GROUP D.9

PHOTOGRAPHIC RECONNAISSANCE CAMERAS (CODE FR)

(P.R. MK.11 Aircraft Only)

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LIST OF ILLUSTRATIONS

TABLE

Introduction

1. This group contains the description and operation of the photographic reconnaissance camera installation and control circuits, together with the information on servicing required to maintain the installation in an efficient condition. Routeing and theoretical circuit diagrams are included. The aircrafts' electrical system is described in Groups A1, A2 and A3. Detailed information on the standard items of equipment used in the circuits will be found in the Air Publications listed in Table 1.

DESCRIPTION

Cameras

2. Three cameras are located on mountings in the front fuselage forward of frame 3. They are installed for low altitude, high and low speed photographic reconnaissance. One camera with 4 in. or 12 in. lens is installed forward with a range of depressions from the horizontal of 10° to 15° for the 4 in. lens and 5° to 15° for the 12 in. lens in 2½° steps, or alternatively this camera with, a 12 in. lens only, may be installed facing vertically downward. The camera is mounted between frames 1 and 2 and when in the forward position, its lens is focussed through eyelids in the nose cone which are operated by a link mechanism and an electrically controlled actuator, but when in the vertical downward position the lens is focussed through a window in the bottom skin between frames 1 and 2.

3. Two cameras with 4 in. lenses only facing obliquely downwards, one to port and one to starboard and installed at 15° depression from the horizontal, are mounted on the forward face of frame 3 with the lenses focussed through windows in the skin between frames 2 and 3. The port window is on the datum line of the aircraft on the port side and the starboard window is below the datum line on the starboard side.

4. The cameras are controlled by selector switches and an intervalometer and operate continuously or on a 'single shot' cycle as selected.

Intervalometer

5. The intervalometer enables the cameras to be operated on a 'single shot' cycle at pre-selected intervals and is located on a mounting plate above the port and starboard cameras between frames 2 and 3. The intervalometer consists of a permanent magnet motor driving a series of cams through the medium of double reduction gearing. The cams operate four pairs of electrical contacts at intervals of ½, ¾, 1 and 2 seconds.

Control and junction boxes

6. A camera control box located at the starboard glare shield, frame 9, and a camera junction box located between frames 4 and 5 at the top of the nose wheel bay accommodate most of the switches, fuses, indicators, resistors, rectifiers and relays in the circuit.

Switches

7. A push switch incorporated in the control column handgrip is used to bring the cameras into operation. This switch is supplied from a fuse on the supply panel via the safety plug and leg compression switches *(Group G.1)*.

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Camera 4 in. F.95 Camera 12 in. F.95 Intervalometer Type 95 Mk.2	A.P.1335C, Vol.1, (2nd Edition), Sect.5
Remote film indicators Type 109 Warning lamps, iris type, Green Rotax 2803	A.P.4343E, Vol.1, Sect.18
Camera push-button switch, *(Part of control column handgrip)* Type AC 12590	A.P.4343X, Vol.1, Sect.7
Relays type SM5A - M4 Relays type 10B No.1 Relays type 10B No.2 Relays type 10B No.14	A.P.4343C, Vol.1, Book 2, Sect.3
Switch D.P. change over centre off Type XD.784 Switch S.P. change over centre off Type XD.776 Switches rotary Type DM	A.P.4343C, Vol.1, Book 1, Sect.1
Actuator Type CZ.72257	A.P.4343D, Vol.1, Book 3, Sect.14

8. A single pole ON/OFF switch marked CAMERA MASTER located on the leg panel controls the power supply to a contact on the caging and camera relay 'U' and also the heater control relay 'A'. The camera heaters are thermostatically controlled to maintain the cameras at their correct operating temperatures and permit effective operation at extreme temperatures.

9. An iris control switch is used to control the aperture setting mechanism to select the correct iris opening during DULL, NORMAL OR BRIGHT conditions and a camera run and interval switch marked INTERVALOMETER are located in the camera control box.

10. To enable each camera to operate at either 8 or 4 films per second independantly, three switches are provided in the camera control box. A double pole change over, centre off switch marked, FWD OR VERT 8 FPS and INTERVAL OR 4 FPS, controls the front camera, together with the eyelid relays. Two single pole change-over centre off switches marked PORT 8 FPS and INTERVAL OR 4 FPS, and STBD 8 FPS and INTERVAL OR 4 FPS, control the port and starboard cameras.

