Chapter 4 INSTRUMENT POWER SUPPLIES

(Completely revised)

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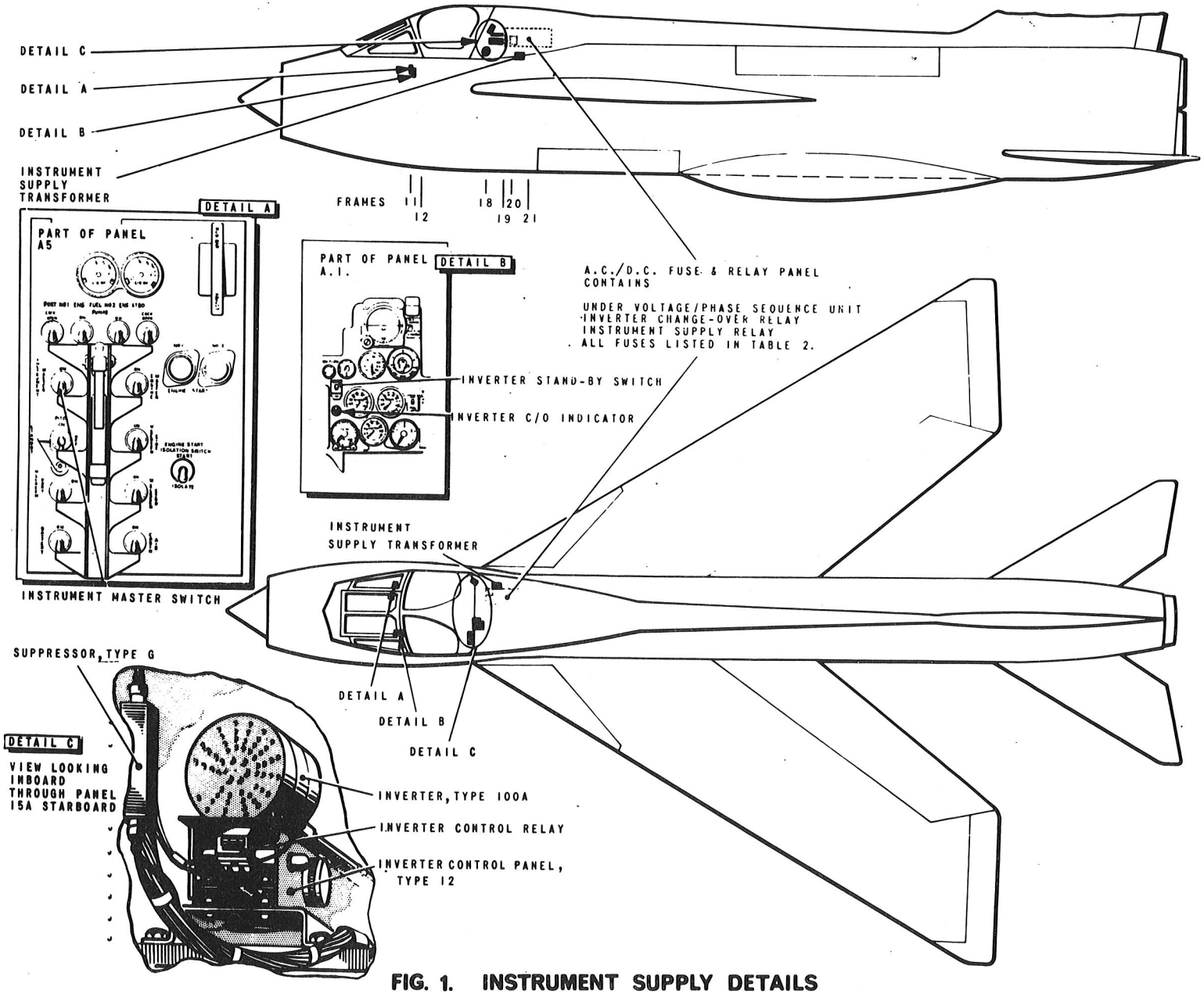

FIG. 1. INSTRUMENT SUPPLY DETAILS

DESCRIPTION

General

1. This chapter gives a description of, and provides circuit and routeing diagrams for, the supplies required by various electrical instruments. These 115-volt, 400 Hz supplies consist of two separate 3-phase busbar systems, one for normal service and one for essential or stand-by use. The normal busbars are fed, via a transformer and an instrument supply relay, from the aircraft's 200-volt, 3-phase, 400 Hz a.c. generator system *(Chap.13)*. In the event of failure of the normal supply, those instruments deemed important to the aircraft's function can be automatically maintained from the essential busbar system. All instruments requiring a d.c. service for their operation are supplied in the normal manner from the d.c. generator system *(Chap.9)*. This chapter has been completely revised to include Mod.4302 and 4377, which were originally Appendix 1 and 2 respectively.

Mod.4302 introduces wiring changes to the supply transformer and the undervoltage phase sequence unit.

Mod.4377 introduces switch Type LHA3-BG-201, Ref.No.5CW/9916 in lieu of switch Type 7690/B101, Ref.No.5CW/8825.

