Group D.9

AUTOSTABILIZER (CODE AS)

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Note . . .

Post Mod.1376 all the autostabilizer installation components and wiring are removed from the aircraft with the exception of the servomotor which is locked in its datum position (refer to Group D.1).

LIST OF ILLUSTRATIONS

TABLE

Introduction

1. This Group contains the description and operation of the aircraft's autostabilizer installation, together with the information necessary to maintain the equipment in an efficient condition. Routeing and theoretical circuit diagrams are also included. For a general description of the aircraft's electrical system, reference should be made to Groups A.1, A.2 and A.3. Detailed information on the standard items used in the circuit will be found in the Air Publications listed in Table 1.

DESCRIPTION

Autostabilizer installation

General

2. The autostabilizer installation of this aircraft is designed to detect and suppress the tendency for the aircraft to yaw. The correcting action is made by movement of the rudder trimming tab, about its normal trim position, by an electric servomotor mounted in the fin. The installation employs 115 volts, 400 c/s, 3-phase a.c., which is obtained from a.c. junction box No.1, and 28 volt d.c. via a fuse on the d.c. supply panel.

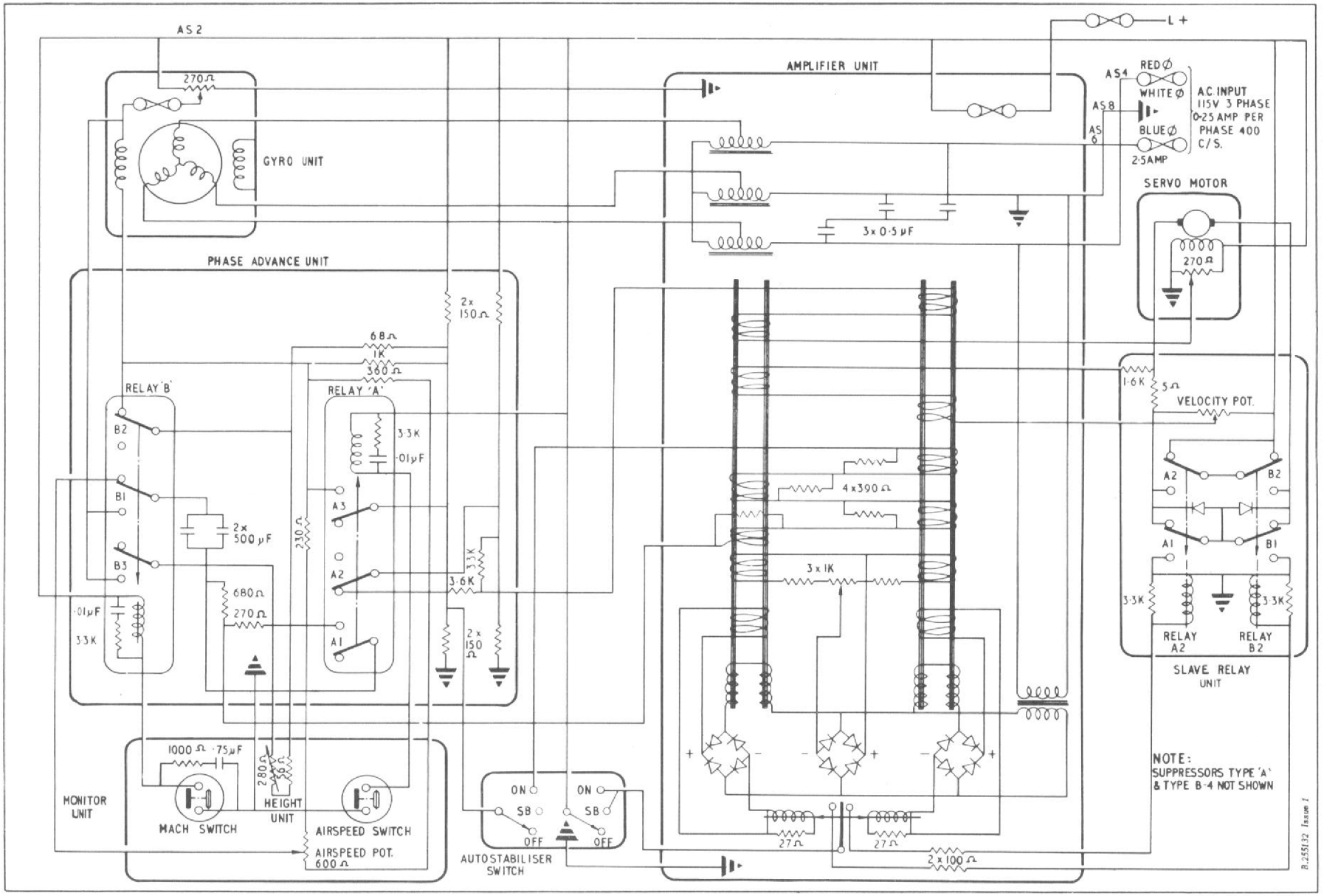

Fig. 1 Autostabilizer (theoretical)

3. The installation is controlled by a three position switch engraved OFF, STANDBY and ON. This switch is situated on the centre instrument panel.

4. In addition to the control switch and servomotor, the installation also incorporates a gyroscope, phase advance unit, monitor, amplifier, suppressor and slave relay, all of which are situated in the hood fairing and described in the following paragraphs.

Gyro unit

5. This unit is mounted to former 18A, on the starboard side in the hood fairing. The unit detects the rate of movement of the aircraft in yaw *(in excess of three degrees per minute)* by precession of the gimbal arm moving a wiper over a potentiometer resistance winding and transmitting a proportional d.c. signal to the monitor unit via the phase advance stage.

