British Teletype Terminal Unit

IF 450 – 470 kHz
Shift 850 Hz nominal

Receiver Adaptor Field C.F.S.

Z.A.39384

Supply Unit D.C.A.C No.3

Z.A.39385

Description, Parts List and Circuit Diagrams

Picture © g3wcd, thanks!

Document 1 Feb 1954
with later Errata sheet

FREQUENCY

The adaptor will accept intermediate frequencies from 450-470kc/s

FREQUENCY SHIFT

Receiver adaptor

Normal working	:	850c/s
Maximum usable shift approximately:		1,500c/s

Sender

Shift adjustable up to about	:	1,500c/s

PERFORMANCE

80 + 80V to line

POWER REQUIREMENTS AND CONSUMPTION

100 - 150V A.C. 40 - 60c/s (0.6A at 110V)
200 - 250V A.C. 40 - 60c/s (0.3A at 230V)
19 - 30V D.C. (5A at 24V)

Supplied from Power supply unit D.C./A.C. No. 3.

SPECIAL FACILITIES

A remote relay unit provides relayed working of the sender telegraph input.

REMARKS

Associated equipments (modified):-

Wireless sender S. 53 Mk. 1 or Mk. 1/1.

Reception sets R209, R107 and AR88.

57/Maint./3295

VALVES

Circuit ref.	*CV No.*	*Function*	
		Adaptor	
V1	CV 138	Frequency-doubler	EF91
V2	CV 138	Limiter/amplifier	
V3	CV 138	Limiter/amplifier	
V4	CV 138	Squelch valve	
V5	CV 138	Slicer	
V6	CV 140	Discriminator	
V7	CV 138	Slicer	
V8	CV 138	Cathode follower (drift indicator)	
V9	CV 140	Clamping diodes	EB91
V10	CV 138	D.C. amplifier	
V11	CV 138	Cathode follower (drift indicator)	
V12	CV 138	Keying valve (space)	
V13, V14	CV 286	Voltage stabilizers for V10	
V15	CV 138	Keying valve (mark)	
V16	CV 138	D.C. feedback cathode follower	
V17, V18, V19	CV 286	Voltage stabilizers	95A1
		P.S.U.	
V1, V2, V3	CV 286	Voltage stabilizers	
V4	CV 378	Full-wave rectifier	GZ37

RECEIVER ADAPTOR FIELD C.F.S.

TECHNICAL HANDBOOK

Errata

Notes: 1. This is not a new Regulation.
2. This Page 0 will be filed immediately in front of Page 1, Issue 1, dated 1 Feb 1954.

1. Amend as follows:

(a) Page 4 Para. 4 line 7 delete '±3kc/s'
insert '±2.75kc/s'

Page 9 Para.19 line 5 delete '±3kc/s'
insert '±2.75kc/s'

Page 9 Para.20 line 2 delete '30 volts'
insert 'approximately 35 volts'

Page 12 Para.35 line 7 delete '10 volts'
insert '18 to 20V'

Page 12 Para.36 line 4 delete '170'
insert '11 volts'

(b) Page 1001 Table 1001

Against R11 delete '22kΩ'
insert '15kΩ'

Against R12 delete '15kΩ'
insert '22kΩ'

Against R38 delete '68kΩ 3/4W ±10% Composition'
insert '33kΩ 6W ±5% Wirewound'

(c) Page 1010 Fig. 1003

Remove Fig. 1003 - 'Circuit diagram of adaptor'
Insert new Fig. 1003, Issue 2.

(d) Page 1002 Table 1001

At bottom of page delete '* R51 and R54 not used'.
Also delete asterisks against R51 and R54 in table.
Against R51 (under 'Circuit diagram') insert N4.
" R54 (" " ") " N5.
Against R51 (under 'Component layout top') insert F5
" R54 (" " " ") " F5
For both resistors under 'Value', 'Rating', 'Type and limit' insert 4.7kΩ ½W ±10% composition.

Distribution - Class 910 Code No. 4

GENERAL

1. The Receiver adaptor field C.F.S. is used in conjunction with a modified Reception set R107, AR88 or R209 for the reception of transmissions from wireless stations employing the carrier frequency shift method of signalling (see E.M.E.R. Tels A 017 for the principles of C.F.S. signalling).

2. The Wireless sender No. 53 (modified for C.F.S. working) is normally the associated sender on the link.

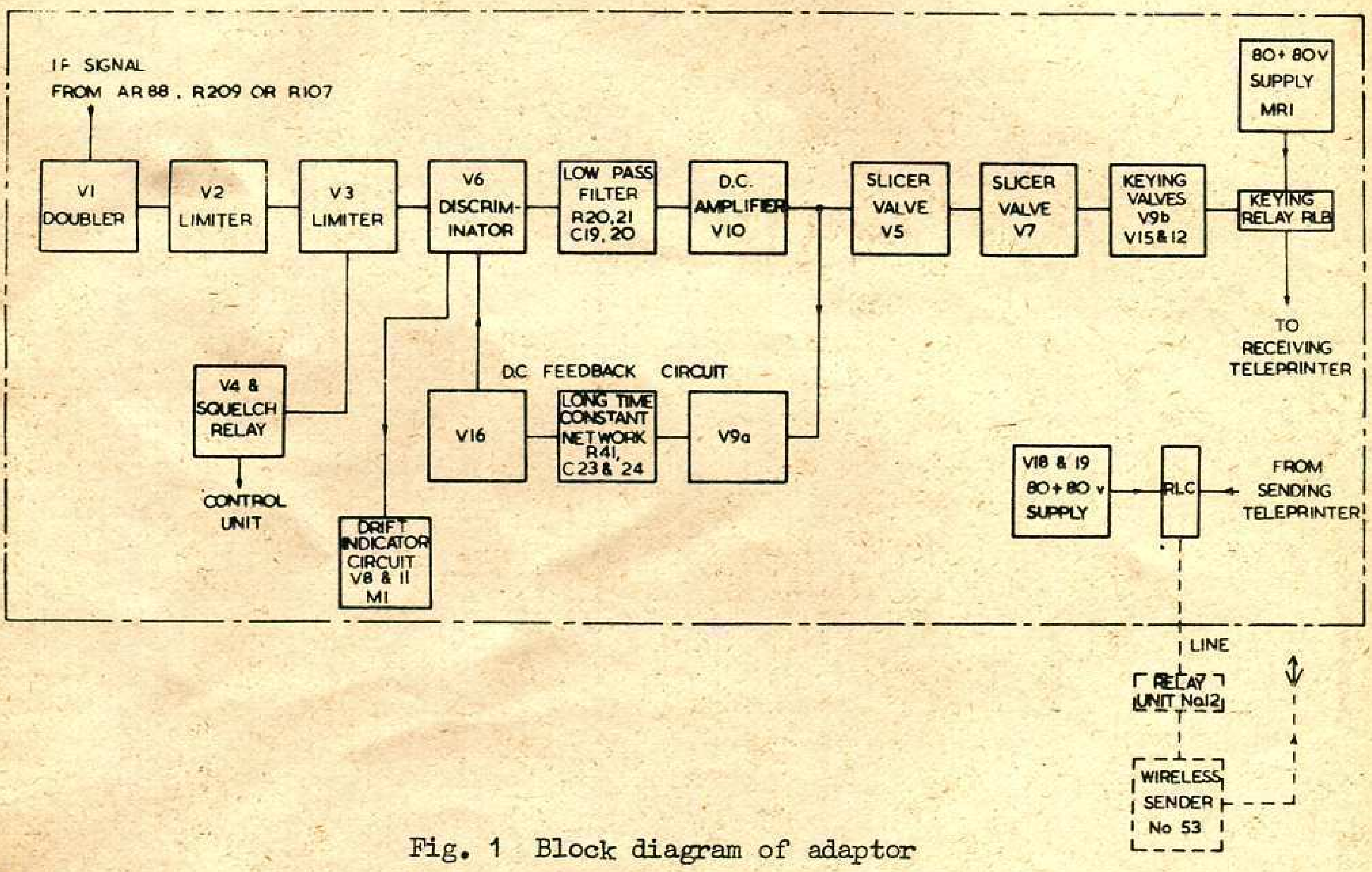


Fig. 1 Block diagram of adaptor

BRIEF ELECTRICAL DESCRIPTION (See fig. 1)

3. The circuit consists basically of an I.F. doubler, followed by two amplifier/limiter stages, a discriminator and keying valves.

