Chapter 1

AIR DATA SYSTEM Mk. 1A—DESCRIPTION

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Introduction

1. The air data system Mk. 1A is a centralized reference source providing aerodynamic information computed from pressure-sensitive transducers. The information is delivered in the form of signals for instrument display, or as parametric gain adjustments for use in the aircraft's flight control system. The units of the system are listed in Table 1 and are described in A.P.4685, Vol. 1.

2. The air data system (A.D.S.) receives pitot and static pressure information from the aircraft pressure head. By logarithmic computation, the system solves the appropriate formulae to produce outputs related to indicated air speed (I.A.S.) Mach number, height and rate of change of height (vertical speed).

Summary of operation (*fig. 2*)

3. The pressure head is connected to a pitot-static (P–S) and a static (S) transducer in the A.D.S. by low pressure pipes; the adaptors fitted to the transducers being of $\frac{5}{16}$ in. and $\frac{3}{8}$ in. outside diameter for pitot and static pressure respectively. The transducers contain pitot-static and static capsule units respectively and the construction of each capsule unit is such that the relevant pressures are transformed, by inductive pick-offs, into electrical signals. These signals are amplified and used to drive a servo system in each transducer which nulls the pick-off and also controls the synchros and potentiometers providing the transducer output signals.

4. Two of these transducer outputs, height and I.A.S. are routed through the computer, but without modification, to the display and the flight control system respectively. The remaining outputs, log P–S, log S and height are fed to the air data computer for computation. Provision is made in the system for pressure error correction (P.E.C.) and this is described in para. 30 to 33.

5. The relation between pitot and static pressures and the various outputs of the system can be expressed as mathematical formulae, as shown later, and it is the function of the computer to solve constantly these equations as the variables change. A number of servo systems are used to make the computation. Although there is some interconnection between the servo systems, the computer can be considered as having three main channels, (*a*) Mach number, (*b*) vertical speed and (*c*) height. The Mach number and vertical speed channels each comprise two servo systems in cascade but the height channel has only a single system. Each servo system is self contained and presents the solution of its particular equation as an output from a synchro, potentiometer or d.c. tachogenerator. The output may be a new logarithmic function for further computation or an output suitable for the display instrument or flight control system. The computer inputs are listed in Table 2 and the outputs in Table 3.

DESCRIPTION

Power supplies

6. The power supplies required to operate the A.D.S. are nominally 115V, 400 c/s, 3-phase, the phase sequence of which is A(red), B(white) and C(blue), with B phase earthed. The equipment will function satisfactorily if the power supplies are maintained within the limits 110V–120V line to line at a frequency of 380–420 c/s.

7. This main aircraft supply is fed through a fuse and relay box to a distribution box, from which it is distributed to the power supply unit and also to the height and height and rate-of-climb display, which contains its own power pack and is thus independent of the A.D.S. supplies. The 4V a.c. supply for display illumination is obtained from a lighting control unit (*para.* 48).

8. The power supply unit provides a number of a.c. and d.c. supplies for the transducers, computer and the display. All the power supply components are located in this unit with the exception of two reference transformers T1 and T2, which are located in the computer. These transformers are fed with the 25V reference supply from the power supply unit and provide 7·5–0–7·5V, used as reference voltages for the computer servo amplifier demodulator circuits. It should be noted that a potentiometer and resistor network is provided in the computer to set up equal loading on the 20V (X) and 20V (Y) supplies to the signal potentiometers. The power supplies are listed in Table 4.

Earth system

9. The A.D.S. has two primary earth lines, bias earth (Bias E), and signal earth (Sig. E) ; both return to the same earth-to-chassis point in the power supply unit.

Servo systems (transducers and computer)

Servo amplifiers

10. All the servo systems in the computer and both transducers employ a servo amplifier to provide a suitable a.c. output signal in order to drive a gearbox assembly incorporating a motor-tachogenerator and its associated gear train. The tachogenerator provides velocity feedback except in the rate of climb servo system (G2) where a separate d.c. tachogenerator is used to provide velocity feedback which is converted to a.c. A servo-driven potentiometer provides position feedback in servo systems G1, G4 and G5. In addition overall amplifier feedback is provided in all systems through a suitable resistor T-network. The servo amplifier consists of a transistor amplifier, a phase-sensitive demodulator and a magnetic amplifier, the overall gain being approximately 130 000. Identical transistor amplifiers and identical magnetic amplifiers are used in the computer and transducers of the A.D.S. but the design of the demodulators varies. Ring bridge demodulators are used in the computer, and two-diode, full-wave demodulators are used in the transducers.

