THE PANDA

PR-120-V TABLE TOP

150 WATT TRANSMITTER

INSTRUCTIONS

Manufactured by

PANDA RADIO COMPANY

58 SCHOOL LANE, ROCHDALE, ENGLAND

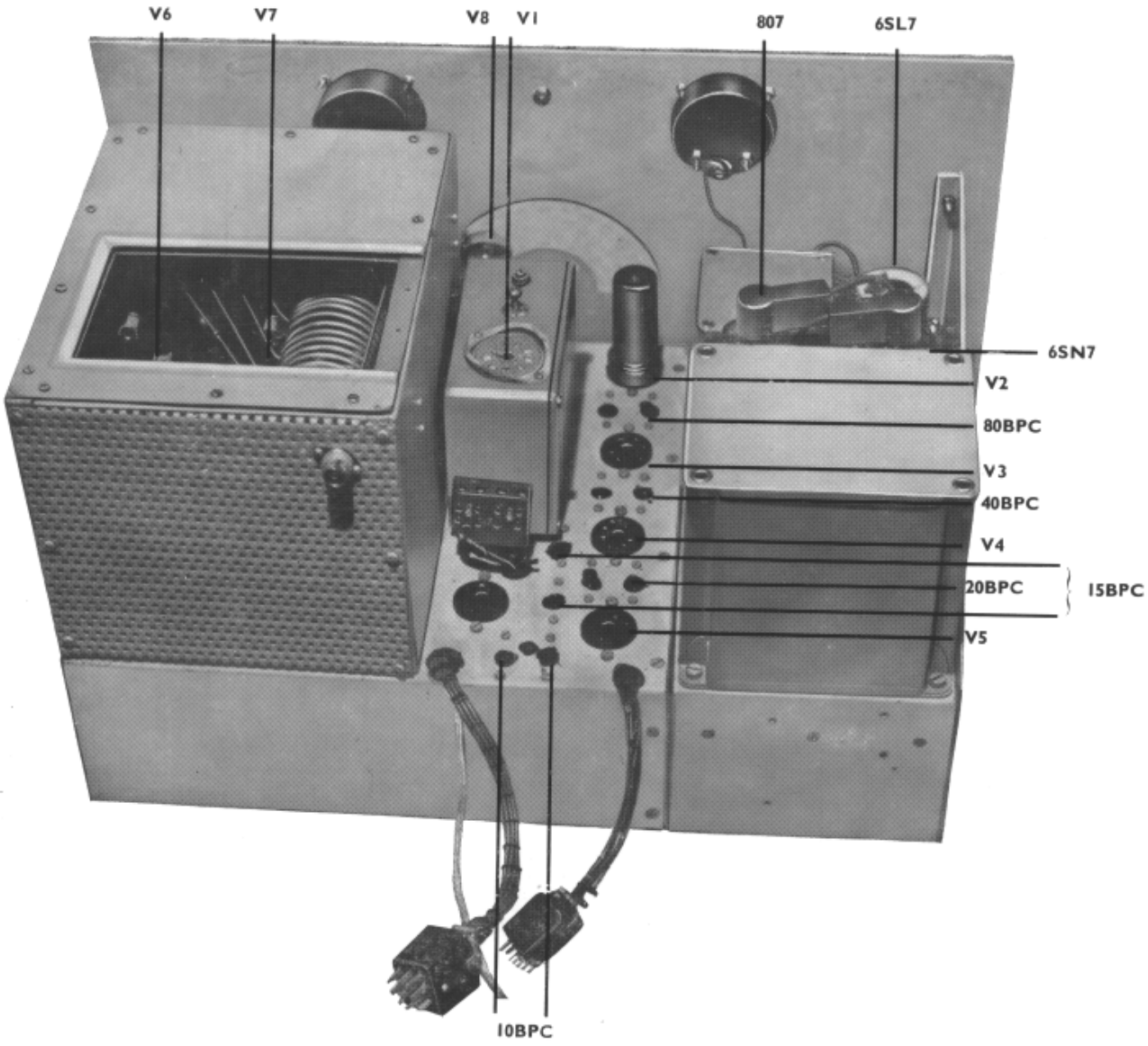
Cables: Panda, Rochdale **Telephone 47861**