4. The output of the discriminator is passed through a L.P. filter to a D.C. amplifier, the output of which is separated into two paths, one for the keying

circuits and the other to a D.C. feedback circuit which neutralizes any D.C. bias in the discriminator due to frequency drift. The output to the keying circuit is passed through a slicer circuit and then operates a keying circuit which in turn actuates a high speed relay. The relay switches the standard 80+80 volts to line. A frequency drift of up to $\pm$3kc/s can be tolerated, and the equipment will work on any shift within the range of 400c/s to 1,000c/s.

5. The line input to the local sender is brought into the adaptor where it works a relay which applies an 80+80 volts supply to the sender frequency shift circuit, either directly if the sender is adjacent to the adaptor or via the Relay unit No. 12 (see E.M.E.R. L 632), if the sender is more than about 200 yards away.

6. The I.F. circuits are capable of being adjusted (internally) to accept input frequencies between 445-470kc/s.

BRIEF MECHANICAL DESCRIPTION

7. The equipment is mounted in two standard instrument cases with 19" panels, suitable for working one on top of the other or for rack mounting. The adaptor unit consisting of the frequency shift and telegraph circuits is contained in one box, whilst the other contains the power supply unit. The latter may be operated from A.C. mains or a 24 volt battery and a cooling fan is provided on the rotary transformer with an outlet on the front panel.

8. All interconnections are by Mk.4 plugs and sockets.

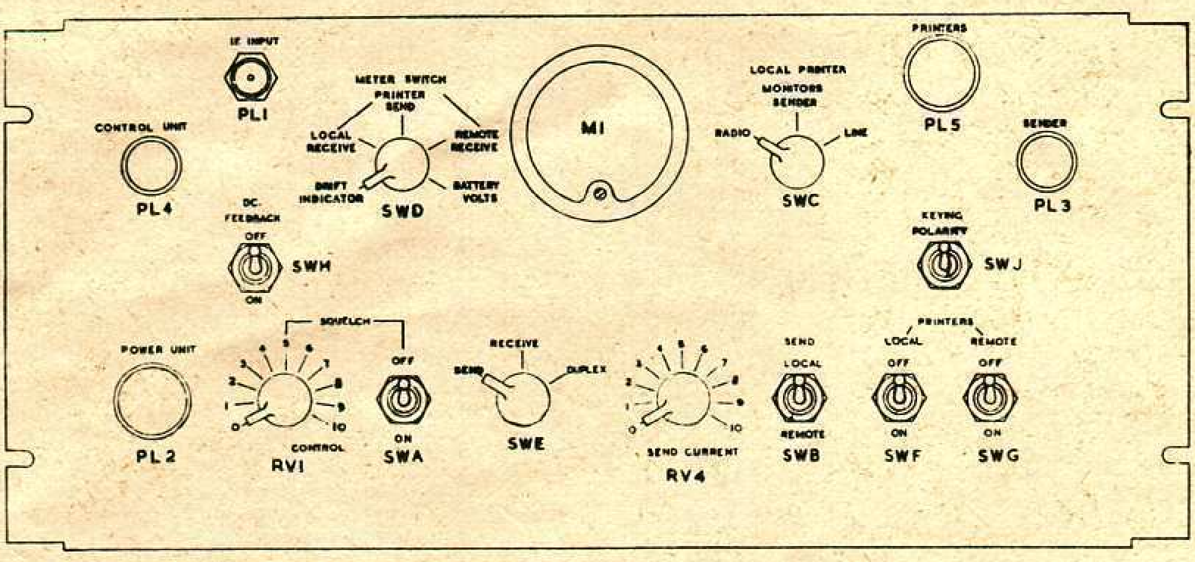


Fig. 2 Adaptor front panel layout

9. <u>Receiver adaptor controls, plugs and sockets</u>

D.C. FEEDBACK ON/OFF SW.H	Interrupts D.C. feedback line.
Squelch control RV1 SWA	Adjusted to prevent random printing under conditions of "no signal".
METER SWITCH SWD	In conjunction with meter M1 monitors teleprinter current, frequency drift and battery input volts.
Squelch ON/OFF switch SWA	Interrupts a squelch line
System switch SWE	Switches line circuits to send, receive or duplex working as required.
SEND CURRENT control RV4	Controls current from sending teleprinter.
LOCAL PRINTER MONITORS switch SWC	Connects local monitor teleprinter to adaptor output, to sender input, or to input from remote sending teleprinter.
LOCAL REMOTE switch SWB	Enables a local or remote teleprinter to be used for sending.
LOCAL and REMOTE PRINTERS switches SWF and SWG	ON/OFF switches for local or remote receiving teleprinters.
KEYING POLARITY switch SWJ	Gives facility of receiving a positive or negative going "space" signal.

10.

PL1	Coaxial plug, I.F. input from receiver.
PL2	12 pin plug Mk.4, power input from P.S.U.
PL3	4 pin Mk.4, keyed output voltage and send receive switching to sender or remote relay unit.
PL4	4 pin Mk.4, to control unit (not in use at present).
PL5	12 pin Mk.4 plug to Teleprinter Terminal unit.

