LLC website at www.thestcgroupllc.com/documents.



3.0 ROLL SERVO INSTALLATION RIGHT (STARBOARD) WING

1. Remove the inspection panels at WS 112.00 and WS 144.80 as depicted in Image 3-1.
2. Lower the aircraft flaps.



IMAGE 3-1 WING ACCESS COVER LOCATIONS – CESSNA 185

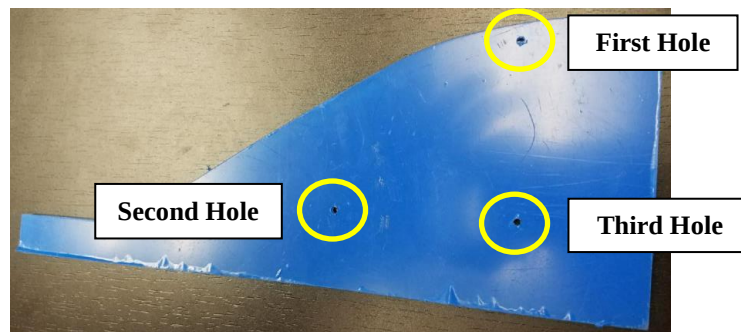


IMAGE 3-2 ROLL SERVO DRILL TEMPLATE

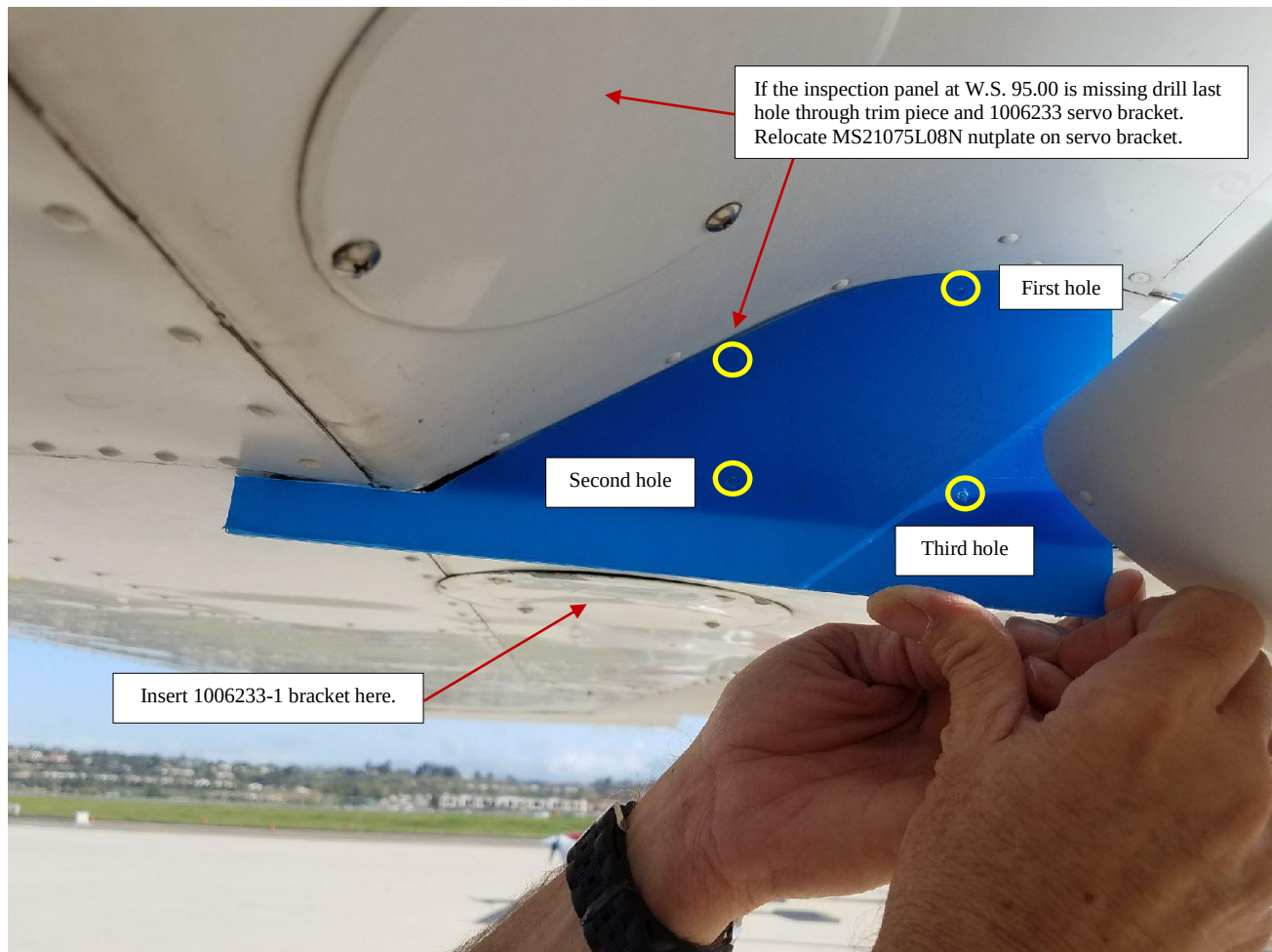


IMAGE 3-3 DRILL TEMPLATE POSITIONED AT W.S. 100.5

Note:

The aileron and elevator control surfaces must be locked into the neutral flight position before starting the installation procedure. Remove control lock first.



3. Drill through the drill template supplied from outside the aircraft. Refer to Image 3-3.
4. Position the drill template, supplied, over WS 100.5 and secure it into position with painter's tape. Refer to Image 3-3.
5. The drill template holes have been drilled with a #40 drill bit.
6. Using the drill template as a guide and a #40 drill bit, center punch and drill the upper aft hole through the WS 100.5 trim piece. Refer to Images 3-2, 3-3, and Figure 3-1.
7. Secure the drill template into position using a 3/32" Silver P Series Cleco Temporary Fastener.
8. Drill the second hole as shown in Images 3-2, and 3-3 using the drill template.
9. Secure the drill template into position using a 3/32" Silver P Series Cleco Temporary Fastener.
10. Drill the third hole using the drill template as a guide. Refer to Image 3-2.
11. Remove the drill template.
12. Enlarge all holes with a #30 drill bit.

NOTE:

If your flap closeout skin does not have an access panel to access the upper forward nutplate, then the upper forward nutplate will have to be the following acceptable replacement hardware; a AN525-832R7 screw with a AN9730-3 washer (on bracket side) and MS21044N08 nut or a AN525-832R7 screw, a AN9730-3 washer (on bracket side) with a CN614CR08P clickbond nutplate secured to inboard side (W.S. 100.5).

13. The newer 1006233 Revision-A servo bracket is shipped with 2 loose nutplates and rivets. The aft upper pilot is for the rivet of the nutplate. If the hardware in the note above is not used, then the forward upper nutplate may be installed on the bracket at this time.
14. Enlarge the holes to the final size using a #18 (0.1695) drill bit.
15. Deburr all holes and clean any debris inside the wing and around the work area.
16. Insert the roll servo bracket, p/n 1006233-1, into the wing through the access hole. Refer to Images 3-1, & 3-3 for access locations.
17. Secure the roll servo bracket, p/n1006233-1, into position (from outside the aircraft) using the MS27039 fasteners supplied. Refer to Image 3-5.
18. The roll servo bracket was manufactured with two 0.250" rivet clearance holes to accommodate the trim piece riveted to WS 100.5. Refer to Images 3-4 and 3-5.
19. It may be required to enlarge the rivet clearance holes due to differences in the rivet patterns between aircraft. Refer to Images 3-4 and 3-5.
20. With the roll servo bracket secured into position locate the position of the two (2) trim piece rivet shop heads on the WS 100.5 rib.
21. Use a permanent marker and mark the trim piece rivet head positions on the Roll Servo Bracket.
22. Enlarge the rivet clearance holes using a Unibit, or equivalent, if required.

Note:



It may be required to re-locate the clearance holes as shown in Image 3-5.

23. From inside the wing center punch through the servo bracket forward upper nutplate into the W.S 100.5 rib. Refer to Image 3-5.

