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Colin Hinson
In the village of Blunham, Bedfordshire.

02 MAR 1988

AP115H-0103-1A2

(Formerly AP115H-0103-1, Sections 5 to 9)

RADAR TYPE 84

DESCRIPTION OF SIGNAL PROCESSING EQUIPMENT

OBSOLETE

Service users should send their comments through the channel prescribed for the purpose in: AP 100B-01, Order 0504

WARNING

RADIATION HAZARDS

KEEP AWAY FROM RADAR AERIAL DURING TRANSMISSION

AVOID EXPOSURE AT AERIAL HEIGHT WITHIN TRANSMISSION ZONE

SEE LEADING PARTICULARS FOR SAFETY LIMITS

DO NOT STARE AT DISCHARGE TUBES

HIGH VOLTAGES

REMEMBER–APPARATUS IS SAFE–
ONLY IF YOUR APPROACH IS CORRECT

PREFACE

1 This publication is now RESTRICTED. New or revised leaves will carry the new grading. AL2 called for the markings on pages already issued to be altered to read RESTRICTED and the CD115H-0103-1 captions to read AP115H-0103-1. Holders must ensure that these alterations have been made before the publication or any part of it is disposed of as waste.

2 This publication was recodified at Amendment 8 of Oct 1979. For reasons of economy pages will retain the original code until changed by future amendments.

ASSOCIATED PUBLICATIONS

RADAR TYPE 84

Leading particulars and general information	CD 115H-0101-1
Description of radar head	AP 115H-0102-1A1 and AP 115H-0102-1A2
Description of signal processing equipment	AP 115H-0103-1A1
Special-to-type test equipment	AP 115H-0104-1
Functional diagrams	AP 115H-0105-10
Aerial mount and turning gear	AP 115J-0100-1 (AP 2886H)

PRELIMINARY MATERIAL

Section 5 Video cabinet

Chapters

Section 6 PRF cabinets

(The PRF cabinets have been replaced by the no-break trigger system AP 115Z-0100-1 (4769E). Regulator voltage (-250V) M4, which was described in Chap. 10 of this section, is described in AP 115G-0103-1 (4769DA) Sect. 2, Chap. 19.)

Section 7 Power supply cabinet

Chapters

Section 8 Control position

Chapters

CONTENTS

Section 9 Interconnections

Chapters

SECTION 5

VIDEO CABINET

CHAPTER 1

VIDEO CABINET AND INTERCONNECTIONS

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Purpose of cabinet

1. The cabinet, electrical equipment M45 (fig.1 and 2) accommodates a number of units which accept video and i.f. signals from the rest of the signal processing equipment and provide a means of selecting the display facility required at the consoles. The cabinet also contains circuits which provide suppression of impulsive interference on certain of the types of display available.

2. A block diagram of signal interconnections within the cabinet is given in fig.3. The cabinet receives inputs from the four processing channels; three of these, the MTI, anti-jamming and log + PLD, being video signals while the fourth, the linear i.f. input, is amplified and demodulated within this cabinet and provision is also made for modifying the signal by the application of an internally-generated reverse swept-gain waveform.

3. There are six MTI bipolar inputs from the cancellation cabinet, three for each cancellation channel. These inputs are applied to the amplifier (video rectifier) M3, which produces a single unipolar video output, consisting of a summation of the effects of both channels.

4. After passing through a 7, microsecond compensating delay network, the video signals are applied to the comparator, signal (video) M4, which discriminates against pulses of a duration greater than that of the transmitter pulse. The resultant pulse-discriminated video signals are applied to one of the three electronic switch units, designated number 1 in fig.3. In this unit a choice is given between the MTI signal and the log + PLD or linear signals, selection being made by the combined rectangle and circle switching waveform derived from the doppler cabinet. These pulse-discriminated MTI video signals are also routed through SKL and SKM of electronic switch No.1 to electronic switch No.2 SKL and SKM. The MTI video signal from electronic switch No.2 socket SKM is terminated by a 75Ω resistor at SKX of unit 403 when amplifier, video and switching 5840-99-626-7183 (Sect.3, Chap. 12) is not fitted, or is routed to the cancellation cabinet, in which case the 75Ω termination is transferred to SKN of unit 104 in the cancellation cabinet. Electronic switch number 2 receives the same video inputs as number 1, but selection in this case is made by the circle switching waveform from the doppler cabinet.

5. The third electronic switch unit receives the log + PLD and the modified or unmodified linear signals, selection of outputs being made by an internally-generated waveform.

6. Selection of the required display facility with respect to a particular console or channel is effected by the relay assembly M2, in conjunction with relay assembly M3. The selector controls are situated on the display equipment. The switching waveform used in electronic switch No.3 is routed to the cancellation cabinet via SKW of unit 403.

7. Anti-impulsive interference facilities are provided on signals fed to the channel 1 display. MTI, log + PLD or linear video signals, as selected by relay assemblies M2 and M3, are applied to the comparator, signal (coincidence) M3. This unit also receives an 8·19 Mc/s carrier, amplitude modulated by the video signal, but delayed by one p.r.f. period. The two signals are coincidence-gated and only those pulses which are coincident in time on both inputs to the gate are passed to the output of the circuit.

8. Five video amplifiers feed the selected signals to the display equipment. Four of the amplifiers receive inputs selected from the video inputs to relay assembly M2, while the fifth amplifier receives only linear video from relay assembly M3.

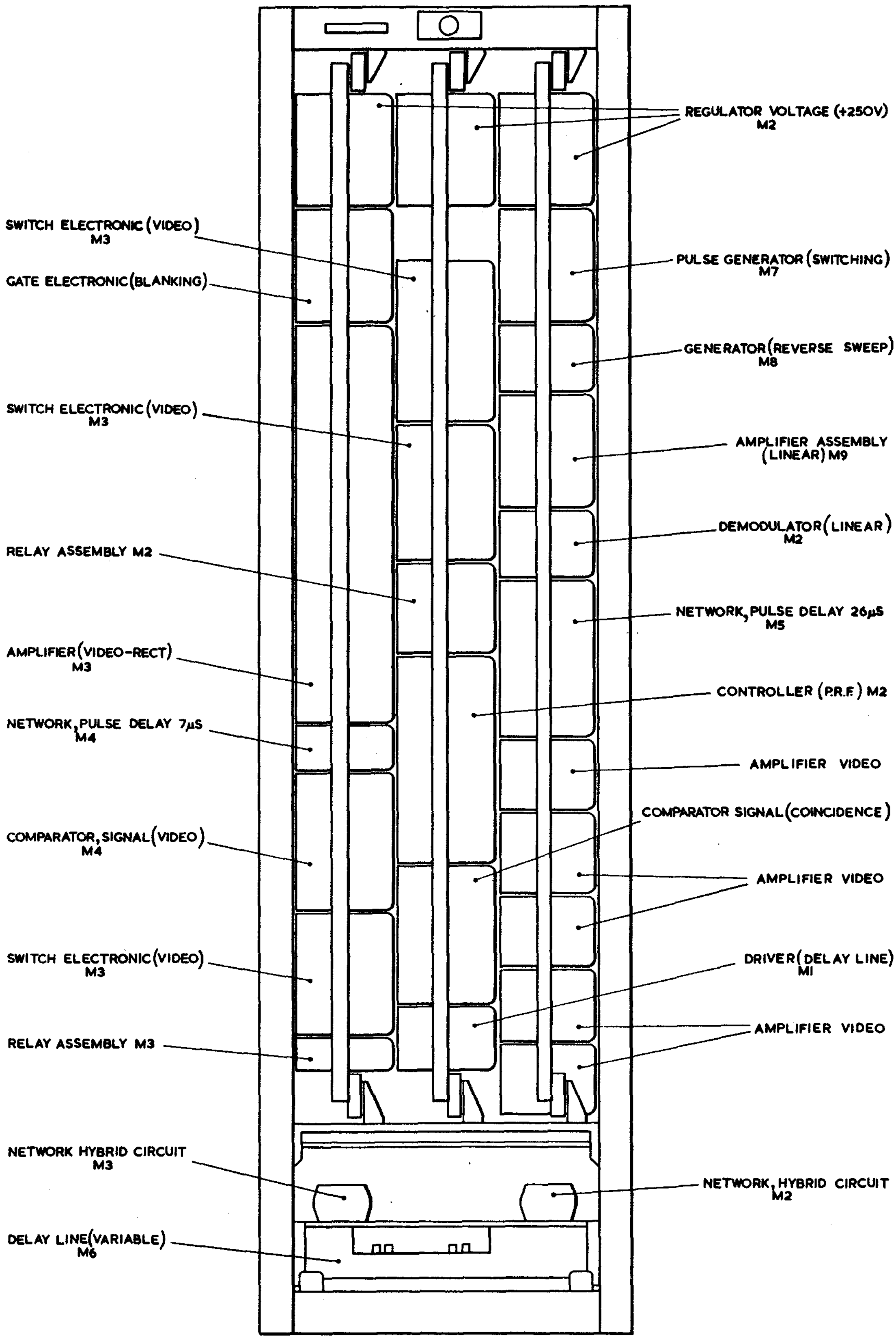


Fig. 1. Video cabinet : front view

Mechanical description

9. A mechanical description common to all cabinets is given in Appendix 1 to Sect. 2, Chap. 1, while mechanical features peculiar to the video cabinet are given herein.

10. The cabinet generally is the same as described in Appendix 1, with the exception that the unit frames are not full-length. The lower section of the cabinet is reinforced to accommodate the horizontally-mounted variable delay line, which rests on nylon rollers. A list of weights and dimensions of individual units is given in Table 1.

Electrical description

11. An electrical description applicable to the video cabinet is given in Sect. 2, Chap. 1.

Power distribution

12. Distribution of power supplies within the cabinet is shown in fig. 4. This drawing includes a circuit diagram of the fault relay assembly, a description of which is given in Sect. 2, Chap. 1. However, in the video cabinet application of the unit, additional fault indications are given by the controller (p.r.f.) M2 and the delay line (variable) M6, giving warning of incorrect delay synchronization and/or mercury leakage.

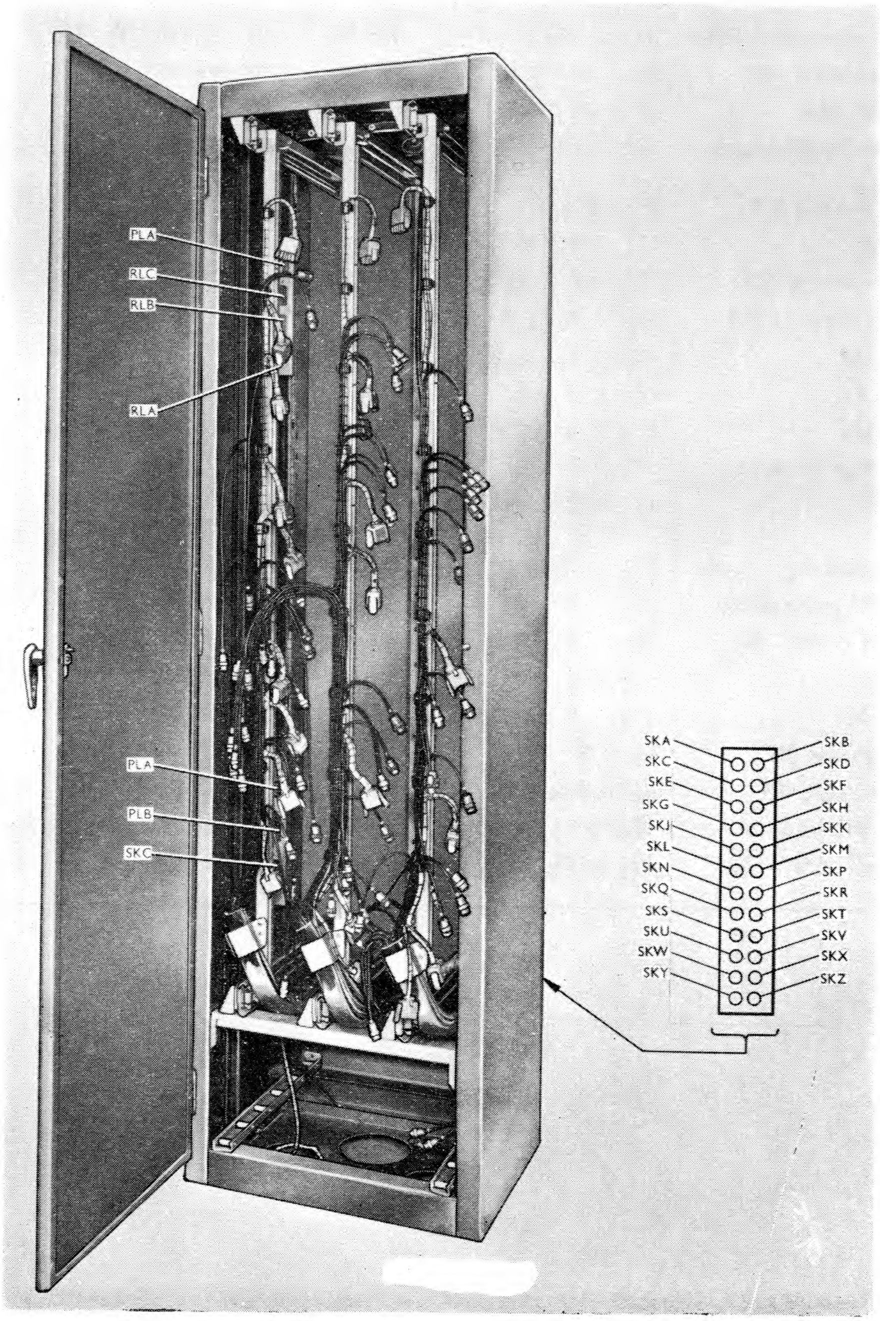
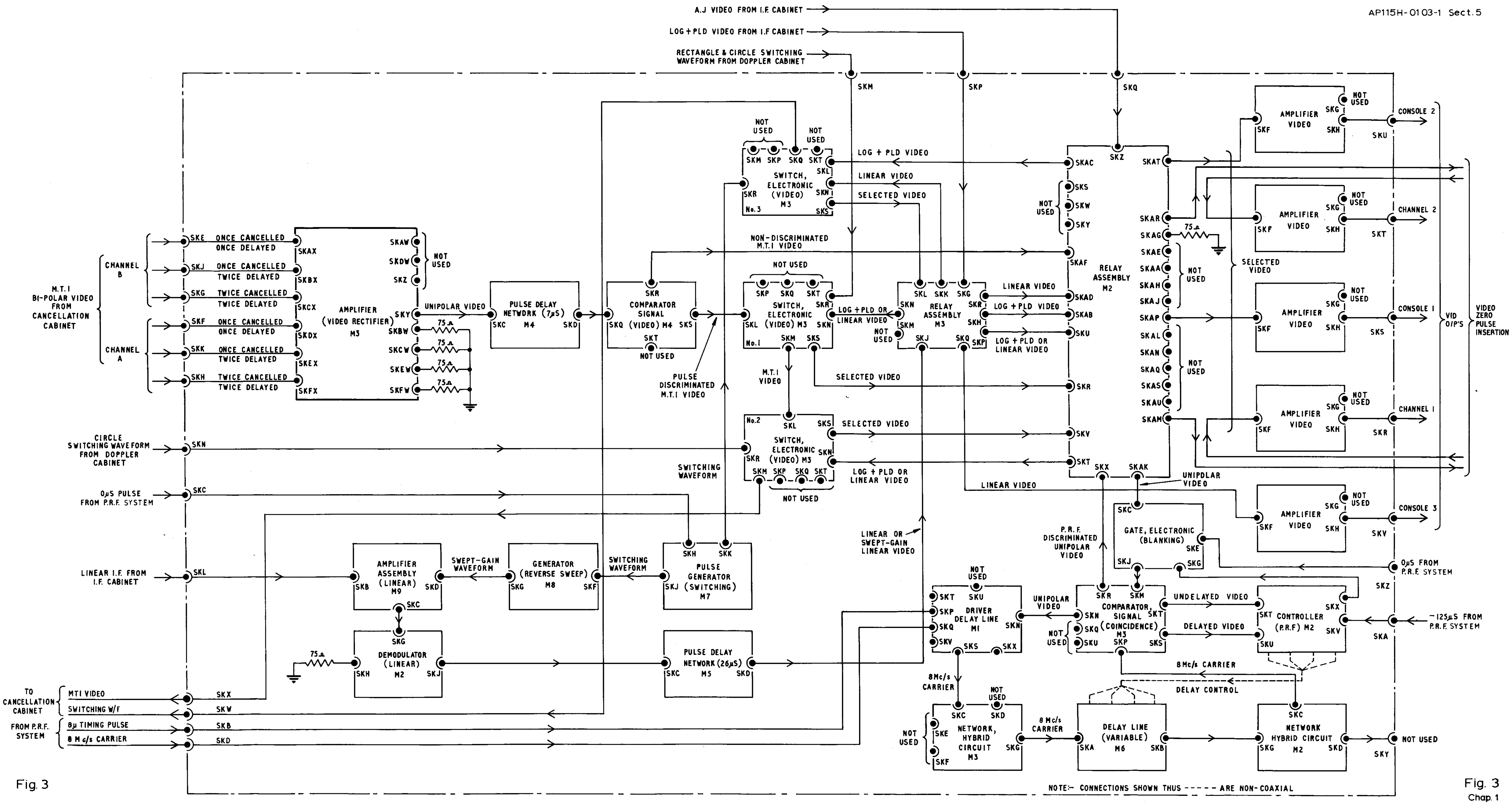


Fig. 2. Cabinet, electrical equipment M45 : rear view

TABLE 1

Weights and dimensions

	Title	Dimensions (inches)	Weight	A.M. Ref.	Chapter
(AL 1)	Cabinet, electrical equipment M45	$84\frac{1}{4} \times 25\frac{1}{4} \times 23\frac{1}{2}$	425 lb	5975-99-999-2692	1
	Amplifier (video-rectifier) M3	$24 \times 11\frac{1}{2} \times 6$	19 lb	10U/17487	2
	Delay line (variable) M6	$18 \times 16\frac{1}{2} \times 7$	336 lb	10D/22700	3
	Comparator, signal (coincidence) M3	$17\frac{1}{2} \times 10\frac{1}{2} \times 6$	11 lb	10D/22646	4
	Switch, electronic (video) M3	$18 \times 9 \times 6$	$6\frac{1}{2}$ lb	10F/20588	5
	Relay assembly M2	$17\frac{1}{2} \times 6 \times 6$	$3\frac{1}{2}$ lb	10F/20589	6
	Generator (reverse sweep) M8	$17\frac{1}{2} \times 6 \times 4\frac{1}{2}$	$4\frac{1}{2}$ lb	10V/16462	7
	Amplifier assembly (linear) M9	$17\frac{1}{2} \times 7\frac{1}{2} \times 6$	11 lb	10U/17493	8
	Amplifier (linear) M8	$13\frac{1}{2} \times 2\frac{13}{16} \times 2\frac{3}{4}$	3 lb	10U/17492	8
	Relay assembly M3	$17\frac{1}{2} \times 6 \times 3$	$1\frac{3}{4}$ lb	10F/20590	9
(AL 1)	Controller (p.r.f.) M2	$17\frac{1}{2} \times 13\frac{1}{2} \times 6$	$12\frac{1}{2}$ lb	6110-99-999-2857	10
	Network (7 μs) M4 pulse delay	$17\frac{1}{2} \times 6 \times 3$	2 lb	10D/22643	Sect. 2, Chap. 5
	Amplifier, video	$17\frac{1}{2} \times 6 \times 4\frac{1}{2}$	5 lb	10U/5840–99–913–2143	11
	Gate, electronic (blanking)	$17\frac{1}{2} \times 7\frac{1}{2} \times 6$	$6\frac{1}{2}$ lb	—	12
	Network (26 μs) M5 pulse delay	$17\frac{1}{2} \times 6 \times 3$	$2\frac{1}{2}$ lb	10D/22644	Sect. 2, Chap. 5
	Comparator, signal (video) M4	$17\frac{1}{2} \times 9 \times 6$	8 lb	10D/22647	Sect. 2, Chap. 6
	Demodulator (linear) M2	$17\frac{1}{2} \times 6 \times 4\frac{1}{2}$	5 lb	10D/22642	Sect. 2, Chap. 14
	Driver, delay line M1	$17\frac{1}{2} \times 6 \times 4\frac{1}{2}$	5 lb	10D/22628	Sect. 3, Chap. 2
	Network, hybrid circuit M2	$4\frac{1}{2} \times 3 \times 4\frac{1}{8}$	$\frac{1}{2}$ lb	10D/22634	Sect. 3, Chap. 3
	Network, hybrid circuit M3	$4\frac{1}{4} \times 3 \times 4\frac{1}{8}$	$\frac{1}{2}$ lb	10D/22635	Sect. 3, Chap. 3
	Pulse generator (switching) M7	$17\frac{1}{2} \times 7\frac{1}{2} \times 6$	$6\frac{1}{2}$ lb	10V/16460	Sect. 4, Chap. 6
	Regulator (voltage +250V) M2	$17\frac{1}{2} \times 7\frac{1}{4} \times 6$	9 lb	10D/22632	Sect. 2, Chap. 17



Video cabinet: signal interconnections (external plot and code extractor fitted)

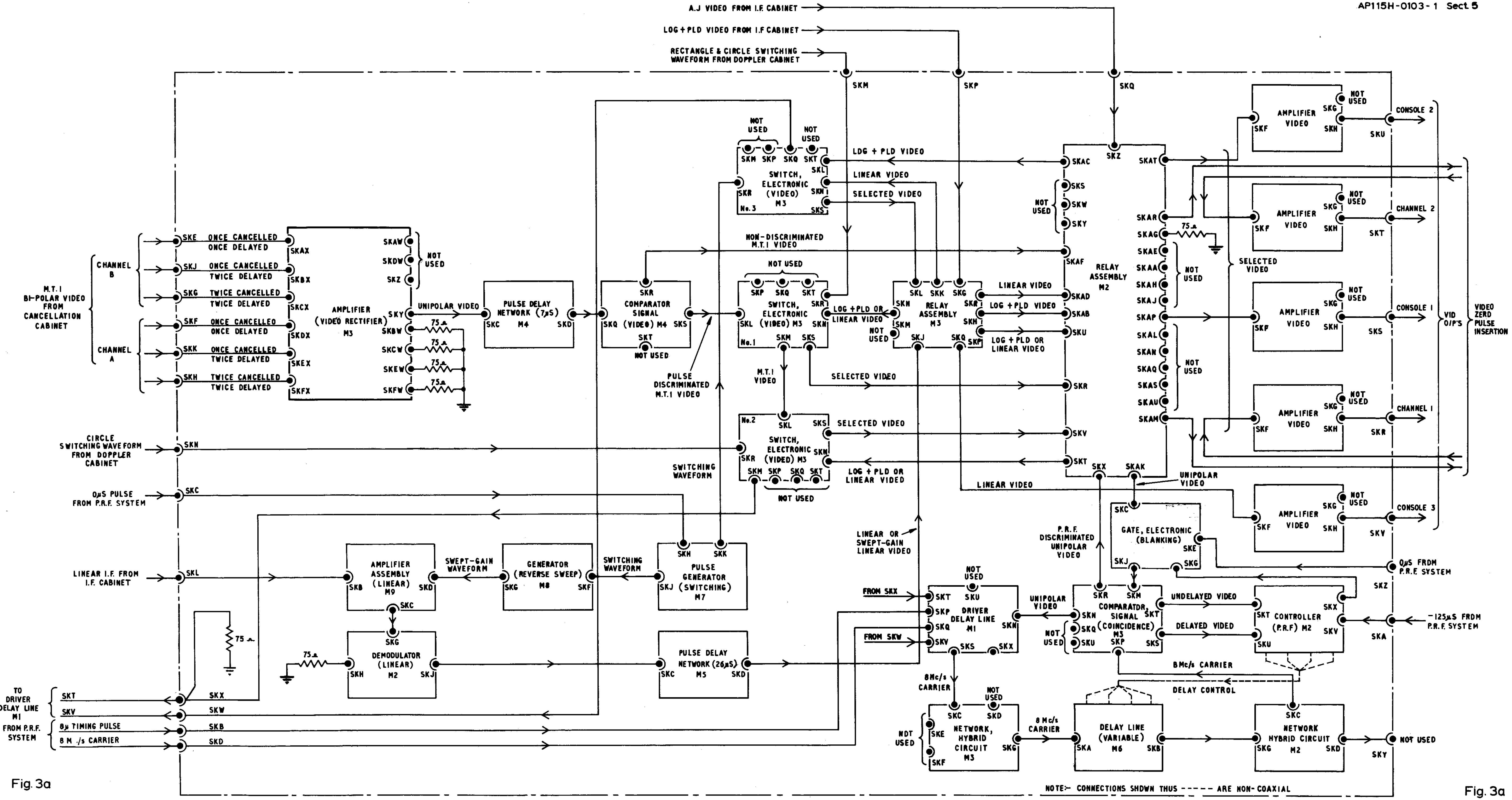


Fig. 3a

cabinet signal interconnections (external plot and code extractor not fitted)

Fig.4

Video cabinet: power distribution

Chapter 2

AMPLIFIER (VIDEO RECTIFIER) M3

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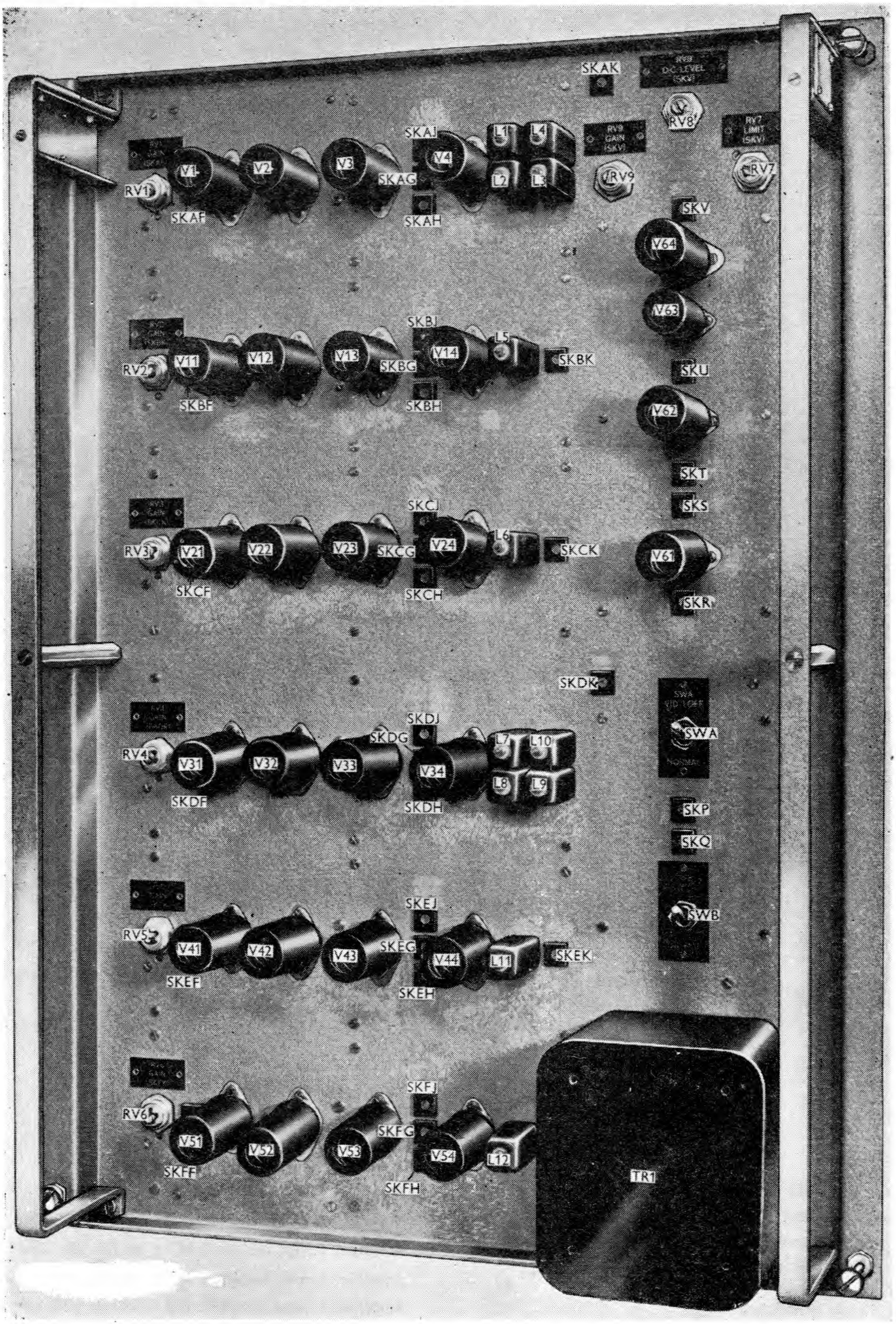

Fig. 1. Amplifier (video rectifier) M3 : front view

Introduction

1. The purpose of the amplifier (video rectifier) M3 (*fig.* 1) is

(1) To rectify the bipolar video signals produced by the cancellation process and give suitable positive-going video signals for display purposes.

(2) To reduce the multiplicity of non-synchronous interference pulses.

(3) To combine the outputs of the two processing channels.

The unit is located in frame 1 of the video cabinet.

2. Six similar amplifier rectifier circuits (*fig.* 2) are used (three for each channel) to accept the cancelled and delayed bipolar video outputs from the comparator, signal M1 (*Sect.* 3, *Chap.* 5) and the comparator, signal M2 (*Sect.* 3, *Chap.* 6). These signals are amplified, limited, rectified and then applied to a three-element coincidence detector in each channel.

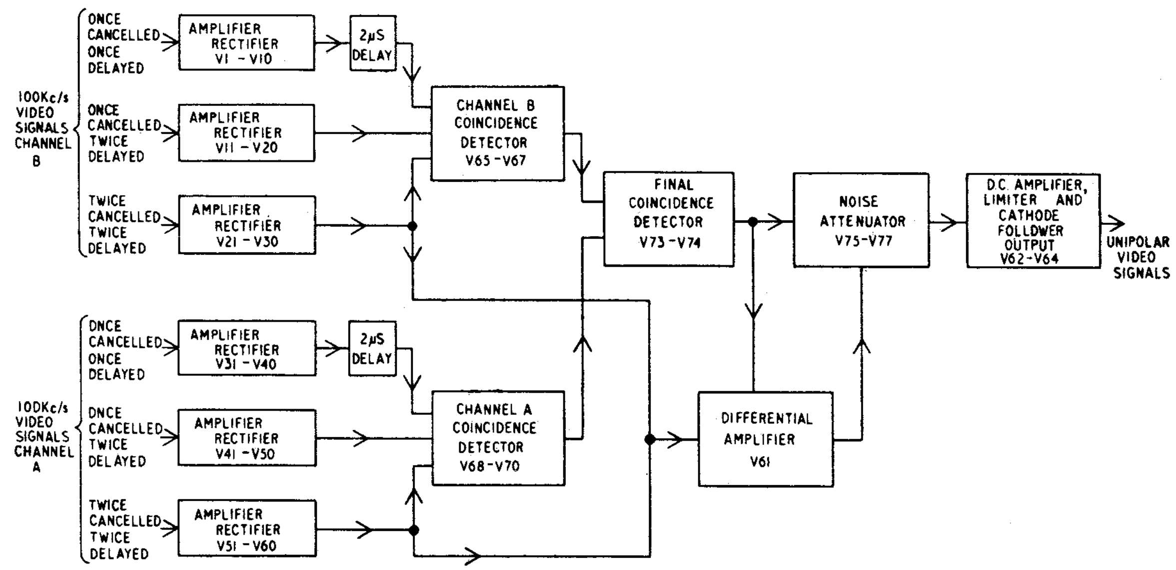

Fig. 2. Amplifier (video rectifier) M3 : overall block schematic

3. The outputs from the two coincidence detectors are applied to a further (two-element) coincidence detector which provides for cancellation in overlapping areas, i.e. where the centre circle and one of the doppler-compensated rectangles overlap. Under these conditions one channel cancels fixed clutter and the other cancels moving clutter. If both are passed to the coincidence detector, both forms of clutter are cancelled with the exception of superimposed clutter. The output from the detector is fed to a video amplifier via a noise attenuator. The video amplifier provides for a certain amount of d.c. level, gain and signal/noise adjustment. The noise attenuator eliminates the 3 dB increase in noise level at the final coincidence detector caused by the non-synchronous pulses present in the video signals.

4. The video signals from both channels are applied via an OR gate to a subtractor circuit, the resultant output of which is used to operate a diode noise attenuator which introduces a 3 dB loss, bringing the noise down to the original level. The twice-cancelled, twice-delayed video is used in this connection because it contains all pulses.

Performance characteristics

Inputs

5. The unit requires the following inputs :

(1) 240V, 50 c/s, single phase a.c. at PLB/7 on PLB/10 via FS1.

(2) +250V ± 5V at 200 mA at PLB/9
−250V ± 5V at 100 mA at PLB/11

(3) Bipolar video at 2·0V ± 1·0V peak-to-peak on a 2·0V ± 0·5V positive d.c. level under the following conditions

(*a*) Once-cancelled, once-delayed at SKAX and SKDX.

(*b*) Once-cancelled, twice-delayed at SKBX and SKEX.

(*c*) Twice-cancelled, twice-delayed at SKCX and SKFX.

The input sockets SKAW to SKFW are not used, sockets SKBW, SKCW, SKEW and SKFW are terminated in 75 ohms at the unit and sockets SKAW and SKDW are terminated in a similar manner in the driver, delay line, M1 (*Sect.* 3, *Chap.* 2) by their common connection to SKAX and SKDX respectively.

Outputs

6. The unit delivers from socket SKY positive-going video signals of sufficient level to give 1·5V ± 0·1V peak on a d.c. level of 0V ± 0·1V as measured at socket SKC on the comparator, signal (video), M4 (*Sect.* 2, *Chap.* 6). This is to allow for the attenuation introduced by the network, pulse delay, M4. The output socket SKZ is not used.

Circuit description

Power supplies (fig. 12)

7. The valve heater supply is obtained from the secondary of transformer TR1 the primary of which is supplied with 240V a.c. mains via PLB/7, FS1(1A) and PLB/10. The +250V and −250V supplies enter the unit at PLB/9 and PLB/11 respectively and are derived from the regulator, voltage (+250V) M2, mounted at the top of frame 1 of the video cabinet.

Note . . .

Owing to the large number of valve heaters supplied by TR1 there is a high current surge upon switching-on when the valves are cold. For this reason, a fuse-link of the anti-surge type is used for FS1. The requirement is indicated by a green dot adjacent to the fuseholder on the unit panel.

Amplifier rectifiers (fig. 9, 10, 11)

8. The three inputs from each cancellation channel are amplified, limited and rectified in six similar amplifier rectifier circuits. As these circuits are similar, only one, that associated with the once-cancelled once-delayed video from channel B will be described (*fig.* 3).

9. The circuit (*fig.* 9) consists of the valves V1 to V10. Bipolar video signals are applied to the grid of V1b via the GAIN (SKAK) control RV1 and the coupling components C1, R1. V1b and V1a form a two stage a.c. coupled amplifier with a gain of approximately 28 dB and are followed by a limiting stage consisting of V2b, V5 and V6. The object of amplifying and limiting is to reduce the signal-to-noise ratio by first amplifying the noise peaks and then limiting the signal. The cathode of V2b is set at about +15V determined by the grid potential derived from R16 and R17. The junction of R13 and R14 is therefore at +7·5V. The amplified signals, a.c. coupled from V1a anode to V2a grid are thus set about a d.c. level of +7·5V and are limited in the negative and positive directions, by V5 and V6 respectively, to 15V peak-to-peak.

10. The valve V2a is a phase splitter and is used to give paraphase outputs to the bridge rectifier. These paraphase outputs from the anode and cathode of the valve are each taken to a cathode follower, V3 for the anode output and V4 for the cathode. The voltage developed across the cathode resistor R19 is applied in the form of negative feedback to the cathode of the first amplifying stage V1b.

11. The outputs from the cathodes of V3 and V4 are applied to either side of the bridge rectifier V7 to V10. The output from the rectifier is taken to one element of the channel B coincidence gate V65 via a 2 μs delay line consisting of L1 to L4, C7 to C11 and C40. Part of this line is used to filter out ripple after rectification. The delay is introduced to compensate for that caused to the twice delayed inputs to the other amplifier rectifiers in passing through the second cancellation stage. The delay line is terminated by R35 at one end and R37 at the other, approximately equal to its characteristic impedance.

12. The remaining five inputs are amplified and rectified in similar circuits, differing only in the amount of delay following the bridge rectifiers in the amplifiers for the twice delayed signals. This delay is negligible and the actual purpose of the circuits is to act as a ripple filter network.

13. The GAIN (SKAK) to GAIN (SKFK) controls (RV1 to RV6 of the six amplifiers) are set to give equal signals at the input to the coincidence detectors with an artificial moving target of 1·0V peak-to-peak. These signals should not be less than 2·5V peak-to-peak on a d.c. level of 1·25V ± 0·75V.

Coincidence detectors (fig. 12)

14. The unipolar video signals from the three amplifiers in each channel are applied to a three-element coincidence detector ; V65, V66 and V67

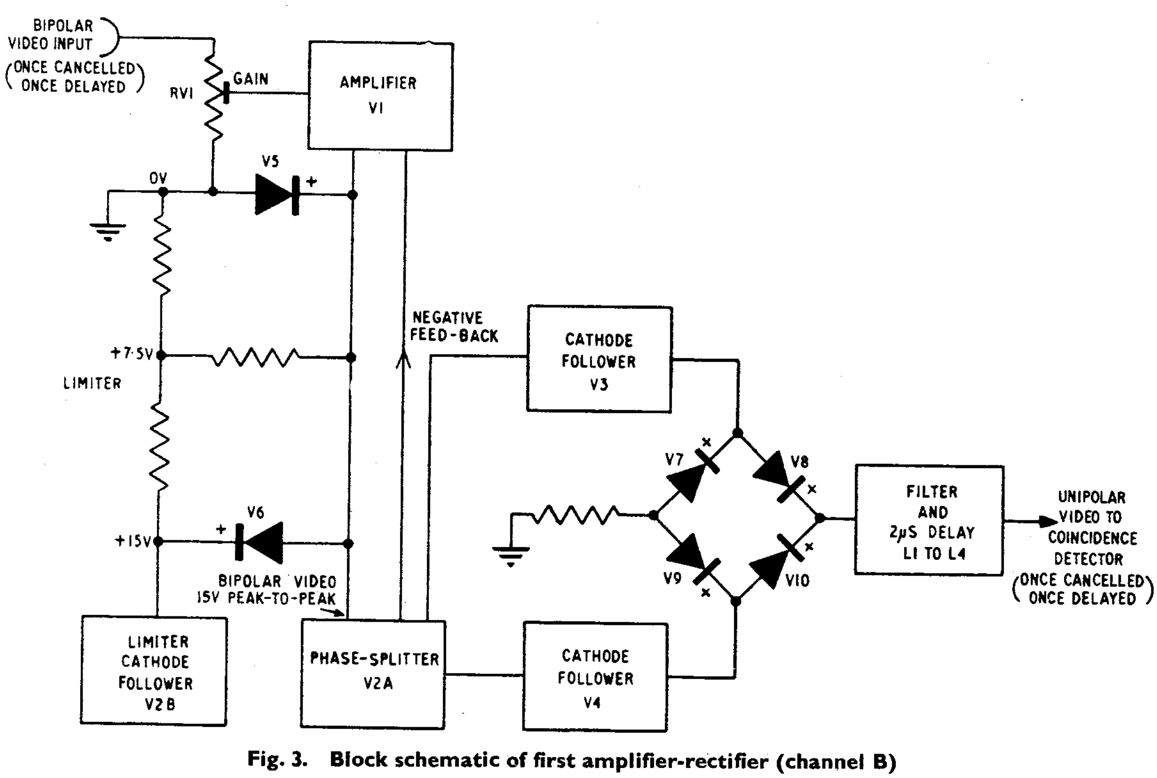

Fig. 3. Block schematic of first amplifier-rectifier (channel B)

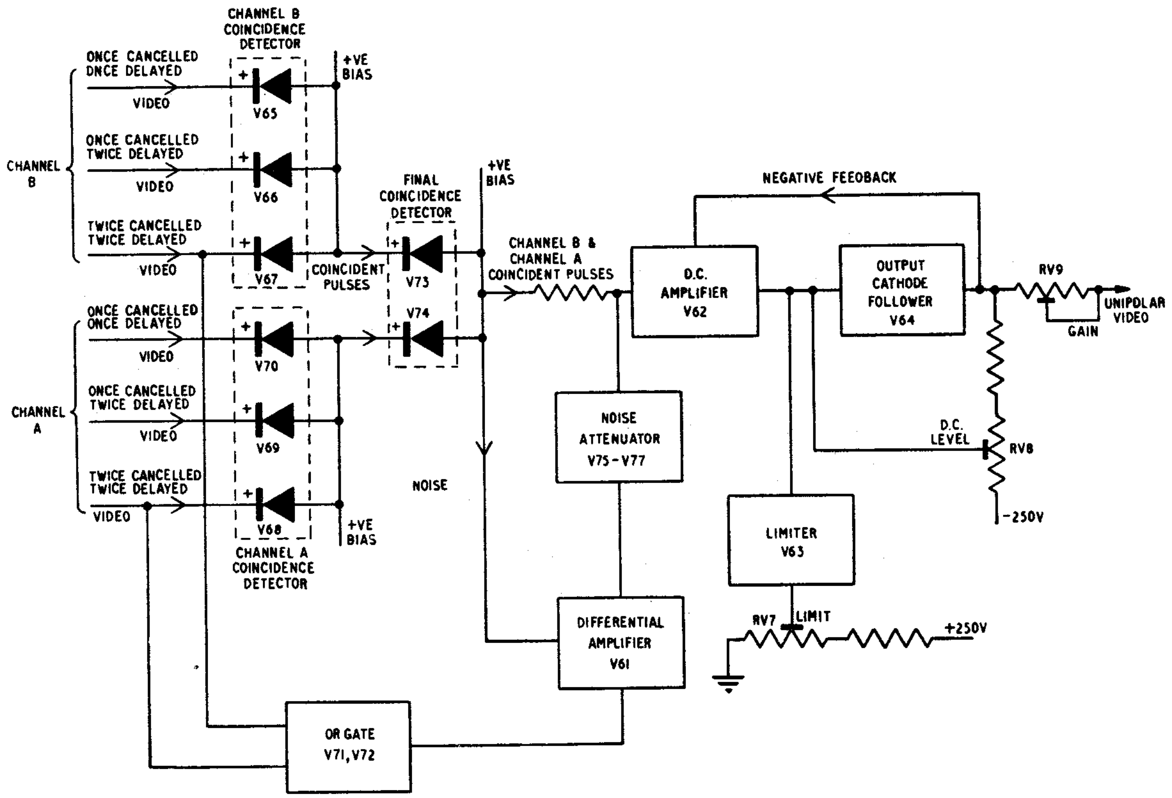

Fig. 4. Block schematic of coincidence detectors and video amplifier

being associated with channel B and V68, V69 and V70 with channel A. As both detectors are similar, only that associated with channel B will be described (*fig.* 4).

15. Each diode element of the detector is biased positively from the +250V line via R225. Under no-signal conditions all three are conducting, returns to earth being made via R37, R74 and R111 respectively. Thus, on receipt of the positive-going video signals from the amplifier rectifiers each diode is cut off, but if these signals are not coincident in time at each diode, the current change at the output is very small due to the high value of R225 compared with the rest of the circuit. If, however, the three inputs are coincident the diodes are cut off simultaneously and their anodes rise to the level of the smallest of the three input signals. Under these circumstances non-synchronous pulses will not be passed.

16. The outputs obtained from each of the channel coincidence detectors are passed to a two-element coincidence detector V73 and V74. This is to provide cancellation in overlapping areas (e.g. when a Doppler compensated rectangle overlaps the centre circle). In such an area one channel will be cancelling fixed clutter and the other moving clutter. The two diodes are biased positively from the +250V line via R229 and respond to their inputs in the same manner as the channel coincidence detectors, i.e. they only respond to coincident pulses, both diodes being cut off simultaneously. The output of this final coincidence detector is fed to the video amplifying stages and the noise attenuating circuit.

17. The switches SWA and SWB (VID. 1 OFF/NORMAL and VID. 2 OFF/NORMAL) are used to break the signal inputs to the final coincidence detector in the event of a failure of one signal processing channel and also for setting-up purposes. The switches also break the inputs to the OR gate associated with the noise attenuator. Operation of either of these switches will make it necessary to reset the limit level in the video amplifier to maintain signal-to-noise ratio.

Video amplifier (*fig.* 12)

18. The positive-going video signals from the final coincidence detector are taken to the grid of V62b. The valve and its associated circuit form a long-tailed pair operating as a high stability d.c. amplifier producing a positive-going output at V62a anode. The output is limited by V63 to the level set by the LIMIT (SKV) control RV7 and d.c. coupled to the output cathode follower V64. The d.c. level of the grids of V64 and hence the d.c. level at the output is set by the D.C. LEVEL (SKV) control RV8. Negative feedback is applied from the output to V62a grid by R250 and R251 and the overall gain of the amplifier approaches unity. The GAIN (SKV) control RV9, in series with the 75 ohm output, acts as an attenuation control.

19. The control RV7 is adjusted to give a peak-to-peak signal output of 1·5V on a d.c. level of 0V ± 0·1V adjusted by RV8 as measured at socket SKC on the comparator, signal (video). The control RV9 is adjusted to give a shoulder noise level of 0·3V at the same point. The reason for setting up at this point is to allow for the attenuation introduced by the network, pulse delay M4.

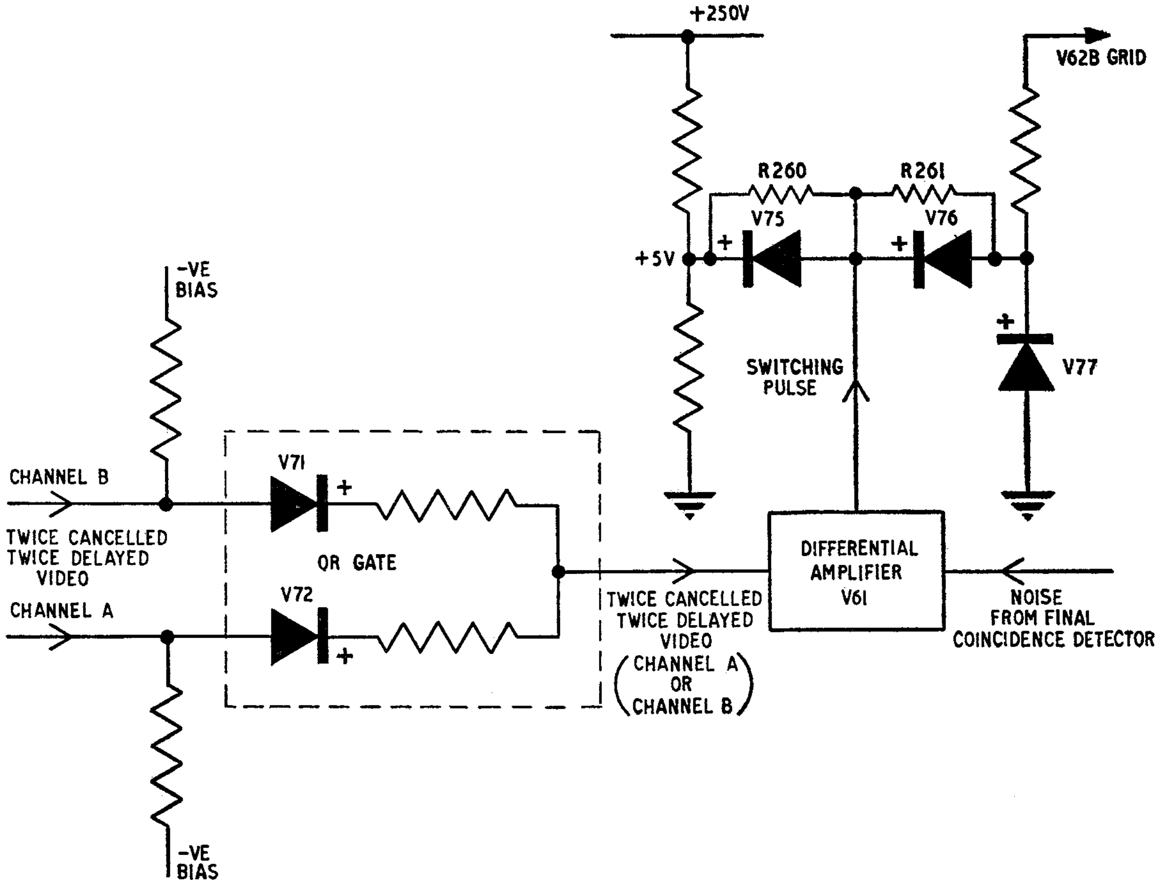

Fig. 5. Block schematic of noise attenuator

Noise attenuator (*fig*. 5, 12)

20. The noise attenuator consists of an OR gate, V71 and V72, a differential amplifier, V61 (used as a subtracting circuit) and the diodes V75, V76 and V77. The circuit is used to eliminate the increase in noise level at the final coincidence detector caused by non-synchronous pulses appearing on one or other of the diodes. This noise is due to the detector not being a perfect device and would eventually appear as an unwanted signal on the display unless it is eliminated.

21. The valve V61 forms a long-tailed pair operating as a differential amplifier and producing at V61a anode an output proportional to the difference in amplitude of the signals applied to the two grids. The twice-cancelled twice-delayed signals of channels B and A are applied via the OR gate, V71 and V72, to the grid of V61a. As these signals have not been through the coincidence detectors it follows that the OR gate will pass the non-synchronous pulses to V61a grid. The increase in noise level at the final coincidence detector caused by the non-synchronous pulses is applied to the grid of V61b. The difference in amplitude between these two inputs produces a negative-going pulse at V61a anode. This pulse is a.c. coupled to the junction of V75 and V76.

22. Under quiescent conditions the three diodes are cut off by the bias on V75 cathode. This bias is derived from the +250V line via R236 and R237. The negative pulse from V61a anode will cause both V76 and V77 to conduct and the noise level at the final coincidence detector will be attenuated by R238, R239 and V77 resulting in the noise being restored to its normal level (*fig*. 6).

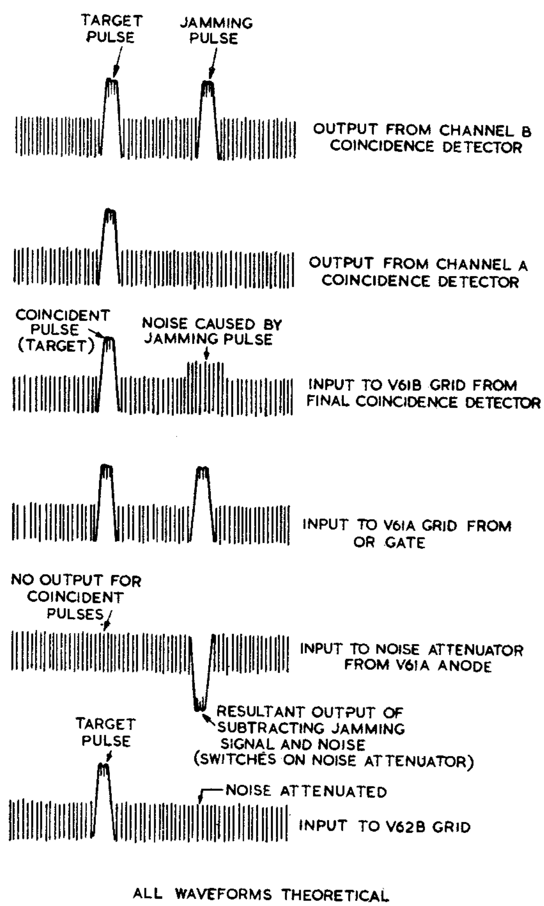

Fig. 6. Principle of operation of noise attenuator

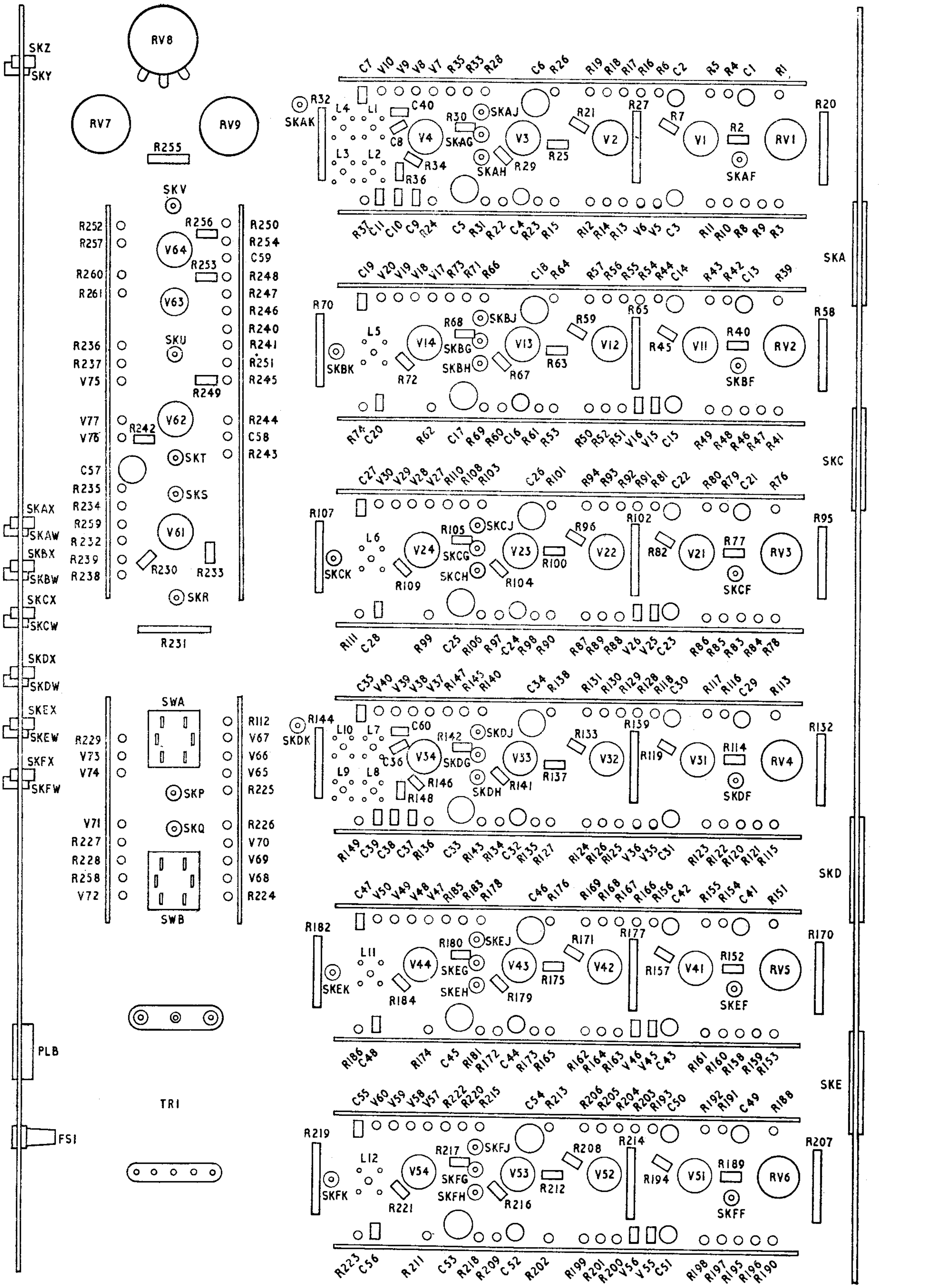

Fig. 7. Amplifier (video rectifier) M3: component layout

23. At the termination of the non-synchronous pulse V76 and V77 are cut off once more and the positive charge which has built up on C57 by the conduction of V76 and V77 leaks away through V75.

24. In the case of target pulses, both inputs to the grids of V61 are of a similar amplitude so the output of V61 is near zero and is not sufficient to switch on the attenuator. No attenuation takes place.

Monitoring facilities

25. Using the monitoring oscilloscope M1 (*Sect.* 7, *Chap.* 4) the waveforms and d.c. levels observed at the monitor points in the circuit are as shown in fig. 8.

Test readings

26. With the multimeter Type 100 connected via the adaptor, plug to socket, to sockets SKA, SKC, SKD and SKE in turn the meter readings should be as indicated in Table 1.

TABLE 1

Multimeter readings

Socket	Multimeter switch position	Measured across	Reading	Tolerance
A	A–L inclusive	R5, R11, R15, R23, R28, R33, R235, R245, R246, R43 and R257.	0·5	±0·1
C	A–L inclusive	R49, R53, R61, R71, R80, R86, R90, R98, R103 and R108.	0·5	±0·1
D	A–L inclusive	R117, R123, R127, R135, R140, R145, R155, R161, R165, R173 and R178.	0·5	±0·1
E	A–G inclusive	R183, R192, R198, R202, R210, R215 and R220.	0·5	±0·1

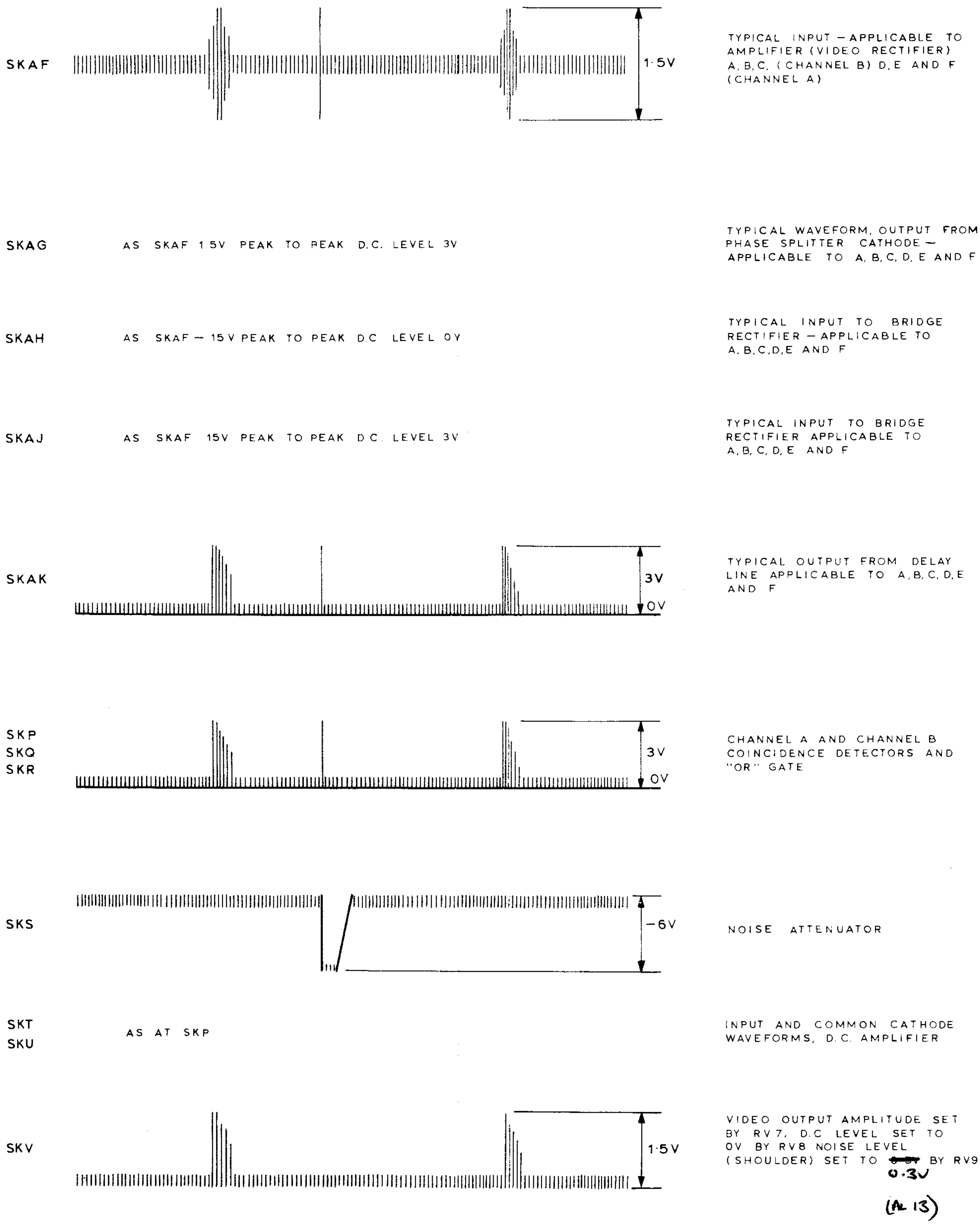

Fig. 8 Monitor point waveforms

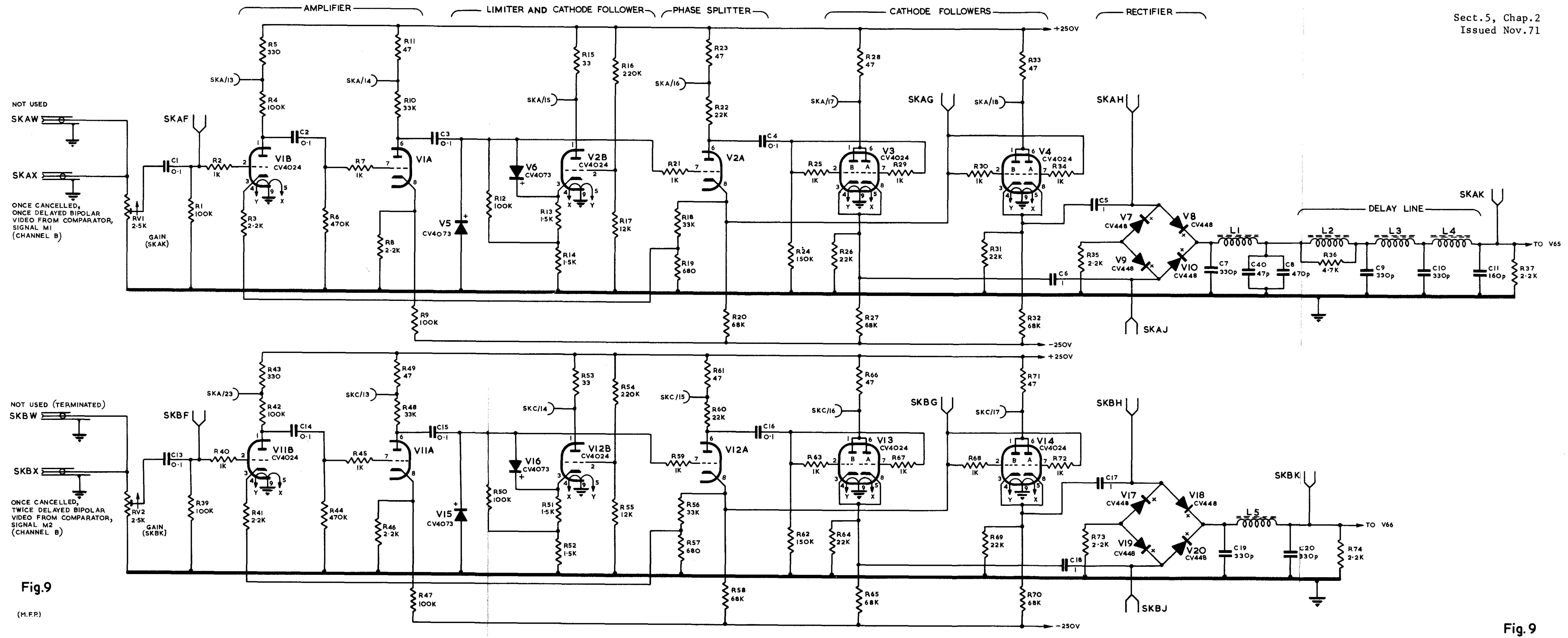

Fig.9

Amplifier (video rectifier) M3: V1 to V20 circuit

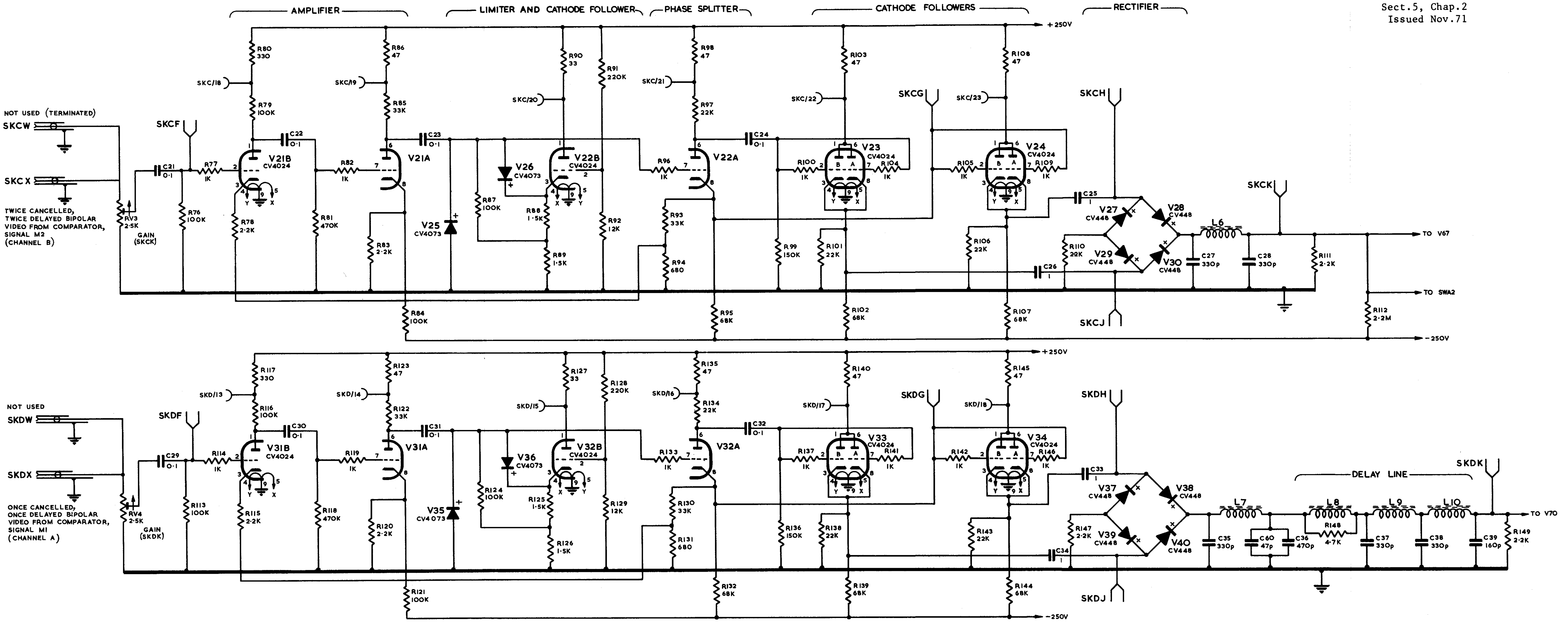

Fig.10

Amplifier (video rectifier) M3: V21 to V40 circuit

Fig.10

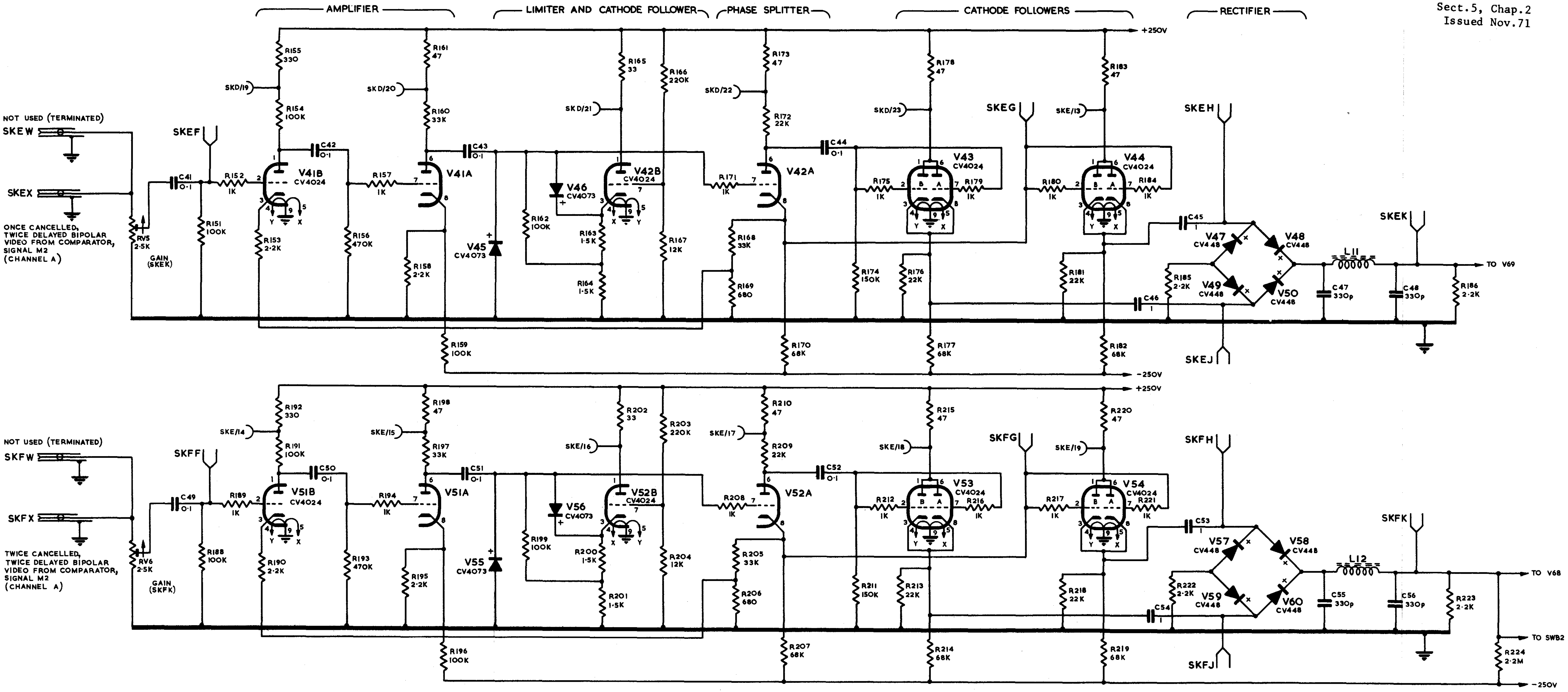

Fig.11

Amplifier (video rectifier) M3: V41 to V60 circuit

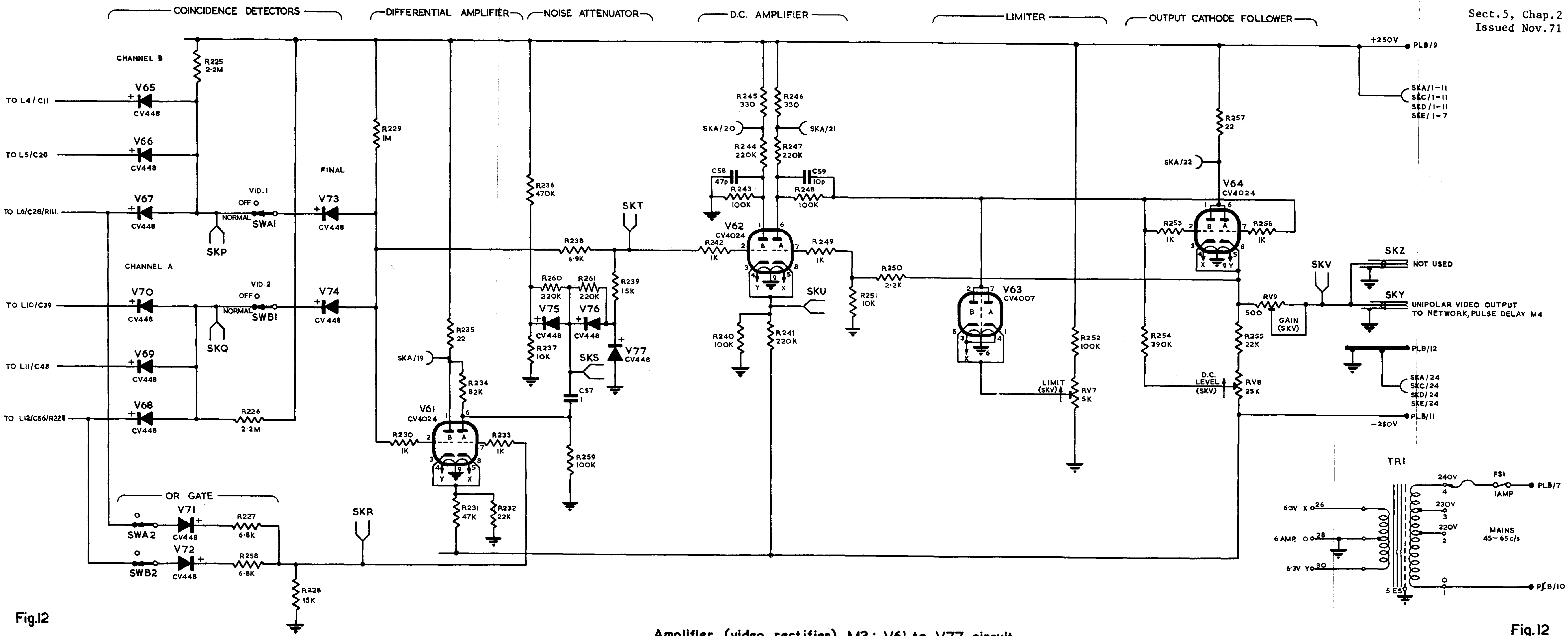

Fig.12

Amplifier (video rectifier) M3: V61 to V77 circuit

Fig.12

Chapter 3

DELAY LINE (VARIABLE) M6

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Introduction

Caution . . .

The following points should be carefully noted:—

(1) *If it becomes necessary to change the delay line it must be handled very carefully and not dropped or bumped in any way. It must be maintained in a horizontal position and only transported by means of the truck, hand platform (Cat. No. 3920–99–913–1222) (Sect. 3, Chap. 4).*

(2) *When the unit is being removed from the cabinet it must not be held or stopped by means of the bellows or the motor assembly.*

(3) *No attempt should be made to lift or carry the unit by fewer than four men, due to its weight (3 cwt).*

(4) *Under no circumstances should the lid or gearbox assembly be removed.*

(5) *The sealed-in set screws which hold the plate glass reflectors in position must not be tampered with.*

1. The delay line (variable) M6 (*fig.* 1) forms part of the p.r.f.d. system and its purpose (*fig.* 2) is to delay the video signals by one pulse period in order that they may be compared with similar but undelayed video signals in the comparator, signal (coincidence) M3 (*Chap.* 4).

2. The unit is located in the base of the video cabinet and contains two independent mercury filled delay paths with provision for variation of the delay time in order to match accurately with the system p.r.f. Only one path is used in this application.

3. The operation of the line is similar to the delay line, fixed (*Sect.* 3, *Chap.* 4) in that the video signals are superimposed on an 8·19 Mc/s carrier in the driver (delay line) M1 (*Sect.* 3, *Chap.* 2) and are propagated through the line by a quartz transducer mounted in one corner. The mechanical construction of the delay line is also similar to the fixed delay line. An internal view of the line is shown in fig. 3.

4. After being reflected within the unit the appropriate number of times, the signals pass through a 45° hole cut in one corner of the glass reflectors and are diverted by means of a reflecting surface mounted at 22½° to the direction of propagation. From here they travel to a 90° reflector and are directed back to the receiving quartz transducer which is mounted on the same block as the 22½° reflector. The principle of operation is shown in fig. 4 and a view of the transducers is given in fig. 5. Full details of the principles of mercury delay lines are given in Sect. 3, Chap. 4.

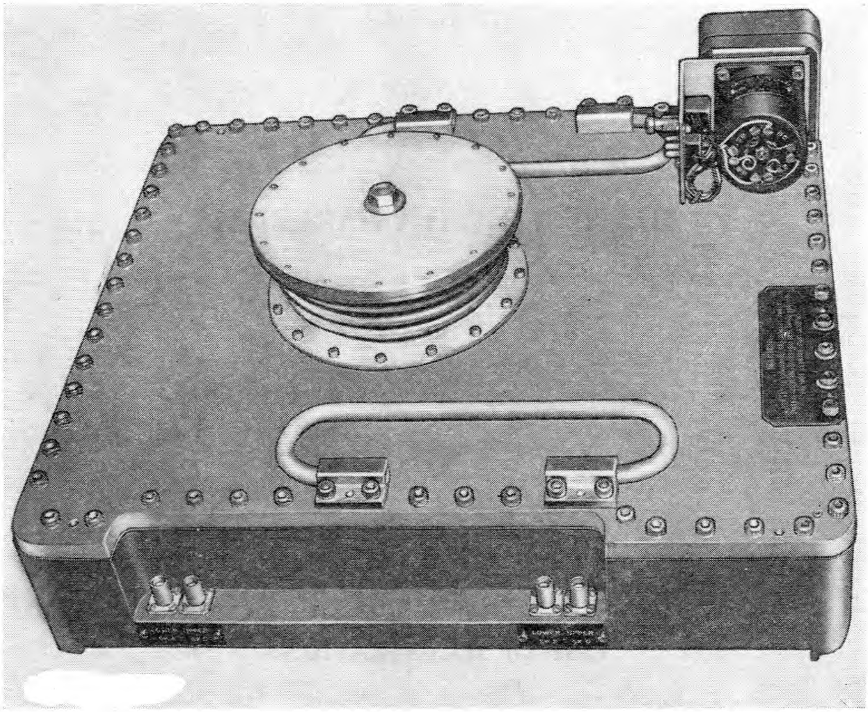
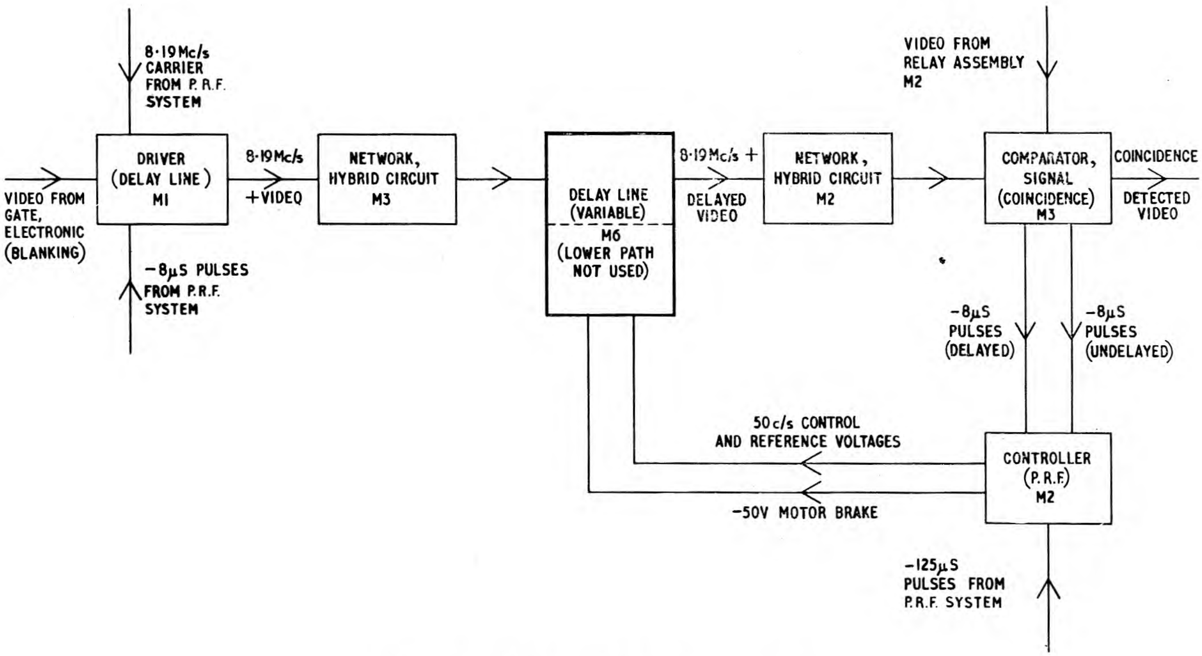


Fig. 1. Delay line (variable) M6: external view



◀Fig. 2. Functional block schematic▶

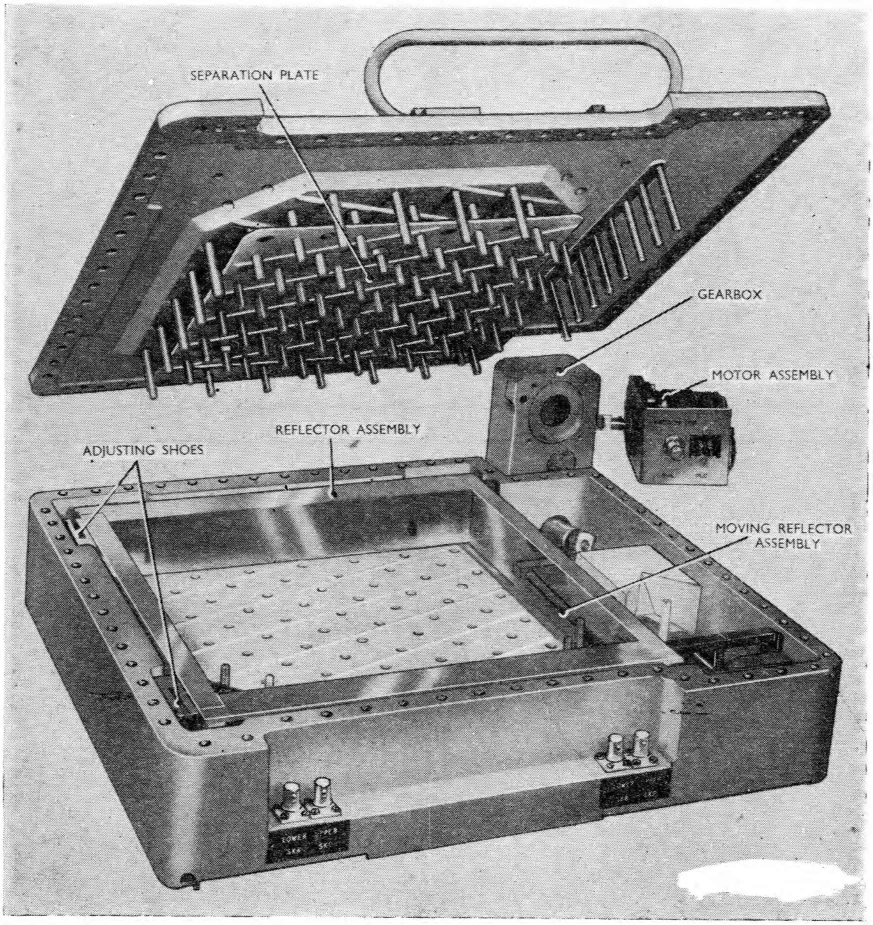


Fig. 3. Delay line (variable) M6 : internal view

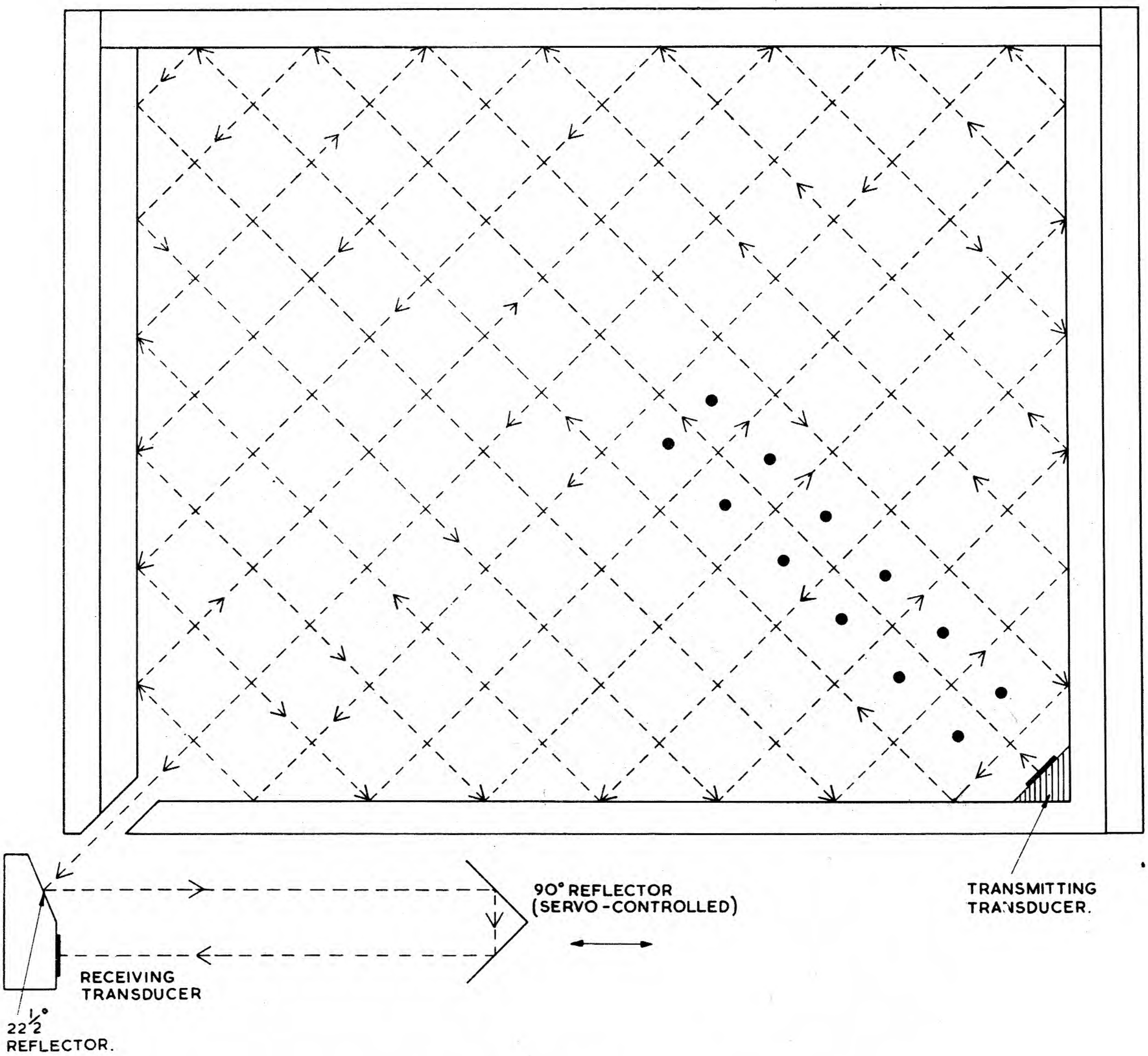


Fig. 4. Principle of operation

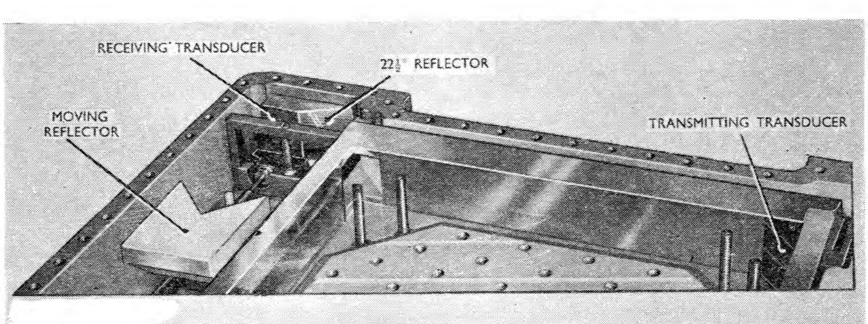


Fig. 5. View of transducers

5. The 90° reflector is mounted on a carriage which is driven by a two-phase synchronous motor via a gearbox. The motor is supplied with reference and control voltages from the controller (p.r.f.) M2 (*Chap.* 10) and drives the reflector in the appropriate direction to correct the delay until it accurately matches the system p.r.f. A d.c. braking voltage is provided to prevent hunting of the motor.