Works: 16-18 HEYWOOD ROAD, CASTLETON Nr. ROCHDALE **Telephone: Castleton 57396**

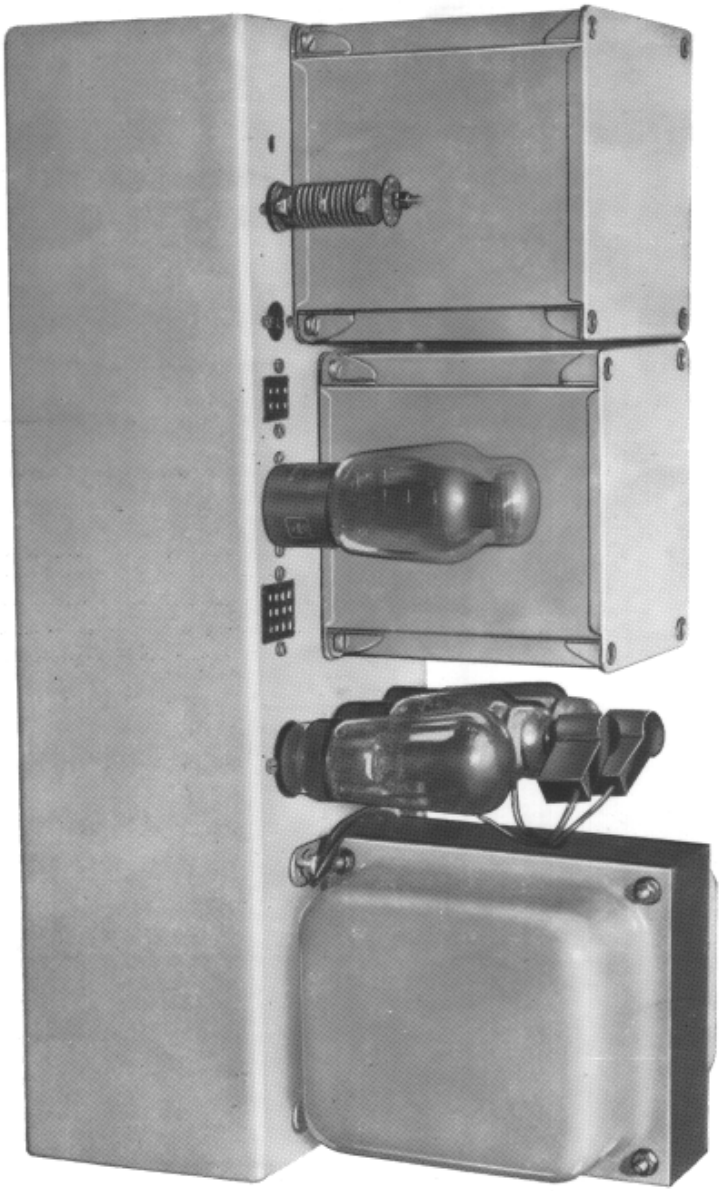
TABLE OF CONTENTS

ILLUSTRATIONS AND CIRCUIT DIAGRAMS

R.F. and MODULATOR UNIT removed from case



POWER UNIT



I. GENERAL DESCRIPTION

1-1 GENERAL

This instruction manual has been prepared to ensure correct installation, operation, adjustment and maintenance of the PANDA PR-120-V Amateur Transmitter.

The PR-120-V is a modern complete " Table Top " Transmitter embodying latest design techniques to ensure high efficiency, accurate and rapid frequency setting, maximum ease and convenience of operation and high inherent harmonic suppression, which enables it to be used in normal Television Service Areas without harmonic interference to Television Reception.

The Transmitter is housed in a single cabinet 21 ins. wide, 18 ins. deep, 13 ins. high, and weight approximately 150lbs. Adequate ventilation is provided if the equipment is correctly installed.

The transmitter comprises three units, each being completely screened, thus complete freedom from R.F. or A.F. feedback is obtained. This complete screening is also an important factor in successful T.V.I. suppression. These units are :—

R. F. Unit : comprising V.F.O., Exciter and P.A. amplifier.

Modulator Unit : comprising high gain speech amplifier and class " AB2 " Modulator.

Power Unit : comprising a low voltage supply (all heaters, grid bias and 350v. at 250 m.a. D.C.), also a High voltage supply giving approx. 750v. at 200 m.a. for C.W. and approx. 650v. at 400 m.a. for Radiotelephone operation (Includes Modulation Load).

All wiring is independent of the main cabinet and the units may easily be removed for inspection or maintenance. The Modulation Unit is part of the R.F. chassis & front panel so that, mechanically, these two assemblies comprise a single unit which slides forward on runners upon releasing the front panel fixing bolts and the power unit inter-connecting cable plugs and sockets.

The PR-120-V covers the 3·5, 7, 14, 21, and 28 Mc/s Amateur bands. Complete bandswitching enables rapid band change. The ingenious system of Band-Pass coupling used between the frequency multiplier and buffer amplifier valves in the exciter chain eliminates tedious retuning of all intermediate stages between the V.F.O. and the P.A. anode circuit.

The electrically-interlocked toggle switches control the Low and High voltage circuits thus ensuring that the supplies are switched on in the correct sequence. A time delay device ensures automatic delay switching of H.T. to the mercury vapour rectifiers used for the High Voltage supply.

A Function Switch provides selection of C.W. or Phone operation with provision for automatic antenna change-over and receiver muting, thus enabling the complete station to be controlled by a single switch at the operator's finger tips. This enables extremely rapid change-over to be achieved-virtually "PUSH-to-TALK" on phone and semi-break-in working on C.W. Full BREAK-IN C.W. working may be had by using a separate antenna for reception and some means of muting the receiver by the keying circuit.

Metering of the P.A. grid current, Modulation anode current, L.V. supply and H.V. supply is obtained by means of a meter switch in conjunction with the general purpose meter. A separate meter is used to measure the P.A. anode current at all times. Metering of individual valve anode currents for maintenance purposes is provided for by the metering resistors in each valve anode circuit across which a suitable test meter may be connected.

An excitation control provides adequate control of P.A. grid current which should be set to the recommended value according to the system of transmission employed.

Speech modulation level is controlled by an Audio Gain Control. The speech amplifier is designed to operate with a crystal microphone (diaphragm type).

1-2 REFERENCE DATA

POWER SOURCE. Normally 230 volts 50 cycle A.C. Provision made for 100 to 250 volts 50-60 cycles Total power input (from mains) : 400 watts (approx). P. A. anode input : 120 watts PHONE, 150 watts C.W.

1-3 VALVE COMPLEMENT

Quantity	Type	Function
1	EF50	V.F.O.
4	6V6	Frequency Multipliers
1	6Y6 or 6L6	Clamper valve
2	807	R.F. P.A.
1	6SL7	Speech Amplifier
1	6SN7	Modulator Driver
2	807	Modulators
1	5U4G	L.V. Rectifier
2	866 Jrs (RG1/240A)	H.V. Rectifier
1	DLS 10/16	Delay valve

II. INSTALLATION

2-1 UNPACKING

After removing the transmitter from its packing case it should be inspected very carefully for any damage which may have occurred in transit so that, if necessary, a suitable claim may be lodged. Check that all panel controls function normally and that the meters are undamaged. Check that all valves are secure in their sockets. If a claim for damage is to be made, the original packing case and packing material must be preserved.

2-2 LOCATION OF TRANSMITTER

This table top transmitter is designed to work alongside the station receiver on the operating desk or table. Sufficient room should be left at the rear to enable the remote change-over relay connections to be made and for replacement of the two fuses located on the rear apron of the power unit chassis. A free circulation of air must be provided to enable the ventilating system to function correctly. Other apparatus should not be

located so close alongside as to prevent free air circulation—nor should anything be placed on the top lid of the cabinet.

2-3 EXTERNAL CONNECTIONS

First check that both L.V. and H.V. switches are in the " off " position before making the external connections. These are :—

(*A*) A.C. supply.
(*B*) Remote change-over relay.
(*C*) Antenna co-axial feeder.
(*D*) Microphone and key.
(*E*) Harmonic check (if required).