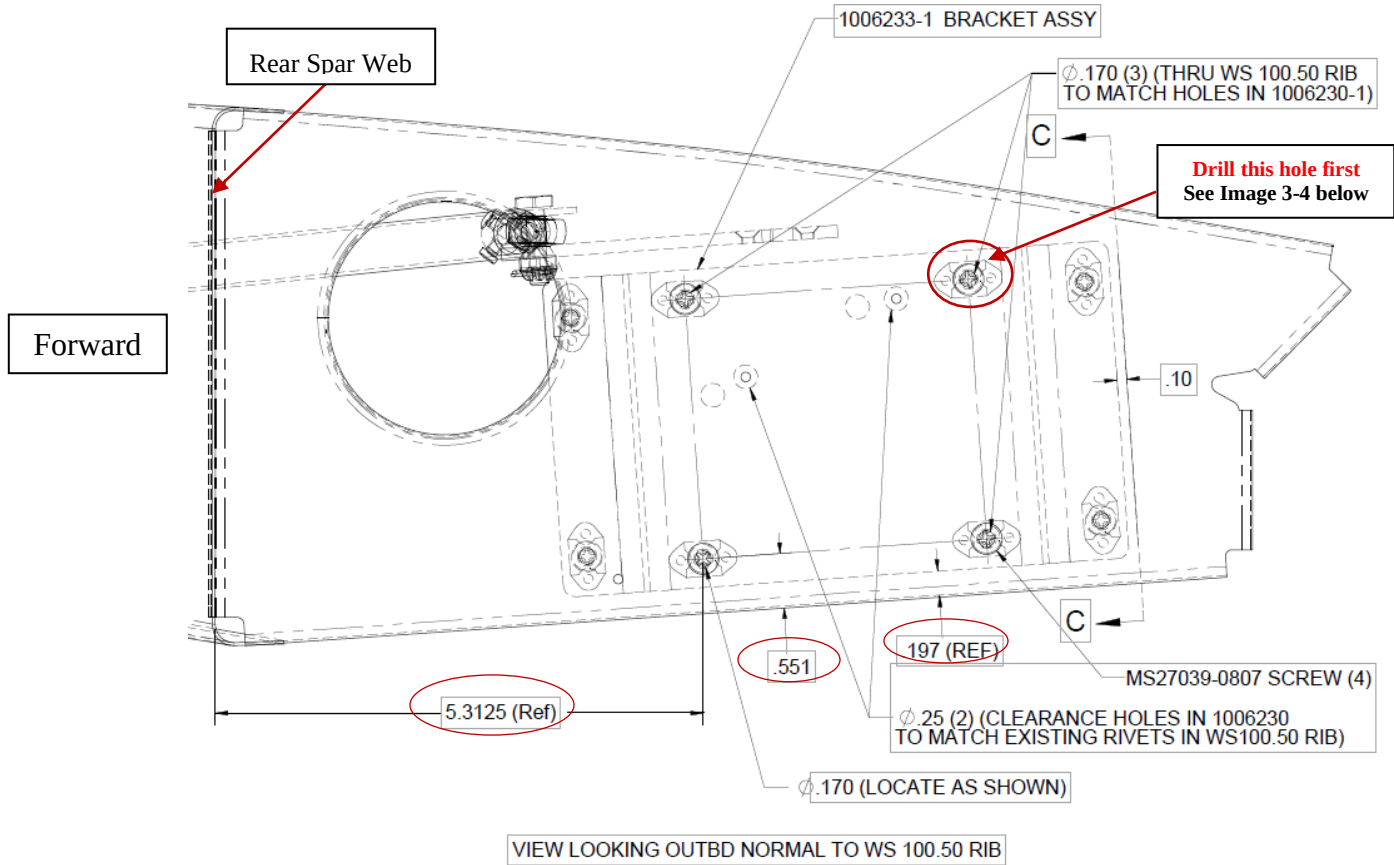


FIGURE 3-1 ROLL SERVO & MOUNTING PLATE INSTALLATION

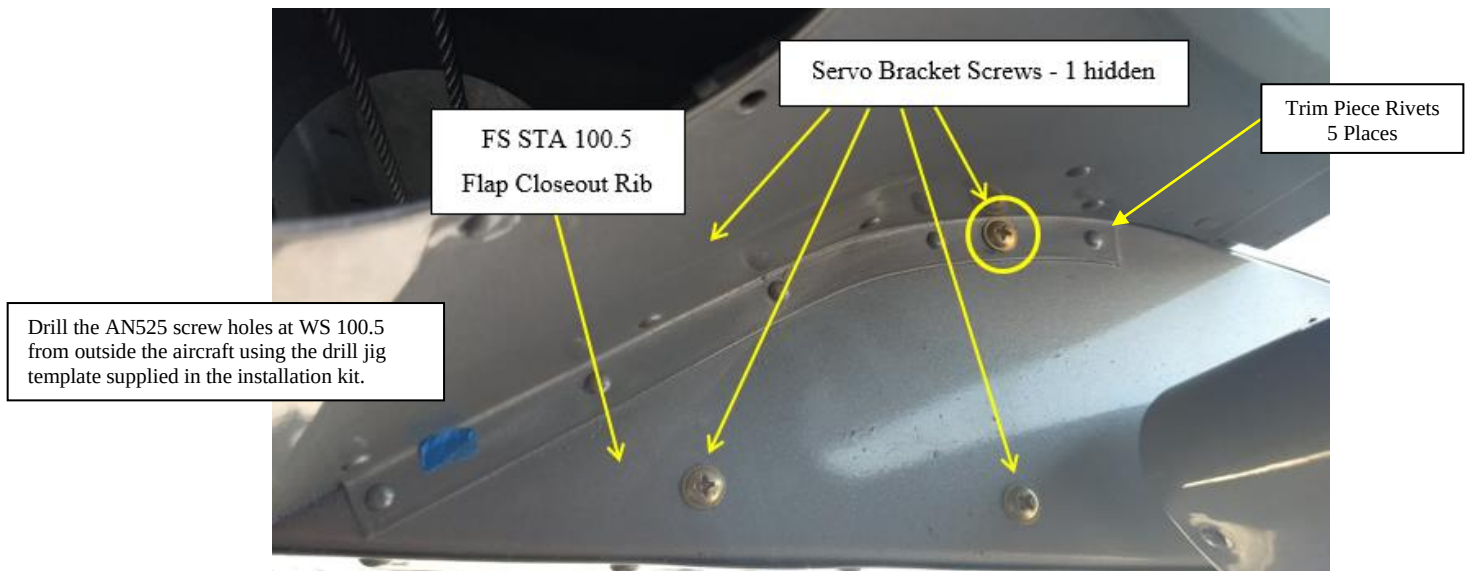


IMAGE 3-4 ROLL SERVO MOUNTING PLATE INSTALLATION

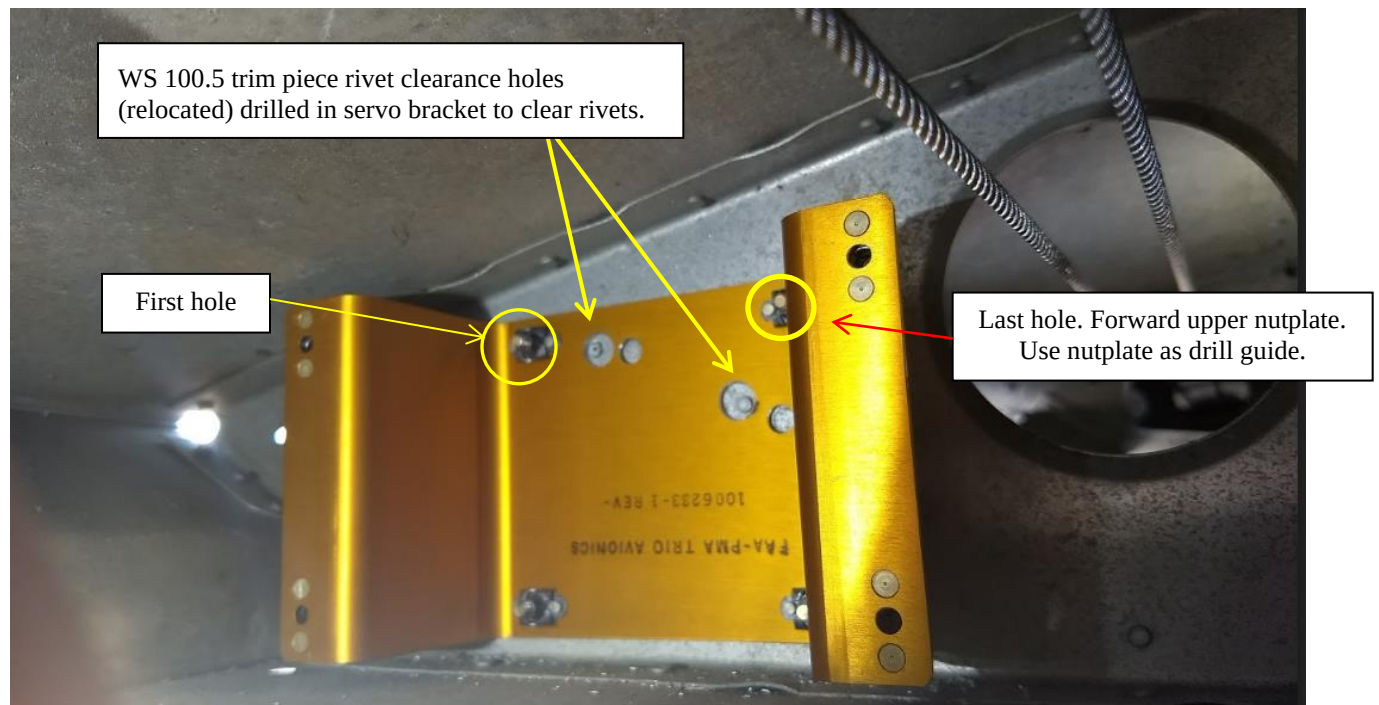


IMAGE 3-5 ROLL SERVO BRACKET ASSEMBLY AT W.S. 100.5



24. Move the bracket out of the way and pilot drill the punched site.
25. Enlarge the hole with #30 drill bit.
26. Deburr the hole.

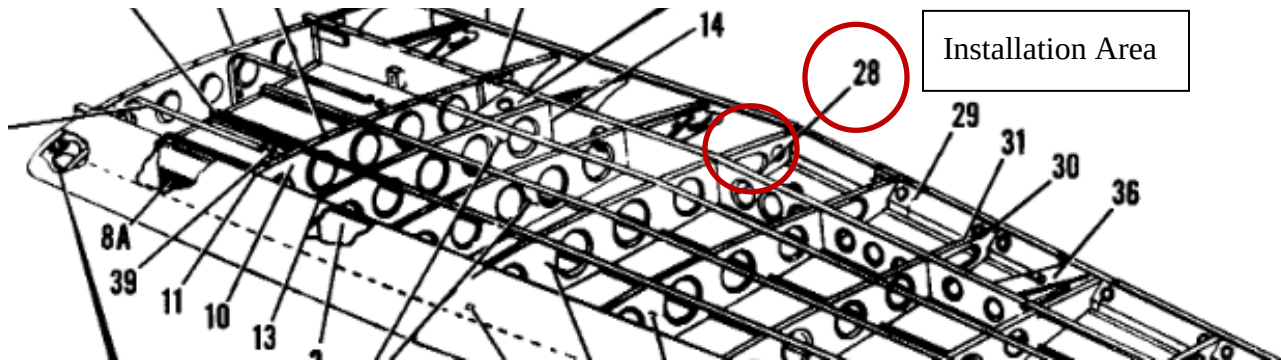


FIGURE 3-2 WS 100.5 SERVO MOUNT RIB LOCATION

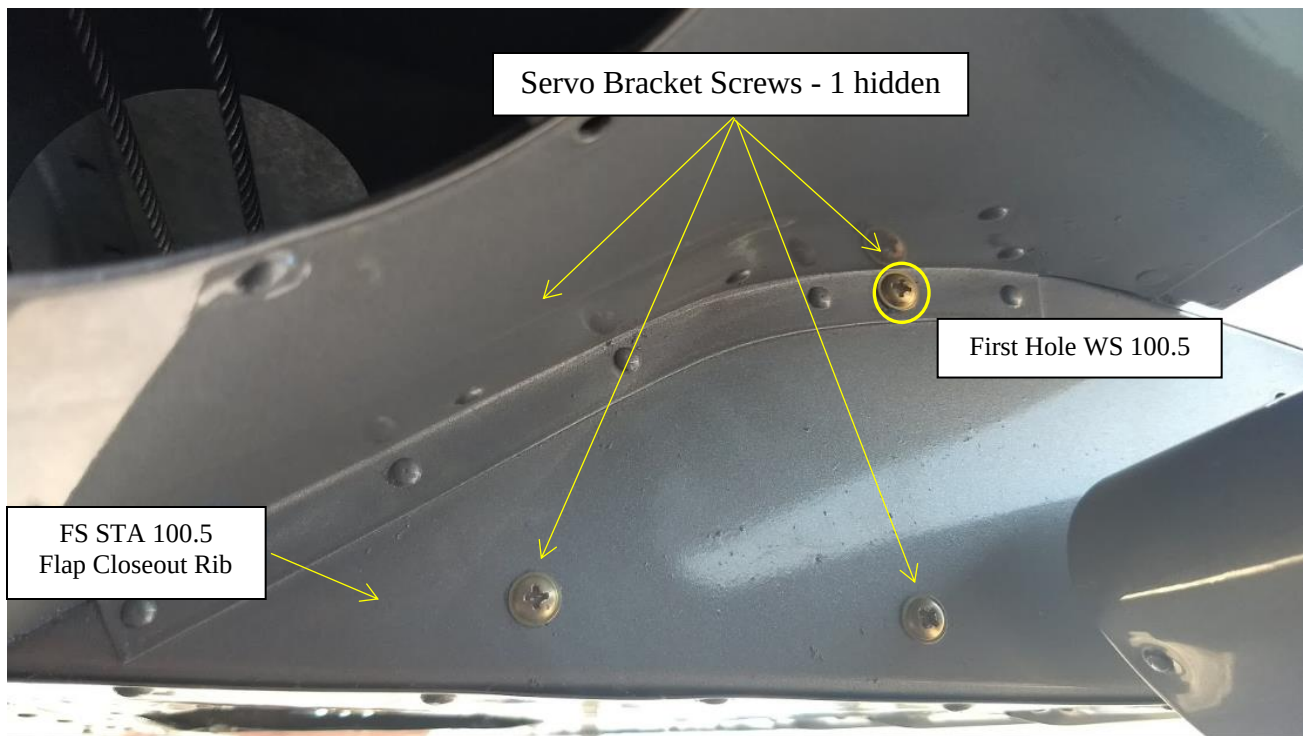


IMAGE 3-6 VIEW LOOKING OUTBOARD AT W.S. 100.5

27. If satisfied with the servo bracket alignment and fitment drill to final size using a #18 drill bit.
28. Deburr the hole and remove any drilling debris.



29. Four (4) M3 screws supplied in the autopilot hardware kit have been coated with Loctite 202 thread locker. **DO NOT** apply additional thread locker to the M3 screws.
30. Fasten the roll servo arm, p/n 1006239-1, to the servo hub using the four (4) M3 (metric) screws supplied.
31. Torque to the screws 8.8 - 9.0 lb.-in. using a calibrated screwdriver with the proper tip inserted.
32. Enlarge the four (4) outer servo baseplate holes using a #18 drill bit. Refer to Image 3-8.

Note:

The bracket assembly and servo must be joined together inside the wing.

33. The four (4) 10085 #8 screw retainers are optional for ease of installation but are not supplied. Refer to Image 3-7.

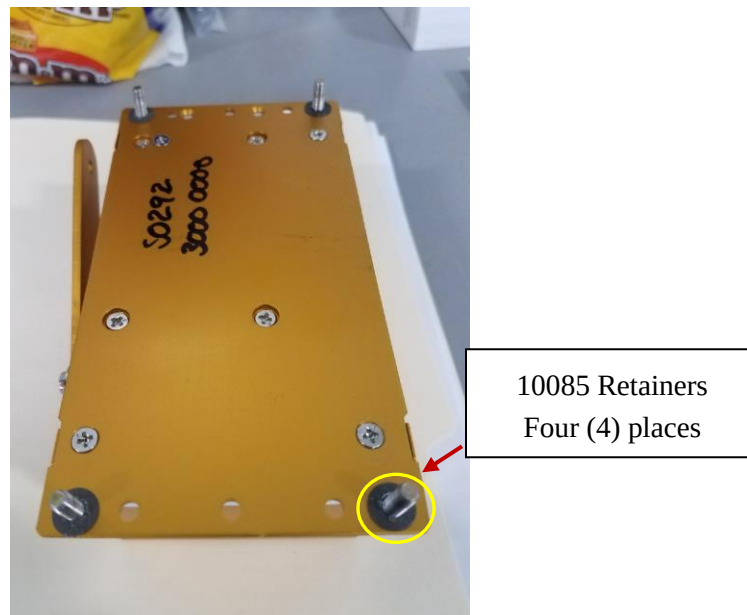


IMAGE 3-7 10085 RETAINER POSITIONING

34. Affix the four (4) 10085 retainers to the MS27039 screws as shown in Image 3-7.
35. Mount the roll servo to the bracket assembly using the four (4) MS27039-0807 screws supplied.
36. Mount the servo and bracket assembly to the 100.5 rib using the AN5250832R7 screws supplied.