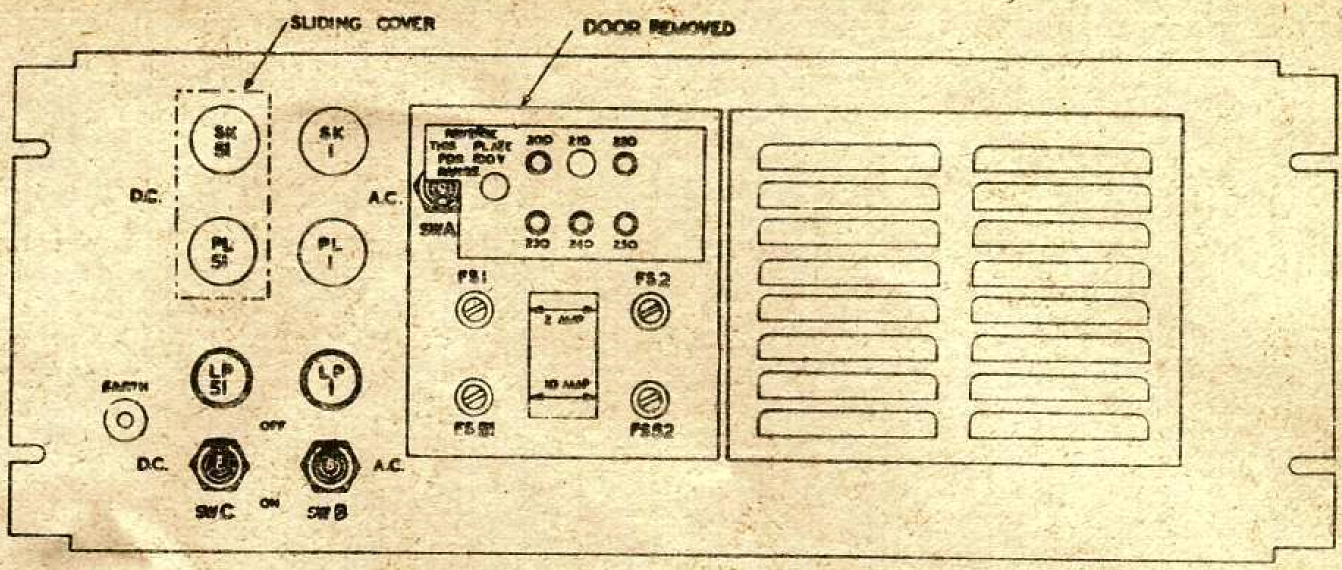


Fig. 3 Supply unit front panel layout

Power supply unit controls, plugs and sockets

11.	Fuses FS1, FS2	Supply fuses for A.C. P.S.U.
	Fuses FS51, FS52	Battery fuses for D.C. P.S.U.
	Switch SWA	Transformer tap changing switch for A.C. P.S.U.
	Switches SWB and SWC	On/Off switches for A.C. and D.C. P.S.U's. respectively.
	Lamps LP1 and LP51	L.T. indicator lamps on A.C. and D.C. P.S.U's. respectively.
	PL1	3 pin Mk.4 plug - A.C. input
	PL51	2 pin Mk.4 plug - Battery input
	SK1	12 point Mk.4 socket - A.C. P.S.U. output to adaptor.
	SK51	12 point Mk.4 socket - D.C. P.S.U. output to adaptor.

RECEIVER ADAPTOR - FIG. 1001

Frequency doubler V1

12. The output at intermediate frequency from the associated receiver is fed in to the adaptor through PL1 to the tuned circuit L1 C1 C2 C3. Alternative methods of connection are provided by link LK1. L1 is slug tuned and is peaked up to the I.F. of the receiver in use.

13. Valve V1 has zero grid bias and conducts fairly heavily. Its anode circuit L2, C5 is adjusted to twice the input frequency and it therefore acts as a frequency doubler. Frequency doubling is utilised to avoid difficulty due to instability, which would arise if all the amplification were effected at the original I.F. The output is R.C. coupled to V2.

Amplifier valves V2 and V3

14. These stages are similar, amplifying the doubled output from V1 and as they are run without standing grid bias and with low anode and screen voltages, they also provide limiting action.

15. By means of RV1 a variable negative voltage may be applied to the grid of V2, provided the squelch switch is on; this is to prevent random printing of the teleprinter between messages. This might occur for example if, on going from "send" to "receive", the carrier of the distant sender was not received immediately; thus noise only would be fed to the adaptor causing random printing. RV1 is adjusted under "no signal" conditions to prevent random printing. Provided the signal voltage is of reasonable strength it will be unaffected by this bias.

Discriminator V6

16. This stage is a conventional Foster-Seeley discriminator (see E.M.E.R. Tels A 013 for detailed description of working) which converts the incoming frequency shift to a voltage change. The normal condition of working is that a space signal produces a negative-going voltage at the cathode of V6a which, via V10, V5, V7 and V12, causes the telegraph relay RLB/1 to transmit a positive signal to line. Switch SWJ however, also permits the C.C.I.T. convention of a negative-going space signal to be used, by reversing the cathodes of V6.

17. The voltage output of the discriminator is fed directly through a low pass R.C. filter, C18, R20, C19, R21, C20, to the grid of the D.C. amplifier V10. The filter is inserted to remove any noise voltages which may be present.

D.C. amplifier V10

18. This stage is a straightforward D.C. amplifier, with its anode supply stabilised by V13 and V14 to prevent H.T. changes affecting the keying circuits.

With the keying circuits at mark, (the resting condition) the valve is arranged to be conducting fairly heavily, hence the anode voltage is low. When a space signal arrives the grid of V10 is driven negative and the anode thus feeds a positive signal through to the slicing valves V5 and V7. Fig. 4 shows waveforms for a letter Y at the various stages from V10 anode onwards.

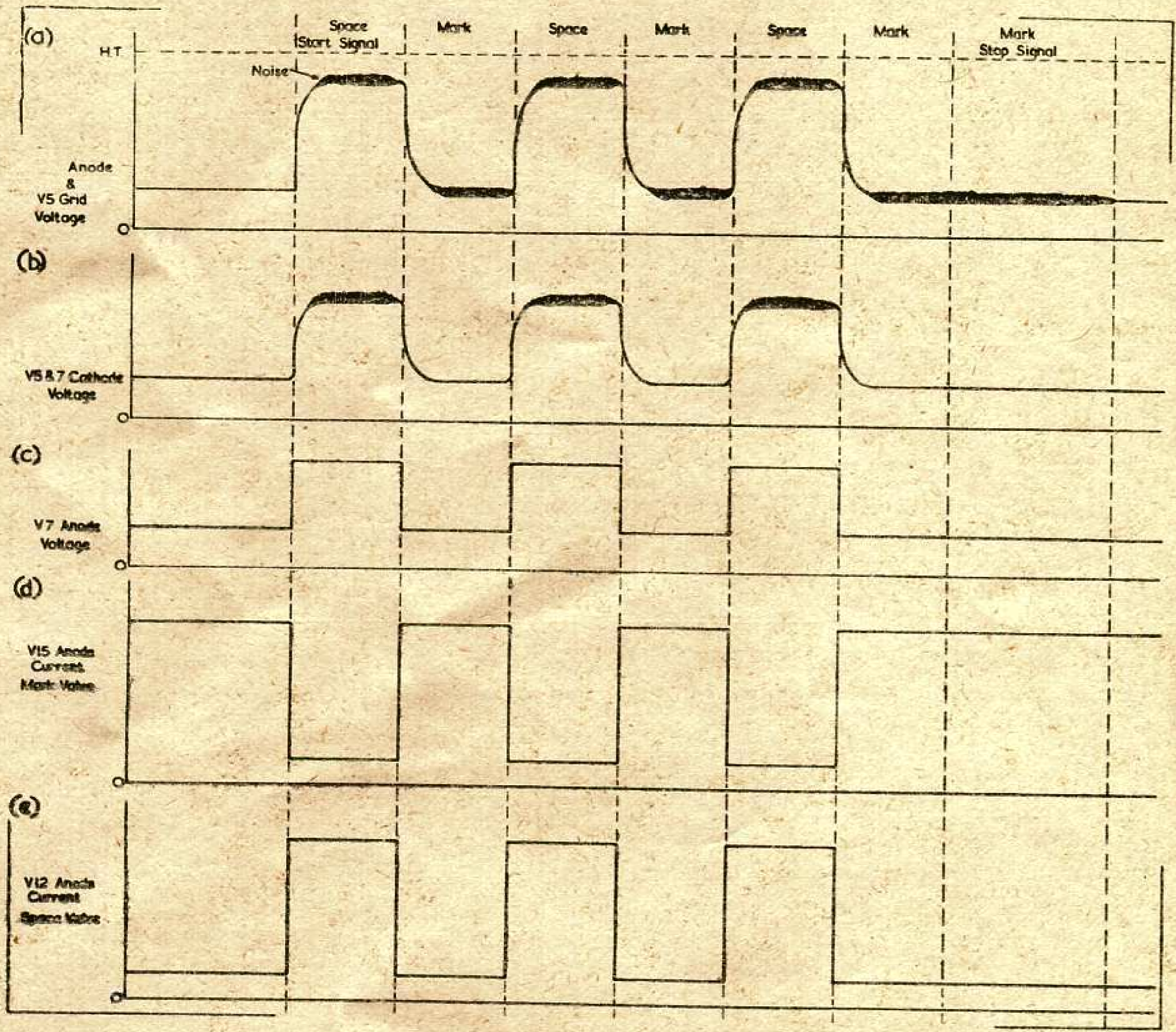


Fig. 4 Valve waveforms for keying circuits (letter Y)

D.C. feedback circuit

19. In order that frequency drift of the distant sender shall not place a permanent bias on V10 due to the out of balance voltage across the discriminator, a D.C. feedback circuit is incorporated. This circuit arranges for an equal and opposite D.C. voltage to that developed by the frequency drift, to be applied to the discriminator from RV3. A drift of up to ±3kc/s may be tolerated.