(*A*) A.C. Supply

The PR–120–V is normally adjusted at the factory to operate from a 230v. 50 cycle single phase supply source, unless specifically ordered for a special voltage. However, the two power transformers have multi-tapped primaries which may be connected so as to permit operation from 100 to 250v., 50 to 60 cycle supply mains.

Access to these transformer tappings may be had by removing the transmitter from its case as described under the section headed " Maintenance."

(*B*) Remote Relay

The pair of contacts located at the rear of the transmitter are connected to the FUNCTION SWITCH (see circuit diagram) so that they are shorted in the " C.W. " and " Phone " positions and are open-circuited in the " Stand-by " or " Receive " position. Thus, by running a screened pair of leads from these sockets to the antenna relay via a suitable source of D.C. energising voltage, complete change-over from transmit to receive may be obtained merely by operation of the FUNCTION SWITCH. If desired, a second relay, having its coil connected in parallel with that of the antenna relay, may be used to mute the receiver by any of the usual methods. The screening braid of the external relay leads should be connected to the transmitter frame by means of the " Earth "terminal provided at the rear.

(*C*) Antenna Feeder

The PR–120–V is designed to work into an unbalanced load (i.e. a co-axial feeder) having an impedance of between 45 and 100 ohms. The simplest arrangement would be to use a dipole feed at its centre with 80 ohms co-axial feeder, but a more satisfactory and flexible arrangement would be to use an antenna tuning unit (A.T.U.) having an input suitable for 45 to 100 ohms co-axial cable and an output capable of connection to any balanced (twin wire) feeder or to an end-fed long wire antenna.

The A.T.U. helps materially to reduce the residual harmonic from the transmitter reaching the antenna and thus is an asset from the T.V.I. suppression aspect.

In certain areas, it may also be necessary to instal a Low Pass Filter in the co-axial feeder, between the transmitter and the A.T.U. to provide adequate harmonic attenuation.

Both A.T.U. and Low Pass Filter can be supplied by PANDA RADIO CO.

(*D*) Microphone and Key

The microphone recommended for use with the PR–120–V is the diaphragm type crystal microphone and is connected by means of a screened lead (light co-axial cable may be used) terminating in a suitable co-axial plug as supplied with the transmitter.

The Key should be connected by a screened pair lead terminating with a ball and sleeve type telephone jack plug. The screening braid should be joined to the sleeve of the plug together with one lead of the pair, the remaining lead being connected to the ball of the jack plug. The braid should not be connected to anything at the KEY end. A Keying relay may, if desired, be used similarly connected via a screened pair. The Keyed current will not exceed 30 m.a. Its exact value will depend upon the setting of the Excitation Control.

(*E*) Harmonic Check

This co-axial outlet provides a sample of the P.A. output, enabling residual harmonic content to be checked by simply plugging in a suitable Harmonic Monitor (a sensitive absorption wave meter fitted with a crystal diode and a micro-ammeter, calibrated to cover the T.V. Service band). See section 3 for instructions on use of this facility.

III. ADJUSTMENT AND OPERATION

3-1 C.W. OPERATION

Having made all external connections as described in Section 2 (Installation) proceed as follows :—

1. Set Function Switch to " Receive."
2. Set V.F.O. to desired frequency by reference to its calibrated scale.
3. Set exciter and P.A. Band Switches to desired band.
4. Set P.A. to approximate position for the centre of the chosen band
5. Set both FINE and COARSE OUTPUT CONTROLS to " 1 " on their scales (i.e. Minimum loading).
6. Set Audio Gain control to " 0."
7. Set G.P. meter switch to L.V. x 100 position.
8. Switch on L.V. supply switch marked " FIL " and note that 807 Modulation Heaters and Low pilot lamp glow. Read Exciter Anode supply voltage. This should be about 350.
9. Turn G.P. METER SWITCH to read P.A. grid current.
10. Turn FUNCTION SWITCH to " C.W."
11. Press Key and adjust EXCITATION CONTROL until P.A. grid current is about 5 m.a. with no H.T. on P.A.
12. Release Key and set POWER SWITCH to the " NET " position.
13. Switch on H.V. supply. (switch marked " PLATE" There will be a delay of approximately one minute before H.T. is applied to the H.V. rectifier via the TIME DELAY VALVE (DLS10 or DLS16)

14. Turn G.P. METER SWITCH to read " High " which will be about 750v. under the Key-Up C.W. condition.

15. Set Power Switch to Low (i.e. Low Power position).

16. Press Key and tune P.A. i.e. " Final " for minimum anode current.

17. Increase coarse output control. Re-tune Final for minimum feed ; this will be greater than that obtained with the coarse output control at " 1 " provided the Antenna Tuning Circuit (A.T.U.) is correctly, or nearly correctly, set for the band in use. Tune A.T.U. (if used) as required to obtain MAXIMUM P.A. LOADING. Adjust FINE OUTPUT LOADING CONTROL as required to obtain 100 M.A., P.A. anode current. Re-trim P.A. Tuning for Minimum feed each time the COARSE or FINE OUTPUT controls are changed. If the P.A. feed exceeds 100 m.a., reduce the COARSE OUTPUT setting & re-adjust the FINE control & P.A. TUNING until the desired loading condition is achieved.

18. Set Power Switch to High (i.e. High Power) and very carefully re-adjust FINE OUTPUT LOADING control, if necessary, to obtain 200 m.a. P.A. anode current. CHECK P.A. Tuning. CHECK H.V. which should be 750v. with the transmitter fully loaded in the Key down C.W. condition. CHECK P.A. Grid current which should be about 5 m.a. on load. Adjust grid current by means of EXCITATION control as required when changing band etc.

The Transmitter is now correctly adjusted and ready for C.W. transmission.

3-2 RADIOTELEPHONY OPERATION

Having set the transmitter as described for C.W. operation, proceed as follows.