Note

The Roll Servo hub roll pin hole must be aligned with the servo stop before attaching the crankarm to the hub. Refer to as depicted Image 3-8.

Note:



The push pull tube assembly, p/n 1006231-1, has been terminated on a single end to allow for manufacturing variations between Cessna Aircraft 100 Series models.

37. Ensure that the aileron surfaces are locked in the neutral flight position using padded blocks before starting this procedure.

Note:

The push pull tube should be protected from damage by covering it with painter's tape or equivalent.

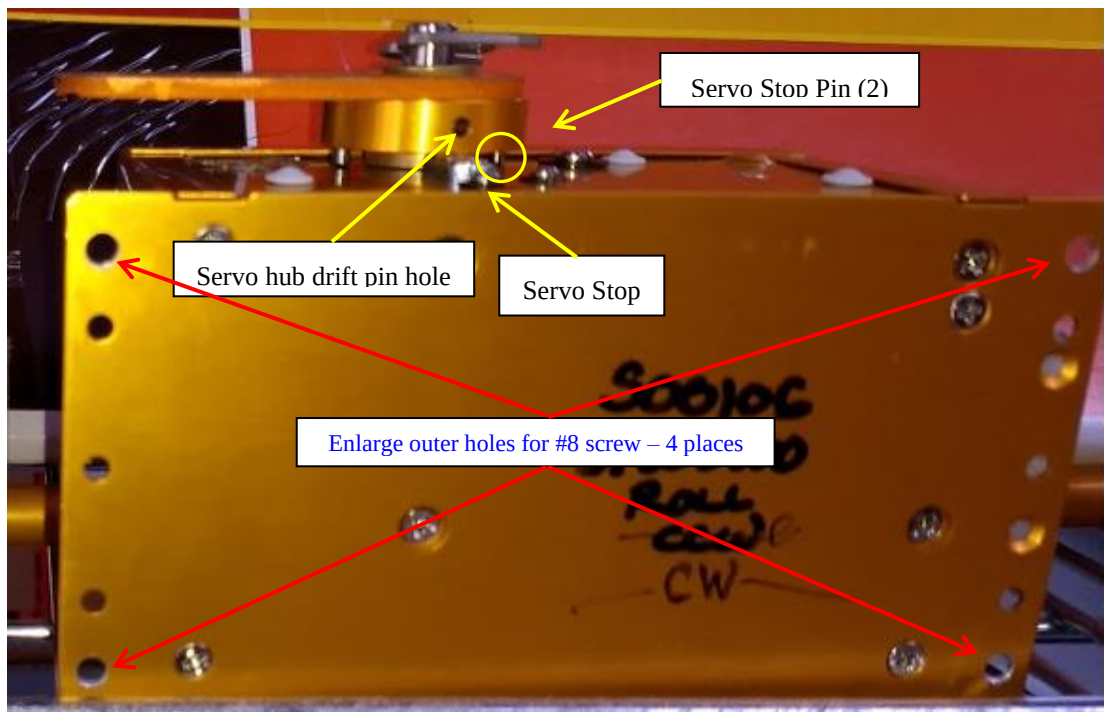


IMAGE 3-8 ROLL SERVO HUB DRIFT PIN & LOCKING PIN HOLE ALIGNMENT

38. Insert the push pull tube, p/n 1006231-1, through the access hole at WS 144.80 with the rod end oriented towards the roll servo arm, p/n 1006239-1.
39. The MM3 rod end should have four (4) threads showing.
40. Attach the push pull tube to the roll servo arm as depicted in Figure 3-3.
41. The servo arm should be at 90 degrees from the servo case, facing forward towards the rear spar web. Refer to Image 3-9.
 - a. Servo arm position will be adjusted in the autopilot setup to +/- 0.00 degrees.
42. Position the push pull tube on top of the **forward aileron bellcrank arm** bolt and mark the "bolt center" location of the aileron cable mounting hole on the push pull tube. Refer to Figure 3-6.



43. This mark represents the center to center distance between rod ends as shown in Figure 3-4.
44. Carefully remove the push pull tube from the wing taking care not to mar surfaces.
45. Measure from the center of the servo arm rod end to the mark that was made on the push pull tube in Step 41.

Note:

Refer to Figure 3-4 for the following steps.

46. The measurement made above will be the Center to Center Rod End measurement with four (4) rod end threads showing on each MM-3 rod end.
47. Trim the push pull tube as required to meet the above center to center distance. Refer to Image 3-10.
48. Deburr and smooth the push pull tube end. Remove any debris.
49. A threaded rod end assembly, p/n 1006405-1, was supplied in the roll servo hardware kit.
50. Remove the MM3 rod end and AN315-3R nut before performing the following steps.
51. Insert the threaded rod end into the trimmed end of the push pull tube.
52. Secure the threaded rod end into position using painters tape or equivalent. ***This is a critical step.***
53. Secure the push pull tube in a V Block.
54. Center punch and drill the forward rivet hole through the push pull tube and threaded rod end assembly using a #40 drill bit as a pilot hole. Refer to Figure 3-4 for rivet positioning.
55. Insert a pin, or equivalent, into the pilot hole.
56. Drill the rear rivet hole using a #40 drill bit as a pilot drill.
57. Insert a pin, or equivalent, into the pilot hole.
58. Enlarge the forward hole using a #30 drill bit.
59. Insert a pin, or equivalent, into the #30 hole.
60. Enlarge the rear using a #30 drill bit.
61. Insert a pin, or equivalent, into the #30 hole.
62. Remove the threaded rod end.
63. Deburr the threaded rod end and push pull tube and remove any debris.
64. Insert the threaded rod end back into the push pull tube and align the rivet holes.
65. Insert a pin, or equivalent, into the rear rivet hole.
66. Secure the threaded rod end forward rivet location the MS20470AD4-10 rivet supplied in the hardware kit.
67. Repeat the above step for the rear rivet hole.
68. Thread the rod end and jam nut into the threaded rod end with four threads showing.
69. Tighten the jam nut, p/n AN315-3R, with four threads showing.
70. Install the push pull tube assembly. Refer to Figures 3-3, 3-5, and 3-6.
71. Attach the DB9 connector to the servo DC9 connector after completing the Wiring harness installation in Appendix A.



72. Ensure that the ailerons are secured in the neutral, in trail, position.
73. Power on the Trio Pro Pilot autopilot and enter the Maintenance menu by pressing the Encoder knob and VMODE button simultaneously. Refer to Image 4-9.
74. Turn, or Press, the Encoder knob until the LNAV SERVO SET screen is displayed.
75. Adjust the rod ends until the LNAV SERVO SET reading is +/- 0.00 degrees. Refer to Image 3-10.
76. Tighten the jam nuts, p/n AN315-3R, on the rod ends and mark both ends with tamper proof torque seal.

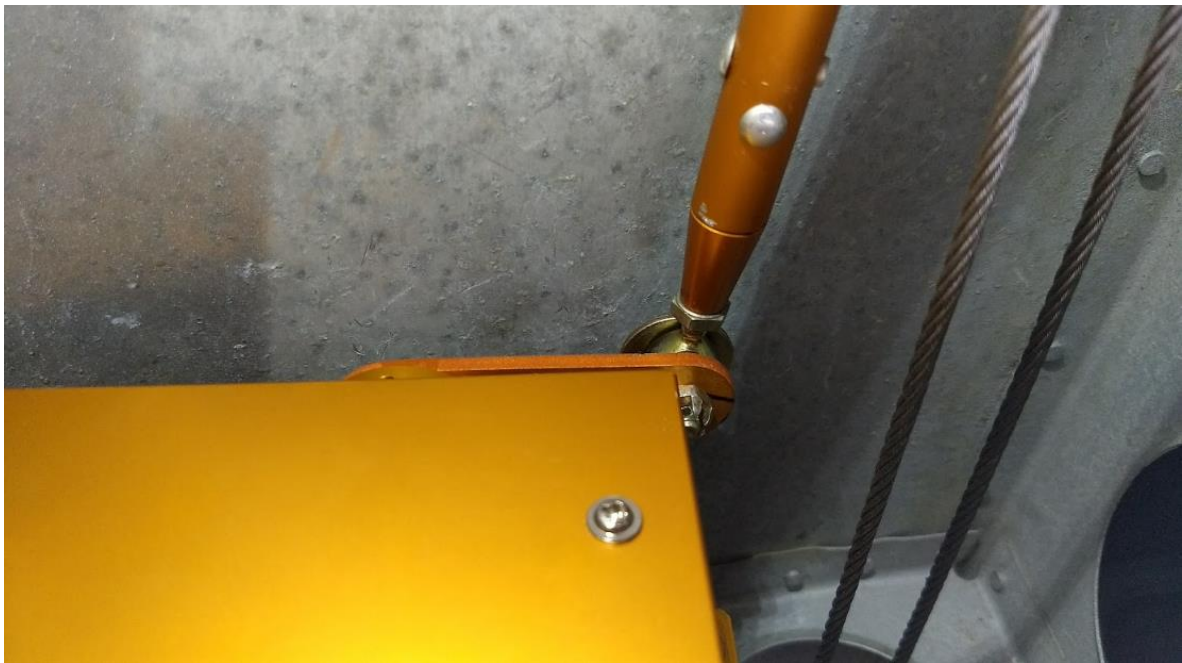


IMAGE 3-9 ROLL SERVO PUSH PULL TUBE ASSEMBLY

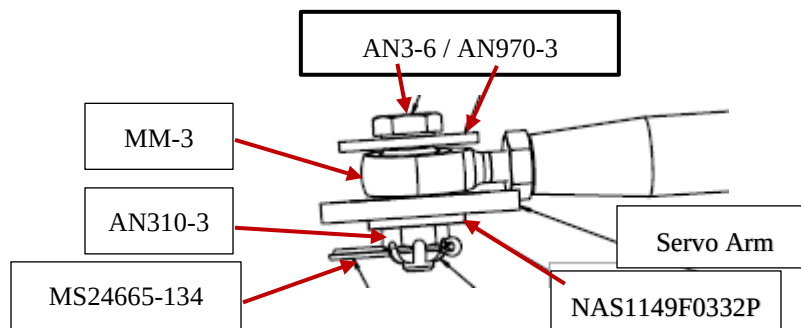


FIGURE 3-3 ROLL SERVO ARM INSTALLATION

1006231-1 P/P Tube

MS20470AD4-10 Rivets (2)

