Group G.1

ARMAMENT SUPPLIES AND CONTROL

(CODE GF, GV, GH, DT, JG AND CG)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

TABLE

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Gun firing and ventilation	
Control column handgrip, Type A.C.61044/A.C.63482 (Mod.1295) or A.C.64614 (Mod.1350)	A.P.4343X Vol.1, Sect. 7
Compression switches, Dowty Type C.1831Y, Mk.2	A.P.4343C, Vol.1, Book 1, Sect. 1
Armament ground test switch, Type XD.779 No.3	
Gun selector switch (Mod.945 aircraft only) Type XD.778 No.3	
Gun firing inverter, Type 300 (Mod.Elec.B/454)	A.P.4343B, Vol.1, Book 3, Sect.16
Gun ventilation actuator, Type CZ.72257	A.P.4343D, Vol.1, Book 3, Sect.14
Thermostat, Type FHO/A/96	A.P. 112G–1122–1
Control relays, Type S.3, and Type 9B, No.1	A.P.113D–1309–1
Drop tanks	
Drop tank refuel switches, single-pole, change-over without centre off Type XD.778, No.3	A.P.4343C, Vol.1, Book 1, Sect. 1
Inboard and outboard pylon stores jettison push-switches Type B	
Slip release units, No.1, Mk.1	A.P.1664A, Vol.1, Second Edition
Control relays, Type S3 and SM.5A - H.19	A.P.113D–1309–1
Outboard drop tanks empty magnetic indicators, Type B.2	A.P.4343E, Vol.1, Book 4, Sect.18
Ejector release units, No.1, Mk.2	A.P.1664E, Vol.1, Part 1, Chap.2
Camera gun	
Camera gun, G.90	A.P.1355D, Vol.1, Sect. 1
Camera master switch, single-pole, "ON" centre "OFF", Type XD.779 No.3	A.P.4343C, Vol.1, Book 1, Sect. 1
Sunny/cloudy switch, double-pole change-over, no centre off Type XD.757 No.3	
Camera test switch, double-pole on-off spring return to off Type XD.786 No.3	
Camera selector switch, change-over no "OFF" position, Type XD.778 No.2	
Camera run indicator lamp, Type A	A.P.4343E, Vol.1, Book 4, Sect.18
Camera recorder, Mk.3	A.P.1355D, Vol.1, Sect. 3

Equipment employed

1. The major components employed in the armament supplies and control circuits are listed in Table 1, together with the appropriate Air Publications to which reference should be made for a detailed description and the necessary servicing required to maintain them in an efficient condition.

DESCRIPTION

Gun firing, ventilation and heating

2. The 30 mm. Aden guns are controlled and fired electrically, via a junction box on each gun. The gun firing operation is actuated by a trigger-operated switch located on the forward face of the control column handgrip. The handgrip also contains two push-switches and a tail plane switch. Both push-switches are located at the top of the handgrip, under two spring-loaded flaps. One switch of the pair is used to operate the reconnaissance cameras *(Group D.10)* or the camera gun independently of the guns and the other is used for drop tank release. The flap over the camera gun switch forms a gun safety catch and must be lifted before the guns can be fired. The flap is, however, cut-away locally to enable the camera switch to be pressed, as desired, without lifting the flap.

3. The supply to the camera, safety and gun firing switches is taken through an easily accessible safety plug located in the port stub wing and through two alighting gear compression switches located one on each main undercarriage leg. When disconnected, the safety plug renders all the armament services inoperative. The compression switches are provided to prevent the guns being fired, the camera operated or the drop tanks released while the aircraft is on the ground. These switches may, however, be overridden, when it is required to fire the guns at the butts, by use of an armament ground test switch *(butt switch)* located on the cabin starboard shelf.

4. The gun firing current is provided by an inverter. The input and output of the inverter is taken through relay E.1 which is controlled by the safety flap switch on the control handgrip. The output from the inverter, via relay E.1, is taken to the guns through relay F.1 which is controlled by the firing trigger switch. The inverter, circuit breaker, supply and gun fuses, together with relays E.1 and F.1 are all mounted on the gun firing panel situated in the radio bay.

5. The gun package is automatically ventilated whenever the guns are fired, by the opening of a small shutter incorporated in a gun access door located in the under-surface of the front fuselage between frames 11 and 12. This shutter is opened and closed by an actuator also mounted on the access door. The supply to the actuator is taken through the contacts of relay C.1, which is also located on the gun firing panel and controlled by relay F.1. The ventilation shutter must open fully in 3.5 seconds after the commencement of the guns firing and close in 3.5 seconds after the end of the guns firing.

6. The gun heating equipment fitted to standard aircraft has been removed, with the exception of the thermostat located in the gun package, the feed being isolated by the fitment of a dummy fuse in fuse position No.6 on the gun firing panel.

7. On aircraft Post Mod.945, selective gun firing is incorporated, to Special Order Only, by the inclusion of a gun selector switch on the cabin starboard shelf and a gun selector relay F.4 on the gun firing panel. This permits the firing of the two inner guns first and then the two outer guns, or alternately all four guns together.

Operation

8. As the aircraft becomes airborne, the weight is taken off its alighting gear, thus allowing the compression switches on each main undercarriage leg to make contact and, with the safety plug connected, feed the positive supply to the switches in the control column handgrip. When it is required to fire the guns, it is first necessary to raise the safety flap. This completes the circuit to the firing trigger switch and also energizes the safety relay E.1. Relay E.1 controls the input to and output from the gun firing inverter and, when energized allows the main

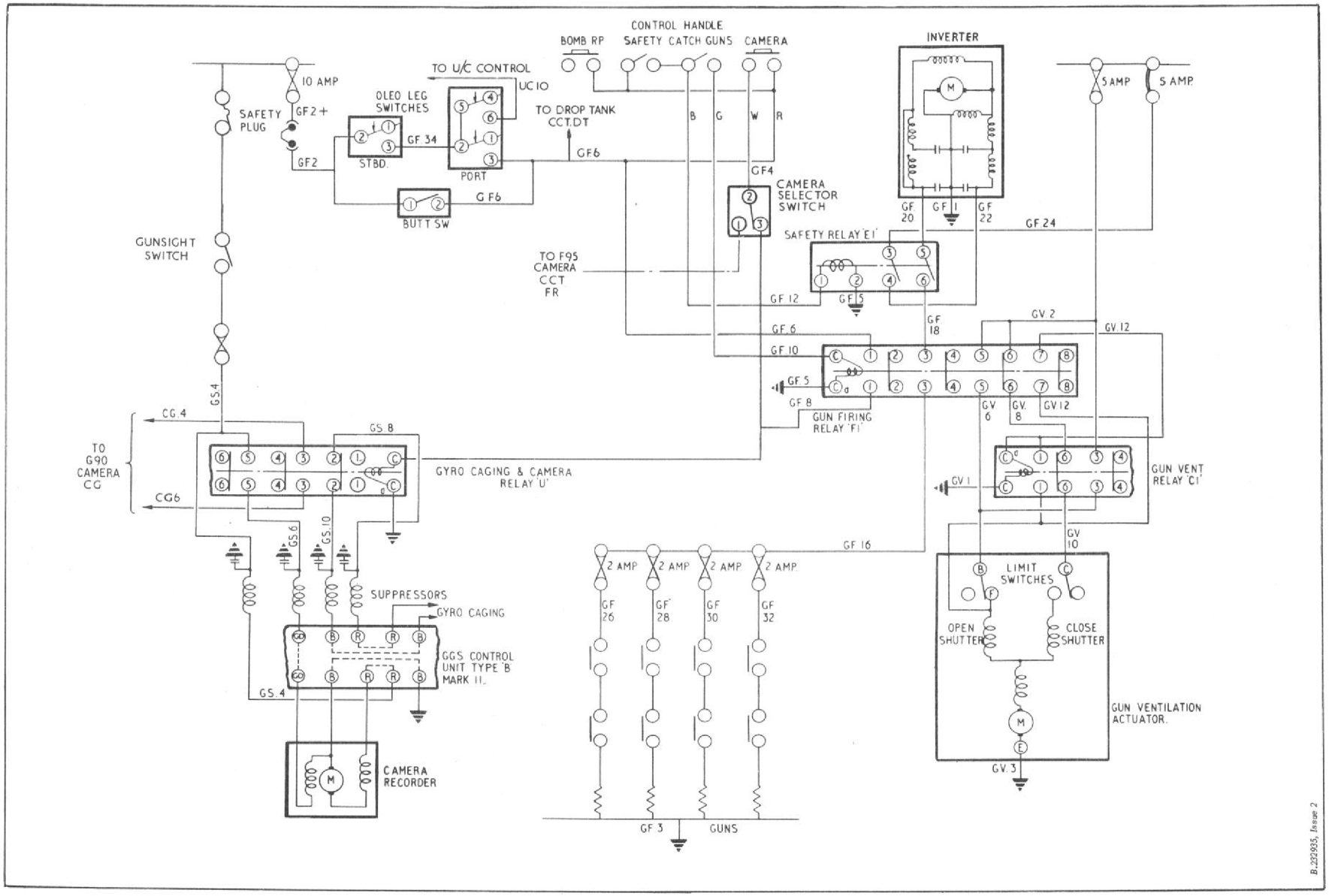

Fig. 1 Gun firing and ventilation (theoretical)

RESTRICTED

positive supply from the circuit breaker to energize the inverter, via its contacts 3-4. As the firing trigger is pressed, it closes the firing switch to energize the firing relay F.1, the contacts 3-3a of which complete the supply from the inverter through contacts 5-6 of the energized relay E.1 to the fuse for each gun, and the guns fire.