Performance characteristics

6. Each delay path in the cell has an overall delay time variable between 3892 and 4098 microseconds and an overall attenuation of 80 to 95 dB at 8·19 Mc/s.

Inputs

7. The unit requires the following inputs :—

(1) Carrier at 8·19 Mc/s ± 100 kc/s, at a level of 6V peak-to-peak modulated with video signals up to 20V peak-to-peak, at socket SKA.

(2) A 50 c/s reference voltage, at a level of 12V, at PLE/2 for motor control.

(3) A 50 c/s control voltage, derived from the controller (p.r.f.) M2, at a level depending on the delay error, at PLE/3 for motor control.

(4) −50V d.c. at PLE/3, to act as a d.c. brake.

Output

8. The unit delivers video signals on an 8·19 Mc/s carrier, at a level determined by the overall attenuation of the line, at socket SKB.

Mechanical description

9. The unit is similar in construction to the fixed delay line, i.e. it consists of a base and lid made of a special grade of cast iron with a fibre glass separation plate between the two delay paths. In this instance, the casting is made large enough to accommodate the carriage and gearbox associated with the delay correction.

10. The carriage mounts the 90° glass reflector and is moved by a lead screw driven from the gearbox by a bellows coupling. The use of a bellows coupling ensures a mercury-tight connection from the gearbox to the carriage. A guide bar parallel with the lead screw maintains the reflector in a stable position horizontally. The assembly is shown in fig. 6.

11. To prevent the reflector carriage from being overdriven at either end of its travel, limit stops are fitted. These consist of adjustable screws mounted on either end of the reflector carriage in the way of stops carried on the lead screw. At either end of the carriage travel the screws encounter the stops and prevent further movement of the lead screw. When this occurs, the gear on the carriage driving shaft is allowed to slip and so protect the motor and gearbox assembly from damage.

12. The gearbox (*fig.* 7) has an approximate ratio of 520 : 1 and consists of a 17-tooth pinion (A) driving a 71-tooth gear (B) compounded with a 13-tooth pinion (C) on the first intermediate shaft. This 13-tooth pinion drives another 71-tooth gear (D) on the second intermediate shaft and the 13-tooth pinion (E) on the same shaft drives a further

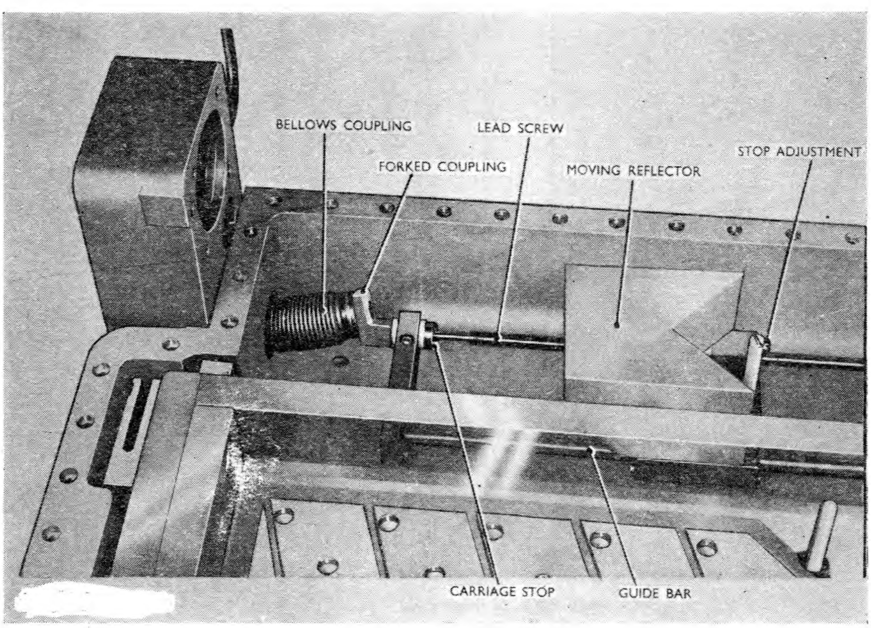


Fig. 6. Moving reflector assembly

71-tooth gear (F) on the third intermediate shaft. The drive to the final 71-tooth gear (H) is from a 17-tooth pinion (G) mounted on the third intermediate shaft. The final gear is held in position on the driving shaft by a spring and is driven through friction faces acting as a slipping clutch above a certain torque level.

13. The bellows coupling is fitted over the driving shaft and is clamped to the gearbox by means of a washer and a sealing ring. The end of the bellows fits into a forked coupling on the carriage lead screw. The driving shaft, which is slightly cranked, rotates inside the bellows and the end of the bellows moves with a circular motion thus imparting drive to the lead screw.

14. The motor is mounted at the top of the gearbox by means of four bolts. A spacing washer between the motor and the gearbox ensures that the motor pinion meshes correctly with the gear train. The panel carrying the input plug and the PRESS TO TEST switch is fastened to the gearbox by the four motor bolts.

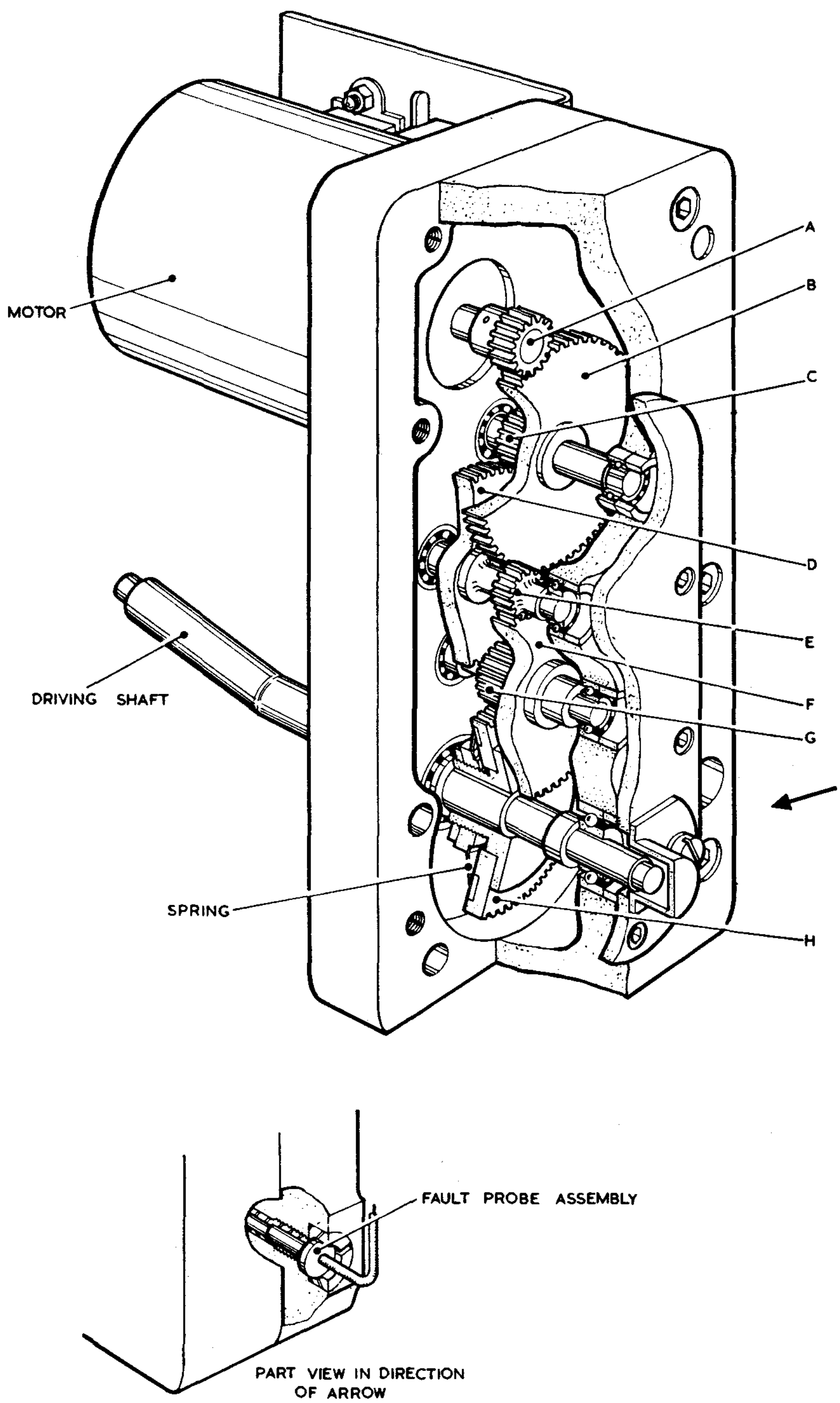


Fig. 7. Sectional view of gearbox

Electrical description

Delay path

15. The delay is obtained in a similar manner to the fixed delay line. The delay, however, is varied over the range 3892 to 4098 microseconds by means of the mechanically driven reflector. The movement of the reflector is servo-controlled by a two-phase asynchronous motor which is supplied with two 50 c/s inputs to its fields. These supplies originate in the controller (p.r.f.) M2, one being a reference voltage obtained from the station a.c. supply via a transformer and the other a control voltage derived from a time error detection circuit. They are connected to the motor via PLE/2 and PLE/3 respectively, PLE/4 being the common connection. The phase difference between these two inputs determines the direction of rotation of the motor. A simplified circuit is shown in fig. 8.

Motor brake

16. A d.c. supply of −50V is supplied from the controller (p.r.f.) M2 to the control field of the motor via PLE/3. This voltage acts as a brake to prevent the reflector drive overrunning the correct delay position and then hunting back and forth to find the position again. The d.c. almost saturates the field and under small error conditions the motor rotates slowly. However, if the error becomes large the d.c. is removed from the field by contacts on the fault relay in the controller (p.r.f.) M2 allowing the motor to rotate at its normal speed. In the no error condition, the error detection circuit produces a 100 c/s voltage which would be sufficient to drive the motor. The application of the braking voltage prevents this occurring.

Fault circuit

17. As the bellows coupling driving the reflector assembly has a finite life it is possible that it may crack during service and allow mercury to leak into the gearbox, causing damage to the slipping clutch and to the ball race housings. To give an indication that mercury is leaking a probe assembly is mounted in the base of the gearbox. If mercury leaks into the bellows it first reaches the probe housing and connects the probe to earth. This completes the earth circuit of relay RLB in the cabinet fault relay assembly via the frame 2 fault wire, and the relay is energized. Contacts RLB1 provide an earth return for the cabinet FAULT lamp thus giving indication of a fault. The cabinet FAULT lamp will give an indication of a fault on units other than the delay line, so in order to check that the delay line is at fault the PRESS TO TEST push button switch (SWA) on the unit must be operated. This switch, when pressed, breaks the fault circuit. If this

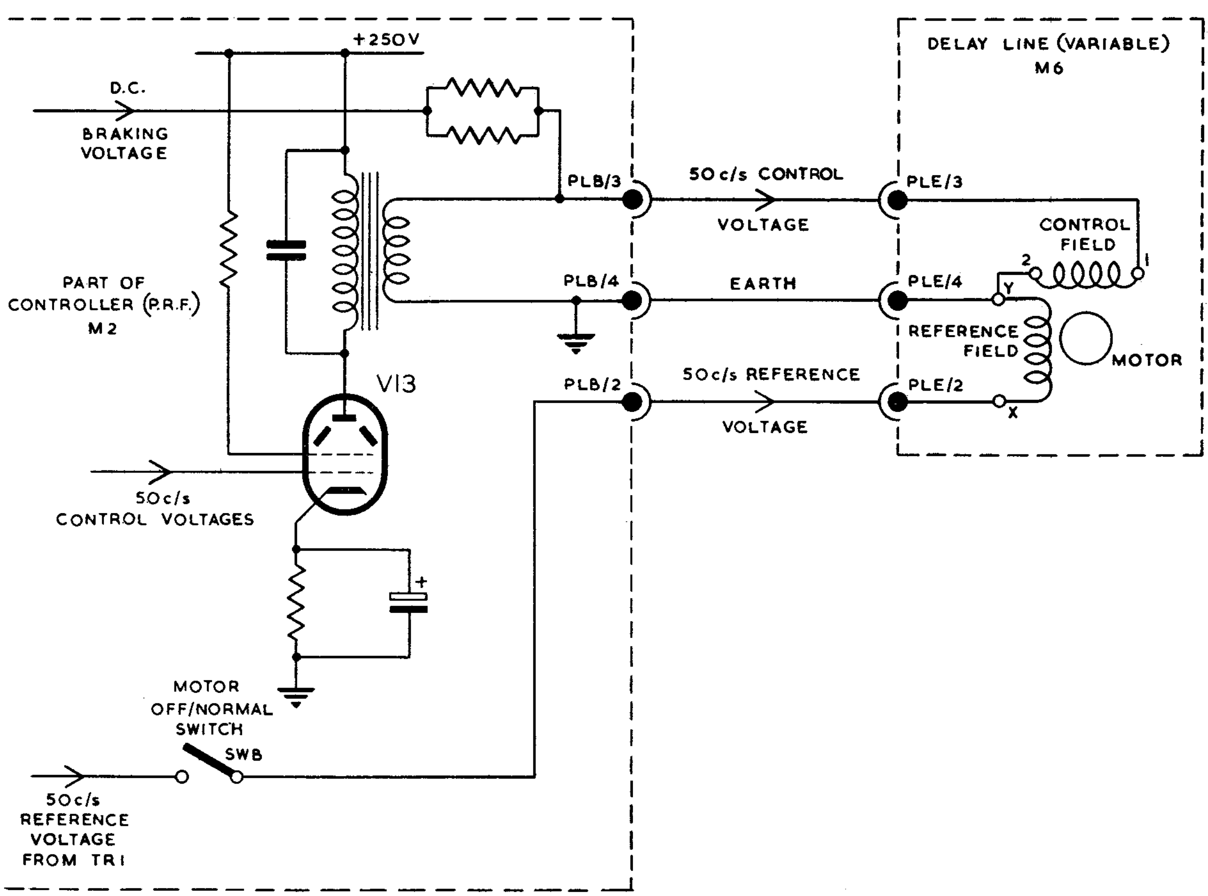


Fig. 8. Simplified circuit of motor supplies

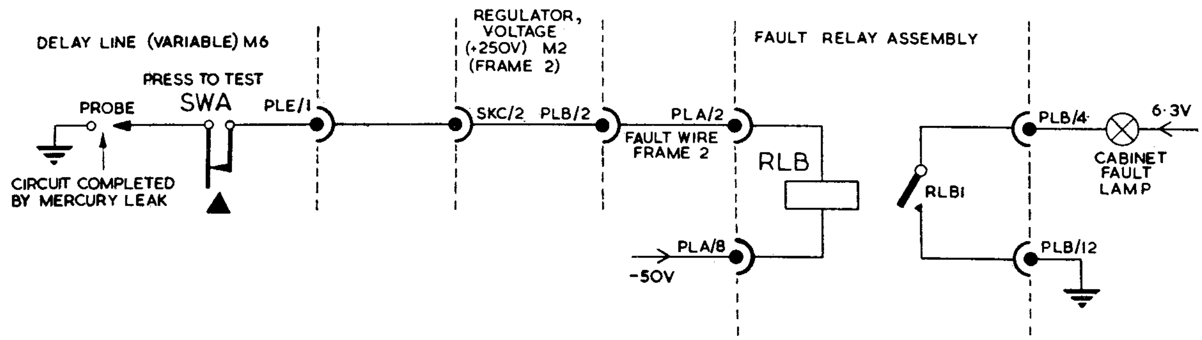


Fig. 9. Fault circuit

operation extinguishes the cabinet FAULT lamp the fault is caused by the delay line. The fault circuit is shown in fig. 9.

Caution . . .

If a fault indication is given due to a mercury leak, the line may continue to be operated for a limited period but it is essential that arrangements be made to change it within 24 hours, otherwise the following may occur :—

(1) *Sufficient mercury may leak into the gearbox to damage the clutch spring and the ball race housings. This may prevent the motor drive from operating and so give rise to a misleading fault condition.*

(2) *If mercury leaks out of the gearbox, e.g. at the bearing covers, and falls to the floor of the cabinet it may eventually find its way into the underfloor cable ducting where it will destroy the coaxial cables.*

Replacement of motor assembly

18. The replacing of PLE, SWA and the motor is straightforward. The motor assembly should be placed on the top of the delay line after removal and the fault probe connection unsoldered from SWA first in order to prevent the lead being damaged.

Replacement of coaxial sockets

Caution . . .

Every care must be taken in carrying out this operation as fracturing of the crystal connecting wires will result in the unit becoming unserviceable and very difficult to repair.

19. The coaxial sockets may be replaced in the following manner :—

(1) Remove the unit from the cabinet, observing the cautionary notice at the beginning of this chapter.

(2) Place it on a firm bench with the side carrying the sockets overhanging, so that the plates covering the socket connections underneath the unit are accessible.

(3) Remove the plates to expose the underside of the sockets and the crystal connections.

(4) Remove damaged socket and lift clear of the body casting, sufficient length of lead has been left in order that this may be done.

(5) Remove the adhesive tape securing the plastic sleeving to the socket pin.

(6) Unsolder and unwrap the wire connection from the pin with a pair of fine nose pliers (a short length of wire has been left unsoldered for this purpose).

(7) If it is necessary to remake the end of the connection the plastic sleeving over the wire must be burnt off with a soldering iron (on no account should any form of stripping tool be used). Sufficient length of wire has been left for this to be done.

(8) The end of the wire should be wrapped round the pin of the new socket, leaving approximately $\frac{1}{16}$ inch free, and soldered.

(9) Secure the plastic sleeving to the socket pin with about three turns of adhesive tape.

(10) Fit socket to body casting.

(11) Replace cover plates, taking care that the excess lead is located in the groove in the casting, where it may be held in position with adhesive tape.

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Chapter 4

COMPARATOR SIGNAL (COINCIDENCE) M3

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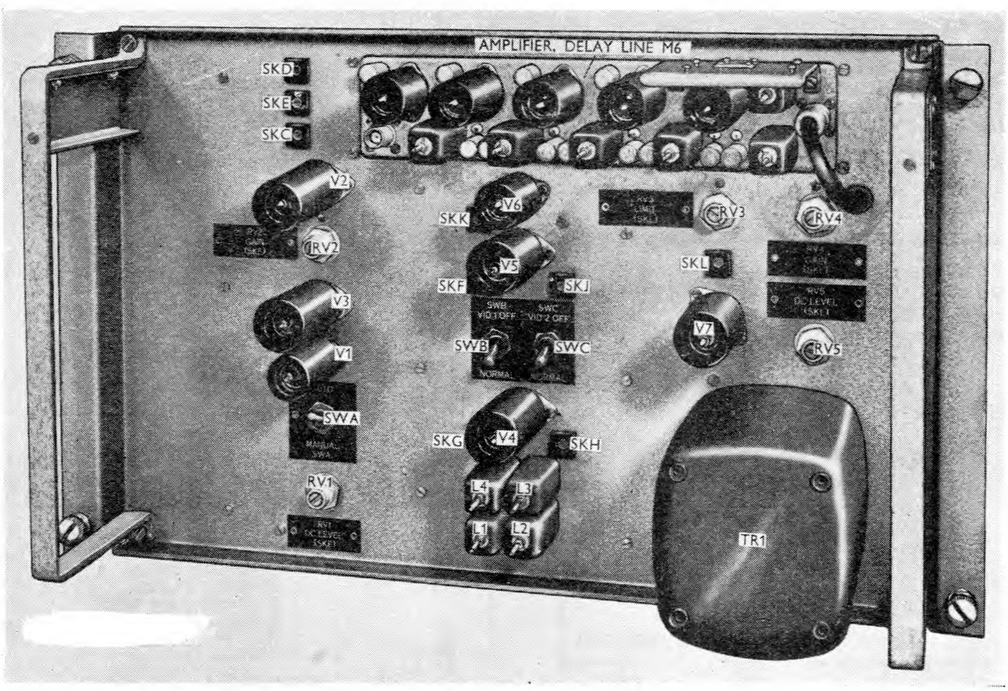


Fig. 1. Comparator signal (coincidence) M3 : front view

Introduction

1. The comparator signal (coincidence) M3 (*fig.* 1 *and* 4) forms part of the p.r.f.d. system and its purpose is to eliminate interference pulses which are not synchronous with the p.r.f. The unit is located in frame 2 of the video cabinet.

2. Two inputs are supplied to the unit, a positive-going video signal from the relay assembly M3 (*Chap.* 9) and an 8·19 Mc/s carrier (amplitude modulated with the same video signal, but delayed one pulse period) from the network, hybrid circuit M2 (*Sect.* 3, *Chap.* 3). This signal is delayed in a delay line (variable) M6 (*Chap.* 3) and amplified and detected by the amplifier, delay line M6 (*Sect.* 3, *Chap.* 7) before application to the signal comparator circuit. The delay line amplifier is a sub-assembly on the signal comparator chassis.

3. The signal comparator consists (*fig.* 2) of a d.c. amplifier followed by a coincidence detector, a noise attenuator and a video amplifier. The d.c. amplifier provides for d.c. level adjustment and gain control of the delayed input and additionally provides bias and a.g.c. for the delay line amplifier.

4. The delayed and undelayed signals are applied to the coincidence detector, synchronous pulses being passed and non-synchronous pulses being suppressed. After the coincidence detector, the resultant signals are passed to a video amplifier via a noise attenuator. The noise attenuator provides a 3dB attenuation, to offset the increase in noise caused at the coincidence detector by non-synchronous pulses. The video amplifier provides for a limited amount of d.c. level, gain and signal/noise adjustment.

5. The unit also provides delayed and undelayed video outputs to the controller (p.r.f.) M2 (*Chap.* 10) for p.r.f. control purposes and a link connection to pass the undelayed video to the driver, delay line M1 (*Sect.* 3, *Chap.* 2).

Performance characteristics

Inputs

6. The unit requires the following inputs :—

(1) 240V 50 c/s single-phase a.c. at PLB/7 and PLB/10.

(2) +250V ±5V at 50 mA at PLB/9.

(3) −250V ±5V at 25 mA at PLB/11.

(4) Positive-going video signals of 1·5V ±0·2V peak on a d.c. level of 0V ±0·2V at SKM.

(5) Carrier at 8·19 Mc/s ±100 kc/s modulated with video at a level of 500 microvolts ±100 microvolts into 75 ohms at SKP.

Outputs

7. The unit provides positive-going video signals of 1·5V ±0·2V peak at a d.c. level of 0V ±0·2V, in the conditions stated at the following points :—

(1) Coincidence-detected at SKR and SKQ (socket SKQ is not used).

(2) Delayed one pulse period (in relation to the input at SKM) at SKS.

(3) Delayed 2 microseconds (in relation to the input at SKM) at SKT.

(4) Undelayed (as the input at SKM) at SKN.

Circuit description (*fig.* 6)

Power supplies

8. The heater supply for the valves in the unit is obtained from transformer TR1, the primary of which is supplied with 240V a.c. mains via PLB/7, FS1 (1A) and PLB/10. The +250V and −250V supplies are applied to the unit via PLB/9 and PLB/11 respectively and are derived from the regulator, voltage (+250V) M2 mounted at the top of frame 2 in the video cabinet.

Delayed signal input

9. The delayed signal input is amplified in the delay line amplifier M6 before application to the signal comparator circuit to compensate for the attenuation suffered in passing through the delay line. The delay line amplifier provides a positive-going video output which is fed to the grid of V2b.

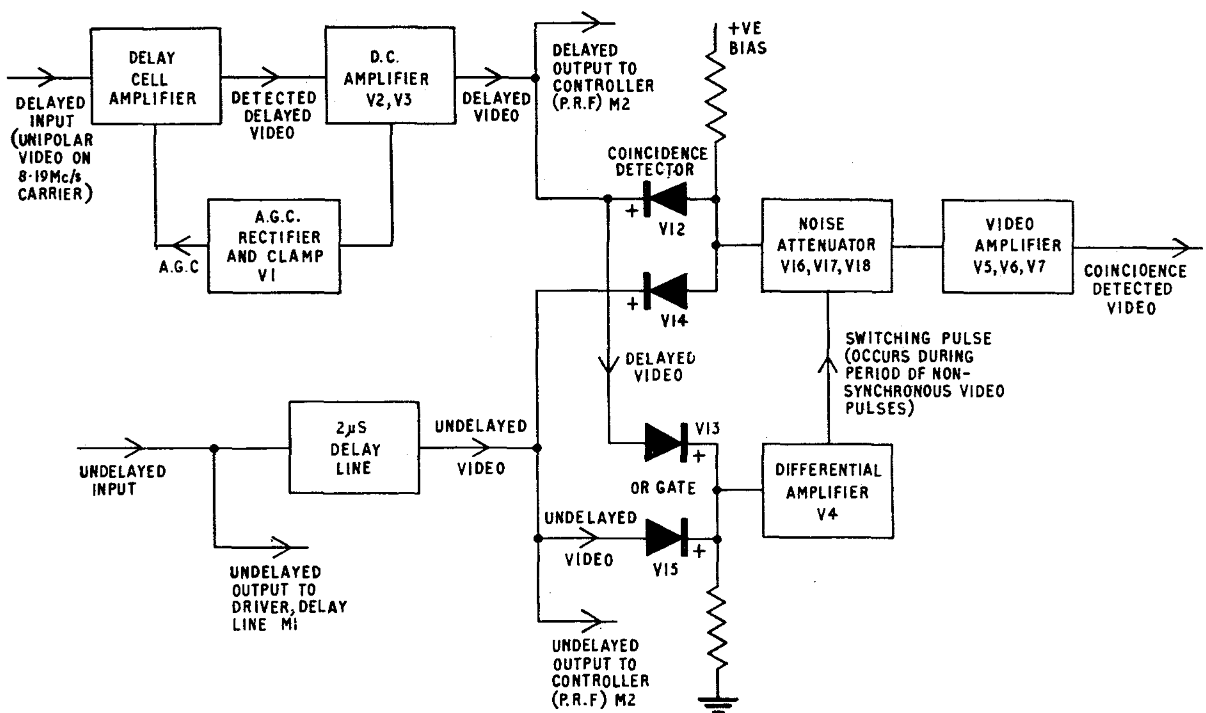


Fig. 2. Comparator signal (coincidence) M3 : block schematic

The valve V2 and its associated circuit form a long-tailed pair operating as a high stability d.c. amplifier and producing a positive-going output at the anode of V2a which is fed to the cathode follower V3. Gain control of the amplifier is effected by the application of negative feedback from V3 cathode to V2a grid via the GAIN (SKF) control RV2. The overall gain of the amplifier approximates to unity and RV2 is set to give a peak output of 1·5V measured at socket SKF. An output to provide a.g.c. for the delay line amplifier M6 is taken from the signal voltages developed across R22 in the anode of V3 (*para.* 13).

10. Two outputs are taken from V3 cathode, one connected to socket SKS for p.r.f. control purposes in the controller (p.r.f.) M2 and the other a.c.-coupled by C5 to one element (V12) of the coincidence detector. Due to the low impedance into which V3 feeds, it is necessary for C5 to be of a large value to prevent differentiation of the video pulses. To protect this capacitor from any reversal of polarity (due to a fault in the amplifier causing V3 cathode to go negative) the diode V8 is included in the circuit. This diode ensures that the positive electrode does not fall more than 0·7V below earth level. The diode V9 acts as a d.c. restorer.

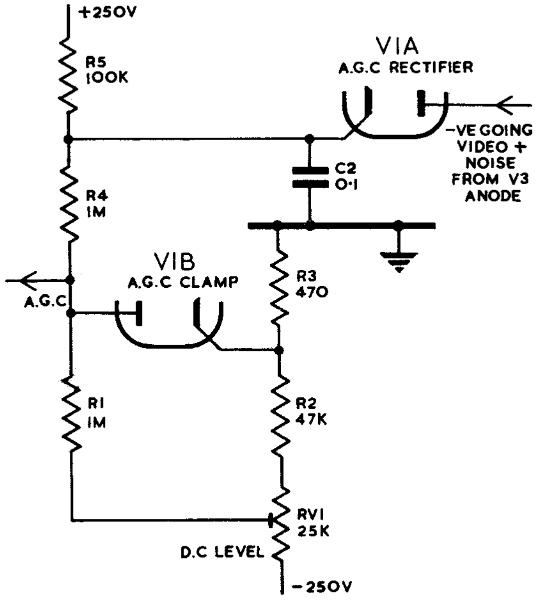
Undelayed signal input

11. The undelayed signal input is applied to the unit via socket SKM. A direct output is taken from this input via socket SKN to the driver, delay line M1.

12. In the signal comparator, the undelayed signals are delayed in a 2-microsecond delay line in order to compensate for the delay imposed on the delayed signal input by the delay line amplifier. This ensures that the two inputs to the coincidence detector are in the same time relationship. Two outputs are taken from the delay line, one to socket SKT for p.r.f. control purposes in the controller (p.r.f.) M2 and the other is a.c.-coupled to the second element, V14, of the coincidence detector via C6. This component together with diodes V10 and V11, performs the same function in this circuit as C5, V8 and V9 in the delayed signal circuit.

Automatic gain control

13. As mentioned in para. 9, the signal voltages developed across R22 in the anode of V3 are used for a.g.c. purposes in the delay line amplifier. The control is only intended to operate over the range of the noise level variation. With the MANUAL/AUTO switch SWA in the AUTO position the a.g.c. line to the amplifier is held at a level determined by the charge on C2. The a.g.c. rectifier V1a is normally conducting, its anode being held more positive than its cathode by the anode circuit of V3, but any change in noise level at the anode of V3 will vary the charge on C2 which in turn will vary the a.g.c. voltage. Video signals above noise level (which, coming from V3 anode, will be negative-going) will cut V1a off and no change will occur in the charge on C2. The a.g.c. clamp diode V1b prevents the a.g.c. line from rising above about −1·5V. The cathode is held at this voltage by the potentiometer chain RV1, R2 and R3. The D.C. LEVEL (SKF) control, RV1, is adjusted to give an 0V d.c. level at socket SKF. A simplified circuit of the a.g.c. system is given in fig. 3.



◀**Fig. 3. Comparator signal (coincidence) M3: automatic gain control**▶

14. With SWA in the MANUAL position, the a.g.c. circuit is switched out and the gain of the delay line amplifier is controlled directly by RV1, V1b still acting as a clamp.

Coincidence detector

15. The coincidence detector is an AND gate consisting of two elements, diodes V12 and V14, both of which are biased from the +250V line via R30. Under no signal conditions they are both conducting. If a pulse appears at either diode, that particular diode is cut off, but as the other is still conducting the pulse is not passed through. If, however, a pulse appears at each diode at the same time, both diodes will be cut off and their anodes will rise to the level of the smaller of the two pulses. Thus the detector will only pass pulses which are coincident in time. Random pulses will be eliminated.

16. One section of each of the switches SWB and SWC (VID. OFF/NORMAL and VID.2 OFF/NORMAL) is used to break the signal input to each element of the coincidence detector in the event of the failure of one input or for setting-up purposes. This allows all pulses on the other element to pass, as the circuit is no longer a coincidence detector. The other sections of SWB and SWC are used in the noise attenuator circuit (*para.* 23).

Video amplifier and noise attenuator

17. These stages operate in a similar manner to the amplifier and noise attenuator circuits in the amplifier (video rectifier) M3 (*Chap.* 2). The valve V5 and its associated circuit form a long-tailed pair whose output is limited by V6 to the level determined by the LIMIT (SKL) control RV3.

The output cathode follower V7 provides negative feedback from its cathode to the grid of V5b via the GAIN (SKL) control RV4. The d.c. level of the output signal is set by the D.C. LEVEL (SKL) control RV5.

18. The amplifier controls are used to give the following conditions: RV3 to give a peak signal output of 1·5V (on a d.c. level of 0V ±0·1V set by RV5) and RV4 to give a noise level of 0·3V measured at socket SKR.

19. The noise attenuator circuit consists of an OR gate, V13 and V15, a subtractor stage V4 and the attenuating diodes V16, V17 and V18. A jamming (non-synchronous) pulse on either element of the coincidence detector allows the noise on the other element to pass at full strength. The jamming pulse is therefore visible on the output as a 3dB increase in noise. To counteract this, the delayed and the undelayed signals are applied, via the OR gate, to the grid of V4a and the output of the coincidence detector to the grid of V4b. The jamming pulse is passed by the OR gate only, so the subtractor circuit receives only one input. This produces a negative-going pulse at the anode of V4a which is a.c.-coupled to the junction of V16 and V17.

20. Under quiescent conditions, the three diodes are cut off by the bias on V16 cathode. This bias is derived from the +250V line via R39 and R40. The negative pulse from V4a anode will cause both V17 and V18 to conduct and the noise level at the coincidence detector will be attenuated by R41, R42 and V18 resulting in the noise being restored to its normal level.

21. At the termination of the non-synchronous pulse, V17 and V18 are cut off and the positive charge which has built up on C7 by the conducting of V17 and V18 leaks away through V16. Resistors R64 and R65 ensure that the noise attenuator circuit operates only in the presence of impulsive jamming.

22. Target pulses, which are coincident, are applied to both grids of V4 and as they are of similar amplitude the output of V4a is near zero and the noise attenuator is not operated.

23. The sections of SWB and SWC connected across V18 short this diode out when only one video input is applied to the coincidence detector. Under these circumstances, the short-out of V18 maintains the signal-to-noise ratio and obviates any need for adjustment of the limit control RV3 in the video amplifier.

Monitoring facilities

24. Using the monitoring oscilloscope M1 (*Sect.* 7, *Chap.* 4) the waveforms and d.c. levels at the monitor points in the circuit are as shown in fig. 5.

Test readings

25. With the multimeter connected via the adapter (plug to socket) to socket SKA, the meter readings should be as indicated in Table 1.

TABLE 1

Multimeter readings

Multimeter switch position	Measured across	Reading	Tolerance
A	R14	0·5	±0·10
B	R15	0·4	±0·08
C	R23	0·5	±0·10
D	R35	0·6	±0·12
E	R46	0·5	±0·10
F	R47	0·5	±0·10
G	R56	0·4	±0·08

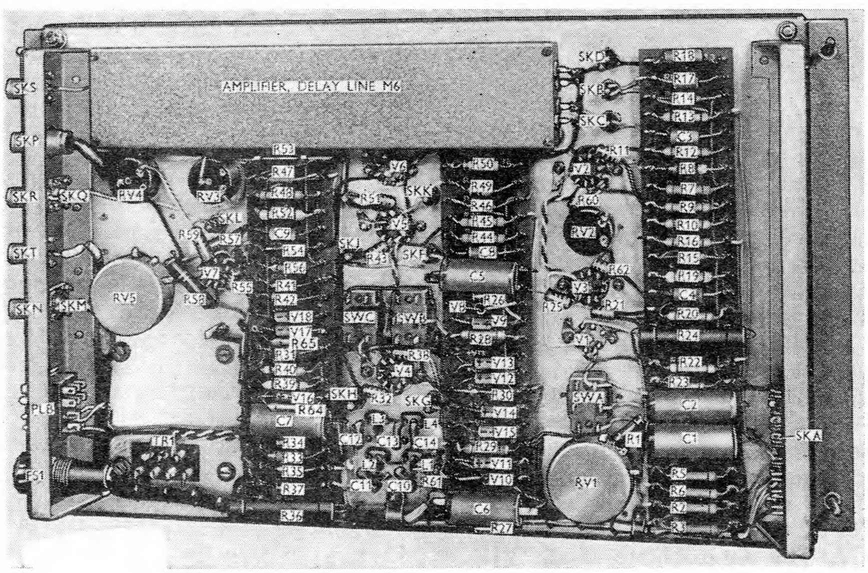


Fig. 4. Comparator signal (coincidence) M3: rear view

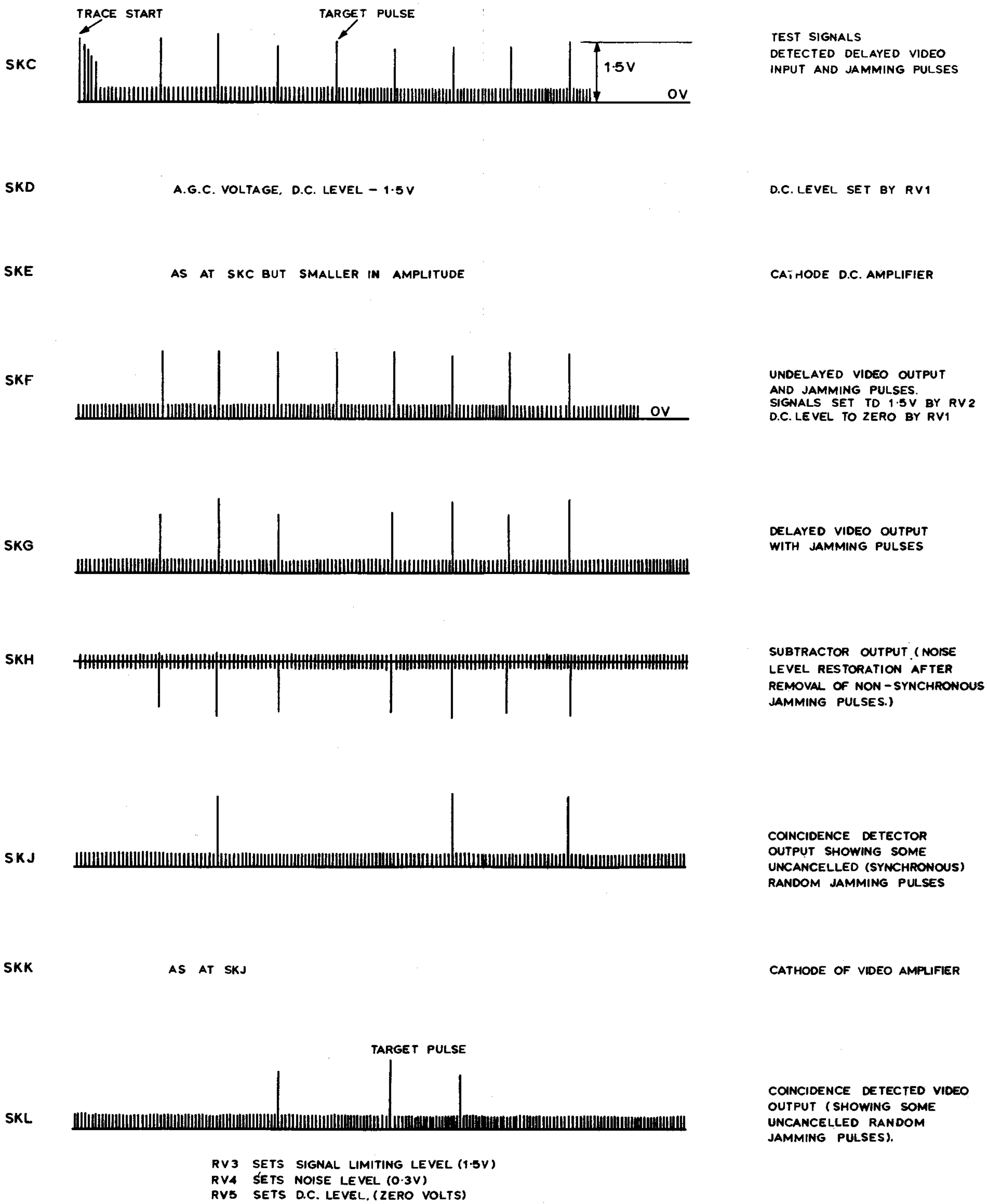


Fig. 5 Comparator signal (coincidence) M3: monitor point waveforms

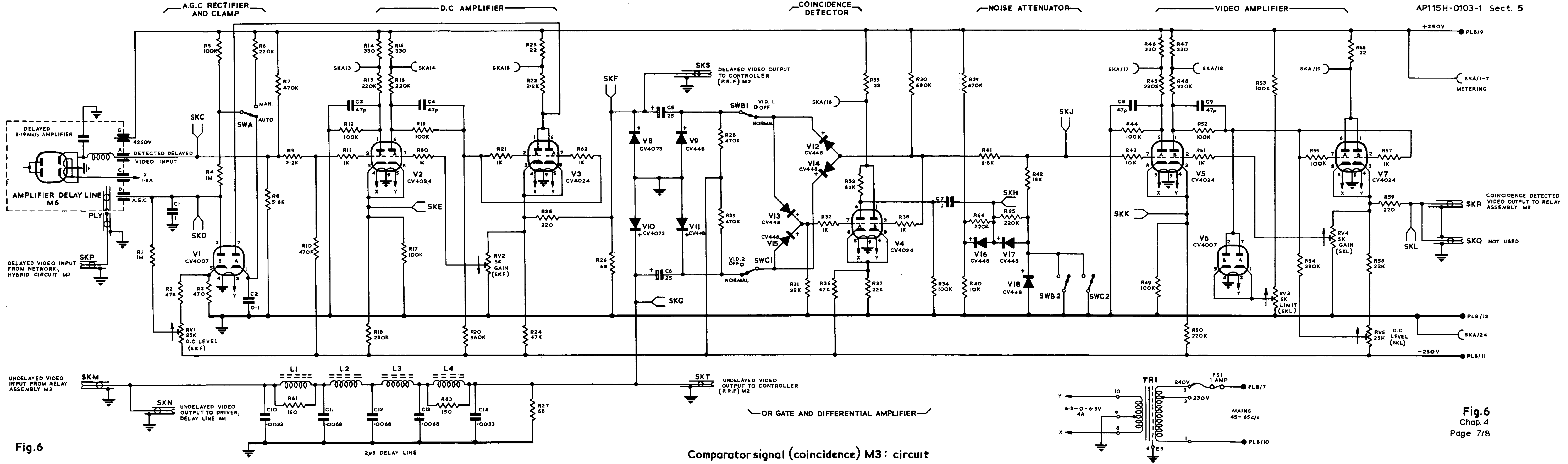


Fig.6

Comparator signal (coincidence) M3: circuit

Chapter 5

SWITCH, ELECTRONIC (VIDEO) M3

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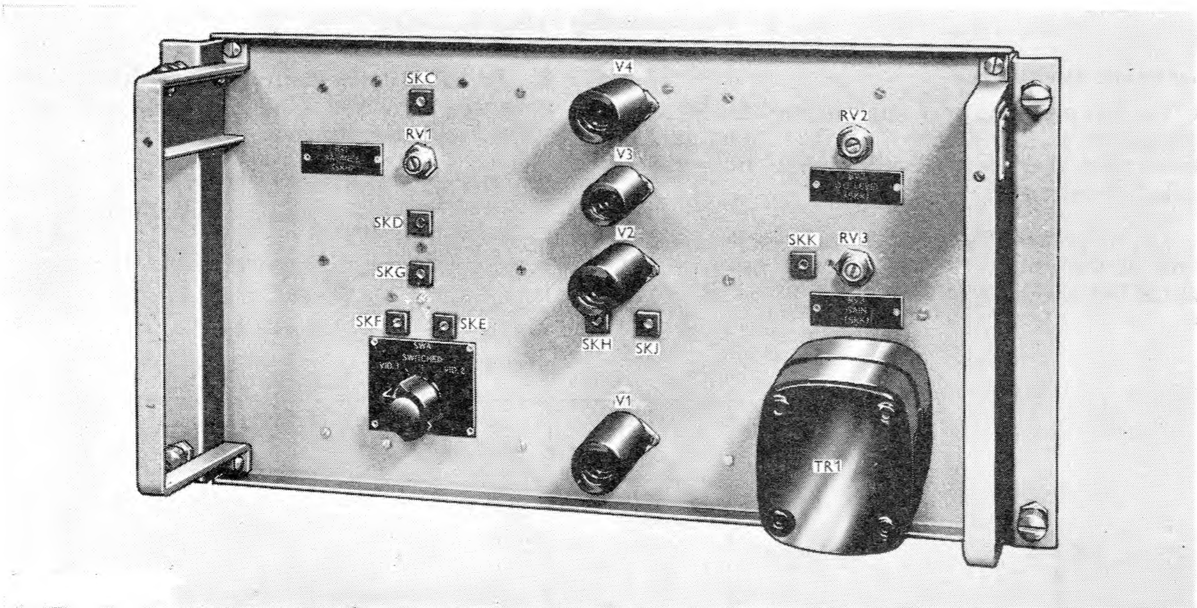


Fig. 1. Switch, electronic (video) M3 : front view

Introduction

1. There are three video switches of this type (*fig.* 1) in the signal processing system. All are located in the video cabinet. Identification of the switches is by numbers, video switch 1 is in frame 1, and the upper and lower units in frame 3 are identified as video switches 2 and 3 respectively.

2. Each switch, depending upon the setting of SWA, provides automatic or manual selection of two video inputs. For automatic selection, SWA is set to SWITCHED and depending upon the presence or absence of a third input, a rectangular switching waveform, one of the two video inputs will be selected. In the SWITCHED condition the video input at SKN is selected, and during the switching pulse on time the input at SKL is selected.

3. For manual operation the required video input is selected out by setting SWA to VID. 1, or VID. 2. In the VID. 1 position SKN video is selected out, and in the VID. 2 position SKL video is selected out. During normal operation SWA is left set to SWITCHED.

4. Video switches 1 and 2 (*fig.* 2) receive their switching waveforms from the area switching panel (*Sect.* 4, *Chap.* 7), which forms part of the doppler compensation system (*Sect.* 1, *Chap.* 5). Both switches have the same video inputs. Video switch 1 operates when the rectangle and centre circle are being displayed, video switch 2 operates when the centre circle only is displayed.

5. The switching waveform to video switch 3 comes from the pulse generator (switching) (*Sect.* 4, *Chap.* 6) in the video cabinet. The two video inputs are derived from the i.f. signal channels, one coming from the log + PLD, the other from the linear channel.

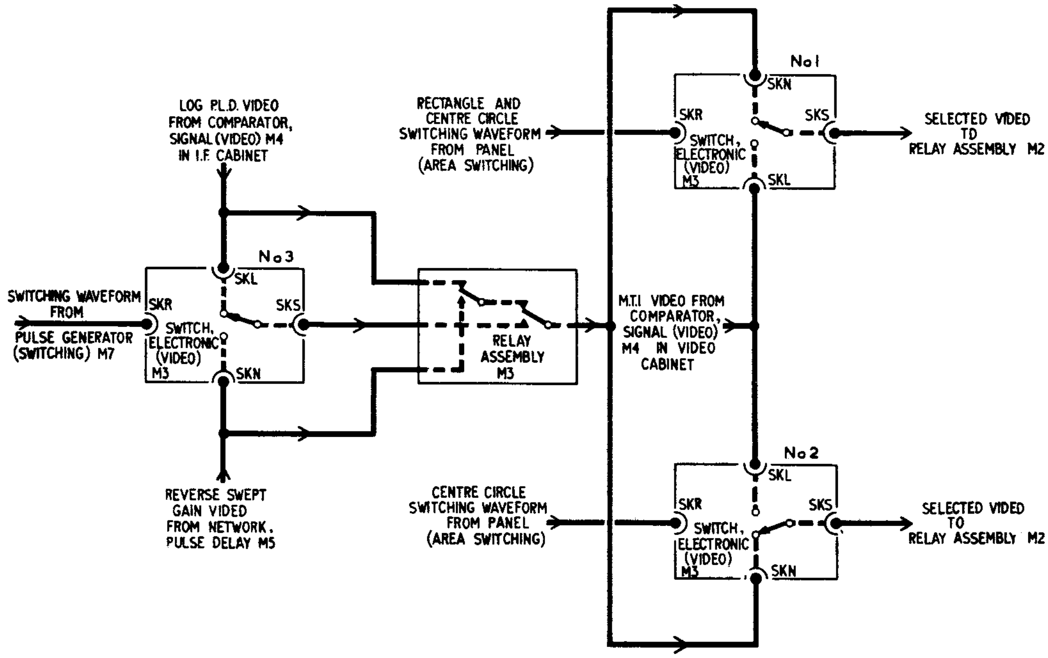


Fig. 2. Video switching : block schematic

Brief circuit description

6. The unit performs two complementary functions simultaneously. It selects the video input, and ensures that there is no breakthrough from the unselected output.

7. The simplified diagram of fig. 3 shows the basic stages in the unit. The bias circuits have been omitted but are dealt with later.

8. In fig. 3 it has been assumed that a positive switching waveform is applied to SKR and that two video inputs are present.

9. The 20V switching waveform overcomes the negative bias on the wiper arm of SWA and is applied to one side of the limiter circuit and to the inversion stage V1. The inverted waveform from V1 is then applied to the other side of the limiter circuit.

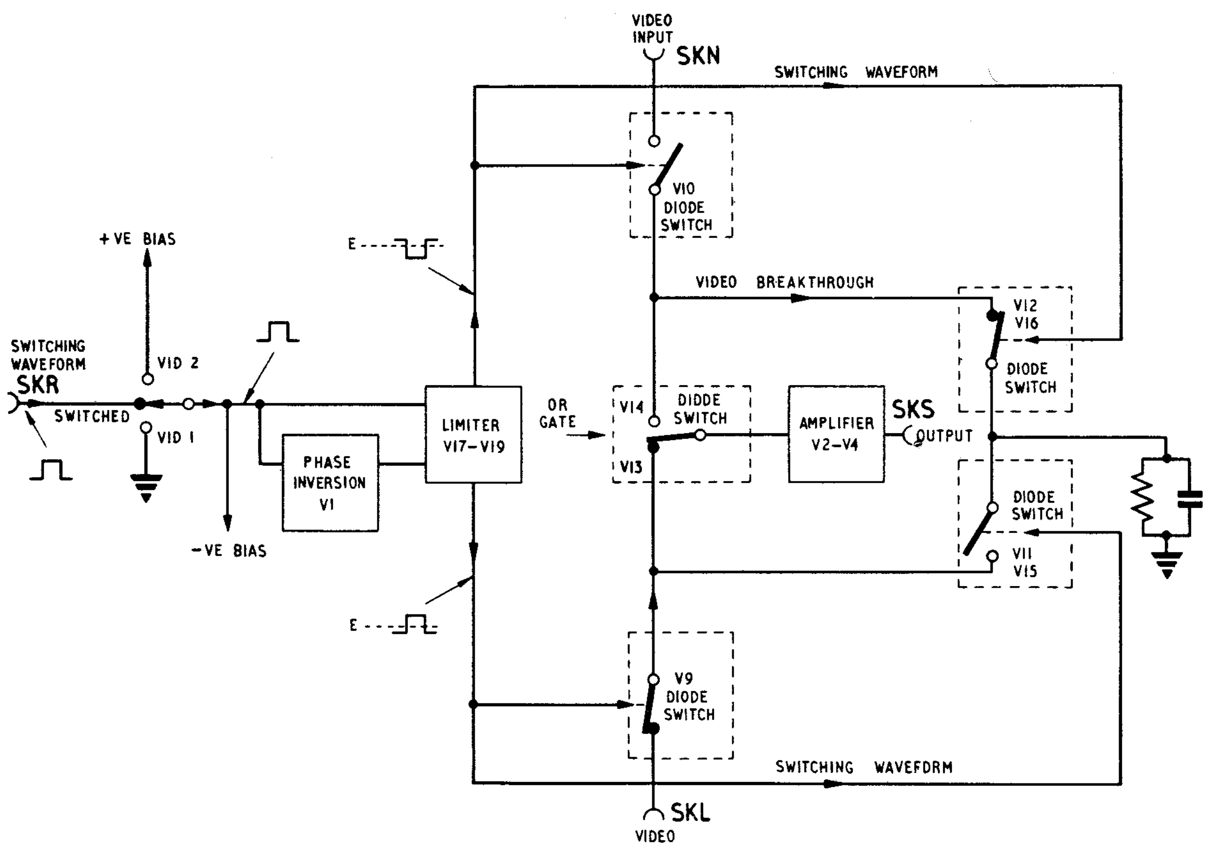


Fig. 3. Switch, electronic (video) M3 : block diagram

10. Limiter diodes V17, 18 and 19 are common connected at their anodes and a bias is applied so that any diode will conduct if the cathode potential exceeds 1 volt.

11. The switching and inverted waveforms are then fed to the two video switch stages. The positive-going switching waveform biases V11 off, causing V9 to conduct, and so allows the video pulse at SKL to be fed through to V13. V13 and V14 form an ' OR ' gate, the video signal passed by V13 biasing V14 off, prohibiting the passage of any video breakthrough from SKN. The video input at SKN is stopped by V10 which is cut off due to V12 conducting. V12 is biased on due to the inverted switching waveform at its cathode, and terminates any transients passed by V10 to earth via the diode V16, which is conducting, and the parallel combination of R13 and C6. The video input at SKL is passed out to the amplifying stage V2.

12. At the end of the switching pulse, the switching waveforms at the junctions of V11 and V12 change polarity and cause V11 to conduct and V9 to cut off. V12 is cut off, V10 and V15 conduct. The video input at SKN is passed by V14 and causes V13 to cut off and the video signal is passed out to the grid of V2.

13. The amplifying stages of V2 are connected as a long-tailed pair and fed to a parallel-connected cathode follower stage V4. Negative feedback is provided from the output to the grid of V2; it is developed across the GAIN potentiometer RV3 and sets the level of amplification.

Performance characteristics

14. The input switching pulse at SKR has a duration according to the application of the switch unit; those for video switches 1 and 2 being of variable duration corresponding to the combination of centre circle and/or rectangle pulses with clutter waveforms. For video switch 3, the waveform has a duration corresponding to the range at which reverse swept gain video is required to be displayed. In all applications, the amplitude of the positive-going switching waveform is 20V ±2V.

15. The video output levels should be not less than 1·5V into an impedance of 75 ohms.

16. The video inputs at SKL and SKN have an amplitude of approximately 1·5V peak with a noise level not greater than 0·3V peak.

Circuit description

17. Heater voltages to the valves are supplied by transformer TR1 (*fig.* 9), the 240V a.c. primary supply for the transformer being received at PLB/7 and PLB/10. The primary supply is controlled by the main system switch which controls the mains supply to all units of the complete system. The −250V supply from the power cabinet is present across PLB/11 (−250V) and PLB/12 (earth). The +250V supply from the +250V voltage regulator in the video cabinet is present across PLB/9 (+250V) and PLB/12 (earth).

Switching waveform circuit

18. The switching arrangements on the unit are controlled by switch SWA which has three positions, designated VID. 1, SWITCHED and VID. 2 (*fig.* 4). In the VID. 1 position of the switch the junction of R15 with R17 is connected to earth. In this condition the cathode of V11 and the grid of V1a are at a negative potential with respect to earth, and the video input at SKN and SKP is passed for amplification.

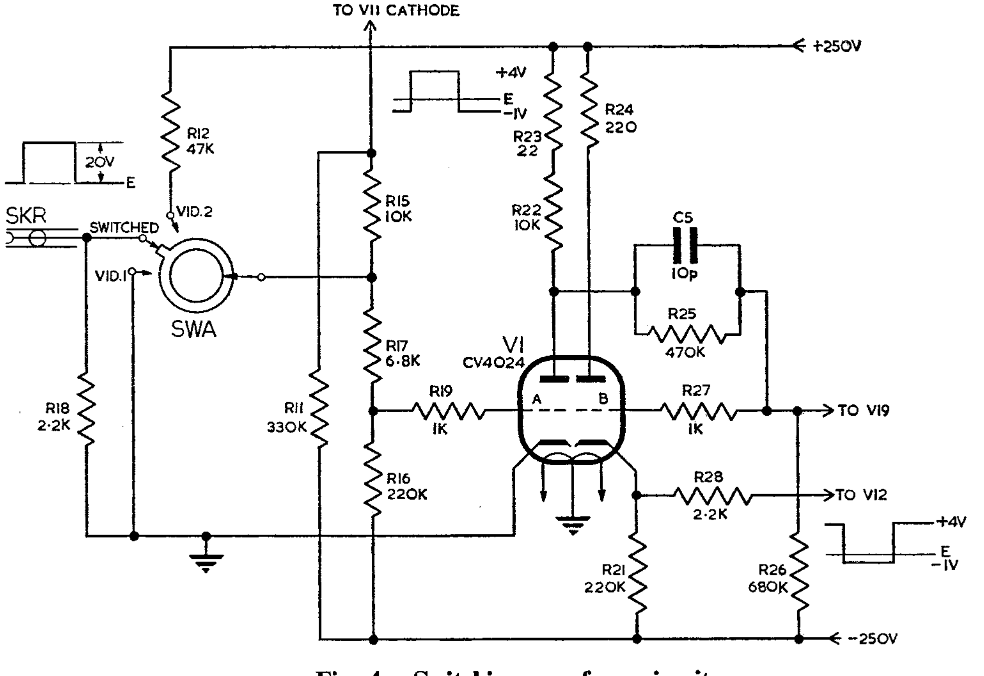


Fig. 4. Switching waveform circuit

19. In the VID. 2 position of SWA, the junction of R15 with R17 is connected to +250V via resistor R12 so that the cathode of V11 and the grid of V1a are positive with respect to earth, the potentials being determined by the potential divider network R12, R17, R16 across +250V and −250V supplies. The video input at SKL and SKM is passed for amplification in this condition.

20. The switching waveform at socket SKR is applied to the cathode of V11 and the grid of V1a via R15 and R17 respectively in the SWITCHED position of SWA. The two halves of V1 are so connected that the output at the cathode of V1b is anti-phase to the input at the grid of V1a, the grid excursion of V1b being limited to +4·0V with respect to earth by the limiting diode V19 in conjunction with the potential divider network R29, R30. C5 is included to steepen the edges of the switching waveform. The output at the cathode of V1b is connected to the cathode of V12 via resistor R28 and the limiting circuits, so that for any conditions at the grid of V1a voltages of opposite polarities are applied to the cathodes of V11 and V12 in the video switching circuits.

Limiting circuit

21. The limiting circuits consist of the diodes V15–V19 with their associated components as shown in fig. 5.

22. The common point of the negative limiting diodes V15 and V16 is connected to the junction of R13 and R14, connected across the −250V supply, so that this point is at a potential of approximately −1·0V with respect to earth. Capacitor C6 is connected across R13 to provide an earth path for the unwanted video signals. Similarly the common point of the positive-limiting diodes V17–V19 is connected to the junction R29–R30, connected across the +250V supply, the potential of this point being approximately +4·0V with respect to earth. The cathodes of V11 and V12 are thus limited in potential in both positive and negative directions.

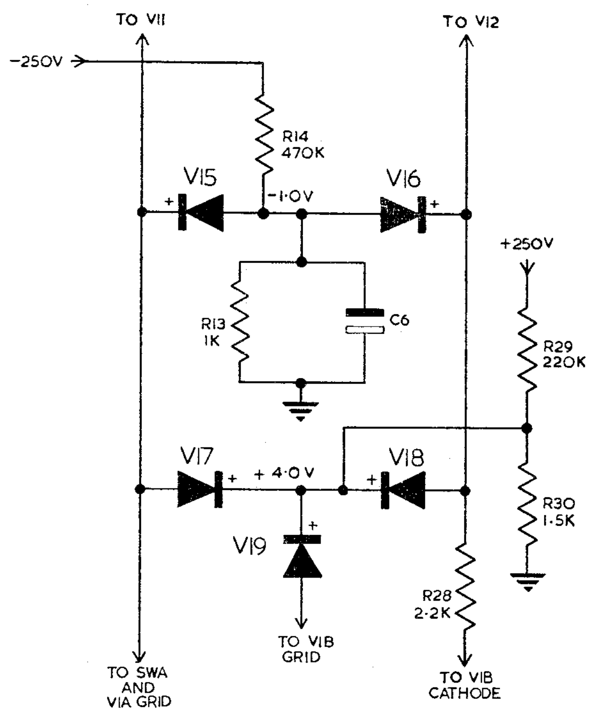


Fig. 5. Limiting circuit

Video switching circuit

23. Two separate positive-going video inputs, with a d.c. level of 0V, are brought in at SKL and SKN as shown in fig. 6. The input at SKL is coupled

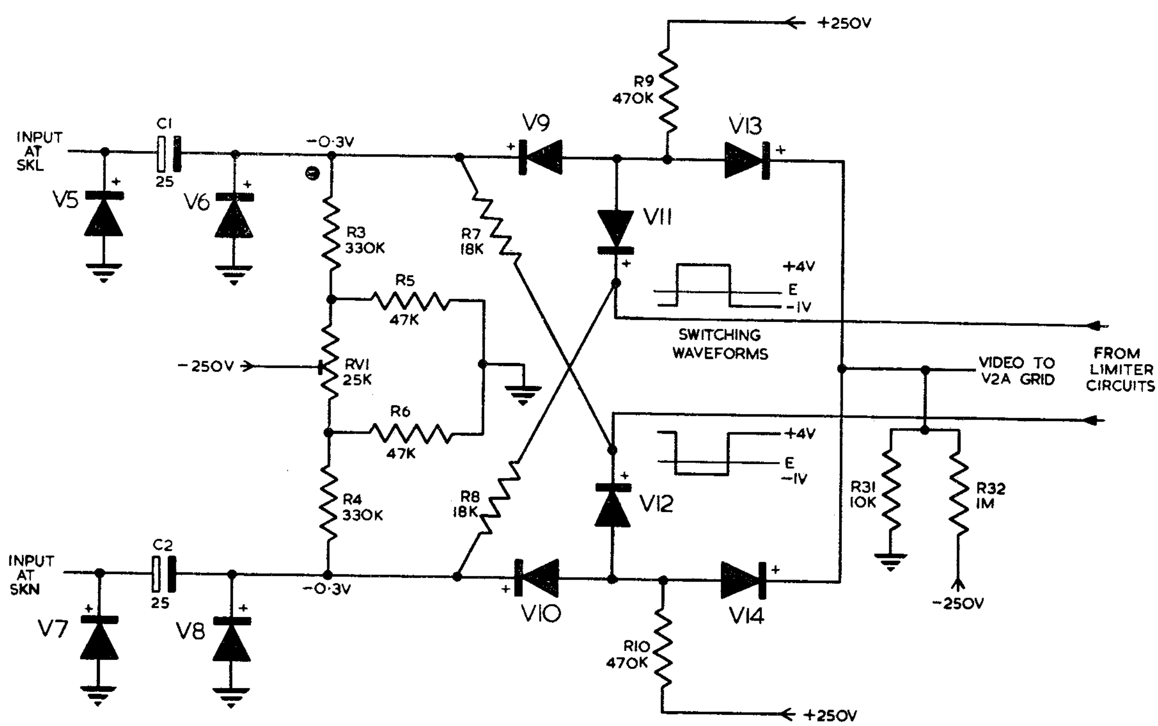


Fig. 6. Video switching circuit

to the switching circuit proper via the d.c. blocking capacitor C1 and d.c. restored by V6. The diode V5 provides protection for the electrolytic capacitor C1 against failure of the cathode follower stage in the preceding unit, since, in the event of failure, the input d.c. level would fall towards —250V. As the junction of C1 and V6 is at a potential of approximately —0·3V with respect to earth, a large negative input at SKL would cause a reverse potential in excess of the rated voltage to be applied across the capacitor. V5 conducts if the input d.c. level exceeds a value of 0·75V negative with respect to earth. The cathode of V9 is held at approximately —0·3V with respect to earth by V6. With a positive switching waveform input at SKR, V11 is cut off by the positive waveform at its cathode and the input video at SKL is passed via V9 and V13 to the grid of V2A. The same positive waveform is also applied to the cathode of V10 via R8 so that V10 is cut off. Diode V9 is conducting due to the standing current from the +250V supply via R9, R3 and part of RV1. The video applied to the anode of V13 is positive-going and therefore the signal at the junction of V13 and V14 causes V14 to be cut off, the two diodes operating as an 'OR' gate. Thus, with a positive switching waveform at SKR, or with SWA operated to the VID. 2 position, diodes V9 and V13 conduct in the path from SKL to V2a whereas V10 and V14 are cut off in the path SKN to V2A, any residual video at the anode of V10 being conducted to earth via conducting diode V12 ; V11 is cut off.

24. With no input at SKR or with SWA operated to VID. 1 a negative voltage is applied to the cathode of V11 and V15 and a positive voltage to the cathode of V9 via R7. V9 is therefore cut off. V10 conducts because the positive potential no longer exists at its cathode. With V11 and V15 conducting, the anode of V9 may be considered as being connected to earth via C6 (*fig.* 5) so that any residual video from the input at SKL is by-passed to earth. V13, in the 'OR' gate, is cut off since under these circumstances the video input from SKN appears at the junction of V13 and V14. Thus, under the circumstances stated at the beginning of this paragraph, the video input at SKL is disconnected from the grid of V2A.

25. Considering the video input at SKN, it will be seen that the circuit is identical to that described above, the switching diodes in this case being V10, V12 and V14. However, the waveform or voltage applied to the cathode of V12 is opposite in phase or sign to that applied to V11 (*para.* 20) and therefore, although the circuit operates in the same manner as that described above, a positive waveform input at SKR or the operation of SWA to VID. 2, connects the video input at SKL to V2A, whereas the input at SKN is inhibited in the switching circuit V10, V12 and V14. Conversely, with no input at SKR or with SWA operated to VID. 1, the input at SKN is connected to V2A whereas the input at SKL is inhibited.

26. An adjustable control, RV1, designated BALANCE (SKH) is provided to ensure that the lower edges of the waveform from both inputs are at the same level above earth as monitored at test socket SKH.

Amplifier and output stages

27. The switched video signals are amplified by the double-triode valve V2 connected as a long-tailed pair with common cathode loads R34 and R35. The grid of V2A is returned to the junction of resistors R31 and R32 to give a grid potential of approximately 2·5V negative with respect to earth, and the cathodes of both halves of the valve are returned to a potential of approximately 80V negative with respect to earth as the cathode load

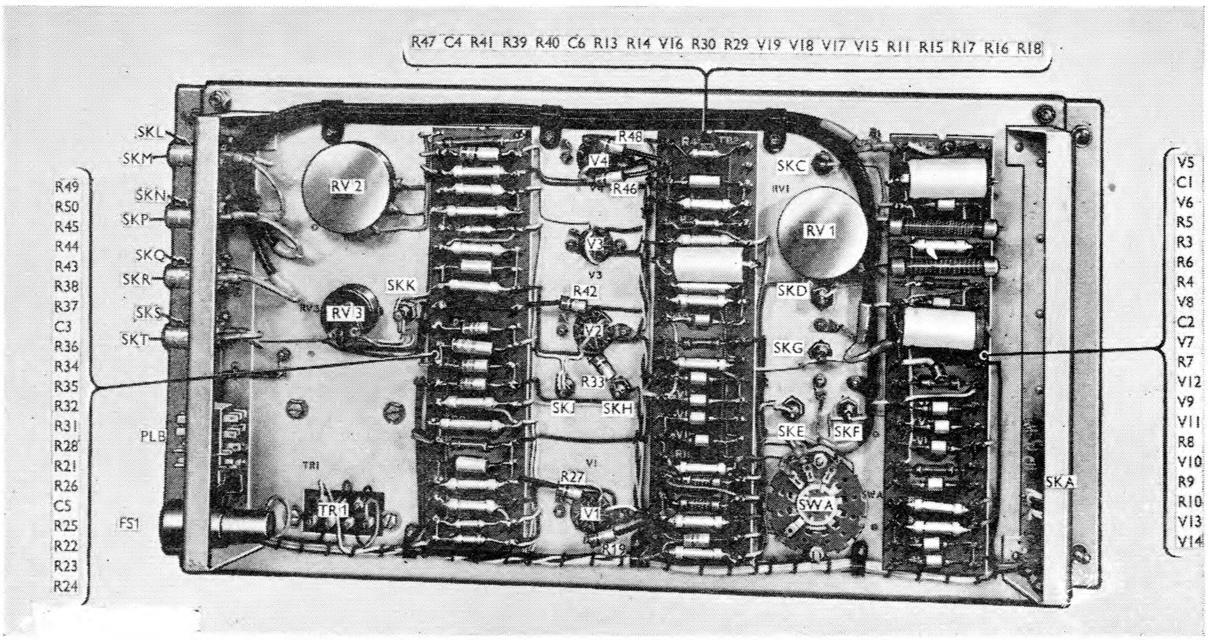


Fig. 7. Switch, electronic (video) : rear view

resistors R34 and R35 are series-connected across the —250V supply. Resistors R36, R41 and capacitors C3, C4 are associated with the anode circuits of V1A and V1B to assist in providing the correct balance between the two halves of the valve. The signal-to-noise ratio at the output of the unit is adjusted by the GAIN (SKK) potentiometer RV3 which controls the amount of feedback from the cathode of V4 to the grid of V2B, and thus sets the degree of automatic gain control for the amplifier as a whole.

28. The output from the anode of V2B is first limited to a level of approximately +6·5V with respect to earth by the double-diode V3, the two halves of which are connected in parallel, and then applied to the output cathode follower stage V4. The two halves of double-triode V4 are connected in parallel with the grids returned to the slider of potentiometer RV2 D.C. LEVEL (SKK) in a resistor chain across the —250V supply. This potentiometer is adjusted so that the bottom peaks of the signal, as monitored at test socket SKK, are at earth potential.

29. The video signal is taken from the unit at socket SKS and developed across the 75-ohm termination in the following unit, resistor R50 being connected in the cathode circuit to improve the efficiency of the cathode follower stage.

Test readings

30. Test socket SKA (poles 1–5 and 13–17) is provided in order to check individual valve performances. These checks should be carried out by connecting multimeter Type 100 to SKA via the electrical plug-to-socket adaptor with SWA in the SWITCHED position, RV3 set at maximum gain, RV2 set for zero volts at SKT with no video inputs, and with an input switching pulse of duration 150μS and amplitude 20V. Under these circumstances readings should be obtained as indicated in Table 1.

Monitor points

31. Test sockets, SKC to SKK, are provided for monitoring purposes. The waveforms existing at these points are illustrated in fig. 8.

TABLE 1

Multimeter readings

Multimeter switch position	Valve monitored	Measured across resistor	Reading	Tolerance	
A	V1A	R23	0·5	±0·1	20 per cent
B	V1B	R24	0·7	±0·14	
C	V2A	R38	0·5	±0·1	
D	V2B	R39	0·5	±0·1	
E	V4	R47	0·4	±0·08	

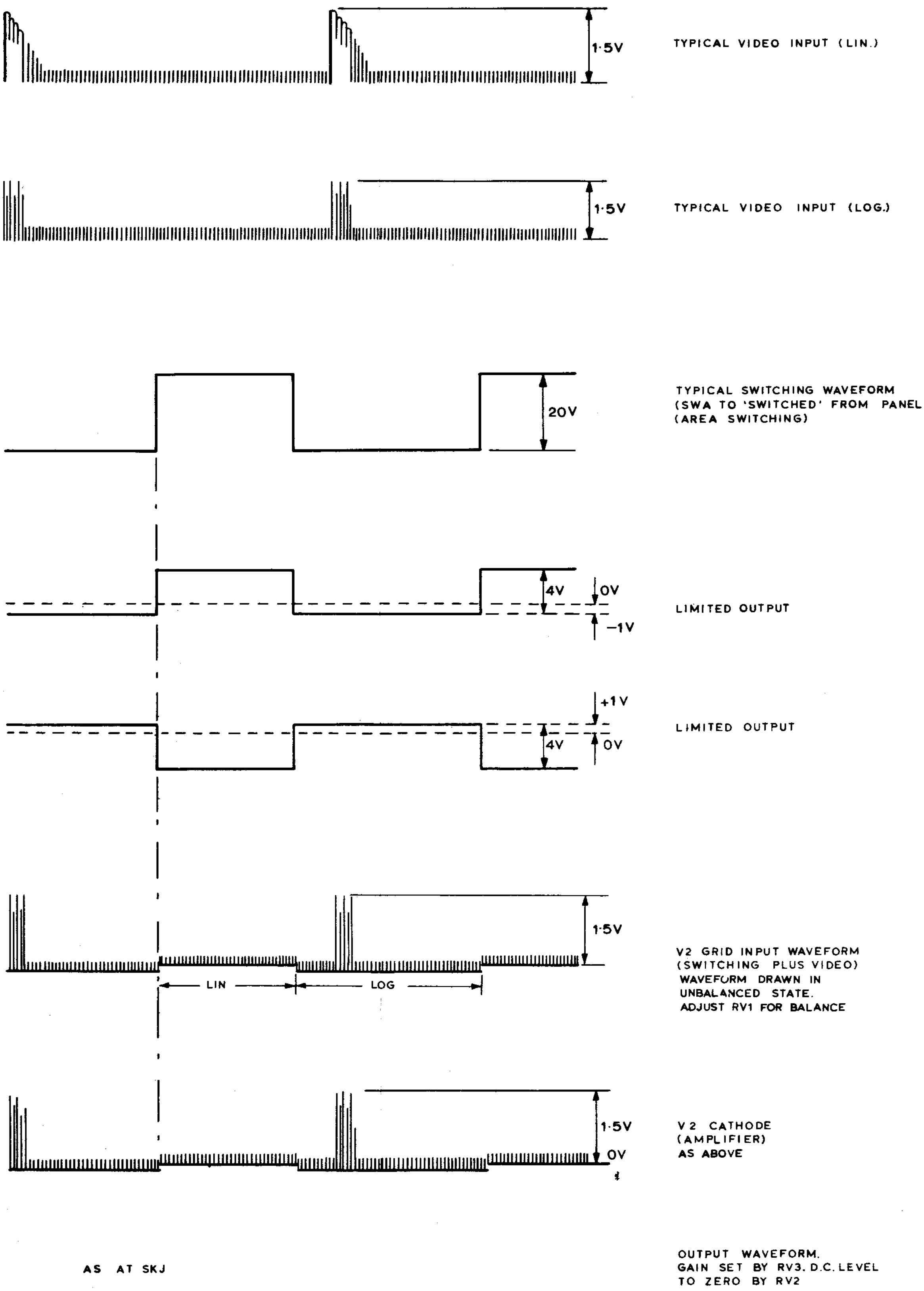
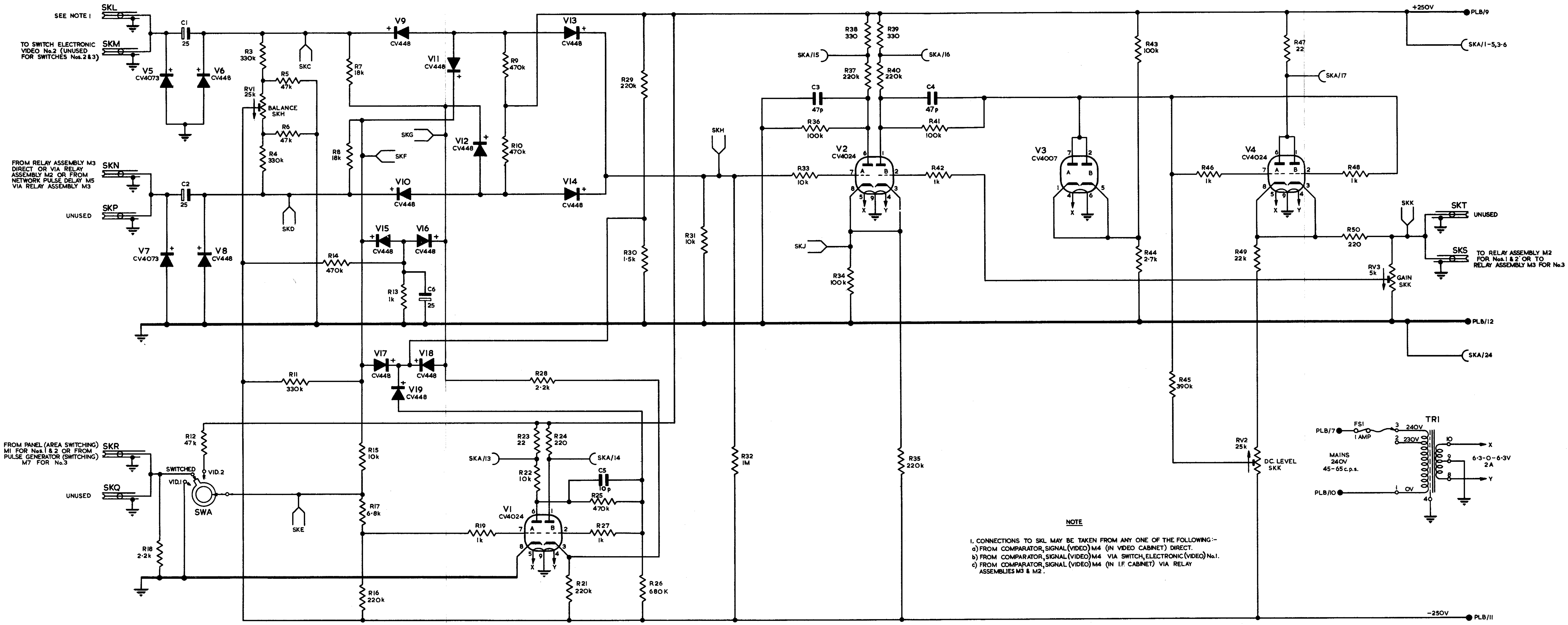


Fig. 8 Waveforms at monitoring points;



NOTE

1. CONNECTIONS TO SKL MAY BE TAKEN FROM ANY ONE OF THE FOLLOWING:-
a) FROM COMPARATOR, SIGNAL (VIDEO) M4 (IN VIDEO CABINET) DIRECT.
b) FROM COMPARATOR, SIGNAL (VIDEO) M4 VIA SWITCH, ELECTRONIC (VIDEO) No.1.
c) FROM COMPARATOR, SIGNAL (VIDEO) M4 (IN I.F. CABINET) VIA RELAY ASSEMBLIES M3 & M2.

Fig. 9 Switch electronic (video) M3 : circuit Fig. 9

Chapter 6

RELAY ASSEMBLY M2

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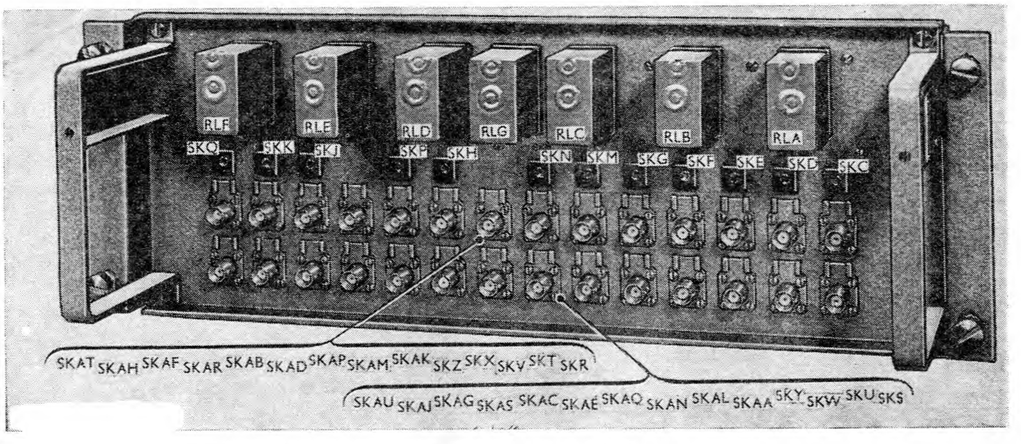

Fig. 1. Relay assembly M2: front view

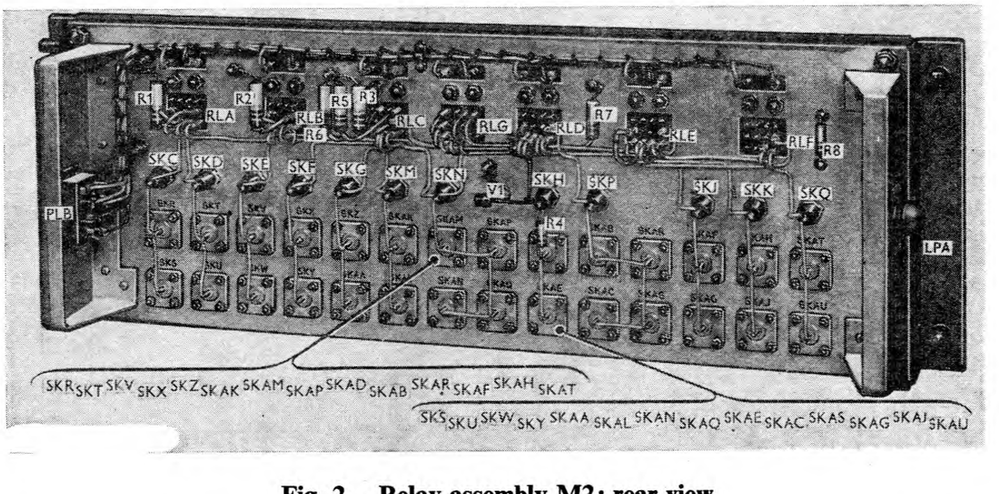

Fig. 2. Relay assembly M2: rear view

Introduction

1. The relay assembly M2 is used in conjunction with relay assembly M3 (*Chap.* 9) to select the type of video signal applied to display consoles 1 and 2 and to channel 1. The assembly is mounted in frame 2 of the video cabinet.

2. Eight video inputs are provided from which the required outputs are selected by groups of relays controlled from the CHANNEL SELECTOR and MONITOR SELECTOR switches on the display console. A direct through connection is also provided from one video input to an output for channel 2.◀The operator at console 2 may isolate the p.r.f. discrimination unit from the user's display, present channel 1 outputs on console 2 and monitor such outputs irrespective of channel 1 selections and without loss of other facilities. An indicator, LPA, on relay assembly M2 is illuminated when the p.r.f. discrimination override is selected.▶

Performance characteristics

Inputs

3. The relay assembly receives the following eight inputs, the input numbers here correspond with those shown in brackets in fig. 3 and 4.

(1) SKR receives a video input from video switch 1 (*Chap.* 5). This input consists of a combination of Doppler-compensated triple pulse cancelled video from the video signal comparator M4 in the video cabinet and of the output from relay assembly M3 as selected by video switch 1 for centre circle and rectangle areas.

(2) SKU receives a video input determined by relay assembly M3.

(3) SKV receives a video input from video switch 2. The inputs to the video switch 2 are the same as that described in (1) above but in this case the output to SKV is selected for the centre circle area only.

(4) SKX receives a video input of p.r.f. discriminated video from signal comparator (coincident) M3 in the video cabinet.

(5) SKZ receives a video input of linear video from pulse delay network in the i.f. cabinet. This video originates in the anti-jamming receiver.

(6) SKAB receives a video input of log + PLD video from signal comparator (video) M4 in the i.f. cabinet. This input is received via a through-connection in relay assembly M3.

(7) SKAD receives a video input of linear video, the characteristic of which is modified by a reverse swept gain waveform, from pulse delay network M5 in the video cabinet. This input is received via a through-connection in relay assembly M3.

(8) SKAF receives a video input of Doppler-compensated triple pulse cancellation video from pulse delay network M4. This input is received via a through-connection in signal comparator (video) M4 in the video cabinet.

(9) A separate pair of input sockets, SKAH and SKAJ, are unused.

Outputs

4. The outputs taken from the relay assembly are as follows, they depend upon the setting of the CHANNEL and MONITOR selector switches.

(1) CHANNEL SELECTOR switch in position 1. Input (1) is connected via SKAK to delay line driver M1 in the p.r.f. discrimination circuits and input (4) via sockets SKAM and SKAP to channel 1 and console 1 respectively; the latter input consists of input (1) after p.r.f. discrimination.

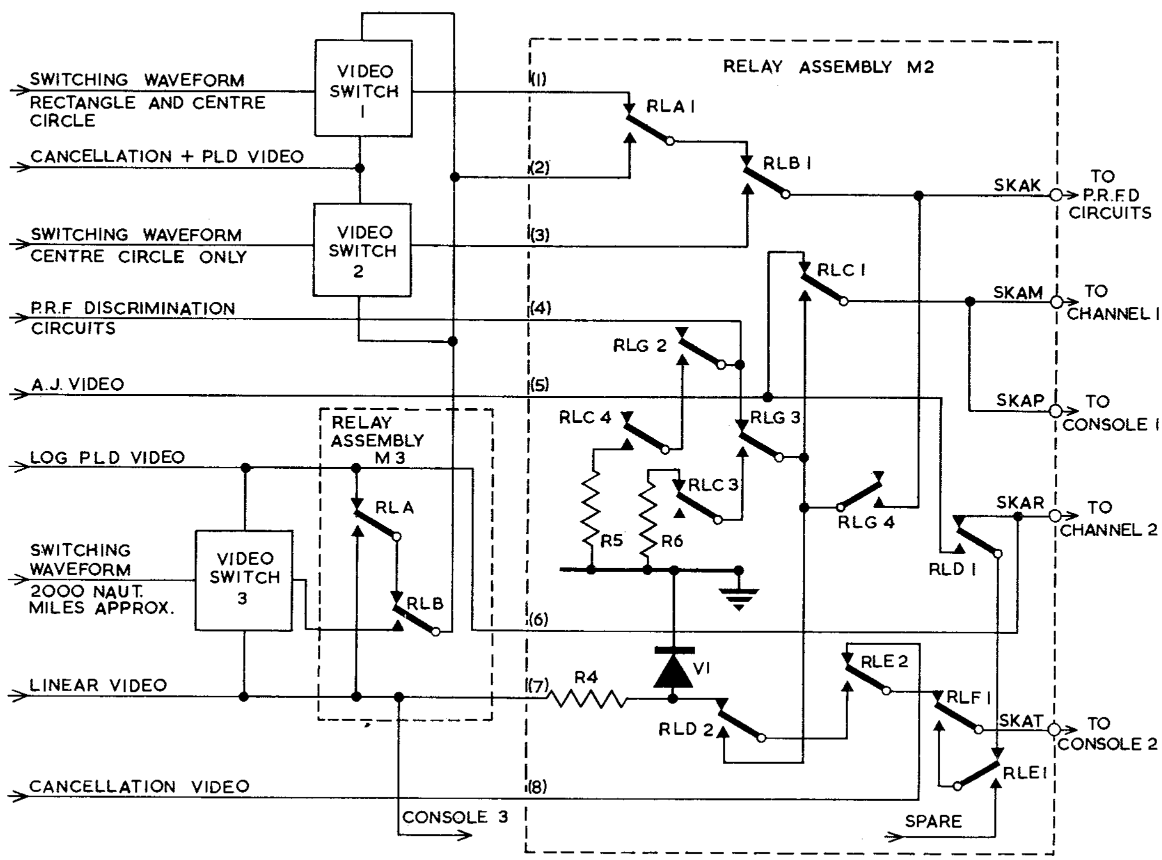

Fig. 3. Functional diagram of video switching

(2) CHANNEL SELECTOR switch in position 2. Input (3) is connected via SKAK to the delay line driver instead of input (1). Whereas input (4) remains connected to sockets SKAM and SKAP, the output to channel 1 and console 1 now consists of input (3) after p.r.f. discrimination.

