

Chapter 18

FIRE DETECTION RELAY BOX, TYPE D1040

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LEADING PARTICULARS

Relay box, Type D1040	Ref. No. 5CZ/5280
<i>Length</i>	7.38in.
<i>Width</i>	4.80in.
<i>Height</i>	4.85in.
<i>Weight</i>	3lb. 14oz.
<i>Relay operating current (Type GD relays)</i>	9-16mA
<i>Relay release current (Type GD relays)</i>	2-6mA
<i>Relay operating current (Type JD relays)</i>	13-17mA
<i>Relay release current (Type JD relays)</i>	6-10mA

Introduction

1. This relay box is for use in the Graviner continuous wire type of fire detection system. It is a 4-unit type of box, which has four detection relay circuits on one chassis, housed together in the one box. Only details of the relay box are given in this chapter, and for information on the system as a whole reference

should be made to A.P.4343, Vol. 1, Section 22, Chapter 2, and for details of the sensing element and accessories to Chapter 2 of this section. For information on the installation as a whole reference may be made to A.P.957C, Vol. 1, Part 1, Section 3, Chapter 1.

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DESCRIPTION

General

2. The relay box, shown in fig. 1, is hermetically sealed and is formed of two light-alloy pressings with flanged edges to permit the two halves to be bolted together. These pressings are similar in size and shape, with the top half serving as a lid and the bottom half being the portion secured to the aircraft.

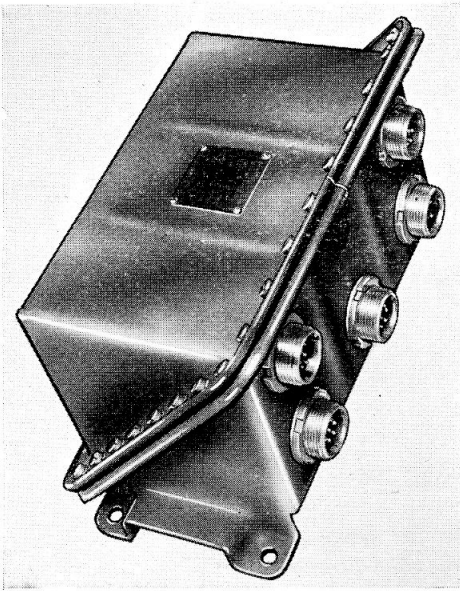


Fig. 1. Relay box, Type D1040

Two mounting brackets are fitted to the underside of the bottom half and each of these is drilled to take a $\frac{1}{4}$ in. diameter mounting bolt at each end. The two halves are secured together by thirty-two 4 B.A. screws and nuts, spaced equidistant around the flanged edges.

3. The components of the relay box, which are shown in fig. 2, are mounted on a light-alloy chassis which is screwed to the lower half of the box. Each relay circuit in the box has its separate transformer, full-wave rectifier, a warning relay, and in early boxes a 330 ohm resistor. Two double-pole change-over test relays, which are operated by remote test relays, which are operated by remote test relays, are mounted with the other components and each of these relays controls the testing of two warning relay circuits. The transformer is a step-down transformer with a tapped primary winding for use on 115V or 26V, 400 c/s a.c. supply. The warning relays used in the boxes are of the GD or JD type, which are identical in operation but differ slightly in manufacturing details, and coil and contact rating. The Type GD relays are fitted to control units of the following serial numbers:—

100 to 107

The 330 ohm resistors, which were intended to compensate for the reduced circuit impedance on operation of the test switch, is deleted on relay box Serial No. 245 and all subsequent units.