9. As the guns fire, the gun ventilation shutter commences to operate *(para.10)* and the camera gun operates to photograph the target *(para.20)*. When the firing trigger is released, relay F.1 is de-energized, thus isolating the supply from the gun firing inverter and the guns cease firing. As the safety flap is replaced over the camera gun switch, the safety switch will be opened and de-energize relay E.1. With relay E.1 de-energized the supply to the gun firing inverter is broken and the inverter ceases operation.

10. When the guns are fired, the firing relay F.1 is energized, breaking its contacts 6-6a *(fig.1)*, supplying contacts 6-6a of the gun ventilation relay C.1,

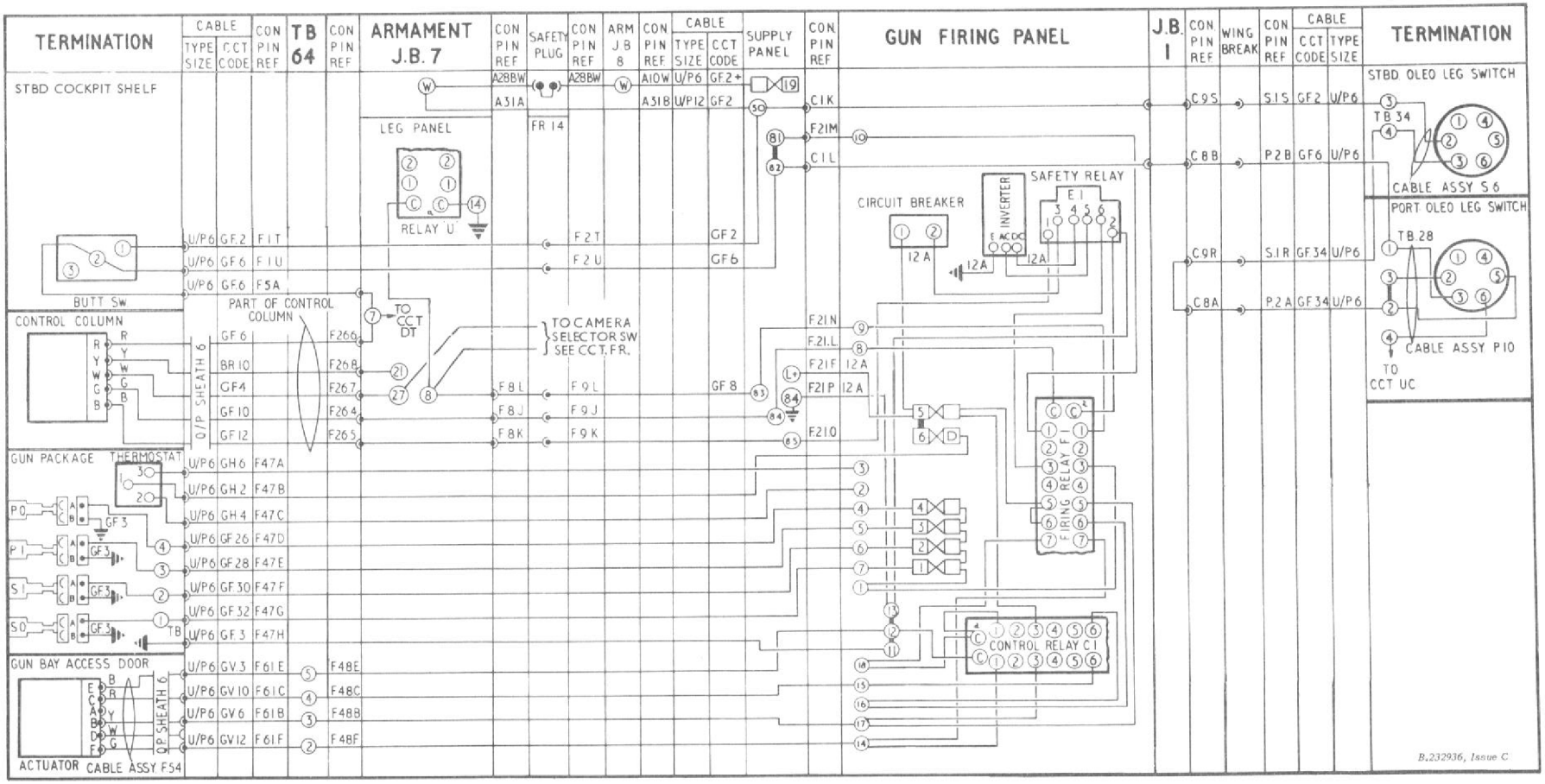

Fig.2 Gun firing and ventilation (routeing)

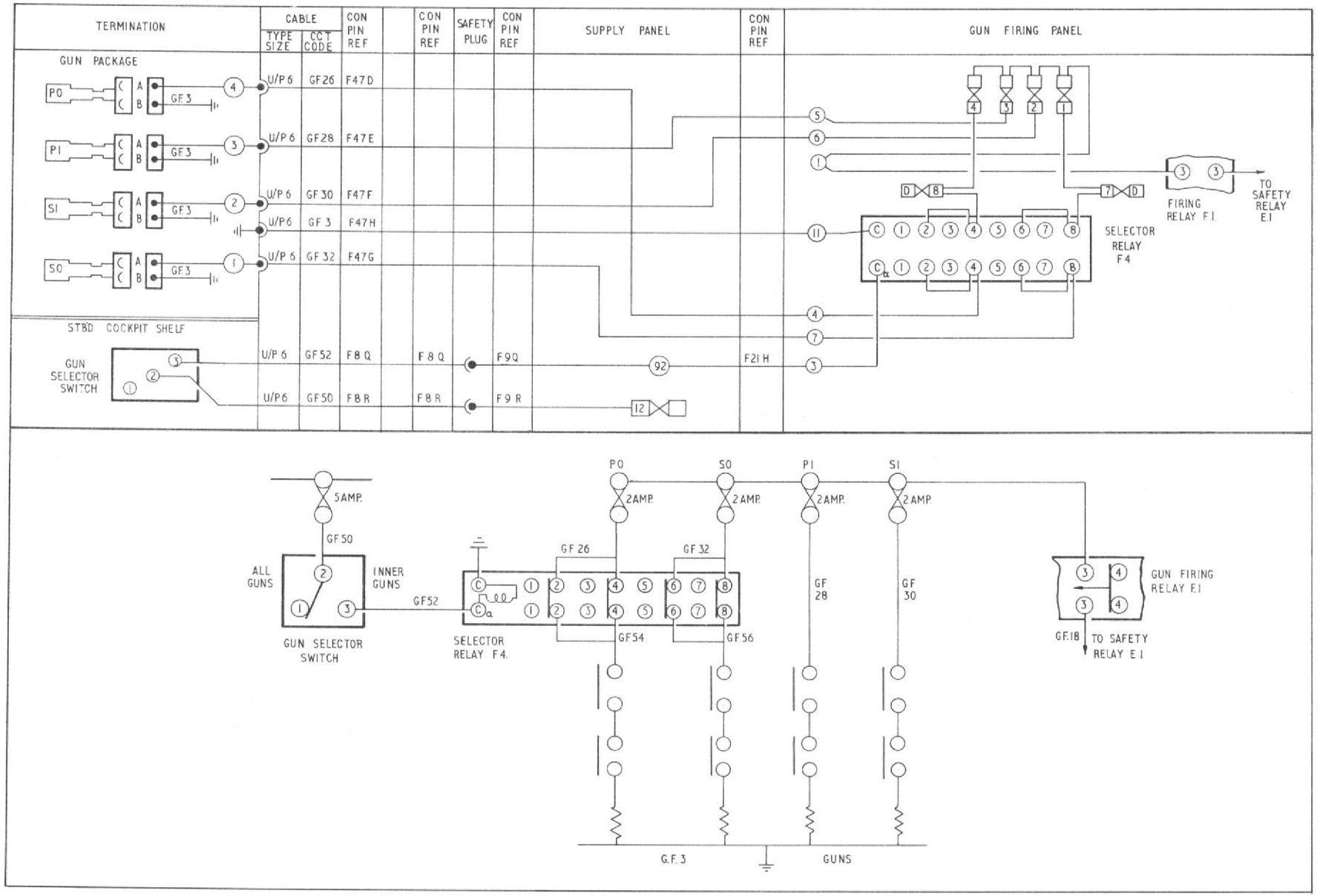

Fig.3 Selective gun firing (Mod.945 only)

which feed the 'close' field coil of the ventilation shutter actuator, and contacts 5-5a of relay F.1 are 'made' to complete the circuit to the actuator 'open' field coil. The actuator will, therefore, start to open the shutter. At the same time contacts 5-5a and 7-7a in relay F.1 complete the supply to relay C.1, via the 'open' limit switch of the actuator. Should the firing trigger switch be released and relay F.1 de-energized, before the actuator completes its full travel, relay C.1 will be maintained in the energized state by a hold-on circuit fed direct from the circuit fuse, through its contacts 3-3a, the actuator 'open' limit switch and contacts 1-1a. This feed also supplies the 'open' field coil of the actuator via contacts 3-3a.