(3) CHANNEL SELECTOR switch in position 3. Input (2) is connected to the delay line driver via SKAK. The outputs at SKAM and SKAP are unchanged as far as this unit is concerned, but now consist of input (2) after p.r.f. discrimination.

(4) CHANNEL SELECTOR switch in position 4. The connections in the unit are the same as for position 3 but since input (2) has been changed in relay assembly M3 to be linear video, modified by reverse swept gain, the output at SKAK and consequently the outputs at SKAM and SKAP after p.r.f. discrimination will be similarly changed.

(5) CHANNEL SELECTOR switch in position 5. Input (1) is connected to SKAK and input (5) to SKAM and SKAP.

(6) MONITOR SELECTOR switch in position 1. The output at socket SKAT to console 2 is the same as that for channel 1 and console 1 from output sockets SKAM and SKAP according to the selected position of the CHANNEL SELECTOR switch.

(7) MONITOR SELECTOR switch in position 2. Input (7) is connected to socket SKAT.

(8) MONITOR SELECTOR switch in position 3. Input (8) is connected to socket SKAT.

(9) MONITOR SELECTOR switch in position 4. Input (6), which is also the output to channel 2, via SKAR, is connected to socket SKAT.

(10) MONITOR SELECTOR switch in position 5. Input (5) is connected to socket SKAT.

(11) MONITOR SELECTOR switch in position 6. Input (9) is connected to socket SKAT.

TABLE 1

Operation of relays RLA, RLB and RLC

CHANNEL SELECTOR position	Relay energized	Input socket	Output socket	Type of video output
1	RLC	SKR	SKAK	Rectangle and centre circle switched : cancellation channel doppler compensated, or relay assembly M3 output
		SKX	SKAM–AN–AP and AQ	As output at SKAK but p.r.f. discriminated
2	RLB and RLC	SKV	SKAK	Centre circle switched : cancellation channel, or relay assembly M3 output
		SKX	SKAM–AN–AP and AQ	As SKAK for SKV input, but p.r.f. discriminated
3	RLA and RLC	SKU	SKAK	Output of relay assembly M3 (*Chap.* 9)
		SKX	SKAM–AN–AP and AQ	As output for SKAK with SKU input, but p.r.f. discriminated
4	RLA and RLC	SKU	SKAK	Output of relay assembly M3 (*Chap.* 9)
		SKX	SKAM–AN -AP–AQ	As output for SKAK but p.r.f. discriminated
5, 6	None	SKZ	SKAM–AN–AP–AQ	Anti-jamming

TABLE 2

Operation of relays RLD, RLE and RLF

MONITOR SELECTOR switch position	Relays energized	Input socket	Type of video output	Output socket
1	RLD RLE	As selected by RLA–RLC	As for channel 1 and console 1	SKAT
2	RLE	SKAD	Limited modified linear	SKAT
3	None	SKAF	Cancellation	SKAT
4	RLF	SKAB	Log–PLD	SKAT
5	RLD RLF	SKZ	Linear (A.J.)	SKAT
6	RLE RLF	SKAH SKAJ	Spare input	SKAT

Circuit description

5. Video inputs are brought in at sockets SKR, SKU, SKV, SKX, SKZ, SKAB, SKAD and SKAP (*fig.* 4). The −50V supply for the relay energizing coil circuits is connected to PLB/8. Direct connections are made to sockets SKT (from SKU) and SKAC, SKAR (from SKAB).

6. For the purpose of this description the relays in the assembly may be divided into three groups :

(1) Relays RLA and RLB select the output at sockets SKAK and SKAL according to the selected position of the CHANNEL SELECTOR switch.

(2) Relay RLC selects the output at sockets SKAM–AN–AP and AQ, and is controlled from the CHANNEL SELECTOR switch.

(3) Relays RLD–E and F select the output at sockets SKAT and SKAU according to the operated position of the MONITOR SELECTOR switch.

7. Although the output at sockets SKAM–AN–AP and AQ is stated (*para.* 6 (2)) to be selected by relay RLC, relays RLA and RLB control the video fed to the p.r.f. discrimination circuits and the output of these circuits is returned to the unit at socket SKX. It is therefore convenient to consider relays RLA–RLC as one group in relation to the operated positions of the CHANNEL SELECTOR switch.

8. The operation of relays RLA, RLB and RLC is conventional, the coil of the relay being energized by an earth applied to the poles of PLB/1–3. One set of relay contacts, e.g. RLA1, is used to select the required input and the second set, e.g. RLA2, to terminate the unused input in 75 ohms via R1. The operational state of the relays in relation to the operated positions of the CHANNEL SELECTOR switch is given in Table 1.

9. The video output at socket SKAT is selected by relays RLD–RLF, the appropriate relays being energized by the application of earth to one or more of poles 4–6 on plug PLB according to the operated position of the MONITOR SELECTOR switch. The operational state of the relays in relation to the operated position of the switch are as stated in Table 2.

10. The input from socket SKAD is limited at earth potential by R4 and V1 before being applied to the output socket.

Monitoring points

11. The inputs to, and the outputs from, the assembly are provided with monitoring points, SKC to SKK and SKM to SKQ, so that the video waveforms may be checked under operational conditions.

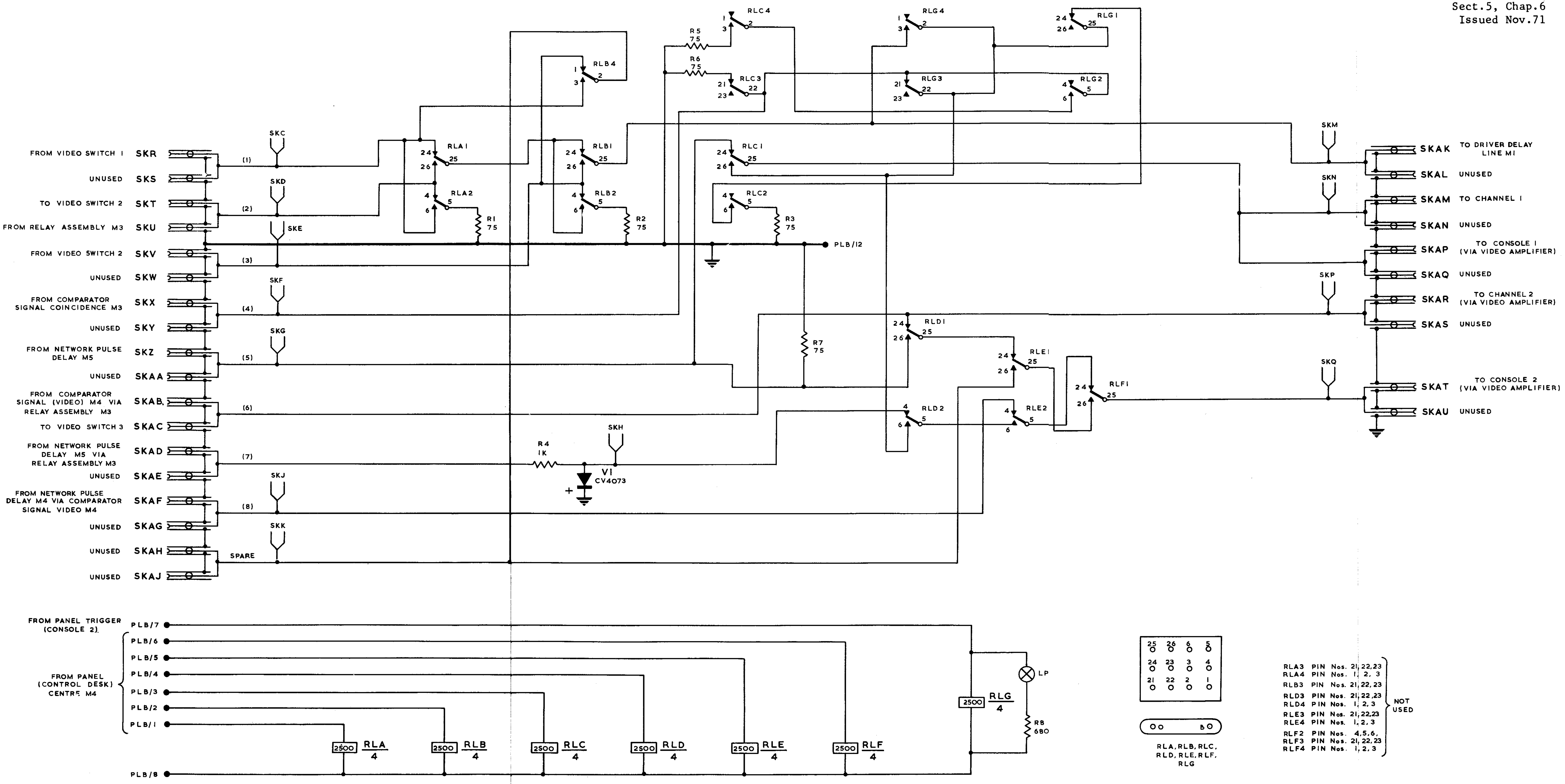

Fig.4 Relay assembly M2: circuit Fig.4

Chapter 7

GENERATOR, REVERSE SWEEP M8

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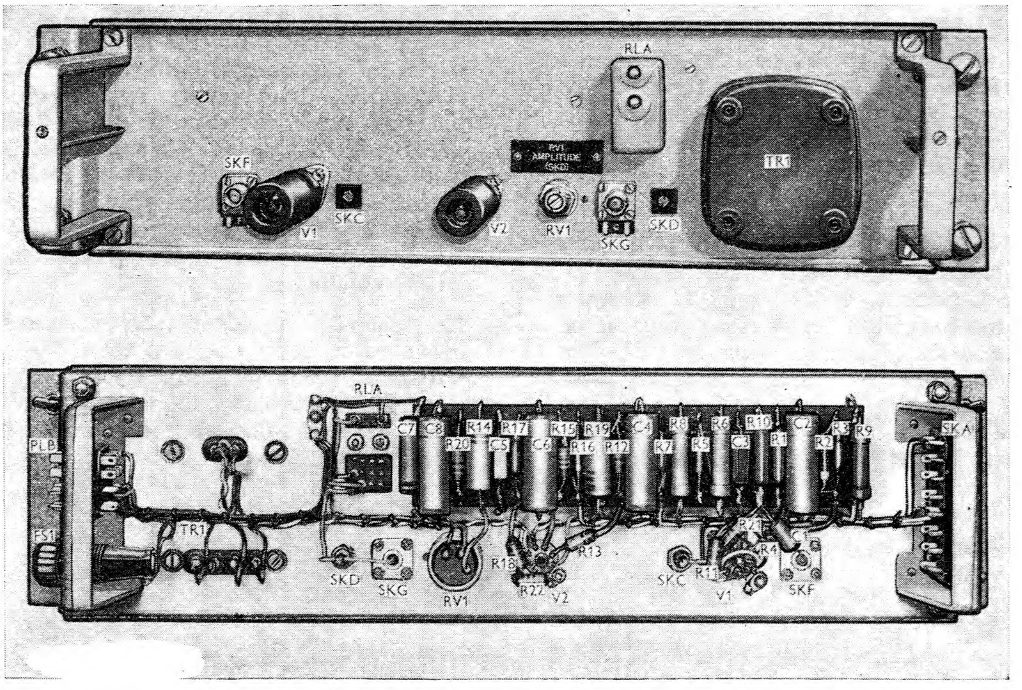


Fig. 1. Generator reverse sweep M8: front and rear views

Introduction

1. The reverse sweep generator (*fig.* 1) is used to develop a negative going sawtooth waveform for application to the gain control circuits of the linear amplifier in I.F. amplifier assembly (linear) M9. The sawtooth waveform, which is initiated at a radar range of 200 nautical miles, serves to progressively reduce the gain of the linear amplifier for the remainder of the timebase sweep. Any airborne jamming signals beyond 200 nautical miles are thereby decreased, with the effect that the radar display is provided with a pointer indicating the position and direction of the jamming source.

2. Reverse swept gain operation is controlled by the LINEAR INJECTION key on the operator's console suite. The facility is available for channel 1 signals, and hence also for console 1, with the VIDEO SELECTOR switch on the console set to any of the positions 1 to 4. The facility is also available on console 3 which directly monitors the output of the linear channel. With the VIDEO SELECTOR switch in positions 1 to 3, operation of the LINEAR INJECTION switch causes the logarithmic video content of the output to channel 1 to be replaced by video from the linear channel but with the reversed swept gain characteristic applied at ranges in excess of 200 nautical miles.

3. The unit, located in frame 3 of the video cabinet, is triggered by the trailing edge of the rectangular pulse from the switching pulse generator (*Sect.* 4, *Chap.* 6). A preset potentiometer is provided for amplitude adjustment of the generated sawtooth waveform.

Performance characteristics

Input

4. A rectangular positive-going pulse of not less than 20V amplitude and with a duration adjustable between 1 and 3 milliseconds is received at SKF. The pulse, which occurs at a nominal p.r.f. of 250 p.p.s., is received directly from pulse generator (switching) M7.

Output

5. The output from SKG is a negative-going sawtooth waveform with a run-down time of 500 microseconds. The amplitude of the waveform is adjustable from 0V to 10V and its recovery time is less than 400 microseconds.

Brief circuit description

6. The rectangular input pulse is differentiated by a resistance-capacitance input circuit to obtain a negative going peak from the trailing edge of the pulse for use as the trigger waveform in a flip-flop circuit (*fig.* 2). A positive going rectangular pulse is generated by the flip-flop and this pulse initiates the action of a Miller integrator which produces the negative going sawtooth waveform required.

7. The output of the Miller integrator is connected to the output socket of the unit by means of relay contacts which close when the LINEAR INJECTION key on the display console is operated.

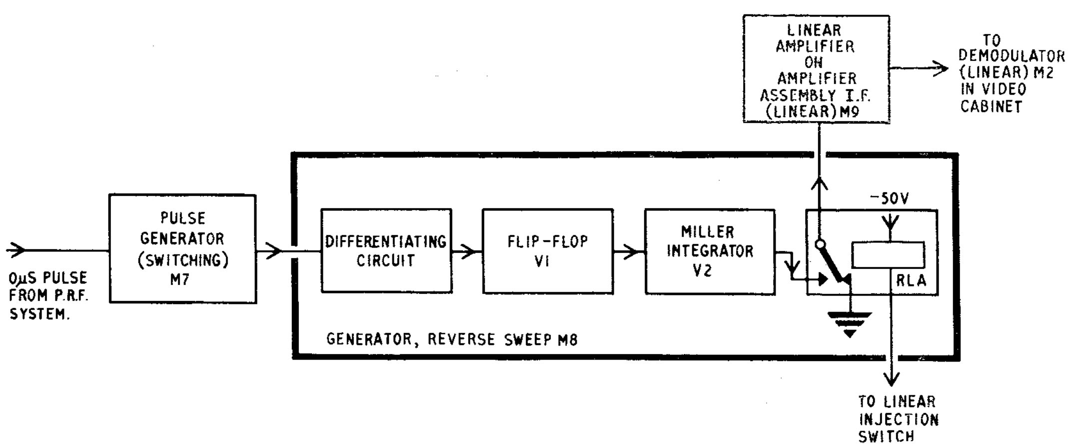
Circuit description

8. Heater voltages for V1 and V2 are supplied from TR1 via dropper resistors R21 and R22, the 240V a.c. supply for the transformer being received at PLB/7 (via FS1) and PLB/10. Control of the a.c. mains supply is effected by the main system switch which controls the mains supply to all units of the complete system. As the h.t. circuit for the valves is unconventional in that their anodes are returned to earth and their cathodes to −250V, one side of the heaters supply is connected to the −250V line so as to avoid a high potential difference between valve heaters and cathodes. This arrangement for the h.t. is adopted in order to obtain the necessary d.c. level for the output waveform. The −250V d.c. supply via the +250V voltage regulator is brought into the unit at PLB/11 (−250V) and PLB/12 (earth).

9. The positive-going rectangular pulse from the switching pulse generator is fed to the unit at socket SKF and differentiated by C1 and R10, the junction of which is connected to V1b grid via R11.

10. Triodes V1b and V1a function as a cathode-coupled flip-flop with V1a normally cut off and V1b normally conducting. V1b grid is returned to a higher potential than that at the grid of V1a by means of the potential divider R1, R2 and R3 across the −250V supply. At the termination of the input pulse, the negative peak of the differentiated pulse across R10 causes a fall in current through V1b (*fig.* 3). This results in a decrease in potential developed across the common cathode resistor R9 and hence a decrease in negative bias at V1a grid. The change in bias is sufficient to permit V1a to conduct.

11. The fall in potential at V1a anode as the valve begins to conduct is applied via C3 to the grid of V1b, causing a further reduction of current through V1b. This feedback action is cumulative and results in the flip-flop triggering to its unstable state with V1a conducting.



◀Fig. 2. Functional block diagram▶

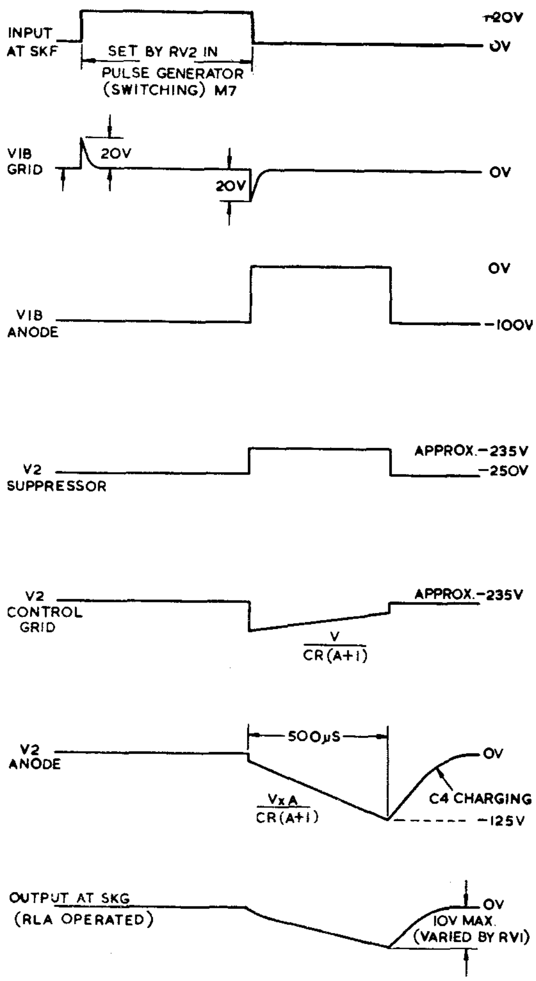


Fig. 3. Generator reverse sweep M8 : theoretical waveforms

12. Capacitor C3 charges through R10, thus maintaining V1b grid beyond cut-off potential. As C3 charges, the voltage developed across R10 falls exponentially according to the time constant of the charging circuit and V1b grid potential rises. This action continues until the voltage across R10 is sufficiently low to allow V1b once more to conduct and the flip-flop circuit reverts to its stable state. The values of C3 and R10 are such that V1b is cut off for a duration of approximately 500 microseconds.

13. The positive-going rectangular pulse produced at V1b anode when the valve is cut-off is coupled through C4 to the suppressor of V2. Valve V2 is connected in a Miller-run-down circuit with its suppressor returned to the −250V supply. Under quiescent conditions there is no pulse input at V2 suppressor grid and the anode is cut off. The voltage developed across the cathode load R15 is due to control grid and screen drawing all the valve current. Since the control grid is conducting, its potential is equal to that of the cathode and C5 is charged to approximately h.t. potential, i.e. earth in this circuit.

14. Upon the arrival of the positive-going pulse at the suppressor, V2 anode takes current and its potential falls (*fig.* 3). The fall in anode potential is coupled back by C5 to the control grid and thus tends to restrict the anode current. Hence, there is a small initial impulse of current such that the consequent negative step in anode potential drives the control grid to a potential just above cut-off level. At this point, equilibrium is reached and the linear run-down of the circuit commences.

15. The control grid of V2 rises towards earth potential as C5 discharges through R17 at a rate $\frac{V}{CR(A+1)}$ volts per second where A is the gain of the valve and CR the time constant of the discharge circuit, R17, for C5. A Miller run-down takes place with the anode potential falling at a rate $\frac{V \times A}{CR(A+1)} \simeq \frac{V}{CR}$ volts/second since the gain is high, $\frac{A}{A+1} \simeq 1$. The run-down continues, with the cathode potential increasing, until the pulse from the flip-flop ceases. Anode current is then cut off by the suppressor, the screen takes all the valve current, its potential falls, and with it, that of the suppressor. The anode rises towards earth potential at a rate determined by the charging path for C5 via R17 and the circuit recovers to its quiescent state. The recovery time should not exceed 400 microseconds after the end of the Miller run-down.

16. The maximum amplitude of the negative-going sawtooth developed across RV1 AMPLITUDE (SKD) is approximately 10V. A proportion of this output is taken from the slider of RV1 to contact 6 of relay RLA. When V2 anode is cut off, no current flows in RV1 and the potentiometer slider is at earth potential. This is the d.c. level from which the reverse sweep commences. Capacitor C7 is included in the output circuit to smooth out the unwanted step characteristic at the start of the Miller run-down.

17. With RLA de-energized, the output is disconnected, and socket SKG is connected to earth so that the swept gain control circuit of the linear amplifier on i.f. amplifier assembly (linear) M9 is taken via relay contact 4, to earth. When the LINEAR INJECTION key on the console suite is operated an earth is applied to PLB/1 causing relay RLA to operate and connect the output at RV1 slider to the output socket SKG.

Multimeter readings

18. Facilities are provided whereby the performance of V1 and V2 can be checked by connecting multimeter Type 100 to socket SKA via the plug-to-socket adaptor. Under normal conditions, i.e., with the correct input applied to SKF, the readings obtained should be as indicated in Table 1.

TABLE 1

Multimeter readings

SKA poles	Multimeter switch position	Stage checked	Measured across resistor	Reading	Tolerance
13,1	A	V1a	R5	0·46	0·09 } i.e. 20%
14,2	B	V1b	R7	0·46	0·09 } i.e. 20%
3,15	C	V2	R16	0·5	0·1 } i.e. 20%

Monitor points

19. Test sockets SKC and SKD are provided for monitoring purposes. With the correct input applied at SKF and relay RLA energized the waveforms existing at these points are illustrated in fig. 4.

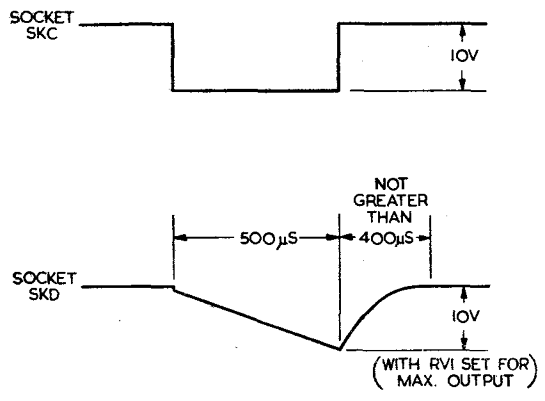


Fig. 4. Waveforms at monitoring points

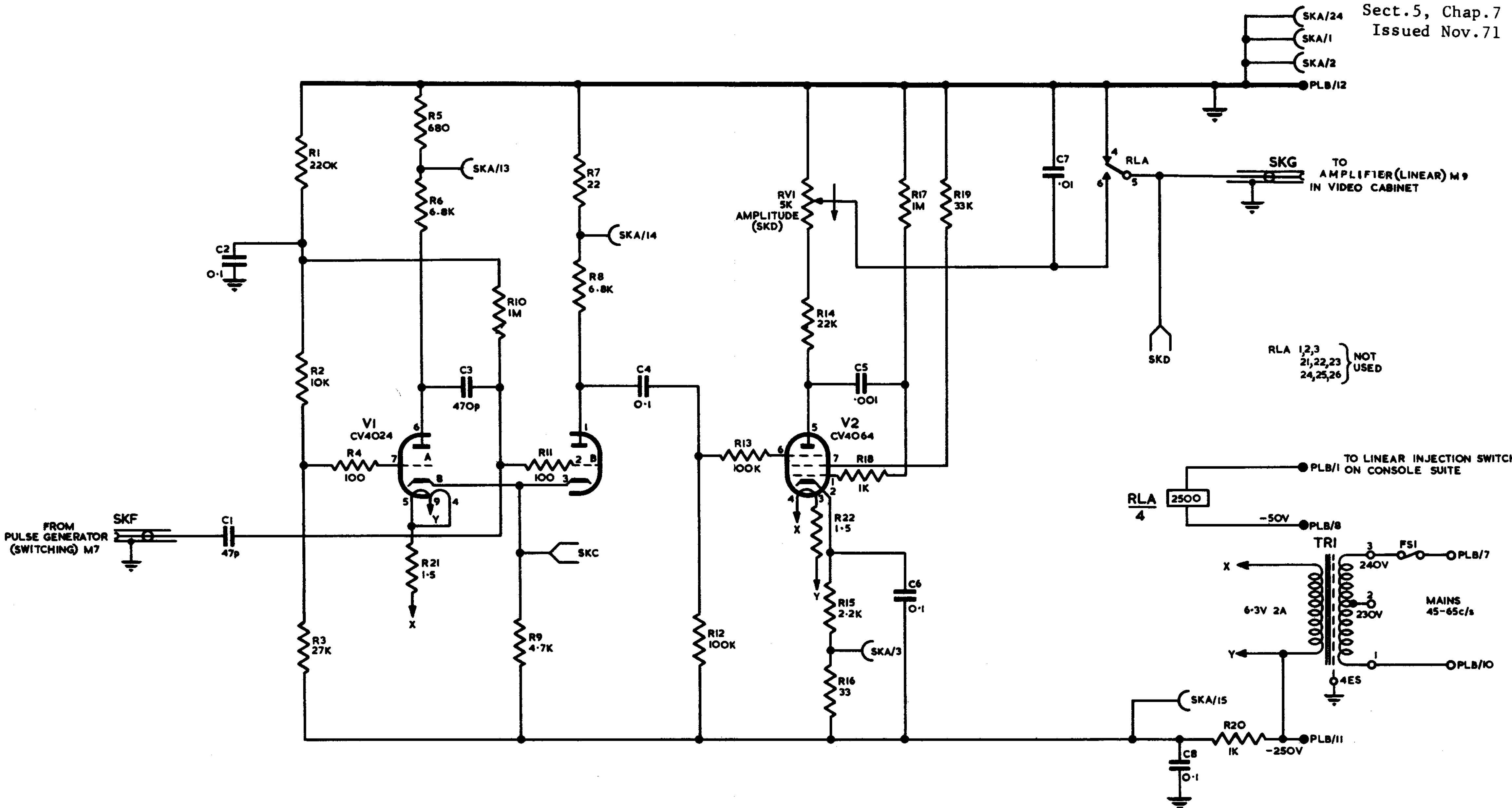


Fig.5

Generator reverse sweep M8: circuit

Fig.5

Chapter 8

AMPLIFIER ASSEMBLY (LINEAR) M9

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LIST OF ILLUSTRATIONS

Introduction

1. The amplifier assembly (linear) M9 (*fig.* 1 *and* 3) forms part of the linear signal channel and is situated in frame 3 of the video cabinet. The assembly consists of a main chassis on which is mounted the amplifier (linear) M8 in the form of an interchangeable sub-assembly. Also mounted on the main chassis are a mains transformer for supplying the valve heaters and a voltage regulator stage which reduces the +250V input to the unit to +100V for the linear amplifier h.t. supply.

2. The linear amplifier is mounted on the main chassis in a similar manner to the amplifier, i.f. (log) M7 (*Sect.* 2, *Chap.* 3). Reference should be made to this chapter for mounting details and also for instructions as to replacing valves and decoupling capacitors.

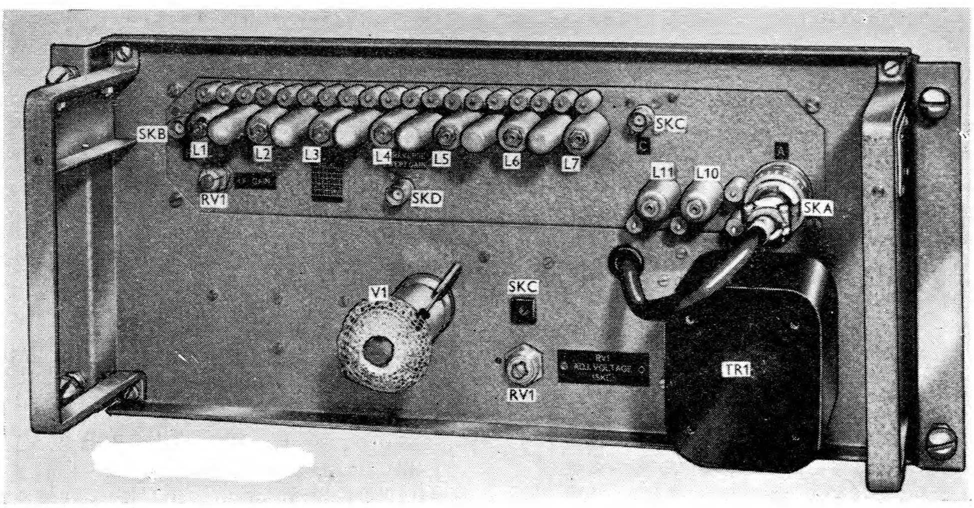

Fig. 1. Amplifier assembly (linear) M9 : front view

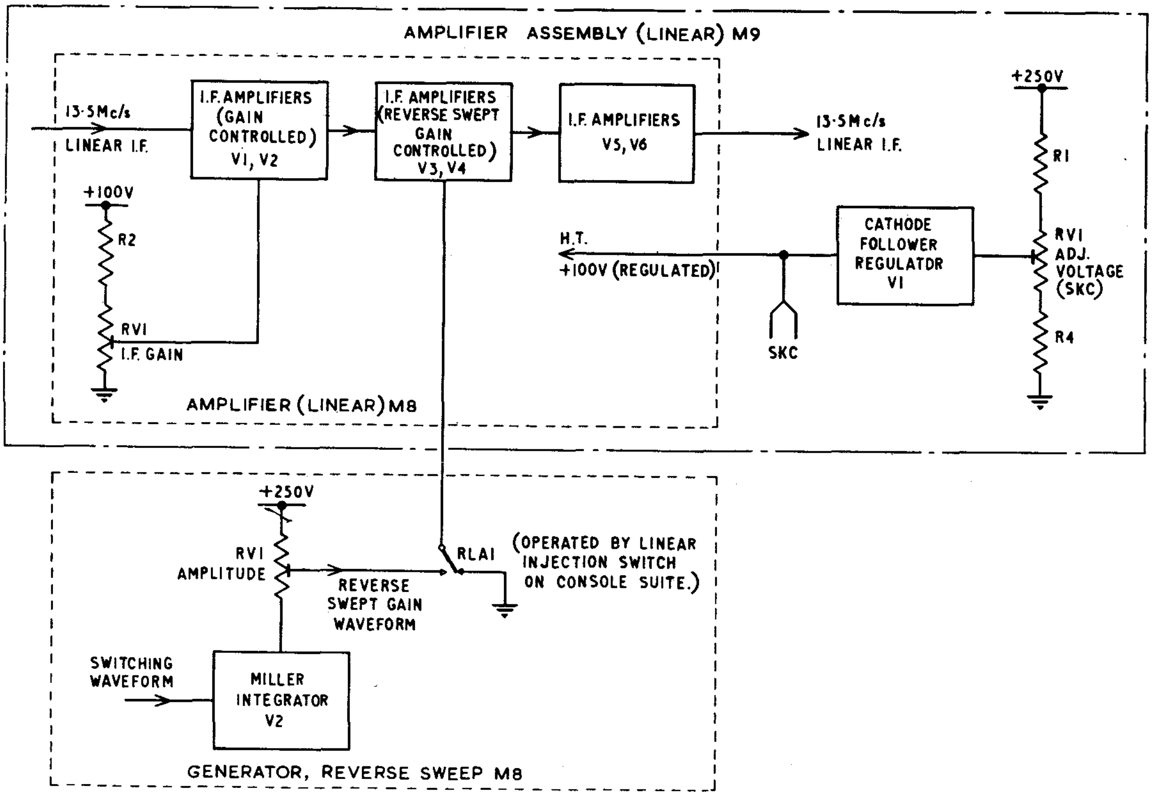

Fig. 2. Functional block schematic

3. The linear amplifier (*fig.* 2) consists of six stages using wired-in valves (CV4501) and provides amplification for the 13·5 Mc/s i.f. signal from the linear channel of the head amplifier at the radar head. This signal is attenuated 15 dB in the switch, electronic (i.f.) M2 (*Sect.* 2, *Chap.* 2) before application to the linear amplifier. The i.f. output from the linear amplifier is passed to the demodulator (linear) M2 (*Sect.* 2, *Chap.* 14) also situated in the video cabinet.

4. Provision is made for the injection of a reverse swept gain waveform into the second two stages of the linear amplifier as an aid to the identification of jamming signals. This swept gain waveform is taken from the generator, reverse sweep M8 (*Chap.* 7) and starts at 200 nautical miles increasing linearly to about 60 dB attenuation during the next 40 miles (*Sect.* 1, *Chap.* 4).

Performance characteristics

5. The linear amplifier operates at a centre frequency of 13·5 Mc/s $\pm$ 100 Kc/s and has a bandwidth at 3 dB points of 900 Kc/s $\pm$ 100 Kc/s. The maximum overall gain is 82 dB $\pm$ 5 dB, with a manual gain control range of 40 dB $\pm$ 7 dB. The input and output impedance is 75 ohms. A reverse swept gain input of -10V is equivalent to a decrease in gain of 60 dB $\pm$ 6 dB.

Inputs

6. The unit requires the following inputs :—

(1) 240V 50 c/s single phase a.c. mains at PLB/7 (via FS1) and PLB/10.

(2) $+250$V $\pm$ 5V at 100 mA at PLB/9.

(3) Linear i.f. signals at 13·5 Mc/s $\pm$ 100 Kc/s, at a level of 55 microvolts, at socket SKB.

(4) A reverse swept gain waveform reaching a maximum of -10V with a duration of 500 microseconds and a recovery time not greater than 400 microseconds at socket SKD.

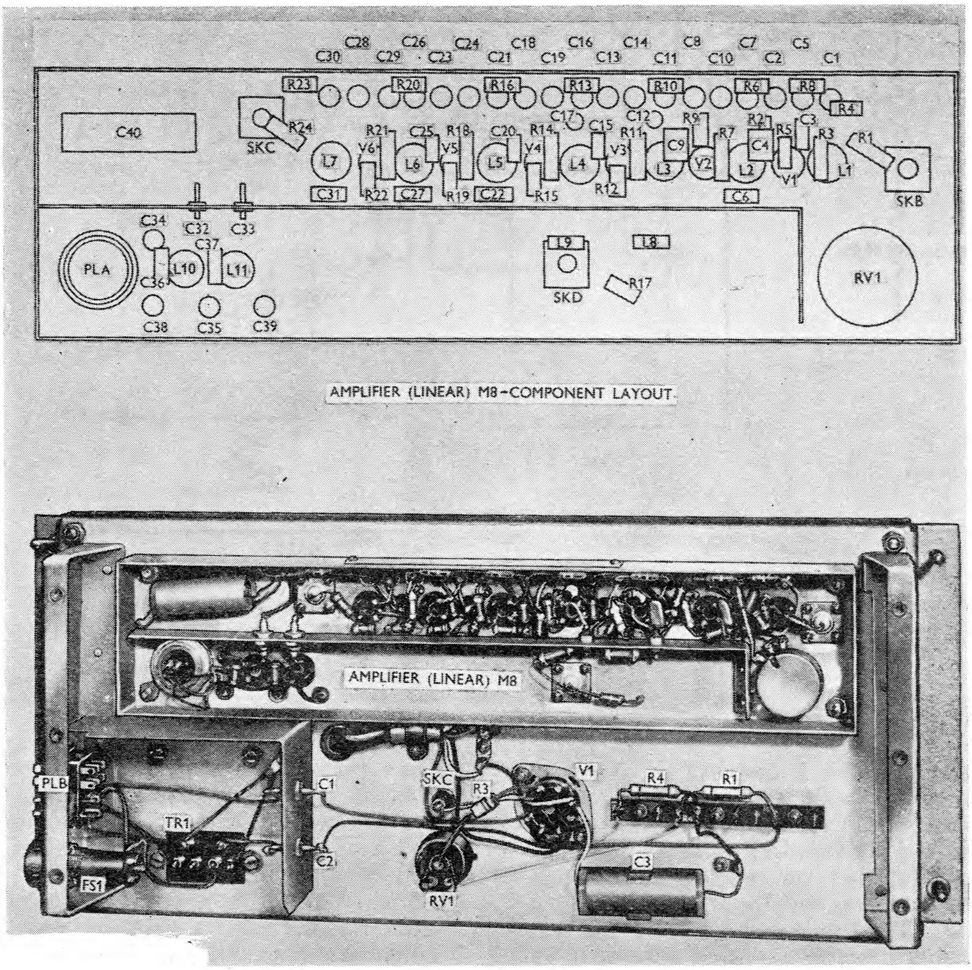

Fig. 3. Amplifier assembly (linear) M9 : rear view

Output

7. The unit provides i.f. signals at 13·5 Mc/s ± 100 Kc/s, at a level of 0·7V r.m.s. with a 70 millivolt noise level, at socket SKC.

Circuit description

Power supplies

8. The valve heaters are supplied from the secondary of transformer TR1 which is mounted on the main chassis (*fig.* 4). The primary of this transformer is supplied with 240V 50 c/s a.c. mains via PLB/7, PLB/10 and FS1(1A). The 6·3V a.c. supply for the linear amplifier heaters enters the sub-assembly via PLA/C and PLA/B (earth). The supply passes through the filter C33, C35, C37, C39 and L11 (*fig.* 5) before reaching the valve heaters.

9. The +250V supply enters the main chassis at PLB/9 (*fig.* 4) and is applied to a cathode follower regulating circuit formed by V1 and its associated components. The grid of V1 is set at +100V by the potentiometer chain R1, RV1 and R4. The ADJ. VOLTAGE (SKC) control RV1 enables adjustments to be made to the +100V setting to allow for slight differences in characteristics of individual CV391 valves. The cathode load of V1 is formed by the h.t. load of the linear amplifier and by cathode follower action the output voltage is held at +100V ± 5V irrespective of variations in cathode loading. The supply enters the sub-assembly via PLA/D and is filtered by the network C32, C34, C38 and L10 (*fig.* 5) before application to the valves.

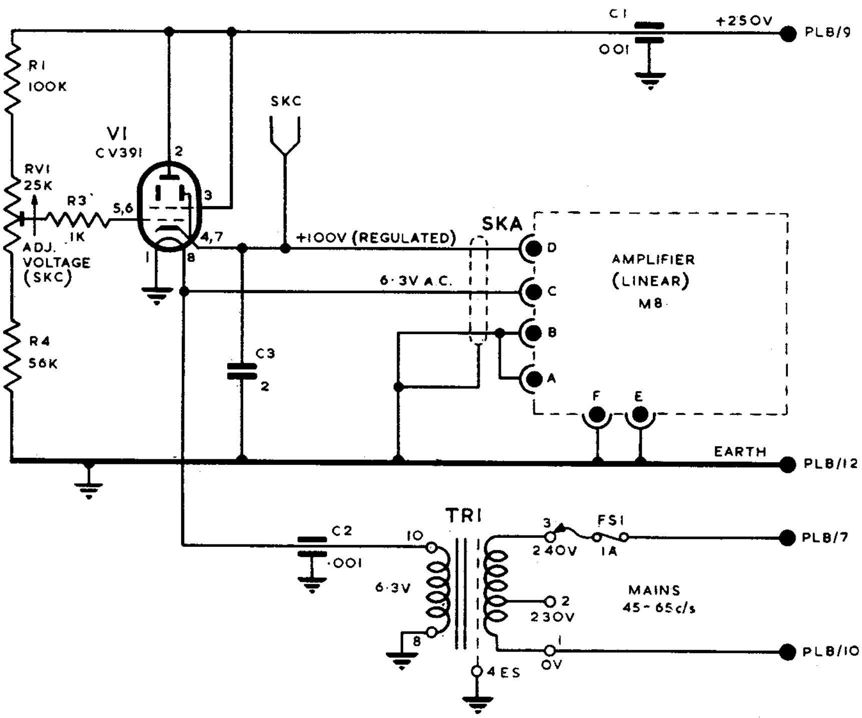

Fig. 4. Main chassis : circuit

Linear amplifier (fig. 5)

10. The linear amplifier consists of six stages of i.f. amplification, V1 to V6, each stage being tuned to a centre frequency of 13·5 Mc/s giving an overall gain of 82 dB and a bandwidth of 900 Kc/s. The i.f. input to the unit is taken to the grid of V1 via the impedance matching resistor R1 and the tuned circuit L1, C3. The first two stages, V1 and V2, are gain controlled by the I.F. GAIN control, RV1 which gives a control range of 40 dB. The control is set to give 0·1V of noise at the input to the linear demodulator when the linear amplifier is operating on a normal i.f. input. The second two stages, V3 and V4, which employ bifilar wound coils in their anode circuits, are gain controlled by the reverse swept gain waveform applied to socket SKD. The inductors L8 and L9 in the reverse swept gain line to V3 and V4 act as decoupling elements between the two stages.

11. The reverse swept gain waveform is only applied to V3 and V4 when the LINEAR INJECTION switch on the console suite is operated. With the switch unoperated socket SKD is held at earth level by a relay contact in the reverse sweep generator (*fig.* 2) and V3 and V4 operate at maximum gain. Operation of the switch changes over the relay contact to a Miller integrator stage, V2 in the reverse sweep generator, which provides an input to socket SKD consisting of a Miller run-down of 500 microseconds duration. This run-down is arranged to start at approximately 2·4 milliseconds after the start of the display trace to give linear response out to 200 miles with increasing attenuation, up to 60 dB, for the remaining 40 miles.

12. The last two stages of the amplifier, V5 and V6, are standard i.f. amplifiers operating at maximum gain. The 13·5 Mc/s linear i.f. output is taken from the tuned circuit L6, C31 in the anode of V6 via the impedance matching resistor R24 to socket SKC.

Test point

13. The output voltage of the regulator valve V1 on the main chassis can be measured with a multimeter Type 1 at test socket SKC. The ADJ. VOLTAGE (SKC) control RV1 should be adjusted to give a reading of +100V ± 1V under operating conditions.

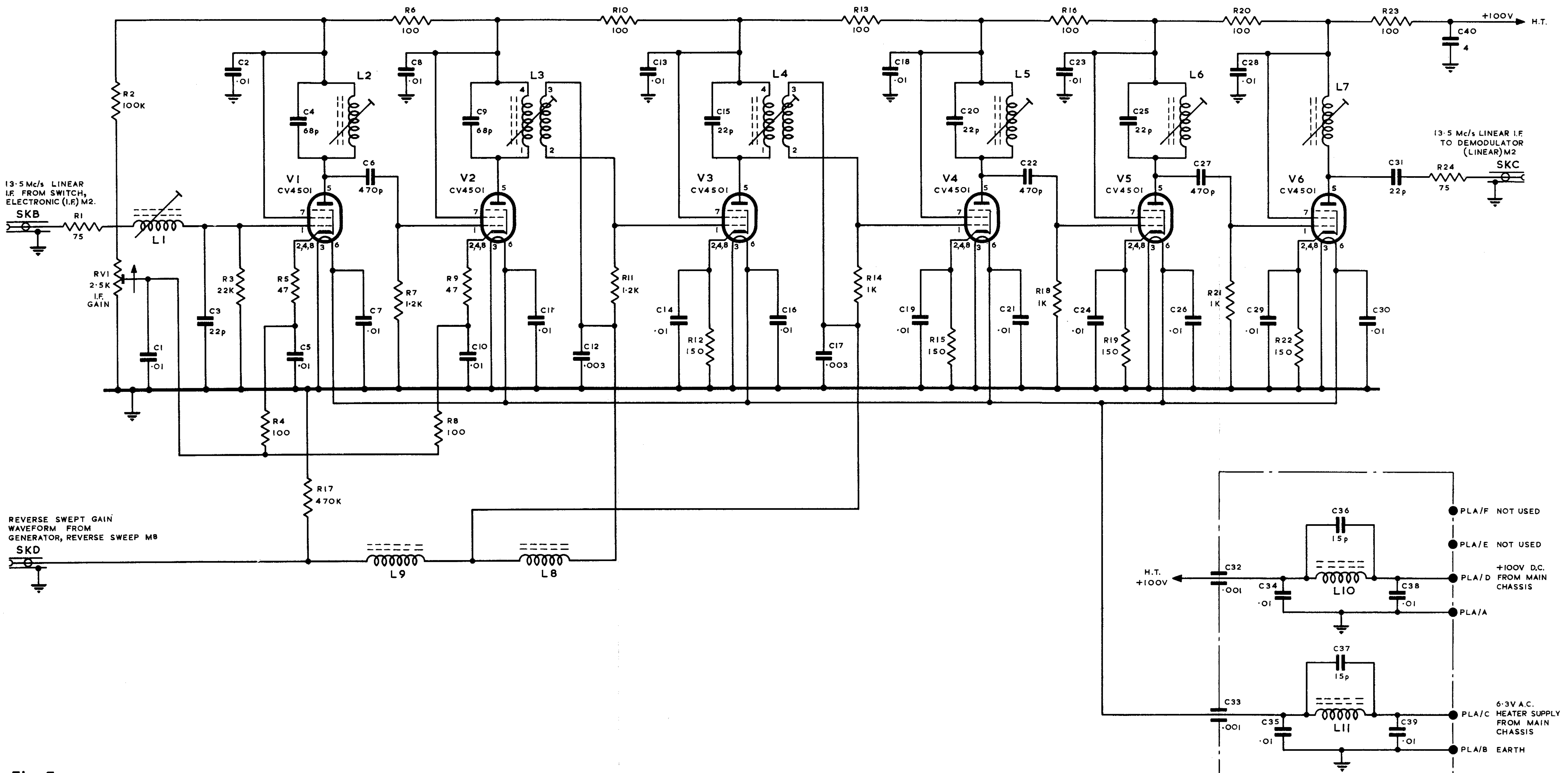

Fig. 5

Amplifier (linear) M8: circuit

Fig. 5

Chapter 9

RELAY ASSEMBLY M3

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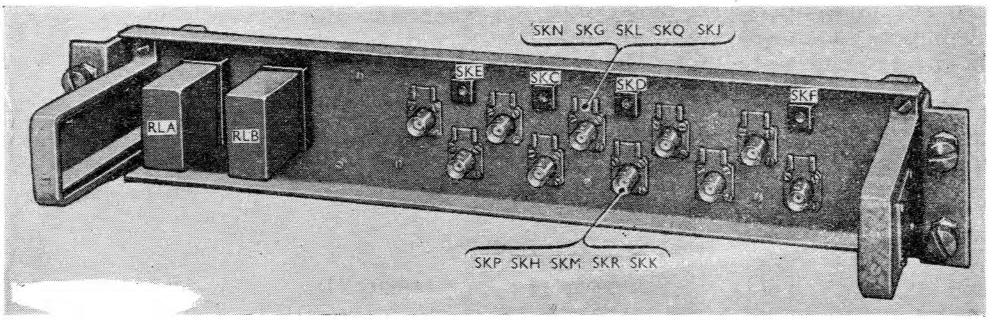

Fig. 1. Relay assembly M3 : front view

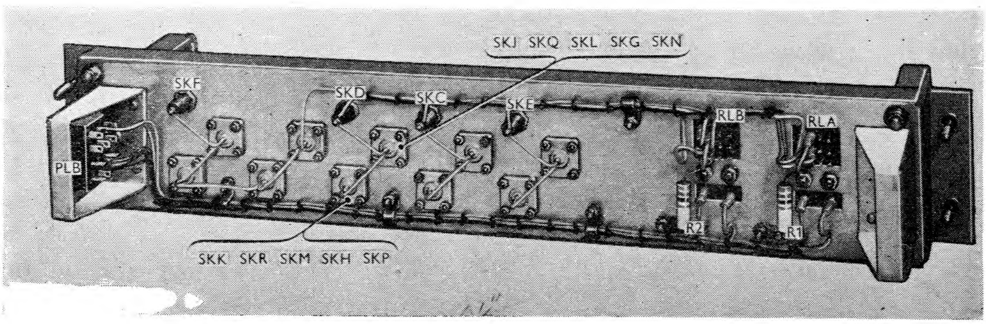

Fig. 2. Relay assembly M3 : rear view

Introduction

1. Relay assembly M3 (*fig.* 1) provides facilities whereby any one of three video inputs may be selected by two relays for through-connection to the subsequent circuits. The first of these relays is controlled in association with certain relays in relay assembly M2 (*Chap.* 6) by the channel selector switch and the second by the linear injection switch, these switches are mounted on the control panel of the centre display console. The associated video circuits are shown in fig. 3 of Chapter 6.

Performance characteristics

Inputs

3. The relay assembly receives the following video inputs

(1) SKG receives a Log–PLD video input from the signal comparator (video) M4 (*Sect.* 2, *Chap.* 6) in the i.f. cabinet.

(2) SKJ receives a linear video input the characteristic of which has been modified by a reversed swept gain waveform from pulse delay network M5 (*Sect.* 2, *Chap.* 5) in the video cabinet.

(3) SKL receives a video input from the video switch 3 (*Chap.* 5) which consists of inputs (1) or (2) as selected by the switch.

Outputs

4. The outputs taken from the relay assembly are as follows

(1) A direct connection from input (1) to socket SKH for relay assembly M2 (*Chap.* 6).

(2) Direct connections from input (2) to sockets SKK, SKO and SKR for video switch 3, console 3 and relay assembly M2 respectively.

(3) With the CHANNEL SELECTOR switch in positions other than position 4 and with the LINEAR INJ. (linear injection) switch unoperated, input (1) is connected to sockets SKN, for video switch 1, and SKP, for relay assembly M2.

(4) With the CHANNEL SELECTOR switch in position 4 and with the LINEAR INJ. switch unoperated, input (2) is connected to sockets SKN and SKP.

(5) With the LINEAR INJ. switch operated, input (3) is connected to sockets SKN and SKP.

Circuit description

5. Three video inputs are brought in at sockets SKG, SKJ and SKL, and the −50V supply at plug PLB/8 (*fig.* 3).

6. With no earth connection to PLB/1 and PLB/2, relays RLA and RLB are not energized and thus the input at SKG is connected through unoperated contacts RLA1 and RLB1 to the output sockets SKN and SKP. The inputs at SKJ and SKL are terminated in 75 ohms by resistors R1 and R2 via the unoperated contacts RLA2 and RLB2 respectively.

7. With an earth connection to PLB/1, i.e. with the CHANNEL SELECTOR switch in position 4, relay RLA is energized and its operated contacts RLA1 connect the input at SKJ to the output sockets SKN and SKP via the unoperated contacts RLB1. The input at SKG is terminated by R1 via the operated contacts RLA2.

8. With an earth connection to PLB/2, i.e. with the linear injection switch operated, relay RLB is energized and its operated contacts RLB1 connect the input at SKL to the output sockets SKN and SKP. The inputs at SKG and SKJ are terminated by R1 and R2 regardless of whether RLA is energized or released.

Monitoring points

9. The inputs to and the outputs from the assembly are provided with monitoring points, SKC to SKF, so that the video waveforms may be checked under operational conditions.

TABLE 1

Operation of relay assembly M3

CHANNEL SELECTOR switch	Relay energized	Input socket	Output socket	Type of video output
Linear injection switch unoperated				
All positions but 4	None	SKG	SKP SKN	Log + PLD
4	RLA	SKJ	SKP SKN	Linear
Linear injection switch operated				
All positions	RLB	SKL	SKP SKN	Video switched : Log + PLD or linear (modified)
Through connections				
		SKG	SKH	Log + PLD
		SKJ	SKK, SKQ SKR	Linear (modified)

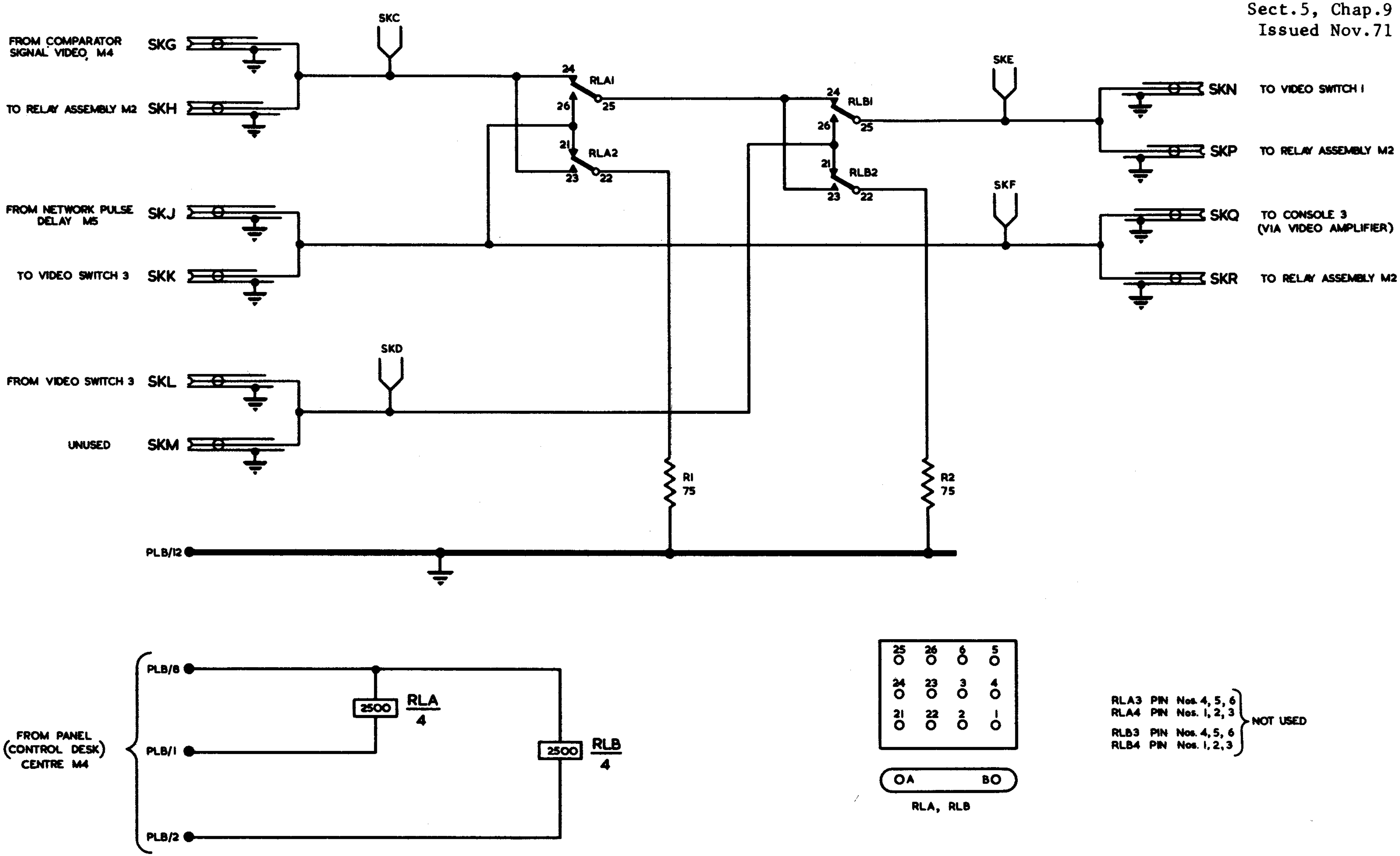

Fig.3 Relay assembly M3 : circuit Fig.3

Chapter 10

CONTROLLER (P.R.F.) M2

CONTENTS

TABLES

ILLUSTRATIONS

Introduction

1. The controller (p.r.f.) M2 (*fig.* 1) forms part of the p.r.f. discrimination system and its purpose is to provide correction voltages to the delay line (variable) M6 (*Chap.* 3) in order that the delay provided by the line is accurately matched to the station p.r.f. This ensures that the delayed and undelayed video signals applied to the comparator, signal (coincidence) M3 (*Chap.* 4) differ in time by exactly one p.r.f. period, thus providing maximum suppression to any non-synchronous pulses present in the pulse train. The unit is located in frame 2 of the video cabinet.

2. The unit receives the –125 microseconds pulse from the p.r.f. system and also delayed and undelayed video signals from the comparator, signal (coincidence) M3. These signals include the –8 microseconds pulses which are compared for time error. From this comparison, a 50 c/s control voltage, which either leads or lags by 90° with respect to a fixed 50 c/s reference voltage obtained from the station a.c. supply, is produced and used to drive a two-phase motor which controls the time delay of the delay line (variable) M6.

Performance characteristics

Inputs

3. The unit requires the following inputs:

(1) A –125 microseconds positive-going pulse, approximately 4 microseconds wide and not less than 15V amplitude at socket SKV.

(2) Undelayed unipolar video signals, including a –8 microseconds pulse, approximately 4 microseconds wide and approximately 1.5V ±0.2V peak at a d.c. level of 0V at socket SKT.

(3) A similar input as socket SKT, but delayed one pulse period, at socket SKU.

Note . . .

Coaxial sockets SKS, SKX, and SKW in parallel with sockets SKT, SKV and SKU respectively, are not used in this application of the unit.

(4) +250V ±5V at 200 mA at PLB/9.

(5) –250V ±5V at 10 mA at PLB/11.

(6) –50V ±5V at 250 mA at PLB8.

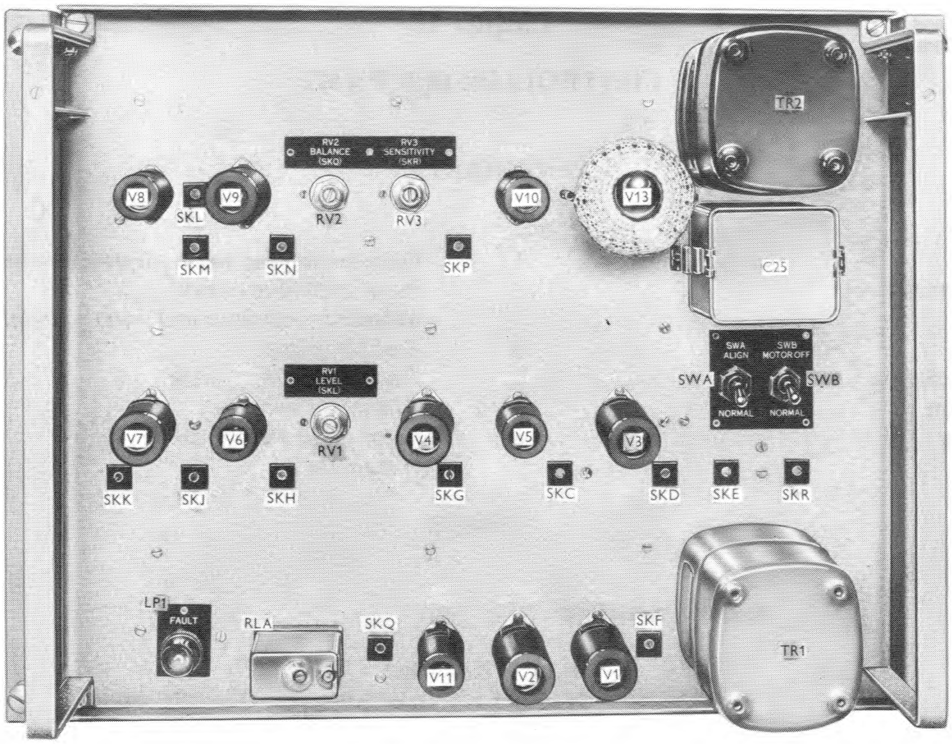

Fig. 1. Controller (p.r.f.) M2: front view

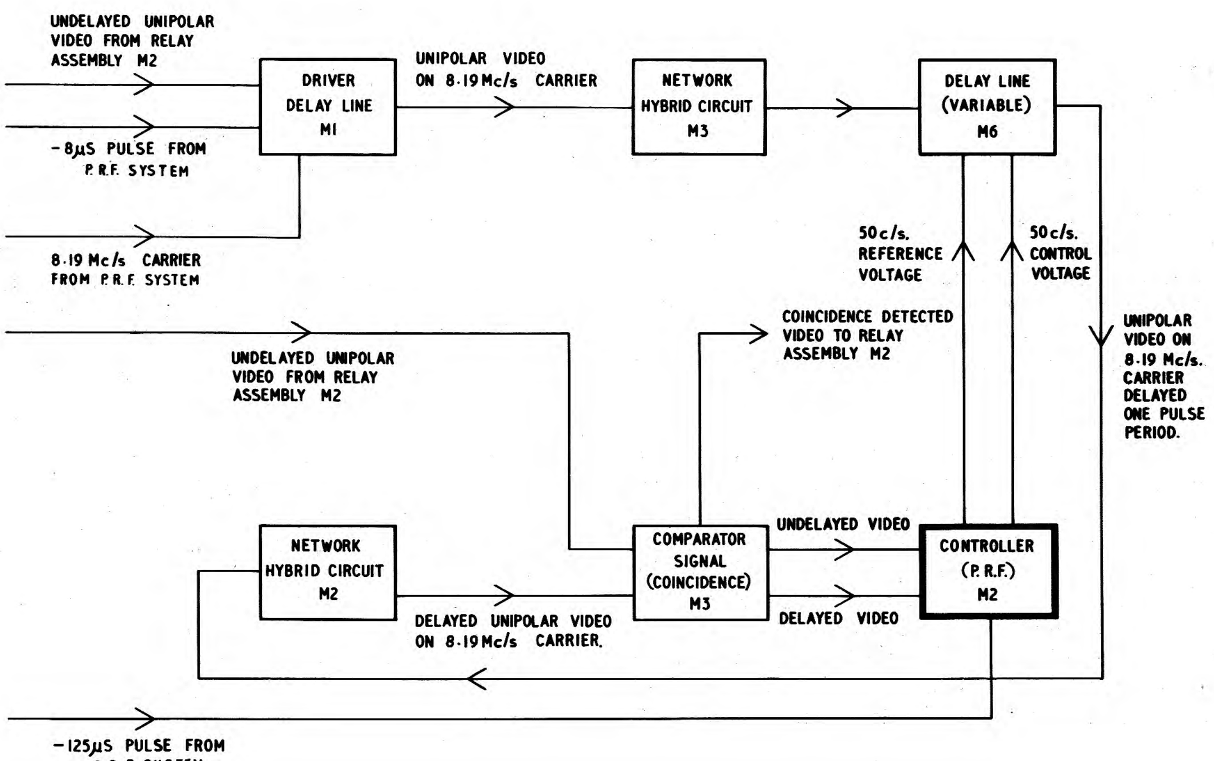

Fig. 2. Functional block schematic

Outputs

4. The unit delivers the following outputs :—

(1) 50 c/s motor driving voltage of variable amplitude (depending on delay error) at PLB/3 and PLB/4.

(2) 50 c/s motor reference voltage of amplitude 12V r.m.s. at PLB/2 and PLB/4.

(3) −50V, to act as a d.c. brake, at PLB/3.

Brief circuit description

5. The circuit consists essentially of a bi-stable pair, triggered by the −125 microseconds pulse, gating a pulse separating stage into which are fed the delayed and undelayed −8 microseconds pulses (*fig.* 3). In the event of an error in the timing of the −8 microseconds pulses this circuit produces either a phase or an anti-phase output which, after application to pulse stretching circuits, becomes a d.c. level with a polarity dependent on whether the delayed pulse or the undelayed pulse arrived first at the pulse separator. This d.c. error signal is then fed to a balanced modulator stage to control the production of a 50 c/s waveform of the required amplitude and phase with respect to a 50 c/s reference voltage. The 50 c/s waveform is fed out by way of a tuned driver stage.

Circuit description

Power supplies

6. The heater supply for the valves is obtained from transformer TR1 which is supplied with 50 c/s mains from PLB/7, via FS1, and PLB/10. This transformer also supplies the 60–0–60V supply to the balanced modulator stage, V9 and the 12V a.c. reference voltage for the two-phase motor in the variable delay line. This supply is taken to the motor via PLB/2 and PLB/4 and is switched by the MOTOR OFF/NORMAL switch SWB. The +250V and −250V supplies enter the unit at PLB/9 and PLB/11 respectively, PLB/12 being the earth connection. These supplies are taken from the +250V regulator at the top of frame 2 in the video cabinet.

Bi-stable pair

7. Double triode V2 and its associated circuit form a cathode-coupled bi-stable pair. Initially V2b is conducting and the cathodes of V2 (monitored at SKG) are at approximately +23V, while V2a grid is at approximately +12V, set by the divider chain R5, R4 and R7, so that V2a is cut off.

8. The incoming −125 microseconds positive-going pulse at SKV is stretched to about 10 microseconds by V12, C2 and R2 and applied to V1a grid. The grid stopper R3 has a high value so that V1a is protected from excessive grid current due to the amplitude of the incoming pulse, which may reach 60V peak. Stretching of the pulse is necessary because the time constant of C4–R11, and therefore the time required to switch the bi-stable circuit, is slightly greater than the nominal width of the −125 microseconds pulse.

9. V1a is a cathode follower and applies the stretched pulse (monitored at SKF) to V2a grid bringing V2a into conduction and, due to the d.c. coupling between V2a anode and V2b grid, cutting off V2b. The potential at the common cathodes of V2 and V4 will now be approximately +7V (*fig.* 4).

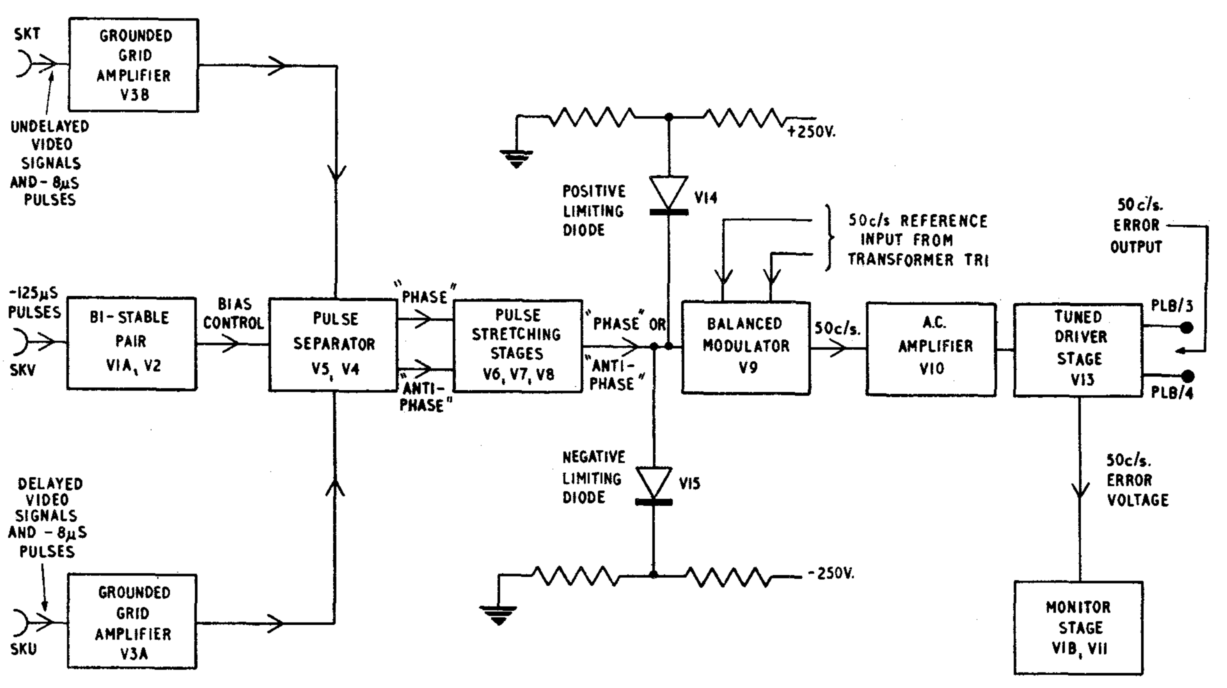

Fig. 3. Controller (p.r.f.) M2 : block diagram

Pulse amplifying and separating circuit

10. The inputs at sockets SKT and SKU consist respectively of undelayed and delayed video signals. As previously stated, the particular video signals used for the delay control function are the positive-going −8 microseconds delayed and undelayed pulses. These pulses are made free from noise and all other extraneous video signals by the gate, electronic (blanking) (*Sect.* 5, *Chap.* 12), so that all video signals for the 125 microseconds period from the −125 microseconds pulse to the 0 microseconds pulse are blanked off. Since the −8 microseconds pulses are fed into the video circuits at the delay line driver unit following the electronic gate these pulses are the only signals received at sockets SKT and SKU during the 125 microsecond period.

11. These signals are amplified by V3a and V3b respectively. The two triode sections are connected as grounded grid amplifiers so as to retain the polarity of the signals. The amplified signals are limited to +13V peak by V5a and V5b in conjunction with the potential divider R30–R31, the undelayed signals being applied to V4a grid and the delayed signals to V4b grid. The capacitors C5 and C7 swamp any stray capacitance that would otherwise affect the shape of the video signals from V3, thus ensuring that the delayed and undelayed signals at the grids of V4 are of similar shape.

12. While the cathodes of V4 are at +23V, V4a and V4b will not be brought into conduction by any video signals applied to their grids, but after the −125 microseconds pulse has switched over the bi-stable pair and reduced V4 cathode potential to about +7V, any incoming signal will bring V4a or V4b into conduction. The first signals to reach the grids of V4a and V4b after the −125 microseconds pulse has switched over the bi-stable pair are the undelayed and delayed −8 microseconds pulses. If either V4a or V4b conducts it will immediately raise the common cathode potential of V2 and V4, which is equivalent to applying a negative-going pulse to V2b grid, thereby restoring the bi-stable pair to its initial condition. Depending on which half of V4 conducts there will be produced at one anode of V4 a short negative-going pulse. If the video signals arriving at the grids of V4a and V4b are coincident then both halves will conduct and produce negative-going pulses at both anodes.

Pulse stretching circuits

13. The negative-going pulses produced at V4a anode and V4b anode are stretched to approximately 100 microseconds by V6b, C14 and R32 (monitored at SKJ) and V6a, C15 and R33 (monitored at SKH) respectively. These pulses are then applied to the grids of the differential amplifier V7, the d.c. potential at the grids being set by the potential divider R27–R22 across the +250V supply. The output developed at V7b anode (monitored at SKK) is either a positive-going pulse, in the case of a signal at V4a anode, or a negative-going pulse in the case of a signal at V4b anode.

14. A positive-going pulse at V7b anode will charge C17 through V8a producing at the storage capacitor C18 (monitored at SKL) a d.c. level of −1·5V. A negative-going pulse at V7b anode will charge C16 through V8b producing at C18 a d.c. level of +1·5V. These voltages are limited in the positive and negative directions by diodes V14 and V15 respectively. If there is no error in the delay time the delayed and undelayed −8 microseconds pulses will be coincident and negative pulses will be applied to both grids of V7 producing zero output at V7b anode. The d.c. level on C18 will therefore also be zero. Potentiometer RV1 LEVEL (SKL) is set to obtain this condition by compensating for any unbalance in the two signal paths.

15. If the delay period is too long the undelayed −8 microseconds pulse will arrive at V4 first, resulting in a positive d.c. level at C18. Similarly, if the period is too short the delayed pulse will arrive first, resulting in a negative d.c. level at C18. Fig. 4 illustrates the theoretical waveforms obtained in the event of a short delay period.

Balanced modulator and output circuit

16. A 50 c/s sinusoidal voltage, balanced about earth potential, from the transformer TR1 is applied via the two 90° phase shift networks R41 with C20, and R54 with C23 to the grids of the balanced modulator V9. This phase shift is necessary as the motor on the variable delay line is a two-phase type requiring a supply having 90° phase difference between voltages for its control and reference phase windings. The 50 c/s supply for the reference phase winding of the motor is also derived from TR1.

17. The phase shift networks attenuate the 50 c/s input so that the waveforms at V9 grids are approximately 2V r.m.s. in amplitude. As these waveforms are in anti-phase, when the d.c. levels on the grids are equal, i.e. at earth potential, the output from the BALANCE (SKQ) control RV2, assuming it to be balanced, will theoretically be zero. In practice however, the output is a 100 c/s signal at low level. If the d.c. level at V9b grid changes to +1·5V or −1·5V due to a delay error there will be a 50 c/s output from RV2, its phase relative to the reference phase supply being dependent on the polarity at V9b grid.

18. The sinusoidal output from RV2 is applied to V10 grid via the SENSITIVITY (SKC) control RV3. The valve V10 is a conventional a.c. amplifier and its output is taken to the grid of V13. This valve and its associated circuit form a tuned driver stage producing an output at the secondary of TR2 (monitored at SKR). The tuning of TR2 by C25 is very wide-band and does not eliminate the 100 c/s output from V9. This is sufficient to drive the motor but is prevented from doing so by the braking voltage (*para.* 19). The gain of V10 is set by RV3 during the initial setting-up of the unit to give a 100 c/s output of 6V peak-to-peak at monitor point SKR. This setting will provide a maximum 50 c/s error output of between 50 and 60V in the event of a delay error.

Braking voltage

19. A d.c. supply of −50V is applied to the control field of the motor on the variable delay line via contacts RLA2 on the unit fault relay, resistors R75, R76 and PLB/3. This supply almost saturates the control field of the motor thus acting as a brake and is used for two purposes. Primarily, it

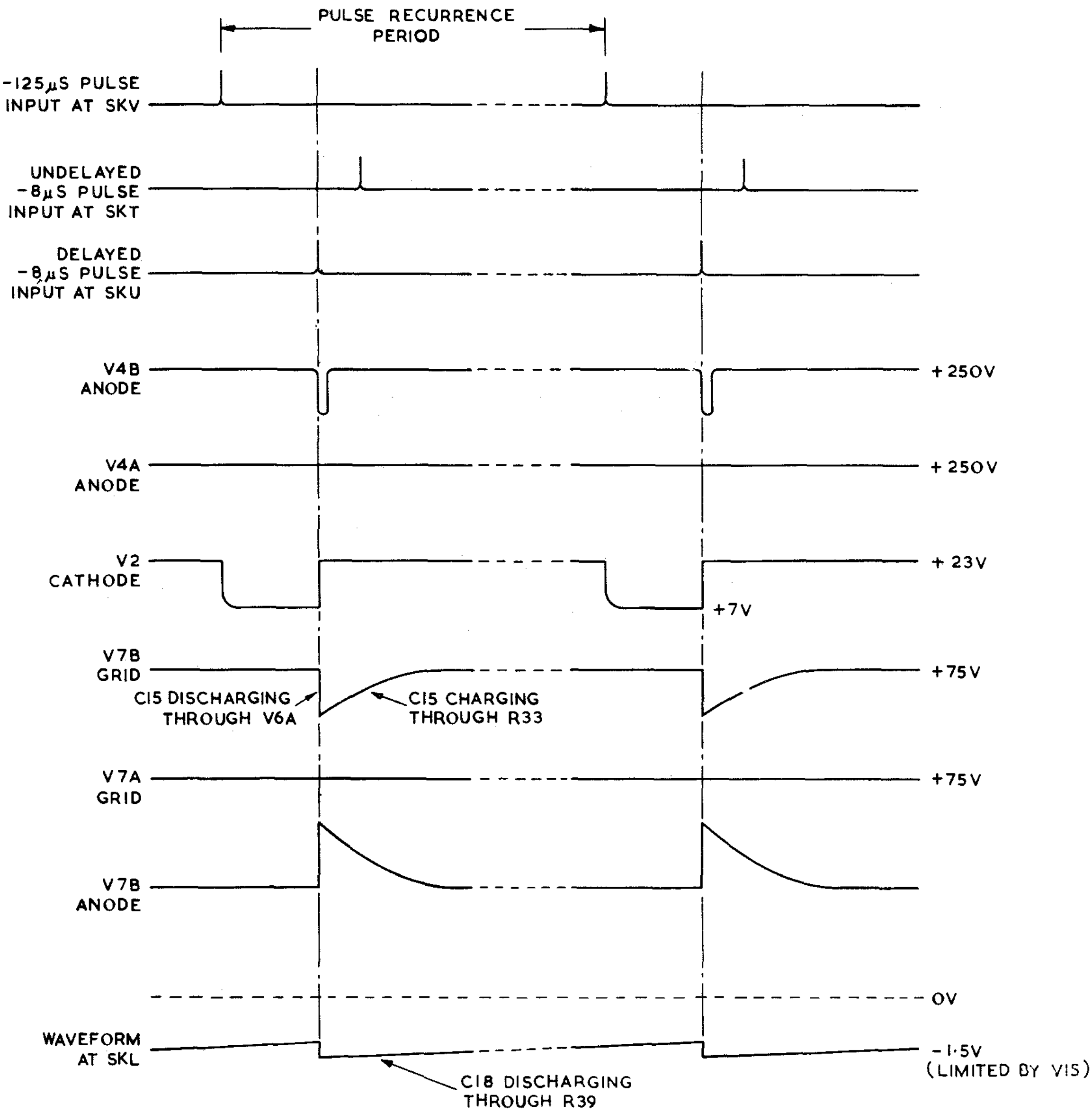

Fig. 4. Effect of delay error

prevents the motor from overrunning the correct delay point and then hunting back and forth to find it again. Secondly, it prevents the 100 c/s waveform obtained from V9 under no error conditions, from driving the motor. The voltage is only applied under small error conditions. If the error becomes large enough to operate the fault circuits, the relay contacts RLA2 open and disconnect the voltage from the motor, allowing it to rotate at normal speed. The metrosil X1 prevents sparking at RLA2 contacts.

Fault indicating system

20. Valves V11 and V1b and their associated circuit form a monitoring system to indicate when a large delay error has occurred. Initially V1b is conducting with its grid at cathode potential due to grid current through R63 and R65, and RLA is energized. The 50 c/s error signal developed at V13 anode is d.c. restored by V11 so that it appears at V11 anode (monitored at SKQ) as a sine wave about a negative d.c. level equal to approximately the peak amplitude of the 50 c/s. The sine wave is smoothed by R66 and C27 and the resulting d.c. level applied to V1b grid cutting off this valve and de-energizing RLA. Contacts RLA1 connect the 6·3V a.c. supply to the unit fault lamp LP1, contacts RLA2 disconnect the motor braking voltage (*para.* 19) and contacts RLA3, via PLB/1 and the cabinet fault relay assembly, complete the supply circuit to the cabinet fault lamp. The circuit utilizes Miller effect by connecting C27 from grid to anode instead of from grid to earth reducing considerably the size of the capacitor. No fault indication is given for the small errors in delay caused by temperature changes.

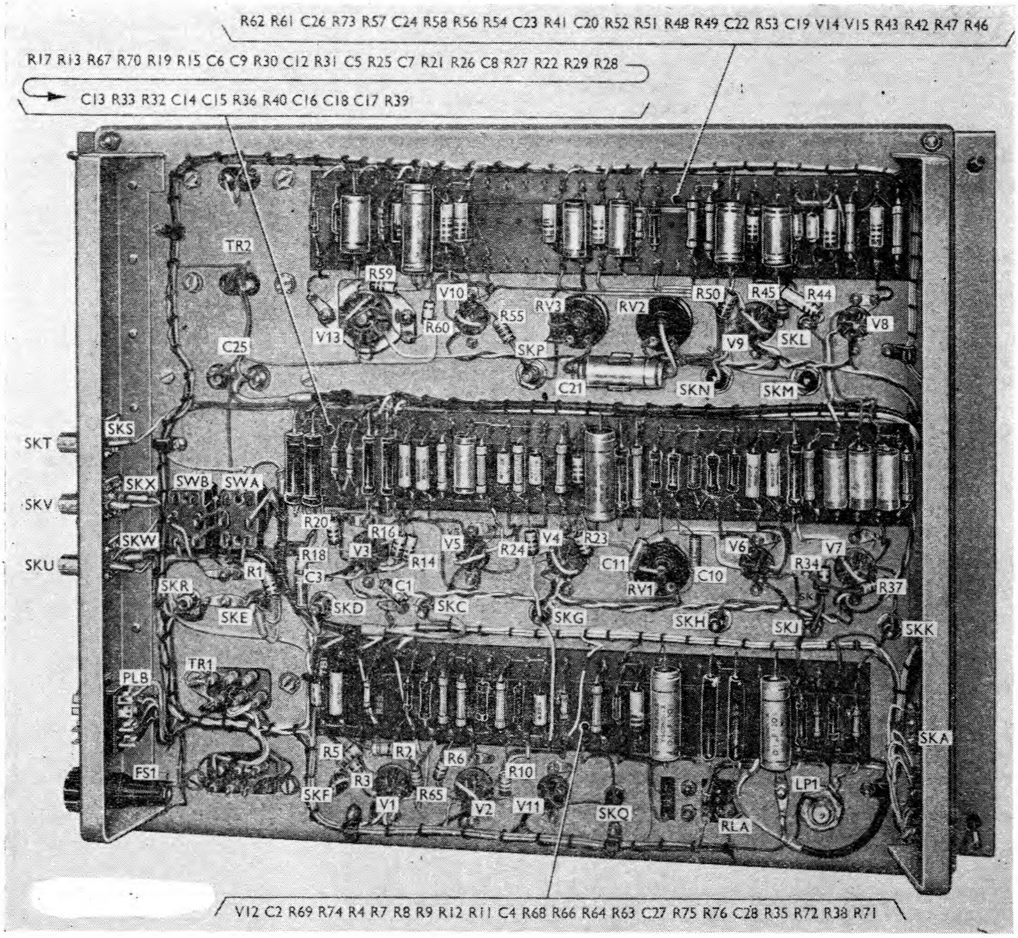

Fig. 5. Controller (p.r.f.) M2 : rear view

Alignment switches

21. The NORMAL/ALIGN and MOTOR OFF/NORMAL switches SWA and SWB are used during the initial setting-up of the equipment. With SWA switched to the ALIGN position, the undelayed −8 micro-seconds pulse is applied to both grounded grid amplifiers V3a and V3b and thence to both grids of V4. The steady d.c. level on V9b grid (monitored at SKL) can then be set to zero by RV1, i.e. so that the outputs from V4a and V4b are balanced. The control RV2 is adjusted to produce a 100 c/s wave-form at V13 anode (monitored at SKQ), i.e. zero output from the balanced modulator V9. Switch SWB, when switched to the MOTOR OFF position, breaks the motor supply from TR1, preventing the motor on the variable delay line from being driven unnecessarily during the setting up procedure. Both SWA and SWB, when not in the NORMAL position, disconnect the h.t. supply to V1b (via SWA2 and SWB2), thus de-energizing RLA and switching on the fault lamps.

Monitor point waveforms

22. Using the monitoring oscilloscope M1 (*Sect.* 7, *Chap.* 4) the idealized waveforms and d.c. levels existing at test sockets SKC to SKR under normal operating conditions (i.e. no delay error and switches SWA and SWB in the NORMAL position) are as indicated in fig. 6. Voltages shown in the illustration indicate the approximate amplitudes of the waveforms.

Test readings

23. With the multimeter Type 100 connected to socket SKA via the plug-to-socket adaptor, with SWA and SWB in the NORMAL position and with RV1 to RV3 correctly adjusted, the readings obtained should be as indicated in Table 1.

