

## CHAPTER 13

## INSTRUMENT SYSTEM

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**CHAPTER 13****INSTRUMENT SYSTEM****13-00 Description**

Standard primary instruments include an airspeed indicator, engine and rotor dual tachometer, altimeter, manifold pressure gage, and magnetic compass. Engine gages include an ammeter, oil pressure, oil temperature, cylinder head temperature, and fuel quantity for main and aux tanks. Also standard are a clock, a carburetor air temperature gage, and a digital outside air temperature gage. A collective-activated hourmeter is located right of the pilot's seat and may be used for recording time in service. (Older R44s may have an hourmeter activated by engine oil pressure.)

For instrument panels with electronic flight displays, a P/N D327 light filter may be used to reduce reflections in the windshield at night. The light filter is installed by clipping it to the front of the display. Filter use is at pilot discretion.

The pitot-static system supplies air pressure to operate the airspeed indicator, altimeter, and vertical speed indicator. The pitot tube is located on the front edge of the mast fairing. The static sources are located on each side of the cabin aft of the rear doors.

Water can be drained from pitot-static lines by removing the plastic drain plugs which are accessible through the forward inspection panel on the underside of the cabin. Draining lines should be required only if the airspeed indicator or altimeter appears erratic.

Pitot and static sources should be inspected frequently for bugs or other obstructions.

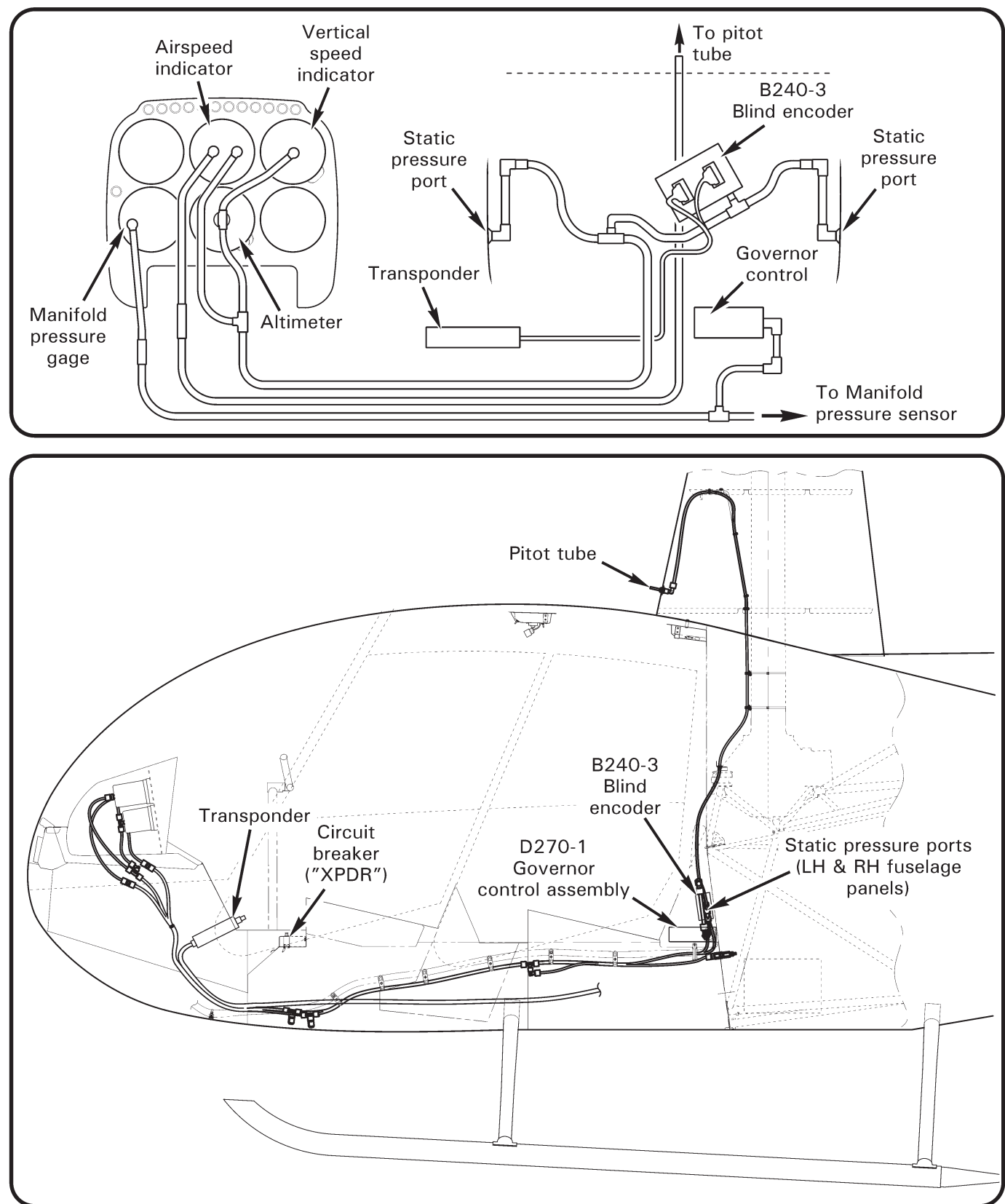


FIGURE 13-1 PITOT-STATIC SYSTEM (SHOWN WITH DIGITAL GOVERNOR)

### 13-10 Pitot-Static System

**CAUTION**

Do not apply suction to pitot system or pressure to static system.

**A. Pitot System Leak Test**

1. Open mast fairing.
2. Refer to Figure 13-1. Seal drain hole in elbow aft of pitot tube with pressure-sensitive tape. Connect a medical syringe, with plunger withdrawn, to pitot tube via flexible tubing.
3. Slowly apply pressure to pitot line by depressing syringe plunger until airspeed indicator reads 70 knots (plunger will remain in place).
4. Gently tap airspeed indicator glass to remove friction effects.
5. If airspeed indication drops more than 10 knots in one minute, an unacceptable leak is indicated. Slowly release pressure. Locate and repair any leak(s). Retest after any repairs.
6. Remove tape from pitot tube drain hole and verify airspeed indicator has returned to zero.
7. Remove test equipment. Close mast fairing.

**B. Static System Leak Test****CAUTION**

Airspeed indicator, altimeter, and vertical speed indicator may be damaged if suction to static line is applied or removed rapidly.

1. Refer to Figure 13-1. Set altimeter to location elevation.
2. Temporarily seal left or right side static opening with pressure sensitive tape. Cover remaining static port with a suction cup attached to a medical syringe, with plunger depressed.
3. Slowly apply suction to static port by withdrawing syringe plunger until altimeter indicates 500 feet greater than location elevation (plunger will remain in place).
4. If altimeter indication drops more than 100 feet in one minute, an unacceptable leak is indicated. Slowly release suction. Locate and repair leak(s). Retest after any repairs.
5. Remove test equipment.

## 13-20 Primary Instruments

### 13-21 Vertical Speed Indicator

#### **A. Description**

The vertical speed indicator indicates rate of ascent or descent. Check vertical speed indicator for a zero-rate needle indication when rotorcraft is in a stationary hover.

#### **B. Diagram**

Refer to Figure 13-1 for pitot-static system diagram.

#### **C. Removal**

##### **CAUTION**

Protect instrumentation using foam padding or equivalent. Handle instruments like eggs.

1. Turn battery switch off and pull out applicable circuit breaker(s).
2. Remove perimeter screws securing face to console and pull face aft.
3. Remove screws securing instrument to face.
4. Disconnect wiring as applicable.
5. Disconnect pitot/static lines and cap & plug instrument and system fittings, as applicable.
6. Remove instrument and place on foam padding.

#### **D. Installation**

##### **CAUTION**

Protect instrumentation using foam padding or equivalent. Handle instruments like eggs.

1. Turn battery switch off and pull out applicable circuit breaker(s).
2. Remove caps and plugs and connect pitot/static lines. Verify security.
3. Connect wiring as applicable. Verify security.
4. Install screws securing instrument to face. Verify security.
5. Install perimeter screws securing face to console. Verify security.
6. Perform pitot-static system checks as required per § 13-10.
7. Perform appropriate function checks per § 2.200.

13-21 Vertical Speed Indicator (continued)**E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

**F. Special Maintenance and Inspections**

1. If vertical speed indicator displays climb indication but does not return to zero in level flight, or if indication is erratic:
  - a. Inspect static system for water or obstructions, and remove water or obstructions if found.
  - b. Perform pitot-static system checks as required per § 13-10.
2. Perform appropriate function checks per § 2.200. If vertical speed indicator still displays erratic indication, or displays no indication, remove indicator per Part C, and return to RHC for inspection.
3. Install airworthy indicator per Part D.

## 13-22    Airspeed Indicator

### **A. Description**

The airspeed indicator displays airspeed in knots and miles or kilometers per hour. The airspeed indicator operates properly in forward flight only; backward or lateral flight will not indicate correct airspeed. The airspeed indicator will indicate airspeeds up to a maximum of 130 knots (red line) for R44s and R44 IIs, and up to a maximum of 120 knots (red line) for R44 Cadet.

### **B. Diagram**

Refer to Figure 13-1 for pitot-static system diagram.

### **C. Removal**

Remove airspeed indicator per § 13-21 Part C.

### **D. Installation**

Install airspeed indicator per § 13-21 Part D.

### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

### **F. Special Maintenance and Inspections**

1. If airspeed indicator displays no indication:
  - a. Inspect pitot tube for obstructions and remove obstructions if found.
  - b. Inspect pitot tube connection, and tighten connection if loose.
  - c. Open upper console and inspect pitot line for kinks or bends.
  - d. Perform pitot-static system checks as required per § 13-10.
  - e. Perform appropriate function checks per § 2.200. If indicator still displays no indication, remove indicator per Part C, and return to RHC for inspection.
  - f. Install airworthy indicator per Part D.
2. If airspeed indicator displays erratic indication:
  - a. Inspect pitot-static system connection(s), and tighten connection(s) if loose.
  - b. Inspect pitot-static system lines and verify no lines are cracked or broken.
  - c. Inspect pitot-static system for water, and remove water if found.
  - d. Open upper console and inspect pitot lines for kinks or bends.
  - e. Perform pitot-static system checks as required per § 13-10.
  - f. Perform appropriate function checks per § 2.200. If indicator still displays erratic indication, remove indicator per Part C, and return to RHC for inspection.
  - g. Install airworthy indicator per Part D.



13-23 Dual Tachometer**A. Description****CAUTION**

Installation of electrical devices can affect accuracy and reliability of electronic tachometers.

An electronic engine and rotor dual tachometer is standard. Engine tachometer signal is provided by magneto breaker points. Rotor tachometer signal is provided by two magnetic senders at the main gearbox drive yoke. Each tachometer is on a separate circuit with its own circuit breaker. With battery and alternator switches off, the tachometers continue to receive power from the battery through a bypass circuit as long as the clutch actuator switch is in the engage position.

**NOTE**

Do not stow helicopter with clutch switch engaged. The tachometers are powered with the clutch engaged and will discharge the battery.

**NOTE**

Do not use magnetized tools.

**CAUTION**

Protect instrumentation using foam padding or equivalent. Handle instruments like eggs.

**B. Removal**

1. Turn battery switch off and pull out TACHS E (2 amp) and R (2 amp) circuit breakers at panel.
2. Remove perimeter screws securing instrument face to console and pull face aft.
3. Remove screws securing console harness connector to C792 dual tachometer and unplug connector.
4. Supporting instrument, remove screws securing tachometer to face, and remove tachometer.

13-23 Dual Tachometer (continued)**C. Installation**

1. Turn battery switch off and pull out TACHS E (2 amp) and R (2 amp) circuit breakers at panel.
2. Install screws securing C792 dual tachometer to instrument face. Verify security.
3. Plug in console harness connector to tachometer and install connector screws. Verify security.
4. Install perimeter screws securing face to console. Verify security.
5. Perform accuracy check and needle synchronization per Part D.

**D. Adjustment****NOTE**

Adjust rotor tachometer if engine and rotor tachometer needles are not within 1% of each other at 102% RPM.

1. Remove screws securing instrument face panel to upper console and carefully pull panel aft.
2. Run-up helicopter per R44, R44 II, or R44 Cadet Pilot's Operating Handbook (POH) Section 6 at 102% engine tachometer indication.
3. Turn adjustment screw on back of tachometer (apply 1/8 turns) clockwise to increase and counterclockwise to decrease rotor tachometer indication. Adjust rotor tachometer to indicate 102%.
4. Shutdown helicopter per POH Section 6. Tighten screws securing instrument panel to upper console.

**E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

Refer to §§ 2.600 & 2.700 for additional component maintenance.

**F. Special Maintenance and Inspections**

1. Perform adjustment as required per Part D.
2. If tachometer cannot be adjusted, remove tachometer per Part B, and return to RHC for inspection.
3. Install airworthy tachometer per Part C.

### 13-24 Altimeter

#### **A. Description**

The sensitive altimeter provides altitude information relative to mean sea level when the barometric pressure correction scale is properly set. Check altimeter calibration by setting correction scale to the current altimeter setting and checking the altimeter reading against field elevation; they must agree within 70 feet.

#### **B. Diagram**

Refer to Figure 13-1 for pitot-static system diagram.

#### **C. Removal**

Remove altimeter per § 13-21 Part C.

#### **D. Installation**

Install altimeter per § 13-21 Part D.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

1. If altimeter displays no indication:
  - a. Inspect static lines for obstructions and remove obstructions if found.
  - b. Perform pitot-static system checks as required per § 13-10.
  - c. Perform appropriate function checks per § 2.200. If altimeter still displays no indication, remove altimeter per Part C, and return to RHC for inspection.
  - d. Install airworthy altimeter per Part D.
2. If altimeter displays erratic indication:
  - a. Inspect static system for water, and remove water if found.
  - b. Perform pitot-static system checks as required per § 13-10.
  - c. Perform appropriate function checks per § 2.200. If altimeter still displays erratic indication, remove altimeter per Part C, and return to RHC for inspection.
  - d. Install airworthy altimeter per Part D.

### 13-25 Manifold Pressure Gage

#### **A. Description**

The manifold pressure gage provides an indicator of absolute air pressure in the engine intake manifold. The red line on the gage indicates the maximum manifold pressure that the rotorcraft is type certificated for at 102% rotor RPM. The manifold pressure gage should indicate within 0.3 inches Hg of ambient barometric pressure when engine is not running.

#### **B. Removal**

Remove manifold pressure gage per § 13-21 Part C.

#### **C. Installation**

Install manifold pressure gage per § 13-21 Part D.

#### **D. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **E. Special Maintenance and Inspections**

##### Manifold Pressure System Leak Check

1. Disconnect C740-1 (O-540) or D740-1 (IO-540) line assembly from engine fitting.
2. Connect a medical syringe, with plunger depressed, to line assembly fitting via flexible tubing.
3. Slowly apply suction to system by withdrawing syringe plunger until manifold pressure gage indicates 10 inches Hg (plunger will remain in place).
4. If manifold pressure gage indication rises more than one inch in one minute, an unacceptable leak is indicated. Slowly release suction. Locate and repair leak(s). Retest after any repairs.
5. Remove test equipment.

### 13-26 Magnetic Compass

#### **A. Description**

An internally illuminated, wet-type compass is attached to the center bow between the windshields above the instrument panel.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

1. Remove hardware securing compass mount to windshield bow.
2. Remove hardware securing compass assembly to mount.
3. Remove heat shrink as required and disconnect light bar wires from airframe harness. Remove compass.

#### **D. Installation**

1. Install heat shrinks over wires and connect compass assembly's light bar wires to airframe harness. Verify security. Activate heat shrinks.
2. Install hardware securing compass to mount. Verify security.
3. Install hardware securing mount to windshield bow. Verify security.
4. At governed RPM, using the airport compass rose, align the helicopter skids on the rose lines, and record the indicated compass headings at 30° increments. Adjust compass compensator magnets as required until the maximum error at any heading is 5° or less with all avionics operating, all exterior lights on, and dimmer full bright. Record the final readings on the aircraft compass card. Re-check 4 cardinal headings with lights off and all avionics off except COM radio 1 and transponder. Verify maximum error remains 5° or less.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

1. Perform compass deviation check per Part D step 4.
2. If compass cannot be adjusted to limits specified, remove compass per Part C, and install airworthy compass per Part D.

## 13-30 Engine Gages

### 13-31 Ammeter

#### **A. Description**

The ammeter indicates electrical system loads. System load is measured across the A780 cable (shunt; cable is calibrated, do not alter cable).

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Instrument Cluster Removal**

1. Turn battery switch off and pull out applicable circuit breaker(s).
2. Remove electronic flight display(s) per § 13-70, if installed.
3. Remove screws securing upper console to lower console and tilt upper console aft.
4. Remove nuts securing console wiring to B144 instrument cluster and remove wiring.
5. Remove screws securing instrument cluster to shell assembly's face plate and remove instrument cluster.

#### **D. Instrument Cluster Installation**

1. Turn battery switch off and pull out applicable circuit breaker(s).
2. Position B144 instrument cluster on shell assembly's face plate and install screws. Verify security.
3. Install nuts securing console wiring to instrument cluster studs. Verify security.
4. Tilt console forward and install screws securing upper console to lower console. Verify security.
5. Install electronic flight display(s) per § 13-70, if removed.
6. Perform appropriate function checks per § 2.200.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

1. Check continuity across two 3-amp fuses in B304-18 fuse assembly (at the ammeter shunt) and replace fuse assembly as required.
2. Inspect wiring for loose, chafed, frayed, or broken wires. Verify no damaged connectors. Verify wiring neatness, proper routing and installation, and security.
3. If ammeter is still inoperative, remove ammeter per Part C, and install airworthy ammeter per Part D.

### 13-32 Engine Oil Pressure Gage

#### **A. Description**

The engine oil pressure gage indicates engine oil pressure and receives its signal from a variable-resistor-type sender located in left-hand forward corner of engine compartment next to hourmeter pressure switch.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

Remove instrument cluster per § 13-31 Part C.

#### **D. Installation**

Install instrument cluster per § 13-31 Part D.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

1. Inspect wiring for loose, chafed, frayed, or broken wires. Verify no damaged connectors. Verify wiring neatness, proper routing and installation, and security.
2. Perform appropriate function checks per § 2.200. If accuracy of engine gage is suspected, remove instrument cluster per § 13-31 Part C, and return to RHC for inspection.
3. Install airworthy instrument cluster per § 13-31 Part D.