20. With the D.C. FEEDBACK switch SWH at ON and under "no signal" conditions, a bias is applied to V10 from RV3 such that its anode voltage is 30 volts; this is the resting or marking condition. The anode of V10 is connected to a diode V9a through R39 and thence through R41 to the grid of V16 a cathode follower. The time constant of the network R39, C23, R41 and C24 is very long, hence the grid of V16 is almost unaffected by the comparatively short space signals which drive the anode of V10 positive. The diode V9a acts similarly to diode V9b in the keying circuit (para. 25) and ensures that the grid of V10 does not drift more positive over a long period due to the space signals. Thus the potential appearing across RV3 by cathode follower action is dependent only on the long term condition of V10 and not on the telegraph signals, and therefore when the system is correctly set up, any permanent bias on V10 caused by frequency drift produces an equal, and (because of reversal of polarity from V10 grid to anode) opposite voltage at the cathode of V6a.

Valve voltmeter circuit

21. V8 and V11, both cathode followers, enable frequency drift to be measured on meter M1 when the meter switch is at DRIFT INDICATOR.

22. With no signal input, or with a signal input at the correct I.F., the grids of V8 and V11 are at equal and opposite potentials, therefore the meter connected between their cathodes indicates zero potential. If the frequency drifts however, the grids have different voltages applied to them and the potential difference across the cathodes causes a meter deflection proportional to drift.

Slicing circuit V5 and V7

23. Valves V5 and V7, a cathode follower and a cathode driven amplifier respectively, take a slice out of the centre of the waveform applied to the grid of V5, so that noise voltages and distortion of the waveform are eliminated, see specimen waveforms (a), (b) and (c) of Fig. 4.

24. The circuit functions as follows:- V5 and V7 are short grid-base valves. A positive going signal at the grid of V5 causes an exact replica to appear across R16 by cathode follower action. A negative going signal at V5 grid will cause V5 to cut off, therefore the signal appearing across R16 will only be a fraction of the input voltage, i.e. the negative peak has been sliced, waveform (b). As V7 is a cathode driven amplifier, the reverse action takes place in this valve, a positive signal at V5 causing V7 to be cut off, slicing the positive peak. Thus the waveform at the anode of V7 is as shown in (c). Adjustment of RV2 sets the cathode potential of the stage to the appropriate value for the correct operating point relative to the anode voltage of V10.

Keying circuit V12, V15 and V9b

25. V12 and V15 are the space and mark keying valves respectively, each valve having a winding of a polarised Carpenter type relay in its anode circuit. Under quiescent conditions, the grids of V12 and V15 and the cathode of V15 are at the same potential, C22 having charged up to the potential at the anode of V7 (mark condition), so that V15 is conducting heavily and V12 is almost cut off due to the drop across R35. When a signal is received, it commences with a space and thus the anode of V7 goes more positive. The potential at the grid of V15 can only change slowly due to the very long time constant of C22 and R22 and for the duration of the space signal remains practically at the "mark" potential, but the grid of V12 is not so restricted and follows the anode of V7 causing V12 to conduct heavily. When V12 current increases so does the voltage drop across R38 and it cuts off V15, operating the "space" winding of $\frac{RLB}{1}$ and putting RLB1 to the +80 volts (see para. 27 below). The elements of the 5 unit code signal then follow - the letter Y is shown in Fig. 4, and $\frac{RLB}{1}$ sends the + or - 80 volts to line. Resistor R40 connected between the anode of V15 and earth ensures that the operating currents through the relay coils are the same on "mark" and "space". The diode V9b ensures that the grid of V15 does not drift up in potential due to C22 assuming a potential which is the average level of the signals received. For example, if C22 commences to charge up towards the positive space voltage, the anode of V9b becomes positive with respect to its cathode and it conducts and effectively short circuits the p.d. across R22, restoring C22 to its original level.

Metering

26. The following metering facilities are provided by SW4 and meter M1 on the adaptor:-

DRIFT INDICATOR	Indicates frequency drift by reading out of balance voltage across discriminator via valves V8 and V11. R66 is put into circuit by SWHa at the FEEDBACK ON condition to reduce the meter sensitivity.
LOCAL RECEIVE	Indicates receive current when using local teleprinter.
SEND	Indicates sending current when using a local or remote teleprinter.
REMOTE RECEIVE	Indicates receive current when using a remote teleprinter.
BATTERY VOLTS	Indicates battery input voltage to power supply unit via PL2L and D and SK1L and D.

TELEGRAPH CIRCUITS

27. An explanatory diagram showing the output circuit of the adaptor, the teleprinter terminal unit and the teleprinter is given in Fig.1004 and will be

referred to in the description below. The signal path for send and receive is shown by the thick lines. The system in use is assumed to be a 2-wire simplex with local record and direct operation.

Receive circuit, local or remote teleprinter

28. The contacts of $\frac{RLB}{1}$ obtain the 80+80 supply for the teleprinter from rectifier MR1 and barretters RB1 and RB2. The signals from RLB1 pass through RLD1, SWEc the Send, receive duplex switch, the local printer switch SWF, the local printer monitor switch SWC and out of the adaptor via PL5E to the T.T.U. and so to the teleprinter receiving electromagnet.

29. If a remote teleprinter is used, the remote printer switch SWG is closed and the output is taken to line via PL5D. The local teleprinter may be used for monitoring the output by having SWC at RADIO and SWF closed.

Send circuit, local teleprinter

30. At the "send" condition, switch SWE will be at either SEND or DUPLEX and the wireless sender keying relay is permanently operated via SWEA6 or 2.

31. The teleprinter sending contacts are supplied with 80+80 volts from RB1 and RB2 in the adaptor via PL5J and G and the signals are fed into the adaptor through PL5F via SWB to $\frac{RLC}{1}$. RV4 controls the send current. RLC1 obtains its 80+80 supply from voltage stabilisers V18 and V19 and the telegraph signals are taken out through PL3A to the master oscillator of the wireless sender via the Relay unit No.12.

Send circuit, remote teleprinter

32. The signals from the remote teleprinter are fed in to the adaptor via PL5D through SWB and thence operate $\frac{RLC}{1}$ as for local teleprinter operating. The local teleprinter may monitor the line input from the remote teleprinter or the output to the wireless sender by putting SWC to LINE or SENDER, respectively.

CONTROL UNIT

33. Provision has been made for remote control operation of the equipment by means of a separate control unit, but this facility will not now be utilised. Relay $\frac{RLD}{1}$, the squelch valve V4 and relay $\frac{RLA}{1}$, which operate when a signal is received, PL4 and relay $\frac{RLD}{1}$ are therefore rendered superfluous.

POWER SUPPLY UNIT

34. The power supply unit may be operated from A.C. mains or a 24v battery. As it is virtually two P.S.U's. on one chassis, each part will be explained separately. To distinguish the components, they are coded from 1-50 for the A.C. section and 51 onwards for the D.C. section.

A.C. section Fig. 1003

35. The power input is fed in through PL1A-B via On/Off switch SW2 and fuses FS1 and FS2 to transformer TR1 which is tapped to permit 100-150v. and 200-250v. A.C. supply to be utilised. Full-wave rectifier V4, smoothing circuits L1 C2 and the voltage stabiliser valves V1, V2 and V3 provide a D.C. output of volts at SK1J. A stabilised supply to the squelch valve V4 is also taken out via SK1M. SK1E and K provide 6.3 volts for the keying valve heaters, the remaining valves are supplied by 10 volts from SK1F and D. An A.C. supply of 180 volts is taken out through SK1C and G for the teleprinter rectifier MR1. Rectifier MR1 in the P.S.U. provides -80 volts through SK1A and B for the sender teleprinter supply and the bias on the D.C. feedback circuit.

