Chapter 7 AUTOMATIC CONTROLS

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Introduction

1. The automatic controls on this aircraft comprise the autopilot/autostabilizer system and a separate yaw damper system; this Chapter contains a brief functional description of the two systems. The servicing diagrams associated with this Chapter and information regarding the location of components complete with a list of associated Air Publications are in the relevant chapter of AP 101B-1202-10B1. A detailed description is in AP 112C-3601-13 and AP 112C-3602-13.

Modification standard

2. This Chapter includes Mod 845, 1032, 1103, 1131, 1152, 1168A, 1185, 1216, 1232, 1290, 1324, 1325, 1517, 1715, 1716, 1717, 1718 and 1770.

AUTOPILOT

General *(Fig.1)*

3. The LN430 autopilot system installed on post-Mod 1770 aircraft provides autostabilization and the autopilot facilities of Mach. No. lock, heading lock and barometric height lock. The pre-Mod 1770 installation remains as described in AP 101B-1202-1B, Cover 2, Sect 7, Chap 7.

4. The autopilot system comprises the following main units:-

Rate gyro unit

Autopilot computer

Pilot's control switches

Autostabilization switch panel

Note...

Although the autopilot is interconnected with the radio altimeter, the original provision of a height signal for a radio height lock mode is not required and the height signal line incorporates a compensating load resistance which is fitted in the autopilot computer.

5. Associated with the autopilot system are four powered control units (PCU) and a height lock transducer. The PCUs are part of the flying controls system *(AP 101B-1202-1A, Cover 2, Sect 3, Chap 6B)* and can work independently of the autopilot. While the height lock transducer obtains its power supplies from the air data system *(AP 101B-1202-1B, Cover 2, Sect 7, Chap 8)*, the information it provides is only fed to the autopilot.

Description

Gyro units

6. The gyro unit contains three miniature rate gyroscopes mounted in mutually perpendicular planes to sense disturbances in the roll, pitch and yaw axes. The gyro rate, wheel speed monitor (WSM) and offset signal voltages produced by the gyros are applied to related channel amplifiers in the computer which raise them to a power level sufficient to operate the electro-hydraulic actuators in the PCUs.

Powered control units

7. Four powered control units, each consisting basically of a hydraulic tandem ram, a lever assembly and an electro-hydraulic actuator, are fitted to provide the means of moving the ailerons, rudder and tail plane and are designed for manual operation by the pilot, with or without autostabilization. In the autopilot modes, only the tail plane and aileron units are fully integrated with the autopilot system. Manual demands operate the PCU via a mechanical linkage, but autostabilization and autopilot demand signals are fed via the computer to the actuator which, in turn, causes movement of the ram. The degree of ram movement is regulated by mechanical or electrical feed back loops on the PCU which permit faithful reproduction of the pilot's stick movements or autopilot demands at the control surfaces.

Height lock transducer

8. The height lock transducer, R-SN, consists of a capsule unit and a servo-operated gearbox, and converts static pressure into a signal voltage representative of barometric height. A follow-up system in the transducer maintains this voltage at zero until disconnected by a signal from the computer when 'height lock' is engaged.

9. Subsequent changes in the height of the aircraft produce a voltage in the transducer which represents the change in height from the stored barometric reference datum. The signal output is fed to the computer and processed to obtain an autopilot demand signal which is a function of barometric height error and the rate of change of height error.

10. With the Type B height lock transducer fitted (Mod 1152), desired changes in aircraft altitude may be achieved in the barometric height lock mode by appropriate selection of the height trim switch (Para 14).