11. When the actuator completes its full travel, the open limit switch will be broken thus stopping the actuator and de-energizing relay C.1. If however, relay F.1 is still energized, the actuator will remain stationary thus keeping the shutter open. When relay F.1 is de-energized the circuit to the 'close' field coil of the actuator will be completed via contacts 6-6a of relays F.1 and C.1. The actuator will now operate to close the shutter and be switched off by the 'close' limit switch at the end of its travel.

Selective gun firing *(Post Mod.945 only)*

12. When the gun selector switch is in the ALL GUNS position, the guns fire as described in para.8, but when INNER GUNS is selected, relay F.4 is energized and its contacts break the firing feed to the two outer guns, thus only the inner guns fire. It is therefore possible, by the use of this switch, to fire all the guns together or alternatively to fire the inner guns, until their ammunition is expended, followed by the outer guns.

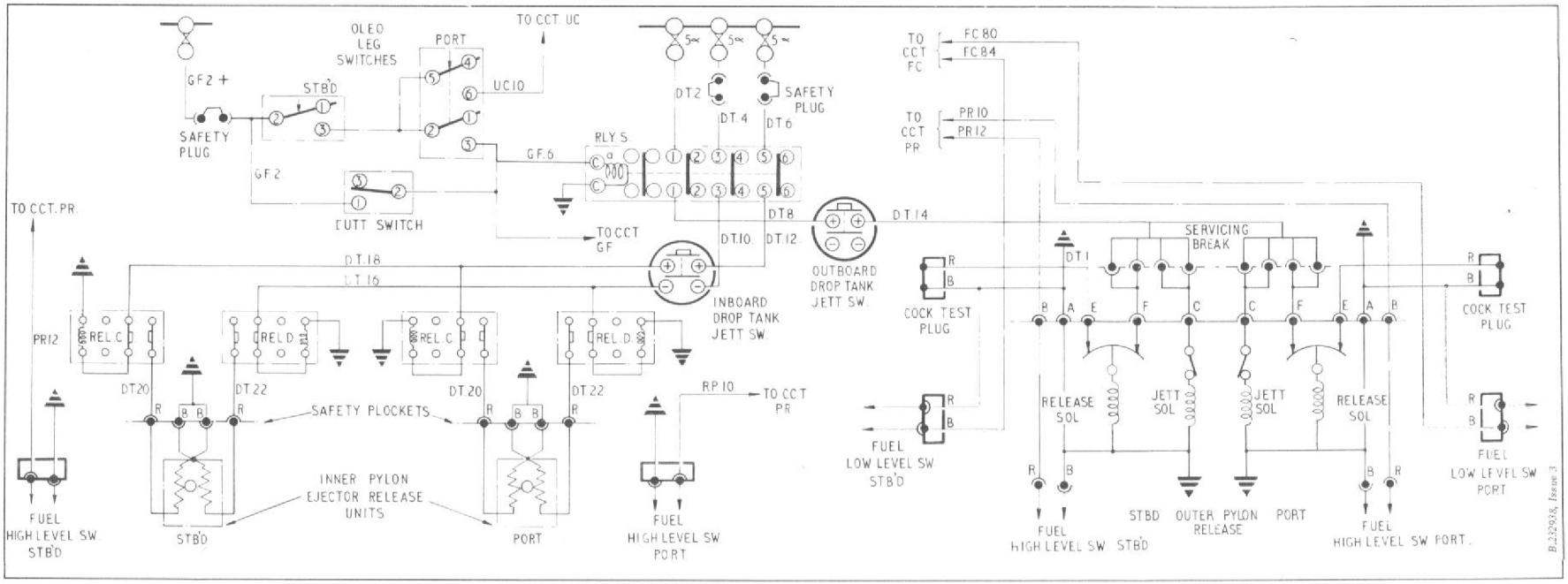

Fig.4 Inboard and outboard drop tank control (theoretical)

Drop tanks jettison

13. Provision is made for jettisoning the drop fuel tanks from each inboard and outboard pylon by operation of push-switches located in the cabin. These push-switches marked INBOARD STORES and OUTBOARD STORES, are mounted on a bracket between the windscreen platform and the top longeron adjacent to the port instrument panel. The jettison mechanism in the inboard pylons consists of an ejector release unit and control relays C and D and is operated by the INBOARD STORES push-switch. The gear in the outboard pylons consists of an electro-magnetic release unit, cock test socket and jettison solenoid located in each pylon and is operated by the OUTBOARD STORES push-switch. Double plocket type safety connections are incorporated in the inboard pylons, and, post Mod.1039, also on the outboard pylons. When it is required to jettison the tanks from all pylons simultaneously the inboard and outboard pylon stores jettison push-switches may be operated together by means of a spring-loaded switch flap marked CLEAR AIRCRAFT.

Operation

Inboard pylon drop tank jettison

14. As the aircraft becomes airborne the weight is taken off its alighting gear thus allowing the compression switches on each main undercarriage leg to make contact and, with the safety plug connected, feed a positive supply to the coil of relay S. With relay S energized, contacts 5-5a will, on operation of the inboard pylon jettison push-switch, feed the port and starboard ejector release unit control relays C, the contacts of which will close and feed the supply, via the safety plockets, to one fuze of the cartridge in each ejector release unit. The cartridges are thus detonated and open the release hooks to eject both tanks. To ensure that the cartridges are detonated, should relays C fail to operate, a separate supply is fed

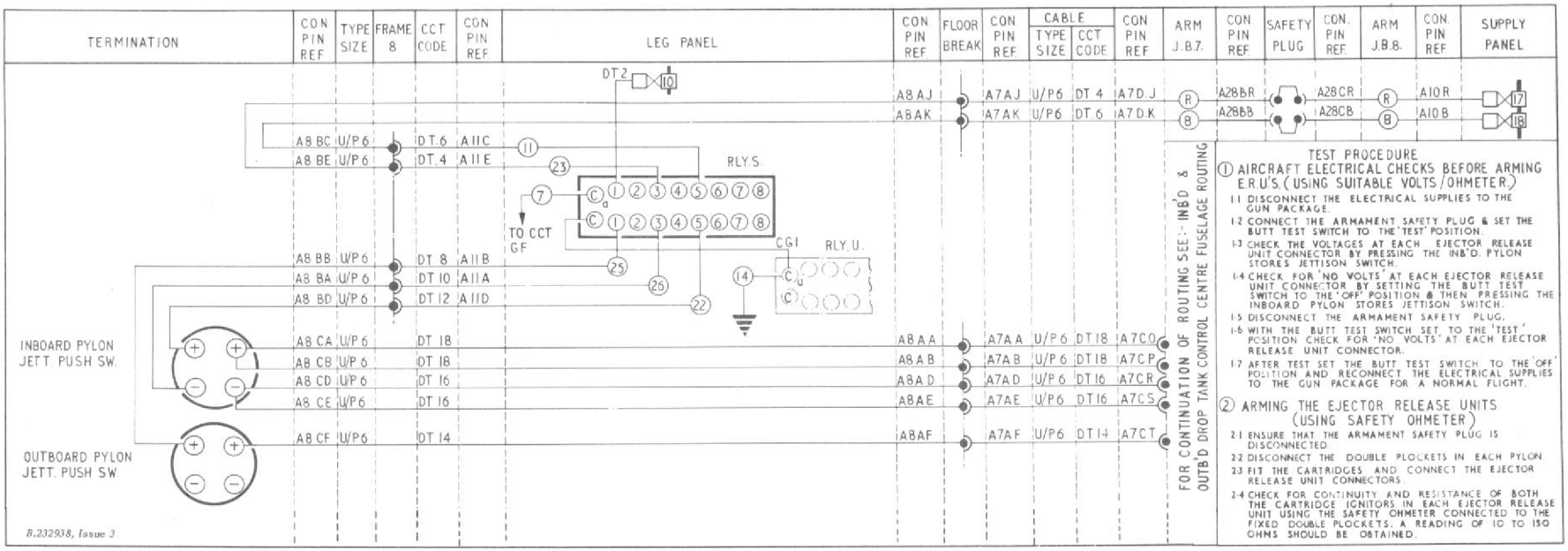

Fig. 5 Inboard and outboard drop tank control (routeing front fuselage)

from contacts 3-3a in relay S to relays D in each pylon. This supply energizes relays D, the contacts of which will close and feed the supply, via the safety plockets, to the second fuze of the cartridges, thus detonating the cartridges if the first fuze has failed to operate.