D.C. section Fig. 1002

36. The battery input is applied to a carbon pile regulator, via PL51A and B, SWC and fuses FS51 and FS52, which maintains the rotary transformer input at approximately 19 volts for battery voltages of 22-32 volts. The machine supplies a D.C. voltage of 370 for the adaptor H.T. and an A.C. voltage of 170 at 93 cycles which is applied to transformer TR51 to give 6.3 volts at SK51E and K for the keying valve heaters, 180 volts at SK51C and G for the teleprinter supply and +80 and -80 volts for the squelch valve and sender teleprinter respectively. The valve heaters are supplied with a regulated 19 volts at SK51F and D. SK51L takes out the battery voltage for metering on M1.

Note : The next page is 1001.

Table 1001 - Component schedule for receiver adaptor

Circuit reference	Location of components			Value	Rating	Type and limit
	Circuit diagram	Component layout				
		Top	Underside			
RESISTORS						
R1	B3	A4		100kΩ	1/2W	±10% Composition
R2	C2		L7	100kΩ	1/2W	±10% Composition
R3	C3	A3		100kΩ	1/2W	±10% Composition
R4	C3	B3		22kΩ	1/2W	±10% Composition
R5	C5	H3		330kΩ	1/2W	±10% Composition
R6	C1		L7	150kΩ	3/4W	±10% Composition
R7	D3	A2		100kΩ	1/2W	±10% Composition
R8	C1		L7	47kΩ	3/4W	±10% Composition
R9	D2	B2		22kΩ	1/2W	±10% Composition
R10	D4		F6	1MΩ	1/2W	±10% Composition
R11	M2		K6	22kΩ	3/4W	±10% Composition
R12	M3		L8	15kΩ	3/4W	±10% Composition
R13	D1		L6	820kΩ	1/2W	±10% Composition
R14	D1		L6	150kΩ	3/4W	±10% Composition
R15	F1		E6	220kΩ	1/2W	±10% Composition
R16	M2		H6	10kΩ	3/4W	±10% Composition
R17	M1		H7	100kΩ	1/2W	±10% Composition
R18	F2		E6	220kΩ	1/2W	±10% Composition
R19	F4		E7	10kΩ	1/2W	±10% Composition
R20	G2		K7	47kΩ	1/2W	±10% Composition
R21	G2		J7	47kΩ	1/2W	±10% Composition
R22	N1		H7	1kΩ	1/2W	±10% Composition
R23	F5	H3		68kΩ	3/4W	±10% Composition
R24	G2		K7	15kΩ	1/2W	±10% Composition
R25	G4		L8	68kΩ	3/4W	±10% Composition
R26	G1		H5	47kΩ	6W	±5% Wire wound
R27	N2		H6	10kΩ	1/2W	±10% Composition
R28	H1		J4	33kΩ	6W	±5% Wire wound
R29	H1		J4	15kΩ	6W	±5% Wire wound
R30	G4		F7	10kΩ	1/2W	±10% Composition
R31	H3		K4	220kΩ	1/2W	±10% Composition
R32	H2		J4	220kΩ	1/2W	±10% Composition
R33	G5	H3		68kΩ	3/4W	±10% Composition
R34	G5	H3		6.8kΩ	3/4W	±10% Composition
R35	O2		D6	4.7kΩ	1/2W	±10% Composition
R36	J2		L8	470kΩ	1/2W	±10% Composition
R37	J2		J4	330kΩ	1/2W	±10% Composition
R38	O3		H5	68kΩ	3/4W	±10% Composition
R39	K2		H4	2.2MΩ	1/2W	±10% Composition
R40	O2		D6	1MΩ	1/2W	±10% Composition
R41	K2		H5	2.2MΩ	1/2W	±10% Composition
R42	L1		L7	12kΩ	3/4W	±10% Composition

Table 1001 (contd.)

Circuit Reference	Location of components			Value	Rating	Type and limit
	Circuit diagram	Component layout				
		Top	Underside			
			RESISTORS (contd.)			
R43	K3		K4	22kΩ	1/2W	±10% Composition
R44	K4		K4	47kΩ	1/2W	±10% Composition
R45	J4		K4	330kΩ	1/2W	±10% Composition
R46	M5		F6	330kΩ	1/2W	±10% Composition
R47	O5	K3		15kΩ	3/4W	±10% Composition
R48	N8	J3		62Ω	1/2W	±5% Wire wound
R49	N8	J3		68Ω	1/2W	±5% Wire wound
R50	L4		L6	1MΩ	1/2W	±10% Composition
*R51						
R52	G7	K3		10Ω	1/2W	±5% Wire wound
R53	C8	J3		10kΩ	1/2W	±10% Composition
*R54						
R55	L4		H6	33kΩ	6W	±5% Wire wound
R56	G6	K3		1Ω	1/2W	±5% Wire wound
R57	G8	K3		470Ω	1/2W	±10% Composition
R58	B8	J3		47kΩ	1/4W	±1% Composition
R59	B7		K6	6.8kΩ	3/4W	±10% Composition
R60	D7		K6	1kΩ	1/2W	±10% Composition
R61	D6		K6	1kΩ	1/2W	±10% Composition
R63	L4	L3		56kΩ	3/4W	±10% Composition
R64	L2	L3		270kΩ	3/4W	±10% Composition
R66	G8	J3		6.8kΩ	3/4W	±10% Composition
R62 and R65 not used. **						
			RESISTORS VARIABLE			
RV1	C4		F8	100kΩ	1/4W	±2%
RV2	M2	G4		10kΩ	1W	±10%
RV3	K4	F4		25kΩ	1W	±10%
RV4	N2		D8	25kΩ	1W	±10%
RV5	L5	E4		25kΩ	1W	±10%
			CAPACITORS			
C1	A3		F8	0.01µF	500V	±20% Paper
C2	B3	B4		470pF	350V	±2% Silvered mica
C3	B3	B4		33pF	350V	±10% Silvered mica
C4	C2		L7	0.1µF	350V	±20% Paper
C5	B2	B3		330pF	350V	±2% Silvered mica
C6	B2	B3		33pF	350V	±10% Silvered mica
C7	C1		L7	0.01µF	350V	±20% Paper

* R51 and R54 not used

** R67
R68

Table 1001 (contd.)

Circuit reference	Location of components			Value	Rating	Type and limit
	Circuit diagram	Component layout				
		Top	Underside			
CAPACITORS (contd.)						
C8	C2	B2		330pF	350V	±2% Silvered mica
C9	B1		L7	0.1µF	350V	±20% Paper
C10	C2	B2		33pF	350V	±10% Silvered mica
C11	D5		L6	0.1µF	350V	±20% Paper
C12	D1		L6	0.1µF	350V	±20% Paper
C13	D2	C2		330pF	350V	±2% Silvered mica
C14	E1		K6	0.1µF	350V	±20% Paper
C15	E2	C2		330pF	350V	±2% Silvered mica
C16	E2	C2		330pF	350V	±2% Silvered mica
C17	E4		H6	0.1µF	350V	±20% Paper
C18	G3		K6	0.01µF	500V	±20% Paper
C19	G3		K7	0.01µF	500V	±20% Paper
C20	G3		H7	0.01µF	500V	±20% Paper
C21	G1		C7	1µF	400V	±20% Paper
C22	O3		A6	4µF	400V	±20% Paper
C23	J3		A8	4µF	400V	±20% Paper
C24	K3		B7	4µF	400V	±20% Paper
C25	G3	F2		4µF	400V	±20% Paper
C26	K4	F3		4µF	400V	±20% Paper
C27	O8	G3		4µF	400V	±20% Paper
C28	M5	L2		8µF	150V	+100% − 20% Electrolytic
C29	M4	L2		8µF	150V	+100% − 20% Electrolytic
C30	M5	L2		8µF	150V	+100% − 20% Electrolytic
C31	M4	K2		8µF	150V	+100% − 20% Electrolytic
* C32						
C33	M5	H2		8µF	150V	+100% − 20% Electrolytic
C34	M4	J2		8µF	150V	+100% − 20% Electrolytic
C35	M5	H2		8µF	150V	+100% − 20% Electrolytic
C36	M4	J2		8µF	150V	+100% − 20% Electrolytic
* C37						
C38	C7	L1		8µF	150V	+100% − 20% Electrolytic
C39	C7	L1		8µF	150V	+100% − 20% Electrolytic

* C32 and C37 not used

Table 1001 (contd.)

