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

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REVISION F
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TRIO AUTO PILOT INSTALLATION INSTRUCTIONS

TRUE FLIGHT HOLDINGS LLC AA-5, AA-5A, AA-5B, AG-5B

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REVISIONS

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Section:	Description
All	Initial Release
Rev. A	Corrections, reorganization, and addition of Figures/Images
Rev. B	Sections 1.0, 2.0, 3.0, 4.0, 5.0, Appendix A, Figures and Images.
Rev. C	Sections 2.0, 3.0, 4.0, 5.0, Figures/Images, and Appendix A & B Images
Rev. D	Sections 2.0, 3.0, 4.0, 5.0 (minor edits)
Rev. E	Section 4.0, 5.0
Rev. F	Appendix B

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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.

AA-5() Maintenance Manual

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

- Cordless or air drill
- Drill bit assortment
- Common hand tools (screwdrivers, combination wrenches)
- 24” ruler or tape measure
- 6” ruler
- Light
- Foam knee pad

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

Autopilot	Trio Pro Pilot Autopilot
C.G.	Center of Gravity
ER	Engineering Record
FAA	Federal Aviation Administration
ICA	Instructions for Continued Airworthiness
LH	Left Hand
OEM	Original Equipment Manufacturer
OTBD	Outboard
PCS	Pilot Controller Steering (Red) Button
Recover	Recover Button
RH	Right Hand
Servo	Trio Pro Pilot Gold Standard Servo
STC	Supplemental Type Certificate

1.0 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 True Flight Holdings LLC (formerly Grumman Aviation Corporation, Grumman American Aviation Corporation, Grumman American Corporation, Gulfstream Aerospace Corporation, American General Aircraft Corporation, American General Aircraft Corporation and Tiger Aircraft LLC) Models AA-5, AA-5A, AA-5B and AG-5B Aircraft.

You may contact The STC Group LLC for hardware and servo installation questions. Contact Trio Avionics, Inc with all autopilot related questions.

Check all items included in the kit to ensure all parts are accounted for. Compare the contents of the kit with the Illustrated Parts Catalog. Please contact The STC Group LLC 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:

1. Care should always be taken to avoid marring or scratching any surfaces of autopilot assemblies including anodized surfaces. Painters tape may be used to prevent damaging hardware surfaces.
2. 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.
3. It is recommended that Test 4 of the Post Installation Flight Checks Document Number F-1006-43, current revision, be completed before the autopilot installation is started. This test will verify that aircraft rigging is correct.

2.0 PREPARE THE SERVOS

1. Remove the Pitch and Roll servos from the shipping boxes.
2. Enlarge the 4 corner mounting holes using a #16 drill bit or equivalent.

Note:

The Grumman Roll Servo Installation Kit, P/N 1AA5400 shipped with all servo arm and servo extension screws are pre-coated with Loctite. Do NOT apply additional Loctite to any screws.

The screws may be reinstalled and torqued up to three (3) times.

3. Position the servo extension taper pin covers, P/N 180608-1, with the retainer tangs positioned over the servo hub taper pins. This cover is designed to retain the servo bushing taper pin. Refer to Image 2-1. Roll servo shown.