11. The transistor amplifiers are printed-circuit sub-assemblies using germanium PNP junction transistors. The demodulator is a phase-sensitive device operating from a 400 c/s signal voltage and a 400 c/s reference voltage which converts the transistor amplifier's a.c. output into a uni-directional signal for application to the magnetic amplifier.

12. Each magnetic amplifier is a sub-assembly of conventional design capable of delivering 5 watts a.c. power to the control-phase winding of the motor portion of a motor-tachogenerator.

Motor-tachogenerator

13. This is basically a two-phase squirrel-cage motor with an induction tachogenerator on the same shaft ; this shaft carries the motor squirrel-cage and the solid rotor of the tachogenerator. The motor is designed for operation from a 400 c/s supply and its reference winding is fed with 50V reference supply in phase quadrature with the control phase. The resulting rotating field causes the motor to rotate at a speed proportional to the output of the servo amplifier, this output being the command signal. The phase of the command signal determines the direction of motor rotation and subsequent gear train rotation. The generator has its excitation winding connected to an 8V 400 c/s supply, and the output winding provides a sinusoidal signal of constant frequency at an amplitude proportional to shaft velocity. This velocity feedback signal is fed to the servo amplifier input and provides a damping factor for the servo system.

D.C. tachogenerator

14. Velocity feedback is provided in the first stage of the vertical speed channel by a d.c. tachogenerator, the output of which is linear over a wide speed range and within a very close tolerance. The magnetic field for the d.c. tachogenerator is provided by stationary permanent magnets and a low-inertia armature is secured to a non-magnetic driving shaft.

Static and pitot-static transducers

15. The air speed information for the A.D.S. is derived from a sensitive differential capsule unit. The capsule is contained in a sealed chamber, located in the pitot-static transducer ; the inside of the capsule is connected to the static line and the sealed chamber is connected to the pitot line of the aircraft's pressure head. It is a reasonable assumption to say that in flight the pitot pressure is greater than the static pressure by an amount depending upon the square of the air speed, and this causes the capsule to contract with increasing air speed, the deflection of the capsule being proportional to the log of pitot minus static pressure (log P–S).

16. Height information is obtained from an aneroid capsule contained in a sealed chamber in the static transducer. The capsule chamber is connected to the static line of the aircraft's pressure head and the capsule assembly is actuated by variations in static pressure.

17. In both transducers the capsule movement is connected by a linkage to the moving-iron armature of a variable-reluctance pick-off. Any pressure change will produce a magnetic unbalance in the respective variable-reluctance pick-off and this unbalance affects a bridge circuit from which an error signal is produced. This signal is amplified in a servo amplifier and used to drive a motor-tachogenerator and a suitable gear-train ; this causes the coil of the pick-off to rotate and follow the moving-iron armature until a zero error signal or null position is found. The servo loop action thereupon ceases and the angular rotation of the various shafts, some of which drive the requisite rotary components (synchros, precision potentiometers, etc.) is thus a measure of the deflection of the appropriate capsule.

18. The deflection/pressure law of individual capsules will vary about the optimum, and an adjustable cam—effectively a variable gear—is incorporated in the gear train between the motor and the pick-off coils. This cam is calibrated to a high order of accuracy in order to compensate for any capsule non-linearity, and its effect is such that approximate measurements of pressure from the pick-off coils are converted into accurate pressure measurements throughout the gear train.

19. Each transducer is compensated for errors arising from varying temperature co-efficients and acceleration, and the sealed chambers containing the capsules are also temperature controlled by means of a heater element surrounding the chamber. Each element is thermostatically controlled by means of a bi-metal switch located within the sealed chamber and, in addition, the heater circuits are height controlled by a microswitch in the computer and rendered ineffective below an altitude of 10 500 ft.

20. The static transducer servo system drives two transmitter synchros. Synchro CX1 provides a linear height signal for use in the computer, and synchro CX2 provides a linear height signal which is fed, via the computer but without modification, to the synchro in the height section of the height and rate-of-climb display. The gear train also drives a potentiometer RV3, which provides an output modified by a computation cam CU1A. This output is the logarithmic function of static pressure (log S).

21. The pitot-static transducer servo system drives a synchro CX1, the output of which is modified by a computation cam CU8. This cam shapes the I.A.S. output so that it is linear below 150 kt. and logarithmic above 150 kt. The I.A.S. output is fed, via the computer but without modification, to the flight control system. The gear train also drives a potentiometer RV3 which provides a voltage proportional to the log of pitot minus static pressure (log (P–S)).