Circuit Reference	Location of components: Circuit diagram	Component layout: Top	Component layout: Underside	Value	Rating	Type and limit
			CAPACITORS (contd.)			
C40	B7	H1		8μF	150V	+100% - 20% Electrolytic
C41	B7	H1		8μF	150V	+100% - 20% Electrolytic
C42	D7		B6	1μF	175V	±20% Paper
C43	D6		B6	1μF	175V	±20% Paper
C44	B6	L1		8μF	150V	+100% - 20% Electrolytic
C45	C6	K1		8μF	150V	+100% - 20% Electrolytic
C46	C6	J1		8μF	150V	+100% - 20% Electrolytic
C47	C6	J1		8μF	150V	+100% - 20% Electrolytic
C48	E2	C2		100pF	500V	±10% Ceramic
			INDUCTORS			
L1	B3	A4				I.F. input coil
L2	B2	A3				Anode coil (V1)
L3	C2	A2				Anode coil (V2)
L4	E2	C2				Discriminator Primary
L5	E2	C2				Discriminator Secondary
			VALVES			
V1	B2	A3	G8			CV.138
V2	C2	A2	G7			CV.138
V3	D2	B2	F6			CV.138
V4	E4	B2	F7			CV.138
V5	L2	D2	D7			CV.138
V6	F2	C2	E7			CV.140
V7	M2	D2	D7			CV.138
V8	F4	C3	E7			CV.138
V9a	J2	D3	D7			CV.140
V9b	N1					
V10	H2	D3	D8			CV.138
V11	G4	B3	F7			CV.138
V12	N1	D2	D6			CV.138
V13	J2	C3	E8			CV.286
V14	J3	B3	F8			CV.286

Table 1001 (contd.)

Circuit reference	Location of Components			Value	Rating	Type and limit
	Circuit diagram	Component layout				
		Top	Underside			
			VALVES (contd.)			
V15	O1	D2	D6			CV.138
V16	K2	D3	D7			CV.138
V17	K4	D3	D8			CV.286
V18	L4	B2	F6			CV.286
V19	M5	B2	F6			CV.286
			SWITCHES			
SWAa	O4		F8			Squelch On/Off
SWAb	N3		F8			
SWB	O8		C8			Local/remote
SWC	F6	E4				Monitor switch
SWDa	G8	C4				Meter switch
SWDb	F8	C4				
SWEa	O4		E8			System switch
SWEb	B7		E8			
SWEc	E6		E8			
SWF	F6		B8			Local printer switch
SWG	F7		B8			Remote printer switch
SWHa	G8	B4				Feedback ON/OFF
SWHb	K4					
SWJ	F2	F4				Keying polarity
			RELAYS			
RLA/1	E4	E1				Switch relay
RLB/1	O1	C1	E6			Telegraph relay
RLC/1	N9	C1	E5			Sender keying relay
RLD/1	B7	E1				Control unit relay
			PLUGS			
PL1	A3	B4				Coaxial plug
PL2			G8			12 pin Mk.IV
PL3		G4				4 pin Mk.IV
PL4		B4				4 pin Mk.IV
PL5		F4				12 pin Mk.IV
			MISCELLANEOUS			
MR1	B6		F8			Selenium bridge
LK1	A3		F8			Link
M1	G8	D4			1-0-1mA	Centre zero
RB1	C7	E1	C5		125V	Barretter lamp
RB2	C6	F1	B5		6W	

Table 1002 - Component schedule for supply unit D.C. section

Circuit reference	Location of components			Value	Rating	Type and limit
	Circuit diagram	Component layout				
		Top	Underside			
RESISTORS						
R51	F4	E1	E5	2kΩ	3W	±5% Wire wound
R52	G5	E1	E5	5.6kΩ	5W	±5% Wire wound
R53	G6	E1	E5	5.6kΩ	1/2W	±5% Composition
R54	E3	E4		1kΩ	3W	±5% Wire wound
R55	F9	E4		2.2kΩ	3/4W	±10% Composition
R56	E1	F3		1kΩ	3W	±5% Wire wound
R57	C8	D4	D8	4Ω	45W	±5% Wire wound
RESISTORS VARIABLE						
RV1	D9	D1				
CAPACITORS						
C51	E9	F4		0.25μF	175V	±20% Paper
C52	E9	E4		0.25μF	175V	±20% Paper
C53	E2	F3		0.01μF	500V	±20% Paper
C54	E2	C2		4μF	400V	±20% Paper
C55	B9	A4		1μF	175V	±20% Paper
C56	B8	A4		1μF	175V	±20% Paper
COILS AND CHOKES						
L51	D5	F1				R.F. suppressors
L52	D6	F2				R.F. suppressor
TRANSFORMERS						
TR51	E5	D2				Supply transformer
SWITCHES						
SWC	B8					On/Off switch
RECTIFIERS						
MR51	F5	F4				H.T. rectifier
MISCELLANEOUS						
X51	D9	E2				Carbon pile regulator Newton Bros.
X52	D2,5&9	F2				Rotary transformer
FS51	B9	C4		10A		Belling Lee
FS52	B8	D4		10A		Belling Lee
PL51	A8, 9	Front Panel				2-way Mk.IV
SK51	G1 - 9	Front Panel				12-way Mk.IV

Table 1003 - Component schedule for supply unit A.C. section

Circuit reference	Location of components			Value	Rating	Type and limit
	Circuit diagram	Component layout				
		Top	Underside			
RESISTORS						
R1	F5	E1	E5	12kΩ	5W	±5% Wire wound
R2	F2	F1	F5	33kΩ	3/4W	±10% Composition
R3	F2	F1	F5	33kΩ	3/4W	±10% Composition
R4	F1	F1	F5	33kΩ	3/4W	±10% Composition
R5	F6	E1	E5	10kΩ	3W	±5% Wire wound
R8	E1	E4		2kΩ	15W	±5% Wire wound
CAPACITORS						
C1	F2	C1		8μF	400V	±20% Paper
C2	E2	D1		4μF	400V	±20% Paper
COILS AND CHOKES						
L1	E1	D3				Smoothing choke
TRANSFORMERS						
TR1	D	B1		-		Mains transformer
SWITCHES						
SWA	C1	C4				Voltage tapping switch
SWB	B1	Front Panel				On/Off switch
RECTIFIERS						
MR1	E5		A7			
VALVES						
V1	F1	E3	C7			CV.686
V2	F2	C3	E7			CV.686
V3	F2	B3	F8			CV.686
V4	D1	A3	F7			CV.378
MISCELLANEOUS						
FS1	B1	C4		2A		Fuse
FS2	B2	D4		2A		Fuse
LP1	E4	Front Panel				Lamp
PL1	A1	Front Panel				3-way Mk.IV
SK1	G	Front Panel				12-way Mk.IV

R6 and R7 not used.