Normal supplies

2. Provided that the engines are running or a ground supply has been connected, the undervoltage/phase sequence unit is energized from the supply transformer secondary windings, and its contacts closed. Operation of the instrument master switch to the ON position energizes the instrument supply relay which feeds the transformer output to the normal busbars. In the normal supply condition the a.c. power for the essential instruments is taken from the normal busbars via the contacts of the change-over relay, the coil of which is in parallel with the supply relay. Two phases of the supply transformer are arranged to control the undervoltage/phase sequence unit, the operation of which controls both the supply relay and the supply change-over relay. A failure in any of the a.c. lines XA, XB, or XC will result in the operation of the undervoltage/phase sequence unit and the dropping out of both the supply busbar relay and the supply change-over relay, and the automatic transfer of essential instruments to the stand-by inverter busbars. The undervoltage phase sequence unit senses the normal busbar voltage, pulling in at approximately 102 volts, thus allowing the change-over relay to become energized. In this condition, the change-over relay feeds the normal supply to the essential busbars XF11, XG11, and XHN.

Essential supplies (stand-by)

3. Should the normal supplies fail, or the voltage drop below a value of approximately 99 volts, the essential loads, consisting of the more important instruments, will be maintained from a Type 100A inverter and its associated Type 12 control panel, which is automatically switched into service. This is accomplished via the contacts of the undervoltage/phase sequence unit, which open and interrupt the d.c. supply to the coil of the change-over relay. A back contact of this relay then provides a d.c. circuit to the inverter control relay, which operates, to start up the inverter. The output from the inverter is fed back through the change-over relay contacts to supply the essential busbars XF11, XG11, and XHN.

Note...

The diagrams included in this chapter show those instruments which are transferable to the inverter supply, and those energized from the normal supply.

Instrument master switch

4. The instrument master switch located on panel A5 is required to be ON for both normal and stand-by operation *(Sect.7, Chap.5)*. The switch is operated by the master ganging bar assembly on the panel, but can be individually selected On or OFF as desired.

Undervoltage/phase sequence unit

5. This unit detects undervoltage and negative phase sequence conditions. With the 115-volt, 3-phase, 400 Hz supply connected, a static transistorized circuit within the unit causes a pair of contacts in a sealed relay to close at a specified voltage level. This action provides a feed to the change-over relay which becomes energized, and via its contacts, the normal supplies are maintained. Should there be a drop in voltage below the specific value, the contacts of the sealed relay will open, de-energizing the change-over

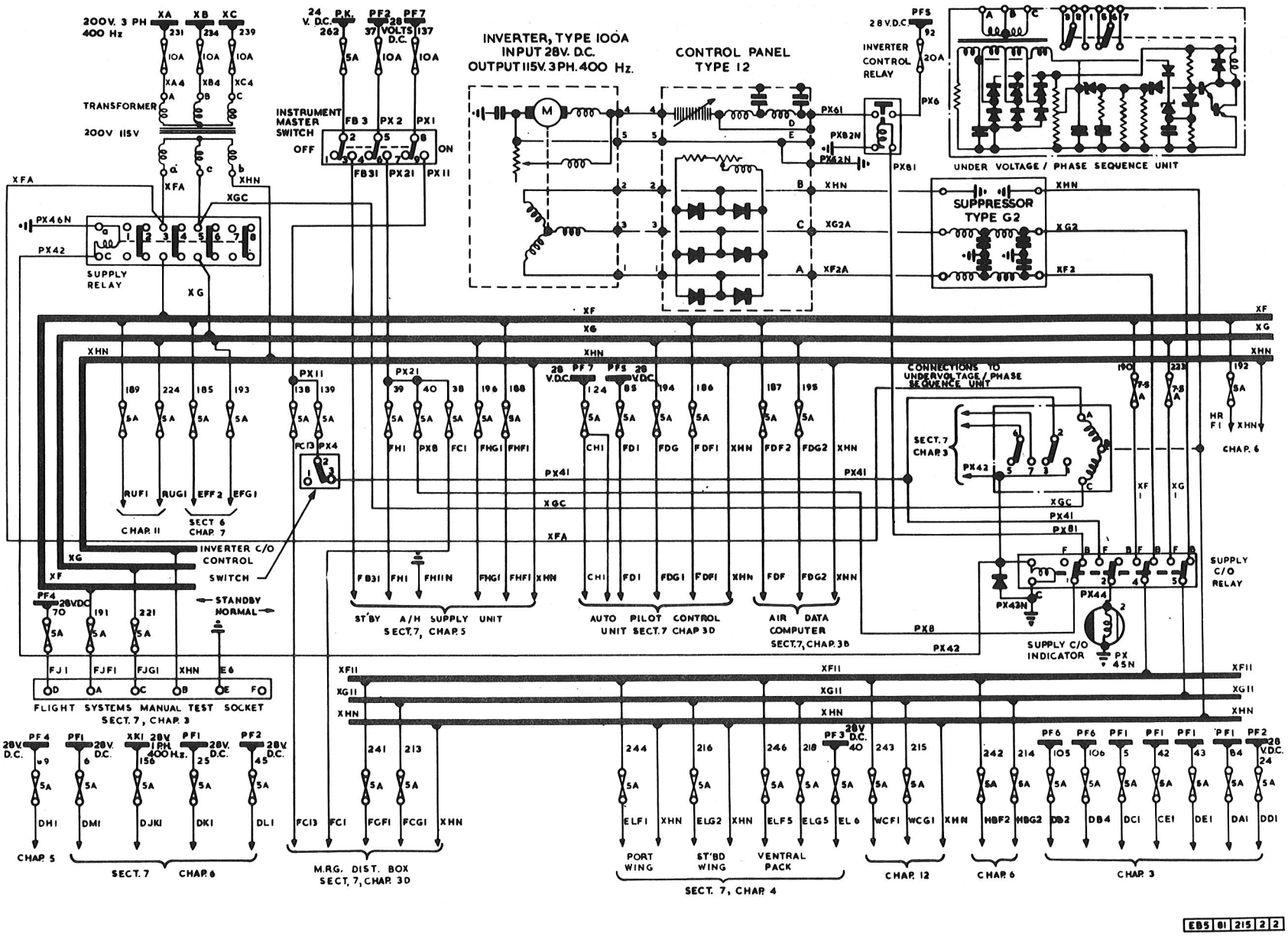

FIG. 2. INSTRUMENT POWER SUPPLIES

relay, and transferring the essential loads to the inverter.

