22 Auto Flights

CHAPTER 22

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CHAPTER 22 - AUTO FLIGHT

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GENERAL - DESCRIPTION AND OPERATION

H-14 AUTOPILOT

The primary components of the autopilot pneumatic system are shown in Figures 202 and 204 in Chapter 36-00-00. Air pressure picked up from the pressure manifold is admitted to the autopilot pneumatic system through the autopilot control valves.

Servo actuators, powered by air pressure move the aircraft control surfaces. The autopilot may be turned on anytime after the aircraft engines have been started. Because the equipment is transistorized, no warm-up time is required; however, make certain that the gyros are erect and stable prior to engaging the system. Electrical power to the autopilot is interrupted by pulling the autopilot circuit breaker.

"END"

GENERAL - MAINTENANCE PRACTICES

H-14 AUTOPILOT

For maintenance, repair, troubleshooting and testing refer to the procedures described in the BEECHCRAFT H-14 Autopilot Maintenance Manual (P/N 130333F) and the Maintenance Manual Supplement (P/N 98-30603).

Access for adjustment of the autopilot is through a removable panel on the left underside of the fuselage immediately aft of the rear pressure bulkhead.

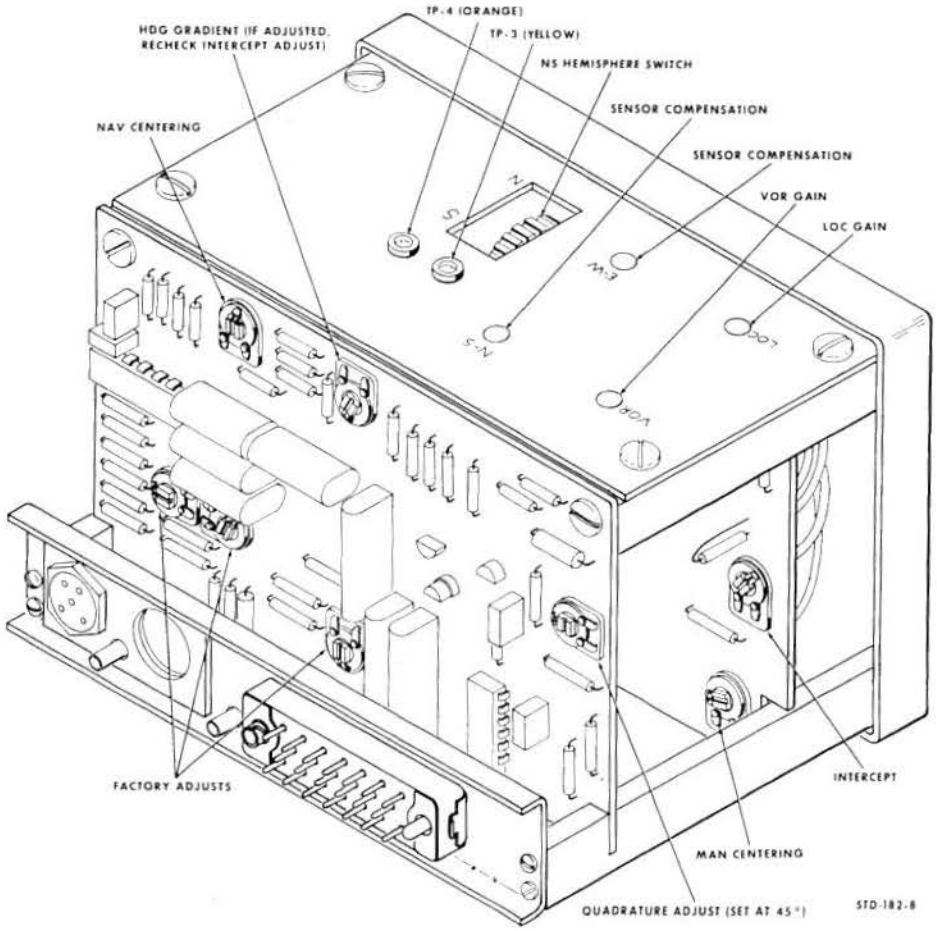
Adjustment of the pneumatic pressure system is performed by adjusting the various regulators in a specified sequence. A PRESSURIZATION SYSTEM ADJUSTMENT CHART corresponding to applicable illustrations and a general adjustment procedure for each individual regulator are provided in Chapter 36-00-00.