Outboard pylon drop tank jettison

15. With relay S energized, via the safety plug and compression switches, as described in para.14, contacts 1-1a are made and feed the OUTBOARD STORES jettison push-switch. Operation of this switch will energize the release units in each outer pylon via the double plocket type safety break and open the release hooks. At the same time a supply will be made to the jettison solenoids, which will be energized and operate the mechanical release plungers on each release unit, to open the release hooks if they have not already opened electrically.

Cock test

16. The cock test sockets are used to connect a test set, consisting of a lamp and low voltage battery, to the release unit circuit. The lamp will light when the release unit is correctly cocked, as a circuit is made through the release unit feed switches, solenoid coil and the test set.

Inboard drop tank gauging

17. The fuel content of the inboard drop tanks is shown, together with that in the aircraft's internal fuel tanks on the fuel gauges located on the cabin starboard shelf. For a description of the fuel gauge installation, reference should be made to Sect.5, Chap.2, Group 2.A.

Outboard drop tanks empty indicators

18. Two magnetic indicators are mounted on the cabin starboard shelf to show when the outboard fuel drop tanks are empty. Each indicator is operated by a float switch situated in the lower section of its associated drop tank.

Operation

19. The circuit of each magnetic indicator is supplied through a fuse from the main starboard positive supply line. The indicators show BLACK when energized and change to WHITE when the tanks are empty and the float switches open. A theoretical diagram is given in Sect.5, Chap.2, Group 2.A.

G.90 camera

20. This camera gun, which incorporates an internal overrun control unit, is located on a mounting platform inside the fuselage nose structure at the top just forward of frame 3 and is focussed through a vision tube riveted around an orifice in the skin. The camera is normally controlled by relay F.1, being operated whenever the gun firing trigger is pulled to fire the guns. The camera can however, be operated independently of the guns, by the operation of the camera push-switch at the top of the control column handgrip after the camera selector switch, marked F.95 and G.90 and located on the forward portion of the cabin port shelf is placed in the G.90 position.

21. The camera body heater, which is thermostatically controlled, is supplied via the CAMERA MASTER switch located on the leg panel adjacent to the battery, pressure head heater and engine master switches. A switch, used to select the correct iris opening during BRIGHT or DULL weather, is located on the starboard instrument panel.

22. To enable the camera to be tested and serviced prior to flight, a switch marked NORMAL and TEST, together with a camera run indicator lamp, are provided in a test box situated in the fuselage nose. When placed in the TEST position, the test switch by-passes relay U and supplies the camera direct from the camera master switch. The camera run indicator lamp is controlled by contacts in the camera and will flash on and off as the film passes through the magazine to indicate that the camera is operating correctly.

Operation

General

23. The camera body heater is supplied when the CAMERA MASTER switch is closed, the heater being thermostatically controlled to maintain the camera at its correct operating temperature. A supply is also made from the camera master switch through the closed contacts of the iris relay to the iris coil in the camera. The supply to the camera push-switch on the control column handgrip is taken