Computation process

22. As previously stated, the computation process for the derivation of Mach number is carried out in logarithmic form. The variables of the equations are supplied for computation as voltages derived from potentiometers connected across a 400 c/s 20V supply ; the phase of the supply is either phase X or phase Y, depending upon whether the requirement is for logarithmic addition or subtraction. Supplementary supply voltages of 9·5V, nominal 10V, X or Y phase, are also used for some computations.

23. The voltages appropriate to an equation are summated at the input to the servo amplifier together with overall amplifier feedback, velocity feedback and position feedback signals as applicable in the particular system. A command signal from the servo amplifier drives a motor-tachogenerator the motor portion of which drives a gear train. Where necessary, computation cams are incorporated in the gear train. Output shafts in the gear train drive the output components, which vary between systems but include synchros, potentiometers and d.c. tachogenerators. The outputs from these components represent the solution of the particular equation and may be fed to another servo system for further computation or fed to the display unit or flight control system.

Mach number computation

24. The mach number channel in the computer comprises two servo systems in cascade, log Mach number servo system G1 and Mach number output servo system G5. Servo system G1 contains a servo amplifier SA2 and a gearbox assembly G1, and servo system G5 contains a servo amplifier SA5 and a gearbox assembly G5.

25. The simplified formula for the derivation of Mach number is as follows :—

$$f(M) = \frac{P-S}{S}$$, where f(M) = a function of Mach number,

P = pitot pressure

and S = static pressure

Therefore,

$$\log f(M) = \log (P-S) - \log S$$

26. Log (P–S), (V1, phase X) and log S (V2, phase Y) are obtained from the pitot-static and static transducers respectively, and are applied to the log Mach number servo system G1 at the summation point of servo amplifier SA2. V1 and V2 are of opposite phases, and therefore

$$\log f(M) = \log (P-S) - \log S = V1 + V2$$

A constant voltage of approximately 15V (V3, phase X) representing S_c is fed from potentiometer

RV1 to the summation point of SA2. This is provided so that the input voltage at the summation point of SA2 does not change sign over the whole range of speed and height and eliminates the need for centre-tapped potentiometers. Then,

$$f(M) \times S_c = \frac{P-S}{S} \times S_c$$

$$\log f(M) + \log S_c = \log (P-S) - \log S + \log S_c = V1 + V2 + V3$$

27. Servo system G1 drives potentiometers RV2, RV3, RV5 and RV7. RV2 is controlled by computation cam CU4 to provide a height pressure error (P.E.) voltage (V4) to servo system G3. RV3, controlled by computation cam CU12, provides a voltage (V7, phase X) representing the log of the Mach number function of P.E., which is fed to the summation point of SA5 in the Mach number output servo system G5. RV5, controlled by computation cam CU6, provides a voltage (V6, phase X) representing log of Mach number, which is also fed to the summation point of SA5. RV7 provides a position feedback voltage ($V_{F/B}$, phase Y) which nulls (V1 + V2 + V3) at the input to SA2.

28. An important feature of servo system G5 is a computation cam CU9 which controls two servo-driven potentiometers RV2 and RV9. RV2 provides a position feedback voltage ($V_{F/B}$, Phase Y) to null the input to SA5 and since the effect of CU9 is to remove the logarithmic function, the outputs from G5 will be proportionate to Mach number. As already stated, however, CU9 also controls RV9 and the output of the latter is a voltage (V9) representing the log of Mach number, supplied to the flight control system.

29. The remaining outputs from G5 consist of Mach number from synchros CX1 and CX2, and the reciprocal of Mach number (V8) derived from potentiometer RV4. All three outputs are routed to the flight control system. In addition, three microswitches operate at various values of Mach number to control certain 28V d.c. circuits within the flight control system. MSW1 closes at 0·38 M, MSW2 closes at 0·98 M and MSW3 opens at 1·06 M.

Pressure error correction

30. As stated in para. 3, pitot and static pressures are supplied to the transducers from the aircraft's pressure head. The pressures recorded are subject, inevitably, to inherent error but in Lightning Mk. 2 aircraft the error can be regarded for all practical purposes as existing only in the static pressure input. The error is shown as an over-reading of static pressure and the A.D.S. Mk. 1A employs a factor known as pressure error correction (P.E.C.) to compensate for this error. The method employed is to create a voltage that will always be proportionate to the height error arising from the immediate aircraft flight conditions. The voltage created is applied to the input of the static transducer servo amplifier so that all outputs from this transducer are corrected for pressure error. A further P.E. signal is created in the Mach channel in order to achieve corrected outputs of Mach number from the computer.

