AIR PUBLICATION

116Q-0508-1

ISSUED OCTOBER 1968

TURNING RECEIVER, SX115

TYPE 6331A B & C

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

FOR USE IN THE
ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

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Components List

Component schedules in this manual are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1, in addition to the normal part identity in column 2.

Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.

This list will be found immediately after the text.

Cross Reference Lists:

These lists will be found adjacent to the circuit diagrams to which they refer.

Illustrations

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TURNING RECEIVER SX115

TYPE 6331A

(W.84542 Ed.A)

1 INTRODUCTION

The Turning Receiver SX115 produces a turning signal from a selsyn whose output is synchronous with the radar aerial. The information is contained in a 3-phase output which normally energises the resolver unit of a fixed coil PPI display. Additionally, auto-align and North marker pulses are provided by this cabinet.

2 DATA SUMMARY

NOTE: *This is not a rigid specification, the performance figures being typical only.*

2.1 POWER SUPPLIES

Mains input	50 c/s mains supply, 200/250V. Unless otherwise specified, transformer taps are set at 230V.
Maximum permissible mains voltage variation:	6%
Approximate current consumption:	3.5A

2.2 INPUT (FROM LINK CHANNELLING RECEIVER SX145)

Composite baseband signal (containing four a.m. carriers):	140-250 kc/s.

2.3 OUTPUTS

British Standard Selsyn System:	(100V stators) 3-phase turning information.
Auto-Align Channel:	Earthed for 352°, open-circuit for 8° of aerial rotation.
North marker pulse:	0.2° - 0.5° wide, 50V negative, once per revolution of aerial.
Ventilation requirements:	Standard blowing system 150-200 cubic feet of air per minute.

3 EQUIPMENT LIST

3.1 LIST OF UNITS CONTAINED IN CABINET

The receiver turning cabinet consists of the following fourteen units which are housed in a 7 foot rack as shown in WZ.21672/B Sh.1. and WZ.21672/D Sh.2. (Figures 1 and 2).

Unit 1	Filter and Detector Unit Type 4267A	(W.59129 Ed.A)
Unit 2	Filter and Detector Unit Type 4267B	(W.59129 Ed.B)
Unit 3	Magslip Amplifier and Monitoring Unit Type 4268A	(W.59113 Ed.A)
Unit 4	Amplifying Unit (Servo) Type 4269A	(W.59130 Ed.A)
Unit 5	North Aligning Unit (Receiver) Type 4626A	(W.59455 Ed.A)
Unit 6	Metering Unit Type 4353C	(W.59075 Ed.C)
Unit 7	Amplifying Unit Type 4272A	(W.59054 Ed.A)
Unit 8	Motor Drive Unit Type 4271A	(W.59031 Ed.A)
Unit 9	Receiver Gearbox Type 4276A	(W.59142 Ed.A)
Unit 10	Gating Waveform Generator Unit Type 4273A	(W.59132 Ed.A)
Unit 11	Error Detector Unit Type 4274A	(W.59033 Ed.A)
Unit 12	Amplifying Unit (Filter) Type 4277A	(W.59133 Ed.A)
Unit 13	Power Supply Unit Type 4275A	(W.59106 Ed.A)

NOTE: *A.C. Switching and Distribution panels located at the bottom form an integral part of the cabinet.*

3.2 DIMENSIONS AND WEIGHTS

	Height	Width	Depth	Weight
Complete Receiver Turning Cabinet	7 ft (213 cm)	2 ft (61 cm)	2 ft (61 cm)	666 lb (302 kg)
Filter and Detector Units, each	$8\frac{3}{4}$ in (21 cm)	$9\frac{1}{4}$ in (23 cm)	- -	11 lb (4.9 kg)
Magslip Amplifier and	7 in (18 cm)	$9\frac{1}{4}$ in (23 cm)	- -	$10\frac{1}{4}$ lb ($4\frac{1}{2}$ kg)
Amplifying Unit (Servo)	7 in (18 cm)	$9\frac{1}{4}$ in (23 cm)	- -	$9\frac{1}{4}$ lb (4 kg)

	Height	Width	Depth	Weight
North Aligning Unit (RX)	5¼ in (13 cm)	9¼ in (23 cm)	- -	7½ lb (3½ kg)
Metering Unit	5¼ in. (13 cm)	9¼ in (23 cm)	- -	3½ lb (1½ kg)
Amplifying Unit	7 in (18 cm)	9¼ in (23 cm)	- -	8¾ lb (4 kg)
Motor Drive Unit	7 in (18 cm)	9¼ in (23 cm)	- -	15 lb (7 kg)
Receiver Gearbox	26 in (66 cm)	9¼ in (23 cm)	- -	53¾ lb (24 kg)
Gating Waveform Generator	7 in (18 cm)	9¼ in (23 cm)	- -	7¾ lb (3½ kg)
Error Detector Unit	12¼ in (31 cm)	9¼ in (23 cm)	- -	12¾ lb (5¾ kg)
Amplifying Unit (Filter)	7 in (18 cm)	9¼ in (23 cm)	- -	19 lb (8¾ kg)
Power Supply Unit	14 in (36 cm)	19¼ in (49 cm)	- -	112 lb (51 kg)
A.C. Switching and Distribution Unit	-	19¼ in (49 cm)	-	-

3.3 VALVE LIST

Unit	Quantity	Type	Function
Filter and Detector Units Type 4267A and B (Units 1 and 2)	8	Z77 (CV138)	Frequency selective amplifiers, cathode follower.
	1	ECC81 (CV455)	
	1	CG4-C (CV448)	Detector (Crystal)
Magslip Amplifier and Monitoring Unit Type 4268A (Unit 3)	2	Z77 (CV138)	'See-Saw' amplifiers.
	2	E2266 (CV2231)	Cathode followers (Part of 'See-saw' amplifiers)

Unit	Quantity	Type	Function
	2	ECC81 (CV455)	Miller amplifiers.
	2	ECC83 (CV492)	Monitor amplifier and part of Miller amplifier.
Amplifying Unit (Servo) Type 4269A (Unit 4)	5	ECC83 (CV492)	Eccles-Jordan trigger, cathode followers, d.c. amplifiers.
	1	ECC81 (CV455)	Squarers
	1	EB91 (CV140)	Clipper diodes
	4	CG4-C (CV448)	Limiters (crystal)
	1	Metrosil	Part of integrator circuit.
North Aligning Unit (Receiver) Type 4626A (Unit 5)	2	ECC83 (CV492)	Auto and North Align pulse amplifiers.
	2	ECC81 (CV455)	Cathode followers/ relay control.
	4	CG4-C (CV448)	Detector-voltage doublers
Metering Unit Type 4353C (Unit 6)	-	-	-
Amplifying Unit Type 4272A (Unit 7)	4	ECC83 (CV492)	D.C. amplifiers
	1	ECC81 (CV455)	Integrator relay control valve.
	1	6F33 (CV2209)	Gate
	1	EA76 (CV469)	D.C. restorer

Unit	Quantity	Type	Function
Motor Drive Unit Type 4271A (Unit 8)	2	ECC83 (CV492)	D.C. amplifiers
	2	E2266 (CV2231)	Power amplifiers (Drive motor field)
Receiver Gearbox Type 4276A (Unit 9)	-	-	-
Gating Waveform Generator Unit Type 4273A (Unit 10)	2	ECC83 (CV492)	Cathode follower, phase inverter
	2	Z77 (CV138)	Squarers
	1	ECC81 (CV455)	Cathode follower
	2	CG4-C (CV448)	D.C. Restorers
Error Detector Unit Type 4274A (Unit 11)	4	ECC83 (CV492)	Amplifiers, cathode followers
	5	ECC81 (CV455)	Amplifiers, cathode followers
	8	Z77 (CV138)	Amplifiers, squarers
	1	EB91 (CV140)	D.C. restorers
	11	CG4-C (CV448)	Phase sensitive rectifiers d.c. restorers (2)
Amplifying Unit (Filter) Type 4277A (Unit 12)	4	ECC83 (CV492)	'See-saw' amplifiers
Power Supply Unit 4275A (Unit 4275A (Unit 13)	5	5R4G (CV717)	Full-wave rectifiers
	2	13E1 (CV2377)	Series voltage regulators
	2	ECC81 (CV455)	Differential amplifiers

Unit	Quantity	Type	Function
	2	ECC83 (CV492)	Differential amplifiers.
	2	QS83/3 (CV449)	Voltage reference tubes.
	2	QS75/20 (CV284)	Voltage reference tubes.

4 GENERAL DESCRIPTION

4.1 MECHANICAL CONSTRUCTION

The equipment comprising the Turning Receiver SX115 is built into units of half and full standard widths namely $9\frac{1}{4}$ inches (23 cm) and 19 inches (48 cm) respectively and installed in a 7 feet (213 cm) high Marconi Cabinet on runner mounted withdrawable steel frames. A list of the units and their dimensions, together with the dimensions of the Cabinet, are given in Section 3. The A.C. Switching and Distributions panels form an integeral part of the Cabinet and are located at the bottom.

The mounting of the units is shown in Figures 1 and 2. The upper part of the Cabinet houses all the half-width units on two frames, mounted side by side. Each frame is capable of carrying upto five of these units, each of which slides into position and is secured by four captive screws on the front panel. The lower part of the Cabinet houses the two full width units which are mounted in separate runner-assemblies and fixed by brackets on the side assemblies.

Flexible connectors facilitate withdrawal of the frames from the front of the Cabinet to the full depth of the units without disconnection and interruption to service. The connectors are so positioned that there is no danger of inter-twisting and fraying when the units are withdrawn and subsequently returned. When withdrawn, the units are accessible from both sides.

A full size door is fitted to the rear of the Cabinet, allowing access to the rear of the units for removal, and to the Distribution panel holding the a.c. mains input and distribution terminal blocks and the incoming and outgoing plugs and sockets.

The cabinet is normally installed over a floor duct or a plinth to allow for inter-cabinet wiring. After installation, access from front only is required for maintenance purposes.

Connection to the units is by means of screw-down terminal strips which secure into a terminal block. This arrangement permits rapid removal of units for bench tests if required, although routine servicing can normally be carried out *in situ*.

Air cooling is employed. The cooling air, generally obtained from an external blowing system, is circulated via the floor duct. Where an external blowing system is not available, a small exhaust fan, fitted at the top of the cabinet, is used.

Adequate built-in metering and monitoring facilities are incorporated.

The equipment is suitable for use in tropical climates. Generously rated high quality components are used throughout to ensure efficiency and reliability.

4.2 BRIEF DESCRIPTION

See Block Diagram WZ.22153/D Sh.1 (Fig.4)

The radar aerial position signals, forming the composite turning signal, are received as part of the link baseband signal and, after selection in the Channelling Receiver SX145, are fed to the Turning Receiver SX115. (See Technical Manual T.4649). These signals (split into two quadrature components) are applied to a resolver, the rotor of which is compared in phase with the transmitted rotor signal, and the error is used to operate a servo correction system which brings the two into synchronism.

The auto-align carrier is separated by means of a crystal filter, and produces a signal to operate a relay which controls the display marker.

The baseband input, in the frequency range 135-350 kc/s, is fed to the two Filter and Detector Units, the North Align Unit and the Auto-Align Unit. The North Align and Auto-Align Units are sub-units on the same chassis and apart from their operating frequency are identical. The circuits comprise conventional amplifiers and demodulators, the outputs being pulses taken from a pair of relay contacts.

The two similar Filter and Detector Units select and amplify a single a.m. frequency from the combined baseband signals. The units function as 200 kc/s and 250 kc/s filters, each unit consisting of three frequency selective amplifiers connected in cascade. Frequency discrimination is effected by high pass filters interposed between the amplifiers and by a low pass filter network which follows a crystal detector. The modulation envelope, a sinewave of approx. 1 kc/s, selected by one unit contains the Magslip resolver information (transmitter rotational information) which is fed to the Amplifying Unit Type 4272A (Unit 7). The output from the other Filter and Detector Unit is a 1 kc/s reference sinewave which feeds the Magslip amplifier.

The sinewave into the Magslip amplifier is split in two and fed to two 'see-saw' amplifiers. The output from one amplifier is used to feed the Magslip X stator with a 1 kc/s sinewave, whilst the other output (phase shifted by 90°) also at 1 kc/s is extended to the Y stator, forming a 2-phase arrangement.

Parallel outputs are taken from the Magslip rotor and fed to the Amplifying Unit (Filter) Type 4277A and the Amplifying Unit Type 4272A. The former is a high Q amplifier through which the rotor output is passed to be monitored. By use of this filter, noise is eliminated, thus facilitating the setting up of this Magslip for maximum output whilst using the monitor. The latter amplifier comprises two 'see-saw' amplifiers which are used to amplify the transmitter and receiver rotor outputs, before feeding into the error detector; the transmitter output is taken also to the gating waveform generator.

The rotational outputs from transmitter and receiver are compared within the error detector and a d.c. error voltage produced when the two are out of synchronism. The inputs are compared by a series of phase sensitive rectifiers which are gated by pulses produced in the gating waveform generator.

The d.c. error voltage is taken to the amplifier (servo) where it is mixed with a d.c. potential as a convenient method of correcting angular errors caused by long term drift in the link. This Amplifying Unit (Servo) is basically a mixing amplifier controlling the frequency response of the servo loop.

A 'run-up' circuit is included within the amplifier (servo) to control the Motor Drive Unit for the running up period. During which time error signals may be oscillatory or non-existent due to instability within the servo loop; once a state of stability is reached, the output of the 'run-up' circuit falls to zero and the d.c. amplifier exercises complete control.

The Motor Drive Unit supplies d.c. potentials for the drive motor. A substantial constant current is passed through the drive motor armature whilst the field coil currents can vary in both amplitude and phase, depending upon the error signal input.

4.3 INTERCONNECTIONS

The connections between the units are made by barrier terminals and fanning strips. This method provides a means of effecting rapid disconnection for unit removal and reliable contact during service.

The interconnections between various units are shown in the Cabinet Wiring Diagram, WZ.25156/D Sh.1 Fig.3.

5 DETAILED DESCRIPTION

5.1 FILTER AND DETECTOR UNITS TYPES 4267A AND B (UNITS 1 AND 2)

5.1.1 General

See Drawing No. WZ.22170/B Sh.1 (Fig.5) Block Diagram.

Two similar Filter and Detector Units are used on the Receiver Turning Receiver cabinet. Both units select and amplify a single amplitude modulated frequency carrying the aerial turning information from the radar link composite baseband signals; units 1 and 2 function as 200 kc/s and 250 kc/s filters respectively. Additional units, Type 4267C and 4267D are available for 300 kc/s and 350 kc/s operation.

Each unit consists of three frequency selective amplifiers connected in casecade; frequency discrimination is effected by high pass filters interposed between the amplifiers and by a low pass filter network which follows a conventional crystal detector. The output of unit 2 is a modulation envelope, which is a sinewave of approximately 1 kc/s, containing the transmitter magslip resolver rotor information. This is fed, via a cathode follower, to the Amplifying Unit Type 4272A. The output of Unit 1 is a 1 kc/s reference sinewave which feeds the Magslip amplifier. Apart from the difference in filter frequencies, the units are similar and a single circuit diagram suffices for both. The circuit description given below applies to Unit 2, whose filters are tuned to accept a frequency of 250 kc/s.

5.1.2 Circuit Description

See Drawing No. WZ.17387/D Sh.1 (Fig.6) for Circuit Diagram.

The radar link baseband input, having a frequency range of 140-350 kc/s, is fed from the Link Channelling Receiver SX145 to PLF on the Filter and Detector Unit and thence to the grid of V1. V1 and V2 together form a conventional 'see-saw' amplifier with slective feedback, although their primary function is to provide a very low output impedance at V2 cathode. The RC network RV1, R81, C36 and C4 forms the negative feedback arm, of which C4 provides d.c. blocking and C36 limits the high frequency response. The gain in the amplifier is controlled by the RF GAIN control RV1 which changes the overall feedback ratio over a limited range.

The subsidiary negative feedback loop formed by C41 is necessary to overcome the inductance formed by the long metering leads connected to R11.

A second 'see-saw' amplifier, V3 and V4, is identical to the first 'see-saw' amplifier except that the feedback loop gain is fixed by R26 and C38. Again, the feedback is a.c. coupled with maximum gain occurring at low frequencies.

The two 'see-saw' amplifiers are coupled by a bandpass filter in which C6, C7 and C8 are the series capacitive arms and L1 the shunt element. C6 is a trimmer permitting fine adjustment of the filter for a frequency of least attenuation at 250 kc/s. The series resistors R14 and R16 ensure correct matching of the filter design impedance to the low output impedance of V2.

Both series and parallel resistors in the tuned circuits are critically adjusted so that effects of temperature drift and component changes are kept extremely low. The third 'see-saw' amplifier V5, V6 is similar to the second 'see-saw' amplifier. Coupling is again effected by a bandpass filter whose arrangement is identical to that of the filter described above.

V7, a cathode follower buffer amplifier, provides a low impedance for driving the crystal detector V10 with negligible loading on the preceding tuned circuit. It is essential to provide a standing current for V10 in order to bias the signal from the non linear characteristic of the diode. The bias is obtained through R64 via V8(a) which also provides matching between the detector and a low pass π filter C28, L4, C30.

The 1 kc/s rotational information output from the Filter and Detector Unit is taken via the AMPLITUDE gain control RV2 and cathode follower V9.

The heater supply for valves in the unit is tied to a negative potential taken from the divider R69, R70 connected across the h.t. supply in order to prevent likely heater/cathode emission. This emission is undesirable since it causes a 50 c/s modulation of the valve currents.

5.1.3 Metering and Monitoring

Monitoring points are provided for input and output inspection with an intermediate point (SKB) at the detector input. Metering facilities exist for anode current measurement by use of the 9-way, single-pole METERING switch SWA and the moving coil meter in Metering Unit Type 4353C Unit 6. Appropriate meter shunts are connected in series with the anodes of each valve.

5.2 MAGSLIP AMPLIFIER AND MONITORING UNIT TYPE 4268A (UNIT 3)

5.2.1 General

See Drawing No. WZ.21663/B Sh.1 (Fig.9) for Block Diagram.

The Magslip Amplifier consists basically of two see-saw amplifiers and a phase shift network. It is supplied with a 1 kc/s sinewave input from the Filter and Detector Unit (Unit 1). One amplifier of the unit provides the Magslip X-stator with a 1 kc/s sinewave; the other amplifier, after a phase shift of 90° degrees, feeds a 1 kc/s cosine wave to the Y-stator in a two-phase arrangement.

The Monitor Unit is an independent twin-triode amplifier, one valve stage of which is fed with the Magslip rotor sinewave output; the other valve is biased such that the crest of each positive half-cycle is amplified enabling very small changes of output from the Magslip rotor to be detected visually. The amplified negative-going crests appear at the output and these are monitored at socket SKC by an external Oscilloscope.

5.2.2 Circuit Description

See Drawing No. WZ.17011/D Sh.1 (Fig.10) for Circuit Diagram.

5.2.2.1 Magslip Amplifier

The 1 kc/s sinewave input is applied, via PLG and see-saw series resistor R61, to the grid of V7. V7 and V8 are arranged as a conventional see-saw amplifier, overall feedback being in the ratio R76:R61. V7 provides the stage amplification: V8 is essentially a cathode follower which gives a low impedance at the output terminal. This section provides the in-phase 1 kc/s sinewave output to the Magslip X-stator.

The same sinewave input at PLG is applied to the phase shift network R1, RV1, C2, R2, C3; a fine degree of phase shift adjustment is permissible by the PHASE control resistor RV1. Both networks give a total phase shift of 90 degrees at one frequency only, in this case 1 kc/s. Small frequency deviations such as those produced by the rotor modulation give an unwanted phase shift to the network and for this reason the capacitive reactance of C3 is self-compensating by shunting it with a frequency selective Miller amplifier, V1, V2.

The apparent capacitance of C3 is C3 x A where A is the gain of the amplifier formed by V1, and for frequencies adjacent to 1 kc/s the phase shift between the input and output at V2(b) cathode remains substantially constant at 90 degrees. The amplifier has a characteristic by which gain varies inversely as frequency.

V1, V2 and V3 are similar directly coupled stages; V1 and V2 are the Miller amplifiers, V1 being a long-tailed pair whose anode load R9 is shunted by the stabilising network R11, C4.

V3 is a 50 c/s amplifier which is preceded by an asymmetric bridge-T filter R23, C8, C9 and R24, having a frequency of least attenuation 50 c/s. Thus all frequencies are substantially attenuated except 50 c/s and this single frequency is fed to the grid of V3(a) for amplification. It is then returned in phase with the signal input to the grid of V1(a) via cathode follower V3(b) and the amplitude is such that hum cancellation takes place in the output.

A second see-saw amplifier, V4 and V5 is fed with the quadrature sinewave from V2(b) cathode. The circuit arrangement is similar (with the exception of the GAIN control RV2) to the first see-saw amplifier associated with V7 and V8, and the Y-stator output (1 kc/s cosine wave) is taken from the cathode of V5 via the d.c. blocking capacitor C14.

5.2.2.2 Monitor Section

The 1 kc/s rotational information from the Magslip rotor is taken via PLH to the grid of V6(b). This valve functions as a medium-gain amplifier having negative feedback due to the un-by-passed cathode resistor R53. The output at V6(b) anode is coupled via C19 to the grid of V6(a); this valve is biased from a negative supply which can be adjusted by the MONITOR AMPLITUDE control to provide a suitable cut-off point. Conduction commences on the crests of the positive-going half-cycles only and the output at socket SKC is a series of amplified negative crests by which close amplitude adjustment can be checked. When the phase and relative amplitudes of the magslip stators are correct, the rotor amplitude is constant, irrespective of rotation, and by viewing the amplified crests of the rotor waveform it is possible to balance the phase and gain controls in the Magslip Amplifier for minimum movement.

5.2.2.3 Metering

Provision is made to meter anode currents of the eight valves on the Metering Unit Type 4353C (Unit 6). Selection is made by the METERING Switch SWA, which is mounted on the front panel of the unit. Monitor points SKA to SKD are included for waveform inspection at the input and both stator outputs, in addition to the Monitor unit output.

5.3 AMPLIFYING UNIT (FILTER) TYPE 4277A (UNIT 12)

5.3.1 General

See Drawing No. WZ.22185/B Sh.1. (Fig.13) for Block Diagram.

The Amplifying Unit (Filter) is a high-Q amplifier through which the receiver Magslip rotor output is taken before monitoring by Unit 7. The amplifier centre frequency is nominally 1 kc/s.

By the use of this filter, much of the radar link noise is eliminated enabling the receiver Magslip to be set up for optimum output on the monitor unit.

5.3.2 Circuit Description

See Drawing No. WZ.17385/D Sh.1. (Fig.14) for Circuit Diagram.

The circuit consists of three similar see-saw amplifier stages connected in cascade, each stage separated by a buffer cathode follower. Two of the stages are frequency selective.

Rotational information from the receiver Magslip (1 kc/s sine-wave) is fed, via PLA, SWA and RV1 to the grid of the first see-saw amplifier which consists of V1(a) and V1(b). The gain of V1 is controlled by 'see-saw' arms R2 and R4; AMPLITUDE control is used to set the gain and SWA removes the input signal for setting up the loop gain. Overall selective feedback path is completed via C2 and R5, the capacitive reactance of C2 being equal to R5 at 1 kc/s. An output is taken from the junction of C2 and R5 causing a stage phase shift of 90 degrees.

V2(a) is the buffer cathode follower coupling the first see-saw amplifier to the second see-saw amplifier which consists of V2(a) and V3(a). Again, frequency-selective negative feedback is used and a small measure of frequency adjustment is permissible by the FREQUENCY control RV2. A further 90 degrees phase shift is caused by R18, RV2, C4 and the associated series amplifier.

V4(a) and V4(b) form the third see-saw amplifier, the buffer cathode follower V3(b) being interposed between the stages. Feedback loop gain in this amplifier is variable by the LOOP GAIN control RV3 and since V4 introduces a further phase shift of 180°, the overall feedback can be either positive or negative. This feedback from the output terminal PLD is applied to the grid of V1(a) via R2 and maximum selectivity in the unit is obtained by adjusting the feedback sp that it is only just negative (i.e., by having slightly less feedback than is necessary to cause loop oscillation).

5.3.3 Metering and Monitoring

Monitor points are provided for input and output waveform inspection (SKA and SKB). Anode currents of the eight half valves can be metered by the metering panel (Unit 6). Selection is made by the panel-mounted METERING switch SWB.

5.3.4 Heater Transformer

A heater transformer TR1 is mounted in the Amplifying Unit. Six l.t. secondary windings provide heater potentials for valves in all the cabinet (Turning Receiver SX115) units (except the Power Supply Unit). The windings are nominally rated at 6.6V permitting a 0.3V drop in the cabinet interconnecting cables.

The transformer primary, which is tapped for local mains voltage variations, is fed with a 50 c/s supply via TB2, pins 1 and 2.

5.4 AMPLIFYING UNIT TYPE 4272A (UNIT 7)

5.4.1 General

See Drawing No. WZ.22177/B Sh.1. (Fig.7) for Block Diagram.

Two identical see-saw amplifiers and an h.t. trip safety circuit are housed in the Amplifying Unit. The see-saw amplifiers each have a gain of approximately 35 dB and are used to amplify the transmitter and receiver Magslip rotor outputs (rotational information). The safety circuit prevents the servo system from 'running away' under fault conditions.

5.4.2 Circuit Description

See Drawing No. WZ.17008/D Sh.1 (Fig.18) for Circuit Diagram.

5.4.2.1 Amplifiers

The transmitter Magslip rotational information is fed via PLH to the first see-saw amplifier, V1 and V2. The see-saw amplifier consists of three d.c. coupled triode amplifiers V1(b), V1(a) and V2(b) connected in cascade; each valve operates with negative feedback due to the non-decoupled cathode resistors R5, R12 and R18. The fourth triode, V2(a) is a cathode follower which provides two outputs at PLJ and PLK; it also provides the low impedance source for overall negative feedback which is returned to V1(b) input via R24. One of the outputs is fed to the Gating Waveform Generator (Unit 10) and the other output is taken to the Error Detector (Unit 11).

Receiver magslip rotational information is fed, via PLL to the second see-saw amplifier which consists of V3 and V4. This amplifier has a higher gain than the first and produces an amplified sinewave output at plug PLM. Additional gain in this stage is necessary to overcome the Magslip attenuation. The output is taken to the Error Detector (Unit 11).

5.4.2.2 H.T. Trip Circuit

The h.t. safety circuit is designed to operate in the event of a link failure or any other lack of control in the servo system, i.e., loss of one or both of the turning square waves. V7 functions as a gate with square waves from the Amplifying Unit (Servo) Unit 4 applied to control and suppressor grids. (See section 5.7). For normal operation the square waves are coincident and the valve is therefore cut-off. Under abnormal conditions, a series of single square waves appear across R51, the amplitude and width of the pulse depending on phase difference of the gating and input pulses. Both suppressor and control grid are returned to the positive h.t. supply via R50 and R49 respectively in such a manner that the valve conducts in the absence of an input.

V5b, a Miller amplifier, is biased positively by the potential at the junction of R57 and R58, connected respectively to the +300V and -300V supplies via R56 and R54 (R58 is of higher resistance than R57). Therefore under normal conditions when no error signal is applied to its grid, V5b conducts. V5a, on the other hand, is cut off by the negative potential applied to its grid from across the +300V and -300V supply lines and the drop at the anode of V5b. RLA forming the load, of V5a is thereby released.

In the case of fault conditions, the error square wave appearing at the anode of V7 is negatively d.c. restored to earth by V6 and fed into an integrating circuit formed by R56 and C15 via the series resistor R55. The negative d.c. voltage produced thereupon by the integrating circuit is applied to the grid of V5b which conducts. The resultant rise in the anode potential of V5b is d.c. coupled to the grid of V5a which conducts and operates RLA. Relay contact RLA1 is in the external safety circuit of the Power Supply Unit Type 4275A (Unit 13) described in Section 5.11.2.3. This contact is closed when RLA is released and allows RLB in the Power Supply Unit to operate, thereby keeping the h.t. supplies switched on. Should RLA1 open under fault conditions, RLB in the Power Supply Unit will release thereby switching off the h.t. supplies.

The H.T. ON biased switch SWB in the Power Supply Unit may however be held operated to by-pass the safety circuit during running up.

NOTE: *Maximum sensitivity of the h.t. trip circuit is obtained by peak rectification and the averaging of pulses at V7 anode. The constants of the Miller circuit R61, R62 and C16, together with R57 and R58 are arranged so that a delay of 4 to 12 seconds takes place before relay RLA operates, the delay time depending on the nature of the fault. This short delay prevents the receiver being switched off in the event of fading or transient changes in the link signals.*

5.4.3 Metering and Monitoring

Waveform monitor points are provided for inputs and outputs of both see-saw amplifiers and the safety circuit input.

The anode currents of 10 valves in the unit can be monitored on the Metering Unit Type 4351C (Unit 6) by means of the METERING switch SWA.

5.5 GATING WAVEFORM GENERATOR TYPE 4273A (UNIT 10)

5.5.1 General

See Drawing No. WZ.22179/B Sh.1. (Fig.121) for Block Diagram.

The unit obtains the 1 kc/s sinewave transmitter magslip rotor waveform, detected in the Filter and Detector Unit Type 4267B (Unit 2) and amplified in the Amplifying Unit Type 4272A (Unit 7), delays and squares it to provide paraphase square waveforms of unity mark/space ratio for gating waveforms in the Error Detector Unit Type 4274A (Unit 11). Both the output paraphase square waves are phase shifted by 90^{o} referrered to the input sinewave.

Three monitoring points are provided on the unit and switch SWA is used to select for metering purposes, the anode current of each valve.

5.5.2 Circuit Description

See Drawing No. WZ.17398/D Sh.1. (Fig.22) for Circuit Diagram.

The amplified transmitter rotor 1 kc/s sinewave input from the Amplifying Unit Type 4272A (Unit 7) is taken, via plug PLE, to the phaseshift network R1, C1; the capacitive reactance of C1 equals R1 at 1 kc/s to give a phase retardation of 45^{o} at V1 input. The first phase shift network is followed by a similar arrangement, R6 and C2. A cathode follower, V1(a), interposed between the phase shift networks, acts as a buffer to make possible a 90^{o} shift using two networks only.

V2(a) and V2(b) are connected as a conventional squarer and phase-splitter with common cathode load R11. Referred to the input across C2, in-phase and anti-phase waveforms appear across R13 and R10 respectively. Further squaring action by V3 and V4 is effected by grid current on positive half-cycles and valve cut-off on negative half cycles; the low value of screen voltage applied to both valves via R24 reduces their grid-bases thereby assisting in adequate cut-off.

The cut-off condition in V3 and V4 is squarer than the conducting state in V2(a) and V2(b). The squaring action is therefore, further improved by V3 and V4 due to the phase shift of 180^{o} between the V2 output & V3 output.

C7 and C8 couple the squaring stages to a pair of cathode followers V5(a) and V5(b) the square waves being positively d.c. restored to earth by V6 and V7, the d.c. restoring action produces an output reference potential to which both outputs are clamped. The square waves are fed via plugs PLG and PLF to the phase sensitive rectifiers in the Error Detector Unit (Unit 11).

Monitor points SKA, SKB and SKC permit inspection of the input sinewave and output square waves by means of an external oscilloscope. The anode currents of V1 and V5 are selected by the METERING switch SWA and indicated on the Metering Unit (Unit 6).

5.6 ERROR DETECTOR UNIT TYPE 4274A (UNIT 11)

5.6.1 General

See Drawing No. WZ.22205/D Sh.1. (Fig.24) for Block Diagram.

The Error Detector Unit squares and compares transmitter and receiver magslip rotational outputs from which a d.c. error voltage proportional to their phase difference is produced. This voltage is amplified in turn by the Amplifying Unit (Servo) Type 4269A (Unit 4) and Motor Drive Unit Type 4271A (Unit 8) before energizing the receiver gearbox drive motor field coils.

Comparison of inputs is effected by a series of phase-sensitive rectifiers; the rectifiers are gated by pulses initiated by the transmitter rotational output, the pulse being produced by the Gating Waveform Generator (Unit 10).

A simplified circuit diagram of the phase-sensitive rectifier arrangement is shown in WZ.22182/B Sh.1 (Fig.26) and typical waveforms are illustrated in WZ.22181/D Sh.1 (Fig.27).

5.6.2 Circuit Description

See Drawing No. WZ.17005/D Sh.1 (Fig.25) for Circuit Diagram.

Transmitter rotor information signal, a sinusoidal wave at 1 kc/s, is fed, via PLK, from the Amplifying Unit Type 4272A (Unit 7) to the grid of V1b. V1b and V1a are connected in a long tailed pair with R5 as the common cathode resistor. The stage gives a high gain due to the large anode resistors R4 and R7. The output is taken from V1a and d.c. coupled to a conventional cathode follower V2b, which in turn feeds the squarer V3. The primary function of V2b is to prevent V3 from overloading the d.c. coupling circuits when grid current occurs. The input waveform is shown as Waveform 1 in Fig.27.

V3 is driven hard and the squaring action is by grid cut off an negative half cycles and grid current on positive hlf cycles. The grid base of the valve is shortened by arranging suitable screen voltage by means of R18 and R125. R14 is the grid stopper, limiting the grid current on positive excursions.

Square waves produced at the anode of V3 (Waveform 2 in Fig.27) are developed across R23, which with R24, forms part of the receiver and transmitter waveforms combining circuits. These square waves are also taken, via the cathode follower V4b, to the output terminal PLL, which feeds the run-up and safety circuits in Amplifying Unit (Servo) Type 4269A (Unit 4) and Amplifying Unit Type 4272A (Unit 7) respectively.

Receiver rotational waveform (1 kc/s sinewave shown as Waveform 3 in Fig.27) is fed, via PLM, from the Amplifying Unit Type 4272A (Unit 7) to the grid of V10a.

V10, V2a, V11 and V4a constitute a circuit which is identical in performance to that described for V1, V2b, V3 and V4b.

Square waves at the anode of V11 are developed across R24 which is part of the combining circuits. These square waves are also taken, via cathode follower V4a, to the output terminal PLN, which feeds, as in the case of transmitter square waves, the run-up and safety circuits in the Amplifying Unit (Servo) Type 4269A (Unit 4) and Amplifying Unit Type 4272A (Unit 7).

The square wave produced from the transmitter sinewave (across R23) form the reference with which the receiver square waves (across R24) are compared by addition to obtain the error signal. Since both the squarer circuits have identical characteristics and since R23 and R24 are balanced about earth, the square waves developed across them have equal amplitudes but differ in phase and/or width by the margin of displacement error in the receiver rotor square waves. If both trains of square waves are anti-phase and of equal width, the potential at V5b grid would be zero, If, however, as is more likely, square wave trains are not completely anti-phase a step waveform, the shape and phase of which will depend upon the error, will be produced and fed to V5b grid.

V5b is a cathode follower feeding two squaring circuits which separately process the positive and negative going pulses in the error signal.

One squaring circuit comprises V19 and V6 and is fed from V5b cathode across R27, and R28 and R30 in parallel. The grid base of V6 is reduced by a low value of screen voltage. Under quiescent conditions V6 is heavily conducting, V19 is cut off and V5b cathode is near earth potential. V19 is so connected that only negative going pulses of amplitude -10V or more make it conduct. These pulses then pass on to the grid of V6 and cut it off. The resultant positive going pulses produced in the anode circuit of V6 are taken from across R36, positively d.c. restored by V20 and applied to the cathode follower V5a. The latter stage feeds the phase sensitive gating circuits formed by diodes V22-V25. The waveforms at V6 grid and V5a cathode are shown in Fig.27. The waveform at V5a cathode is monitored at SKE.

A second squaring circuit is formed by V7, V8 and V9a and is fed from across the parallel combination of R28 and R30 in the cathode of V5b. While the first squaring circuit operates on negative going pulses only, the second circuit operates on the positive going pulses only, An inverter stage V8 is added to produce positive going square waves from the latter circuit. The squarer V7 is held cut off under quiesecent conditions by the negative bias obtained from R27, and R28 and R30 in parallel. Positive going pulses override the bias and cut V7 on to produce negative going pulses across the anode resistor R46. These pulses are then inverted by V8. The valve is normally conducting and the pulses cut it off, thus in addition to pulse inversion, the stage assists in further squaring of the pulses. The positive pulses from V8 anode are d.c. restored positively by V21 and applied to V9a grid. V9a is a cathode follower feeding the phase sensitive circuit V26 to V29. The waveform at V9a cathode is monitored at SKF and shown in Fig.27.

From the description in the last paragraph it can be seen that both the positive and negative constituents of the waveform appearing at V5b grid are used. This gives increased sensitivity and also allows for different mark-space ratio of the squared transmitter and receiver magslip waveforms. For certain errors the resultant output could be 1 kc/s or 2 kc/s positive or negative pulses. The condition A + D is most likely to be encountered when the timing is stationary, but under limit conditions of valves and components the same conditions will apply with normal running. It will be seen that alternate pulses are of different width, giving positive and negative error, the sum of which will be finite.

The most likely condition to be encountered is that both sets of square waves (transmitter and receiver rotor) have the same mark-space ratio but slightly differ in phase. In this condition the gating waveforms appearing at PLP and PLQ will, trough the arrangement of the phase sensitive diode circuits (V22-V29), divert the pulses at SKE and SKF to both grids of V12 or V14 depending whether the error signal is negative or positive respectively. The gating waveforms are square waves of frequency 1 kc/s, generated in the Gating Waveform Generator Type 4273A (Unit 10) from the transmitter rotor sinewave of 1 kc/s. These are applied in push-pull at PLP and PLQ and are shifted in phase by 90° compared to the square waves produced from the transmitter rotor sinewave in the Error Detector Unit (across R23) and their bases are d.c. restored to earth potential. See Fig.27.

The operation of the phase-sensitive gating circuits under the control of the gating waveforms is as follows:

Consider a train of pulses at SKE. If these correspond to a negative error, the gating waveform at PLP will be positive at the same time as a pulse occurs at SKE. This means that the cathode of both diodes V22 and V23 will be about 50V positive simultaneously and their anodes (diode junction of R82) will rise to a similar potential and so will the grid of V12b. At this instant, the gating pulse at PLQ will be at earth potential. Although the cathode of V24 is positive due to the pulse at SKE, the cathode of V25 is 0 due to the potential of the gating pulse at PLQ. When the pulse at SKE falls to earth potential the gating pulse at PLQ is at its positive potential. Now V24 cathode is at earth potential and V25 cathode is positive. It can be seen that, under the earrangement, the cathodes of both V24 and V25 can never be positive at the same time. Thus the diode junction of R83 will be held at earth potential and so will be the grid of V14a.

A similar set of conditions arise with the output from SKF. The pulses at this socket are phase-shifted by 180° relative to the pulses at SKE. When the pulse at SKF is positive, the gating pulse at PLQ will also be positive and anode junction of V28 and V29 with R85 will rise and apply a positive pulse to the grid of V12b. Under the circumstances, the cathode of V26 and V27 will never be positive at the same time and thus the grid of V14b will be held at earth potential.

For a positive error, the conditions reverse and the error pulses are gated to the grids of V14a and V4b while the grids of V12a and b are held at the earth potential.

The pulses at the grids of V12 (due to negative errors) are combined in its cathode circuit and monitored at SKG. The pulses at the grids of V14 due to positive error will be combined at its cathode and monitored at SKH. The pulses in either case will be at 2 kc/s and one or the other will exist.

The conditions described above are the most likely to be met. In remote circumstances the conditions A + B + C could exist when the error voltage required is derived exactly from the difference in square wave discrepancies. Waveform A + D, (or the inversion, when D is wider than A), however, is a reality and often occurs when the turning is stationary resulting in a series of positive or negative error pulses at V5b, consequently a train of 2 kc/s pulses will appear at SKE or SKF. The gating arrangement will cause the 1 kc/s pulse trains to appear at SKG and SKH; these pulses will be of a different width at the negative error valve (V12) cathode than at the positive valve (V14) cathode and consequently the error will be the sum of positive and negative values.

The combined signal across R89 is passed to a d.c. amplifier V13 giving negative-going pulses across R94. Similarly the combined signal across R99 is passed to the d.c. amplifier V15, which is followed by an inverter-squarer stage, V16, in order to obtain positive-going pulses across R110. The quiescent condition of V16 is such that with no signal input, the valve is conducting due to a positive grid voltage obtained from the h.t. line via R107. The large, negative-going input signals cut the valve off to produce positive pulses at its anode.

The positive pulses from R110 are positively d.c. restored to earth by V17b and the negative pulses from R94 are negatively d.c. restored to earth. These pulses are then combined across a common load, C17 (one train of pulses being 0 in the most likely condition encountered). The comparatively long time constants R113-C17 and R114-C17 partially integrate the pulses to produce a unidirectional voltage of low frequency which can be positive or negative depending on the pulse width at V17b or V17a, or the sum of the average d.c. produced at both halves of V17. This voltage is d.c. coupled to a cathode follower, V18b, in whose cathode circuit two further long time constant circuits complete the integration process. R119-C19 and R122-C20 form the integrating networks, which are connected in cascade and their d.c. output is developed across the grid of the output cathode follower V18a. R117 produces the desired grid bias for V18a to ensure that its cathode is at a d.c. potential similar to V18b grid. The d.c. voltage at the cathode of V18a representing the error voltage is fed via PLR to the d.c. amplifier in the Amplifying Unit (Servo) Type 4269A (Unit 4).

5.6.3 Metering and Monitoring

Provision exists to meter the anode currents of 23 valves of the unit by means of the common Metering Unit Type 4353C (Unit 6). The selector switch on the Error Detector Unit is SWA, having twelve positions; its range is doubled by a signal pole changeover switch SWB.

Eight monitor sockets on the unit permit visual inspection of waveforms at different stages by means of an oscilloscope.

5.7 AMPLIFYING UNIT (SERVO) TYPE 4269A (UNIT 4)

5.7.1 General

See Drawing No. WZ.22172/B Sh.1 (Fig.30) for Block Diagram.

The Amplifying Unit (Servo) is basically a mixing amplifier which controls the frequency response of the servo loop. A d.c. potential is mixed with the error input as a convenient method of correcting angular errors ($\pm 4^\circ$) caused by long term drift in the link.

A secondary or 'run-up' circuit is included in this unit to control the Motor Drive Unit (Unit 8) for the running up period, during which time, error signals may be oscillatory or non-existent due to instability in the servo loop; once stability is reached, output from the 'run-up' circuit falls to zero and the d.c. amplifier then exercises complete control.

V6 and V7 together form the d.c. amplifier, and the 'run-up' circuit consists of V1 to V5. Waveforms appearing at various points in the 'run-up' circuit as shown in WZ.22173/B Sh.1. (Fig.32).

5.7.2 Circuit Description

See Drawing No. WZ.17386/D Sh.1. (Fig.31) for Circuit Diagram.

5.7.2.1 D.C. Amplifier (V6 and V7)

An error signal from the Error Detector Unit (Unit 11) is passed to the grid of V6(b) via plug PLH and the input (see-saw' arm resistor R45; V6(a) and V6(b) function as a long-tailed pair with the common cathode load R50.

V7(b) is a high gain amplifier directly coupled to V6(a) via the potential divider R55, R56. A low impedance output at the output plug PLK is provided by the cathode follower V7(a) which is directly coupled to V7(b) anode via R60. High frequency stability is esnured by the phase-correcting capacitors C14, C15 and C16.

Overall feedback in the d.c. amplifier is completed via R54, which, with R45 and R46 form a conventional 'see-saw' arrangement.

A tachogenerator input is coupled directly to the receiver selsyn drivem via PLJ and under irregular speed of 'hunting' conditions produces a similarly changing output. Due to the capacitive reactance of C13, this voltage is not impeded and supplements the feedback voltage causing anti-phase variations in the amplifier gain with consequent damping of the motor drive output. Under steady state conditions the direct voltage from the tachogenerator is blocked by C13 and normal feedback action follows.

A d.c. potential in the range +25V to -25V is available at the slider of RV1, this being part of a resistive divider with R67 and R70 which is connected between the positive and negative h.t. supplies.

5.7.2.2 'Run-Up' Circuit

Two trains of square waves, which are derived from the transmitter and receiver Magslip rotor waveforms via the Error Detector Unit, are applied to plugs PLG and PLF. These square waves are used as a reference with which the transmitter Magslip rotor output is compared enabling an error voltage to be produced for overriding the servo control.

The transmitter Magslip rotor output contains the turning information as an increase or decrease in frequency about the master 1 kc/s reference. A maximum speed of 10 rev/min in a clockwise direction gives a rotor output of 1005 c/s and maximum speed counter-clockwise gives 995 c/s.

The transmitter rotational information is therefore contained in the second train of square waves applied to PLG (waveforms 1 or 5, WZ.22173/B Sh.1 (Fig.32). Both sets of square waves are differentiated by the short time constants C1-R2 and C2-R14 for the receiver and transmitter rotational information signals respectively. Positive-going spikes appearing across R2 and R14 are eliminated by V1(a) and V1(b) which obtain their conduction point bias from potential dividers R1-R2 and R13-R14 respectively.

Each half of an Eccles-Jordan trigger, V2(a) and V2(b), conducts alternately on negative-going spikes only, and a rectangular wave of varying mark-space ratio appears across R12 as shown in WZ.22173/B Sh.1 Fig.32. This rectangular wave is integrated by the comparatively long time constants R19-C6, R20, C7, whilst a buffer cathode follower V3(a) prevents these components from loading the Eccles-Jordan trigger.

The integrated waveform (WZ.22173/B Sh.1 Fig.32) has opposite polarities for opposite rotational signals and closely resembles a sawtooth having a short fly back time; this fly back time is differentiated by the short time constants C8-R24 for clockwise rotation signals and by C10-R35 for counter-clockwise signals.

Positive and negative derivatives from the clockwise and counter-clockwise waveforms are removed by V8 and V11 respectively. These diodes are each returned to a small potential which is positive in the case of V8 (from divider R25, R26), and negative in the case of V11 (from divider R33, R34). The negative-going spikes are applied to the grid of V4(a) and the positive-going spikes to the grid of V4(b).

Both halves of V4 function as triode pulse shapers having a common anode load R30. V4(a) accepts clockwise signals only and V4(b) counter-clockwise signals only. The quiescent condition of V4 is such that V4(a) is conducting since its grid is held at approx. +20V, (the anode current is approximately 1 mA fixing the anodes at a potential of 220V) and V4(a) is cut-off since its grid is held at -20V via V11, the cathode being effectively earthed by V10. These bias voltages make V4 insensitive to pulse having an amplitude of less than 20V.

Positive pulses for one direction of rotation or negative pulses for the opposite direction of rotation appear across R30 and are fed to a cathode follower, V5(a). This valve provides a low source impedance for an integrating circuit which produces the final d.c. output voltage. MR1 and C12 form an integrating circuit which has a non-linear transfer characteristic due to the Metrosil MR1. This component has a high resistance at low voltage levels (less than 1V) which changes almost exponentially to a very low resistance at approximately 10V and over. The circuit is therefore conscious to amplitude in addition to pulse width and p.r.f.

V5(b) is a cathode follower which forms part of the integrating circuit, having a feedback loop for the d.c. output voltage. A high degree of smoothing is applied to the integrated voltage due to the long time constant. The d.c. output voltage, which can be positive, negative or zero is taken to the grid of V6(a), which is part of the d.c. amplifier previously described. Under normal conditions the integrator output is zero and no change is made to the d.c. amplifier gain.

During the running-up period, however, the integrator output far exceeds the error pulse amplitude at PLH and the running-up circuit assumes complete control.

5.7.3 Metering and Monitoring

Full metering and monitoring facilities are provided on this unit. Meter selection, is effected by SWA, which is mounted on the front panel.