Indicators

11. Visual warning that the cameras are operating correctly is given by three green warning lamps located in the camera control box. They blink slowly as the cameras operate at the selected speed.

12. Three electro-magnetically operated film indicators marked, PORT, FWD OR VERT and STBD are also located in the camera control box. They rotate to show the amount of film remaining in the magazine of each camera.

Circuit breaker

13. The camera control circuit is protected by a 45 amp circuit breaker located below the supply panel adjacent to the I.F.F. and U.H.F. circuit breakers between frames 16 and 17 on the starboard side of the front fuselage. Each camera is also protected by a 10 amp fuse which is located together with the control relays, fuses and resistors, in the camera junction box.

Operation

General

14. The theoretical diagrams of the circuit *(figs. 1 and 2)* are shown in the condition found when the cameras are not operating, the irises fully open and the eyelid actuator has closed the eyelids. The cameras are operated by pressing the camera push-switch after the iris aperture has been chosen and the cameras set to the desired operating speed. The camera push-switch is supplied as described in Group G.1.

15. The CAMERA MASTER switch controls the circuit for the camera heaters through relay 'A' *(fig.1)* which when closed makes contacts 1-1a, 3-3a and 5-5a thus allowing current to pass via these contacts and 7 amp fuses to pin 'E' of the camera 7 pin plug. A supply is also made via three 10 amp fuses to the iris selector switches and to the contacts of relay 'B' in preparation for supplying the camera when the camera switch is pressed *(para. 18)*.

16. The intervalometer switch *(shown as camera run and interval switch in fig.2)* is supplied from a 2 amp fuse and contacts 7-7a of relay 'B' and controls the operation of the intervalometer according to its setting i.e. 8 or 4 FPS, ½, ¾, 1 or 2 seconds. When the switch is in the 8 or 4 FPS position the intervalometer is out of circuit.

Forward camera

17. The eyelid switch supplies relay 'J' from a 5 amp fuse and when contacts 5 and 6 are made current passes to pin 'B' of the eyelid actuator and the closed contacts of the 'OPEN' limit switch. When the eyelids are fully open the limit switch changes over and breaks the supply to the motor and at the same time a supply is made via pin 'A' to the coil of relay 'K'. With this relay energized its contacts 2 and 3 are bridged and the supply from the camera run and interval switch completes the circuit to relay 'D'. With the coil of relay 'D' energized the bridged contacts 1-1a complete the circuit to the speed selector switch and via this switch to the camera motor speed circuits.