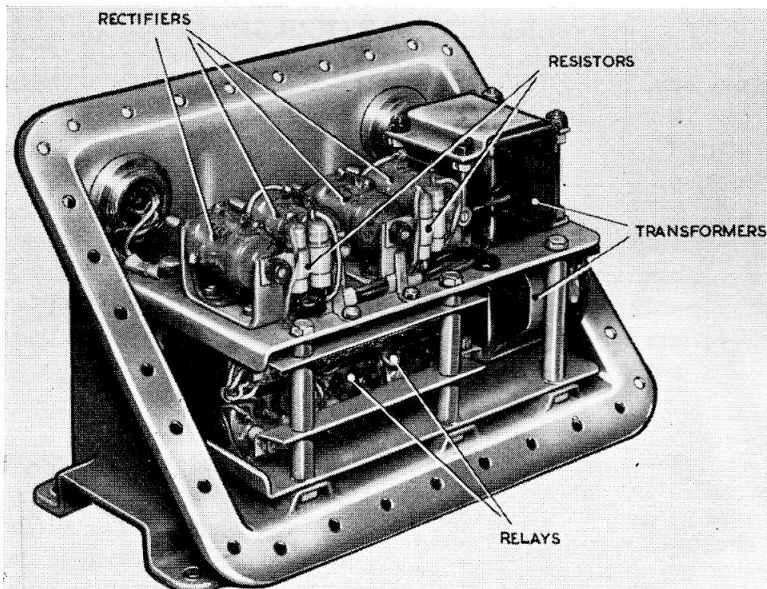


Fig. 2. Contents of relay box

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4. One 3-pole and four 6-pole plugs are mounted on the rear face of the bottom half of the box. Viewing from the back, they are arranged as follows:—

(1) Top left-hand corner. A 6-pole plug which takes the connections from two of the sensing elements. Pins A and D are used for the connections from the outer tubes of the elements and pins C, B, F and E are used for the connections from the central electrodes.

(2) Bottom left-hand corner. A 6-pole plug which takes the 400 c/s a.c. supply of 115 volts or the alternative level of 26 volts for the transformer primaries. Pins A and B are used for the higher voltage and pins B and C for the lower. The remaining pins are spare.

(3) Lower centre. A 6-pole plug used for the warning lamp circuits. A positive 24-volts d.c. supply enters via pin E and is passed on to the warning lamps via pins A, B, C and D, when their respective relays close. Pin F is spare.

(4) Top right-hand corner. A 6-pole plug which takes the connections from the two remaining sensing elements. Pins A and D connect the outer tubes of the elements and pins C, B, F and E the central electrodes.

(5) Bottom right-hand corner. A 3-pole plug, pins A and B of which take the 24 volts d.c. supply, for the test relays, which is applied when the remote test switch is depressed. The 6-pole plug inserts are orientated so that the supply sockets are not interchangeable.

OPERATION

Test relays un-energized

5. From the circuit diagram shown in fig. 3 it will be seen that the four transformer primary windings are connected in parallel to the a.c. supply. These primaries are tapped to allow for the use of the alternative voltage level of 26 volts. When the test switch is in its normal position, i.e., the test relays are un-energized, the transformer secondary cir-

cuits are completed through the filling material of the sensing elements.

6. Considering just one relay circuit of the four actually in the box: a rise in temperature in the potential fire zone causes the resistance of the filling material in the sensing element concerned to decrease, allowing an increased current to flow in the transformer secondary circuit. This current is rectified and passed through the coil of the warning relay. When the current passing through the relay has risen to within the range 13–16mA (9–16mA for Type GD relays) the relay will operate to complete the circuit to the warning lamp.

7. Should the fire-zone temperature subsequently fall, the resistance of the filling material will rise, and the rectified current through the warning relay decrease. When this current falls to within the range 6–10mA (2–6mA for Type GD relays) the relay will open and break the warning-lamp circuit.

Test relays energized

8. When the remote test switch is depressed, 24 volts d.c. is applied to the coils of the test relays, which will then operate. The effect of these relays operating is to cause the secondary circuits of the four transformers to be completed through the central electrodes of their respective sensing elements instead of through the filling material. A 330-ohm resistor is connected in series in each sensing circuit when the test relay operates to compensate for the reduced impedance of the circuit. Provided that there is continuity in the central electrodes the currents under these conditions will be sufficient to operate the warning relays.

SERVICING

General

9. The relay box is hermetically sealed and no dismantling is permissible. Servicing should be restricted to an examination to ensure that the box is mechanically sound and undamaged.

Testing

10. The relay box may be functionally tested using the procedure and test circuit given in the Standard Serviceability Test, Appendix A (R.N.) and Appendix B (R.A.F.).

Appendix A

STANDARD SERVICEABILITY TEST

for

FIRE DETECTION RELAY BOX, TYPE D1040 (R.N.)