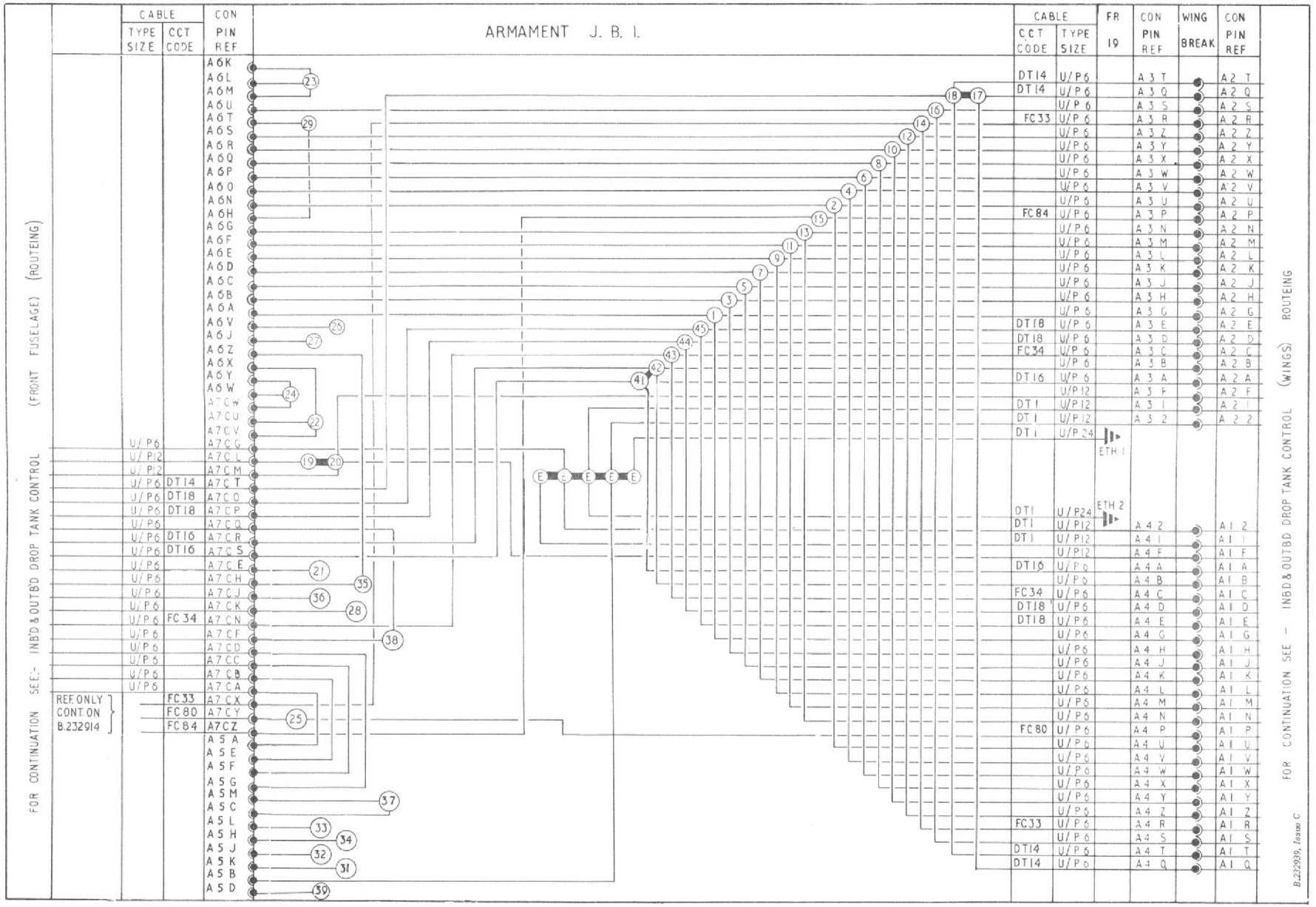

Fig.6 **Inboard and outboard drop tank control (routeing centre fuselage)**

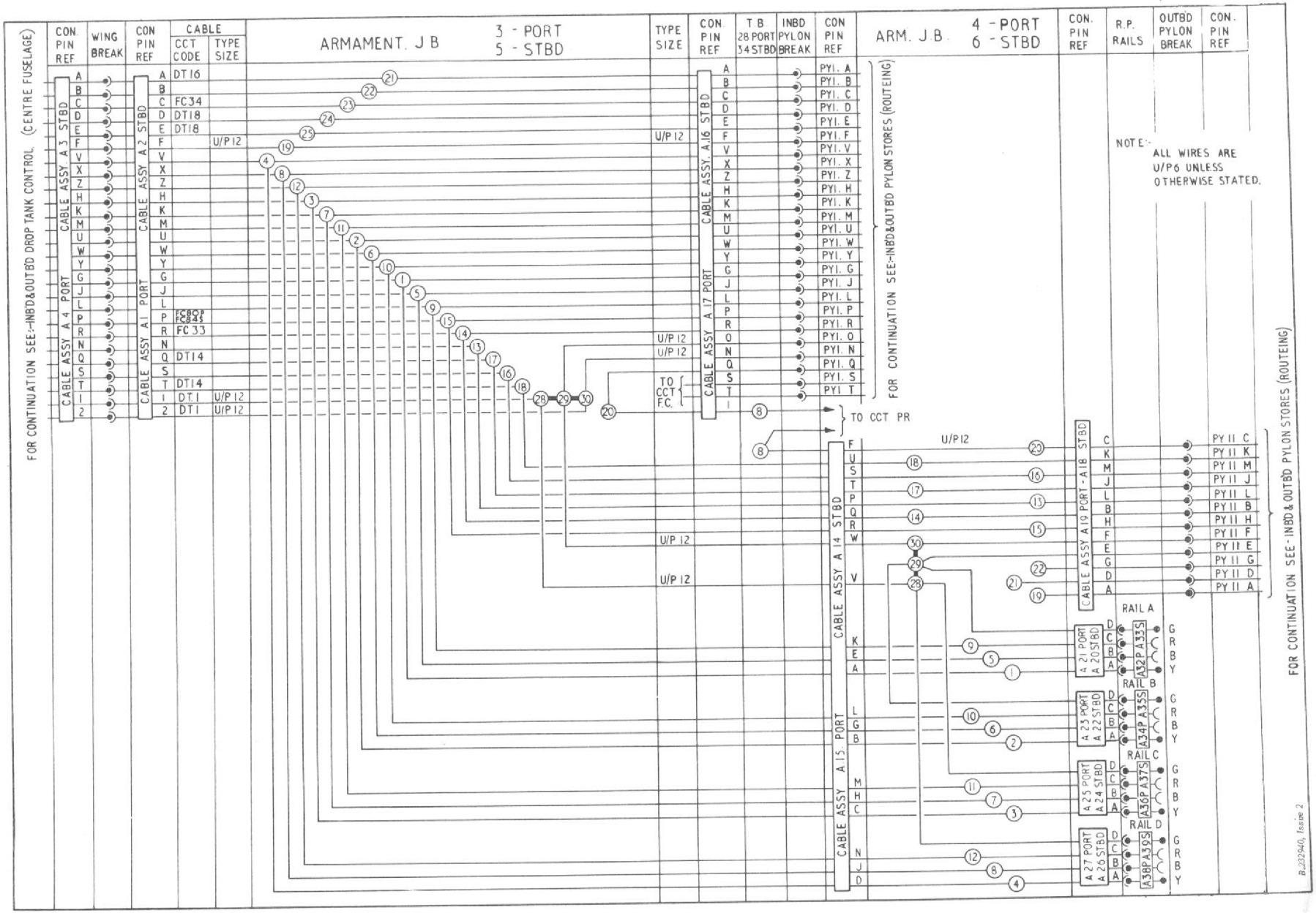

Fig.7 Inboard and outboard drop tank control (routeing wings)

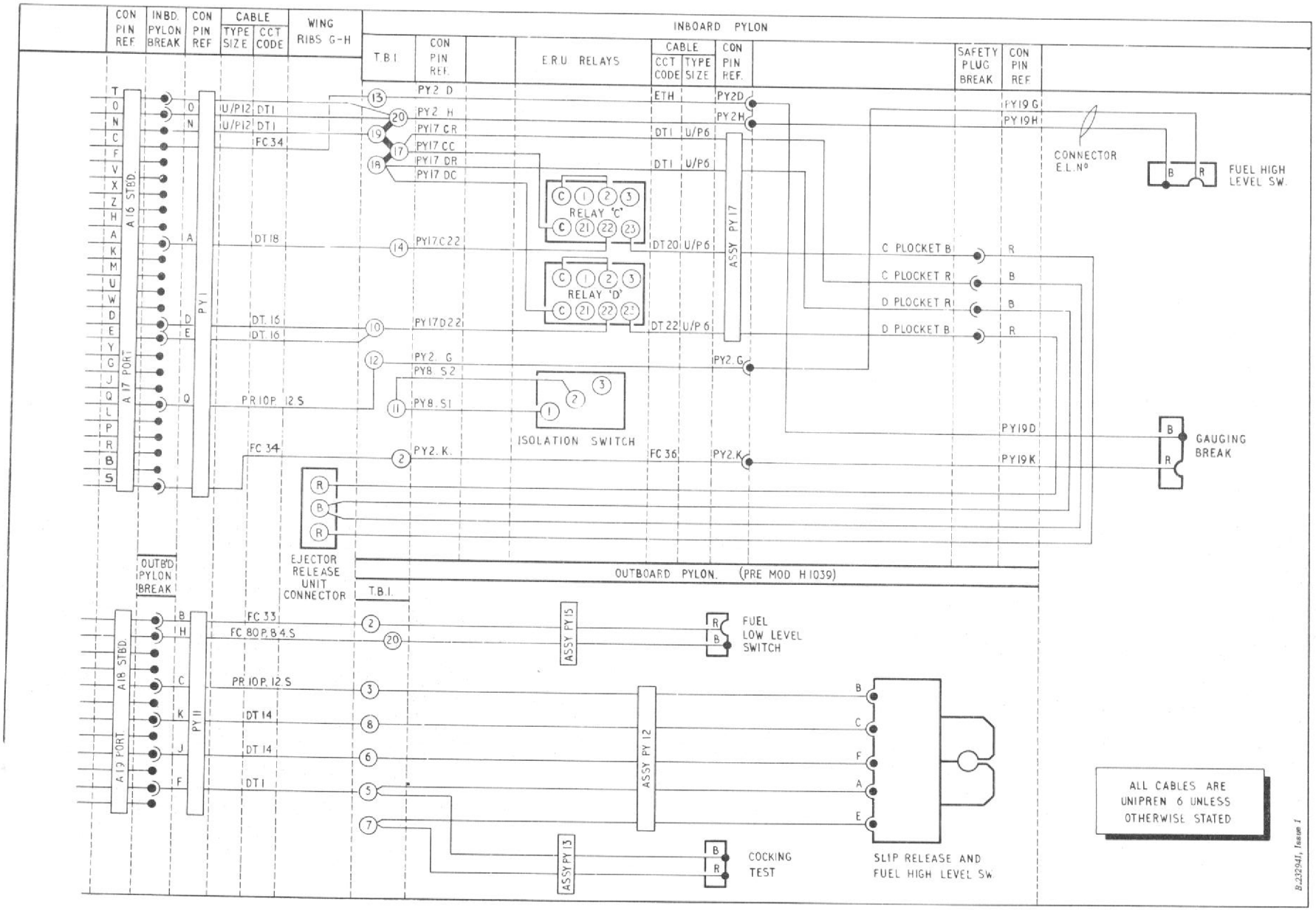

Fig.8 Inboard and outboard pylon stores (routeing)

from the gun firing circuit fuse, via the safety plug and alighting gear compression switches.

Camera operation independent of gun firing

24. When the aircraft is airborne, the compression switches make contact and complete the supply to the camera push-switch, thus when the switch is pressed to operate the camera independently of the guns, the supply is fed to the coil of relay U via contacts 2 and 3 of the camera selector switch. With relay U energized, contacts 3-3a will complete the supply from the camera master switch to pin C of the camera.

25. Pin C of the camera is in connection with the overrun indicator coil, overrun clutch coil and the camera motor, via the overrun selector, when in the non-overrun position. The camera will, therefore, run with the overrun mechanism inoperative e.g. clutch disengaged and overrun indicator retracted, until switched off when the camera push-switch is released to de-energize relay U.

26. When the overrun selector is in the overrun position, pin C of the camera feeds the overrun indicator coil and the overrun clutch coil as before, but the feed to the camera motor is taken from pin D of the camera, via the overrun microswitch and overrun selector. When the camera push-switch is released to de-energize relay U, the overrun indicator and overrun clutch coils will be de-energized, but the camera motor will continue to run until the overrun micro-switch is operated. The overrun micro-switch is operated by a cam, driven via the clutch, from the camera layshaft. When the clutch coil is de-energized, the clutch engages with the layshaft and rotates the cam to operate the microswitch. The operation of this switch will cut off the supply to the camera motor and the camera will stop, having overrun for approximately two seconds after the camera push-switch was released. When the overrun indicator coil is de-energized it will allow the overrun indicator pointer to appear in the film gate aperture so that it will be visible in that section of the film exposed during the overrun period.

Camera operation with gun firing

27. When the gun firing trigger is pulled, relay F.1 is energized and a supply is made through contacts 1-1a to energize relay U via contacts 2-2a of relay S. With relay U energized a supply is made to the camera in a manner similar to that described in para.24 to 26. The camera will therefore, operate to photograph the target as the guns are fired.

Camera recorder

28. If the camera recorder is in position on the gun sight at the time that the camera gun is operated, contacts 5-5a in relay U will complete the supply to the solenoid controlling the camera recorder claw mechanism, as described in Sect.5, Chap.2, Group 4.A and the camera recorder will operate to record the target and graticule display on the gun sight reflector.

Drop tank fuel high level switches

29. These switches and the drop tank refuel switches, shown on fig.8, control the drop tank refuelling operation. For the wiring inboard of T.B.28 and 34 and a description of their operation, reference should be made to Group C.3 .

SERVICING

General

30. For general servicing of the electrical system, reference should be made to Group A.1. All the components should be kept clean and examined periodically for signs of damage and to ensure that they are securely mounted. Apart from the standard routine serviceability and bench testing of the components, as described in the appropriate Air Publications listed in Table 1, no further servicing should be necessary.