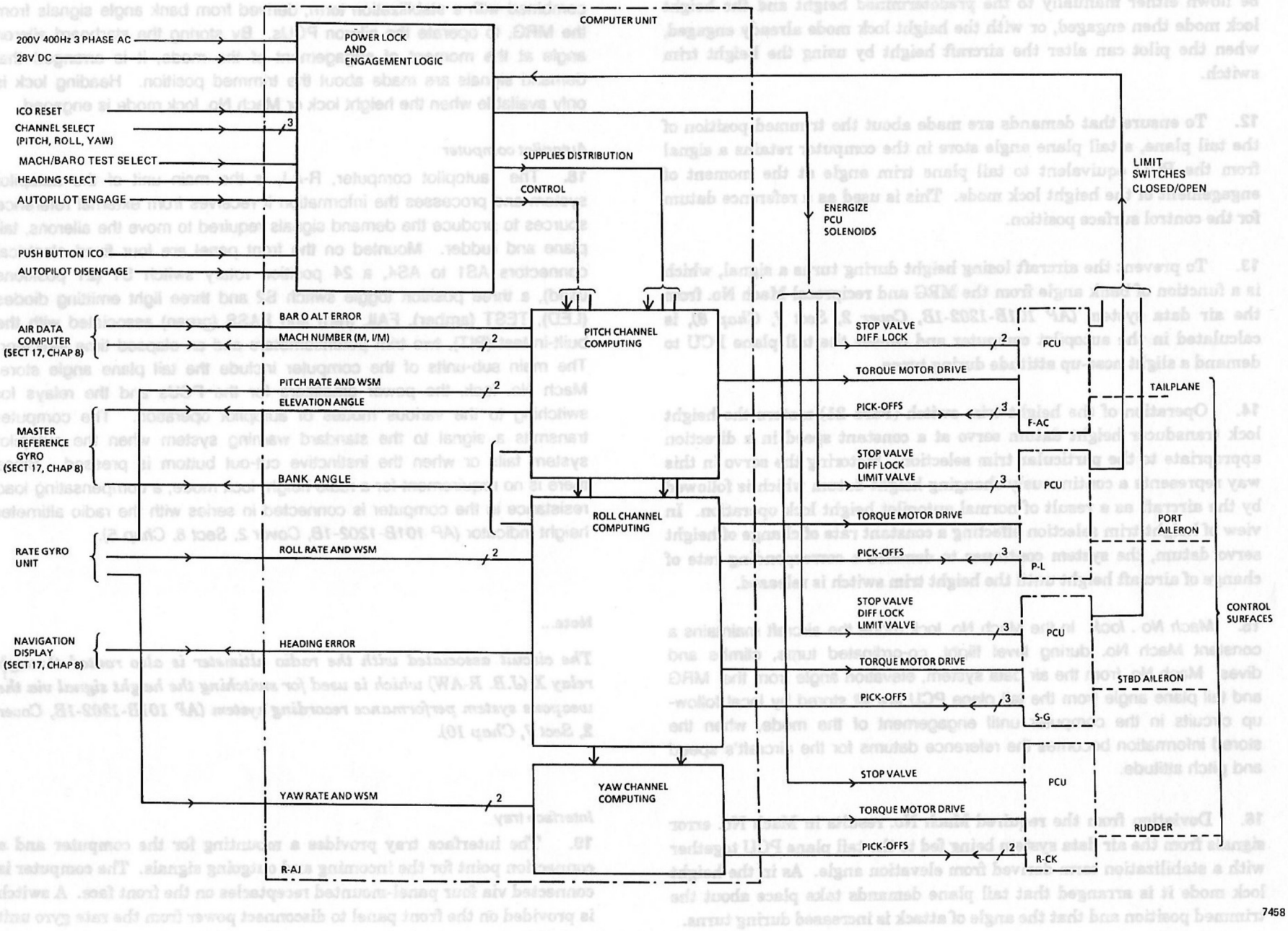

Fig.1 Automatic flight control system - block diagram

Autopilot modes

11. *Height lock.* The height lock mode provides a barometric height lock to maintain the aircraft at a predetermined height. The aircraft can be flown either manually to the predetermined height and the height lock mode then engaged, or with the height lock mode already engaged, when the pilot can alter the aircraft height by using the height trim switch.

12. To ensure that demands are made about the trimmed position of the tail plane, a tail plane angle store in the computer retains a signal from the PCU equivalent to tail plane trim angle at the moment of engagement of the height lock mode. This is used as a reference datum for the control surface position.

13. To prevent the aircraft losing height during turns a signal, which is a function of bank angle from the MRG and reciprocal Mach No. from the air data system *(AP 101B-1202-1B, Cover 2, Sect 7, Chap 8)*, is calculated in the autopilot computer and causes the tail plane PCU to demand a slight nose-up attitude during turns.