5.8 NORTH ALIGNING UNIT (RECEIVER) TYPE 4626A (UNIT 5)

5.8.1 General

Auto-Align and North Marker pulses are derived by this unit from the composite link baseband signal. The chassis consists of two sub-units which are conventional amplifiers and demodulators. Outputs are taken from a pair of relay contacts.

The h.t. supplies are obtained from the Power Unit (Unit 13) and l.t. supplies from the Amplifying Unit (Filter) (Unit 12). Full metering and monitoring facilities are provided on both units.

5.8.2 Circuit Description

See Drawing No. WZ.18022/D Sh.1 (Fig.34) for Circuit Diagram.

The Auto-Align sub-unit consists of V1 and V2, and the North-Align sub-unit, V3 and V4. As both sub-units are identical except for their operating frequency, the Auto-Align sub-unit only is described below.

The composite turning signal in the range 140-250 kc/s is applied to crystals XL1 and XL2, via plug PLE. Crystal XL1 operates in the series mode as a high Q accepter circuit tuned to 140 kc/s. Similarly the resonant frequency of crystal XL2 is 145 kc/s and this selects the North Align Unit signal input.

V1(a) and V1(b) are 'see-saw' amplifiers connected in cascade. Both valves have a measure of negative feedback via the paths C5, R3 in the case of V1(a) and C8, R10 in the case of V1(b).

Cathode follower V2(b) provides a low impedance output for driving the voltage-doubling detector circuit C11, V5, V6 and R20. A peak-to-peak output is obtained from this type of detector and filtering of the 140 kc/s a.c. component is effected by C12, R21.

V2(a) is a relay control and under normal conditions (i.e., with a c.w. carrier input), the valve is cut-off by the negative voltage derived from V5, V6. When the carrier is interrupted by an auto-align pulse, the valve conducts and relay RLA is operated. Anode series resistors R22 and RV1 determine the relay current, hence sensitivity. Relay contacts RLA1 are changed over during the valve conducting period which is determined by the radar aerial auto-align contact, and the output is earthed for 352° and open circuit for 8° of the radar aerial rotation.

5.8.3 Metering and Monitoring

Provision is made to meter the anode currents of the eight half-valves in the unit; monitor points SKA, SKB and SKC permit the inspection of the input, amplified Auto-align and amplified North align waveforms respectively.

5.9 MOTOR DRIVE UNIT TYPE 4271A (UNIT 8)

5.9.1 General

See Drawing No. WZ.22175/B Sh.1. (Fig.37) for Block Diagram.

The d.c. potentials for both field and armature excitation for the d.c. Servo Motor of the Receiver Gearbox Type 4276A (Unit 6) are supplied by the Motor Drive Unit. A substantial constant current is passed through the drive motor armature whilst the field coil currents can vary in both amplitude and phase, depending on the error signal input.

5.9.2 Circuit Description

See Drawing WZ.17006/D Sh.1 (Fig.38) for Circuit Diagram.

5.9.2.1 Field Supply

An error signal input from the Amplifying Unit (Servo) Type 4269A (Unit 4) is amplified in a long-tailed pair V1, this being the first valve in a d.c. power amplifier consisting of V1 and V2. V2 is a power pentode which is directly coupled to V1(b) via R7, the input to V2 being in-phase with the error signal input. V2 anode load is one field winding of the drive motor, the connections being made via TB2, pins 2 and 6. Negative feedback from V2 cathode is applied to V1(b) via R9, R10 and high frequency compensation in the loop is effected by the phase-correscting capacitors C4 and C5. Overall gain between PLE and SKB is approximately 3.

The same error signal input from the Amplifying Unit (Servo) is also amplified in a long-tailed pair V3, this being the first valve in a second d.c. power amplifier consisting of V3 and V4. The amplifier is a 'see-saw' amplifier resembling V1 and V2 except that the input to V4 is anti-phase with the error signal input since the oppsoite triodes are used in V1 and V3. The input arm is R2 and negative feedback arm R25. The current in V4 anode field coil is opposite in phase to that in V2 anode field coil; under quiescent conditions these currents are equal and the drive motor speed is zero.

A positive d.c. error voltage at plug PLE causes the field current through V2 to increase and that through V4 to decrease. The drive motor will then rotate in clockwise direction. Conversely, a negative d.c. error voltage at PLE will cause counterclockwise rotation.

5.9.2.2 Armature Supply

The 230V, 50 c/s a.c. mains supply is applied via a double-pole switch SWB (SERVO ON) and fuse FS1 to a bridge-connected rectifier MR1. C1, C2 and C3 are also series-connected with the mains supply and their capacitive reactance (130Ω) limits the armature starting and running currents.

The d.c. output is applied directly to the drive motor armature via TB2, pins 5(-) and 7(+). The second pole of SWB is used to by-pass the h.t. trip circuit in Amplifying Unit Type 4272A (Unit 7). This prevents the Power Supply Unit (Unit 13) being switched off when this unit is switched off.

5.9.3 Metering and Monitoring

Sockets SKA, SKB, SKC permit inspection of input and both output waveforks by means of an external oscilloscope.

The anode currents of each valve are metered in Metering Unit Type 4353C (Unit 6), selection being made by the 6-way METER switch SWA.

5.10 RECEIVER GEARBOX TYPE 4276A (UNIT 9)

Three views of the gearbox are shown in WZ.22184/D (Figures 43 and 44). The gears are driven by a drive motor and through the gears mechanical coupling is made to the receiver output selsyn, receiver Magslip and a d.c. tachogenerator. The output selsyn stator can be rotated with respect to the rotor shaft for alignment purposes, the selsyn shaft being fitted with a scale calibrated from 0° to 12°, which corresponds to actual degrees of aerial movement.

In addition, a hand-turning screw is provided for selsyn rotor adjustment for test purposes. Electrical connections to the selsyn, motor and Magslip stators are made via a pair of barrier strips, the Magslip rotor and d.c. tachogenerator outputs being made via coaxial connectors.

NOTE: *As the receiver selsyn rotor voltage must be in phase with the receiver gearbox transmitter selsyn, a common supply is used and this is not removed from the rotor when the entire cabinet is switched off. To completely isolate the gearbox unit, it is necessary to withdraw plug PLF from the Distribution Panel (Unit 14).*

5.11 POWER SUPPLY UNIT TYPE 4275A (UNIT 13)

5.11.1 General

The Power Supply Unit provides h.t. potentials of positive and negative 300 volts which feed all units in the Turning Receiver cabinet. The positive and negative supplies can deliver maximum currents of 500 and 320 mA respectively, and a safety circuit is provided which will switch off both supplies in the event of a failure in either h.t. line. The safety circuit also works in association with the h.t. trip circuit in the Amplifying Unit Type 4272A (Unit 7) such that in the event of a link failure or any other lack of control in the servo system, the h.t. supplies are switched off.

Two similar regulating circuits are employed for positive and negative supplies, and each has a fine degree of control by the use of two differential amplifiers connected in cascade.

Output voltage metering facilities are provided on this unit.

5.11.2 Circuit Description

See Drawing No. WZ.17001/D Sh.1 (Fig.45) (Circuit Diagram)

5.11.2.1 Supply Circuits

Single phase a.c. mains, in the range 200-250 volts at 50 c/s, is applied to the primary winding of mains transformer TR1 via the double pole 230V ON switch SWA and fuse FS1. The transformer winding is tapped permitting connection to be made suiting the local voltage.

TR1 has nine secondary windings: seven of these are l.t. and supply heater current to the Power Unit control and rectifier valves; the remaining windings are centre-tapped and provide h.t. potentials for the positive and negative regulating circuits. Three full-wave rectifiers V1, V2 and V3 are connected in parallel to the positive h.t. winding, and, since a lower current is required from the negative supply, only two rectifiers, V4 and V5, are used. The d.c. output from both groups of rectifiers is passed to conventional smoothing circuits (C1, L1 and C3 and C13, L2 and C15) and to the series regulating valves V6 and V11.

As both regulating circuits are similar in operation, the positive circuit only is described below. The negative regulating circuit has its positive pole connected to earth.

The d.c. output from the cathode of V6 is taken directly to the output terminal, pin 2 on TB1. Variations in output voltage are attenuated by the potential divider R31, R32, R33 and RV2 to within a few volts of the voltage reference tube V9, whose load is R22 and R23, and applied to the grid of the first d.c. amplifier V10b. For rapid fluctuations on the h.t. line R32 is by-passed by C10. Adjustment of the regulated h.t. output is effected by the SET +300V control RV2.

These h.t. variations are compared with the constant voltage on V10a grid such that amplified difference voltages are produced at both anodes of V10.

V8 is d.c. coupled to V10 in a push-pull arrangement, and an anti-phase output is developed at V8a anode. This output is used as V6 control voltage such that an increase in the output voltage produces a negative grid voltage, and the impedance of V6 is increased with consequent reduction in h.t. voltage.

A supply voltage of 375 volts is required to give V8a a final anode voltage of about 280, and this is obtained by returning R19 to the unregulated h.t. supply via R15. This supply is then stabilised by V7, whose cathode is returned to the 300V regulated h.t. line via R31. R31 is included in the cathode circuit of V7 to inject into the amplifier a small unregulated ripple voltage (since V7 is passing a current with a superimposed ripple). The phasing of the injected ripple is arranged to reduce the effect of the 100 c/s on V6 anode.

High frequency gain in the differential amplifiers is reduced by RC networks C9-R29, C8-R25 and C5-R17; the phase shift produced by these networks also ensures stability in the regulating circuit.

5.11.2.2 Metering

Two potential dividers, R34, R35 and R60, R61 are connected across the positive and negative supplies respectively. The voltage from these dividers is taken to the Metering Panel (Unit 6) where it is selected and registered on a moving coil meter.

5.11.2.3 Fuses and Safety Circuits

In addition to the mains supply fuse FS1, fuses are inserted in both positive and negative unregulated h.t. lines. Each fuse is bypassed by a neon lamp and its associated series resistor. The lamp is arranged to glow only when the fuse is broken.

A switching delay of the h.t. supplies relay is provided by RLA. This is a thermal relay with a combined hold relay fitted to a common frame; the contacts RLA-1 are normally closed, completing to earth a 6.3 volt circuit through the bi-metal thermal contact RLA3.

When the unit is switched on, LP1 and LP2 light indicating that the mains supply is on. Bi-metal strip thermal contact RLA3 receives 6.3 volts and commences heating. The thermal capacity of this contact is approximately equal to the valve heaters of the unit and after the heating cycle has completed RLA3 closes. Relay RLA is connected to the unregulated positive h.t. supply at the junction of the potential divider network R63 and R62 and operates via closed RLA3. Contact RLA1 changing over disconnects the heating supply from RLA3 and provides a hold-on path for RLA when RLA3 opens after cooling. The unregulated positive supply is also connected to relay RLB from the junction of R63 and R64 via the biased H.T. OFF switch SWC. The operation of the spring action (biased) H.T. ON switch SWB now closes the supply circuit for RLB via closed RLA2, which operates and is held by its own contact RLB4 via the safety circuit. Contacts RLB2 and RLB3 operating, switch on both the h.t. supplies, which action is indicated by the lighting of the H.T. ON lamp LP3 via RLB1. Subsequent operation of the spring action H.T. OFF switch SWC will open the supply circuit for RLB, which on releasing will switch off the h.t. supplies.

The safety circuit relevant to the unit is controlled by relay RLC. The coil of this relay is connected between earth and the positive and negative supply lines via R36 and R66. When both the voltages are normal no supply is available for RLC. Should, however, the h.t. voltages become unbalanced or either supply fail. RLC will energise. Action RLC1 will thereby open to de-energise RLB, switching the h.t. supplies off.

For the safety circuit associated with link failure etc. see Section 5.4.2.2.

The time constants C4, R12; C16, R38 are connected across RLB-2 and RLB-3 respectively. These prevent the sudden removal of anode supplies to V6 and V11 when the relay contacts open, thereby reducing arcing.

NOTE: *Pin 8 on TB1 is taken to earth via the Amplifying Unit Type 4272A (Unit 7).*

5.12 METERING UNIT TYPE NO. 4353C (UNIT 6)

5.12.1 General

This panel is a central monitoring point for voltage and currents in the Turning Receiver cabinet units and consists of a 13-position selector switch and a 0-1 mA f.s.d. moving coil meter movement.

5.12.2 Circuit Description

See Drawing No. WZ.18010/B Sh.1 (Fig.48) for Circuit Diagram.

The circuit shows the double-pole switch SWA, meter M1 and meter multiplier R1. The sensitivity of the meter is reduced one thirtieth full scale by switching in shunt R2 with the biased switch SWB. This switch offers meter protection and should not be depressed if a reading of greater than 4% f.s.d. is observed.

5.13 A.C. SWITCHING AND DISTRIBUTION PANELS

These panels are integral parts of the Turning Receiver cabinet and reference should be made to the cabinet wiring diagram WZ.25156/D Sh.1 (Fig.3) for circuit details.

On the A.C. Switching Panel are mounted the receiver master switch SWA (CABINET) and a service point (3 pin, 5A sockets) with its associated switch and 5A fuse.

Distribution of cables is effected by a terminal block and 12-way socket mounted on the rear Distribution Panel.

6 INSTALLATION

6.1 GENERAL

The Turning Receiver Cabinet should be mounted on a false floor over a floor duct, or on a small plinth about 8-10 inches high, to allow for inter-cabinet wiring and for adequate circulation of cooling air. Ensure that the cabinet framework is securely bolted down and that a suitable earthing connection is made to the earth block supplied. The cabinet must be ventilated, and provision is made for installation into a standard air blowing system, where this is not available, however, a small exhaust fan may be fitted to the top of the cabinet. The following checks should be carried out:-

1. Ensure that all units are located correctly in the Turning Receiver Cabinet after first checking each unit individually for electrical or mechanical damage.

2. Check that all valves are firmly seated in their holders and that unit interconnecting leads are tight in their respective terminal blocks.

3. Check also that the Receiver Gearbox (Unit 9) is lubricated and that the Selsyn rotors are free.

4. Adjust the primary windings of transformers in the following units to the nearest voltage tapping above that of the local mains supply:-

   (a) Power Supply Unit (Unit 13)

   (b) Amplifying Unit (Filter) (Unit 12)

5. Connect a coaxial cable to plug PLB, located on the Distribution Panel, from the Distribution Panel on the Channeling Receiver SX145.

6. Ensure that all toggle switches on the front panel of the Power Supply Unit (Unit 13) are OFF.

7. Connect the mains supply to the rack input socket PLA (5A, 3 pin) at the rear of the Distribution Panel (Unit 14).

8. Switch on the supply to the Turning Receiver Cabinet by means of the switch SWA (CABINET) mounted on the right hand side of the A.C. Switching Panel Unit (Unit 14). Ensure that the valve heaters are alight in all Units.

6.2 PRELIMINARY CHECKS

After initial installation has been carried out the Turning Receiver Cabinet should be checked as follows:-

1. Switch on the Cabinet, SWA on A.C. Switching Panel.

2. Switch on the Power Supply Unit (Unit 13), SWA only. Check that LP2 lights.

3. Switch on the h.t. supplies using SWB and SWC.

4. Check that the total positive h.t. current is approximately 455 mA; check also that the negative h.t. current is 315 mA ±10%. If these current readings are satisfactory, switch OFF the cabinet prior to setting up. If the currents differ appreciably, use the Table of Currents (Maintenance Section) to locate the unit(s) giving an unsatisfactory reading.

7 SETTING UP PROCEDURE

When setting up the whole of the cabinet equipment, the units should be set up in the order shown. Each unit is factory aligned and has been tested functionally before installation.

The SKF of the Cabinet should be connected to a Selsyn Type S1406B shown in Fig.50k(i). The PLB of the cabinet should be connected to the Channelling receiver so that the signal over the link is used. Ensure that the Turning Transmitter on the Transmitter end of the link is correctly set up. A dummy load may be used to terminate PLB and the setting up procedure suitably modified.

The Cabinet should be switched on by operating the MAINS ON switch on the Distribution Panel.

7.1 POWER SUPPLY UNIT (UNIT 13)

NOTE: *If the link is switched off ensure that the ON/OFF switch on the Servo Amplifier is at OFF.*

Set up as follows:-

1. Switch on the Power Unit and allow approximately 1 minute as warm up time.

2. Press SWB.

3. Adjust RV2 to give 300V, measured on the meter M1 of the Metering Unit (f.s.d.) with SWA in the SET +300V position on the meter.

4. Adjust RV1 to give -300V, measured on the meter M1 of the Metering Unit (f.s.d.) with SWA in the -300V position.

5. Check that LP1 (Cabinet Heaters) and LP2 and LP3 on the Power Unit are lit.

7.2 FILTER AND DETECTOR UNITS (UNITS 1 AND 2)

Set up as follows:-

1. Monitor, with an oscilloscope, the signal at SKB.

2. Adjust RV1 for a modulated carrier of 6.3V peak to peak.

3. Monitor, with an oscilloscope, the signal at SKC.

4. Adjust RV2 to give a sinewave of 1V peak to peak.

7.3 AMPLIFYING UNIT (FILTER) (UNIT 12)

Set up as follows:-

1. Ensure that the Magslip Amplifier of the Transmitter Cabinet is correctly set up by adjusting RV1 (PHASE and RV2 AMPLITUDE) for minimum amplitude variation at SKC of the unit.

2. Close SWA (SERVO ON) of the Amplifying Unit (Servo) (Unit 4) and reset the h.t. with H.T. ON the P.U.

3. Place SWA, SET LOOP GAIN/NORMAL Switch, to the NORMAL position. Turn RV1, AMPLITUDE control, fully clockwise, and RV3, LOOP GAIN control, fully counterclockwise.

4. Monitor the output at SKB with an oscilloscope, and adjust RV2, FREQUENCY control, for maximum output.

5. Place SWA to the SET LOOP GAIN position. Turn RV3 slowly clockwise, to the point where oscillations occur, then slightly back to remove oscillation.

6. Set SWA to the NORMAL position and re-adjust RV2 for maximum output then set RV1 for an output of 1.0V peak to peak.

7. Check that self oscillation has not occurred by setting SWA to SET LOOP GAIN. If necessary re-adjust RV3 and RV1 as in (5) and (6) above.

7.4 MAGSLIP AMPLIFIER AND MONITOR UNIT (UNIT 3)

NOTE 1: *Socket SKC of this unit is live approx. 300V d.c. an isolating capacitor of approx. 0.1 µF should be included in the test lead to this socket.*

NOTE 2: *It is essential that Radar aerial rotational information of between 2 and 6 rev/min is driving the Magslip Drive Unit whilst this unit is being set up.*

Proceed as follows:-

1. Monitor the output at SKC with an oscilloscope.

2. Adjust RV3, MONITOR AMPLITUDE, to produce negative-going sinewave crests of 30V peak amplitude.

3. Adjust RV1, GAIN control and RV2, PHASE control, alternately to progressively reduce the amplitude variation at socket SKC to a minimum, adjusting RV3 as necessary to prevent limiting.

4. Reset RV3 as necessary to prevent the amplitude of the waveform exceeding 40V peak.

7.5 ALIGNMENT OF RECEIVER AND TRANSMITTER MAGSLIPS, AND NORTH ALIGNING UNIT

1. Switch off the Aerial or (Selsyn Simulator) drive to the Transmitter cabinet and check with an AVO meter Model 8 that the D.C. voltage between the wiper of RV1 of the Amplify Unit (Servo) Type 4269A (Unit 4) and earth is less than 50 mV. Adjust RV1 as necessary to obtain this condition.

2. Set the Magslip Drive Unit scale in the transmitter cabinet to zero degrees by means of the spring loaded screwdriver control. Slacken the four fixings of the link magslip in the Receiver cabinet and rotate the body until the gear box scale reads zero.

3. Check that a minimum variation of ±12 minutes of the degree scale can be obtained by adjusting RV1 of the Servo Amplifier 4269A. Reset this control for 0 degrees on the gearbox scale.

4. By manually setting the Transmitter Magslip Drive Unit to 12 intervals of 1 degree check that the maximum peak to peak error of the receiver scale is not greater than 4 minutes.

5. Rotate the Transmitter Selsyn at approximately 180 R.P.M. and check with a strobescope on the Receiver Gear Box scale, that the peak to peak jitter is not greater than 5 minutes.

6. In order to ascertain that correct gating connections have been maintained throughout the system, check that the positive going pulses at SKG or SKH or the Error Detector Type 4274A (Unit 11) have a short mark to space ratio as distinct from 1 to 1.

7. Check with a strobescope on a scale or gear on the shaft of the S1406B selsyn (Fig.50K(i)) being driven from the receiver cabinet, that it is running in synchronism with the receiver scale.

8. Monitor the outputs of the North Aligning Unit (Receiving) 4626A at SKB and SKC and check that the peak to peak amplitudes are not less than 10 volts.

9. Connect PLC pin 7 of the Transmitter Distribution Unit to -50V relative to chassis, set Metering Unit 4353C in Receiver cabinet to read V2a of North Aligning Unit 4626A and adjust RV1 (Auto Align Sensitivity) for a current of 10 mA (Meter F.S.D = 30 mA). Check that SKF pin 7 of the Receiver Distribution Unit is connected to earth.

10. Transfer connection from PLC7 to PLC8 in the Transmitter cabinet and with receiver meter set to read V4b of North Aligning Unit, adjust RV2, (North Mark Sensitivity) for a current of 10 mA and

check that SKF pin 8 of the Receiver Distribution Unit is connected to earth. Check that SKF pin 7 has no connection to earth. Remove -50 volt connection and check that SKF pin 8 has no connection to earth.

7.6 RECEIVER GEARBOX (UNIT 9)

For setting of Selsyn Electrical Zero ('Coding') proceed as follows:

1. Slacken off the three bolts mounted radially around the selsyn top flange.
2. Connect up the circuit as shown in WZ.22204/B Sh.1 (Fig.42). Both meters (M1 and M2) should be multi-range (Avometer Model 7 or 8) so that the F.S.D. of M1 can be reduced as the output nears zero.
3. Use the hand turning screw to set the rotor for a scale reading of 0°.
4. Hold the selsyn rotor rigid by means of the hand turning screw.
5. Rotate stator of selsyn until M1 reaches a minimum (i.e. a fraction of a volt) and M2 registers approximately 110V a.c. this is the coded position of the selsyn.

NOTE: *If M1 is set to give a minimum reading and M2 registers approximately 250V, this is the 180 degree position and the stator must be rotated a further 180 degrees to obtain the condition 5.*

7.7 MOTOR DRIVE UNIT (UNIT 8)

Proceed as follows:-

1. Monitor sockets SKA, SKB and SKC with an oscilloscope. SKB and SKC should be observed simultaneously and show squarewaves of opposite polarity, those at SKC being in phase with the input of SKA.
2. Switch on SWB. Ensure that the Receiver Gearbox Drive motor rotates.

7.8 FINAL INSTALLATION SETTING UP

Having coded the Selsyn, switch on the link, set the radar aerial in the North position and rotate the body of the link magslip for a reading of zero on the scale.

8 OPERATION

1. Ensure that the equipment has been installed correctly and set up in accordance with instructions given in Section 7.

2. As the Radar Link is designed to run for long periods unattended, operation of the Turning Receiver is simple and limited to switching procedures; tuned circuits are fixed in frequency by the choice of appropriate crystals and further adjustment is unnecessary.

3. It is essential to monitor the voltage and currents in the Receiver units which are selected by the Metering Panel. A list of typical current readings expected from each unit is given in the MAINTENANCE Section. When the Receiver Turning Cabinet is operating correctly, a list of INDIVIDUAL valave currents should be recorded and checked at least weekly.

NOTE: *THE REGULAR RECORDING OF METER READINGS WILL LARGELY REDUCE THE RISK OF FAULTS BECOMING SERIOUS.*

9 MAINTENANCE

9.1 GENERAL

The Turning Receiver Cabinet is constructed so that maintenance may be carried out quickly and efficiently; the cabinet is fitted with a back door but after initial installation, routine servicing can be effected entirely from the front.

In the event of a complete breakdown, the Metering Panel (Unit 6) should be used to check the Power Supply output. If this is in order proceed to check the units, in the order given in the Setting-up procedure (Section 7) and as follows:-

1. First check that the Transmitter 1 kc/s master sinewave is in fact being transmitted. If so, it should be present at the output of the Filter and Detector Unit (Unit 1).

2. Check that the Magslip Amplifier and Monitor Unit is operating and that the Receiver magslip stator coils are energised by two 1 kc/s sinewaves having a phase difference of 90° as measured on a Double Beam Oscilloscope.

   NOTE: *When the receiver Magslip is stationary, a 1 kc/s output is available from the rotor by mutual induction. This output should be available at the coaxial plug PLB.*

3. Monitor all inspection sockets on Amplifying Unit Type 4272A (Unit 7).

4. Monitor all inspection sockets on Error Detector Unit (Unit 11).

9.2 SPECIALIZED MAINTENANCE

NOTE: *The maintenance procedures given in this section are meant to be carried out during overhaul or a major repair. Parts may be used for routine maintenance.*

9.2.1 Filter and Detector Units Type 4267A and B (Units 1 and 2)

Circuit Diagram	Fig.6
Component Layout	Figures 7 and 8

9.2.1.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)
Signal Generator covering 150 kc/s - 400 kc/s capable of being modulated to a depth of 30% by 1 kc/s sinewave and giving an unmodulated output of 2V peak to peak.	
1 kc/s Oscillator capable of delivering 0.5V sinewave.	
Valve Voltmeter range 100 mV -35V.	
Power Supply Unit Type 4275A	(Unit 13)

9.2.1.2 Mechanical Tests

1. Check wiring against circuit diagram for correctness and continuity.

2. Check that soldered connections are good.

3. Check that the rotary switch operates mechanically and locates correctly.

9.2.1.3 Electrical Tests

1. Place all valves and make the following connections to TB1.

	TB1 Tag
+300V	1
Earth of P.S.U.	2
-300V	3
6.3V a.c. 50 c/s	4 and 5
Metering Unit Type 4353C TB1(1) and TB1(8)	6 and 7 respectively.

2. Set the AMPLITUDE control RV2 to its fully clockwise position and check with the Metering Unit, set to '4267A' that the quiescent valve currents are within the limits shown in Table 1.

Table 1

Valve	Current in mA	F.S.D. mA
V1 - V7 inclusive	6.2 - 8.4	30 mA
V8	7.2 - 10.5	30 mA
V9	6.5 - 8.8	30 mA

3. With the R.F. GAIN control RV1 in fully clockwise position, connect the signal generator between PLF and earth and the valve voltmeter between SKB and earth. With the signal input set to 100 mV r.m.s. at 200 kc/s or 250 kc/s for Units 1 or 2 respectivelt adjust C6, C14 and C22 for maximum output at SKB.

4. Adjust the input level for 3.5 Volts r.m.s. at SKB and check that the input is between 90 mV and 135 mV r.m.s.

5. Rotate the R.F. GAIN control RV1 in a counterclockwise direction and check that the output at SKB is smoothly reduced to between 1 and 1.4 Volts. Reset RV1 fully clockwise.

6. Connect the A1 amplifier of the oscilloscope in parallel with the Valve voltmeter and adjust and record the input for an output at SKB of 100 mV. Observe with the oscilloscope that less than 10% of the overall amplitude is due to hum pick-up.

7. Set the input to 50 kc/s higher than in step 6 and adjust the level for 100 mV at SKB. The input should be a minimum of 45 dB greater than that recorded in step 6.
Repeat step 7 with the input 50 kc/s lower than in step 6.

8. Set the input as in step 4 and modulate it with 1 kc/s sinewave to a depth of 30%. Transfer the valve-voltmeter and oscilloscope to PLE and check that the waveform is 1 kc/s and of an amplitude between 0.7 and 1.1V r.m.s.

9. Adjust the input for 0.5V at PLE and rotate the AMPLITUDE control RV2 counterclockwise and check that the output at PLE and SKC is smoothly reduced to between 0.2 and 0.3V.

9.2.2 Magslip Amplifier and Monitoring Unit Type 4268A (Unit 3)

Circuit Diagram	Fig.10
Component Layout	Fig.11 and 12

9.2.2.1 Test Equipment Required

Multi-range meter	(Avometer model 8)
Oscilloscope	(Cossor Type 9172)
Oscillator capable of delivering 1 kc/s sinewave at 1.5V	
Test Potentiometer comprising 1 - 10Ω, 1 - 270Ω, and 1 - 68Ω, ½ watt resistors.	(See Fig.50(a))
Metering Panel Type 4353C	(Unit 6)
Magslip Drive Unit Type 4285A	
Power Supply Unit Type 4275A	(Unit 9)

9.2.2.2 Mechanical Tests

1. Check wiring against the circuit diagram for correctness and continuity.

2. Check that soldered connections are good.

3. Check that the votary switch operates mechanically and locates correctly.

9.2.2.3 Electrical Tests

1. With all the valves in place in the unit, make the following connections to TB1.

Tag 1	to +300V supply and TB1(10) of Metering Unit.
Tag 2	to Tag 4, to Terminal A of the Test Potentiometer, and earth.
Tag 3	to -300V supply.
Tag 4)) Tag 5)	to TB2(3) Magslip Drive Unit, 6.3V a.c. 50 c/s at 4.2 Amp and terminal D of Test Potentiometer (1-270Ω)
Tag 6	to TB1(3) of Metering Unit.
Tag 7	to TB2(1) of Magslip Drive Unit.
Tag 8	to TB2(2) of Magslip Drive Unit.

2. Switch Metering Panel to this unit and SWA of this unit to the V6a position.
Rotate the MONITOR AMPLITUDE control RV3 fully clockwise and note that the current is between 0.8 and 2.1 mA. (Full scale deflection of the meter is 3 mA).

3. Connect Test Potentiometer (1-68Ω) to PLH. Check that RV3 can be adjusted such that the sinewave peaks can be viewed at SKC on the 5V range of A1 amplifier of the oscilloscope. Remove connection to PLH.

4. Check with the Metering Unit that the quiescent value currents are within the limits shown in Table 2.

Table 2

Switch Position	Current in mA	Full scale of meter
V1 (a)	1.6 - 3.0	3.0 mA
V1 (b)	2.7 - 4.5	10.0 mA
V2 (a)	2 - 3.5	10.0 mA
V2 (b)	1.5 - 2.5	3.0 mA
V3 (a)	0.75 - 1.25	3.0 mA
V3 (b)	0.75 - 1.25	3.0 mA
V4	3 - 6	10 mA

Table 2 (Contd.)

Switch Position	Current in mA	Full scale of meter
V5	14 - 24	30 mA
V7	3 - 6	10 mA
V8	14 - 24	30 mA

5. Connect the Test Potentiometer B (1 - 10Ω) to PLG (1 kc/s INPUT) and turn the PHASE control RV1 fully clockwise. Check the amplitude of the sinewave at SKA is not greater than 1V peak-to-peak. Disconnect the Test Potentiometer.

6. Connect PLA of the Magslip Drive Unit to PLH of this unit. Connect the output of the 1 kc/s Oscillator to PLG. With the 1 kc/s input at PLG set to 1V peak-to-peak and the Magslip driven at between 120 and 180 r.p.m., adjust the MONITOR AMPLITUDE control RV3 so that the sinewave peaks are not limiting on their maximum amplitude on the 5V range of the A1 amplifier of the oscilloscope.

7. Adjust the PHASE control RV1 and the GAIN control RV2 alternately to obtain sinewave peaks of constant amplitude at SKC. Resetting of the MONITOR AMPLITUDE control RV3 may be found necessary to obtain satisfactory balance.

8. Adjust RV3 (MONITOR AMPLITUDE) for an overall amplitude of 5V and check that the variation of amplitude is less than 2V on the 50V A1 amplifier of the oscilloscope.

9.2.3 Amplifying Unit (Servo) Type 4269A (Unit 4)

Circuit Diagram	Fig.31
Component Layout	Fig.33

9.2.3.1 Test Equipment Required

Multi-range Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)
Two AF Oscillators capable of delivering 1 kc/s at 10V.	
Error Detector Unit Type 4274A	(Unit 11)
Amplifying Unit Type 4272A	(Unit 7)

Phase Inverter	(Fig.50(b))
Metering Unit Type 4353C	(Unit 6)
Power Supply Unit Type 4275A	(Unit 13)

9.2.3.2 Mechanical Tests

1. Ensure that all soldered joints are good.

2. Point-to-point check that the wiring is correct to the circuit diagram, and is continuous.

3. Check that the rotary switch operates mechanically and locates correctly.

9.2.3.3 Electrical Tests

1. Insert all valves and make the following connections to TB1.

   Tag 1 to Metering Unit Type 4353A TB1(11) and +300 volts.

   Tag 2 to tag 4 and chassis of power unit.

   Tag 3 to -300 volts.

   Tag 4)
) To 6.3V Volts 50 cycles.
   Tag 5)

   Tag 6 to Metering Unit Type 4353A TB1 (4)

2. Set the METERING switch on the Metering Unit to the appropriate position and then rotate the METERING switch on this unit to meter the quiescent valve currents. Check, after momentarily earthing the junction of R3 and R5, that these are within the limits shown in Table 3.

Table 3

Switch SWA Position	Current in mA	F.S.D. in mA
V2a	.24 - .35	3
V2b	1.5 - 1.3	3
V3a	.78 - 1.1	3
V3b	1.2 - 1.7	3
V4	.88 - 1.2	3
V5a	.78 - 1.1	3
V5b	.53 - .77	3
V6a	.50 - .72	3
V6b	.32 - .68	3
V7a	.88 - 1.1	3
V7b	.78 - 1.1	3

3. With the unit connected as shown in Fig.50(c) set the A.F. oscillators 1 and 2 to 1000 and 1020 c/s respectively and SWB to position 2. Check with the oscilloscope on its slowest range, that a waveform of a positive going sawtooth is present at SKC. Check that the overall amplitude is not less than 85 volts.

4. Check with a multirange meter that a positive voltage of not less than 25 volts is available at SKD.

5. Set SWB to position 3 and check that a waveform of a negative going sawtooth type is present at SKC. Check that the overall amplitude is not less than 85 volts.

6. Check with the multirange meter that a negative potential of not less than 25 volts is available at SKD.

7. With SWB set to position 1 check with the multirange meter that V5(6) grid (Junction of C12 and MR1) is within 100 mV of earth.

8. Connect PLH to earth, set RV1 fully clockwise and check that the d.c. output measured at SKD is between the limits 4.0 and 5.4V positive with respect to chassis.

9. Rotate RV1 to its fully counterclockwise position and check that the voltage at SKD is between 4.0 and 5.4V negative with respect to chassis.

10. Set RV1 such that the voltage between SKD and chassis is less than ±100 mV.

11. Inject a 1 kc/s sinewave of 10V peak-to-peak amplitude to PLH and check that a sinusoidal output of between 19 and 25V is available at PLK.

12. Transfer the input from PLH to PLJ and with the amplitude set to 4V p-p check that the output at PLK is between 20 and 29V peak-to-peak.

9.2.4 North Aligning Unit (Receiver) Type 4626A (Unit 5)

Circuit Diagram	Fig.34
Component Layout	Figures 35 and 36.

9.2.4.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)
Metering Unit Type 4353C	(Unit 6)
Signal Generator capable of supplying 140 and 145 kc/s up to 1V peal-to-peak.	
Power Supply Unit Type 4275A	(Unit 13)

9.2.4.2 Mechanical Tests

1. Ensure that all soldered joints are good.

2. Point to point check that the wiring is correct to the Circuit Diagram, and is continuous.

3. Check that the rotary switch operates mechanically and locates correctly.

9.2.4.3 Electrical Tests

1. Insert all valves, set RV1 (AUTO/ALIGN SENSITIVITY) and RV2 (NORTH-MARK SENSITIVITY) fully counterclockwise and make the following connections to TB1 and TB2:-

TB1:
- Tag 1 to +300 volts
- Tag 2 to Tag 4 and earth of power supply
- Tag 3 to -300 volts

(Tag 4)
TB1 (   ) 6.3 Volts 50 cycles
(Tag 5)

(Tag 3 to Metering Unit Type 4353C TB1 (5)
TB2 (
(Tag 4 to Metering Unit Type 4353C TB1 (12)

2. Earth PLE, switch Metering unit to 4626C and SWA to V2A.

3. Check that by adjusting RV1 (AUTO ALIGN SENSITIVITY) the current can reach 15 mA (F.S.D. 30 mA) before setting this control for 10 mA.

4. Repeat steps 2 and 3 with SWA set to V4b and by adjusting RV2 (NORTH MARK SENSITIVITY).

5. Check with a continuity tester that TB2(2) and TB2(6) are connected to earth and that TB2(1) and TB2(5) have no connection to earth.

6. Check with the Metering unit that the quiescent valve currents are within the limits shown in Table 4.

Table 4

Switch SWA Position	Current in mA	F.S.D. in mA
V1(a)	1.1 - 1.65	3
V1(b)	1.1 - 1.65	3
V2(b)	5 - 7.5	10
V3(a)	1.1 - 1.65	3
V3(b)	1.1 - 1.65	3
V4(a)	5 - 7.5	10

7. Remove earth connection from PLE and feed in 145 kc/s at 250 mV peak-to-peak from the signal generator. Check that this waveform appears at SKA. Tune the generator for maximum output observed on the A1 Amplifier of the oscilloscope at SKB. Adjust C27 for 10V negative to earth at the junction of C12 and R21.

8. Check that the peak-to-peak waveform at SKC is less than 1.2 volts. Check that TB2(1) and TB2(6) is connected to earth and that TB2(2) and TB2(5) have connection to earth.

9. Repeat step 7 above with the frequency set up 140 kc/s. The a.c. output monitored at SKC and the negative voltage developed across R45 should be adjusted to 10V by C28.

10. Check that the peak-to-peak waveform at SKB is less than 12 volts. Check that TB2(5) and TB2(2) are earthed and that TB2(6) and TB2(1) have no connection to earth.

9.2.5 Metering Unit Type 4353C (Unit 6)

Circuit Diagram	Fig.48
Component Layout	Fig.49

9.2.5.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Megger 500V	

9.2.5.2 Mechanical Tests

1. Ensure that all soldered joints are good.

2. Point to point check that the wiring is correct to the Circuit Diagram.

3. Check that the rotary switch operates mechanically and locates correctly.

4. Check that the biased lever switch functions correctly.

9.2.5.3 Electrical Tests

1. Point to point check with a multirange meter that all wiring is continuous but ensuring that it is not at any time connected across the meter M1.

2. Temporarily short circuit the meter M1 and check that the operation of switch SWB causes R1 to be short circuited and R2 to measure its normal resistance.

3. Using the Insulation Tester (Megger) check that all terminals of TB1 and TB2 are not less than 20 MΩ to frame.

9.2.6 Amplifying Unit Type 4272A (Unit 7)

Circuit Diagram	Fig.18
Component Layout	Fig.19 and 20

9.2.6.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 1035)
Two Sinewave L.F. Oscillators capable of delivering 2V peak-to-peak.	
Error Detector Unit Type 4272A	(Unit 11)
Gating Waveform Generator Type 4273A	(Unit 10)
Metering Unit Type 4353C	(Unit 6)

9.2.6.2 Mechanical Tests

1. Ensure that all solder joints are good.
2. Point to point check that the wiring is correct to the Circuit Diagram.
3. Check that the rotary switch operates mechanically and locates correctly.

9.2.6.3 Electrical Tests

1. Insert all valves and make the following connections to TB1.

   Tag 1 to Metering Unit Type 4353C TB2 (9) and +300 volts

   Tag 2 to Chassis of Power Units and one side of heater supply.

   Tag 3 to -300 volts.

   Tag 4 }
   Tag 5 } to 6.3V, 50 c/s heater supply

   Tag 6 to Metering Unit Type 4353C TB2 (4)

2. Earth SKA and SKC and check with the Metering Unit switched to 4272A, that the quiescent valve currents are within limits shown in Table 5.

Table 5

Switch Position	Current in mA	F.S.D.
V1 (a)	0.57 - 1.4	3 mA
V1((b)	0.57 - 1.4	3 mA
V2 (a)	0.76 - 1.1	3 mA
V2 (b)	0.77 - 1.42	3 mA
V3 (a)	0.57 - 1.4	3 mA
V3 (b)	0.57 - 1.4	3 mA
V4 (a)	0.77 - 1.42	3 mA
V4 (b)	0.76 - 1.1	3 mA
V5 (a)	8 - 14	30 mA
V5 (b)	0 0.23	10 mA

3. Remove earth connections to SKA and connect an L.F. Oscillator set to 1.5 volts peak-to-peak at 1000 c/s to PLH. Check on the A.1 amplifier of the oscilloscope that a 1 kc/s sinewave between 45 and 65 volts is present at PLJ, PLK and SKB.

4. Check with the oscilloscope that no waveform greater than 1V peak-to-peak is present at PLM.

5. Transfer connection from PLH to PLL, earth SKA and remove earth connection from SKC and check on the A.1 amplifier of the oscilloscope that a 1 kc/s sinewave between 65 and 90V is present at PLM and SKD.

6. Check with the oscilloscope that no waveform greater than 1V peak-to-peak is present at PLJ.
Make the connections to the unit as shown in Fig.50(d) with both SWB and SWC in position 1 and the oscillators set to give 50 volts peak-to-peak at 1 kc/s and 1.05 kc/s at PLK and PLM respectively. Check that TB1 (8) is connected to earth.

7. After about 10 seconds move SWB to position 2 and check that TB1 (8) is disconnected from earth in less than four seconds.

8. Return SWB to position 1 and after 30 seconds check that V5 (a) anode current is less than 0.5 mA.

9. Set SWC to position 2 and check that TB1 (8) remains connected to earth for not less than 4 seconds and not more than 12 seconds.

10. After 30 seconds, with SWC in position 1, remove PLN and check that TB1 (8) is connected to earth for not less than 2 seconds and not more than 10 seconds. Replace PLN.

11. Repeat Step 10 removing PLP instead of PLN.

12. After 30 seconds, with PLP replaced, move SWC to position 3 and check that TB1 (8) is connected to earth for not less than 2 seconds and not more than 10 seconds.

9.2.7 Motor Drive Unit Type 4271A (Unit 8)

Circuit Diagram	Fig.38
Component Layout	Fig.39 and 40

9.2.7.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Metering Unit Type 4353C	(Unit 6)

Two 1.5 kΩ, 15W Resistors

One 10Ω, 30W Resistor

Power Supply Unit Type 4275A (Unit 13)

9.2.7.2 Mechanical Tests

1. Ensure that all soldered joints are good.

2. Point to point check that the wiring is correct to the Circuit Diagram.

3. Check that the rotary switch operates mechanically and locates correctly.

4. Check that the toggle switch operates correctly.

9.2.7.3 Electrical Tests

1. Insert all valves and make the following connections to TB1 and TB2.

TB1. Tag 1 to +300 volts and TB2 (12) of Metering Unit 4353C

Tag 2 to earth and tag 4

Tag 3 to -300 volts.

Tag 4)
Tag 5) to 6.3 volts 50 cycles

Tag 6 to TB2 (3) of Metering Unit 4353C

TB2. Between tags 2 & 6, and connect one 1.5KΩ Watt resistor

Between tags 4 & 8, connect one 1.5KΩ 15 Watt resistor

Between tags 5 & 7, connect one 10Ω, 30 Watt resistor

Tag 1 to 230 Volts 50 c/s Neutral

Tag 2 to 230 Volts 50 c/s Line

2. Close SWB (SERVO ON) and check with a multirange meter 8 that the d.c. voltage across tags 5 and 7 of TB2 is between 13 and 19V.

3. Earth PLE and check with the Metering Unit switched to 4271A that the valve anode currents are within the limits shown in Table 6.

Table 6

Switch Position	Current in mA	F.S.D.
V1 (a)	0.8 - 1.75	3 mA
V1 (b)	0.45 - 1.1	3 mA
V2	29 - 49	100 mA
V3 (a)	0.8 - 1.75	3 mA
V3 (b)	0.45 - 1.1	3 mA
V4	29 - 49	100 mA

4. Connect PLE to a d.c. voltage from which the potentials required in the following tests may be obtained.
Check that V2 and V4 anode currents are within the limits shown in Table 7.

Table 7

Input Voltage at PLE	Valve	Current in mA	F.S.D.
+1.5	V2	31 - 64	100 mA
+1.5	V4	18 - 46	100 mA
-1.5	V2	18 - 46	100 mA
-1.5	V4	31 - 64	100 mA
+8.5	V2	64 - 95	100 mA
+8.5	V4	0 - 9	100 mA
-8.5	V2	0 - 9	100 mA
-8.5	V4	64 - 95	100 mA

9.2.8 Receiver Gearbox Unit Type 4276A (Unit 9)

Circuit Diagram Fig.41

Component Layout Fig.43 and 44

9.2.8.1 Test Equipment Required

Angle Dekkor (2 required)

12 Sided Polygon (2 required)

An input attachment capable of being mounted in place of the Servo Motor and provided with means for:-

(a) A pinion fitted in the same manner as the normal driving element.

(b) Mounting a Polygon (To be known as setting polygon).

(c) Applying a constant retarding torque (in either direction of rotation) of 4 - 5 oz. ins.

An output attachment capable of being mounted in place of the selsyn and coupled to the existing coupling and providing means for:-

(a) Mounting a Polygon. (To be known as Indicating Polygon).

(b) Means of applying a constant retarding torque (in either direction to the input) of 4 - 5 oz. ins.

9.2.8.2 Measurement of Total Error

1. Remove Servo.Motor.
   Care should be taken when disengaging pinion on motor from its meshing gear wheel.
   Replace by the input attachment as given in 9.2.8.1 care to be taken not to damage teeth of meshing gear wheel.

2. Remove Selsyn.
   Replace by the output attachment as shown in 9.2.8.1.

3. Mount the gearbox on a secure base and set Angle Dekkors in position as Fig.50(e) so as to take readings on the indicating and setting polygons.

4. Rotate the setting polygon through 7 faces (i.e. 210°) this will rotate indicating polygon one face (i.e. 30°) and a reading must be taken on the Angle Dekkor from the indicating polygon.

5. Repeat operation (see step 4) 11 times reaching 360° rotation of indicating polygon.

6. Continue rotating polygon for at least 2 faces. Reverse direction of setting polygon back to 'Zero' corresponding to 360° reading on indicating polygon from which a reading should be taken.

7. Repeat procedure of Steps 4 and 5 in reverse direction until the original setting of indicating polygon is reached.

8. Plot the error curve which will consists of one curve going 0° to 360° and one going 360° to 0°.

9. Determine the value of the greatest positive and negative ordinates which must not appear on the same single curve.
   The arithmetical addition of these values is equal to the TOTAL ERROR.
   In the case of a pair of curves consisting wholly of positive or wholly of negative oridnates the numerical value of the greatest ordinate shall be taken to equal of TOTAL ERROR.
   For the unit under test the TOTAL ERROR should not exceed 20 minutes of Arc from input to output.

9.2.9 Gating Waveform Generator Unit Type 4273A (Unit 10)

Circuit Diagram	Fig.22
Component Layout	Fig.23

9.2.9.1 Test Equipment Required

Multirange meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)
Oscillator capable of giving a sinewave of 1 kc/s at 50V peak-to-peak.	
Phase Shift Network consisting of calibrated 25 kΩ, $\frac{1}{2}$W variable resistor, 15000 pF ±2%, 1500 pF ±2%, and 110 kΩ, $\frac{1}{2}$W 1% resistor as shown in Fig.50(f).	
Metering Unit Type 4353C	(Unit 6)
Power Supply Unit Type 4275A	(Unit 13)

9.2.9.2 Mechanical Tests

1. Ensure that all soldered joints are good.

2. Point to point check that the wiring is correct to the Circuit Diagram.

3. Check that the rotary switch operates mechanically and locates correctly.

9.2.9.3 Electrical Tests

1. Insert all valves and make the following connections to TB1:-

   Tag 1 to +300 Volts and Metering Unit Type 4353C TB2 (10)

   Tag 2 to earth of power supply and tag 4

   Tag 3 to -300 Volts

   Tag 4) to 6.3 Volts 50 cycles
   Tag 5)

   Tag 6 to Metering Unit Type 4353C. TB2(5)

2. Temporarily earth the junction of C3 and R8 and check with Metering Unit switched to 4273C, that the quiescent valve currents are within limits shown in Table 8.