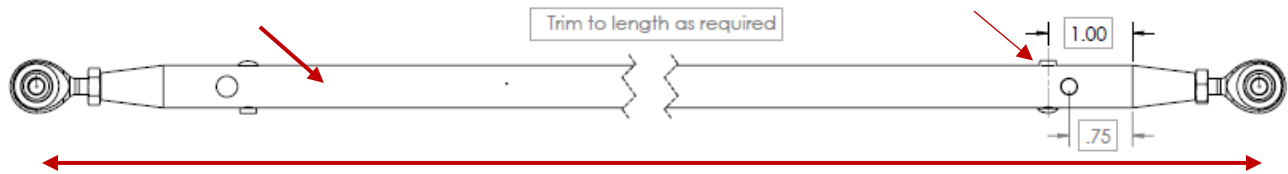


FIGURE 3-4 ROLL SERVO ARM CENTER TO CENTER DISTANCE & RIVET LOCATIONS

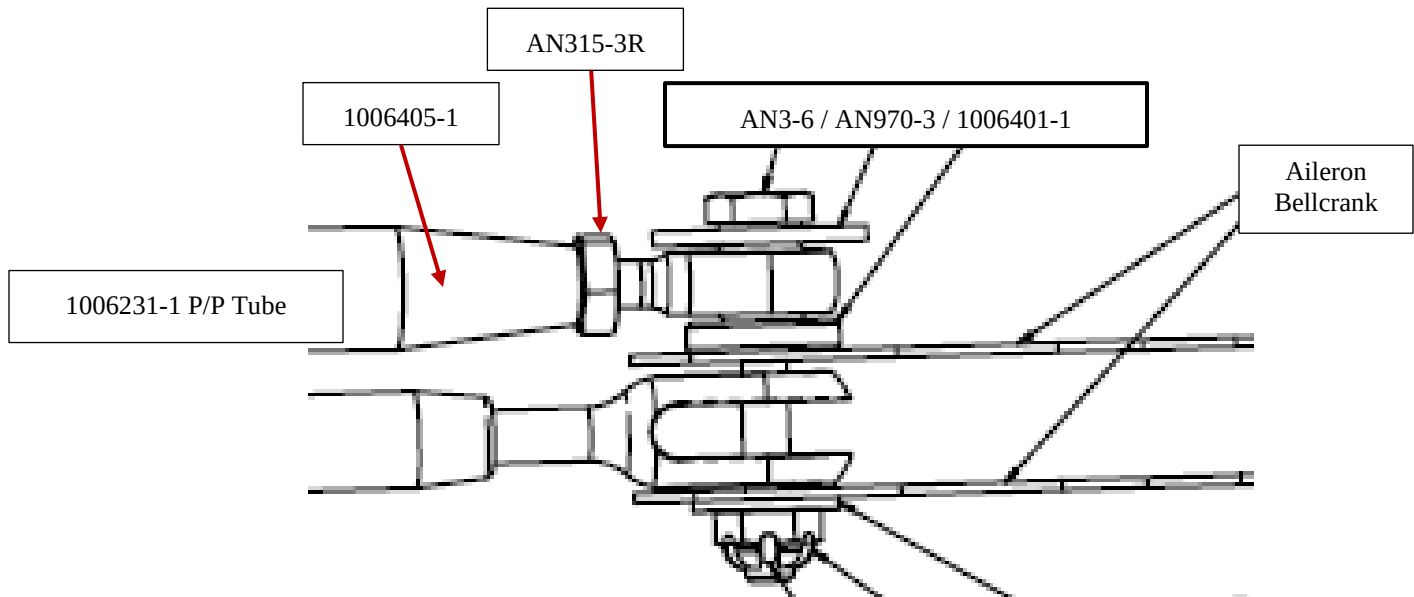


FIGURE 3-5 AILERON BELLCRANK INSTALLATION

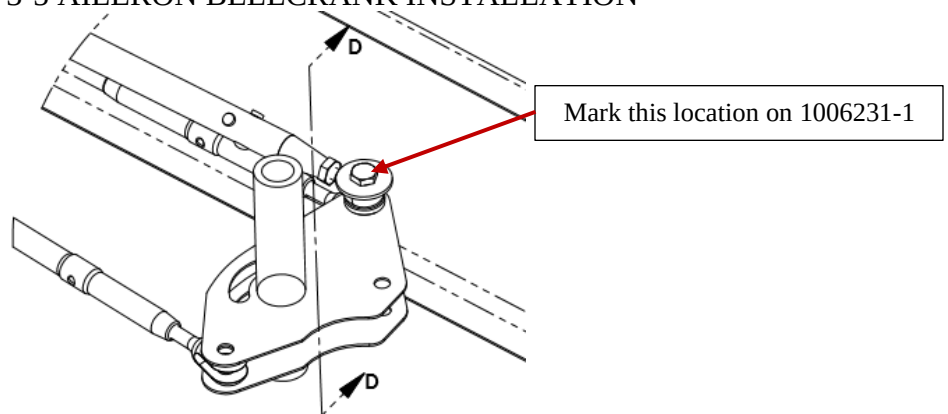


FIGURE 3-6 AILERON BELLCRANK INSTALLATION

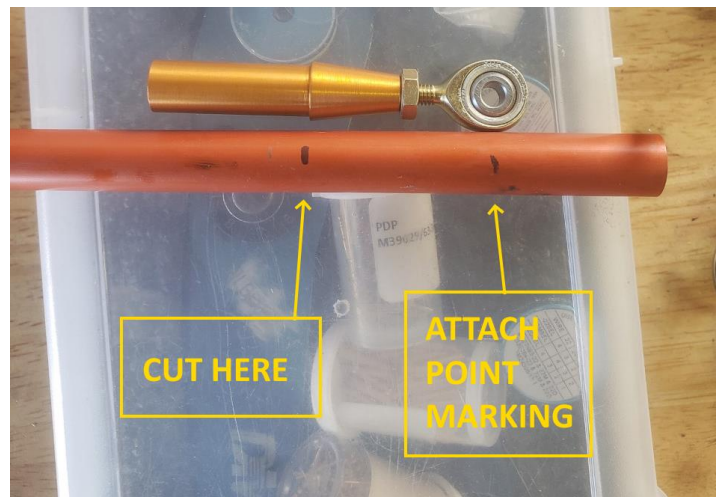


IMAGE 3-10 TRIMMING PUSH PULL TUBE



IMAGE 3-11 LNAV SERVO SET SHOWING SERVO ARM POSITION

77. Ensure that the Lock the elevators in neutral
78. Enter the VNAV Servo Set screen
79. Record the servo arm position with the elevators locked in neutral.
80. Unlock the elevators
81. Record the full up servo arm position
82. Record the full down servo arm position
83. Record the VNAV servo gains – I have never had to change these -the defaults work great
84. Record the HNAV and VNAV Servo gains
85. HNAV _____



86. VNAV _____ By the way. VNAV gains from 18 to 20 work great on any aircraft we use them on. (PIPER, GRUMMAN, Cessna, etc.)
87. Lock the ailerons in neutral
88. Enter the LNAV Servo Set screen
89. Ensure that the servo arm is at 0.00 degrees or close to that. If not:
90. Leaving the ailerons locked in neutral adjust the rod ends so the servo arm gets as close to 0.00 degrees as possible.
91. Unlock the aileron
92. Record the full up servo arm position
93. Record the full down servo arm position
94. Record the HNAV gain settings
95. TRK
96. CRS
97. PI
98. After you have recorded and fine tuned forward all the above to me please. I want to include in the setup instructions for the 172.
99. Ensure that the Lock the elevators in neutral
100. Enter the VNAV Servo Set screen
101. Record the servo arm position with the elevators locked in neutral.
102. Unlock the elevators
103. Record the full up servo arm position
104. Record the full down servo arm position
105. Record the VNAV servo gains – I have never had to change these -the defaults work great
106. Record the HNAV and VNAV Servo gains
107. HNAV _____
108. VNAV _____ By the way. VNAV gains from 18 to 20 work great on any aircraft we use them on. (PIPER, GRUMMAN, Cessna, etc.)
109. Lock the ailerons in neutral
110. Enter the LNAV Servo Set screen
111. Ensure that the servo arm is at 0.00 degrees or close to that. If not:
112. Leaving the ailerons locked in neutral adjust the rod ends so the servo arm gets as close to 0.00 degrees as possible.
113. Unlock the aileron
114. Record the full up servo arm position
115. Record the full down servo arm position
116. Record the HNAV gain settings
117. TRK
118. CRS
119. PI



4.0 PITCH SERVO INSTALLATION

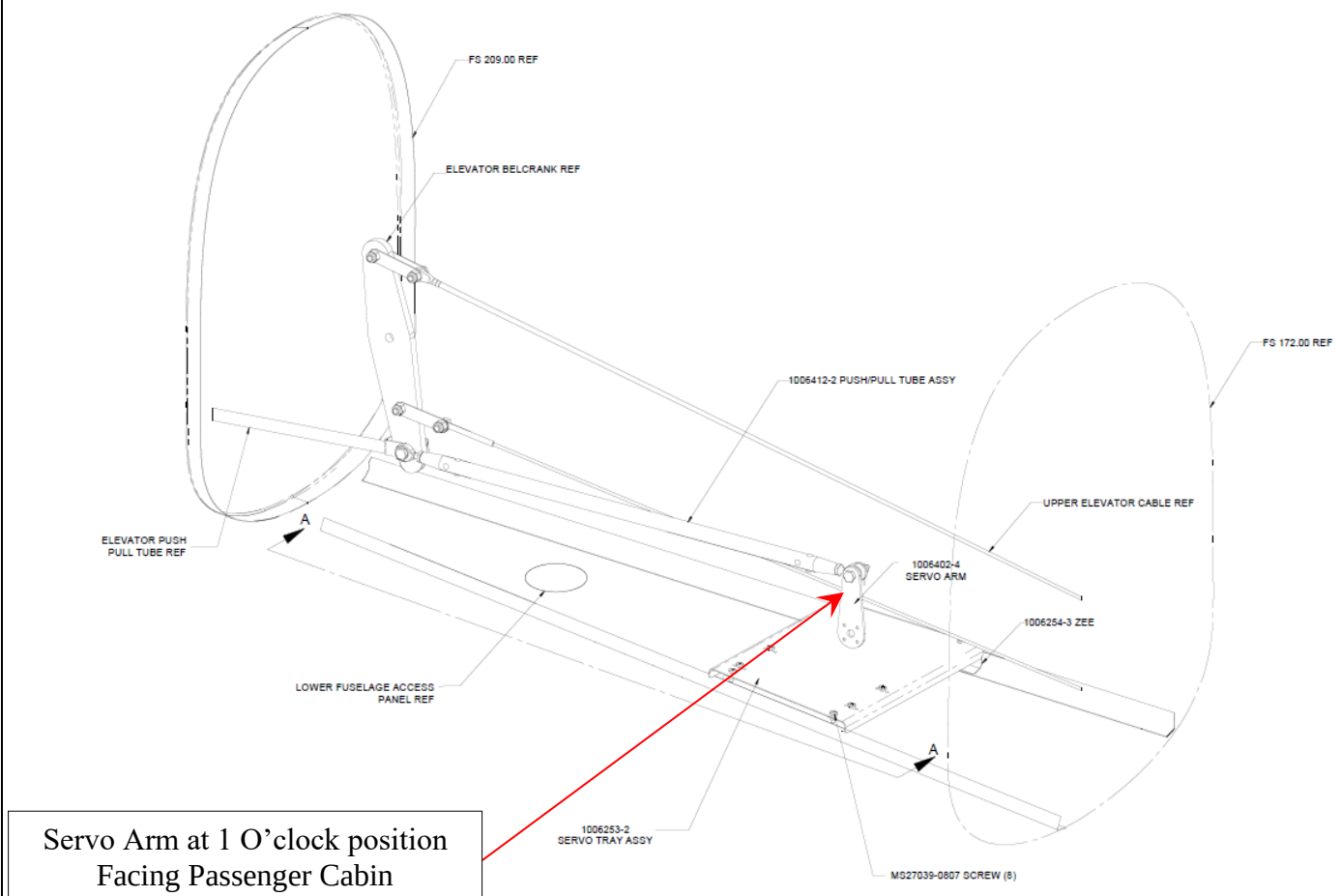


FIGURE 4-1 PITCH SERVO INSTALLATION

Note:

The elevators must be locked into the neutral position prior to pitch servo installation. Wood blocks installed on the upper and lower elevator surfaces and four (4) one (1) inch $\frac{1}{4}$ x 20 or 28 bolts, or equivalent washers, and nuts may be used. Take care to protect all aircraft surfaces.

The Pitch Servo arm must face forward towards the passenger cabin at approximately the 1 o'clock position. Refer to the red arrow in Figure 4-1.



4.1 Pitch Servo Mount Installation

1. The pitch servo tray, p/n 1006253, and Zee Angles, p/n 1006254-3, have been pilot drilled with #40 (0.098") holes to accommodate all models of Cessna 180, 182, and Cessna 185 aircraft models. Refer to Figure 4-2.

Note:

This section of the Installation Instructions references using 1006254-3 ZEE Angles.

The Pitch Servo installation referenced in this section will vary significantly from the 1953 C180 through 1961 C180E models.

2. The Pitch Servo Tray, "as shipped", is depicted in Figure 4-2.
 - a. Note that the Pitch Servo Tray is shipped with two (2) MS21075L08N nutplates installed.
3. Four (4) MS21075L08N nutplates will require installation. These nutplates will be installed on the underside of the ZEE Angles. Figure 4-3 depicts the location of the MS21075L08N nutplate locations (Zee Angles not shown).
- 4.