Phase advance unit

6. This unit is mounted on the port side of the autostabilizer mounting structure extending across formers 17A and 17B in the hood fairing. The unit counteracts electrical and mechanical delays in the whole system by an arrangement of a passive resistor-capacitor network. Certain relays operated by the monitor mechanism are also contained within the phase advance unit.

Monitor unit

7. This unit is carried on a mounting plate extending between the port side of former 18A and the aft angle member of the autostabilizer mounting structure in the hood fairing. The unit is connected to the pressure and static pipe-lines of the pressure head installation described in Sect.5, Chap.2, Group 3C.

8. Signals received by the monitor unit are varied according to the indicated air speed, height and Mach number within certain limits. The unit consists of conventional mechanisms without pointers; the final drive, in the case of air speed and height, being a variable resistor with a pick-off wiper. The machmeter has contacts which operate at a pre-set value.

Amplifier unit

9. The amplifier unit, which contains a magnetic amplifier and Carpenter relay, is situated in the centre of the autostabilizer mounting structure in the hood fairing. The unit is employed to integrate the signals from the gyro, phase advance and monitor units with the servomotor feedback signals and amplify the resultant, to operate the slave relays via the Carpenter relay.

10. The magnetic amplifier consists essentially of two iron cores around which a.c. and d.c. coils are wound. The a.c.

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Servomotor, Type B Slave relay, Type A Gyro unit, Type A Amplifier unit, Type H Phase advance unit, Type B Monitor unit, Type B Control switch, Type A	A.P.1469S, Vol.1, Sect.3
Suppressor, Type G.5	A.P.4343C, Vol.1, Book 3, Sect.5