14. Operation of the height trim switch (Para 21) motors the height lock transducer height datum servo at a constant speed in a direction appropriate to the particular trim selection. Motoring the servo in this way represents a continuously changing height datum which is followed by the aircraft as a result of normal autopilot height lock operation. In view of height trim selection effecting a constant rate of change of height servo datum, the system continues to demand a corresponding rate of change of aircraft height until the height trim switch is released.

15. *Mach No . lock.* In the Mach No. lock mode the aircraft maintains a constant Mach No. during level flight, co-ordinated turns, climbs and dives. Mach No. from the air data system, elevation angle from the MRG and tail plane angle from the tail plane PCU are all stored by local follow-up circuits in the computer until engagement of the mode, when the stored information becomes the reference datums for the aircraft's speed and pitch attitude.

16. Deviation from the required Mach No. results in Mach No. error signals from the air data system being fed to the tail plane PCU together with a stabilization term derived from elevation angle. As in the height lock mode it is arranged that tail plane demands take place about the trimmed position and that the angle of attack is increased during turns.

17. *Heading lock.* In the heading lock mode the autopilot will fly the aircraft on any heading selected by the pilot on the navigation display. If the aircraft deviates from a selected heading, the navigation display instrument feeds error signals to the autopilot computer and these are combined with a stabilization term, derived from bank angle signals from the MRG, to operate the aileron PCUs. By storing the starboard aileron angle at the moment of engagement of the mode, it is arranged that demand signals are made about the trimmed position. Heading lock is only available when the height lock or Mach No. lock mode is engaged.

Autopilot computer

18. The autopilot computer, R-AJ, is the main unit of the autopilot system and processes the information it receives from external reference sources to produce the demand signals required to move the ailerons, tail plane and rudder. Mounted on the front panel are four fixed electrical connectors AS1 to AS4, a 24 position rotary switch S1 (21 positions used), a three position toggle switch S2 and three light emitting diodes (LED), TEST (amber), FAIL (red) and PASS (green) associated with the built-in-test (BIT), two trim potentiometers and an elapsed time indicator. The main sub-units of the computer include the tail plane angle store, Mach No. lock, the power amplifiers for the PCUs and the relays for switching to the various modes of autopilot operation. The computer transmits a signal to the standard warning system when the autopilot system fails or when the instinctive cut-out buttom is pressed. Since there is no requirement for a radio height lock mode, a compensating load resistance in the computer is connected in series with the radio altimeter height indicator *(AP 101B-1202-1B, Cover 2, Sect 8, Chap 5)*.

Note...

The circuit associated with the radio altimeter is also routed through relay X (J.B. R-AW) which is used for switching the height signal via the weapons system performance recording system (AP 101B-1202-1B, Cover 2, Sect 7, Chap 10).

Interface tray

19. The interface tray provides a mounting for the computer and a connection point for the incoming and outgoing signals. The computer is connected via four panel-mounted receptacles on the front face. A switch is provided on the front panel to disconnect power from the rate gyro unit and the computer during prolonged ground testing of the aircraft systems.

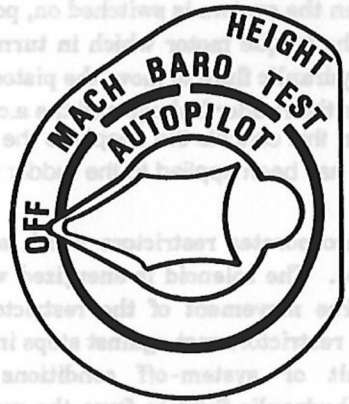

Fig.2 Autopilot mode selector switch

Pilot's control switches

20. Five switches on the starboard dashboard shroud panel, C-X, three switches on the throttle box (panel C-E) and two switches on the pilot's control column, C-AM, are the means whereby the pilot can engage and disengage the various facilities of the autopilot system.