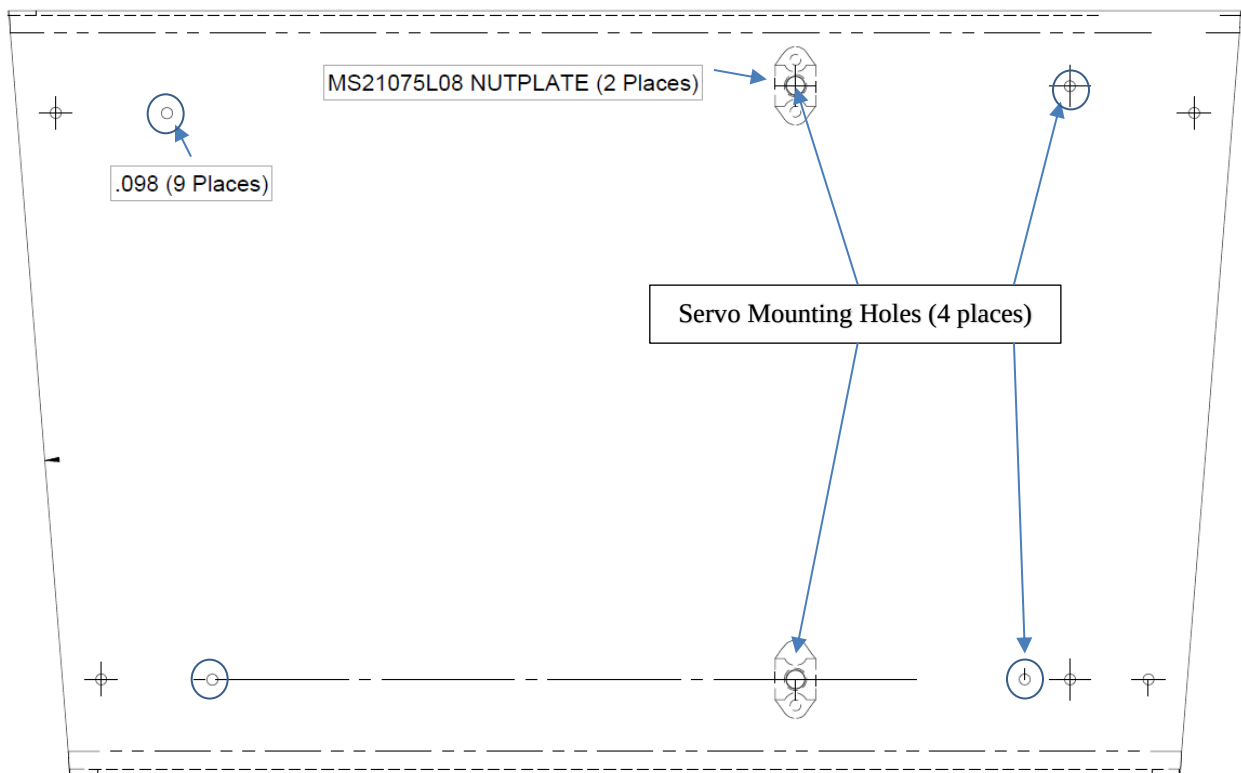


FIGURE 4-2 PITCH SERVO MOUNTING PLATE P/N 1006253

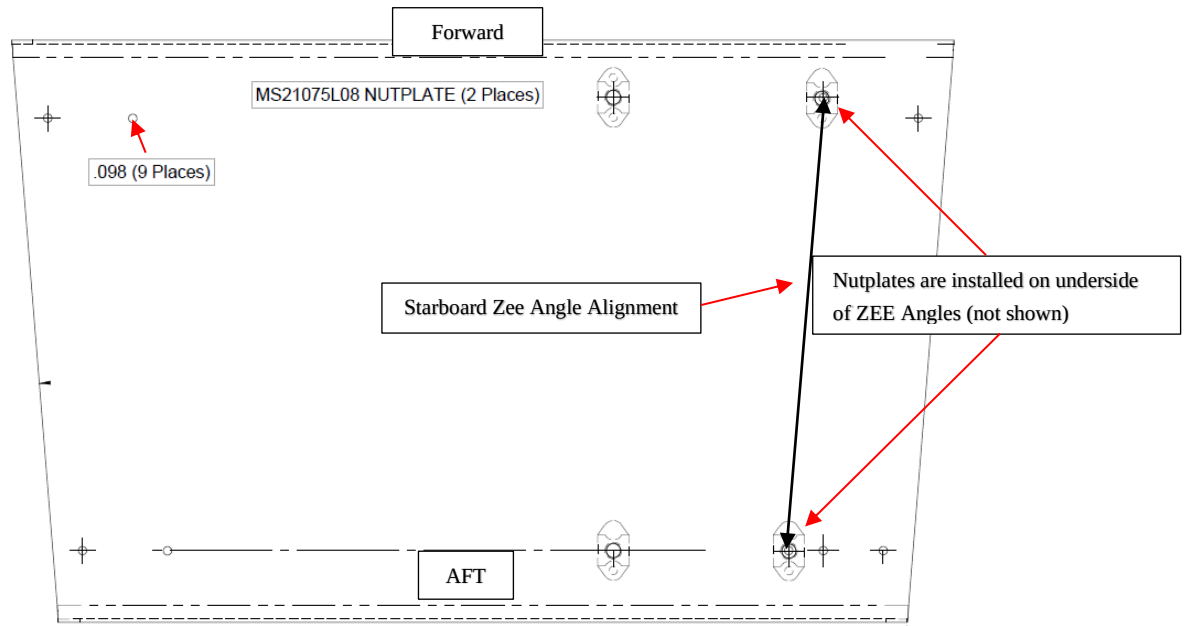


FIGURE 4-3 NUTPLATE LOCATIONS

5. Secure the pitch servo tray to the Zee Angles using P Series Silver Cleco Temporary Fasteners. Refer to Image 4-1.
 - a. The aft end (short side) of the Pitch Servo Tray has been pilot drilled to allow the Pitch Servo to use the second inboard servo baseplate mounting hole inboard. Refer to Image 4-1.

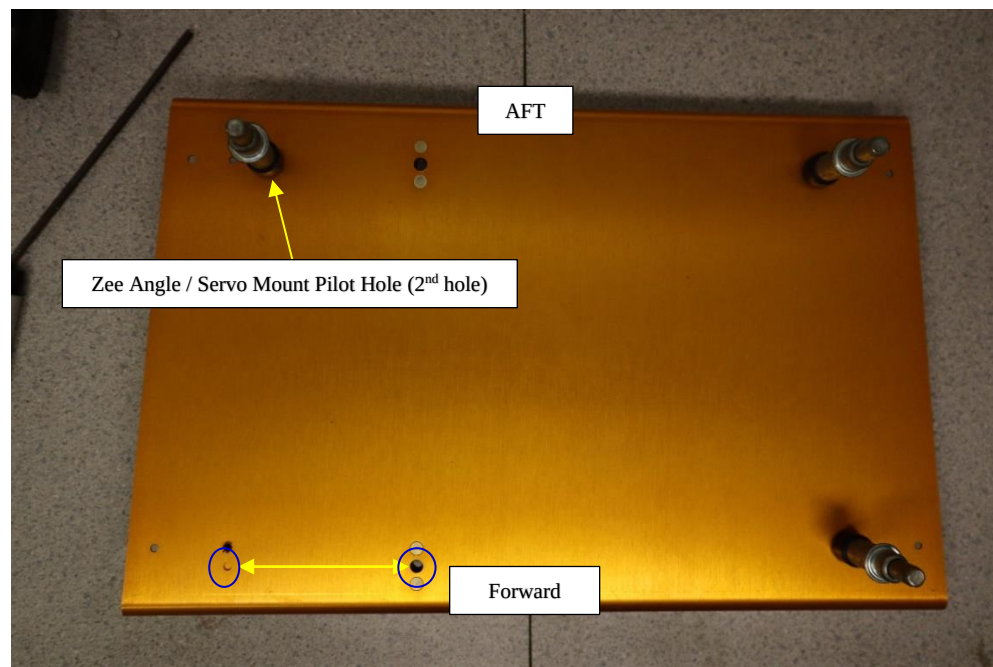


IMAGE 4-1 ZEE ANGLE PILOT HOLE POSITION



- b. The starboard (STBD) Zee Angle has been pilot drilled to allow the pitch servo tray to be positioned precisely. Refer to Figure 4-3, and Images 4-2 & 4-3.
- c. Secure the aft Zee Angle using a P Series Silver 3/32" Cleco Temporary fastener.

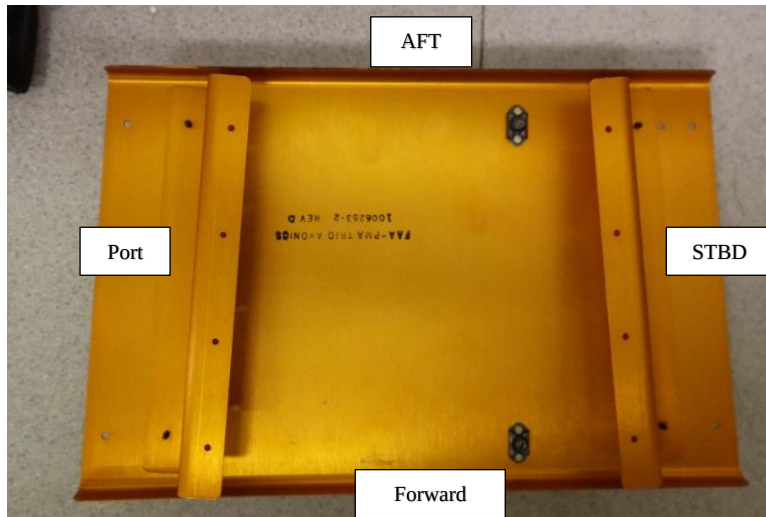


IMAGE 4-2 ZEE ANGLE POSITIONING

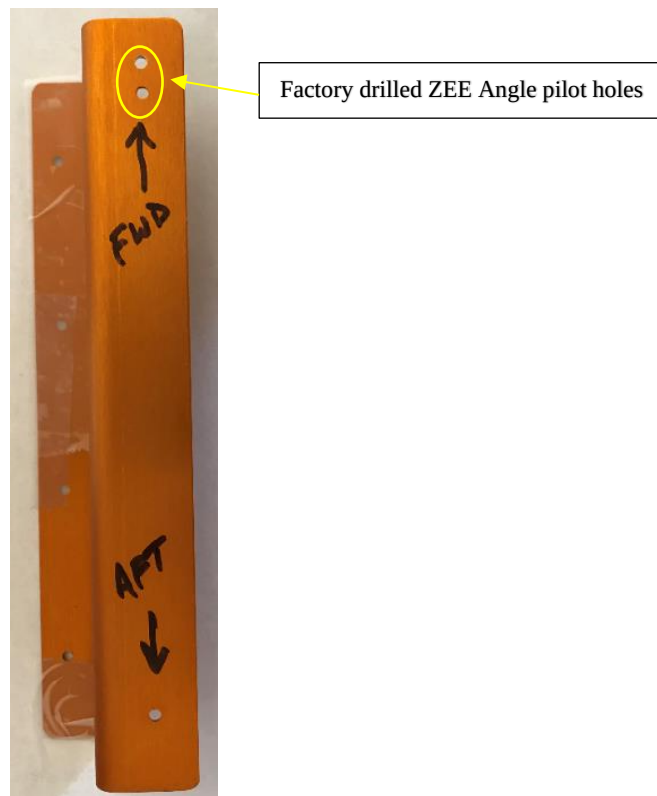


IMAGE 4-3 STARBOARD ZEE ANGLE WITH #40 PILOT HOLES DRILLED



6. Enlarge and deburr the pre-drilled servo mounting hole and matching ZEE Angle Servo Mounting hole made above by first using a #30 (0.1285) drill bit.
7. Enlarge the hole to final size using a #18 (0.1695") drill bit. Refer to Images 4-4 and 4-5.
8. Use a nutplate jig, or equivalent, to install the four (4) MS21075L08N nutplates on the undersides of the Zee Angles. Refer to Images 4-4 & 4-5.
9. Secure the ZEE Angles to the pitch servo tray using MS27039 fasteners supplied. Refer to Image 4-6.
10. Remove the fasteners that secure the elevator idler bellcrank inspection plate. Refer to Image 4-7 (Cessna 182 used for example only).
11. Access the aft area of the aircraft by removing the baggage compartment cover.
12. Protect the elevator, trim cables, aircraft structure, and any avionics with padding and blankets.
13. Access the fuselage between F.S. 185.5 and F.S. 199.00. Refer to Figure 4-1.
14. Position the Pitch Servo Tray Assembly between the left hand and right-hand stringers and slide the tray assembly aft until the ZEE Angles are snug against the stringers. Figure 4-4.