31. It is essential that the P.E.C. voltage, shown as V5 in fig. 2, is a function of both height and Mach number. The Mach number function is derived within servo system G2 from a potentiometer RV2 driven by a computation cam CU4 positioned in the servo gear train. RV2 is supplied from a 20V (Y) line, via a trimmer potentiometer RV9, and its output is routed to potentiometer RV2(a) in servo system G3. RV2(a) is driven by a computation cam CU1A, the primary function of which is to produce an output proportional to the log of static pressure. This cam, together with RV2(a) and its associated circuitry, produce the required attenuation, with height, of the P.E. output of RV2. The output of RV2(a) is thus a function of both Mach number and height and is the final P.E.C. voltage (V5). This voltage is applied to the static transducer servo amplifier.

32. Prior to receiving the correction, the gear train in the static transducer had been stabilized, by normal servo loop action, to a position related to the existing static pressure recorded by the capsule assembly within the transducer. When the V5 input appears at the static transducer servo amplifier the motor will be energized and will drive the gear train and the pick-off coils. The servo system will come to rest when the output from the pick-off coils is equivalent to the V5 input. The sense of the P.E.C. signal is such that the height synchro outputs increase when P.E.C. is applied, so correcting the initial low height outputs arising from the over-reading of static pressure. The inputs to G1 servo system, from the transducers, are now log S corrected and log P–S uncorrected. The calculations made in designing the log Mach cam CU6 were, however, based upon wholly uncorrected inputs and it is therefore necessary to re-establish this condition in G1. This is achieved by feeding a proportionate amount of the P.E.C. signal directly to the input of the servo amplifier in G1, thus effectively restoring the log S, corrected, input to its former uncorrected state.

33. To achieve corrected Mach number outputs, a further P.E. signal (V6) is created within servo system G1. This signal is derived from potentiometer RV3, driven by a computation cam CU12 in the G1 gear train. V6 is defined as a Mach number function of P.E. and its sense is chosen so that its application will increase the output of Mach number. Because V6 is a function of Mach number, it can be wholly correct only at any one given height and in the A.D.S. Mk. 1A the chosen height is 30 000 ft.

Height channel

34. This channel employs only a single servo system G3. The corrected height output of the 10-turn transmitter synchro CX1 in the static transducer is fed to a control transformer synchro CT1 in G3. Any signal in the rotor of CT1 is fed, via the de-energized contact of relay RLA, to the input of servo amplifier SA3 which controls a motor-tachogenerator. The motor drives a gear train and the tachogenerator provides velocity feedback, via RV1, to SA3. The gear train drives the rotor of CT1 back to null and simultaneously positions a synchro CX1 and three cams, operating microswitches MSW1, MSW2 and MSW3. It also drives two potentiometers RV2(a) and (b), both of of which are controlled by computation cam CU1A.

35. The synchro CX1 provides a height output to the flight control computer. MSW1 and MSW2 operate at specified heights to control 28V d.c. circuits within the flight control system. MSW1 is open over a range of zero to 45 000 ft. and is closed above 45 000 ft. MSW2 is open from zero to 30 000 ft. and closed above 30 000 ft. MSW3 is open from zero to 10 500 ft. but it closes above 10 500 ft. to operate two relays in the A.D.S. computer which control the heater elements in the two transducers.

36. The output of potentiometer RV2(a) is shaped by the computation cam to add a height variable to the P.E. output from the log Mach number servo system G1, the resultant output (V5) being applied to the static transducer and back to G1. RV2 (b) is adjusted by a preset resistor RV3 so that its output to TA6 is equal to the log S input to TA6 when CT1 is in synchronization with CX1 in the static transducer.