21. A push-switch marked ICO RESET (instinctive cut-out reset), Z on panel C-X, is used as the power switch for connecting the aircraft power supplies to the autopilot system. Three single-pole, 3-position switches, A, B and C on panel C-X, marked PITCH, ROLL and YAW respectively and AUTOSTABILISER, APPROACH-OFF-HIGH SPEED collectively, control the autopilot system in the autostabilizer/manual mode and a rotary selector switch (Fig.2), X on panel C-X, marked AUTOPILOT, OFF-MACH, -HEIGHT, BARO-TEST is used to select the autopilot modes.

Note...

When the autopilot system is inoperative a guard plate marked INOPERATIVE is secured under the knob of the rotary switch, X (panel C-X), locking the switch in the OFF position.

22. A mode is engaged by operating a push-switch, U on panel C-E, marked AUTOPILOT ENGAGE. Also on panel C-E is the heading lock selector switch, Q, marked AUTOPILOT HEADING, ON-OFF and a single-pole, spring-return to centre switch, P, marked HEIGHT TRIM, DOWN-UP.

23. An autopilot I/CUT-OUT (instinctive cut-out) switch, G, and an autopilot DISENGAGE switch, H, are both located on the pilot's grip unit unit. The instinctive cut-out switch is the manual safety device which, in emergency conditions, is operated to disconnect all the electrical supplies to the autopilot system, connect a d.c. supply to illuminate the indicator window marked AP on the standard warning panel, initiate the operation of the standard warning system *(AP 101B-1202-1B Cover 1, Sect 6, Chap 10A)* and restore the aircraft to manual control. The disengage switch, when operated, disconnects the electrical supplies to the PCUs and the computer, and restores the aircraft to manual control or autostabilizer/manual mode if this facility has been selected.

Indicator

24. A 3-position magnetic indicator, Y, on the starboard dashboard shroud panel, displays OFF until autopilot mode is selected, RDY (ready) when a mode has been selected and the autopilot is ready to operate, and ENG (engage) when an autopilot mode is in actual operation. OFF is also displayed when the system is only operating in the autostabilizer mode.

Safety micrswitches

25. Two limit microswitches are fitted to the tail plane and aileron flying control mechanisms to limit the authority of the autopilot and prevent runaways. When any of these switches is operated, the electrical supplies to the autopilot are switched off, restoring the aircraft to manual control and operating the standard warning system. Information concerning the location and setting of these limit microswitches is in AP 101B-1202-1A, Cover 2, Sect 3, Chap 4B and 4D.

Power supplies

26. The autopilot computer is powered by 200 V, 3-phase, 400 Hz a.c. and 28 V d.c. The 200 V a.c. is supplied via fuses 2A2, 2B2 and 2C2 in distribution box R-A to pins A, B and C respectively of connector 13, and 28 V d.c. is supplied via fuses A9 and B9 (panel R-C) to pins B and A of connector 10. A 28 V d.c. supply for the operation of the standard warning system is routed from fuse A6 (panel R-C) via pin A of connector 6. With the IFIS isolation switch *(AP 101B-1202-1B, Cover 2, Sect 7, Chap 8)* at ON and a.c. and d.c. power available at junction box R-AW, relay J in the junction box is energized. A 115 V, 3-phase, 400 Hz supply

is routed from connector 14 to fuses P and Q and contacts 8-9 and 11-12 of relay J, then via sub-fuses M and N to connector 3 and the height lock transducer. With the IFIS isolation switch at OFF, relay J is de-energized and the a.c. supply to the transducer is disconnected.

YAW DAMPER

Description

27. The yaw damper system is an emergency system for use as a substitute for the rudder autostabilizer mode of the autopilot. The circuit contains three main units, a yaw rate gyro, a yaw damper amplifier and an actuator. The rate gyro detects any change in the rate of yaw of the aircraft and transmits a signal to the amplifier from which further signals are sent to the actuator. The actuator is mechanically connected to the rudder control to operate the rudder and correct the initial deviation. The system is controlled by a single-pole toggle switch, G on panel C-X, marked YAW DAMPER, ON-OFF; a.c. and d.c. power supplies complete the installation.