Table 8

Switch Position	Current in mA	F.S.D. mA
V1	0.75 - 1.05	3
V2 (a)	0.95 - 1.3	3
V2 (b)	0.2 - 0.3	3
V3	0 - 0.1	10
V4	4.4 - 6.8	10
V5 (a)	5.1 - 6.9	10
V5 (b)	5.1 - 6.9	10

3. Remove earth connection from C3 and connect phase shift network Fig.50(f) as follows:- Point C to PLE, point A to the Oscillator set to 1080 c/s ±5% at 50 volts ±10% and point D to the 50 volts range of the A2 Amplifier of the oscilloscope.

4. With the junction of C2 and C3 monitored on the 15 volt range of the A1 amplifier, adjust RV1 of the phase shift network such that the two sinewaves displayed are in phase. Check that the resistance of RV1 is between 5.5 kΩ and 17.5 kΩ.

5. Remove the phase shift network and connect the oscillator as set in Step 3 to PLE. With the A1 amplifier of the oscilloscope positively triggered from SKB, check that the waveforms at PLF, SKC, PLG and SKB are within the limits specified in Fig.50(g).

6. Check on the d.c. plates of the oscilloscope that the waveforms at SKC and SKB have their negative extremeties d.c. restored slightly positive to earth.

9.2.10 Error Detector Unit Type 4274A (Unit 11)

Circuit Diagram	Fig.25
Component Layout	Fig.28 and 29

9.2.10.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)
AF Oscillator capable of delivering 1.5V at 1 kc/s	

Magslip Amplifier and Monitoring Unit Type 4268A	(Unit 3)
Amplifying Unit Type 4272A	(Unit 7)
Resolver Magslip Type 15 RX 15K (CB)	(AG1)
Gating Waveform Generator Type 4273A	(Unit 10)
Power Supply Unit Type 4275A	(Unit 13)
Metering Unit Type 4353C	(Unit 6)

9.2.10.2 Mechanical Tests

1. Ensure that all solder joints are good.

2. Point to point check that the wiring is correct to the Circuit Diagram.

3. Check that the rotary switch operates mechanically and locates correctly.

4. Check that the toggle switch operates correctly.

9.2.10.3 Electrical Tests

1. Insert all valves and make the following connections to TB1:-

   Tag 1 to +300 volts and Metering Unit Type 4353C TB2(9)

   Tag 2 to Earth of power supply and tag 4

   Tag 3 to -300 Volts

   Tag 4)
) 6.3 Volts 50 cycles
   Tag 5)

   Tag 6 to Metering Unit Type 4353C TB2 (6)

   Earth PLP and PLQ and check on the Metering Unit that the quiescent valve currents are within the limits shown in Table 9.

Table 9

Switch Position	Current in mA	F.S.D. mA
V1a	0.6 - 1.0	3
V1b	0.3 - 0.7	3
V2a	0.8 - 2.0	3
V2b	0.8 - 2.0	3
V3	0 - 5.8	10
V4a	5.3 - 6.8	10
V4b	5.3 - 6.8	10
V5a	5.3 - 6.8	10
V5b	4.3 - 5.8	10
V6	2.7 - 4.0	10
V7	0 - 0.2	3
V8	2.7 - 4.0	10
V9a	5.3 - 6.8	10
V10a	0.3 - 0.7	3
V10b	0.6 - 1.0	3
V11	0 - 5.8	10
V12	0.8 - 2.0	3
V13	0 - 0.2	10
V14	0.8 - 2.0	3
V15	0 - 0.2	10
V16	3.3 - 4.8	10
V18a	0.8 - 1.0	3
V18b	0.8 - 1.0	3

2. Set up the test arrangement as shown in Fig.50(h). The Magslip Amplifier and its associated Magslip should be set up as detailed in Section 9.2.2. If for convenience of testing, a calibrated scale is fitted to the Magslip, it may be found necessary to reset the Magslip Amplifier controls about once a day, and the oscillator frequency should be stable to ±2%.

3. With the A.F. oscillator set to 1 kc/s at 1.25 volts and the A1 Amplifier of the Oscilloscope connected to the junction of C7 and R25 and positively triggered from SKD, adjust the rotor of the Magslip to obtain a waveform with a mark to space ratio as shown by Fig.50j(i). Check that the pulse amplitudes are as shown by Fig.50j(i).

4. Check that the waveforms at PLL and PLN are as shown by Figs.50j (ii) and 50j(iii) and that the time intervals A and B are between 475 and 525 μs.

5. Check that the waveform at SKB and SKD are similar to those at PLL and PLN respectively.

6. Check that the waveforms at SKE and SKF are as shown by Fig.50k (iv) and 50k(v) respectively, and that the pulse amplitudes are between 36 and 55 Volts d.c. restored slightly positive to earth on their negative extremeties.

7. Transfer the oscilloscope to SKG and check that the waveform observed is as Fig.50k(vi).

8. Check that no pulses are present at SKH.

9. With the multirange meter on the 100 volt d.c. range, check that the negative voltage at PLR is between 22 and 28 volts.

10. Interchange the inputs to PLP and PLQ and note that a waveform similar to Fig.50k(vi) is observed at SKH and that no pulses are present at SKG.

11. As in Step 9 check that a positive voltage of between 20 and 30 Volts is available at PLR.

12. Check that waveform at PLR is less than 50 mV peak to peak.

13. With the multirange meter still connected as in Step 1 rotate the magslip rotor and observe that the d.c. output increase smoothly to at least +45 volts before reducing smoothly to at least -42 volts.

9.2.11 Amplifying Unit (Filter) Type 4277A (Unit 12)

Circuit Diagram	Fig.14
Component Layout	Fig.15 and 16

9.2.11.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)
A.F. Oscillator covering range 800 c/s to 1500 c/s	
Metering Unit Type 4353C	(Unit 6)
Power Supply Unit Type 4275A	(Unit 13)

9.2.11.2 Mechanical Tests

1. Ensure that all soldered joints are good.
2. Point to point check that the wiring is correct to the Circuit Diagram.
3. Check that the rotary switch operates mechanically and locates correctly.

9.2.11.3 Electrical Tests

1. Ensure that the primary of the mains transformer is wired for the mains supply voltage (230V a.c. unless otherwise specified).
2. Insert all valves and make the following connections to TB1 and TB2.

<u>TB1</u> Tag 1 to Metering Unit Type 4353C TB2(12) and +300V,

Tag 2 to Chassis of Power Supply Unit.

Tag 3 to -300 Volts

Tag 6 to Metering Unit Type 4353C TB2(7)

<u>TB2</u> Tag 1 to 230V 50 c/s line.

Tag 2 to 230V 50 c/s neutral.

3. Set RV3 (LOOP GAIN) fully counterclockwise and check with the A.1 amplifier of the oscilloscope, that less than 100 mV peak waveform is present at PLD.

4. Check with the Metering Unit switch set to 4277A, that the quiescent valve currents are within the limits shown in Table 10.

Table 10

SWB. Switch Position	Current in mA	F.S.D.
V1 (a)	0.7 - 1.4	3 mA
V1 (b)	0.75 - 1.1	3 mA
V2 (a)	0.75 - 1.1	3 mA
V2 (b)	0.7 - 1.4	3 mA
V3 (a)	0.75 - 1.1	3 mA
V3 (b)	0.75 - 1.1	3 mA
V4 (a)	0.7 - 1.4	3 mA
V4 (b)	0.75 - 1.1	3 mA

5. Connect the A.F. oscillator, set to 1 Volt peak-to-peak at 900 c/s to PLE and close SWA (SET LOOP/GAIN NORMAL) to NORMAL. With RV1 (AMPLITUDE) fully clockwise and RV3 fully counterclockwise, adjust RV2 (FREQUENCY) for a maximum output of 900 c/s at PLD. Check that it is possible to tune through the maximum with RV2.

6. Repeat Step 5 with the oscillator set to 1150 c/s.

7. With RV2 set for maximum output at PLD and identically at SKB, set SWA to SET LOOP GAIN and adjust RV3 for an output of 20V peak-to-peak at 1150 c/s at PLD. Check that at least 20% of the full rotation of RV3 is available in both clockwise and counterclockwise directions.

8. Set RV3 just prior to the point when oscillation is observed at PLD. Operate SWA to the NORMAL position and if necessary reset RV2 for maximum output.

9. Rotate RV1 slowly in counterclockwise direction and note that the output at PLD is smoothly reduced to not greater than 100 mV peak-to-peak.

10. Set RV1 for 1 Volt peak-to-peak at PLD and check with the A.1 Amplifier of the oscilloscope that the input at the junction of RV1 and R1 is between 45 mV and 120 mV.

11. Set the A.F. oscillator to 1500 c/s and 800 c/s and check that the output at PLD is less than 150 mV.

12. Check with the multirange meter that between 6.6 volts and 7.2 volts are available between the following points:-

TB2 (3) and (4), (5) and (6), and (7) and (8)

TB3 (1) and (2), (3) and (4), and (5) and (6)

9.2.12 Power Supply Unit Type 4275A (Unit 13)

Circuit Diagram	Fig.45
Component Layout	Figures 46 and 47.

9.2.12.1 Test Equipment Required

Multirange Meter	(Avometer Model 8)
Oscilloscope	(Cossor Type 9172)

600Ω 150W Resistor and 1 kΩ, 90W resistor.

(Alternatively these resistors may be replaced by an electronic load for 500 mA at +300V and 300 mA at -300V)

Metering Panel Type 4353C	(Unit 6)

230V 1 KVA Variac,
0-270V output.

9.2.12.2 Mechanical Tests

1. Check wiring against circuit diagram for continuity and correctness.

2. Check that the soldered connections are sound.

3. Check that the potentiometers rotate smoothly.

4. Check that the toggle switches and push button switches are mechanically sound.

9.2.12.3 Electrical Tests

1. With all valves in place make the following connections on TB1.

Tags 2 and 3	600Ω 150 Watt load resistor
Tag 3 to TB2(2) of	Metering Panel
Tag 4 to TB2(1) of	Metering Panel
Tag 5 to TB1(6) of	Metering Panel
Tags 5 and 6	1 KΩ 90W load resistor
Tag 8 to Tag 4	(temporary connection)

2. Adjust the SET +300V control RV2 and the SET -300V control RV1 to their mid-positions and remove the P.O. relay cover.

3. Connect the output of the variac set to 230V to input terminals of PLA.

4. Close the MAINS ON switch SWA and check that LP2 lights. Observe that RLA energises in 30-90 seconds.

5. Check that the voltage at the valve heater pins are as follows:-

   6.1V to 6.5V a.c. between pins 4 and 9 of V8, V10, V13 and V15,

   4.85V to 5.15V a.c. between pins 2 and 8 of V1, V2, V3 and V5,

   and 25.2V and 26.8V a.c. between pins 1 and 7 of V6 and V11.

   NOTE: *Special care must be taken when measuring these voltages as most heaters are at a considerable d.c. potential relative to the chassis.*

6. Press the H.T. ON switch SWB and check that LP3 is lit.

7. Adjust RV2 and RV1 for +300V and -300V respectively as indicated on the Metering Panel set to the appropriate switch positions. Check with an accurate multirange meter that the voltages between TB1(4) and earth and TB1(6) and earth are +293 and -307V d.c. respectively.

8. Vary the SET--300V control RV1 from end to end and check that the output voltage monitored on multirange meter at TB1(6) increases negatively with clockwise rotation.
   The output voltage should vary over a range not less than 50V and not more than 90V, and it should be possible to set the voltage to any point within the range -285V to -315V.

9. Vary the SET +300V control RV2 from end to end and check that the output voltage monitored with the multirange meter at TB1(2) increases positively with clockwise rotation.
The output voltage should vary over a range not less than 50V and note more than 90V and it should be possible to set the voltage to any point within the range +285V to +315V.

10. Check with the oscilloscope that the ripple at V6 and V11 anodes is not less than 50V peak-to-peak.

11. Check that the unregulated d.c. voltage across C3 and C15 is not less than 420V and not more than 540V.

12. Vary the input mains voltage over the range 215V to 245V and check that there is no perceptible change of the regulated output voltage and that the ripple does not exceed 25 mV.

13. Check that the mains input voltage can be reduced to at least 210V before regulation falls out.

14. Press the H.T. OFF switch SWC and check that LP3 goes out and no h.t. voltages appear on any tags of TB1.

15. Momentarily earth tag 7 of TB1 and observe that the unit h.t. is switched on, indicated by the lighting of LP3.

16. Remove the connection between tags 4 and 8 of TB1 and note that the h.t. is switched off (LP3 goes out). Restore the connection.

17. Switch on the h.t. by pressing the H.T. ON switch SWB.

18. Remove fuse FS3 and check that the h.t. is switched, LP3 extinguished but LP5 glows. Replace FS3.

19. Switch on the h.t. by operating SWB. Remove FS2 and check that LP3 extinguishes and LP4 glows. Replace FS2.

20. Switch the h.t. on by operating the H.T. ON switch SWB and check the supply of 250V, 50 c/s exists between one pole of SWA and tag 1 of TB1.
Remove FS1 and check that the above voltage no longer exists and LP1 glows. Replace FS1.

21. Remove the mains input to h.t. chassis and replace relay cover.

MCL:- T.4719
Issue:- 2
Date:- 3-12-64

MASTER COMPONENTS LIST

FOR

TUNING RECEIVER SX.115 TYPE 6331A

(W.84542 Ed.A)

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1, in addition to the normal part identity.

2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.

3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but are not necessary.

4. Prices are subject to change without notice.

5. All items reference PC are standardised items and comply with Government specifications where these exist.

6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.

7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.

P.T.O.

8. The following abbreviations are used throughout this Master List:

Cap.	Capacitor
Carb.	Carbon
Cer.	Ceramic
C/O	Changeover
Coef.	Coefficient
Comp.	Composition
DP	Double Pole
DT	Double Throw
En.	Enamelled
Elyc.	Electrolytic
Fil.	Filament
FSD	Full Scale Deflection
Gd.	Grade
HS	High Stability
Indr.	Inductor
Insd.	Insulated
Insr.	Insulator
Lg.	Long
Lin.	Linear
Metd.	Metallised
Mld.	Moulded
Neg.	Negative
Osc.	Oscillator
Pap.	Paper
pF	Picofarad Micro-Microfarad
Psn.	Position
Potr.	Potentiometer
Prim.	Primary (winding)
PVC	Polyvinyl Chloride Compound Insulated
Rect.	Rectifier
Res.	Resistor
Sec.	Secondary (winding)
Sil.Mica.	Silver Mica
Sil.Mica.Prot.	Silver Mica Protected
SP	Single Pole
Temp.	Temperature
Term.	Terminal
Transf.	Transformer
Tub.	Tubular
Vble.	Variable
Vit.	Vitreous
W/W	Wirewound

No.	Description and Identity	Qty.	Price Each † £. s. d.
43	Cap. Pap. 0.02uF ±20% 150V PC.19307-8	1	3 0
44	Cap. Pap. 8uF ±20% 800V PC.19213-4	4	1 10 0
45	Cap. Pap. 0.1uF ±20% 1000V PC.19205-10	2	2 6
46	Cap. Pap. 0.5uF ±20% 1000V PC.19214-2	2	11 6
47	Cap. Sil. Mica 0.005uF ±2% 350V WIS.7587-B-1-13	2	1 15 0
48	Cap. Sil. Mica 0.03uF ±2% 350V WIS.7584-B-1-4	4	1 15 0
49	Cap. Mica 100pF ±2% 350V PC.18803-25	2	5 6
50	Cap. Pap. 0.5uF ±20% 500V PC.19203-24	2	3 6
51	Cap. Pap. 4uF ±20% 600V PC.19212-3	2	1 1 0
52	Cap. Vble. 3-30pF 75V PC.20001-2	6	2 0
53	Cap. Retaining WIS.6647-B-1-2	3	1 0
54	Clamp Spring PC.20702-1	4	2 6
55	Connector Assembly (Top Cap) W.25457-C-3-AE	2	14 0
56	Connector Assembly (Top Cap) W.25457-C-3-AD	2	14 0
57	Crystal Quartz 140 kc/s Type QO.1655A	1	4 11 6
58	Crystal Quartz 145 kc/s Type QO.1655A	1	4 11 6
59	Fuse 5A WIS.2947-1-11	1	+3 6
60	Fuse 7.5A WIS.3117-1-1	1	+3 6
61	Fuse 750mA WIS.2947-1-6	1	+3 6
62	Fuse 500mA WIS.2947-1-5	1	+3 6
63	Fuseholder WIS.4154-C-1-1	4	3 6
64	Generator WIS.8078-B-1-1	1	32 7 6
65	Indr. WIS.5690-B-108	3	9 12 6
66	Indr. WIS.5690-B-110	3	9 12 6
67	Indr. WIS.5690-B-109	2	9 12 6
68	Indr. WIS.5696-C-99	1	17 10 0
69	Indr. WIS.5696-C-98	1	12 0 6
70	Knob Finger WIS.6647-B-1-5	3	3 0
71	Lamp Neon 0.2W PC.48702-1	3	3 0
72	Lamp 2.3W PC.48701-2	2	1 0
73	Lampholder M.E.S. WIS.6258-C-1-2	2	13 0
74	Lampholder S.E.S. WIS.6565-C-1-1	3	19 6

No.	Description and Identity	Qty.	Price Each † £. s. d.
238	Socket WIS.6562-C-1-14	37	1 0
239	Socket WIS.6562-C-1-6	9	1 0
240	Socket Relay PC.66202-1	3	19 6
241	Socket Relay PC.66205-1	1	3 6
242	Nut (Spindle Locking Device) PH.71101-1	2	1 0
242A	Cap (Spindle Locking Device) PH.71103-1	2	1 0
243	Spring Retaining PC.66204-1	1	1 0
244	Spring Retaining PC.66201-1	3	4 0
245	Switch WIS.5555-C-507	2	1 6 0
246	Switch WIS.5555-C-493	1	1 6 0
247	Switch WIS.5811-B-22	1	3 12 0
248	Switch WIS.5103-C-2-21	1	9 0
249	Switch WIS.5555-C-522	1	1 6 0
250	Switch WIS.5555-C-516	1	1 6 0
251	Switch WIS.5555-C-506	1	1 6 0
252	Switch WIS.5555-C-463	1	1 6 0
253	Switch PC.71301-2	2	7 0
254	Switch PC.71304-1	1	10 0
255	Switch WIS.7244-C-1-1	2	9 0
256	Switch WIS.5555-C-505	1	1 6 0
257	Switch WIS.5555-C-462	1	1 13 0
258	Term. Block WIS.6601-C-1-22	1	3 6
259	Term. Block WIS.6601-C-1-20	1	2 6
260	Term. Block WIS.6602-C-1-44	6	5 6
261	Term. Block WIS.6602-C-1-48	2	7 6
262	Term. Block WIS.6602-C-1-42	5	4 0
263	Term. Block W.59389-B-1-A	1	2 1 6
264	Transf. WIS.5695-C-225	1	46 13 0
265	Valve Z77	28	
266	Valve ECC81	16	
267	Valve ECC83	23	
268	Valve E2266	4	
269	Valve EB91	2	
270	Valve CV469	1	
271	Valve CV2209	1	
272	Valve 5R4G	5	
273	Valve 13E1SB	2	
274	Valve QS75/20	2	
275	Valve QS83/3	2	

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No.	Description and Identity	Qty.	Price Each † £. s. d.
75	Magslip Resolver WIS.7017-B-1-1	1	121 0 0
76	Metal Mounting WIS.6647-B-1-1	3	4 0
77	Meter WIS.3686-15-225A	1	5 16 6
78	Motor (Split Field) WIS.8079-B-1-1	1	52 19 0
79	Plate PC.66203-1	1	1 0
80	Plug Coaxial WIS.4650-B-1-3	32	5 0
81	Plug WIS.3049-1-1	1	9 0
82	Rect. Crystal CV448	2	2 6
83	Rect. Crystal CV448	21	2 6
84	Rect. Metrosil WIS.4601-C-1-15	1	9 6
85	Rect. Selenium WIS.2360-5-59	1	9 2 0
86	Relay PC.65201-5	3	2 6 6
87	Relay 2C PC.65404-5	0	1 17 6
88	Relay WIS.1829-39-537	1	2 15 6
89	Relay WIS.1829-39-542	1	2 6 6
90	Relay PC.65403-5	1	2 19 0
91	Relay Cover PC.66002-1	1	8 0
92	Res. Comp. 4.7k ohms ±5% 0.5W PC.66605-33	2	1 0
93	Res. Comp. 33k ohms ±10% 0.5W PC.66611-43	17	1 0
94	Res. Comp. 100 ohms ±10% 0.25W PC.66610-13	46	1 0
95	Res. W/W 33k ohms ±5% 6W PC.67010-22	18	4 0
96	Res. Carb. 10 ohms ±5% 0.5W PC.66605-1	25	1 0
97	Res. Comp. 12k ohms ±10% 0.75W PC.66612-32	12	1 0
98	Res. Comp. 470k ohms ±10% 0.25W PC.66610-57	24	1 0
99	Res. Comp. 330 ohms ±10% 0.25W PC.66610-19	72	1 0
100	Res. Carb. 68 ohms ±2% 0.5W WIS.7313-B-1-20	3	2 0
101	Res. Carb. 47 ohms ±2% 0.5W WIS.7462-B-1-88	3	3 0
102	Res. Carb. 10 ohms ±2% 0.5W WIS.7462-B-1-86	3	3 0
103	Res. Carb. 330k ohms ±5% 0.5W PC.66605-55	5	1 0
104	Res. Carb. 560k ohms ±5% 0.5W PC.66605-58	2	1 0
105	Res. Carb. 220k ohms ±2% 0.5W **WIS.7313-B-1-77**	2	3 0
106	Res. Carb. 330k ohms ±2% 0.5W WIS.7313-B-1-11	4	3 0
107	Res. Carb. 100k ohms ±2% 0.5W WIS.7313-B-1-12	6	3 0
108	Res. Comp. 33k ohms ±10% 0.25W PC.66610-43	6	1 0
109	Res. Carb. 430k ohms ±2% 0.5W WIS.7313-B-1-80	3	3 0
110	Res. Comp. 100k ohms ±10% 0.25W PC.66610-49	8	1 0

No.	Description and Identity	Qty.	Price Each † £. s. d.
111	Res. Comp. 1.5k ohms ±10% 0.25W PC.66610-27	2	1 0
112	Res. Carb. 430 ohms ±2% 0.5W WIS.7313-B-1-82	2	3 0
113	Res. Comp. 220k ohms ±10% 0.5W PC.66611-53	7	1 0
114	Res. Comp. 22k ohms ±10% 0.25W PC.66610-41	4	1 0
115	Res. Comp. 10k ohms ±10% 0.25W PC.66610-37	5	1 0
116	Res. Comp. 1k ohms ±10% 0.25W PC.66610-25	8	1 0
117	Res. Comp. 470 ohms ±10% 0.25W PC.66609-15	2	1 0
118	Res. Comp. 100 ohms ±10% 0.5W PC.66611-13	2	1 0
119	Res. Comp. 7.5k ohms ±5% 0.5W WIS.7313-B-1-74	2	2 6
120	Res. Comp. 330k ohms ±10% 0.25W PC.66610-55	9	1 0
121	Res. Comp. 33 ohms ±5% 0.5W PC.66605-7	22	1 0
122	Res. Comp. 27k ohms ±10% 0.75W PC.66612-36	6	1 0
123	Res. Comp. 150 ohms ±5% 0.5W PC.66605-15	48	1 0
124	Res. Comp. 39k ohms ±5% 0.5W PC.66605-44	2	1 0
125	Res. Comp. 680k ohms ±2% 0.75W WIS.7312-B-1-41	5	3 0
126	Res. Comp. 1M ohms ±2% 1W WIS.7311-B-1-13	3	4 6
127	Res. Comp. 150k ohms ±10% 0.75W PC.66612-45	1	1 0
128	Res. Comp. 15k ohms ±10% 0.25W PC.66610-39	5	1 0
129	Res. Comp. 56k ohms ±5% 0.5W PC.66605-46	1	1 0
130	Res. Comp. 1.8k ohms ±5% 0.5W PC.66605-28	1	1 0
131	Res. Comp. 1M ohms ±10% 0.25W PC.66610-61	9	1 0
132	Res. Comp. 100k ohms ±5% 1W PC.66607-49	3	1 6
133	Res. Comp. 330k ohms ±10% 0.75W PC.66612-49	1	1 0
134	Res. Comp. 100k ohms ±5% 0.5W PC.66605-49	4	1 0
135	Res. Comp. 1k ohms ±10% 0.5W PC.66611-25	4	1 0
136	Res. Comp. 180k ohms ±2% 0.75W WIS.7312-B-1-45	2	3 0
137	Res. Comp. 270k ohms ±2% 1W WIS.7311-B-1-23	2	4 6
138	Res. Comp. 1k ohms ±5% 0.75W PC.66606-25	2	1 0
139	Res. Comp. 75k ohms ±2% 0.5W WIS.7313-B-1-108	2	3 0
140	Res. Comp. 1M ohms ±5% 1W PC.66607-61	2	1 6
141	Res. Comp. 1.5M ohms ±10% 0.25W PC.66610-63	2	1 0
142	Res. Comp. 150k ohms ±5% 0.5W PC.66605-51	2	1 0
143	Res. Comp. 150k ohms ±10% 0.5W PC.66611-51	5	1 0
144	Res. Comp. 3.3k ohms ±10% 0.5W PC.66611-31	1	1 0
145	Res. Comp. 68k ohms ±10% 0.5W PC.66611-47	1	1 0
146	Res. Comp. 10k ohms ±10% 0.75W PC.66612-31	3	1 0
147	Res. Comp. 330k ohms ±10% 0.5W PC.66611-55	9	1 0
148	Res. Comp. 150k ohms ±10% 0.25W PC.66610-51	1	1 0
149	Res. Comp. 2.7k ohms ±10% 0.25W PC.66610-30	1	1 0
150	Res. Comp. 10 ohms ±10% 0.25W PC.66610-1	3	1 0
151	Res. Comp. 680k ohms ±10% 0.25W PC.66610-59	2	1 0
152	Res. Carb. 1M ohms ±2% 0.75W PC.66619-2	13	1 0
153	Res. Carb. 1.5M ohms ±2% 0.75W PC.66619-3	6	1 0

No.	Description and Identity	Qty.	Price † Each £. s. d.
154	Res. Comp. 100k ohms ±10% 0.5W PC.66611-49	21	1 0
155	Res. Comp. 2.2M ohms ±10% 0.25W PC.66610-65	6	1 0
156	Res. Comp. 82k ohms ±10% 0.25W PC.66610-48	1	1 0
157	Res. Comp. 4.7k ohms ±10% 0.25W PC.66610-33	3	1 0
158	Res. Carb. 220k ohms ±5% 0.5W PC.66605-53	6	1 0
159	Res. Carb. 1.2M ohms ±2% 0.75W WIS.7312-B-1-4	2	3 0
160	Res. Carb. 1M ohms ±5% 0.5W PC.66605-61	2	1 0
161	Res. Carb. 150k ohms ±5% 0.75W PC.66606-51	2	1 0
162	Res. Carb. 15k ohms ±5% 0.5W PC.66605-39	2	1 0
163	Res. Carb. 3.3k ohms ±5% 0.5W PC.66605-31	2	1 0
164	Res. Carb. 33k ohms ±5% 0.5W PC.66605-43	2	1 0
165	Res. Carb. 470k ohms ±5% 0.5W PC.66605-57	5	1 0
166	Res. Comp. 220k ohms ±10% 0.75W PC.66612-47	4	1 0
167	Res. Comp. 3.3M ohms ±10% 0.5W PC.66606-70	2	1 0
168	Res. Comp. 100k ohms ±10% 0.75W PC.66612-43	26	1 0
169	Res. Comp. 47k ohms ±10% 0.5W PC.66610-45	2	1 0
170	Res. Carb. 10k ohms ±5% 0.5W PC.66605-37	1	1 0
171	Res. Comp. 6.8k ohms ±10% 0.25W PC.66610-35	6	1 0
172	Res. Comp. 1.8k ohms ±10% 0.25W PC.66610-28	2	1 0
173	Res. Carb. 1.5M ohms ±2% 1W WIS.7311-B-1-25	7	4 6
174	Res. Carb. 6.8k ohms ±5% 0.5W PC.66605-35	1	1 0
175	Res. Comp. 1M ohms ±10% 0.5W PC.66611-61	6	1 0
176	Res. Comp. 33k ohms ±10% 0.5W PC.66611-43	1	1 0
177	Res. Carb. 2.4M ohms ±1% 0.75W WIS.7312-B-1-2	1	4 6
178	Res. Carb. 3.3M ohms ±1% 0.75W WIS.7312-B-1-3	1	5 6
179	Res. Comp. 390k ohms ±10% 0.25W PC.66610-56	1	1 0
180	Res. Comp. 3.3M ohms ±10% 0.5W PC.66611-67	2	1 0
181	Res. Comp. 2.2M ohms ±10% 0.5W PC.66611-65	1	1 0
182	Res. Carb. 1.5M ohms ±1% 0.75W WIS.7312-B-1-5	1	4 6
183	Res. W/W 10k ohms ±10% 3W PC.67008-19	1	3 0
184	Res. Comp. 220k ohms ±10% 0.25W PC.66610-53	2	1 0
185	Res. Comp. 150k ohms ±5% 1W PC.66607-51	2	1 6
186	Res. Comp. 1M ohms ±2% 0.5W WIS.7313-B-1-10	2	3 0
187	Res. Comp. 15k ohms ±10% 0.75W PC.66612-33	2	1 0
188	Res. Comp. 1.5M ohms ±2% 0.5W WIS.7313-B-1-83	1	4 0
189	Res. Comp. 18k ohms ±2% 0.5W WIS.7313-B-1-84	2	3 0
190	Res. Comp. 330k ohms ±2% 0.75W WIS.7312-B-1-44	2	3 0
191	Res. Comp. 680 ohms ±5% 0.5W PC.66605-23	2	1 0
192	Res. W/W 470 ohms ±5% 6W PC.67010-11	2	2 6
193	Res. W/W 100 ohms ±5% 6W PC.67010-7	10	2 6
194	Res. Comp. 220 ohms ±10% 0.25W PC.66610-17	2	1 0
195	Res. W/W 22k ohms ±5% 6W PC.67010-21	7	4 0
196	Res. Comp. 68k ohms ±2% 0.5W WIS.7462-B-1-21	2	2 0

No.	Description and Identity	Qty.	Price Each † £.	s.	d.
197	Res. Comp. 4.7k ohms ±2% 0.5W WIS.7462-B-1-22	4		2	0
198	Res. Comp. 120k ohms ±5% 0.5W PC.66605-50	2		1	0
199	Res. Comp. 10k ohms ±10% 0.25W PC.66610-37	2		1	0
200	Res. Comp. 15k ohms ±5% 0.75W PC.66606-39	2		1	0
201	Res. Comp. 47k ohms ±10% 0.5W PC.66611-45	4		1	0
202	Res. Comp. 100k ohms ±10% 0.25W PC.66610-49	2		1	0
203	Res. Comp. 300k ohms ±1% 0.75W WIS.7463-B-1-13	2		2	6
204	Res. W/W 68k ohms ±5% 6W PC.67010-24	1		6	0
205	Res. W/W 56k ohms ±5% 6W WIS.7415-B-1-4	1		9	0
206	Res. W/W 22 ohms ±5% 30W PC.67003-3	1		8	6
207	Res. Comp. 100k ohms ±1% 0.5W WIS.7313-B-1-54	1		3	6
208	Res. Comp. 110k ohms ±1% 0.5W WIS.7313-B-1-85	1		3	6
209	Res. Comp. 470k ohms ±10% 0.5W PC.66611-57	1		1	0
210	Res. Comp. 39k ohms ±10% 0.25W PC.66610-44	1		1	0
211	Res. Comp. 270k ohms ±10% 0.5W PC.66611-54	1		1	0
212	Res. Comp. 10k ohms ±10% 0.5W PC.66611-37	5		1	0
213	Res. Comp. 22k ohms ±10% 0.75W PC.66612-35	4		1	0
214	Res. Comp. 330k ohms ±5% 1W PC.66607-55	2		1	6
215	Res. Comp. 910k ohms ±1% 1W WIS.7311-B-1-26	2		5	0
216	Res. Comp. 3.3k ohms ±10% 0.25W PC.66610-31	1		1	0
217	Res. Comp. 560k ohms ±10% 0.75W PC.66612-52	1		1	0
218	Res. Comp. 22k ohms ±10% 0.5W PC.66611-41	1		1	0
219	Res. Comp. 68k ohms ±10% 0.75W PC.66612-41	6		1	0
220	Res. Comp. 33k ohms ±10% 0.75W PC.66612-37	2		1	0
221	Res. Comp. 47k ohms ±10% 0.5W PC.66611-45	1		1	0
222	Res. Comp. 8.2k ohms ±10% 0.25W PC.66610-36	2		1	0
223	Res. Comp. 150 ohms ±10% 0.25W PC.66610-15	2		1	0
224	Res. Comp. 39k ohms ±10% 0.5W PC.66611-44	2		1	0
225	Res. Comp. 4.7k ohms ±10% 0.25W PC.66610-33	1		1	0
226	Res. Comp. 5.6k ohms ±10% 0.25W PC.66610-34	1		1	0
227	Res. Comp. 2.2k ohms ±10% 0.25W PC.66610-29	1		1	0
228	Res. Comp. 18k ohms ±10% 0.75W PC.66612-34	3		1	0
229	Res. Comp. 15k ohms ±10% 0.5W PC.66611-39	2		1	0
230	Res. Vble. W/W 1k ohms ±10% 1W PC.67402-29	2		11	0
231	Res. Vble. W/W 10k ohms ±10% 1W PC.67402-41	2		11	6
232	Res. Vble. W/W 50k ohms ±10% 1W PC.67402-49	4		11	6
233	Res. Vble. W/W 100k ohms ±10% 1W PC.67402-53	1		13	6
234	Res. Vble. Comp. 100k ohms ±20% 0.25W PC.67202-25	1		6	6
235	Res. Vble. W/W 25k ohms 1W PC.67402-45	2		11	6
236	Selsyn WIS.6740-1-2	1	64	6	0
237	Socket Coaxial WIS.4650-B-1-4	2		5	6

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No.	Description and Identity	Qty.	Price Each † £. s. d.		
238	Socket WIS.6562-C-1-14	37		1	0
239	Socket WIS.6562-C-1-6	9		1	0
240	Socket Relay PC.66202-1	3		19	6
241	Socket Relay PC.66205-1	1		3	6
242	Nut (Spindle Locking Device) PH.71101-1	2		1	0
242A	Cap (Spindle Locking Device) PH.71103-1	2		1	0
243	Spring Retaining PC.66204-1	1		1	0
244	Spring Retaining PC.66201-1	3		4	0
245	Switch WIS.5555-C-507	2	1	6	0
246	Switch WIS.5555-C-493	1	1	6	0
247	Switch WIS.5811-B-22	1	3	12	0
248	Switch WIS.5103-C-2-21	1		9	0
249	Switch WIS.5555-C-522	1	1	6	0
250	Switch WIS.5555-C-516	1	1	6	0
251	Switch WIS.5555-C-506	1	1	6	0
252	Switch WIS.5555-C-463	1	1	6	0
253	Switch PC.71301-2	2		7	0
254	Switch PC.71304-1	1		10	0
255	Switch WIS.7244-C-1-1	2		9	0
256	Switch WIS.5555-C-505	1	1	6	0
257	Switch WIS.5555-C-462	1	1	13	0
258	Term. Block WIS.6601-C-1-22	1		3	6
259	Term. Block WIS.6601-C-1-20	1		2	6
260	Term. Block WIS.6602-C-1-44	6		5	6
261	Term. Block WIS.6602-C-1-48	2		7	6
262	Term. Block WIS.6602-C-1-42	5		4	0
263	Term. Block W.59389-B-1-A	1	2	1	6
264	Transf. WIS.5695-C-225	1	46	13	0
265	Valve Z77	28			
266	Valve ECC81	16			
267	Valve ECC83	23			
268	Valve E2266	4			
269	Valve EB91	2			
270	Valve CV469	1			
271	Valve CV2209	1			
272	Valve 5R4G	5			
273	Valve 13E1SB	2			
274	Valve QS75/20	2			
275	Valve QS83/3	2			

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No.	Description and Identity	Qty.	Price Each † £. s. d.
276	Valveholder PC.81811-1	37	1 0
277	Valveholder PC.81816-1	39	1 0
278	Valveholder PC.81817-1	4	1 0
279	Valveholder PC.81809-1	2	1 15 0
280	Valveholder PC.81814-1	5	1 0
281	Valve Retainer WIS.6271-C-2-11	4	10 0
282	Valve Retainer WIS.3449-C-1-6	2	7 6
283	Valve Retainer WIS.3701-C-1-12	5	2 0
284	Relay 2C 300V PC.65408-5	1	2 2 0
285	Cap. sil. mica. 220pF ±2% 350V PC.18803-33	4	2 6
286	Cap. sil. mica. 180p. ±2% 350V PC.18803-31	1	2 6

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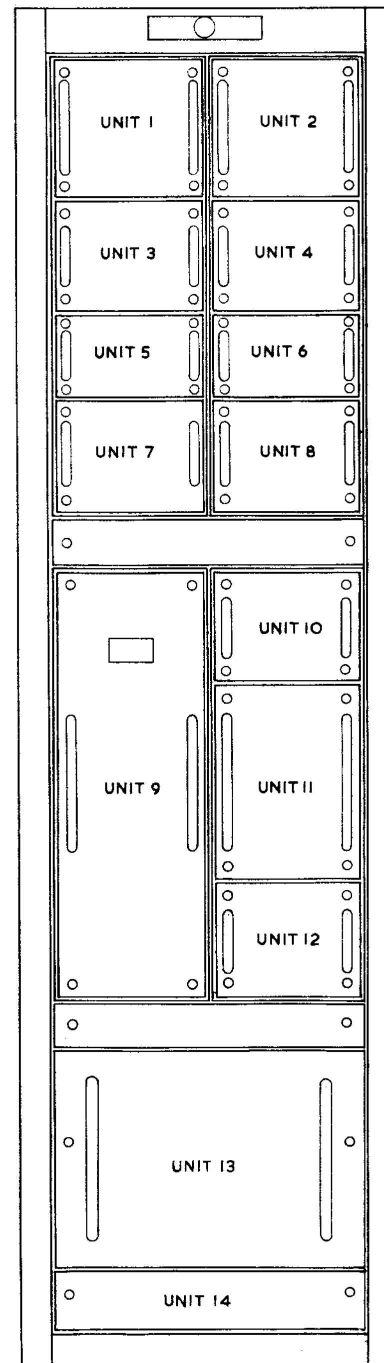
REAR VIEW

KEY

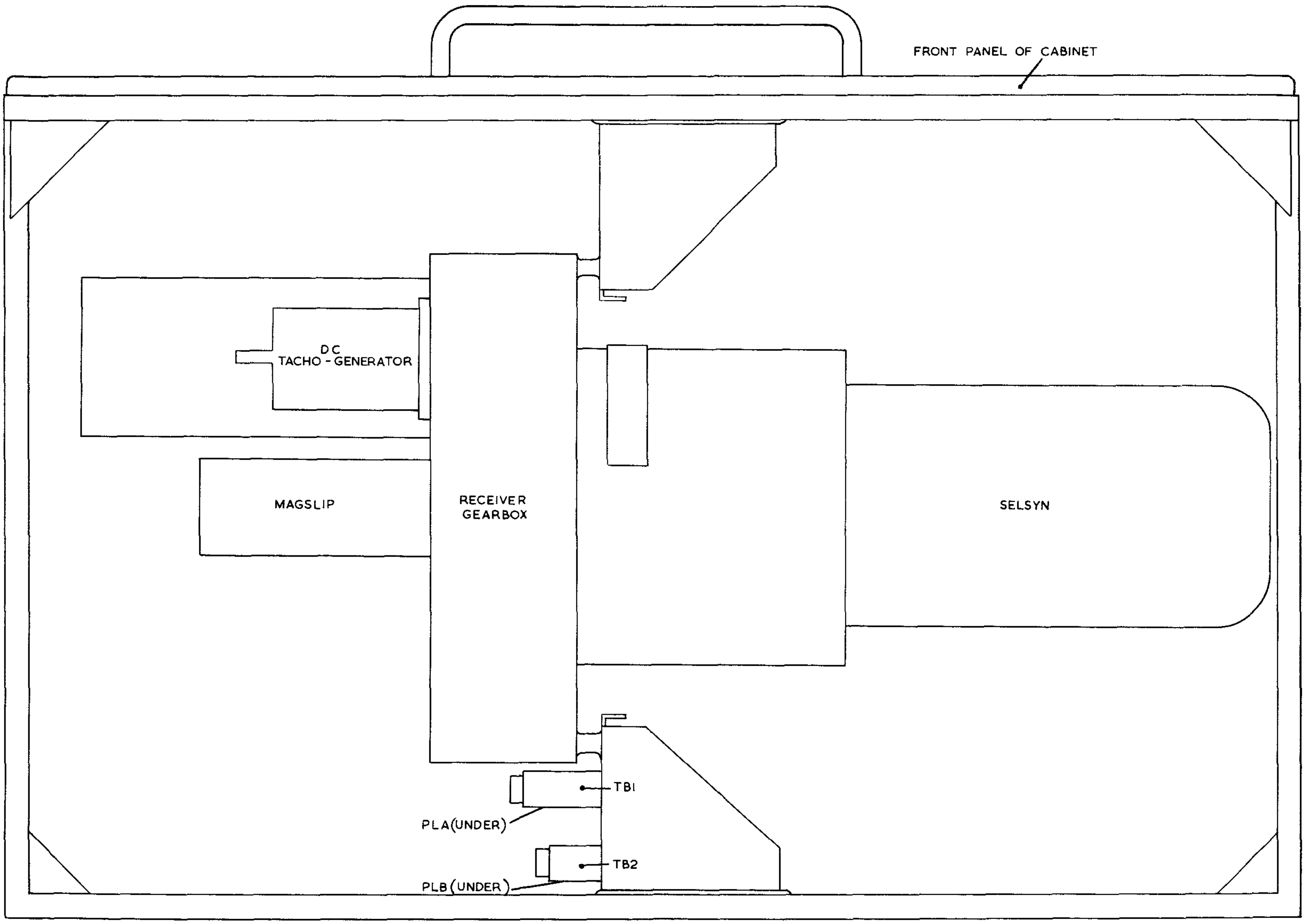
UNIT	DESCRIPTION
1	FILTER AND DETECTOR UNIT TYPE 4267A
2	FILTER AND DETECTOR UNIT TYPE 4267B
3	MAGSLIP AMP. AND MONITOR UNIT TYPE 4268A
4	AMPLIFIER UNIT (SERVO) TYPE 4269A
5	NORTH ALIGNING UNIT (RECEIVING) TYPE 4626A
6	METERING UNIT TYPE 4353C
7	AMPLIFYING UNIT TYPE 4272A
8	MOTOR DRIVE UNIT TYPE 4271A
9	RECEIVER GEARBOX TYPE 4276A
10	GATING WAVEFORM GENERATOR UNIT TYPE 4273A
11	ERROR DETECTOR UNIT TYPE 4274A
12	AMPLIFYING UNIT (FILTER) TYPE 4277A
13	POWER UNIT TYPE 4275A
14	AC SWITCHING AND DISTRIBUTION PANEL



FRONT VIEW

RECEIVER TURNING CABINET SX115
UNIT LAYOUT
WZ. 21672/B Sh. 1 Iss. 2

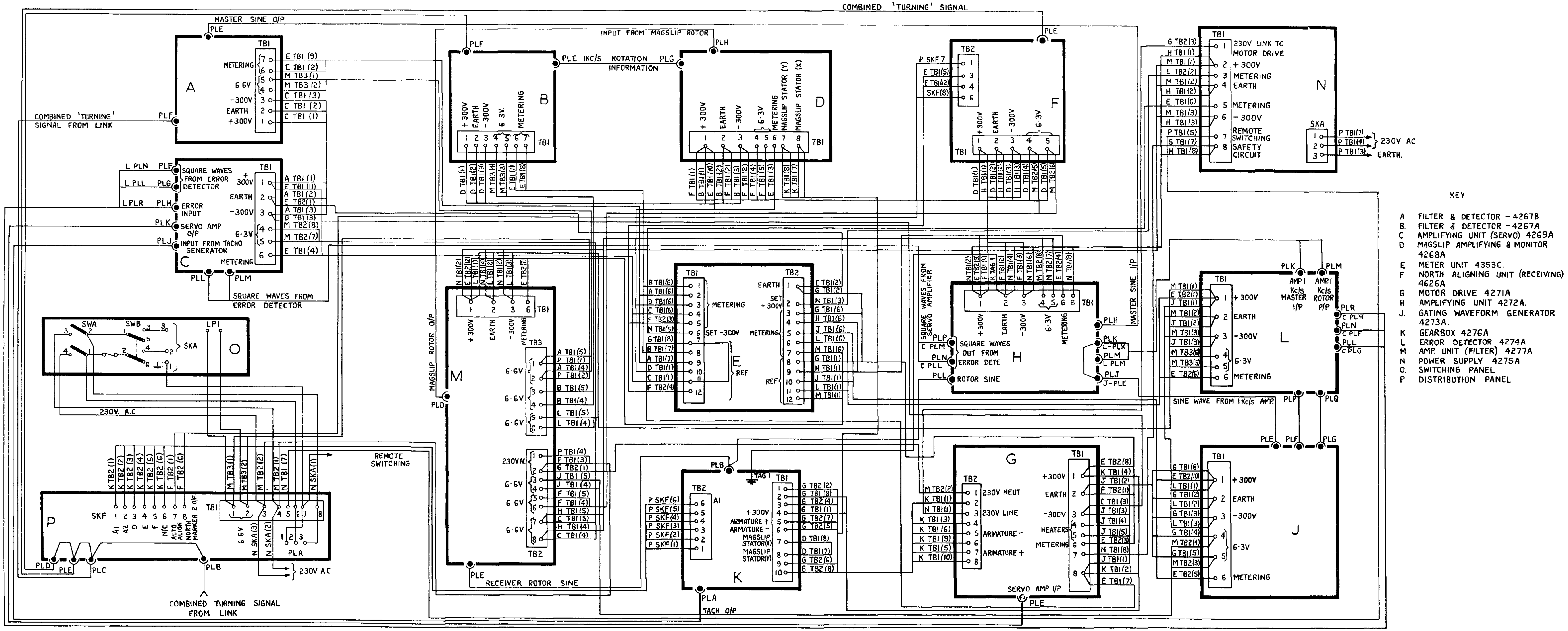
FIG. 1



SIDE VIEW OF RECEIVER GEARBOX AND MOUNTING
(FRAME VIEWED FROM RUNNER SIDE)

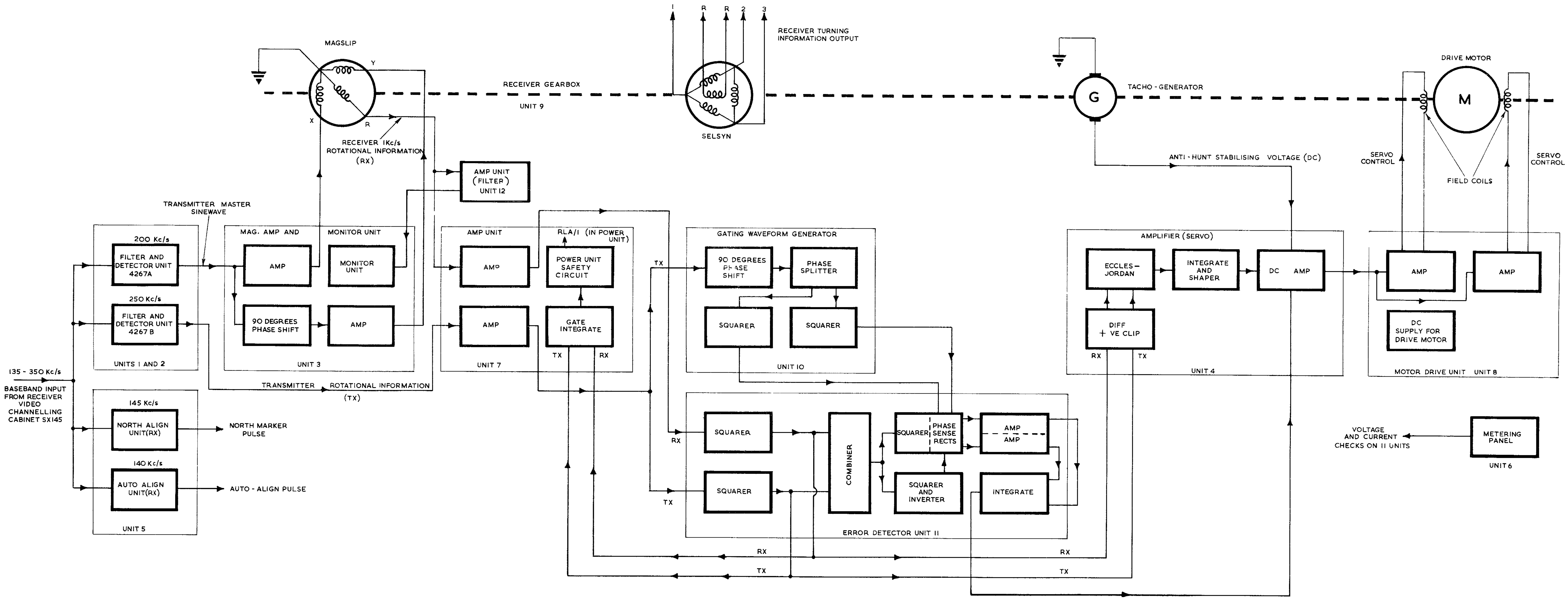
RECEIVER TURNING CABINET SX115
UNIT LAYOUT
WZ. 21672/D Sh. 2 Iss. 2

FIG. 2



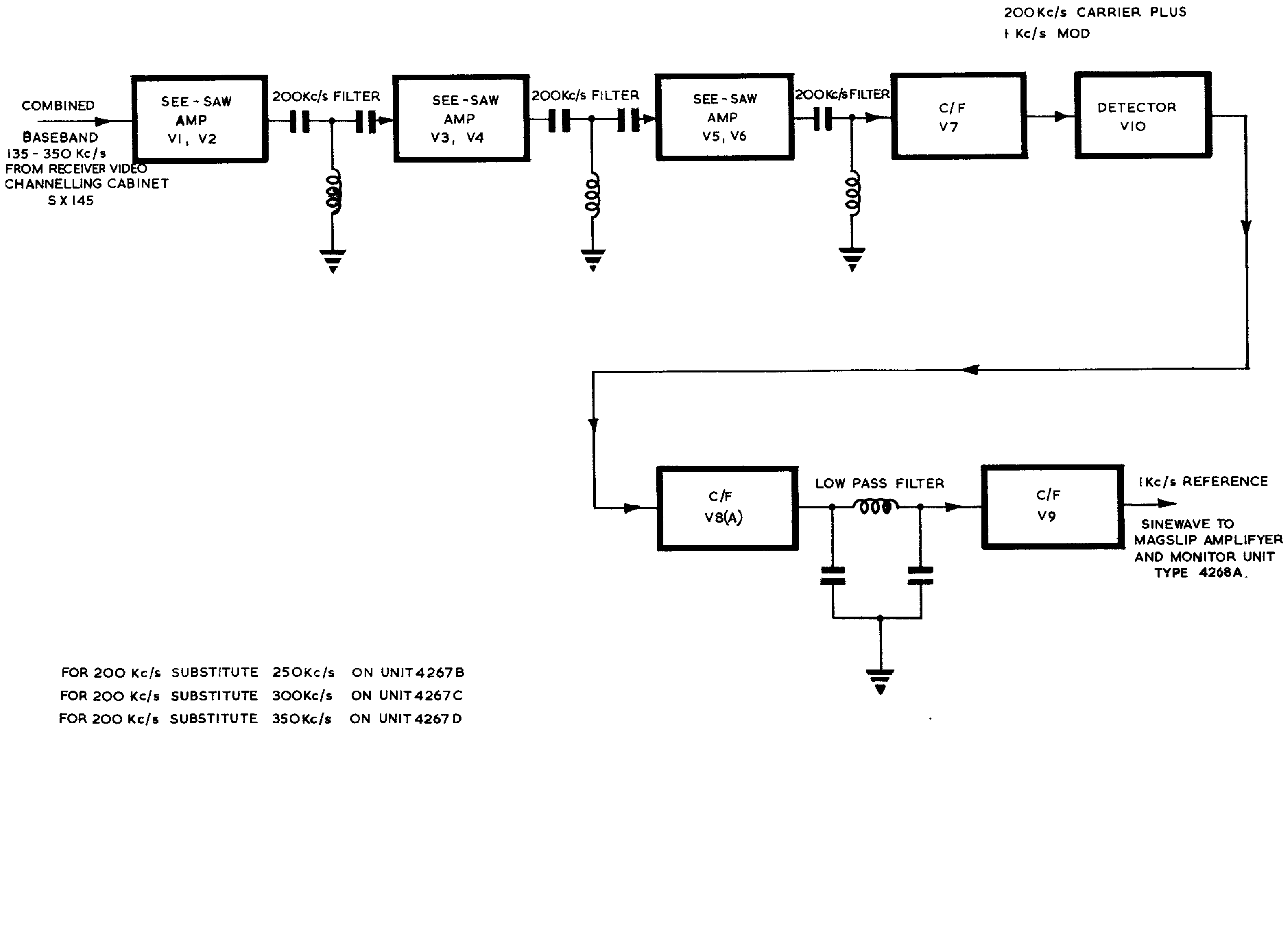
TURNING RECEIVER SX115
CABINET WIRING DIAGRAM
WZ.25156/D Sh.1 Iss.2

FIG.3



RECEIVER TURNING CABINET SX115
BLOCK DIAGRAM
WZ. 22153/D Sh. 1 Iss. 2

FIG. 4



FILTER & DETECTOR UNIT TYPE 4267A-D
BLOCK DIAGRAM
WZ.22170/B Sh.1 Iss.1

FIG.