Alignment circuit

37. The synchro link between the static transducer (CX1) and G3 (CT1) consists of ten-turn synchros ; it is essential to protect CT1 against incorrect sensing of the true electrical zero and the consequent displacement of critical datum levels. To remove any possible ambiguity, an alignment circuit is incorporated in the height servo system, consisting of an additional transistor amplifier, TA6, a relay and a full-wave rectifier circuit. The input to TA6 consists of log S (phase Y) from the static transducer and a signal equal to log S but of opposite phase which is provided by RV3, controlled by cam CU1A in the height servo system. The output from TA6 when the synchros are in step is therefore zero. If the synchros become out of step, a potential difference appears between the two inputs to TA6 and part of this output is rectified and used to operate the relay. The relay contact removes the rotor output of CT1 from SA3 and replaces it with the TA6 output. The G3 gear train is thus driven by the output of TA6 and SA3 and this condition continues until the two log S inputs to TA6 cancel each other. This occurs when CX1 in the static transducer and CT1 in the height channel are synchronized, whereupon the output from TA6 will become zero, the relay will be de-energized and the CT1 rotor output re-routed to SA3 for normal operation.

Vertical speed computation

38. A synchro link is provided between CX1 (height corrected) in the static transducer and CT1 in the rate-of-climb servo system G2. The output from CT1 rotor is applied as the input signal to SA1, and G2 drives CT1 to its null, following up CX1 in the static transducer linearly and providing $\frac{dh}{dt}$ (rate of change of height or vertical speed). G2 also drives a d.c. tacho-generator (d.c. TG1), the output of which is chopped to provide a 400 c/s simulated a.c. velocity feedback signal to the summation point of SA2. The output from d.c. TG1 is also the input to SA4 in the V.S. output servo system, this signal being controlled by a tendency, chopper and shaping circuit. (The rate-of-climb display is required to show $\frac{dh}{dt}$ from zero to $\pm$6 000 ft/min., but is not required to be sensitive to irregular changes in pressure. The delay circuit ensures that the rate-of-climb display does not respond to transient changes in pressure error signals.) G4 drives RV3, RV5 and the torque transmitter TX1. RV3 provides $V_{F/B}$ and RV5 provides linear $\frac{dh}{dt}$ to the flight control system. The torque transmitter TX1 is controlled by computation cam CU10 which converts linear $\frac{dh}{dt}$ to logarithmic $\frac{dh}{dt}$, the scale of the rate-of-climb display being logarithmic. TX1 is linked to the torque synchro receiver (TR) in the rate-of-climb section of the height and rate-of-climb display (*para.* 44). A further linear $\frac{dh}{dt}$ output is provided by d.c. tacho-generator (d.c. TG2) in G2, but this is not used.

Height formulae

39. The air data system is calibrated over a range of 50 000 ft. with a total range of 100 000 ft. The system is calibrated in accordance with the Wright Air Development Centre (W.A.D.C.) standard atmosphere. For convenience, it is assumed that the temperature above the tropopause (36 090 ft.) and up to the stratopause (104 986·88 ft.) is constant at −56·5 degrees C (216·66 degrees K).

40. The following equations apply :—

(1) Up to tropopause,

$$P = P_0\left[1 - \frac{aZ}{T_0}\right]^n$$

where P = pressure at altitude Z

P_0 = standard sea-level pressure = 1013·25mb

T_0 = standard absolute sea-level temperature = 288·16 degrees K

a = temperature lapse rate = 0·00198 degrees C per foot change in altitude

Z = altitude above sea-level

n = constant = 5·2561155

$$\text{or } S = 1013{\cdot}25\left[\frac{288{\cdot}16 - 0{\cdot}00198 \times H}{288{\cdot}16}\right]^{5{\cdot}25}$$

where S = static pressure in mb

H = height in ft.

(2) Stratosphere,

$$\log_e P = n \log_e p_a - (Z - Za)$$

where P = pressure at altitude Z

P_a = pressure at the tropopause = 226·319 mb

Z = altitude above sea-level

Z_a = altitude at the tropopause = 36 089·24 ft.

$$\text{or } S = 226{\cdot}319 \times e^{-[1{\cdot}57\times10^{-4}\times(0{\cdot}3048\times H-11000)]}$$

where S = static pressure

H = height in ft.

I.A.S. formulae

41. I.A.S. is provided as a synchro output from the P–S transducer and is routed through the computer, without modification, to the flight control system. At standard sea-level density, I.A.S. is equal to the true air speed (T.A.S.), but at greater altitudes the I.A.S. is reduced in the same proportion as the square root of the density, so that at 40 000 ft., where the standard density is one quarter of the sea-level density, the I.A.S. display will indicate about half the T.A.S.