Introduction

1. The following tests may be applied to a relay box to ascertain its serviceability, or prior to installation in an aircraft.

TEST EQUIPMENT

2. The following test equipment, or suitable equivalents, will be required:—

(1) A single-pole changeover switch with centre-off position, Ref. No. 5CW/6431, and two single-pole ON/OFF switches, Ref. No. 5CW/6430.

(2) A decade resistance box 0-111110 ohms, Ref. No. 10S/16237.

(3) Four Type B warning lamps, Ref. No. 5CX/1553, fitted with 24V 3.5 watt filament lamps.

(4) A 28V d.c. supply and a 115/26V 400 c/s a.c. supply.

(5) A 250V insulation resistance tester, Ref. No. 0557/AP.5047.

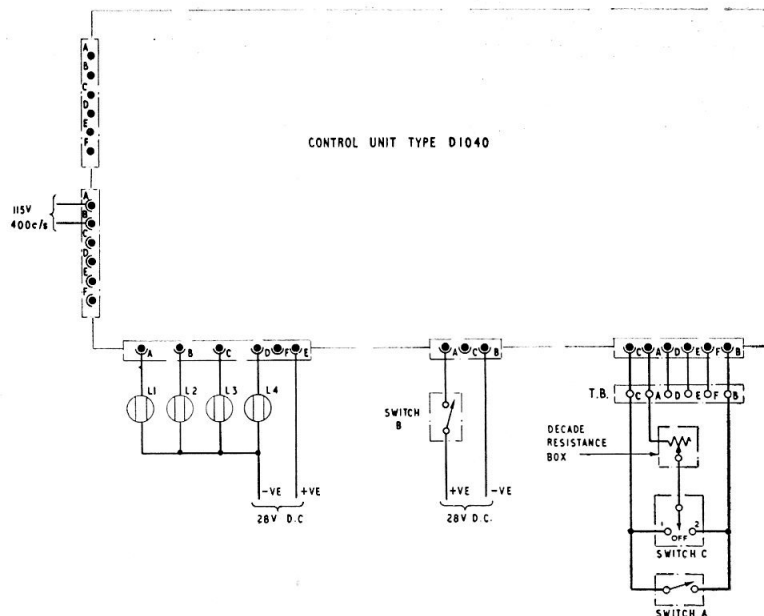


Fig. 1. Test circuit diagram

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TEST PROCEDURE

Note . . .

Differences in test figures for relay boxes fitted with a 330 ohm resistor (Serial Nos. prior to 245) are shown in brackets.

3. (1) Connect the relay box to a test circuit, as shown in fig. 1, using suitable 6-pole and 3-pole sockets and a 6-way terminal block. The socket connecting the 6-way terminal block and its associated circuit should be connected to the 6-pole plug PL1 on the top left-hand corner of the relay box.

(2) Ensure all switches are off and set the decade resistance to 2350 (2000) ohms for units fitted with Type GD relays, or to 1250 (900) ohms for those fitted with Type JD relays.

(3) Place switch C to position 1 and ensure that all the warning lamps remain out.

(4) Return switch C to the OFF position and set the decade resistance to 500 (200) ohms.

(5) Place switch C to position 1 and ensure that the warning lamp L1 is illuminated.

(6) Slowly decrease the decade resistance until the warning lamp goes out. The decade resistance at which this occurs must be between 3000 (2700) and 12350 (12000) ohms for units fitted with Type GD relays, and between 1300 (1000) and

5350 (5000) ohms for those fitted with Type JD relays.

(7) Repeat the tests in (2)–(6) with switch C in position 2.

(8) After completing the tests as defined in (7) set switch C to the OFF position and switches A and B to ON and check that the warning lamp L1 is illuminated.

(9) With all switches set to OFF and all supplies switched off, disconnect the connections to terminals A, B and C of the 6-way terminal block and reconnect them to terminals D, E and F respectively.

(10) Switch on the supplies and repeat the tests outlined in (2)–(8) checking the indications of warning lamp L2.

(11) After completion of the tests outlined in (10) set all switches to OFF and switch off all supplies then disconnect the 6-pole plug from plug PL1 and reconnect to plug PL5 at the top right-hand corner of the relay box.

(12) Following the completion of (11) repeat the tests as outlined in (2)–(10) checking the indications of warning lamps L3 and L4 respectively.