IMAGE 4-4 ZEE ANGLE MATCHED DRILLED FOR SERVO SCREWS

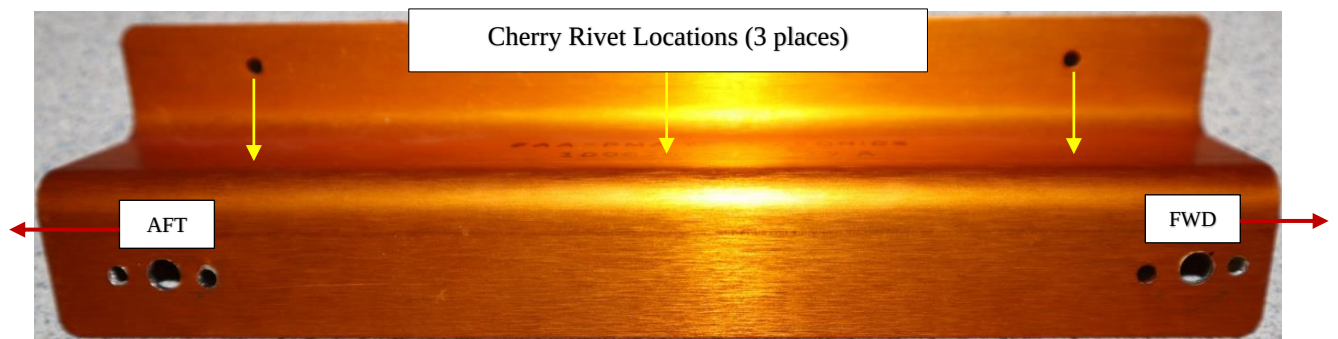


IMAGE 4-5 ZEE ANGLE DRILLED FOR NUTPLATES

15. Measure the distance between the aft end of the Pitch Servo Tray and the face of the F.S. 199.00 frame web.



Note:

The distance is approximately 3.25" in most applications. This distance will vary due to manufacturing variations. This is not a critical distance.

Note:

Take a Red or Black "fine tip" permanent marker with you to complete the next steps.

16. The pitch servo tray is now in the correct mounting location.
17. Once again measure the distance between the aft face of the servo tray and the face of F.S. 199.00.
18. Again - this distance should be approximately 3.25". This may vary due to manufacturing variations.
19. Mark the forward and aft edges of the Zee Angles using a "fine tip" permanent marker. Refer to Figure 4-4.

Note:

These marks must be precisely located, or the pitch servo tray alignment will be inaccurate.

20. Remove the pitch servo tray assembly.
21. Remove the ZEE Angles from the servo tray.



IMAGE 4-6 PITCH SERVO TRAY ASSEMBLY

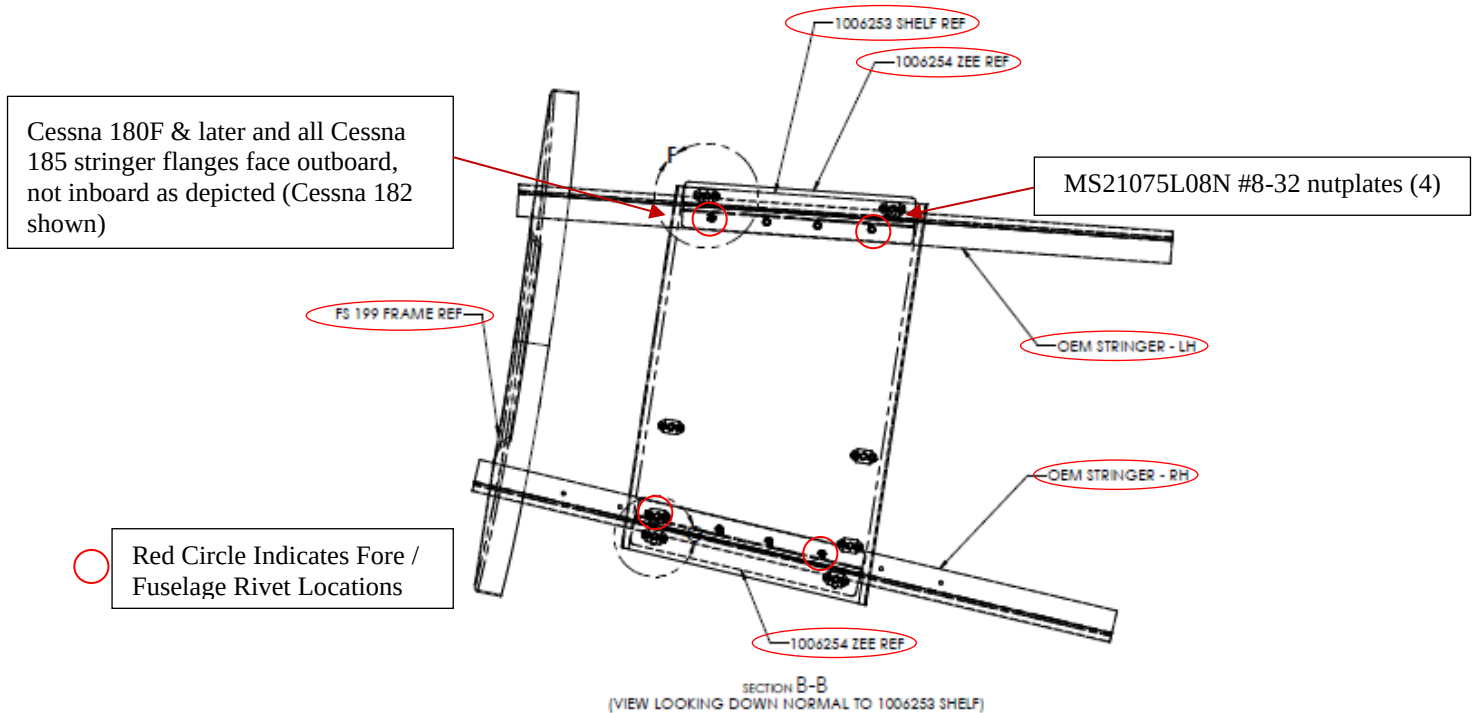


FIGURE 4-4 PITCH SERVO TRAY INSTALLATION

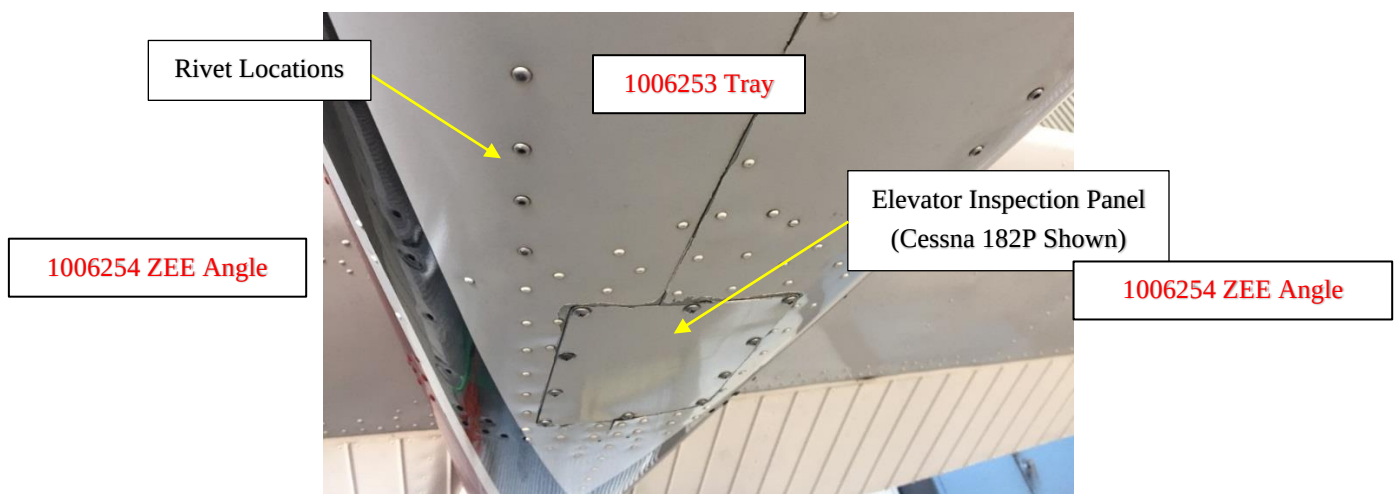


IMAGE 4-7 ACCESS PANEL SCREWS AND ZEE ANGLE RIVET LOCATIONS

22. Position one of the ZEE Angles between the fore and aft location marks made above.
23. Ensure that the Zee Angle is snug against the stringer.
24. Secure the Zee Angle into position using painters tape. Be precise. *This is a critical operation.*



25. Using the forward ZEE Angle pre-drilled rivet hole as a guide, drill a single #40 (.098") hole through the fuselage skin. Refer to Figures 4-4 and 4-5.
26. Secure the Zee Angle into position from outside the aircraft using a P Series Silver Cleco Temporary fastener.
 - a. Have a helper secure the ZEE Angle into position from outside the aircraft.
27. Using the aft ZEE Angle rivet hole as a guide, drill a single #40 (.098") hole through the fuselage skin. Refer to Figure 4-5.