42. The air loads on an aircraft in level flight or straight dives and climbs are directly proportional to the dynamic pressure and thus to the I.A.S. For example, an aircraft flying at approximately 75 000 ft. at a T.A.S. of some 1 300 knots has a corresponding I.A.S. of 270 knots. Thus, although the T.A.S. is high, the forces experienced by the airframe are the same as those which it would experience at sea-level at a T.A.S. and I.A.S. of 270 knots, and the air loads on the airframe are therefore determined by the I.A.S.

43. Indicated air speed as a function of P–S pressure is represented by the following equations :—

(1) I.A.S. less than speed of sound

$$V_i = C_0\sqrt{5\left[\left(\frac{P-S}{1013{\cdot}25}+1\right)^{2/7}-1\right]}$$

(2) I.A.S. greater than speed of sound

$$\frac{P-S}{1013{\cdot}25} = 166{\cdot}92\,\frac{\left(\frac{V_i}{C_0}\right)^7}{7\left[\left(\frac{V_i}{C_0}\right)^2-1\right]^{5/2}} - 1$$

where C_0 = Speed of sound at sea-level = 661·03 knots

S = Static pressure in mb

P = Pitot pressure in mb

V_i = Indicated air speed

Height and rate of climb display, Type C, Ref. No. 6A/6695

44. This unit displays height from 0 to 100 000 ft. and vertical speed (rate of climb or dive) over a range of ±6 000 ft./min. by means of conventional dials and pointers. The height scale is graduated in hundreds of feet with subdivisions of 50 ft. One revolution of the pointer represents 1 000 ft. and the number of revolutions is indicated on a two-digit counter. A control is provided to enable the display to be adjusted for variations in ground barometric pressure and the setting is displayed on a millibar counter. Provision is also made for adjusting the height zero over a range of ±55 ft. The vertical speed scale is graduated in thousands of ft./min. over a non-linear scale. Although it is only calibrated over a range of ±6 000 ft./min., the unit will accept rates of up to 60 000 ft./min.

45. The unit contains a power pack for use in the height section of the display and is connected to the 115V, 3-phase, 400 c/s supply. If the supply fails or the phasing is incorrect, an orange disc is displayed in an aperture in the height dial ; with a correct supply, the disc is covered by a solenoid-operated black shutter.

46. The vertical speed section of the display is operated by means of a synchro torque transmission system. The pointer is mounted directly on the rotor shaft of a synchro receiver which is coupled to a torque transmitter synchro in the computer. Hence any change in computer synchro angle is repeated at the display.

47. The height section of the display uses a synchro control transmission system. A control transformer synchro in the display is linked, via the computer, to a transmitter synchro in the static transducer. Any misalignment in the synchro loop results in an error signal from the rotor of the control transformer synchro. This error signal is applied to a transistor amplifier and the amplified signal is applied to the control winding of a servo-motor. The servomotor is driven to realign the synchros and also repositions the presentation pointer and counter, via a differential gear. Barometric pressure adjustment is applied through the same differential gear ; zero setting is applied by adjustment of the synchro rotor/stator relationship.

48. For illumination purposes, the display is fitted with two pairs of internal lamps fitted with diffusing filters. Each pair of lamps is fed from a separate 4V, 400 c/s supply and the lamps are connected so that illumination is retained even though an individual lamp, or supply, has failed. Illumination is controlled by a lighting control unit in the pilot's cockpit.

TABLE 1

List of units

Unit	Ref. No.	A.P.4685 Vol., Part 2
Static transducer, Type A	6A/5551	Sect. 3 Chap. 1
Pitot-static transducer, Type A	6A/5550	Sect. 3 Chap. 2
Air data computer, Type A	6A/5398	Sect. 3 Chap. 6
Power supply unit, Type B	6A/6822	Sect. 3 Chap. 9
Height and rate of climb display, Type C	6A/6695	Sect. 5 Chap. 6
Transducer mounting tray, Type A	6A/5934	Sect. 3, Chap. 1 and 2.
Computer mounting tray	—	Sect. 3, Chap. 6.

TABLE 2

Computation inputs

Input	Source	Destination
Log P–S	Pitot-static transducer	Mach number channel
Log S	Static transducer	Mach number channel Height channel
Height	Static transducer	Height channel Vertical speed channel

TABLE 3

Output signals

Signal	Destination	Type
Height (corrected) (from static transducer)	Display unit	Synchro CX2
Height	Flight control system	Synchro C3/CX1
Vertical speed (logarithmic)	Display unit	Synchro G4/TX1
Vertical speed (linear)	Flight control system	Potentiometer G4/RV5
I.A.S. (from pitot-static transducer)	Flight control system	Synchro CX1
Log Mach number	Flight control system	Potentiometer G5/RV5
Mach number	Flight control system	Synchro G5/CX1 G5/CX2
Reciprocal Mach number	Flight control system	Potentiometer G5/RV4

TABLE 4

Power supplies from P.S.U.