"END"

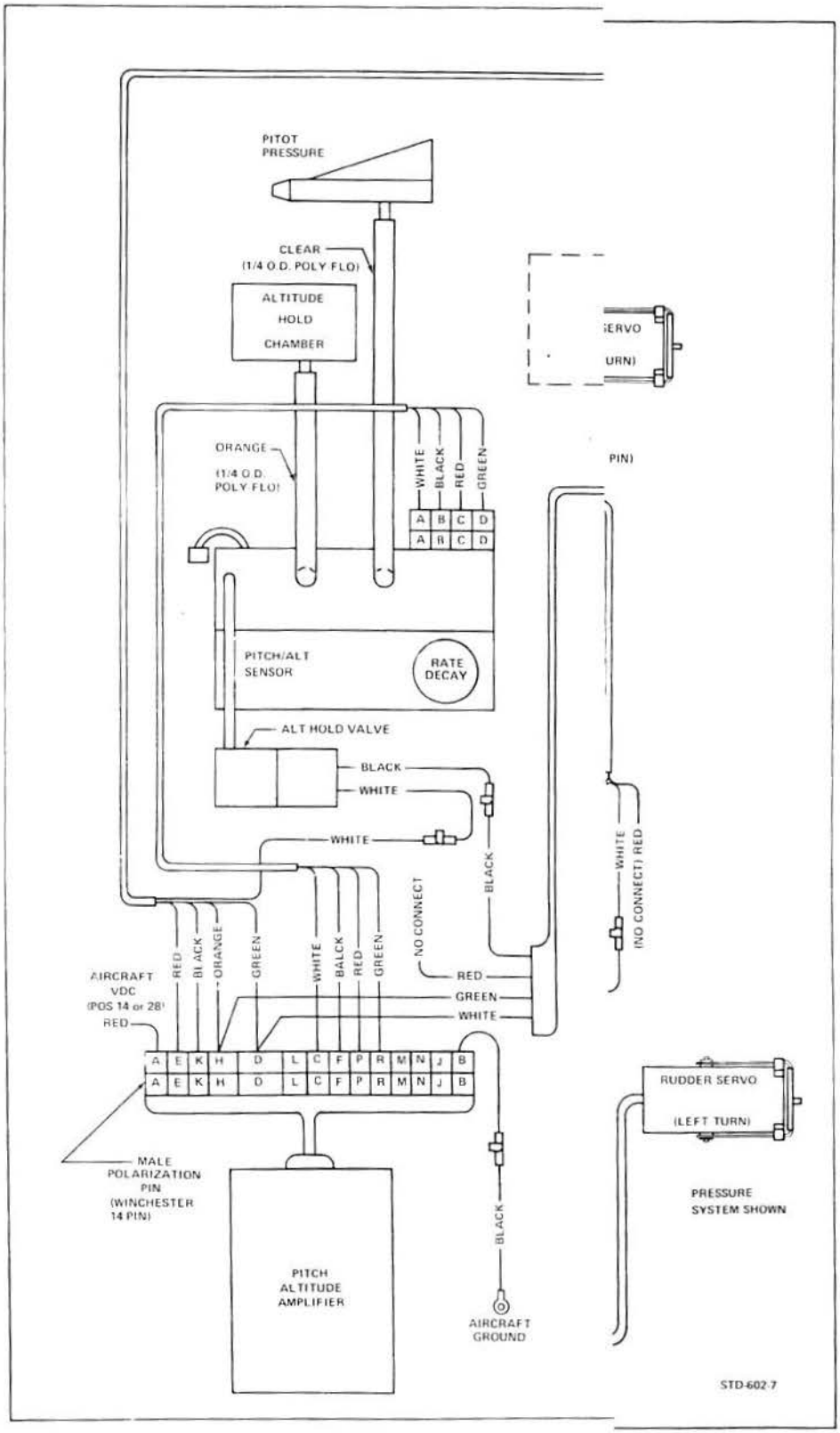
GENERAL - DESCRIPTION AND OPERATION

NEW-MATIC AUTOPILOT

The BEECHCRAFT New-matic autopilots operate on an electro-pneumatic concept. Electronic circuitry is used for navigational beam detections, magnetic heading direction, and turns. Pneumatic servos are used for the flight control actuators. The systems are completely non-tumbling. Yaw, roll and turn detection is made by a tilted gyro EVT turn coordinator (electrical vacuum torquing combination) mounted in the instrument panel. A dampened miniature aircraft serves as the instrument indicating arm. Any deviation from straight flight causes the rate gyro to move a pressure (or vacuum) valve which puts force into the aileron or rudder to return the aircraft to straight flight. Turns or beam following is made by rotating a valve sleeve by a torquing movement proportional to the voltage imposed upon it. This unit also supplies an output voltage proportional to the turning rate that is used for dip compensation and nose up signal during turns. The pitch control system does not use a gyro for reference, but uses the airspeed, rate of airspeed change and inertial signals to control the elevator through the pitch servos. An altitude hold sensing unit works in conjunction with the pitch control to sustain a given altitude.



Heading Loc/Navigation Coupler System Adjustments
Figure 1



New-matic Autopilot Block Diagram
Figure 2

"END"