Yaw damper amplifier

28. The yaw damper amplifier, R-GA, is located on the starboard side of the radio bay. Electrical connections are made by Plessey Mk. 4 plugs and sockets. The amplifier is housed in a metal container and consists of a magnetic amplifier, a dither oscillator, two relays and a distribution system of resistors and capacitors. These receive and modify the impulses from the rate gyro and transmit the resultant to the torque motor in the actuator. The d.c. and a.c. power supplies are fed into the amplifier, which acts as a junction box and feeds out the power to supply the rate gyro rotor and the valve solenoid in the actuator. The dither oscillator generates 'dither' impulses at 21 Hz which are fed to the actuator for improved hydraulic control.

Rate gyro

29. The rate gyro, R-GF, operates in the yaw plane and is mounted in the radio bay. Any rate of turn of the aircraft causes the rate gyro to produce a proportional electrical output which is fed to the yaw damper amplifier.

Actuator

30. The electro-hydraulic actuator, R-GB, incorporates a torque motor, a hydraulic relay valve, a solenoid-operated valve, a piston assembly and an a.c. pick-off which detects movement of the piston. The actuator is connected in series with the rudder manual input circuit so that, when the system is not in use, it forms a fixed pivot about which the rudder control operates. When the system is switched on, power is fed from the amplifier to operate the torque motor which in turn operates the relay valve, thus allowing hydraulic fluid to move the piston. Movement of the piston is transferred to the rudder linkage and the a.c. pick-off feeds back a signal to the amplifier: this cancels the supply to the torque motor when the required correction has been applied to the rudder linkage.

31. The actuator incorporates restrictors which are controlled by a solenoid-operated valve. The solenoid is energized when the system is operative to permit free movement of the restrictors and hence the piston. In practice the restrictors rest against stops in a central position. Under electrical fault or system-off conditions the solenoid is de-energized to allow hydraulic fluid to force the restrictors apart and lock the piston in a central position. The design of the actuator is such that the piston locks due to inbuilt friction if the hydraulic supply fails.

Operation

32. A 115 V single-phase a.c. supply from fuse 1C4 in distribution box R-A is fed via pin A of plug No. 1 of the amplifier to T1. From this transformer supplies are fed to T2, T3, T4 and the dither oscillator. The secondary output of T2, after rectification, energizes relay B, while T3 supplies power to the rate gyro motor. The d.c. power supplies are provided from fuse C10 (panel R-C) and fed to pin D of plug No. 1 of the amplifier. When the control switch is selected to ON, a d.c. supply from fuse H11 (panel C-Q) is connected via pin F on plug No. 1 and the closed contacts of relay B to the solenoid of the restrictor valve in the actuator. Relay A is also energized and the relay contacts complete a circuit from the rate gyro to the magnetic amplifier.

33. Any tendency for the aircraft to change the rate of yaw is detected by the yaw rate gyro and a signal is passed to the amplifier. The modified and amplified signal is passed to the torque motor, which moves the piston, in turn moving the rudder to make the required correction. The a.c. pick-off arm moves with the actuator piston and feeds back a position signal to the amplifier, thereby controlling the supply to the torque motor. The piston stops when the feed back signal has cancelled the demand signal.

34. Should the a.c. supply fail when the equipment is operating, relay B will become de-energized, thus releasing relay A, also removing the d.c. supply from the actuator solenoid valve, when the restrictors will lock the actuator piston (Para 31).

SERVICING

Function tests

35. Function tests of the autopilot and yaw damper systems are in AP101B-1202-5A3 and CSDE Schedule 5A3.

Testing

36. The built-in-test (BIT) function is used to perform a pre-flight confidence test, and to perform 1st line diagnostic tests. A BIT is selected and controlled by two switches, S1 and S2, and appropriate indications are provided by the TEST, FAIL and PASS lamps. Switch S2 injects test pulses into the computer unit printed circuit boards (pcb) during the 1st line test and switch S1 is used to sequence the computer unit through twenty-one available tests. The TEST indicator (amber) illuminates to show that a test is in progress. The PASS indicator (green) illuminates to show that the test is satisfactory and the operator is free to select the next test while the FAIL indicator (red) illuminates if the test in progress fails.