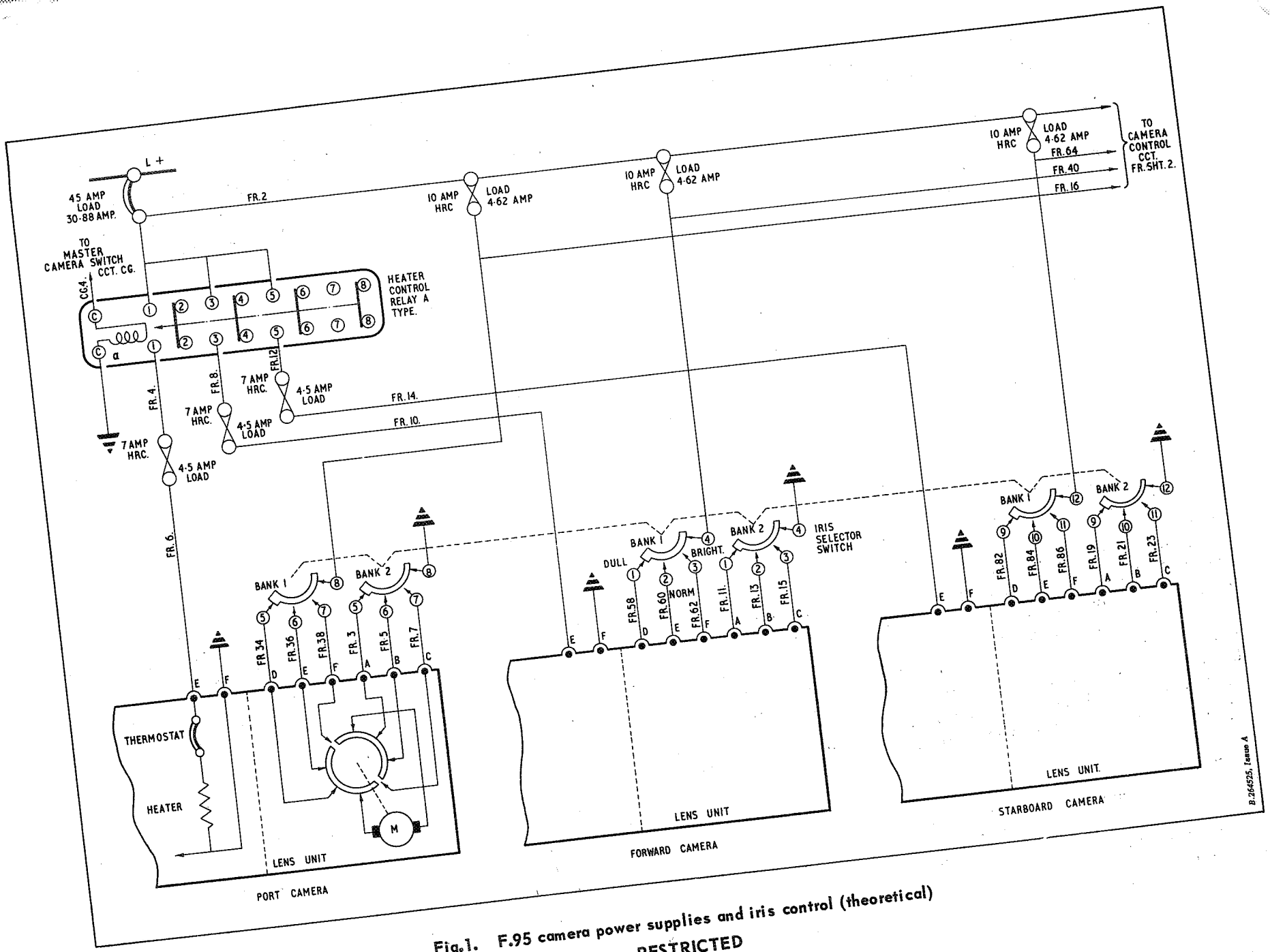

Fig.1. F.95 camera power supplies and iris control (theoretical)