FILTER & DETECTOR UNIT TYPE 4267A
(W.59129 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17387/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	3	C23	285			R13	94			R57	99	R79	115	TB1	260
C2	4	C24	10			R14	100	R36	103	R58	96	R80	116		
C3	3	C25	3			R15	93	R37	106	R59	95	R81	117	V1	
C4	3	C26	4	L1	65			R38	109	R60	94	R82	118	to	265
C5	3	C27	11	L2	65	R17	103	R39	99	R61	93			V7	
C6	52	C28	12	L3	65	R18	105	R40	96	R62	110			V8	266
C7	285	C29	286	L4	67	R19	106	R41	97	R63	99			V9	265
C8	7	C30	14			R20	99	R42	97	R64	98			V10	82
C9	3	C31	15	PLE	80	R21	96	R43	95	R65	96				
C10	9	C32	4	PLF	80	R22	97	R44	94	R66	111				
C11	3	C33	4			R23	97	R45	107	R67	95				
C12	3	C34	4	R1	92	R24	95	R46	93	R68	112				
C13	3	C35	16	R2	93	R25	94	R47	98	R69	113	RV1	230		
C14	52	C36	285	R3	94	R26	107	R48	99	R70	114	RV2	231		
C15	285	C37	8	R5	95	R27	93	R49	96	R71	115				
C16	7	C38	17	R6	96	R28	98	R50	95	R72	94	SKA	238		
C17	3	C39	8	R7	97	R29	99	R51	100	R73	94	SKB	238		
C18	9	C40	19	R8	97	R30	96	R52	94	R74	99	SKC	238		
C19	3	C41	20	R9	98	R31	95	R53	93	R75	96	SKD	239		
C20	3	C42	20	R10	99	R32	100			R76	95				
C21	3	C43	20	R11	96	R33	94			R77	94	SWA	245		
C22	52			R12	95	R34	108	R56	107	R78	93				

MISCELLANEOUS MECHANICAL ITEMS

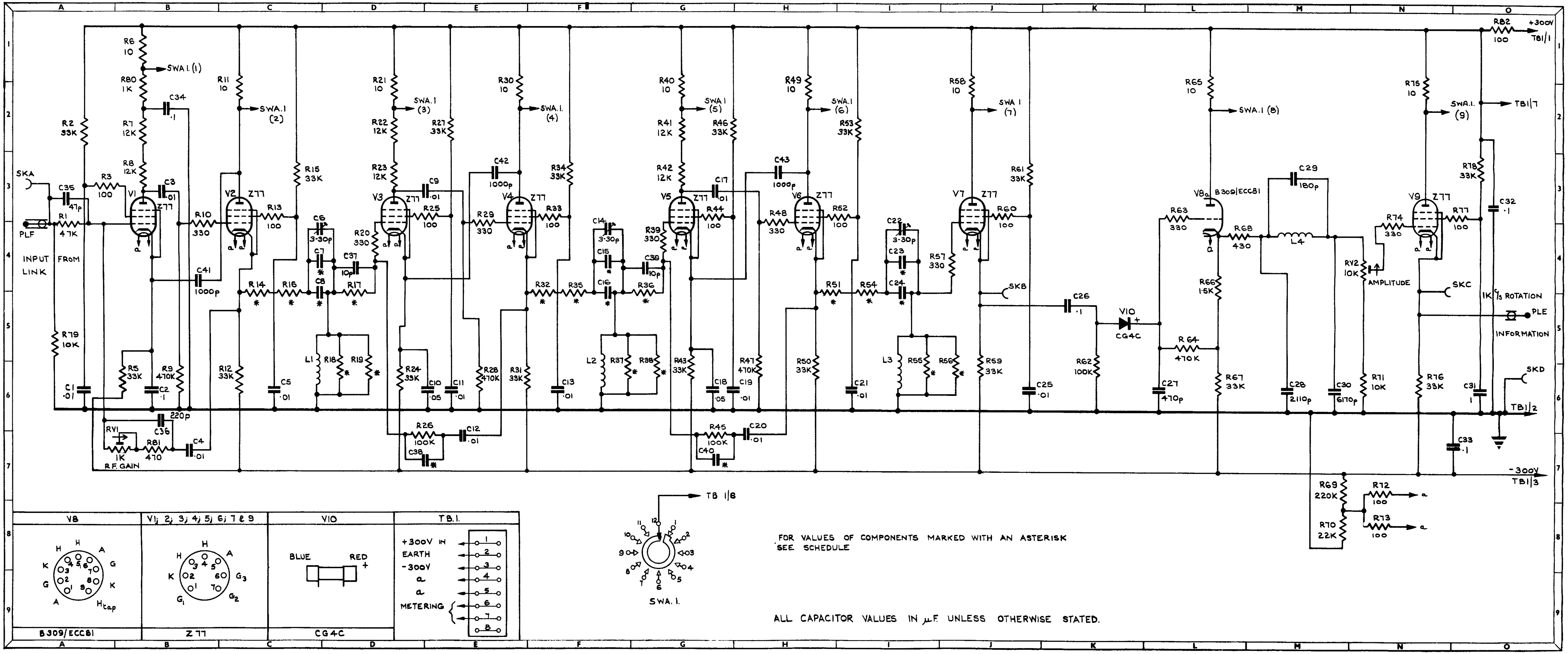
Ref.1	Valveholder for V1-V7 & V19	No.276
Ref.2	Valveholder for V8	No.277
Ref.3	Can Screening for V1-V7 & V9	No. 1
Ref.4	Can Screening for V8	No. 2

FILTER & DETECTOR UNIT TYPE 4267B
(W.59129 Sh.1 Ed.B)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17387/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	3	C23	6			R13	94	R35	102	R57	99	R79	115	TB1	260
C2	4	C24	8			R14	101	R36	104	R58	96	R80	116		
C3	3	C25	3			R15	93	R37	109	R59	95	R81	117	V1	
C4	3	C26	4	L1	66	R16	102	R38	109	R60	94	R82	118	to	265
C5	3	C27	11	L2	66	R17	104	R39	99	R61	93			V7	
C6	52	C28	12	L3	66	R18	106	R40	96	R62	110			V8	266
C7	6	C29	13	L4	67	R19	106	R41	97	R63	99			V9	265
C8	8	C30	14			R20	99	R42	97	R64	98			V10	82
C9	3	C31	15	PLE	80	R21	96	R43	95	R65	96				
C10	9	C32	4	PLF	80	R22	97	R44	94	R66	111				
C11	3	C33	4			R23	97	R45	107	R67	95				
C12	3	C34	4	R1	92	R24	95	R46	93	R68	112				
C13	3	C35	16	R2	93	R25	94	R47	98	R69	113	RV1	230		
C14	52	C36	5	R3	94	R26	107	R48	99	R70	114	RV2	231		
C15	6	C37	8	R5	95	R27	93	R49	96	R71	115				
C16	8	C38	18	R6	96	R28	98	R50	95	R72	94	SKA	238		
C17	3	C39	8	R7	97	R29	96	R51	101	R73	94	SKB	238		
C18	9	C40	17	R8	97	R30	99	R52	94	R74	99	SKC	238		
C19	3	C41	20	R9	98	R31	95	R53	93	R75	96	SKD	239		
C20	3	C42	20	R10	99	R32	101	R54	102	R76	95				
C21	3	C43	20	R11	96	R33	94	R55	106	R77	94	SWA	245		
C22	52			R12	95	R34	108	R56	105	R78	93				

MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Valveholder for V1-V7 & V19	No.276
Ref.2	Valveholder for V8	No.277
Ref.3	Can Screening for V1-V7 & V9	No. 1
Ref.4	Can Screening for V8	No. 2

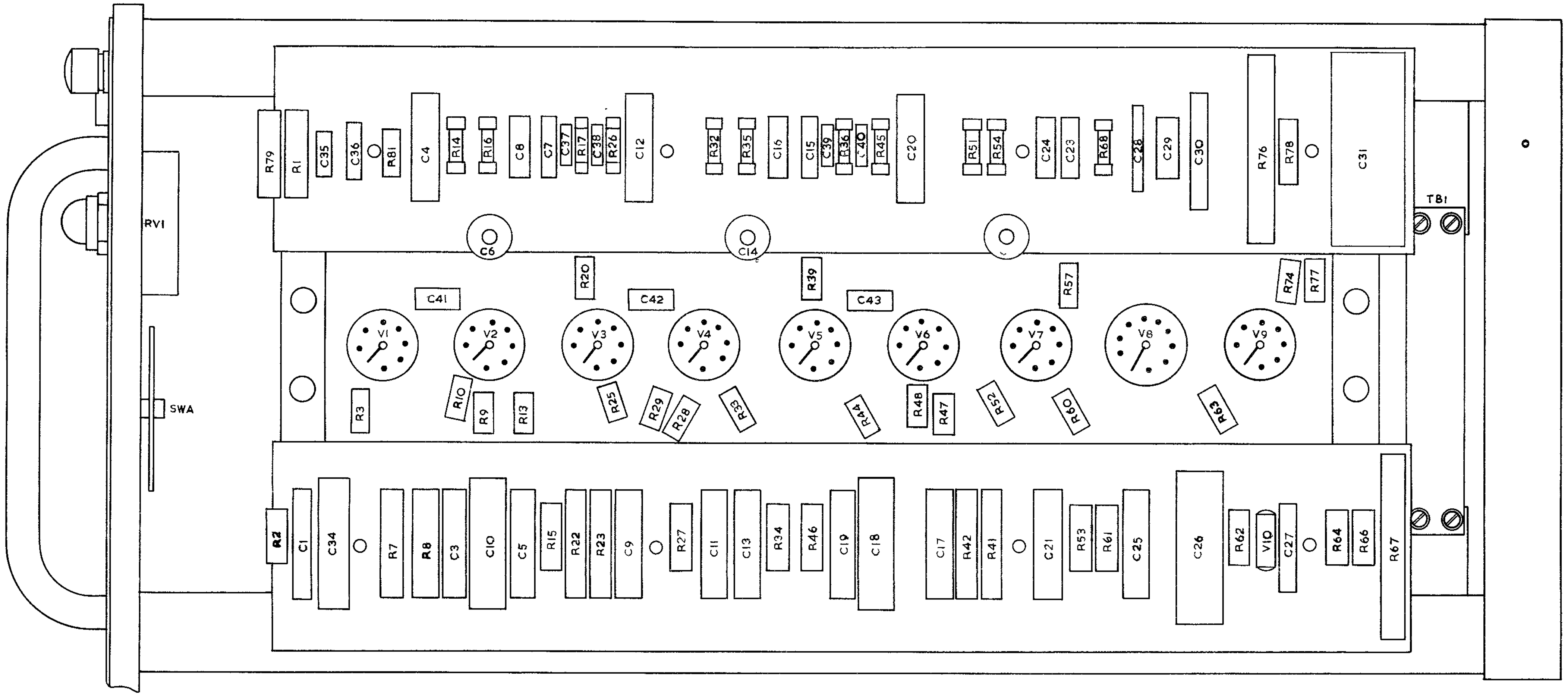


FILTER & DETECTOR UNIT TYPE 4267

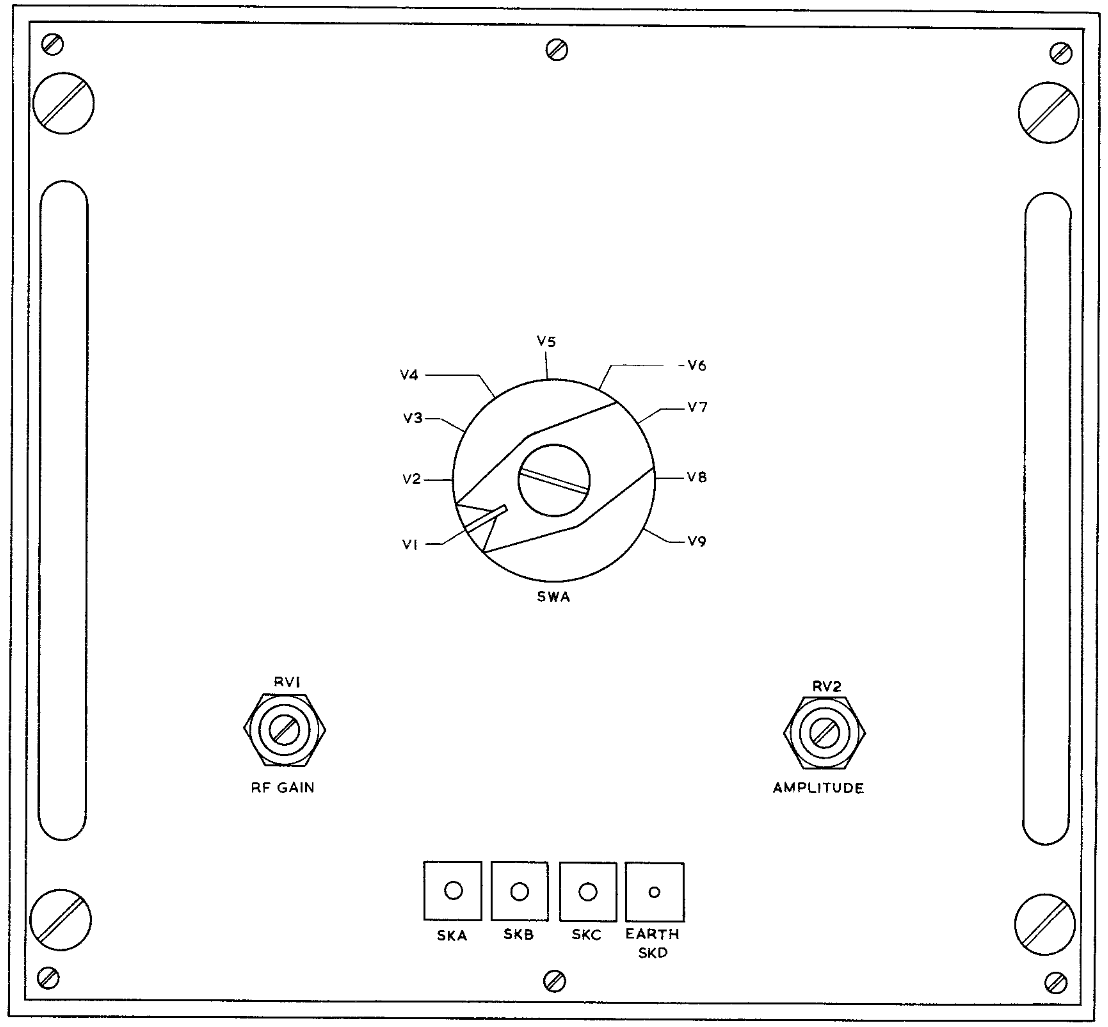
CIRCUIT

WZ.17387/D Sh.1 Iss.3

FIG.6



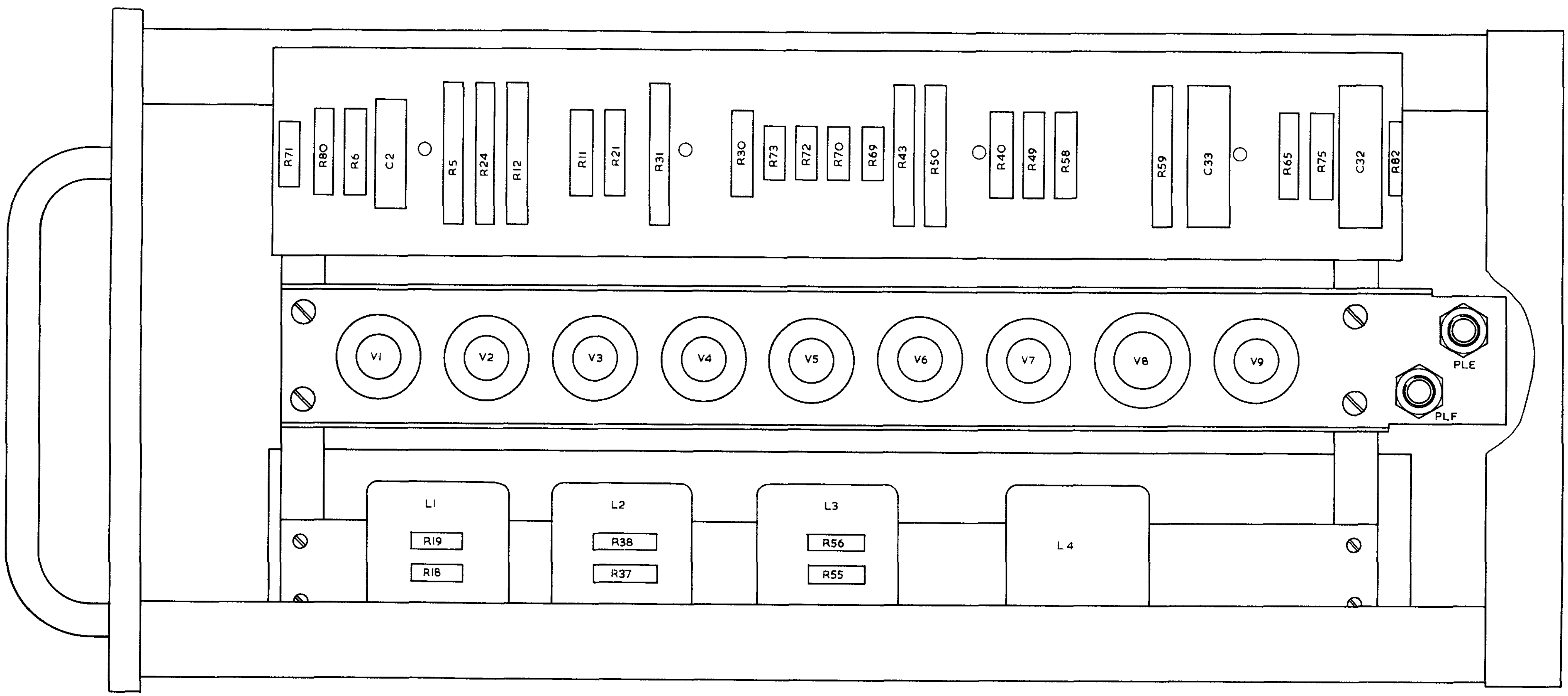
LEFT HAND SIDE VIEW



FRONT VIEW

FILTER & DETECTOR UNIT TYPE 4267B
COMPONENT LAYOUT
WZ.22171/D Sh.1 Iss.1

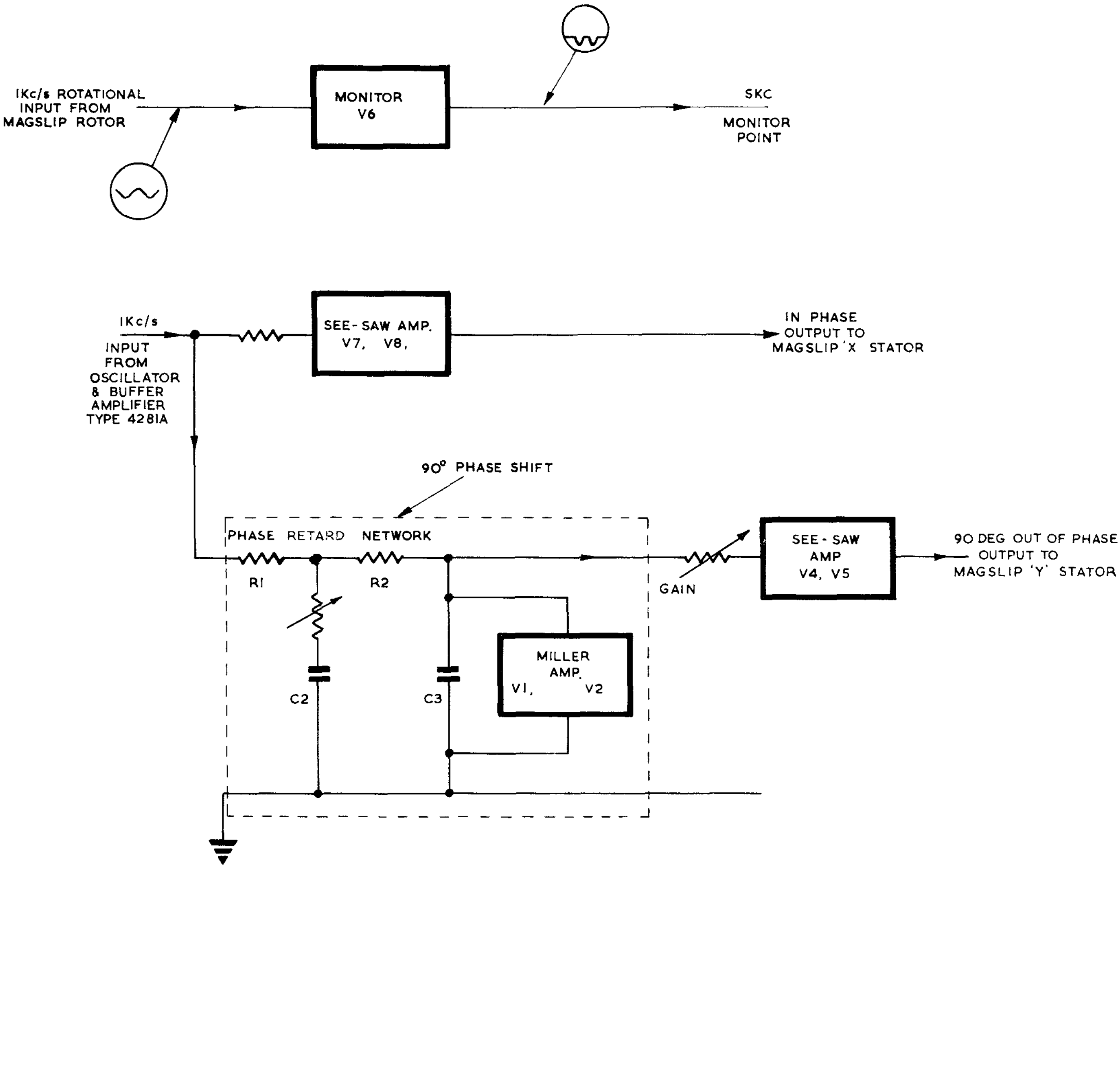
FIG.7



RIGHT HAND SIDE VIEW

FILTER & DETECTOR UNIT TYPE 4267B
COMPONENT LAYOUT
WZ.22171/D Sh.2 Iss.1

FIG.8



MAGSLIP AMPLIFIER & MONITOR UNIT
TYPE 4208A - BLOCK DIAGRAM
WZ.21663/B Sh.1 Iss.1

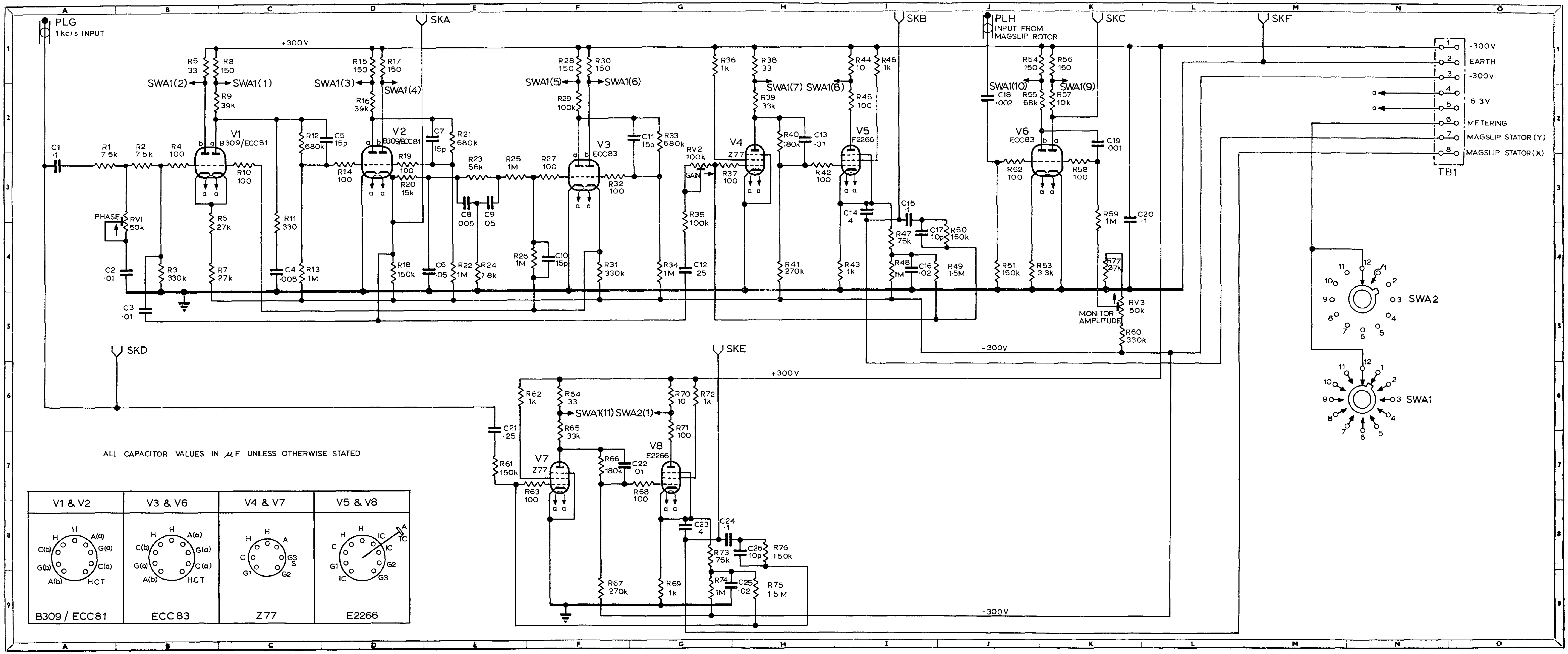
FIG.9

MAGSLIP AMPLIFIER & MONITORING UNIT TYPE 4268A
(W.59113 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17011/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	4	C19	30	R5	121	R23	129	R41	137	R59	131	R77	149	SWA	246
C2	21	C20	4	R6	122	R24	130	R42	94	R60	147				
C3	22	C21	25	R7	122	R25	131	R43	138	R61	148			TB1	260
C4	23	C22	3	R8	123	R26	131	R44	96	R62	135				
C5	24	C23	26	R9	124	R27	94	R45	94	R63	94			V1	266
C6	9	C24	4	R10	94	R28	123	R46	135	R64	121			V2	267
C7	24	R25	27	R11	99	R29	132	R47	139	R65	93			V3	265
C8	23	C26	28	R12	125	R30	123	R48	140	R66	136			V4	265
C9	9			R13	126	R31	133	R49	141	R67	137			V5	268
C10	24			R14	94	R32	94	R50	142	R68	94	RV1	232	V6	267
C11	24			R15	123	R33	125	R51	143	R69	138	RV2	233	V7	265
C12	25	PLG	80	R16	124	R34	126	R52	94	R70	96	RV3	232	V8	268
C13	3	PLH	80	R17	123	R35	134	R53	144	R71	94				
C14	26			R18	127	R36	135	R54	123	R72	135	SKA			
C15	4	R1	119	R19	94	R37	94	R55	145	R73	139	to	238		
C16	27	R2	119	R20	128	R38	121	R56	123	R74	140	SKE			
C17	28	R3	120	R21	125	R39	93	R57	146	R75	141	SKF	239		
C18	29	R4	94	R22	126	R40	136	R58	94	R76	142				

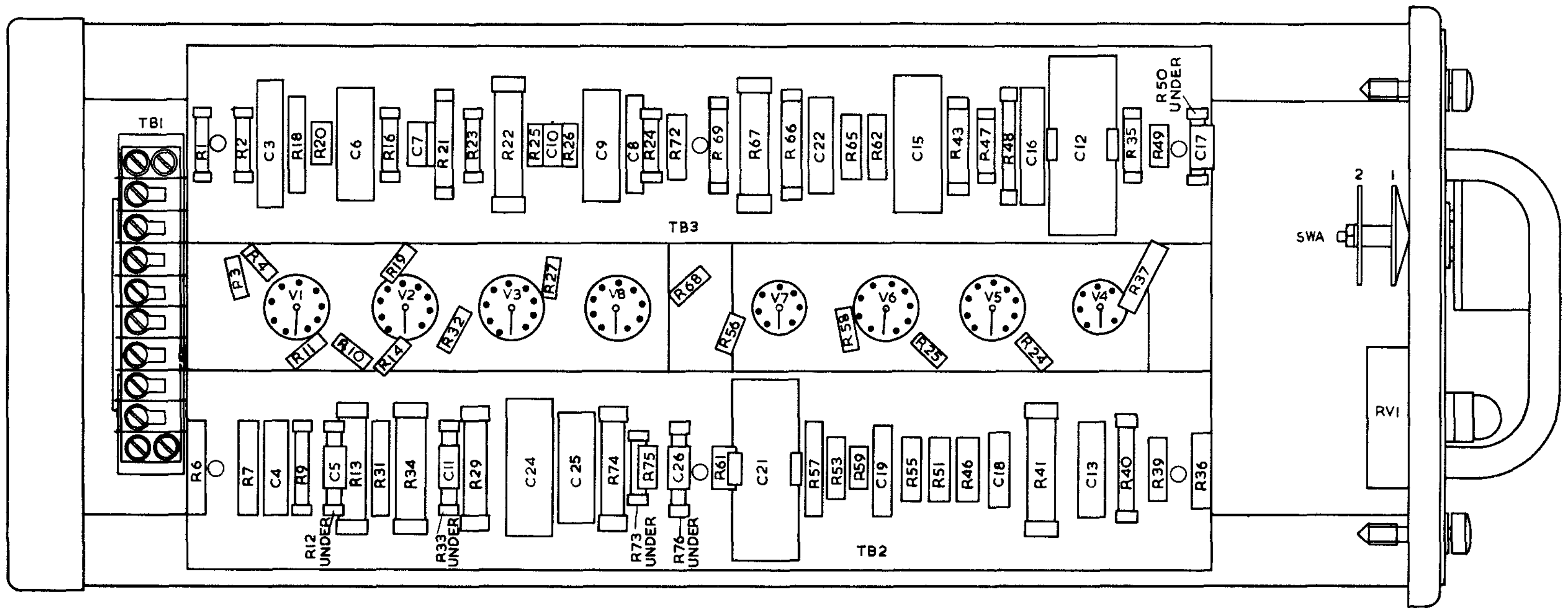
MISCELLANEOUS MECHANICAL ITEMS

Ref. 1	Valveholders for V4, V7	No.276
Ref. 2	Valveholders for V1,V2,V3,V6	No.277
Ref. 3	Valveholders for V5,V8	No.278
Ref. 4	Connector Assembly (Top Cap) for V5,V8	No. 55
Ref. 5	Can Screening for V1,V2,V3,V6	No. 2
Ref. 6	Can Screening for V4,V7	No. 1
Ref. 7	Valve Retainer	No.281
Ref. 8	Knob Finger	No. 70
Ref. 9	Metal Mounting	No. 76
Ref.10	Cap. Retaining	No. 53
Ref.11	Clamp Spring	No. 54

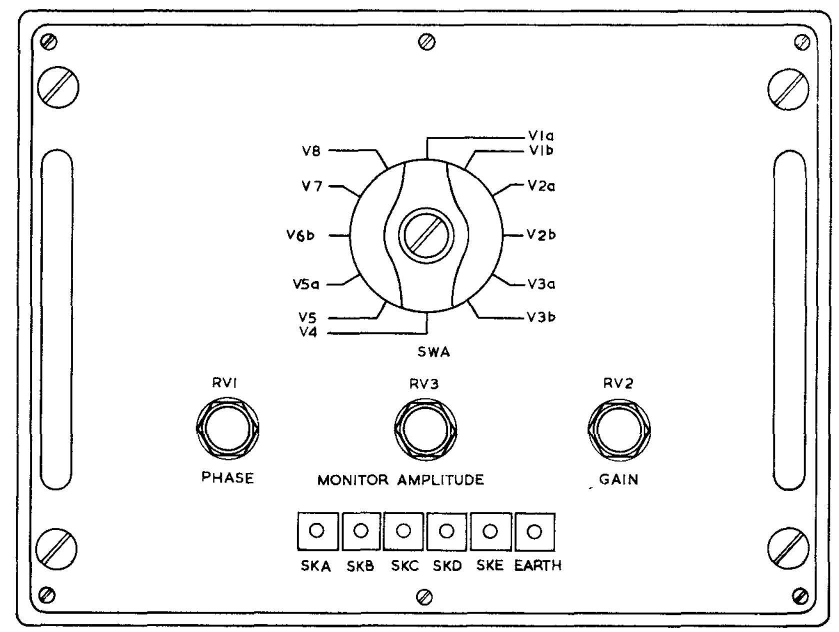


MAGSLIP AMPLIFIER & MONITOR UNIT
TYPE 4268A - CIRCUIT
WZ.17011/D Sh.1 Iss.7

FIG.10



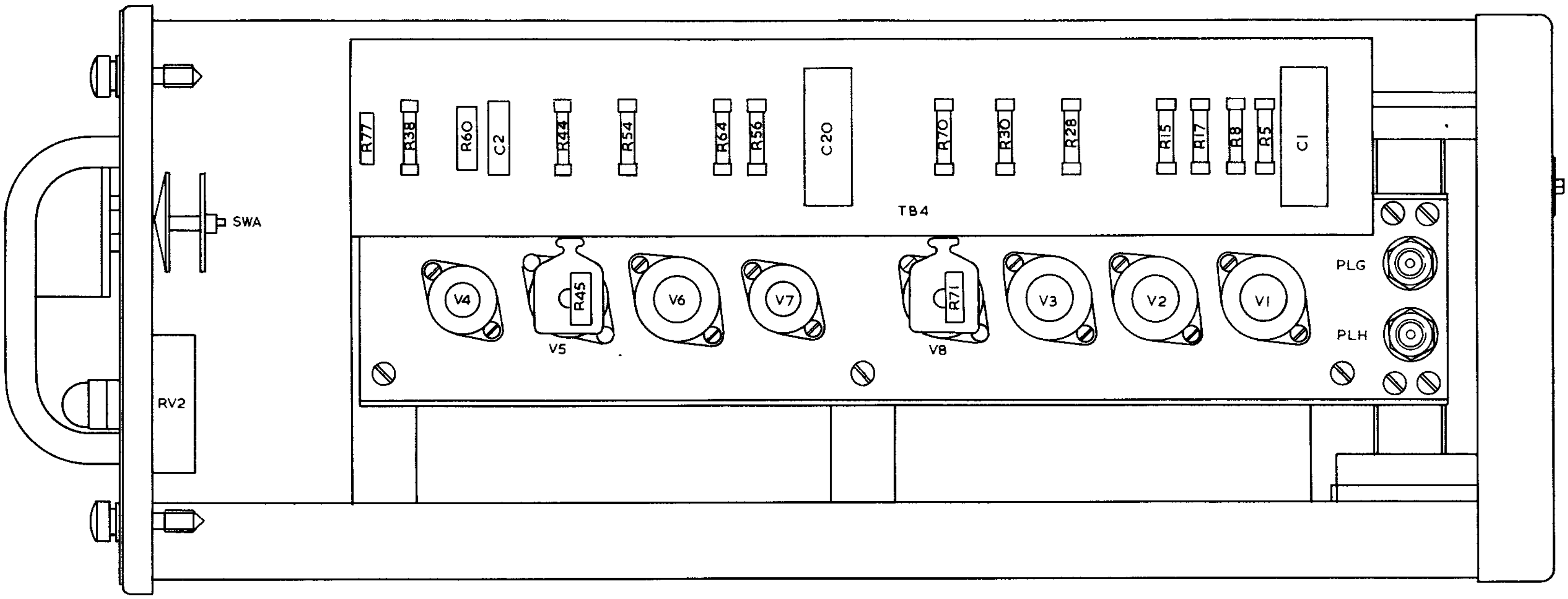
LEFT HAND SIDE VIEW



FRONT VIEW

MAGSLIP AMPLIFIER & MONITOR UNIT
TYPE 4268A - COMPONENT LAYOUT
WZ.21664/D Sh.1 Iss.1

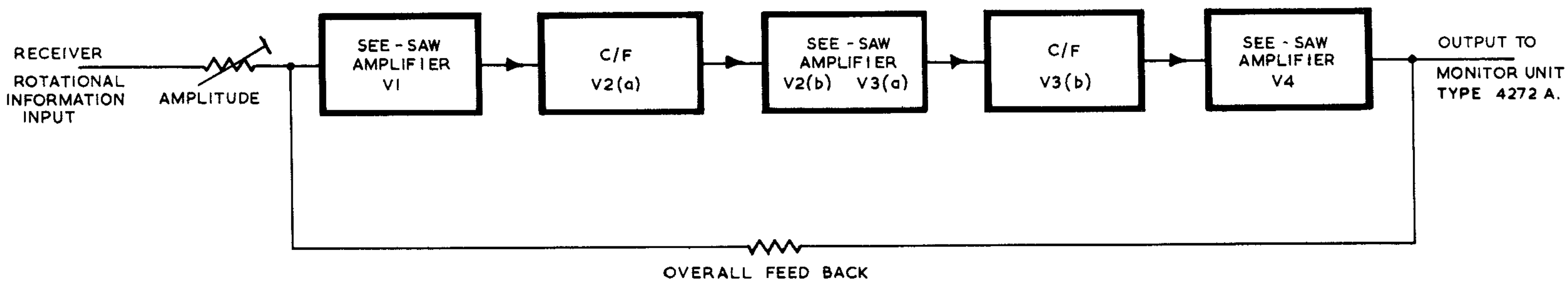
FIG. 11

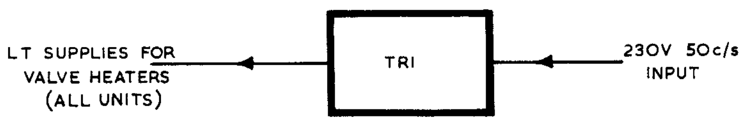


RIGHT HAND SIDE VIEW

MAGSLIP AMPLIFIER & MONITOR UNIT
TYPE 4268A - COMPONENT LAYOUT
WZ.21664/D Sh.2 Iss.1

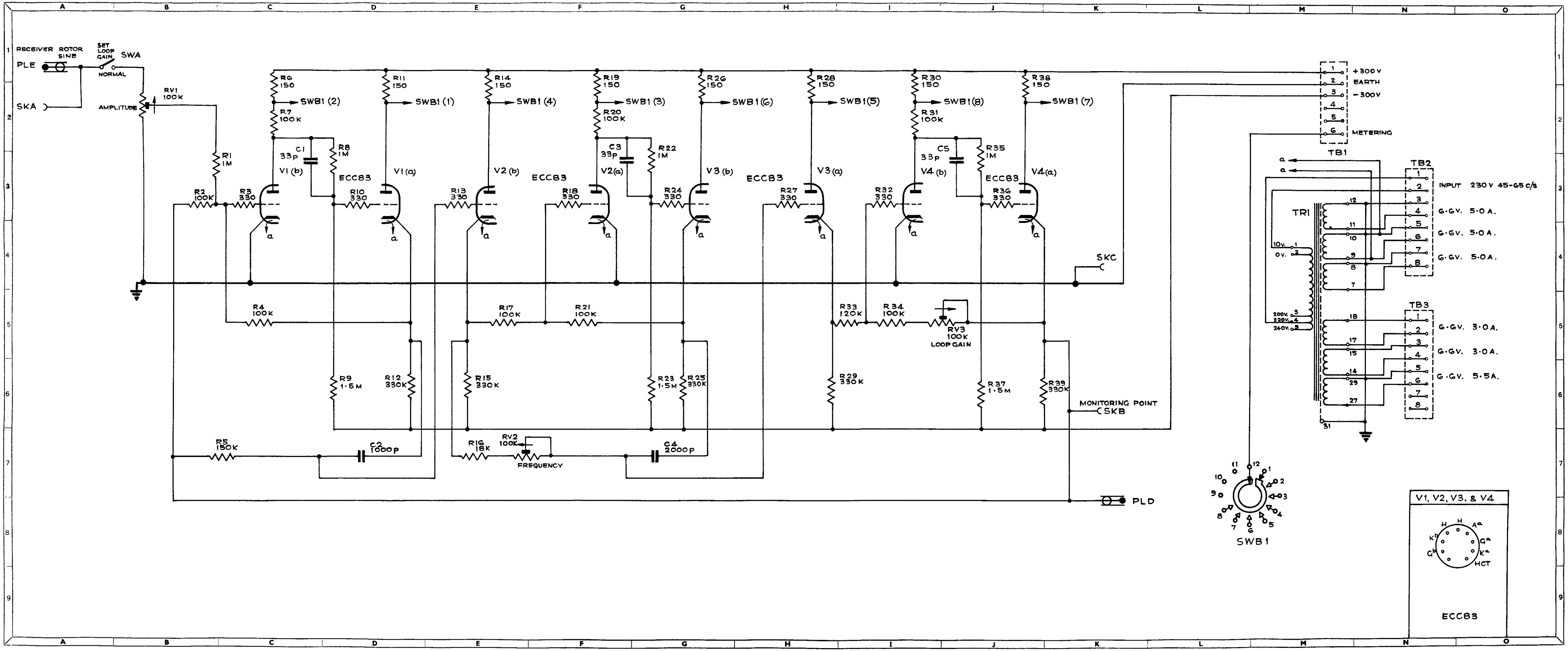
FIG.12





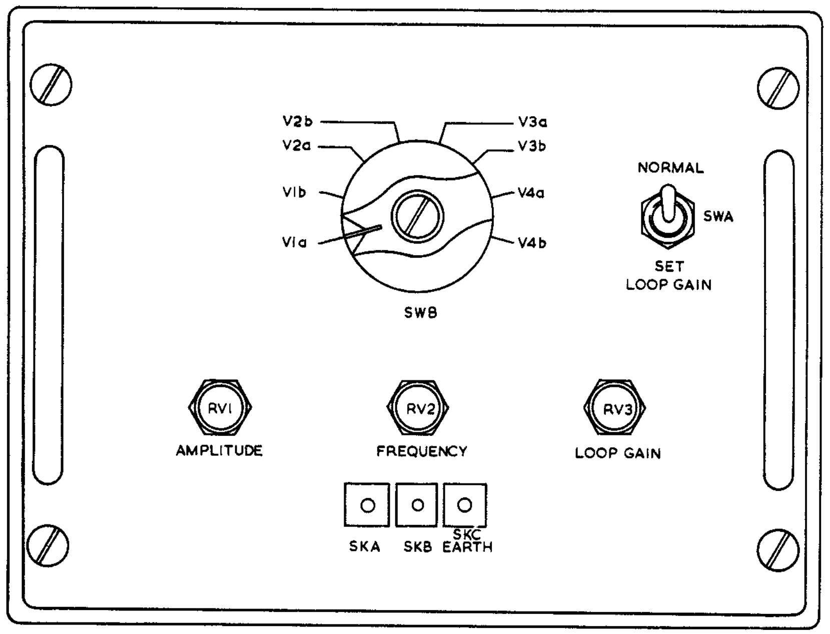
AMPLIFYING UNIT (FILTER)
TYPE 4277A - BLOCK DIAGRAM
WZ. 22185/B Sh. 1 Iss. 1