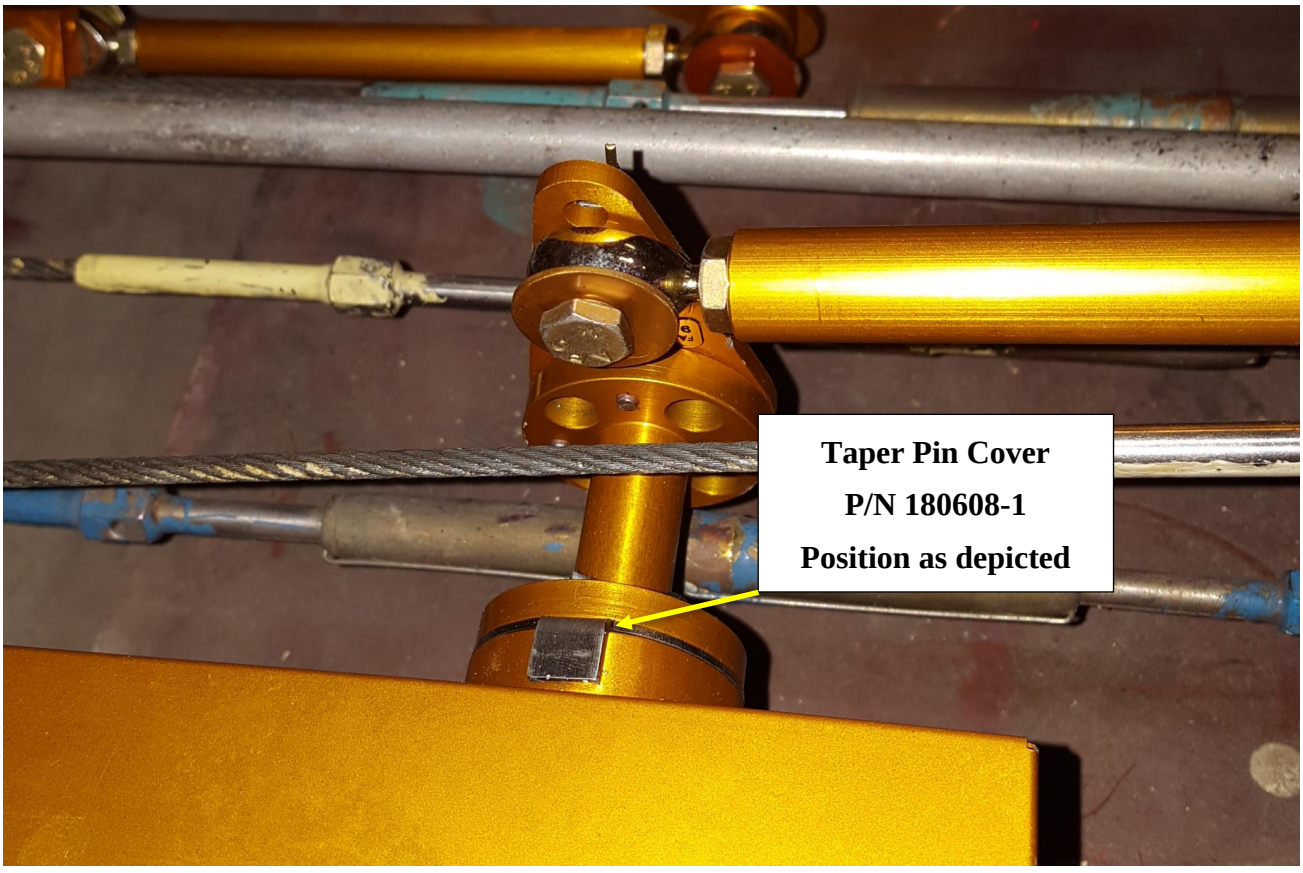


IMAGE 2-1 SERVO EXTENSION AND TAPER PIN COVER

4. Attach the Pitch servo 2” extension, P/N 1AA5101, to the Pitch servo bushing using the M3 x 12mm hex drive screws and star washers supplied in the hardware kit.

5. Attach the Roll servo 1.5” extension, P/N 1AA5401, to the Roll servo bushing using the M3 x 12mm hex drive screws and star washers supplied in the hardware kit.
6. Safety the extensions to the bushing using the cotter pin supplied in the hardware kit.
7. Center each servo bushing extension and attach the servo arm, P/N 901-114, to each extension with the end of the Pitch Servo arm pointing towards the base of the servo (**Down**) and the end of the Roll Servo arm pointing away from the base of the servo (**Up**).
8. Secure the servo arms with the M3 x 10mm screws supplied in the hardware kit.
9. Secure the servo arm using the NAS1149F0563P washer and MS24665-302 cotter pin through the hole in the outer end of each extension.

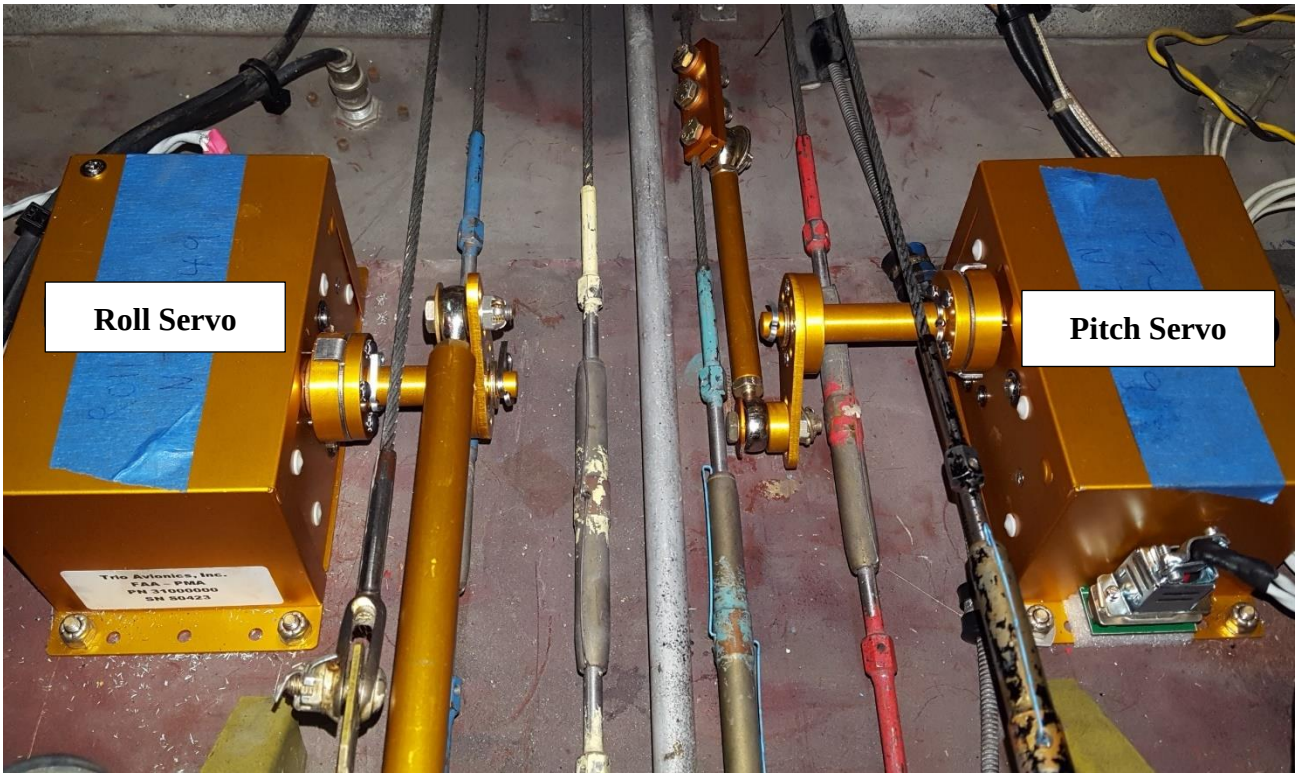


IMAGE 2-2 SERVO INSTALLATIONS GENERAL VIEW

3.0 PREPARE THE AIRCRAFT FOR THE INSTALLATION

Note:
Refer to the Aircraft Maintenance Manual specific to the aircraft model for instructions and proper procedures.