◀ 30A. The Bomb/R.P. push switch Part No. 22556/6, *(initial fitting to control column Part No. AC 63482)*, is subject to failure by jamming. When necessary, switch Part No. 24484/7 *(Mod.1335)* is fitted in lieu. ▶

Testing and arming ejector release units

31. The procedure for testing and arming the ejector release units fitted to aircraft is given in the following paragraphs:-

WARNING

Before proceeding with the following test, ensure that the battery master switch is in the OFF position and that the guns

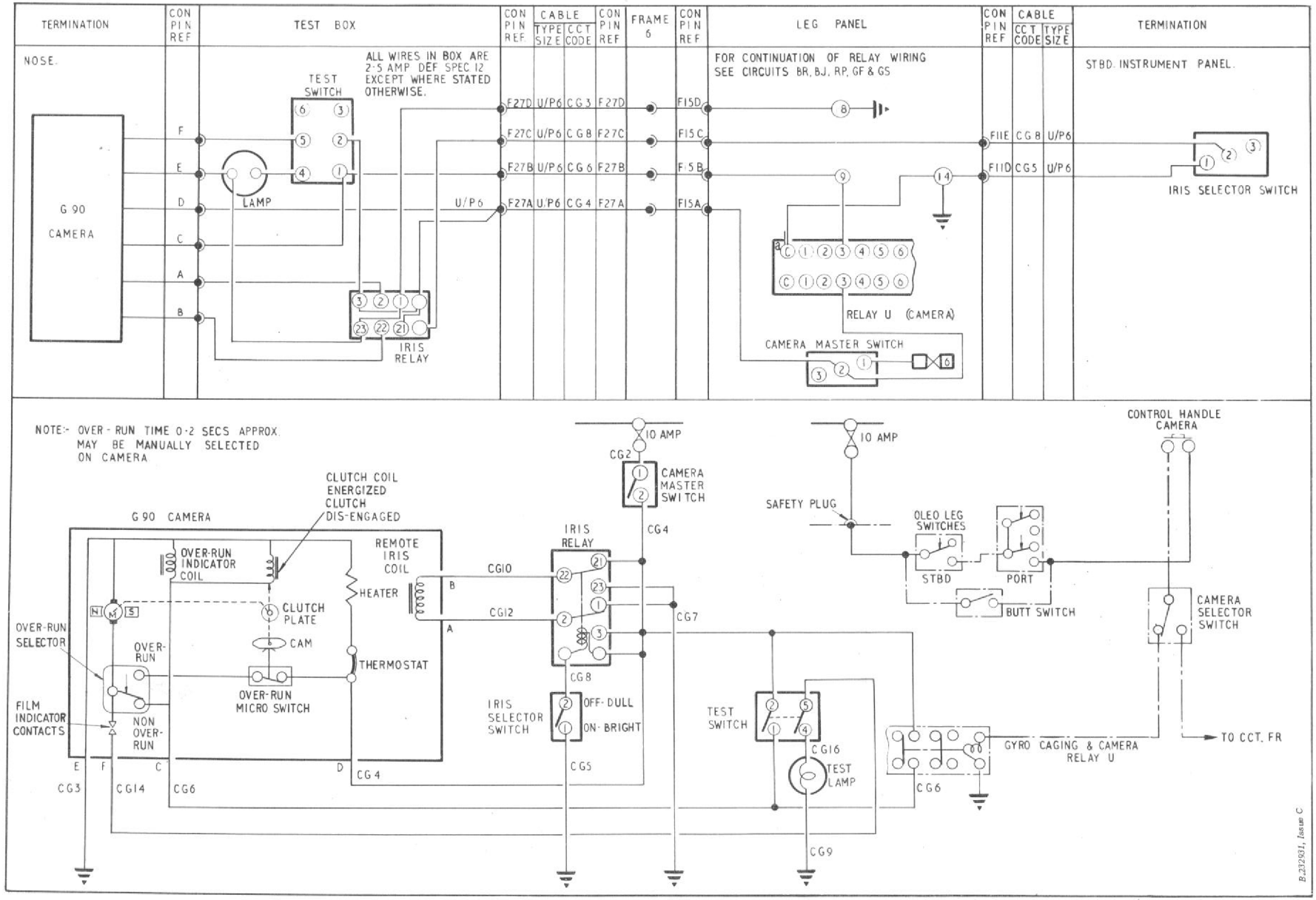

Fig. 9 G.90 Camera

are rendered electrically safe as follows:-

(1) **ARMAMENT SAFETY PLUG:-**
Disconnect the armament safety plug.

(2) **GUNS:-**
Trip the guns circuit breaker on the gun firing panel.

Note . . .
These armament services must not be operated, unless the ejector release unit plockets C and D, in the pylons, are disconnected.

32. To test the ejector release unit's electrical circuit in the port and starboard inboard pylons proceed as follows:-

(1) Ensure that the ejector release unit connectors are disconnected.

(2) Connect plockets C and D.

(3) Connect the armament safety plug.

(4) Select the butt test switch to TEST

(5) Select the battery master switch to ON.

(6) Check the voltage at each ejector release unit's connector by operating the inner pylon stores jettison switch. The reading obtained should be the supply voltage.

(7) Select the butt test switch to OFF operate the inner pylon stores jettison switch, check for *no* volts at the ejector release unit's connections.

(8) Disconnect the armament safety plug, and select the butt test switch to TEST. Operate the inner pylon stores jettison switch and check for *no* volts at the ejector release unit's connectors.

(9) Select the butt test switch to OFF.

Note . . .
Do not re-connect the armament safety plug.

(10) Re-set the guns circuit breaker.

33. To arm the ejector release units proceed as follows:-

(1) Disconnect the electrical supply to the aircraft.

(2) Disconnect plockets C and D in each pylon.

(3) Check for open contacts on relays C and D using a 250 volt Meggar between the RED and BLUE wires on plockets C and D *(free ends)*. The readings obtained should be between 20 megohms to infinity.

(4) Fit a cartridge in each ejector release unit and assemble the connectors.

(5) Check the resistance of the cartridge fuzing circuit, by using a suitable Safety Ohmeter *(0-500 ohms)* connected between the RED and BLUE wires on plockets C and D *(fixed ends)*. The readings obtained should be between 15 and 500 ohms.

(6) Re-connect plockets C and D in each pylon just prior to flight.

Note . . .
All arming of units must be carried out in accordance with local orders. The armament safety plug must only be re-connected just prior to butt test or flight.

REMOVAL AND ASSEMBLY

General

34. Once access has been obtained, the removal and assembly of the components forming the armament services should present no difficulties. The removal of the gun firing panel and ARM junction boxes, which carry the majority of the components is fully described in Group A.2. The location of and access to all the components is indicated in Group A.3. The removal of the guns is covered in Sect.7, Chap.3 and the removal of the pylons in Sect.3, Chap.2.

APPENDIX 1

MODS. 1209, 1210 and 1288

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TABLE

TABLE 1

Equipment type and Air Publication reference

Equipment type	Air Publication
E.R.U. firing relays Type S.M.5A-M4	A.P.4343C, Vol. 1, Book 2, Sect. 3

1. *Equipment employed*
Any major component which is added or changed from that contained in Table 1 of Group G1, will be found in Table 1 of this Appendix.

Introduction
Mod. 1288
2. This modification introduces new

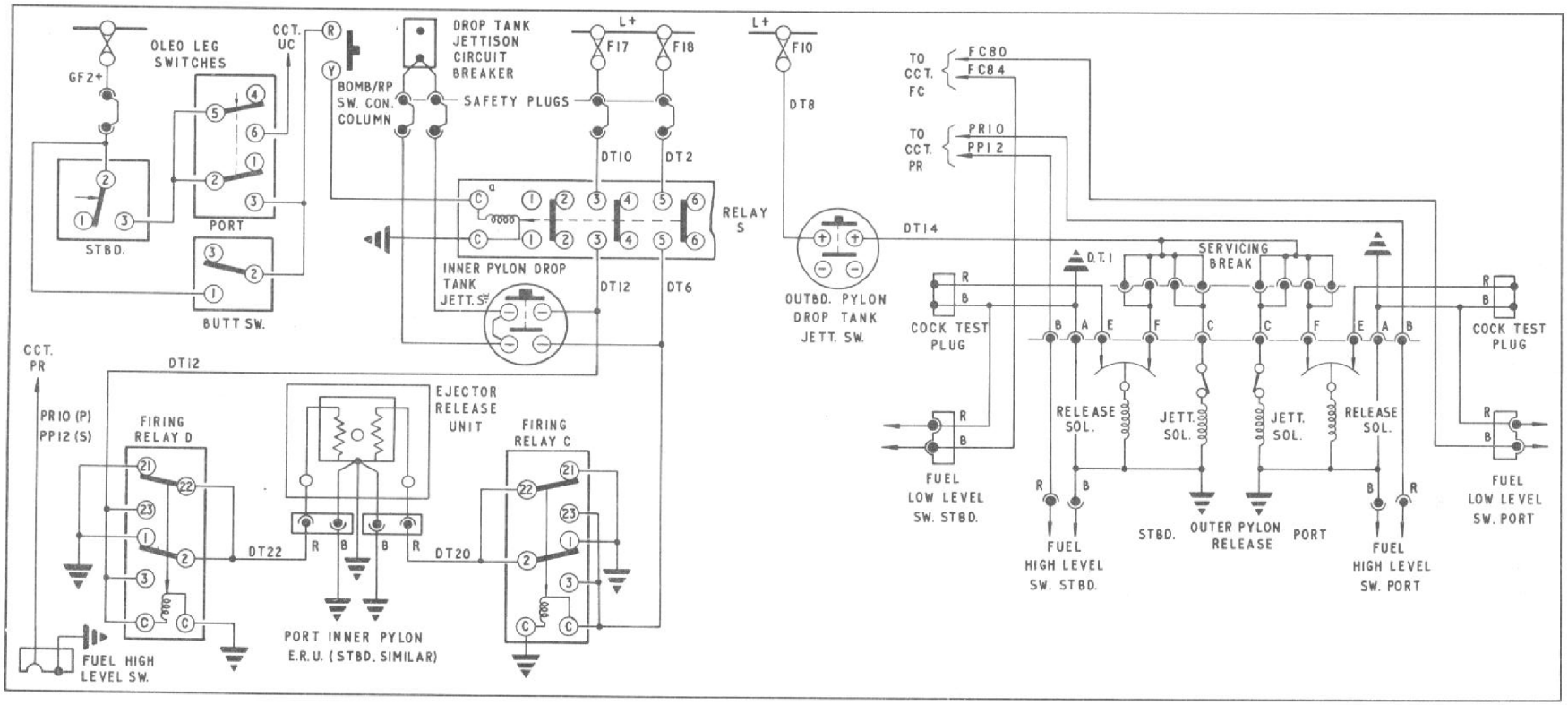

Fig. 1 Inboard and outboard drop tank control (theoretical)