### 13-33 Engine Oil Temperature Gage

#### **A. Description**

The engine oil temperature gage indicates engine oil temperature and receives its signal from a probe mounted in the engine oil pressure screen housing or oil filter adapter.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

Remove instrument cluster per § 13-31 Part C.

#### **D. Installation**

Install instrument cluster per § 13-31 Part D.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

Perform special maintenance and inspections per § 13-32 Part F.

### 13-34 Cylinder Head Temperature Gage

#### **A. Description**

The cylinder head temperature gage indicates the temperature of cylinder #2 (O-540), cylinder #1, or #5 (IO-540) and receives its signal from a probe installed in the bottom of the cylinder head.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

Remove instrument cluster per § 13-31 Part C.

#### **D. Installation**

Install instrument cluster per § 13-31 Part D.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

Perform special maintenance and inspections per § 13-32 Part F.



### 13-35 Fuel Quantity Gages

#### **A. Description**

The fuel quantity gages indicate the fuel level of main and aux fuel tanks and receive signals from variable-resistance-type senders mounted on the bottom of each tank.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

Remove instrument cluster per § 13-31 Part C.

#### **D. Installation**

Install instrument cluster per § 13-31 Part D.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

Perform special maintenance and inspections per § 13-32 Part F.

### 13-36 Carburetor Air Temperature Gage (O-540)

#### **A. Description**

The carburetor air temperature gage is used to determine when carburetor heat is required during possible carburetor icing conditions, such as high humidity. Apply heat as required to keep needle out of yellow band. The carburetor air temperature gage should read approximately the same as the OAT gage when engine is cold.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

Remove instrument cluster per § 13-31 Part C.

#### **D. Installation**

Install instrument cluster per § 13-31 Part D.

#### **E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

#### **F. Special Maintenance and Inspections**

Perform special maintenance and inspections per § 13-32 Part F.

**13-40 Additional Standard Indicating Equipment****13-41 Clock****A. Description**

A manually set electric analog clock is standard equipment; a digital clock is optional.

**B. Schematic**

Refer to Figure 14-21 for electrical schematic.

**C. Removal**

1. Turn battery switch off.
2. a. Remove perimeter screws securing face to console and pull face aft.  
b. Remove electronic flight display(s) per § 13-70, and remove screws securing upper console to lower console and tilt upper console aft.
3. Remove screws securing clock to face.
4. Disconnect console wiring from clock wiring at connectors, and remove clock.

**D. Installation**

1. Turn battery switch off.
2. Connect console wiring to clock wiring at connectors. Verify security.
3. Install screws securing clock to face. Verify security.
4. a. Install perimeter screws securing face to console and verify security.  
b. Tilt console forward and install screws securing upper console to lower console and verify security; install electronic flight display(s) per § 13-70, if removed.
6. Perform appropriate function checks per § 2.200.

**E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

**F. Special Maintenance and Inspections**

1. Check AGC-3 (3 amp) fuse at firewall for evidence of melting and replace fuse as required.
2. Inspect wiring for loose, chafed, frayed, or broken wires. Verify no damaged connectors. Verify wiring neatness, proper routing and installation, and security.
3. If clock is still inoperative, remove clock per Part C, and install airworthy clock per Part D.

**13-42 Outside Air Temperature (OAT) Gage/Voltmeter****A. Description****NOTE**

No cutting or splicing of OAT probe wires is permitted.

The outside air temperature indicator has a stainless steel probe protruding from chin of rotorcraft and is connected to gage by a calibrated length of cable.

**B. Schematic**

Refer to Figure 14-21 for electrical schematic.

**C. Removal**

1. Turn battery switch off.
2. Remove electronic flight display(s) per § 13-70, if installed.
3. Remove screws securing upper console to lower console and tilt upper console aft.
4. Remove screws securing OAT gage to face.
5. Disconnect console wiring from OAT gage wiring at connectors, and remove gage.

**D. Installation**

1. Turn battery switch off.
2. Connect console wiring to OAT gage wiring at connectors. Verify security.
3. Install screws securing OAT gage to face. Verify security.
4. Tilt console forward and install screws securing upper console to lower console. Verify security.
5. Install electronic flight display(s) per § 13-70, if removed.
6. Perform appropriate function checks per § 2.200.

**E. Scheduled Maintenance and Inspections**

Refer to § 2.400 100-Hour/Annual Inspection.

**F. Special Maintenance and Inspections**

1. Inspect wiring for loose, chafed, frayed, or broken wires. Verify no damaged connectors. Verify wiring neatness, proper routing and installation, and security.
2. If OAT gage is still inoperative, remove OAT gage per Part C, and install airworthy OAT gage per Part D.

### 13-43 Hourmeter

#### **A. Description**

An hourmeter actuated by engine oil pressure and collective switch is located to the right of the pilot's seat.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

1. Remove screws securing D830-2 hourmeter to C353-2 panel, right of the pilot's seat.
2. Disconnect airframe wiring from hourmeter and remove hourmeter.

#### **D. Installation**

1. Connect airframe wiring to hourmeter (C859-42 to positive terminal). Verify security.
2. Install screws securing D830-2 hourmeter to C353-2 panel, right of the pilot's seat. Verify security.

#### **E. Scheduled Maintenance and Inspections**

On condition.

#### **F. Special Maintenance and Inspections**

1. Inspect wiring for loose, chafed, frayed, or broken wires. Verify no damaged connectors. Verify wiring neatness, proper routing and installation, and security.
2. If hourmeter is still inoperative, remove hourmeter per Part C, and install airworthy hourmeter per Part D. Make appropriate maintenance record entries.

## 13-50 Senders and Sensors

### 13-51 Oil Temperature Senders

#### **A. Description**

A760-1 Oil temperature sender (single) is for use with the B144-3 (14V) or B144-4 (28V) instrument cluster. A760-3 oil temperature sender (dual) is for use with the B144-5 (10–32V) instrument cluster.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

1. Remove left side engine cowling.
2. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
3. Using backup wrench, remove nut securing C049 harness assembly's wire terminal to A760 oil temperature sender stud.
4. Cut and discard lockwire securing sender to thermostatic oil cooler bypass valve. Remove sender from D723-1 adapter assembly.

#### **D. Installation**

1. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install gasket supplied with A760 oil temperature sender, and sender, in D723-1 adapter assembly. Special torque sender to 300 in.-lb and torque stripe per Figure 2-1. Safety sender to thermostatic oil cooler bypass valve using 0.032-inch diameter lockwire.
3. Attach C049 harness assembly's wire terminal to sender; using backup wrench, install nut securing wire terminal to sender. Special torque nut to 20 in.-lb and torque stripe per Figure 2-1.
4. Install left side engine cowling. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

### 13-52 Cylinder Head Temperature (CHT) Senders

#### **A. Description**

A760-2 Cylinder head temperature sender is for use with the B144-5 (10–32V) instrument cluster. 3080-00038 cylinder head temperature probe is for use with the B144-3 (14V) or B144-4 (28V) instrument cluster.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

1. Remove right or left side engine cowling, as applicable.
2. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
3. Using backup wrench, remove palnut and brass nut securing C049 harness assembly's -34 wire terminal to A760-2 or 3080-00038 cylinder head temperature sender/probe stud (one brass nut remains on stud). Discard palnut.
4. Remove sender/probe from cylinder head (O-540 without air conditioning: aft, RH [#2]; O-540 with air conditioning: forward, LH [#5]; IO-540: forward, LH [#5]).

#### **D. Installation**

1. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install gasket supplied with A760-2 or 3080-00038 cylinder head temperature sender/probe, and sender/probe, in cylinder head (O-540 without air conditioning: aft, RH [#2]; O-540 with air conditioning: forward, LH [#5]; IO-540: forward, LH [#5]). Special torque sender/probe to 75 in.-lb and torque stripe per Figure 2-1.
3. Calibrate cylinder head temperature gage per Part E, as required.
4. Attach C049 harness assembly's -34 wire terminal to sender/probe. Using backup wrench, install brass nut securing wire terminal to sender/probe; tighten nut. Install new B330-2 palnut; tighten palnut. Torque stripe per Figure 2-1.
5. Install engine cowling. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

13-52 Cylinder Head Temperature (CHT) Senders (continued)**E. Calibration****NOTE**

C691-1 Circuit board assembly must be installed on B144 instrument cluster to perform calibration. For earlier helicopters, order and install KI-249 CHT Gage Calibration Kit, as required (refer to R44 Service Letter SL-59).

1. Turn battery switch off and pull all circuit breakers.
2. Remove right or left side engine cowling, as applicable.
3. Using backup wrench, remove palnut and brass nut securing C049 harness assembly's -34 wire terminal to A760-2 or 3080-00038 cylinder head temperature sender/probe stud (one brass nut remains on stud). Discard palnut.
4. Open instrument console for access to back side of CHT gage in B144 instrument cluster.
5. Refer to Figure 13-2. Adjust resistance decade box to  $32 \pm 0.4$  ohms and verify resistance with multimeter. Alternately, a  $32.0 \pm 0.4$  ohm resistor may be used instead of decade box. Connect a low-impedance ( $<1$  ohm) test lead to one terminal on decade box and clamp opposite end of lead to hexagonal body of CHT probe; do not connect lead to center conductor of sender/probe. Connect -34 wire to remaining terminal on decade box.