TROUBLESHOOTING
NEW-MATIC AUTOPILOT

TROUBLE	PROBABLE CAUSE	REMARKS
ROLL AXIS		
1. Insufficient or excessive pressure indicated on aircraft system gage.	a. Leak in aircraft pressure system.	a. Check all lines and fittings for breaks, looseness, kinks, etc.
	b. Regulator valve improperly adjusted.	b. Adjust regulator valve as outlined in Chapter 36.
	c. Regulator improperly adjusted.	c. Adjust regulator as outlined in Chapter 36.
	d. Faulty (pressure) pump.	d. Replace pump.
	e. Ambient air filter clogged.	e. Clean or replace filter.
	f. Clogged system filter.	f. Check filters as outlined in Chapter 36 and replace if necessary.
2. Aircraft hunts or recovers slowly from turn in one direction.	a. Regulator valve improperly adjusted.	a. Adjust regulator valve as in Chapter 36.
	b. Loose aircraft primary cables or excessive friction in aileron and/or rudder cables, pulleys, bell cranks or loose servo cables.	b. Check security of attachment, binding, etc. and adjust as outlined in Chapter 27.
	c. Leak in servo or servo lines.	c. Check for leaks.
	d. Obstruction in servo lines.	d. Check for foreign matter.
	e. Faulty turn coordinator gyro.	e. Replace turn coordinator.
3. Autopilot sluggish.	a. Low system pressure setting.	a. Check system filters and adjust as outlined in Chapter 36.
4. Aircraft turns continuously on basic stabilization. (Controller "OFF").	a. Aircraft out of trim or improperly rigged.	a. Trim aircraft or check controls for proper rig as outlined in Chapter 27.
	b. Loose primary cables or excessive friction in cables and system. Loose servo cable.	b. Check security of attachment, binding, etc, and adjust as outlined in Chapter 27.
	c. Defective turn coordinator gyro.	c. Replace turn coordinator gyro.
	d. Leak in servo or servo line.	d. Check for servo or line leaks.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
ROLL AXIS (Cont'd)		
5. Aircraft rate of turn too fast or too slow.	a. Improper regulator adjustment.	a. Adjust regulator as outlined in Chapter 36.
	b. Turn coordinator faulty.	b. Replace turn coordinator.
6. Continuous control wheel oscillation in smooth air.	a. Turn coordinator faulty.	a. Replace turn coordinator.
	b. Improper gyro speed or excessive pressure in system.	b. Adjust system pressure as outlined in Chapter 36.
7. No turns or turns in one direction only, in response to turn control or on all modes of navigation coupler operation.	a. Faulty turn coordinator.	a. Replace turn coordinator.
	b. Faulty controller/amplifier.	b. Replace controller/amplifier.
8. Aircraft rolls in one direction only either left or right.	a. Servos improperly phased.	a. See System Block Diagram, Figure 2.
	b. Turn coordinator not plumbed properly.	b. Plumb per System Block Diagram, Figure 2.
9. Aircraft turns in the wrong direction in "CAP" and "TRK" modes.	a. Nav input signal reversed.	a. Reverse connectors to VOR.