1. Reset Power Switch to Low.
2. Short Key, or remove Key Jack Plug from its socket.
3. Set Function Switch to " Phone."
4. Adjust drive to about 5 M.A.
5. Check Modulation feed on G.P. meter. This should be between 50 and 60 m.a. If necessary, adjust BIAS POTENTIOMETER (located near FUSE CARRIERS at rear of transmitter) to produce a quiescent modulation Feed Current of 55 m.a. i.e. 1.8 on G.P. Meter with switch in " MOD x 30 " position on 7 mcs. (Note that the transmitter will be " On the Air " during this adjustment so that the use of a 100 W load lamp in place of the antenna is recommended, and, in fact, should be used for the complete sequence of initial adjustments on installing the transmitter. It is necessary to have the R.F. portion of the trans- mitter correctly adjusted and drawing normal current in the " Key-down " condition when adjusting the modulator bias to obtain correct standing, or quiescent feed since this ensures normal loading on the L.V. and H.V. power supplies.
6. Advance AUDIO GAIN control to about 6 or 7 on the scale. On speaking into the microphone, at normal voice level, about 40 ins. from the microphone, the modulation feed should Kick up around 150 m.a. i.e. 5 on G.P. meter, on speech peaks. The antenna feeder current (measured in the feeders running from the A.T.U. to the antenna) should show a rise of from 10 to 15% on normal speech. This corresponds roughly to a 22·5% rise under SINE WAVE modulation conditions and indicates approximately 100% amplitude modulation. If any difficulty is found in obtaining this rise of feeder current (or correct modulation envelope pattern if a C.R.O. be used), the fault may be due to :—

(*A*) Low heater volts.

(*B*) Insufficient P.A. grid drive (i.e. low grid current).

(*C*) Antenna loading too tight.

Normally P.A. grid current should be increased slightly, say to 5 m.a. and antenna loading decreased slightly when changing from C.W. to " Phone " working if the P.A. had been adjusted originally for maximum output on C.W.

If Phone operation is likely to be more frequent than C.W. or at least 50% of the total operating time is to be spent on Phone, it is recommended that the transmitter be adjusted as for PHONE operation, i.e. 120 watts input, and left at that adjustment as far as EXCITATION and LOADING are concerned when using C.W. There will, of course, be some increase in input power when switching from 'Phone to C.W. due to the modulation anode feed being suppressed in the C.W. position, with a consequent rise in P.A. anode volts.

3-3 QSY OR " NETTING "

Having adjusted the transmitter as described, QSY or " Netting " on to any desired frequency within the amateur band in use may be achieved as follows :—

1. Set V.F.O., by reference to its scale calibration, approximately to desired frequency with FUNCTION SWITCH at " REC."
2. Turn POWER SWITCH to " Net " and AUDIO GAIN to Zero.
3. Tune V.F.O. to desired spot frequency while monitoring on " muted " i.e. the receiver R.F. gain must be reduced either manually or, preferably, automatically when transmitting to avoid receiver blocking or overloading receiver. Zero-beat V.F.O. frequency to received signal frequency on which it is desired to net.
4. Switch to L or H on POWER SWITCH as desired.

The transmitter is now ready to transmit on the desired frequency. If the V.F.O. frequency has been changed by more than ±10 Kc/s in the 3·5 Mc/s band, and roughly proportionately in the higher frequency bands (i.e. ±50 Kc/s in the 14 Mc/s band), it will be necessary to retrim P.A. and A.T.U. tuning slightly.

3-4 Harmonic Output Check

With the transmitter correctly adjusted, a suitable Harmonic Indicator may be plugged into the HARMONIC CHECK socket and tuned to obtain a maximum

meter deflection at the undesired harmonic frequency in the local T.V. channel. The P.A. TUNING and FINE LOADING controls should then be re-adjusted slightly to produce minimum deflection of the Harmonic Indicator meter. In general, it will be found that the correct position of these controls for maximum fundamental power output coincides with minimum harmonic output. The residual harmonic indication, using a sensitive Harmonic Indicator with a 0 to 100 micro-ammeter should not exceed a few micro-amperes.

The following circuit description is intended for the guidance of the owner-operator of the PR–120–V and should be studied carefully before attempting any maintenance.

Finally . . .
DON'T use PHONE on Low Power.
DON'T allow Final Current to exceed 200 mas.
DON'T switch off FIL and leave PLATE on.
DON'T switch on PLATE nntil approx. one minute from swltching on FIL.
DON'T over-drive. 5 mas. on PHONE & 3-4 mas on CW
DON'T use a high impedence type of antenna straight into transmitter output.
DON'T over modulate.
DON'T tune up on High Power.

IV. CIRCUIT DESCRIPTION

4-2 CIRCUIT DESIGN

(*A*) V.F.O.

The V.F.O. Unit is contained in a separate robust, metal box in order to achieve the extra screening necessary for Break-in working since the oscillator itself is not Keyed, a high-stability Clapp oscillator on 1·7 Mc/s provides a stable source of signal on all bands. The cathode of the following 3.5 mc. Dblr. is keyed. A Screw-driver adjusted air trimmer condenser, located on the top front of the V.F.O. unit, provides a means of re-setting the V.F.O. to its calibrated scale.

The large full-vision directly calibrated slow-motion V.F.O. dial enables rapid frequency selection within any given band to be made with ease and precision.

(*B*) Exciter

The four valves, following the V.F.O. unit are used as Frequency Multipliers or Buffer stages according to the frequency band selected. On 3·5 Mc/s. V2 acts as an F.D. while V3 becomes an untuned B.A. and V4 a tuned B.A. This arrangement ensures adequate drive for the P.A. on 3·5 Mc/s, on the remaining bands the various F.D·valves are brought into circuit as required. On 21 Mc/s, V4 becomes a Frequency Tripler. The various multiplier stages are tuned and coupled by an ingenious arrangement of switched band-pass couplers which ensure almost constant drive amplitude to the P.A. over each of the five amateur bands employed. Small variations of drive amplitude over a particular band are easily taken care of by slight re-adjustment of the excitation control. This control is also used to set the P.A. grid current to the desired value when switching from one band to another.

Apart from the great convenience of eliminating tedious stage-by-stage re-tuning when changing frequency, this method of inter-stage coupling results in greater suppression of unwanted harmonic products in the grid circuit of the P.A. and thus in its anode circuit.

Anode, screen and heater power for the Exciter and V.F.O. is supplied by the L.V. power unit. The anode and screen voltage to the V.F.O. unit is stabilised by means of a VR150/30.