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F.S./3

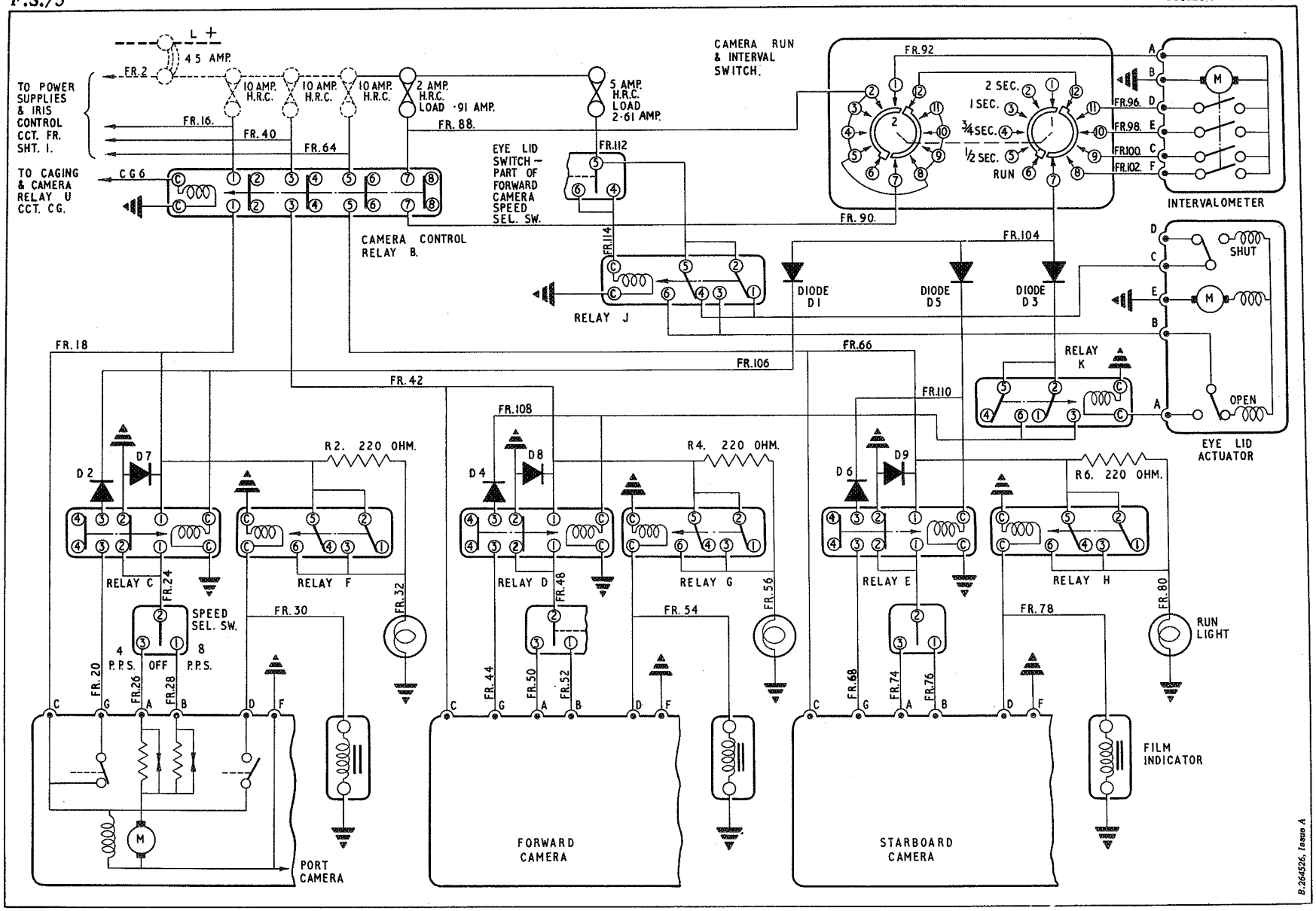

Fig.2 F.95 camera control (theoretical)

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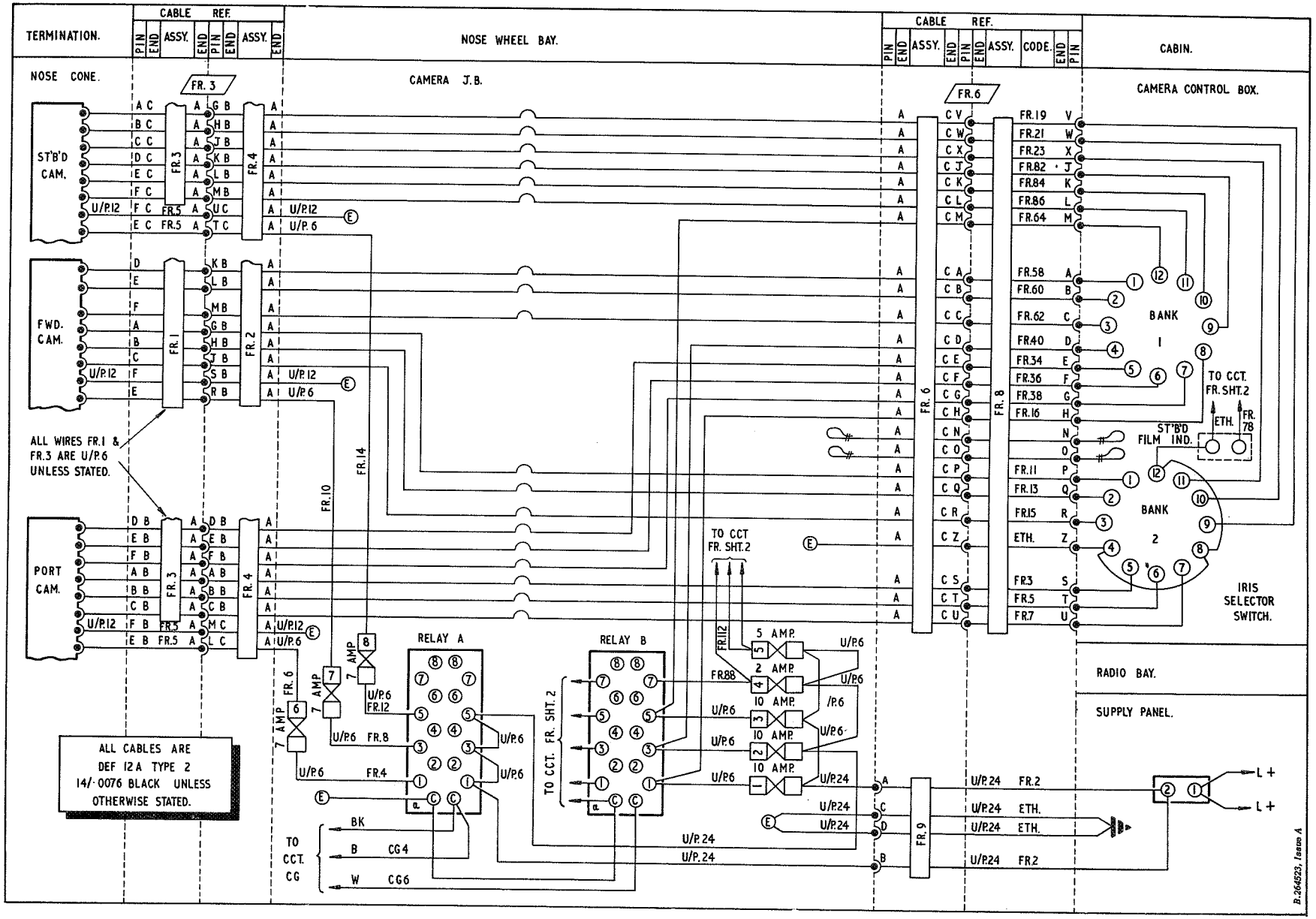