ejector release unit firing relays, together with cable links to afford additional earthing facilities on the inboard pylons to obviate transient energy hazard. In board pylons affected by this modification are listed below.

Port inner pylon	Stbd. inner pylon
Part No.	Part No.
243127	243128
263850	263851
267584	267585
236811	236812
250720	250721

3. This mod. is self-explanatory and requires no elaboration. The additional earthing afforded by these relays can be seen by comparing Fig.4 of Group G1 with Fig.1 of this Appendix.

Mod. 1210

4. This modification introduces inboard pylons with provision for the carriage of banner target containers and is S.O.O. to inboard pylons part numbers E.239752 and E.239753. The modification is carried out by re-wiring the pylon ISOLATE switch and labelling it PRACTICE/ NORMAL switch. The PRACTICE/NORMAL switch becomes an essential part of the drop tank jettison circuit only when the aircraft is in the target towing role. This may be seen by a study of Group G2 in this A.P.

Mod.1209

5. This modification reconciles the armament installation electrics pre and post Mod.1018 (target towing), to the standard servicing and testing procedure and basically alters the circuitry and routeing of the drop tank jettison circuits. It is therefore the main subject of this Appendix.

Description

Mod.1209

6. Post Mod.1209 two methods of jettisoning the inboard pylon drop tanks are available. In the FR role one method is by using the control column RP push switch and relay S, with positive supply from fuses 17 and 18 in the supply panel. The second method is by using the inboard jettison push switch with positive supply from the drop tank jettison circuit breaker in the supply panel. When the aircraft is converted to the T.T. role, only the second method of inboard drop tank jettison is available. A study of Group G2 in this A.P. will make this point clear.

7. Post Mod.1209 jettison of the outboard pylon drop tanks in both the FR and TT role is by the outboard pylon drop tank jettison switch, with positive supply from fuse 10 in the leg panel.

Operation *(Fig. 1 refers)*

8. *Inboard pylon drop tank jettison (R/P switch)*

As the aircraft becomes airborne the weight is taken off its alighting gear, allowing the compression switch on each main undercarriage leg to make contact, and, with the safety plug connected, feed a positive supply to one side of the control column Bomb/RP push switch. When this switch is pressed the coil of relay S is energized, closing contacts 3-3a and 5-5a. Positive supply from fuse 17 in the supply panel can cross contacts 3-3a and energise the port and starboard E.R.U. firing relays D. With the firing relay contacts closed supply will be fed via the safety plockets to one fuse of the cartridge in each ejector release unit. The cartridges are thus detonated and open the release hooks to eject both inner pylon tanks. In case relays D fail to operate, a separate supply is fed from fuse 18 in the supply panel, across contacts 5-5a of relay S to energize relay C in each inner pylon. With these relays energized, supply is fed to the second fuse of each cartridge. Thus detonation is assured if the first fuse has failed to operate.

9. *Inboard pylon drop tank jettison (jettison switch).*

With this method of jettison, supply is taken from the drop tank circuit breaker in the supply panel, directly to the inboard drop tank jettison switch. This circuit is therefore live whenever there is power to the supply panel and the drop tank circuit breaker is closed with the safety plug connected. With the above conditions, if the jettison switch is pressed, supply will pass across the positive contacts and directly to the port and starboard E.R.U. firing relays D in the inboard pylons. With these relays closed supply will pass via the safety plockets to one fuse of the cartridge in each E.R.U. The cartridges are thus detonated and open the release hooks to eject both tanks. To ensure the cartridges are detonated should relays D fail to operate, a separate supply across the negative contacts of the jettison

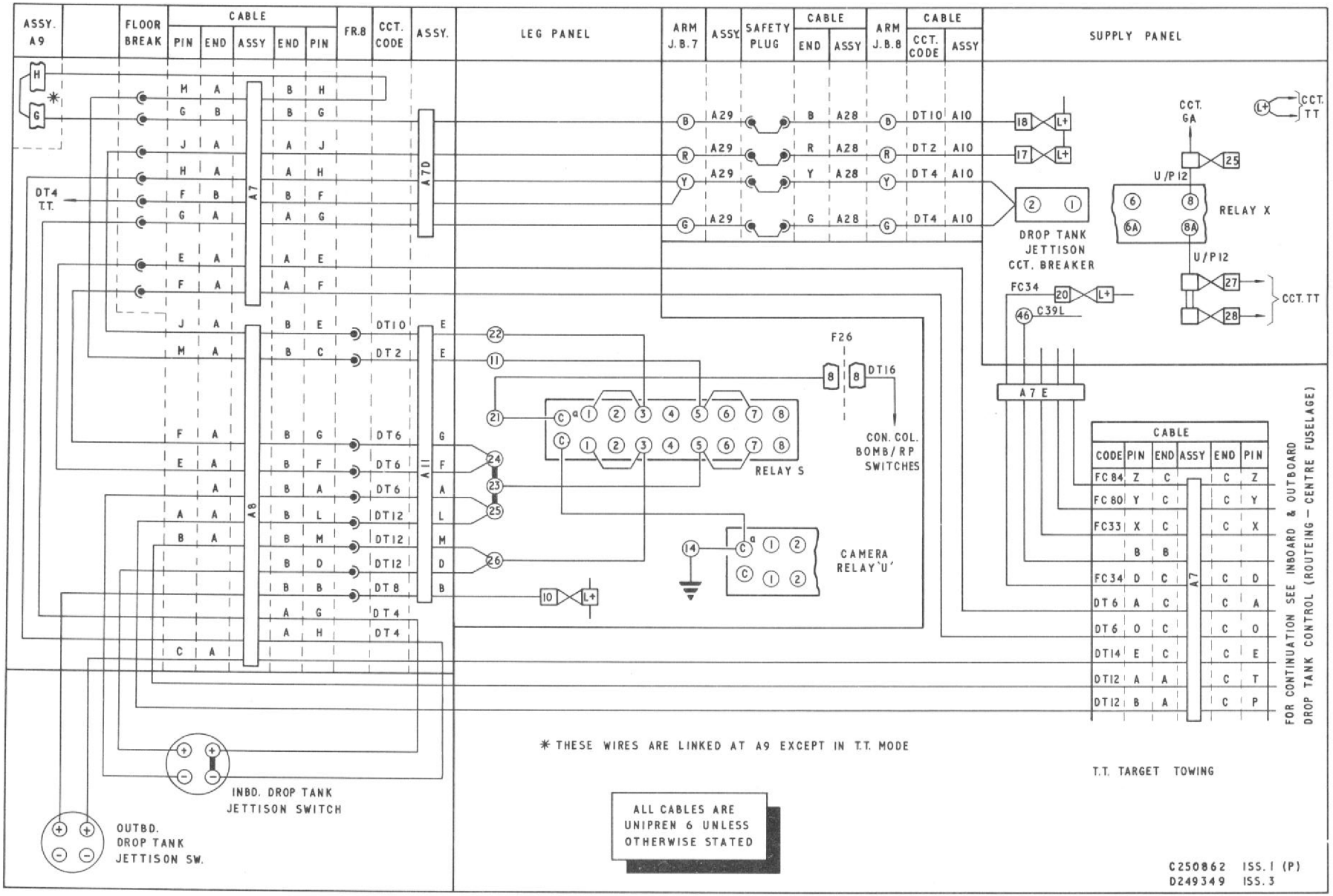

Fig. 2 Inboard and outboard drop tank control (routeing front fuselage)