1. Remove the following items:
   a. Glare Shield
   b. Instrument panel covers, and instruments as needed
   c. Front Seats
   d. Center Seat Belts and retaining bolts
   e. Center Console Covers
   f. Rear Seat Backs
   g. Rear Seat Bottom
   h. Canvas Cover under rear seat
   i. Angle stiffener on front of rear seat support on right side (if necessary). Refer to Image 3-1.

IMAGE 3-1 ANGLE STIFFENER AND AILERON (ROLL) CONTROL HORN

2. Remove the clips / safety wire from the right aileron turnbuckle and/or the carry through cable turnbuckle. Refer to Figure 3-1.
3. Mark both sides of the turnbuckles so they may be returned to the correct (starting) position after installation.
4. Rotate both turnbuckle(s) sufficiently to release cable tension.
5. Remove the AN24 Clevis Bolt from the right-hand Aileron (Roll) control horn.
6. Replace the factory installed AN24 clevis bolt with the AN24-22 clevis bolt included in the hardware kit with the nut facing inboard.
7. Install the roll servo push pull rod spacer, P/N 1006401-11.
8. Install the roll servo push pull rod assembly, P/N 1AA5601, provided in the installation kit. Refer to Image 4-1, and Figure 4-2.

Note:

Position the MM4 rod end over the end of the AN24-22 clevis bolt with the rod toward the rear of the aircraft.

9. Install the NAS1149F0363P washer, AN310-4 nut and cotter pin supplied.
10. Tension the turnbuckles and check aileron rigging per the aircraft maintenance manual.
11. Reinstall the retaining clips or safety wire the turnbuckles that were loosened. Refer to the AA-5() maintenance manual.
12. Replace the angle stiffener on the front of the rear seat support if previously removed.
13. Verify correct elevator (pitch) control system cable tensions and rigging.

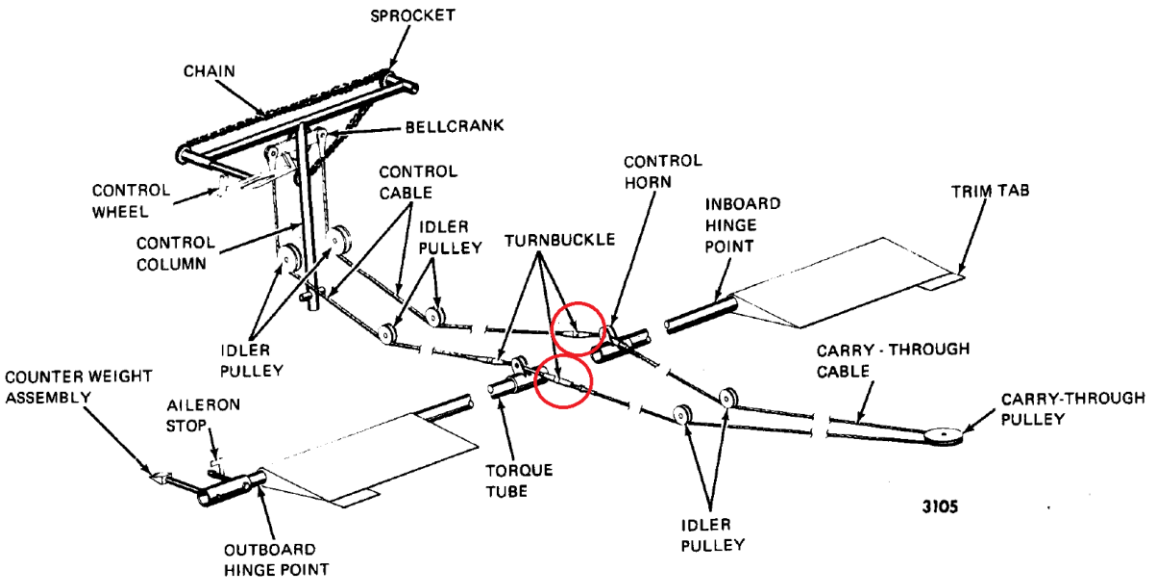


FIGURE 3-1 AILERON (ROLL) CONTROL SYSTEM

4.0 SERVO INSTALLATIONS

4.1 Roll Servo Installation

1. Position the roll servo approximately four (4) inches to the co-pilot side of the trim pushrod. Refer to Image 4-1.
2. The rear edge of the servo should be aligned to the rear edge of the floor reinforcement. Ensure proper edge distance for servo mounting screws.
3. Align the roll servo assembly left or right so that there is clearance between all moving parts. Refer to Image 4-1.