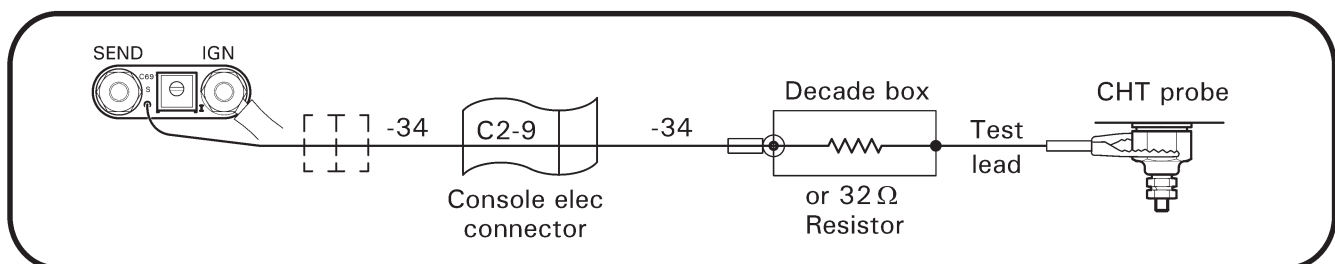


FIGURE 13-2 CYLINDER HEAT TEMPERATURE GAGE CALIBRATION

6. Refer to Figure 13-3. Push in GAGES 2-amp circuit breaker. Turn battery switch on and observe CHT gage. Adjust potentiometer screw on C691-1 circuit board assembly until gage indicates within limits shown with console in closed position (CHT probe resistance is  $32 \pm 0.4$  ohms at  $500^{\circ}$  F).
7. Cut small square of A701-1 aluminum tape sized to fit potentiometer face. Apply tape to potentiometer and press tape tight against adjustment screw to prevent rotation (pressing with a pencil eraser works well). Verify CHT needle has not moved. If movement is noted, remove tape and repeat step 6 as required. Turn battery switch off.

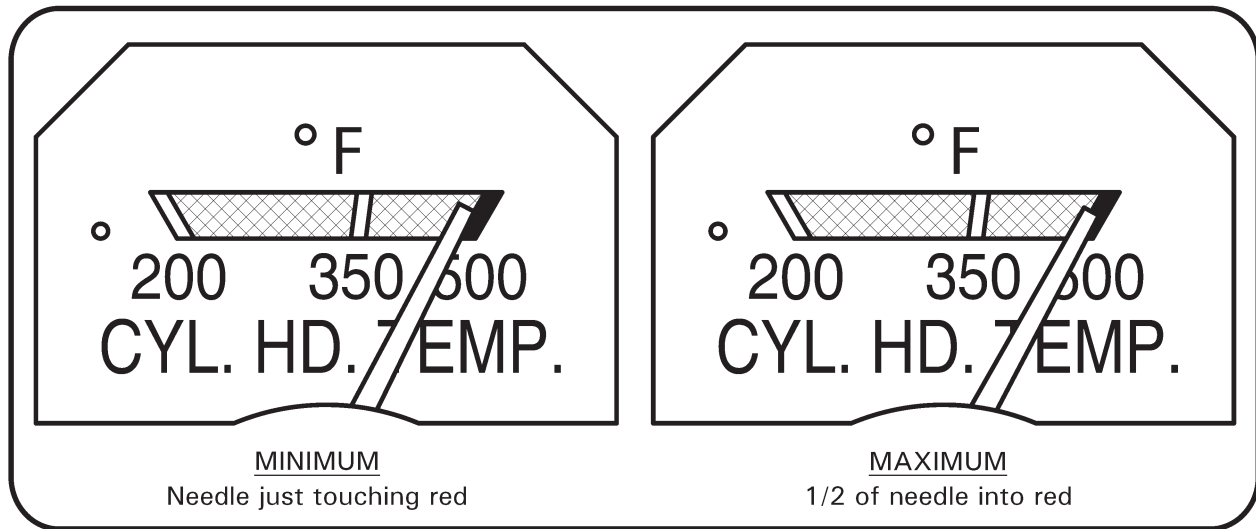


FIGURE 13-3 CYLINDER HEAT TEMPERATURE GAGE CALIBRATION

### 13-52 Cylinder Head Temperature (CHT) Senders (continued)

#### E. Calibration (continued)

8. Close and secure instrument console. Push in all remaining circuit breakers.
9. Attach C049 harness assembly's -34 wire terminal to sender/probe. Using backup wrench, install brass nut securing wire terminal to sender/probe; tighten nut. Install new B330-2 palnut; tighten palnut. Torque stripe per Figure 2-1.
10. Install engine cowling.



### 13-53 Outside Air Temperature (OAT) Senders

#### **A. Description**

The A760-4 OAT sender is the data input for the D270-1 governor/engine monitoring unit; the B341-4 OAT sender is the data input for the B341-1 OAT gage.

#### **B. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **C. Removal**

1. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
2. Remove forward belly panel.
3. Cut and discard ty-raps as required and disconnect A760-4 OAT wiring from airframe harness at connectors; remove hardware securing ground wire. Using backup wrench, remove nut and lockwasher securing sender probe to cabin.

#### **D. Installation**

1. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install lockwasher and nut securing A760-4 OAT sender probe to cabin. Using backup wrench, special torque nut to 18 in.-lb. Verify security.
3. Connect OAT sender wiring to airframe harness at connectors; install hardware securing ground wire. Verify security. Install ty-raps as required to securing wiring; cinch ty-raps until snug without overtightening and trim tips flush with heads.
4. Install forward belly panel. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

### 13-54 Engine Tachometer Hall Effect Sensor Assembly

#### **A. Schematic**

Refer to Figure 14-21 for electrical schematic.

#### **B. Removal**

1. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
2. Remove engine left side cowling.
3. Cut and discard ty-raps as required and disconnect C143-2 hall effect sensor assembly wiring from airframe harness at connectors.
4. Remove engine-supplied hardware securing sensor assembly and engine-supplied gasket to engine; remove sensor assembly and gasket.

#### **C. Installation**

1. Turn battery switch off & pull out GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install engine-supplied gasket and C143-2 hall effect sensor assembly on engine and install engine-supplied hardware. Special torque nuts to 96 in.-lb. Verify security.
3. Connect sensor assembly wiring to airframe harness at connectors and install ty-raps, as required. Cinch ty-raps until snug without overtightening and trim tips flush with heads.
4. Install engine left side cowling. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

### 13-60 Instrument Markings

See R44, R44 II, or R44 Cadet Pilot's Operating Handbook (POH) Section 2 for instrument markings.

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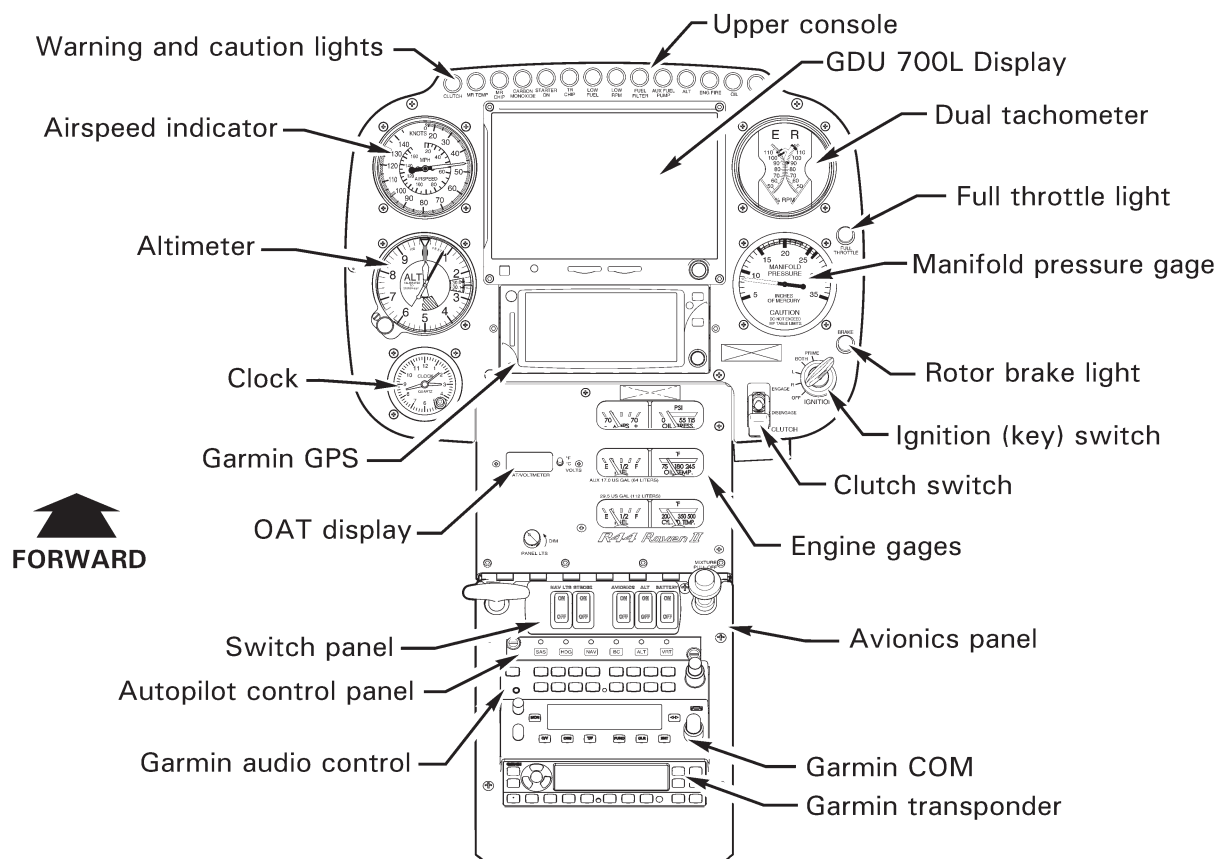


FIGURE 13-4 GARMIN G500H UPPER CONSOLE WITH GDU 700L (R44 II SHOWN)

## 13-70 Electronic Flight Displays

### 13-71 Garmin Display Unit (GDU) 700L

#### NOTE

Refer to Garmin G500H Instructions for Continued Airworthiness.