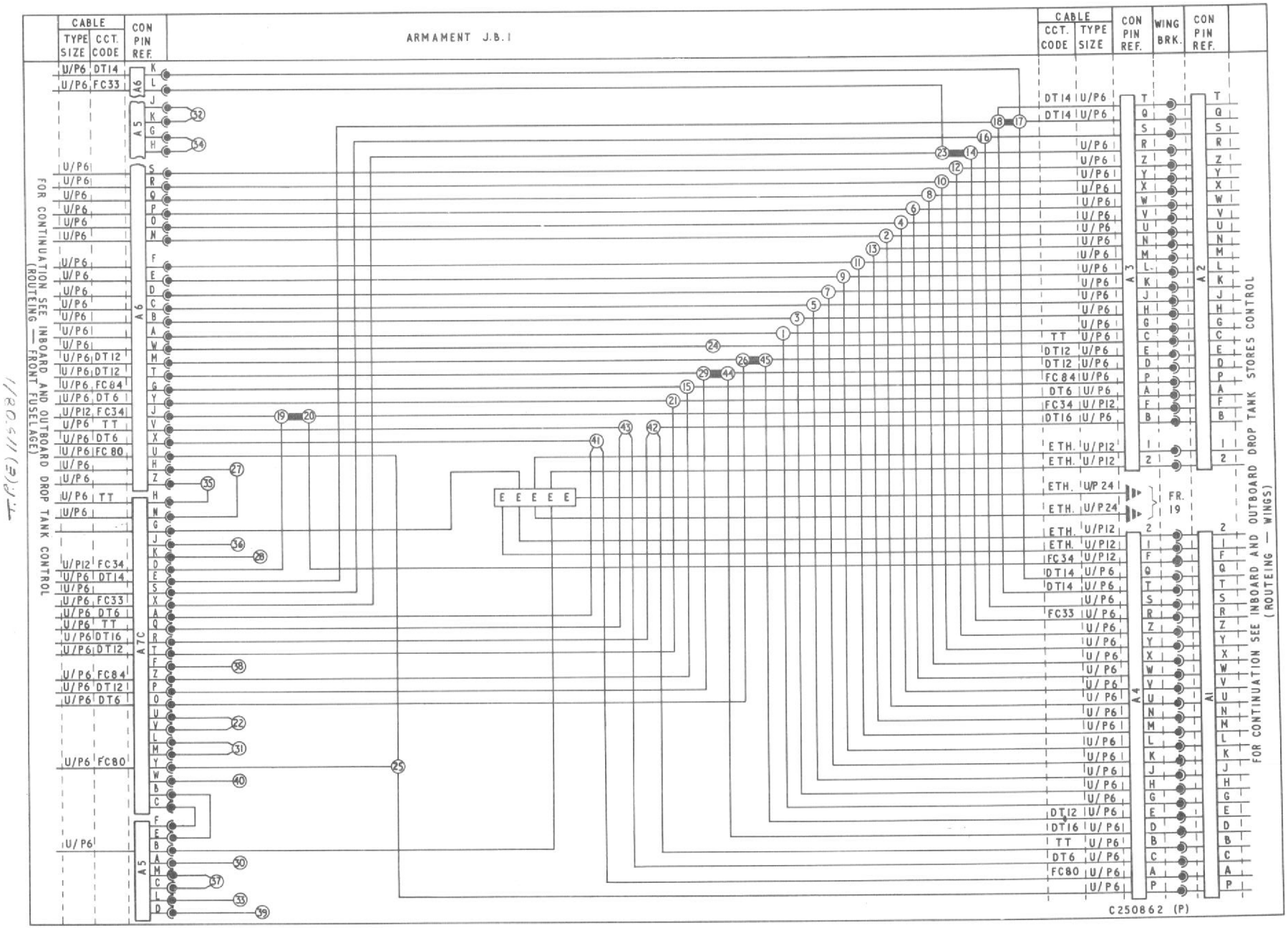

Fig. 3 Inboard and outboard drop tank control (routeing centre fuselage)

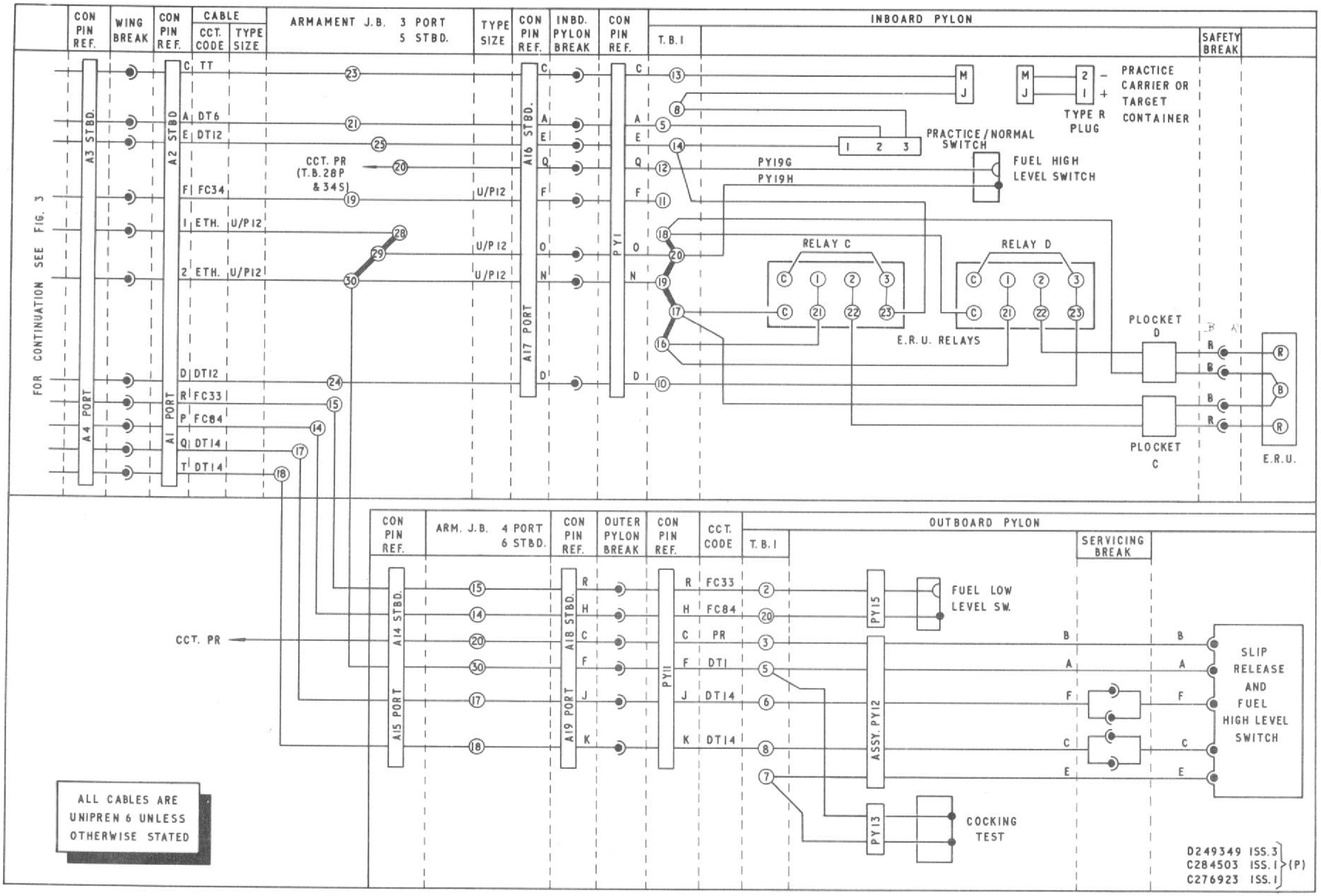

Fig. 4 Inboard and outboard drop tank control (routeing mainplanes and pylons)

switch is fed to firing relays C in the port and starboard inboard pylon. With these relays energized, supply is fed, via the safety plockets, to the second fuse of the cartridges, thus ensuring detonation.

10. *Outboard pylon drop tank jettison*
Supply for the outboard pylon drop tank jettison is taken from fuse 10 in the leg panel, direct to one contact of the outboard drop tank jettison switch. With this switch pressed, supply can pass across the positive contacts and out via the double plocket type safety break (post Mod.1039) to the port and starboard outboard E.M. R.U's. and open the release hooks. At the same time a supply is made to the jettison solenoids, to operate the mechanical release plungers on each release unit, to open the release hooks if they have not already opened electrically.

11. *Cock test*
This remains as described in Group G1, para. 16.

12. *Inboard drop tank gauging*
This remains as described in Group G1, para. 17.

13. *Outboard drop tank empty indicators*
This remains as described in Group 1 paras. 18-19.

14. *G90 camera and camera recorder*
This remains as described in Group G1, paras. 20-28.

15. *Drop tank fuel high level switches*
This remains as described in Group G1, para. 29.

SERVICING

16. *General*
This remains as described in Group G1, para. 30.

17. *Testing and arming ejector release units*
This remains as described in Group G1, paras.31-33, except for para.32, sub-para. (7) which should now read:— post Mod. 1209 this test will give a supply voltage reading unless the drop tank circuit breaker in the supply panel is also tripped. If this circuit breaker is tripped to obtain a no voltage reading, it should be re-set before sub-para. (8) test.

REMOVAL AND ASSEMBLY

18. *General*
This remains as described in Group G1, para. 34.