Fig.3 F.95 camera power supplies and iris control (routeing)

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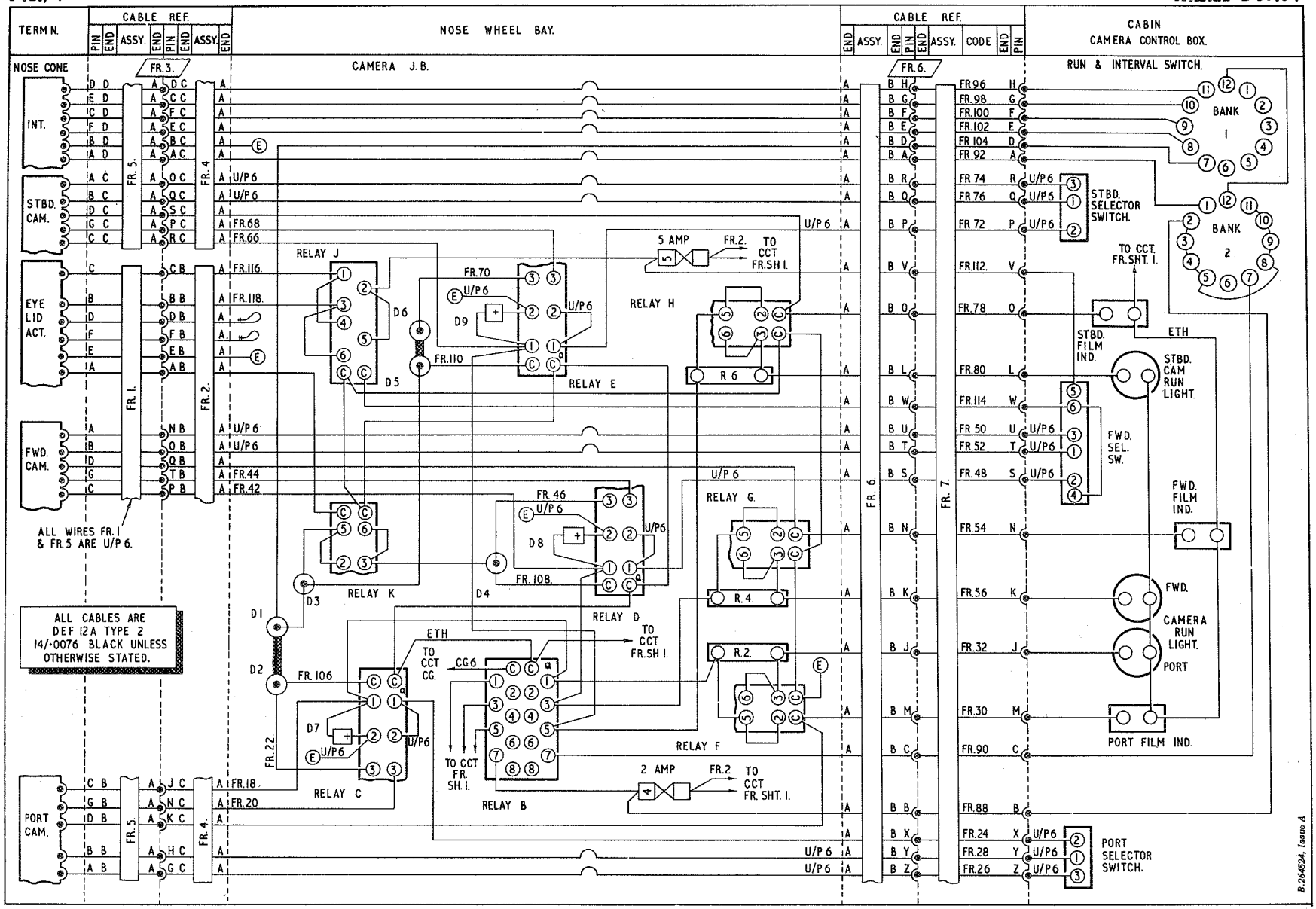