TABLE 1
Multimeter readings

Multi-meter switch position	Stage moni-tored	Measured across resistor	Reading	Tolerance
A	V1a	R67	0·6	±0·12
B	V1b	R74	0·42	±0·08
C	V2b	R68	0·5	±0·1
D	V3a	R67	0·48	±0·1
E	V3b	R70	0·52	±0·1
F	V7b	R71	0·48	±0·1
G	V7a	R72	0·5	±0·1
H	V9	R52	0·6	±0·12
J	V10	R73	0·52	±0·1
K	V13	R62	0·52	±0·1

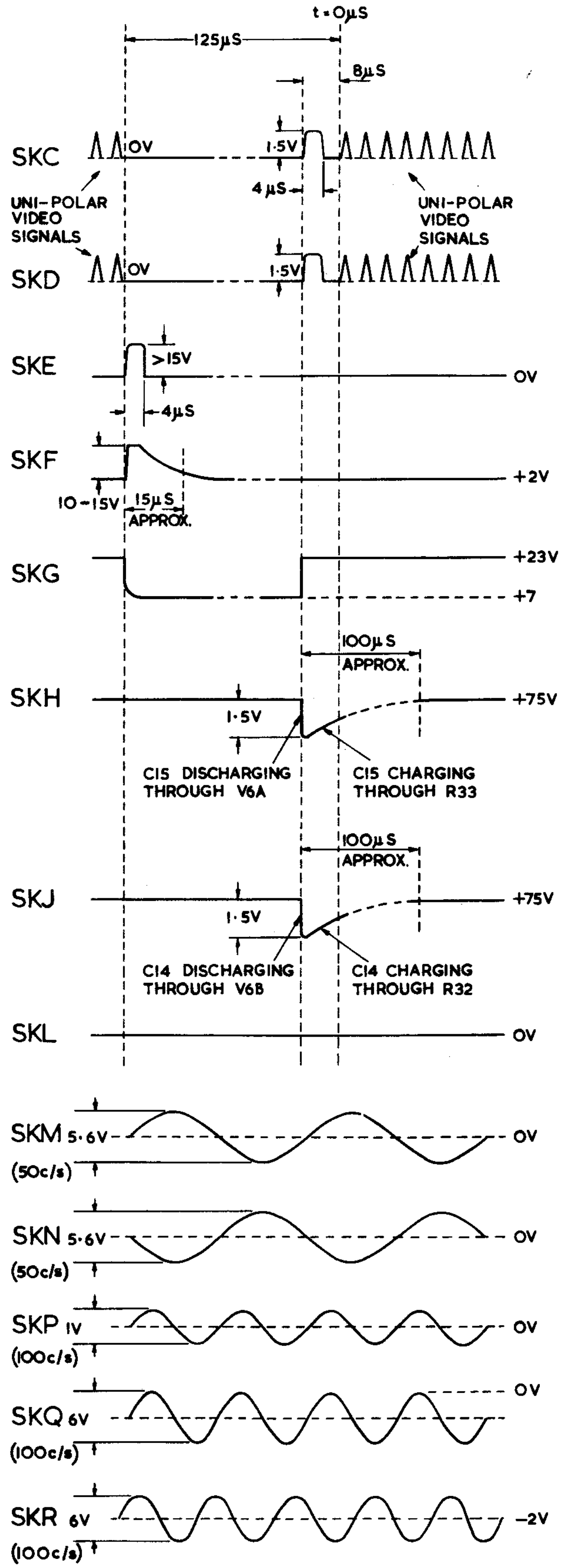

Fig. 6. Monitor point idealized waveforms

Controller (p.r.f.) M2: circuit

Fig. 7

Chapter 11

AMPLIFIER (VIDEO)

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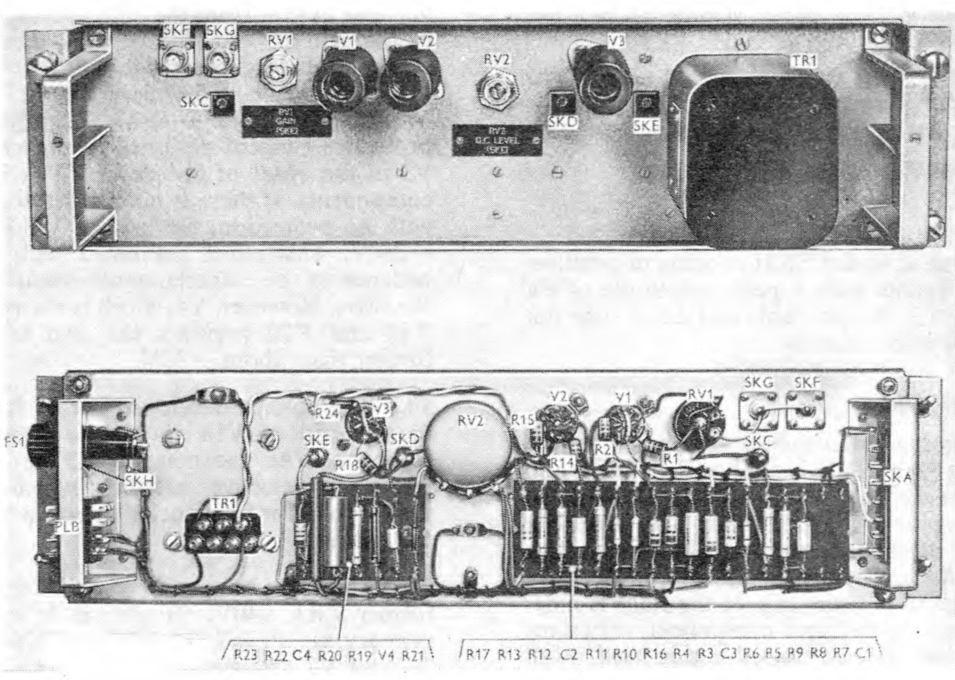

Fig. 1. Amplifier (video): front and rear views

Introduction

1. The purpose of the amplifier (video) (*fig.* 1) is to amplify the video signals to a value suitable for display purposes. Five of these units are used in the Type 84 equipment, one in each monitor console input and the fourth and fifth in channels 1 and 2. The amplifiers are located in frame 3 of the video cabinet.

2. The amplifiers for consoles 1 and 2 and for channels 1 and 2 receive their signal input from relay assembly M2 (*Chap.* 6) whilst that for console 3 receives its input from relay assembly M3 (*Chap.* 9).

3. Each unit (*fig.* 2) consists of a three-stage d.c. amplifier having an overall linear amplification factor of not less than 3. The first stage is a long-tailed pair, which feeds into a cathode-follower isolating stage. The cathode-follower prevents the capacitive load from adversely affecting the long-tailed pair. The output stage is another cathode-follower designed to give sufficient power output to drive into the 75-ohm output load. Negative feed-back is applied from the output to the longtailed pair to aid linearity. Facilities are provided for the control of gain and output d.c. level.

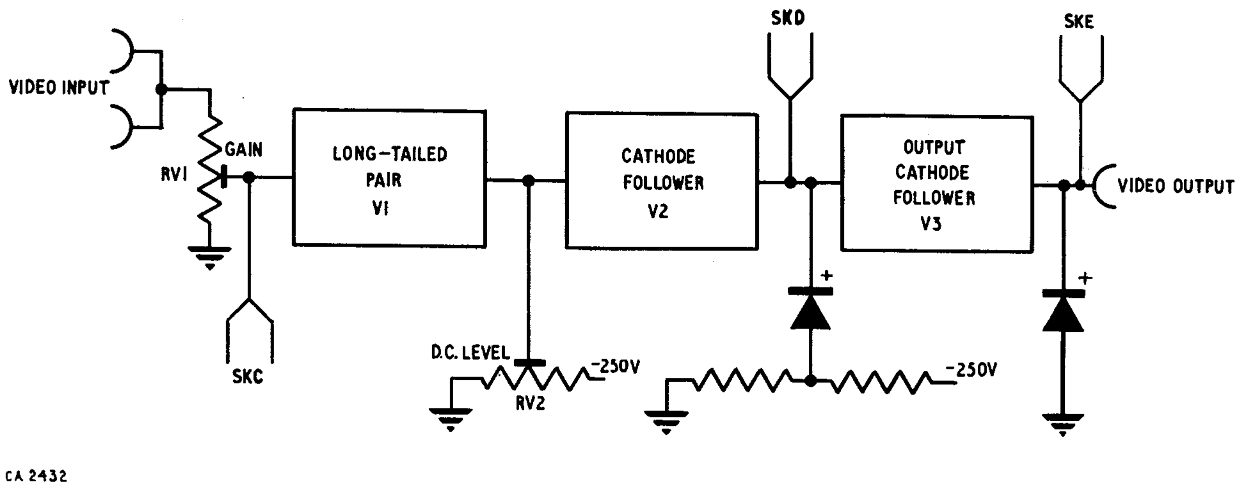

Fig. 2. Amplifier (video): block schematic

Performance characteristics

Inputs

4. Each amplifier requires the following inputs:—

(1) Positive-going video signals of not less than 1·5V amplitude at socket SKF.

(2) 240V, 50 c/s single-phase a.c. at 0·2A via FS1 at PLB/7 and PLB/10.

(3) +250V at 30mA at PLB/9.

(4) −250V at 30mA at PLB/11.

Output

5. The output at socket SKH consists of positive-going video signals with a peak amplitude of 6V (CA 2432) into a 75-ohm cable and a rise time not exceeding 3·0 microseconds.

Circuit description (*fig*. 3)

6. Positive-going video signals are applied to the grid of V1 via SKF (SKG is not normally used) and the GAIN (SKE) control RV1. V1 forms a long-tailed pair operating as a high stability d.c. amplifier producing a positive output at V1a anode. The anode loads R8 and R11 of the halves of the valve are made large so that the gain of the stage is independent of h.t. supply and component variations and is dependent only on the valve gain itself. With a long-tailed pair, the gain is half that of a single valve and in this instance is 25. The anode circuits are balanced by R7–C1 and R12–C2 respectively, to ensure that the current flow is equally distributed between the halves of the valve.

7. The resistor R5 in the cathode circuit acts as a safety device in the event of a failure in the stage, e.g. loss of input, and prevents the cathodes of V1 from approaching −250V with consequent damage to the valve.

8. The output from V1a anode is applied to the grids of the cathode follower V2. The bias on these grids can be adjusted to set the d.c. level of the signal by the LEVEL (SKE) control RV2. This stage is used to act as an isolator between V1 and V3. The input capacitance of V3 is high (10 pF) and this would adversely affect the rise time of the signal if the output stage directly followed V1. The gain of V2 approaches unity.

9. The output from the cathodes of V2 is applied to the grid of V3. This valve is used as a power cathode-follower to provide sufficient drive into the low impedance (75-ohms) output circuit. The overall stage gain is 0·25. The diode V4 is a protective element designed to prevent damage to V3 in the event of failure of V2 or its associated components. If there is no current flow in V2, then with no protection, the grid of V3 will approach −250V. This effect combined with the low impedance of the cathode would result in damage to the valve. However, V4, which is biased to −36V by R19 and R20 prevents the grid from dropping further than about −30V.

10. The voltage developed across R23 is applied to the grid of V1a via R4 to provide negative feedback. The components R3 and C3 form a frequency selective network which gives more weight to lower frequencies and so helps to preserve the rise time.

11. The valve heaters are supplied from the transformer TR1. 240V, 50 c/s a.c. is applied to the primary via PLB/7, PLB/10 and FS1. The valves V1 and V2 are supplied with 12·6V and V3 with 6·0V via R24 from the centre-tapped secondary. The +250V and −250V supplies are applied to the unit via PLB/9 and PLB/11 respectively.

Monitoring facilities

12. Facilities for monitoring are provided at SKC, SKD and SKE. RV2 is adjusted to give a d.c. level of 0V ±0·1V at SKE and RV1 is adjusted to give a minimum output of 6·0V at SKE with a video input of 1·5V (CA 2432).

Test readings

13. With a multimeter Type 100 connected to SKA (via the adapter, plug to socket) a reading of 0·5 ±0·1 should be obtained at positions A, B, C and D of the meter selector switch.

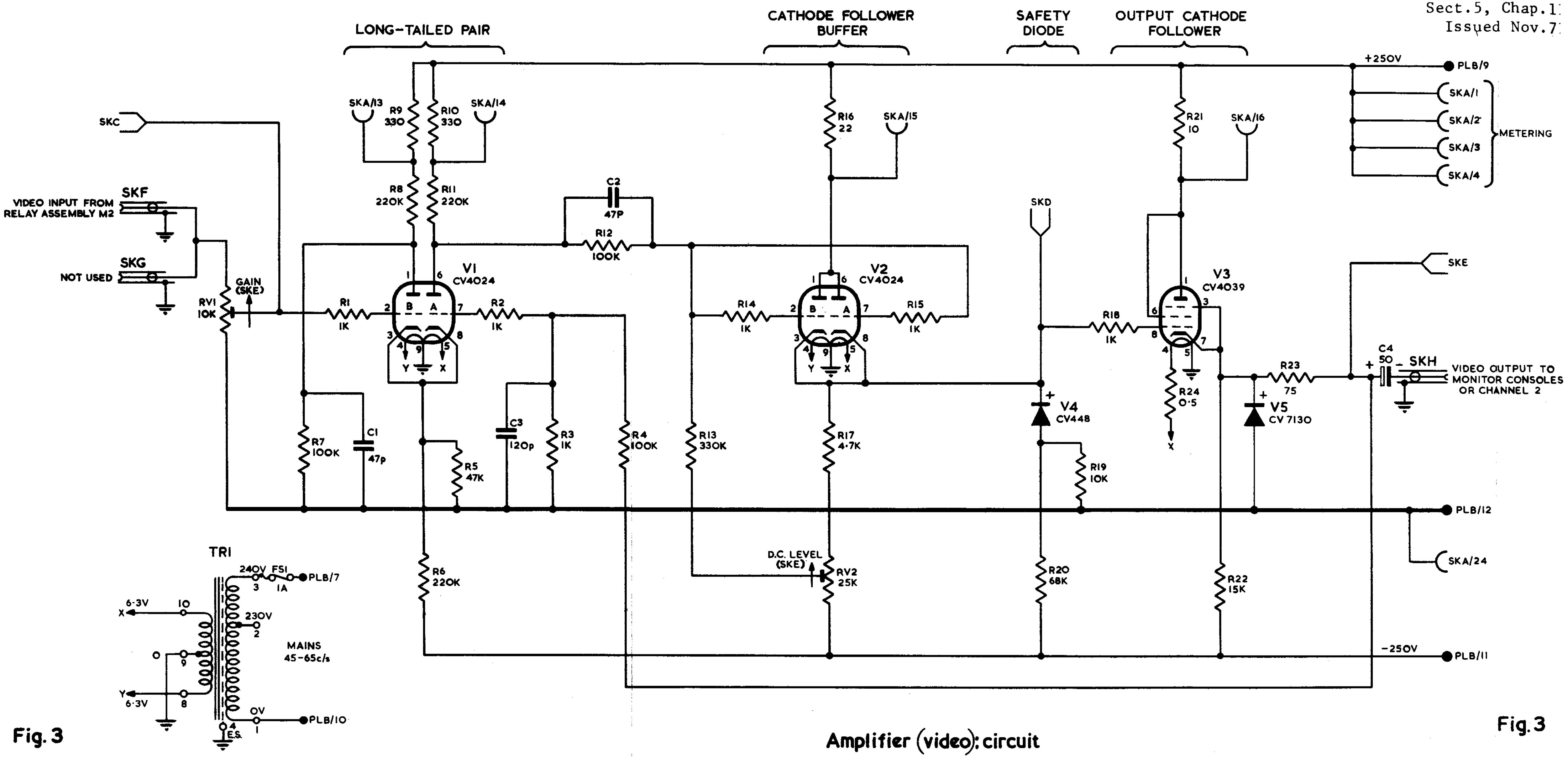

Fig. 3

Amplifier (video): circuit

Fig. 3

Chapter 12

GATE, ELECTRONIC (BLANKING)

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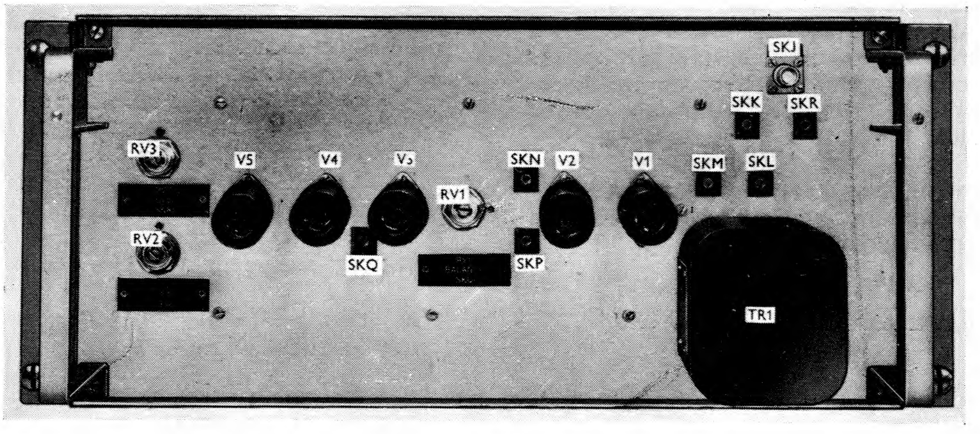


Fig. 1. Gate, electronic (blanking): front view

Introduction

1. The gate, electronic (blanking) (*figs.* 1 *and* 3) forms part of the p.r.f.d. system and its purpose is to blank out any video signals occurring between t_{-125} and t_0. This ensures that the -8 micro-second pulses used for timing are the only signals to reach the controller (p.r.f.) M2 (*Chap.* 10) during this period, thus preventing the occurrence of unnecessary delay corrections in the delay line (variable) M6 (*Chap.* 3).

2. The unit is located in frame 1 of the video cabinet and consists of a cathode-coupled flip-flop, a cathode follower stage and a clamping circuit which provide the blanking, with a cathode follower stage and a standard video amplifier for the video signals (*fig.* 2).

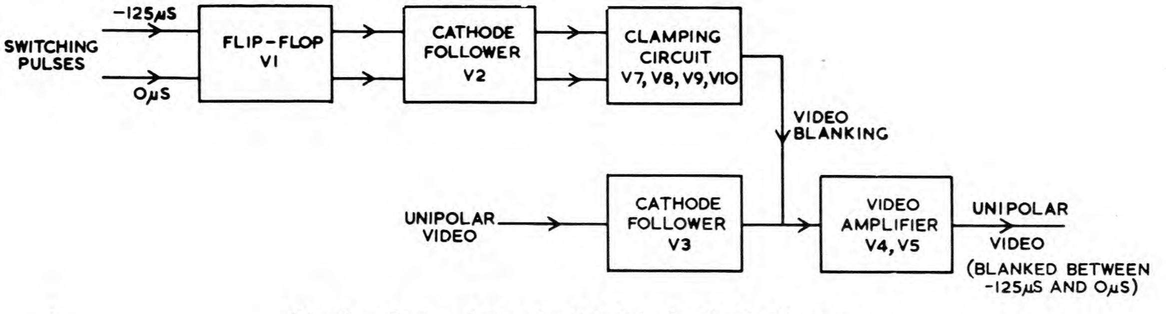


Fig. 2. Gate, electronic (blanking): block diagram

3. The blanking of the video signals is carried out by using the positive- and negative-going square waves generated by the flip-flop to switch on and off a diode clamp which controls the passage of video signals.

4. The flip-flop is triggered on by a −125 microseconds pulse from the relay assembly M1 (*Sect.* 6, *Chap.* 9) and remains on until it is retriggered by an 0 microsecond pulse from the relay assembly M1. This retriggering ensures that no video signals are lost after t_0. Two outputs are taken from the flip-flop to the cathode follower stage where they are used to control a four-diode clamping circuit.

5. Video signals from the relay assembly M2 (*Chap.* 6) are applied to a cathode follower stage, the output of which is fed to the video amplifier. The clamping circuit is also connected to the video amplifier. During the display period, the diodes in the clamping circuit are cut off and present a high impedance at the input to the video amplifier, thus allowing the video signals to pass through.

6. At t_{-125} the flip-flop is triggered and its resulting outputs cause the diodes to conduct, thus presenting a low impedance at the video amplifier and virtually short circuiting the video signals. This condition is maintained until the flip-flop reverts to its stable state by virtue of its time constant or by the application of a pulse at t_0. Immediately, the diodes are cut off again and the video signals are allowed to pass through.

7. The video amplifier consists of a long-tailed pair and a cathode follower and provides for a limited amount of level and gain adjustment.

Performance characteristics

Inputs

8. The unit requires the following inputs:—

(1) 240V 50c/s single phase a.c. at PLB/7 and PLB/10.

(2) +250V at 60 mA at PLB/9.

(3) −250V at 50 mA at PLB/11.

(4) A −125 microseconds pulse, amplitude **not less than 15V with a width of** 4 microseconds **nominal ±1 microsecond at socket SKG.**

(5) An 0 microsecond pulse, amplitude **not less than 15V** with a **width of 4 microseconds nominal ±1 microsecond at socket SKE.**

(6) Unipolar video at a level of 1·5V ±0·1V on a d.c. level of 0V ±0·1V at socket SKC.

Sockets SKD, SKF and SKH are not used, SKD being terminated in 75 ohms.

Output

9. The unit delivers an output of unipolar video at a level of 1·5V ±0·1V on a d.c. level of 0V ±0·1V at socket SKJ. This output is blanked out for 125 microseconds before the start of the display trace.

Circuit description (*fig.* 5)

Power supplies

10. The valve heater supplies are provided by transformer TR1 the primary of which is supplied with a.c. mains via PLB/7, FS1 (1A) and PLB/10. The +250V and −250V supplies enter the unit at PLB/9 and PLB/11 respectively and are derived from the +250V regulator mounted at the top of frame 1 in the video cabinet.

Blanking waveform generator

11. The blanking waveform is produced by V1, which with its associated components forms a cathode-coupled flip-flop. Under quiescent conditions V1a is conducting and V1b cut off. With the arrival of the −125 microseconds pulse at the grid of V1b, this half of the valve is forced into conduction and by the common cathode connection V1a is cut off. The circuit remains in this stage for a period determined by the time constant C2, R11 (this is approximately 125 microseconds) when it reverts to its original condition, i.e. with V1a conducting and V1b cut off.

12. In order to ensure that no video signals are lost, an 0 microsecond pulse is applied to the anode of V1b via socket SKE. This pulse effectively cuts off V1b if this has not already occurred naturally. As the negative-going portion of the input pulse is sufficient to trigger the circuit again the diode V6 is used to clip this portion off.

13. The components C8, R1 and C9, R2 in the input circuits to V1 enable the unit to be used with either a high- or low-impedance pulse input.

14. Two outputs are taken from V1, a positive-going square wave from V1a and a negative-going square wave from V1b. The outputs, which are approximately 30 volts in amplitude, are taken to the grids of V2 via C3 and C4 respectively.

Cathode follower and clamping circuits

15. The valve V2 is a double cathode follower with V2a grid at approximately +10V and V2b grid at approximately −10V. The negative-going output from V1 is applied to V2a grid and the positive-going to V2b grid. At the cathodes of V2 there are two outputs, a positive-going square wave which starts at a negative level and rises through zero at V2b and a negative-going square wave which starts at a positive level and falls through zero at V2a. These two waveforms are used to bring the clamping circuit into and out of conduction.

16. The clamping circuit consists of diodes V7, V8, V9 and V10 and its purpose is to clamp the video signals at the video cathode follower V3 to zero level. This is achieved by lowering the output impedance of the clamping circuit to as near zero as possible. During the display trace period the diodes are cut off by virtue of the positive and negative bias voltages at V2, and at the junction of V9 and V10 a high impedance exists. When the square wave outputs appear at V2 cathodes, the

bias on the diodes is reversed as each output goes through zero and the diodes conduct bringing the junction of V9 and V10 to a low impedance value. The resistors R23 and R24 are used to match the impedance between the cathodes of V2 and the clamping circuit.

Video cathode follower

17. The video input enters the unit at socket SKC and is fed to the grid of V3 via the capacitor C5. The signals are d.c. restored by the diode V11 to a level determined by the setting of the BALANCE (SKQ) control RV1. This control is adjusted to eliminate any step in the blanking period, as monitored at socket SKQ, caused by the impedance of the individual diodes in the clamp affecting the clamping point.

18. During the display trace period the video signals are developed across the potentiometer network formed by R28 and the impedance of the clamping circuit. As this impedance is high the video signals experience very little attenuation as they are passed to the grid of V4. During the 125 microseconds period that the clamping diodes are conducting and the impedance is at a low level the junction of R28 and the clamping circuit is near zero and the video signals are virtually short-circuited.

Video amplifier

19. The video signals from the cathode of V3 are fed to the grid of V4. The valve V4 forms a long-tailed pair operating as a high stability a.c. amplifier and producing a positive-going output at V4a anode. The anodes of the two valves are slightly unbalanced by making C6 larger than C7. This gives better linearity of the stage plus a certain amount of increased gain without materially affecting the d.c. conditions.

20. The output of V4a anode is taken to the grids of the output cathode follower V5. The bias on these grids can be adjusted to set the d.c. level of the video signals by means of the LEVEL (SKR) control RV3. The overall gain of the stage is controlled by varying the feedback between V5 cathode and V4a grid by the GAIN (SKR) control RV2. The video output is taken from socket SKJ, R40 being used to match the output to the 75 ohm output cable.

Monitoring facilities

21. Facilities for monitoring are provided at sockets SKK to SKR. Idealized waveforms at these points are given in fig. 4. RV1 is adjusted to eliminate any step in the blanking waveform at sockets SKQ and RV2 is adjusted to give a video output of 1·5V peak on a d.c. level of 0V ±0·1V (set by RV3) at socket SKR.

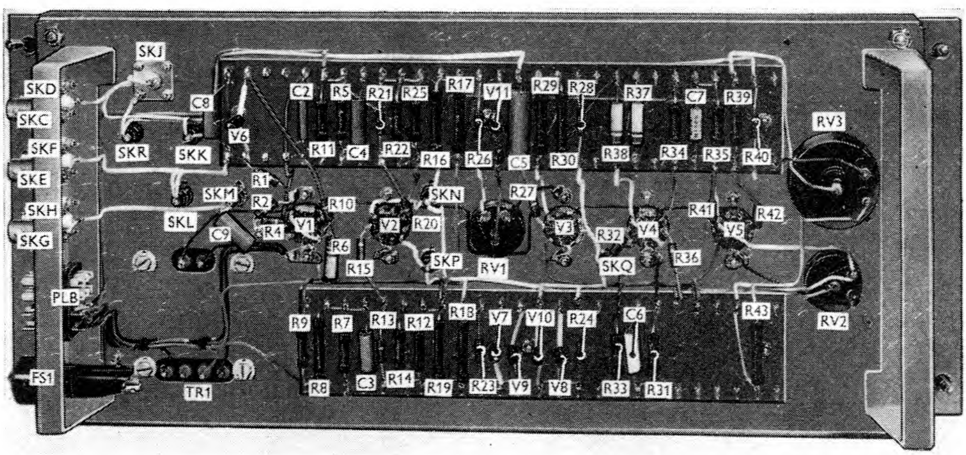
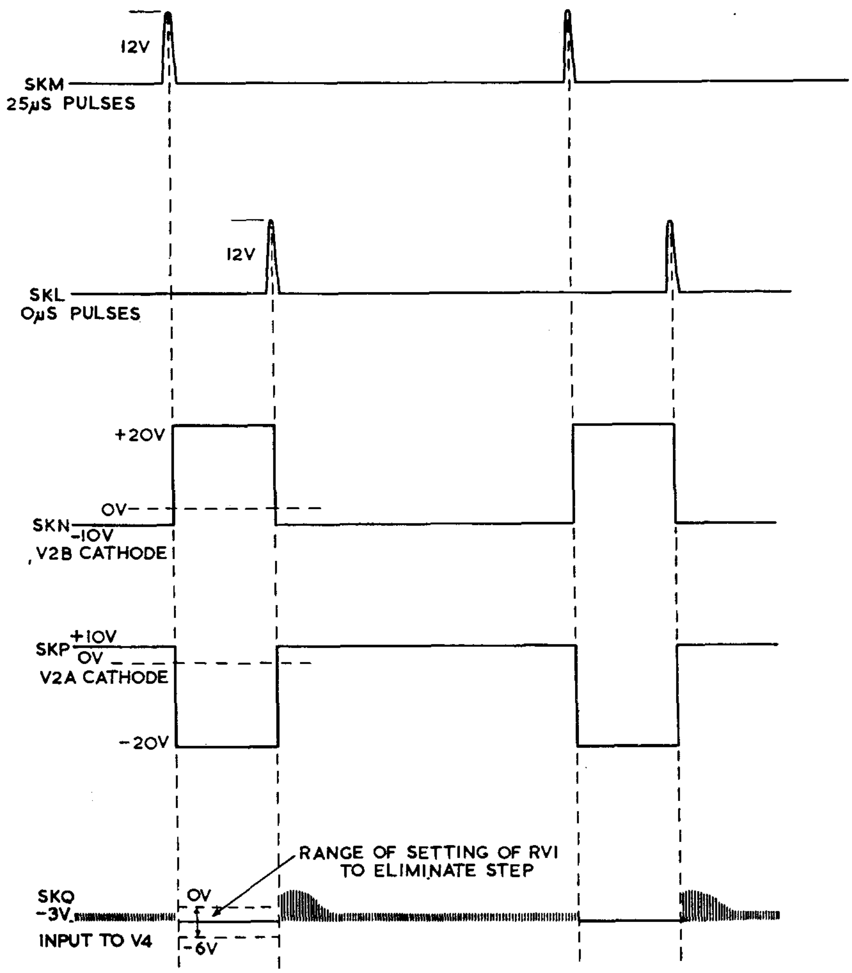


Fig. 3. Gate, electronic (blanking): rear view



SKR AS SKQ BUT WITH VIDEO SET ON ZERO D.C. LEVEL

Fig. 4. Monitor point idealized waveforms

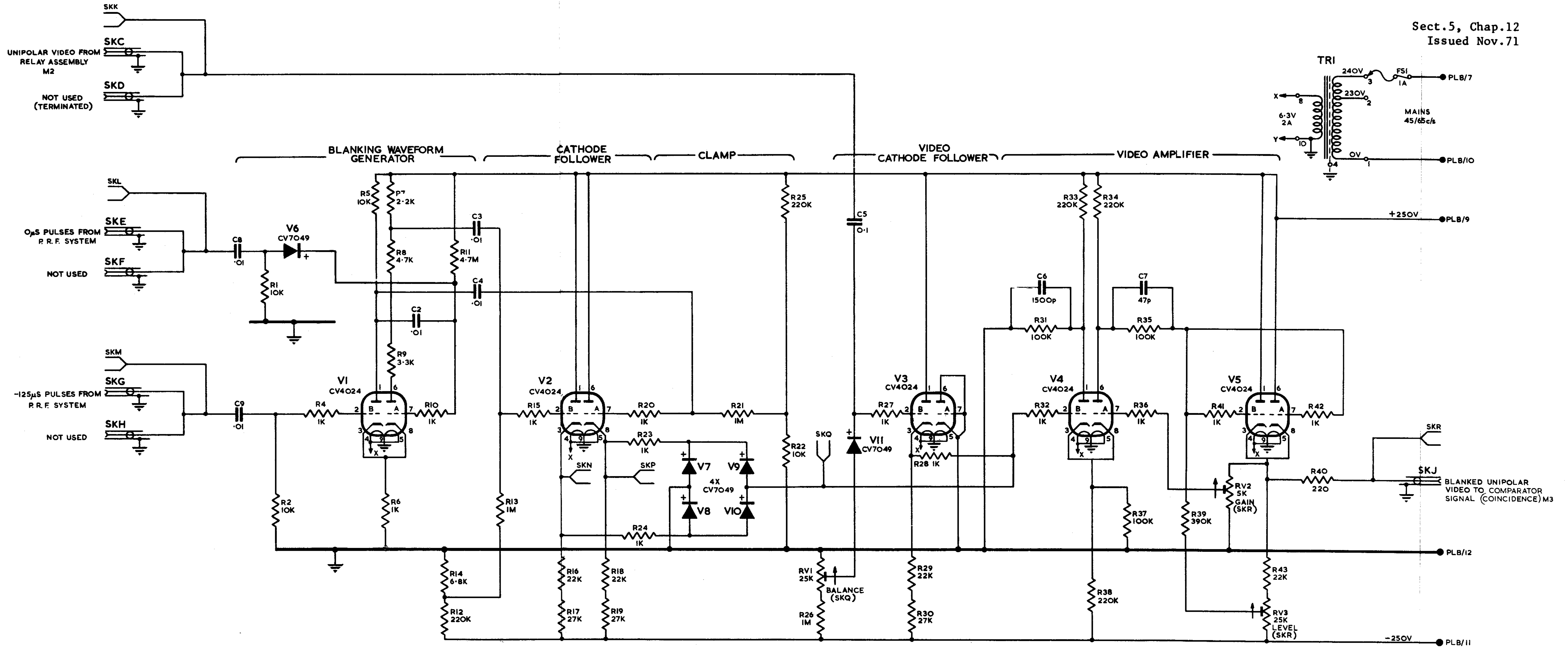


Fig. 5

Gate, electronic(blanking): circuit

Fig. 5

SECTION 6

P.R.F. CABINETS

Section 6

P.R.F. CABINETS

Note . . .

The timing pulses for the Type 84 *radar and associated equipment were formerly derived from two p.r.f. cabinets which formed part of the Type* 84 *signal processing equipment. This method of triggering has now been replaced by the no-break trigger system, which is a separate equipment described in A.P.*4769*E. Accordingly the two p.r.f. cabinets have been deleted from the Type* 84 *equipment, and their description has been deleted from this handbook. The regulator voltage* (−250*V*) *M*4, *which was described in Chap.* 10 *of this section, is used elsewhere in the Type* 84 *equipment; a description of it is to be found in A.P.*4769*DA, Sect.* 2, *Chap.* 19.

SECTION 7

POWER SUPPLY CABINET

Chapter 1

POWER SUPPLY CABINET AND INTERCONNECTIONS

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Purpose of cabinet

1. The cabinet, electrical equipment M47 (*fig.* 1 *and* 4) provides accommodation for various units of power equipment and distribution, a resolver unit for the doppler compensation circuits and an oscilloscope for monitoring purposes. A block diagram of the units in the cabinet is shown in fig. 2.

2. The power and distribution equipment consists of a +250V and −250V power unit for the emergency display channel, two voltage regulator units, each containing two regulator circuits, which provide −250V for the cancellation, i.f., doppler and video cabinets and a lampholder assembly which provides fusing and distribution of the +450V and −50V bulk power supplies. The lampholder assembly also provides 6·3V for the unit and cabinet fault lamps in the signal processing system.

3. A comprehensive system of fault indicating lamps is provided on the cabinet and power and regulator units. The circuits are fully described in the appropriate chapters and a brief description is given in para. 15.

4. The resolver unit converts aerial rotational information into 500 c/s resolved voltages suitable for application to the wind DIRECTION controls on the console suite, for doppler compensation purposes.

5. The monitoring oscilloscope provides a means of monitoring the units in the signal processing system. The instrument is synchronized by a −8 microsecond pulse from the p.r.f. system

Mechanical description

6. The power cabinet is similar in its external construction to the other cabinets in the signal processing system, as described in the Appendix to Sect. 2, Chap. 1. In this instance, however, the units are mounted across the full width of the cabinet and not on individual frames.

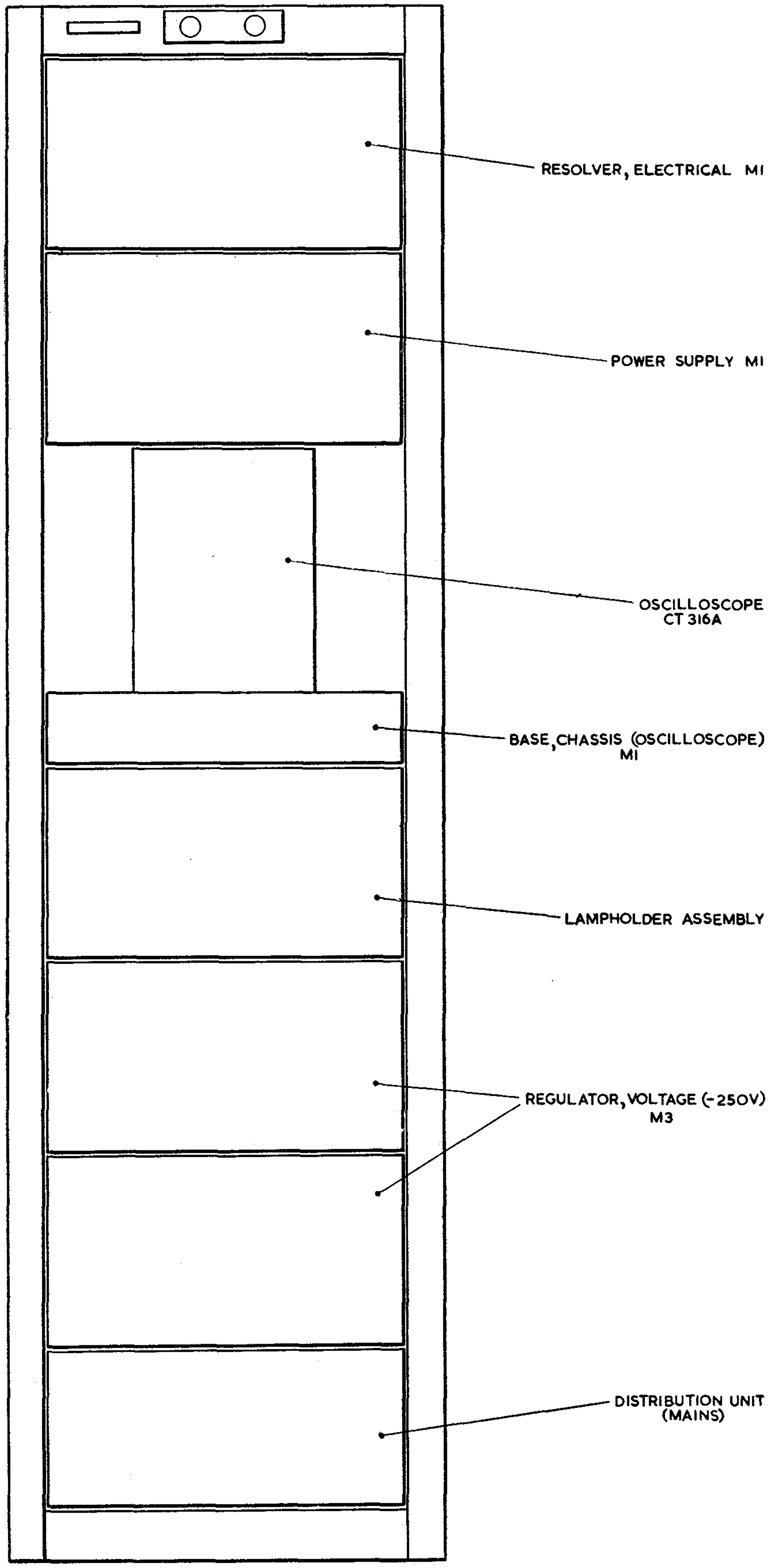
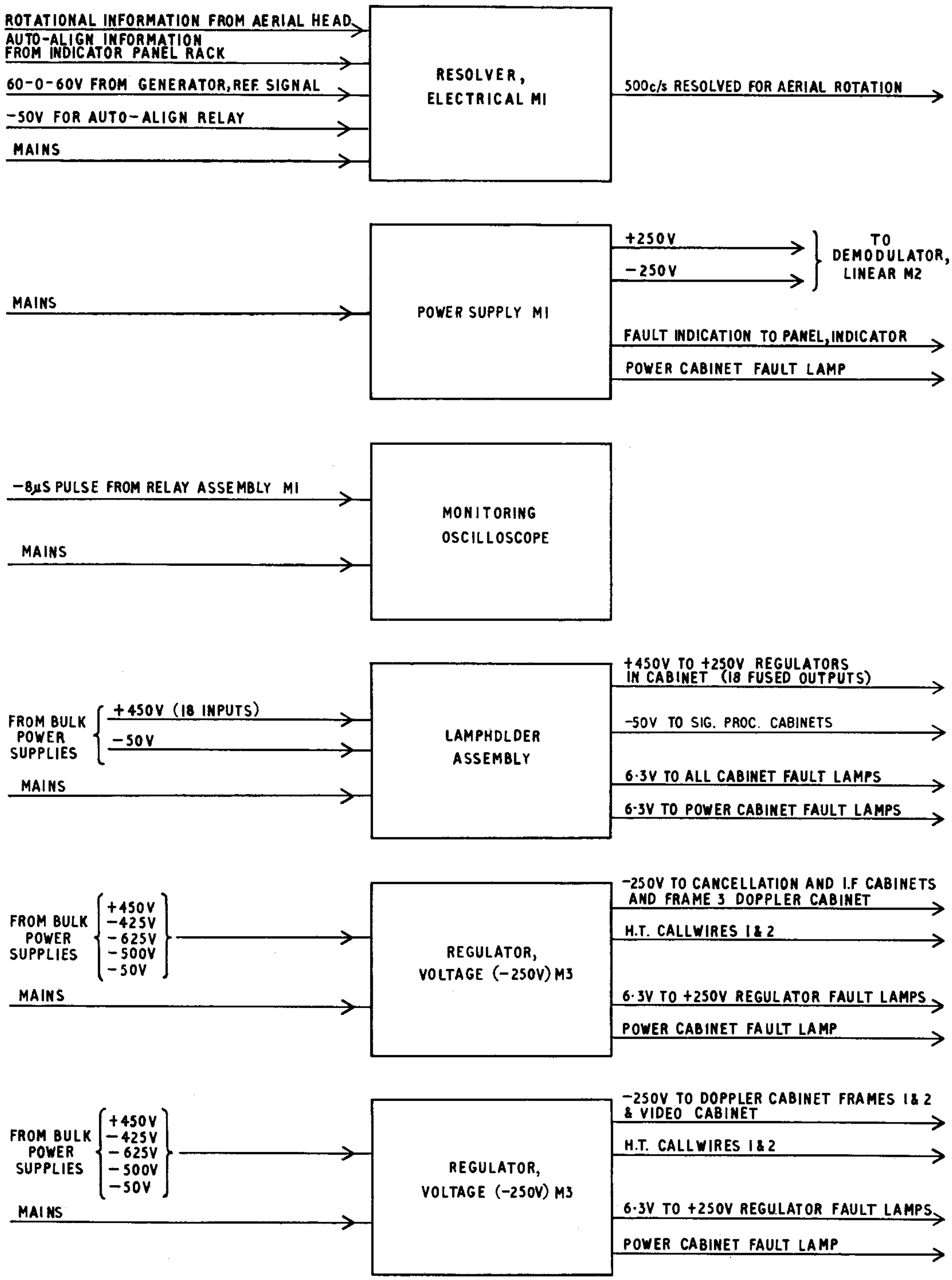


Fig. 1. Power cabinet : front view



◀**Fig. 2. block diagram**▶

7. Each unit is mounted on telescopic runners by means of six captive screws and, in addition, all units, with the exception of the oscilloscope, are held in the cabinet by captive screws on their respective front panels. The oscilloscope is fastened by spring clips in order that it may be withdrawn from the cabinet during monitoring operations.

8. The cabinet distribution panel (*fig.* 3) is mounted at the bottom rear of the cabinet. A corresponding panel on the front of the cabinet provides three 3-pole fused mains outlets for ancillary equipment.

9. The units can be removed from the cabinet by releasing the captive screws on their front panels, where applicable, drawing them forward to the full extent of the telescopic runners, removing the connecting plugs and sockets and undoing the captive screws which retain the units on the runners.

10. The oscilloscope is mounted on a base and when withdrawn from the cabinet can be rotated on either side of its stowed position to provide convenient viewing of its screen. In order to prevent damage to the instrument, in the event of its being pushed back into the cabinet in other than the correct position, a guide bracket is fitted to each side of the cabinet. These brackets are so shaped as to move the oscilloscope into the correct position. Each bracket carries a spring clip at the rear into which the spigots on the oscilloscope base locate.

11. A list of weights and dimensions of the individual units is given in Table 1.

Electrical description

Cabinet wiring

12. The cabinet wiring is carried in a single cableform between the distribution panel and the various units. This cableform also carries the inter-unit wiring and is held in position by the cabinet structure. The connections to each unit are taken off the cable form and cleated to a cable strap mounted on the telescopic runners.

13. The only coaxial cable in the cabinet is the one which feeds the −8 microseconds pulse to the oscilloscope. This cable is carried in the main cableform from socket SKA on the distribution panel.

Power distribution

14. Distribution of power supplies within the cabinet are shown in fig. 5. Also included in the diagram are the inputs and outputs of the units not directly concerned with the power function of the cabinet.

Fault circuits

15. In general, the fault circuits associated with the cabinet and the units are fully described in the chapters covering the appropriate units. A brief description is given here to show the association between the cabinet and unit fault lamps.

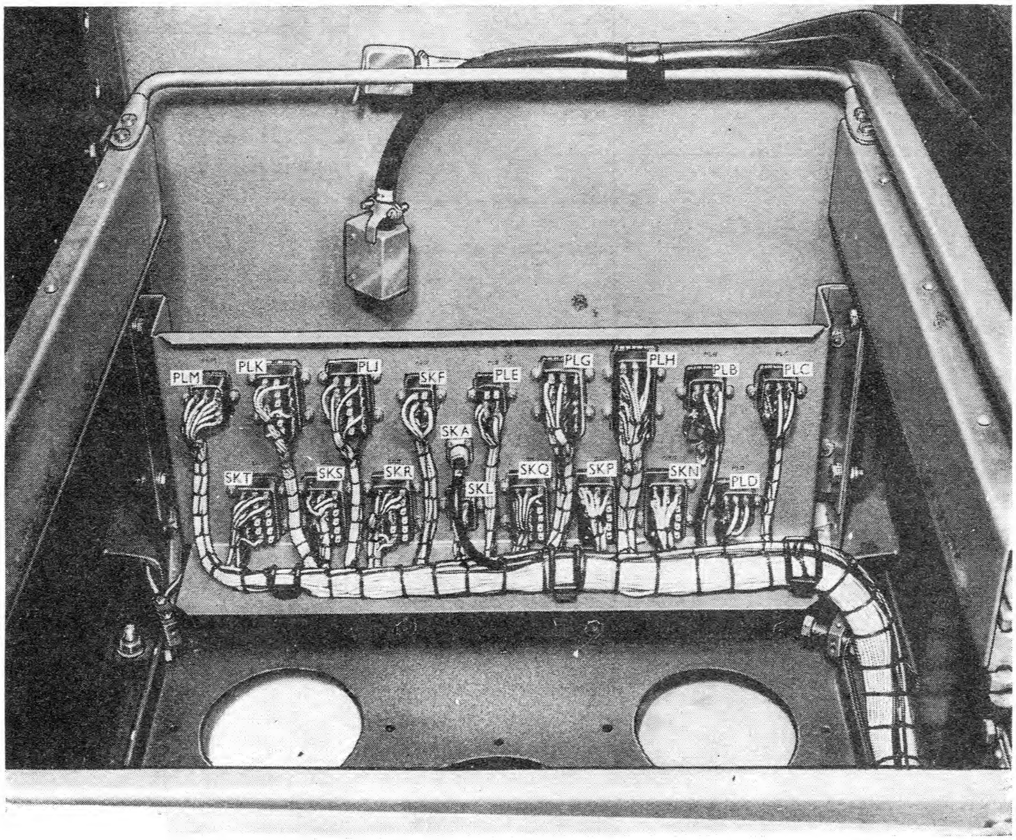


Fig. 3. Cabinet distribution panel

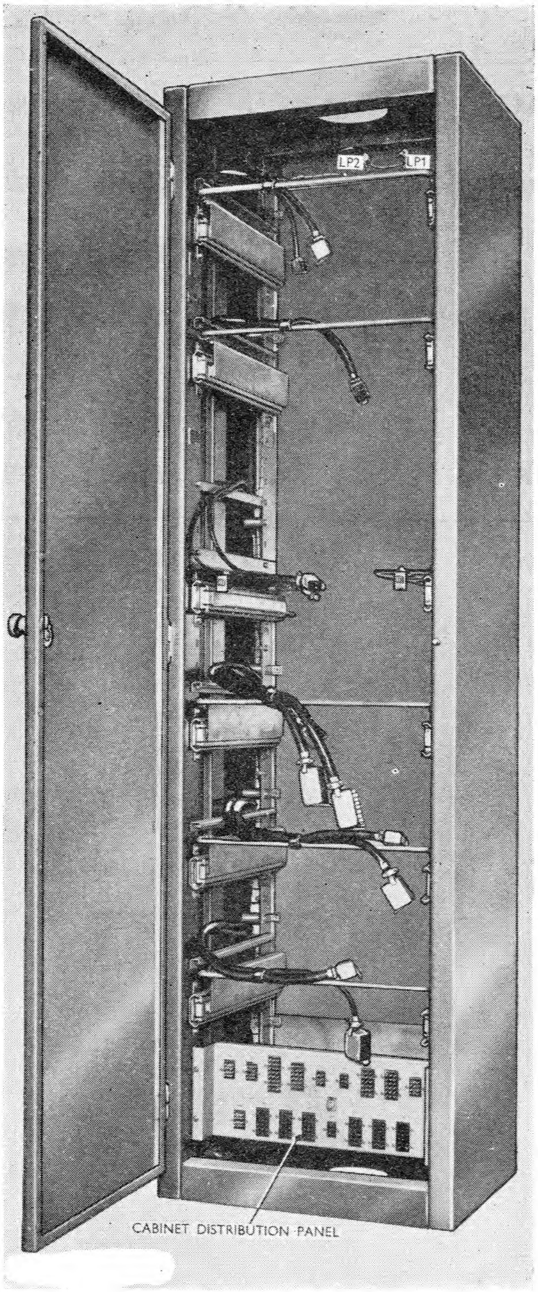


Fig. 4. Cabinet, electrical equipment M47 : rear view

16. Two fault indicating lamps are mounted on the upper front of the cabinet and these give indication of faults in the —250V and —50V supplies respectively. The power and regulator units also carry their own fault lamps. In these units and also in the lampholder assembly, certain voltages act as holding voltages for relays which become de-energized when the particular voltage fails. Contacts on these relays then complete the circuit to the unit fault lamp, where applicable, and also to the appropriate fault lamp on the cabinet. In addition, a fault circuit is taken from the power supply unit to the indicator panel mounted above the console suite.

17. In the event of a mains failure to the regulator units provision is made, by means of a relay, to break the —50V supply to the h.t. call wires in these units and thus disconnect the bulk power supplies. This prevents damage to the valves which would be caused by their being run with h.t. supplies but with no heater supplies.

TABLE I

Weights and dimensions

Title	Dimensions (inches)	Weight	A.M. Ref.	Chapter
Cabinet, electrical equipment M47	$84\frac{1}{4} \times 23\frac{1}{2} \times 25\frac{1}{4}$	440 lb	10D/23280	1 and Appendix 1 to Sect. 2, Chap. 1
Resolver, electrical M1 (incorporating drive unit, mechanical).	$17\frac{1}{2} \times 19\frac{1}{4} \times 10\frac{3}{8}$	55 lb	10AE/2147	3
Power supply M1	$17\frac{1}{2} \times 19\frac{1}{4} \times 10\frac{3}{8}$	35 lb	10K/21346	2
Base, chassis (oscilloscope) M1 (incorporating oscilloscope Type CT316A).	$17\frac{1}{4} \times 19\frac{1}{4} \times 20\frac{1}{4}$	61 lb	10D/22639	4
Lampholder assembly	$17\frac{1}{2} \times 19\frac{1}{4} \times 10\frac{3}{8}$	16 lb	10AE/2148	6
Regulator, voltage (—250V) M3	$21 \times 19\frac{1}{4} \times 10\frac{1}{2}$	45 lb	10D/22638	5

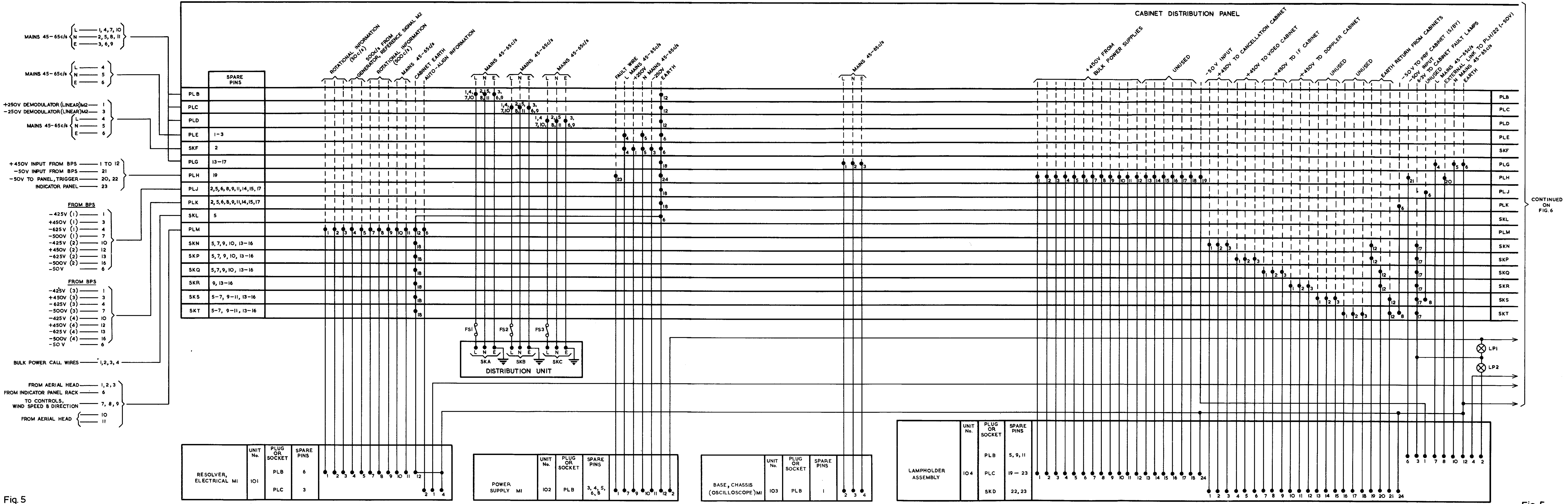


Fig. 5

Power distribution

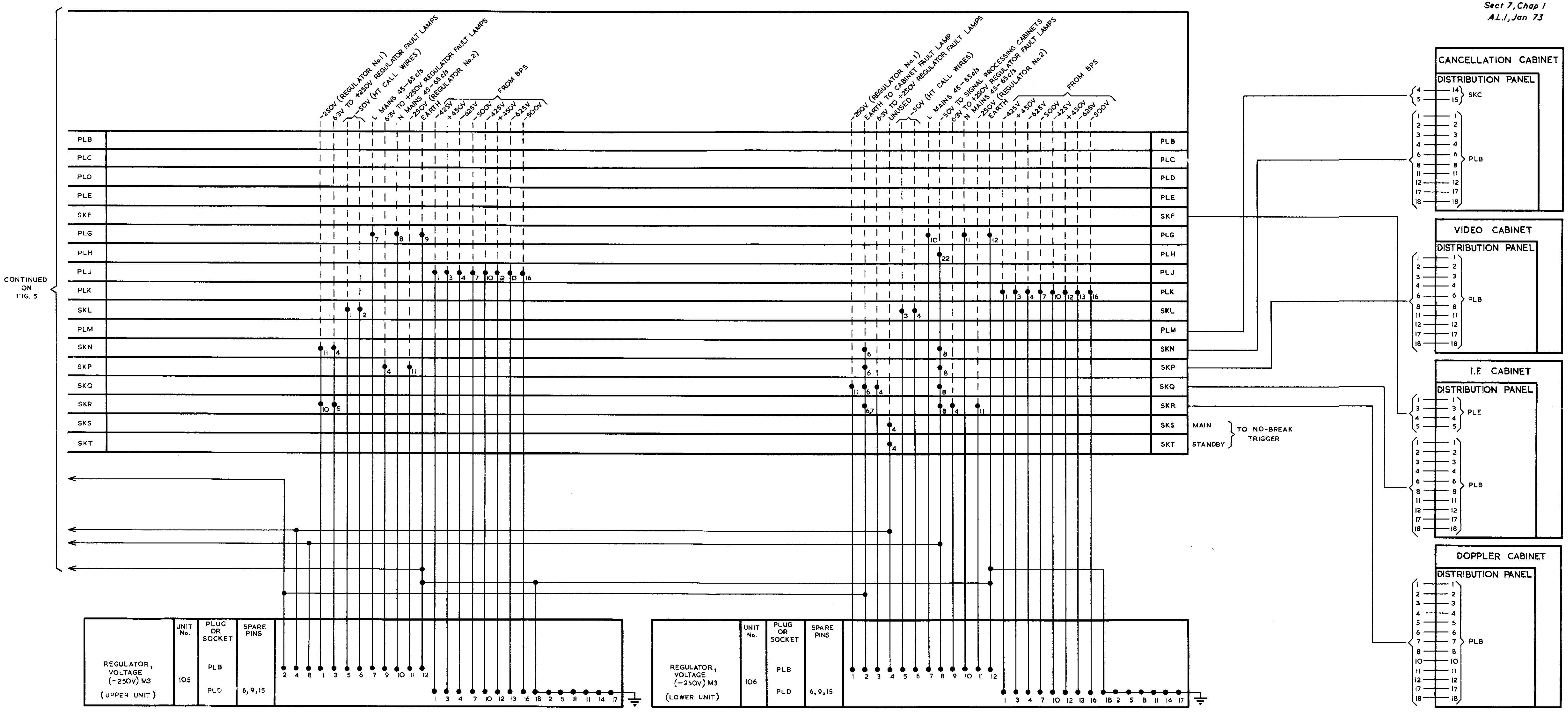


Fig. 6 Power distribution Fig. 6

Chapter 2

POWER SUPPLY M1

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Introduction

1. The purpose of the power supply M1 (*fig*. 1) is to provide +250V and −250V supplies for the demodulator (linear) M2 (*Sect*. 2, *Chap*. 14) in the anti-jamming signal channel. This ensures that in the event of a failure of the signal processing system some form of radar display is still available to the operator.

2. The unit consists of two full-wave rectifier circuits with associated regulators, one providing the +250V output and the other the −250V output (*fig*. 2). The negative output is used as a reference for the positive.

3. A relay is included in each output to provide fault indication facilities. In addition, the relay in the −250V output controls the +250V output.

Performance characteristics

Input

4. The unit requires 240V 50c/s single-phase a.c. at PLB/7 and PLB/10.

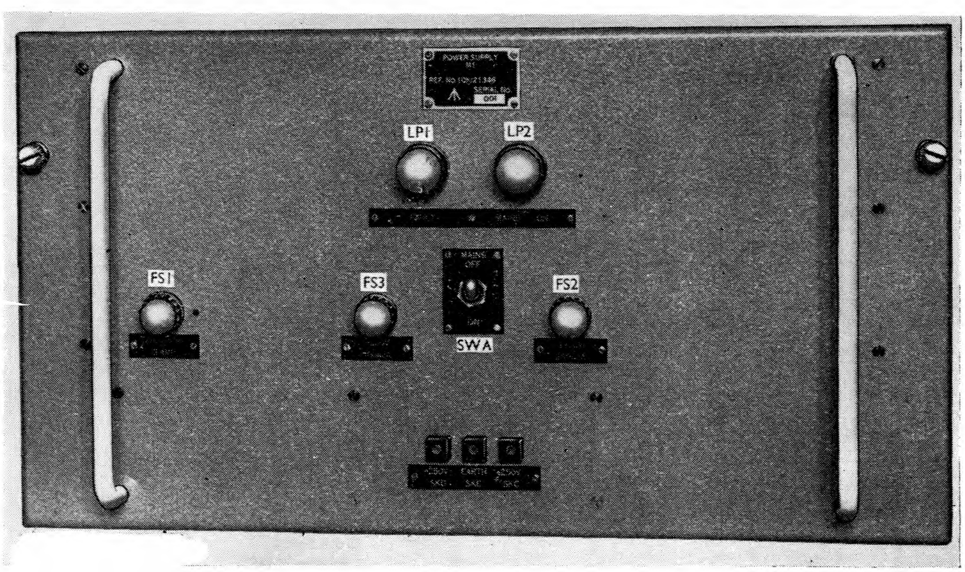


Fig. 1. Power supply M1: front view

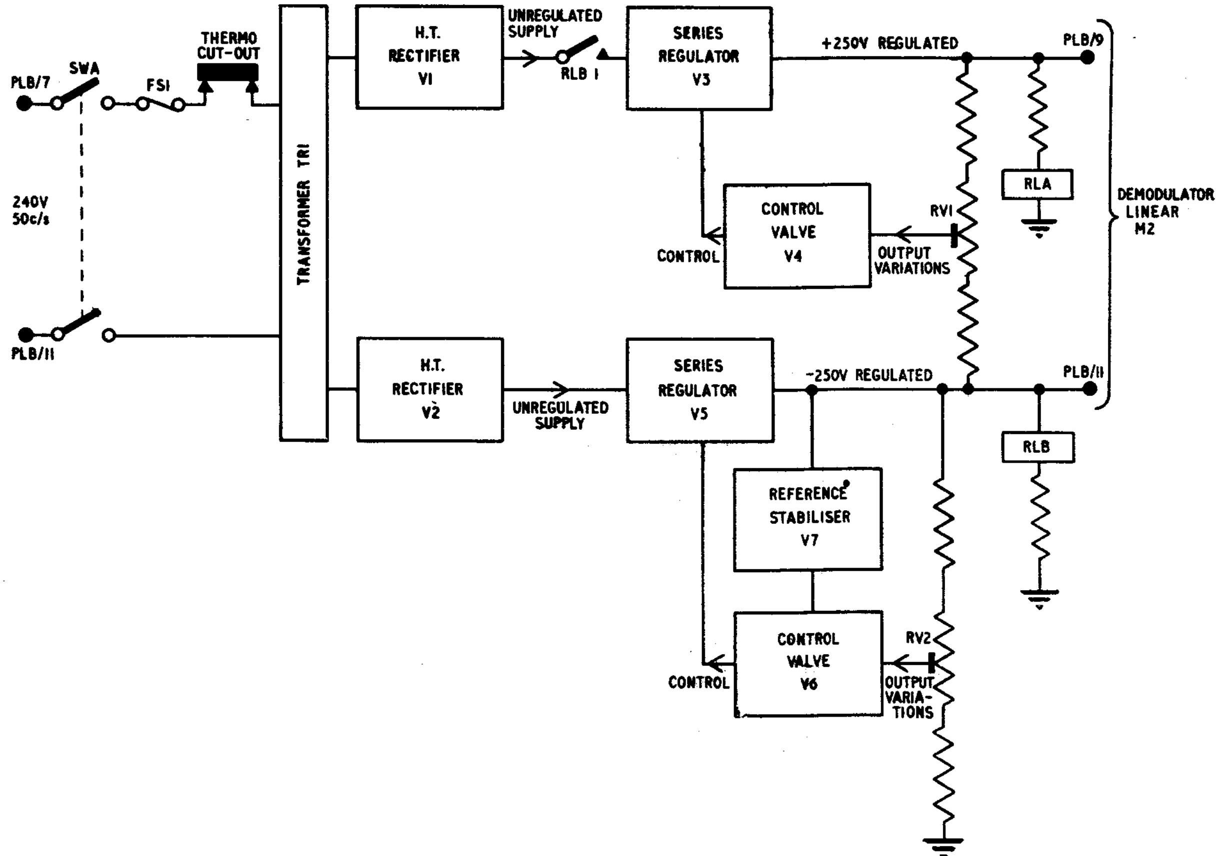


Fig. 2. Power supply M1: block schematic

Outputs

5. The following outputs are provided:

(1) +250V ±2V with a peak ripple of less than 20 mV at 150 mA from PLB/9. This output is fused by FS2 (250 mA).

(2) −250V ±2V with a peak ripple of less than 10 mV at 50 mA from PLB/11. This output is fused by FS3 (100 mA).

Circuit description (*fig.* 6)

Switching sequence

6. With SWA operated, 240V a.c. is applied to the transformer TR1 via the fuse FS1 (3A) and the thermo cut-out X1. From the relevant windings of the transformer, supplies are available for the valve heaters and rectifier anodes. The MAINS ON lamp LP2, the unit FAULT lamp LP1 and the cabinet FAULT lamp are also illuminated.

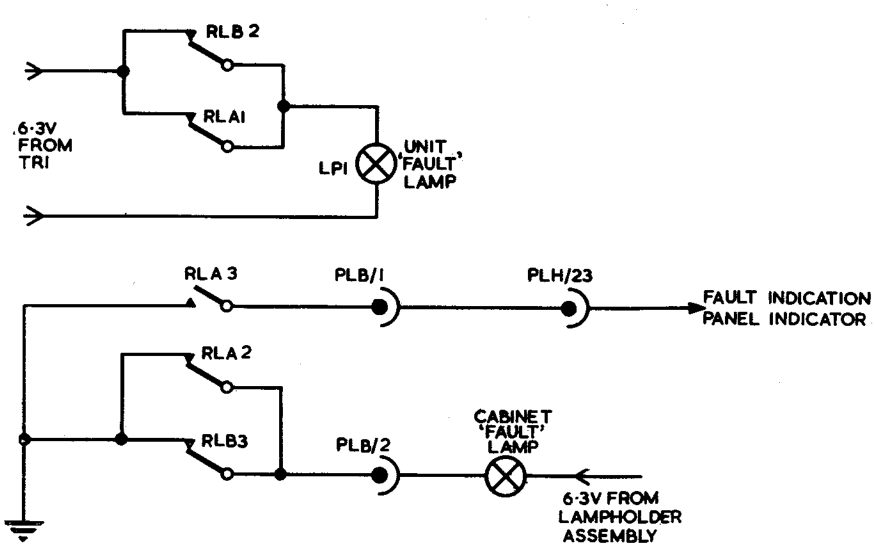


Fig. 3. Fault indication circuits

7. When the −250V output becomes available, relay RLB operates and contacts ◀RLB1▶ complete the +250V supply. Spark suppression at contacts RLB4 is provided by C5 and R4. Relay RLA operates when the +250V output is available and its contacts extinguish the unit and cabinet FAULT lamps.

Note . . .

Owing to the large amount of iron in the transformer TR1 there is a high current surge when switching on. For this reason a fuse link of the anti-surge type is used for FS1. This requirement is indicated by a green dot adjacent to the fuseholder on the front panel of the unit.

Thermo cut-out

8. As a safeguard against overheating of the transformer TR1, a thermo cut-out ◀(10AE/654)▶ is fitted to the transformer casing. This cut-out is wired in series with the primary. If the transformer temperature exceeds a safe value, a soft metal plug fitted in the cut-out melts and releases a spring-loaded contact which open-circuits the primary.

Rectification

9. The valves V1 and V2 are full-wave rectifiers, V1 being used for the +250V supply and V2 for the −250V supply. Each d.c. output is smoothed by a capacitive input filter consisting of C1, C2 and L1 for the positive circuit and C3, C4 and L2 for the negative. The output from each filter is applied to the associated regulator circuit, in the case of the positive supply via relay contacts ◀RLB1.▶ The switching of the positive regulation circuit ensures that the reference voltage is immediately available to the positive output.

Regulation

10. The circuits of both regulators are similar with the exception that the stabilizer valve V7 is included in the cathode of the control valve V6 in the negative regulator. This provides the necessary reference voltage for the negative regulator, which, in turn, supplies the reference for the positive regulator.

11. As the reference voltage is obtained from the negative regulator its operation only will be described. The regulation circuits include V5 and V6. V5 is connected in a series regulatoı circuit which ensures that the current passed by the valve is automatically corrected by grid control to bring the output voltage back to its original value should any fluctuation occur.

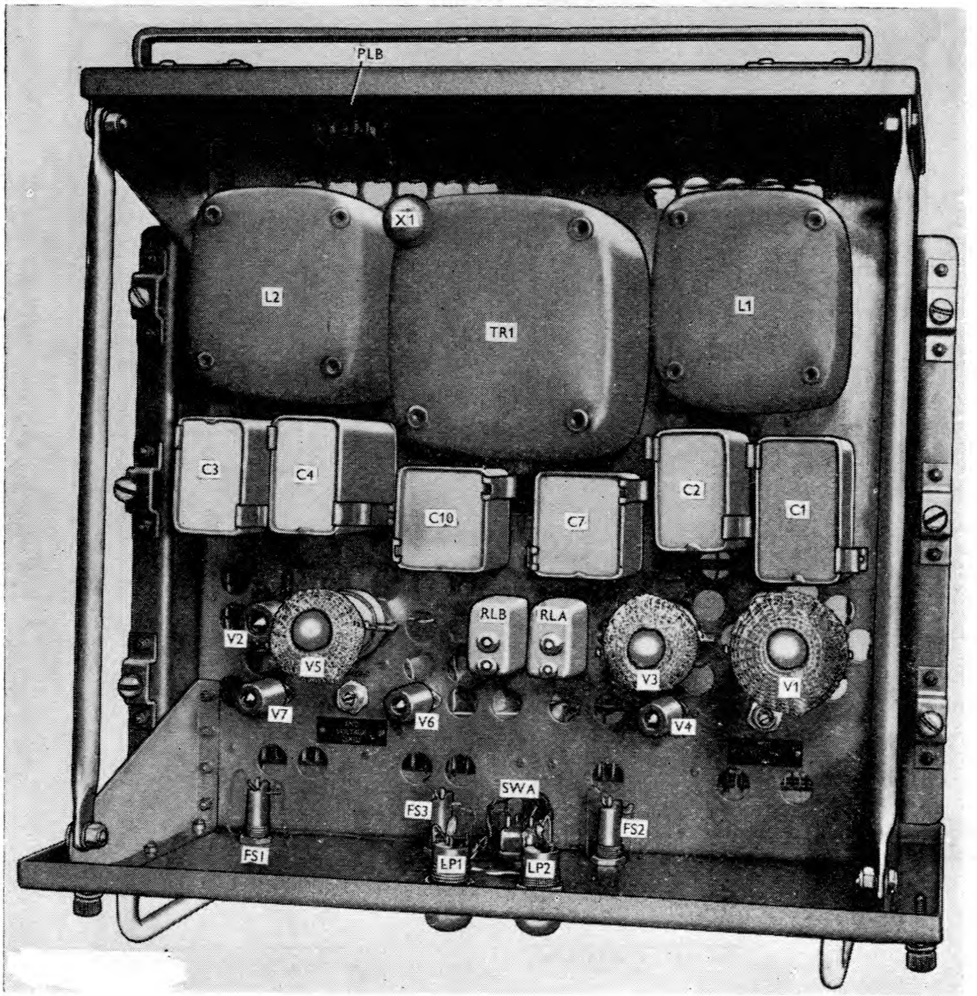


Fig. 4. Power supply M1: top view

12. The associated control amplifier V6 receives its h.t. supply from the input to the regulator. The resistor and capacitor combination R25 and C11 is used for smoothing purposes.

13. The grid of V6 is returned via R27 to the slider of the VOLTAGE (SKD) potentiometer RV2. RV2 forms part of the resistor chain between −250V and earth. The capacitor C9 and resistor R26 provide smoothing facilities for the grid of V6.

14. If, for example, the −250V output tends to rise towards earth the grid to cathode voltage of V3 will fall and its anode current will decrease, raising the anode voltage. This change of voltage is communicated to the grid of the series regulator via R20. The raising of grid volts on V5 will lower the impedance of the valve. Thus the original change in output voltage will be counteracted by less voltage drop occurring across V5.

Fault indication circuits (fig. 3)

15. Fault indication facilities are provided by relay RLA in the +250V output and relay RLB in the −250V output.

16. With the unit operating normally the unit and cabinet FAULT lamps are extinguished and an earth return is provided for the indicating circuit on the panel, indicator.

17. If either supply should fail the relays will become de-energized and contacts RLA1 or ◀RLB2▶ will complete the 6·3V supply from TR1 to the unit FAULT lamp. Contacts ◀RLA2▶ or RLB3 will complete the earth return for the cabinet FAULT lamp.

18. Contacts ◀RLA3▶ control the fault circuit for the indicator panel and fault conditions will be shown if either or both supplies fail.

Test readings

19. The +250V output can be monitored by a multimeter Type 1 connected between SKC and SKE. The VOLTAGE (SKC) potentiometer RV1 should be adjusted to give a reading of +250V ±2V under load conditions.

20. The −250V output can be monitored under similar conditions between SKD and SKE. The VOLTAGE (SKD) potentiometer RV2 should be adjusted to give a reading of −250V ±2V under load conditions.

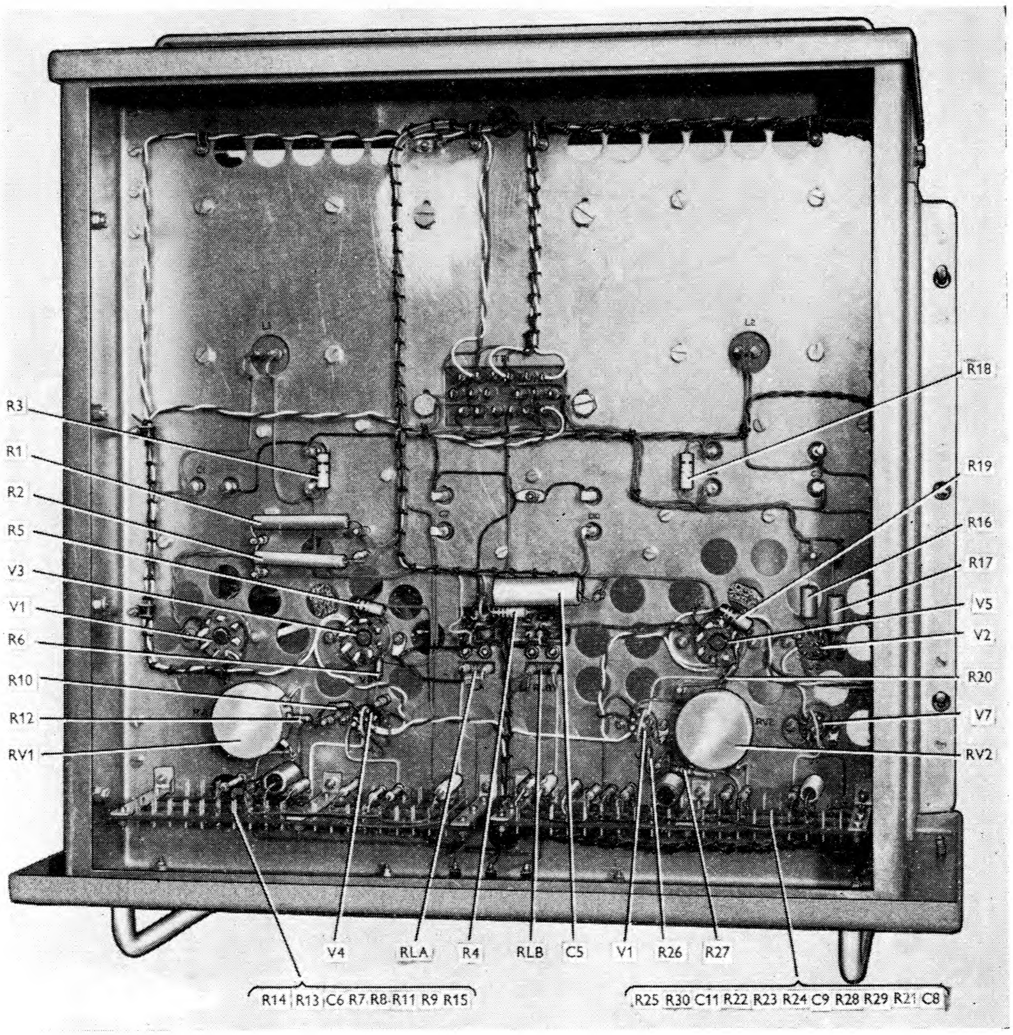
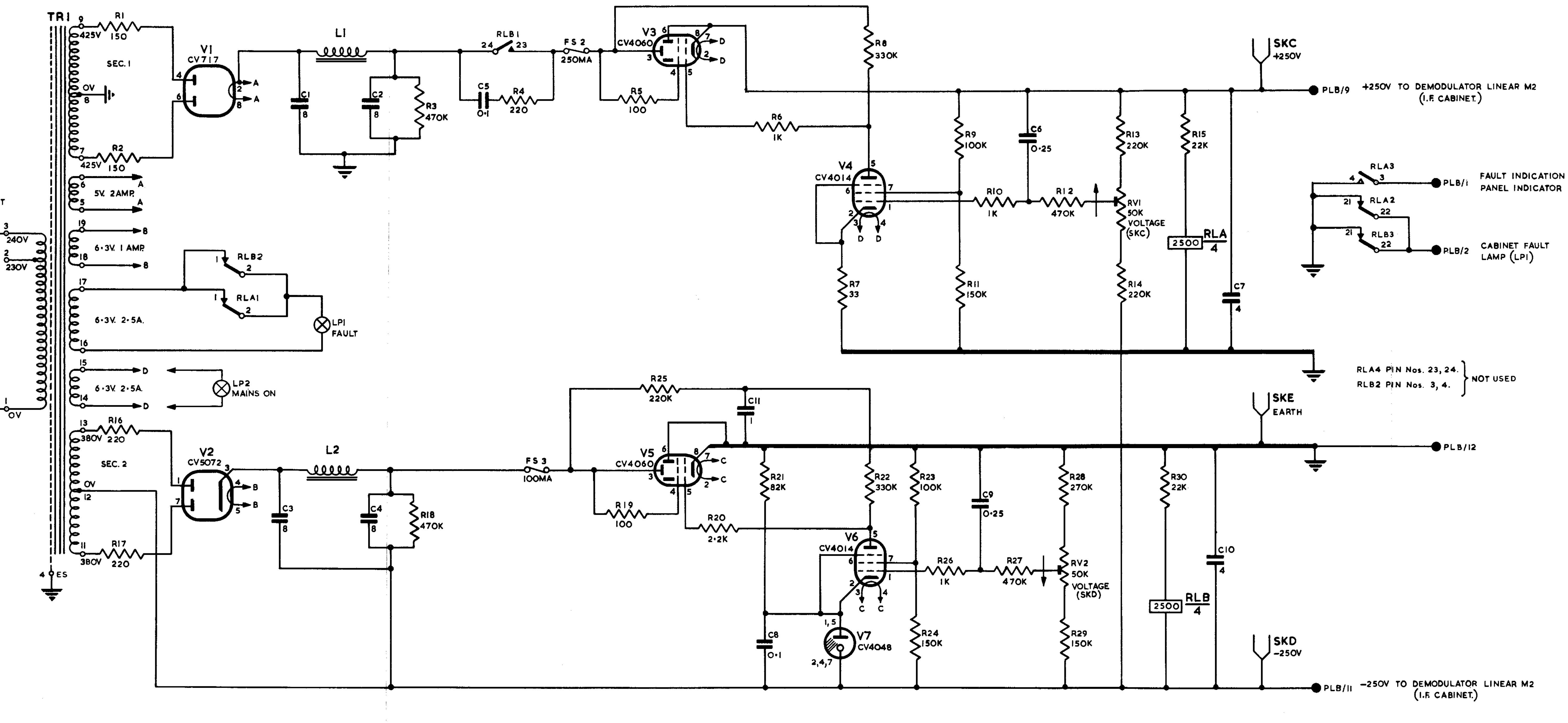


Fig. 5. Power supply M1: underside view



Power supply M1: circuit

Fig. 6

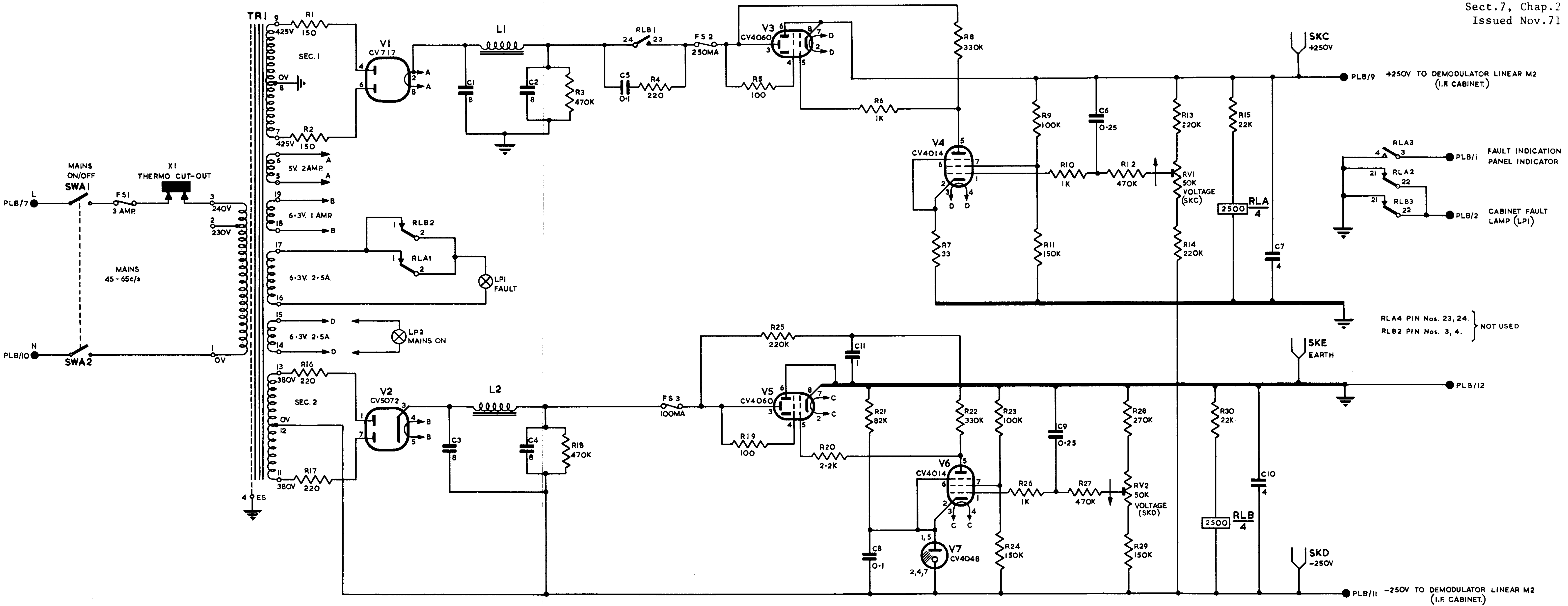


Fig.6 Power supply M1: circuit Fig.6

Chapter 3

RESOLVER ELECTRICAL MI

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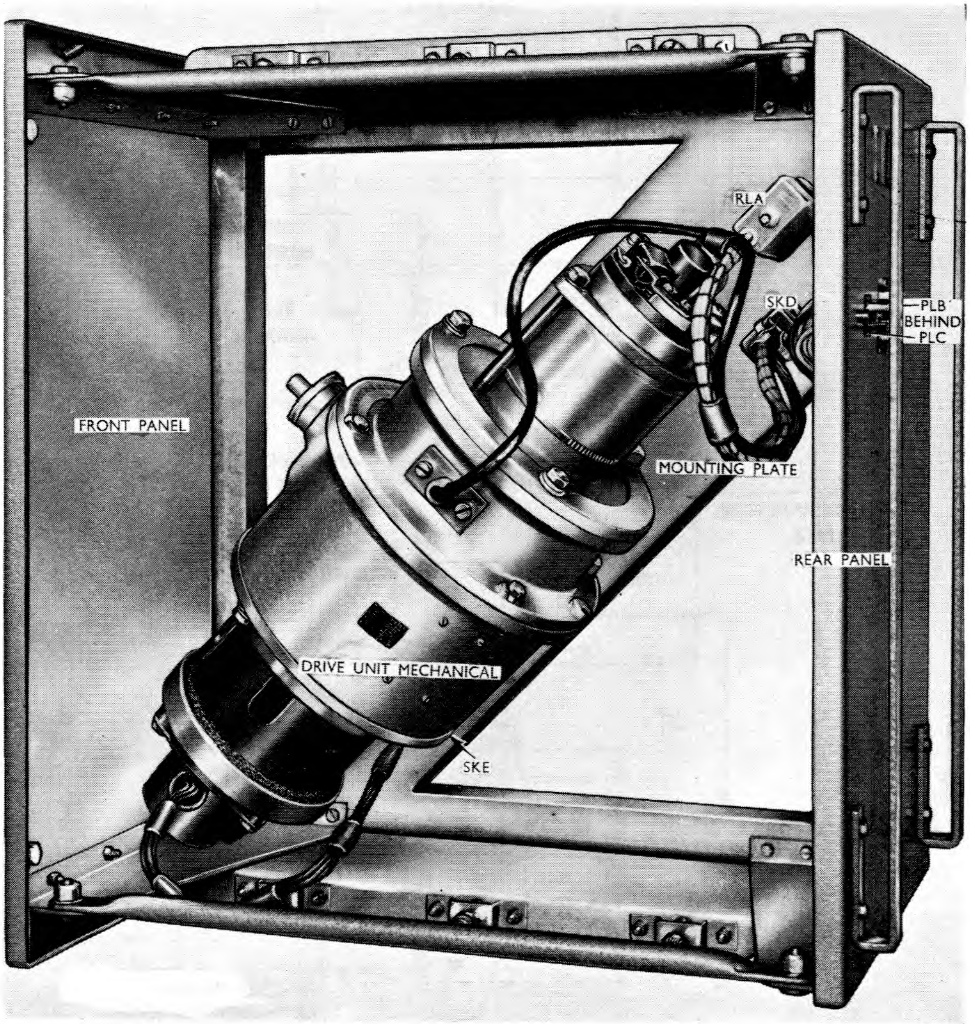


Fig. 1. Resolver electrical MI: top view

Introduction

1. The purpose of the resolver electrical M1 (*fig.* 1) is to provide modulation of the doppler compensating frequency at aerial speed and so allow for different wind radial velocities at different aerial headings. The unit consists of a main frame and a drive unit. The main frame carries the drive unit, the input and output plugs and sockets and the auto-align relay. The drive unit consists of a selsyn receiver arranged to drive a magslip resolver via a 30:1 reduction gear. The selsyn receives rotational information from a selsyn transmitter driven by the aerial turning gear. This selsyn is driven at 30 times aerial speed, so that the drive unit turns the magslip at true aerial speed (*fig.* 2).

2. The rotor of the magslip is fed with a 500 c/s sine wave from the generator, reference signal (*Sect.* 3, *Chap.* 11) and the outputs from the stator windings are 500 c/s sine and cosine waveforms resolved for aerial rotation. These outputs are fed to three wind speed and direction control units on the radar operators' console, each control unit being associated with a doppler compensated rectangular area on the display. The angle of the rotor of the magslip in each control unit can be manually adjusted by the WIND DIRECTION control and the amplitude of the resolved output from the magslip by the WIND SPEED control, in order to set up the required doppler compensation.