Change-over indicator

6. A magnetic indicator mounted on panel A1, operates in conjunction with the change-over relay. When the relay is de-energized to effect transfer of the essential load to inverter supply, the indicator is also de-energized and shows the letters ON in black on a white background. In the energized, i.e. normal condition, the indicator shows black.

Inverter change-over switch

7. A manually-operated switch labelled NORMAL/STANDBY INVERTER is located on panel A1. When the locking guard, which retains the switch in the NORMAL position, is raised and the switch moved to panel A1. When the locking guard, which retains the switch in the NORMAL position, is raised and the switch moved to the STANDBY INVERTER position, the d.c. supply to the undervoltage/phase sequence unit is cut off and the change-over relay is de-energized. This action starts up the inverter to supply power to the essential instruments.

Flight instrument system interlock

8. With the instrument power supplies operating from the Type 100A inverter lines, contacts No.6 and 7 of the undervoltage/phase sequence unit are wired to the M.R.G. of the flight instrument system and prevent the M.R.G. being started from the inverter lines. This is necessary because of the heavy load the M.R.G. would impose on these lines during starting.

9. If the M.R.G. is already running when the undervoltage/phase sequence unit operates and change-over takes place, the M.R.G. load on the inverter lines will be lightened via a lead PX42 which feeds the M.R.G. This line automatically changes over a relay circuit in the M.R.G. resulting in a portion of the normal a.c. load being transferred to the d.c. lines.

Circuits requiring d.c. supplies

10. Apart from the d.c. provided for the flight display and the stand-by inverter circuits, a number of other instruments require a d.c. supply for their operation. These are given in the following list along with the associated section and chapter in which they appear.

Combined position indicator	Sect.6, Chap.3
Flap indicators	Sect.6, Chap.3
Alighting gear indicator	Sect.6, Chap.5
Fuel contents gauging	Sect.7, Chap.4
Fatigue meter	Sect.7, Chap.6
Liquid oxygen contents gauge	Sect.7, Chap.6
Wheel brake pressure gauge	Sect.7, Chap.6

Test socket

11. A test socket, located in the starboard side of the main equipment compartment, is used in conjunction with the power supply testing of the flight instrument system *(Sect.7, Chap.3)*. It can also, if so desired, be used for checking the 115-volt, 3-phase, 400 Hz output of the transformer to the normal busbar lines XF, XG, XHN, and the 28-volt line PL.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cockpit or performing any operations upon the aircraft.

Inverter system

12. Test equipment required:-

Voltmeter, a.c., range 0–150 volts

Phase rotation meter

Frequency meter, 400 Hz

Inverter setting-up procedure

13. The procedure for setting up the inverter when a Mk.2 M.R.G. is installed in the aircraft is described in A.P. 113D-0104-16 and this calls for the use of an inductive loading panel, Ref.No. 5G/565. If, however, a Mk.1 M.R.G. is installed as an alternative to a Mk.2, changes must be made to the inductive loading panel before setting up the inverter. The changes involve connecting a 1mF, 200-volt capacitor between terminals 8 and 10, 10 and 12, and 12 and 8,

to raise the specified power factor from between 0.8 and 0.82 to unity. If it is found impossible to attain the specified frequency regulation, the best possible regulation should be obtained and then adjusted on load to 395 Hz by means of the shunt field circuit.

Test procedure

14.

(1) Remove the following fuses, 186, 187, 188, 194, 195, 196, 213 and 241 from the a.c. fuse and relay box. Connect a phase rotation meter to the busbars, A to XF, B to XHN, C to XG, and a suitable range voltmeter to the socket in the rear spine.

(2) Connect both a.c. and d.c. ground supplies.

(3) With the instrument master switch set to ON, check the phase rotation and the voltage. The rotation should be correct and the voltage between any pair of lines should be 115 volts.

(4) Check that the inverter is not running and that the change-over indicator shows black.

(5) Set the instrument master switch to OFF.

(6) Connect the phase rotation meter to the busbars A to XF11, B to XHN, C to XG11.

(7) Set the instrument master switch to ON, check phase rotation and the voltage. The rotation should be correct and the voltage reading between any pair of lines should be 115 volts. Check that the inverter is not running and that the change-over indicator shows black.

(8) Select the inverter stand-by switch to STANDBY. The inverter should run and the change-over indicator show white.

(9) Check the phase rotation, frequency, and voltage on busbars XF11, XG11 and XHN. The phase rotation should be correct, the frequency 400 Hz ± 5 Hz, and the voltage, between any pair of lines, 115 volts.

(10) Select the inverter stand-by switch to NORMAL. The inverter should stop and the indicator show black.

(11) Remove fuse 231. The inverter should run and the indicator show white.

(12) Replace fuse 231. The inverter should stop and the indicator show black.

(13) Disconnect the a.c. ground supply. The inverter should run and the indicator show white.

(14) Set the instrument master switch to OFF. Remove the d.c. ground supply. Replace fuses 186, 187, 188, 194, 195, 196, 213 and 241 in the a.c. fuse and relay box.