FIG. 13

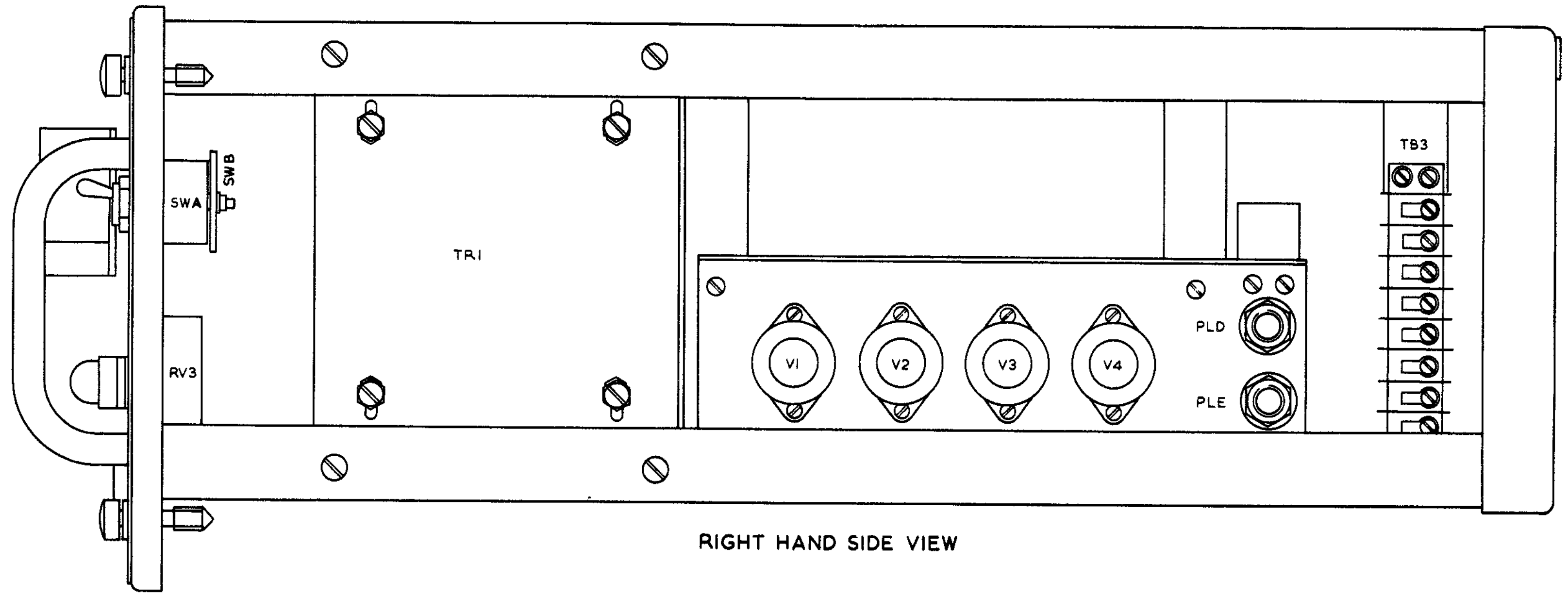


AMPLIFYING UNIT (FILTER)
TYPE 4277A - CIRCUIT
WZ.17385/D Sh.1 Iss.2

FIG.14



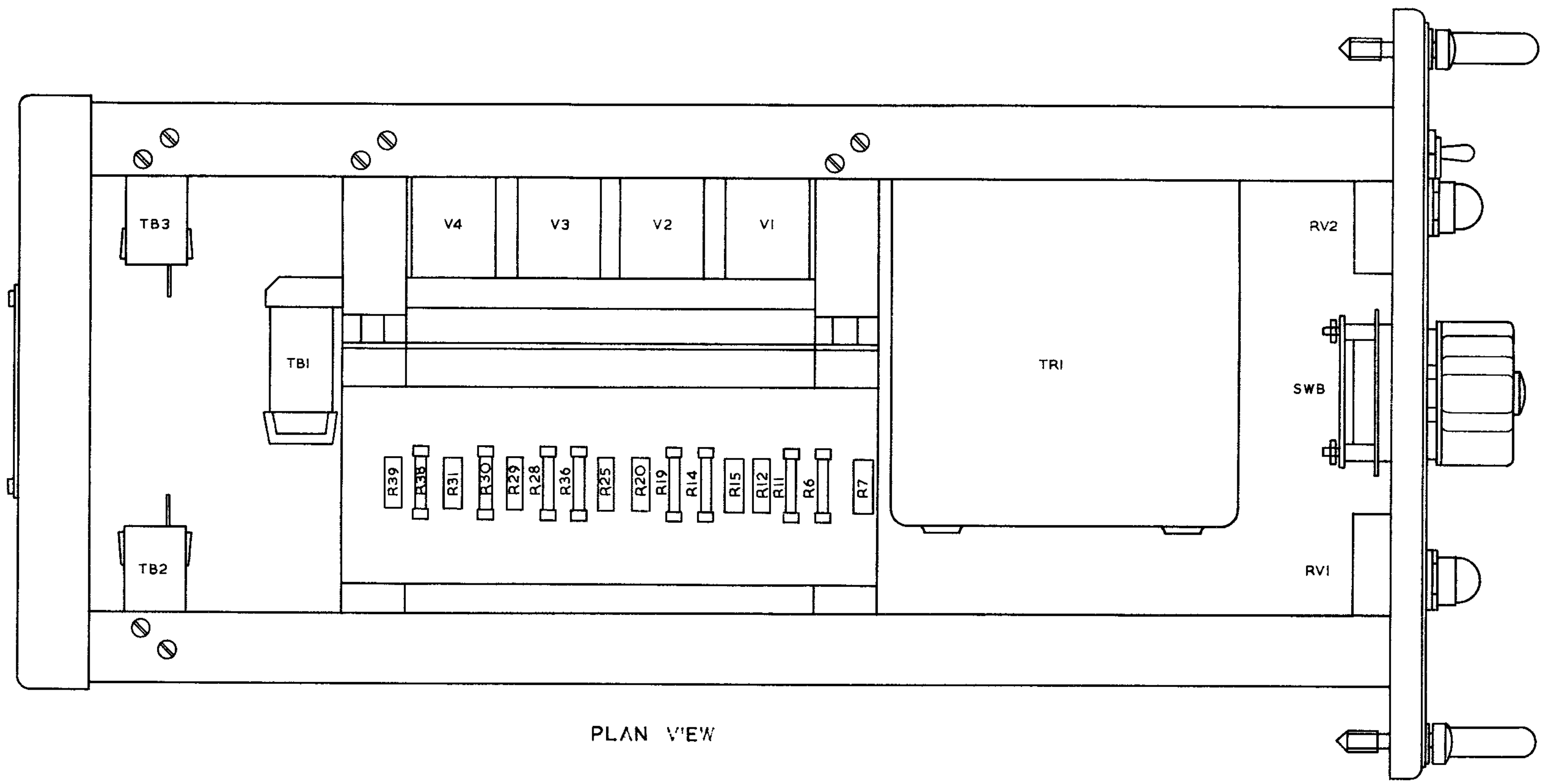
FRONT VIEW



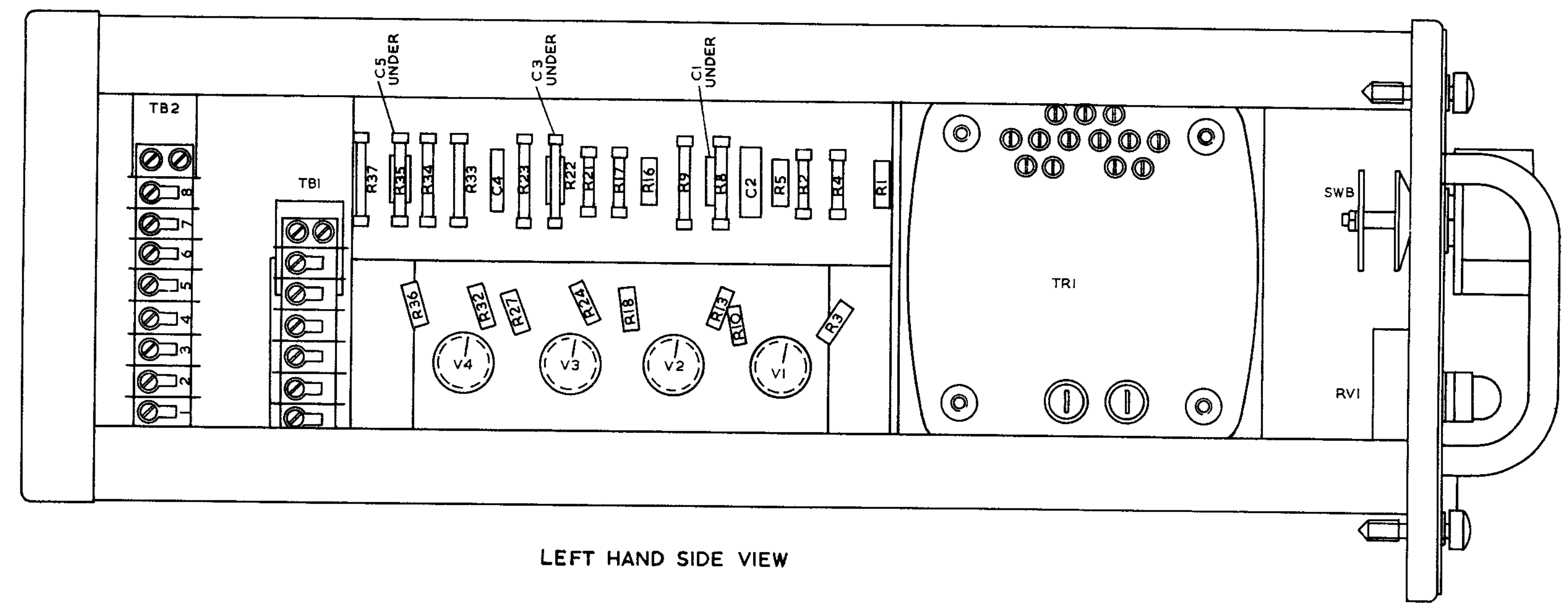
RIGHT HAND SIDE VIEW

AMPLIFYING UNIT (FILTER)
TYPE 4277A - COMPONENT LAYOUT
WZ.22186/D Sh.1 Iss.1

FIG.15



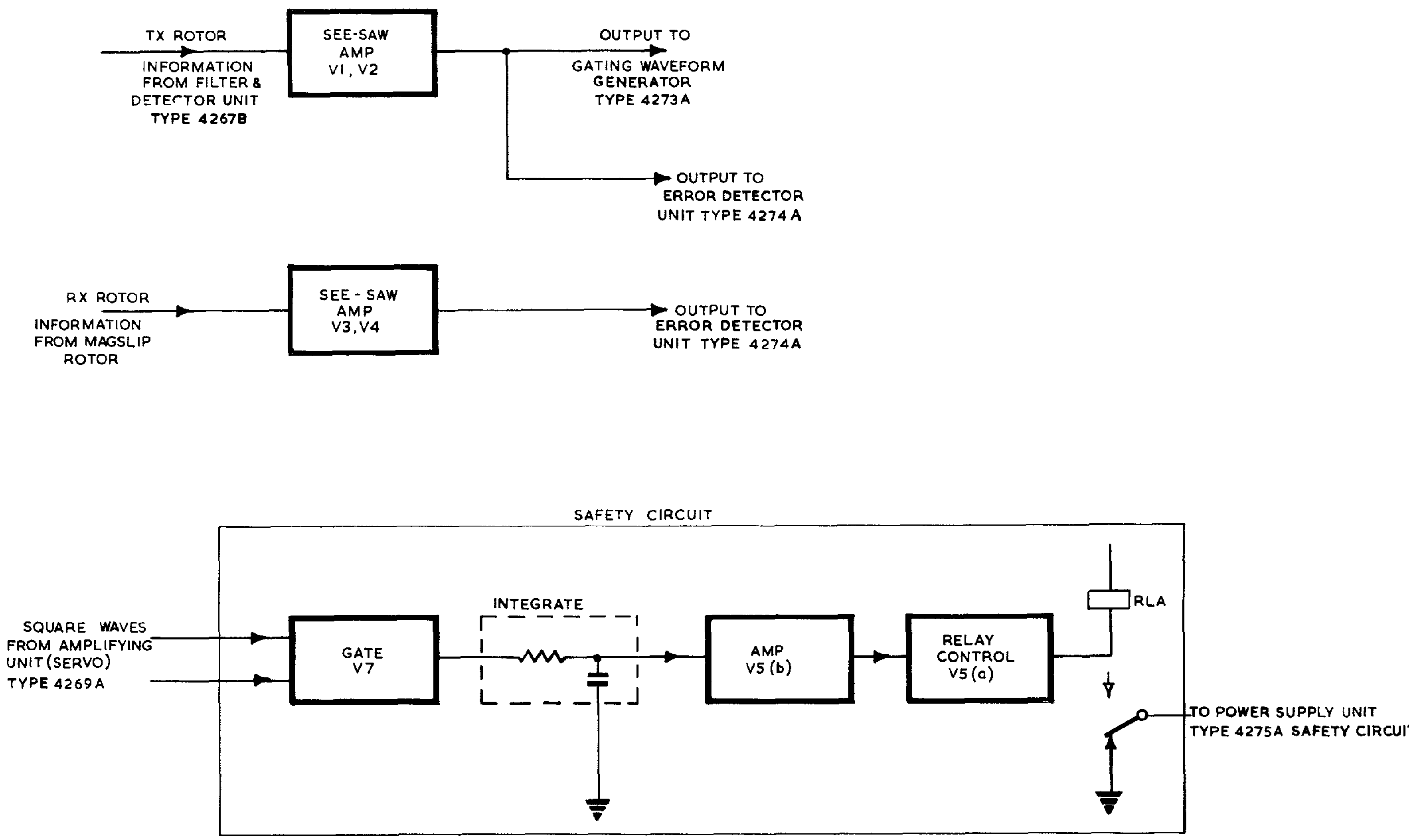
PLAN VIEW



LEFT HAND SIDE VIEW

AMPLIFYING UNIT (FILTER)
TYPE 4277A - COMPONENT LAYOUT
WZ.22186/D Sh.2 Iss.1

FIG.16



AMPLIFYING UNIT TYPE 4272A
BLOCK DIAGRAM
WZ. 22177/B Sh. 1 Iss. 1

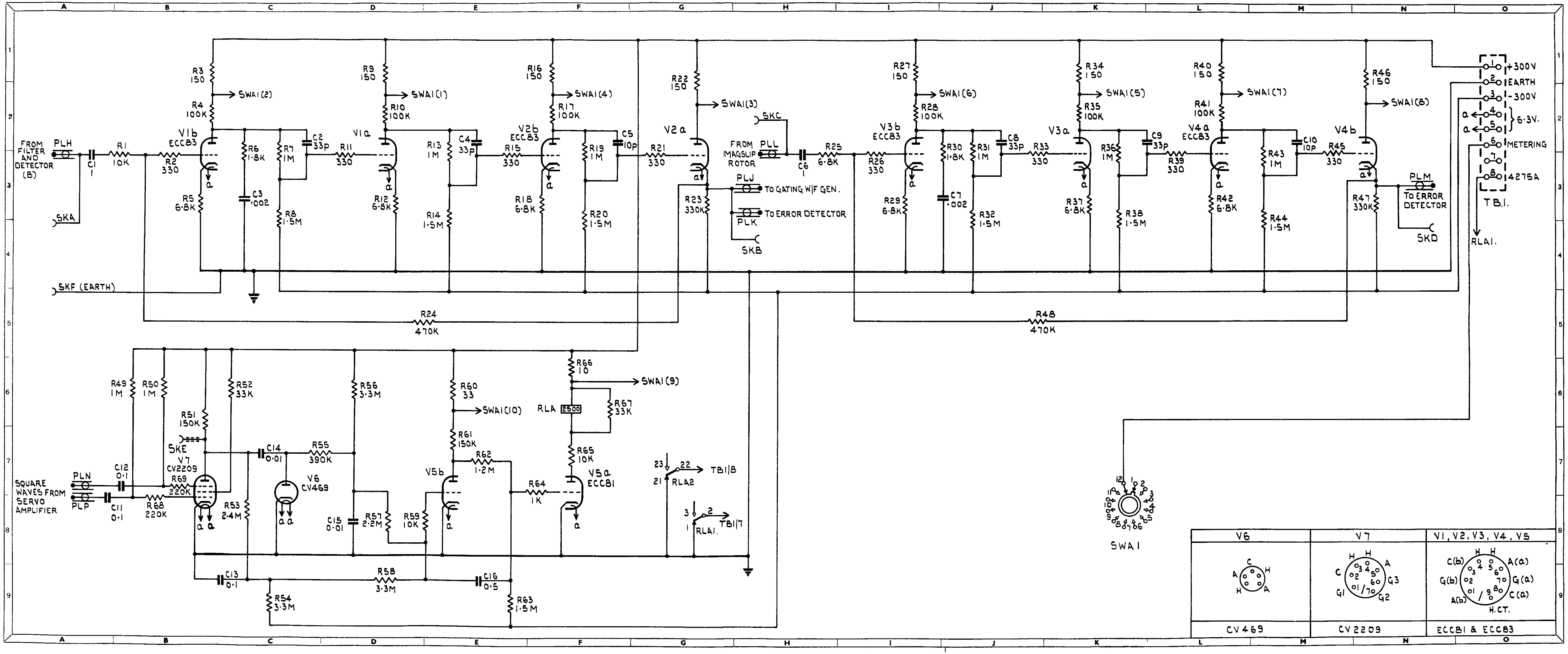
FIG. 17

AMPLIFYING UNIT TYPE 4272A
(W.59054 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17008/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	36	C16	37	R9	123	R24	165	R39	99	R54	178	R69	184	SWA	251
C2	32			R10	154	R25	174	R40	123	R55	179				
C3	29			R11	99	R26	99	R41	154	R56	180			TB1	260
C4	32	PLH		R12	171	R27	123	R42	171	R57	181				
C5	128	to	80	R13	152	R28	154	R43	152	R58	180			V1	267
C6	36	PLP		R14	173	R29	171	R44	173	R59	115			V2	267
C7	29			R15	99	R30	172	R45	99	R60	121			V3	267
C8	32	R1	170	R16	123	R31	152	R46	123	R61	143			V4	267
C9	32	R2	99	R17	154	R32	173	R47	147	R62	159	RLA	284	V5	266
C10	28	R3	123	R18	171	R33	99	R48	165	R63	182			V6	270
C11	4	R4	154	R19	152	R34	123	R49	175	R64	116	SKA		V7	271
C12	4	R5	171	R20	173	R35	154	R50	175	R65	183	to	238		
C13	4	R6	172	R21	99	R36	152	R51	143	R66	96	SKE			
C14	3	R7	152	R22	123	R37	171	R52	176	R67	108	SKF	239		
C15	3	R8	173	R23	147	R38	173	R53	177	R68	184				

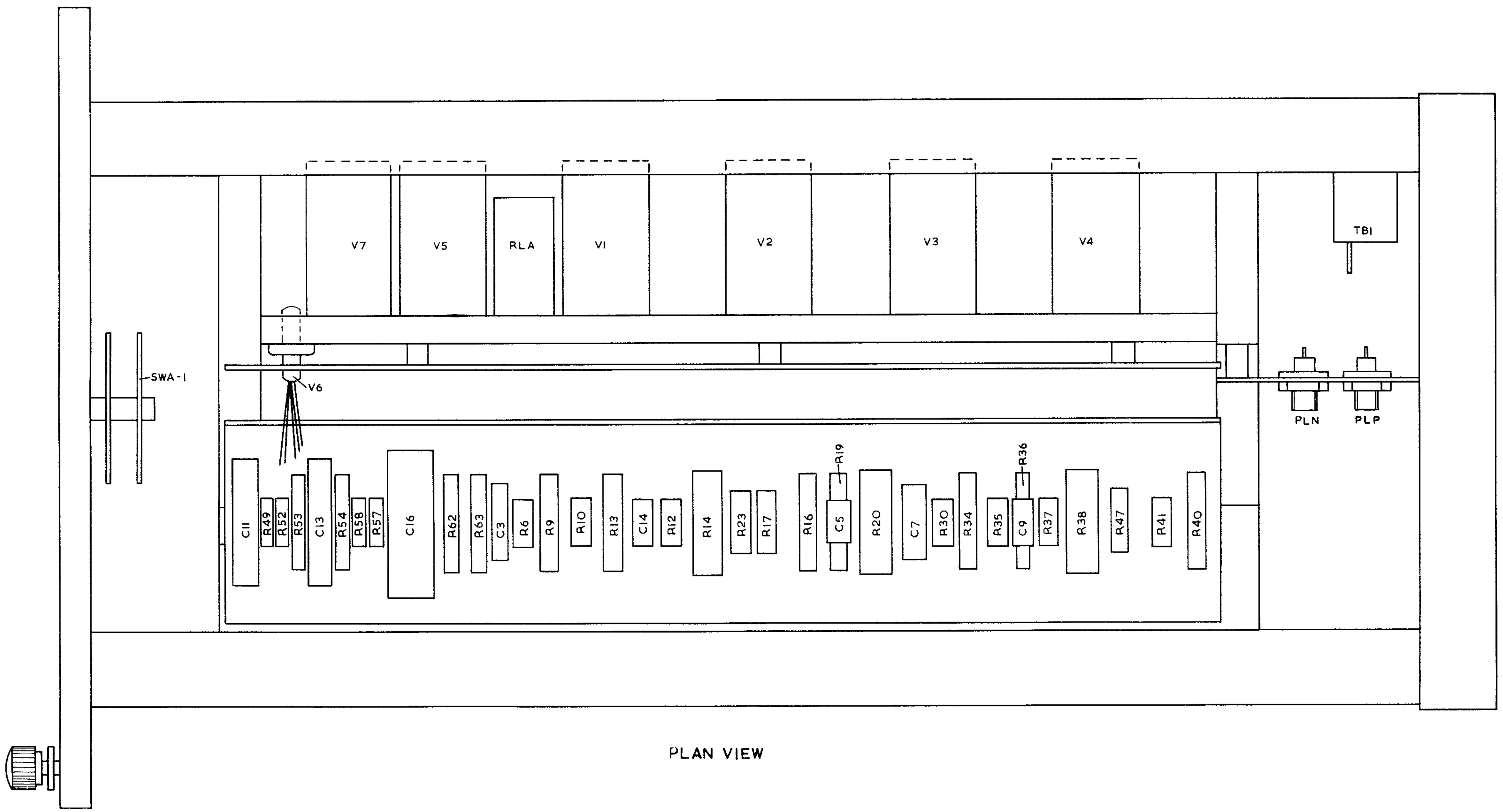
MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Valveholder for V1-V5	No.277
Ref.2	Can Screening for V1-V5	No. 2
Ref.3	Can Screening for V7	No. 1
Ref.4	Valveholder for V7	No.276

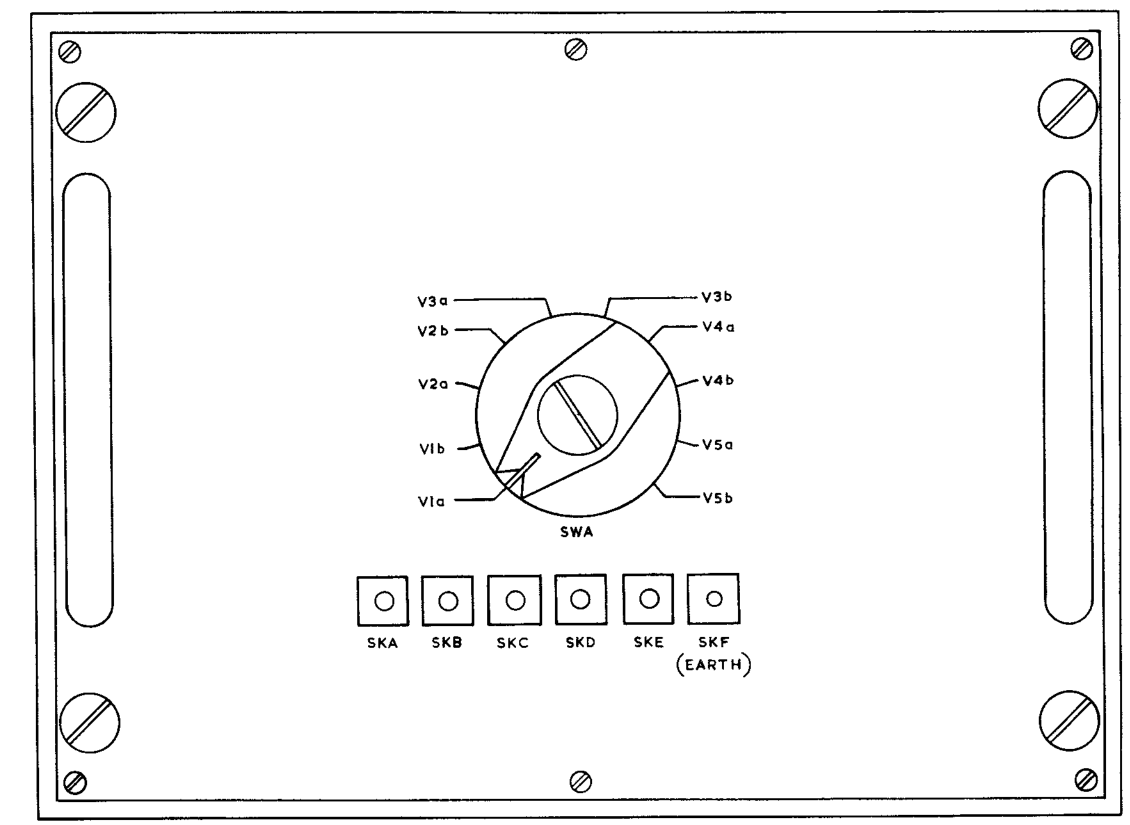


AMPLIFYING UNIT
TYPE 4272A - CIRCUIT
WZ.17008/D Sh.1 Iss.4

FIG.18



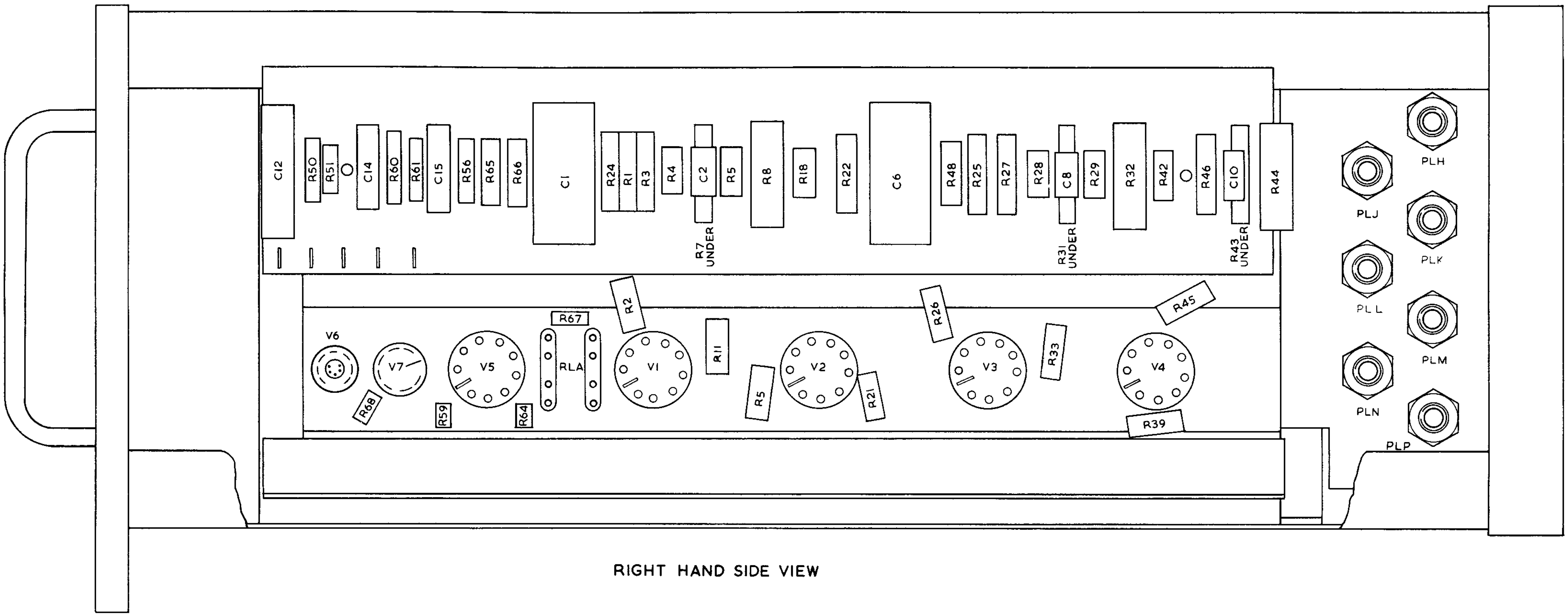
PLAN VIEW



FRONT VIEW.

AMPLIFYING UNIT TYPE 4272A
COMPONENT LAYOUT
WZ. 22178/D Sh. 1 Iss. 1

FIG. 19



RIGHT HAND SIDE VIEW

AMPLIFYING UNIT TYPE 4272A
COMPONENT LAYOUT
WZ.22178/D Sh.2 Iss.1

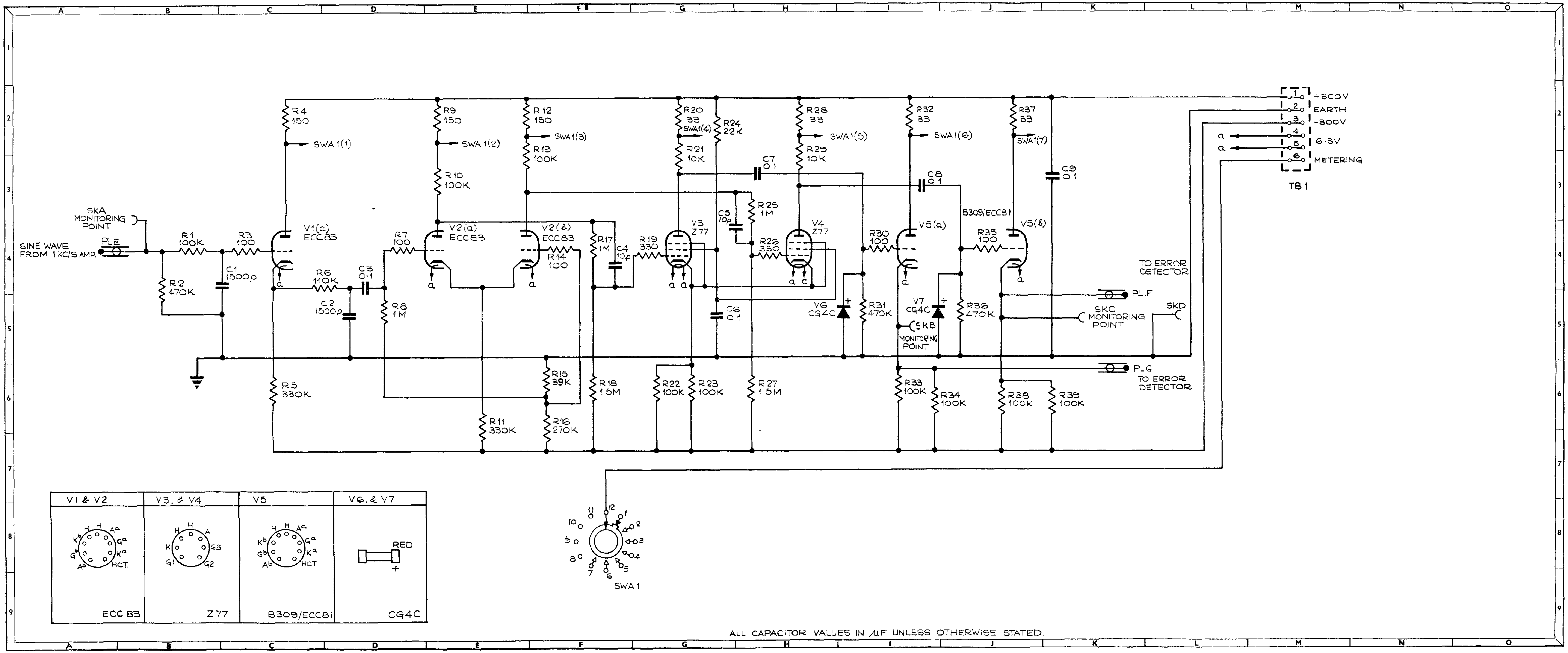
FIG. 20

GATING WAVEFORM GENERATOR TYPE 4273A
(W.59132 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17398/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	39			R6	208	R16	211	R26	99	R36	98	SKC	238	V4	265
C2	39	PLE	80	R7	94	R17	152	R27	153	R37	121	SKD	239	V5	266
C3	4	PLF	80	R8	175	R18	153	R28	121	R38	168			V6	83
C4	38	PLG	80	R9	123	R19	99	R29	212	R39	168	SWA	256	V7	83
C5	28			R10	154	R20	121	R30	94						
C6	4	R1	207	R11	147	R21	212	R31	98			TB1	262		
C7	4	R2	209	R12	123	R22	168	R32	121						
C8	4	R3	94	R13	154	R23	168	R33	168			V1	267		
C9	4	R4	123	R14	94	R24	213	R34	168	SKA	238	V2	267		
		R5	147	R15	210	R25	152	R35	94	SKB	238	V3	265		

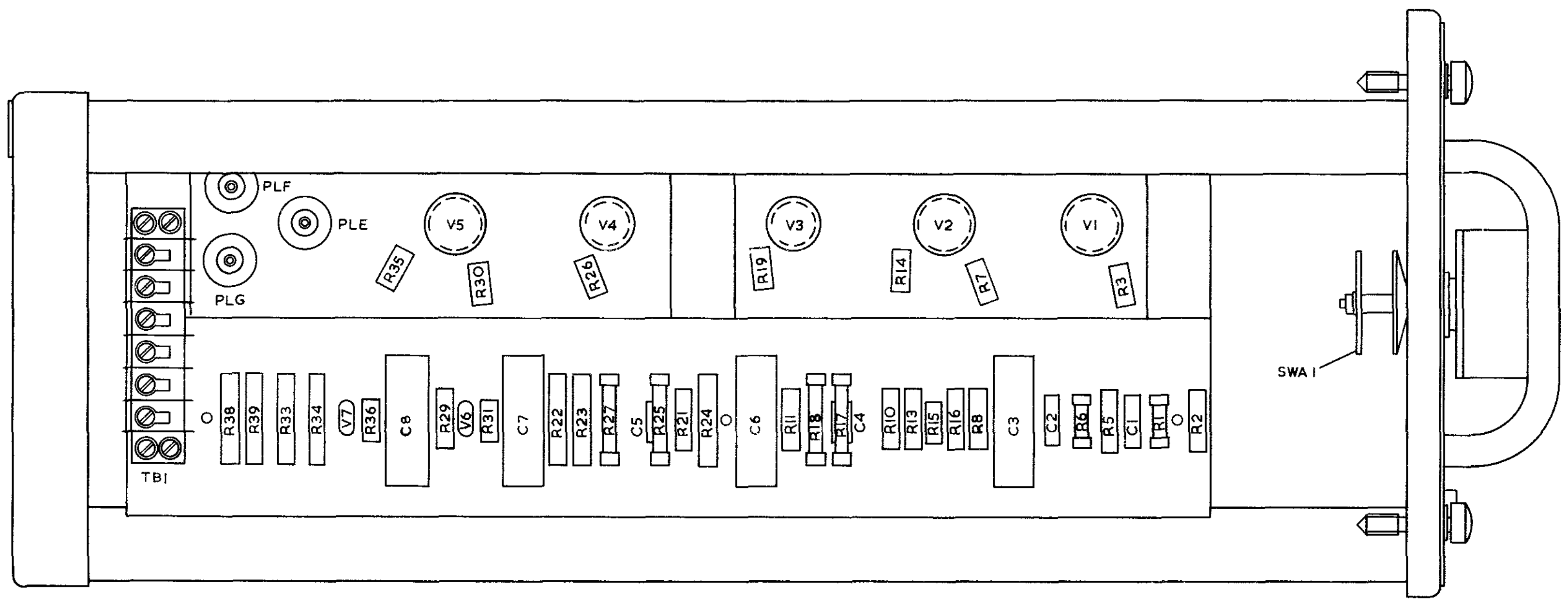
MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Valveholder B7G	No.276
Ref.2	Valveholder B9A	No.277
Ref.3	Can Screening B7G	No. 1
Ref.4	Can Screening B9A	No. 2
Ref.5	Knob Finger	No. 70
Ref.6	Metal Mounting	No. 76
Ref.7	Cap. Retaining	No. 53

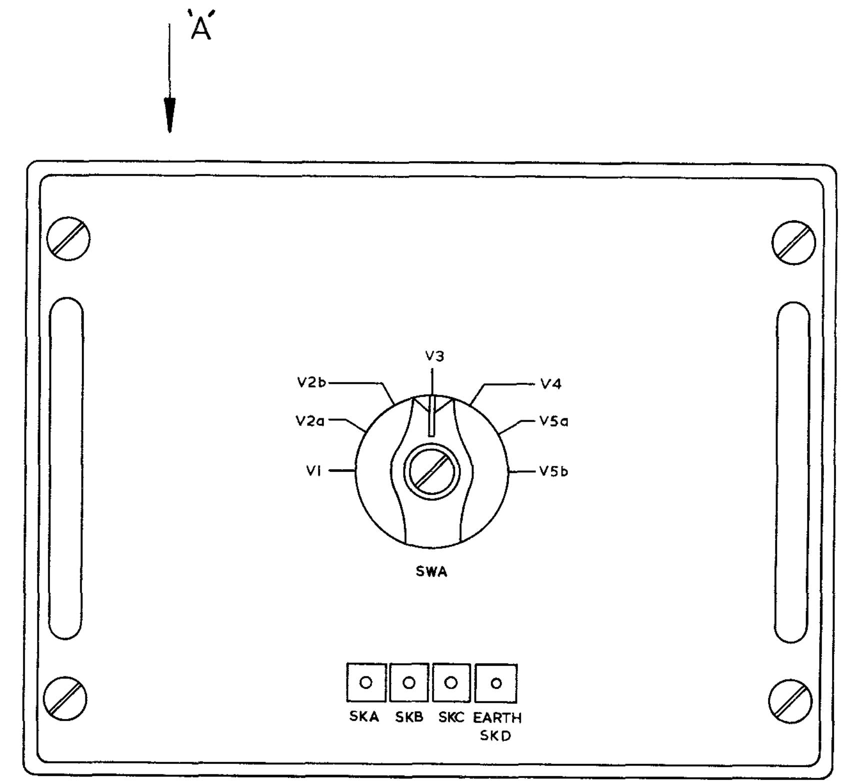


GATING WAVEFORM GENERATOR
TYPE 4273A - CIRCUIT
WZ.17398/D Sh.1 Iss.1

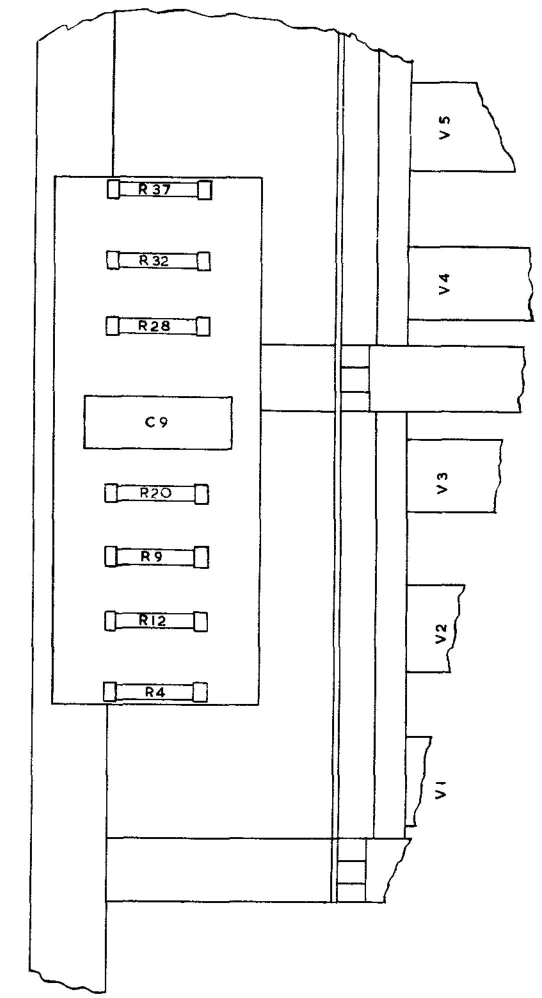
FIG.22



LEFT HAND SIDE VIEW



FRONT VIEW

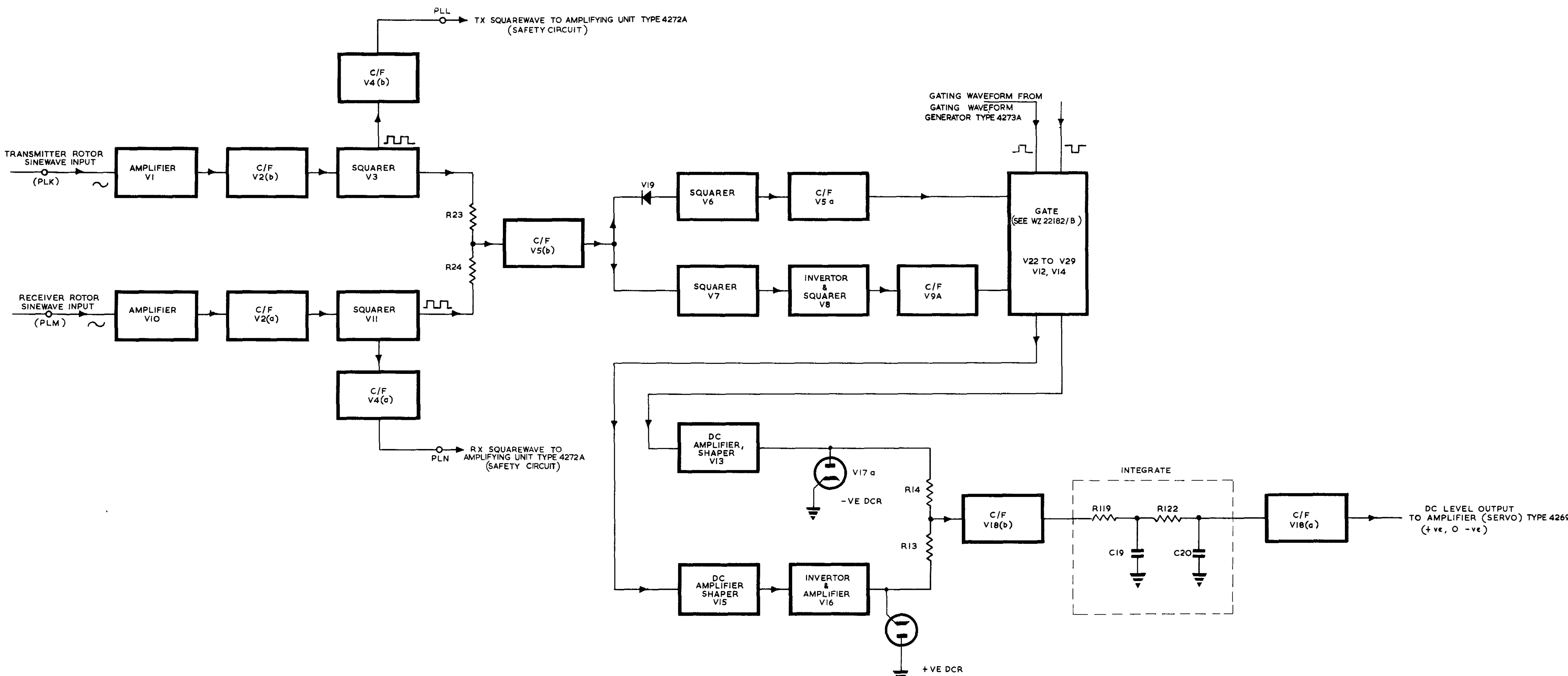


SCRAP VIEW IN DIRECTION OF ARROW 'A'