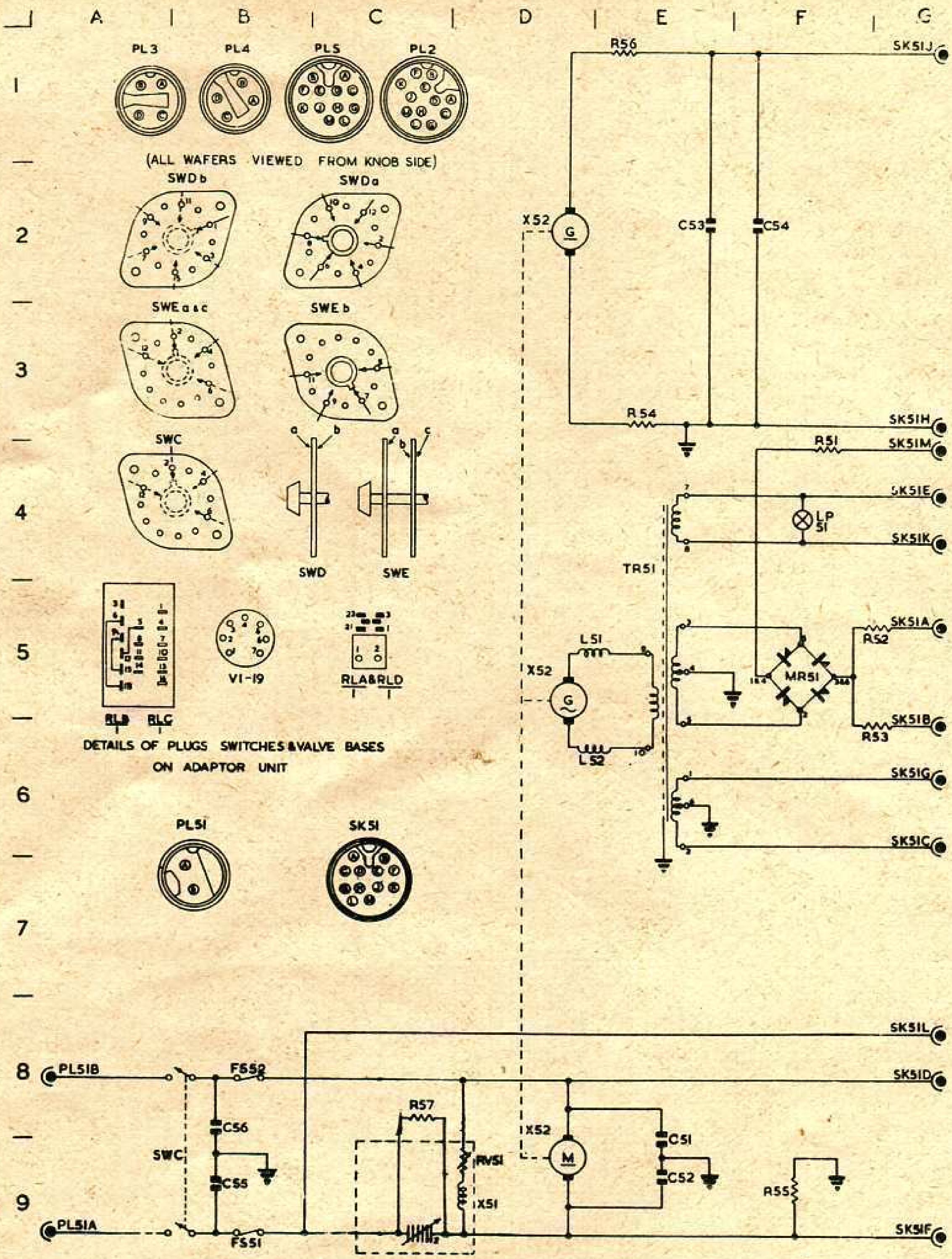


Fig. 1001 Circuit diagram of supply unit - D.C. section

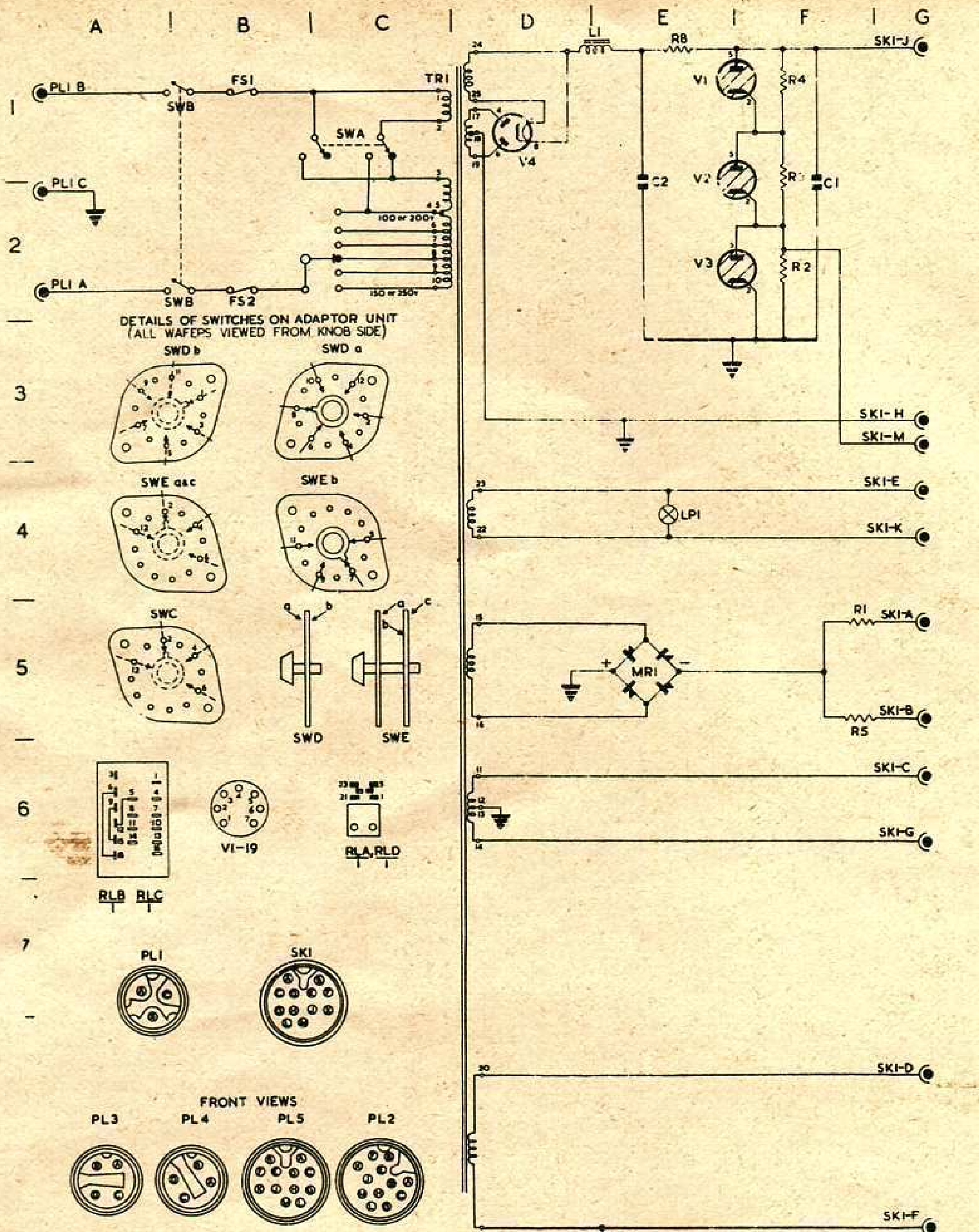


Fig. 1002 Circuit diagram of supply unit - A.C. section

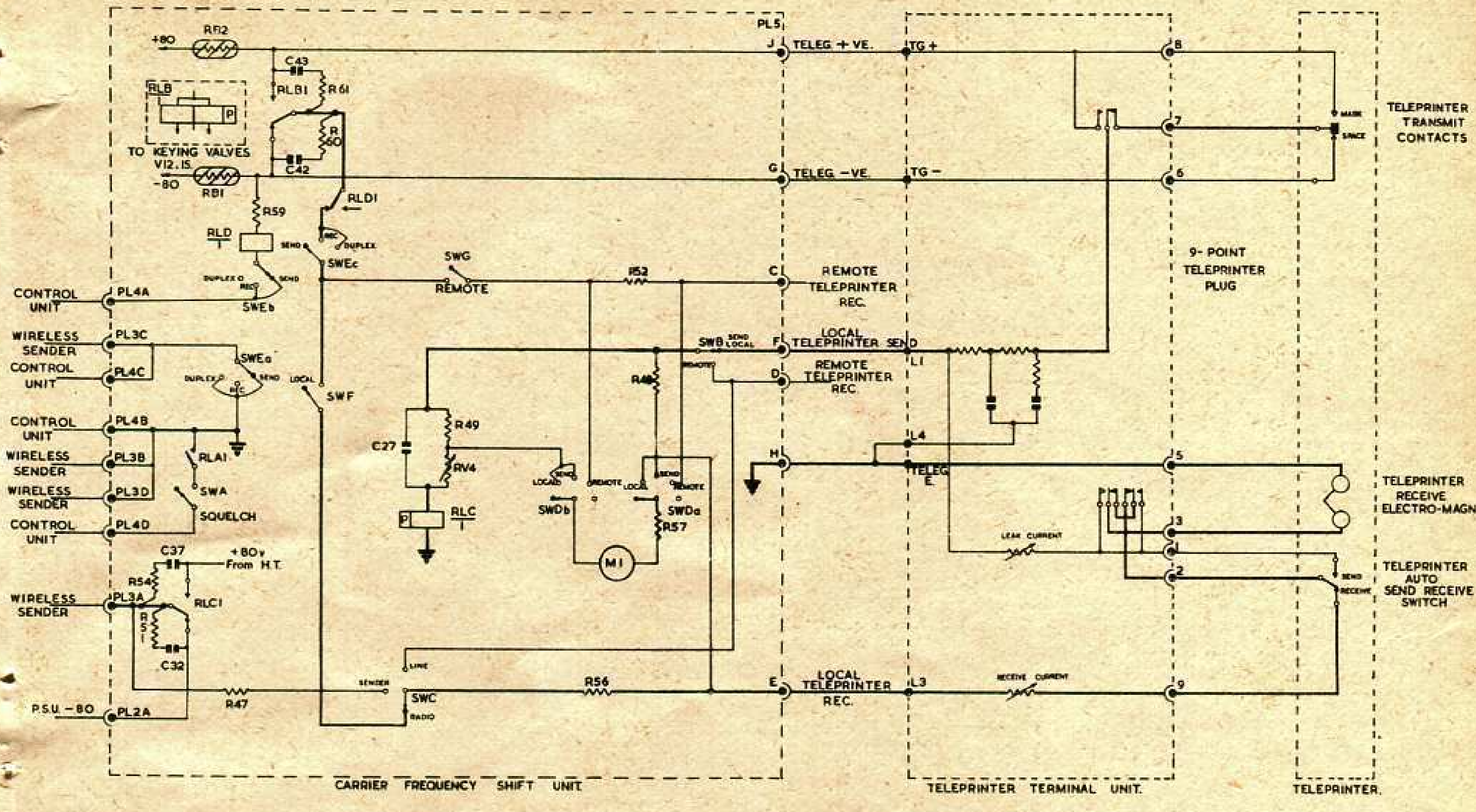