3. To maintain accurate alignment between the aerial heading and the resolver, an auto-align

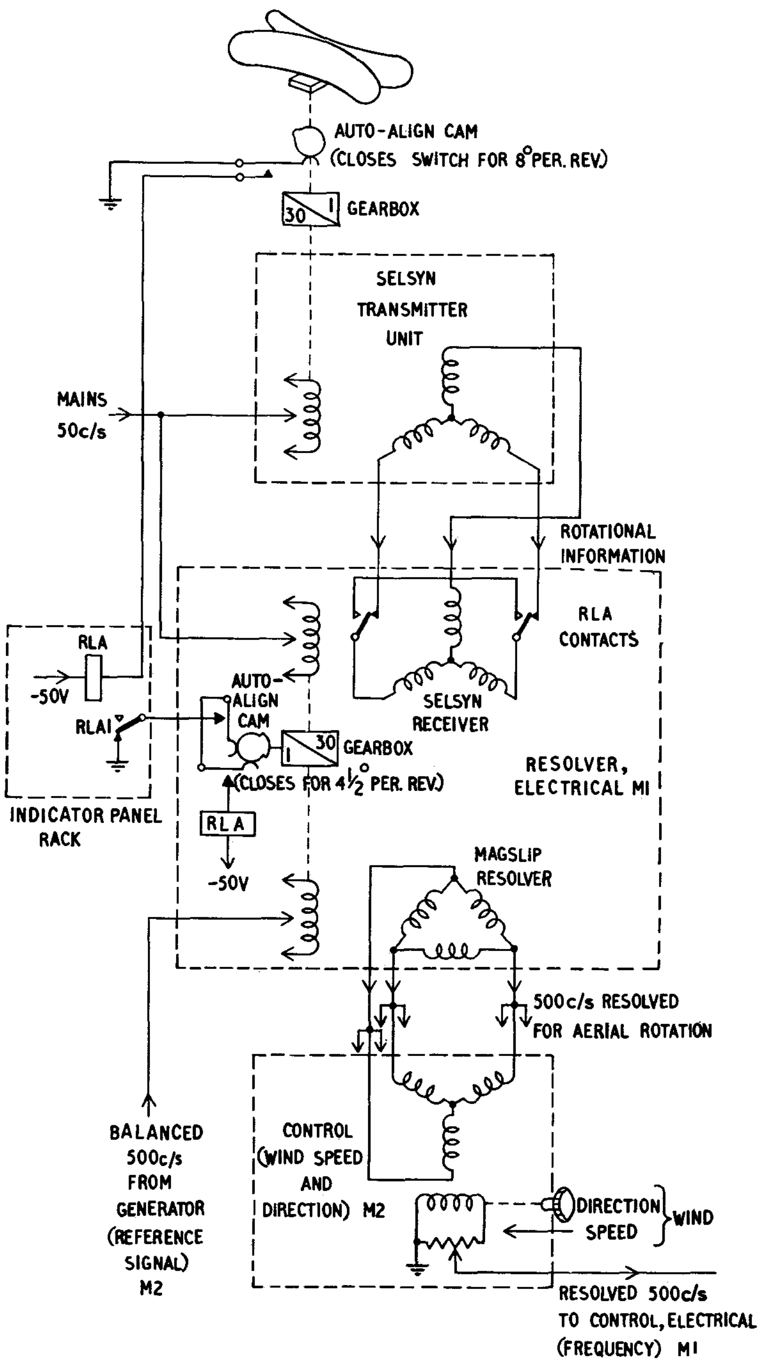


Fig. 2. Resolver electrical M1: block schematic

system is fitted. This system ensures that should misalignment occur, the selsyn receiver is prevented from rotating until it is correctly aligned with the selsyn transmitter at the aerial.

Performance characteristics

Inputs

4. The selsyn requires the following inputs:–

(1) 240V 50 c/s single-phase a.c. (rotor supply).
(2) Rotational information from the aerial in the form of resolved sine and cosine voltages (stator supply).

The magslip requires a 500 c/s sine wave of 120V ±20V peak-to-peak. In addition a –50V supply is required for the auto-align relay.

Output

5. The magslip delivers resolved 500 c/s sine and cosine waveforms (at 120V ±40V peak) to the wind speed and direction control magslips.

MECHANICAL DESCRIPTION (fig.1)

Main frame

6. The unit is of open panel construction, designed to mount in the power cabinet. The mounting for the drive unit is a metal plate welded diagonally across the framework. This plate also carries the selsyn and magslip input and output sockets SKD and SKE and the auto-align relay. The main input and output plugs PLB and PLC are fitted to the rear panel.

Drive unit

7. The unit consists of the following mechanical components:–

(1) Selsyn receiver.
(2) 30:1 reduction gearbox.
(3) Auto-align cam.
(4) Magslip resolver.

Selsyn receiver

8. The selsyn receiver is a synchronous link torque motor connected by five leads to a selsyn transmitter at the aerial. The receiver accurately repeats angular information from the transmitter. The three stator windings are carried in slots in the yoke and their connecting wires are brought out through the end frame together with the rotor connections. The stator windings are star-connected and are distributed to give accurately balanced phase voltages and correct flux distribution.

9. The single-phase rotor is wound on an 'H' armature fitted to the main shaft. This shaft rotates in precision ball bearings which on assembly are dipped in transformer oil (B.S.148, grade B.30). No further lubrication is normally needed during the life of the selsyn. The rotor supply is taken in via two silver-graphite composition brushes (Morgan Link Type S.M.3) and solid silver slip rings. These materials are used to secure good electrical contact with minimum brush friction. Brush pressure is maintained by non-adjustable helical springs. The minimum brush length for satisfactory contact is ¼ in.

30:1 Reduction gearbox

10. The selsyn is flange-mounted to the gearbox assembly (fig.3) by a mounting ring having three ¼ in. B.S.F. bolts fitting into tapped holes in the gearbox case. The selsyn shaft carries a 28-tooth pinion (A) which meshes with a 140-tooth wheel (B) fitted to a layshaft in the gearbox; the layshaft is mounted in ball bearings. Also fitted to the layshaft is a 24-tooth pinion (C) which meshes with a 144-tooth wheel (D) mounted on the magslip drive shaft. Thus a step-down ratio of 30:1 is obtained in two stages of 5:1 and 6:1.

11. To facilitate hand adjustment of the resolver assembly the layshaft carries a bevelled disc upon which bears a rubber friction drive from a hand wheel which is mounted on the outer case of the gearbox. The hand drive is not engaged until the outer knurled ring has been pressed and turned clockwise (bayonet action). The drive can be disengaged by pressing and turning the ring counter-clockwise.

Note ...
The knurled ring must be disengaged (in the OFF position) whilst the selsyn is rotating.

Auto-align cam

12. The drive shaft from the gearbox extends through ball bearings in the central wall of the casting which separates the gearbox compartment from the cam switching compartment. The auto-align cam assembly is attached to the drive shaft. The cam assembly consists of two separate cams whose relative positions are adjustable. The two cams are so adjusted that their combined effect is equivalent to a single cam having a profile of 94½ deg.

13. Associated with the cam assembly are two roller-ended switches set 90 deg. apart around the assembly, so that simultaneous closing of both switches occurs during only 4½ deg. of cam rotation. These switches are push-rod operated.

Magslip resolver

14. On the side of the auto-align cam is a peg which fits into a rubber-lined socket on the magslip coupling plate. This plate is attached to the magslip driving shaft so that torque from the gearbox is applied to the magslip rotor.

15. The magslip is flange-mounted to the gearbox by means of an adaptor frame and a magslip control ring, which is secured to the adaptor by two screws. The magslip is clamped rigidly to the adaptor by two long bolts and the assembly mounted on the gearbox using a clamp ring and three ¼ in. B.S.F. bolts.

16. The magslip is a Muirhead Type E-17-C/2 whose stator consists of three windings delta-connected and sinusoidally distributed, the leads being brought out to terminals 1, 2 and 3 on the spindle end cover. The rotor is a single-phase winding set in a slotted armature and mounted in single-row ball journal bearings. Connections are brought out via silver slip rings and gold strip brushes. The brush leads are terminated on the spindle end cover at terminals X and Y.

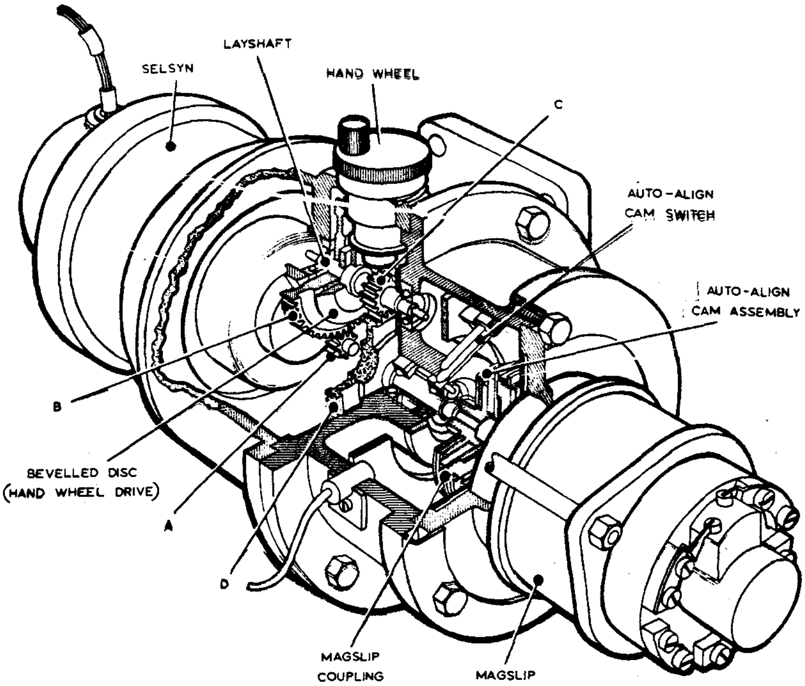


Fig. 3. Drive unit: sectional view of gearbox

CIRCUIT DESCRIPTION (fig.4)

17. The electrical circuit of the complete resolver may be considered in three parts:—

(1) Selsyn receiver.
(2) Auto-align system.
(3) Magslip resolver.

Selsyn receiver

18. The selsyn stator is connected in parallel with the stator of a selsyn transmitter at the aerial via PLB/1, PLB/2 and PLB/3 (providing the auto-align relay RLA is de-energized). The rotor winding is connected in parallel with the rotor of the transmitter selsyn via PLB/10 and PLB/11 and both rotors are connected to the same 240V 50 c/s supply. A 220 ohm resistor in series with the receiving selsyn rotor winding provides damping in the event of juddering being caused by misalignment in the auto-align system. Alternating sine and cosine voltages are induced in the transmitter stator windings, their values varying with aerial rotation. These voltages are fed to the stator windings of the selsyn receiver where they set up an alternating field which interacts with the field of rotor and produces a torque causing the rotor to turn. Thus, as the rotor of the transmitter selsyn is rotated, the rotor in the receiver selsyn follows the movement. The accuracy of follow is within 1 deg. providing the rotor is not too heavily loaded mechanically.

19. To reduce the torque required from the receiver selsyn and therefore improve the accuracy of follow, the transmitter selsyn is rotated at 30 times aerial speed and a 30:1 step-down gearbox is inserted between the receiver selsyn and the magslip resolver.

Auto-align system

20. The main disadvantage of stepping up the speed of the selsyns (para.19) is that it becomes possible for the magslip to align itself into any 12 deg. sector, i.e. in 29 positions other than the correct one. To overcome this disadvantage an auto-align system is fitted.

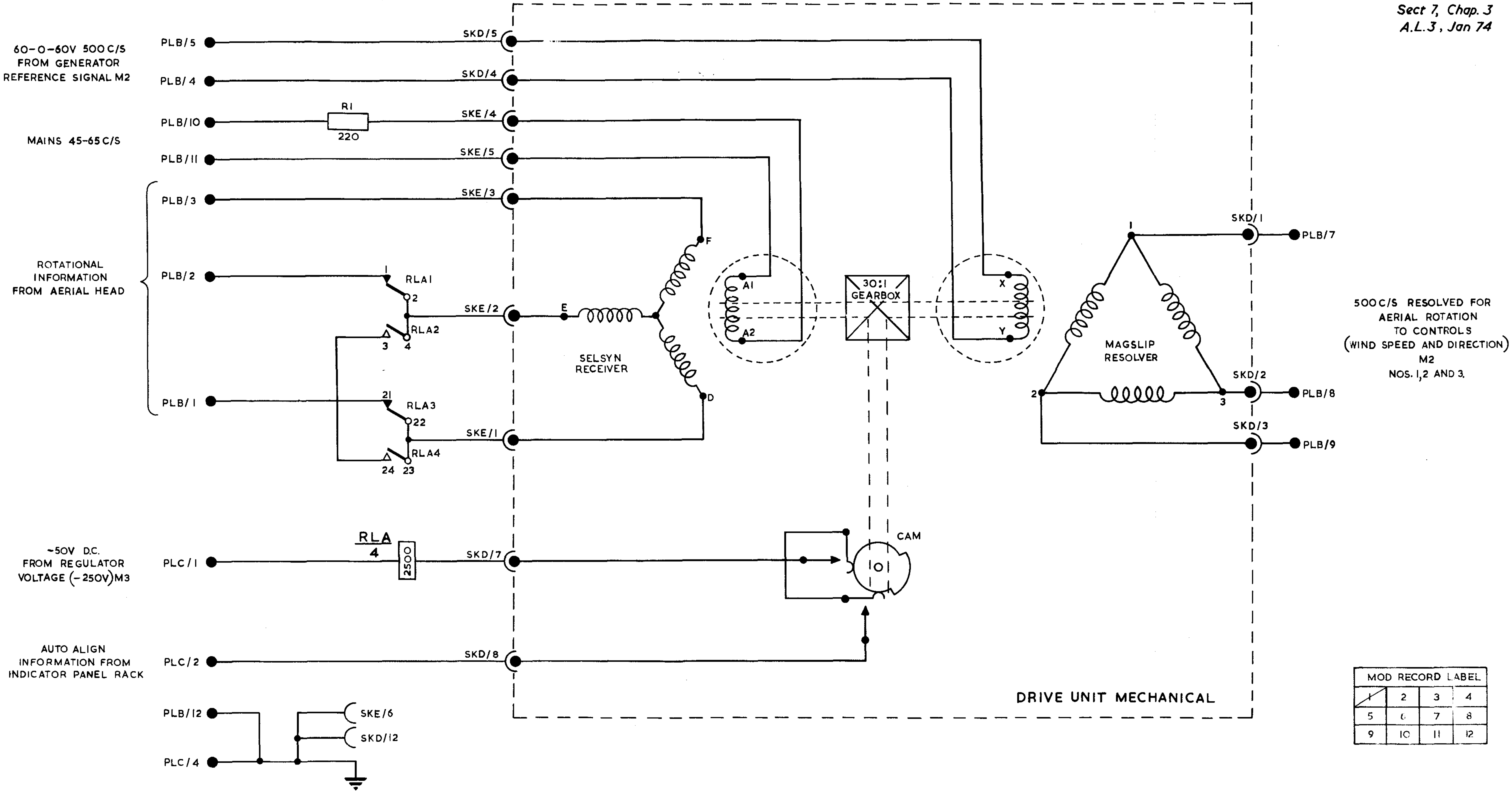
21. The complete auto-align system (fig.2) consists of a cam-operated switch at the aerial, a relay in the indicator panel rack and a cam-operated switch and a relay in the resolver electrical. The cam which operates the switch at the aerial is driven at aerial speed. For 352 deg. of aerial rotation the switch is unoperated and the −50V supply to RLA in the indicator panel rack is broken, contacts RLA1 of this relay maintaining an earth on the auto-align lead from the resolver electrical. During the remaining 8 deg. of aerial rotation the switch is closed and RLA is operated, breaking the earth on the auto-align lead. At the same time, the cam in the resolver is rotating at aerial speed and during 4½ deg. of the travel the two-cam-operated switches, which are mounted 90 deg. apart and are wired in series with each other, are closed. If the resolver auto-align cam is correctly aligned with the cam at the aerial, the 4½ deg. closing arc of the switches occurs during the 8 deg. closing of the switch at the aerial.

22. If the two cams become misaligned, closure of the resolver switches will occur during the period the aerial switch is open. With the aerial switch open, the relay in the indicator panel rack is de-energized and the −50V supply to relay RLA in the resolver is completed. The relay operates and contacts RLA1 and RLA3 break the information circuit to two stator windings of the receiver selsyn whilst contacts RLA2 and RLA4 short circuit these two windings. This operation locks the selsyn rotor, thus preventing the magslip and the auto-align cam from rotating. Consequently RLA remains energized, keeping the resolver stationary whilst the aerial continues to rotate.

23. When the aerial cam reaches the position where the switch is closed, the −50V supply to RLA in the indicator panel rack is completed. The relay is energized and contacts RLA1 break the −50V circuit to relay RLA in the resolver. Relay RLA is de-energized and the receiver selsyn resumes normal rotation with the resolver in synchronism with the aerial heading.

Magslip resolver

24. Basically, the magslip may be regarded as a variable ratio three-phase transformer in which the rotor winding forms the primary and each stator winding a secondary. The rotor is supplied with 120V at 500 c/s from the generator, reference signal (*Sect.* 3, *Chap.* 11) via PLB/4 and PLB/5 and as it is turned by the selsyn drive sine and cosine voltages are induced in each stator winding. These voltages, which are 120 deg. out of phase with each other, are taken to the stators of the three wind speed and direction control magslips on the console, via PLB/7, PLB/8, and PLB/9, for doppler compensation purposes.



MOD RECORD LABEL			
1	2	3	4
5	6	7	8
9	10	11	12

Fig.4 Resolver electrical M1 : circuit Fig. 4

Chapter 4

MONITORING OSCILLOSCOPE

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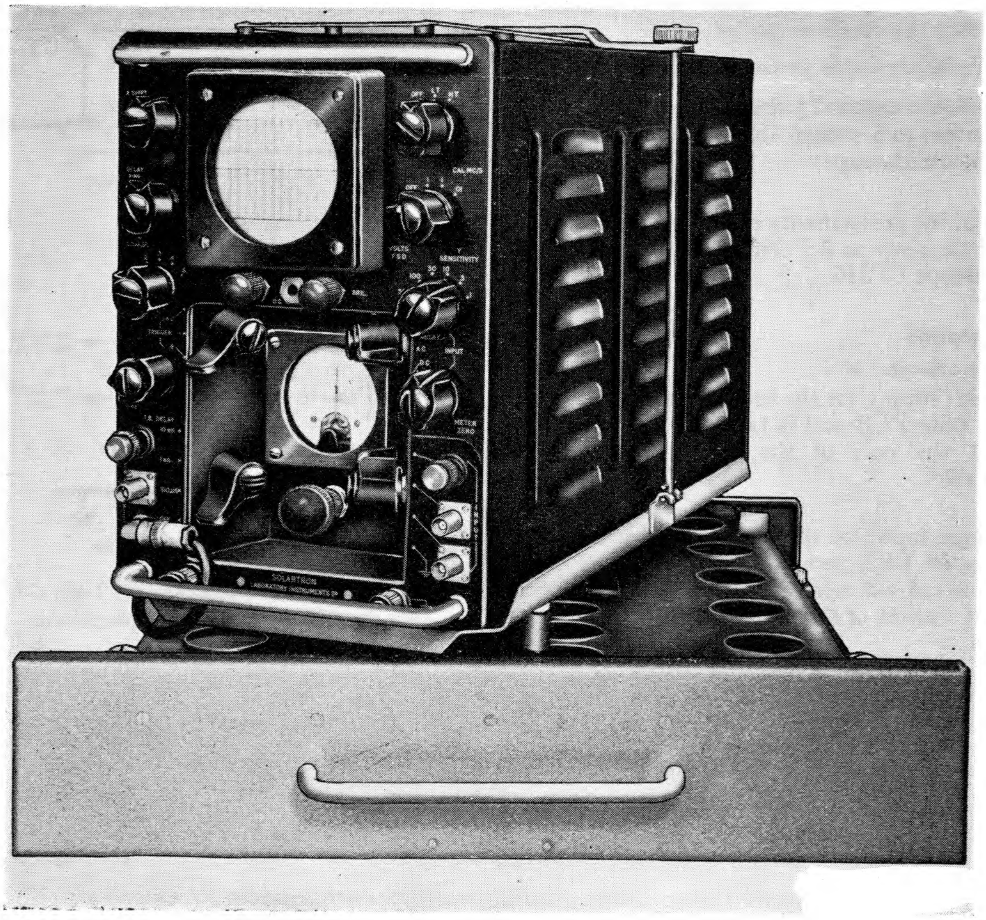

Fig. 1. Monitoring oscilloscope : front view

Introduction

1. The monitoring oscilloscope (*fig.* 1) consists of an oscilloscope Type CT316A mounted on a base, chassis (oscilloscope) M1. The instrument is located in the power cabinet and is used to check the waveforms at the various monitor points in the signal processing system.

2. The oscilloscope Type CT316A is a slightly modified version of the Type CT316, the latter being fully described in A.P.2563CA. The modifications include changes to the types of trigger and signal input sockets on the front of the instrument and to the mains input socket at the rear, accompanied by a small change in the wiring of the input selector switch. The carrying handles of the instrument have been shortened slightly, to enable the instrument to be fitted into the cabinet.

3. The chassis base consists of a frame, carrying a mounting tray in which the oscilloscope is clamped by means of retaining rods and a strap. The mounting tray is pivoted to the frame and can be turned to give an adequate view of the oscilloscope. For convenience in use, the assembly can be pulled forward from the cabinet on runners.

Performance characteristics

Inputs

4. The following inputs are taken to the chassis base to operate the oscilloscope :—

(1) 240V, 50 c/s single phase a.c. to a plug PLB.

(2) A −8 microsecond pulse (scope sync) from the p.r.f. system to a socket SKA, to act as trigger input for the oscilloscope.

5. Details of the performance characteristics of the oscilloscope are given in A.P.2563CA—General Purpose Oscilloscope CT316.

Circuit description

Base, chassis (oscilloscope) M1

6. The mains supply for the oscilloscope enters the chassis at a plug PLB and is taken to a plug PLA mounted at the rear of the oscilloscope via a three-core cable.

7. The trigger input for the oscilloscope enters the unit at a socket SKA mounted at the rear of the chassis and is fed via a coaxial cable to one of the trigger input sockets of the oscilloscope.

Oscilloscope, Type CT316A (fig. 2)

8. As this instrument, apart from the modifications shown in fig. 2, is identical to the Type CT316, reference should be made to A.P.2563CA for a full circuit description.

9. For normal monitoring purposes a lead fitted with a spade terminal and a probe is connected to terminal TL2 on the oscilloscope. When not in use the lead is stored in the cable storage box fitted in the i.f. cabinet.

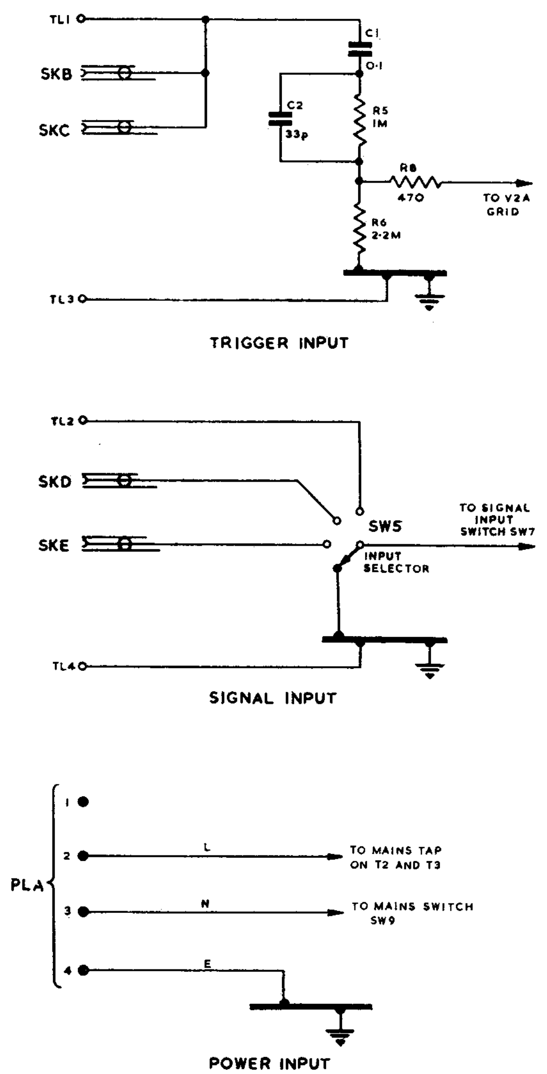

Fig. 2. Oscilloscope, Type CT316A : circuit modifications

Chapter 5

REGULATOR, VOLTAGE (—250V) M3

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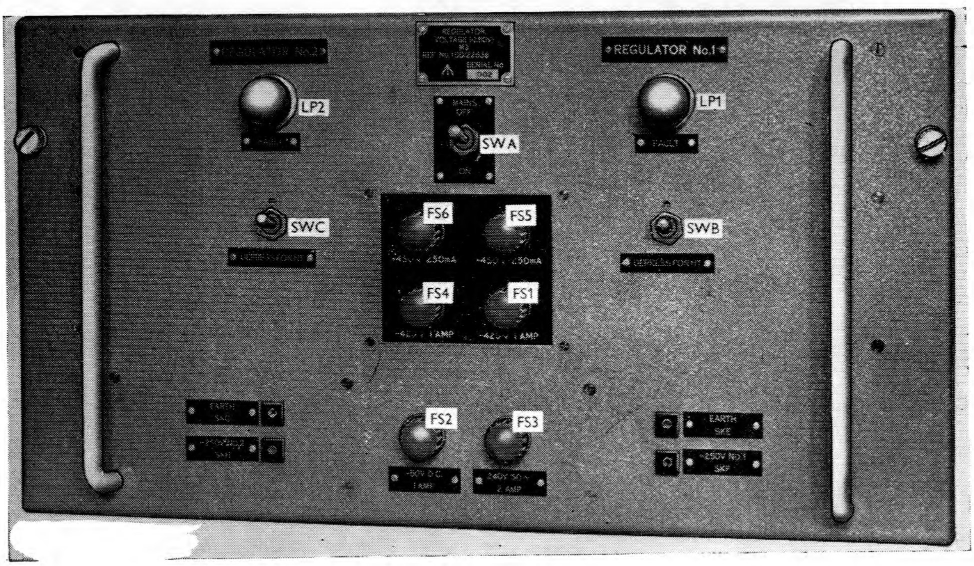


Fig. 1. Regulator, voltage (—250V) M3 : front view

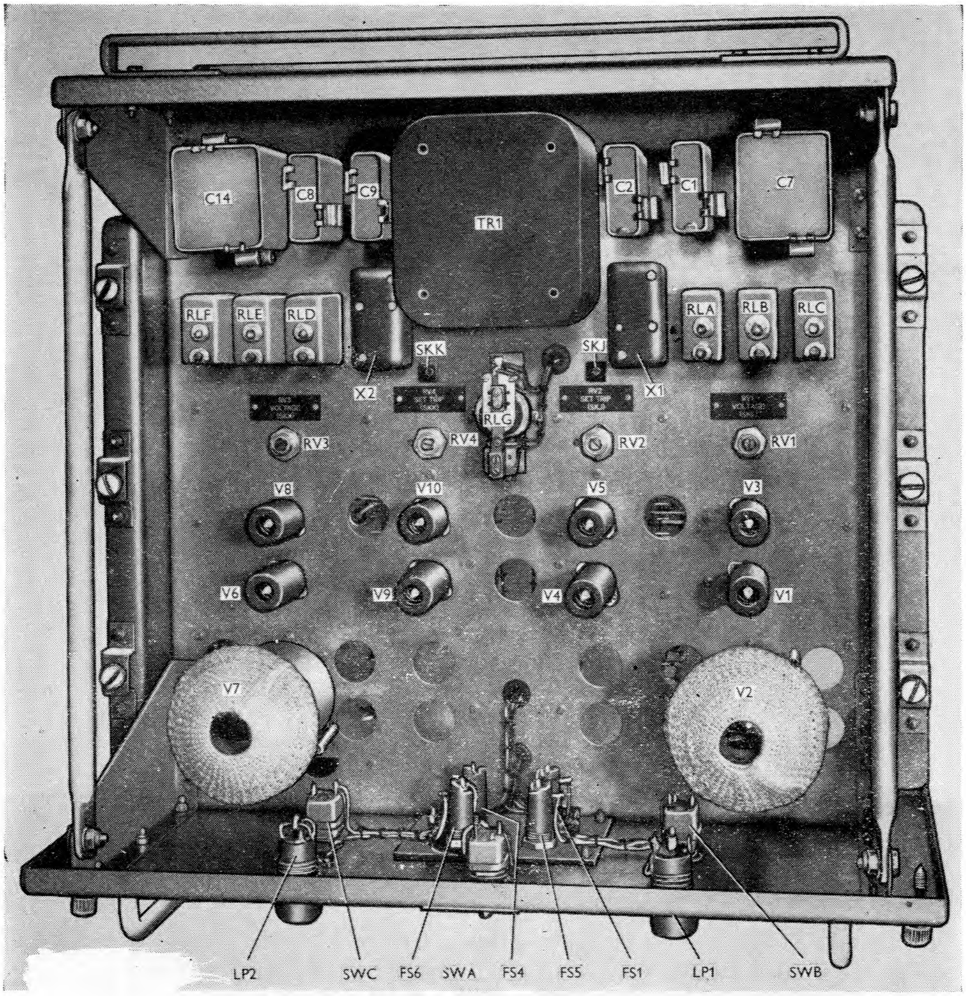


Fig. 2. Regulator, voltage (−250V) M3 : top view

Introduction

1. The purpose of the regulator, voltage (–250V) M3 (*fig.1, 2 and 3*) is to produce a –250V regulated supply from a –425V input. Two of these units are used in the power cabinet. The upper of the two provides the –250V supply and the reference voltage for the +250V regulators in the cancellation cabinet, the i.f. cabinet and frame 3 of the doppler cabinet, whilst the lower unit provides similar supplies for frames 1 and 2 of the doppler cabinet and all frames on the video cabinet.

2. The –50V from the station supply is routed through each unit via switching and fault relay contacts to the h.t. call wires for the radar office. The h.t. supplies are received via the bulk power supply racks, in which are located relays which switch h.t. to any particular regulator.

3. In the regulator, the –250V outputs and the +450V, –425V and –635V inputs act directly or indirectly as hold voltages for the fault relays. These relays are de-energized under fault conditions. Each regulator circuit has an associated FAULT lamp, which is illuminated under fault conditions via contacts on the fault relays. The cabinet FAULT lamp is also controlled by these relays and 6.3V a.c. from the lampholder assembly is routed via further contacts to provide a supply for fault indication on the +250V regulators in the cancellation, i.f., doppler and video cabinets. Fig.4 shows the supply and fault circuits for the regulator associated with the cancellation cabinet.

Performance characteristics

Inputs

4. Each regulator requires the following inputs:–

(1) +450V unregulated supply from the bulk power supplies at PLD/3 and PLD/12.
(2) –425V unregulated supply from the bulk power supplies at PLD/1 and PLD/10.
(3) –625V unregulated supply from the bulk power supplies at PLD/4 and PLD/13.
(4) –500V reference supply, with a peak ripple not exceeding 5mV, at PLD/7 and PLD/16.
(5) –50V from the bulk power supplies at PLB/8.
(6) 240V 50 c/s single-phase a.c. at PLB/7 and PLB/10.
(7) 6.3V 50 c/s a.c. from the lampholder assembly at PLB/4.

Outputs

5. With the correct inputs, two outputs of –250V, with a ripple not exceeding 20mV peak-to-peak at a maximum current of 500mA, are provided at PLB/1 and PLB/11 respectively. These outputs are taken to the +250V regulators as follows:–

(1) Upper unit–No.1 regulator: cancellation cabinet, doppler cabinet (frame 3).
No.2 regulator: i.f. cabinet.
(2) Lower unit–No.1 regulator: doppler cabinet (frames 1 and 2).
No.2 regulator: video cabinet.

6. The 6.3V a.c. input is routed to the +250V regulator FAULT lamps in the same cabinets via the fault relay contacts and PLB/3 and PLB/9 in each instance.

7. The –50V input is routed to the bulk power supplies (h.t. call wires No.1 and 2) via the h.t. switching-on circuits initially and via the fault relay contacts when the regulators are operating normally (PLB/5 and PLB/6).

Circuit description (*fig.4 and 5*)

Switching sequence (fig.5)

8. With SWA operated, 240V a.c. is applied to the transformer TR1. 6.3V is then available for the valve heaters and the thermal delays X1 and X2. At the same time, relay RLG is operated so that the –50V circuit from the bulk power supplies to the unit is completed via contact RLG1.

9. After a time delay of approximately 30 seconds, the switching contacts of X1 and X2 close and complete the –50V supply to relays RLA and RLD. Contacts RLA2 and RLD2 break the 6.3V circuit to X1 and X2 and contacts RLA4 and RLD4 hold RLA and RLD in the operated condition.

10. Contacts RLA3 and RLD3 complete the –50V circuit to switches SWB and SWC (DEPRESS FOR H.T.) in the h.t. call wire circuits to the bulk power supplies. Operation of these switches, which are of the non-locking type, completes the appropriate relay circuits in the bulk power supplies.

11. When the h.t. supplies become available at the regulators, relays RLB and RLC in regulator No.1 and RLE and RLF in regulator No.2 are operated. Contacts RLB3 and RLC3 lock the –50V on h.t. call wire No.1 and contacts RLE3 and RLF3 perform a similar function on h.t. call wire No.2.

12. Switching-on the bulk power supplies makes the following supplies available at the unit:–

No.1 regulator:
(1) +450 fused at 250mA by FS5.
(2) –425V fused at 1A by FS1.
(3) –625V unfused.
(4) –500V (station reference) unfused.

No.1 regulator:
(1) +450V fused at 250mA by FS6.
(2) –425V fused at 1A by FS4.
(3) –625V unfused.
(4) –500V (station reference) unfused.

13. The unit FAULT lamps are extinguished by the operation of relays RLB, RLC, RLE and RLF. 6.3V from the lampholder assembly is made available to the FAULT lamp control elements on the +250V regulators in the cancellation, i.f., doppler and video cabinets via contacts RLB2 and RLE2. The power cabinet FAULT lamp is extinguished via contacts RLB1 and RLE1; since these contacts are in parallel the lamp is extinguished only when both regulators are operating normally.

Regulation

14. As the circuit of each of the four regulators is similar, only one, that of regulator No.1 in the upper unit, is described.

15. The regulation circuits include the valves V1 to V4. V2 is connected in a series regulator circuit which ensures that the current passed by the valve is automatically corrected by grid control to bring the output voltage back to its original value should any fluctuation occur.

16. As the regulator controls a negative supply, the associated control amplifier, V3, is operated from an even more negative supply obtained from the –500V station reference. A bias input of –625V is also required for the constant current valve V1 and the trip valve V5.

17. The grid of V3 is returned via R21 to the slider of the VOLTAGE (SKF) potentiometer RV1. RV1 forms part of the resistor chain between the –500V reference line and earth. The capacitor C6 and resistor R21 smooth out transients on the –500V input. The anode of V3 derives its h.t. supply from a stabilized voltage of +150V obtained from the +450V line by V4 in conjunction with the resistors R10, R59 and the reservoir capacitor C1.

18. Any change occurring in the –250V output with reference to the –500V line will produce a change in the grid/cathode potential of V3. This change is amplified by the valve and applied to the grid of V2 via V1. V1, which is a constant current pentode, forms part of the divider chain R20, R8, V1 and R5, the purpose of which is to lower the d.c. level from V3 anode to a value suitable for application to the grid of V2. A bias voltage of –570V (from the junction of R1 and R2) is applied to the grid of V1 to ensure constant current conditions. R3 and C3 are included for smoothing purposes. To ensure maximum compensation for fluctuations of the –425V input a connection is made between that input and the cathode of V3 via R15.

19. The resistors R6, R13 and R17 raise the heaters of V1, V2 and V3 respectively to cathode potential to eliminate heater/cathode breakdown in these valves. R7, R12 and R18 are included in the grid circuits to assist in the prevention of parasitic oscillations.

20. The correct setting of RV1 is such that the output voltage lies between the limits of –250V ±2V over a load current of 300 to 500 mA.

Fault circuits

21. Fault indication facilities are provided by RLB in conjunction with V5 and RLC in regulator No.1 and RLE in conjunction with V10 and RLF in regulator No.2.

22. Relays RLB and RLE cover failures in the –250V outputs and the +450V and –425V inputs. RLC and RLF cover failures in the –625V input and RLG covers failures in the mains supply to the unit.

23. As both regulator fault circuits are similar, only that applicable to failures on No.1 regulator will be described.

24. Failure of the +450V input will result in the removal of the h.t. supply to V5. Failure of the –250V output removes the operating voltage of RLB. V5 is normally conducting at a level which is between –200V to –300V as determined by R26, the 150V Zener diodes D1 and D2, and which is set by adjustment of the SET TRIP (SKJ) potentiometer RV2. This setting is such that RLB is energized. Thus if either the +450V or the –250V supplies fail, RLB becomes de-energized. The –250V is dependent on the –425V input, so that if this supply fails RLB will be de-energized. If RLB is de-energized, the following events will occur:–

(1) Contacts RLB1 complete the earth return to the power cabinet FAULT lamp (LP1) which is thus illuminated.

(2) Contacts RLB2 remove the 6.3V fault supply to the +250V regulators in the cancellation cabinet thus ensuring that a +250V fault indication is not given at these regulators as this may prove misleading.

(3) Contacts RLB3 break the –50V supply to h.t. call wire No.1 thus switching off the bulk power supplies.

(4) Contacts RLB4 complete the 6.3V supply to the local FAULT lamp (LP1) on the unit.

25. Capacitor C17 is included in the circuit to act as a delay to prevent a fault indication being given when changing over from one source of bulk power to another. The charge on the capacitor is sufficient to maintain V5 in a conducting condition, thus ensuring that RLB remains operated during the change over period.

26. Failure of the –625V supply will result in the cathode of V1 rising to earth level with a consequent reduction in valve current. This change will cause the –250V output to go more negative. At the same time the grid of V5 will rise to earth level, increasing the current through the valve. Consequently, RLB will remain energized and no fault indication will be given. To overcome this effect, relay RLC with resistor R4 is connected between the –625V and –425V lines and under failure conditions the relay will become de-energized. The following event will then occur:–

(1) Contacts RLC3 break the –50V supply to h.t. call wire No.1 thus switching off the bulk power supplies.

(2) Contacts RLC4 complete the 6.3V supply to the local FAULT lamp (LP1) on the unit.

27. Capacitor C15 is connected across the operating coil of RLC to prevent a fault indication being given when changing over from one source of bulk power to another. The charge on the capacitor slugs the relay and makes is slow to release.

28. If the mains supply to the regulators should fail, e.g. fuse failure, the valve heater supply will be removed and the valves left with h.t. supplies on with a consequent risk of damage. This risk is

removed by the de-energizing of RLG which is normally energized from one of the windings of TR1. Contacts RLG1 break the −50V supply to both h.t. call wire circuits thus removing the bulk power supplies from the regulators.

Test readings

29. Sockets SKF on regulator No. 1 and SKH on regulator No. 2 are provided for output voltage monitoring. With a multimeter Type 1 connected between either of these sockets and the appropriate earth socket (SKE or SKG) RV1 or RV3 should be adjusted to give a reading of −250V ± 2V.

30. Sockets SKJ and SKK are provided to monitor the setting of RV2 and RV4. With a multimeter Type 1 connected between either of these sockets and socket SKE or SKG, RV2 or RV4 should be adjusted to give a reading of 85V ± 8V.

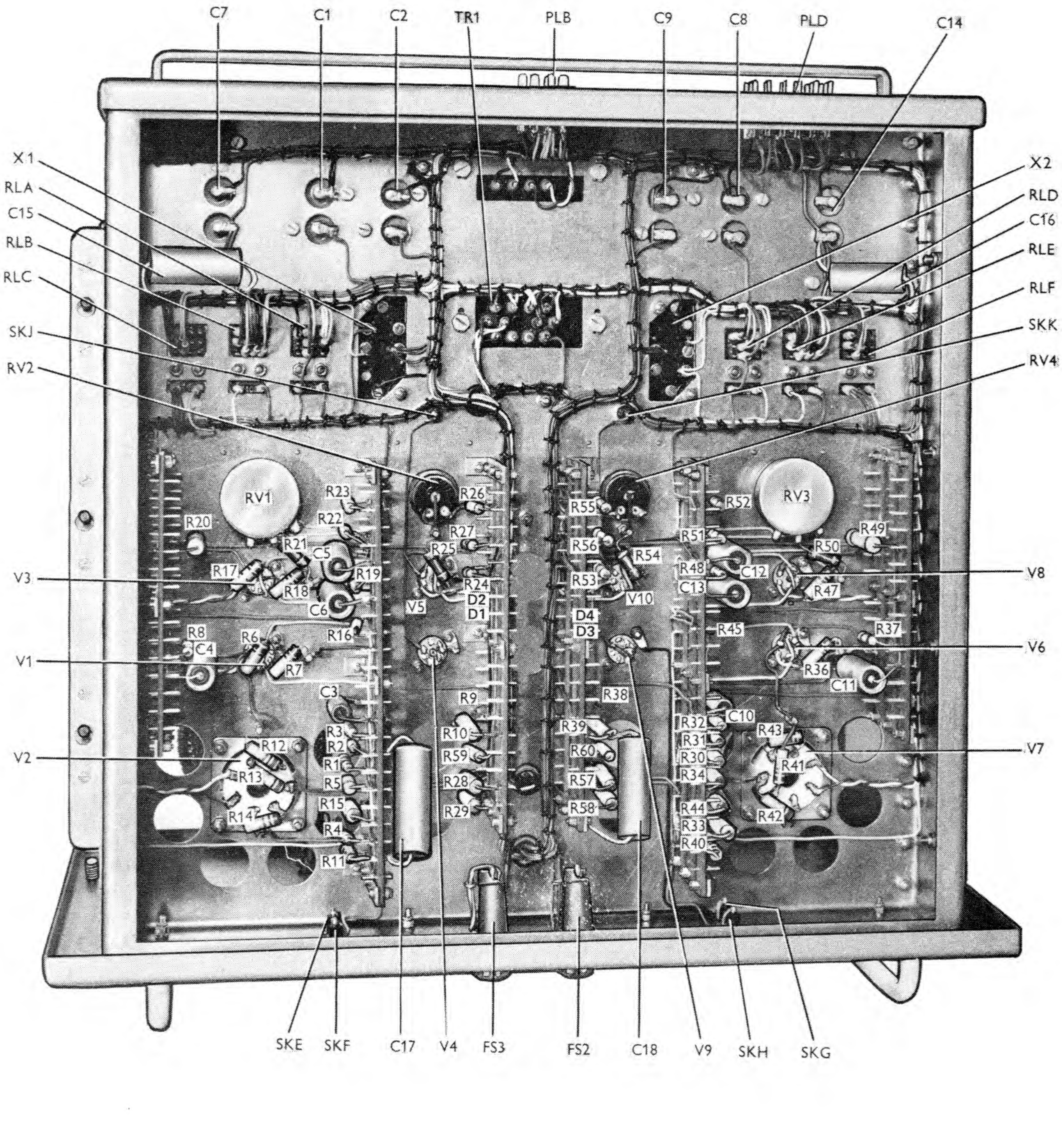


Fig. 3 Regulator, voltage (−250V) M3 : underside view

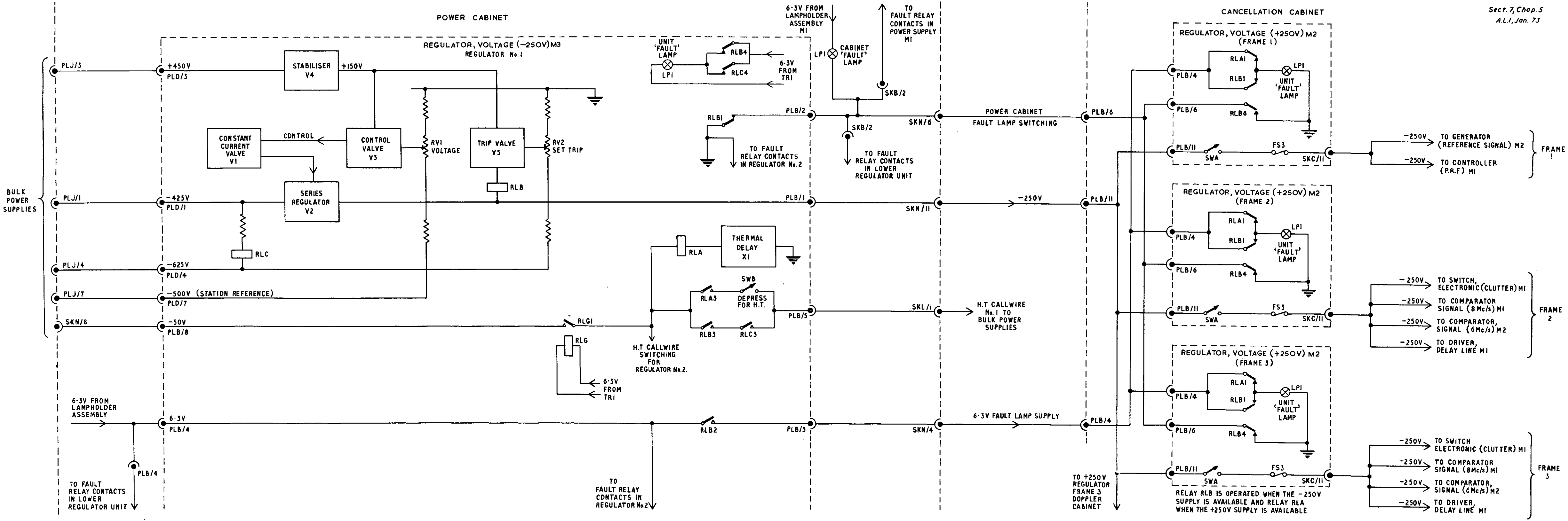


Fig.4 Regulator, voltage (−250V) M3: block schematic for regulator no. 1 Fig.4

NOTE: WHEN THERMAL RELAYS 5945-99-653-4945 (MOD CAB107/2) ARE FITTED, X1 AND X2 PIN NUMBERS CHANGE AS FOLLOWS:

PIN TO PIN (CAB107/2)	
4	1
3	2
8	3
6	4

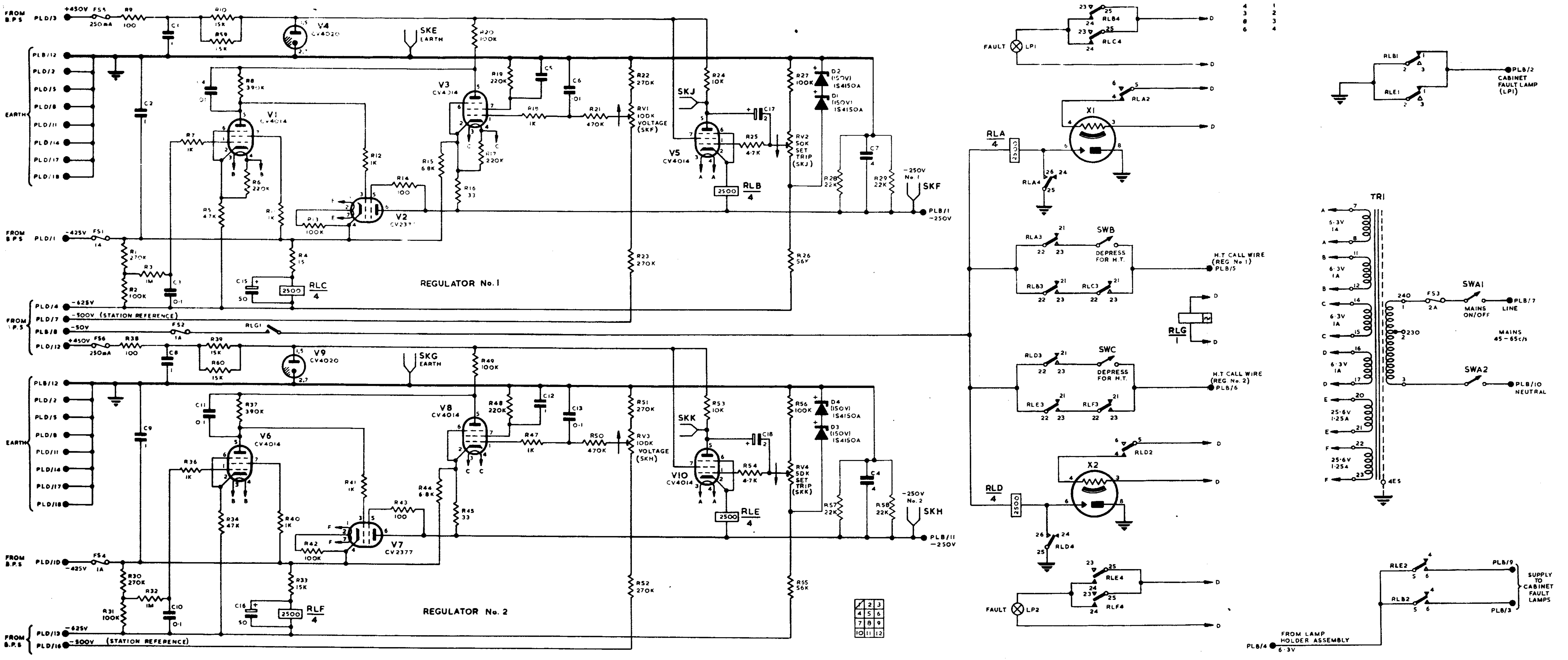


Fig.5.

Regulator, voltage (-250V) M3: circuit

Fig. 5

Chapter 6

LAMPHOLDER ASSEMBLY
(Completely revised)

CONTENTS

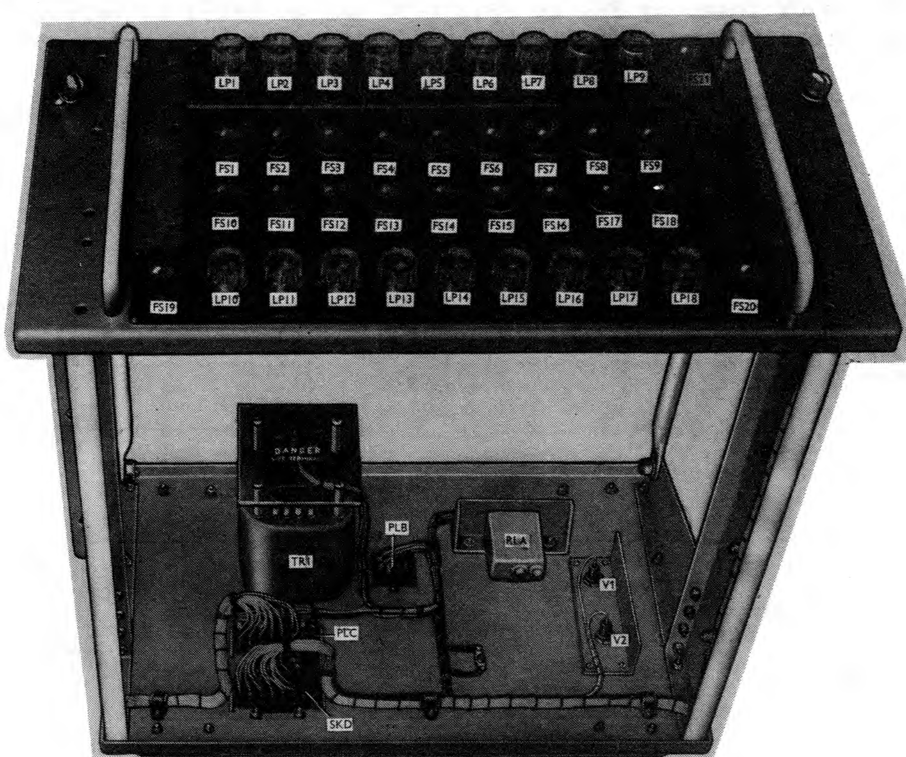


Fig.1 Lampholder assembly: general view

INTRODUCTION

1 The purpose of the lampholder assembly (fig. 1 and 5) is to distribute and provide fusing facilities for the +450V and -50V outputs from the bulk power supplies to the signal processing system. It also provides 6.3V a.c. for the cabinet FAULT lamps, power cabinet -50V FAULT lamp and the FAULT lamps for the +250V regulators in the cabinets.

2 A relay connected across the -50V input to the unit provides facilities for -50V fault indication and also controls the 6.3V FAULT lamp supply to the -250V regulators.

PERFORMANCE CHARACTERISTICS

Inputs

3 The unit requires the following inputs:

3.1 +450V from the bulk power supplies at PLC/1 to PLC/12.

3.2 -50V from the bulk power supplies at PLB/1.

3.3 50 c/s single-phase a.c. mains at PLB/7 and PLB/10.

Outputs

4 The following outputs are provided:

4.1 +450V fused by FS1 to FS12 (750 mA) at SKD/1 to SKD/12 for the +250V regulators in the cancellation, i.f., Doppler, and video cabinets.

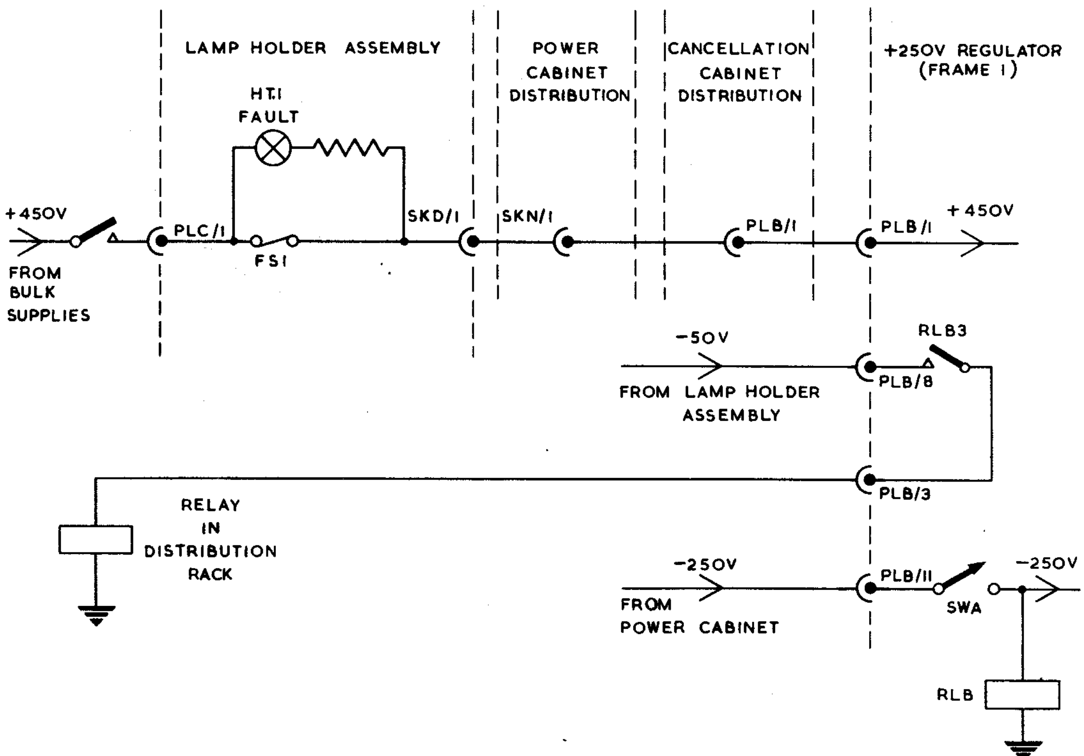


Fig.2 Lampholder assembly: +450V switching

4.2 -50V fused by FS20 and FS21(5A) at PLB/8 for general distribution to the signal processing system.

4.3 6.3V a.c. at PLB/3 for the system cabinet FAULT lamps and the -50V FAULT lamp on the power cabinet.

4.4 6.3V a.c. at PLB/4 for the +250V regulator FAULT lamps.

<u>CIRCUIT DESCRIPTION</u> (Fig.6)

<u>+450V supplies</u>

5 The +450V output from the bulk power supplies is split twelve ways and connected to the unit via PLC/1 to PLC/12. The separate inputs are switched independently before being applied to the unit. In the unit each circuit is individually fused by a 750 mA fuse. Twelve outputs are taken from the other side of the fuses to provide the +450V input to the +250V regulators in the signal processing system. These outputs are distributed as follows:

5.1 SKD/1, SKD/2, SKD/3 } cancellation cabinet

5.2 SKD/4, SKD/5, SKD/6 } video cabinet

5.3 SKD/7, SKD/8, SKD/9 } I.F. cabinet

5.4 SKD/10, SKD/11, SKD/12 } doppler cabinet

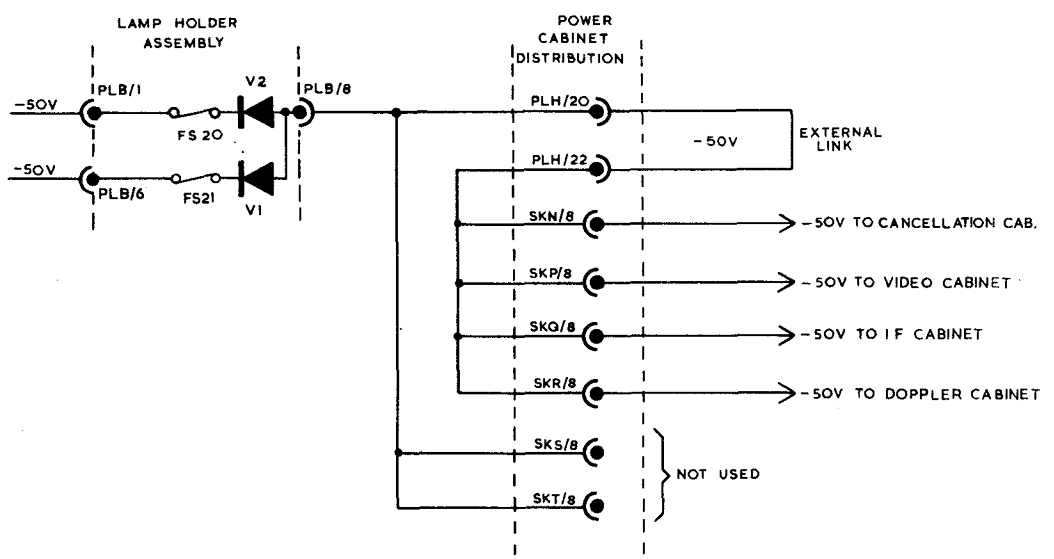


Fig.3 Lampholder assembly: -50V distribution

6 The switching of the individual +450V inputs is controlled (fig.2) at each particular regulator by completing the -250V supply from the regulators in the power cabinet. Completion of the supply operates relay RLB in the +250V regulator. Contacts RLB3 complete the -50V circuit to a relay in the distribution rack, contacts of which switch on the appropriate +450V input to the lampholder assembly. Fig. 2 shows the switching circuit for the regulator on frame 1 of the cancellation cabinet.

7 A neon indicator is connected across each fuse to give indication of fuse failure. These neons are designated FAULT H.T.1 to H.T.12 respectively.

-50V supply (Fig. 3)

8 The -50V outputs from the bulk power supplies enter the unit at PLB/1 and PLB/6 and are routed out via the SA fuses (FS20 and FS21), V1, V2 and PLB/8 for general distribution to the signal processing system.

9 Provision for indication of -50V failure is given by the relay RLA (fig. 6) which is directly connected across the -50V supply. This relay is energized when the supply is available. In the event of a failure the relay de-energizes and contacts RLA1 complete the earth return for the power cabinet -50V FAULT lamp. This lamp is supplied with 6.3V from transformer TR1.

6.3V supply

10 A mains input of 240V a.c. is applied to the primary of transformer TR1 via a 1A fuse (FS19). The 6.3V output from the secondary is taken to PLB/3 and thence out to all the cabinet FAULT lamps. The supply for the -50V FAULT lamp is also taken from this source.

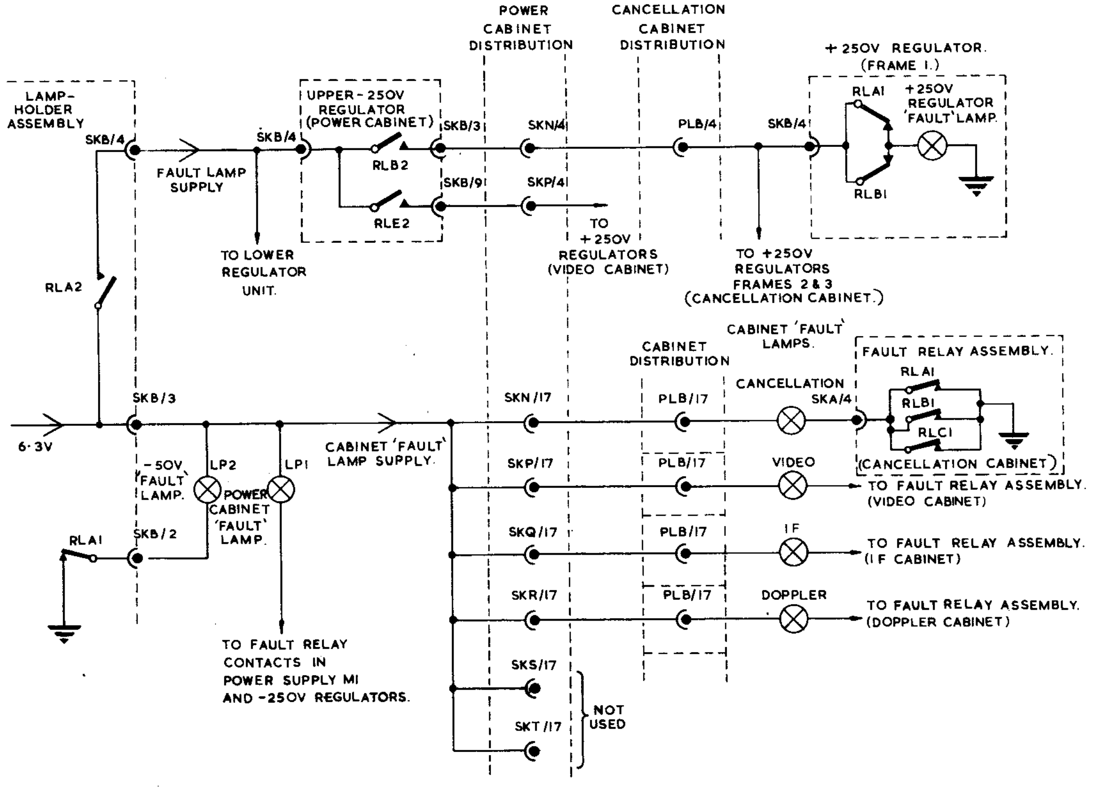


Fig.4 Lampholder assembly: 6.3V distribution

11 A further output is taken via relay contacts RLA2 to PLB/4 to supply 6.3V for the FAULT lamps on the +250V regulators in all cabinets. This supply is routed through the fault relay contacts in the appropriate -250V regulators to prevent the +250V regulator lamps showing fault conditions in the event of a -250V failure. Contacts RLA2 are closed when the -50V is available.

12 Fig. 4 shows the 6.3V distribution for all cabinet FAULT lamps and the FAULT lamp supply for the +250V regulator on frame 1 of the cancellation cabinet.

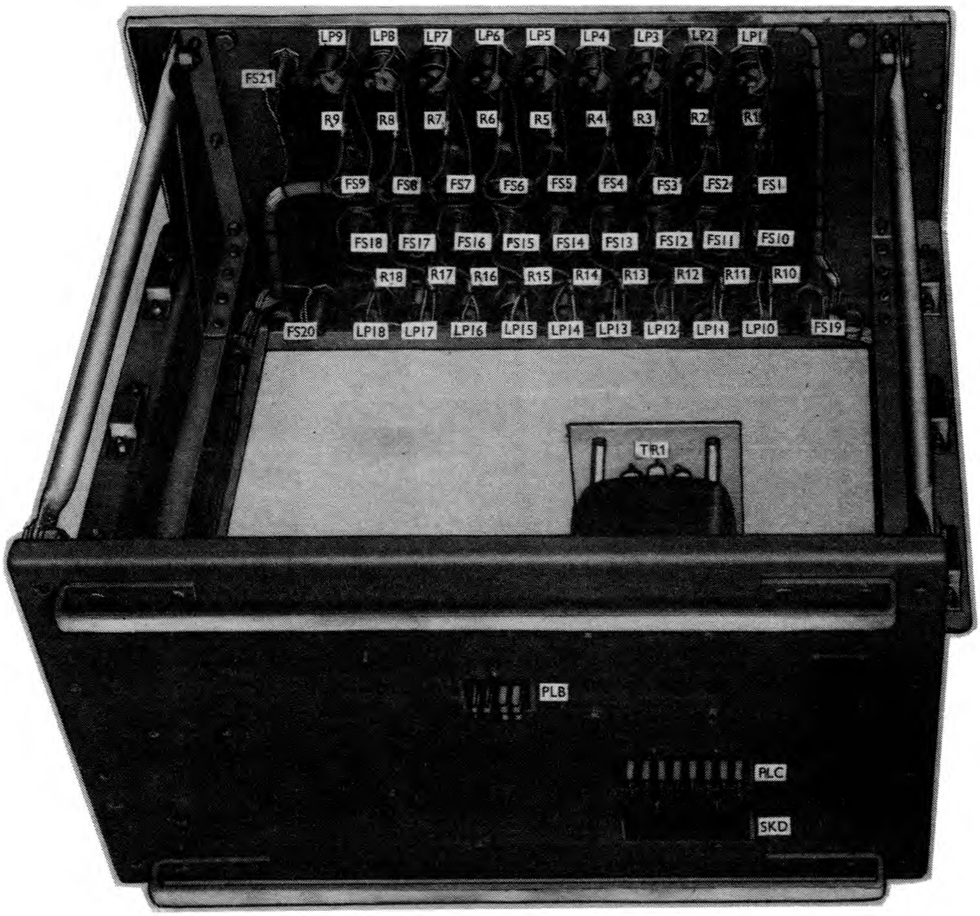


Fig.5 Lampholder assembly: rear view

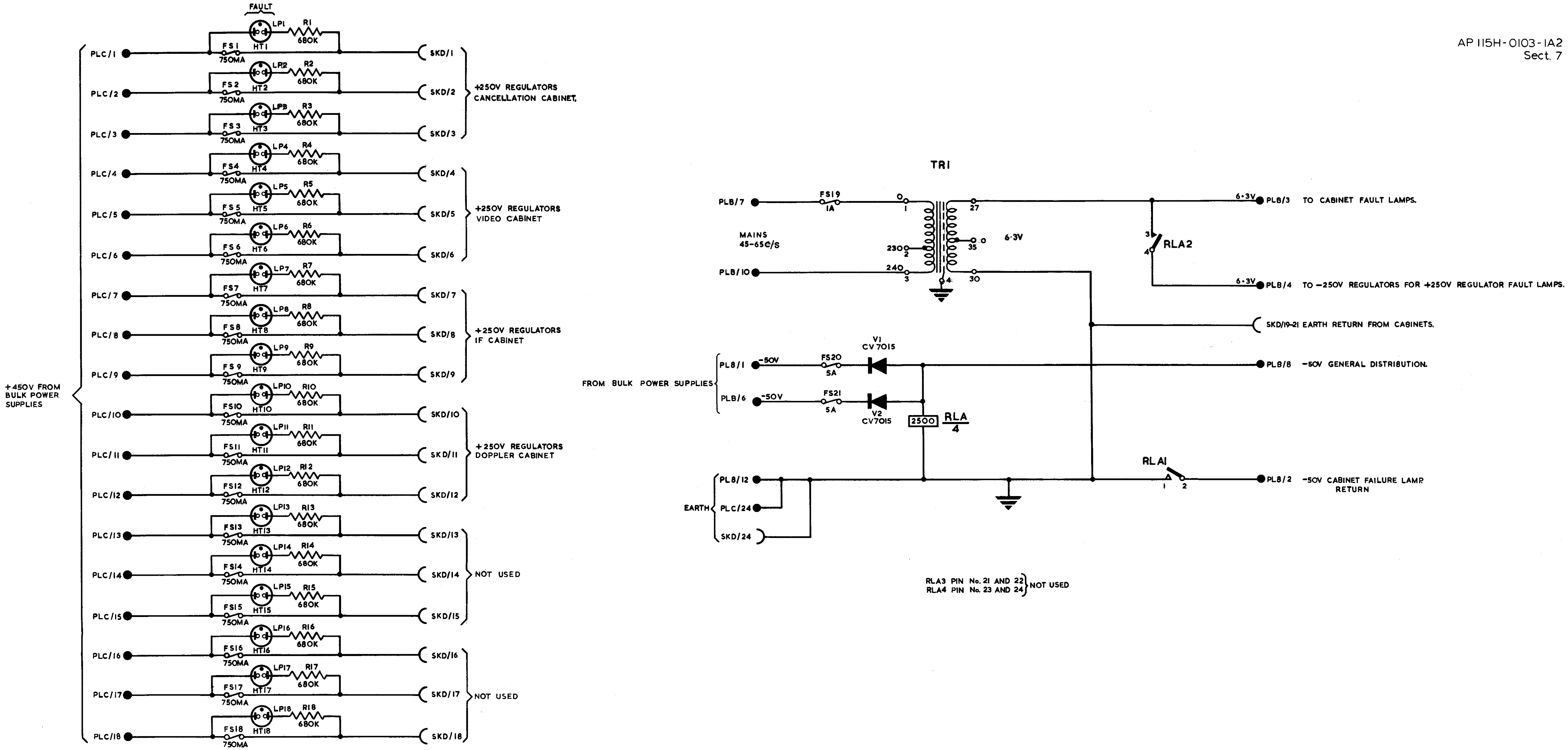


Fig. 6 Lampholder assembly : circuit Fig. 6

SECTION 8

CONTROL POSITION

Chapter 1

GENERAL DESCRIPTION

LIST OF CONTENTS

Introduction

1. The units comprising the control position and the relevant descriptive chapters in this section are:—

Rack, electrical equipment (console) M.1.10D/22802 (*Chap.* 2), and:—

Rack, electrical equipment (indicator) 5975–99–913–3581 (*Chap.* 3), containing:—

Panel, indicator, 5840–99–952–6587 (*Chap.* 3)
Panel, trigger, linesman sites, 5840–99–952–9064, or

Panel, trigger, non-linesman sites, 5840–99–952–9065 (*Chap.* 3)

Aerial turning control panel M.14 (*Chap.* 5),

and

Panel, control (fault override), 5840–99–952–6588 (*Chap.* 3) situated on the right-hand side below the Rack, electrical equipment (indicator) adjacent to the distribution trunking,

and

Panel, control, indicator (D.A.T.O.), 5840–99–953–7691 (*Chap.* 3) situated on the left-hand side below the Rack, electrical equipment (indicator) adjacent to the distribution trunking.

A further unit, the Panel, control, 5840–99–952–9066 (*Chap.* 3), is sited close to the signal processing equipment.

2. The control position provides facilities which enable one operator to monitor, and to some extent control, the radar Type 84 installation, including aerial, transmitter receivers and signal processing equipment. The scope of the control facilities is basically limited to transmitter on/off switching, aerial speed control, and the determination of the type of display fed to the users.

Location

3. The control position is so arranged that one operator, seated at the suite of three consoles comprising the rack, electrical equipment (console), can observe the overall equipment state on the indicator panel rack. To effect this the rack, electrical equipment containing the indicating and monitoring devices is mounted immediately behind the console suite at such a height as to be visible to the MTI operator.

4. The associated item of equipment, the panel, control is not available to the MTI operator, and is located adjacent to the signal processing equipment.

Function

5. Although a detailed description of each unit is given in the relevant chapter of this section, a brief description, outlining the function of the units, is given herein.

Rack, electrical equipment (console) M1

6. The rack, electrical equipment (console) comprises three consoles, so arranged as to form a composite console suite, and giving a control position for one operator. From the console suite, the operator can not only select and set up the display to be passed to the users, but can also maintain a comparative monitoring watch, thereby ensuring that the best possible display is available under given circumstances.

Rack, electrical equipment (indicator)

7. The rack, electrical equipment is a framework housing the indicator panel, trigger panel and aerial turning control panel. The unit also contains the station auto-align relays and a transformer which produces a valve heater and indicator light supply for the sub-units.

Panel, Indicator

8. The unit is essentially an illuminated block diagram of the signal processing system. When used in conjunction with the panel, control and the fault relay assemblies mounted in each signal processing cabinet, it provides a system serviceability guide, showing faults due to the h.t. failure and all other known faults as indicated by the panel, control.

9. Each unit in the system where failure will render part of the system unserviceable is represented by a light which is normally illuminated to denote a serviceable unit. In addition, the panel uses all fault indication fed into it to compute those outputs on channel 1 which are left available for use. The panel also contains a fault indicator system which provides a flashing light on the panel, trigger.

Panel, trigger

10. The linesman and non-linesman trigger panels differ only in the details of the P.R.F. trigger state information provided. The trigger panel can be regarded as consisting of three sections, The upper section provides remote facilities for switching the Type 84 transmitter on or off and also gives indications of the progress of the 10-minute running-up period. Indication is also given of the mean power output of the transmitter.

11. The centre section supports a ninged panel carrying the PRFD by-pass control and indication and the impulsive interference suppression system (I.I.S.) by-pass control and indication. To show partial failure of the trigger system an emergency trigger indicator lamp is fitted. This illuminates when the trigger system falls into the flywheel sync. condition. The non-linesman panel, trigger also provides PRF A and B trigger and maintenance state indications.

12. The lower section of the panel is devoted to fault indicators for the signal processing cabinets. A normally illuminated indicator is provided for each frame of the cabinets, a fault being localized by the appropriate indicator being extinguished. At the same time a FAULT indicator on the panel is made to flash.

Aerial turning control panel

13. This panel houses the aerial starting and rotational speed controls. A full description is given in Section 8, Chapter 5.

Panel, control (fault override)

14. This unit carries fifteen double-pole switches. With these in their normal condition the panel indicator fault system is activated by failure of any one of the inputs. When the panel indicator fault lamp flashes it may be reset to a steady state by setting the appropriate switch in the panel control (fault override). The panel indicator fault lamp is then ready to indicate, by flashing, a further fault. The position of the switch or switches in the panel control (fault override) provides the operator with an indication of the fault areas, the switches remaining set until returned to the normal condition when the fault or faults have been rectified. An indicator lamp on the panel control (fault override) illuminates when any switch on the panel is set to a fault condition.

Panel, control, indicator (D.A.T.O.)

15. This unit provides remote indication of operational and serviceability status of the D.A.T.O. cabinets in R12 and R17 buildings. Fault conditions in the D.A.T.O. cabinets for Type 84 and 85 radars are indicated; also the maintenance status of the D.A.T.O. cabinet in R17 building is indicated.

16. When operator control is from this panel (indicated by a lamp on the panel), selection of either channel (A or B) from the Type 84 radar head in R17 building is available.

Panel, control

17. As stated previously, the control panel is not located at the control position, but is associated with it. Forty-nine switches on this unit pass unit and system serviceability information to the indicator panel and the trigger panel. Forty-eight switches, each corresponding to a unit in the signal processing system, modify the indicator panel display to register known faults. The remaining switch is operated during system maintanence periods to inform the trigger panel by lighting a MAINTENANCE indicator. A MAINTENANCE lamp on the control panel also lights.

Chapter 2
(Completely revised)

CONSOLE SUITE

CONTENTS

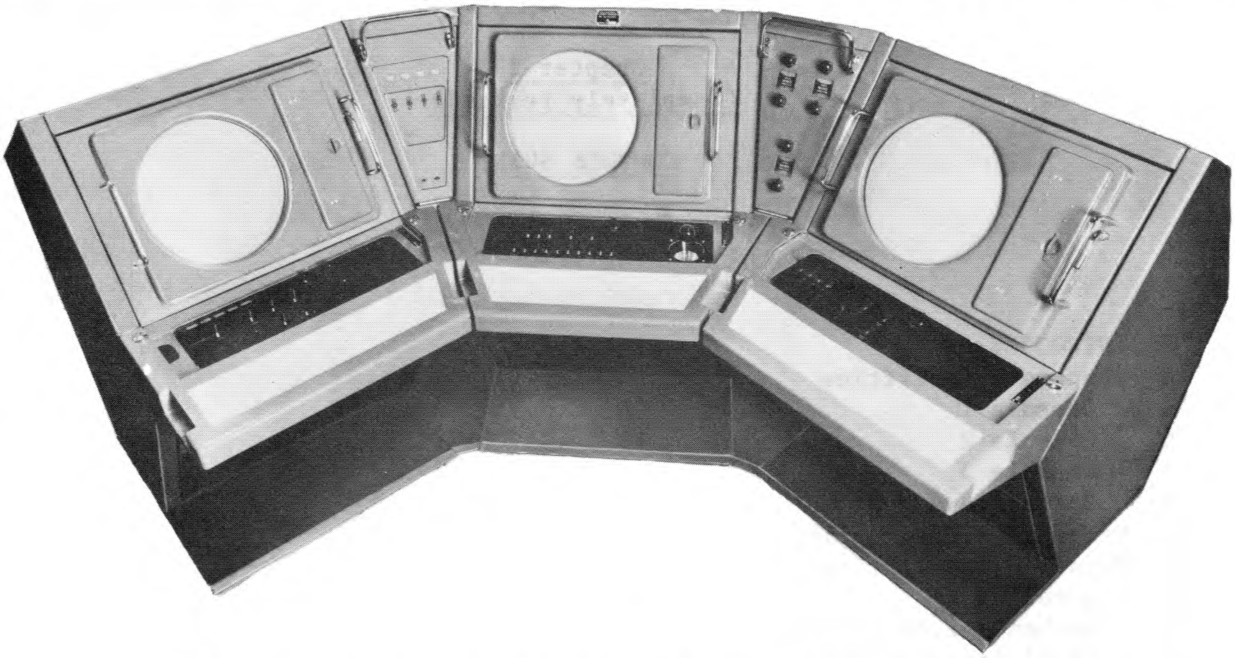


Fig.1 Rack, electrical equipment (console) M1: front view

INTRODUCTION

1 The rack, electrical equipment (console) M1 (fig. 1) is the MTI operator's control position, from which he can select and set up the type of display to be fed to the users. The operator can also maintain a monitoring watch, so that the best possible operational display is available under prevailing conditions.

2 The equipment itself comprises three 12-inch Type 64 fixed coil consoles, arranged at 45 degrees to each other, so giving a composite console suite. The consoles proper are standard items, a description of which is given in AP 115K-0301-1. The Type 84 requirements are met by the addition of different control desks and panels, descriptions of which are given herein. A complete list of units, showing standard and non-standard items, are given in Table 1.

TABLE 1 LIST OF UNITS

Console Type 64 Units

Name	N.S.N./A.M. Ref.	Qty.
Indicating unit (c.r.t.) T16452	10Q/164698	3
Amplifying unit (video)	5840-99-946-7730	3
Waveform generator (video gating)	5840-99-954-8829	3
Blanking Unit T26A	10D/22316	3
Panel Control T859C	10D/22389	3
Amplifying Unit (R.H.)	5840-99-946-7734	3
Amplifying Unit (L.H.)	5840-99-946-7735	3
Stabilizer Voltage T51	10D/18642	3
Power Unit (e.h.t.) T898	10K/16952	3
Panel (distribution)	5840-99-946-7740	3
Panel (fuse) T860	5840-99-999-8882	3

TABLE 1 (Continued)

Type 84 Units

Name	N.S.N. 5840-99-	Qty.
Panel (control desk) L.H. M3	-112-8991	1
Panel (control desk) Centre M4	-112-8992	1
Panel (control desk) R.H. M5	-112-8990	1
Panel (relay) M6	-947-1161	1
Panel (connector) M7	-999-9254	3
Control (wind speed and direction) M3	-999-9251	3

Operator's facilities

3 By the operation of controls on the console suite, the MTI operator can select the degree of processing which is applied to the received signals before the display is presented to the users. The facilities available to the operator are described below.

Console 1

4 This is the left-hand console, as viewed from the operator's position, and displays channel 1 information, which is fed to the users as the best available display. Channel 1 gives a choice of any one of five types of video, involving differing types of signal processing, selected by the MTI operator at the request of the user.

5 The five types of video available to the operator are:

5.1 Fully processed. This is the best display that the operator can produce in given conditions. Fig. 2 shows a display in which three rectangles and the centre circle are in use. The centre circle, preset to suit site conditions, defines the area in which permanent echoes are cancelled, while the rectangles define areas in which various types of moving clutter may be cancelled. The size and positions of the rectangles are independently adjustable from the console suite, and in certain circumstances may overlap each other or the centre circle. In this event, a system of priorities is used, whereby rectangle 1 takes precedence over 2 and 3, and rectangle 2 takes precedence over 3, precedence being indicated by the obliteration of the boundary marker of the 'inferior' rectangle. Where a rectangle overlaps the centre circle, permanent echoes and moving clutter are cancelled providing a fully-processed display within the area of the circle. The MTI on the fully processed display may be clutter-switched, the circle and rectangles merely defining the boundaries of the clutter-switched areas. However, there are four switches which allow clutter-switching to be dispensed with any of the areas, the result being MTI all over the area.

5.2 Semi-processed. This is the best display which can be produced without rectangles. It consists of a background of log + P.L.D. with MTI applied to the centre circle.

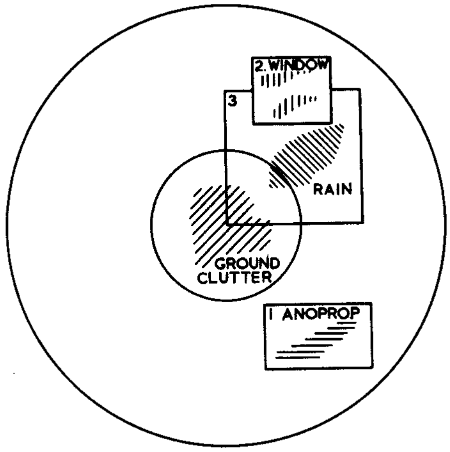


Fig.2 Typical fully processed display

5.3 Log + P.L.D. With this facility selected the display consists of signals which have passed through stages of logarithmic amplification and pulse length discrimination. The log + P.L.D. signal also provides the 'background' for the fully-processed and semi-processed displays.

5.4 Linear. This facility gives an unprocessed, or 'raw' display. After linear amplification and detection, the signals pass through p.r.f. discrimination circuits before being applied to the displays.

5.5 A/J direct. In the event of jamming being experienced, the user's displays may be fed with the detected output of the Dicke-Fix receiver, by-passing the remainder of the signal processing circuits. The signal processing circuits of the anti-jamming channel have independent power supplies, so that in the event of a major signal processing failure the users would still have an anti-jamming display available as a standby.

Console 2

6 This is the centre of the three consoles, and is the MTI monitor console. It enables the operator to choose any of the following displays independent of the display being fed to the users.

6.1 Channel 1, the user's display, including semi-processed video while the user is on fully processed video and vice-versa.

6.2 Lin. Mod. A linear display, limited at a low level to avoid 'blooming' the PPI.

6.3 MTI. This displays MTI all over the screen, and so enables the operator to set up any rectangles he may need for the cancellation of moving clutter, and also to optimize the wind speed and direction conditions within the rectangles. It also assists in the detection of faults in the MTI systems, since because of the composite nature of the channel 1 display a fault may not be apparent.

6.4 P.L.D. Provides monitoring of the log + P.L.D. channel.

6.5 A/J. Monitors the output of the Dicke-Fix receiver.

6.6 Spare. This is a test facility, and may be used during servicing.

Console 3

7 This is the right-hand console, and gives a linear display which shows the operator the extent and nature of clutter and jamming. The display is subject to reversed swept gain beyond 200 miles in order to given an indication of the direction of a jammer. This is not an operational display, and is not passed to the users.

Rectangle adjustment

8 The MTI operator can adjust the three rectangles to any desired size or position by means of switches and a joystick control. The rectangles are defined by corner dots which are injected during the intertrace period, so that they are always visible during the setting-up procedure.

9 When a rectangle has been set up in the required position, the operator optimizes the cancellation by adjustment of the wind speed and direction controls. Only when the best result has been obtained is the display passed to the users, thereby ensuring that the users' display is not degraded during the setting-up period.

Mechanical description

10 The three Type 64 consoles are bolted together in such a way that adjoining consoles form an angle of 45 degrees. The correct spacing and necessary rigidity is achieved by the use of sheet steel channelling and mild steel fillets, while the spaces between the consoles are covered by removable steel panels. The whole assembly is mounted on a low plinth which is extended in front of the displays to include the operator's position.

Detailed description

11 A detailed description of the units comprising the console Type 64 will be found in AP 115K-0301-1. Units peculiar to the Type 84 application are described herein.

Control desks

12 The three control desks used on the console suite are similar in construction, differences being the control functions which they perform. Therefore a mechanical description common to all desks will be given, followed by an electrical description of the individual desks covering the function and operation of each control.

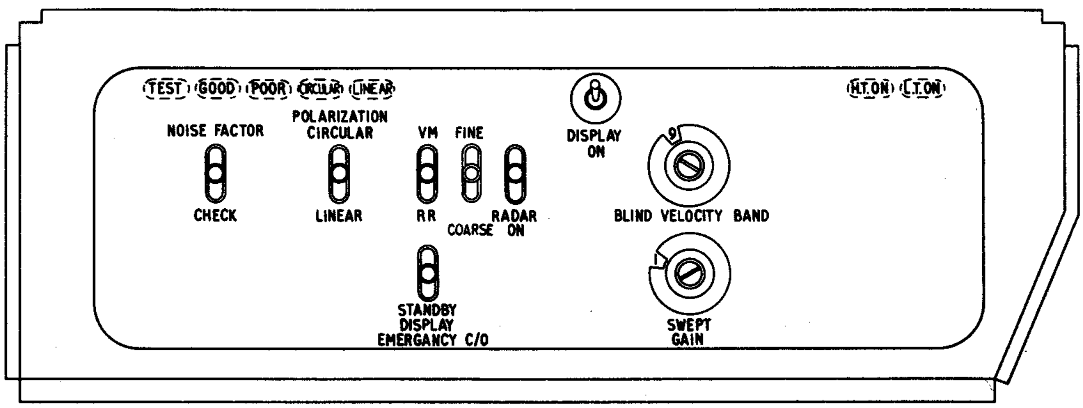
Mechanical description

13 The unit consists of a rectangular chassis on which the components and controls are mounted. The control inscriptions are engraved on the black-painted inside surface of a perspex panel, which is retained on the chassis by means of a metal escutcheon. Four panel lights provide edge-illumination of the engravings without radiating light externally.

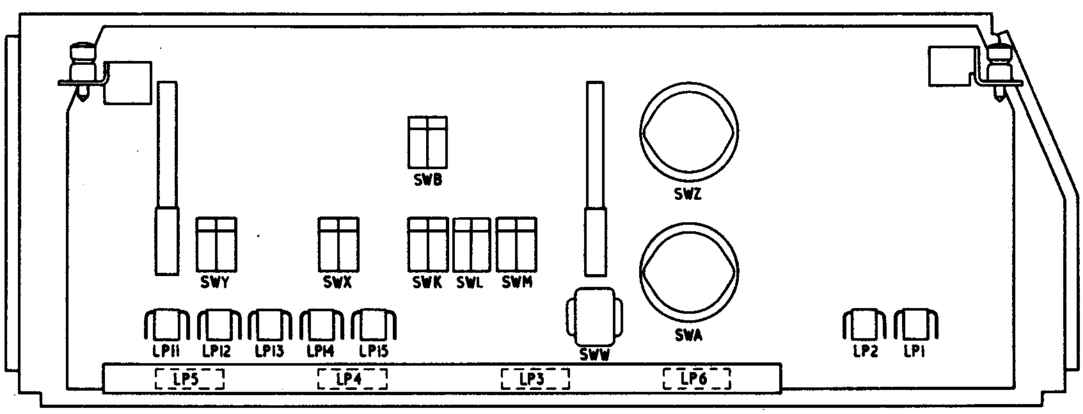
14 The desk is mounted on the front of the console by inserting the two locating studs at the rear of the desk into keyhole-shaped slots on the console, and is retained in this position by means of the two captive screws under the front edge of the desk. Assembly is completed by fitting the sheet-metal outer desk cover, which then protects the controls by forming a 'well' in which they are situated. The outer cover is retained in position by captive screws.