SHOWING LAYOUT OF COMPONENT BOARD

GATING WAVEFORM GENERATOR
TYPE 4273A - COMPONENT LAYOUT
WZ. 22180/D Sh. 1 Iss. 1

FIG. 23



ERROR DETECTOR UNIT
TYPE 4274A - BLOCK DIAGRAM
WZ. 22205/D Sh. 1 Iss. 1

FIG. 24

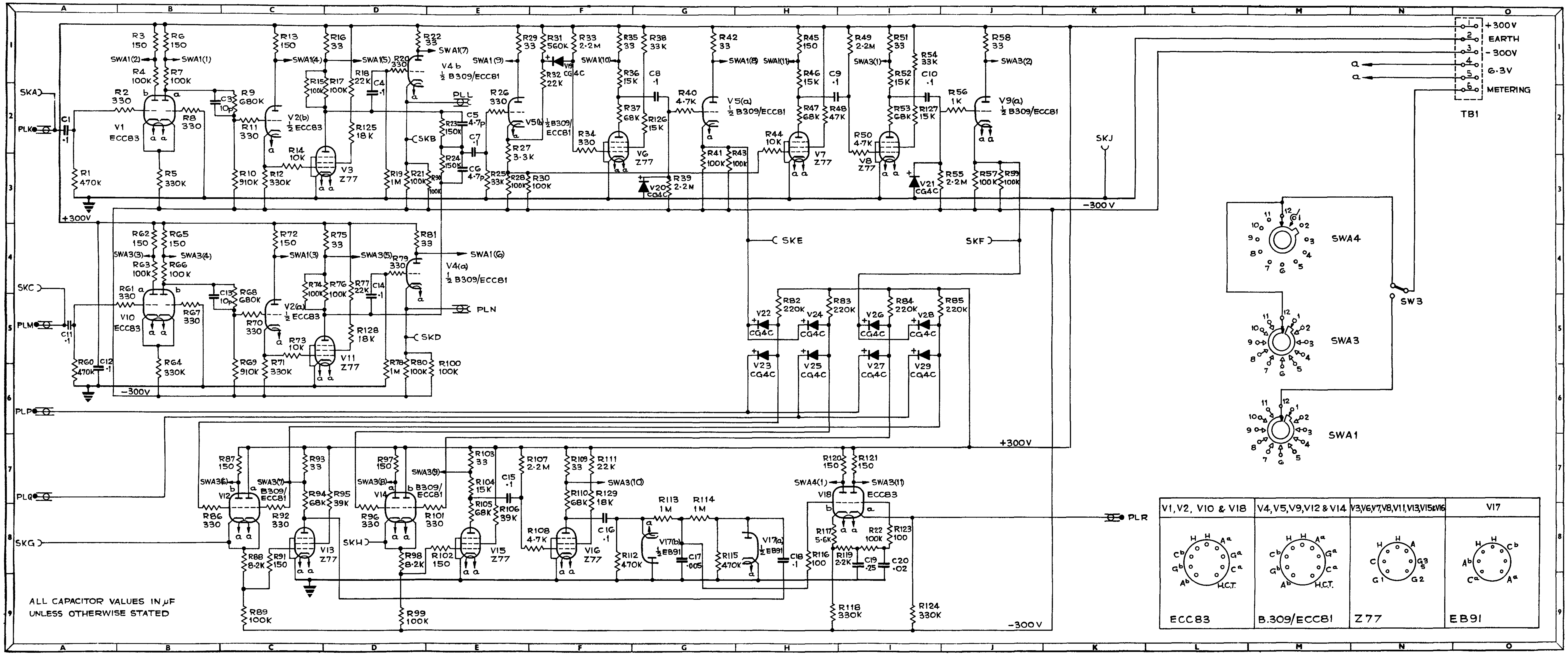
ERROR DETECTOR UNIT TYPE 4274A
(W.59033 Sh.1 Ed.A)
(Refer to Master Components List T4719)

**Cross Reference List
for WZ.17005/D Sh.1**

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	4	R2	99	R28	168	R54	220	R80	168	R106	224			V9	266
C3	40	R3	123	R29	121	R55	155	R81	121	R107	155			V10	267
C4	4	R4	154	R30	168	R56	116	R82	113	R108	225			V11	265
C5	34	R5	214	R31	217	R57	168	R83	113	R109	121			V12	266
C6	34	R6	123	R32	218	R58	121	R84	113	R110	219			V13	265
C7	4	R7	154	R33	155	R59	168	R85	113	R111	213			V14	266
C8	4	R8	99	R34	99	R60	98	R86	99	R112	98			V15	265
C9	4	R9	125	R35	121	R61	99	R87	123	R113	152			V16	265
C10	4	R10	215	R36	128	R62	123	R88	222	R114	152	SKA		V17	269
C11	4	R11	99	R37	219	R63	154	R89	168	R115	98	to	238	V18	267
C12	4	R12	147	R38	220	R64	214	R90	168	R116	94	SKH		V19	
C13	40	R13	123	R39	155	R65	123	R91	223	R117	226	SKJ	239	to	83
C14	4	R14	212	R40	157	R66	154	R92	99	R118	147			V29	
C15	4	R15	168	R41	168	R67	99	R93	121	R119	227	SWA	257		
C16	4	R16	121	R42	121	R68	125	R94	219	R120	123	SWB	253		
C17	41	R17	168	R43	168	R69	215	R95	224	R121	123				
C18	4	R18	213	R44	212	R70	99	R96	99	R122	110	TB1	262		
C19	42	R19	131	R45	123	R71	147	R97	123	R123	94				
C20	43	R20	99	R46	128	R72	123	R98	222	R124	147	V1	267		
		R21	168	R47	219	R73	212	R99	168	R125	228	V2	267		
		R22	121	R48	221	R74	168	R100	168	R126	229	V3	265		
PLK		R23	143	R49	155	R75	121	R101	99	R127	229	V4	266		
to	80	R24	143	R50	157	R76	168	R102	223	R128	228	V5	266		
PLR		R25	93	R51	121	R77	213	R103	121	R129	228	V6	265		
		R26	99	R52	128	R78	131	R104	128			V7	265		
R1	98	R27	216	R53	219	R79	99	R105	219			V8	265		

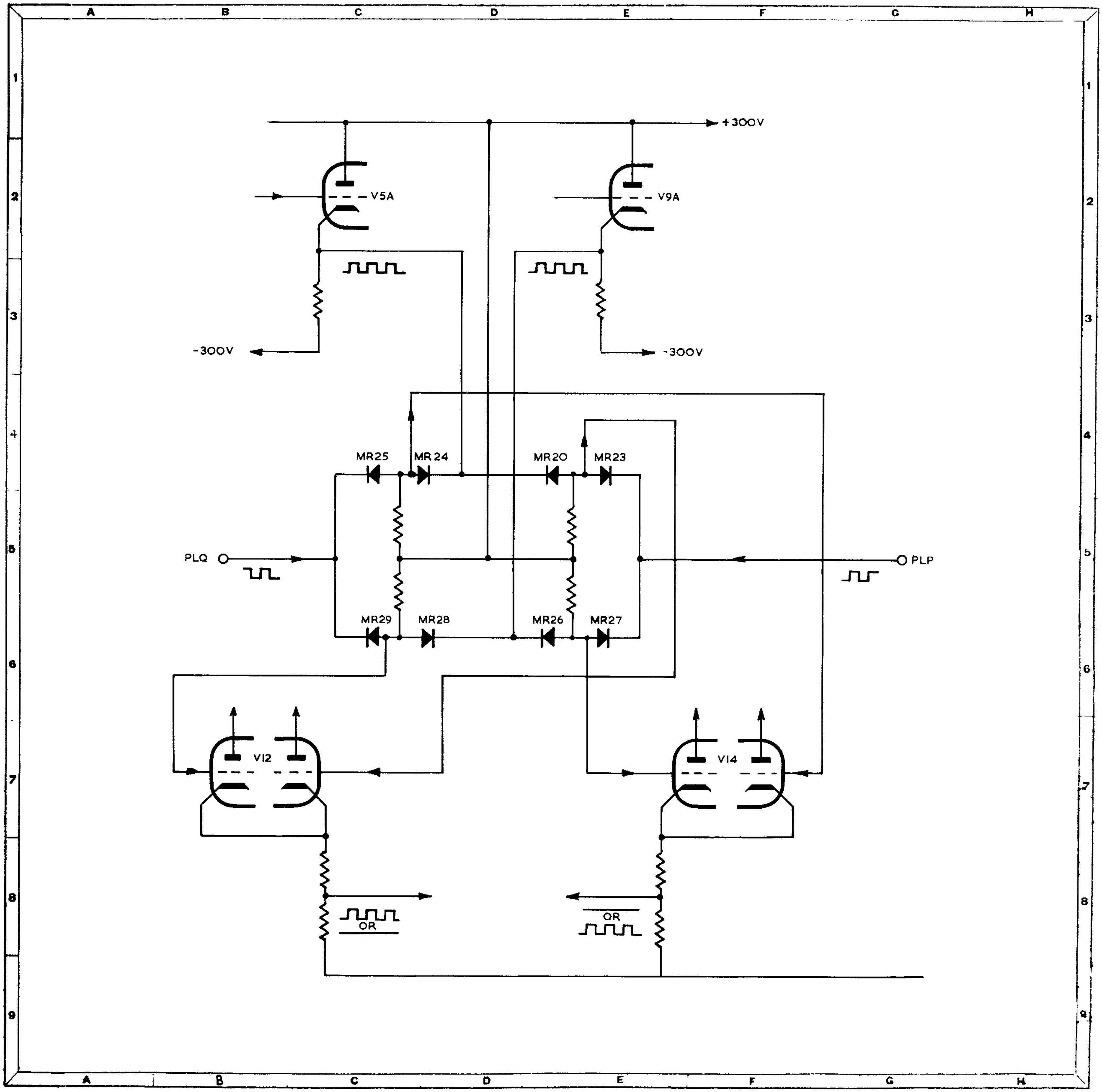
MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Valveholder B9A	No.277
Ref.2	Valveholder B7G	No.276
Ref.3	Can Screening B9A	No. 2
Ref.4	Can Screening B7G	No. 1
Ref.5	Knob Finger	No. 70
Ref.6	Metal Mounting	No. 76
Ref.7	Cap. Retaining	No. 53



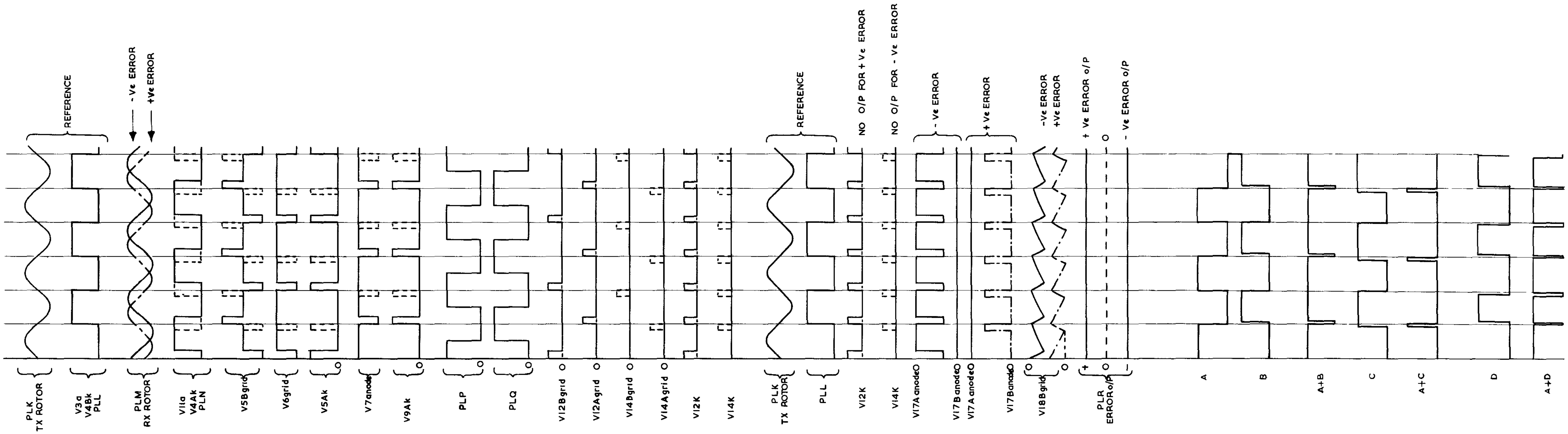
ERROR DETECTOR UNIT
TYPE 4274A - CIRCUIT
WZ.17005/D Sh.1 Iss.3

FIG. 25



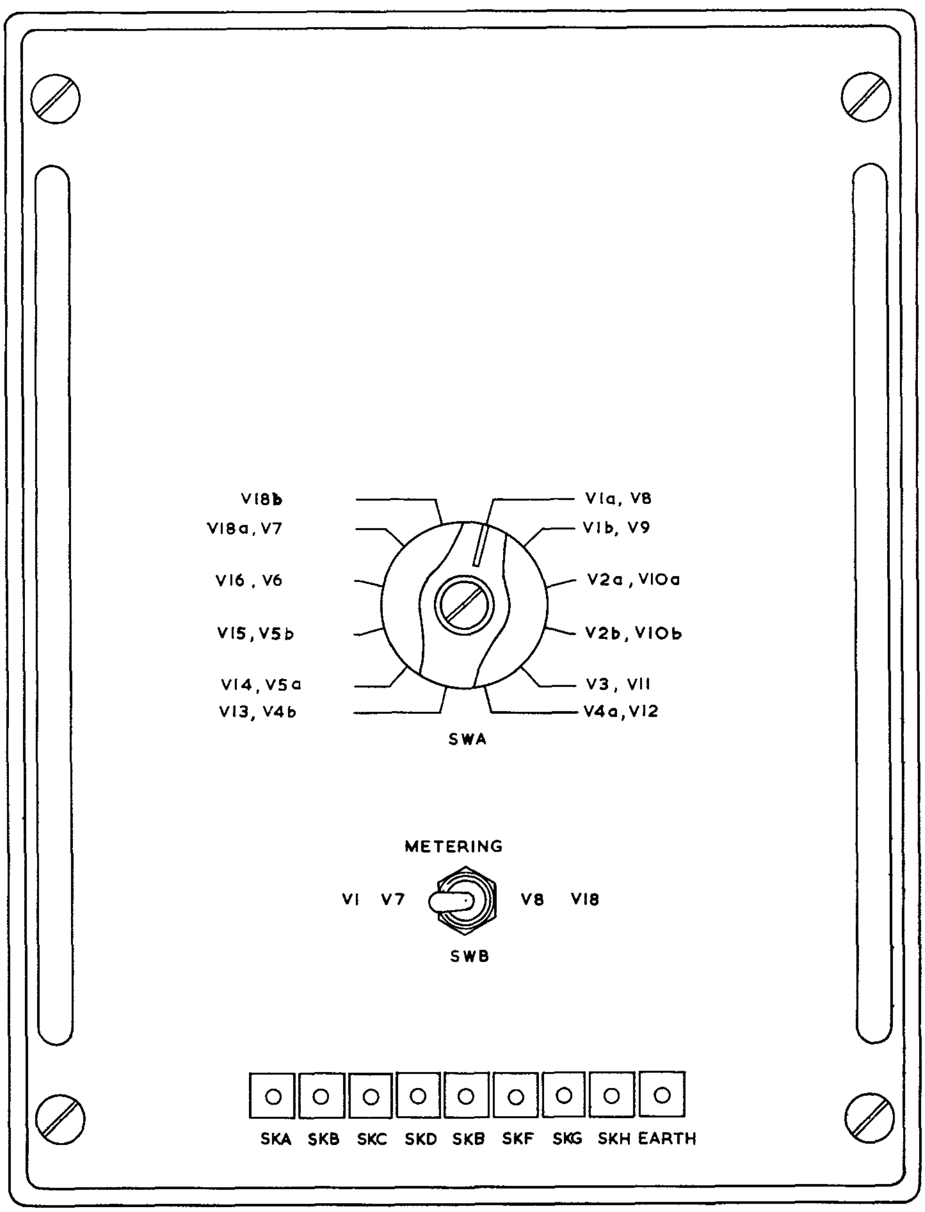
ERROR DETECTOR UNIT TYPE 4274A
SIMPLIFIED CIRCUIT DIAGRAM
WZ. 22182/B Sh. 1 Iss. 1

FIG. 26



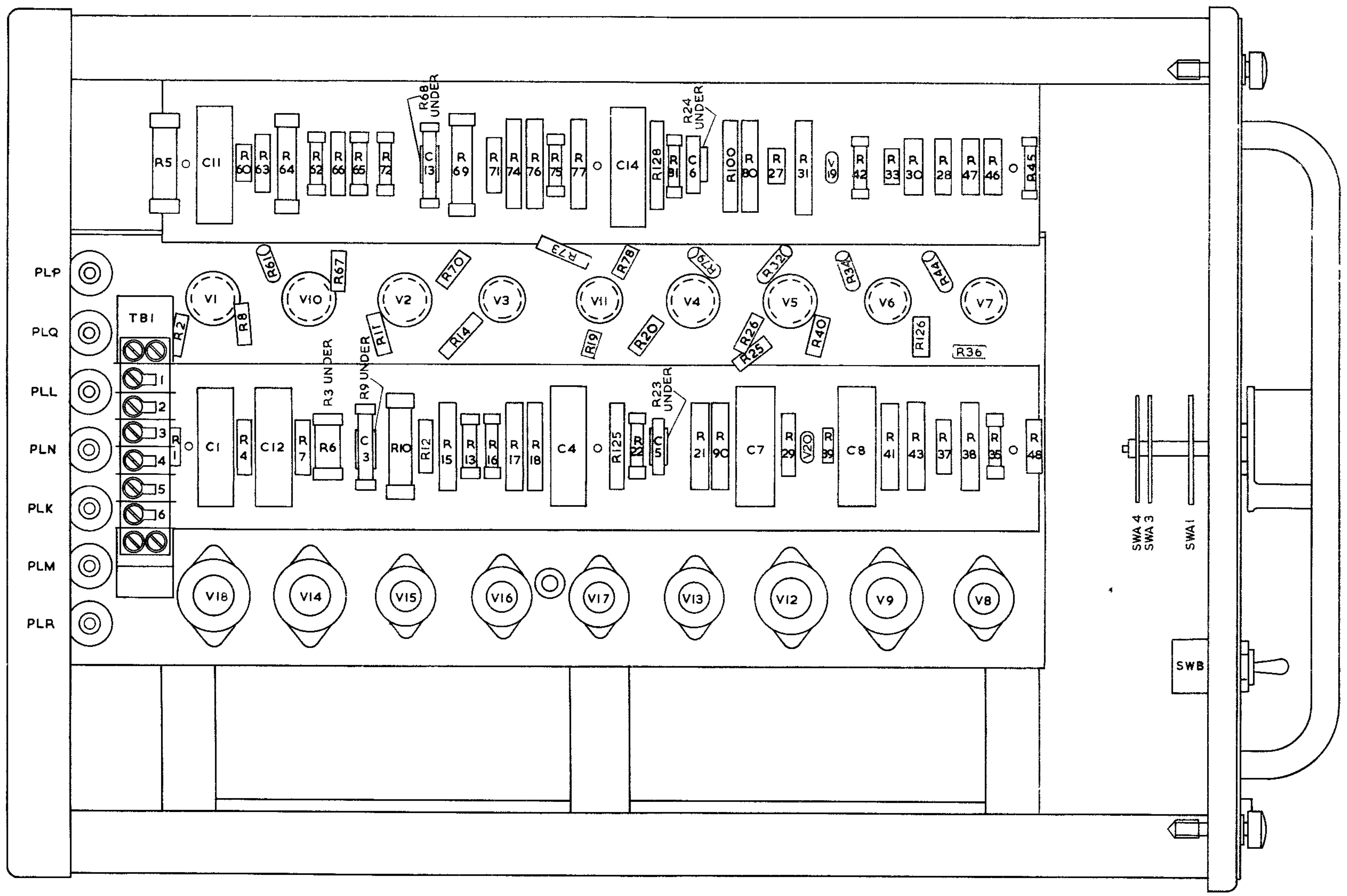
ERROR DETECTOR UNIT TYPE 4274A
TYPICAL WAVEFORMS
WZ.22181/D Sh.1 Iss.2

FIG. 27

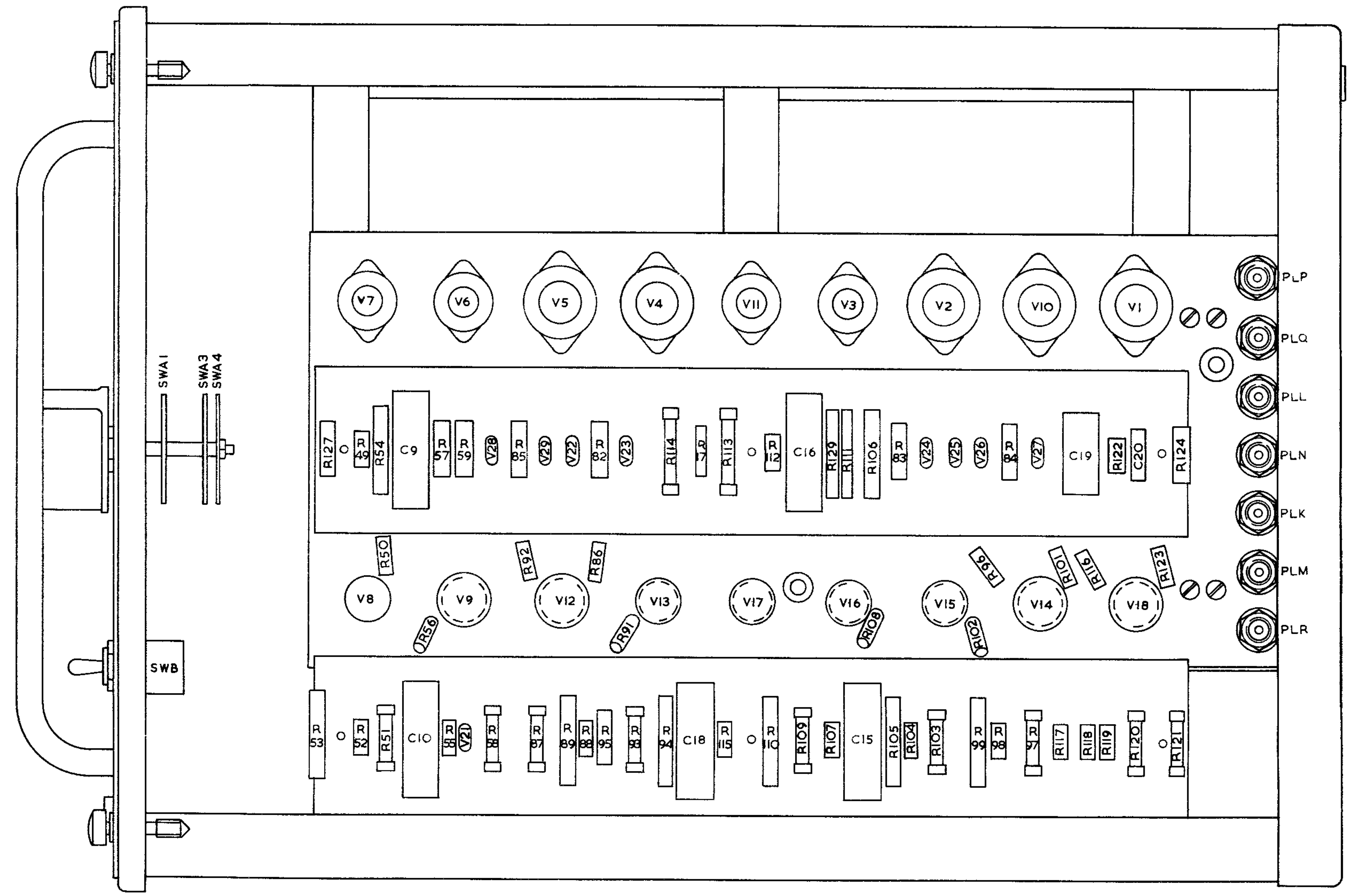


FRONT VIEW

ERROR DETECTOR UNIT TYPE 4274A
COMPONENT LAYOUT
WZ.22183/B Sh.1 Iss.1



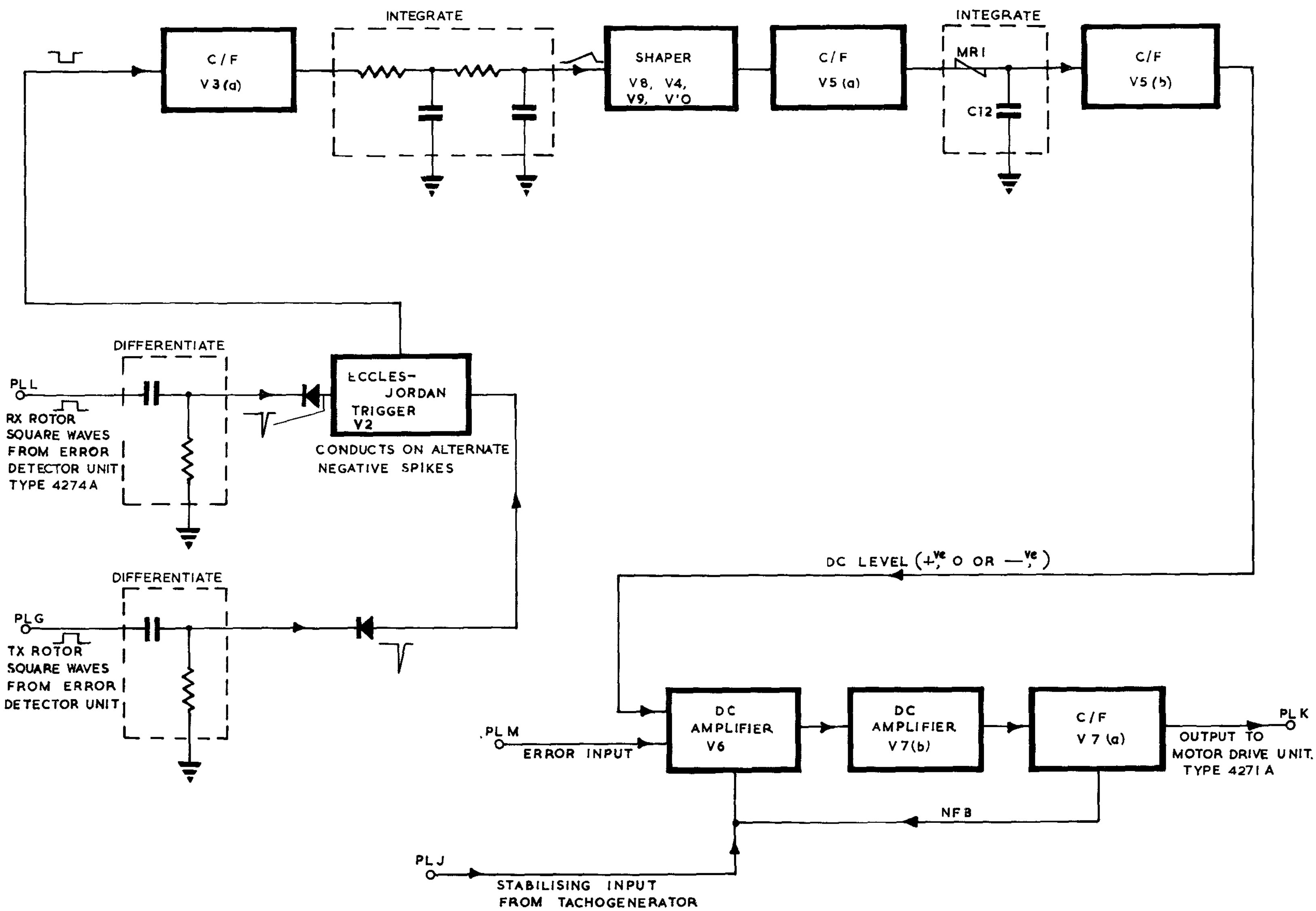
LEFT HAND SIDE VIEW



RIGHT HAND SIDE VIEW

ERROR DETECTOR UNIT TYPE 4274A
COMPONENT LAYOUT
WZ. 22183/B Sh. 2 Iss. 1

FIG. 29



AMPLIFYING UNIT (SERVO)
TYPE 4269A - BLOCK DIAGRAM
WZ.22172/B Sh.1 Iss.1

FIG.30

AMPLIFYING UNIT (SERVO) TYPE 4269A
(W.59130 Sh.1 Ed.A)

(Refer to Master Components List T4719)

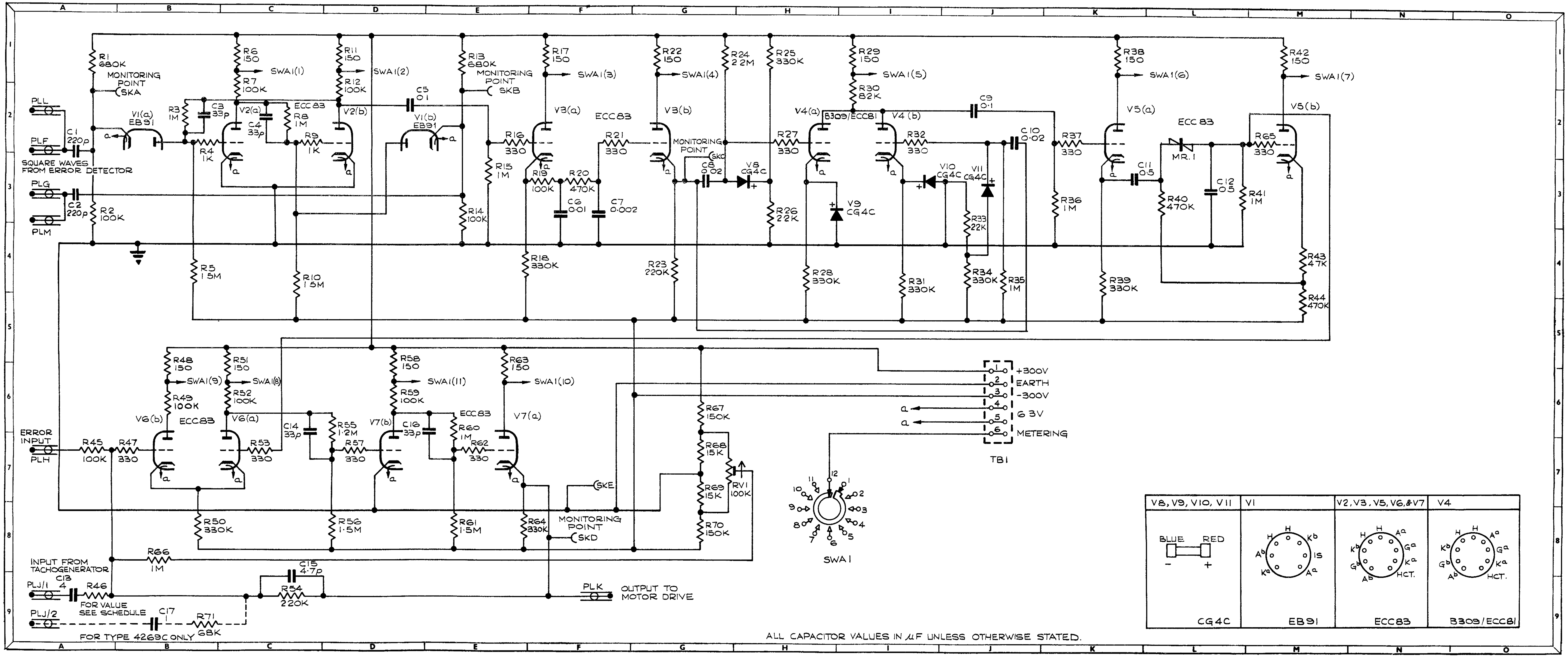
Cross Reference List

for WZ.17386/D Sh. 1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	31			R9	116	R25	120	R41	131	R57	99				
C2	31			R10	153	R26	114	R42	123	R58	123			V1	269
C3	32	MR1	84	R11	123	R27	99	R43	157	R59	154			V2	267
C4	32			R12	154	R28	120	R44	98	R60	152			V3	267
C5	4	PLF		R13	151	R29	123	R45	134	R61	153			V4	266
C6	3	to	80	R14	110	R30	156	R46	108	R62	99	RV1	234	V5	267
C7	29	PLM		R15	131	R31	120	R47	99	R63	123			V6	267
C8	27			R16	99	R32	99	R48	123	R64	120	SKA	238	V7	267
C9	4	R1	151	R17	123	R33	114	R49	154	R65	99	SKB	238	V8	83
C10	27	R2	110	R18	120	R34	120	R50	120	R66	160	SKC	238	V9	83
C11	33	R3	152	R19	110	R35	131	R51	123	R67	161	SKD	238	V10	83
C12	33	R4	116	R20	98	R36	131	R52	154	R68	162	SKE	239	V11	83
C13	26	R5	153	R21	99	R37	99	R53	99	R69	162				
C14	32	R6	123	R22	123	R38	123	R54	158	R70	161	SWA	249		
C15	34	R7	154	R23	113	R39	120	R55	159						
C16	32	R8	152	R24	155	R40	98	R56	153			TB1	262		

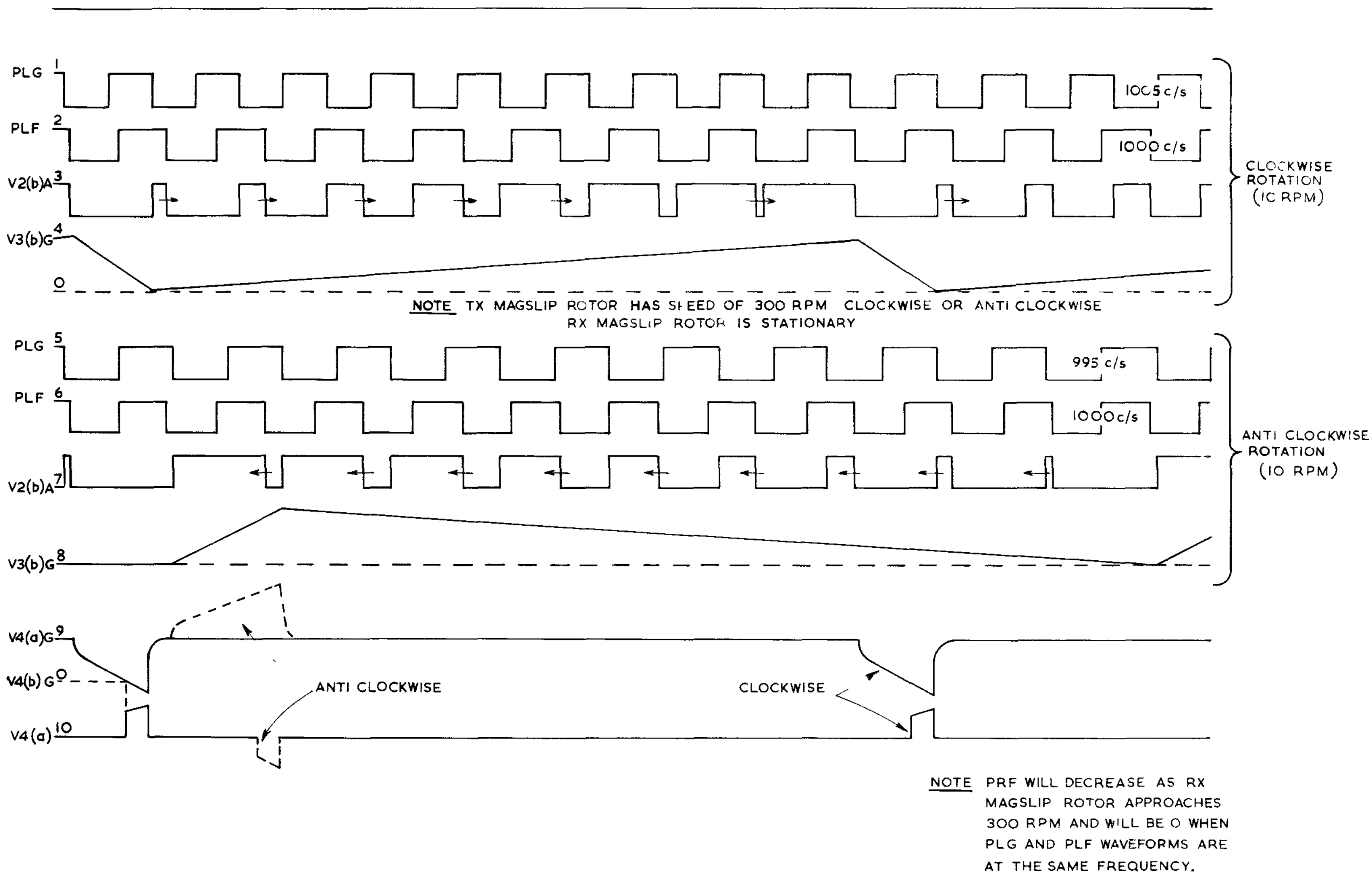
MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Valveholder for V2-V7	No.277
Ref.2	Valveholder for V1	No.276
Ref.3	Can Screening for V2-V7	No. 1
Ref.4	Can Screening for V1	No. 2



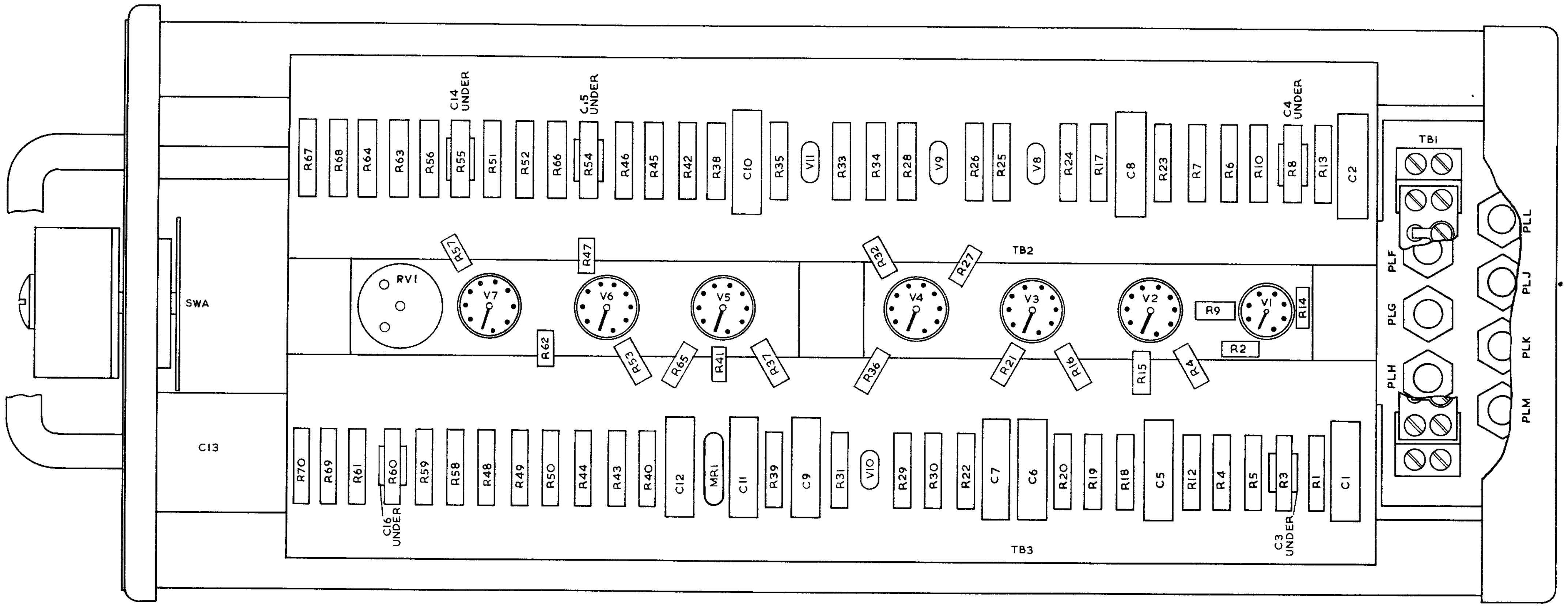
AMPLIFYING UNIT (SERVO)
TYPE 4269A - CIRCUIT
WZ.17386/D Sh.1 Iss.2

FIG.31

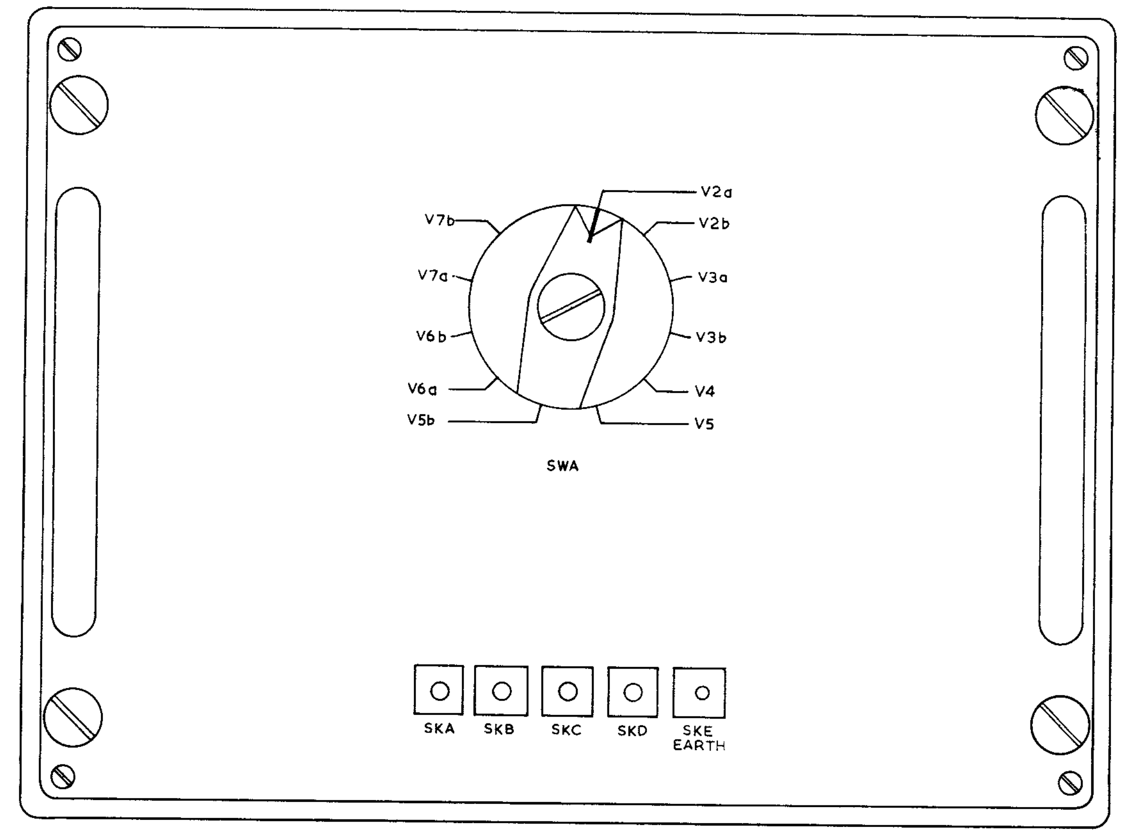


AMPLIFYING UNIT (SERVO) TYPE 4269A
RUN-UP CIRCUIT TYPICAL WAVEFORMS
WZ.22173/B Sh.1 Iss.1

FIG.32



LEFT HAND SIDE VIEW



FRONT VIEW

AMPLIFYING UNIT (SERVO) TYPE 4269A
COMPONENT LAYOUT
WZ. 22174/D Sh. 1 Iss. 1

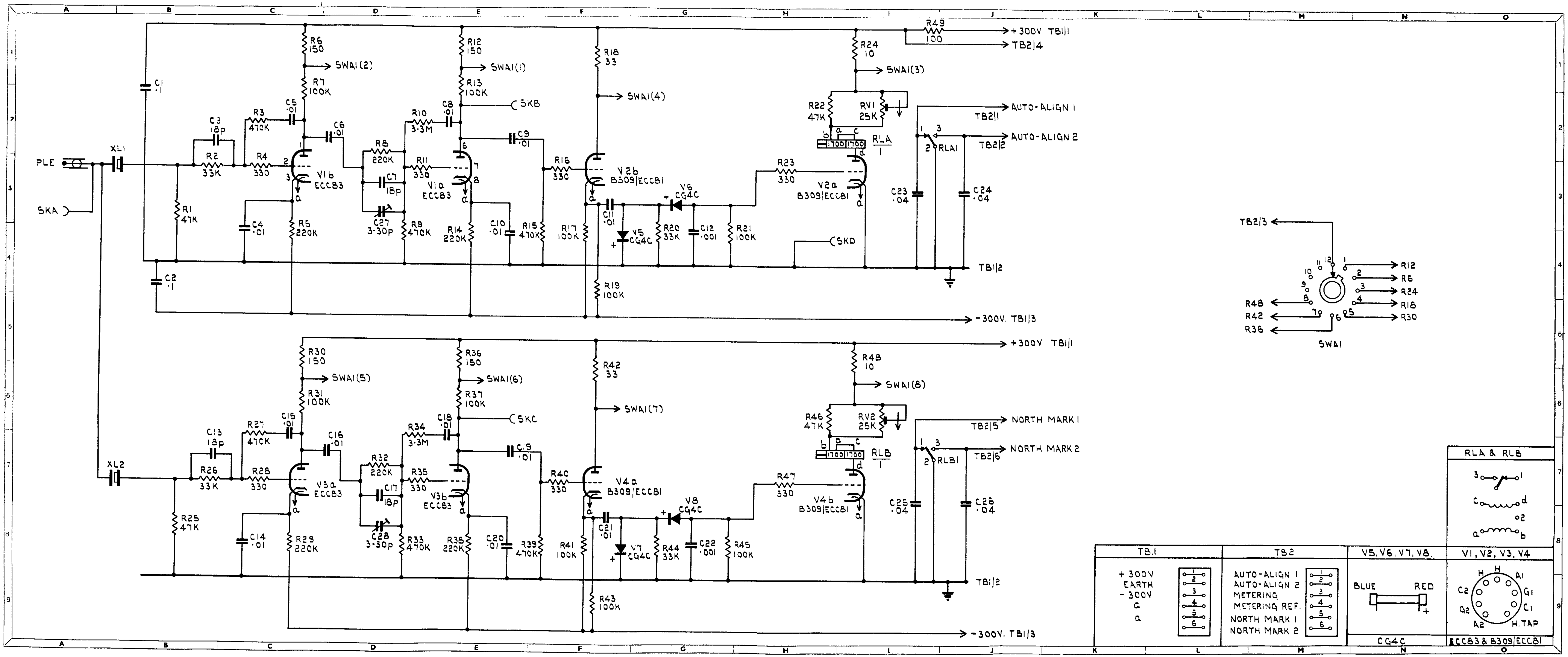
FIG. 33

NORTH ALIGNING UNIT (RECEIVING) TYPE 4626
(W.59455 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.18022/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	4	C15	3	R3	165	R17	168	R31	154	R45	110	RV2	235	V3	267
C2	4	C16	3	R4	99	R18	121	R32	158	R46	169			V4	266
C3	35	C17	35	R5	166	R19	168	R33	98	R47	99	SKA	238	V5	83
C4	3	C18	3	R6	123	R20	108	R34	167	R48	96	SKB	238	V6	83
C5	3	C19	3	R7	154	R21	110	R35	99	R49	94	SKC	238	V7	83
C6	3	C20	3	R8	158	R22	169	R36	123			SKD	239	V8	83
C7	35	C21	3	R9	98	R23	99	R37	154						
C8	3	C22	30	R10	167	R24	96	R38	166			SWA	250	XL1	58
C9	3	C2		R11	99	R25	163	R39	99					XL2	57
C10	3			R12	123	R26	164	R40	98			TB1	262		
C11	3	PLE	80	R13	154	R27	165	R41	168	RLA	86	TB2	262		
C12	30			R14	166	R28	99	R42	121	RLB	86				
C13	35	R1	163	R15	98	R29	166	R43	168			V1	267		
C14	3	R2	164	R16	99	R30	123	R44	108	RV1	235	V2	266		

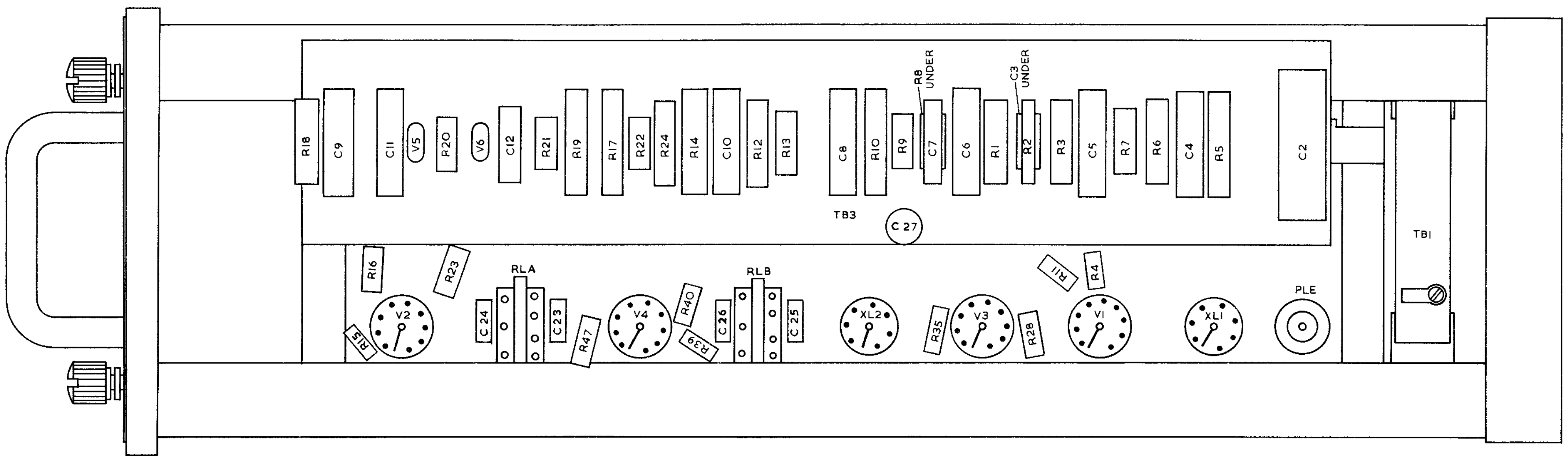
MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Valveholder for XL1 & XL2	No.276
Ref.2	Valveholder for V1-V4	No.277
Ref.3	Cans Screening for XL1 & XL2	No. 1
Ref.4	Cans Screening for V1-V4	No. 2
Ref.5	Socket Relay for RLA & RLB	No.240
Ref.6	Spring Retaining	No.244