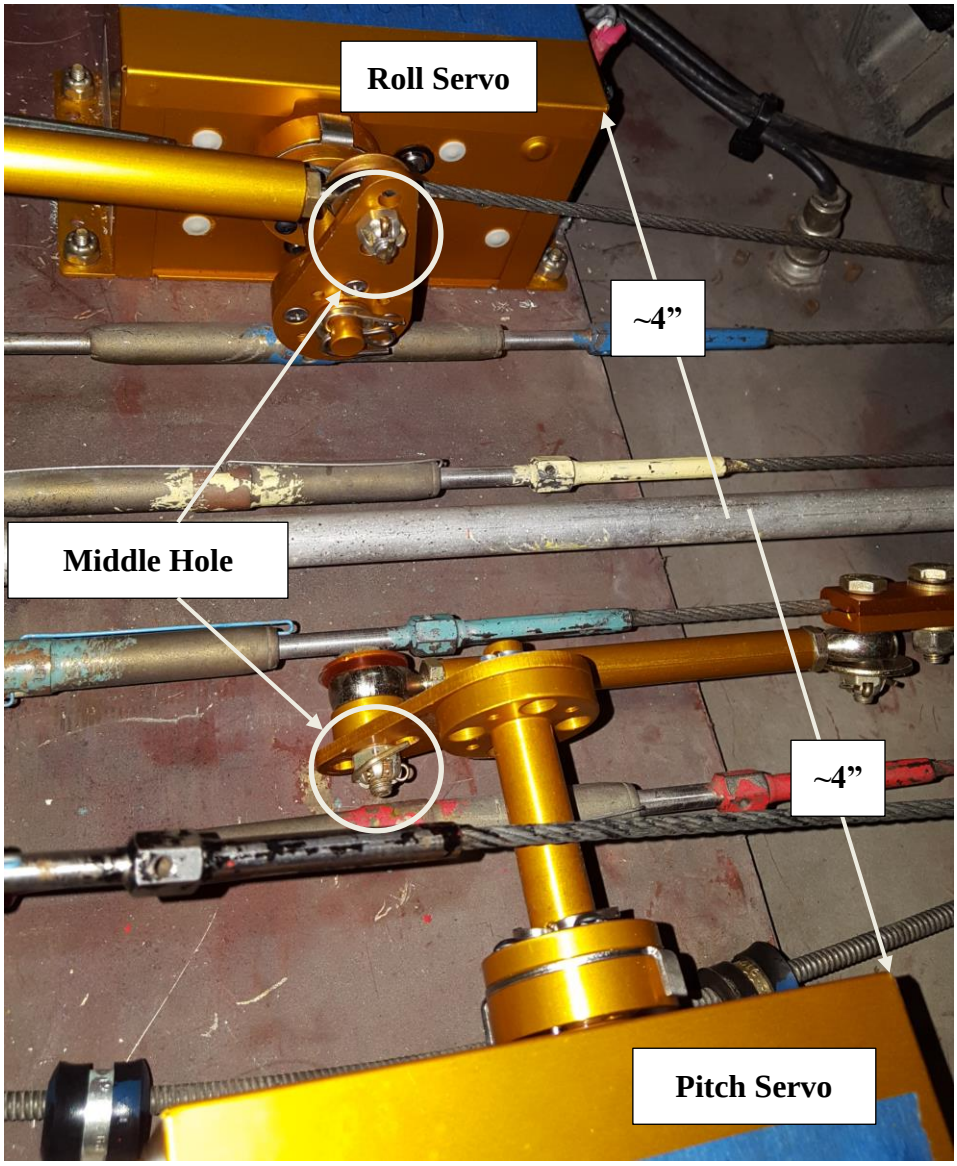


IMAGE 4-1 ROLL AND PITCH SERVO INSTALLATION

Note:

On early model AA-5 aircraft it may be necessary to insert spacers under the roll servo and possibly use a 2" servo arm extension, P/N 1AA5101. Contact The STC Group if you need assistance. If spacers are used, then longer AN525 fasteners may be required.

4. After dry fitting the roll servo assembly for clearance mark the floor of the aircraft with the position of the four (4) roll servo baseplate holes using a center punch.
5. Remove the servo and drill the four baseplate hole positions using a #30 drill bit.
6. Enlarge each hole using a #16 drill bit.
7. Secure the servo to the floor reinforcement with the AN525-832R14, MS21044N08, and NAS1149F0832P hardware supplied.

Note:

AN970-3 washers may be utilized under the head of the screw on the underside of the aircraft if required (not supplied).

8. Attach and adjust the aileron (roll) push rod length by adjusting the rod ends.
9. The servo arm should be pointed straight up with the ailerons locked in neutral.
10. Secure the MM3 rod-end in the middle hole of the roll servo arm using the AN3-6 bolt and hardware supplied. Refer to Figure 4-1 and Image 4-1.

4.2 Pitch Servo Installation

1. Position the pitch servo on the pilot side of the cables with the spacer and arm facing inboard. Refer to Image 4-1.
2. The pitch servo arm should be oriented **DOWN**.
3. Align the rear edge of the pitch servo with the rear edge of the floor reinforcement.

Note:

On some aircraft it may be necessary to position the pitch servo forward of the reinforcement rear edge to alleviate cable clamp interference with rear seat aft support.

4. The pitch servo should be positioned approximately four (4) inches from the trim tube. Refer to Image 4-1.
5. Align the pitch servo assembly left or right so that there is clearance between all moving parts. Refer to Image 4-1.
6. After dry fitting pitch assembly for clearance mark the floor of the aircraft with the position of the 4 pitch servo baseplate holes using a center punch or equivalent.
7. Remove the servo and drill the four baseplate hole positions marked above using a #30 drill bit.
8. Enlarge each hole using a #16 drill bit or equivalent.
9. Secure the pitch servo to the floor reinforcement using the AN525-832R14 and MS21044N08 hardware provided in the kit.