Fig.4 F.95 camera control (routeing)

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18. By pressing the camera control push-button switch a supply from the camera master switch energizes the coil of relay 'B' *(fig.2)*. A supply now passes from the 45 amp. circuit breaker and 10 amp fuse to the bridged contacts 3-3a of relay 'B' to pin 'C' on the camera, and the camera commences operation.

19. With the camera operating at the speed selected its indicator micro-switch contacts open and close to feed the coil of the run warning light relay 'G' and film indicator. Relay 'G' when energized closes contacts 2 and 3 and causes the run warning light to blink slowly thus indicating that the film is moving in the camera. The film indicator rotates at the same time to give indication of the amount of film remaining in the camera magazine.

20. The above paragraphs describe the operation while the camera run and interval switch is in the 8 or 4 FPS position i.e. the intervalometer out of circuit. When the camera run and interval switch is placed in any one of its other positions, the intervalometer is brought into circuit and its cam operated switches control the supply to energize relay 'D' at pre-selected intervals. When relay D is energized its contacts 3-3a pass a supply to the single-shot switch in the camera, via pin 'G' of the 7 pin plug. The camera will thus run at the interval selected, i.e. ½, ¾ 1 or 2 second intervals and continue to do so until a new selection is made.

Port and starboard cameras

21. These cameras operate in a manner similar to the front camera with the exception that they have no eyelid actuator or eyelid relays in the circuit.

SERVICING

General

22. For general servicing of the electrical system, reference should be made to Group A.1, which also contains a table giving the types of filament lamps used in this circuit. All the components should be kept clean and inspected periodically for signs of damage and to ensure that they are securely mounted. Apart from the servicing of the cameras as described in the Air Publication listed in Table 1, and checking the filament lamps for serviceability no further servicing should be necessary.

23. An extension lead Part No. B.236750 is located between frames 2 and 3 on the starboard side of the front fuselage for use when checking the forward camera with the nose piece removed. The removal of the nose piece is described in A.P.4347 L&S, Book 1, Sect.3, Chap.1, and care must be taken to coil this cable under the straps provided for cables FR1 and FR2 before replacing the nose piece. It is essential that cable assembly FR2 from the camera junction box is strapped to the structure of frame 4 to prevent any foul on the nose undercarriage door when the nose cone is removed.

REMOVAL AND ASSEMBLY

General

24. The removal and assembly of the components forming the reconnaissance camera circuit should present no difficulties. The removal of the cameras is described in A.P.4347 L&S, Book 1, Sect.3, Chap.1. The removal of the camera junction box in Group A.2 and the location and access to all equipment is given in Group A.3.