10. No aircraft response from navigation coupler in any mode, ground check shows electrical.	a. Faulty turn coordinator gyro.	a. Replace turn coordinator.
	b. Obstruction in pressure lines.	b. Check for foreign matter.
11. Aircraft fails to turn to and hold magnetic headings.	a. Faulty magnetic heading sensor.	a. Replace magnetic heading sensor.
	b. Faulty heading selector resolver.	b. Replace controller/amplifier.
	c. Faulty controller/amplifier.	c. Replace controller/amplifier.
12. Magnetic heading consistently high or low.	a. Heading sensor misaligned in aircraft.	a. Check for proper installation.
	b. Heading azimuth dial shifted on shaft.	b. Tighten screw and re-calibrate.
	c. Improper adjustment of controller/amplifier.	c. Calibrate for the magnetic cardinal points.
13. Cardinal headings inaccurate.	a. Controller/amplifier improperly adjusted.	a. Calibrate for the magnetic cardinal points.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE		*PROBABLE CAUSE*		*REMARKS*
ROLL AXIS (Cont'd)				
13. Cardinal headings inaccurate.(Cont'd)	b.	Leak in servo system.	b.	Check for leaks.
	c.	Low primary pressure.	c.	Adjust system as outlined in Chapter 36.
14. Cardinal headings accurate but intermediate headings inaccurate.	a.	Faulty heading sensor.	a.	Replace the heading sensor.
	b.	Faulty controller/amplifier.	b.	Replace controller/amplifier.
15. Insufficient or no control in "CAP" and "TRK" modes.	a.	Faulty controller/amplifier.	a.	Replace controller/amplifier.
	b.	Faulty omni converter.	b.	Replace omni converter.
	c.	Insufficient signal from omni.	c.	Repair or replace omni indicator.
	d.	"NAV SENS" improperly adjusted.	d.	Readjust.
16. Localizer approach is either sluggish or too sensitive.	a.	"LOC GAIN" is set high or low.	a.	Adjust.
17. No electrical output left or right on controller/amplifier test jacks.	a.	No A+ input or improperly grounded.	a.	Check A+ and ground.
	b.	Defective controller/amplifier or power supply.	b.	Replace controller/amplifier or power supply.
18. Output only one way on controller/amplifier test jacks.	a.	Defective controller/amplifier.	a.	Replace controller/amplifier.
19. No output on HDG mode on controller/amplifier test jacks.	a.	Defective controller/amplifier, or harness, or heading sensor.	a.	Replace controller/amplifier; or harness, or heading sensor.
20. Heading output on two reciprocal headings, but not on the other two.	a.	Defective sensor; or harness; or faulty controller/amplifier.	a.	Replace heading sensor, or check harness. Replace controller/amplifier.
21. "O" output when in CAP, TRK, or APP mode, with nav signal.	a.	Defective nav switching console; or no nav information; or defective controller/amplifier.	a.	Check nav input leads. Replace controller/amplifier.
22. Output voltage in CAP mode decays to "O" voltage.	a.	Wrong nav input signals.	a.	Check wiring.
	b.	Defective switching console (if installed).	b.	Repair or replace console.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