(15) Remove all test equipment and replace all items removed for the purpose of the tests.

TABLE 1

Equipment details

Equipment	Type/Ref.No.	Location	Access	Air publication
Instrument supply transformer 200/115-volt	Type C No.1 RD5891 Ref.No.5UB/6478	Main equipment compartment. Between fr.20-21 starboard	18S	4343B, Vol.1, Book 3
Instrument supply relay	Ref.No.5CW/6698	No.36 in the A.C./D.C. fuse and relay box	16S	4343C, Vol.1
Instrument master switch	Type 7690/B101	Panel A5	Cabin	4343C, Vol.1
Undervoltage/phase sequence unit	Type AE5600 Ref.No.5UC/6938	A.C./D.C. fuse and relay panel	18S	4343B, Vol.1, Book 2
Inverter	Type 100A	Forward face of fr.19 spine compartment	15AS	113D-0104-16
Control panel	Type 12	Forward face of fr.19 spine compartment	15AS	113D-0104-16
Suppressor	Type G No.2	Forward face of fr.19 spine compartment	15AS	4343, Vol.1, Sect.5
Inverter change-over relay	Ref.No.5CW/7273	A.C./D.C. fuse and relay panel	18S	4343C, Vol.1
Inverter control relay	Type AH/IM/28/30	Forward face of fr.19 spine compartment	15AS	4343C, Vol.1
Inverter stand-by switch	Type 8810/B104	Panel A1	Cabin	4343C, Vol.1, Sect.1
Inverter c/o indicator, Mk.2	Ref.No.5CZ/6500	Panel A1	Cabin	

TABLE 2

Fuses, circuits, and locations

Fuse No.	Rating	Code	Circuit	Location
37	10A	PX2	Flight instrument master supply	A.C./D.C. fuse and relay panel
38	5A	FC1	M.R.G. power c/o relay	
39	5A	FH1	Stand-by artificial horizon	
40	5A	PX8	Inverter control relay	
70	5A	FJ1	Auto check out supply	
85	5A	FD1	Autostabilizer	
92	20A	PX6	Inverter control panel	
124	7.5A	CH1	Auto trim selection and flight control	
125	5A	CH2	Test supply 'G' switch	

continued...

TABLE 2 Fuses, circuits, and locations - *continued*

Fuse No.	Rating	Code	Circuit	Location
137	10A	PX1	Flight instrument master supply	A.C./D.C. fuse and relay panel
138	5A	FC13	M.R.G. power c/o relay	
139	5A	PX4	Inverter c/o relay	
140	5A	PX7	200-volt relay control	
185	5A	EFF2	J.P.T. warning	
186	5A	FDF1	Pilot's control autopilot	
187	5A	FDF2	Air data computer	
188	5A	FHF1	Stand-by artificial horizon	
189	5A	RUF1	Data link	
190	7.5A	XF1	Inverter c/o relay	
191	5A	FJF1	Auto check out supply	
192	5A	HRF1	Equipment bay temp. control	
193	5A	EFG1	J.P.T. warning	
194	5A	FDG1	Pilot's control autopilot	
195	5A	FDG2	Air data computer	
196	5A	FHG1	Stand-by artificial horizon	
213	5A	FCG1	Master reference gyro J.B.	
214	5A	HBG2	Cabin temperature control	
215	5A	WCG1	Firewire relays	
216	5A	ELG1	Starboard wing tank aft	
218	5A	ELG5	Ventral tank	
221	5A	FJG1	Auto check out supply	
223	7.5A	XG1	Inverter c/o relay	
224	5A	RUG1	Data link	
231	10A	XA4	200/115-volt, 3-phase transformer	
234	10A	XB4	200/115-volt, 3-phase transformer	
239	10A	XC4	200/115-volt, 3-phase transformer	
241	5A	FCF1	Master reference gyro J.B.	
242	5A	HBF2	Cabin temperature control	
243	5A	WCF1	Firewire relays	
244	5A	ELF1	Port wing tank aft	
246	5A	ELF5	Ventral tank	
262	5A	FB3	Stand-by gyro instruments	

FIG.3. INSTRUMENT POWER SUPPLIES

(illustration overleaf)