Note:

AN970-3 washers may be utilized under the head of the screw on the underside of the aircraft if required (not supplied). Longer AN525 fasteners may be required if spacers are utilized.

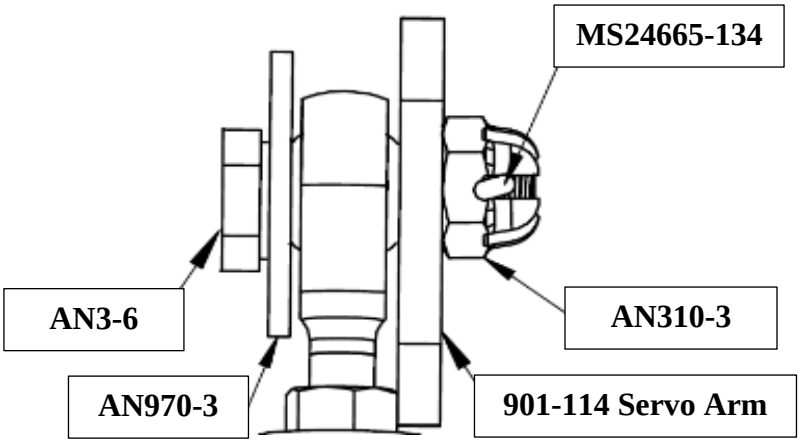


FIGURE 4-1 ROLL SERVO ARM CONNECTION (SERVO SIDE)

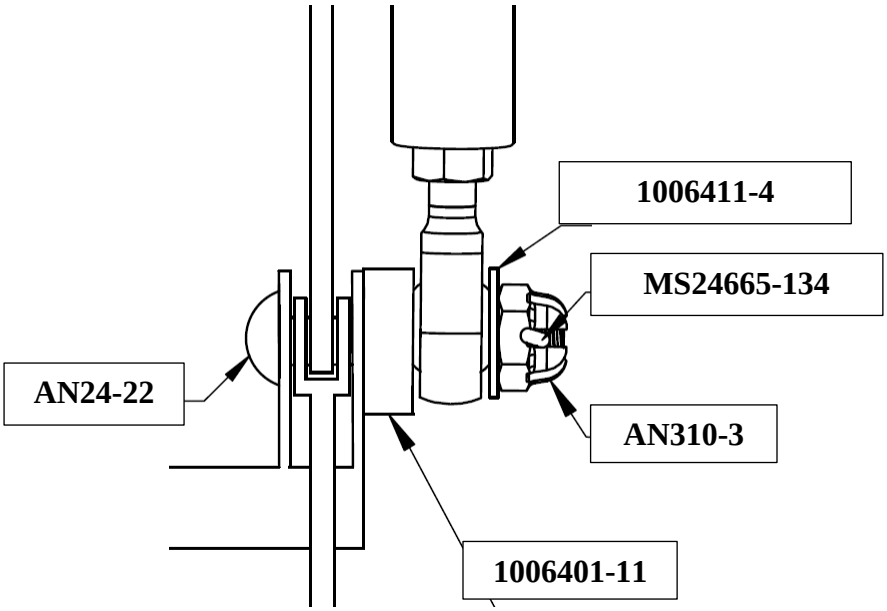


FIGURE 4-2 AILERON (ROLL) CONTROL HORN CONNECTION

10. With the pitch servo arm pointed **DOWN**; attach the pitch cable clamp onto the pitch cable. Refer to Figure 4-5.
11. Secure the pitch cable clamp to the pitch cable with AN3-6A bolts, washer, and stop nuts supplied in the hardware kit. Refer to Figure 4-3.