(*C*) Power Amplifier

Parallel connected 807 valves are used in the P.A. in conjunction with a high-efficiency band-switched Pi-filter network tank circuit. This arrangement ensures a high degree of harmonic suppression. The provision of both Coarse and Fine output loading controls enables exact matching to the co-axial feeder output circuit to be obtained. A bank of fixed mica condensers, selected by the switch SW4, and a variable air condenser, C34, provides Coarse and Fine loading respectively.

The second half of the split-stator condenser, C40, is automatically switched in parallel with the first half in order to preserve the correct L.C. ratio of the P.A. tank circuit when the 3·5 and 7 Mc/s band are selected.

The screens and anodes of the P.A. valves are modulated simultaneously for speech transmission.

A 6L6 (or 6Y6) screen grid clamper valve used to protect the P.A. valves during Keying or stand-by.

(*D*) Audio Circuits

The speech amplifier consists of a twin triode, 6SL7GT, used as a two-stage voltage amplifier embodying high gain with excellent speech quality and complete stability. A 6SN7GT operated with its two triode sections connected in parallel functions as a low impedance driver for the two 807 class AB2 modulators. The secondary of the modulation transformer, T2, is automatically shorted in the " C. W. " position of the FUNCTION SWITCH. Grid bias for the modulation valves is supplied by a Selenium Rectifier embodied in the L.V. power unit and is adjustable by means of the pre-set potentiometer P3.

During C.W. operation, and in the " REC." position of the FUNCTION SWITCH, H.T. is removed from the anode of the first section of V11 (the 6SL7GT voltage amplifier,)— and the screens of the modulator valves.

(*E*) Low Voltage Supply

This is actually a part of the composite power unit which also includes the HIGH VOLTAGE SUPPLY. The transformer T3, supplies all valve heaters and, via the rectifier valve, 350 volts at 250 m.a. D.C. for the V.F.O., Exciter and Audio Units. It also supplies, via the selenium rectifier, SR, a maximum of 50 volts D.C. for grid bias. The actual bias voltage applied to the modulation valves is set at about —30 by means of the potentiometer P3.

(*F*) High Voltage Supply

The 650 to 750 volt H.T. for the P.A. and modulator valves is supplied by a pair of mercury vapour rectifiers which are protected from application of H.T. before completion of the required " warm up time " by the delay valve, A swinging choke input filter provides good regulation and a maximum D.C. output of 400 m.a.

V. MAINTENANCE

5-1 INSPECTION

(*A*) The PR–120–V has been constructed with the best possible quality components throughout and, with reasonable care in use, should require only a minimum of maintenance and servicing.

A routine inspection shedule should be established for periodic checks of the equipment and attention should be paid to wear of working parts and the ingress of dust which should never be allowed to accumulate.

(*B*) Cleaning

The set should always be kept clean and free from dust or corrosion. In order to prevent the latter, the equipment must be kept dry and should never be stored in a damp atmosphere. In salt-laden atmospheres especial care must be taken to check corrosion. In general, contacts such as tap switches, valve prongs should be inspected frequently in such atmospheres and a suitable switch contact lubricant should be applied.

(*C*) Valves

A periodic emission check of all valves should be made, say about every three months or so depending on the amount of use of the equipment. A log should be kept noting the date when new valves are put into service so that they may be renewed within a reasonable time after the valve manufacturer's life guarantee has expired. The renewal of weak valves usually results in a noticeable improvement in set performance. Care should be exercised in removing anode top cap connections so as not to damage the valve envelope seal at this point or to loosen the valve cap. The following points should be noted to ensure long valve life :—

1. Always remove A.C. power plug to the equipment before attempting to withdraw any valve from its socket.
2. Operate all valves within $\pm 5\%$ of their rated heater voltage.
3. Do not exceed the rated anode current of any valve during normal operation of the equipment, always tune up the transmitter with POWER SWITCH in the Low position thus limiting the unavoidable transcient overload current condition to safe (short period) value.
4. Make sure that valves are replaced in the correct sockets.

5-2 FAULT LOCATION

The most usual cause of breakdown is valve failure. Defective valves causing overload in power circuits, etc., may generally be located by careful inspection of the suspected valve and its associated components. Signs of over-heating of resistors, wax melting from condensers, etc., should be noted. The components used in the construction of the PR–120–V are amply rated and no overloading should occur in normal circumstances.

The circuit diagrams used in conjunction with the table of operating current and voltage values facilitate rapid and accurate fault location. A general purpose multi-range A.C.–D.C. test meter should be available for testing and maintenance.

The fuses provided are adequately rated for the adjustment of the power transformer primary taps requested when ordering the transmitter (i.e. 110 or 230v. 50 to 60 cycle A.C.) and should be replaced only after examination of the circuit shows that no permanent fault exists.

5-3 ALIGNMENT

The dust iron slugs used to tune the band pass coupler windings in the Exciter circuit are firmly secured at the factory after being set correctly on test and will not normally require any further adjustments in service. However, if for any reason—excessive vibration or movement in transit, or tampering—the slugs have been moved in the coil formers resulting in insufficient grid current to the P.A. on one or more bands, it will be necessary to re-align the exciter. The following procedure should be adopted :—

A. Set G.P. meter switch to read P.A. grid current.

B. Set FUNCTION SWITCH to " C.W."

C. Switch on L.V. only.

D. Set exciter band switch to 3·5 Mc/s. Set V.F.O. to 3750 Kc/s.

E. Switch on L.V. *ONLY*.

F. Press key and advance EXCITATION control until a P.A. grid current of 5 m.a. is obtained. If this current value is not reached, re-tune the 3·5 Mc/s B.P.C. primary winding by adjusting its dust-iron slug carefully using a properly designed trimmer tool or insulated screw driver which just fits the adjusting slot in the core. Care must be taken not to use undue force or haste in turning the threaded core or it may have to be drilled out before a new slug can be substituted. Having obtained the required grid current at 3750 Kc/s, re-set the V.F.O. to 3550 Kc/s and trim the 3·5 Mc/s coupler secondary. Next set V.F.O. at 3,600 Kc/s and trim the single slug-tuned winding in the anode of the 3·5 Mc/s tuned B.A. (V4). However, as this is least likely to affect the results and its adjustment necessitates removing the R.F. and Modulator units from the cabinet, since this coil is located on the Exciter band switch, it should not be attempted unless careful re-adjustment of the 3·5 Mc/s F.D. coupler does not succeed in restoring the P.A. grid current to normal. *NOTE*. Always check for a faulty valve before attempting to re-align the exciter unit, thus perhaps avoiding unnecessary trouble.