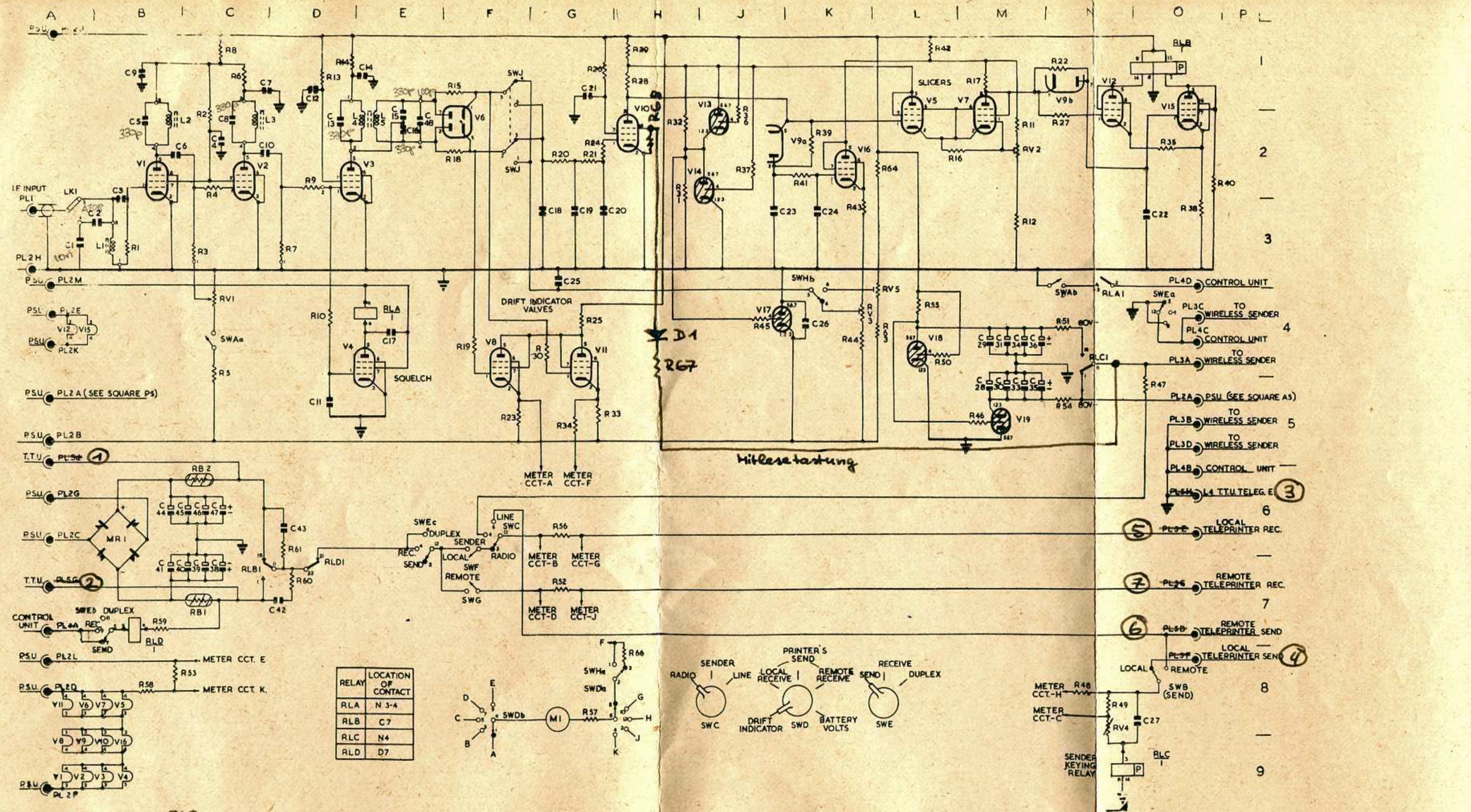


Fig. 1004 - Simplified overall diagram of send and receive telegraph circuits



RLB
RLC in Ruhe auf Seite −/+, Signal imp. +/−

Fig. 1003 - Circuit diagram of adaptor

⊙ Oktal sockel "Printers"