Built-in-test

37. The twenty-one tests comprising the BIT 1st line test procedure enable diagnoses of faults in 1st line replaceable units (LRU), i.e. the rate gyro unit, the computer unit and the control surface actuators. Both 28 V d.c. and 200 V a.c. supplies are required; pre-test requirements are included in Table 1. Engagement of the computer is necessary in all tests, i.e. the ICO RESET must be pressed and in all cases it is necessary to set the pitch, roll and yaw autostabiliser switches to APPROACH or HIGH SPEED as required. In addition it may be necessary to select an autopilot mode and/or apply hydraulic power. The test sequences are selected by setting S1 to positions 1 to 21 in turn, and initiated by setting S2 to up (+ve) or down (ve) as required.

Note...

With S1 set to any position other than OFF, the CWP lamp will remain illuminated. This reminds the operator to return S1 to OFF at the end of the test sequence.

Preparation

38. (1) Ensure that serviceable fuses of the correct rating are fitted as follows:

Panel	Fuse	Rating
R-A	2A2	2.5 amp
R-A	2B2	2.5 amp
R-A	2C2	2.5 amp
R-C	A6	2.5 amp
R-C	A9	5.0 amp
R-C	B9	20.0 amp

(2) Connect and switch on external electrical power supply (AP 101B-1202-1B, Cover 1, Sect 6, Chap 1).

(3) Connect the hydraulic ground supply (AP101B-1202-1A, Cover 2, Sect 3, Chap 6).

Test procedure

39. Perform the tests listed in Table 1.

Removal and installation

General

40. Prior to removal and installation of equipment from the aircraft, the system must be rendered electrically safe in accordance with AP 101B-1202-1B, Cover 1, Sect 6, Chap 1. After installation of any component, the component, system and associated equipment are to be tested to ensure correct operation of the system.

Computer unit

41. *Removal*

(1) Disconnect four electrical connectors AS1, AS2, AS3 and AS4 from face of unit.

(2) Release locking and two quick release clamps securing computer to interface tray.

(3) Grasp handle of unit and withdraw it carefully from tray until spigots disengage, then lift unit from interface tray.

Installation

(1) Position computer unit on interface tray and engage spigots.

(2) Connect two quick release clamps on interface tray and lock.

(3) Reconnect electrical connectors to appropriate sockets.

Interface unit

42. The removal and installation of this item is considered to be self-evident.

Rate gyro unit (Fig.3)

CAUTIONS...

(1) Allow three minutes to elapse after switching off the electrical supply to the rate gyro unit before attempting to remove the unit.

(2) During handling of the rate gyro unit care must be taken to ensure that the unit is not jarred or knocked, otherwise damage could occur to the gyroscopes.

43. *Removal*

(1) Disconnect electrical connector BK-D from front face of unit.

(2) Remove bolts 1 and washers 2 from side attachments and bolts 3, washers 4 and nuts 5 from front attachment.

(3) Carefully remove unit from mounting plate.

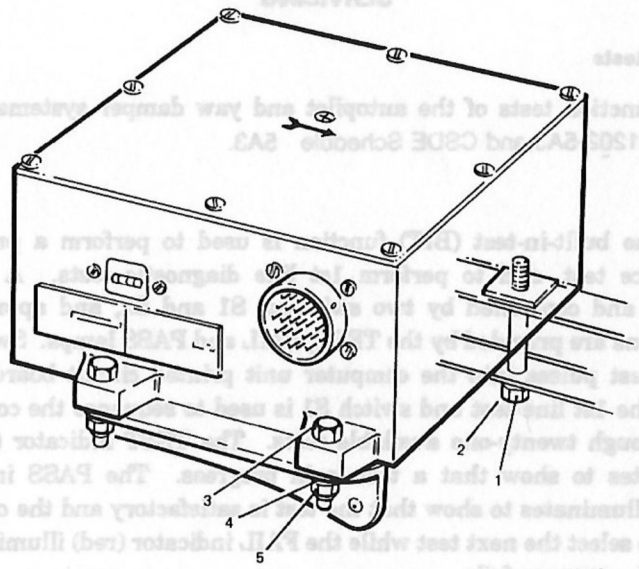

Fig.3 Rate gyro unit - removal and installation

44. *Installation*

(1) Carefully position unit on mounting plate.

(2) Secure unit to mounting plate with bolts 1 and washers 2 and bolts 3, washers 4 and nuts 5.