#### A. Description

The GDU 700L integrates with the Garmin G500H Electronic Flight Instrument System (EFIS). Similar to the GDU 620, the GDU 700L electronically displays primary flight instrumentation via a primary flight display (PFD) and moving map and other functionality via a multifunction display (MFD), but includes touch-screen technology on one 7 inch display.

Refer to § 38-10 for Garmin G500H EFIS system components.

#### B. Schematics

Refer to Figure 14-36 for GDU 700L installation electrical schematic.

Refer to Figures 13-1, 13-5 (STD), & 13-6 (Floats) for Garmin G500H upper console pitot-static schematic.

13-71 Garmin Display Unit (GDU) 700L (continued)**C. Removal**

1. Turn battery & avionics switches off and pull out EFIS circuit breaker (5 amp) at panel.
2. Remove screws securing GDU display to console face.
3. Pull out and support display, unplug console harness connectors, and remove display.

**D. Installation**

1. Turn battery & avionics switches off and pull out EFIS circuit breaker (5 amp) at panel.
2. Visually inspect console harness connectors and verify no bent or damaged pins. Support display and plug in console harness connectors.
3. Place GDU display in console, then install and tighten screws. Verify security.
4. Push in EFIS circuit breaker at panel. Turn battery & avionics switches on.

**NOTE**

Refer to R44 Service Letter SL-57A. There is no continuing airworthiness requirement to check or update avionics software levels. Software updates should not be attempted without a thorough understanding of approval status and compatibility.

5. Perform appropriate functional checks per Garmin G500H Instructions for Continued Airworthiness. Turn battery & avionics switches off.

**E. Scheduled Maintenance and Inspections**

Refer to Garmin G500H Instructions for Continued Airworthiness.

**F. Special Maintenance and Inspections**

1. Remove GDU per Part C.
2. Open circuit breaker panel and upper console.
3. Inspect condition of and verify no obvious damage to GDU, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify installed equipment security.
4. Secure circuit breaker panel and upper console.
5. Install GDU per Part D.

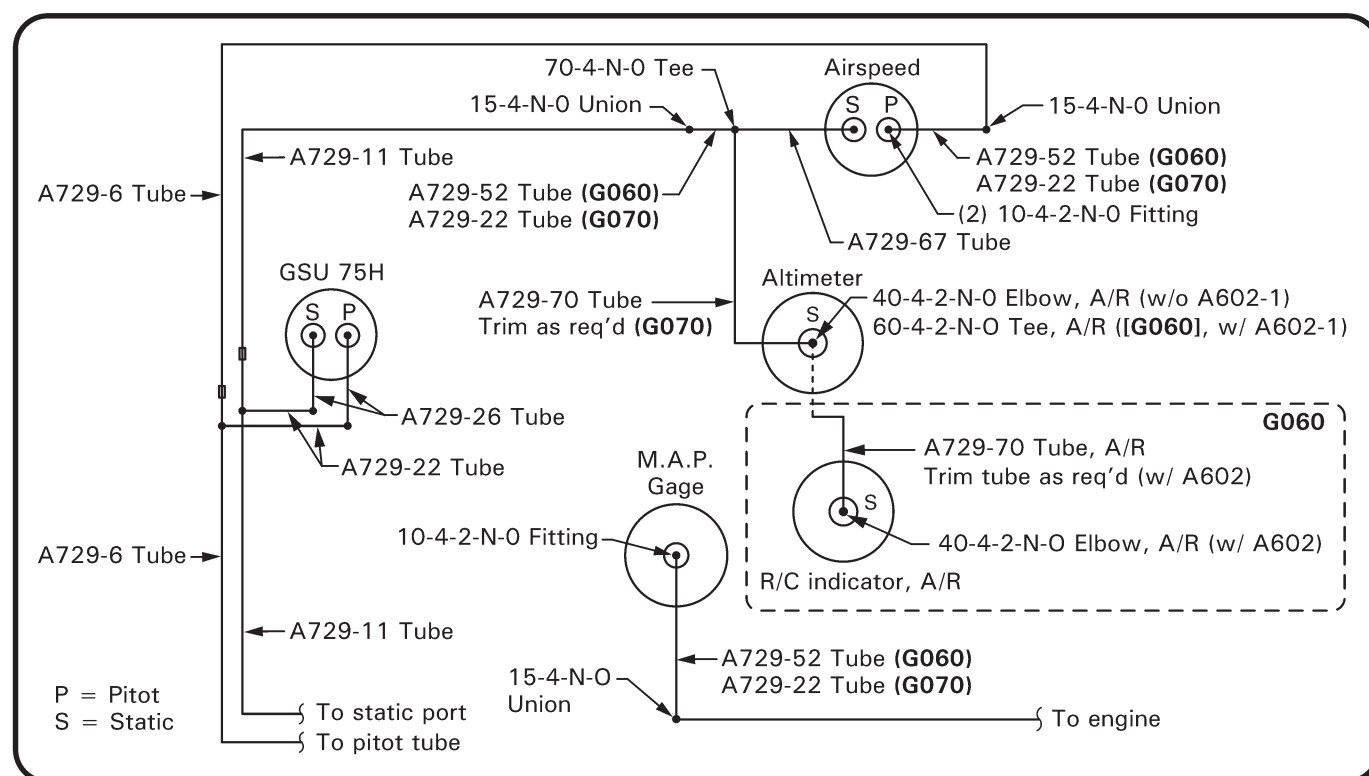


FIGURE 13-5 GARMIN G500H UPPER CONSOLE PITOT-STATIC SCHEMATIC (STD)

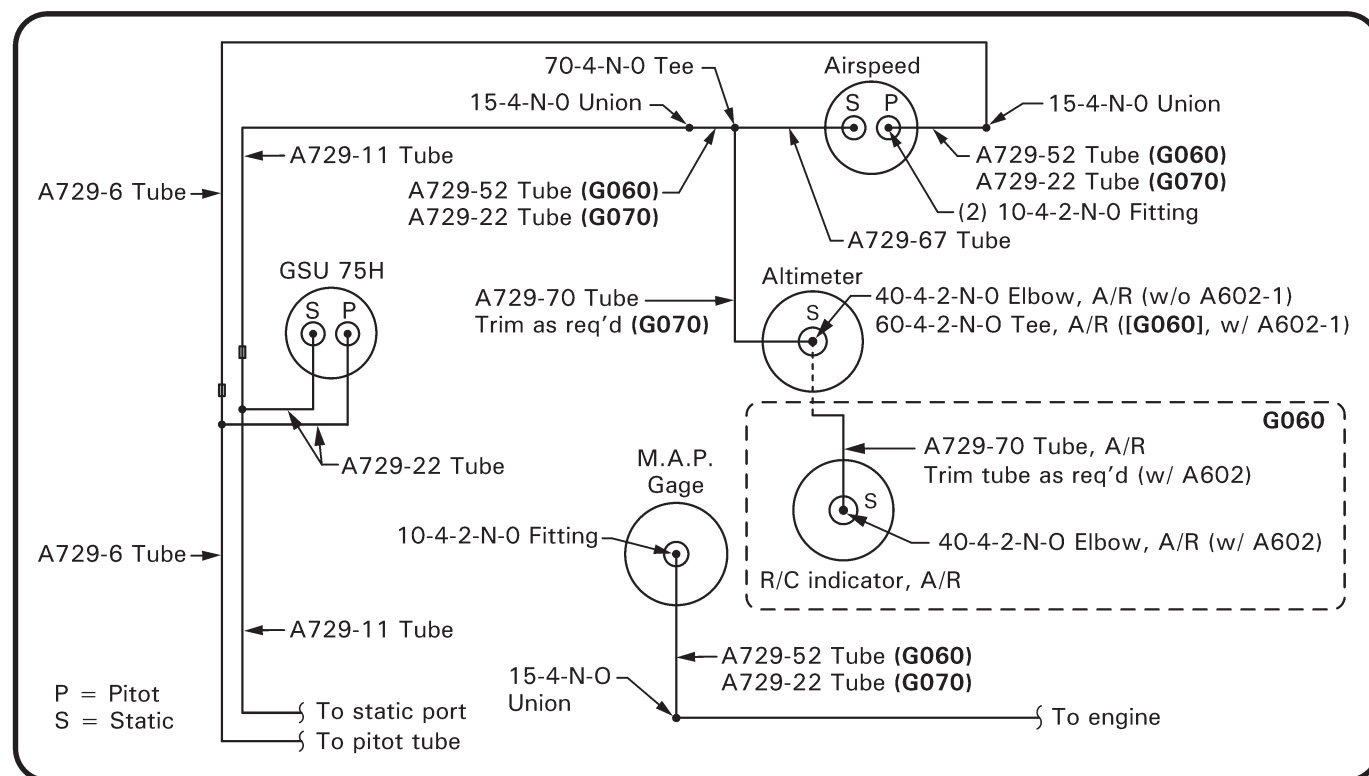


FIGURE 13-6 GARMIN G500H UPPER CONSOLE PITOT-STATIC SCHEMATIC (FLOATS)