Panel (control desk) L.H. M3 (fig.3)

15 A circuit diagram of the unit is shown in fig. 12. External connections are made via free plugs, which mate with panel-mounted sockets on the console control desk connector panel. This panel carries seven sockets to cater for the various applications of the different types of desk, and connections are made as appropriate. Certain of the controls, namely DISPLAY ON, RADAR ON and VM/RR operate circuits within the console Type 64, and are described in AP 115K-0301-1.



FRONT VIEW



COMPONENT LAYOUT

Fig.3 Panel (control desk) L.H. M3: front view and component layout

16 The control desks accept a 50V supply, negative with respect to earth, and switch both lines of this supply to provide control of certain functions.

17 Blind velocity band selector (SWA). This is a three-position rotary switch, the positions being 9, 13 and 19 knots. In the 13- and 19-knot positions, 50V (+) is fed via PL4/X and PL4/Y respectively to the amplifier (i.f.) M1 (Sect.2, Chap.9), where it completes the energizing circuit for relays RLA and RLB. In the 9-knot position of the switch both relays are de-energized.

18 Check noise factor (SWY). This two-position key operates in conjunction with the three indicator lamps LP11, LP12 and LP13 (TEST, GOOD and POOR) to provide an indication of the noise factor of the Type 84 radar, without interrupting normal operation.

19 When SWY is set to the CHECK position, 50V (+) supply is completed, via PL4/A and PL4/O, to relay RLG in the monitor, noise figure M1 unit (Part 2, Sect.7, Chap.5) of the transmitter, thereby initiating the checking sequence. At the same time the TEST lamp, LP11, on the control desk is illuminated. The indication of noise factor is then given by either LP12 or LP13, dependent upon whether or not the noise factor is within the prescribed limits, i.e. the GOOD lamp is illuminated for noise factors of 6.4 to 9 dB, while the POOR lamp is illuminated for noise factors in excess of 9 dB. The indication, whether GOOD or POOR, is maintained for 10 seconds.

20 Swept gain (SWZ), is a four-position rotary switch, used by the MTI operator to select the amplitude of the gain-sweeping waveforms produced by the generator sweep (video) M3 (Sect.2, Chap.4) and the limiter, electrical noise M1 (Sect.2, Chap.7). Both of these units contain similar, relay-controlled attenuator circuits. The amount of attenuation applied is the same for both units, since the relay energizing circuits of both units are parallel-connected. With the SWEPT GAIN switch set to position 1, relays RLA and RLB are de-energized. In positions 2, 3 and 4, 50V (+) is applied to the appropriate relays, so that either or both are energized.

21 Display emergency C/O (SWB) is a two-position key. In the event of an operational failure of the MTI (console 2) display, the operator can, by setting the switch to STANDBY, reverse the displays available on consoles 2 and 3. The changeover is effected by relays RLA, RLB and RLC in the panel (relay) M6 (para.40). The energizing circuit for these relays is completed by the application of 50V (+) when SWB is set to the STANDBY position.

22 Polarization (SWX). This is a two-position key providing selection of the type of polarization applied to the radiated pulses. The switch operates in conjunction with LP14 and LP15, the CIRCULAR and LINEAR lamps on the control desk. With SWX set to the LINEAR position, 50V (+) is fed via PL4/F to the polarizer relay in the waveguide assembly (polarizer) to affect the changeover. At the same time, the appropriate indicator lamp on the control desk is illuminated.

<u>Panel (control desk) R.H. M5 (fig.4)</u>

23 The panel (control desk) R.H., a circuit of which is shown in fig. 13, accepts a 50V d.c. supply, negative with respect to earth, and switches out both lines of this supply to control the clutter switching of the three rectangles and centre circle, and the controls associated with the console itself. These latter controls are described in AP 115K-0301-1. Interconnection arrangements are as described in para. 15.

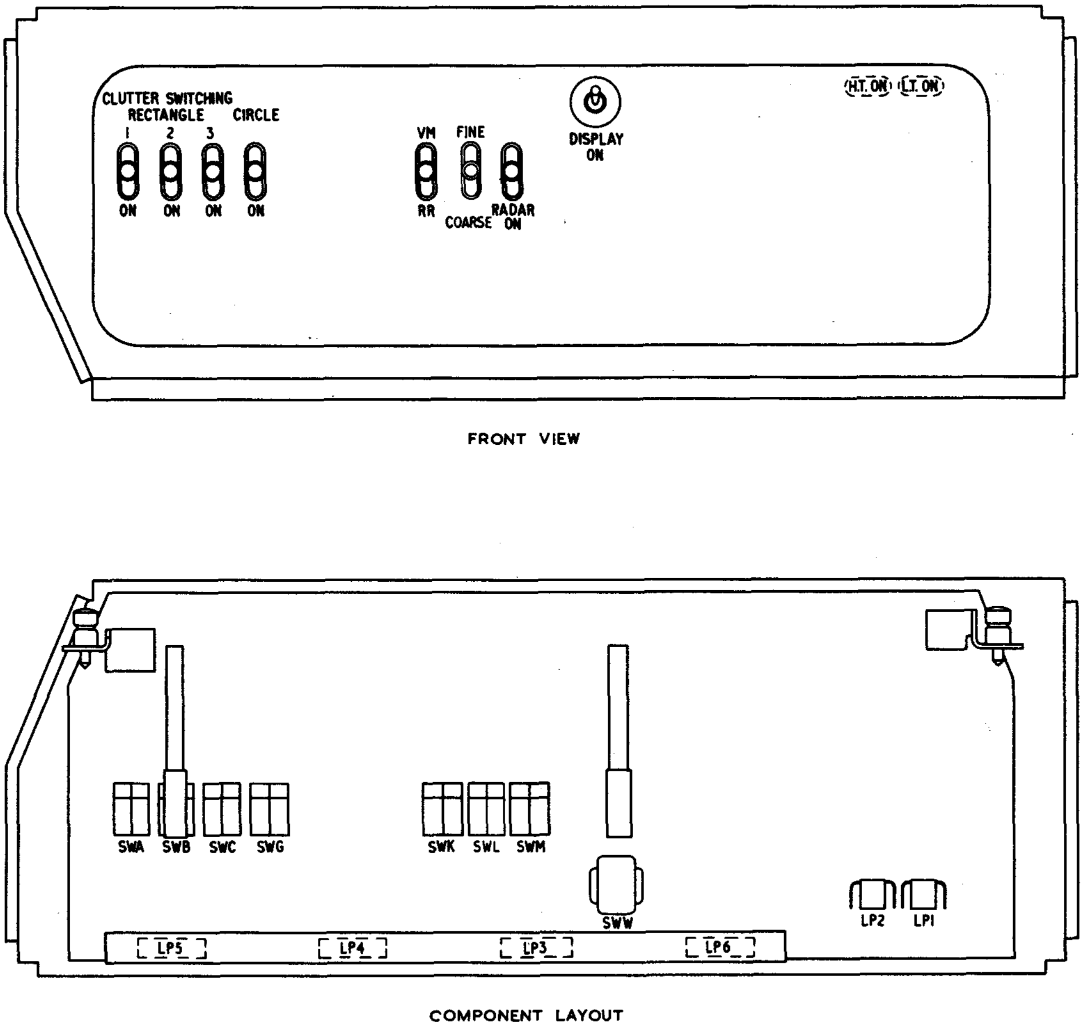
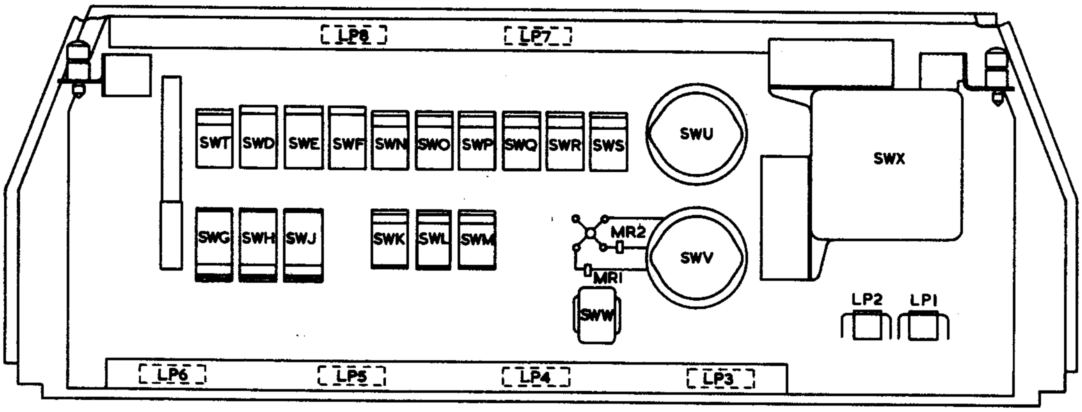


Fig.4 Panel (control desk) R.H. M5: front view and component layout

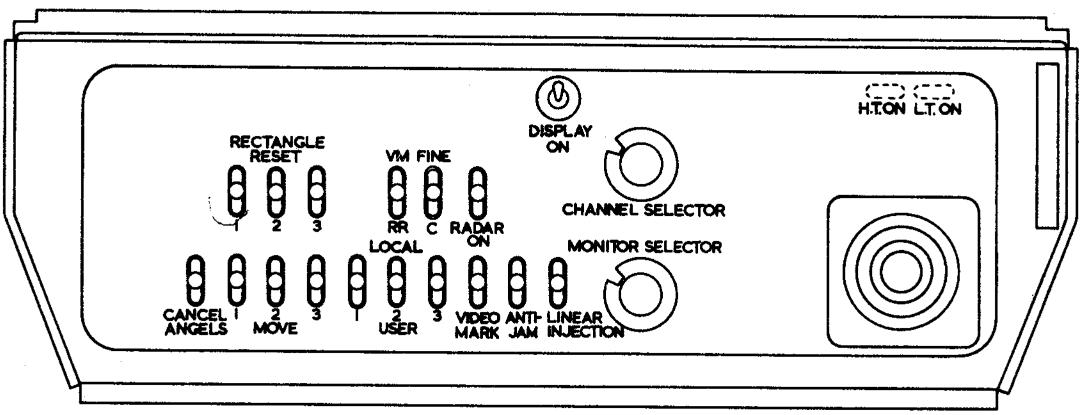
24 Clutter switching is effected by four keys SWA, B, C and G. Keys SWA, SWB and SWC control rectangles 1, 2 and 3 respectively, while SWG controls the centre circle. With any of the keys set to the OFF position, 50V (+) is fed to the panel (area switching) M1, where it completes the energizing circuit of one of the four relays RLG to RLK. With one or more of the relays energized, the clutter switching waveform is not effective in the selected area.

Panel (control desk) centre M4 (fig. 5)

25 In addition to the controls associated with the switching-on and operating of console 2 (centre), the control desk also carries a joystick control and a number of keys and rotary switches which are used in the selection, setting-up and monitoring of the users' display. The controls peculiar to the console itself, i.e. DISPLAY ON, VM/RR and RADAR ON are described in AP 115K-0301-1, while the remainder of the controls are described herein. The VIDEO MARK control (SWQ) functions in the manner described in para.28. A circuit diagram of the control desk is given in Fig. 14.



COMPONENT LAYOUT



FRONT VIEW

Fig.5 Panel (control desk) centre M4: front view and component layout

26 Channel selector (SWV). This is a SIX position rotary switch, by means of which the MTI operator can select the type of display to be fed to the users' on Channel 1. The switch has four wafers; two of these, (a) and (b) feed out 50V (+) to relay assemblies M3 and M2, (Sect.5, Chap.9 and 6 respectively), where it completes the energising circuit of the channel selection relays. Wafer (d) of the switch provides a visual indication of the selected channel of the panel indicator, (Sect.8, Chap.3), by simultaneously completing the illuminating circuits of the appropriate SELECTED OUTPUT lamp and the relevant section of the routeing diagram. Connected to wafer (e) are two diodes D1 and D2. The function of D1 is to prevent 50V d.c. com. reaching PL6Q when the switch is set to position 2. Diode D2 prevents 50V d.c. com. reaching PL6Q and PL6R when the switch is set to position 3.

27 Fine/coarse switch SWL. The FINE/COARSE switch is connected via PL2 to the C.E.E. head and p.r.f. The operation of this switch permits the selection of fine or coarse video map signals when VM has been selected or the choice of 5-mile or 10-mile range rings on RR.

28 Video marks (SWQ). When the key is operated, 50V (+) is applied via PL2/P to RLB in the amplifier video Type 312A. With RLB energised, the rectangle video marks from the panel (area switching) M1 (Sect.4, Chap.7) are passed to the display provided that this input is connected to the amplifier.

29 Monitor selector (SWU), is a six-position rotary switch providing selection of the type of display fed to the MTI monitor console. Two wafers of the switch are used; of these, wafer (b) feeds 50V (+) to the relay assembly M2, where it completes the energizing circuit of the monitor display selector relays (RLD, E and F). Thus, for a given switch position the appropriate relay, or combination of relays, is energized, and the selected display applied to console 2. Wafer (d) of the switch is not used in the present application, although it is wired to provide six switched outputs, plus common, to PL6/A-G.

30 Cancel Angels (SWT), in the event of 'angel' interference being experienced, the CANCEL ANGELS key is operated, thereby applying 50V (+) via PL7/S to RLA in the switch, electronic (clutter) M1 (Sect.3, Chap.9). The relay is energized, and the angel switching circuit is brought into operation.

31 Linear injection (SWS). With the LINEAR INJECTION key operated, 50V (+) is fed via PL7/R to RLA in the generator, reverse sweep M8 (Sect.5, Chap.7), and also to the channel selector relays in the relay assembly M3. Energization of RLA in the generator, reverse sweep causes reverse swept gain to be applied to

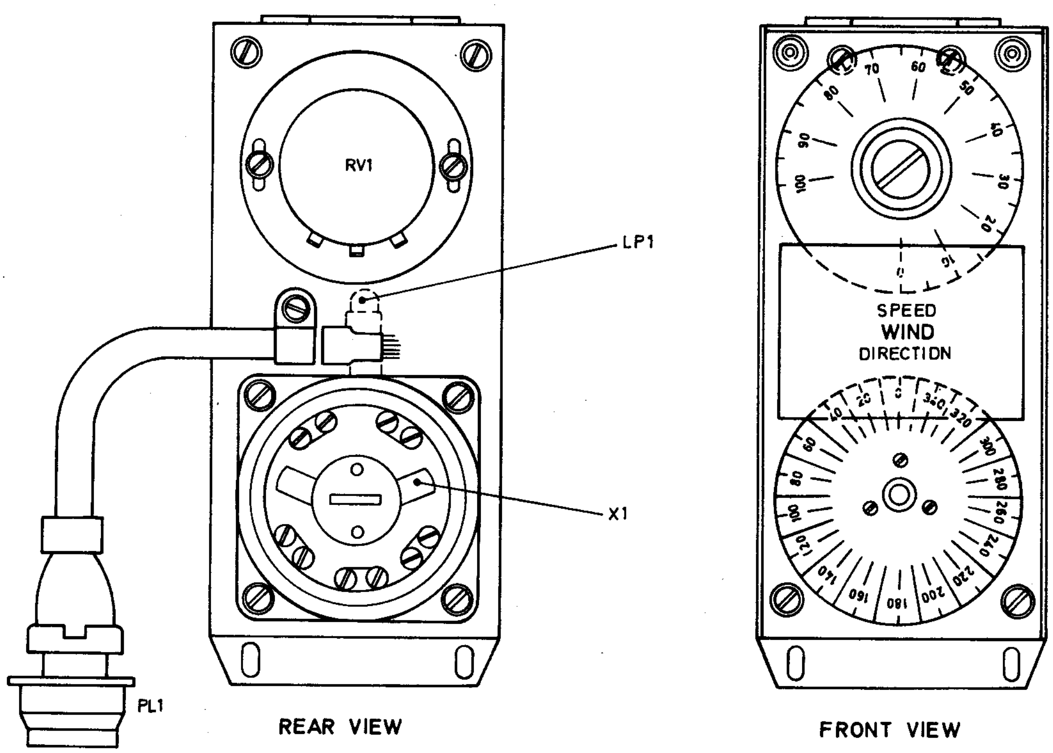


Fig.6 Control (wind speed and direction) M3: front and rear views

signals in the linear channel after the first 200 miles. The relays in the relay assembly M3 also change the 'background' of the channel 1 display from log + P.L.D. to linear, modified by reverse swept gain beyond 200 n.miles, as already described.

32 Anti-jam (SWR). This key enables the i.f. input to the MTI and log PLD signal channels to be changed from anti-jamming i.f. to linear i.f. With the key in the operated position, 50V (+) is fed via PL7/Q to RLA in the switch, electronic (i.f.) M2 (Sect.2, Chap.2). The relay is thereby energized, thus effecting the changeover between the anti-jamming and linear circuits.

33 Move/size (SWD, E and F). These three switches are used in conjunction with the control desk joystick to set up the positions and sizes of the three rectangles on the MTI operators display. Only one rectangle can be adjusted at a time, since the operation of one of the switches to either of its positions isolates the other two. With one of the switches operated, 50V (+) is fed to the intertrace equipment via PLE/X. This supply, known as the earth passwire, readies the intertrace equipment for the production of corner dot markers. The dot marker switching for a particular rectangle is effected by relays in the appropriate pulse generator (rectangle) M1 (Sect.4, Chap.2), the relays being energized by a 50V (+) supply applied by contacts of either the SIZE or MOVE sections of the relevant switch. With one of the switches operated, the joystick push-button (SWX) is depressed and the joystick moved to effect the required function. Movement of the joystick alters the positions of the wipers of the two associated potentiometers, thereby varying the two d.c. potentials fed to the controller, motor M3 (Sect.4, Chap.4) via PL5/C and PL5/D. When a switch is set to the MOVE position, joystick movement alters the position of the entire rectangular area, as defined by the four corner dots; in the SIZE position, movement of the joystick in the X and Y axis changes the position of either the upper or right-hand pair of dots, so that the rectangle can be adjusted to cover the required area.

34 Local/users (SWN, O and P). These three keys determine the distribution of the rectangles. Thus, with any of the switches set to the LOCAL position, a complete rectangle is displayed on the centre console only, enabling the operator to set up doppler compensation. When this has been done, the switch is moved to the USERS position, and the compensated area is passed to the users' display. The user, however, receives no indication of the position of the rectangle. Selection and switching of the rectangles is effected by 50V (+), fed out of the control desk on PL5/N to PL5/V, and used to complete relay energizing circuits in the panel (area switching) M1 and the three pulse generators (rectangle) M11.

35 Reset (SWG, H and J). These keys enable any of the rectangle to be returned to a predetermined position. The pre-selection is effected mechanically by means of manually-adjusted cams in each of the motor assemblies M1, so that when one of the RESET switches is operated an earth is applied via PL5/Z to the controller, motor M3, where it completes the energizing circuit for the reset relay, RLA. At the same time, the move relay in the associated motor assembly is energized, and the motor rotates until the cam position is reached, thereby moving the rectangle to the pre-set position.

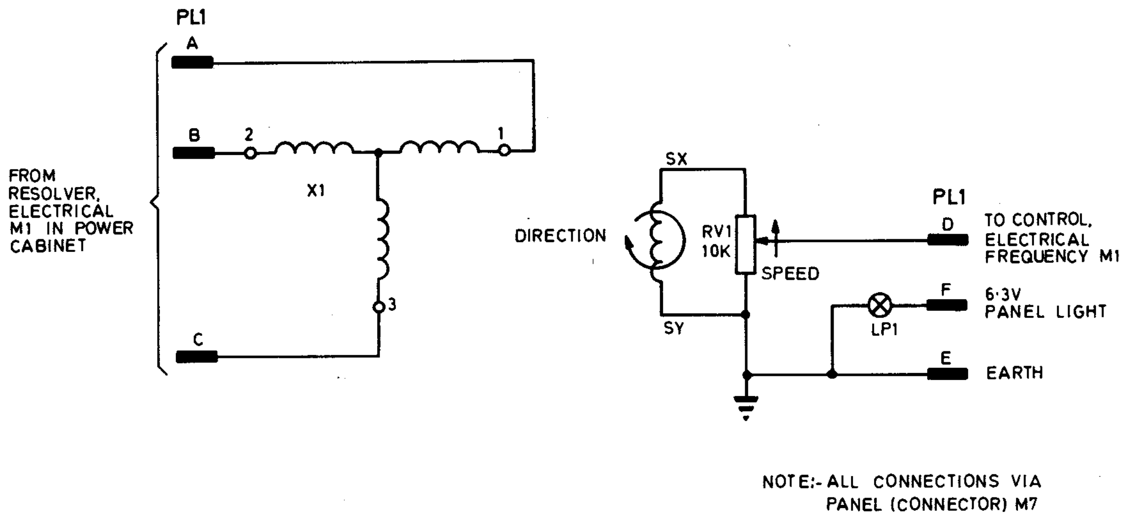


Fig.7 Control (wind speed and direction) M3: circuit

Control (wind speed and direction) M3 (fig 6)

36 Three of these units, a circuit of which is given in fig. 7, are used in the console assembly. They are mounted on a sub-panel, situated between the centre and right-hand consoles. The purpose of the units, each of which consists of a magslip and a potentiometer, is to provide the MTI operator with a means of setting up the doppler compensation within each of the rectangular areas.

37 The input to the unit at PL1/A, B and C consists of aerial rotational information in the form of a waveform which changes in phase due to aerial rotation. This information is applied to the stator windings of the magslip. The magslip rotor is in a position determined by the manually-adjusted DIRECTION control, so that the phase of the signal developed in the rotor either leads or lags the input signal by an amount determined by the setting of the control, which is calibrated in degrees of azimuth.

38 The rotor signal is developed across the SPEED potentiometer, RV1, adjustment of which selects a proportion of the total amplitude of the rotor signal, and feeds it, via PL1/D, to the associated control, electrical frequency M1 (Sect.4, Chap.11).

Panel (connector) M7 (fig.8)

39 The panel (connector) M7, a circuit of which is given in fig.9, is mounted behind the wind speed and direction controls. Its function is to accept and re-route the inputs to and outputs from the three control units.

Panel (relay) M6 5840-99-947-1161 (fig.10)

40 The panel, relay is mounted behind the sub-panel between the left-hand and centre consoles in the T.84 suite. A front view of the panel showing the component layout, is given in fig.10: the circuit diagram is shown in fig.11. The panel effects changeover of displays between the centre console and the right-hand console, in the event of the centre console display being unserviceable.

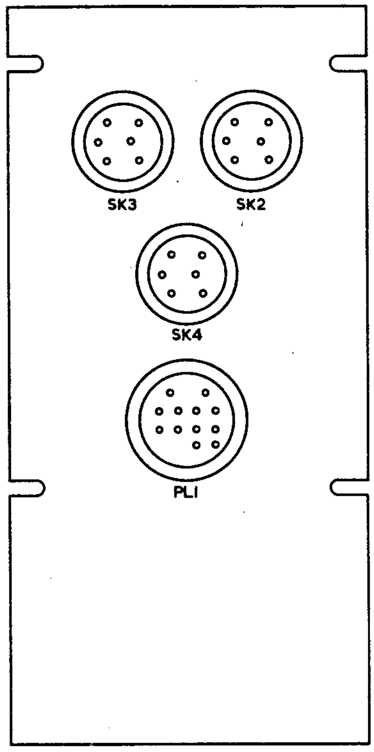


Fig.8 Panel (connector) M7: front view and component layout

41 The circuit consists of three relays connected in parallel between the -50V supply and a switched +50V supply. When the DISPLAY EMERGENCY C/O switch on the left-hand control desk is in the NORMAL position, all relays are de-energized. With the switch in the STANDBY position however, +50V is applied via PL1/A to energize the relays. The contacts of RLA effect the changeover of video signals between the two consoles. RLB1 changes the earth passwire connection to the I.T.B.U. Selection equipment from one console to the other. RLC effects the changeover of I.T.B.U. and video marks between the two consoles.

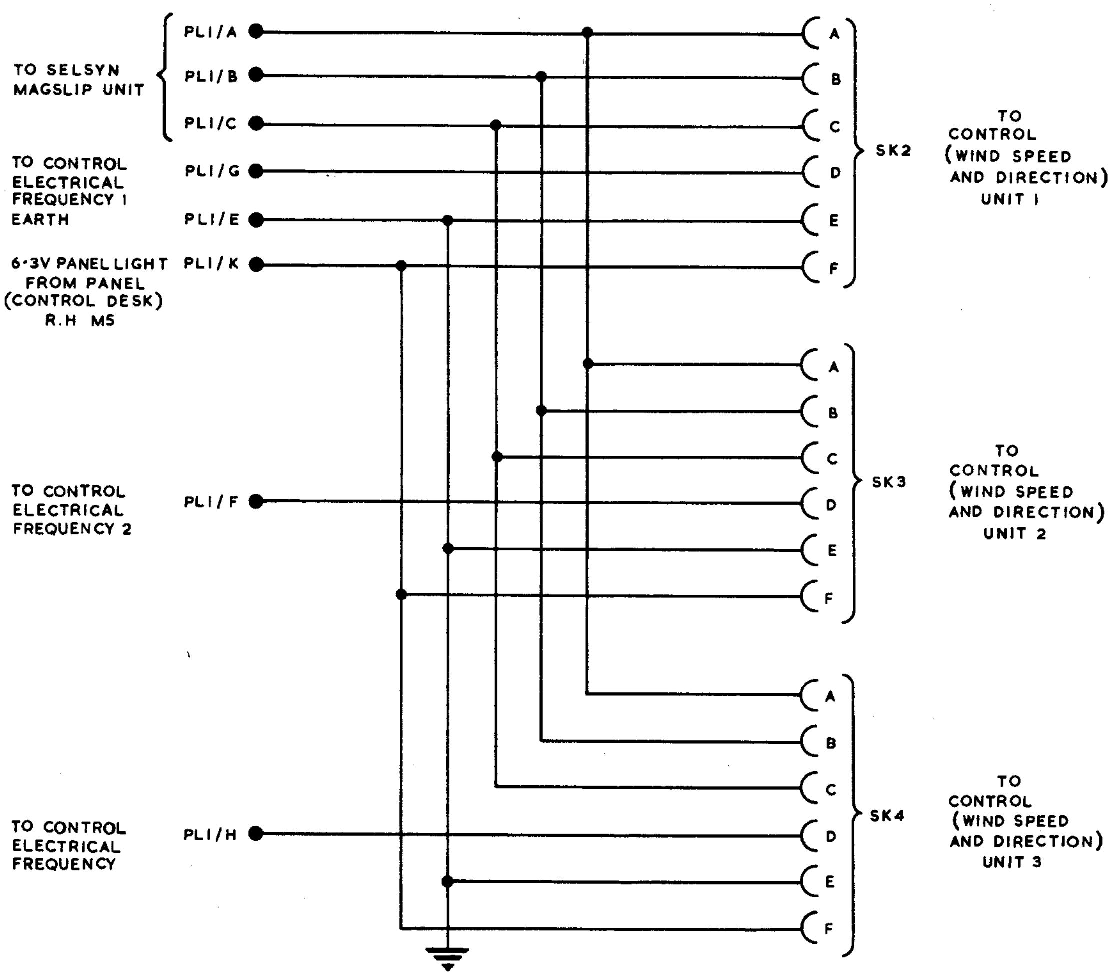


Fig.9 Panel (connector) M7: circuit

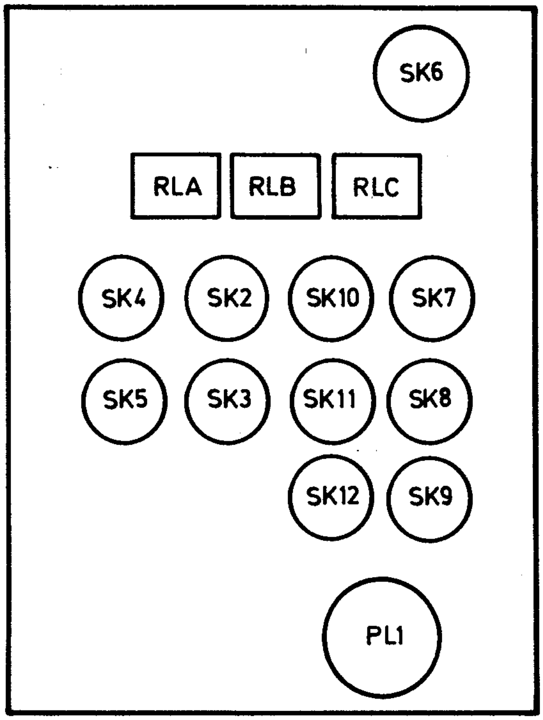


Fig.10 Panel relay 5840-99-947-1161-front view

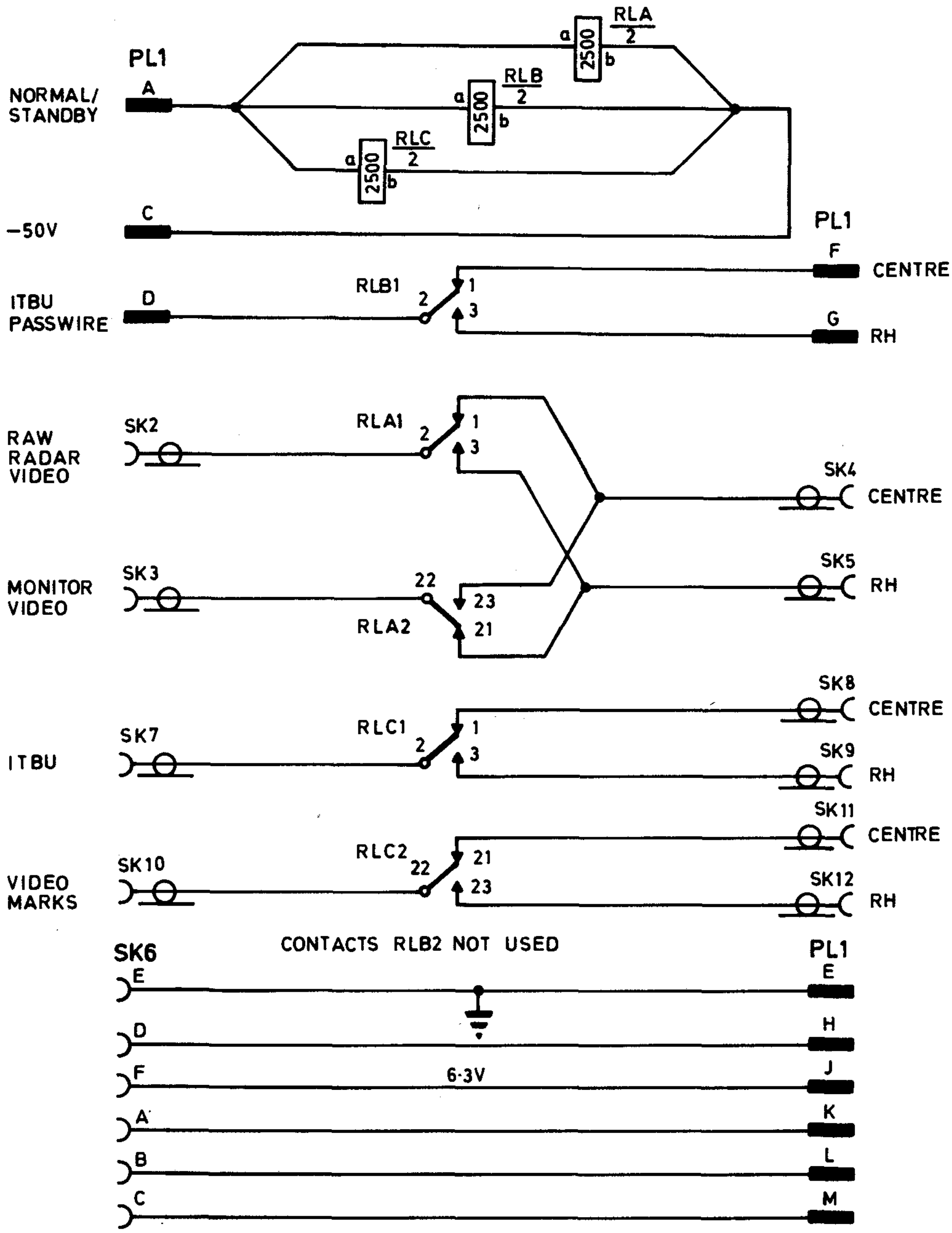


Fig.11 Panel relay 5810-99-947-1161-circuit

NOTE
THE POSITION ANNOTATIONS SHOWN ON THE SWITCHES ARE RELATED TO THE ENGRAVING ON THE CONTROL DESK PANEL AND THUS THE LEVER POSITION. THE SWITCH CONTACT NEED NOT NECESSARILY MOVE IN THE SAME DIRECTION DUE TO THE SWITCH LEVER ACTION.

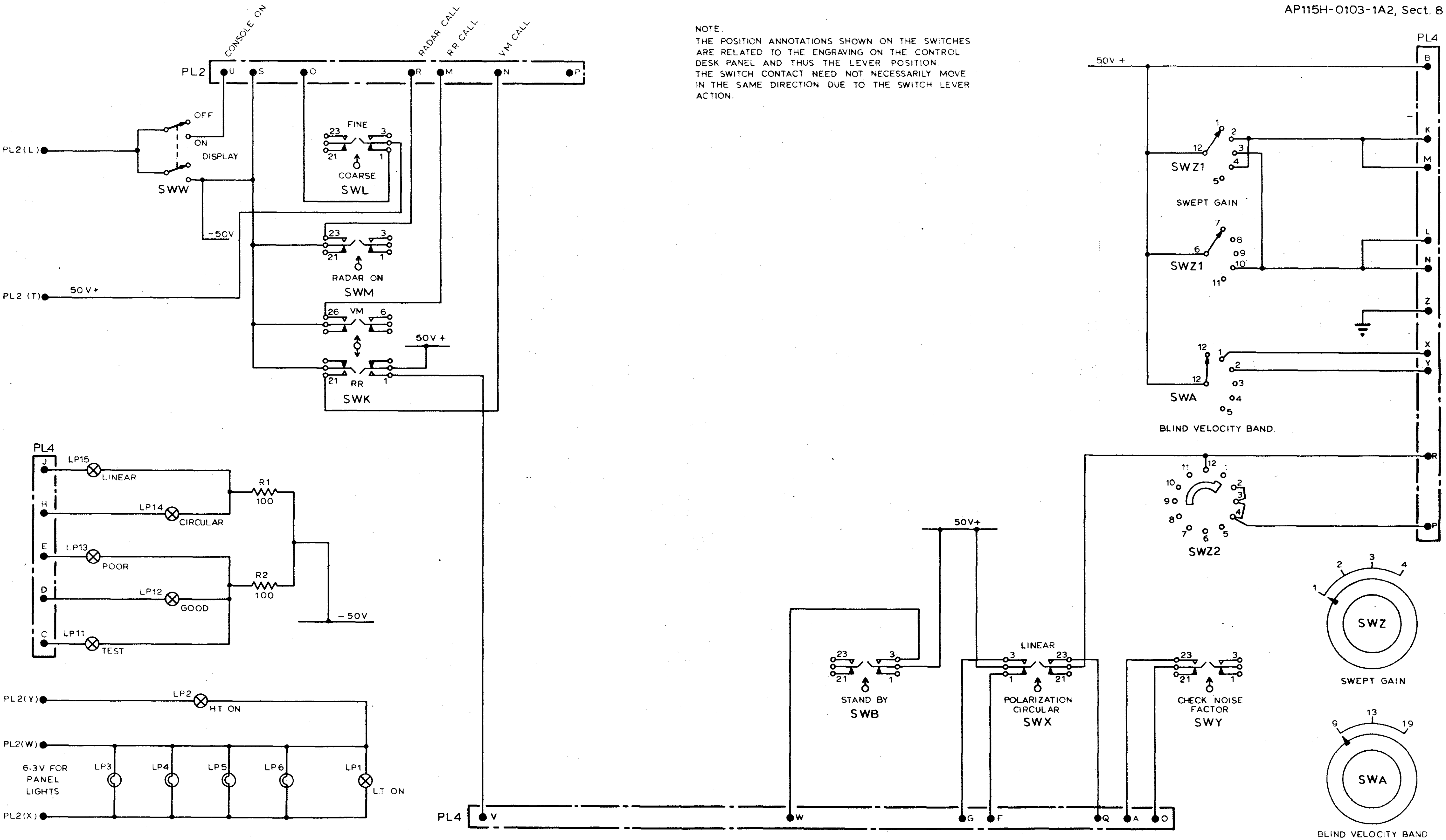
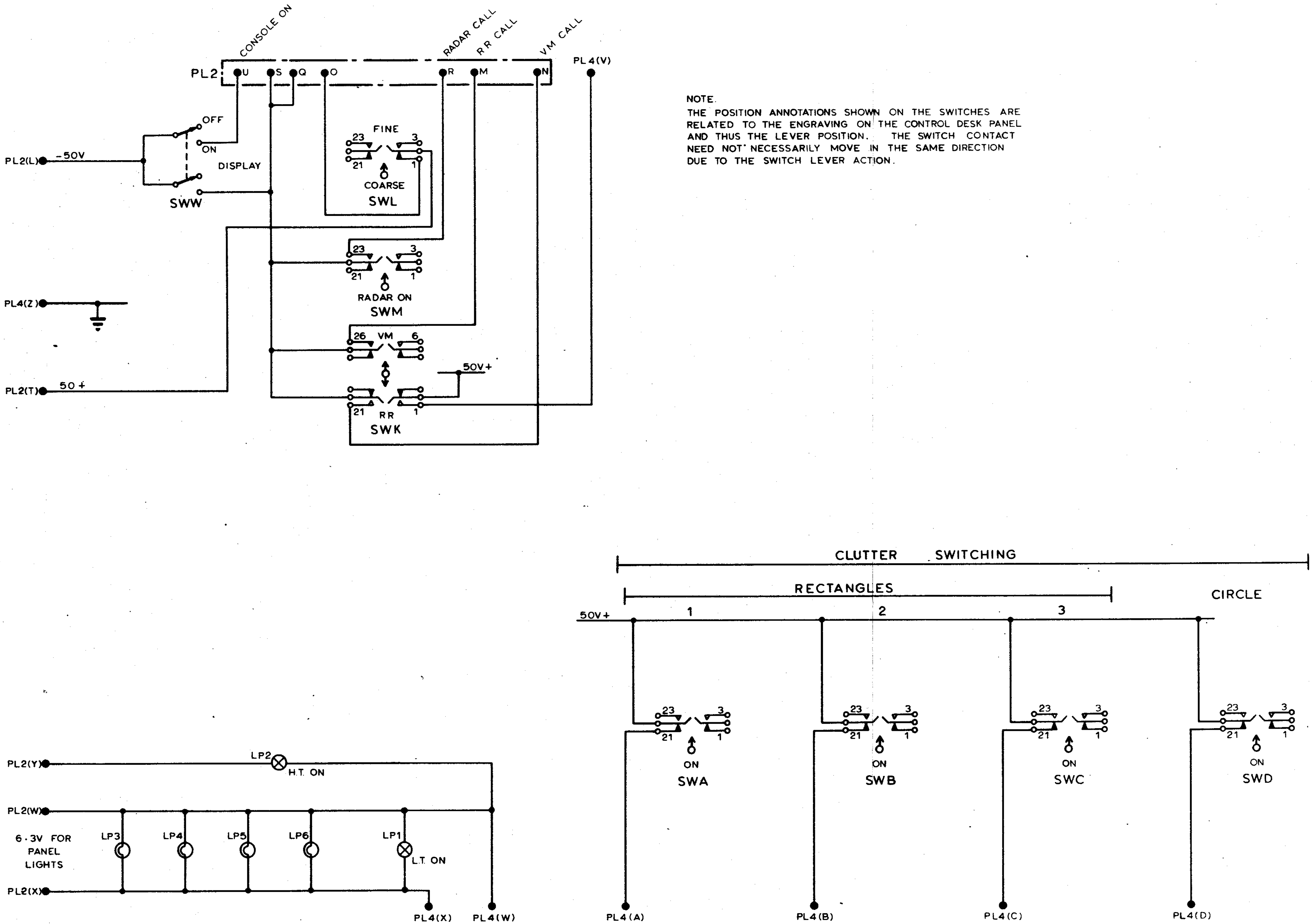


Fig. 12

Panel, control desk-left hand-5840-99-112-8991 - circuit diagram



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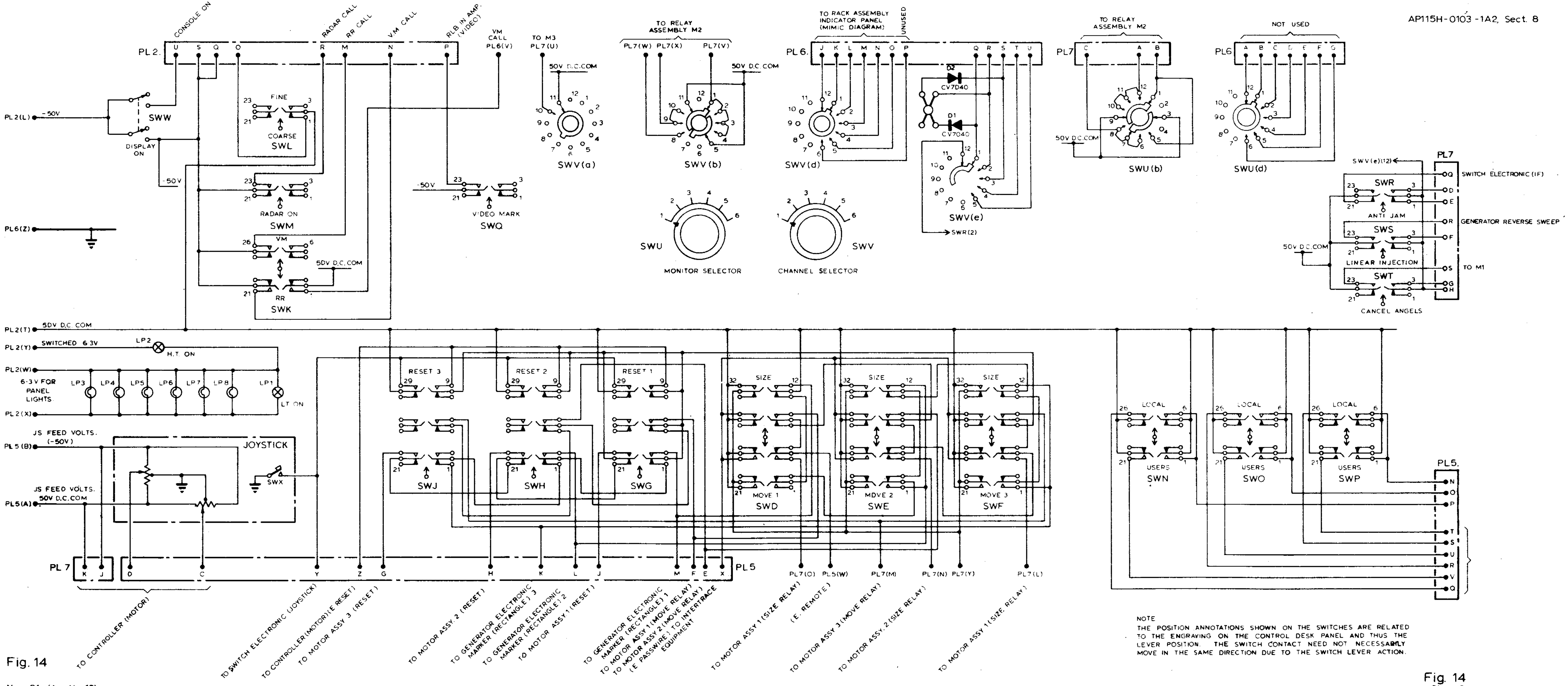
Panel, control desk-right hand — 5840-99-112-8990 — circuit diagram



NOTE
THE POSITION ANNOTATIONS SHOWN ON THE SWITCHES ARE RELATED TO THE ENGRAVING ON THE CONTROL DESK PANEL AND THUS THE LEVER POSITION. THE SWITCH CONTACT NEED NOT NECESSARILY MOVE IN THE SAME DIRECTION DUE TO THE SWITCH LEVER ACTION.

Fig. 14

Panel - centre 5840-99-112-8992 – circuit diagram

Chapter 3

INDICATOR PANELS

(*Completely revised*)

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LIST OF ILLUSTRATIONS

Introduction

1. The indicator panels associated with the signal processing equipment consist of the following:—

(1) Panel, indicator.

(2) Panel, trigger.

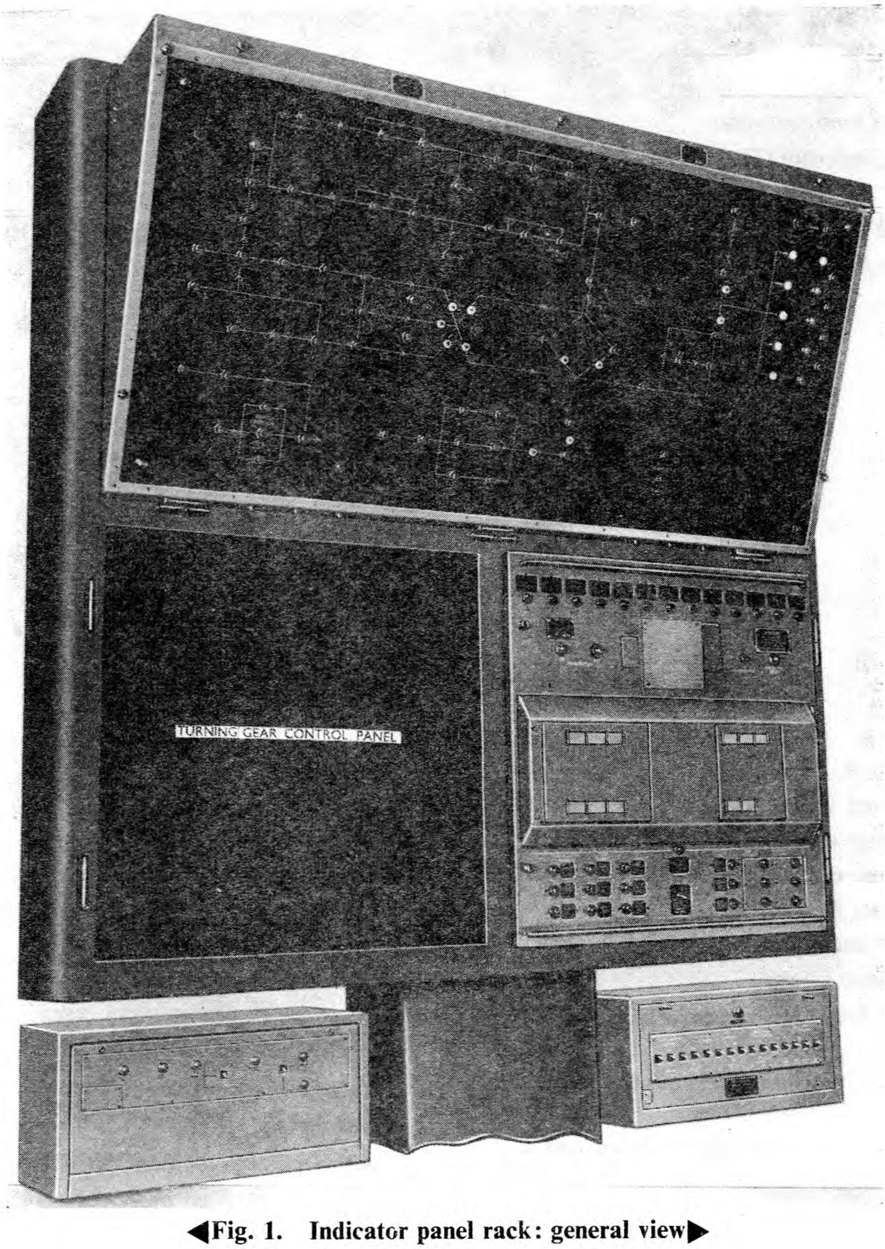
◀(3) Panel, control (fault override).

(4) Panel, control, indicator (D.A.T.O.).

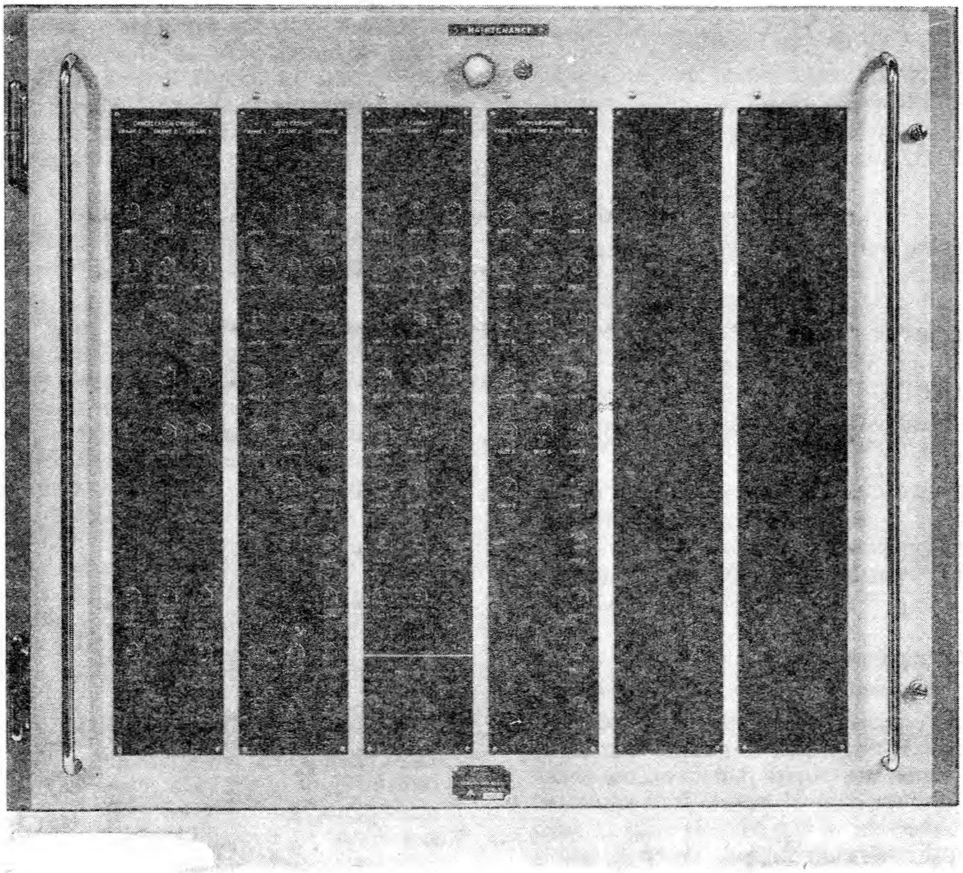
(5) Panel, control.▶

The indicator panel and the trigger panel (*fig.* 1) are located in a rack, electrical equipment which is mounted on the wall at the rear of the console suite. The panel, control (fault override) (*fig.* 1) is ◀situated on the right-hand side just below the trigger panel adjacent to the cable trunking. The panel, control, indicator (D.A.T.O.) (*fig.* 1) is situated on the left-hand side just below the aerial turning control panel adjacent to the cable trunking.▶The control panel (*fig.* 2) is separately mounted on the wall of the equipment room.

2. The purpose of these panels is to provide the operator with the latest information regarding the serviceability and availability of the facilities offered by the signal processing equipment. The indicator panel is virtually an illuminated block diagram of the system. In conjunction with the control panel and the fault relay assemblies mounted in each signal processing cabinet, it provides a system serviceability guide, taking into consideration all faults due to h.t. failure and all ◀known faults (*defined in para.* 20▶) as indicated by the control panel. The major components of the signal processing system are represented by lights which are normally illuminated to indicate serviceable units, the appropriate lights being extinguished when any fault occurs. In addition, the panel uses the fault indications fed into it to compute those video outputs which are left available for use. The panel provides fault indications by means of a flashing lamp on the trigger panel, and for known fault indications it provides ◀a steady light both on the trigger panel and▶ the control panel.



◀Fig. 1. Indicator panel rack: general view▶



◀Fig. 2. Control panel: front view▶

3. The trigger panel provides remote control facilities and indications for the signal processing equipment. The transmitter-receiver remote control circuit is described in Chap. 4. System maintenance indicators, emergency trigger indicators and bypass controls for impulsive interference suppression and p.r.f.d. systems are carried on a hinged sub-panel. The state of each p.r.f. system is also indicated on this panel. The indicators for the signal processing system have two illuminated legends, the lamps behind which are controlled either by the fault information from the indicator panel or the control panel. These lamps give an indication on which frame in which cabinet a fault has occurred.

4. The panel, control (fault override) prevents saturation of the fault indication system in the indicator panel. Each fault indicator input to the indicator panel is routed via a switch in the panel, control (fault override). When a fault signal causes the trigger panel fault lamp to flash, the appropriate switch on the panel, control (fault override), as indicated by the indicator panel diagram, is depressed. This extinguishes the fault lamp on the trigger panel and leaves it available to accept further fault signals.

5. The panel, control, indicator (D.A.T.O.) provides remote indication of operational and serviceability status of the D.A.T.O. cabinets in R12 and R17 buildings. Fault conditions in the D.A.T.O. cabinets for both Type 84 and Type 85 radars are indicated; the maintenance status of the D.A.T.O. cabinet in R17 building is also indicated. When operator control is from this panel (indicated by a lamp on the panel), selection of either channel (A or B) from the Type 84 radar head in R17 building is available. A full description of this panel and its function within the D.A.T.O. system is given in A.P.4773D, Vol. 1, Sect. 2, Chap. 2.

6. The control panel provides indication of a known fault, i.e. when a unit on the signal processing equipment is being serviced. The panel contains 85 switches (*fig.* 2). During maintenance periods the switch adjacent to the MAINTENANCE lamp is closed and this indicator, together with the MAINTENANCE lamp on the trigger panel, is lit. The remaining 84 switches, each corresponding to a particular unit, are arranged in cabinet and frame order. When a unit needs attention, the appropriate switch on the panel is depressed. This operation modifies the state of the indicator panel and extinguishes the appropriate frame indicating lamp on the trigger panel.

Performance characteristics

Inputs

7. The following inputs are taken to the rack, electrical equipment:—

(1) $-50V \pm 5V$ d.c. at TB36/1.

(2) 240V 50 c/s single-phase a.c. at TB36/3 and TB36/4 fused by FS2.

(3) Auto-align information from the aerial head at TB37/1.

Outputs

8. The following outputs are taken from the rack, electrical equipment:—

(1) $-50V \pm 5V$ d.c. at ITB2/2, fused by FS1, for the indicator panel.

(2) $6{\cdot}3V \pm 0{\cdot}3V$ 50 c/s single-phase a.c. at ITB4/2 and ITB4/3, for the trigger panel.

(3) Switched earths for auto-align purpose at TB37/2 and TB37/3.

9. The indicator panel accepts and delivers various switched $-50V$ supplies and earths for fault indication purposes and also provides a $-50V$ supply to the CHANNEL SELECTOR switch on the console suite.

Mechanical description

Rack, electrical equipment

10. The rack consists of an open-fronted box, louvred top and bottom, and is designed to carry the indicator panel, the trigger panel and the aerial turning gear remote control panel. It is mounted on the wall at the rear of the console suite in such a position that the associated panels, when installed, may be readily seen by the operator.

11. The rack carries a transformer, TR1, which provides a 6·3V a.c. to the trigger panel, two relays RLA and RLB, circuit fuses FS1 and FS2 and the internal terminal blocks ITB1 to ITB4. The circuit fuses are carried on a bracket inside the rack underneath TR1 and are accessible by opening the trigger panel. The internal terminal blocks provide for interconnection between the panels and in some instances between the panels and the external equipment.

12. The terminal blocks, TB1 to TB40, which provide for the main interconnections between the panels and the external equipment, are mounted in a terminal chamber on the framework under the rack. The internal cables from these are carried to the appropriate panels by cableforms which are held in clamps fastened to the back of the rack.

Indicator panel

13. The indicator panel is mounted in the top portion of the rack and is held in position by captive screws at the top and by hinges at the bottom. This allows the panel to be hinged forward for servicing purposes. Stays at either end of the panel maintain it in a horizontal position when it is lowered.

Caution . . .

The panel must be supported whilst being lowered to prevent its full weight dropping suddenly on the hinges and stays.

14. The shape of the panel is such that the front escutcheon is inclined forward for easy viewing when in position. The front escutcheon consists of a perspex sheet with its face sprayed matt black and engraved with the lamp titles and routeing lines. This, together with an aluminium backing plate, carries the indicating lampholders, the assembly being mounted to the panel but insulated from it to provide a $-50V$ return circuit. A fault lamp override switch with an associated warning lamp is fitted to the side of the panel. The relays and component boards (*fig.* 16) are mounted on three sub-assemblies which are, in turn, mounted on the rear of the panel.

Trigger panel

15. The trigger panel (*fig.* 3) is mounted in the rack below the indicator panel by means of captive screws and hinges. Access can thus be obtained to the rear of the panel for servicing purposes. All components associated with the panel (*fig.* 19) are mounted on the rear. The transmitter-receiver control and indicators are at the top. The emergency trigger indicators, the by-pass indicators and the system maintenance indicators are on a hinged sub-assembly in the middle and the frame fault indicating lamps are positioned at the bottom of the panel. The indicators have two windows with appropriate legends illuminated as required.

Panel, control (fault override)

16. This panel is mounted on the wall at the bottom right of the rack, electrical equipment. The front panel bearing 15 switches and a fault indicator is secured to a shallow mounting box. The interconnecting terminal blocks and fanning strips are secured to the base of the box.

◀*Panel, control, indicator (D.A.T.O.)*

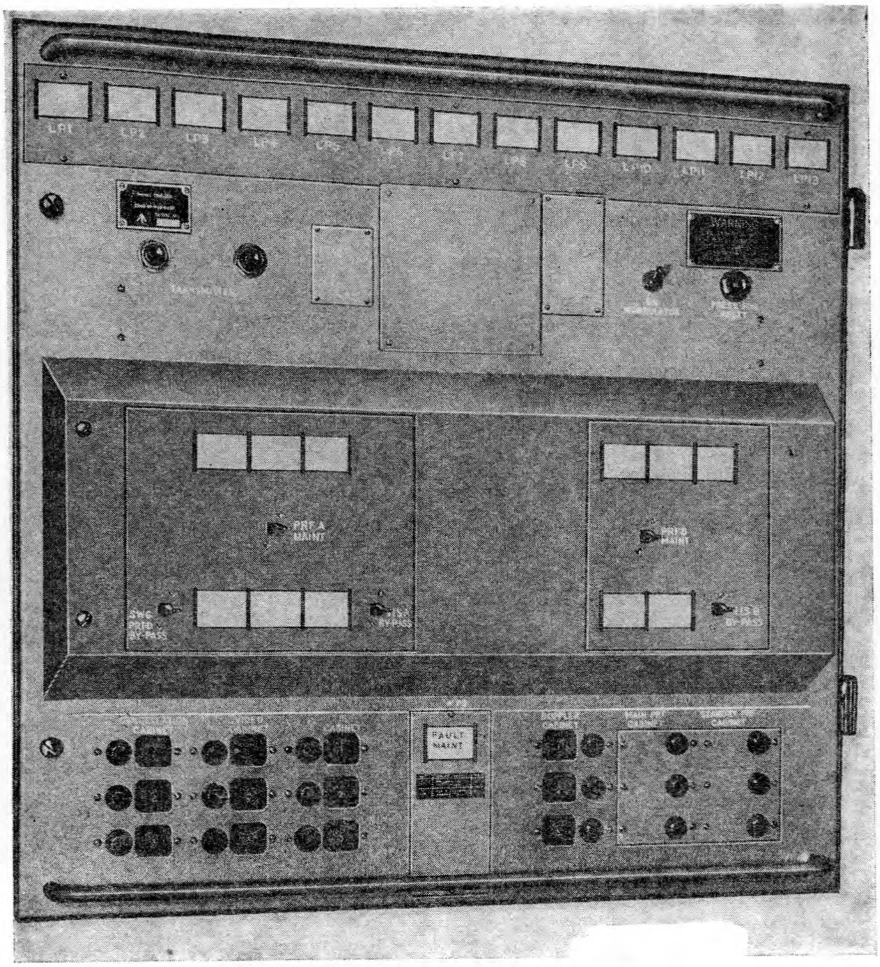
17. This panel is mounted on the wall at the bottom left of the rack, electrical equipment. The front panel, bearing two switches and six indicator lamps, is secured to a shallow mounting box. The interconnecting terminal blocks and fanning strips are secured to the base of the box.

Control panel

18. This panel is normally mounted in the equipment room and consists of a shallow box with a front panel mounted to it by means of captive screws and hinges. Thus access may be obtained to the rear of the front panel. Eighty-four switches, each one associated with a unit in the signal processing system, are mounted on the panel in cabinet and frame order vertically, the panel being suitably engraved. At the top centre of the panel is a switch associated with the entire system, and a lamp engraved MAINTENANCE indicating when lit that any of the 85 switches has been operated.▶

Principles of fault indications (*fig.* 6)

19. Fault indications on the indicator panel are based on a system of multiple OR gates whereby a cabinet frame fault or a known fault causes a relay connected to each OR gate to become energized. Contacts on these relays suitably modify the OUTPUT AVAILABLE state on the indicator panel and also control the FAULT lamps flashing circuit. The



◀**Fig. 3. Trigger panel: front view**▶

diodes in each OR gate are normally biased off under fully serviceable conditions, thus preventing the controlled relay from becoming energized. Each diode represents a unit in the signal processing system and they are so combined that one multiple OR gate covers fault indications for one complete section of the system. The voltage which biases off the diodes also serves to illuminate the unit lamps on the indicator panel.

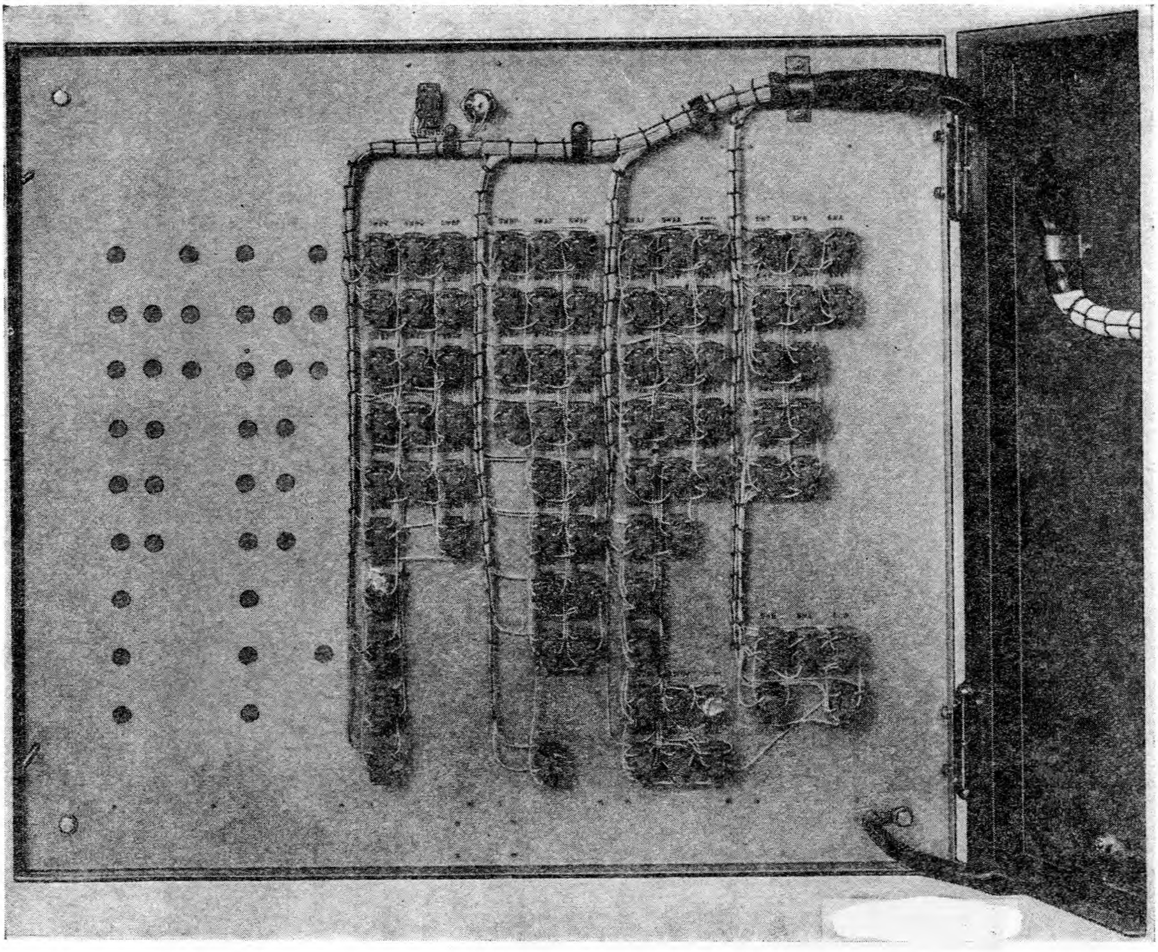
Cabinet frame faults

20. Each frame in each cabinet of the signal processing system has a corresponding relay on the indicator panel. Under fully serviceable conditions, these relays are energized by receiving an earth via the appropriate frame fault relay contacts in the fault relay assemblies fitted in the cabinets. Contacts on the indicator panel relays complete the biasing circuit to the OR gate diodes vià the unit switches on the control panel.

21. If a fault occurs on a particular frame, the fault relay associated with that frame breaks the earth to the associated relay on the indicator panel. The bias on the OR gate diodes is thus removed, and the controlled relay allowed to become energized. The OUTPUT AVAILABLE state is modified, indicating which of the video outputs is no longer available. At the same time, any of the unit lamps associated with units in the faulty frame will be extinguished. On the trigger panel the appropriate frame indicating lamp will be extinguished and the FAULT lamp will commence to flash.◀This fault indication can be reset by setting the appropriate switch in the panel, control (fault override) causing the fault lamp to be extinguished, and the fault indication to be stored in the panel, control (fault override) as a steady light.▶Fault or faults will cause it to flash as before until again reset. The panel control fault override switches are double pole, one pole open-circuiting the −50 Volt supply to the flasher relays (RLW and RLX) while the remaining pole makes the −50 Volt supply directly to the fault lamp.

Known faults

22.◀During routine monitoring of the signal processing equipment a switch on the control panel makes the circuit to the control panel relay in the indicator panel. Contacts of this relay complete the circuit to the MAINTENANCE lamp in the control panel and the MAINTENANCE indicator in the trigger panel. If no faults are discovered on opening the switch the maintenance indications are extinguished. If faults are discovered during routine monitoring, i.e. known faults, the switches on the control panel appropriate to the unserviceable units



◀**Fig. 4. Control panel: rear view**▶

are depressed. As one section of each switch is wired in series with the frame fault relay contacts on the indicator panel, it follows that operation of the switch will give the same effect on the indicator panel as a frame fault, with the exception that if the unit has an associated lamp only, this lamp will be extinguished. The other half of the unit switch breaks the circuit to the frame lamp on the trigger panel, and, as in the case of the routine monitoring switch, makes the circuit to the control panel relay in the indicator panel. Contacts of this relay again complete the circuit to the MAINTENANCE lamp in the control panel and to the MAINTENANCE indicator in the trigger panel▶

Circuit description

Power supplies (*fig.* 23)

23. The −50V supply for the indicator panel is routed from the bulk power supplies to the panel via TB36/1, ITB1/4, FS1(7A) and ITB2/2. From ITB2/2 it is distributed to the indicator panel for the fault relays, the panel lamps and the flashing circuit relays. Supplies for the system fault relays and indicating lamps on the indicator panel are taken out to the control panel at TB23/3, TB24/3 and TB32/11 to the unit switches associated with units not controlled by a cabinet frame fault relay. A further supply is taken from TB35/1 for the CHANNEL SELECTOR switch on the console suite.

24. A separate −50V return is taken directly back to the bulk power rack via ITB2/1, ITB1/5 and TB36/2. The object of this is to prevent the large earth currents, which would be present with earthing taking place directly at the panels, from affecting the rest of the signal processing equipment.

25. The 6·3V a.c. for the frame and trigger state indicating lamps on the trigger panel is provided by the transformer TR1. This transformer is supplied with a.c. mains via TB36/3, FS2/1A and TB36/4, the 6·3V being taken from the secondary to the trigger panel via ITB4/2 for the frame indicating lamps and at ITB4/3 for the trigger state lamps and the main FAULT lamp.

26. Two supplies of +50V are taken to the trigger panel at TB15/2 and TB15/5. These are taken via SWH and SWJ (I.I.S. BY-PASS) respectively to the I.I.S. A and B cabinets.

Cabinet frame and system fault circuits (*fig.* 10, 14 *and* 20)

27. System state indications on the indicator panel and frame fault indications on the trigger panel are controlled by the cabinet frame fault relays RLA to RLT on the indicator panel and the unit switches SWA to SWDY on the control panel.

28. In general the first set of contacts of each relay, e.g. RLA1, completes the −50V supply

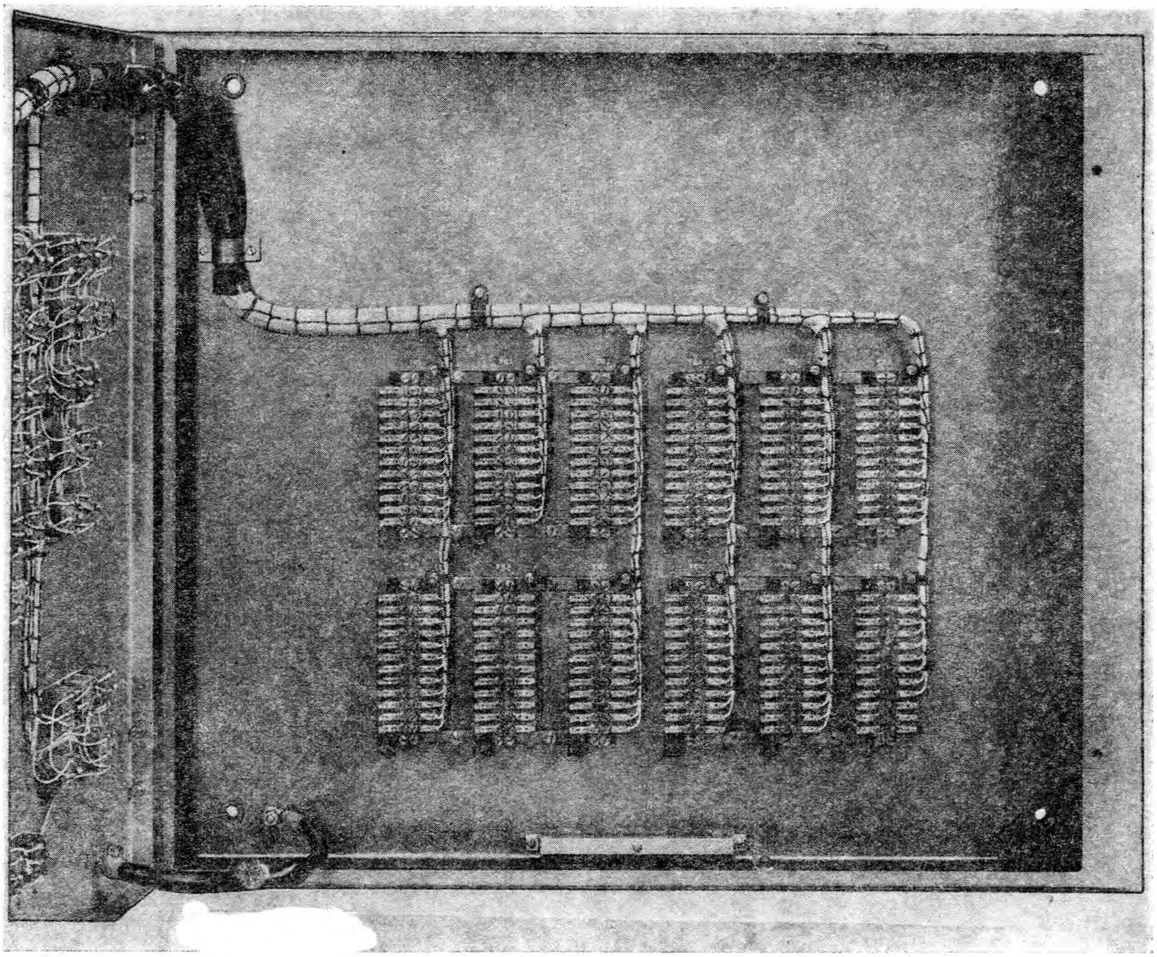


Fig. 5. Control panel: view of terminal blocks

through a sequence of unit switches (these switches are associated with the units in a particular frame) to the system OR gates and, if applicable, the appropriate lamps on the indicator panel (*fig*. 7, 10 *and* 11).

29. The second set of contacts controls the fault lamps flashing circuit, the −50V return being broken when the system is fully serviceable.

30. In most instances, the third set of contacts is not used. The exceptions are the cancellation frames 2 and 3, relays RLB RLC. These contacts are used to link the fault control circuits of units which, whilst being associated, are in different frames or positions in the same cabinet.

31. The fourth set of contacts provides an earth return for the frame indicating lamps LP14 to LP25 on the trigger panel (*fig*. 12). These contacts are connected to the lamps through a sequence of unit switches which correspond to the units in a particular frame. The other side of the lamps is supplied with 6·3V a.c.

32. The system fault relays RLAT, RLAM, RLAQ, RLAR, RLAN, RLAU and RLAV control the OUTPUT AVAILABLE lamps LP81, LP83, LP85, LP87 and LP89 on the indicator panel. Under fully serviceable conditions, these relays are maintained in a de-energized condition due to the −50V control voltages applied to the diodes in the multiple OR gates via the frame fault relays and unit switches. Their contacts thus maintain the −50V supply to the OUTPUT AVAILABLE lamps.

33. The majority of the fault circuits is similar, the circuit associated with frame 1 of the cancellation cabinet being typical and as described in para. 32 et seq. The exception is the Doppler rectangle generation circuits, which are described in para. 43 et seq.

34. The relay associated with frame 1 of the cancellation cabinet is RLA. Under fully serviceable conditions, this relay is energized by virtue of the −50V circuit being completed by the frame fault relay contacts in the fault relay assembly fitted in the cancellation cabinet. Contacts RLA1 are thus made and the −50V circuit is routed by these contacts to one section of the two unit switches on the control panel, SWA and SWB. These switches are associated with the generator, reference signal M2 and the controller (p.r.f.) M1 which are fitted in frame 1 of the cancellation cabinet. From SWA and SWB connections are returned to the indicator panel, one to the junction of R64 and V42

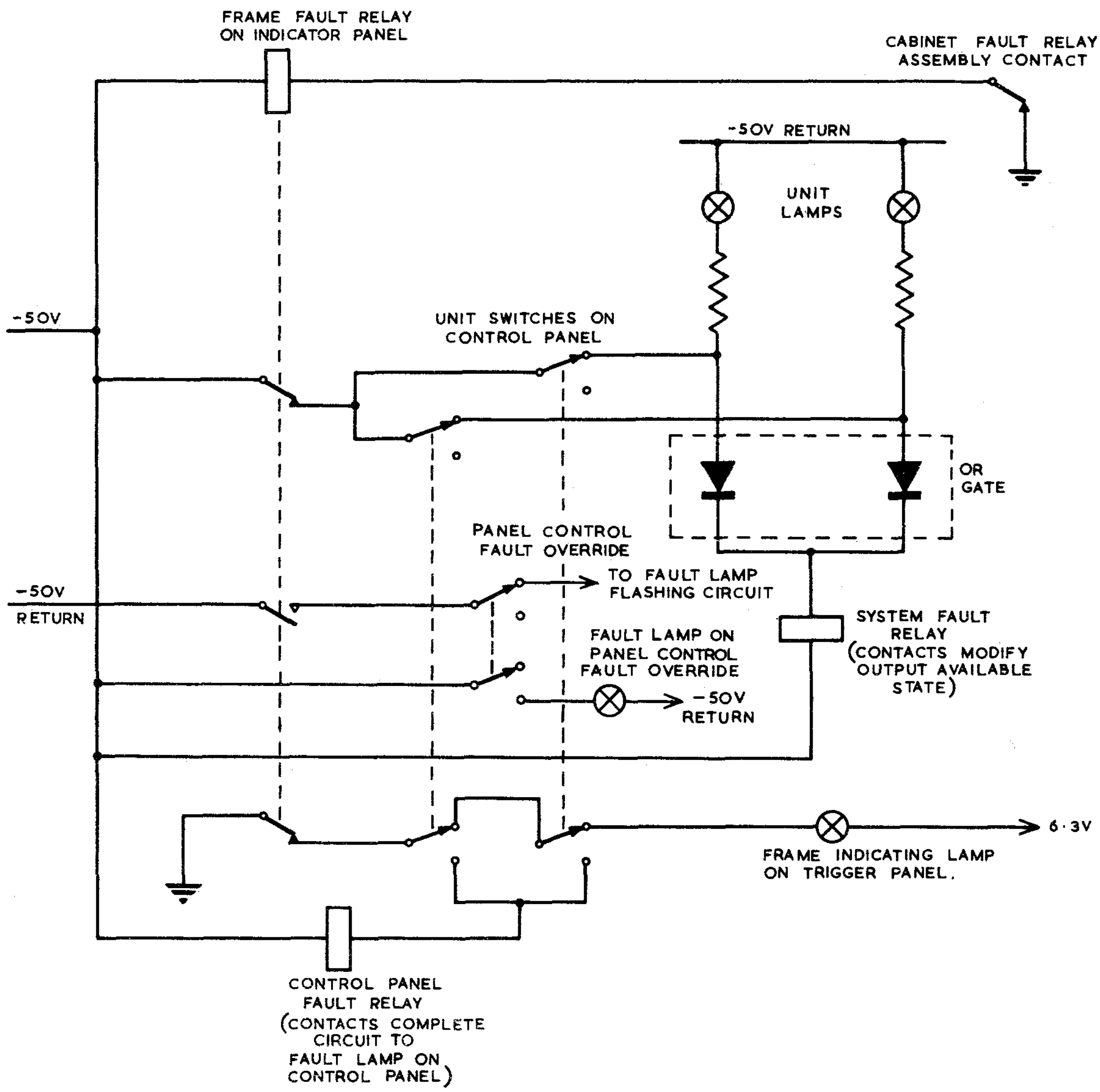


Fig. 6. Principles of fault indication

at TB23/4 and the other to the junction of R65 and V43 at TB23/5. Thus at these two points −50V is present and the two unit lamps LP62 and LP63 are illuminated. (The lamps used are rated at 28V so the resistors R64 and R65 are included to drop the excess voltage). The −50V also acts as a control voltage for the OR gate, the cathodes of the two diodes being connected to the system fault relay RLAN, the other side of which is also connected to −50V. Under these conditions the relay remains de-energized.

35. The contacts RLA2 break the −50V supply to the fault lamps flashing circuit relays RLW and RLX. Contacts RLA4 complete the earth return to the CANCELLATION CABINET FRAME 1 indicating lamp, LP14, on the trigger panel via the second section of unit switches SWA and SWB. These contacts are also connected to the unit switch SWM (resolver, electrical M1) as this unit is associated with the generator, reference signal.

36. When a fault occurs relay RLA becomes de-energized and contacts RLA1 remove the −50V control voltage from TB23/4 and TB23/5. This action extinguishes LP62 and LP63 and at the same time opens the OR gate allowing relay RLAN to become energized, the −50V supply being completed through the two diodes and the lamps (the current drawn by the relay will cause the lamps to glow slightly but this is not apparent when viewing the indicator panel).

37. With relay RLAN energized contacts RLAN1 break the −50V supply to the OUTPUT AVAILABLE lamps LP81 and LP83. Extinguishing of these lamps indicates that the fully processed and semi-processed video outputs are no longer available.

38.◀At the same time contacts RLA2 complete, via SA on the panel, control (fault override), the −50V return to the flashing circuit relays RLW and RLX. Contacts RLW3 then alternately make and break the earth return to the FAULT lamp, LP34A, on the trigger panel. When switch SA is operated, the −50V line to the flashing circuit relays is open-circuited by contacts SA1 and LP34A is extinguished. Contacts SA2 complete a −50V supply to the indicator lamp 1LP1 on the panel, control (fault override) showing that a fault has been stored. LP34A is then available to indicate further failures.▶

39. Contacts RLA4 break the earth return to the frame indicating lamp LP14, on the trigger panel. This extinguishes the lamp giving an indication that a fault has occurred on frame 1 of the cancellation cabinet.

40.◀If the fault is a known one, for example, on the reference signal generator, switch SWA on the control panel will be operated. This action extinguishes LP62 and energizes RLAN on the indicator panel by virtue of removing the control voltage from TV23/4. The OUTPUT AVAILABLE lamps, LP81 and LP82 are again extinguished and also, via the second section of SWA, LP14 on the trigger panel will be extinguished. At the same time the second section of SWA on the control panel completes the earth return to the control panel fault relay, RLV on the indicator panel, via TB12/7 on the control panel to TB14/8 in the terminal chamber and then to ITB3/3. The relay thus becomes energized and contacts RLV1 complete the circuit to the control panel MAINTENANCE lamp LP1. This lamp is supplied with 6·3V a.c. from the rack termination TB14/9 to TB12/9 on the control panel.

41. Contacts RLV1 also complete the circuit to the MAINTENANCE lamp LP34B on the trigger panel.▶

42. Certain units, e.g. the electronic clutter switches, which do not materially affect the system state, are not covered by system fault relays and, therefore, the OUTPUT AVAILABLE state is not altered if a fault occurs on these units. An indication of a fault is given, however, by the extinguishing of the appropriate unit lamp on the indicator panel, i.e. LP10, LP11, LP27, LP29 or LP31 and the operation of the appropriate flashing FAULT lamp by virtue of either the frame fault relays or unit switches.

43. The diagrams (*fig.* 8 *and* 9) show the condition of all panels for the three possible equipment conditions, i.e. fully serviceable, cabinet frame fault and known fault while Tables 1 and 2 show the effect of relay and switch operation on the panels.

Doppler rectangle indicating and fault circuits

44. These circuits operate in a slightly different manner to the other unit fault circuits and are based on a simple logic circuit whereby any two of three combinations of units can develop a fault without affecting the system state (the display is considered to be processed if only one rectangle circuit is available).

45. The three motor assemblies associated with rectangle generator are represented on the indicator panel by LP53, LP54 and LP55. If a fault occurs on one or two of the three units the associated lamp will be extinguished, but as the diodes V68, V69 and V70 form (with V71) an AND gate, the system fault relay RLAM will not be energized. If, however, all three units develop a fault, none of the three diodes will be cut off and relay RLAM will be energized thus extinguishing the OUTPUT AVAILABLE lamp LP81, indicating that the fully processed facility is no longer available.

46. The reference oscillators and rectangle generators are linked together in a similar circuit. This circuit gives eight possible combinations of three unit faults which will energize the system fault relay.

I.F. inputs fault circuit

47. The i.f. inputs to the signal processing system are indicated by three lamps on the indicator panel, the main inputs being indicated by LP22 (A.J. I.F.) and LP28 (LINEAR I.F.) and the anti-jamming direct channel input by LP36 (A.J. I.F.). If the response of either of the two channels is being monitored at the transmitter-receiver a +50V supply is fed to the indicator panel from the panel monitor M13 (*Part* 2, *Sect.* 7, *Chap.* 2). This supply energizes either relay RLY for the linear channel or RLZ for the anti-jamming channel.

48. With RLY energized contacts RLY1 break the −50V supply to LP28 indicating that the linear channel is no longer available. Contacts RLY2 remove the −50V control voltage at the junction R49, V29 allowing the system fault relay RLAQ to be energized. Contacts RLAQ1 break the −50V supply to the OUTPUT AVAILABLE lamp, LP87, indicating that the linear video output is no longer available.

49. Similarly, with RLZ energized contacts RLZ1 break the −50V to LP22 and LP36 indicating that the anti-jamming channel is not available. Contacts RLZ2 remove the control voltage at the junction R52, V32 allowing the system fault relay to energize. Contacts RLAR1 break the −50V to the OUTPUT AVAILABLE lamp, LP88, indicating that the anti-jamming direct channel is no longer available.

50. Contacts RLY3 and RLZ3 perform no function in this particular application as it is not possible for both i.f. inputs to be removed from the signal processing equipment at the same time. Contacts RLY4 and RLZ4 initiate the fault lamp flashing circuit when either relay is energized.

Lock pulse fault indication

51. The availability of the lock pulse input to the signal processing system is indicated by the lamp LP48 (LOCK PULSE) on the indicator panel. Under these conditions the lock pulse fault relay RLAA is maintained in an energized condition by contacts RLA2 in the trigger panel. The relay RLA is maintained in an energized condition by the presence of the trigger pulses at the transmitter.

52. If the lock pulse fails, relay RLA becomes de-energized, thus de-energizing RLAA. Contacts RLAA1 remove the control voltage from the junction R11, V64 extinguishing LP48 and allowing the system fault relay RLAN to energize. This action extinguishes the OUTPUT AVAILABLE lamps LP81 and LP83 indicating that the fully and semi-processed facilities are no longer available. Contacts RLAA2 complete the fault lamp flashing circuit.

Anti-jamming channel power supply fault indications

53. The fault circuit from the power supply M1 (*Sect.* 7, *Chap.* 2) which provides h.t. supplies for the anti-jamming direct channel, normally maintains the fault relay RLU in the energized condition by providing an earth return. If a fault occurs on the power supply the earth is removed and RLU is de-energized. Contacts RLU1 remove the control voltage from TB27/4 and TB27/5 extinguishing LP37 (LINEAR DET) on the indicator panel allowing the system fault relay RLAR to energize. Contacts RLAR1 break the −50V supply to the OUTPUT AVAILABLE lamp. LP89, indicating that the anti-jamming direct channel is no longer available. Contacts RLU2 complete the faults lamp flashing circuit.

Fault lamp flashing circuit (*fig.* 16)

54. This circuit consists of the two relays, RLW and RLX, which are connected to form a mechanical flip-flop, i.e. a set of contacts on one relay are connected in the supply circuit of the coil of the other.

55. The −50V supply to the relays is controlled by contacts on the frame fault relays, the ancillary fault relays and the i.f. switching relays. If, for example, a fault occurs on one of the cabinet frames, the appropriate indicator panel fault relay is de-energized and one set of its contacts completes the −50V return to relays RLW and RLX. These relays then commence their flip-flop action and contacts RLW3 alternately make and break the earth return to the trigger panel FAULT lamp, LP34A causing it to give a flashing indication.