(3) Reconnect electrical connector BK-D to front of unit.

TABLE 1 Built-in-test

Test No.	Test	Action	Indication	Requirements
1	Pitch gyro	Select S1 to 1		
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
2	Roll gyro	Select S1 to 2		
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
3	Yaw gyro	Select S1 to 3		
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
4	Pitch stabilizer	Select S1 to 4		PITCH autostabilizer switch to APPROACH
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	PITCH autostabilizer switch to OFF

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
5	Roll stabilizer	Select S1 to 5		ROLL autostabilizer switch to APPROACH
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
6	Roll limiter	Select S1 to 6		
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	ROLL autostabilizer switch to OFF
7	Yaw stabilizer	Select S1 to 7		YAW autostabilizer switch to APPROACH
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	YAW autostabilizer switch to OFF
8	Pitch – turn compensation	Select S1 to 8		
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
9	Pitch – mach lock	Select S1 to 9		Autopilot mode selector to MACH
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	Autopilot mode selector to OFF Operate autopilot DISENGAGE
10	Pitch – height lock	Select S1 to 10		Autopilot mode selector to BARO HEIGHT
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
				Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	Autopilot mode selector to OFF Operate autopilot DISENGAGE

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
11	Roll – heading lock	Select S1 to 11		Autopilot mode selector to MACH HEADING switch to ON Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	Autopilot mode selector to OFF HEADING switch to OFF Operate Autopilot DISENGAGE
12	Sensor power supplies	Select S1 to 12		
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
13	Tailplane differential lock	Select S1 to 13		Autopilot mode selector to BARO HEIGHT HEADING switch to ON Apply hydraulic power to both flying controls hydraulic systems. Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates during test cycle FAIL: illuminates on completion of test	
				Operate Autopilot DISENGAGE
		Select S2 to +	Computer disengages TEST, PASS and FAIL lamps extinguish	

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
14	Port aileron differential lock	Select S1 to 14		Autopilot mode selector to BARO HEIGHT HEADING switch to ON Apply hydraulic power to both flying controls hydraulic systems. Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates on test cycle FAIL: illuminates on completion of test	
				Operate Autopilot DISENGAGE
		Select S2 to +	Computer disengages TEST, PASS and FAIL lamps extinguish	
15	Starboard aileron differential lock	Select S1 to 15		Autopilot mode selector to BARO HEIGHT HEADING switch to ON Apply hydraulic power to both flying controls hydraulic systems. Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates during test cycle FAIL: illuminates on completion of test	
				Operate Autopilot DISENGAGE
		Select S2 to +	Computer disengages TEST, PASS and FAIL lamps extinguish	Autopilot mode selector to OFF HEADING switch to OFF
16	Tailplane actuator	Select S1 to 16		Apply hydraulic power to both flying controls hydraulic systems.
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
17	Port aileron actuator	Select S1 to 17		Apply hydraulic power to both flying controls hydraulic systems.
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
18	Starboard aileron actuator	Select S1 to 18		Apply hydraulic power to both flying controls hydraulic systems.
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
19	Rudder actuator	Select S1 to 19		Apply hydraulic power to both flying controls hydraulic systems.
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
20	Tailplane ram actuator	Select S1 to 20		PITCH, ROLL and YAW switches to APPROACH Autopilot mode selector to BARO HEIGHT Apply hydraulic power to both flying controls hydraulic systems.
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
				Operate AUTOPILOT ENGAGE
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
				PITCH, ROLL and YAW switches to OFF Autopilot mode selector to OFF Operate Autopilot DISENGAGE
21	Starboard aileron ram	Select S1 to 21		Apply hydraulic power to both flying controls hydraulic systems.
		Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
				Autopilot mode selector to BARO HEIGHT HEADING switch to ON

(continued)

TABLE 1 Built-in-test (continued)

Test No.	Test	Action	Indication	Requirements
21 *(continued)*	Starboard aileron ram actuator	Select S2 to +	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S2 to –	TEST: illuminates during test cycle PASS: illuminates when test is satisfactory	
		Select S1 to OFF		Autopilot mode selector to OFF HEADING switch to OFF Hydraulic power OFF