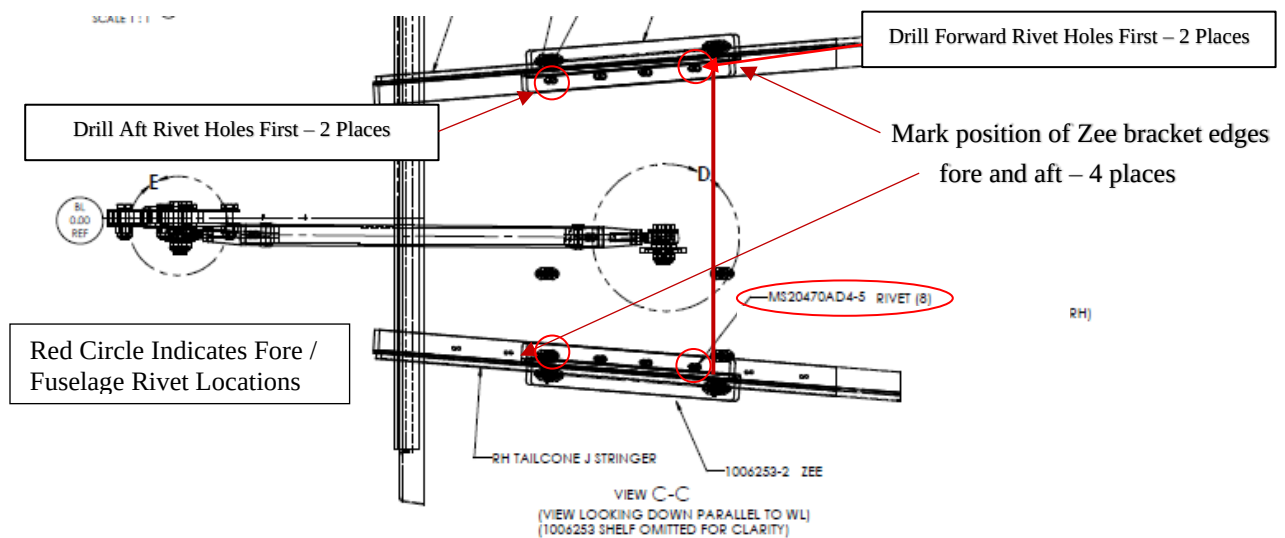


FIGURE 4-5 ZEE ANGLE LAYOUT

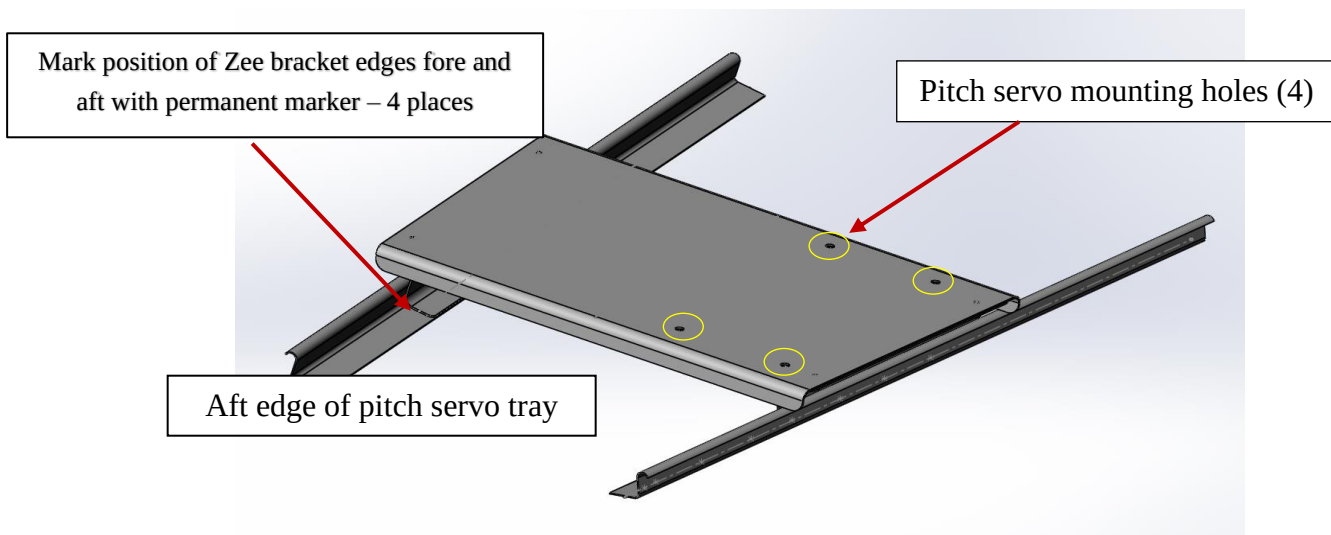


FIGURE 4-6 PITCH SERVO SHELF ASSEMBLY POSITIONING



28. Secure the Zee Angle into position using a P Series Silver Cleco Temporary fastener.
 - a. Have a helper secure the ZEE Angle into position from outside the aircraft.
29. Position the opposite side ZEE Angle between the fore and aft location marks made above.
30. Ensure that the Zee Angle is snug against the stringer.
31. Use a straightedge to check ZEE Angle alignment. *This is a critical step.*
32. Secure the Zee Angle into position using painters tape. Be precise. *This is a critical step.*
33. Using the forward ZEE Angle rivet hole as a guide, drill a single #40 (.098") hole through the fuselage skin. Refer to Figure 4-4.
34. Secure the Zee Angle into position using a P Series Silver Cleco Temporary fastener.
 - a. Have a helper secure the ZEE Angle into position from outside the aircraft.
35. Using the aft ZEE Angle rivet hole as a guide, drill a single #40 (.098") hole through the fuselage skin.
36. Secure the Zee Angle into position using a P Series Silver Cleco Temporary fastener.
 - b. Have a helper secure the ZEE Angle into position from outside the aircraft.
37. Secure the pitch servo tray to the ZEE Angles and check for accuracy.
38. Make any alignment adjustments necessary.
39. If satisfied remove the pitch servo tray from the Zee Angles and drill the remaining holes using the ZEE Angle rivet holes as a guide.
 - c. Have a helper secure the ZEE Angle into position from outside the aircraft.
40. Secure the servo tray to the Zee Angles and check for alignment a final time.
41. If satisfied remove the servo tray from the Zee Angles.
42. Mark the Zee Angles Starboard and Port.
43. Remove the ZEE Angles.
44. Enlarge the holes drilled in the fuselage skin above using a #30 (0.1285") drill bit.
45. Deburr all holes in the fuselage skin.

Note:

If the ZEE Angle pre-drilled rivet location holes were damaged deburr damaged holes.

46. Remove all debris.
47. Have a helper secure the ZEE Angles back into position from outside the aircraft using P Series Copper Cleco Temporary Fasteners.
48. Ensure that the ZEE Angles are snug against the stringers. This is a critical step.
49. ZEE Angles will be secured to the stringers using CR3213-4-4 Cherry Aerospace rivets supplied in the hardware kit. Refer to Image 4-4.
 - a. Use three (3) Cherry rivets per ZEE Angle.
50. Hole size limits for the CR3213-4-4 rivets supplied are 0.129" to 0.132".
 - a. A #30 drill bit will work but a 3.3mm drill bit is preferred for this application
51. Drill three #40 (.098") holes through the ZEE Angles into the aircraft stringers. Refer to Image 4-4.



- a. The first Cherrymax rivet hole should be drilled through the center of the aircraft J stringer.
 - b. Locate the J stringer center location and mark this on the ZEE Angle.
 - c. Using a center punch, locate the first hole on the ZEE Angle.
 - d. Drill through the ZEE Angle into the J stringer of the aircraft.
52. Secure the ZEE Angle into position using a P Series Silver 3/32" Cleco Temporary Fastener.
53. If satisfied drill the other two holes using a #40 drill bit.
54. Repeat the above steps on the opposite stringer ZEE Angle.
55. Enlarge the holes drilled in the ZEE Angles and J stringers above using a #30 (0.1285") or 3.3mm (preferred) drill bit.
56. Deburr all holes.
57. Remove all debris from the area using a vacuum or equivalent.
58. Have a helper secure the ZEE Angles back into position using P Series Copper Cleco Temporary Fasteners.
59. Secure the Zee Angles to the J stringers using P Series Copper Cleco Temporary Fasteners.
60. Secure the ZEE Angles to the aircraft skin using the MS20470AD4-4 (or -5 as required) rivets supplied in the hardware kit.
61. Secure the ZEE Angles to the J stringers using the Cherry Aerospace CR3213-4-4 rivets supplied in the hardware kit.
62. Mount the servo tray to the ZEE Angles using the MS27039 screws supplied.
63. Secure the pitch servo, p/n 30000000, to the servo tray using the MS270490807 screws supplied in the hardware kit.
64. Verify that fastener torque is 12 to 15 lb. in. using a calibrated screwdriver.

4.2 Push Pull Tube Installation, Servo Arm Positioning

1. Have an assistant attach the pitch servo push pull tube, p/n 1006412 (p/p tube), to the elevator idler bellcrank using the AN4-13 bolt and hardware supplied. Refer to Figure 4-7, Detail E.
2. Adjust the Aurora MM-4 rod end at the elevator bellcrank end of the p/p tube so that there are four (4) threads showing.
3. Tighten the AN315-4R nut to lock the rod end into position.
4. Position the pitch servo arm, p/n 1006402-4 or -6, facing forward at the 1 o'clock position.
5. Secure the servo arm in position with painter's tape or equivalent. Refer to Figure 4-1.

Note:

The servo arm position will be checked in the VNAV Servo Set screen for precise positioning when the Trio Pro Pilot autopilot is powered on the first time.



6. Position and secure the unterminated end of the p/p tube against the servo arm AN4 bolt hole using painters tape, or equivalent.
7. Mark the center location of the servo arm bolt hole on the p/p tube using a permanent marker. Refer to Figure 4-8.
 - a. This mark represents the center to center distance between idler bellcrank and Servo Arm Aurora MM-4 rod ends.
8. Remove the p/p tube assembly from the aircraft.

Note:

The pitch servo hardware kit is supplied with an Aurora MM-4 rod end preassembled with an AN315-4R nut, and 05-01150 pushrod threaded end fitting. Two (2) MS20470AD-12 rivets are also included.

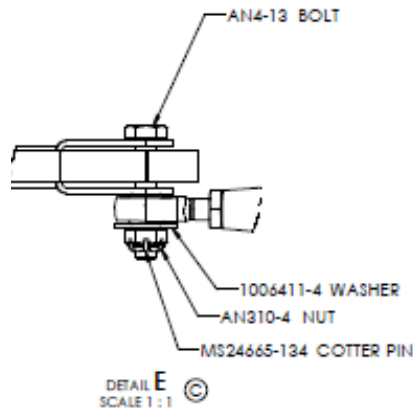


FIGURE 4-7 ELEVATOR IDLER BELLCRANK PUSH PULL TUBE INSTALLATION

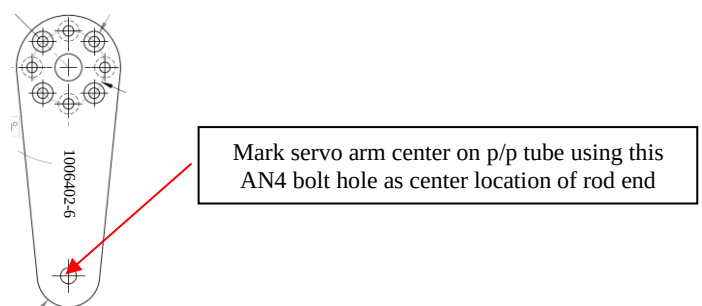


FIGURE 4-8 SERVO ARM TO P/P TUBE REFERENCE POINT

9. Adjust the Aurora MM-4 rod end screwed into the 05-01150 threaded insert included in the parts bag so there are four (4) threads showing.



10. Position the 05-01150 threaded rod end assembly on the unterminated end of the p/p tube so that *the center of the MM-4 rod end* is over the mark made on the p/p tube. *This is a critical measurement.*
11. Make a mark on the unterminated end of the p/p tube at the 05-01150 flange location using a permanent marker. Refer to Figure 4-9, and Image 4-8.
 - a. This is the location where the p/p tube will be trimmed.
12. Trim the unterminated end of the p/p tube at the mark made above.
13. Square, deburr, and smooth the trimmed area of the p/p tube.
14. Insert the 05-01150 Threaded Insert into the P/P tube and secure with painter's tape or equivalent.
15. Place the p/p tube assembly into a V Block and secure.
16. Install the two (2) MS20470AD4-12 rivets supplied in the hardware kit as depicted in Figure 4-9 using the following steps.
 - a. It is recommended to first drill a pilot hole using a #40 (0.098") drill bit.
 - b. Insert a pin in the #40 hole to prevent insert movement then drill second hole and insert a second pin (a drill bit works fine for the pin).
 - c. Enlarge the pilot hole using a #30 (0.1285"). Again, use a pin (drill bit), to prevent movement).
17. After drilling has been completed remove the 05-01150 threaded insert from the p/p tube.
18. Deburr the rivet holes and remove debris.
19. Secure the 05-01150 threaded insert using the MS20470AD4-12 rivets supplied.

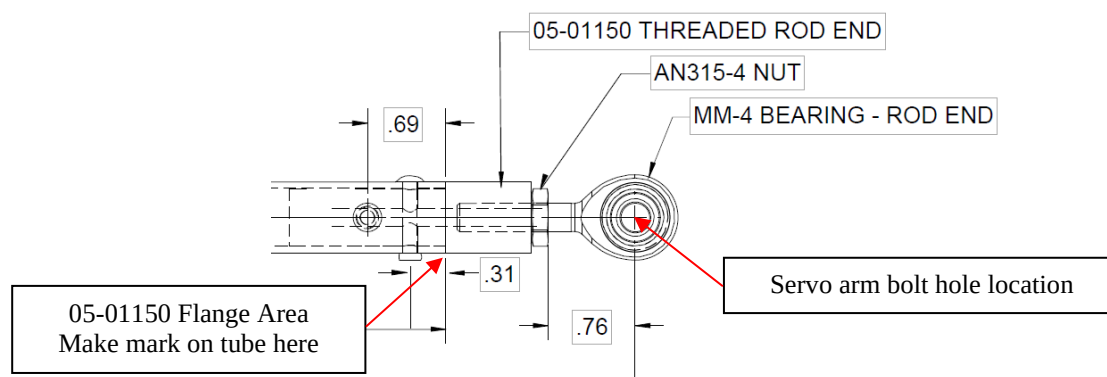


FIGURE 4-9 SERVO SIDE PUSH PULL TUBE FINAL ASSEMBLY

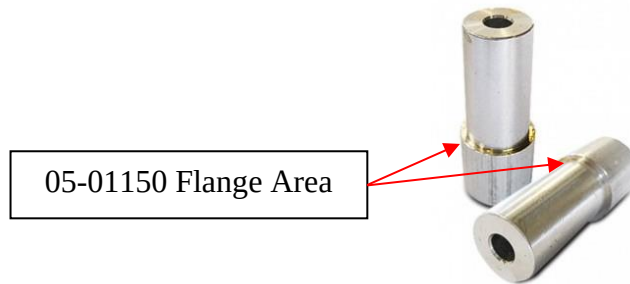


IMAGE 4-8 - 05-01150 THREADED ROD END INSERT

4.3 Servo Tray, Push Pull Install, Position Servo Arm

1. Mount the Pitch Servo to tray as described in the last section.
2. Ensure the push pull tube connection to the elevator idler bellcrank is attached securely using the supplied hardware. Four (4) threads should be showing on the rod end. Refer to Figures 4-7.
3. Verify that the rod end jam nut and rod end threads is marked with tamper proof torque seal.
4. The pitch servo was secured to the pitch servo tray using the MS27039 fasteners supplied in the pitch servo kit in a previous step.
5. Verify that fastener torque is 12 to 15 lb. in. using a calibrated screwdriver.
6. Position the servo arm as shown in Figure 4-1. The servo arm should face towards the front of the aircraft at approximately the 1 o'clock position.
7. Attach the p/p tube to the servo arm using the hardware supplied. Refer to Figure 4-10.
8. It may be necessary to use spacers to prevent the rod end jam nut from contacting the servo arm.
9. Verify that the p/p tube has proper clearance from control cables. 0.125" clearance is sufficient.
10. It is recommended to cover the pitch cable with 0.125" I.D. plastic tubing (available at any hardware store) as an "anti-chaff" indicator. 12 inches will suffice.