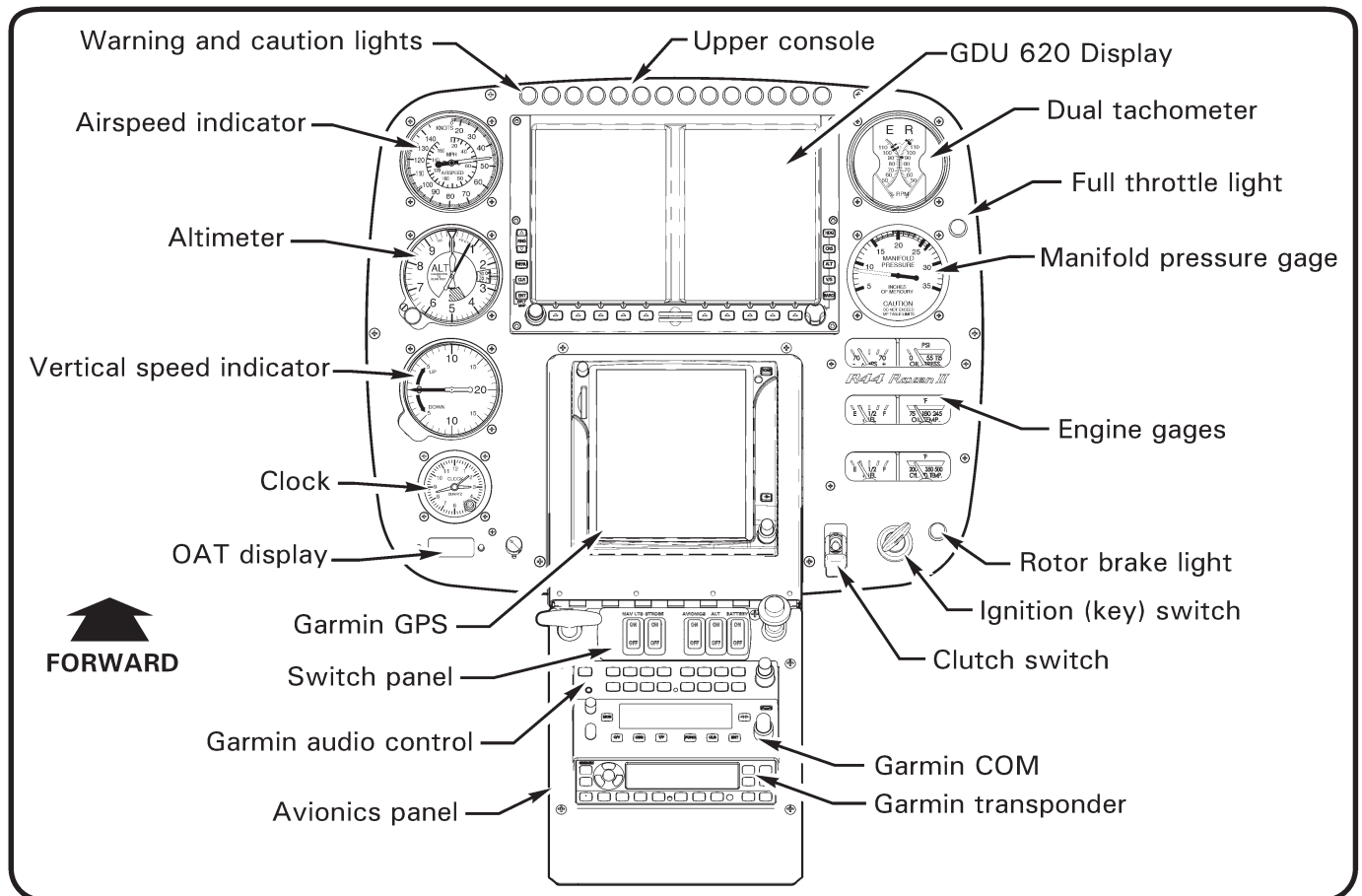


FIGURE 13-7 GARMIN G500H UPPER CONSOLE WITH GARMIN GDU 620 DISPLAY (R44 II SHOWN)

### 13-72 Garmin Display Unit (GDU) 620

#### NOTE

Refer to Garmin G500H Instructions for Continued Airworthiness.

#### A. Description

The GDU 620 integrates with the Garmin G500H Electronic Flight Instrument System (EFIS). The GDU 620 electronically displays primary flight instrumentation via a primary flight display (PFD) and moving map, weather, traffic, terrain and other functionality via a multifunction display (MFD) on dual 6.5 inch displays.

Refer to § 38-10 for Garmin G500H EFIS system components.

#### B. Schematics

Refer to Figure 14-35 for GDU 620 installation electrical schematic.

Refer to Figures 13-1, 13-5 (STD), & 13-6 (Floats) for Garmin G500H upper console pitot-static schematic.

**13-72 Garmin Display Unit (GDU) 620 (continued)****C. Removal**

Remove GDU per § 13-71 Part C.

**D. Installation**

Install GDU per § 13-71 Part D.

**E. Scheduled Maintenance and Inspections**

Refer to Garmin G500H Instructions for Continued Airworthiness.

**F. Special Maintenance and Inspections**

Refer to § 13-71 Part F.



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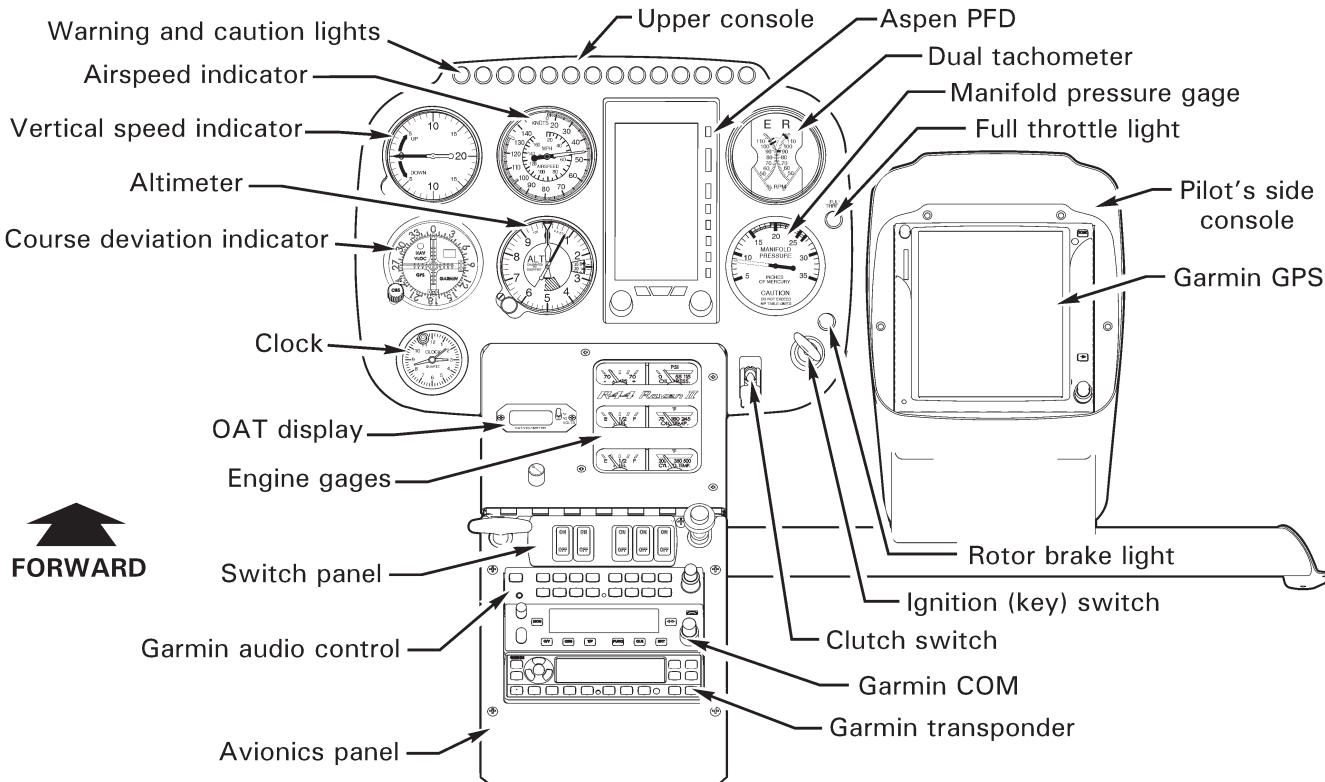


FIGURE 13-8 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD - TYPICAL (R44 II SHOWN)