56. Capacitors C1 and C2 act as slugging components to slow down the make-and-break cycle in order that the FAULT lamp may have sufficient time to illuminate and extinguish fully. The voltage sensitive resistors X1 and X2 tend to prevent sparking at contacts RLW1 and RLX1 whilst the resistors R128 and R129, by limiting the charging currents of C1 and C2, also serve to eliminate sparking. In the event of a fault occurring it is possible to stop the fault lamp flashing by means of the FAULT OVERRIDE switch SW1 mounted on the side of the indicator panel rack. One section of this switch breaks the circuit to the flashing relays whilst the other section completes −50V to LP105, also mounted on the side of the rack, indicating that the flashing circuit has been rendered inoperative but that a fault still exists. In normal use the switches on the panel control (fault override) are used to reset the flashing indicators as each fault arises. Switch SW1 is only used when it is desired to override the flashing light system so that no further fault may operate the FAULT light.

Linear injection indications

57. When linear injection is applied to the display by means of the LINEAR INJECTION key on the console suite, relay RLAE on the indicator panel is energized by an earth being applied to TB35/7. Contacts RLAE1 make the −50V supply to the routeing lamp LP69 whilst contacts RLAE2 break the supply to either the routeing lamps LP70 or LP71 depending on which output has been selected for display purposes. The energizing of relay RLAE thus indicates that the video signals are being fed from video switch No. 3.

Trigger indications (*fig.* 17, 18)

58. The state of the main and standby trigger pulses is given on the trigger panel by LP48 and LP49. The illumination of these lamps is controlled by the change-over relay RLAD operated by a switched earth from the p.r.f. equipment. The 6·3V a.c. for the lamps is supplied from TR1 on the rack electrical equipment.

Selected output indications and signal routeing (*fig.* 15)

59. The video output in use on channel 1 is shown on the indicator panel by either LP82 (FULLY PROCESSED), LP84 (SEMIPROCESSED), LP86 (PLD), LP88 (LINEAR) or LP90 (A.J. DIRECT). The output is selected by the CHANNEL SELECTOR switch on the console suite. The −50V supply to the indicator panel is routed to the console via TB35/1 and the switch makes the supply to the indicating lamps via TB35/2 to TB35/6.

60. In addition the switch also makes the −50V supply to relays RLAF to RLAK. These relays are associated with the selected output indications and their contacts switch the −50V to the routeing lamps LP38, LP69, LP70, LP71, LP72, LP73, LP74, LP75, LP76 and LP78. These lamps indicate the signal routeing on the front of the indicator panel depending upon which output is selected for channel 1.

Panel illumination (*fig.* 15)

61. The engraving on the front of the indicator panel is illuminated by lamps set at strategic points. These lamps are fitted with black caps so that their light is directed edgewise through the perspex. The lamps are fed from the −50V supply to the panel and are designated LP68 and LP94 to LP104.

Auto-align circuit (*fig.* 23)

62. The auto-align information from the aerial head is taken through the rack, electrical equipment and distributed to the radar link and to the resolver, electrical M1 (*Sect.* 7, *Chap.* 3) in the power cabinet. The information enters the terminal chamber at TB37/1 and provides an earth connection during 8 deg. of each complete aerial rotation. This earth connection completes the −50V supply to relay RLA. With the relay energized, contacts RLA1 close and provide auto-align information to the radar link at TB37/2. Contacts RLA2 provide similar facilities for the resolver, electrical M1 at TB37/3. Relay RLB is provided to enable a circuit change-over to be made in the event of failure of relay RLA.

TABLE 1

Effect of fault relay operation on indicator and trigger panels

Note . . .
◀*In all instances except RLJ the trigger panel* FAULT *lamp* (*LP*34) *will be flashing.*▶

Relay	Purpose	Indicator panel			Trigger panel	
		Unit lamps extinguished	System fault relay energized	Output available lamps extinguished	Frame fault lamps extinguished	Other indicating lamps extinguished
RLA	Cancellation cabinet—frame 1 fault	LP62, LP63	RLAN	LP81, LP83	LP14	
RLB	Cancellation cabinet—frame 2 fault	LP4, LP6 & LP14, LP8, LP10, LP12, LP16	RLAN	LP81, LP83	LP15	
RLC	Cancellation cabinet—frame 3 fault	LP5, LP7 & LP15, LP9, LP11, LP13, LP17	RLAM	LP81	LP16	
RLD	Video cabinet—frame 1 fault	LP18, LP19, LP34	RLAN	LP81, LP83	LP17	
RLE	Video cabinet—frame 2 fault	LP27, LP33, LP35, LP39, LP40, LP41	RLAV	LP81, LP83, LP85, LP87	LP18	
RLF	Video cabinet—frame 3 fault	LP29, LP30, LP31, LP32	RLAQ	LP87	LP19	
RLG	I.F. cabinet—frame 1 fault	LP1, LP2, LP3, LP20, LP21, LP23	RLAU	LP81, LP83, LP85	LP20	
RLH	I.F. cabinet—frame 2 fault	LP24, LP25, LP26, LP42, LP43	RLAU	LP81, LP83, LP85	LP21	
RLJ	I.F. cabinet—frame 3 fault				LP22	
RLK	Doppler cabinet—frame 1 fault	LP49, LP52, LP53, LP56, LP57	RLAM	LP81	LP23	
RLL	Doppler cabinet—frame 2 fault	LP50, LP51, LP54, LP55, LP91	RLAN	LP81, LP83	LP24	
RLM	Doppler cabinet—frame 3 fault	LP47	RLAN	LP81, LP83	LP25	
RLU	Anti-jamming channel power unit fault	LP37	RLAR	LP89		
RLAA	Lock pulse fault	LP48	RLAN	LP81, LP83		
RLY	Linear i.f. inputs fault	LP28	RLAQ	LP87		
RLZ	Anti-jamming i.f. input fault	LP22, LP36	RLAR	LP89		

TABLE 2

Effect of control panel switch operation on indicator and trigger panels

Note . . .

In all instances the control panel MAINTENANCE *lamp* (*LP*1) *and trigger panel* MAINTENANCE *lamp* (*LP*34*B*) *will be continuously lit.*

Switch	Associated Unit	Indicator panel			Trigger panel	
		Unit lamps extinguished	System fault relay energized	Output available lamps extin-guished	Frame fault lamps extin-guished	Other indicating lamps extin-guished
SWA	Generator, reference signal M2	LP62	RLAN	LP81, LP83	LP14	
SWB	Controller (p.r.f.) M1	LP63	RLAN	LP81, LP83	LP14	
SWC	Driver, delay line M1	LP4, LP12	RLAN	LP81, LP83	LP15	
SWD	Network, hybrid circuit M3	LP6, LP14	RLAN	LP81, LP83	LP15	
SWE	Delay line (fixed)	LP6, LP14, LP7, LP15	RLAN	LP81, LP83	LP15	
SWF	Delay line (variable) M1		RLAN	LP81, LP83	LP15	
SWG	Network, hybrid circuit M2	LP6, LP14	RLAN	LP81, LP83	LP15	
SWH	Comparator, signal (8Mc/s) M1	LP8	RLAN	LP81, LP83	LP15	
SWJ	Comparator, signal (6Mc/s) M2	LP16	RLAM	LP81	LP15	
SWK	Switch, electronic (clutter) M1	LP10			LP15	
SWL	Driver, delay line M1	LP5, LP13	RLAM	LP81	LP16	
SWM	Resolver, electrical M1	LP44, LP45, LP46	RLAM	LP81		
SWN	Network, hybrid circuit M3	LP7, LP15	RLAM	LP81	LP16	
SWP	Network, hybrid circuit M2	LP7, LP15	RLAM	LP81	LP16	
SWQ	Delay line, variable M1		RLAM	LP81	LP16	
SWR	Comparator, signal (8Mc/s) M1	LP9	RLAM	LP81	LP16	
SWS	Comparator, signal (6Mc/s) M2	LP17	RLAM	LP81	LP16	
SWT	Switch, electronic (clutter) M1	LP11			LP16	
SWU	Amplifier (video-rectifier) M3	LP18	RLAN	LP81, LP83	LP17	
SWV	Network, pulse delay (7μs) M4		RLAN	LP81, LP83	LP17	
SWW	Comparator, signal (video) M1	LP19	RLAN	LP81, LP83	LP17	
SWX	Switch, electronic (video) M3	LP34	RLAM	LP81	LP17	
SWY	Relay assembly M3		RLAV	LP81, LP83, LP85, LP87	LP17	
SWZ	Switch, electronic (video) M3	LP27			LP18	

TABLE 2 *(continued)*

Switch	Associated Unit	Indicator panel			Trigger panel	
		Unit lamps extinguished	System fault relay energized	Output available lamps extinguished	Frame fault lamps extinguished	Other indicating lamps extinguished
SWAA	Switch, electronic (video) M3	LP33	RLAL	LP83	LP18	
SWAB	Relay assembly M2		RLAT	LP81, LP83, LP85, LP87, LP89	LP18	
SWAC	Network, hybrid circuit M2	LP40	RLAV	LP81, LP83, LP85, LP87	LP18	
SWAD	Delay line (variable) M6	LP40	RLAV	LP81, LP83, LP85, LP87	LP18	
SWAE	Controller (p.r.f.) M2	LP41	RLAV	LP81, LP83, LP85, LP87	LP18	
SWAF	Network, hybrid circuit M3	LP40	RLAV	LP81, LP83, LP85, LP87	LP18	
SWAG	Comparator, signal (coincidence) M3	LP39	RLAV	LP81, LP83, LP85, LP87	LP18	
SWAH	Driver, delay line M1	LP35	RLAV	LP81, LP83, LP85, LP87	LP18	
SWAJ	Pulse generator (switching) M7	LP29			LP19	
SWAK	Generator, reverse sweep M4	LP31			LP19	
SWAL	Amplifier assembly (linear) M9	LP30	RLAQ	LP87	LP19	
SWAM	Network, pulse delay (28 μs)		RLAQ	LP87	LP19	
SWAN	Demodulator (linear) M2	LP32	RLAQ	LP87	LP19	
SWAP	Switch, electronic (i.f.) M2	LP23	RLAU	LP81, LP83, LP85	LP20	
SWAQ	Limiter, electrical noise M1	LP21	RLAN	LP81, LP83	LP20	
SWAR	Amplifier assembly, i.f.(i.a.g.c.) M2	LP20	RLAN	LP81, LP83	LP20	
SWAS	Amplifier (i.f.) M1	LP1	RLAN	LP81, LP83	LP20	
SWAT	Demodulator, coherent M1	LP2	RLAN	LP81, LP83	LP20	
SWAU	Demodulator, coherent M1	LP3	RLAM	LP81	LP20	
SWAV	Network, pulse delay (26 μs)		RLAR	LP89	LP20	
SWAW	Demodulator, linear M2	LP37	RLAR	LP89	LP20	
SWAX	Amplifier assembly, i.f. (log) M10	LP24	RLAU	LP81, LP83, LP85	LP21	
SWAY	Generator, sweep (video) M3	LP25	RLAU	LP81, LP83, LP85	LP21	

TABLE 2 *(continued)*

Switch	Associated Unit	Indicator panel			Trigger panel	
		Unit lamps extinguished	System fault relay energized	Output available lamps extin-guished	Frame fault lamps extin-guished	Other indicating lamps extin-guished
SWAZ	Network, pulse delay (16 μs)		RLAU	LP81, LP83, LP85	LP21	
SWBA	Comparator, signal (video) M4	LP26	RLAU	LP81, LP83, LP85	LP21	
SWBB	Oscillator (coherent) M1	LP43	RLAN	LP81, LP83	LP21	
SWBC	Mixer stage, frequency M1	LP42	RLAM	LP81	LP21	
SWBD	Mixer stage, frequency M1	LP42	RLAM	LP81	LP21	
SWBE	Control (i.f. level) M7				LP21	
SWBF	Signal generator (video) M2				LP22	
SWBG	Signal generator (i.f.) M9				LP22	
SWBH	Amplifier assembly (noise) M58				LP22	
SWBJ	Controller (motor) M3	LP56	RLAM	LP81	LP23	
SWBK	Motor assembly M1	LP53			LP23	
SWBL	Pulse generator (rectangle) M11	LP52			LP23	
SWBM	Panel (area switching) M1	LP49	RLAN	LP81, LP83	LP23	
SWBN	Power supply (±50V)		RLAM	LP81	LP23	
SWBP	Switch, electronic (joystick) M5	LP57	RLAM	LP81	LP23	
SWBQ	Motor assembly M1	LP54			LP24	
SWBR	Pulse generator (rectangle) M11	LP91			LP24	
SWBS	Motor assembly M1	LP55			LP24	
SWBT	Pulse generator (rectangle) M11	LP51			LP24	
SWBU	Pulse generator (switching) M7	LP50	RLAN	LP81, LP83	LP24	
SWBV	Oscillator, reference M3	LP47	RLAM	LP81	LP25	
SWBW	Panel, distribution (reference frequency) M2		RLAM	LP81	LP25	
SWBX	Switch, electronic (reference frequency) M4		RLAM	LP81	LP25	
SWBY	Switch, electronic (reference frequency) M4		RLAM	LP81	LP25	
SWBZ	Control, electrical frequency M1	LP44			LP25	

TABLE 2 (*continued*)

Switch	Associated Unit	Indicator panel			Trigger panel	
		Unit lamps extinguished	System fault relay energized	Output available lamps extinguished	Frame fault lamps extinguished	Other indicating lamps extinguished
SWCA	Oscillator, reference M3	LP44			LP25	
SWCB	Control, electrical frequency M1	LP45			LP25	
SWCC	Oscillator, reference M3	LP45			LP25	
SWCD	Control, electrical frequency M1	LP46			LP25	
SWCE	Oscillator, reference M3	LP46			LP25	
SWDS	Amplifier (video)				LP19	
SWDT	Amplifier (video)				LP19	
SWDU	Amplifier (video)				LP19	
SWDV	Amplifier (video)				LP19	
SWDW	Attenuator Assembly				LP22	
SWDX	Gate, electronic (blanking)		RLAV	LP81, LP83, LP85, LP87	LP17	
SWDY	Amplifier (video)		RLAT	LP81, LP83, LP85, LP87, LP89	LP19	
◀SWDZ	All units.▶					

TABLE 3

Internal interconnections

Origin	Internal block connection	Service	Destination
TB36/3	ITB1/1	A.C. mains input	Transformer TR1 on rack
TB36/4	ITB1/2	A.C. mains input	Electrical equipment
TB36/12	ITB1/3	System earth 8	ITB2/4; ITB4/4

TABLE 3 (*continued*)

Origin	Internal block connection	Service	Destination
TB36/1	ITB1/4	−50V input	ITB2/2
TB36/2	ITB1/5	−50V return	ITB2/1
TB37/1	ITB1/6	Auto-align input	Relay RLA on rack, electrical equipment
Contacts RLA1 on rack, electrical equipment	ITB1/7	Auto-align output	TB37/2
Contacts RLA2 on rack, electrical equipment	ITB1/8	Auto-align output	TB37/3
ITB1/5	ITB2/1	−50V return	Indicator panel
ITB1/4	ITB2/2	−50V input	Indicator panel
◀Relay contacts RLW3 on indicator panel▶	ITB2/3	Trigger panel fault lamp switching	ITB4/1
ITB1/3	ITB2/4	System earth	Indicator panel
TB14/10	ITB2/8	I.I.S. By-pass	Indicator panel
TB12/8	ITB3/1	Linear i.f. fault indication	Linear i.f. fault relay (RLY) on indicator panel
TB12/9	ITB3/2	A.J. i.f. fault indication	A.J. i.f. fault relay (RLZ) on indicator panel
TB14/7	ITB3/3	Control panel fault indications	Control panel fault relay (RLV) on indicator panel
Relay contacts RLV1 on indicator panel	ITB3/4	◀Control panel maintenance lamp switching▶	TB14/8
TB15/1	ITB3/5	Trigger state indication	Emergency trigger relay (RLAD) on indicator panel
TB34/7	ITB3/6	Signal processing on link	
TB34/8	ITB3/7		
TB35/8	ITB3/8	Remote wobbulator on/off switching	Switch SWC on trigger panel
TB12/11	ITB3/9	I.F. fault indication return	I.F. fault relays (RLY and RLZ) on indicator panel
Switched earth via relay contacts RLA2 on trigger panel	ITB3/10	Lock pulse fault indication	Lock pulse fault relay (RLAA) on indicator panel
Panel indicator	ITB3/11	Emergency trigger indication	LP48 on trigger panel
Panel indicator	ITB3/12	−50V supply	
ITB2/3	ITB4/1	Trigger panel fault lamp switching	LP34 on trigger panel
Transformer TR1 on rack, electrical equipment	ITB4/2 ITB4/3	6·3V a.c.	Trigger panel
ITB1/3	ITB4/4	System earth	Trigger panel

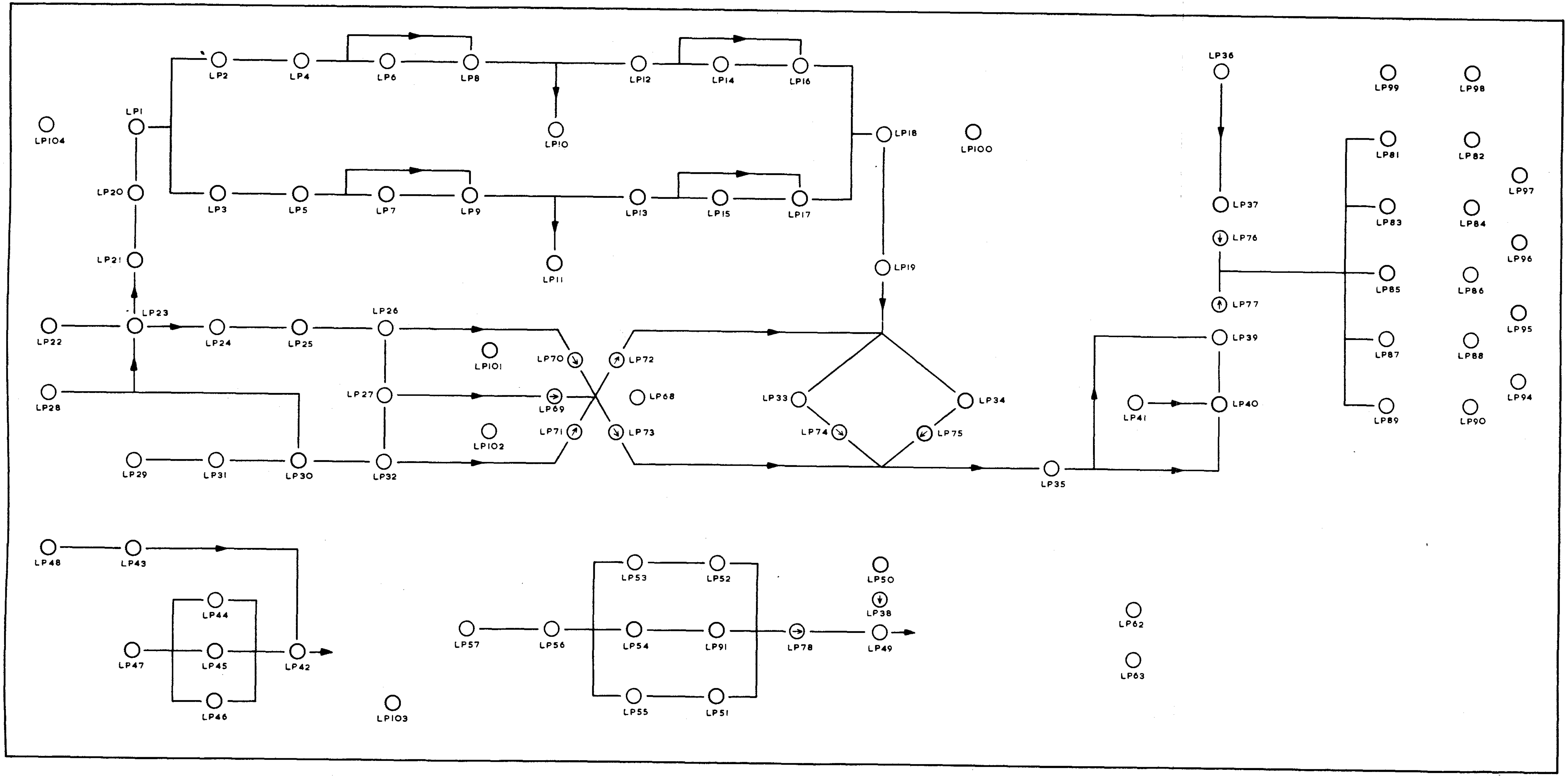


Fig. 7 Indicator panel lamp layout Fig. 7

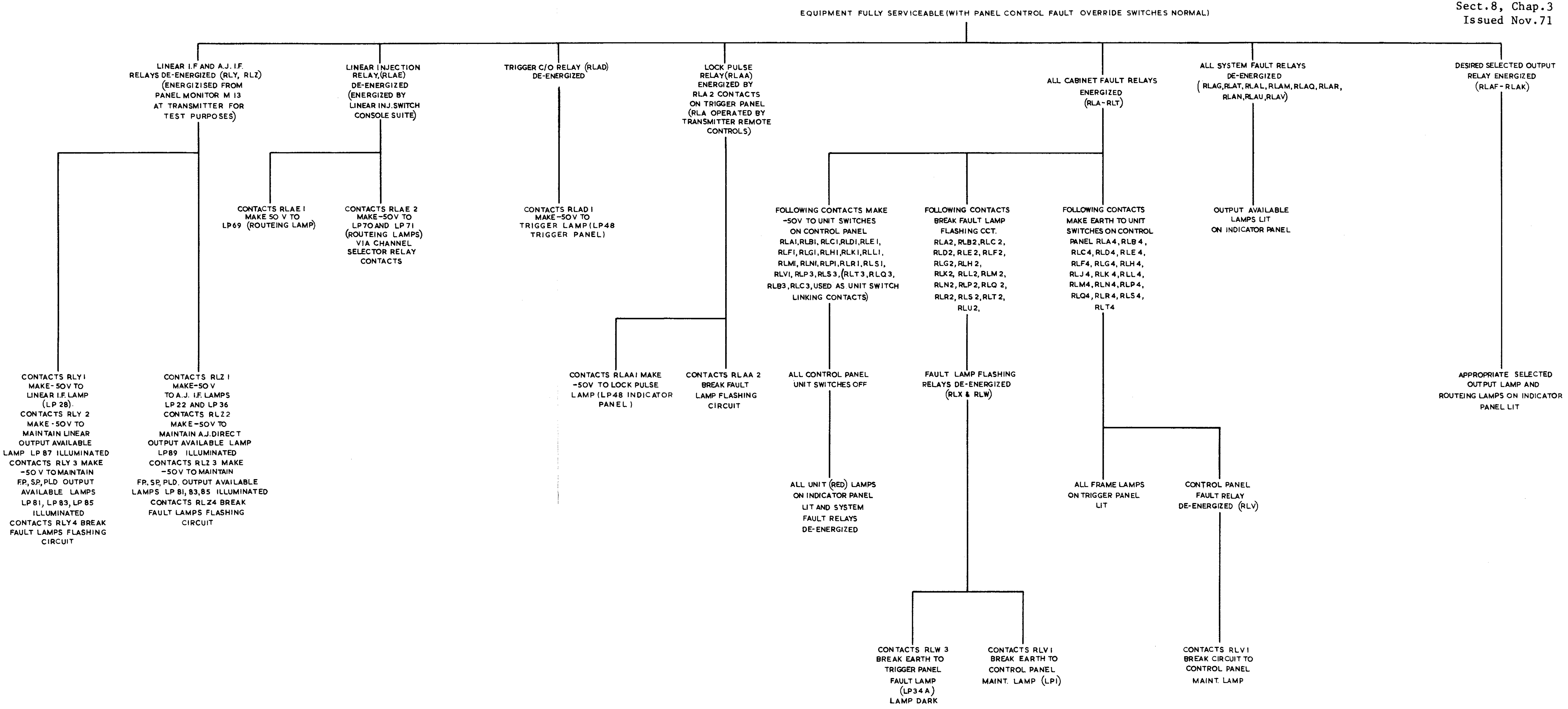


Fig. 8 Condition of panels with equipment fully serviceable. Fig. 8

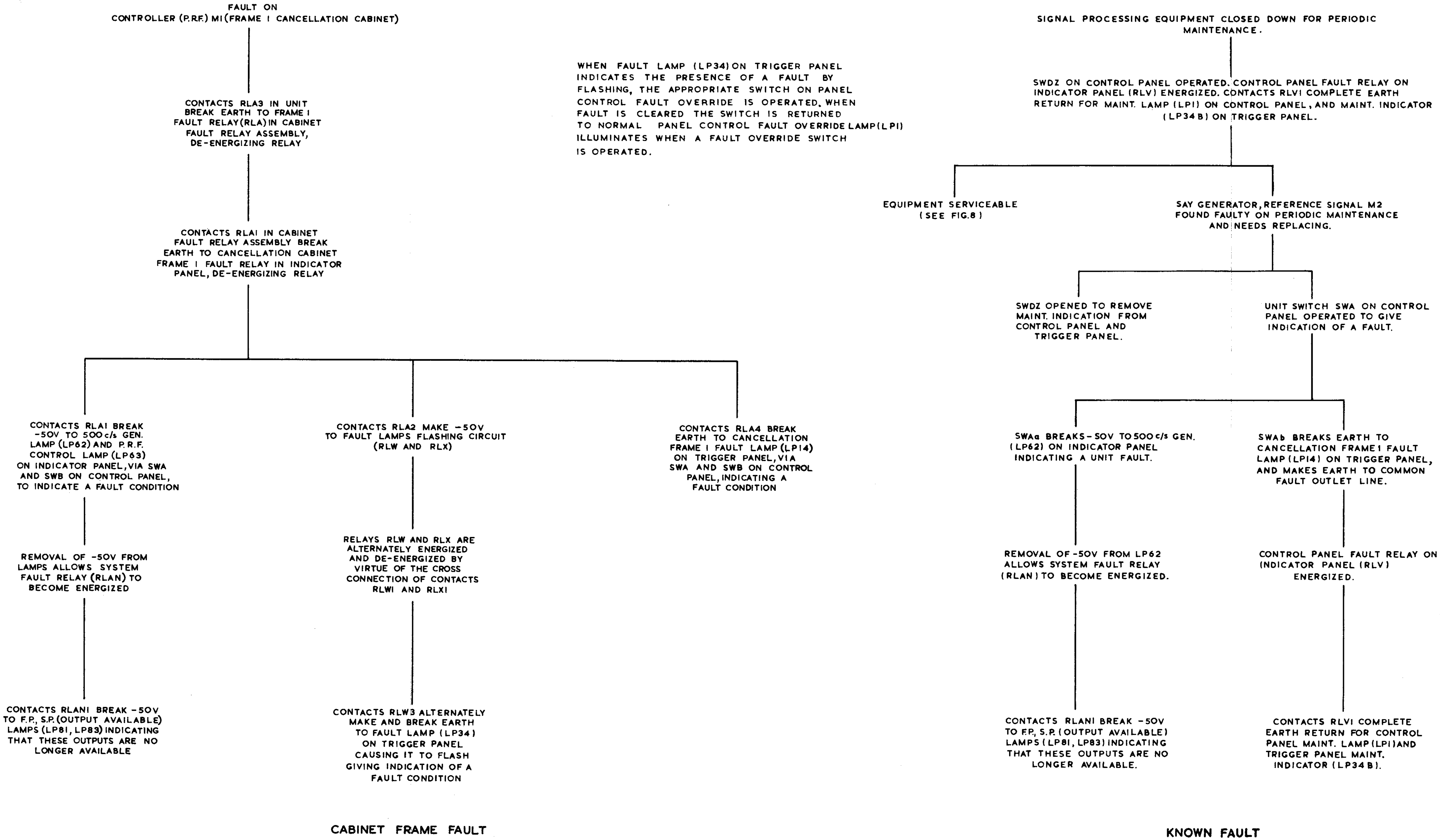
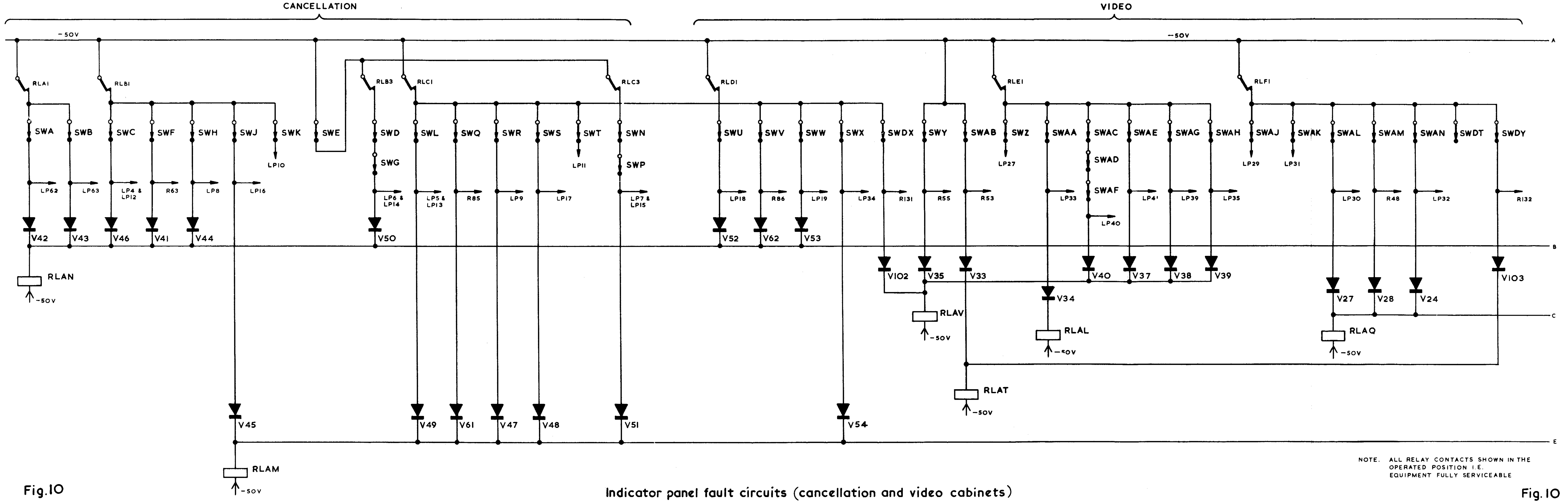


Fig.9 — Condition of panels with cabinet frame and known faults — Fig.9



NOTE. ALL RELAY CONTACTS SHOWN IN THE OPERATED POSITION I.E. EQUIPMENT FULLY SERVICEABLE

Fig.10 Indicator panel fault circuits (cancellation and video cabinets) Fig.10

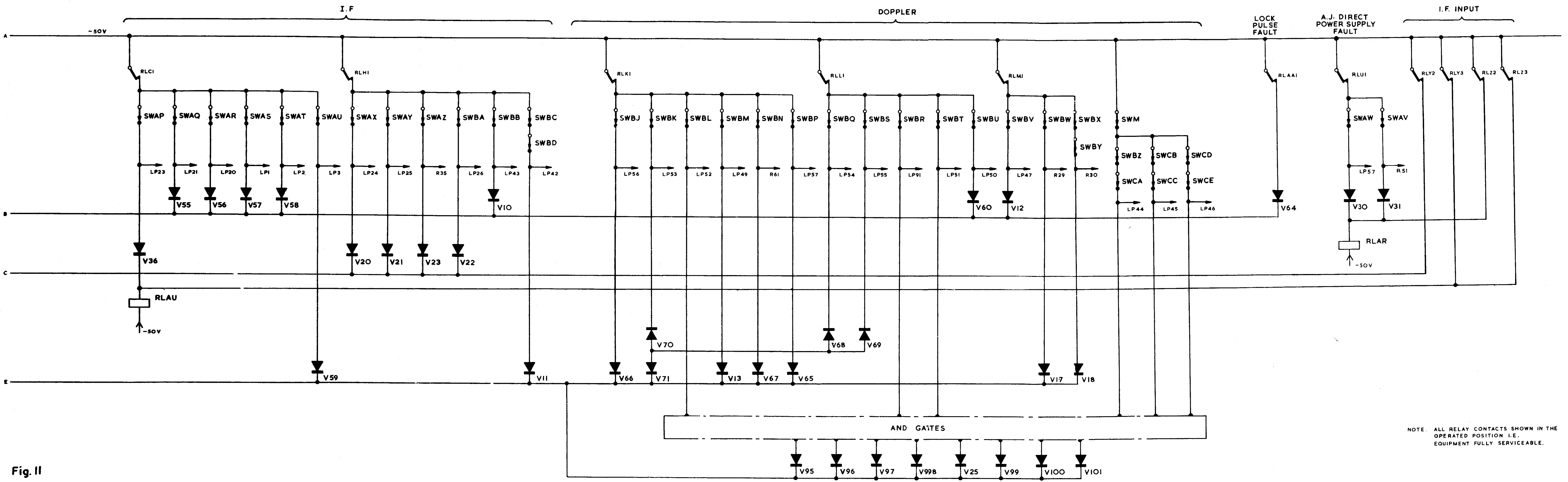


Fig. 11

Indicator panel fault circuits (i.f., doppler cabinets)

Fig. 11

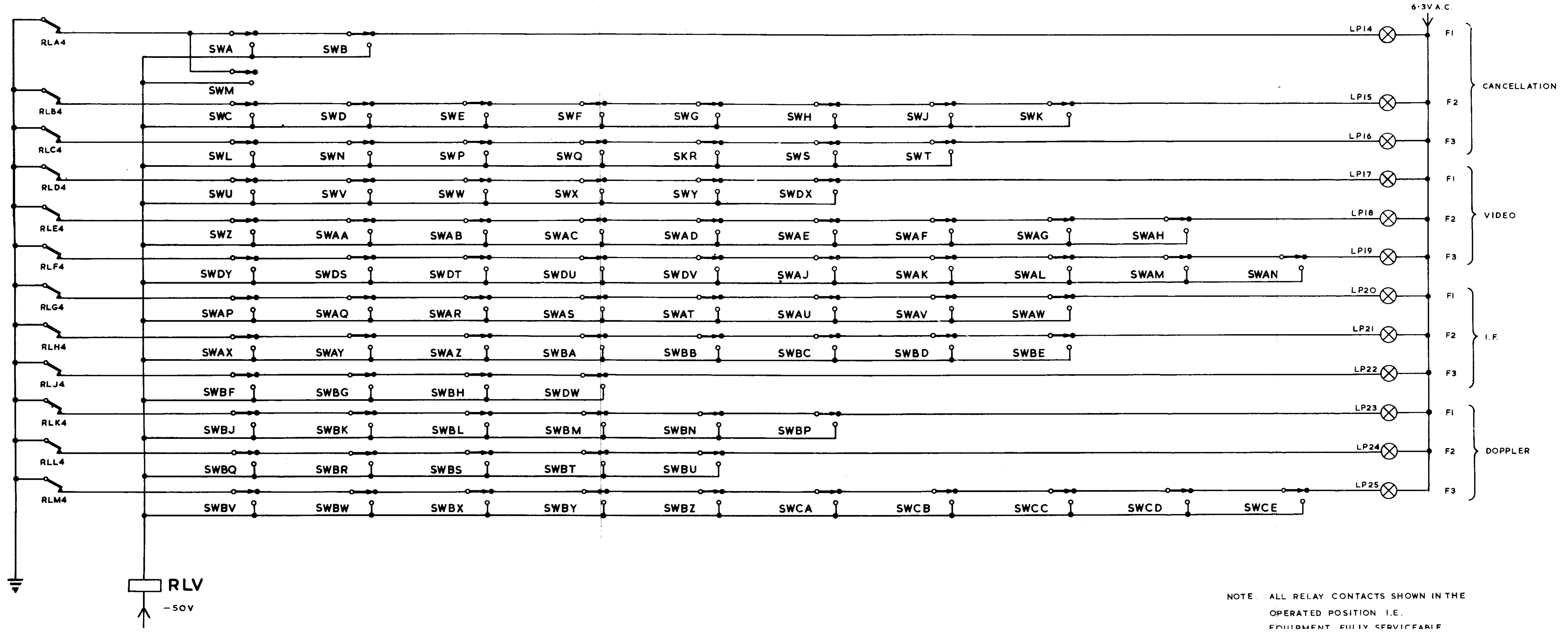
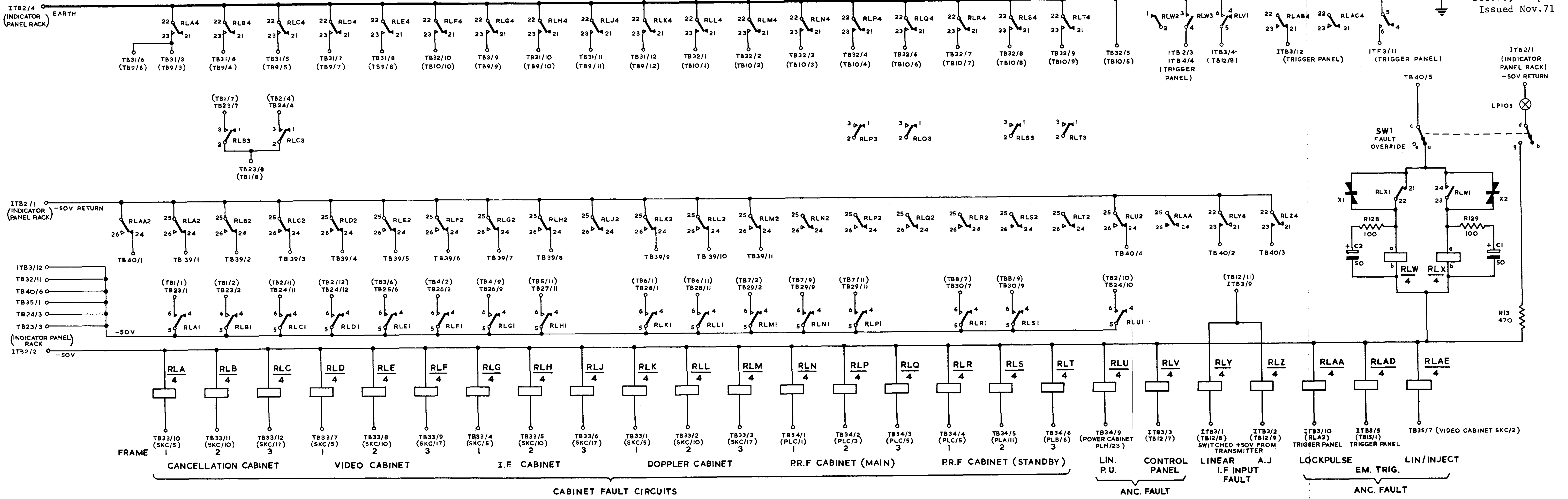


Fig.12 Trigger panel frame fault indicating circuits Fig.12



NOTE. TERMINAL BLOCK NUMBERS IN PARENTHESES DENOTE DESTINATION ON CONTROL PANEL UNLESS OTHERWISE STATED. PLUG AND SOCKET REFERENCES IN PARENTHESES DENOTE DESTINATION ON CABINET DISTRIBUTION PANELS.

Fig.13 **Indicator panel: circuit of cabinet frame fault relays** Fig.13

Fig. 14 Indicator panel: circuit of system OR gates. Fig. 14

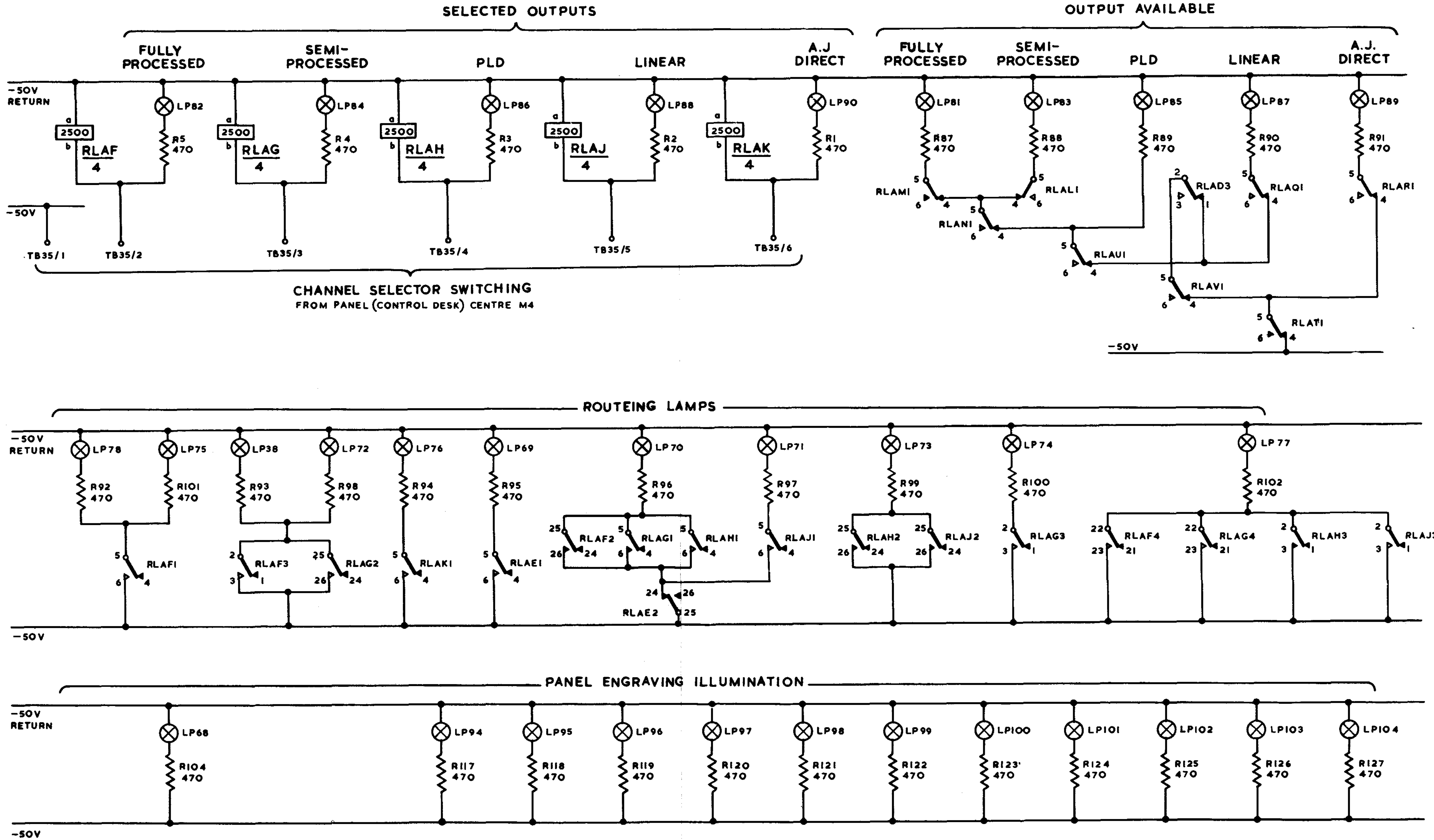


Fig.15 Indicator panel: circuit of output selection and panel illumination. Fig.15

Fig.16 Indicator panel: component layout Fig.16

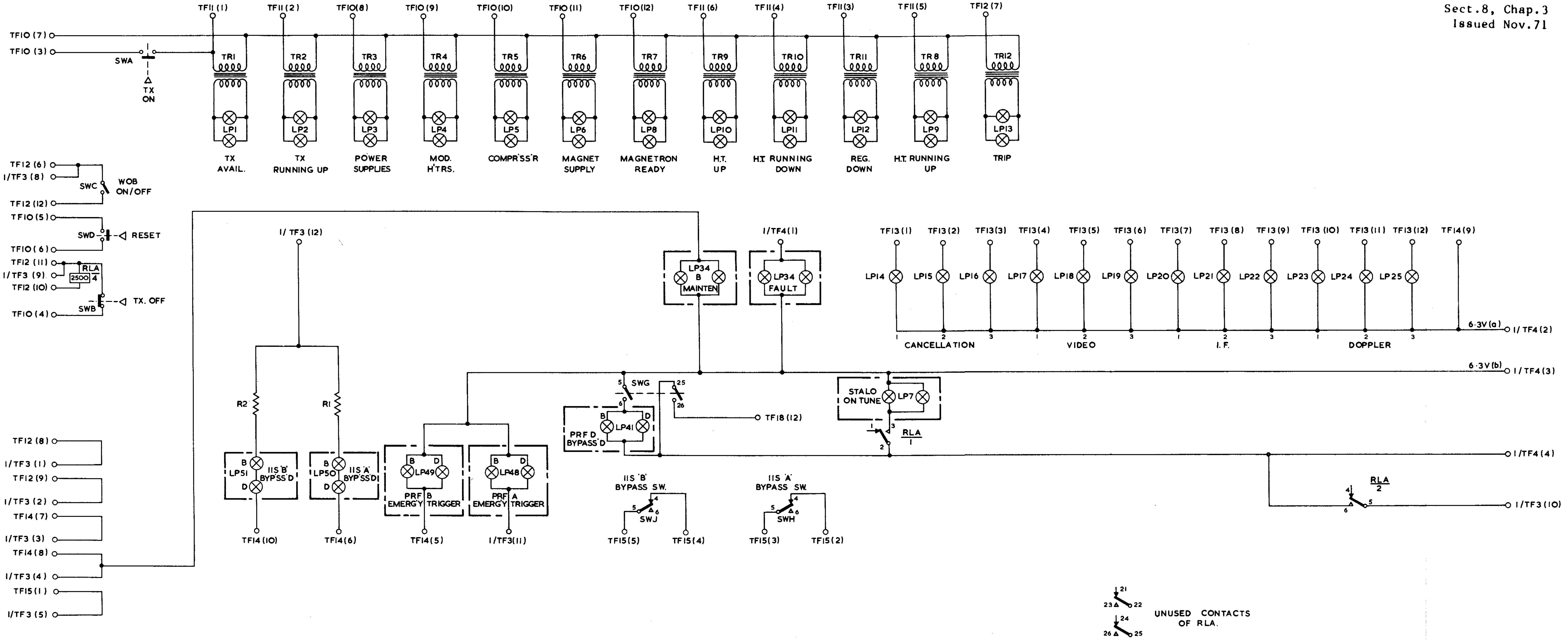


Fig.17

Trigger panel : linesman: circuit

Fig.17

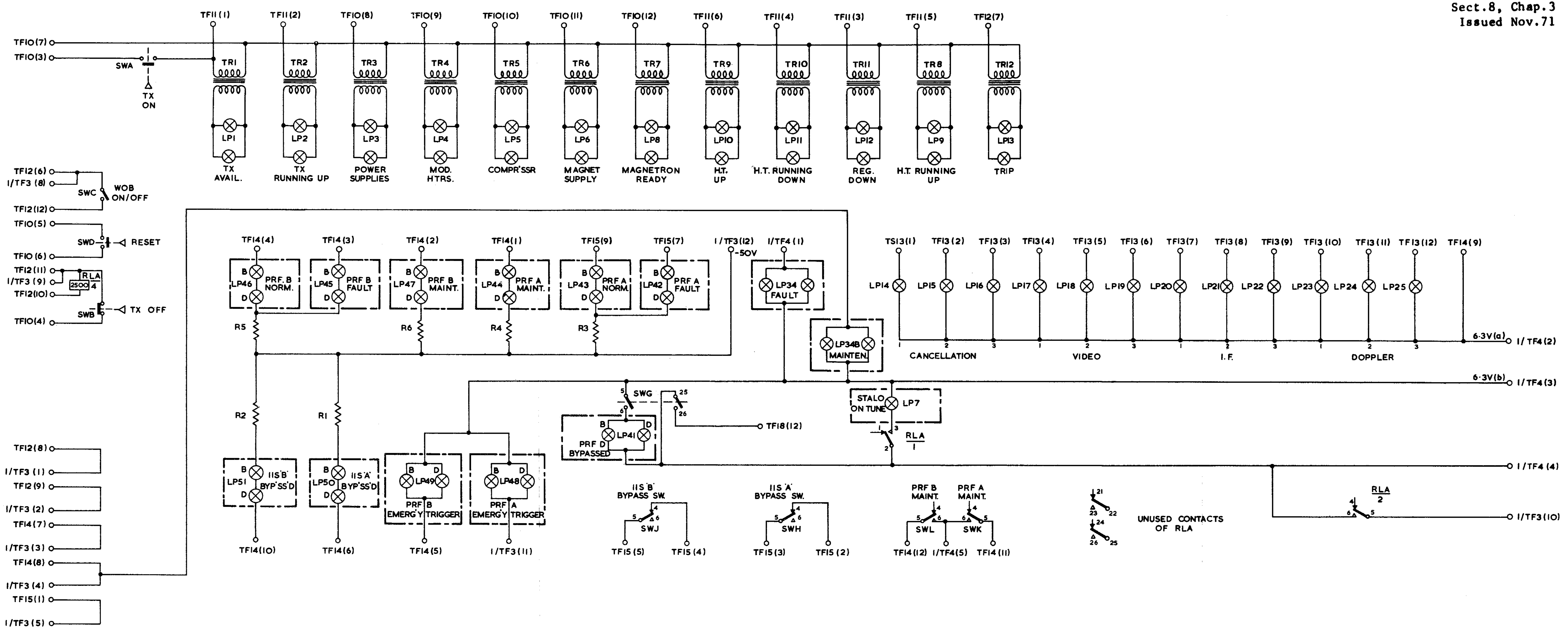
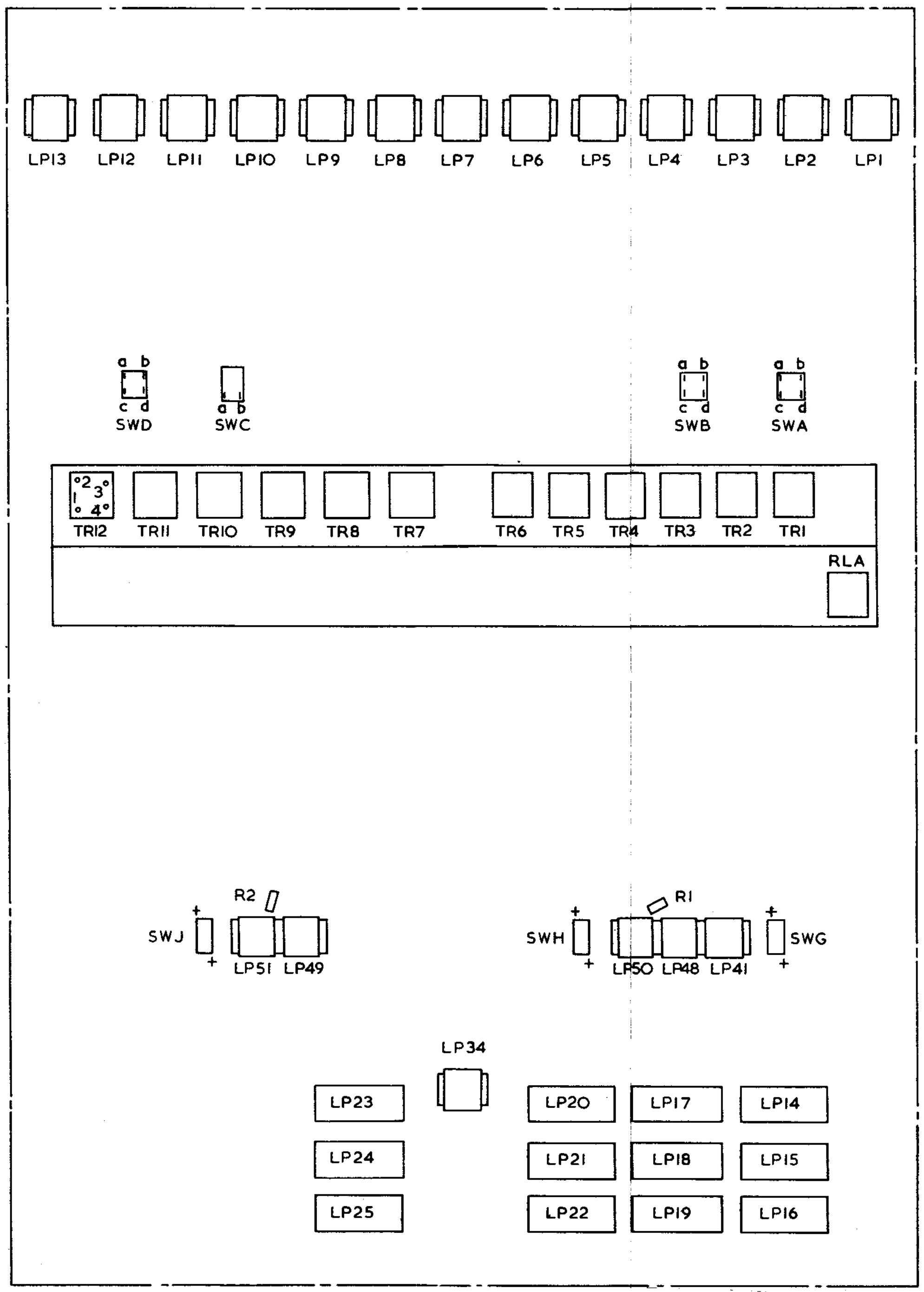


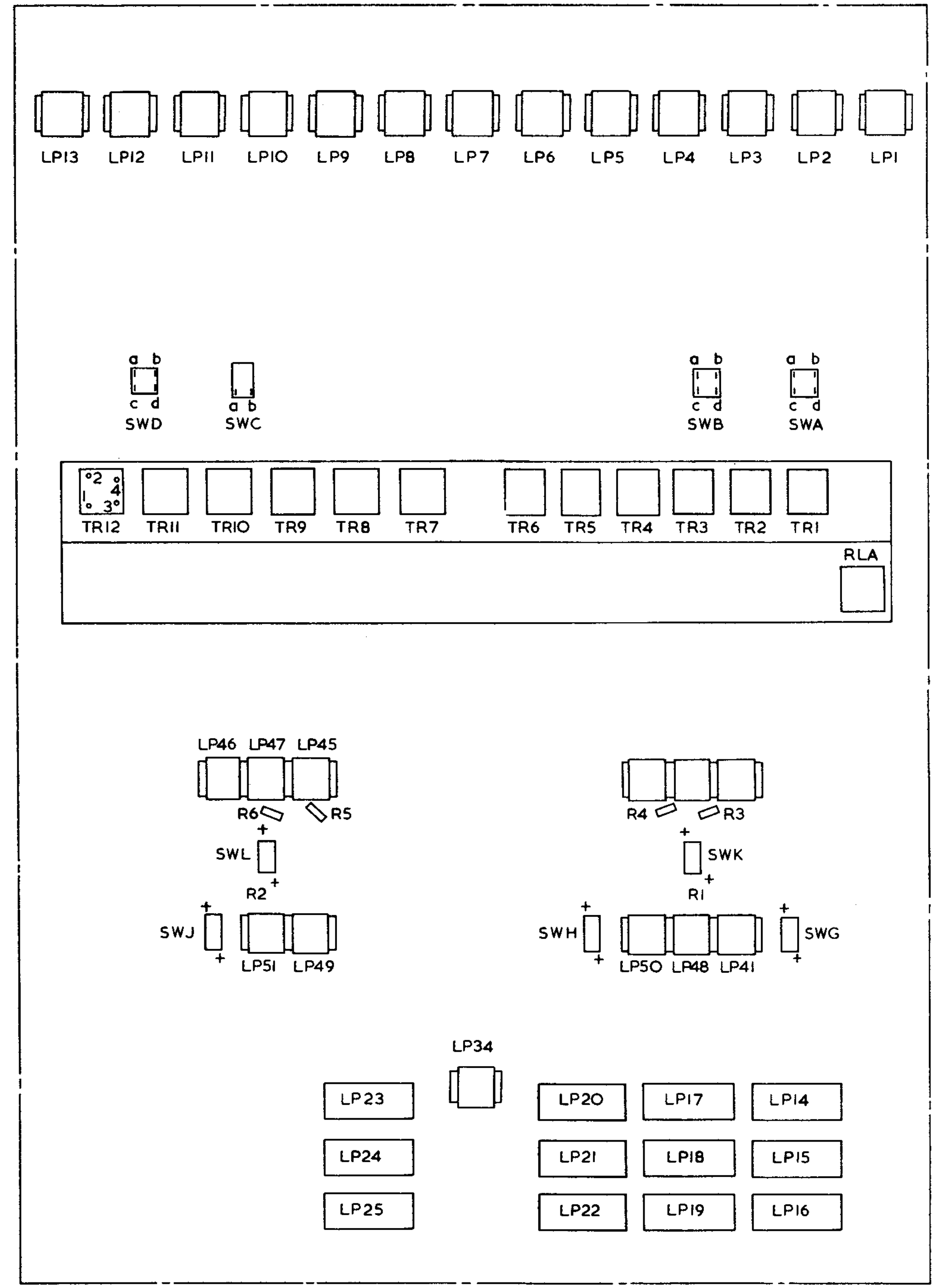
Fig.18

Trigger panel : non – linesman : circuit

Fig.18



Linesman



Non – linesman

Trigger panels : component layouts

Fig. 19

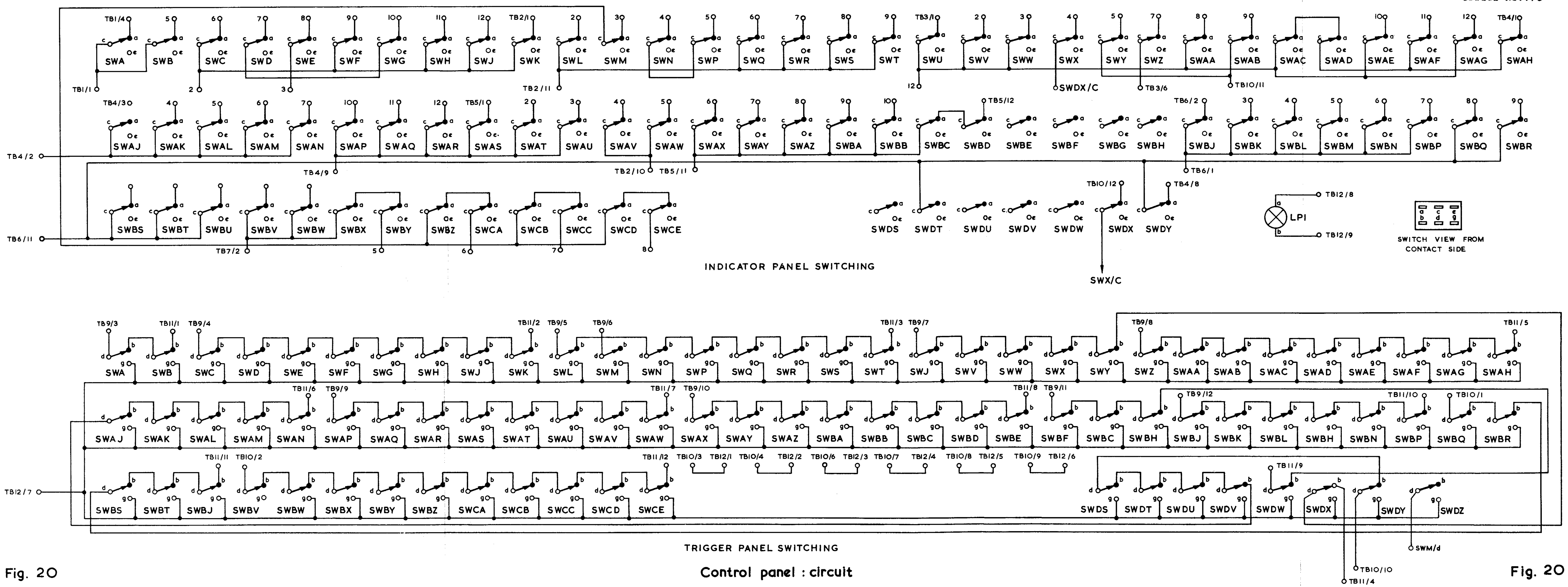


Fig. 20 Control panel : circuit Fig. 20

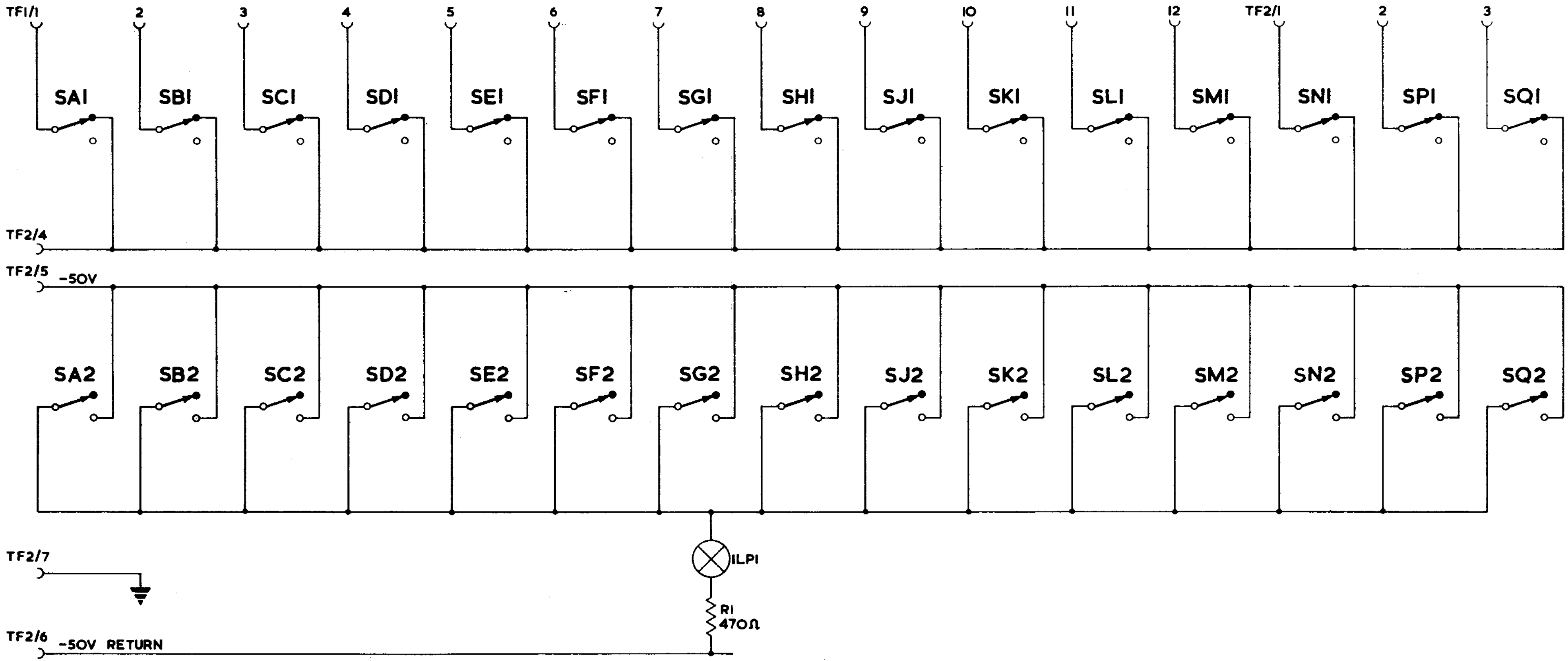


Fig. 21 Control panel (fault override) : circuit Fig. 21

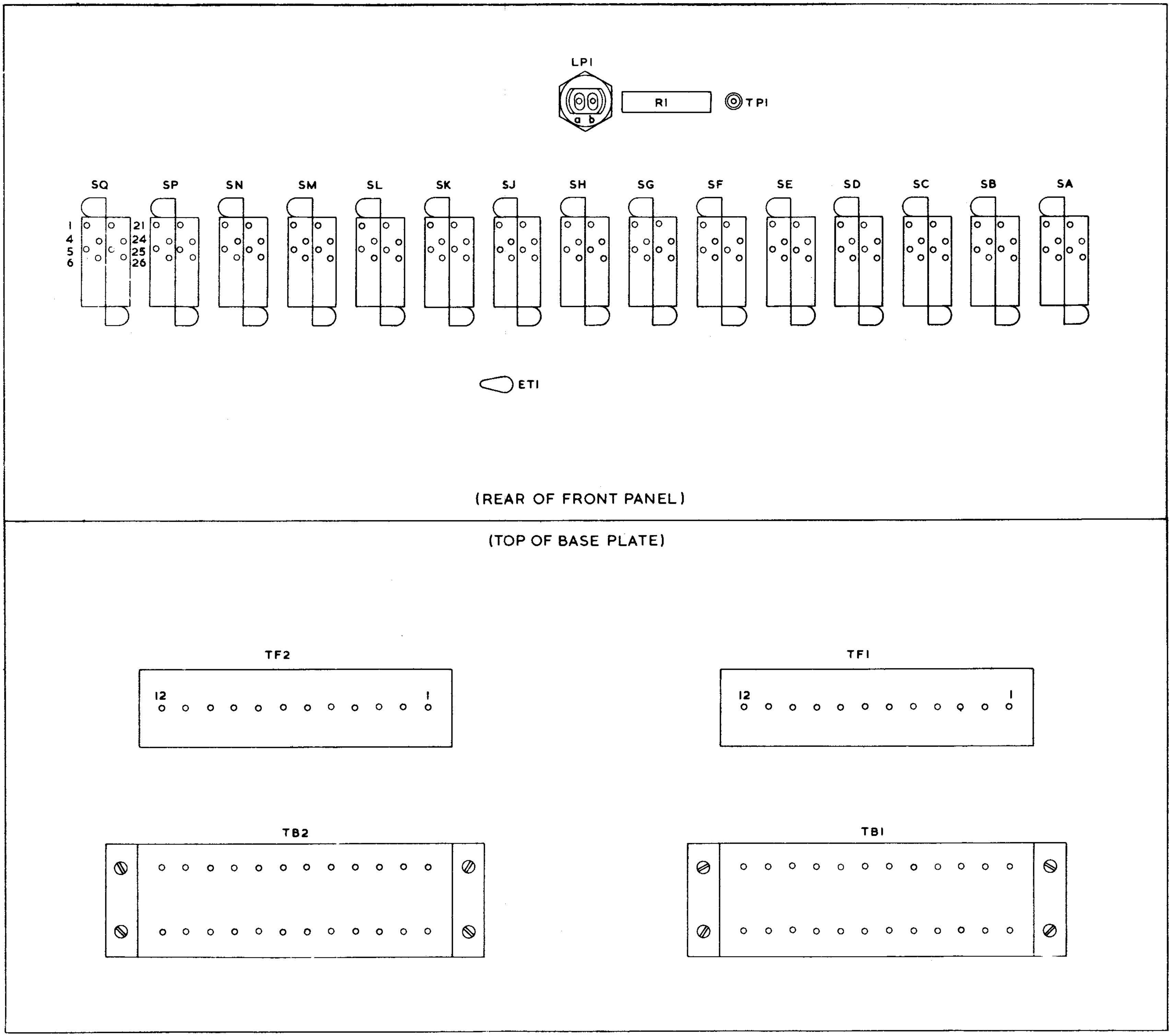


Fig.22 Panel control fault override Fig.22

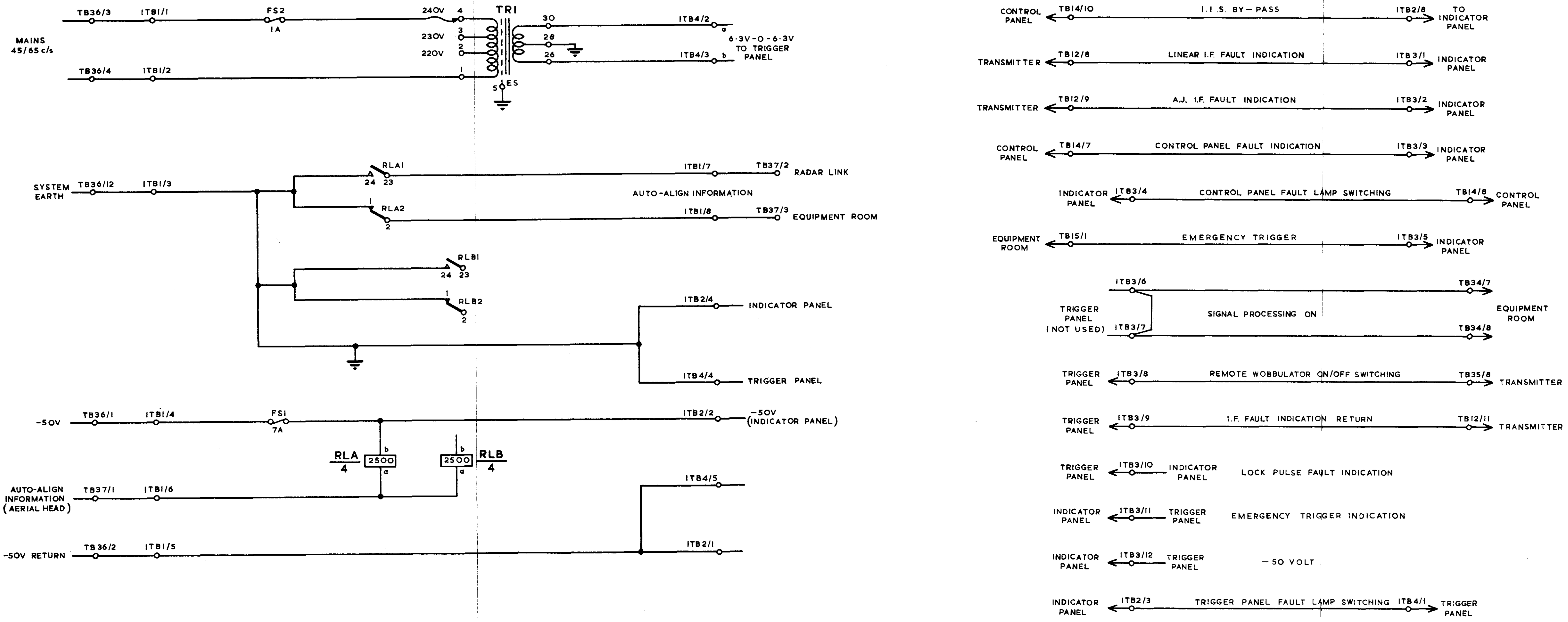


Fig.23 Rack, electrical equipment : circuit Fig.23

Chapter 4

TRANSMITTER REMOTE CONTROLS

CONTENTS

ILLUSTRATIONS

INTRODUCTION

1. Once initiated, the switching-on and making operational of the Radar Type 84 transmitter/receiver is completely automatic. Supplies and services are made available to the various units in a set sequence, the sequence being controlled by timing circuits in control panel M15 (AP115H-0102-1, Sect.6, Chap.2). The transmitter switching-on sequence can be initiated locally at the transmitter, or remotely at the trigger panel located above the display console in the operations room.

2. Lamps are provided on the trigger panel to indicate the operational state of the transmitter. A meter on the panel, which forms part of the transmitter r.f. power measurement system (AP115H-0102-1, Sect.7, Chap.6), continuously monitors the mean forward power in the waveguide system.

3. The overall function of the trigger panel is described in Chap.3; the panel circuits associated with transmitter control are shown in fig.2.

CIRCUIT DESCRIPTION

Transmitter switching

4. As shown in fig.1, a 240V a.c. supply is routed to the 50V power unit M7 when either the local (SG, SH) or remote (SWA) TRANSMITTER ON switch is operated. The +50V d.c. supply produced by the 50V power unit energizes relay RLA in control panel M15. When this relay is energised, contact RLA1 closes and provides a hold-on circuit; the operation of the remaining contacts of relay RLA initiates the transmitter switching-on sequence as described in AP115H-0102-1, Sect.6, Chap.2. Switch SA on control panel M15 provides a means of preventing the transmitter being switched on remotely while work is being carried out at the transmitter.

5. Relay RLA is de-energized and the transmitter switched off when either the local (SJ, SK) or remote (SWB) TRANSMITTER OFF switch is operated.

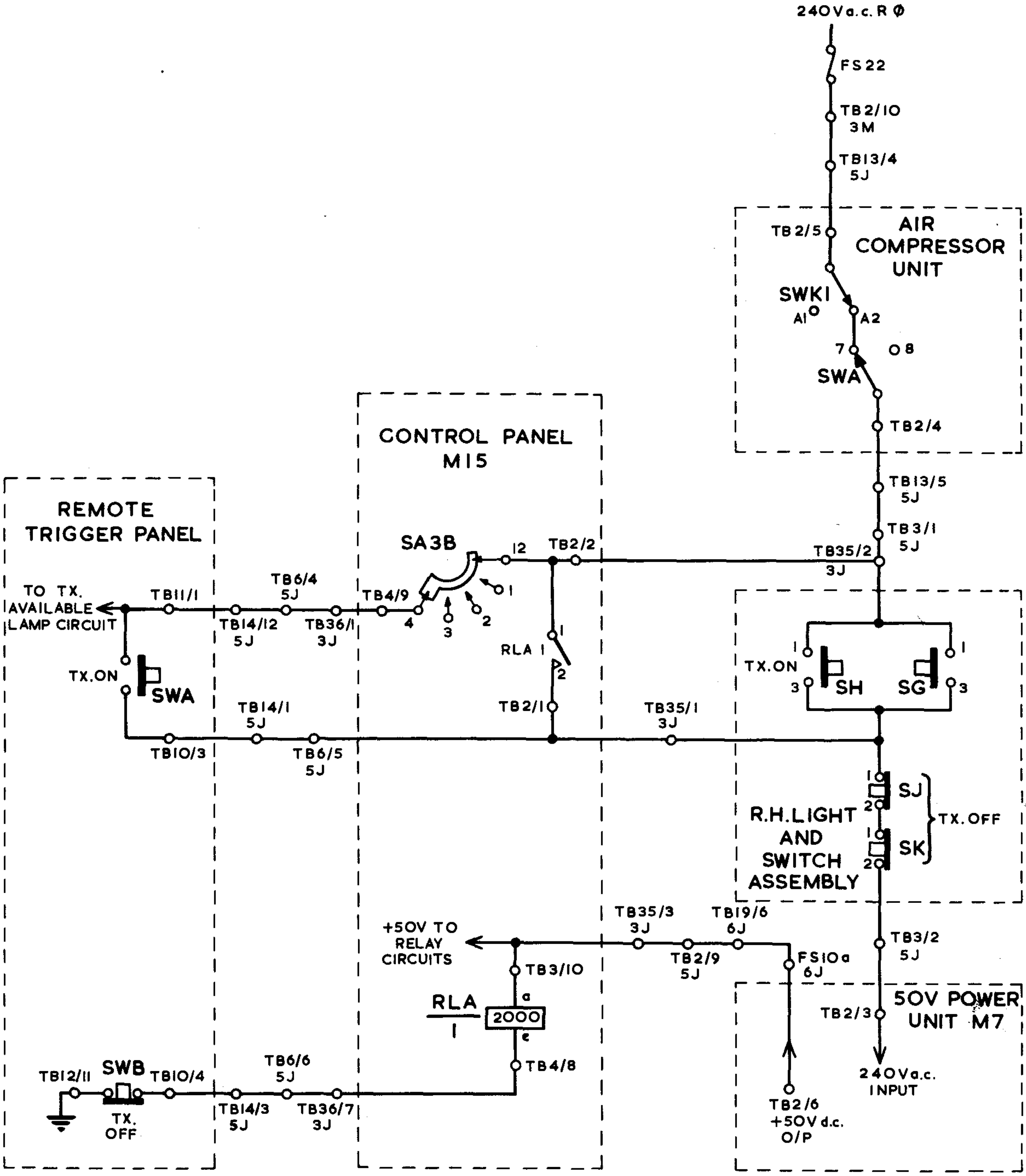


Fig.1 Transmitter switching circuit

6. The level of the e.h.t. applied to the modulator is automatically controlled by a motor-driven voltage regulator (AP115H-0102-1, Sect.3, Chap.3). In the event of an overload condition, the modulator e.h.t. supply is switched off and restored after a one-second delay period. If the overload condition persists or is recurrent during the next minute (during which period the TRIP lamp (fig.2) on the trigger panel is lit) the e.h.t. supply is again switched off and the regulator runs down to its lower limit. The e.h.t. supply is then restored and the regulator runs up to produce the correct operating level of e.h.t. Should an overload occur during the time that the

regulator is running up, the e.h.t. supply is again switched off and can only be restored by manually operating the H.T. RESET switch on control panel M15, or the H.T. RESET (SWD) on the trigger panel. Before the trigger panel H.T. RESET is operated, the motor-driven voltage regulator must first be allowed to run down to its lower limit, as indicated when the REGULATOR DOWN lamp on the trigger panel lights.

7. Monitoring facilities are provided at the transmitter to check the frequency response of the linear and the anti-jamming i.f. channels, as described in AP115H-0102-1, Sect.7, Chap.2 and 3. When these checks are carried out the i.f. input to the signal processing system, and therefore the video input to the displays, is removed. Remote control of the i.f. response monitoring system is provided at the display console by the WOBBULATOR switch on the trigger panel. When this switch is set to the ON position a +50V d.c. supply is routed to the selector panel on the waveform monitor. This allows the i.f. response to be displayed on the monitor c.r.t. by operating the appropriate selector push-button (AP115H-0102-1, Sect.7, Chap.2).

Power measurement

8. Power meter M1 (0-20kW) on the trigger panel indicates the mean forward power in the waveguide system. The meter has a f.s.d. of 250 μA and is fed with a fixed d.c. reference and a variable d.c. supply from the test set r.f. power in the transmitter (AP115H-0102-1, Sect.7, Chap.6).

9. The REMOTE FINE ZERO control RV1 is adjusted to give a zero meter reading when the r.f. input to the test set r.f. power is removed. The REMOTE CALIBRATION control RV2 provides a means of calibrating the meter reading against that of the local power meter located on the L.H. light and meter assembly of the transmitter.

Indicator lamp circuits

10. Indicator lamps on the light and switch assemblies (AP115H-0102-1, Sect.6, Chap.5) indicate the operational state of the transmitter. These indicator lamps are fed with 6.3V a.c. supplies from individual transformers. The 240V a.c. supplies to the primaries of a number of these transformers are also fed to indicator lamp circuits on the trigger panel to give a remote indication of the operational state of the transmitter. The function of the indicator lamps on the trigger panel will now be described in the order in which they light when the transmitter is made operational.

11. The TX AVAILABLE lamp indicates that the remote transmitter switching-on facility is available and that the switching circuit (fig.1) is complete to the trigger panel. The 240V a.c. supply to this indicator circuit is derived from TB2/10 on the circuit breaker assembly (AP115H-0102-1, Sect.6, Chap.3).

12. The TX ON indicator lights when either the local or remote TRANSMITTER ON switch is operated, and indicates that the transmitter switching-on sequence has been initiated. The 240V a.c. supply to this indicator circuit is derived from TB1/1 on the circuit breaker assembly.

13. The POWER SUPPLIES indicator lights when all the power units in the transmitter are functioning and producing their specified output voltages. If any of the power units fail, or if their voltage outputs are outside a set tolerance, then this indicator flashes to give warning of the failure. It

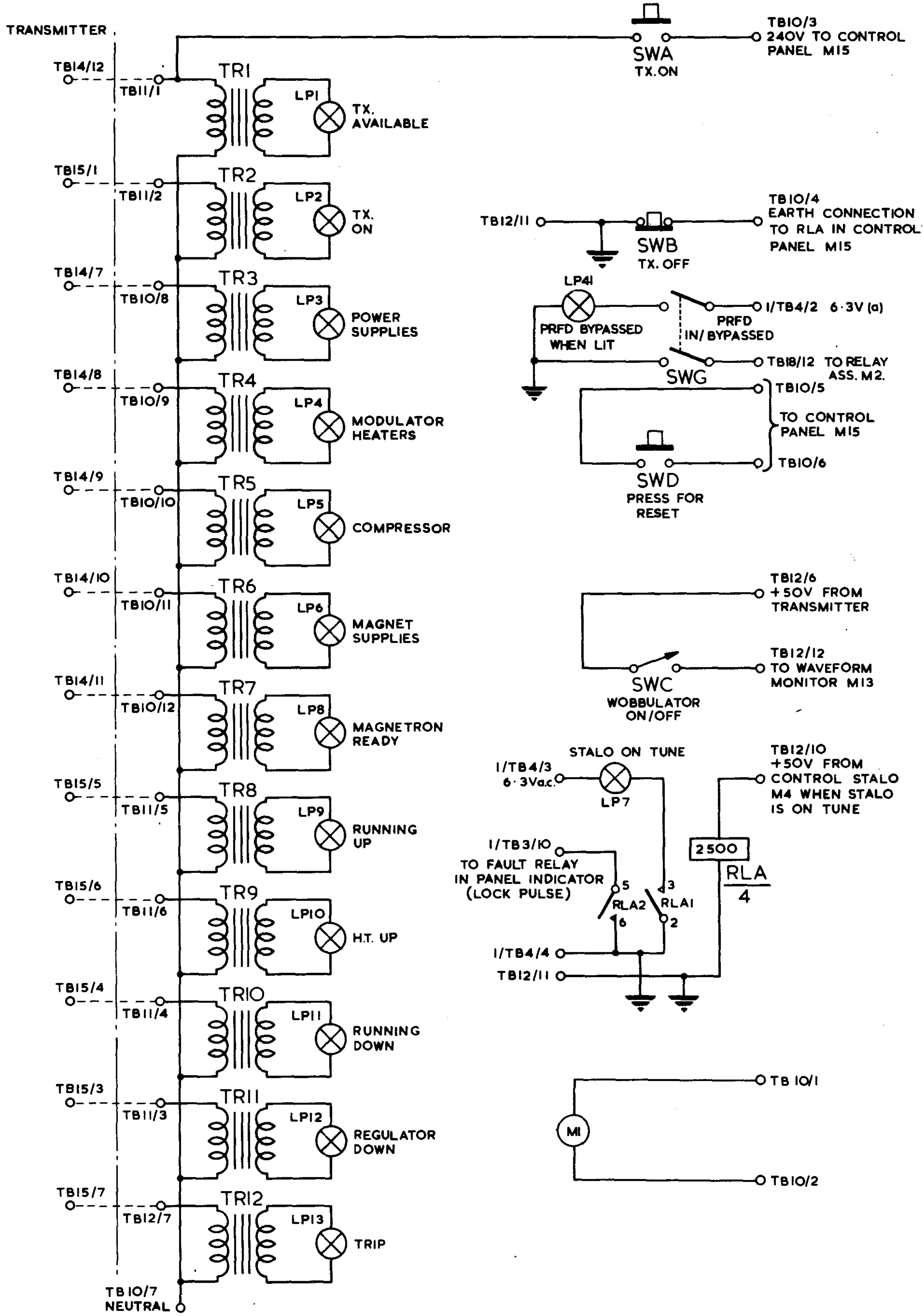


Fig.2 Trigger panel, transmitter control circuits

should be noted that the indicator will flash immediately the transmitter is switched on, but will remain steady when all the power units have warmed up and become fully operational. The 240V a.c. supply to this indicator circuit is derived from PLAA 21 in the L.H. light and meter assembly.

14. The MODULATOR HEATERS lamp lights when contactor B on the circuit breaker assembly closes and routes a.c. supplies to the heater transformer of the e.h.t. rectifiers, charging diodes and over-swing diodes of the transmitter modulator system (AP115H-0102-1, Sect.3, Chap.3). The 240V a.c. supply to this indicator circuit is derived from TB1/9 in the circuit breaker assembly.

15. The COMPRESSOR lamp indicates that the air compressor unit, situated in the transmitter room annexe, is operational. The 240V a.c. supply to this indicator circuit is derived from TB2/6 in the air compressor unit (AP115H-0102-1, Sect.2, Chap.2).

16. The MAGNETRON READY indicator lights when the eight-minute magnetron warm-up period has elapsed. The 240V a.c. supply to this indicator circuit is taken from the e.h.t. interlock circuit (AP115H-0102-1, Sect.6, Chap.4) and is fed from TB6/6 in the circuit breaker assembly.

Note...

The following five indicator lamps form part of the modulator e.h.t. control system (AP115H-0102-1, Sect.6, Chap.2) and do not light in any set sequence.

17. The RUNNING UP lamp indicates that the motor-driven voltage regulator is in the process of running up. The a.c. supply to energize the regulator motor is controlled by contactor M on the circuit-breaker assembly. The 240V a.c. supply to the operating coil of contactor M is also fed to the running-up indicator circuit via TB5/6 in the circuit breaker assembly.

18. The H.T. UP indicator lights when the motor-driven voltage regulator has run up to produce the required operating level of modulator e.h.t. and thus indicates that the transmitter is fully operational. The 240V a.c. supply to this indicator circuit is taken from the e.h.t. interlock circuit and is fed from TB2/7 in control panel M15.

19. The RUNNING DOWN lamp indicates that the motor-driven voltage regulator is in the process of running down. The a.c. supply to energize the regulator motor is controlled by contactor L on the circuit breaker assembly. The 240V a.c. supply to the operating coil of contactor L is also fed to the running-down indicator circuit via TB5/6 in the circuit breaker assembly.

20. The REGULATOR DOWN indicator lights when the motor-driven voltage regulator has run down to its bottom limit, e.g. during the overload and reset sequence described in para.6. The 240V a.c. supply to this indicator circuit is fed from TB2/5 in control panel M15.

21. The TRIP indicator lights during a transmitter overload and reset sequence as described in para.6. The 240V a.c. supply to this indicator circuit is fed from TB2/12 in control panel M15.

22. When the stable local oscillator (stalo) is on tune, a +50V d.c. supply is fed from TB2/6 in control stalo M4 (AP115H-0102-1, Sect.4, Chap.6) to energize relay RLA in the trigger panel (fig.1). Contact RLA1 routes a 6.3V a.c. supply to the STALO ON TUNE lamp and contact RLA2 provides an earth connection to a fault indicator relay in panel indicator (lock pulse), the function of which is described in Chap.3.

Chapter 5

AERIAL TURNING GEAR REMOTE CONTROLS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. The aerial turning gear remote controls are located on the unit control, aerial, M14. This unit is one of three units mounted in the rack, electrical equipment (indicator) at the control position (*Chap.* 1). The control, aerial, M14 (which will subsequently be referred to as the aerial turning control panel) occupies a position at the top left of the rack.

2. By means of the aerial turning control panel, remote control of the aerial motor drive groups and operational control over the movement of the aerial can be exercised from the control position. To assist in these controls, the panel incorporates simple monitoring devices and tell-back facilities. Full control, monitoring and tell-back facilities are only available when the control station selector switch on the master control cubicle at the radar head (A.P.2886H) is set to REMOTE, When the switch is set to LOCAL, control over aerial movement and the aerial motor drive groups is substantially passed to the master control cubicle, only two controls remaining effective from the aerial turning control panel. With only one exception, all monitoring and tell-back facilities continue to function.