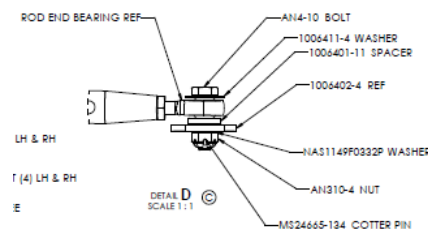


FIGURE 4-10 PITCH SERVO PUSH PULL TUBE INSTALLATION



11. Secure the tubing with tie wraps if required.

Note:

Tubing may be removed at the next inspection interval if no chafing is present.

12. Remove the blocks that were used to neutralize the elevator controls.
13. Check for full range of motion on pitch controls and recheck for clearance on the cables, servo arm and elevator idler bellcrank.
14. Re-install the blocks on the elevator.

4.4 Position the Servo Arm (completed after autopilot installation)

Note:

A notepad will be required for the following steps. You will be recording the Pitch Servo Arm position in three (3) locations, neutral, full up elevator, full down elevator.

1. Power ON the Pro Pilot autopilot.
2. Press the Encoder knob when Elevation is displayed.
3. **Press and Hold** the Encoder knob and V MODE button at the same time. Refer to Image 4-9.
4. After several seconds the Maintenance Setting screen will appear. Refer to Image 4-9.
5. Advance through the Maintenance Settings screens by either pressing or turning the Encoder knob until VNAV Servo Set screen is displayed. Refer to Image 4-11.
6. The reading should be approximately 7.9 degrees to 8.4 degrees.
7. If the reading is not in this range adjust the rod ends equally until the above value is obtained.
8. Lock the rod ends into position and mark with tamper proof torque seal.
9. Record the reading in the VNAV Servo Set screen.
10. Remove the blocks locking the elevator.
11. Move the control yoke fully aft until the elevator reaches the mechanical stops.
12. Record the reading on the VNAV Servo Set screen. Refer to Image 4-12.
13. The reading should not exceed 45 degrees.



IMAGE 4-9 MAINTENANCE SETTINGS



IMAGE 4-10 FIRST SCREEN IN MAINTENANCE MENUS



IMAGE 4-11 ELEVATOR POSITIONED IN NEUTRAL (EXAMPLE)



IMAGE 4-12 ELEVATOR FULL UP



IMAGE 4-13 ELEVATOR FULL DOWN

14. Move the control yoke fully forward until the elevator reaches the mechanical stops.
15. Record the reading on the VNAV Servo Set screen. Refer to Image 4-13.



16. The reading should not exceed 45 degrees.
17. The elevator travel tests and readings are complete.
18. Power OFF the autopilot.

120. Ensure that the Lock the elevators in neutral
121. Enter the VNAV Servo Set screen
122. Record the servo arm position with the elevators locked in neutral.
123. Unlock the elevators
124. Record the full up servo arm position
125. Record the full down servo arm position
126. Record the VNAV servo gains – I have never had to change these -the defaults work great
127. Record the HNAV and VNAV Servo gains
128. HNAV _____
129. VNAV _____
130. Lock the ailerons in neutral
131. Enter the LNAV Servo Set screen
132. Ensure that the servo arm is at 0.00 degrees or close to that. If not:
133. Leaving the ailerons locked in neutral adjust the rod ends so the servo arm gets as close to 0.00 degrees as possible.
134. Unlock the aileron
135. Record the full up servo arm position
136. Record the full down servo arm position
137. Record the HNAV gain settings
138. TRK _____
139. CRS _____
140. PI _____



APPENDIX A – TRIO PRO PILOT AUTOPILOT INSTALLATION

NOTE:

Prior to plugging harness DB9 or DB37 into servos or autopilot control perform a full power, ground, and data test on the harness by ringing the wires from plug to plug using PRO PILOT WIRING HARNESS DWG 41300008 or latest approved version. Refer to Appendix B.

Call Trio Avionics at +1 619-448-4619 if you have additional questions or need assistance.

The Trio Pro Pilot autopilot controller must be integrated with the aircraft pitot and static system. A pitot and static system test must be performed prior to opening the pitot and static system. A pitot and static system test must be performed after the Trio Pro Pilot autopilot is installed.

Roll Servo Harness Installation

1. Remove interior trim panels on cockpit passenger side
2. Remove existing Cessna factory autopilot wiring and set aside for weighing if so equipped.
3. Route Trio Harness Roll servo wiring along same path and using the same clamps as factory autopilot wiring.
4. Take care to protect harness pins at end of harness.
5. Terminate supplied DB9 connector per Trio diagram.
6. Attach DB 9 connector to Trio Roll Servo.
7. Secure harness cable end at the servo end with supplied clamp or equivalent.

Pitch Servo Harness Installation

1. Remove co-pilot seat
2. Route Trio Harness Pitch servo wiring under cockpit floor taking care to secure away from other aircraft wiring and moving components.
3. Route harness to Trio Pitch Servo location.
4. Take care to protect harness pins at end of harness.
5. Terminate supplied DB9 connector per Trio diagram.
6. Attach DB 9 connector to Trio Roll Servo.
7. Secure harness cable end at the servo end with supplied clamp or equivalent.

Trio Autopilot Controller

1. The Trio autopilot controller is ordered in Panel Mount or Instrument Mount versions.
2. The Trio autopilot controller will support 12 to 30 volts.
3. The Trio controller is provisioned with Pitot and Static ports.
4. **A pitot static system check must be performed before installation** to verify system operation and integrity.
5. The Trio Pro Pilot autopilot controller is provisioned with Pitot and Static ports on the rear of the controller.



6. The controller pitot and static ports must be plumbed into the aircraft pitot and static systems.
7. Every aircraft Pitot and Static system is different. The following are for example only as the aircraft systems will vary.
8. The following components, or equivalent, will be used in most installations.:
 - a. Tygon tubing. 2 each x 24" pieces. Aircraft Spruce P/N 05-00944, or equivalent.
 - b. Nylo Seal fittings. 2 each. Aircraft Spruce P/N 264-N04.
 - c. Nylo Seal Inserts. 8 each. Aircraft Spruce P/N 259-N04.
9. Extend the pitot & static hoses & cable connector through the tray and out through the front of the instrument panel to allow for ease of servicing.
10. Mate & secure the pitot and static hoses to the control head.
11. Mate the 37 pin D connector to the control head using the screws provided.
12. If using an Instrument mount control head secure the control head using #6 brass instrument screws.
13. If using a Panel mount control head slide the control head into the tray, then tighten the securing screw. Do not over tighten control head in the tray.
14. It is required that a pitot and static system leak test is performed after autopilot installation.
15. Install the controller using best practices in either panel or hole locations. Refer to AC 43-13 for this step and all following steps.
16. Utilize Trio DWG 413000XX and Appendix B for the following steps.
17. Install supplied 5-amp circuit breaker within easy reach of the pilot and label per Illustrated Parts Catalog 1006906.
18. If a Panel Mount unit is ordered install the supplied power switch and label.
19. Terminate supplied DB37 connector per Trio drawing in Step 3.
20. Terminate wiring with aircraft GPS or handheld.
21. If ARINC 429 is available from GPS terminate ARINC 429 connections.
22. Install the supplied PCS button on the left side of the pilots control yoke and label PCS.
23. Install Recover button in an available convenient location within easy reach of the pilot and label AP Recover.
24. Ensure that the analog alarm out is connected to the un-switched audio input on the Audio Panel.
25. Install Limitation Placard, P/N 1006450-1, supplied in plain view of Pilot.

Trio Autopilot Data Connections

1. For the RS-232 connection set the output at the GPS unit to "Aviation w/ no altitude" or NMEA 0183 OUT.
2. If your aircraft is equipped with a GPS that has ARINC 429, set unit to output "GAMA" Low Speed.
3. Prior to making the connections to the GPS unit in the aircraft determine what else is connected.



4. It may be necessary to parallel the connections.
 - a. If parallel connections are required, verify that the lines you are connecting to use, or can use, the same data format that is required.
5. Both the RS-232 and the ARINC 429 can be paralleled with like connections.

Trio Initial Setup and Checks

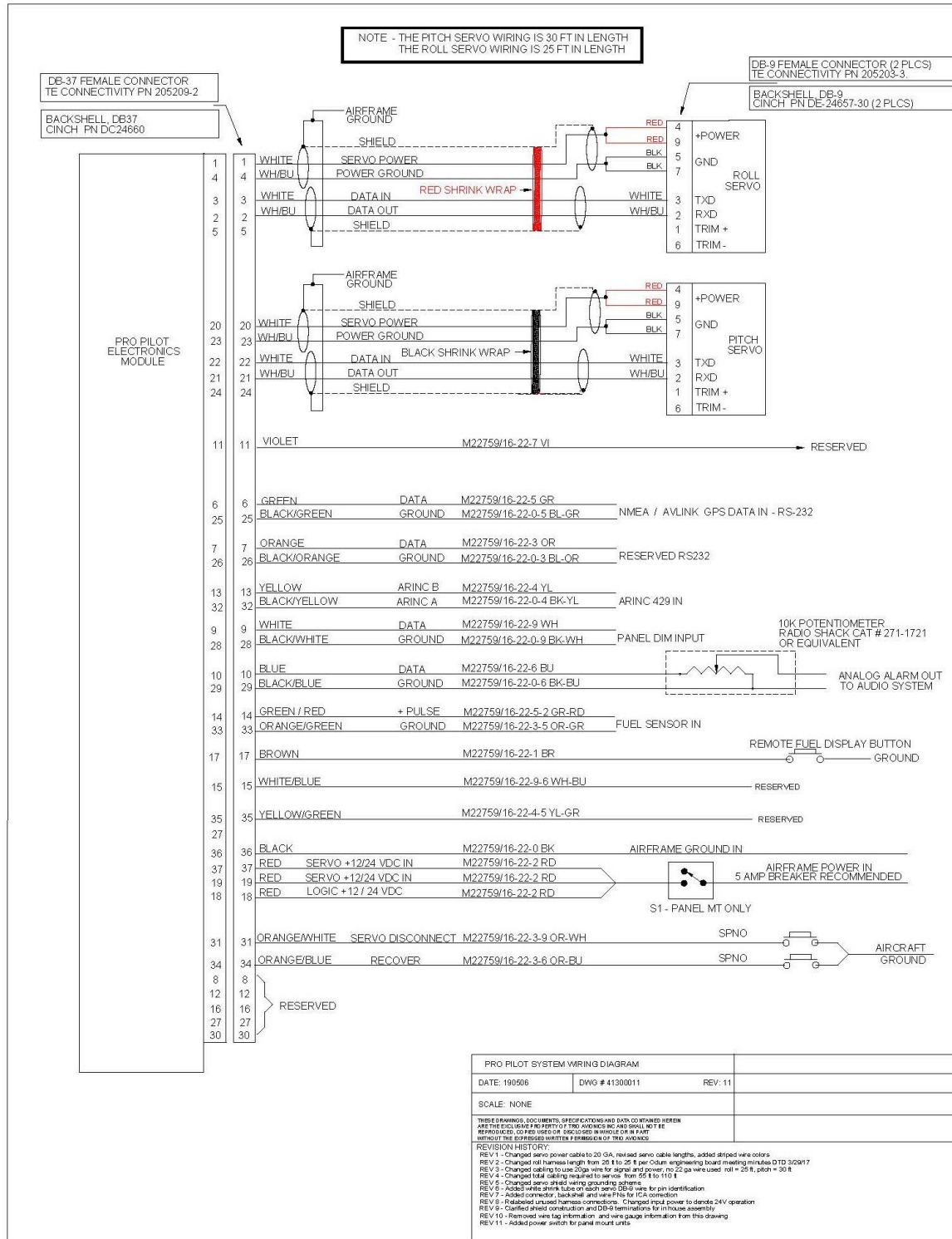
1. Refer to The Avionics Addendum Section 9 for initial checks and setup of the autopilot installation.
2. Autopilot gain settings have been programmed before shipment.
3. Individual aircraft may require fine tuning of servo gains on the first few test flights.
4. The Avionics Addendum may be downloaded at www.thestcgroupllc.com.

END



APPENDIX B – TRIO PRO PILOT WIRING DIAGRAM

ORIGINAL WIRING DIAGRAM





NEW WIRING DIAGRAM (CURRENT DIAGRAM SHIPPED WITH HARNESS)