Insulation resistance test

4. Using a 250V insulation resistance tester the insulation resistance when measured between each pin of the relay box plugs and the case should be not less than 20 megohms.

Appendix B

STANDARD SERVICEABILITY TEST

for

FIRE DETECTION RELAY BOX, TYPE D1040 (R.A.F.)

Introduction

1. The following tests may be applied to ascertain the serviceability of a relay box, or prior to its installation in an aircraft.

TEST EQUIPMENT

2. The following test equipment, or suitable equivalents, will be required:—

- (1) The Graviner Firewire test set, Ref. No. 5G/3487.
- (2) A 250V insulation resistance tester, Ref. No. 5G/152.
- (3) A 28V d.c. supply and 115V, 400c/s a.c. supply.

TEST PROCEDURE

3. Ensure that the test set switches SA, SB and SC are set to position 1 and the resistance controls RV1 and RV2 fully counter-clockwise and then connect the relay box to the test set as follows:—

- (1) Connect the test set cable No. 1 to the bottom left hand plug on the relay box and to socket A on the test set.
- (2) Connect test set cable No. 2 to the top left hand plug on the relay box and to socket C on the test set.
- (3) Connect test set cable No. 3b to the bottom right hand plug on the relay box and to socket D on the test set.
- (4) Connect test set cable No. 4a to the bottom centre plug on the relay box and to socket E on the test set.
- (5) Connect test set cable No. 5b to the top right hand plug on the relay box and to socket B on the test set.
- (6) Connect test set cable No. 6 to plug B on the test set and the free end of this cable to the 24V d.c. supply ensuring correct polarity, positive to pin A and negative to pin B.

- (7) Connect test set cable No. 7 to plug A on the test set and the free end of this cable to the 115V, 400c/s supply.

Circuit 1

Note . . .

Switch SD is a scale change switch in the circuits of meters M1 and M2 and should not be operated during unit testing except where detailed. Operation of the switch gives readings on the 0–5mA scale of meter M1 and on the 0–40mA scale of meter M2.

Functional test

4. (1) Switch on the a.c. and d.c. supplies and ensure that lamps LP1 and LP4 are illuminated. Set switch SA to position 3.
- (2) Set SC to position 3 and depress switch SG, lamp LP2 illuminated.
- (3) Release switch SG and ensure that lamp LP2 is extinguished.

Input current consumption test

5. (1) Set switch SB to position 2, the standby current now indicated on meter M2 on the 0–40mA scale, depress switch SD, should be not more than 31mA.
- (2) Set switch SB to position 3 and ensure that lamp LP2 is illuminated, the operating current now indicated on meter M2 on the 0–40mA scale, depress switch SD, should be not more than 37mA.

Relay current test

Note . . .

Difference in test figures for relay units fitted with Type GD warning relays (Serial Nos. 100 to 107) are shown in brackets.

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6. (1) Set switch SB to position 4, and rotate the resistance control RV1 clockwise to the point where lamp LP2 is illuminated.
- (2) The relay operating current now indicated on meter M1 of the 0-20mA scale should be between 13-17mA (9-16mA).
- (3) Return the resistance control RV1 to the point where lamp LP2 is again extinguished.
- (4) The relay release current now indicated on meter M1 on the 0-20mA scale should be between 6-10mA (2-6 mA).
- (5) Return resistance control RV1 fully counter-clockwise and set switch SB to position 5.
- (6) The maximum relay current (short circuit detector) now indicated on meter M2 on the 0-40mA scale, depress switch SD, should be not greater than 35mA.

- (7) Return switches SB and SC to position 1.

Circuit 2, 3 and 4

7. The above procedure should be repeated to make functional and current consumption tests on circuits 2, 3 and 4 of the relay box with the following changes in para. 4, sub-para. (2):—

- | | |
|-----------|-------------------------|
| Circuit 2 | Switch SC in position 4 |
| Circuit 3 | Switch SC in position 5 |
| Circuit 4 | Switch SC in position 6 |

Insulation resistance test

8. The insulation resistance of the relay unit may be measured using a 250V insulation resistance tester. The reading obtained when measuring between each pin of the relay plugs and the casing should be not less than 20 megohms.