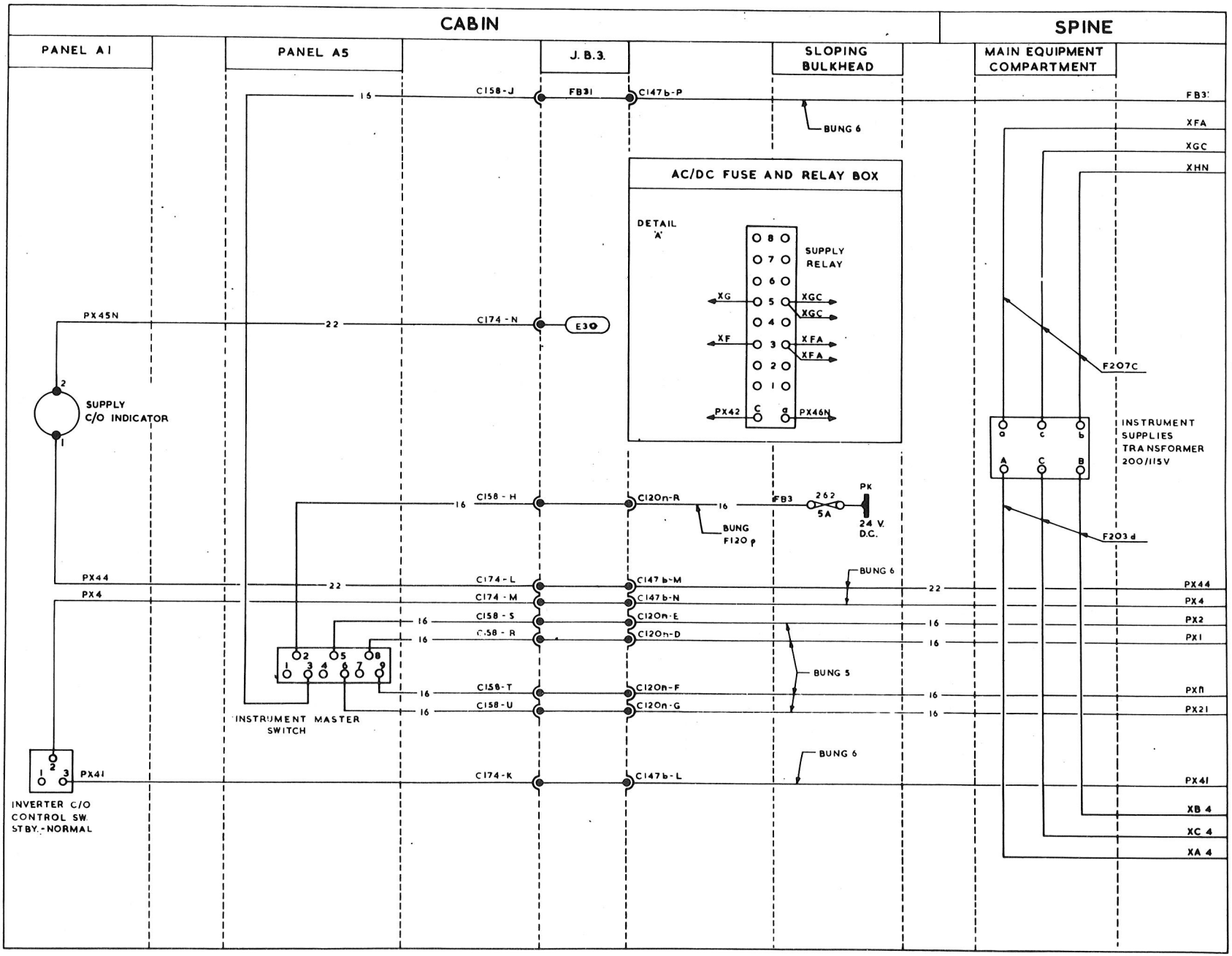

FIG. 3. INSTRUMENT POWER SUPPLIES

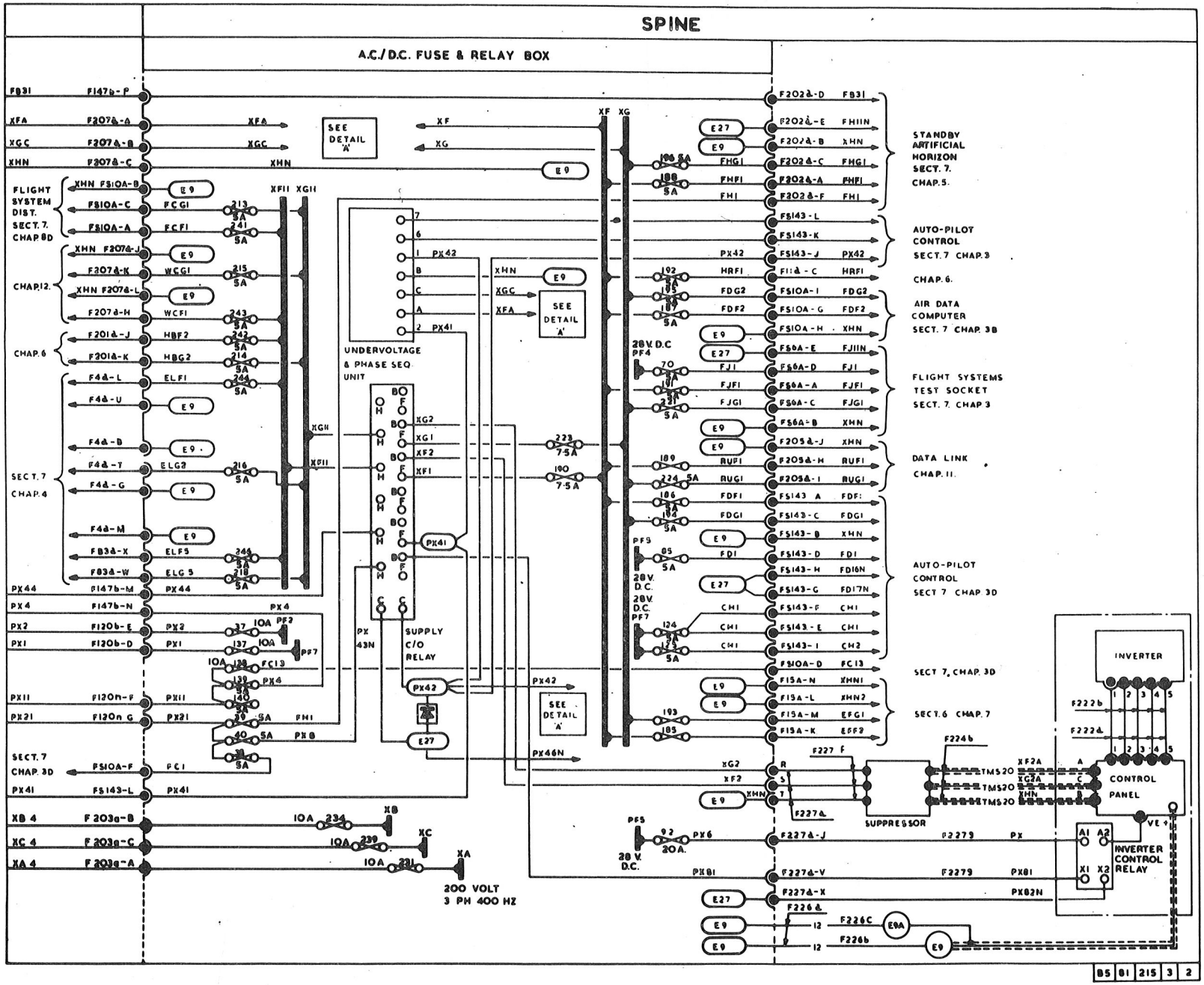

FIG. 3A. INSTRUMENT POWER SUPPLIES

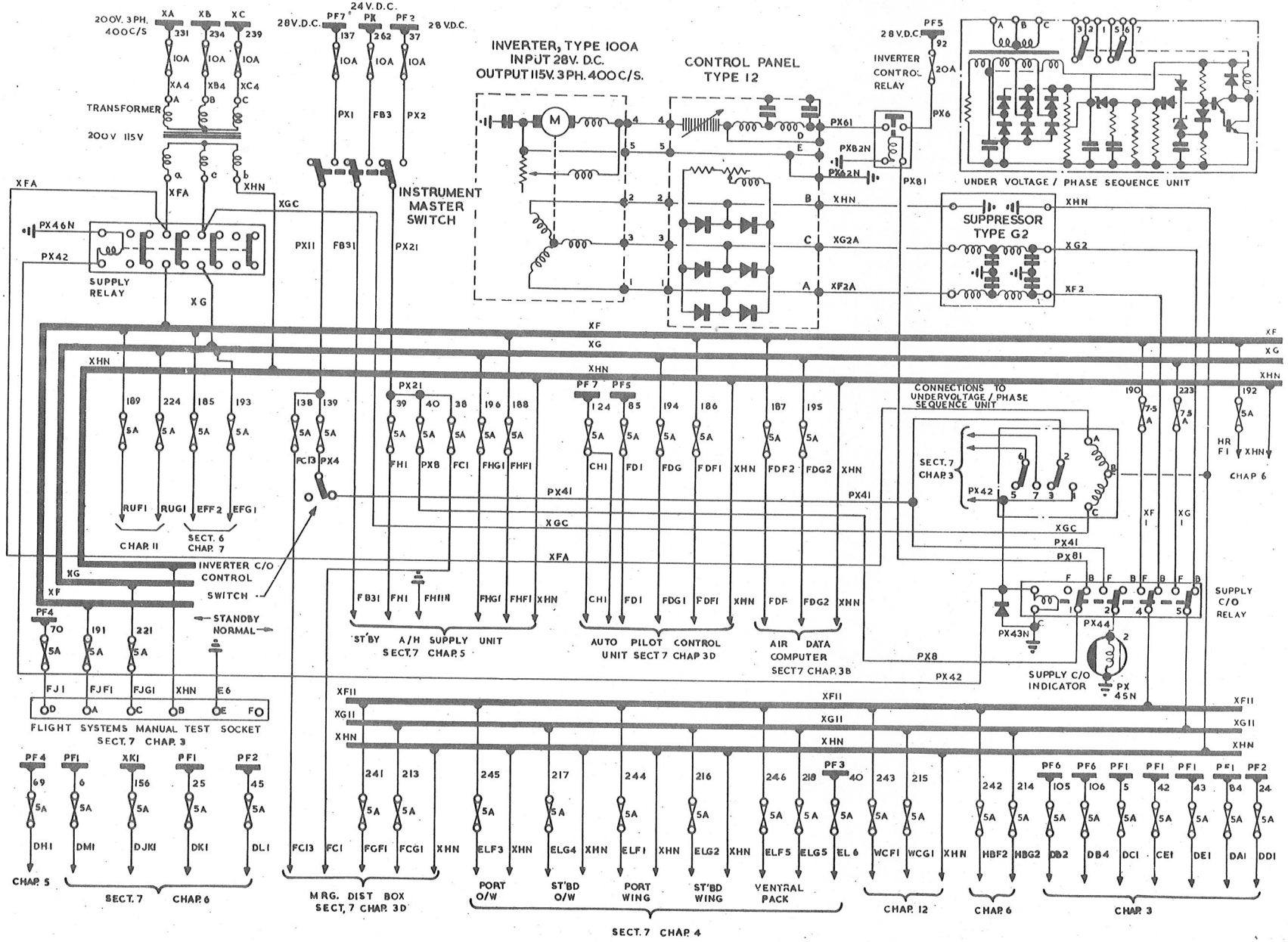

FIG. 1. INSTRUMENT POWER SUPPLIES (MOD. 4302)

B5-81-215-2-2

4 Minor alterations

(5) Set the instrument master switch to OFF.

(6) Connect the phase rotation meter to the busbars A to XF11, B to XHN, C to XG11.

(7) Set the instrument master switch to ON, check phase rotation and the voltage. The rotation should be correct and the voltage reading between any pair of lines should be 115 volts. Check that the inverter is not running and that the change-over indicator shows black.

(8) Select the inverter stand-by switch to STANDBY. The inverter should run and the change-over indicator show white.