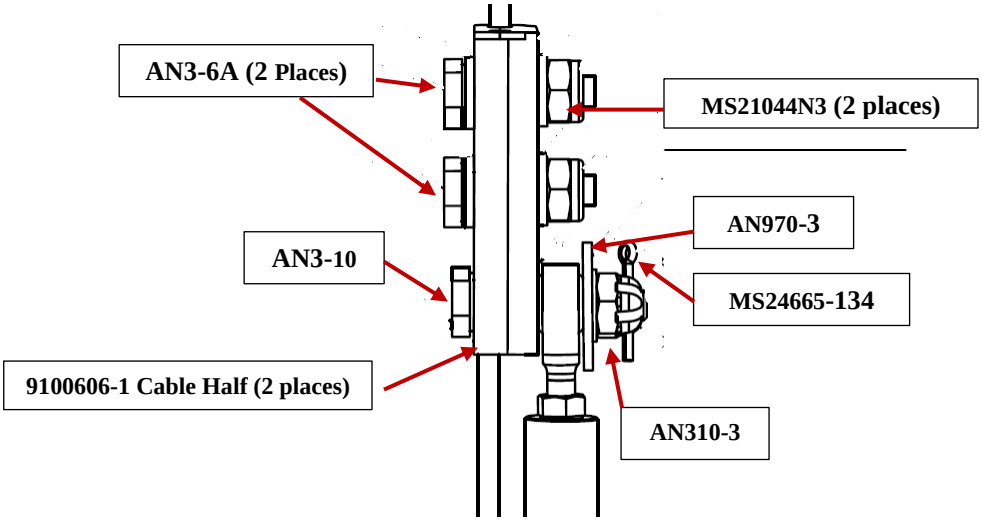


FIGURE 4-3 PITCH CABLE CLAMP CONNECTION

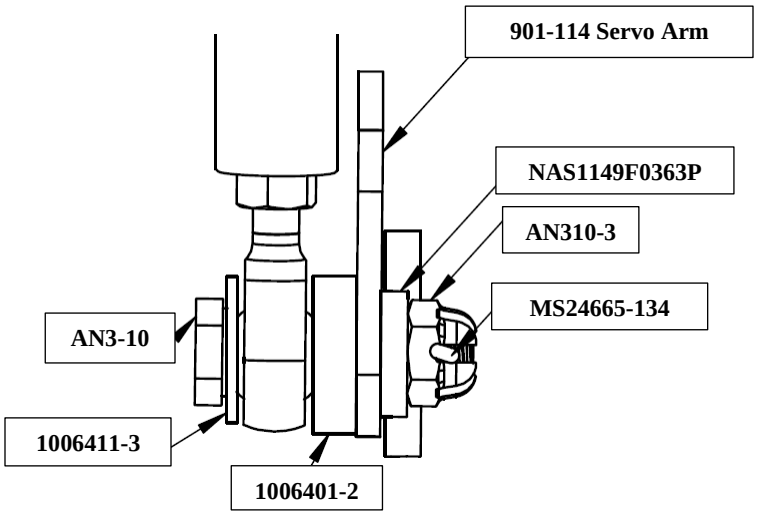


FIGURE 4-4 PITCH SERVO ARM CONNECTION (SERVO SIDE)

12. Install the pitch push pull rod assembly, P/N 1AA5201, by securing the pitch servo push pull rod to the cable clamp and servo arm using the hardware supplied. Refer to Figures 4-3 and 4-4.
13. Adjust the length of the pushrod by adjusting the rod ends in or out so that servo arm is pointed straight **down**, with the elevators locked in neutral.
14. Secure the MM3 rod-end to the forward hole in the cable clamp using the AN3-10 bolt supplied. Refer to Figure 4-3.