Voltage a.c. 400 c/s	Phase with respect to reference	Function
25V (REF. 1)	—	Reference voltage (REF. 2 earthed)
8V	Anti-phase	Excitation phase, tachogenerator
85V (AC1)	In-phase	Transductor load windings, magnetic amplifiers
85V (AC2)	Anti-phase	(Transductor load windings, magnetic amplifiers)
20V (X)	Anti-phase	A.D.S. signal voltage supply (computation voltage)
20V (Y)	In-phase	(A.D.S. signal voltage supply (computation voltage))
9·5V (X)	Anti-phase	Potentiometer supply (rate of climb)
9·5V (Y)	In-phase	(Potentiometer supply (rate of climb))
6V (X)	Anti-phase	Transducer pick-off coil excitation
6V (Y)	In-phase	(Transducer pick-off coil excitation)
3V–0–3V	—	Not in use
50V	90 degrees in advance	Excitation phase for motor portion of motor-tachogenerator
115V (A)	—	Synchro excitation
115V (B)	—	(Synchro excitation)
115V (A)	—	Transducer heater elements, via RLB or RLC
115V (C)	—	(Transducer heater elements, via RLB or RLC)
Voltage d.c.		
–30V		Magnetic amplifier bias and supply voltage to relay solenoids
–6V (A)		Collector voltages, transistor amplifiers
+9V		Emitter bias transistor amplifiers