G. Switch to 7 Mc/s and set the V.F.O. to 7,300 Kc/s. Re-trim the 7 Mc/s F.D. coupler for maximum grid current to P.A. (Advance or RETARD the EXCI TATION control as required so as to obtain a maximum of about 5 to 6 m.a. during the alignment process). Next, set the V.F.O. to 7000 Kc/s and trim the 7 Mc/s secondary for maximum grid current.

H. Proceed in a similar manner for each of the remaining bands, setting the V.F.O. to the H.F. end of the band in question first and adjusting the appropriate F.D. stage coupler Primary winding first, then setting the V.F.O. to the L.F. end of the band and adjusting the Secondary winding for maximum grid current. In the case of the 3·5 and 28 Mc/s bands the V.F.O. should be set about 50 and 500 Kc/s in from each end of the band respectively for trimming purposes.

All slugs are sealed with shellac, which should be softened with methylated spirit before adjusting.

5-4 V.F.O. CALIBRATION

The V.F.O. calibration may be re-set to line up with the dial markings by adjustment of the pre-set air trimmer condenser C2, located on top of the V.F.O. box towards the front edge. For the purpose of calibration it will only be necessary to switch on the L.V. supply. The signal should be audible in the station receiver or heterodyne frequency meter by means of which an accurate calibration check should be made.

5-5 REMOVING POWER UNIT

For the purpose of changing transformer primary taps, or servicing components located inside the power unit chassis, the following procedure should be adopted :

A. Remove power plug from mains outlet.

B. Release fixing screws in front panel and pull R.F. and Modulator chassis forward about 6 inches to facilitate removal of power and control interconnecting cable plugs from their sockets on the power unit, then pull R.F. and modulator chassis clear of cabinet.

C. Carefully turn the cabinet on to its back after first placing two wooden battens so as to avoid damage to rear terminals, etc. With the underside of the cabinet facing towards the person, the four fixing bolts holding power unit to base of cabinet will be seen. Release these bolts.

D. Carefully turn cabinet back to normal position. Slide power unit forward and clear of cabinet.

E. To return unit to cabinet reverse this procedure.

VI. PARTS LIST

1. R.F. UNIT.

Resistors

Item	Value	Rating	Function
R1	100K ohms	½ W	Osc. Grid Leak
R2	6K ohms	10 W	Stabilizing Resistor
R3	22K ohms	½ W	V2 Grid Leak
R4	10K ohms	1 W	Bias Voltage divider
R5	470 ohms	½ W	V2 Cathode bias
R6	50 ohms	½ W	V2 Anode metering
R7	22K ohms	½ W	V3 Grid Leak
R8	470 ohms	½ W	V3 Cathode bias
R9	47K ohms	1 W	Bias Voltage divider
R10	50 ohms	½ W	V3 Anode metering
R11	22K ohms	½ W	V4 Grid Leak
R12	300 ohms	5 W	V4 Cath bias
R13	50 ohms	½ W	V4 Anode metering
R14	50 ohms	½ W	V5 „ „
R15	12K ohms	2 W	P.A. Grid leak
R16 & 16A	17 ohms	½ W (wound six turns 22 S.W.G.)	P.A. Grid Stopper
R17	50 ohms	½ W (wound six turns 22 S.W.G.)	P.A. Anode Stopper
R18	2x35 K in Series	20 W	P.A. Screen dropper (low power)
R19	2x35K in Paralled	20 W	P.A. Screen dropper (high power)
R20	22K ohms	½ W	V5 Grid leak
R21	16½ ohms	1 W	P.A. Grid metering (2 x 33 ohms. in Parallel)
P1	20 K	5 W Pot.	Drive Control

1(b) Condensers

C1	Special		V.F.O. Tuning
C2	100 pf variable		V.F.O. Trimmer
C3			Temp. Compensating
C4	1000 pf S. Mica	350v.	
C5	1000 pf S· Mica	350v.	V.F.O. Feedback potentiometer
C6	·01 paper	350v.	V1 screen by-pass
C7	·01 paper	350v.	Bias decoupling
C8	100 pf S. Mica	350v.	V2 Grid Coupling
C9	·01 paper	350v.	V2 cathode by-pass
C10	·01 paper	550v.	V2 Screen by-pass
C11	·001 mica	350v.	V2 anode decoupling
C12	.001 mica	350v.	V3 anode decoupling
C13	·01 paper	350v.	V3 Cathode by-pass
C14	·01 paper	350v.	V3 screen by-pass
C15	·001 mica	350v.	V3 anode decoupling
C16	100 pf mica	350v.	V4 grid coupling
C17	500 pf mica	350v.	V4 grid coupling
C18	·01 paper	350v.	V4 cathode by-pass
C19	·01 „	350v.	V4 screen by-pass
C20	·001 mica	350v.	V4 anode decoupling
C21	·01 mica	350v.	P.A. Heater by-pass
C22	·01 paper	350v.	V5 Screen by-pass
C23	·001 mica	350v.	V5 plate decoupling
C24	500 pf mica	350v.	V6 Coupling
C25	1000 pf mica	350v.	P.A. Bias decoupling
C26	1000 pf mica	2000v.	P.A. anode decoupling
C27	·1 mica	1500v.	P.A. Tank coupling

Condensers

Item	Value	Rating	Function
C28	·001 mica	2000v.	V.H.F. filtering
C29	·001 mica	2000v.	V.H.F. filtering
C30	·001 mica	350v.	,, ,,
C31	·001 mica	350v.	,, ,,
C32	·001 mica	350v.	,, ,,
C33	.001 mica	350v.	,, ,,
C34	.0003 mica	2000v.	Ant coupling coarse
C35	·0003 ,,	2000v.	,, ,, ,,
C36	.0003 ,,	2000v.	,, ,, ,,
C37	·0003 ,,	2000v.	,, ,, ,,
C38	·0003 variable		,, ,, fine
C39	3 pf s. ceramic		Harmonic sampling
C40 & 40 A			P.A. Tank tuning
C41	100 pf mica	350v.	P.A. grid coupling
C42	100 pf mica	350v.	V3 ,, ,,
C43	100 pf mica	350v.	V5 ,, ,,
C44	·001 mica	2000v.	V.H.F. filtering