(9) Check the phase rotation, frequency, and voltage on busbars XF11, XG11 and XHN. The phase rotation should be correct, the frequency 400 c/s ± 5 c/s, and the voltage, between any pair of lines, 115 volts.

(10) Select the inverter stand-by switch to NORMAL. The inverter should stop and the indicator show black.

(11) Remove fuse 231. The inverter should run and the indicator show white.

(12) Replace fuse 231. The inverter should stop and the indicator show black.

(13) Disconnect the a.c. ground supply. The inverter should run and the indicator show white.

(14) Set the instrument master switch to OFF. Remove the d.c. ground supply. Replace fuses 186, 187, 188, 194, 195, 196, 213 and 241 in the a.c. fuse and relay box.

(15) Remove all test equipment and replace all items removed for the purpose of the tests.

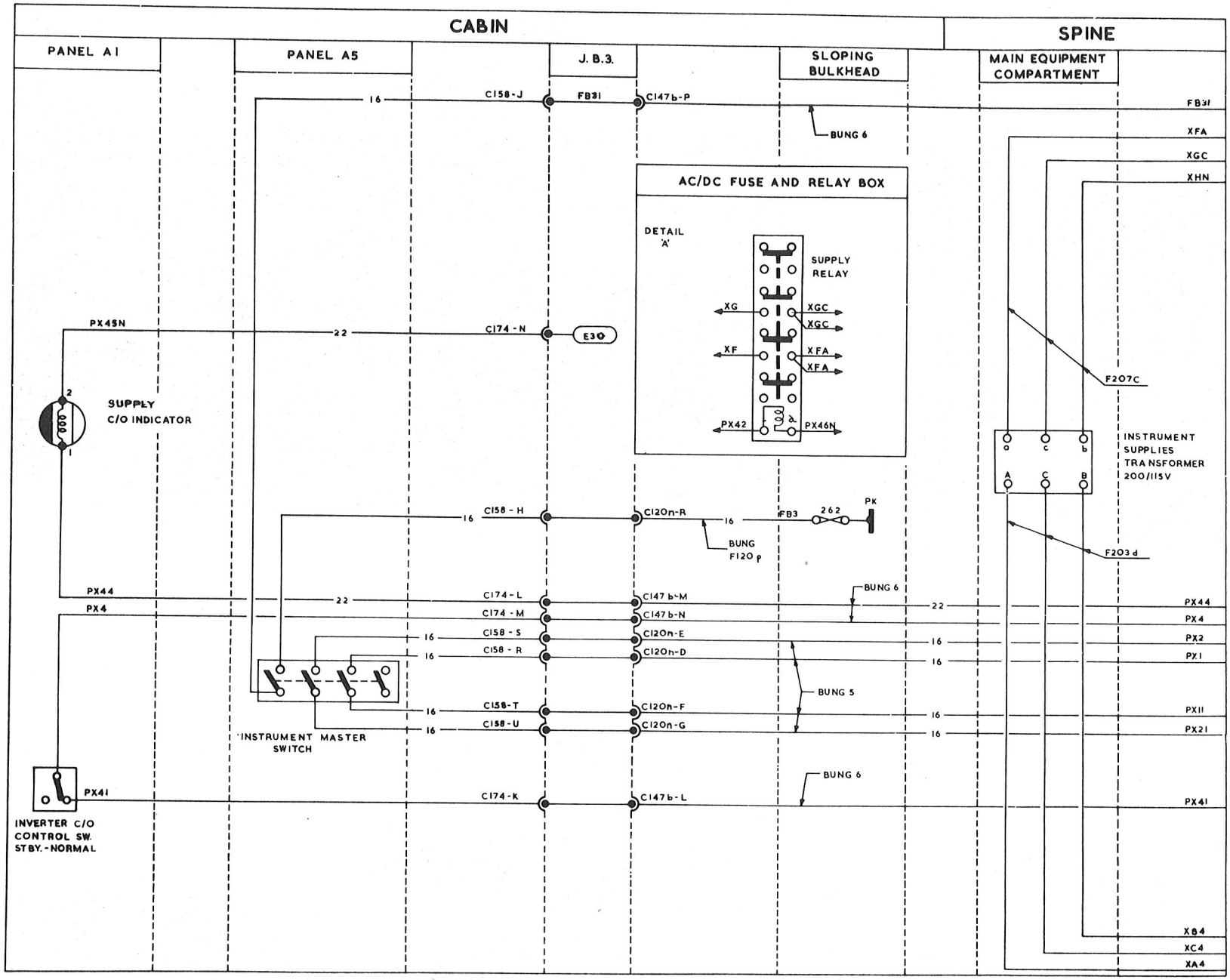

FIG. 2. INSTRUMENT POWER SUPPLIES (MOD. 4302)