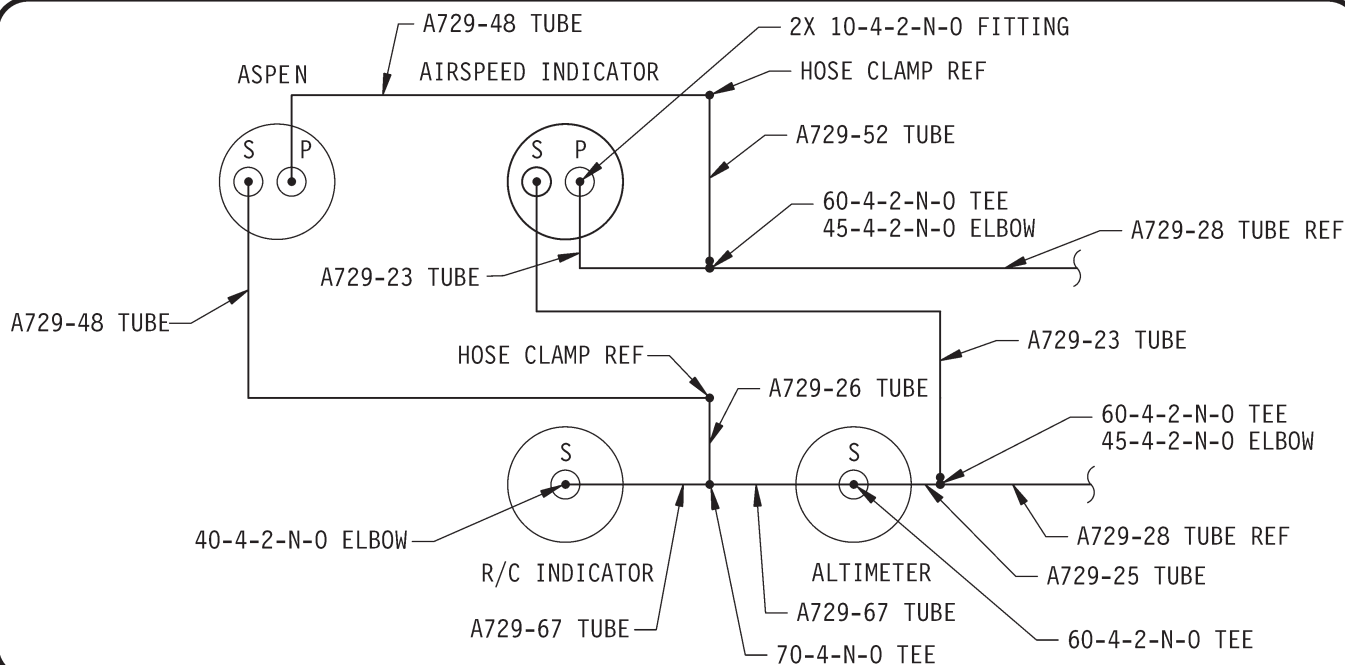


FIGURE 13-9 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD PITOT-STATIC SCHEMATIC

## 13-73 Aspen EFD500H &amp; EFD1000H Display(s)

**A. Description**

R44 options include a single screen Aspen PFD, or a dual-screen Aspen PFD and MFD.

The Aspen PFD (Primary Flight Display) is an LCD unit with displays for attitude, altitude, airspeed, heading, and optional NAV (HSI/CDI). The Aspen PFD is a situational awareness aid, to be used in conjunction with required VFR instruments (altimeter, airspeed indicator, and magnetic compass).

The standard Aspen PFD installation configures the lower half of the display as a directional gyro. An optional installation configures the lower half of the display to a Horizontal Situation Indicator (HSI). Primary GPS position data is provided by GTN-series GPS. Heading and outside air temperature data is received from the Aspen remote sensor module (RSM). The RSM provides backup GPS position data if primary GPS fails.

The Aspen MFD (Multifunction Display) is an LCD unit with displays for moving map navigation data, terrain, and traffic. Terrain and traffic may also be overlaid on moving map. GPS position data is provided by Garmin GTN-series GPS for moving map and terrain displays. Aspen MFD also includes an internal terrain database. TIS-A traffic data may be received from Garmin GTX330 transponder for moving map display.