3. The principal function of this chapter is to describe the purpose of the control, monitoring and tell-back facilities available at the aerial turning control panel. The manner in which the controls affect circuits to produce the required effect on the aerial turning gear is not described. Such a description will be found in A.P.2886H. It should be noted that circuit components on the panel, when shown in systems diagrams contained in that chapter, have been given the prefix X in the case of synchro elements and prefix RS in the case of all other components.

Layout

4. The unit has all its components mounted on one panel. This panel is hung vertically from hinges on the rack, electrical equipment (indicator). All controls, monitoring and tell-back devices are mounted on the front face of the panel. The bulk of the controls consist of switches, push buttons and potentiometers, whilst the monitoring and tell-back devices consist of lamps, synchro display dials and meters. The only pre-set control (RV1) is accessible from the back of the panel. Front and rear views of the panel, showing the component layout, are given in fig. 1 and 2.

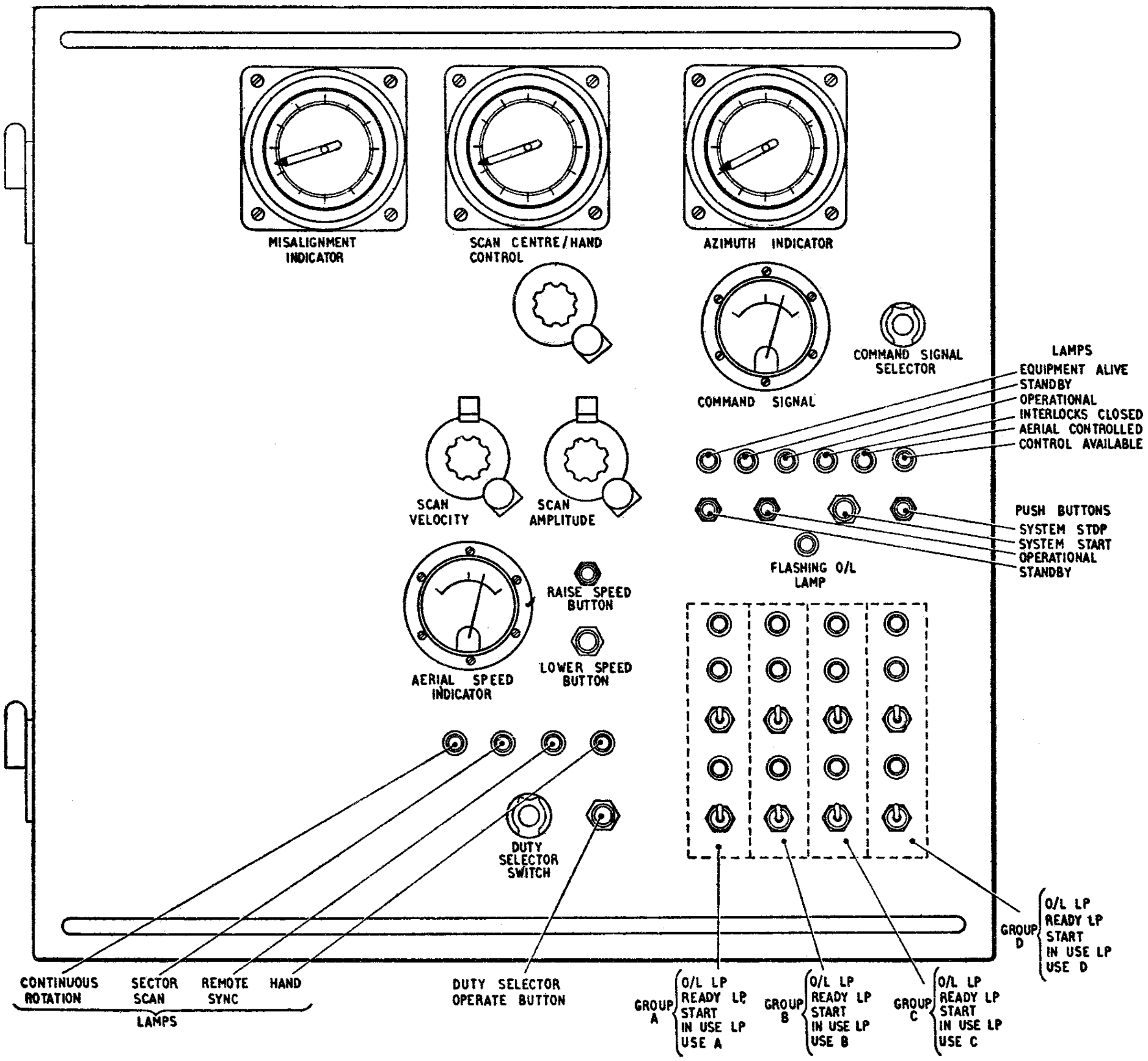


Fig. 1. Control, aerial, M14: layout of front of unit

Controls and control facilities

General

5. The control facilities described in paras. 6–14 which follow, exist at the aerial turning control panel when the CONTROL STATION SELECTOR at the master control cubicle is set to REMOTE. The control facilities which remain when CONTROL STATION SELECTOR is set to LOCAL are those exercised by the STANDBY and SYSTEM STOP buttons (*para.* 11 and 12). The component references quoted are those given in fig. 3.

Duty selection

6. By means of a DUTY SELECTOR SWITCH (ST1), selection of one of four possible modes of operation of the aerial can be made, i.e. CONTINUOUS ROTATION, SECTOR SCAN, REMOTE SYNC or HAND may be chosen. The continuous rotation mode is automatically engaged when the main turning equipment is first switched up. This initial engagement of continuous rotation occurs irrespective of the setting of the DUTY SELECTOR SWITCH.

7. To engage one of the three modes sector scan, remote sync or hand from the continuous rotation mode, in addition to the operation of the DUTY SELECTOR SWITCH as necessary, a duty selector OPERATE (SU) button must be pressed and certain non-misalignment conditions must be satisfied. Until the duty selector OPERATE button is pressed and until the non-misalignment conditions are satisfied, the continuous rotation mode will continue to exist. In the interval between making a duty selection and the required non-misalignment conditions occurring, misalignment information is presented on a misalignment indicator (*para.* 30). Misalignment information is not presented when returning from some other duty to CONTINUOUS ROTATION. To return to continuous rotation it is necessary only to return the DUTY SELECTOR SWITCH to CONTINUOUS ROTATION and then press SU.

RAISE *and* LOWER SPEED *buttons* (*SP & SN*)

8. These buttons give control over the speed of aerial rotation when the continuous rotation duty is engaged.

SCAN CENTRE/HAND *control* (*MS4*)

9. Operation of this control adjusts the position of the rotor of a synchro transmitter, MS4. By this means, the azimuth of the centre of the sector scanned may be chosen when engaged in sector scan operation, and when in hand operation, the aerial can be set to any desired azimuth.

SCAN VELOCITY *and* SCAN AMPLITUDE *controls*

10. These controls are used when the sector scan mode of operation is engaged. The potentiometer RV2 (SCAN VELOCITY) gives control over the rate at which a sector may be scanned. The setting of potentiometer RV3 (SCAN AMPLITUDE) determines the limits of the sector scanned.

STANDBY *and* OPERATIONAL *buttons* (*SX & SV*)

11. A standby state exists as soon as the isolator switch for the master control cubicle is closed on the A.M.W.D. auxiliary distribution board at the radar head. In the standby state, periodic or continuous actuation of the aerial turntable lubrication system occurs. Pressing the OPERATIONAL button causes the turntable lubrication feed to become fully operative, completes the supply to various transformers (including a synchro 50V supply transformer), energizes a one-minute delay relay and causes the OPERATIONAL lamp to light. Pressing the STANDBY button returns the equipment to the standby state and causes a STANDBY lamp to light.

SYSTEM START *and* SYSTEM STOP *buttons* (*SL & SM*)

12. The SYSTEM START button (SL) has no effect until an INTERLOCKS CLOSED lamp lights (*para.* 20) and until one minute has elapsed from pressing the

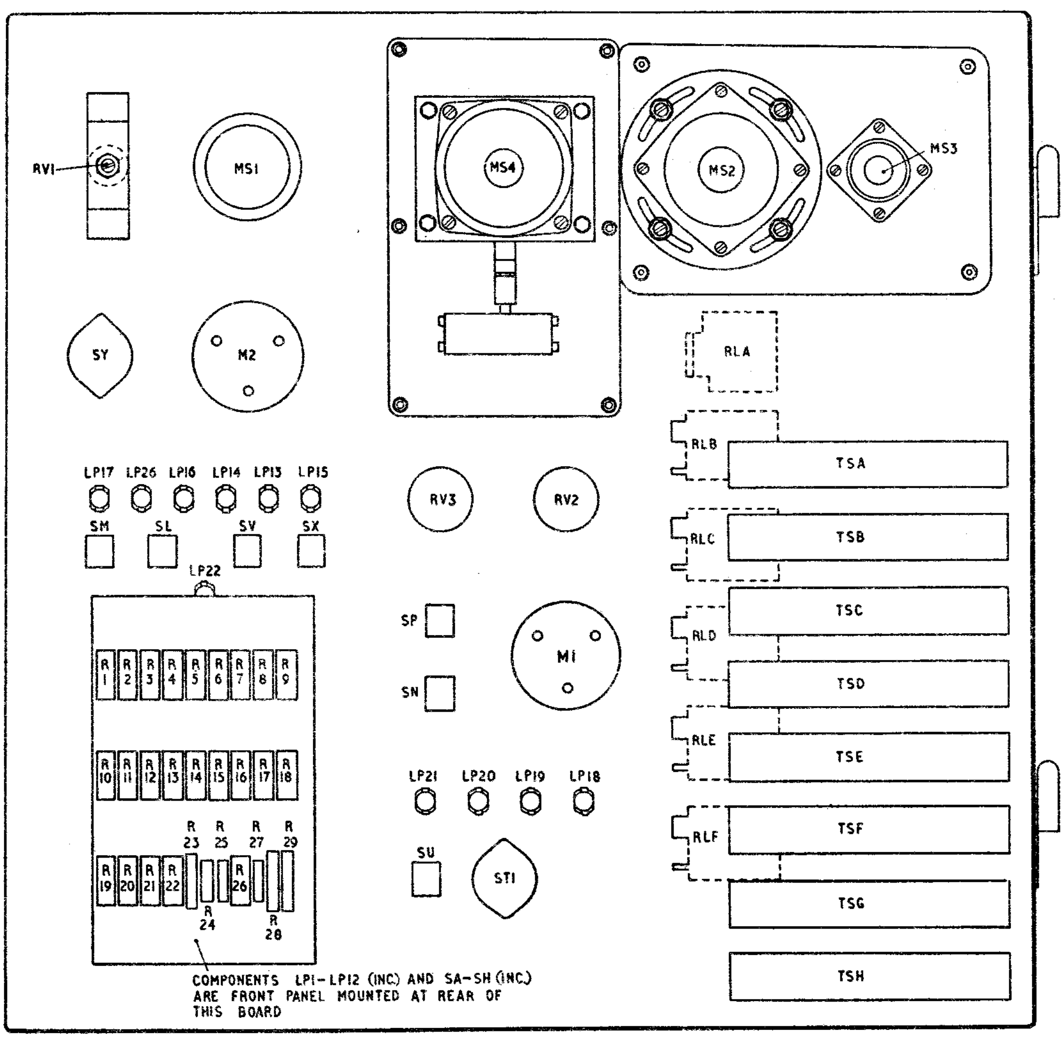


Fig. 2. Control, aerial, M14: component layout at rear of unit

OPERATIONAL button. When pressing of the SYSTEM START button becomes effective, an " about to operate " warning siren sounds at the radar head for one minute. At the end of this minute:—

(1) A relay RLA (*fig.* 3) is energized from a 240V supply at the master control cubicle, so closing the contact RLA 1 in series with an AERIAL CONTROLLED lamp.

(2) Providing the running up of one or more aerial drive motor generator sets has been completed and the use of one or more of these drive groups has been chosen, one or more of the aerial motor circuits will be completed and the aerial will rotate. Subject also to the foregoing proviso, one or more of the relays RLC, RLD, RLE and RLF (*fig.* 3) will be energized according to which aerial motor or motors have been selected for use.

START A, B, C & D *switches* (*SA–SD*)

13. Closing of any of these switches causes the supply circuit to the appropriate aerial drive motor generator set to be completed and the motor generator set to run up to speed. Run up time is approximately one minute.

USE A, B, C & D *switches* (*SE–SH*)

14. When any one of these switches is closed, the appropriate aerial motor control circuit, i.e. aerial motor control circuits A, B, C or D, has power made available to it via the system start control circuits, subject to one minute having elapsed from the pressing of SYSTEM START and the closing of the appropriate START switch.

Monitoring devices and tell-back facilities

General

15. The monitoring and tell-back facilities described in para. 16–32 which follow exist at the aerial turning control panel irrespective of whether the CONTROL STATION SELECTOR at the master control cubicle is set to REMOTE or LOCAL, except that misalignment indication is not given when at LOCAL. When at LOCAL, the controls which affect the indications given are all exercised from the master control cubicle with the exception that appropriate indications will be given if the SYSTEM STOP and STANDBY buttons at the aerial turning control panel are operated.

Lamps and lamp circuits

16. Lamps are employed as monitoring devices on the panel. The supplies to the lamp circuits are in all cases approximately 50V (see para. 33 for details) and all lamps are rated at 50V, 5W. All lamp circuits include a 220Ω resistor in series with the lamp. These resistors are included to reduce the brilliance of the lamps to a level suited to the conditions in the control position.

17. EQUIPMENT ALIVE *lamp LP*15. This lamp indicates to the control position that the master control cubicle isolator switch on the A.M.W.D. auxiliary distribution board has been closed and that control of the aerial turning gear is becoming possible.

18. STANDBY *lamp LP*13. This lamp lights simultaneously with the EQUIPMENT ALIVE lamp. The lamp is extinguished when the OPERATIONAL button is pressed.

19. OPERATIONAL *lamp LP*14. This lamp lights when the operational state is engaged by pressing the OPERATIONAL button. It is extinguished when the STANDBY button is pressed.

20. INTERLOCKS CLOSED *lamp LP*16. This lamp will not light unless interlocks associated with the aerial turning gear e.g. aerial clamp, aerial safety switches etc., are closed and unless the turntable lubrication system is functioning correctly.

21. CONTROL AVAILABLE *lamp LP*17. The lighting of this lamp indicates that control of the aerial motor drive groups and operational control over aerial movement is available from the control position, i.e. the CONTROL STATION SELECTOR at the master control cubicle has been set to REMOTE. The lamp cannot light however until approximately one minute after pressing the OPERATIONAL button and then only if the interlocks are closed as indicated by the INTERLOCKS CLOSED lamp.

22. A, B, C & D READY *lamps LP*5–*LP*8. The lighting of any one of these lamps indicates that the appropriate drive group motor generator has run up to speed and the associated d.c. generator field supply has been completed.

23. A, B, C & D IN USE *lamp circuits* (*LP*9–*LP*12). Relays RLC, RLD, RLE and RLF become energized under the circumstances indicated in para. 12. When one of these relays becomes energized, one of the contacts RLC1, RLD1, RLE1 or RLF1 closes and completes the appropriate lamp circuit, so giving indication of which aerial motor is driving the aerial.

24. AERIAL CONTROLLED *lamp circuit* (*LP*26). The lighting of lamp LP26 indicates that one or more aerial motors is running and that the aerial is thus under control. Completion of the lamp circuit by relay contacts RLA1 and one or more of relay contacts RLC1–RLF1 is dependent upon the energization of RLA and relays RLC–RLF as indicated in para. 12.

25. *Duty selection lamps LP18–LP21.* Lighting of the CONTINUOUS ROTATION, SECTOR SCAN, REMOTE SYNC or HAND lamps indicates in which mode of operation the aerial is engaged.

26. A, B, C *and* D O/L *lamps LP*1–*LP*4. If an overload exists on any one of the aerial motors of drive groups A, B, C and D, then the O/L lamp appropriate to the overloaded aerial motor will light. The lighting of an O/L lamp implies that a further drive group should be brought into operation.

27. Flashing O/L *lamp LP*22. The supply circuit to this lamp is completed via relay contact RLB1, and in installations where Radar Type 84 coexists with Radar Type 85, via a flashing unit (flasher, relay, indicator, −13·5V, M2) located in a relay cabinet on the Type 85 radar. A 50V d.c. supply to the flashing unit is completed through RLB2. Relay RLB is energized from the 50V d.c. supply via aerial motor overload contacts which are actuated by the drive control circuits. Thus when an overload exists on one or more aerial motors, LP22 flashes a warning additional to the warning provided by the A, B, C and D O/L lamps. In installations where there is no associated radar fitted with a flashing unit, the supply to the lamp is completed direct by contacts RLB1 and 2, terminals TSH5 and 6 being connected to TSH4 and the positive side of the 50V supply. In this instance, LP22 will burn steadily when an overload exists.

Azimuth indication

28. A synchro receiver, MS1, is fed from a synchro transmitter which is driven from a data gearbox at the aerial turning gear. MS1 thus indicates the azimuth of the local aerial.

Speed indication

29. A centre zero meter, M1, functions as a speed indicator, indicating the speed of rotation of the aerial in rev/min. Clockwise rotation of the aerial causes the indicator needle to deflect to the right of zero, counter-clockwise rotation causes deflection to the left of zero. A variable resistor RV1, in series with M1, functions as a sensitivity trimmer for calibration purposes.

Misalignment indication

30. A torque differential receiver, MS2, has its rotor windings fed from the synchro transmitter at the data gearbox, i.e. its rotor is fed with information proportional to the local aerial azimuth. Depending on the duty selected, the stator windings of MS2 can be fed from a remote aerial synchro transmitter giving information proportional to the remote aerial azimuth, or from the local SCAN CENTRE/HAND CONTROL transmitter. The rotor of MS2 thus takes up a position dependent on the amount of misalignment between the local aerial azimuth and the source feeding information to the stator. This misalignment is displayed on the MISALIGNMENT INDICATOR dial and is presented in the interval between making one of the duty selections SECTOR SCAN, REMOTE SYNC or HAND and the engagement of the selected mode. No misalignment indication is given when the control station is LOCAL, i.e. when control over the aerial is exercised from the master control cubicle.

31. A synchro control transformer, MS3, is geared to the rotor of MS2. The output of MS3 is fed to misalignment control circuits in the master control cubicle.

COMMAND SIGNAL *meter*

32. In conjunction with a switch COMMAND SIGNAL SELECTOR, SY, a centre zero COMMAND SIGNAL meter, M2, indicates the value of the command signal in the CURRENT COMMAND position of the selector switch. The meter deflects according to the setting of the SCAN AMPLITUDE and SCAN VELOCITY potentiometers when in those positions of the selector switch, the potentiometers producing the indication being local or remote as decided by the control station selected.

Power supplies

General

33. At the appropriate stage in switching and control sequences, the power supplies applied to the unit are as follows:—

50V, 50 c/s, a.c.: providing X & Y supplies to synchros MS1, MS3 and MS4.

46V, 50 c/s, a.c.: providing supply to lamp circuits of LP13–LP21 (inc.).

50V, d.c.: providing supply to lamp circuits of LP1–LP4, LP9–LP12, LP22 & LP26.

50V (approx.), 50 c/s, a.c. from transformer F/T2: providing supply to lamp circuits of LP5–LP8.

Caution . . .

The lines carrying the 50V supply from transformer F/T2 may be at mains potential (240V, 50 c/s, a.c.).

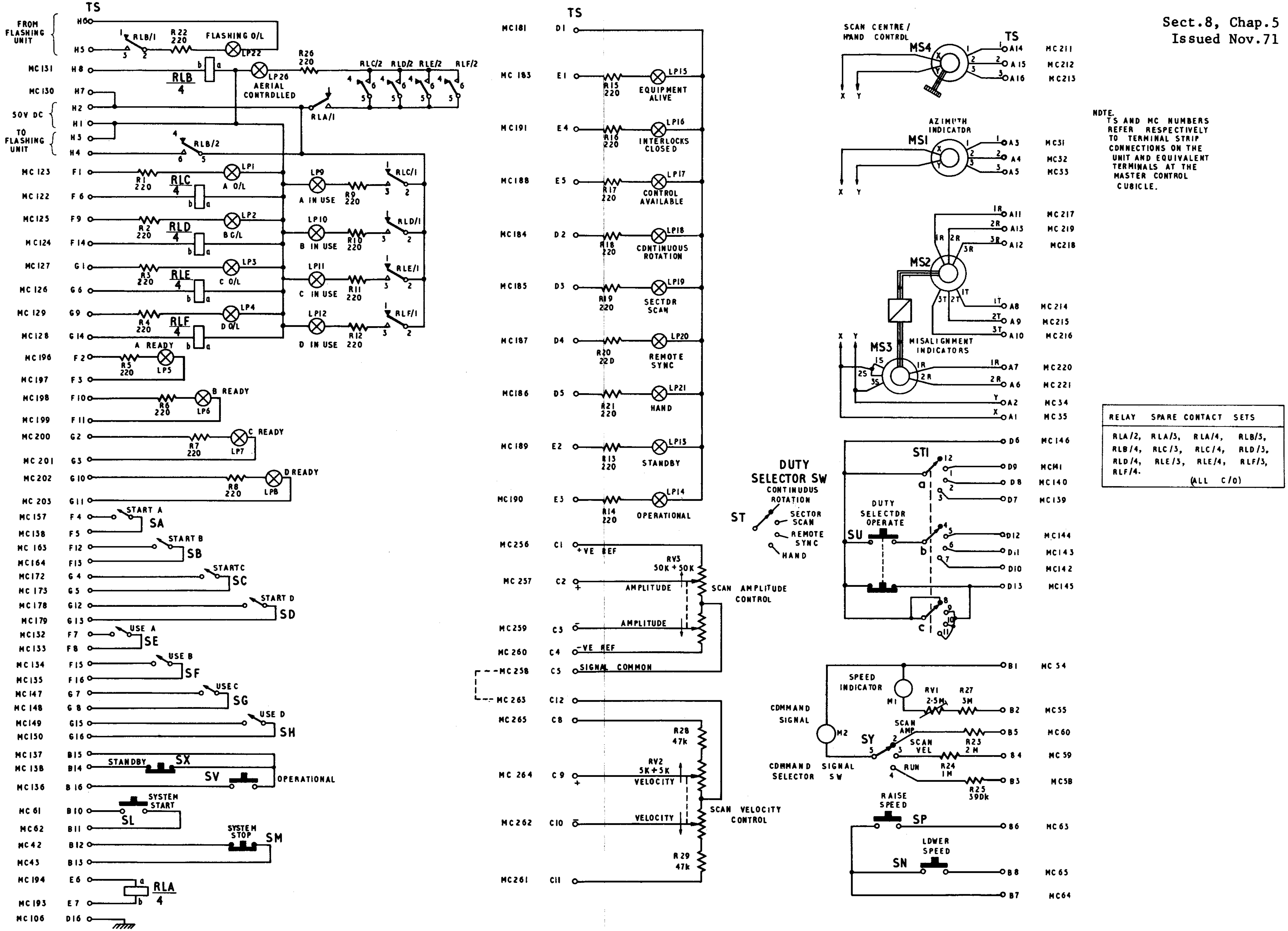


Fig.3 Control, aerial, M14: circuit Fig.3

SECTION 9

INTERCONNECTIONS

Chapter 1

(*Completely revised*)

EXTERNAL CONNECTIONS TO SIGNAL PROCESSING CABINETS

LIST OF CONTENTS

LIST OF TABLES

Introduction

1. The external connections to the signal processing cabinets are listed in Tables 1 to 5.

2. Connections to the no-break trigger system are identified as being made to the appropriate unit of the p.r.f. system.

Intermediate connections

3. The ultimate termination of the external connections is shown in columns 3 and 4 of the tables. However, station wiring will be such that these terminations are reached via station junction boxes. Reference should be made to station wiring schedules for such intermediate connections.

TABLE 1

External connections to power cabinet

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
Coaxial SKA		Standby cabinet (p.r.f. system)	402/ SKTBC	−8μs pulse (scope sync.)
Multicore PLB	1		—	Line
	2		—	Neutral
	3		—	Earth
	4		—	Line
	5	Radar office a.c. mains supply No. 1 (pins 5–7)	—	Neutral (A.C. mains input for power socket SKA via FS1)
	6		—	Earth (A.C. mains input for power socket SKA via FS1)
	7		—	Line (A.C. mains input for power socket SKA via FS1)
	8		—	Neutral
	9		—	Earth
	10		—	Line
	11		—	Neutral
	12		—	Earth

TABLE 1 *(continued)*

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
PLC	1		—	Line
	2		—	Neutral
	3		—	Earth
	4		—	Line
	5	Radar office a.c. mains supply No. 1	—	Neutral — A.C. mains input for power socket SKB via FS2
	6		—	Earth
	7		—	Line
	8		—	Neutral
	9		—	Earth
	10		—	Line
	11		—	Neutral
	12		—	Earth
PLD	1		—	Line
	2		—	Neutral
	3		—	Earth
	4		—	Line
	5	Radar office a.c. mains supply No. 1	—	Neutral — A.C. mains input for power socket SKC via FS3
	6		—	Earth
	7		—	Line
	8		—	Neutral
	9		—	Earth
	10		—	Line
	11		—	Neutral
	12		—	Earth
PLE	1	Not used	—	
	2		—	
	3		—	
	4	A.C. mains supply No. 2	—	Line — A.C. mains input for power supply M1
	5		—	Neutral
	6		—	Earth
SKF	1	I.F. cabinet	PLE/1	+250V output from power supply M1
	3	I.F. cabinet	PLE/3	−250V output from power supply M1
	4	I.F. cabinet	PLE/4	A.C. mains line output
	5	I.F. cabinet	PLE/5	A.C. mains neutral output
PLG	1	A.C. mains supply No. 1	—	Line — A.C. mains input for base chassis oscilloscope
	2		—	Neutral
	3		—	Earth
	4		—	Line — A.C. mains input for lampholder assembly.
	5		—	Neutral
	6		—	Earth
	7		—	Line — A.C. mains input for regulator, voltage (−250V) (upper)
	8		—	Neutral
	9		—	Earth
	10		—	Line — A.C. mains input for regulator, voltage (−250V) (lower)
	11		—	Neutral
	12		—	Earth

TABLE 1 (*continued*)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
PLH	1		—	
	2		—	
	3		—	
	4		—	
	5		—	
	6		—	
	7	+450V input from radar office	—	+450V for lampholder assembly
	8		—	
	9		—	
	10		—	
	11		—	
	12		—	
	13		—	
	14		—	
	15		—	
	16	Not used	—	
	17		—	
	18		—	
	20			−50V external link to PLH/22
	21	Bulk power supply	—	−50V input to lampholder assembly
	22			−50V external link to PLH/20
	23	Indicator panel	TB34/9	Switched earth (fault) from power supply M1
PLJ	1		—	−425V
	3		—	+450V Supplies for regulator, voltage −250V (upper) — Regulator No. 1
	4		—	−625V Supplies for regulator, voltage −250V (upper) — Regulator No. 1
	7	Bulk power supplies	—	−500V Supplies for regulator, voltage −250V (upper) — Regulator No. 1
	10		—	−425V Supplies for regulator, voltage −250V (upper) — Regulator No. 2
	12		—	+450V Supplies for regulator, voltage −250V (upper) — Regulator No. 2
	13		—	−625V Supplies for regulator, voltage −250V (upper) — Regulator No. 2
	16		—	−500V
PLK	1		—	−425V
	3		—	+450V Supplies for regulator, voltage −250V (lower) — Regulator No. 1
	4		—	−625V Supplies for regulator, voltage −250V (lower) — Regulator No. 1
	7	Bulk power supplies	—	−500V Supplies for regulator, voltage −250V (lower) — Regulator No. 1
	10		—	−425V Supplies for regulator, voltage −250V (lower) — Regulator No. 2
	12		—	+450V Supplies for regulator, voltage −250V (lower) — Regulator No. 2
	13		—	−625V Supplies for regulator, voltage −250V (lower) — Regulator No. 2
	16		—	−500V
SKL	1	Radar office	—	H.T. callwires out (−50V) — Regulator, voltage (upper)
	2	Radar office	—	H.T. callwires out (−50V) — Regulator, voltage (upper)
	3	Radar office	—	H.T. callwires out (−50V) — Regulator, voltage (lower)
	4	Radar office	—	H.T. callwires out (−50V) — Regulator, voltage (lower)
PLM	1	Aerial head	—	Rotational information (50c/s) for resolver electrical M1
	2	Aerial head	—	Rotational information (50c/s) for resolver electrical M1
	3	Aerial head	—	Rotational information (50c/s) for resolver electrical M1
	4	Cancellation cabinet	SKC/14	500c/s for resolver electrical M1
	5	Cancellation cabinet	SKC/15	500c/s for resolver electrical M1
	6	Trigger panel	TB37/3	Auto-align earth
	7	Control desk, panel (connector) M7	PL1/A	Rotational information (500c/s) from resolver electrical M1
	8	Control desk, panel (connector) M7	PL1/B	Rotational information (500c/s) from resolver electrical M1
	9	Control desk, panel (connector) M7	PL1/C	Rotational information (500c/s) from resolver electrical M1
	10	Aerial head	—	500c/s input to resolver electrical M1
	11	Aerial head	—	500c/s input to resolver electrical M1

TABLE 1 (*continued*)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
SKN	1		PLB/1	
	2	Cancellation cabinet	PLB/2	+450V from lampholder assembly
	3		PLB/3	
	4	Cancellation cabinet	PLB/4	Switched 6·3V from regulator, voltage −250V (upper)
	6	Cancellation cabinet	PLB/6	Switched earth (fault) to −250V cabinet fault lamp
	8	Cancellation cabinet	PLB/8	−50V output
	11	Cancellation cabinet	PLB/11	−250V from regulator, voltage −250V (upper)
	12	Cancellation cabinet	PLB/12	Earth return for lampholder assembly
	17	Cancellation cabinet	PLB/17	6·3V from lampholder assembly
	18	Cancellation cabinet	PLB/18	Earth
SKP	1		PLB/1	
	2	Video cabinet	PLB/2	+450V from lampholder assembly
	3		PLB/3	
	4	Video cabinet	PLB/4	Switched 6·3V from regulator voltage −250V (upper)
	6	Video cabinet	PLB/6	Switched earth (fault) to −250V cabinet fault lamp
	8	Video cabinet	PLB/8	−50V output
	11	Video cabinet	PLB/11	−250V from regulator, voltage −250V (upper)
	12	Video cabinet	PLB/12	Earth return for lampholder assembly
	17	Video cabinet	PLB/17	6·3V from lampholder assembly
	18	Video cabinet	PLB/18	Earth
SKQ	1		PLB/1	
	2	I.F. cabinet	PLB/2	+450V from lampholder assembly
	3		PLB/3	
	4	I.F. cabinet	PLB/4	Switched 6·3V from regulator voltage −250V (lower)
	6	I.F. cabinet	PLB/6	Switched earth (fault) to −250V cabinet fault lamp
	8	I.F. cabinet	PLB/8	−50V output
	11	I.F. cabinet	PLB/11	−250V from regulator, voltage −250V (lower)
	12	I.F. cabinet	PLB/12	Earth return for lampholder assembly
	17	I.F. cabinet	PLB/17	6·3V from lampholder assembly
	18	I.F. cabinet	PLB/18	Earth
SKR	1		PLB/1	
	2	Doppler cabinet	PLB/2	+450V from lampholder assembly
	3		PLB/3	
	4	Doppler cabinet	PLB/4	Switched 6·3V from regulator, voltage −250V (lower)
	5	Doppler cabinet	PLB/5	Switched 6·3V from regulator, voltage −250V (upper)
	6	Doppler cabinet	PLB/6	Switched earth (fault) to −250V cabinet fault lamp
	7	Doppler cabinet	PLB/7	
	8	Doppler cabinet	PLB/8	−50V output
	10	Doppler cabinet	PLB/10	−250V from regulator, voltage −250V (upper)
	11	Doppler cabinet	PLB/11	−250V from regulator, voltage −250V (lower)
	12	Doppler cabinet	PLB/12	Earth return for lampholder assembly
	17	Doppler cabinet	PLB/17	6·3V from lampholder assembly
	18	Doppler cabinet	PLB/18	Earth
SKS		Not used		
SKT		Not used		

TABLE 2

External connections to cancellation cabinet

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
Multicore PLA	1	A.C. mains supply	–	240V a.c. mains (line)
	2	A.C. mains supply	–	240V a.c. mains (neutral) Frame 1
	3	A.C. mains supply	–	240V a.c. mains (earth)
	4	A.C. mains supply	–	240V a.c. mains (line)
	5	A.C. mains supply	–	240V a.c. mains (neutral) Frame 2
	6	A.C. mains supply	–	240V a.c. mains (earth)
	7	A.C. mains supply	–	240V a.c. mains (line)
	8	A.C. mains supply	–	240V a.c. mains (neutral) Frame 3
	9	A.C. mains supply	–	240V a.c. mains (earth)
PLB	1	Power cabinet	SKN/1	+450V for Frame 1
	2	Power cabinet	SKN/2	+450V for Frame 2
	3	Power cabinet	SKN/3	+450V for Frame 3
	4	Power cabinet	SKN/4	Switched 6·3V for +250V regulator lamps
	6	Power cabinet	SKN/6	Switched earth from +250V regulator (–250V fault)
	8	Power cabinet	SKN/8	–50V input
	11	Power cabinet	SKN/11	–250V input
	12	Power cabinet	SKN/12	Earth return to lampholder assembly
	17	Power cabinet	SKN/17	6·3V for cabinet fault lamp
	18	Power cabinet	SKN/18	Earth
SKC	1	Relay assembly (p.r.f. system)	PLA/4	500c/s variable from controller (p.r.f.)
	2	Main and standby cabinets (p.r.f. system)	401/SKTD/18	500c/s fixed (earthy) from generator (reference signal)
	3	Relay assembly (p.r.f. system)	PLA/3	500c/s fixed from generator (reference signal)
	4	Main and standby cabinets (p.r.f. system)	401/SKTD/19	500c/s variable (earthy) from controller (p.r.f.)
	5	Indicator panel	TB33/10	Switched earth from Frame 1 fault relay
	6	Doppler cabinet	PLD/5	500c/s from generator (reference signal)
	7	Bulk power supply	–	Power callwire–Frame 1
	8	Bulk power supply	–	Power callwire–Frame 2
	9	Bulk power supply	–	Power callwire–Frame 3
	10	Indicator panel	TB33/11	Switched earth from Frame 2 fault relay
	11	Doppler cabinet	PLD/1	500c/s from generator (reference signal)
	13	Doppler cabinet	PLD/3	500c/s from generator (reference signal)
	14	Power cabinet	PLM/4	500c/s from generator (reference signal)
	15	Power cabinet	PLM/5	500c/s from generator (reference signal)
	16	Panel (control desk) centre	PL7/S	Switched earth from CANCEL ANGELS switch
	17	Indicator panel	TB33/12	Switched earth from Frame 3 fault relay
Coaxial SKA		Dist. unit pulse (p.r.f. system)	SKTAC	–125 μs pulse for controller (p.r.f.)
SKB		Dist. unit pulse (p.r.f. system)	SKCZ	–8 μs pulse for driver delay line (Channel B)
SKC		Relay assembly (p.r.f. system)	SKU	8 Mc/s carrier for driver delay line (Channel B)
SKD		Relay assembly (p.r.f. system)	SKX	8 Mc/s carrier for driver delay line (Channel A)
SKE		Relay assembly (p.r.f. system)	SKG	6 Mc/s carrier for driver delay line (Channel B)
SKF		Relay assembly (p.r.f. system)	SKK	6 Mc/s carrier for driver delay line (Channel A)
SKG		Doppler cabinet	SKE	Clutter waveform from switch, electronic (clutter) (Channel B)

TABLE 2 (continued)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
SKH		Doppler cabinet	SKF	Clutter waveform from switch, electronic (Channel A)
SKJ		Video cabinet	SKE	Once-cancelled video from comparator (signal) M1 (Channel B)
SKK		Video cabinet	SKF	Once-cancelled video from comparator (signal) M1 (Channel A)
SKL		Video cabinet	SKG	Twice-cancelled video from comparator (signal) M2 (Channel B)
SKM		Video cabinet	SKH	Twice-cancelled video from comparator (signal) M2 (Channel A)
SKN		Video cabinet	SKJ	Once-cancelled, twice delayed video from comparator (signal) M2 (Channel B)
SKP		Video cabinet	SKK	Once-cancelled, twice delayed video from comparator (signal) M2 (Channel A)
SKQ		I.F. cabinet	SKM	Video input to driver (delay line) (Channel B)
SKR		I.F. cabinet	SKN	Video input to driver (delay line) (Channel A)
SKS		Relay assembly (p.r.f. system)	SKTD	500c/s (p.r.f. reference)
SKT–SKZ		Spare ◄(At sites where an external plot and code extractor is not used)►		
◄SKT		Doppler cabinet	SKM	Rectangle outline marker)
SKU		Plot and code extractor	–	Rectangle outline marker)
SKV		Monitor suite	–	Rectangle outline marker) At sites where an
SKW		Video cabinet	SKW	Switching waveform) external plot and code
SKX		Video cabinet	SKX	MTI video) extractor is used.
SKY		Plot and code extractor	–	Switching waveform)
SKZ		Plot and code extractor	–	MTI video)►

TABLE 3

External connections to video cabinet

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
Multicore				
PLA	1	Station mains supply	–	240V a.c. mains (line)
	2	Station mains supply	–	240V a.c. mains (neutral) Frame 1
	3	Station mains supply	–	240V a.c. mains (earth)
	4	Station mains supply	–	240V a.c. mains (line)
	5	Station mains supply	–	240V a.c. mains (neutral) Frame 2
	6	Station mains supply	–	240V a.c. mains (earth)
	7	Station mains supply	–	240V a.c. mains (line)
	8	Station mains supply	–	240V a.c. mains (neutral) Frame 3
	9	Station mains supply	–	240V a.c. mains (earth)
PLB	1	Power cabinet	SKP/1	+450V for Frame 1
	2	Power cabinet	SKP/2	+450V for Frame 2
	3	Power cabinet	SKP/3	+450V for Frame 3
	4	Power cabinet	SKP/4	Switched 6·3V for +250V regulator lamps
	6	Power cabinet	SKP/6	Switched earth from +250V regulator (–250V fault)
	8	Power cabinet	SKP/8	–50V input
	11	Power cabinet	SKP/11	–250V input
	12	Power cabinet	SKP/12	Earth return to lampholder assembly
	17	Power cabinet	SKP/17	6·3V for cabinet fault lamp
	18	Power cabinet	SKP/18	Earth

TABLE 3 (continued)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
SKC	1	Panel (control desk-centre	PL7/U	Switched earth from CHANNEL SELECTOR switch
	2	Panel (control desk) centre	PL7/R	Switched earth from LINEAR INJECTION switch
	4	Panel (control desk) centre	PL7/R	Switched earth from LINEAR INJECTION switch
	5	Indicator panel	TB33/7	Switched earth from Frame 1 fault relay
	7	Bulk power supply	–	Power callwire–Frame 1
	8	Bulk power supply	–	Power callwire–Frame 2
	9	Bulk power supply	–	Power callwire–Frame 3
	10	Indicator panel	TB33/8	Switched earth from Frame 2 fault relay
	11	Panel (control desk) centre	PL7/X	Switched earth from CHANNEL SELECTOR switch
	12	Panel (control desk) centre	PL7/W	
	13	Panel (control desk) centre	PL7/V	
	14	Panel (control desk) centre	PL7/B	Switched earth from MONITOR SELECTOR switch
	15	Panel (control desk) centre	PL7/C	
	16	Panel (control desk) centre	PL7/A	
	17	Indicator panel	TB33/9	Switched earth from Frame 3 fault relay
Coaxial				
SKA	M	I.F. cabinet	SKU	Relay assembly M2
SKA	R	I.F. cabinet	SKV	Relay assembly M2
SKF	–	I.F. cabinet	SKX	Channel 1 video amplifier
SKF	–	I.F. cabinet	SKY	Channel 2 video amplifier
SKA		Dist. unit pulse (p.r.f. system)	SKTW	–125 μs pulse for controller (p.r.f.)
SKB		Dist. unit pulse (p.r.f. system	SKTDT	–8 μs pulse for driver (delay line)
SKC		Dist. unit pulse (p.r.f. system)	SKTET	0 μs pulse for pulse generator (switching)
SKD		Relay assembly (p.r.f. system	SKTAA	8 Mc/s carrier for driver (delay line)
SKEA		Cancellation cabinet	SKJ	Once-cancelled video (Channel B)
SKF		Cancellation cabinet	SKK	Once-cancelled video (Channel A)
SKG		Cancellation cabinet	SKL	Twice-cancelled video (Channel B)
SKH		Cancellation cabinet	SKM	Twice-cancelled video (Channel A)
SKJ		Cancellation cabinet	SKN	Once-cancelled, twice delayed video (Channel B)
SKK		Cancellation cabinet	SKP	Once-cancelled, twice delayed video (Channel A)
SKL		I.F. cabinet	SKK	Linear i.f. input to amplifier assembly (linear)
SKM		Doppler cabinet	SKG	Switching waveform to switch, electronic (video) No.1
SKN		Doppler cabinet	SKD	Switching waveform to switch, electronic (video) No.2
SKP		I.F. cabinet	SKT	Log-PLD video input to relay assembly
SKQ		I.F. cabinet	SKL	A/J video input to relay assembly
SKR		Users displays	–	Channel 1 video output from amplifier, video
SKS		Console 1	–	Selected video output from amplifier, video
SKT		Users displays	–	Channel 2 video output from amplifier, video
SKU		Panel (relay) M6	SK3	Selected video output from amplifier, video
SKV		Panel (relay) M6	SK2	Linear video output from amplifier, video
SKW		◀Unused } At sites where an external plot and code extractor is not used.▶	–	6 Mc/s carrier input to driver (delay line)
SKX		Unused } At sites where an external plot and code extractor is not used.▶	–	Signal input to driver (delay line)

TABLE 3 (continued)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
SKW		Cancellation cabinet SKW Switching Waveform (At sites where an external plot and code extractor is used.)		
SKX		Cancellation cabinet SKX MTI Video (At sites where an external plot and code extractor is used.)		
SKY		Unused	–	Modulated 6 Mc/s carrier delayed from network, hybrid circuit
SKZ		Dist. unit. pulse (p.r.f. system)	SKTDW	0μs pulse for gate, electronic (blanking)

TABLE 4

External connections to i.f. cabinet

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
Multicore PLA	1	Station mains supply		240V a.c. mains (line)
	2	Station mains supply		240V a.c. mains (neutral) Frame 1
	3	Station mains supply		240V a.c. mains (earth)
	4	Station mains supply		240V a.c. mains (line)
	5	Station mains supply		240V a.c. mains (neutral) Frame 2
	6	Station mains supply		240V a.c. mains (earth)
	7	Station mains supply		240V a.c. mains (line)
	8	Station mains supply		240V a.c. mains (neutral) Frame 3
	9	Station mains supply		240V a.c. mains (earth)
PLB	1	Power cabinet	SKQ/1	+450V for Frame 1
	2	Power cabinet	SKQ/2	+450V for Frame 2
	3	Power cabinet	SKQ/3	+450V for Frame 3
	4	Power cabinet	SKQ/4	Switched 6·3V for +250V regulator lamp
	6	Power cabinet	SKQ/6	Switched earth to –250V fault lamp
	8	Power cabinet	SKQ/8	–50V supply input
	11	Power cabinet	SKQ/11	–250V supply input
	12	Power cabinet	SKQ/12	Earth return to lampholder assembly
	17	Power cabinet	SKQ/17	6·3V for cabinet fault lamp
	18	Power cabinet	SKQ/18	Earth
SKC	1	Panel (control desk) L.H.	PL4/K	Switched earth from SWEPT GAIN switch
	2	Panel (control desk) L.H.	PL4/L	Switched earth from SWEPT GAIN switch
	3	Panel (control desk) L.H.	PL4/M	Switched earth from SWEPT GAIN switch
	4	Panel (control desk) L.H.	PL4/N	Switched earth from SWEPT GAIN switch
	5	Indicator panel	TB33/4	Switched earth from Frame 1 fault relay
	7	Bulk power supply	–	Power callwire–Frame 1
	8	Bulk power supply	–	Power callwire–Frame 2
	9	Bulk power supply	–	Power callwire–Frame 3
	10	Indicator panel	TB33/5	Switched earth from Frame 2 fault relay
	12	Panel (Control desk) L.H.	PL4/X	Switched earth from BLIND VELOCITY BAND switch (13K)
	13	Panel (Control desk) L.H.	PL4/Y	Switched earth from BLIND VELOCITY BAND switch (19K)
	14	Panel (Control desk) L.H.	PL7/Q	Switched earth from ANTI-JAM switch

TABLE 4 (continued)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
SKC	17	Indicator Panel	TB33/6	Switched earth from Frame 3 fault relay
PLD	1	Transmitter	TB16/8	LIMIT LEVEL
	2	Transmitter	TB16/9	A.J. LEVEL
	3	Transmitter	TB16/10	LINEAR LEVEL from control (i.f. level)
	4	Transmitter	TB16/11	Common bias
	5	Transmitter	TB16/6	Meter (go)
	6	Transmitter	TB16/7	Meter (return)
	8	Transmitter	TB16/5	LIMIT LEVEL switch
PLE	1	Power cabinet	SKF/1	+250V input
	3	Power cabinet	SKF/3	−250V input to demodulator (linear) in A.J. channel
	4	Power cabinet	SKF/4	240V a.c. mains (line)
	5	Power cabinet	SKF/5	240V a.c. mains (neutral)
Coaxial				
SKA		Transmitter	SKTL	Lock pulse input
SKB		Dist. unit, pulse (p.r.f. system)	SKTEJ	0μs pulse for limiter, electrical noise
SKC		Dist. unit, pulse (p.r.f. system)	SKTEM	0μs pulse for demodulator (coherent)
SKD		Dist. unit, pulse (p.r.f. system)	SKTEF	0μs pulse for generator, sweep (video)
SKE		Dist. unit, pulse (p.r.f. system)	SKTEQ	0μs pulse for signal generator (i.f.)
SKF		Dist. unit, pulse (p.r.f. system)	SKTAQ	−125μs pulse for demodulator (coherent)
SKG		Dist. unit, pulse (p.r.f. system)	SKTAF	−125μs pulse for oscillator (coherent)
SKH		Transmitter	SKTM	Linear signal input
SKJ		Transmitter	SKTN	A.J. signal input
SKK		Video cabinet	SKL	Linear i.f. output (15 dB down)
SKL		Video cabinet	SKQ	A.J. video output
SKM		Cancellation cabinet	SKQ	Video output—cancellation Channel B
SKN		Cancellation cabinet	SKR	Video output—cancellation Channel A
SKP		Doppler cabinet	SKJ	Fixed reference frequency for mixer stage (frequency) Channel B
SKQ		Doppler cabinet	SKK	Variable reference frequency for mixer stage (frequency) Channel B
SKR		Doppler cabinet	SKH	Fixed reference frequency for mixer stage (frequency) Channel A
SKS		Doppler cabinet	SKL	Variable reference frequency for mixer stage (frequency) Channel A
SKT		Video cabinet	SKP	Log-PLD video output
SKU		Video cabinet	SKAM	Input to VZRPG
SKV		Video cabinet	SKAR	Input to VZRPG
SKX		Video cabinet	SKF Channel 1	Output from VZRPG
SKY		Video cabinet	SKF Channel 2	Output from VZRPG
SKW		No-break trigger cabinet		t_0 −8μsec pulse
SKZ				Video zero pulse to trigger monitor

TABLE 5

External connections to Doppler cabinet

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
Multicore PLA	1	Station mains supply	–	240V a.c. mains (line)
	2	Station mains supply	–	240V a.c. mains (neutral) Frame 3
	3	Station mains supply	–	240V a.c. mains (earth)
	4	Station mains supply	–	240V a.c. mains (line)
	5	Station mains supply	–	240V a.c. mains (neutral) Frame 2
	6	Station mains supply	–	240V a.c. mains (earth)
	7	Station mains supply	–	240V a.c. mains (line)
	8	Station mains supply	–	240V a.c. mains (neutral) Frame 1
	9	Station mains supply	–	240V a.c. mains (earth)
PLB	1	Power cabinet	SKR/1	+450V for Frame 1
	2	Power cabinet	SKR/2	+450V for Frame 2
	3	Power cabinet	SKR/3	+450V for Frame 3
	4	Power cabinet	SKR/4	Switched 6·3V for +250V regulator lamps (frames 1 and 2)
PLB	5	Power cabinet	SKR/5	Switched 6·3V for +250V regulator lamps (Frame 3)
	6	Power cabinet	SKR/6	Switched earth from +250V regulators (–250V fault) (Frames 1 and 2)
	7	Power cabinet	SKR/7	Switched earth from +250V regulators (–250V faults) (Frame 3)
	8	Power cabinet	SKR/8	–50V input
	10	Power cabinet	SKR/10	–250V input for Frame 3
	11	Power cabinet	SKR/11	–250V input for Frames 1 and 2
	12	Power cabinet	SKR/12	Earth return to lampholder assembly
	17	Power cabinet	SKR/17	6·3V for cabinet fault lamp
	18	Power cabinet	SKR/18	Earth
SKC	1	Intertrace mixing equipment	–	D.C. outputs from pulse generator (rectangle)
	2	Intertrace mixing equipment	–	} (See station schedule for details)
	3	Intertrace mixing equipment	–	
	4	Intertrace mixing equipment	–	
	5	Indicator panel	TB33/1	Switched earth from Frame 1 fault relay
	7	Bulk power supply	–	Power callwire–Frame 1
	8	Bulk power supply	–	Power callwire–Frame 2
	9	Bulk power supply	–	Power callwire–Frame 3
	10	Indicator panel	TB33/2	Switched earth from Frame 2 fault relay
	11	Panel (control desk) centre	PL5/M	Switched earth from MOVE/SIZE or RESET switch–Rectangle 1
	12	Panel (control desk) centre	PL5/L	Switched earth from MOVE/SIZE or RESET switch–Rectangle 2
	13	Panel (control desk) centre	PL5/K	Switched earth from MOVE/SIZE or RESET switch–Rectangle 3
	14	Panel (control desk) centre	PL5/P	Switched earth from LOCAL/USERS switch–Rectangle 1
	15	Panel (control desk) centre	PL5/O	Switched earth from LOCAL/USERS switch–Rectangle 2
	16	Panel (control desk) centre	PL5/N	Switched earth from LOCAL/USERS switch–Rectangle 3
	17	Indicator panel	TB33/3	Switched earth from Frame 3 fault relay
◄ SKM		Cancellation cabinet	SKT	Rectangle outline marker (At sites where an external plot and code extractor is used) ►

TABLE 5 (*continued*)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
PLD	1	Cancellation cabinet	SKC/11	500c/s for control, electrical frequency unit (pins 1 and 3)
	3	Cancellation cabinet	SKC/13	
	5	Cancellation cabinet	SKC/6	500c/s for controller (motor)
SKE	1	Panel (control desk) centre	PL5/J	Switched earth from RESET switch — Rectangle 1 (pins 1–3)
	2	Panel (control desk) centre	PL5/F	Switched earth from MOVE or RESET switch
	3	Panel (control desk) centre	PL7/O	Switched earth from SIZE switch
	4	Panel (control desk) centre	PL5/H	Switched earth from RESET switch — Rectangle 2 (pins 4–6)
	5	Panel (control desk) centre	PL5/E	Switched earth from MOVE or RESET switch
	6	Panel (control desk) centre	PL7/N	Switched earth from SIZE switch
	7	Panel (control desk) centre	PL5/G	Switched earth from RESET switch — Rectangle 3 (pins 7–9)
	8	Panel (control desk) centre	PL7/M	Switched earth from MOVE or RESET switch
	9	Panel (control desk) centre	PL7/L	Switched earth from SIZE switch
	11	Panel (control desk) centre	PL5/V	Switched earth LOCAL from LOCAL/USERS switch Rectangle 1
	12	Panel (control desk) centre	PL5/U	Switched earth LOCAL from LOCAL/USERS switch Rectangle 2
	13	Panel (control desk) centre	PL5/T	Switched earth LOCAL from LOCAL/USERS switch Rectangle 3
	14	Panel (control desk) centre	PL5/Q	Switched earth USERS from LOCAL/USERS switch Rectangle 1
	15	Panel (control desk) centre	PL5/R	Switched earth USERS from LOCAL/USERS switch Rectangle 2
	16	Panel (control desk) centre	PL5/S	Switched earth USERS from LOCAL/USERS switch Rectangle 3
	17	Panel (control desk) R.H.	PL4/A	Switched earth from CLUTTER SWITCHING switch—Rectangle 1
	18	Panel (control desk) R.H.	PL4/B	Switched earth from CLUTTER SWITCHING switch—Rectangle 2
	19	Panel (control desk) R.H.	PL4/C	Switched earth from CLUTTER SWITCHING switch—Rectangle 3
	20	Panel (control desk) R.H.	PL4/D	Switched earth from CLUTTER SWITCHING switch—CIRCLE
	21	Panel (control desk) centre	PL5/Z	Switched earth from RESET switches
	22	Panel (control desk) centre	PL5/Y	Switched earth from joystick button or RESET switches

TABLE 5 (*continued*)

PL or SK number on distribution panel	Pin	Destination	Plug or socket	Services
PLF	1	Panel (relay) M7	PL1/F	500c/s Doppler information (Rectangle 1) for control, electrical frequency
	2	Panel (relay) M7	PL1/E	
	3	Panel (relay) M7	PL1/G	500c/s Doppler information (Rectangle 1) for control, electrical frequency
	4	Panel (relay) M7	PL1/E	
	5	Panel (relay) M7	PL1/H	500c/s Doppler information (Rectangle 1) for control, electrical frequency
	6	Panel (relay) M7	PL1/E	
	13	Panel (control desk) centre	PL5/C	D.C. (X axis) from joystick
	14	Panel (control desk) centre	PL5/D	D.C. (Y axis) from joystick
	15	Panel (control desk) centre	PL5/A	+50V from power supply for joystick
	16	Panel (control desk) centre	PL5/B	−50V from power supply for joystick
	17	Panel (control desk) centre	PL5/W	Remote earth from controller (motor) for MOVE/SIZE and RESET switches
	21	Panel (control desk) centre	PL5/X	Intertrace passwire from controller (motor)
Coaxial SKA		Dist. unit, pulse (p.r.f. system)	SKTDZ	0 μs pulse for pulse generator (switching)
SKB		Fixed coil displays	—	X resolved timebase for pulse generators (rectangle)
SKC		Fixed coil displays	—	Y resolved timebase for pulse generators (rectangle)
SKD		Video cabinet	SKN	Circle switching waveform from pulse generator (switching)
SKE		Cancellation cabinet	SKG	Clutter switching waveform for panel (area switching)
SKF		Cancellation cabinet	SKH	Clutter switching waveform for panel (area switching)
SKG		Video cabinet	SKM	Combined switching waveform from panel (area switching)
SKH		I.F. cabinet	SKR	Fixed reference frequency from panel distribution (reference frequency)
SKJ		I.F. cabinet	SKP	Fixed reference frequency from panel distribution (reference frequency)
SKK		I.F. cabinet	SKQ	Doppler compensated reference frequency from switch electronic (reference frequency)
SKL		I.F. cabinet	SKS	Doppler compensated reference frequency from switch electronic (reference frequency)
SKM		Console assembly		Display rectangle and circle markers from panel (area switching)

Note . . .
There are possibly two extra leads plugged into SKY *and* SKZ *for convenience. These can be interchanged with lead to* SKM *if rectangle markers etc. are required on alternative consoles.*

Chapter 2

(Completely revised)

EXTERNAL CONNECTIONS TO INDICATOR RACK

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LIST OF TABLES

Introduction

1. External connections to the indicator rack housing the technical monitoring and control equipment are listed in Table 1. Connections to and from the aerial turning gear are made through terminal blocks TB1 to TB9 and those associated with the Type 84 radar through terminal blocks TB10 to TB37. Connections TB1 to TB9 are to be issued later.

2. External connections are brought in to fixed terminal blocks on the rack. Internal connections to units in the rack are made through fanning strips (designated TF1 to TF37) which are secured directly to the terminal blocks bearing the same serial number. As an example, consider rack termination TB11/1. This is connected by external wiring to TB14/12 in the transmitter, and carries switched 240V a.c. for the rack TX. AVAILABLE lamp, etc. Within the rack, TB11/1 is connected to fanning strip TF11/1 (and thence to the lamp etc., on the trigger panel).

Connections to panel, control

3. The terminations on the panel, control, are shown as TF numbers because on this unit, the external connections are made through fanning strips. The fanning strips are secured to fixed terminal blocks and together form part of the panel, control. An example of the method by which connections between the indicator rack and the panel, control, may be traced, follows:

Indicator rack fanning strip TF23/1 to adjacent terminal block TB23/1 and thence via external wiring to panel, control, fanning strip TF1/1, which makes direct connection to adjacent terminal block TB1/1.

TABLE 1

External connections to indicator rack (rack electrical equipment 5975-99-913-3581)

Rack termination	Destination	Remote termination	Service
TB1 to TB9	Aerial turning gear	—	From aerial turning gear control panel
TB10/1	Transmitter	TB12/1	Power meter +ve
	Transmitter	TB12/2	Power meter −ve
TB10/3	Transmitter	TB14/1	Switched 240V a.c.—TX.ON button return from SWA
TB10/4	Transmitter	TB14/3	Switched 50V return from TX.OFF SWB
TB10/5	Transmitter	TB14/4 }	Switched line. Remote SWD H.T. RESET
TB10/6	Transmitter	TB14/5 }	
TB10/7	Transmitter	TB14/6	240V a.c. common return to lamps and SWA
TB10/8	Transmitter	TB14/7	Switched 240V a.c.—POWER SUPPLIES
TB10/9	Transmitter	TB14/8	Switched 240V a.c.—MOD. HTRS.
TB10/10	Transmitter	TB14/9	Switched 240V a.c.—COMPRESSOR
TB10/11	Transmitter	TB14/10	Switched 240V a.c.—MAGNET SUPPLY
TB10/12	Transmitter	TB14/11	Switched 240V a.c.—MAGNETRON READY
TB11/1	Transmitter	TB14/12	Switched 240V a.c.—TX.AVAIL lamp and TX. ON button
TB11/2	Transmitter	TB15/1	Switched 240V a.c.—TX.ON
TB11/3	Transmitter	TB15/3	Switched 240V a.c.—REG. DOWN
TB11/4	Transmitter	TB15/4	Switched 240V a.c.—RUNNING DOWN
TB11/5	Transmitter	TB15/5	Switched 240V a.c.—RUNNING UP
TB11/6	Transmitter	TB15/6	Switched 240V a.c.—H.T.UP
TB12/6	Transmitter	TB14/2	50V input from transmitter to SWC
TB12/7	Transmitter	TB15/7	Switched 240V a.c.—TRIP
TB12/8	Transmitter	TB16/1 }	Switched +50V { LIN. I.F. lamp
TB12/9	Transmitter	TB16/2 }	Switched +50V { A.J.I.F. lamp
TB12/10	Transmitter	TB16/3	Switched +50V in to RLA STALO ON TUNE
TB12/11	Transmitter	TB16/4	50V return to RLA and SWB
TB12/12	Transmitter	TB16/12	Switched 50V out from SWC WOB/ON/OFF
TB13/1	Panel, control	TF11/1	Switched earth, SWA, SWB normal
TB13/2	Panel, control	TF11/2	Switched earth, SWC–SWK normal
TB13/3	Panel, control	TF11/3	Switched earth, SWL, SWN–SWT normal
TB13/4	Panel, control	TF11/4	Switched earth, SWU–SWY and SWDX normal
TB13/5	Panel, control	TF11/5	Switched earth, SWZ, SWAA–SWAH normal
TB13/6	Panel, control	TF11/6	Switched earth, SWDS–SWDV, SWAJ–SWAN and SWDY normal.
TB13/7	Panel, control	TF11/7	Switched earth, SWAP–SWAW normal
TB13/8	Panel, control	TF11/8	Switched earth, SWAX–SWAZ, SWBA–SWBE normal
TB13/9	Panel, control	TF11/9	Switched earth, SWBF–SWBH and SWDW normal
TB13/10	Panel, control	TF11/10	Switched earth, SWBJ–SWBP normal
TB13/11	Panel, control	TF11/11	Switched earth, SWBQ, SWBR and SWBS–SWBU normal
TB13/12	Panel, control	TF11/12	Switched earth, SWBV–SWBZ, SWCA–SWCE normal

TABLE 1 (*continued*)

Rack termination	Destination	Remote termination	Service
TB14/1	Panel, control	TF12/1	PRFA maintenance LP44
TB14/2	Panel, control	TF12/2	PRFB maintenance LP47
TB14/3	Panel, control	TF12/3	PRFB fault LP45
TB14/4	Panel, control	TF12/4	PRFB normal LP46
TB14/5	Panel, control	TF12/5	PRFB emergency trigger LP49
TB14/6	Panel, control	TF12/6	IIS 'A' bypassed LP50
TB14/7	Panel, control	TF12/7	Switched earth, COMMON FAULT
TB14/8	Panel, control	TF12/8	Switched earth—COMMON FAULT, for panel, control, fault lamp
TB14/9	Panel, control	TF12/9	6·3V for panel, control, fault lamp
TB14/10	Panel, control	TF12/10	IIS 'B' bypassed LP51
TB14/11	Panel, control	TF12/11	PRFA maint.
TB14/12	Panel, control	TF12/12	PRFB maint.
TB15/1	Main p.r.f. cabinet	PLD/10	Switched earth—emergency trigger
TB23/1	Panel, control	TF1/1	Switched −50V normal, frame 1, cancellation cabinet
TB23/2	Panel, control	TF1/2	Switched −50V normal, frame 2, cancellation cabinet
TB23/3	Panel, control	TF1/3	−50V input from supplies
TB23/4	Panel, control	TF1/4	Switched −50V SWA normal
TB23/5	Panel, control	TF1/5	Switched −50V SWB normal
TB23/6	Panel, control	TF1/6	Switched −50V SWC normal
TB23/7	Panel, control	TF1/7	Switched −50V SWD normal
TB23/8	Panel, control	TF1/8	Switched −50V SWE normal
TB23/9	Panel, control	TF1/9	Switched −50V SWF normal
TB23/10	Panel, control	TF1/10	Switched −50V SWE, SWD, SWG normal
TB23/11	Panel, control	TF1/11	Switched −50V SWH normal
TB23/12	Panel, control	TF1/12	Switched −50V SWJ normal
TB24/1	Panel, control	TF2/1	Switched −50V SWK normal
TB24/2	Panel, control	TF2/2	Switched −50V SWL normal
TB24/3	Panel, control	TF2/3	−50V input from supplies
TB24/4	Panel, control	TF2/4	Switched −50V SWN normal
TB24/5	Panel, control	TF2/5	Switched −50V, SWN, SWP normal
TB24/6	Panel, control	TF2/6	Switched −50V SWQ normal
TB24/7	Panel, control	TF2/7	Switched −50V SWR normal
TB24/8	Panel, control	TF2/8	Switched −50V SWS normal
TB24/9	Panel, control	TF2/9	Switched −50V SWT normal
TB24/10	Panel, control	TF2/10	Switched −50V normal, LIN.PU.
TB24/11	Panel, control	TF2/11	Switched −50V normal, frame 3, cancellation cabinet
TB24/12	Panel, control	TF2/12	Switched −50V normal, frame 1, video cabinet
TB25/1	Panel, control	TF3/1	Switched −50V SWU normal
TB25/2	Panel, control	TF3/2	Switched −50V SWV normal
TB25/3	Panel, control	TF3/3	Switched −50V SWW normal
TB25/4	Panel, control	TF3/4	Switched −50V SWX normal
TB25/5	Panel, control	TF3/5	Switched −50V SWY normal
TB25/6	Panel, control	TF3/6	Switched −50V normal, frame 2, video cabinet
TB25/7	Panel, control	TF3/7	Switched −50V SWZ normal
TB25/8	Panel, control	TF3/8	Switched −50V SWAA normal
TB25/9	Panel, control	TF3/9	Switched −50V SWAB normal
TB25/10	Panel, control	TF3/10	Switched −50V SWAE normal
TB25/11	Panel, control	TF3/11	Switched −50V SWAF normal
TB25/12	Panel, control	TF3/12	Switched −50V SWAG normal

TABLE 1 (*continued*)

Rack termination	Destination	Remote termination	Service
TB26/1	Panel, control	TF4/1	Switched −50V SWAH normal
TB26/2	Panel, control	TF4/2	Switched −50V normal, frame 3, video cabinet
TB26/3	Panel, control	TF4/3	Switched −50V SWAJ normal
TB26/4	Panel, control	TF4/4	Switched −50V SWAK normal
TB26/5	Panel, control	TF4/5	Switched −50V SWAL normal
TB26/6	Panel, control	TF4/6	Switched −50V SWAM normal
TB26/7	Panel, control	TF4/7	Switched −50V SWAN normal
TB26/8	Panel, control	TF4/8	Switched −50V SWDY normal
TB26/9	Panel, control	TF4/9	Switched −50V normal, frame 1, i.f. cabinet.
TB26/10	Panel, control	TF4/10	Switched −50V SWAP normal
TB26/11	Panel, control	TF4/11	Switched −50V SWAQ normal
TB26/12	Panel, control	TF4/12	Switched −50V SWAR normal
TB27/1	Panel, control	TF5/1	Switched −50V SWAS normal
TB27/2	Panel, control	TF5/2	Switched −50V SWAT normal
TB27/3	Panel, control	TF5/3	Switched −50V SWAU normal
TB27/4	Panel, control	TF5/4	Switched −50V SWAV normal
TB27/5	Panel, control	TF5/5	Switched −50V SWAW normal
TB27/6	Panel, control	TF5/6	Switched −50V SWAX normal
TB27/7	Panel, control	TF5/7	Switched −50V SWAY normal
TB27/8	Panel, control	TF5/8	Switched −50V SWAZ normal
TB27/9	Panel, control	TF5/9	Switched −50V SWBA normal
TB27/10	Panel, control	TF5/10	Switched −50V SWBB normal
TB27/11	Panel, control	TF5/11	Switched −50V normal, frame 2, i.f. cabinet
TB27/12	Panel, control	TF5/12	Switched −50V SWBC, SWBD normal
TB28/1	Panel, control	TF6/1	Switched −50V normal, frame 1, doppler cabinet
TB28/2	Panel, control	TF6/2	Switched −50V SWBJ normal
TB28/3	Panel, control	TF6/3	Switched −50V SWBK normal
TB28/4	Panel, control	TF6/4	Switched −50V SWBL normal
TB28/5	Panel, control	TF6/5	Switched −50V SWBM normal
TB28/6	Panel, control	TF6/6	Switched −50V SWBN normal
TB28/7	Panel, control	TF6/7	Switched −50V SWBP normal
TB28/8	Panel, control	TF6/8	Switched −50V SWBQ normal
TB28/9	Panel, control	TF6/9	Switched −50V SWBR normal
TB28/10	Panel, control	TF6/10	Switched −50V SWBS normal
TB28/11	Panel, control	TF6/11	Switched −50V normal, frame 2, doppler cabinet
TB28/12	Panel, control	TF6/12	Switched −50V SWBT normal
TB29/1	Panel, control	TF7/1	Switched −50V SWBU normal
TB29/2	Panel, control	TF7/2	Switched −50V normal, frame 3, doppler cabinet
TB29/3	Panel, control	TF7/3	Switched −50V SWBV normal
TB29/4	Panel, control	TF7/4	Switched −50V SWBW normal
TB29/5	Panel, control	TF7/5	Switched −50V SWBX, SWBY normal
TB29/6	Panel, control	TF7/6	Switched −50V SWBZ, SWCA normal
TB29/7	Panel, control	TF7/7	Switched −50V SWCB, SWCC normal
TB29/8	Panel, control	TF7/8	Switched −50V SWCD, SWCE normal
TB29/9	Panel, control	TF7/9	Switched −50V normal, frame 1, main p.r.f. cabinet.

TABLE 1 (*continued*)

Rack termination	Destination	Remote termination	Service
TB31/3	Panel, control	TF9/3	Switched earth, normal, frame 1, cancellation cabinet
TB31/4	Panel, control	TF9/4	Switched earth, normal, frame 2, cancellation cabinet
TB31/5	Panel, control	TF9/5	Switched earth, normal, frame 3, cancellation cabinet
TB31/6	Panel, control	TF9/6	Switched earth, normal, frame 1, cancellation cabinet
TB31/7	Panel, control	TF9/7	Switched earth, normal, frame 1, video cabinet
TB31/8	Panel, control	TF9/8	Switched earth, normal, frame 2, video cabinet
TB31/9	Panel, control	TF9/9	Switched earth, normal, frame 1, i.f. cabinet
TB31/10	Panel, control	TF9/10	Switched earth, normal, frame 2, i.f. cabinet
TB31/11	Panel, control	TF9/11	Switched earth, normal, frame 3, i.f. cabinet
TB31/12	Panel, control	TF9/12	Switched earth, normal, frame 1, Doppler cabinet
TB32/1	Panel, control	TF10/1	Switched earth, normal, frame 2, Doppler cabinet
TB32/2	Panel, control	TF10/2	Switched earth, normal, frame 3, Doppler cabinet
TB32/3	Panel, control	TF10/3	PRFA maintenance LP44
TB32/4	Panel, control	TF10/4	PRFB maintenance LP47
TB32/5	Panel, control	TF10/5	System earth
TB32/6	Panel, control	TF10/6	PRFB fault LP45
TB32/7	Panel, control	TF10/7	PRFB normal LP46
TB32/8	Panel, control	TF10/8	PRFB emergency trigger LP49
TB32/9	Panel, control	TF10/9	IIS 'A' bypassed LP50
TB32/10	Panel, control	TF10/10	Switched earth, normal, frame 3, video cabinet
TB32/11	Panel, control	TF10/11	−50V input from supplies
TB32/12	Panel, control	TF10/12	Spare
TB33/1	Doppler cabinet	SKC/5	Switched earth, normal, frame 1, Doppler cabinet
TB33/2	Doppler cabinet	SKC/10	Switched earth, normal, frame 2, Doppler cabinet
TB33/3	Doppler cabinet	SKC/17	Switched earth, normal, frame 3, Doppler cabinet
TB33/4	I.F. cabinet	SKC/5	Switched earth, normal, frame 1, i.f. cabinet
TB33/5	I.F. cabinet	SKC/10	Switched earth, normal, frame 2, i.f. cabinet
TB33/6	I.F. cabinet	SKC/17	Switched earth, normal, frame 3, i.f. cabinet
TB33/7	Video cabinet	SKC/5	Switched earth, normal, frame 1, video cabinet
TB33/8	Video cabinet	SKC/10	Switched earth, normal, frame 2, video cabinet
TB33/9	Video cabinet	SKC/17	Switched earth, normal, frame 3, video cabinet
TB33/10	Cancellation cabinet	SKC/5	Switched earth, normal, frame 1, cancellation cabinet
TB33/11	Cancellation cabinet	SKC/10	Switched earth, normal, frame 2, cancellation cabinet
TB33/12	Cancellation cabinet	SKC/17	Switched earth, normal, frame 3, cancellation cabinet

TABLE 1 (*continued*)

Rack termination	Destination	Remote termination	Service
TB34/1	Main p.r.f. cabinet	PLC/1	Switched earth, normal, frame 1, main p.r.f. cabinet
TB34/2	Main p.r.f. cabinet	PLC/3	Switched earth, normal, frame 2, main p.r.f. cabinet
TB34/3	Main p.r.f. cabinet	PLC/5	Switched earth, normal, frame 3, main p.r.f. cabinet
TB34/4	Standby p.r.f. cabinet	PLC/5	Switched earth, normal, frame 1, standby p.r.f. cabinet
TB34/5	Standby p.r.f. cabinet	PLA/11	Switched earth, normal, frame 2, standby p.r.f. cabinet
TB34/6	Standby p.r.f. cabinet	PLB/6	Switched earth, normal, frame 3, standby p.r.f. cabinet
TB34/7	Power cabinet	PLH/20	−50V external link to PLH/22
TB34/8	Power cabinet	PLH/22	−50V external link to PLH/20
TB34/9	Power cabinet	PLH/23	Switched earth, normal, LIN. PU.
TB34/10			Spare
TB34/11			Spare
TB34/12			Spare
TB35/1	Signal processing monitor console	PL6/J	−50V input from supplies
TB35/2	Signal processing monitor console	PL6/K	Switched −50V FULLY PROCESSED
TB35/3	Signal processing monitor console	PL6/L	Switched −50V SEMI-PROCESSED
TB35/4	Signal processing monitor console	PL6/M	Switched −50V PLD
TB35/5	Signal processing monitor console	PL6/N	Switched −50V LIN
TB35/6	Signal processing monitor console	PL6/O	Switched −50V AJ
TB35/7	Video cabinet	SKC/2	Switched earth—LINEAR INJECTION
TB35/8	Transmitter	TB14/2	−50V output to transmitter
TB35/9			Spare
TB35/10			Spare
TB35/11			Spare
TB35/12			Spare
TB36/1	Main power supply		−50V input
TB36/2	Main power supply		−50V return
TB36/3	Main power supply		240V a.c. (line)
TB36/4	Main power supply		240V a.c. (neutral)
TB36/5–11			Spare
TB36/12			System earth
TB37/1	Aerial head		Head auto-align in
TB37/2	Radio link		Auto-align for remote station
TB37/3	Power cabinet	PLM/6	Auto-align for signal processing equipment

Chapter 3

CONNECTIONS TO CONTROL DESKS IN MONITOR CONSOLE

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Introduction

1. The connections to the control desks and associated panels on the console assembly fall into two categories. Of these categories, the first, involving connections between control desks and Type 64 consoles, carries services peculiar to the fixed coil display system. These connections are listed in Table 1 and are identical for each console and its associated control desk.

2. The second category carries services applicable to the Type 84 radar system as a whole and are mainly connections external to the console assembly. These connections are listed in Tables 2 to 6 inclusive.

TABLE 1

Connections between control desks and Type 64 consoles

Panel termination	Destination	Remote termination	Service
PL2/L	Panel, distribution, Type 861	SK11/L	—50V from bulk power supplies
PL2/M	Panel, distribution, Type 861	SK11/M	Switched —50V for range rings
PL2/N	Panel, distribution, Type 861	SK11/N	Switched —50V for video map
PL2/P	Panel, distribution, Type 861	SK11/P	Switched 50V (+) for rectangle marks.
PL2/R	Panel, distribution, Type 861	SK11/R	Switched —50V for radar on
PL2/S	Panel, distribution, Type 861	SK11/S	Switched —50V to initiate console switching
PL2/T	Panel, distribution, Type 861	SK11/T	50V (+) in from bulk supplies
PL2/U	Panel, distribution, Type 861	SK11/U	Switched —50V to bulk power supplies
PL2/W	Panel, distribution, Type 861	SK11/W	6·3V input for lamps
PL2/X	Panel, distribution, Type 861	SK11/X	6·3V input for lamps
PL2/Y	Panel, distribution, Type 861	SK11/Y	Switched 6·3V for H.T. on lamp

TABLE 2

External connections to panel (control desk) left hand M3

Panel termination	Destination	Remote termination	Service
PL4/A	Transmitter	TB14/2	50V to SWY CHECK NOISE FACTOR
PL4/B	Transmitter	TB15/8	50V (+) lamps common
PL4/C	Transmitter	TB15/10	Switched 50V (+) to TEST lamp
PL4/D	Transmitter	TB15/12	Switched 50V (+) to GOOD lamp
PL4/E	Transmitter	TB15/11	Switched 50V (+) to POOR lamp
PL4/F	Not used	—	
PL4/G	Relay polarizer	3/3	Switched 50V POLARIZATION CIRCULAR
PL4/H	Relay polarizer	4/1	Switched 50V to CIRCULAR lamp
PL4/J	Relay polarizer	4/2	Switched 50V to LINEAR lamp
PL4/K	I.F. cabinet	SKC/1	Switched 50V SWEPT GAIN (position 2 and 4)
PL4/L	I.F. cabinet	SKC/2	Switched 50V SWEPT GAIN (position 3 and 4)
PL4/M	I.F. cabinet	SKC/3	Switched 50V SWEPT GAIN (position 2 and 4)
PL4/N	I.F. cabinet	SKC/4	Switched 50V SWEPT GAIN (position 3 and 4)
PL4/O	Transmitter	TB15/9	Switched 50V from SWY CHECK NOISE FACTOR
PL4/V	Height finder patching rack	—	Switched 50V (+) RANGE RINGS
PL4/W	Panel relay, M6	PL1/A	Switched 50V (+) NORMAL/STANDBY
PL4/X	I.F. cabinet	SKC/12	Switched 50V (+) BLIND VELOCITY BAND (13k)
PL4/Y	I.F. cabinet	SKC/13	Switched 50V (+) BLIND VELOCITY BAND (19k)

TABLE 3

External connections to panel (control desk) centre M4

Panel termination	Destination	Remote destination	Service
PL5/A	Doppler cabinet	PLF/15	+50V for joystick
PL5/B	Doppler cabinet	PLF/16	−50V for joystick
PL5/C	Doppler cabinet	PLF/13	D.C. (X axis) from joystick
PL5/D	Doppler cabinet	PLF/14	D.C. (Y axis) from joystick
PL5/E	Doppler cabinet	SKE/5	Switched earth—MOVE or RESET Rectangle 2
PL5/F	Doppler cabinet	SKE/2	Switched earth—MOVE or RESET Rectangle 1
PL5/G	Doppler cabinet	SKE/7	Switched earth—RESET Rectangle 3
PL5/H	Doppler cabinet	SKE/4	Switched earth—RESET Rectangle 2
PL5/J	Doppler cabinet	SKE/1	Switched earth—RESET Rectangle 1
PL5/K	Doppler cabinet	SKC/13	Switched 50V (+) MOVE/SIZE or RESET Rectangle 3
PL5/L	Doppler cabinet	SKC/12	Switched 50V (+) MOVE/SIZE or RESET Rectangle 2
PL5/M	Doppler cabinet	SKC/11	Switched 50V (+) MOVE/SIZE or RESET Rectangle 1
PL5/N	Doppler cabinet	SKC/16	Switched 50V (+) LOCAL/USERS Rectangle 3
PL5/O	Doppler cabinet	SKC/15	Switched 50V (+) LOCAL/USERS Rectangle 2
PL5/P	Doppler cabinet	SKC/14	Switched 50V (+) LOCAL/USERS Rectangle 1
PL5/Q	Doppler cabinet	SKE/14	Switched 50V (+) USERS Rectangle 1
PL5/R	Doppler cabinet	SKE/15	Switched 50V (+) USERS Rectangle 2
PL5/S	Doppler cabinet	SKE/16	Switched 50V (+) USERS Rectangle 3

TABLE 3 (continued)

Panel termination	Destination	Remote destination	Service
PL5/T	Doppler cabinet	SKE/13	Switched 50V (+) LOCAL Rectangle 3
PL5/U	Doppler cabinet	SKE/12	Switched 50V (+) LOCAL Rectangle 2
PL5/V	Doppler cabinet	SKE/11	Switched 50V (+) LOCAL Rectangle 1
PL5/W	Doppler cabinet	PLF/17	Remote earth for MOVE/SIZE and RESET switches
PL5/X	Panel (relay) M6 Doppler cabinet	PL1/D PLF/21	Passwire for intertrace equipment
PL5/Y	Doppler cabinet	SKE/22	Switched 50V (+) from RESET switches or earth from joystick
PL5/Z	Doppler cabinet	SKE/21	Switched earth from RESET switches
PL6/A	Not used	–	Common connection for all positions of MONITOR SELECTOR switch
PL6/B	Not used	–	MONITOR SELECTOR–Position 1
PL6/C	Not used	–	MONITOR SELECTOR–Position 2
PL6/D	Not used	–	MONITOR SELECTOR–Position 3
PL6/E	Not used	–	MONITOR SELECTOR–Position 4
PL6/F	Not used	–	MONITOR SELECTOR–Position 5
PL6/G	Not used	–	MONITOR SELECTOR–Position 6
PL6/H			
PL6/J	Panel, indicator	TF35/1	–50V common to CHANNEL SELECTOR switch
PL6/K	Panel, indicator	TF35/2	Switched –50V CHANNEL SELECTOR–Position 1
PL6/L	Panel, indicator	TF35/3	Switched –50V CHANNEL SELECTOR–Position 2
PL6/M	Panel, indicator	TF35/4	Switched –50V CHANNEL SELECTOR–Position 3
PL6/N	Panel, indicator	TF35/5	Switched –50V CHANNEL SELECTOR–Position 4
PL6/O	Panel, indicator	TF35/6	Switched –50V CHANNEL SELECTOR–Position 5
PL6/P	Not used	–	Switched –50V CHANNEL SELECTOR–Position 6
PL6/V	Height finder patching rack	–	Switched 50V (+)–RANGE RINGS
PL6/Z	–	–	Earth
PL7/A	Video cabinet	SKC/16	Switched 50V (+) MONITOR SELECTOR–Positions 4, 5 and 6
PL7/B	Video cabinet	SKC/14	Switched 50V (+) MONITOR SELECTOR–Positions 1 and 5
PL7/C	Video cabinet	SKC/15	Switched 50V (+) MONITOR SELECTOR–Positions 1, 2 and 6
PL7/J	Unused	–	–50V
PL7/K	Unused	–	+50V
PL7/L	Doppler cabinet	SKE/9	Switched earth SIZE–Rectangle 3
PL7/M	Doppler cabinet	SKE/8	Switched earth–MOVE or RESET–Rectangle 3
PL7/N	Doppler cabinet	SKE/6	Switched earth SIZE–Rectangle 2
PL7/O	Doppler cabinet	SKE/3	Switched earth SIZE–Rectangle 1
PL7/Q	I.F. cabinet	SKC/14	Switched 50V (+) ANTI JAM
PL7/R	Video cabinet	SKC/2 SKC/4	Switched 50V (+) LINEAR INJECTION
PL7/S	Cancellation cabinet	SKC/16	Switched 50V (+) CANCEL ANGELS
PL7/U	Video cabinet	SKC/1	Switched 50V (+) CHANNEL SELECTOR–Position 4
PL7/V	Video cabinet	SKC/13	Switched 50V (+) CHANNEL SELECTOR–Positions 1, 2, 3 and 4
PL7/W	Video cabinet	SKC/12	Switched 50V (+) CHANNEL SELECTOR–Position 2
PL7/X	Video cabinet	SKC/11	Switched 50V (+) CHANNEL SELECTOR–Positions 3 and 4

TABLE 4

External connections to panel (control desk) right-hand M5

Panel termination	Destination	Remote destination	Service
PL4/A	Doppler cabinet	SKE/17	Switched 50V (+) CLUTTER SWITCHING–Rectangle 1
PL4/B	Doppler cabinet	SKE/18	Switched 50V (+) CLUTTER SWITCHING–Rectangle 2
PL4/C	Doppler cabinet	SKE/19	Switched 50V (+) CLUTTER SWITCHING–Rectangle 3
PL4/D	Doppler cabinet	SKE/20	Switched 50V (+) CLUTTER SWITCHING–CIRCLE
PL4/V	Height finder patching rack	–	Switched 50V (+) RANGE RINGS
PL4/W	Panel (Relay) M6	PL1/J	6.3V a.c. lamp supplies for P.O. panel
PL4/X	Panel (Relay) M6	PL1/K	
PL4/W	Panel (connector) M7	PL1/K	6.3V a.c. lamp supplies for controls (wind speed and direction) M3

TABLE 5

Connections to panel (relay) M6

Panel termination	Destination	Remote destination	Service
PL1/A	Panel (control desk) left-hand M3	PL4/W	Switched 50V (+)–NORMAL/STANDBY
PL1/C	–	–	50V
PL1/D	Panel (control desk) centre M4	PL5/X	Passwire for intertrace equipment
PL1/E	–	–	Earth
PL1/F	Modulator I.T.B.U. NO.2		Passwire for intertrace equipment
PL1/G	Modulator I.T.B.U. No.3		Passwire for intertrace equipment
PL1/H	Panel (control desk) right-hand M5	PL4/X	6.3V a.c. lamp supplies for P.O. panel
PL1/J	Panel (control desk) right-hand M5	PL4/W	
PL1/K, PL1/L, PL1/M	Doppler cabinet	SKF/10, SKF/11, SKF/12	Remote M.T.I. range control
SK2	Video cabinet		Raw radar
SK3	Video cabinet		Video as selected by monitor
SK4	Console 2		Selected video
SK5	Console 3		Selected video
SK7	I.T.B.U.		I.T.B.U.
SK8	Console 2		
SK9	Console 3		
SK10	Video cabinet		Video marks
SK11	Console 2		
SK12	Console 3		
SK6/A, SK6/B, SK6/C	Panel assembly left-hand	PL6/A, PL6/B, PL6/C	Remote M.T.I. range control
SK6/D	P.O. Panel		6.3V a.c. lamp supply
SK6/E	–	–	Earth
SK6/F	P.O. Panel		6.3V a.c. lamp supply

TABLE 6

Connections to panel (connector) M7

Panel termination	Destination	Remote destination	Service
PL1/A	Power cabinet	PLM/7	500Hz rotational information for controls (wind speed and direction)
PL1/B	Power cabinet	PLM/8	
PL1/C	Power cabinet	PLM/9	
PL1/D			
PL1/E	Doppler cabinet	PLF/2,4,6	Earth
PL1/F	Doppler cabinet	PLF/1	500Hz rotational information doppler compensated–Rectangle 2
PL1/G	Doppler cabinet	PLF/3	500Hz rotational information doppler compensated–Rectangle 1
PL1/H	Doppler cabinet	PLF/5	500Hz rotational information doppler compensated–Rectangle 3
PL1/K	Panel, control desk, right-hand M5	PL4/W	6.3V for controls (wind speed and direction)
SK2/A	Control (wind speed and direction) M3 No.1	PL1/A	500Hz rotational information
SK2/B	Control (wind speed and direction) M3 No.1	PL1/B	
SK2/C	Control (wind speed and direction) M3 No.1	PL1/C	
SK2/D	Control (wind speed and direction) M3 No.1	PL1/D	500Hz rotational information doppler compensated–Rectangle 1
SK2/E	Control (wind speed and direction) M3 No.1	PL1/E	Earth
SK2/F	Control (wind speed and direction) M3 No.1	PL1/F	6.3V for edge light
SK3/A–F	Control (wind speed and direction) M3 No.2	PL1/A–F	Services as for SK2 but for Rectangle 2
SK4/A–F	Control (wind speed and direction) M2 No.3	PL1/A–F	Services as for SK2 but for Rectangle 3