◀ Minor alterations ▶

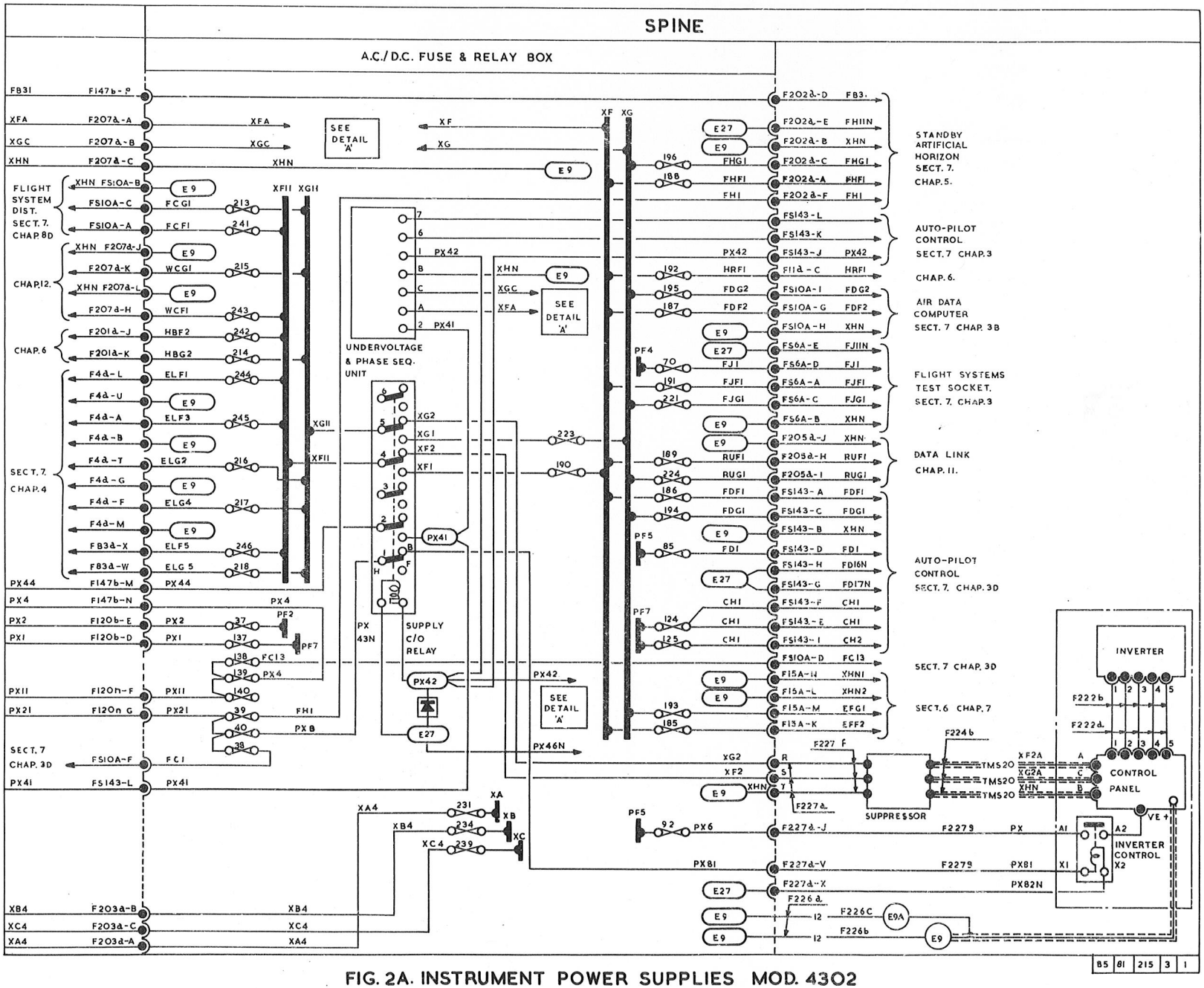

FIG. 2A. INSTRUMENT POWER SUPPLIES MOD. 4302

Appendix 2 MOD.4377

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LIST OF ILLUSTRATIONS

General

1. This modification provides a Type LHA 3-BG-201 instrument master switch, Ref.No.5CW/9916, in lieu of Type 7690/B101, Ref.No.5CW/8825, and affects the aircraft in the post Mod.4302 state *(App.1)*. The alterations to Appendix 1, fig.1 and fig.2 are shown in fig.1 and fig.2 below.

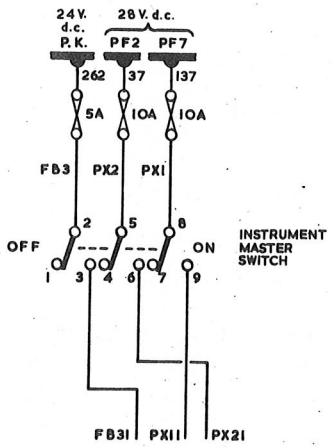

Fig.1. Alteration to App.1, fig.1 by Mod.4377

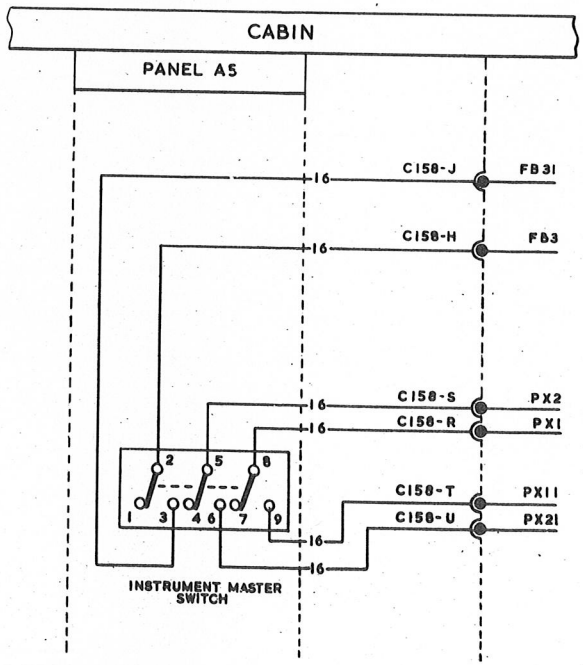

Fig.2. Alteration to App.1, fig.2 by Mod.4377