Inductances

L1	—	—	V.F.O. Tank
L2	—	—	P.A. Tank 3·5, 7, 14 mcs.
L3	—	—	P.A. Tank 21 & 28 mcs.
L4	—	—	3·5 M. B A.
B.P.C.1	3·5 Mc.		Band pass coupler
,, 2	7·0 ,,		,, ,, ,,
,, 3	14·0 ,,		,, ,, ,,
,, 4	21·0 ,,		,, ,, ,,
,, 5	28.0 ,,		,, ,, ,,
RFC1	—	—	V.F.O. anode load
RFC2	—	—	V.F.O. cathode
RFC3	—	—	V3 anode load 3.5 mcs.
RFC4	—	—	P.A. anode feed

Switches

SW1A–E	—	—	Exciter band switch. ceramic
SW2	—	—	P.A. Band switch
SW3	—	—	Coarse ant coupling
SW4	—	—	Net-high-low switch
TS1	—	—	Heater and Low Volts on/off
TS2	—	—	Plate H.T. on/off

Miscellaneous

J1	—	—	Keying jack
V1	—	—	E.F.50
V2	—	—	6V6
V3	—	—	6V6
V4	—	—	6V6
V5	—	—	6V6
V6	—	—	807
V7	—	—	807
V8	—		VR150/30
V9	—		6L6

2 **Modulator Unit. Resistors**

Item	Value	Rating	Function
R1	4·7K. ohms	½ W	R.F, Stopper
R2	4·7M. ohms	½ W	Grid leak V1.
R3	1K. ohms	½ W	Cathode V1.
R4	250K. ohms	Potr	Gain Control
R5	100K. ohms	½ W	V1 Anode load,
R6	100K. ohms	½ W	V1 Anode load.
R7	220K. ohms	½ W	V2 Grid leak.
R8	600 ohms	3 W	V 2 Cathode
R9	100 ohms	½ W	Screen suppressor, V3.
R10	100 ohms	½ W	Screen suppressor, V4.
R11	47K. ohms	1 W	Anode decoupling V1.
R12	47K. ohms	1 W	Anode decoupling V1.
R13	1M ohms	1 W	L.V. meter shunt.
R14	1M ohms	1 W	H.V. meter shunt.
R15	4.7K. ohms	2 W	Screen dropper V3 and V4.
R16	Special wire wound.		Mod. V. meter shunt.

2 **Modulator Unit. Condensers**

C1	47 pf mica	350v.	R.F. by pass
C2	·01 μF metalmite	350v.	Audio Coupling.
C3	.005 μF ,,	350v.	Audio Coupling.
C4	2 μF electrolytic	150v.	V2 Cathode
C5	8 μF ,,	500v.	V1 Anode decoupling.
C6	8 μF ,,	500v.	V1 Anode decoupling.
C7	8 μF ,,	500v.	Screen decoupling V3 and V4

2 **Modulator Unit. Transformers**

	Type	Function
T	DT.1	Mod. Driver Transformer
T2	UM2	Modulation Transformer

3 **Power Units. Condensers**

C1	8 μFd electrolytic	500	L,V. Smoothing
C2	8 μFd ,,	500	,,
C3	8 μFd ,,	200	Bias ,,
C4	50 μFd	50	Bias ,,
C5	3 x 2 μFd paper	750	H.V. ,,
C6	.001 mica	2000	Mains Decoupling
C7	.001 ,,	,,	,, ,,

3 **Power Units. Resistors**

R1	1000 ohms	1 w	Bias
P3	1000 ohms	3 w Potr	Bias adjust
R2	8.5 ohms	—	Dropper for H.V. Indicator Lamp
R3	,,	—	,, ,, ,, ,, ,,

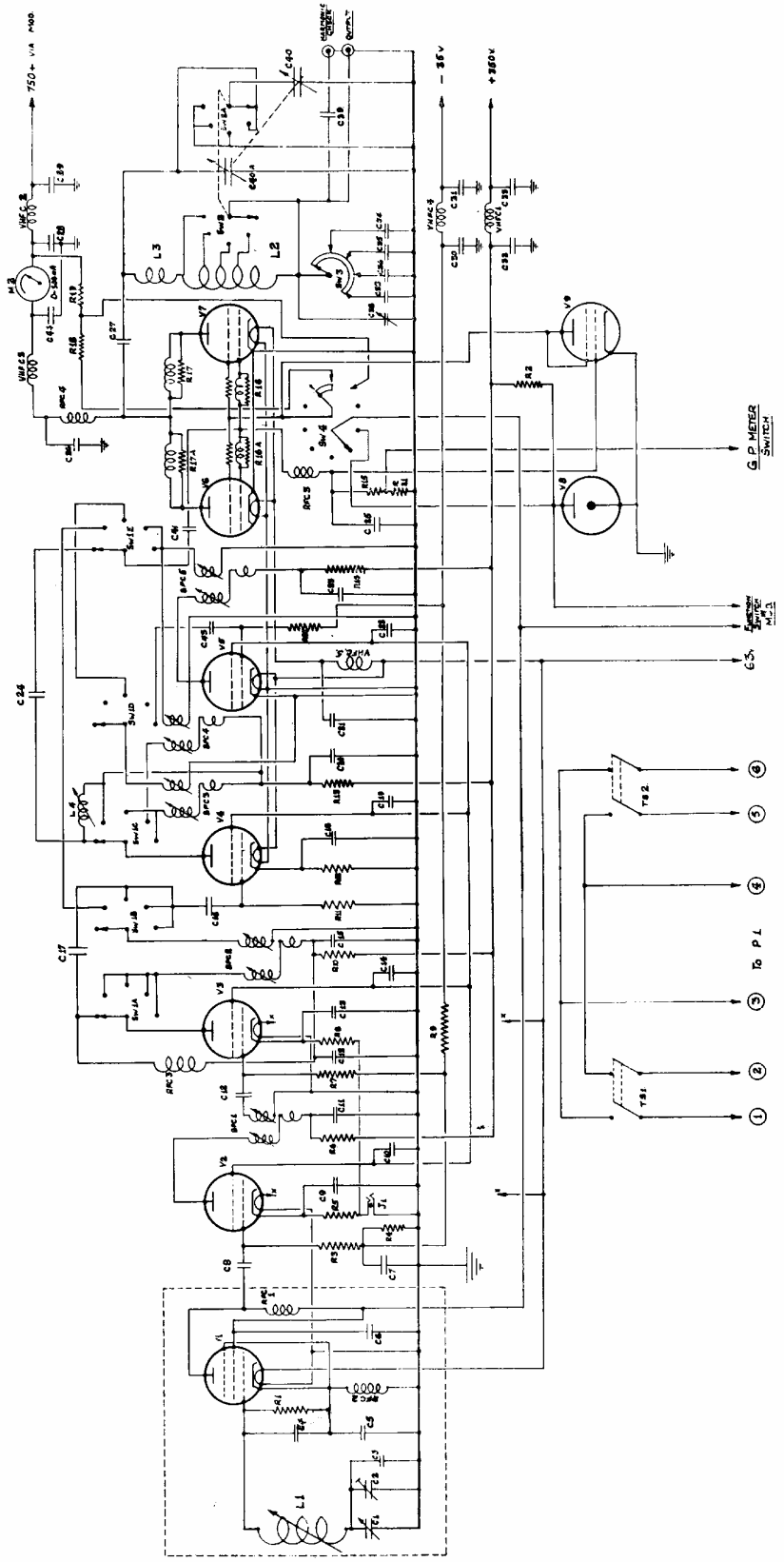
3 **Power Units. Chokes and Transformers**