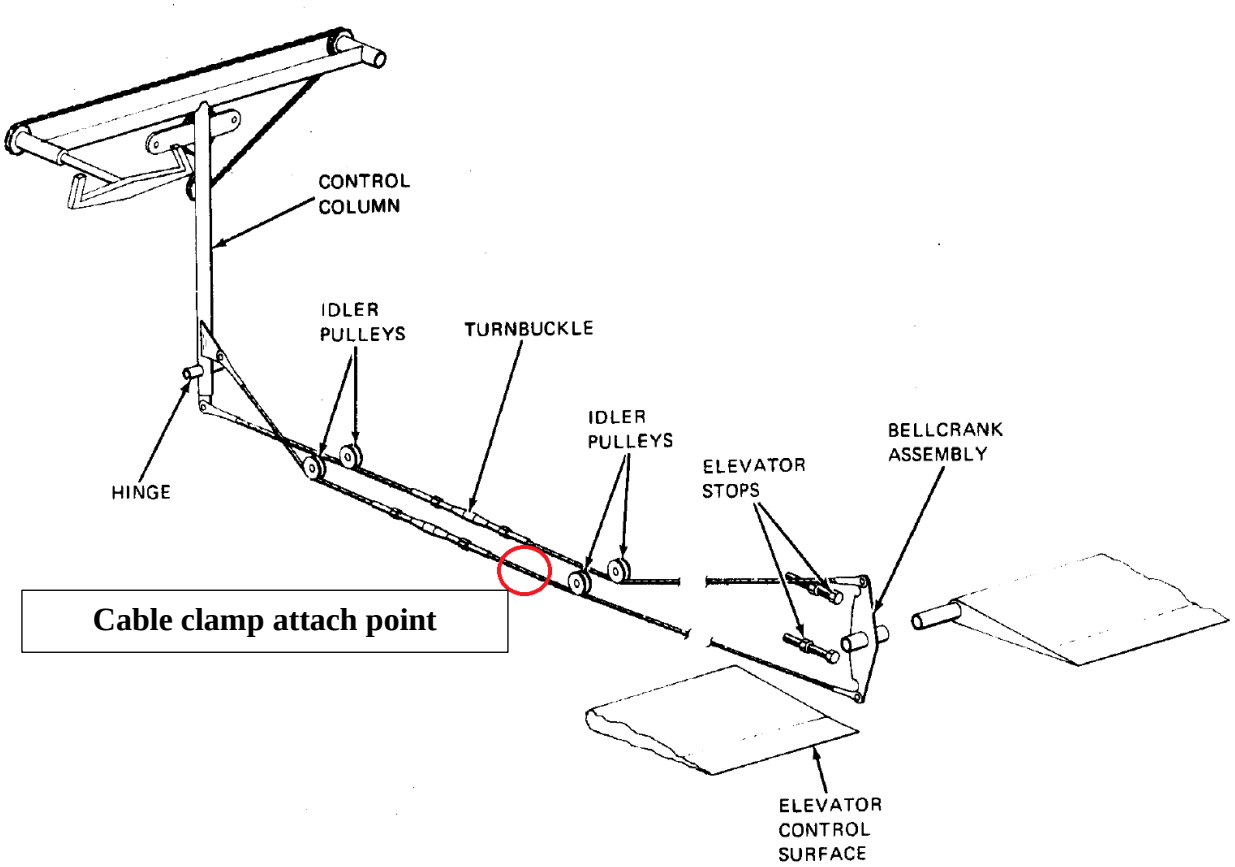


FIGURE 4-5 ELEVATOR (PITCH) CONTROL SYSTEM

5.0 ADJUST THE SERVOS

5.1 ROLL SERVO

1. Attach the harness DB9 connector to the servo DB9 connector after completing the Wiring harness installation in Appendix A.
2. Ensure that the control yoke is centered, and the ailerons are neutral.
3. Power on the Trio Pro Pilot autopilot and enter the Maintenance menu by pressing the Encoder knob and VMODE button simultaneously.
4. Turn, or Press, the Encoder knob until the LNAV SERVO SET screen is displayed.
5. Adjust the roll rod ends until the LNAV SERVO SET reading is 0.00 degrees.
    a. Tolerance is + / -1°
6. Tighten the jam nuts on the rod ends and mark both ends with tamper proof torque seal.

5.2 PITCH SERVO

1. Attach the harness DB9 connector to the servo DB9 connector after completing the Wiring harness installation in Appendix A.
2. Ensure that the elevators are neutral.
3. Power on the Trio Pro Pilot autopilot and enter the Maintenance menu by pressing the Encoder knob and VMODE button simultaneously.
4. Turn, or Press, the Encoder knob until the VNAV SERVO SET screen is displayed.

NOTE:
IT IS VITAL THAT THE PITCH PUSH ROD AND CABLE CLAMP ARE ORIENTED IN A WAY THAT WILL NOT ALLOW AN OVER CENTER CONDITION.

5. Adjust the rod ends until the VNAV SERVO SET reading has equal throw in both directions within +/- 1°.
6. Tighten the nuts on the rod ends and mark both ends with tamper proof torque seal.
7. Power off the autopilot.

5.3 POSITION THE SERVO ARMS

Note:
A notepad will be required for the following steps.

In these steps the Pitch Servo Arm position will be recorded in three (3) locations: neutral, full up elevator, full down elevator.

1. Refer to the Maintenance Manual for the specific model you are working on.
2. Power ON the Pro Pilot autopilot.
3. Press the Encoder knob when Elevation is displayed (field elevation is not required).
4. Simultaneously Press and Hold the Encoder knob and V MODE button. Refer to Image 5-1.

5. After approximately three (3) seconds the Maintenance Setting screen will appear. Refer to Image 5-1.
6. Advance through the Maintenance Settings by either pressing or turning the Encoder knob until VNAV Servo Set screen is displayed. Refer to Images 5-2 and 5-3.
7. The readings in each direction should be approximately + / -1° from each other. The Image shown is an example only.
8. If the readings are not in this range adjust the rod ends equally or reposition the cable clamp until the VNAV Servo Set screen have equal throw in both directions + / - 1°.

Note:

The Aurora Bearing Company recommends a minimum of 1.5 x thread diameter for rod end engagement in the push pull rods.

9. Lock the rod ends into position and mark them with tamper proof torque seal.
10. Record the reading shown on the VNAV Servo Set screen.
11. Remove the blocks locking the elevator.
12. Move the control yoke fully aft until the elevator reaches the mechanical stops.
13. Record the reading on the VNAV Servo Set screen. Refer to Image 5-4.
14. The reading cannot not exceed 45 degrees. The electrical limit is approximately 44.7°.

IMAGE 5-1 MAINTENANCE SETTINGS

IMAGE 5-2 FIRST SCREEN IN MAINTENANCE MENUS

IMAGE 5-3 ELEVATOR POSITIONED IN NEUTRAL (EXAMPLE)

IMAGE 5-4 ELEVATOR FULL UP

IMAGE 5-5 ELEVATOR FULL DOWN

15. Move the control yoke fully forward until the elevator reaches the mechanical stops.
16. Record the reading on the VNAV Servo Set screen. Refer to Image 5-5.
17. The reading should not exceed 45 degrees.
18. The elevator travel tests and readings are complete.
19. Each aircraft may require adjustments to the servo gains. The average servo gain settings, derived from flight tests, for Grumman AA-5 series aircraft are as follows:

    "SET SERVO GAINS"

    HNAV=19 VNAV=19
20. Power OFF the autopilot.
21. Turn off the aircraft radio master, if so equipped.
22. Turn off the aircraft power.

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 41300010 or latest approved version. Refer to Appendix B.

Call Trio Avionics at +1 619-448-4619 if you need assistance.

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

Servo Harness Installation

1. Route the Trio servo harnesses from the location in the panel that the Trio Pro Pilot Controller is mounted through the center console above the control cables using existing Adel clamps or replacing with larger clamps as required. Divide the Roll and Pitch harnesses under the forward edge of the rear seat.
2. Route the Roll harness to the Roll Servo on the right side of the aircraft and secure the harness to the aircraft floor with adhesive cable clips or equivalent, not supplied.
3. Route the Pitch harness to the Pitch Servo on the left side of the aircraft and secure to the aircraft floor with adhesive cable clips, or equivalent, not supplied.
4. Take care to protect harness pins at end of harness.
5. Terminate the supplied DB9 connector per the Trio wiring diagram.
6. Attach the DB 9 connector to each servo.
7. Secure the harness at the servo with the MS21919 clamp, supplied, 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 leak check must be performed before, and after, installation to verify system operation and integrity.
5. The controller pitot and static ports must be integrated into the aircraft pitot and static systems.
6. Every aircraft Pitot and Static system is different.