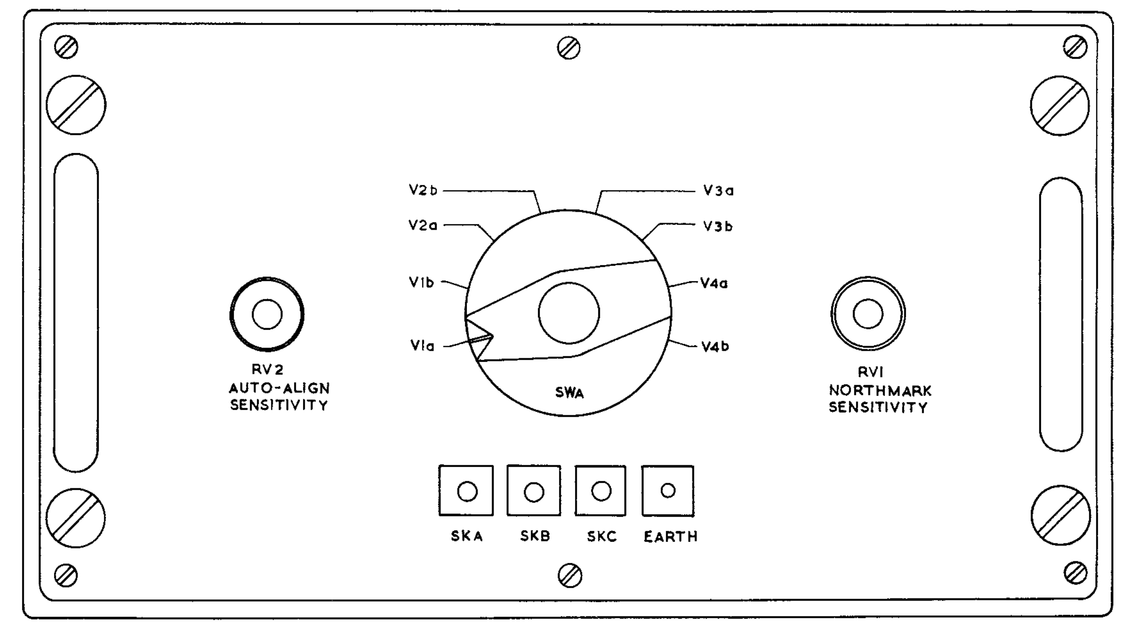


NORTH ALIGNING UNIT (RECEIVER)
TYPE 4626A - CIRCUIT
WZ.18022/D Sh.1 Iss.2

FIG.34



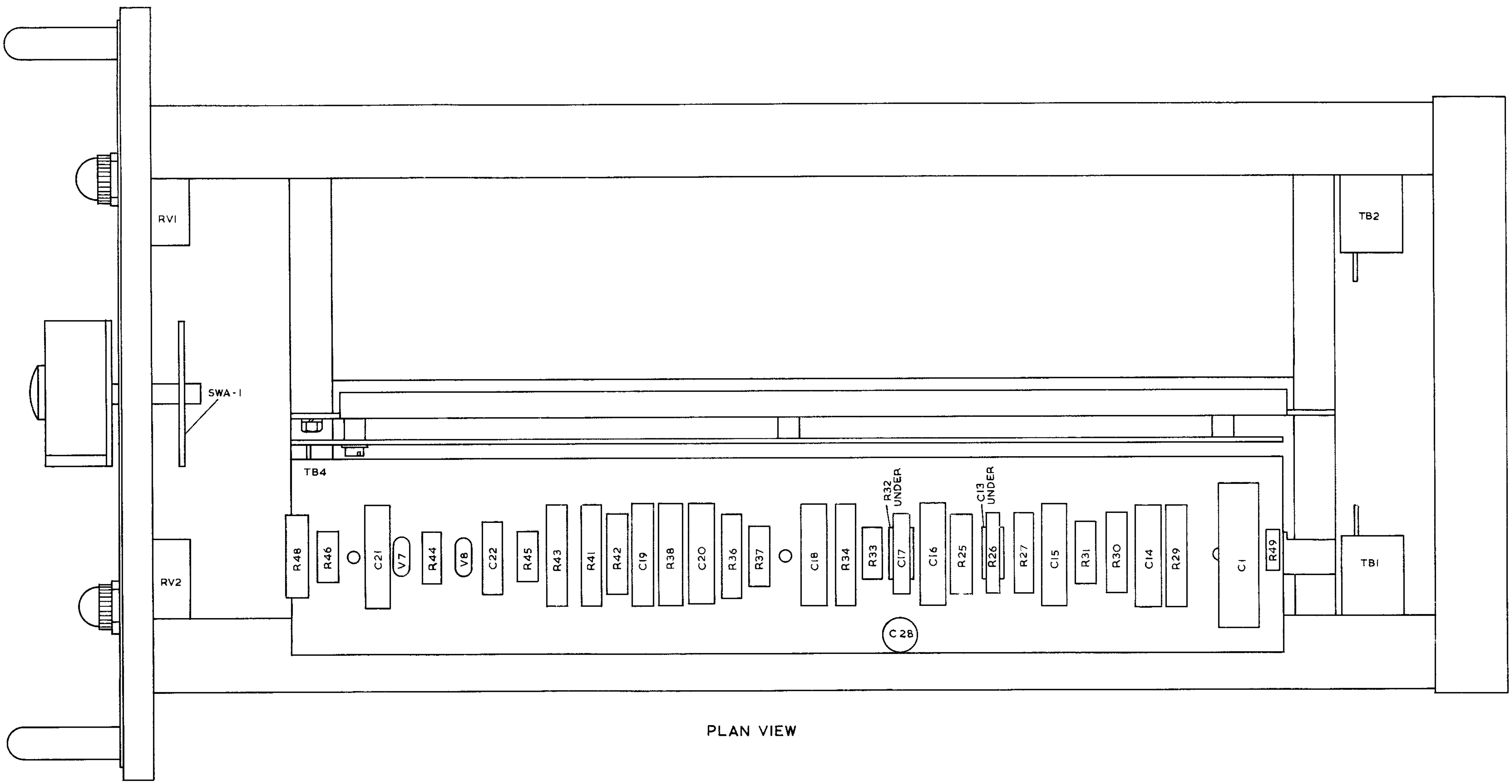
RIGHT HAND SIDE VIEW



FRONT VIEW

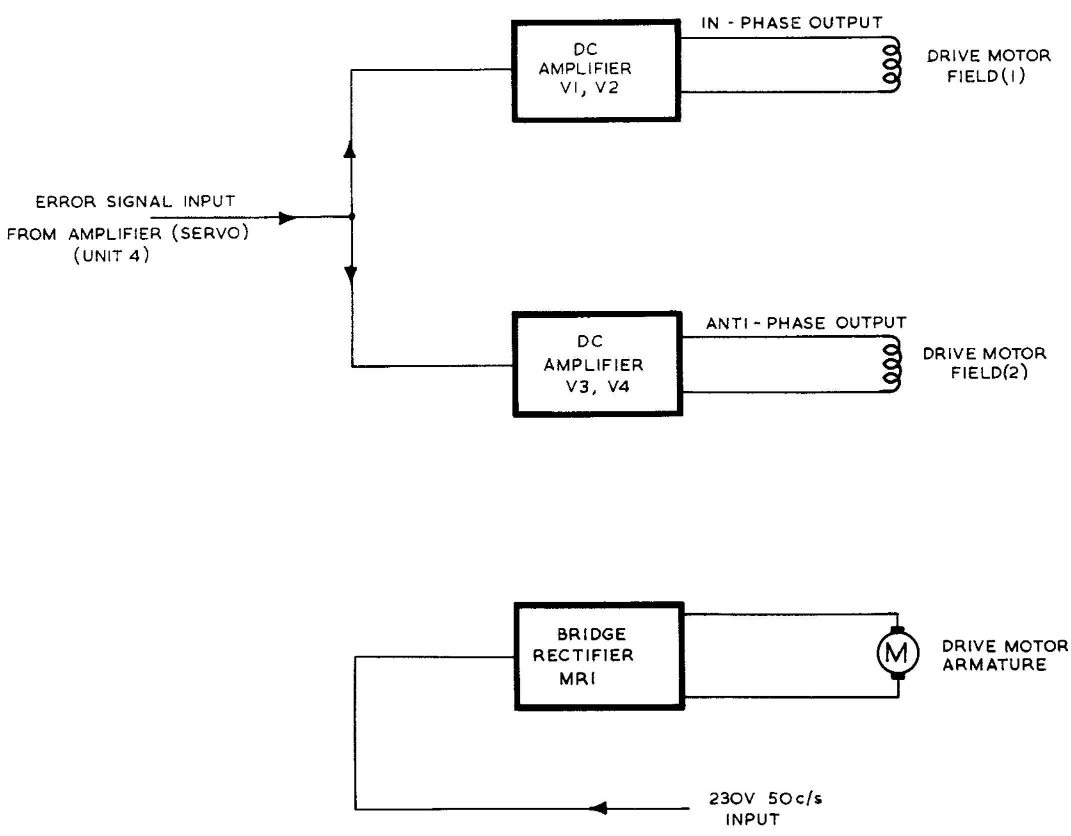
NORTH ALIGNING UNIT (RECEIVER)
TYPE 4626A - COMPONENT LAYOUT
WZ.22169/D Sh.1 Iss.2

FIG.35



NORTH ALIGNING UNIT (RECEIVER)
TYPE 4626A - COMPONENT LAYOUT
WZ. 22169/D Sh. 2 Iss. 2

FIG. 36



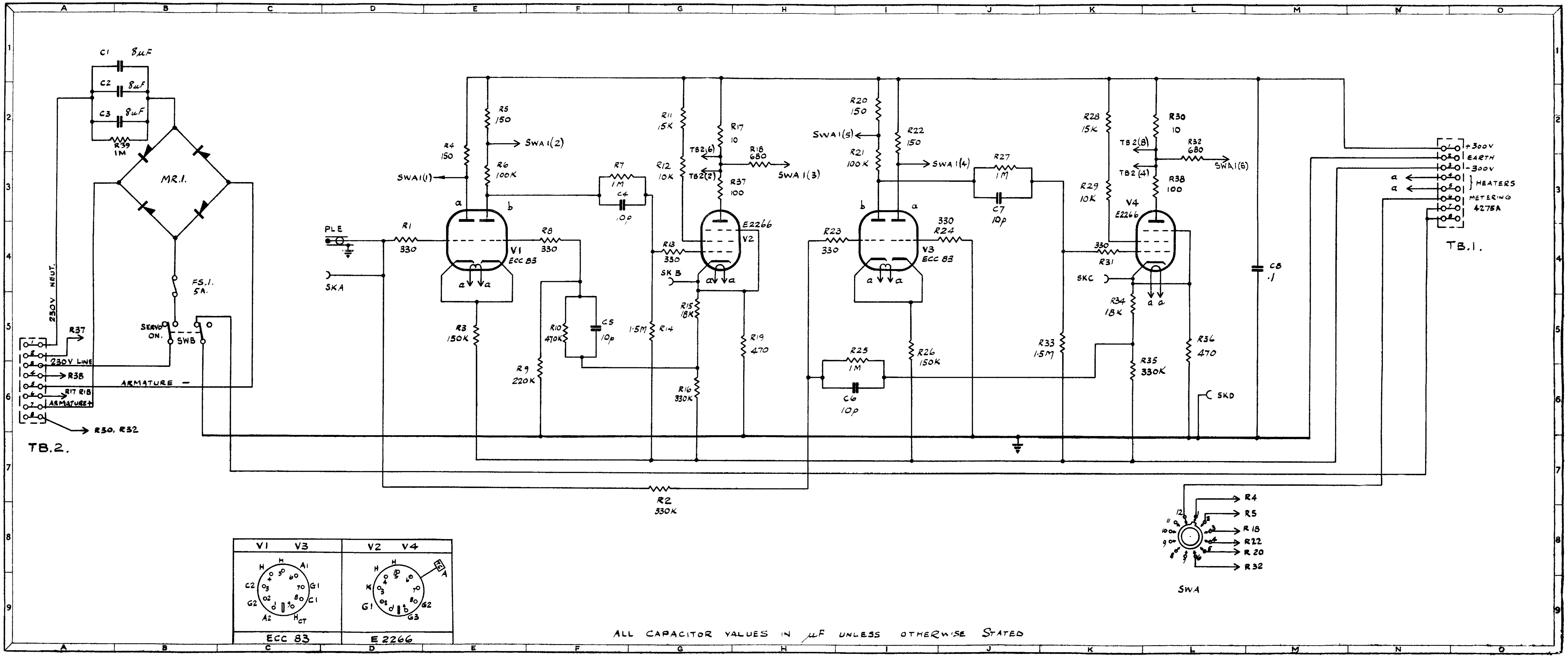
MOTOR DRIVE UNIT TYPE 4271A
BLOCK DIAGRAM
WZ.22175/B Sh.1 Iss.1

MOTOR DRIVE UNIT TYPE 4271A
(W.59031 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17006/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	38	FS1	59	R5	123	R15	189	R25	160	R35	190	SKB	238	V1	267
C2	38			R6	132	R16	190	R26	185	R36	192	SKC	238	V2	268
C3	38	MR1	85	R7	186	R17	96	R27	186	R37	94	SKD	239	V3	267
C4	28			R8	99	R18	191	R28	187	R38	94			V4	268
C5	28	PLE	80	R9	158	R19	192	R29	146	R39	175	SWA	252		
C6	28			R10	165	R20	123	R30	96			SWB	253		
C7	28	R1	99	R11	187	R21	132	R31	99						
C8	4	R2	105	R12	146	R22	123	R32	191			TB1	260		
		R3	185	R13	99	R23	99	R33	173			TB2	260		
		R4	123	R14	188	R24	99	R34	189	SKA	238				

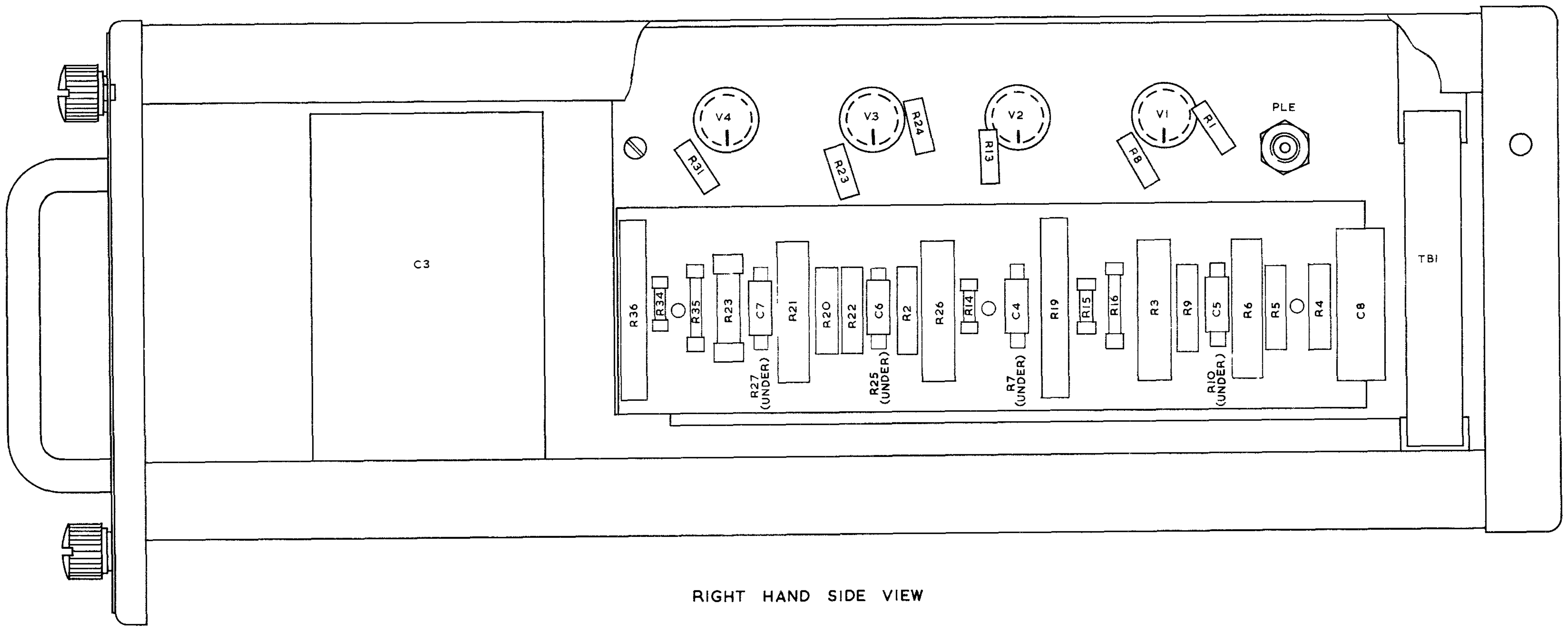
MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Fuseholder	No. 63
Ref.2	Valveholder for V2,V4	No.278
Ref.3	Valveholder for V1,V3	No.277
Ref.4	Can Screening for V1,V3	No. 2
Ref.5	Connector Assembly (Top Cap) for V2,V4	No. 56
Ref.6	Valve Retainer for V2,V4	No.281

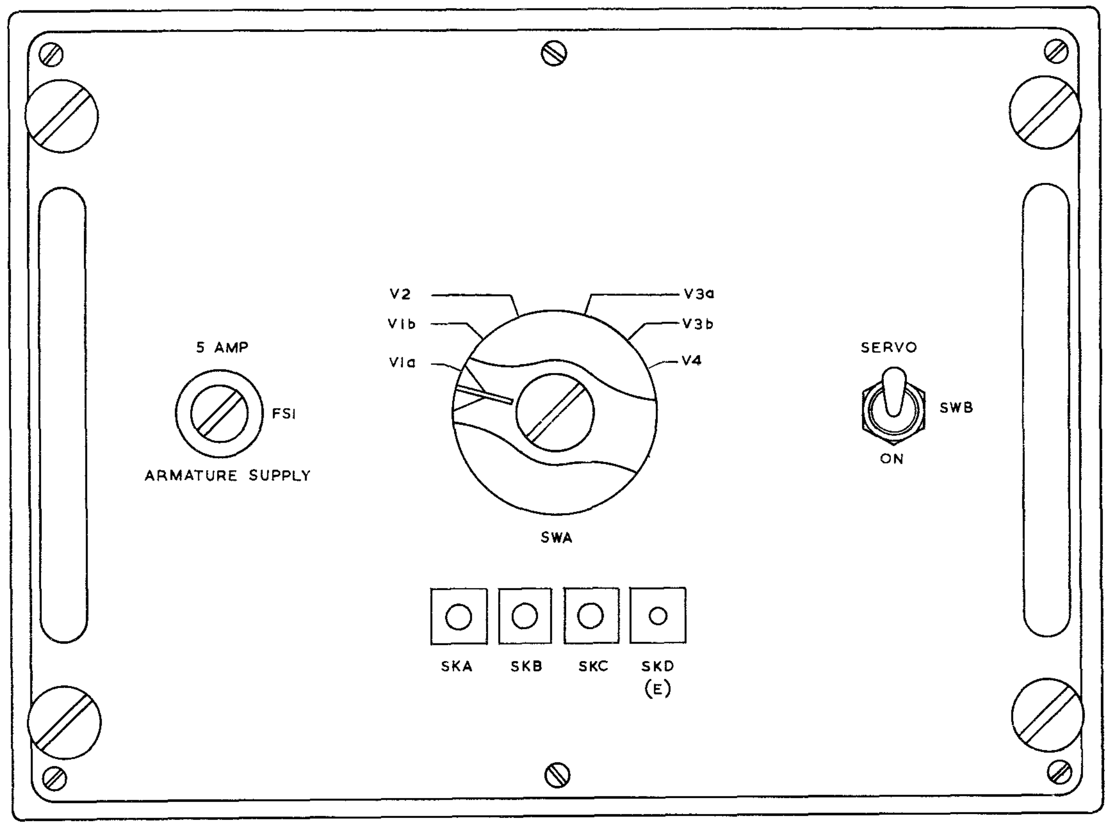


MOTOR DRIVE UNIT TYPE 4271A
CIRCUIT
WZ.17006/D Sh.1 Iss.2

FIG.38



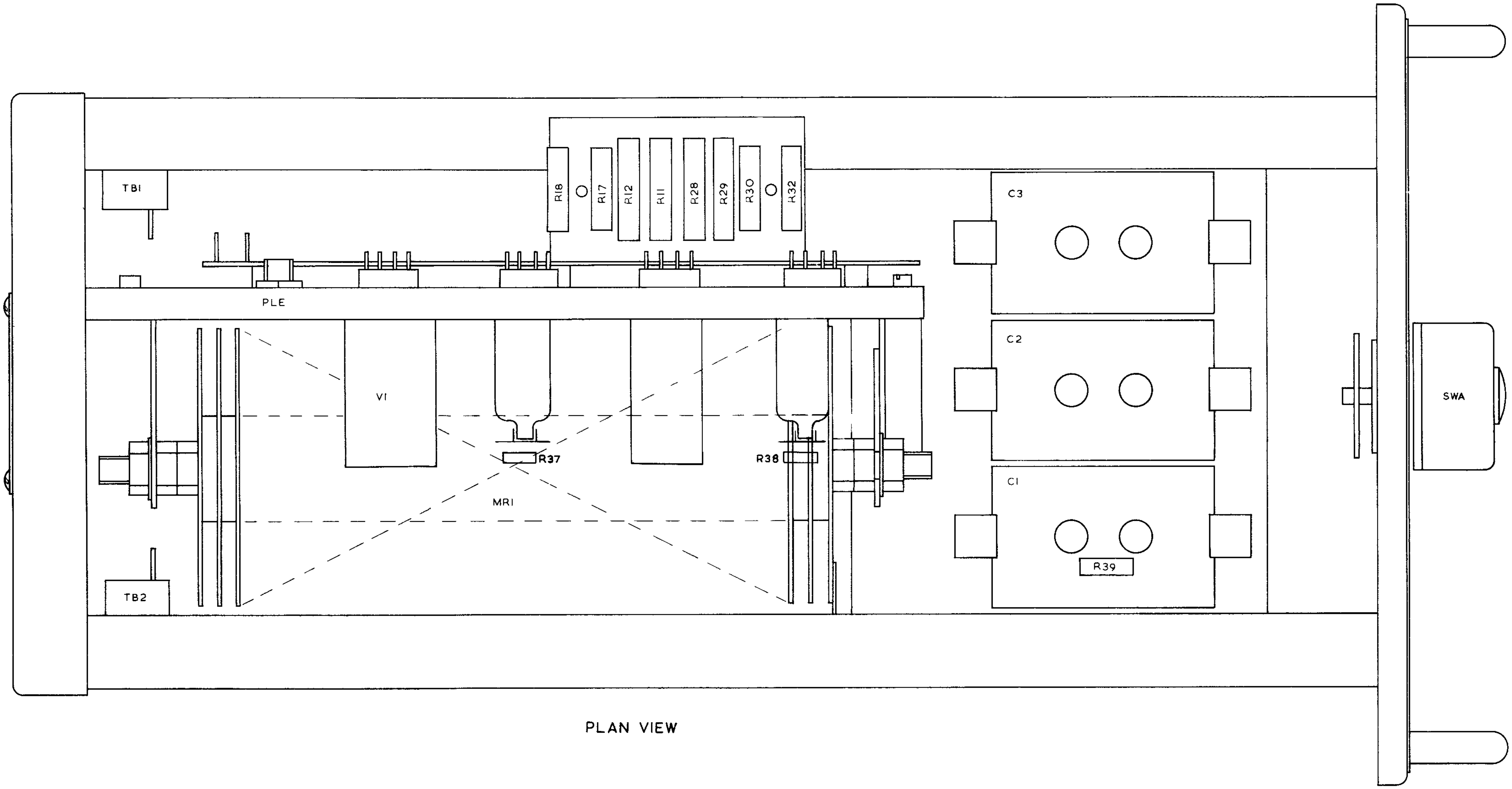
RIGHT HAND SIDE VIEW



FRONT VIEW

MOTOR DRIVE UNIT TYPE 4271A
COMPONENT LAYOUT
WZ.22176/D Sh.1 Iss.1

FIG.39



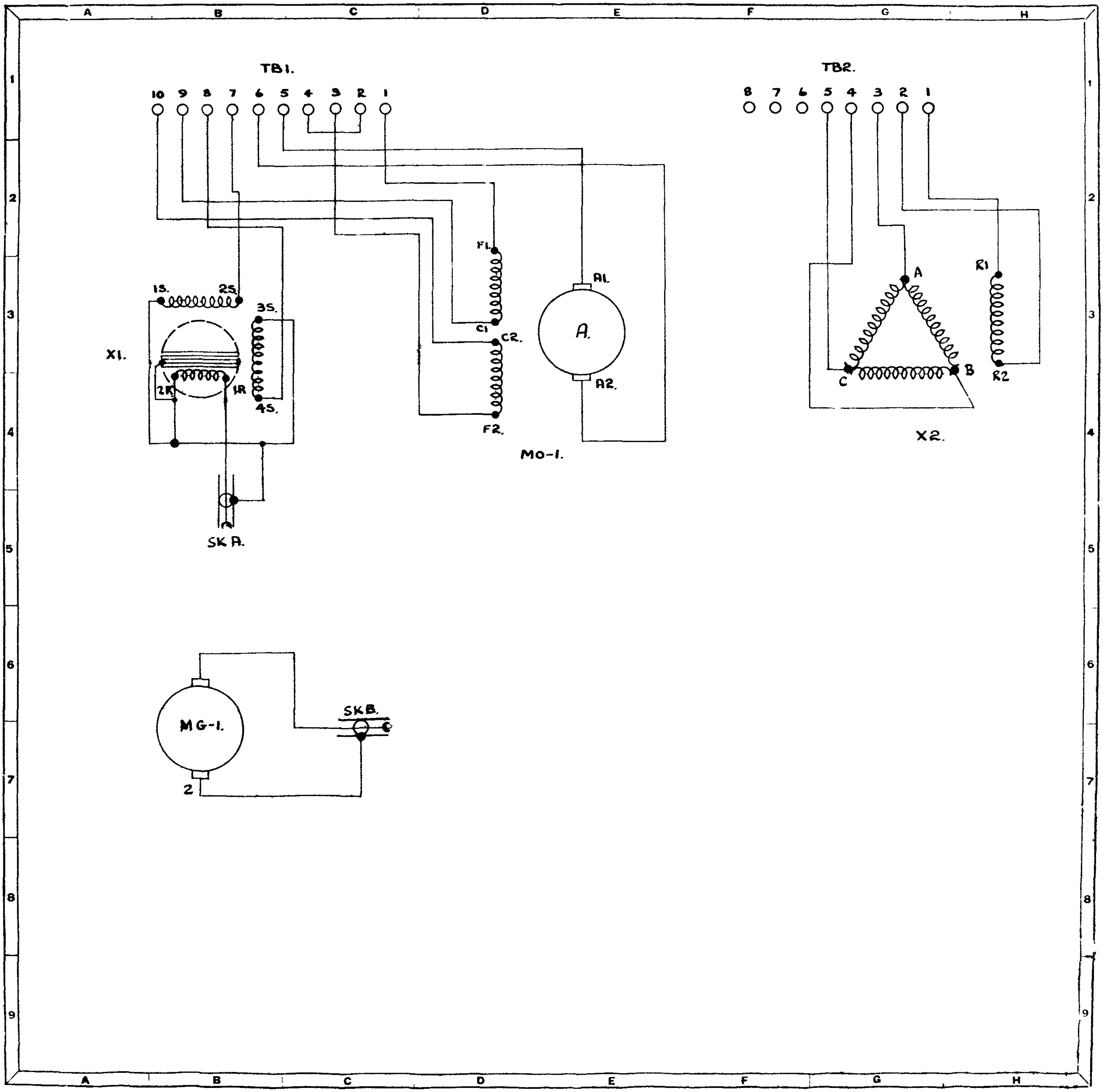
PLAN VIEW

MOTOR DRIVE UNIT TYPE 4271A
COMPONENT LAYOUT
WZ.22176/D Sh.2 Iss.1

FIG.40

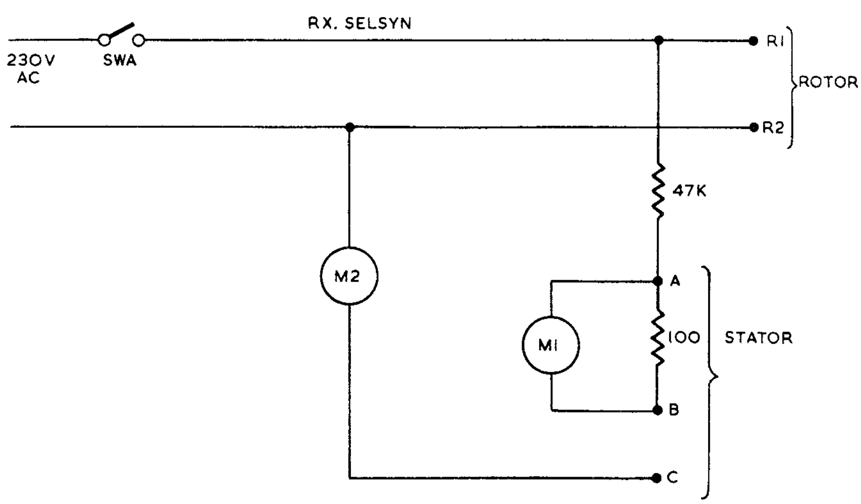
RECEIVER GEARBOX TYPE 4276A
(W.59142 Sh.1 Ed.A)
(Refer to Mater Components List T4719)
Cross Reference List
for WZ.19655/B Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
MG1	64	MO1	78	SKA	237	SKB	237	TB1	258	TB2	259	X1	75	X2	236

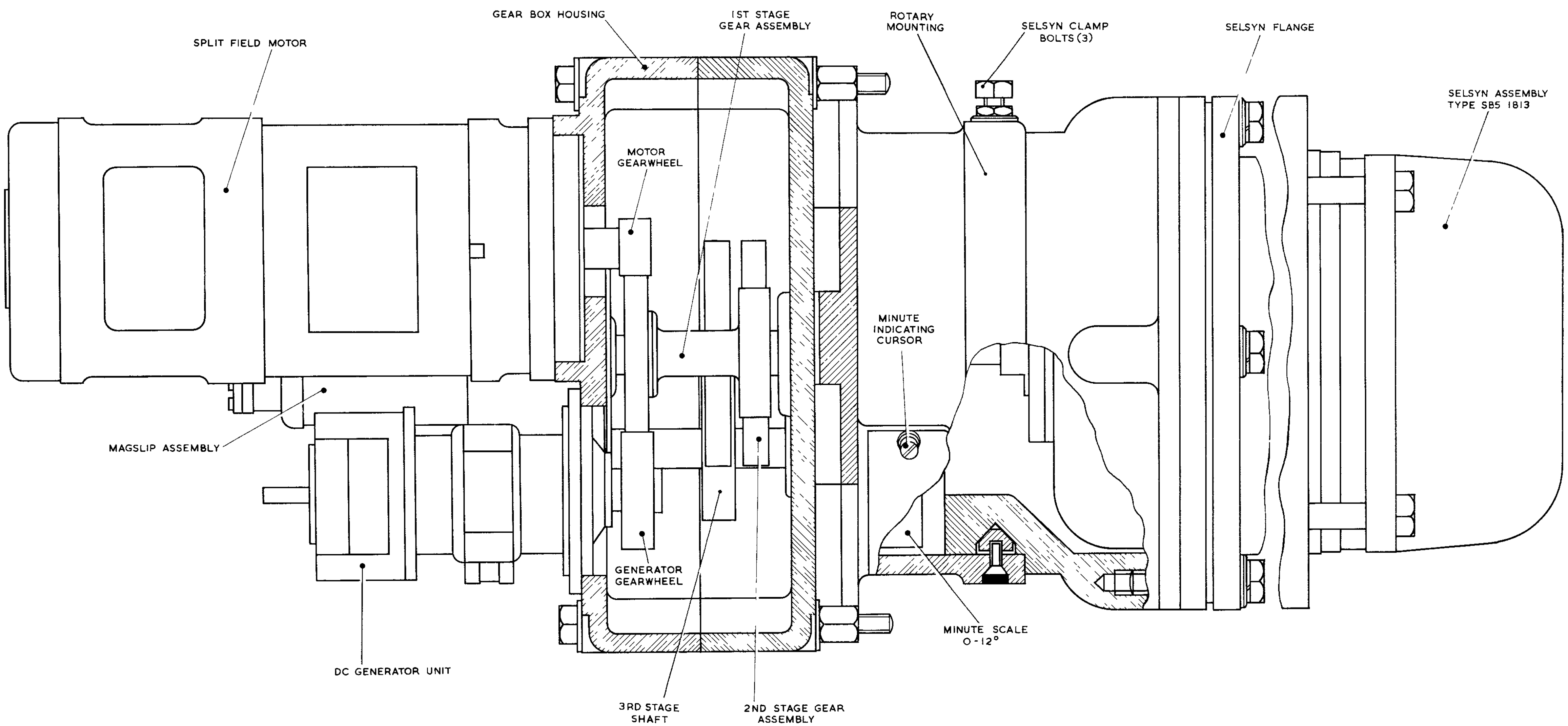


RECEIVER GEARBOX TYPE 4276A
CIRCUIT
WZ.19655/B Sh.1 Iss.1

FIG.41



RECEIVER GEARBOX TYPE 4276A
CODING OF RECEIVER SELSYN CIRCUIT
WZ.22204/B Sh.1 Iss.1

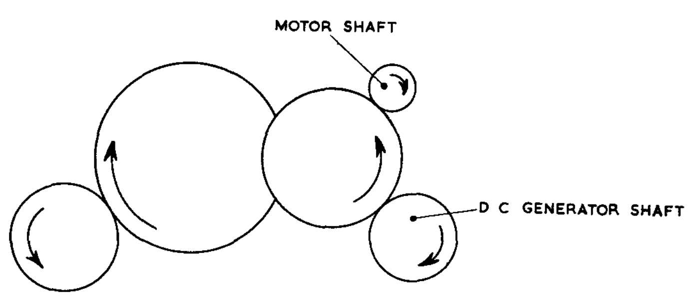


TO ROTATE SELSYN, RELEASE SELSYN CLAMP BOLTS (3) AND TURN SELSYN BODY. TIGHTEN CLAMP BOLTS WHEN SELSYN IS CORRECTLY ALIGNED WITH RESPECT TO GEARBOX

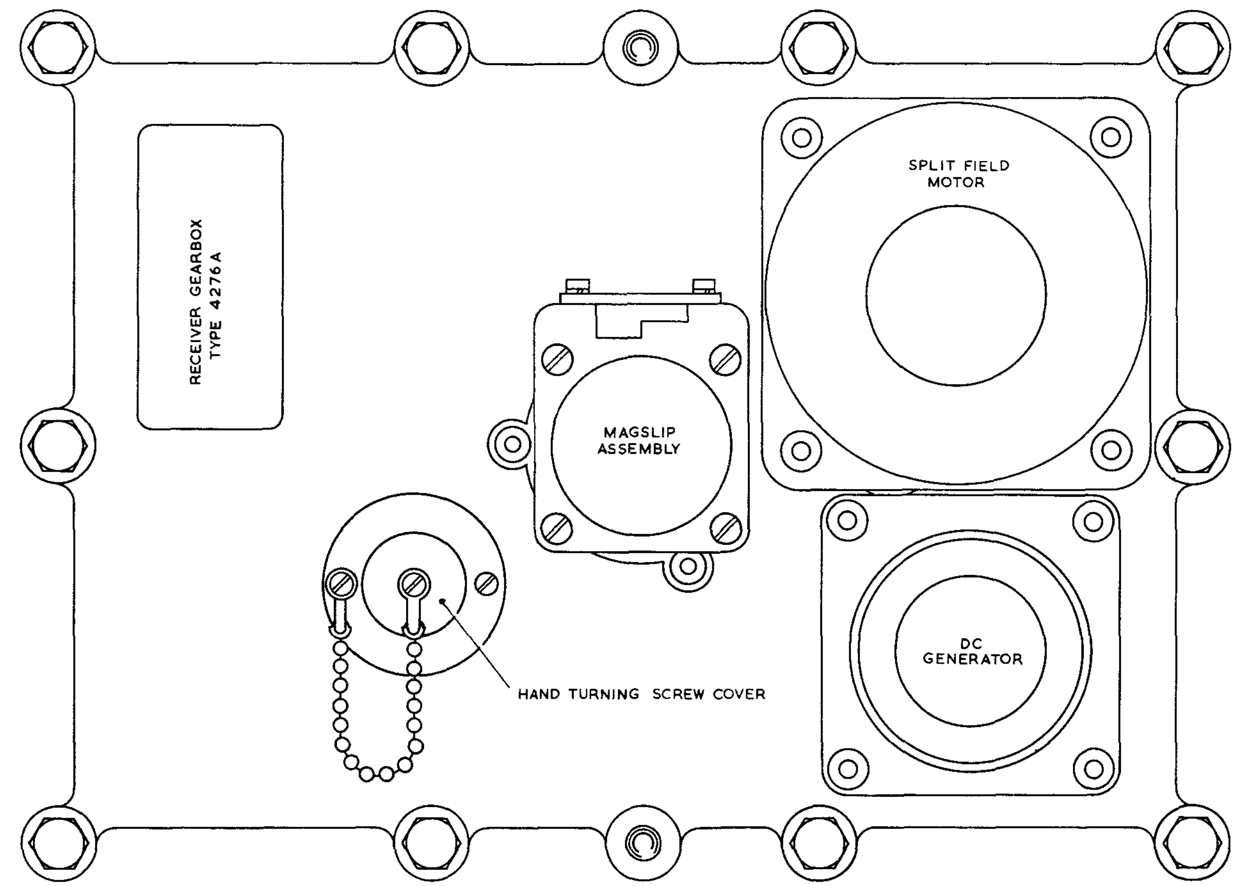
SIDE VIEW

RECEIVER GEARBOX TYPE 4276A
LOCATION OF UNITS
WZ.22184/D Sh.1 Iss.1

FIG.43



DIRECTION OF GEARING



END VIEW

LUBRICATION OF UNIT

BALL BEARINGS TO BE CLEANED AND RELUBRICATED WITH GREASE SPEC.W. 125/39

RECEIVER GEARBOX TYPE 4276A
LOCATION OF UNITS
WZ.22184/D Sh.2 Iss.1

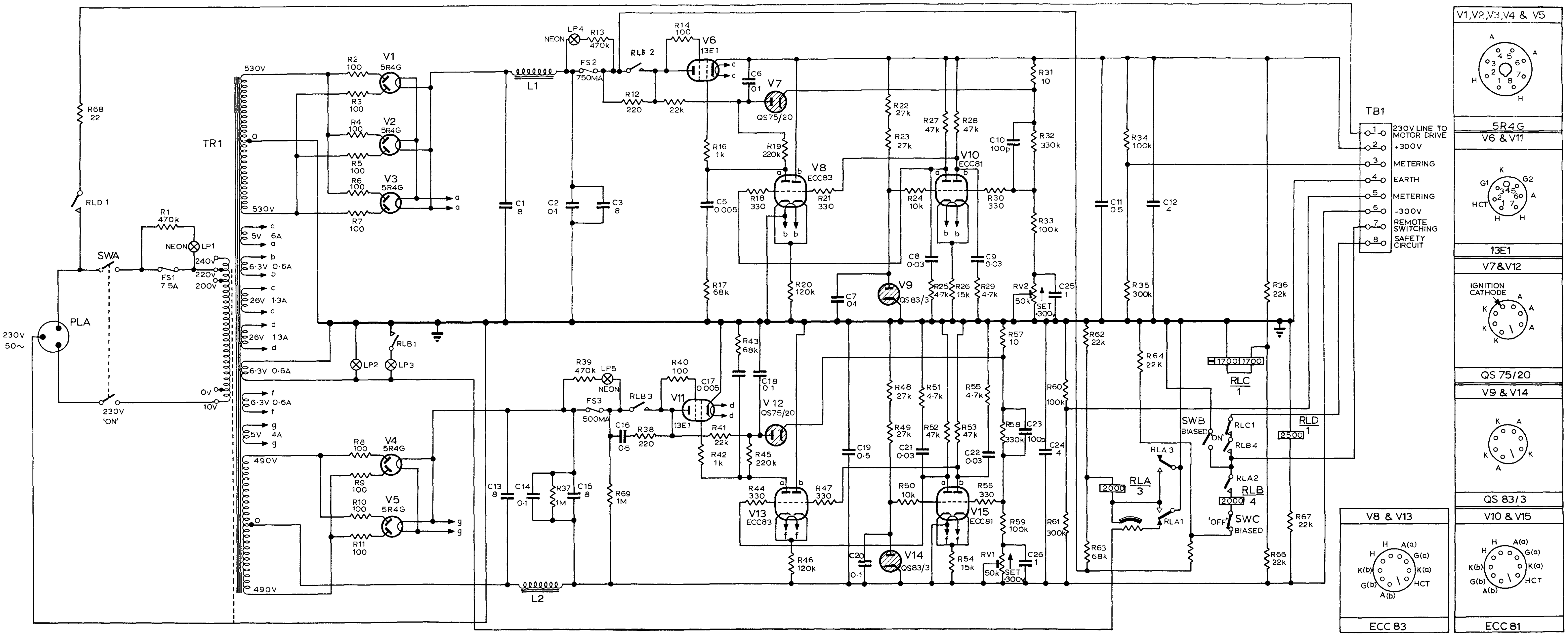
FIG.44

POWER SUPPLY UNIT TYPE 4275A
(W.59106 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.17001/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	44	C20	4	LP3	72	R21	99	R40	94	R59	134	RLB	89	V5	272
C2	45	C21	48	LP4	71	R22	122	R41	195	R60	202	RLC	86	V6	273
C3	44	C22	48	LP5	71	R23	122	R42	116	R61	203	RLD	90	V7	274
C4	46	C23	49			R24	199	R43	196	R62	195			V8	267
C5	47	C24	51	PLA	81	R25	197	R44	99	R63	204	RV1	232	V9	275
C6	4	C25	36			R26	200	R45	158	R64	195	RV2	232	V10	266
C7	4	C26	36	R1	98	R27	201	R46	198	R65	205			V11	273
C8	48			R2		R28	201	R47	99	R66	195	SWA	254	V12	274
C9	48			to	193	R29	197	R48	122	R67	195	SWB	255	V13	267
C10	49			R11		R30	99	R49	122	R68	206	SWC	255	V14	275
C11	50	FS1	60	R12	194	R31	150	R50	199	R69	175			V15	266
C12	51	FS2	61	R13	98	R32	103	R51	197			TB1	263		
C13	44	FS3	62	R14	94	R33	134	R52	201						
C14	45			R15	195	R34	202	R53	201			TR1	264		
C15	44	L1	68	R16	116	R35	203	R54	200						
C16	46	L2	69	R17	196	R36	195	R55	197			V1	272		
C17	47			R18	99	R37	175	R56	99			V2	272		
C18	4	LP1	71	R19	158	R38	194	R57	150			V3	272		
C19	50	LP2	72	R20	198	R39	98	R58	103	RLA	88	V4	272		

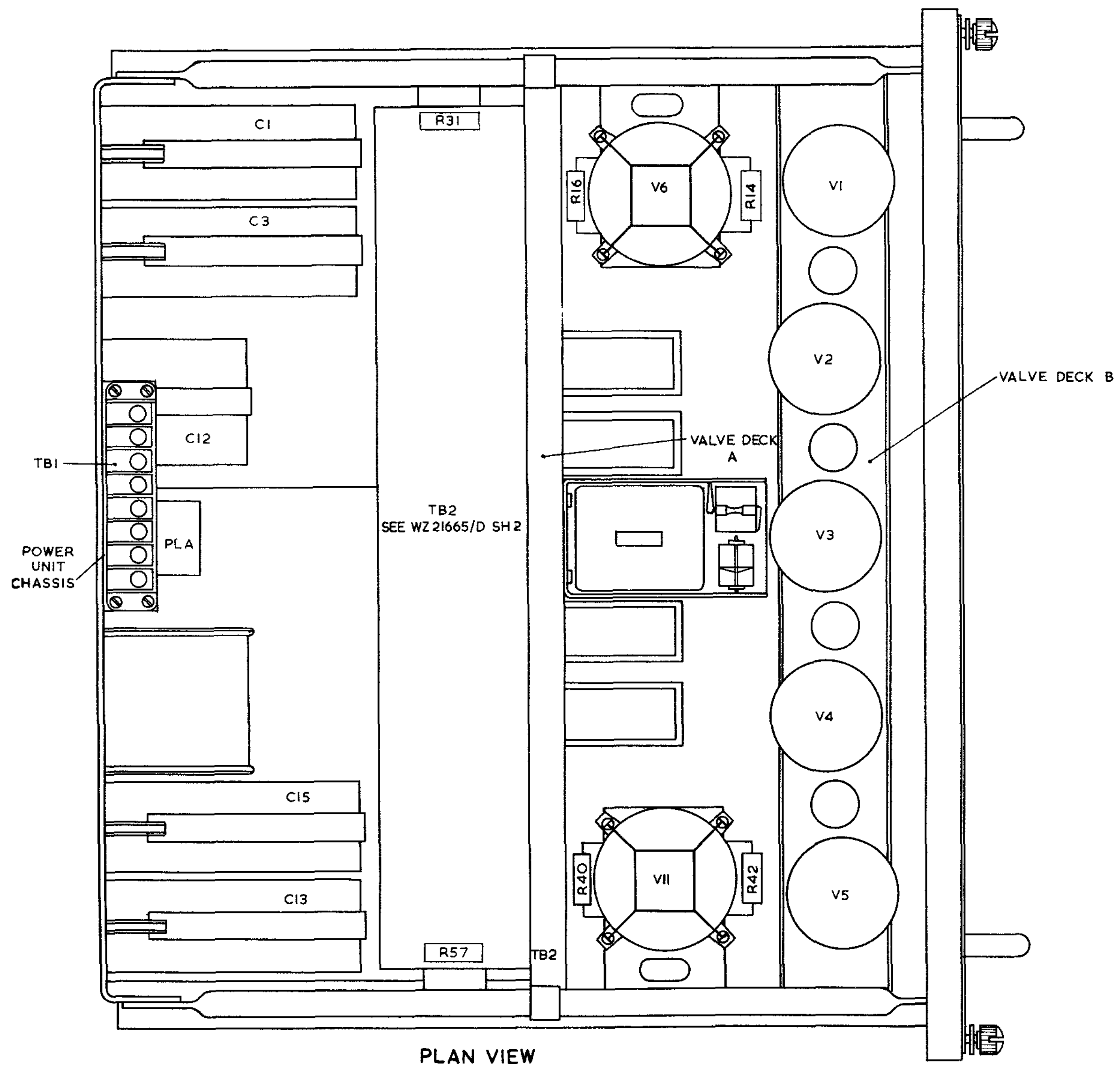
MISCELLANEOUS MECHANICAL ITEMS

Ref. 1	Valveholder B9A	No.277
Ref. 2	Valveholder B7G	No.276
Ref. 3	Valveholder B7A	No.279
Ref. 4	Valveholder I.O.	No.280
Ref. 5	Can Screening B9A	No. 2
Ref. 6	Can Screening B7G	No. 1
Ref. 7	Valve Retainer	No.282
Ref. 8	Valve Retainer	No.283
Ref. 9	Spindle Locking Device	No.242 & 242A
Ref.10	Fuseholder	No. 63
Ref.11	Lampholder M.E.S.	No. 73
Ref.12	Lampholder S.E.S.	No. 74
Ref.13	Relay Cover	No. 91
Ref.14	Socket Relay	No.240
Ref.15	Socket Relay	No.241
Ref.16	Plate	No. 79
Ref.17	Spring Retaining	No.243
Ref.18	Spring Retaining	No.244