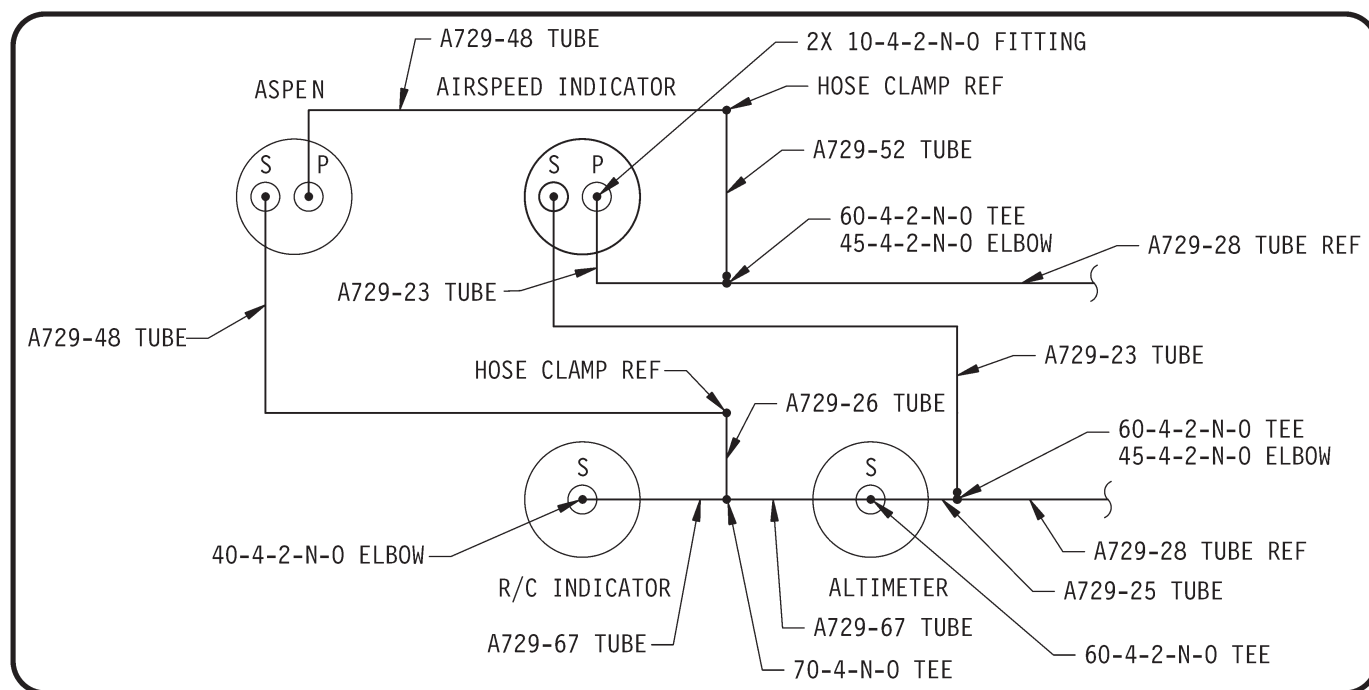


FIGURE 13-10 SIX-INSTRUMENT CONSOLE WITH ASPEN PFD PITOT-STATIC SCHEMATIC

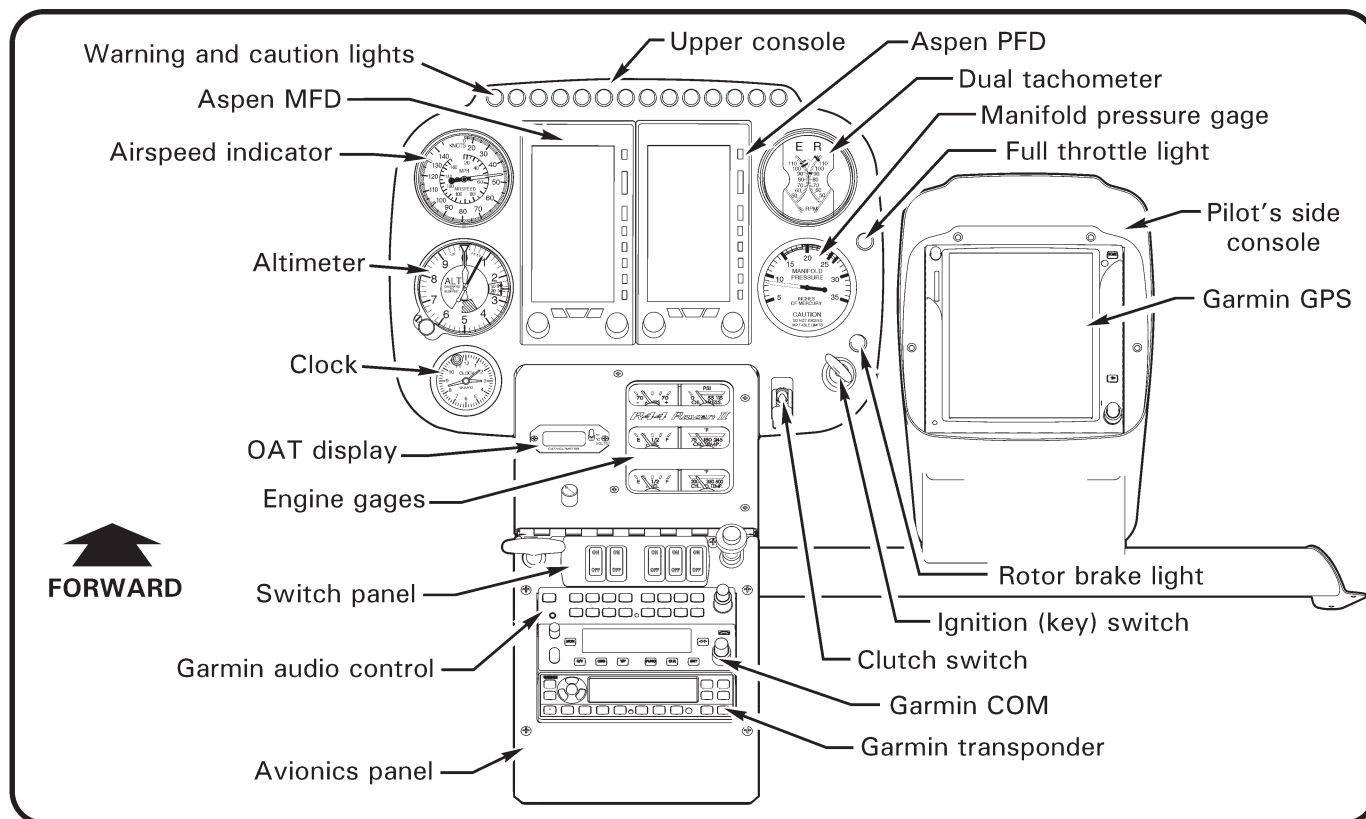


FIGURE 13-11 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD AND MFD – TYPICAL (R44 II SHOWN)

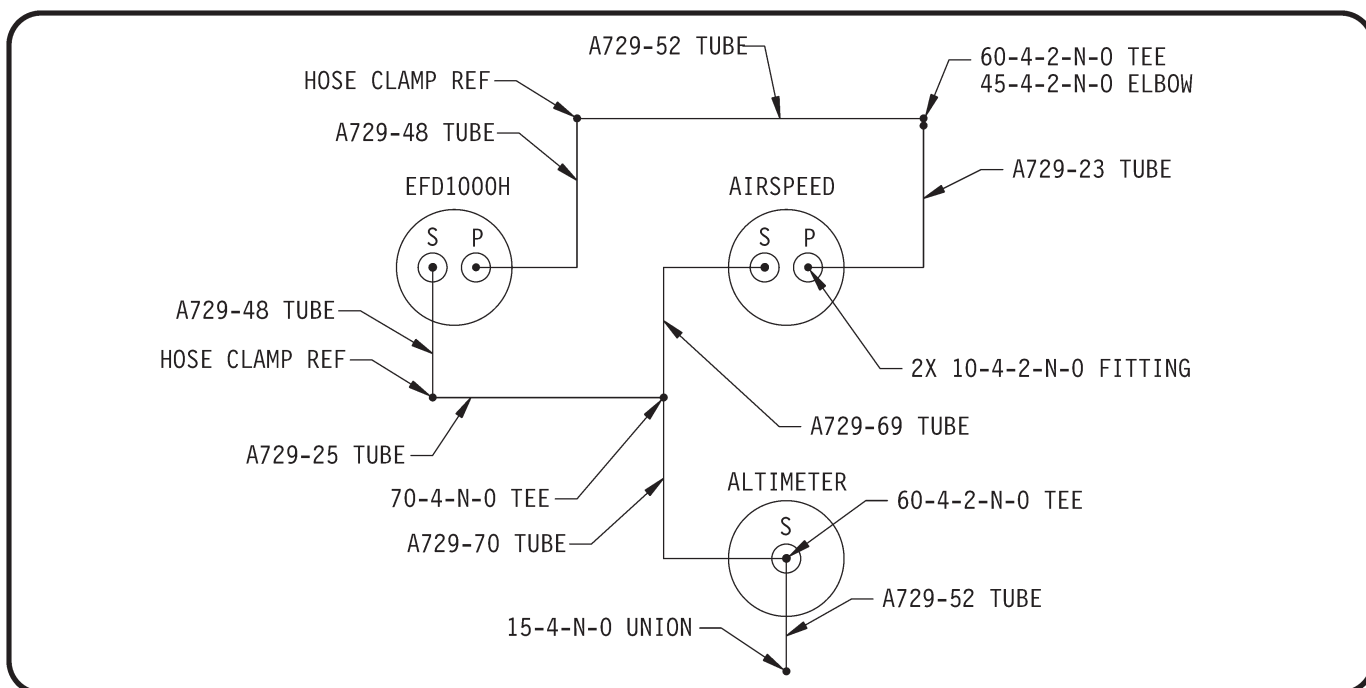


FIGURE 13-12 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD AND MFD PITOT-STATIC SCHEMATIC

13-73 Aspen EFD500H & EFD1000H Display(s) (continued)**B. Schematics**

Refer to Figure 14-23 for C800-1 Aspen PFD electrical schematic, and Figure 14-24 for C800-3 Aspen PFD and MFD electrical schematic.

Refer to Figures 13-1, 13-9, & 13-10 for Aspen PFD pitot-static schematic, and Figures 13-1 and 13-12 for Aspen PFD and MFD pitot-static schematic.

**C. Removal**

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Gently depress blue tab(s) at top of Aspen PFD/MFD to release display(s) from mounting bracket(s).
3. PFD only: Disconnect pitot and static lines from display using quick-disconnect couplers. Temporarily cap pitot and static line fittings at display and in aircraft to prevent contamination.
4. Loosen screws securing airframe wiring harness connector(s) to display(s), unplug connector(s), and remove display(s).

**D. Installation**

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Plug airframe wiring harness connector(s) into Aspen PFD/MFD display(s) and tighten screws. Verify security.
3. PFD only: Remove temporary fitting caps and connect pitot and static lines to display using quick-disconnect couplers.
4. Insert display(s) into mounting bracket(s) until blue tab(s) snap(s) into place. Verify security.
5. Push-in EFIS circuit breaker (7.5 amp) at panel. Turn battery & avionics switches on.
6. Perform appropriate functional checks per Aspen EFD1000H PFD / EFD500H MFD Pilot's Guide. Turn battery and avionics switches off.
7. Perform pitot-static leak check.

13-73 Aspen EFD500H & EFD1000H Display(s) (continued)**E. Remote Sensor Module (RSM) Antenna****NOTE**

Do not use magnetized tools.

Removal

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) on circuit breaker panel.
2. Refer to § 16-70 for antenna locations. Using plastic scraper, remove B270-1 sealant from around EFIS antenna at corners where it attaches to tailcone.
3. Cut and discard ty-raps as required and disconnect antenna cable at connectors (secured to frame). Remove screws securing antenna and antenna ground wire to tailcone and remove antenna.

Installation

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) on circuit breaker panel.
2. Remove paint & primer from antenna and antenna ground wire mating surfaces to ensure electrical ground.
3. Install screws securing antenna and antenna ground wire to tailcone. Verify security.
4. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to tailcone and allow to dry.
5. Connect antenna cable at connectors; secure to frame using ty-raps. Verify security.
6. Perform ground checks per Part D steps 5 and 6.

**F. Scheduled Maintenance and Inspections**

Maintenance is on condition. Contact Aspen Avionics at [www.aspenavionics.com](http://www.aspenavionics.com) for instructions for continued airworthiness.

**NOTE**

Refer to § 38-60 for avionics software information.

**G. Special Maintenance and Inspections**

1. Turn battery and avionics switches off. Open circuit breaker panel and upper console.
2. Inspect condition of and verify no obvious damage to Aspen displays, pitot-static lines, metal braiding, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.
3. Secure circuit breaker panel and upper console. Perform ground checks per Part D steps 5 and 6.

13-80 Console Assemblies**NOTE**

Refer to applicable Pilot's Operating Handbook Section 7 for views of typical instrument panels, and the Optional Avionics Supplement for views of panels with electronic flight displays.

**A. Opening Console**

Upper instrument panels that do not include Electronic Flight Displays (EFDs) or other avionics may be "opened" by removing screws securing console assembly to forward keel panels and hinging console aft. Secure console by hinging forward and installing screws. If an EFD or any other avionics are installed in the upper instrument panel, remove console per Part B.

**B. Removing Console**

1. Remove EFD if installed per § 13-70.
2. Remove avionics if installed and located in upper instrument console per Chapter 38.
3. Remove HeliSAS control panel if installed and located in upper instrument console (not required if control panel is located at top of avionics stack).
4. Remove perimeter screws securing instrument face to console.
5. Disconnect instrument pitot-static lines. Plug lines.
6. Remove screws securing console assembly to forward keel panels and lower panel. Remove console and disconnect console harness from airframe harness.

**C. Installing Console**

1. Connect console assembly harness to airframe harness and install screws securing console to forward keel panels and lower panel.
2. Position instrument face in helicopter, remove plugs, and connect pitot-static lines.
3. Install perimeter screws securing face to console. Verify security.
4. Install HeliSAS control panel, if removed.
5. Install avionics per Chapter 38, if removed.
6. Install EFD per § 13-70, if removed.
7. Perform pitot-static system leak check per § 13-10.

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