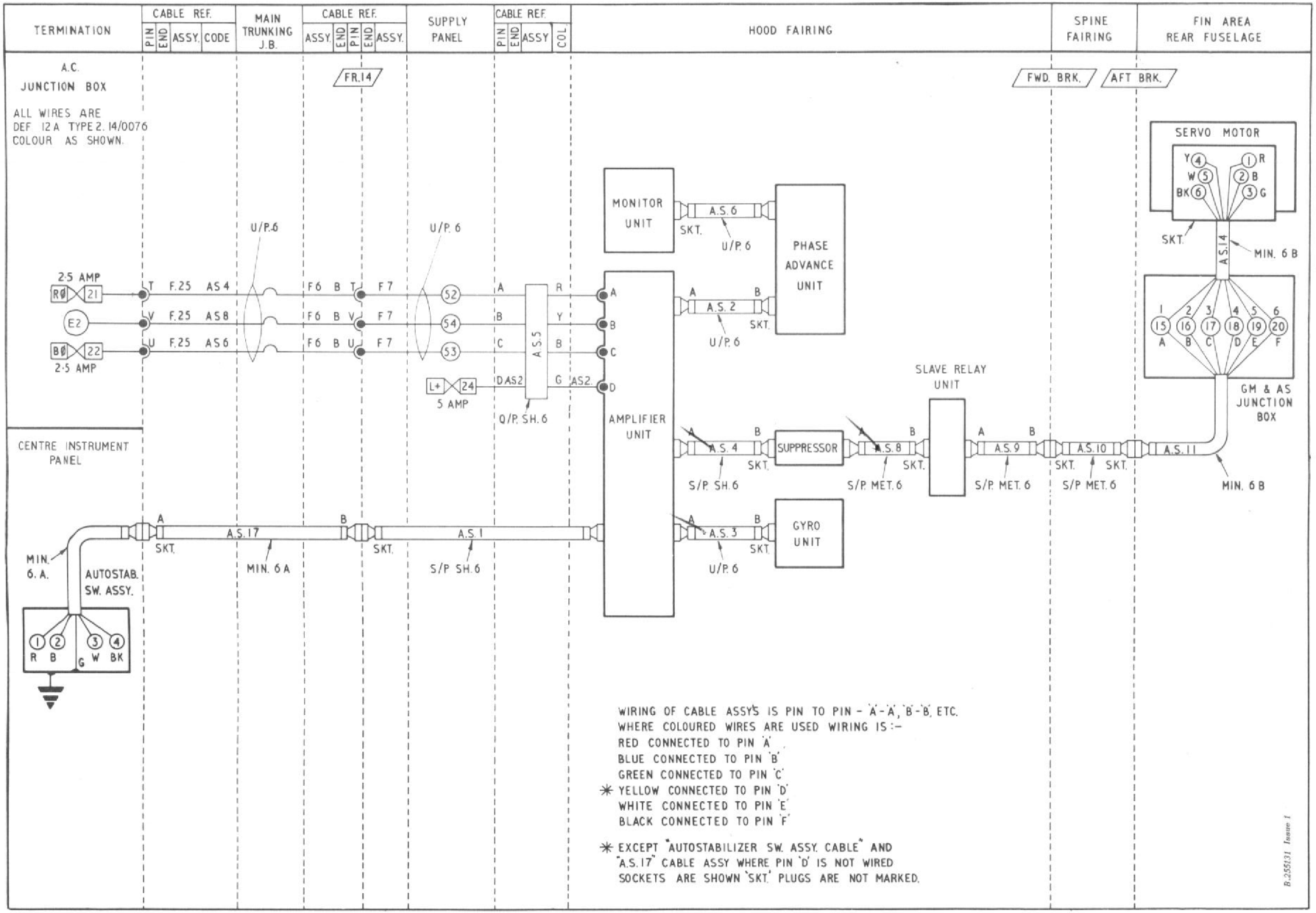

Fig.2 Autostabilizer (routeing)

output appears as d.c. after rectification. When the gyro signal input is at zero the amplifier is balanced, maintaining the Carpenter relay in the centre *(OFF)* position.

11. The Carpenter relay is of the centre-stable type, polarized to respond to "sensed" signals from the magnetic amplifier. Out-of-balance conditions in the amplifier operate the relay in whichever direction the signal dictates.

Slave relay unit

12. This unit is located on the starboard side of the autostabilizer mounting structure in the hood fairing. The unit contains two relays and a velocity feedback potentiometer. The relays are controlled by the Carpenter relay in the amplifier unit and, in turn, control the d.c. supply to the armature of the servomotor. The function of the velocity potentiometer is to transmit a feedback signal in proportion to the servomotor armature speed to the magnetic amplifier in opposition to the input signal.