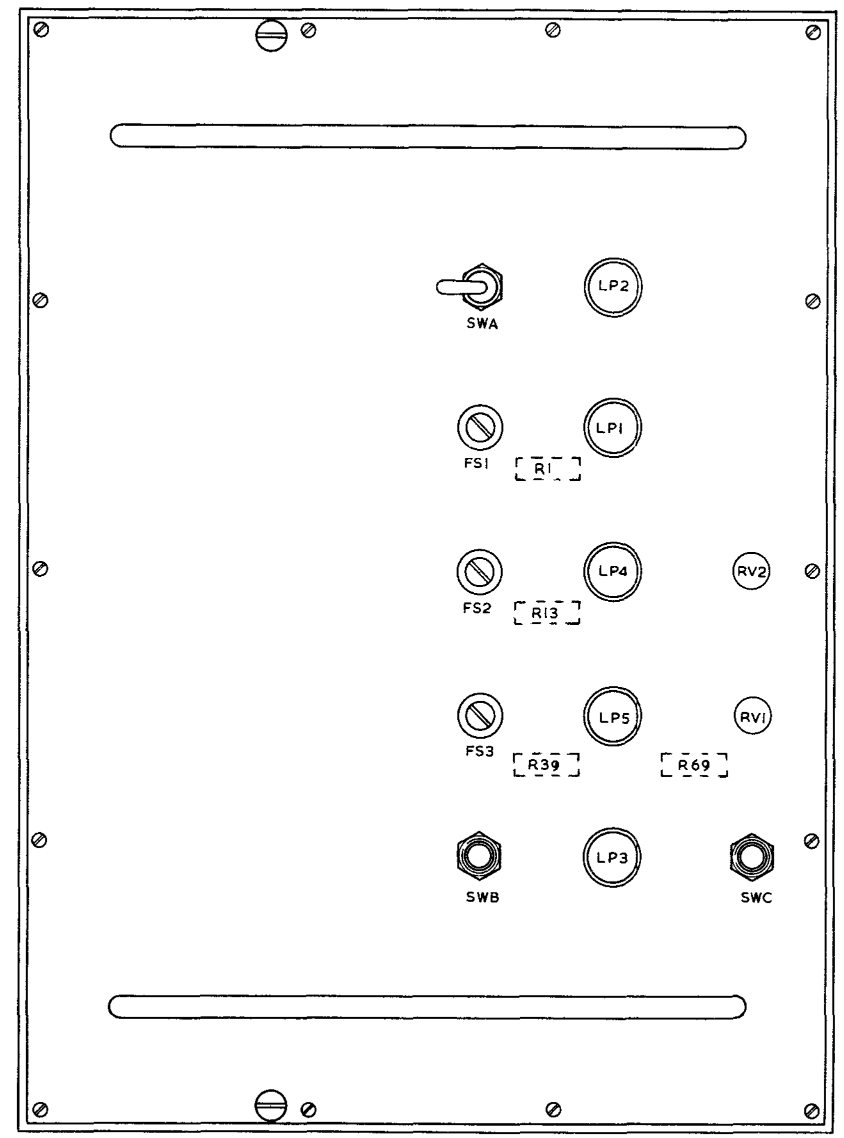


POWER SUPPLY UNIT TYPE 4275A
CIRCUIT
WZ.17001/D Sh.1 Iss.4

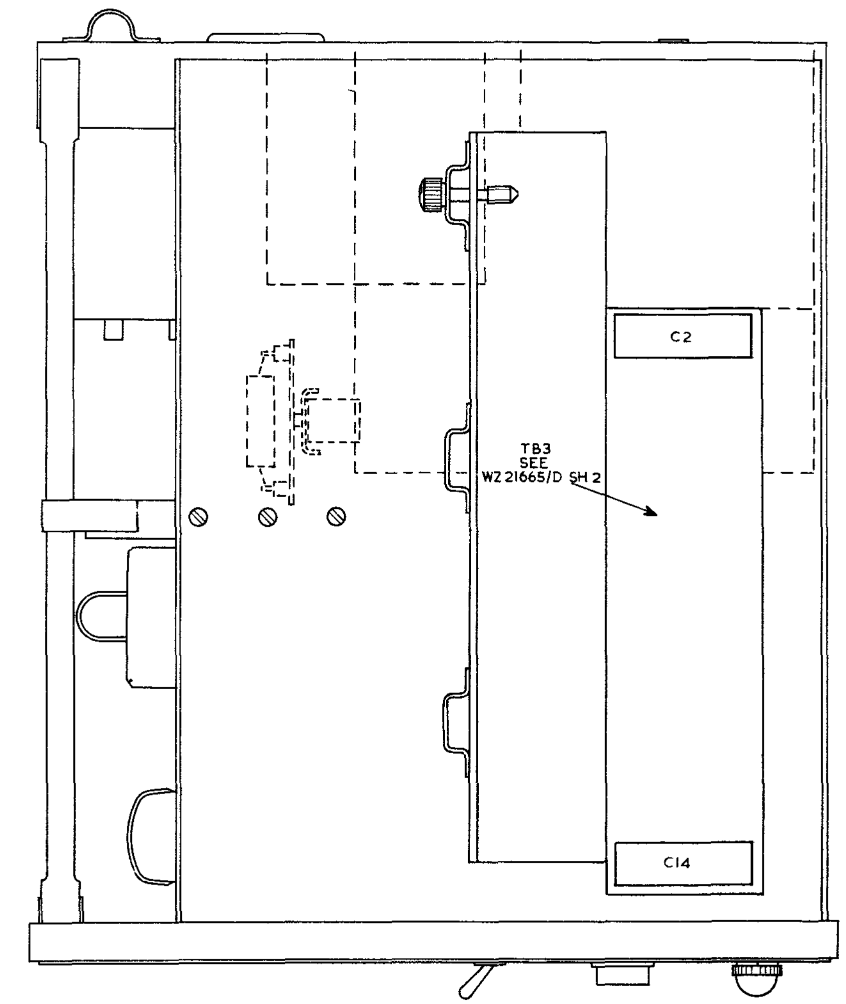
FIG.45



PLAN VIEW



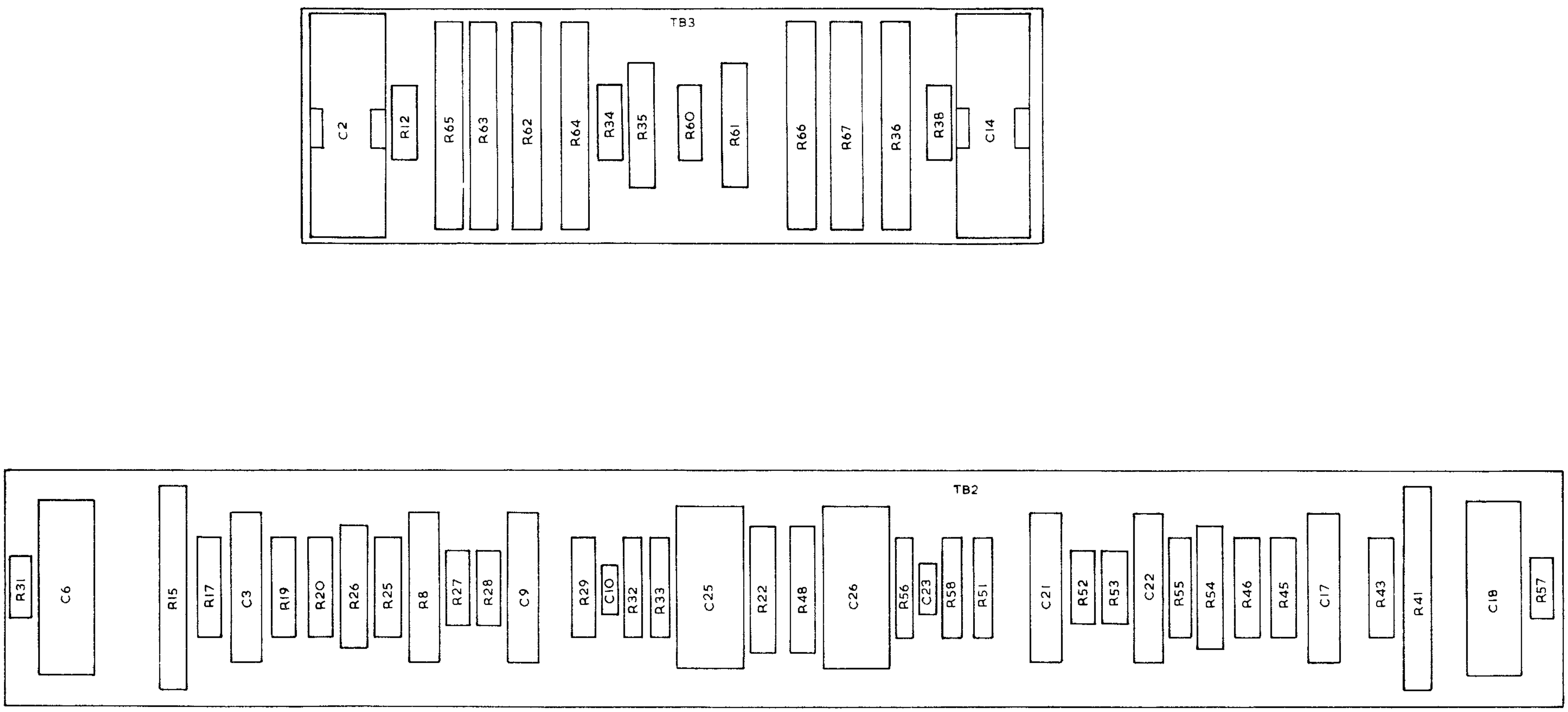
FRONT VIEW



RIGHT HAND SIDE VIEW

POWER SUPPLY UNIT TYPE 4275A
COMPONENT LAYOUT
WZ. 21665/D Sh. 1 Iss. 1

FIG. 46

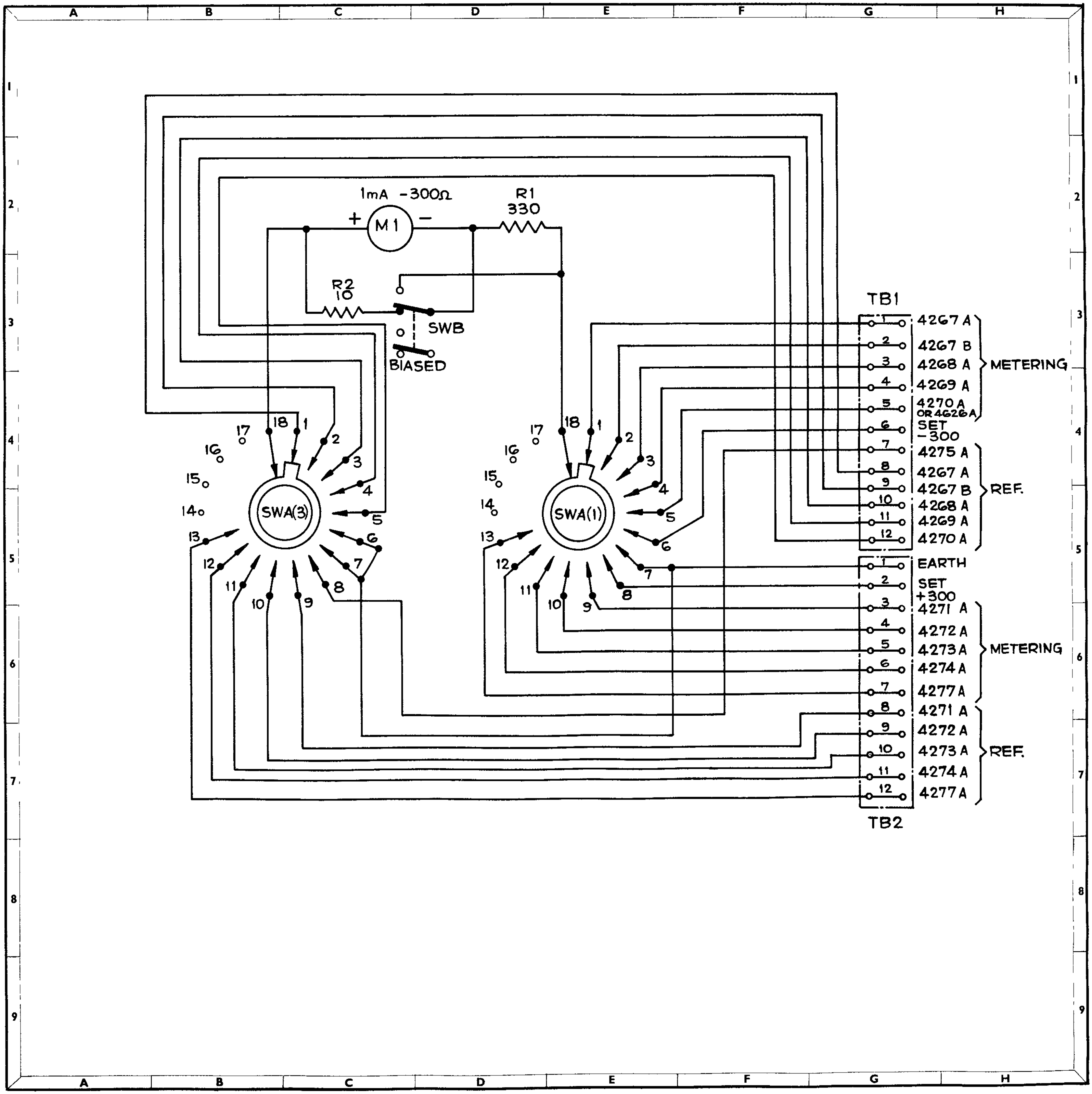


POWER SUPPLY UNIT TYPE 4275A
COMPONENT LAYOUT
WZ. 21665/D Sh. 2 Iss. 1

FIG. 47

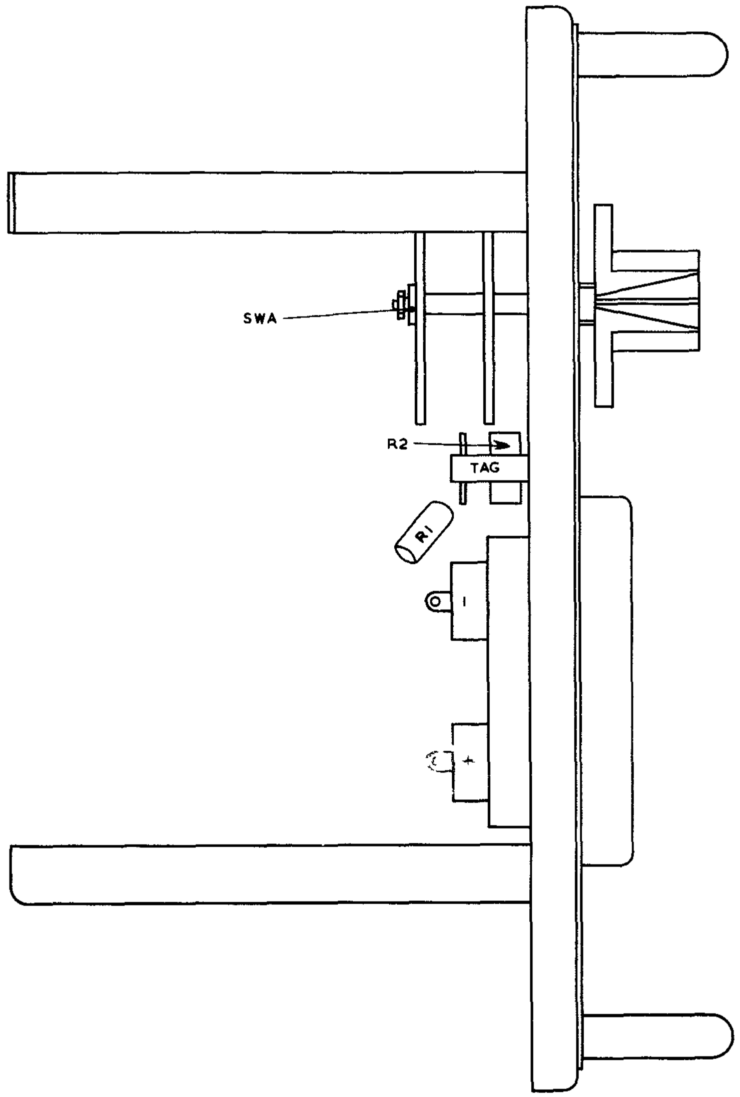
METERING PANEL TYPE 4353A
(W.59075 Sh.1 Ed.A)
(Refer to Master Components List T4719)
Cross Reference List
for WZ.18010/B Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
M1	77	R1	99	R2	150			SWA	247	SWB	248	TB1	261	TB2	261

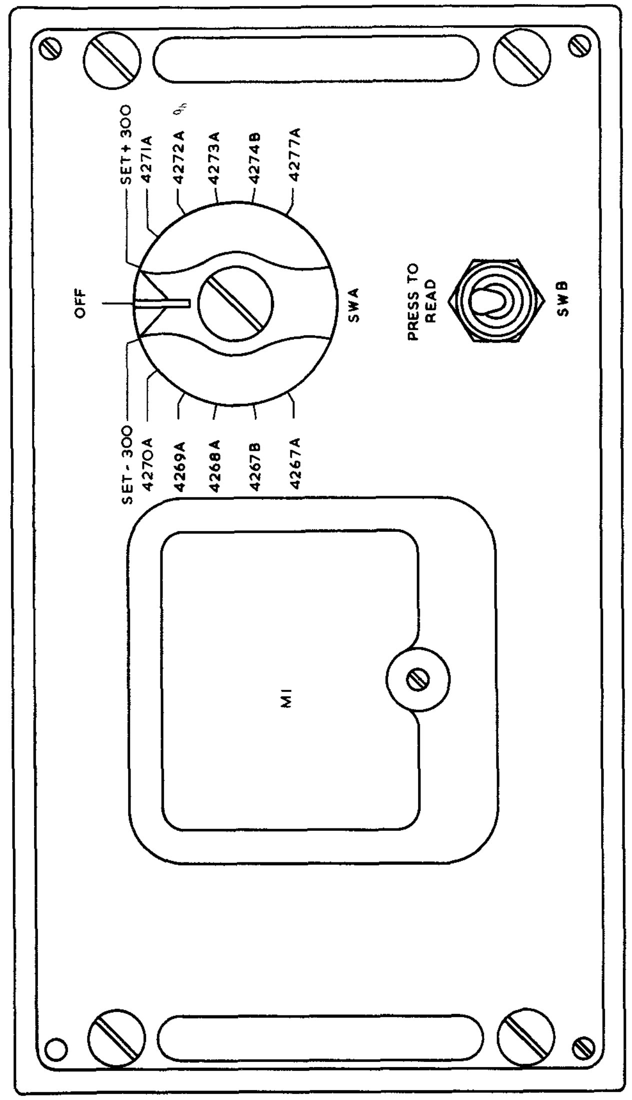


METERING PANEL TYPE 4353A & C
CIRCUIT
WZ.18010/B Sh.1 Iss.2

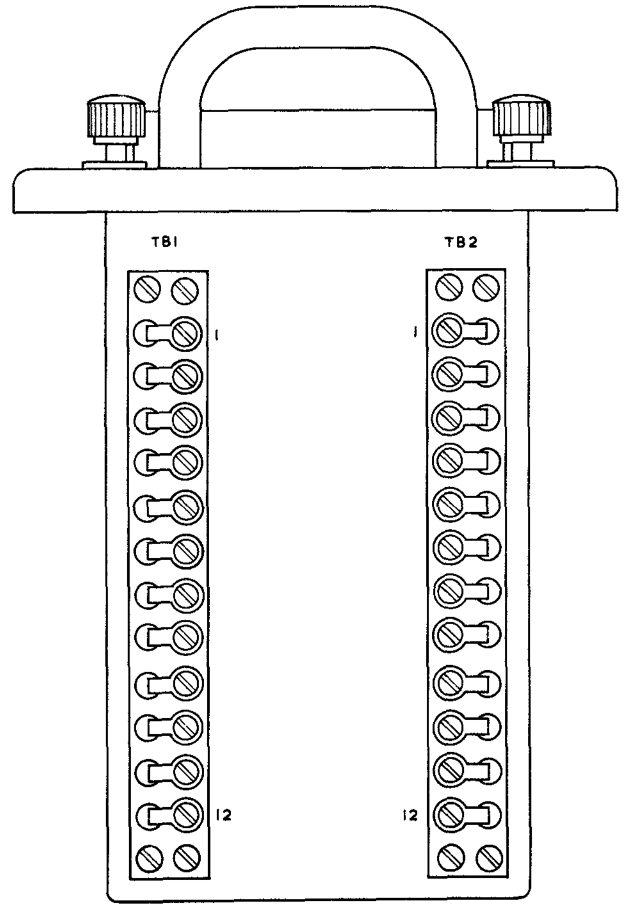
FIG.48



PLAN VIEW



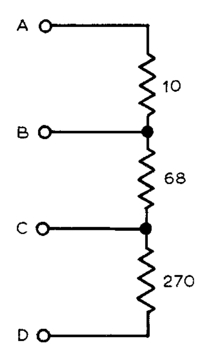
FRONT VIEW



SIDE VIEW

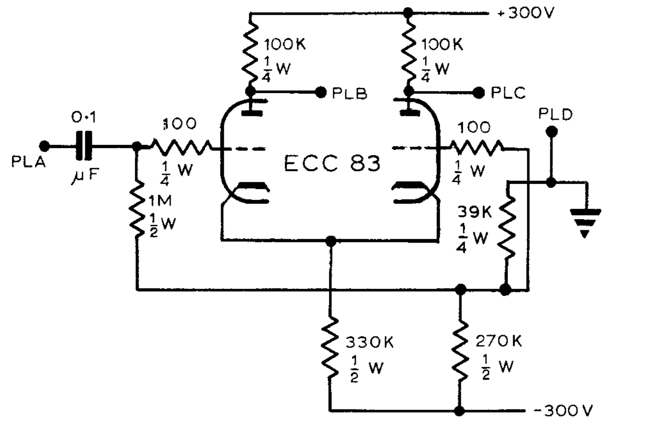
METERING PANEL TYPE 4353A & C
COMPONENT LAYOUT
WZ.22154/D Sh.1 Iss.2

FIG.49



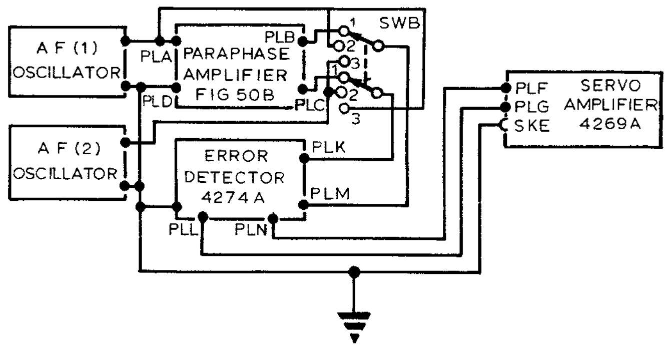
(a)

TEST POTENTIOMETER - MAGSLIP AMPLIFIER & MONITORING UNIT TYPE 4268A (UNIT 3)



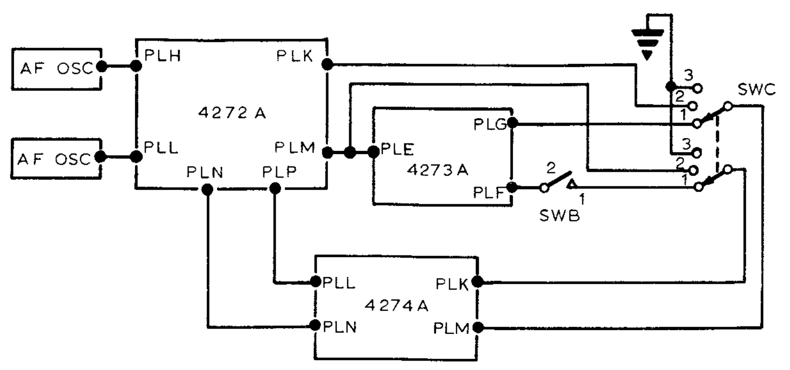
(b)

TEST PHASE INVERTER-AMPLIFYING UNIT (SERVO) TYPE 4269A (UNIT 4)



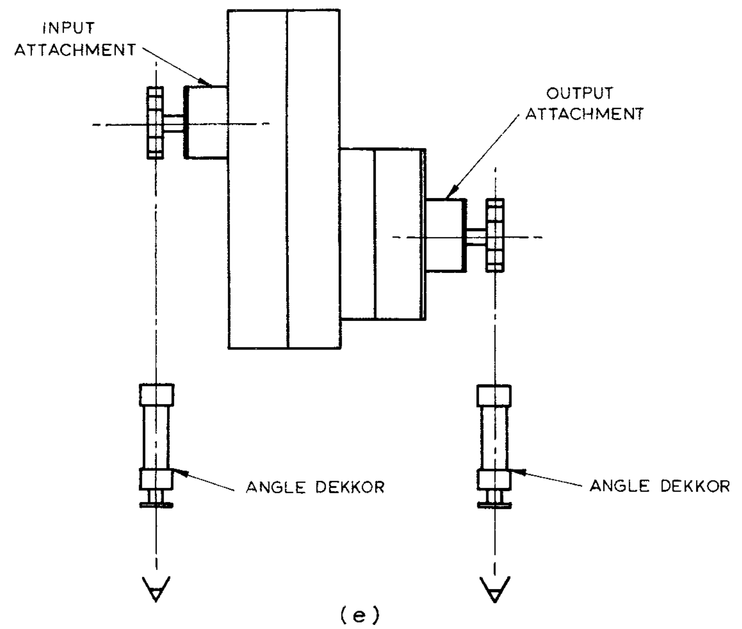
(c)

TEST ARRANGEMENT - AMPLIFYING UNIT (SERVO) TYPE 4269A (UNIT 4)



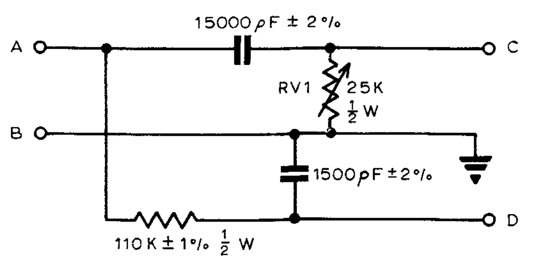
(d)

TEST ARRANGEMENT - AMPLIFYING UNIT TYPE 4272 A (UNIT 7)



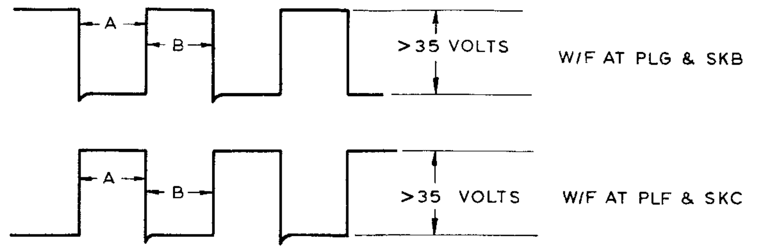
(e)

TEST ARRANGEMENT - RECEIVER GEARBOX TYPE 4276 A (UNIT 9)



(f)

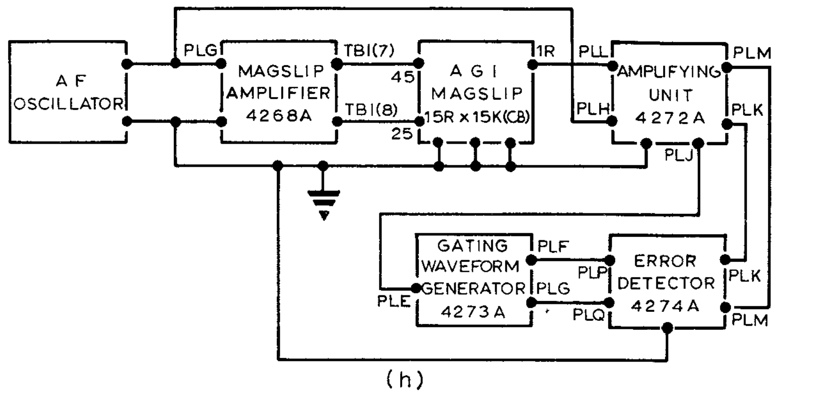
TEST PHASE SHIFT NETWORK - GATING WAVEFORM GENERATOR TYPE 4273A (UNIT 10)



RISE TIME OF EDGES FOR 80% OF AMPLITUDE TO BE LESS THAN 10 μS. $\frac{A}{B}$ TO BE BETWEEN 0·85 & 1·15

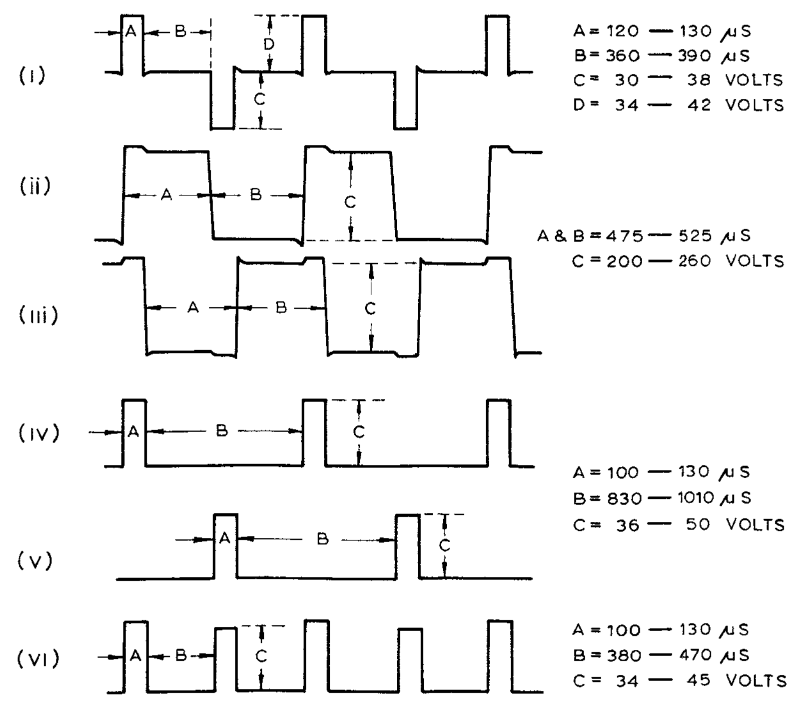
(g)

WAVEFORMS - GATING WAVEFORM GENERATOR TYPE 4273A (UNIT 10)



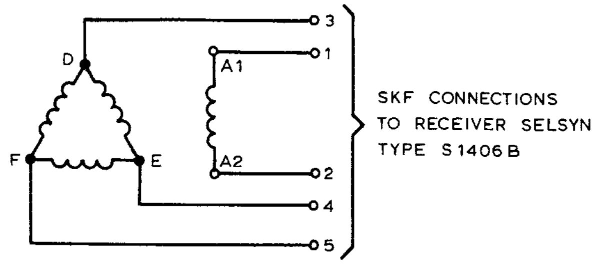
(h)

TEST ARRANGEMENT - ERROR DETECTOR UNIT TYPE 4274A (UNIT 11)



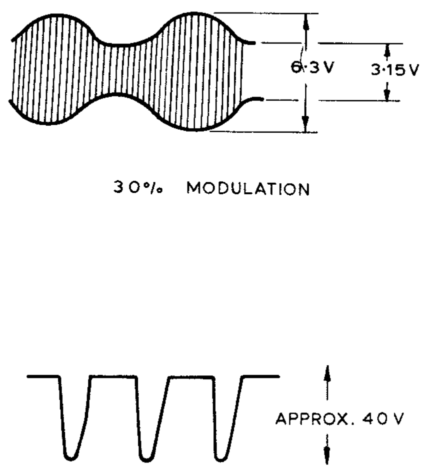
(J)

WAVEFORMS - ERROR DETECTOR UNIT TYPE 4274A (UNIT 11)



(k)

RECEIVER SELSYN TYPE S1406B - TURNING RECEIVER CABINET



(ℓ)

MONITORED WAVEFORM AT SKC OF MAGSLIP AMPLIFIER AND MONITORING UNIT TYPE 4268A - TURNING RECEIVER CABINET SETTING UP

R30-2352 SH1
ISSUE 01

TURNING RECEIVER SX115 TEST ARRANGEMENT FOR UNITS. FIG 50

Marconi
Technical Manual
T.4719 Supplement 1

TURNING RECEIVER SX115
TYPE 6331B and 6331C
(W.84542 Ed.B and W.84542 Ed.C)

THE MARCONI COMPANY LIMITED
CHELMSFORD
Printed in Great Britain.

TURNING RECEIVER SX115
TYPE 6331B and 6331C
(W.84542 Ed.B and W.84542 Ed.C)

List of Contents

List of Illustrations

RECEIVER TURNING CABINET CX115
TYPE 6331 (W.64542) Ed. B & C
(M.O.A. ref. W.105335 Ed. A & B)
(5840-99-951-0855)
(5840-99-952-0053)

INTRODUCTION

1. This supplement covers editions B and C of the Receiver Turning Cabinet CX115 Type 6331 A described in Technical Manual T.4719. These editions are basically the same as the original cabinet and the layout of the various units within the cabinet remains unchanged as shown in T.4719 fig.1. Edition B, however, incorporates a modified servo amplifier, Amplifier unit (Servo) Type 4269C, to meet the sector scanning requirements of the WJD/VQJ radar link; whilst Edition C has been modified for 300/350 kc/s operation to meet the requirements of the 100/61 radar link system.

EQUIPMENT LIST

2. The arrangement of the various units in the cabinet is unchanged (see T.4719 fig.1). In the following list, Ministry references are printed in italics.

Unit 1 (6331 B)	Filter and Detector Unit Type 4267A *Demodulator Unit 5840-99-951-0848*	(W.59129 Ed.A) *(W.105340 Ed.A.)*
Unit 1 (6331 C)	Filter and Detector Unit Type 4267C *Demodulator Unit 5840-99-952-0051*	(W.59129 Ed.C) *(W.105340 Ed.C.)*
Unit 2 (6331 B)	Filter and Detector Unit Type 4267B *Demodulator Unit 5840-99-951-0847*	(W.59129 Ed.B) *(W.105340 Ed.B.)*
Unit 2 (6331 C)	Filter and Detector Unit Type 4267D *Demodulator Unit 5840-99-952-0052*	(W.59129 Ed.D) *(W.105340 Ed.D.)*
Unit 3	Magslip Amplifier and Monitoring Unit Type 4268A *Amplifier Synchro 5840-99-951-0804*	(W.59113 Ed.A) *(W.105337 Ed.A.)*
Unit 4	Amplifier Unit (Servo) Type 4269C *Amplifier Servo 5840-99-951-0803*	(W.59130 Ed.C) *(W.105336 Ed.A.)*
Unit 5	North Aligning Unit (Receiver) Type 4626A *Receiver North Align 5840-99-951-0846*	(W.59455 Ed.A) *(W.105360 Ed.A.)*
Unit 6 (6331 B)	Metering Panel Type 4353E *Metering Unit 5840-99-951-0827*	(W.59075 Ed.E) *(W.105343 Ed.C.)*
Unit 6 (6331 C)	Metering Panel Type 4353F *Metering Unit 5840-99-951-0828*	(W.59075 Ed.F) *(W.105343 Ed.D.)*
Unit 7	Amplifying Unit Type 4..A *Amplifier Rotor 5840-99-951-0812*	(W.59054 Ed.A) *(W.105362 Ed.A.)*

TURNING RECEIVER SX115

Unit 8	Motor Drive Unit Type 4271A *Motor Drive 5840-99-951-0840*	(W.59031 Ed.A) *(W.105345 Ed.A.)*
Unit 9	Receiver Gearbox Type 4276A *Receiver Gearbox 5840-99-951-0811*	(W.59142 Ed.A) *(W.105356 Ed.A.)*
Unit 10	Gating Waveform Generator Unit Type 4273A *Generator, Gating Waveform 5840-99-951-0801*	(W.59132 Ed.A) *(W.105342 Ed.A*
Unit 11	Error Detector Unit Type 4274A *Error Detector 5840-99-951-0808*	(W.59033 Ed.A) *(W.105341 Ed.A.)*
Unit 12	Amplifying Unit (Filter) Type 4277A *Amplifier Filter 5840-99-951-0845*	(W.59133 Ed.A) *(W.105363 Ed.A.)*
Unit 13	Power Unit Type 4275A *Power Supply 5840-99-951-0799*	(W.59106 Ed.A) *(W.105352 Ed.A.)*
Unit 14	A.C. Switching and Distribution Panel	(part of cabinet)

DETAILS OF MODIFICATIONS

The wiring diagram of the modified cabinets is shown in fig.1.

Cabinet Type 6331 Ed.B (M.O.A. ref. W.105335 Ed.A)

3. To permit sector scanning, Amplifier Unit (Servo) Type 4269A (unit 4) is replaced by Amplifier Unit (Servo) Type 4269C. This later edition is fitted with an additional input for the tacho-generator feedback, thus providing two alternative degrees of damping for the servo system. The additional input plug and circuit components are shown on the existing circuit diagram of the unit (T.4719 fig.31), and the modification is also covered by Amendment No.1 to T.4719. Metering Panel Type 4353C (unit 6) is replaced by Metering Panel Type 4353E. This incorporates the necessary change to the selector switch panel markings.

Cabinet Type 6331 Ed.C (M.O.A. ref. W.105335 Ed.B)

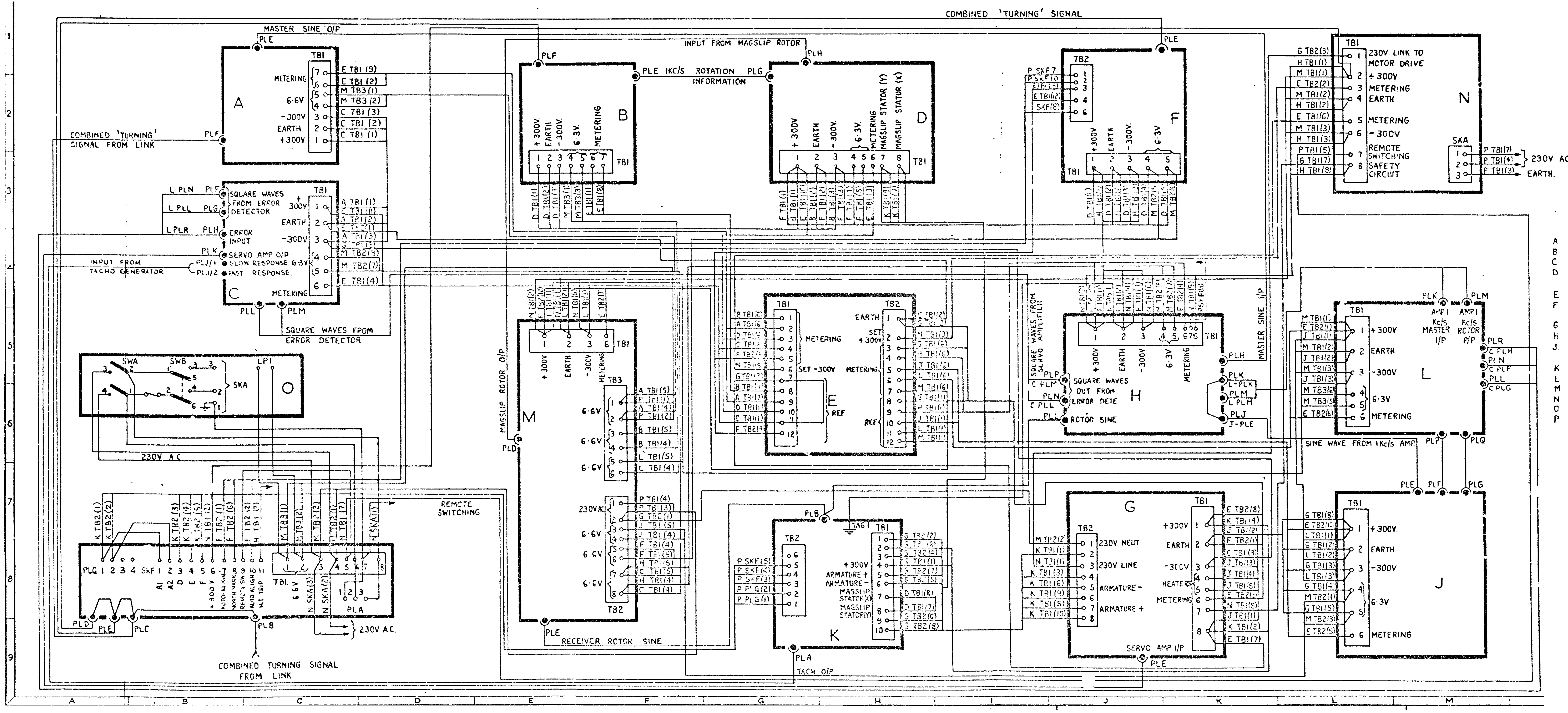
4. This cabinet has been modified for 300/350 kc/s operation. The Filter and Detector Units (units 1 and 2) Type 4267A (200 kc/s) and Type 4267B (250 kc/s) are replaced by units Type 4267C (300 kc/s) and Type 4267D (350 kc/s). These new units differ from the original units only in the values of certain components in the filter networks (see T.4719 fig.6). Metering Panel Type 4353C (unit 6) is replaced by Metering Panel Type 4353F which incorporates the necessary new panel markings.

INSTALLATION and MAINTENANCE

5. The installation, setting-up, operating and maintenance procedures for the cabinets are as described in T.4719 sections 6-9, except that in the case of cabinet edition C, frequencies of 300 kc/s and 350 kc/s respectively, must be used when carrying out tests on the Filter and Detector Units Type 4267 C and D (section [illegible].2.1.3).

TITLE

TURNING RECEIVER SX 115
TYPE 6331 B & C
CABINET WIRING DIAGRAM



KEY

A FILTER & DETECTOR - 4267B OR D
B FILTER & DETECTOR - 4267A OR C
C AMPLIFYING UNIT (SERVO) 4269C
D MAGSLIP AMPLIFYING & MONITOR 4268A
E METER UNIT 4353E OR F
F NORTH ALIGNING UNIT (RECEIVING) 4626A
G MOTOR DRIVE 4271A.
H AMPLIFYING UNIT 4272A
J. GATING WAVEFORM GENERATOR 4273A.
K GEARBOX 4276A
L ERROR DETECTOR 4274A.
M AMP UNIT (FILTER) 4277A.
N POWER SUPPLY. 4275A
O SWITCHING PANEL
P DISTRIBUTION PANEL.

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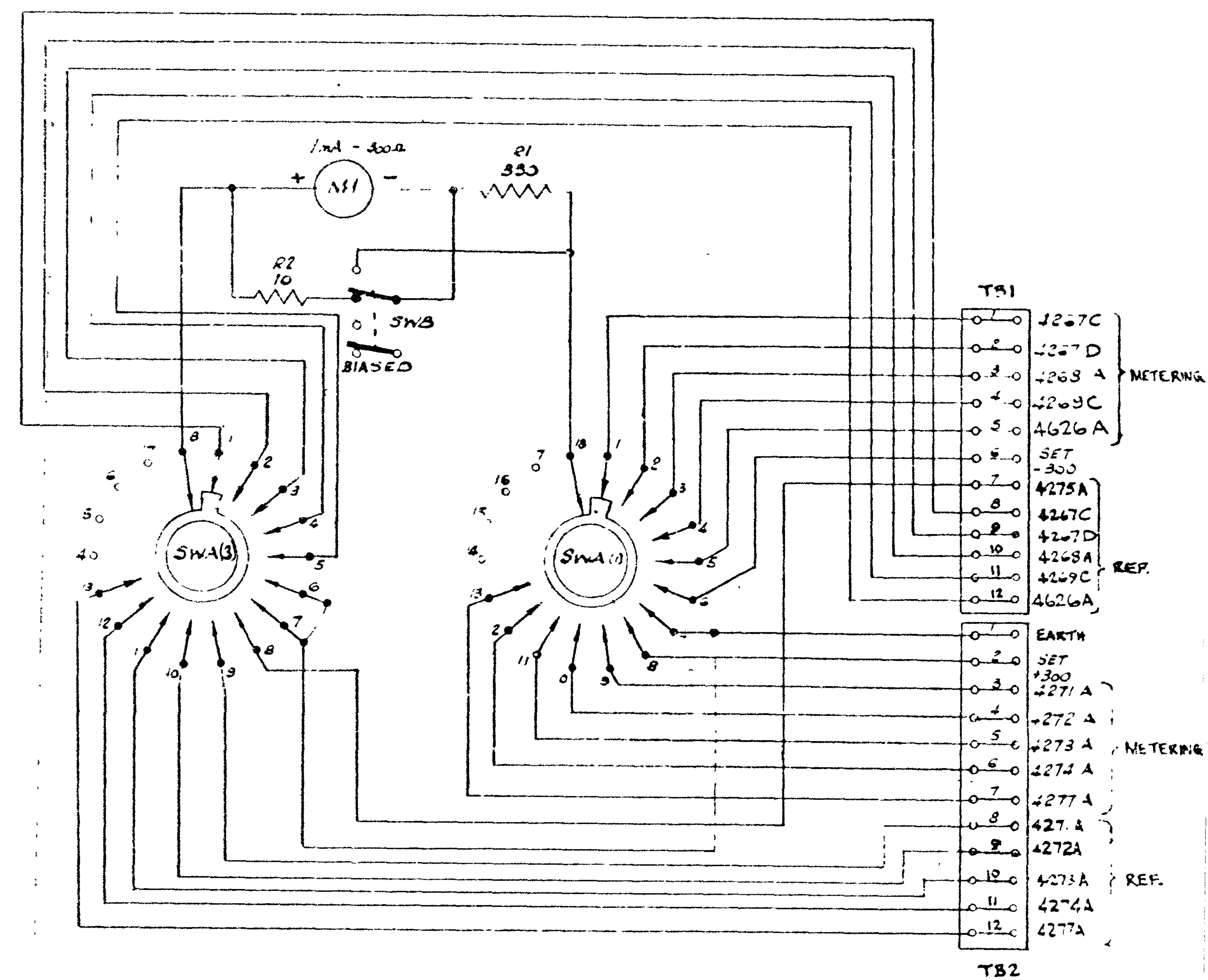
DRAWING No. WZ. 31319/D.

SHEET No 1	CONTIN. ON
SCALE	

TITLE

CIRCUIT DIAGRAM
METERING PANEL
TYPE No 4353 F.



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DATE 26-11-63												