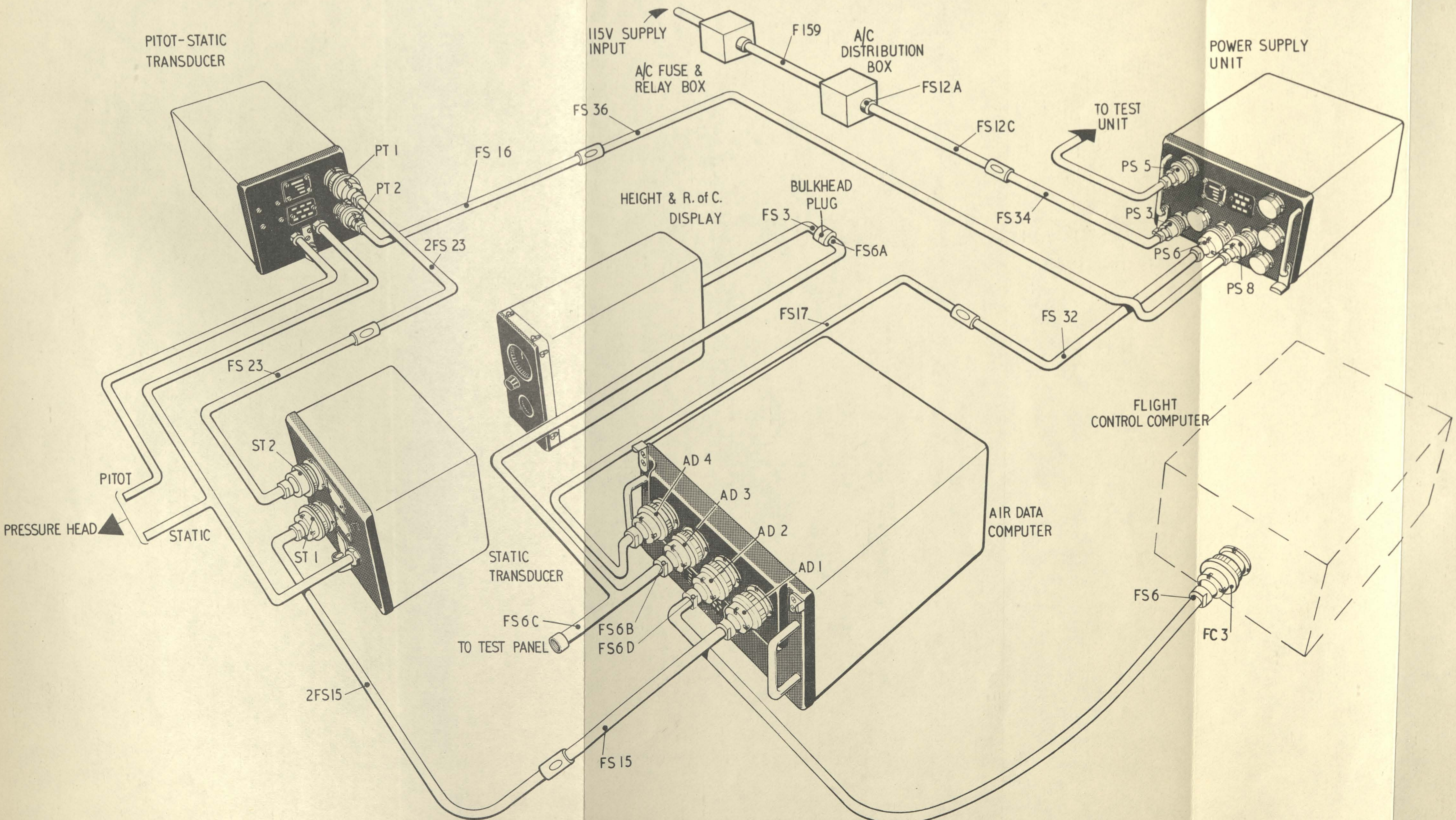

Fig. 1

A. D. S. Mk. 1A—interconnection diagram

Fig. 1

Fig. 1

51475-(M.F.P.)

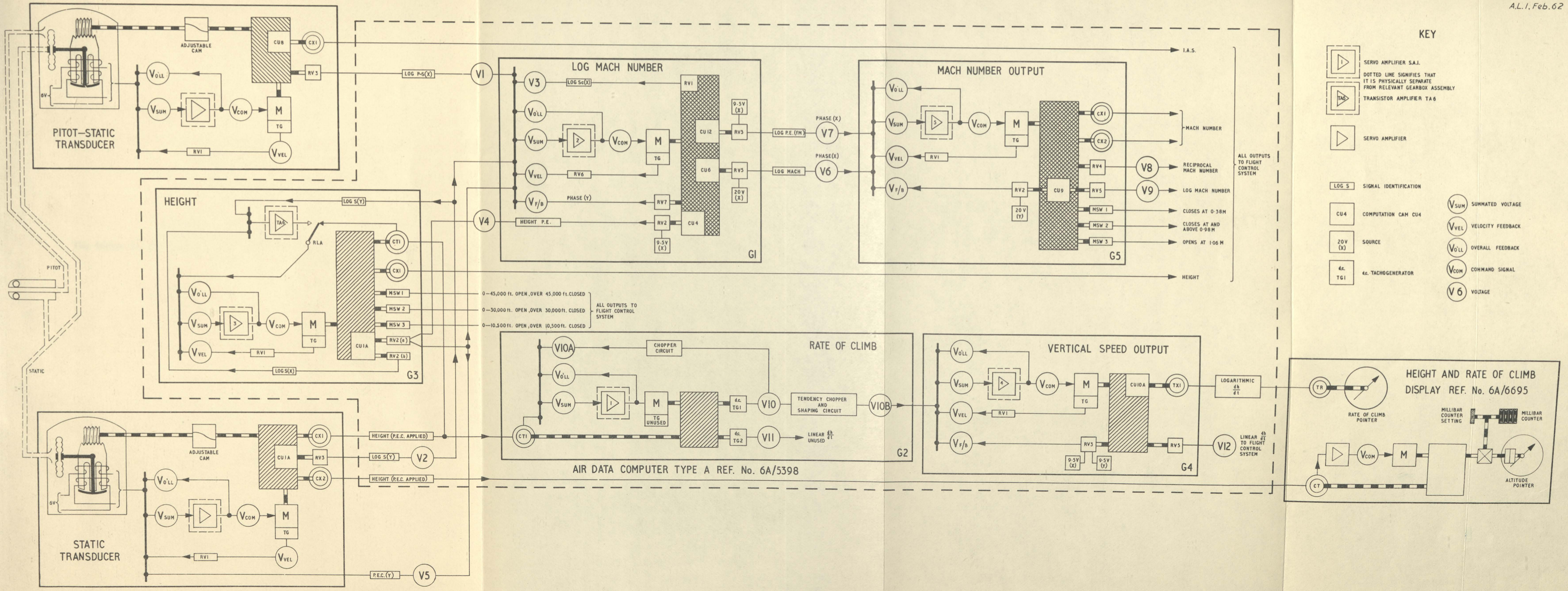

Fig.2

(M.F.P.)

A.D.S. Mk.1A – system schematic diagram

Fig.2