Suppressor

13. This suppressor is mounted to former 18A just above the gyro unit in the hood fairing. The suppressor is used as a guard against interference with the radio installations of the aircraft.

Operation

14. The basic principles of autostabilizer operation are described in A.P.1496S, Vol.1, to which reference should be made when detailed information is required. A brief summary of the method of operation of the equipment installed in this aircraft is, however, given in the following paragraphs.

15. The control switch is engraved OFF, STANDBY and ON. In the ON position, the whole installation is operative, but in the STANDBY position the circuit connecting the gyro pick-off signal to the magnetic amplifier is interrupted so isolating the detecting circuit. When the switch is in the OFF position, both the detecting circuit and the d.c. supply to the servomotor armature are disconnected.

16. With the power switched on and the installation energized, yaw oscillation is detected by the rate gyroscope in the gyro unit. Precession of the gyroscope operates the potentiometer wiper and a d.c. voltage signal is transmitted to the monitor unit via the phase advance unit. This signal is proportional to the rate of precession and "sensed" to detect direction of oscillation.

17. To provide optimum performance from the installation under varying flight conditions, the gyro signal is modified by the monitor unit in accordance with air speed, height and Mach number. The modified signal is then advanced by the phase advance unit to counteract any delays in the system, and fed to the magnetic amplifier. In the amplifier this signal is integrated with the feedback signals from the servomotor and the amplified result operates the centre-stable Carpenter relay in whichever direction the signal dictates.

18. The contacts of the Carpenter relay connect a d.c. supply to energize one or the other of the relays in the slave relay unit. These relays, in turn, complete the circuit to the servomotor armature, thus controlling the direction of rotation of the servomotor and the rudder tab movement. To ensure that the rotation of the servomotor armature is proportional to the gyro signal, a position feedback signal is fed to the magnetic amplifier from a potentiometer in the servomotor. This feedback signal cancels the effect of the input signal when the servomotor is displaced by an amount which produces the required feedback current. To suppress hunting of the servomotor due to lag and overshoot, a signal, proportional to the servomotor velocity and in opposition to the input signal, is also fed back to the magnetic amplifier.

SERVICING

General

19. General servicing of the aircraft electrical system is described in Group A.1. Apart from the primary servicing and functional tests described in the following paragraphs, all other servicing is described in the Air Publications listed in Table 1.

Primary servicing

20. Primary servicing of the autostabilizer installation is confined to examinations for signs of damage and to ensure that all the units are securely mounted. Plug and socket connections must be checked for security of attachment one to another.

Functioning test

21. With the aircraft services on and the autostabilizer control switch set to ON, push the tail of the aircraft to port. The rudder tab should move to starboard and return smoothly to the neutral position. Push the tail of the aircraft to starboard. The rudder tab should move to port and return smoothly to the neutral position.

22. If the test in para.21 is satisfactory, set the control switch to STANDBY. Repeat the test in para.21; there should be no movement of the rudder tab.

23. If the tests are not satisfactory, the use of the No.1, Mk.2 test set will be necessary to establish which unit is at fault. This test set, with Mod.ASTAB S/50 incorporated, must also be used when checking the tab travel as quoted in Book 1, Sect.3, Chap.4. The tab is moved in the required direction by operation of switch S.1 in the test set and held deflected by the depression of switch S.4. Instructions for the use of this test set appear in A.P.1469S, Vol.1.

WARNING

If, in the test procedure detailed above, the rudder tab moves in the opposite direction, the phase sequence may have been changed. This is a dangerous condition, and must be carefully checked from the a.c. supply source to the amplifier unit.

REMOVAL AND ASSEMBLY

General

24. Once access has been obtained, the removal and assembly of the components forming the autostabilizer installation should present no difficulties. The location of and access to all the components is indicated in Group A.3.