	TROUBLE		*PROBABLE CAUSE*		*REMARKS*
ROLL AXIS (Cont'd)					
22.	Output voltage in CAP mode decays to "0" voltage. (Cont'd)	c.	Dirty input signal (AC volts).	c.	Check indicators.
23.	Voltage output in MAN, CAP, TRK, and APP mode but none in HDG mode.	a.	Polarization pins reversed on heading sensor plug.	a.	Reverse pins. See System Block Diagram, Figure 2.
24.	Nav indicator needle deflects left or right when controller/amplifier or radio is turned on.	a.	One of the components is shorted to ground.	a.	Check for shorts.
25.	Low or high intercept angle.	a.	Incorrect setting on controller/amplifier.	a.	Adjust intercept angle.
		b.	Low or high voltage output on nav indicators.	b.	Check nav indicators to manufacturer's specs.
PITCH AXIS					
1.	Pitch channel will not center up electrically.	a.	Defective pitch/altitude sensor or amplifier.	a.	Check on Test Set TS-108 or replace one at a time.
2.	Altitude channel will not center up electrically.	a.	Defective pitch/altitude sensor or amplifier.	a.	Check on Test Set TS-108 or replace one at a time.
3.	Altitude hold solenoid valve will not actuate.	a.	Pressure switch on servo control valve out of circuit.	a.	Check for faulty switch and replace if necessary.
		b.	Defective solenoid valve.	b.	Replace solenoid valve.
		c.	Defective altitude switch on controller/amplifier.	c.	Check continuity. See System Block Diagram, Figure 2.
4.	Servo control valve will not center.	a.	Improper pressure adjustment.	a.	Adjust pressure as outlined in Chapter 36.
		b.	Sticky valve.	b.	Replace valve.
5.	Output voltage is inadequate.	a.	Pitch/altitude amplifier sensor or harness shorted or improperly wired.	a.	See System Block Diagram, Figure 2, run check for shorts.
6.	Pressure switch will not make contact when pressure is on.	a.	Defective pressure switch or not set at proper pressure.	a.	Replace pressure switch.
7.	Output voltage one way only on pitch and altitude channels.	a.	Servo control valve shorted to ground.	a.	Replace valve.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

	TROUBLE		*PROBABLE CAUSE*		*REMARKS*
PITCH AXIS (Cont'd)					
8.	System will not maintain trimmed configuration even though centered electrically.	a.	Servo control valve not pneumatically centered.	a.	Disconnect electrical power. Center valve pneumatically by use of differential gage to ± .04 in Hg.
		b.	Leak in servos or improperly rigged.	b.	Check for leaks and rig.
		c.	Leak in pitch/altitude sensor.	c.	Replace sensor.
9.	System will not respond to airspeed changes.	a.	Primary vacuum (pressure) not set properly.	a.	Adjust pressure as outlined in Chapter 36.
		b.	Pitot pressure inadequate.	b.	Check pitot plumbing.
		c.	Decay rate improperly adjusted.	c.	Adjust as required.
10.	System will not respond to up command adjustment.	a.	Defective pitch/altitude amplifier.	a.	Replace pitch/altitude amplifier.
		b.	No EVT potentiometer.	b.	Replace turn coordinator.
11.	System will not respond to altitude gain adjustment.	a.	Pitch/altitude amplifier limiter improperly set.	a.	Adjust as required.
12.	Aircraft has long term oscillation about pitch axis with altitude hold OFF.	a.	Decay rate improperly adjusted.	a.	Adjust as required.
		b.	Pitch altitude gain improperly adjusted.	b.	Adjust as required.
		c.	Friction in elevator or servo system.	c.	Check for friction and correct.
13.	Aircraft has short term oscillation about pitch axis.	a.	Decay rate too tight.	a.	Adjust as required.
		b.	Pitch gain too high.	b.	Adjust as required.
		c.	Primary pressure too high.	c.	Readjust pressure as outlined in Chapter 36.
14.	Aircraft oscillates with altitude hold ON.	a.	Altitude gain too high.	a.	Adjust as required
		b.	Decay rate improperly adjusted.	b.	Adjust as required.
15.	Aircraft does not return to altitude when displaced.	a.	Altitude hold solenoid inoperative.	a.	Replace solenoid.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
PITCH AXIS (Cont'd)		
15. Aircraft does not return to altitude when displaced. (Cont'd)	b. Leak in altitude system.	b. Check for leaks.
	c. Altitude limiter improperly adjusted.	c. Adjust as required.
16. Aircraft descends or ascends continually when system engaged.	a. Servo control valve not phased correctly.	a. Apply positive 6.0 volts (max) to blue lead and verify nose up response.

"END"

GENERAL - MAINTENANCE PRACTICES

NEW-MATIC AUTOPILOT

For maintenance, repair, troubleshooting and testing refer to the procedures described in the BEECHCRAFT New-Matic Autopilot B-8 Ground and Flight Check Procedures Manual (P/N 3957).

"END"