CH1	—	—	L.V. Smoothing
CH2	—	—	Bias ,,
CH3	—	—	H.V. ,,
T3	—	—	L.V. Transformer
T4	—	—	H.V. ,,

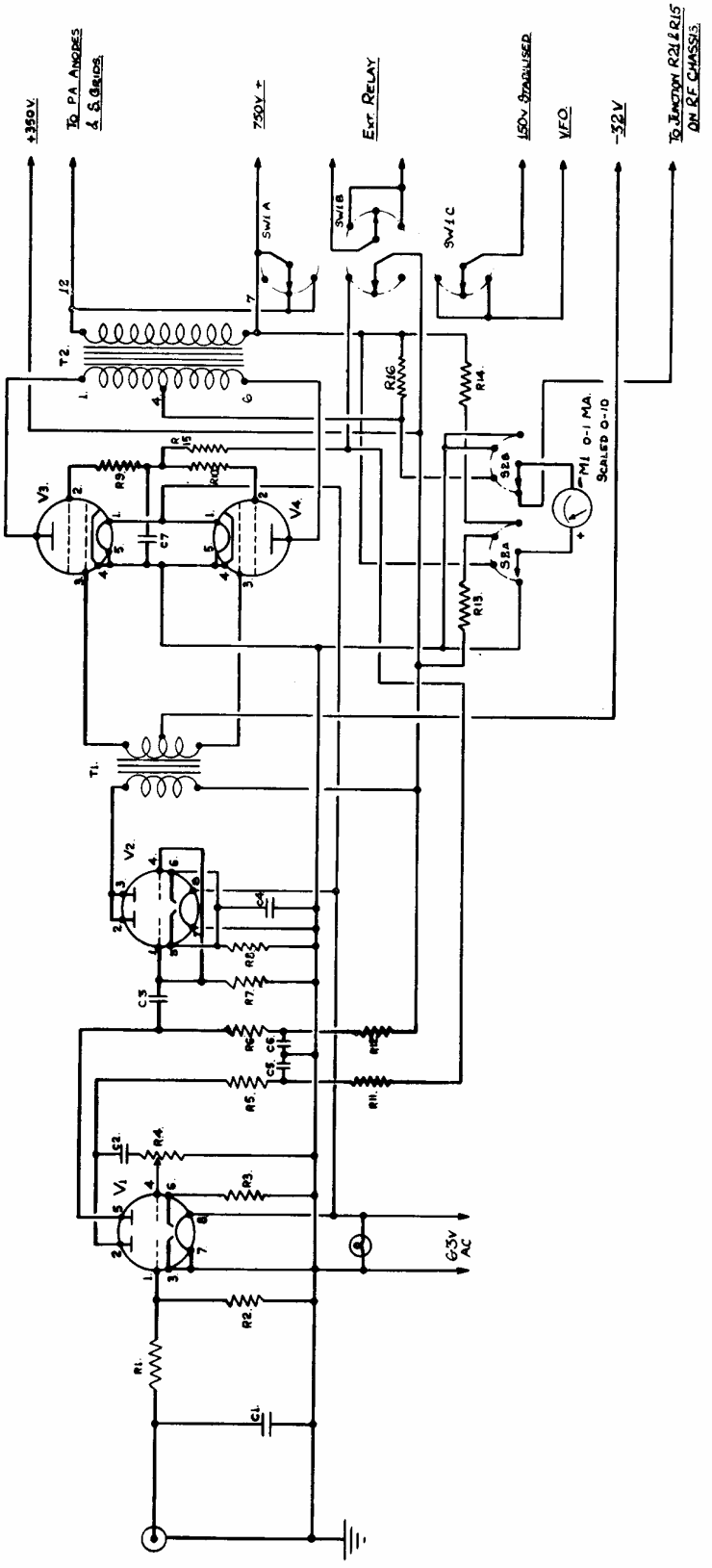
3 **Power Units. Miscellaneous**

SR	Selenium Rect.	Bias Rectifier
V1	U52 or 5U4	L.V. Rectifier
V2	DLS10 or DLS16	Delay Valve
V3	RG1-240A	H.V. Rectifier
V4	,, ,,	,, ,,
F1		3A Mains fuse
F2		,,

CIRCUIT DIAGRAM OF R.F. CHASSIS



CIRCUIT DIAGRAM OF MODULATOR CHASSIS



CIRCUIT DIAGRAM OF POWER UNIT