Note:

The following are for example only as the aircraft systems will vary.

7. 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.
8. 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.
9. Mate the pitot and static hoses to the control head.
10. Use constant pressure clamps, or equivalent, to secure the pitot and static connections at the rear of the autopilot controller.
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. Install the controller using best practices in either panel or hole locations. Refer to AC 43-13 for this step and all following steps.
15. Utilize the Trio wiring diagram in Appendix B for the following steps.
16. Install the supplied 5 ampere circuit breaker within easy reach of the pilot and label per Illustrated Parts Catalog. **Or use the 5A breaker labeled AUTOPILOT originally installed in the aircraft.**
17. If a Panel Mount unit is ordered install the supplied power switch and label.
18. Terminate the supplied DB37 connector.
19. Terminate the wiring with aircraft GPS or handheld.
20. If ARINC 429 is available from GPS terminate ARINC 429 connections.
21. Install the supplied Red Disconnect button on the left side of the pilots control yoke and label “AP DSC” “PCS” or “Autopilot Disconnect.”
22. Install the Recover button, supplied, in an available convenient location within easy reach of the pilot and label AP Recover.
23. Ensure that the analog alarm out is connected to the un-switched audio input on the Audio Panel.
24. Install the 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.

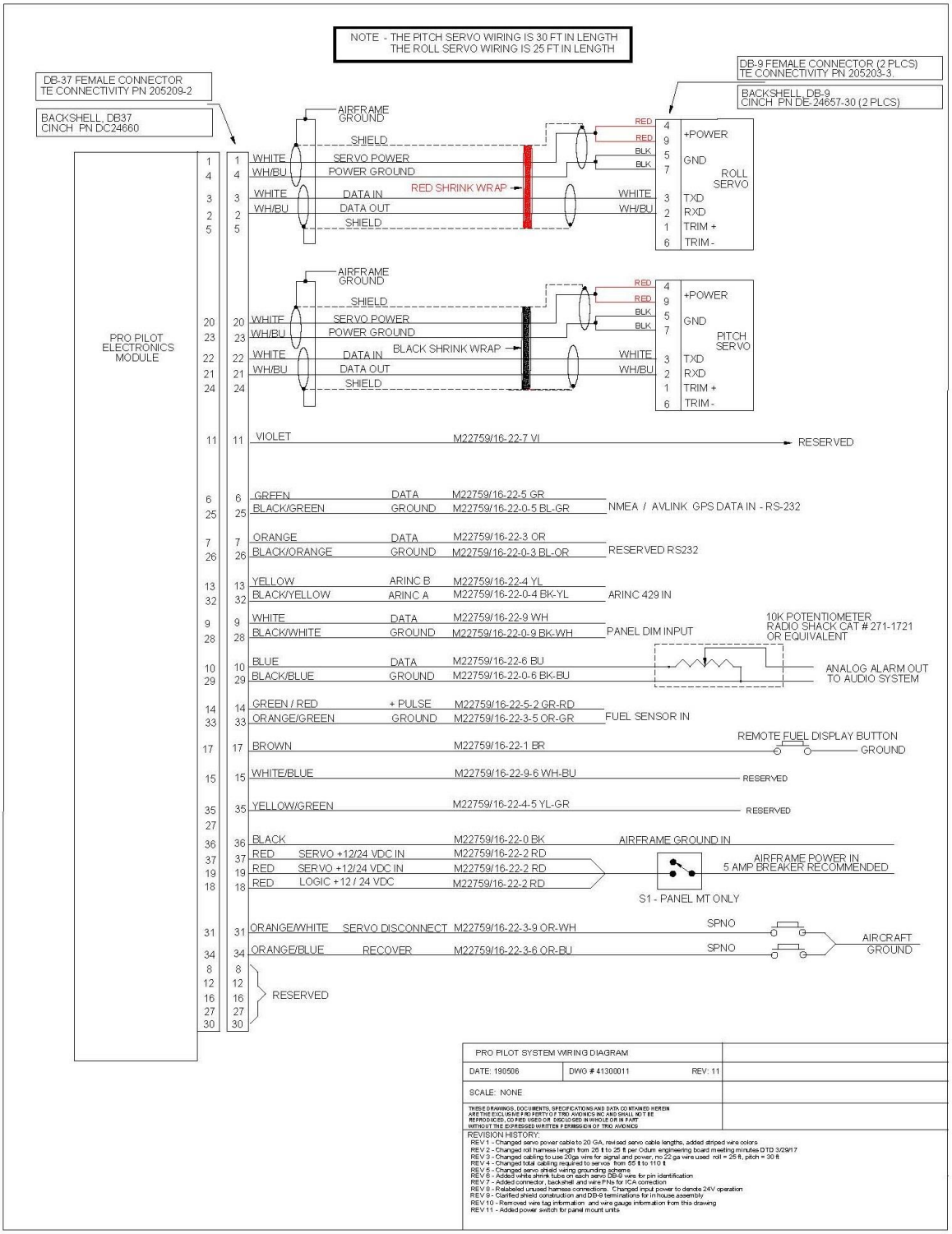
Trio Initial Setup and Checks

1. Refer to The Avionics Addendum Section 10 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 installer must complete Tests 1 through 3 of the Post Installation Flight Checks Document Number F-1006-43 current revision before the aircraft is returned to service.
5. The Avionics Addendum and Post Installation Flight Check 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)