

K.W. COMMUNICATIONS SINGLE-SIDEBAND TRANSMITTER

KW 204 INSTRUCTION MANUAL

Issue 2

DANGER

EXTREME CARE MUST BE TAKEN
WHEN SERVICING THIS EQUIPMENT,
ESPECIALLY IF ANY COVERS ARE
REMOVED, SINCE POTENTIALS AS
HIGH AS 900 VOLTS ARE PRESENT.

K.W. COMMUNICATIONS LTD.,
VANGUARD WORKS, 1 HEATH STREET, DARTFORD, KENT. DA1 2LH.
Tel: DARTFORD 25574 and 21919

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K.W. 204 TRANSMITTER.

SECTION 1

GENERAL DESCRIPTION AND SPECIFICATION.

1.1 Introduction

The K.W. 204 Transmitter is engineered for optimum performance on SINGLE SIDEBAND SUPPRESSED CARRIER upper or lower sideband, SINGLE SIDEBAND WITH CARRIER upper or lower sideband and C.W. A TONE OSCILLATOR is provided for sidetone generation during C.W. operation. It operates on all Amateur Bands between 1.8 MHz and 30 MHz. The power input is 180 watts PEP on SSB, 75 watts on AM and 150 watts on CW. A Pi output stage provides a variable output impedance. The power supply is built-in and operates from a supply voltage of 117v or 234v \pm 5% AC 45-65 Hz. An optional plug-in VOX Unit is available.

1.2 Specification

EMISSION:	Single Sideband suppressed carrier (A3J) Single sideband with carrier (A3H)C.W. (A1)
BANDS COVERED:	1.8 - 2.0, 3.5 - 4.0, 7.0 - 7.5, 14.0 - 14.5, 21.0 - 21.5, 28.0 - 28.5, 28.5 - 29.0, 29.0 - 29.5, 29.5 - 30 MHz.
AMBIENT TEMPERATURE RANGE:	- 10°C to + 40°C.
VFO STABILITY:	With constant input voltage, better than 200 Hz after warm-up period of 30 minutes.
POWER REQUIREMENTS:	117v or 234v \pm 5% AC 45-65 Hz.
POWER CONSUMPTION:	Approximately 320 watts on transmit.
CABINET DIMENSIONS:	Height 6 $\frac{1}{4}$ " (15.8 cm) Width 13 $\frac{7}{8}$ " (35.2 cm) Depth 13 $\frac{1}{4}$ " (33.6 cm)
WEIGHT:	27lbs. approximately (12kg)
TYPE OF SERVICE:	S.S.B. - continuous. A.M. - continuous. C.W. - 50% duty cycle.
CARRIER SUPPRESSION:	50 db down relative to maximum output.
UNWANTED SIDEBAND:	45 db down relative to maximum output.
SECOND HARMONIC:	40 db down from output signal.
THIRD ORDER DISTORTION:	30 db down from output signal.
MIC INPUT:	High Impedance.

AUDIO RESPONSE: 300 - 2500 Hz \pm 6 db.
 RF OUTPUT IMPEDANCE: 52 ohms.
 PLATE POWER INPUT: 180 watts on SSB, 75 watts on AM, 150 watts on CW.
 OUTPUT POWER: 80-10M 100 Watts PEP (nominal) into 52 ohms 160M 40 watts PEP (nominal) into 52 ohms.

1.3 Tube and Semi-Conductor Complement

<u>SYMBOL</u>	<u>FUNCTION</u>	<u>TYPE</u>
V1	Mic Amp/Tone Osc.	12AX7
V2	Audio Cathode Follower/ Carrier Osc.	12AT7
V3	455 KHz Amp.	EF183
V4	1st Mixer	12AT7
V5	2nd Mixer	12AT7
V6	Driver	6CH6
V7, 8	Power Amplifier	6146
V9	V.F.O.	6U8
V10	H.F. Crystal Osc.	6AM6
V11	Voltage Stabiliser	OA2
D1, 2	Balanced Modulator	AA119
D3	Cal Set Diode	IN4148
D4, 5	A.L.C. Rectifier	BY236
D6	A.L.C. Blocking Diode	BY236
D7	R.F. Indicator Diode	AA119
D8-11	E.H.T. Rectifiers	BY238
D12-15	H.T. Rectifiers	BY238
D16	Bias Rectifier	BY238
D17	12v D.C. Rectifier	40266
D18	-10v Stabilised	1ZM10
D19	C.W. VOX Blocking Diode	BY236
F1	Mains Fuse	3 amp (234v) 5 amp (117v)
LP1, 2	Dial Lamps	6.3v .15A L.E.S.

CIRCUIT DESCRIPTION2.1 Transmitter Circuits1. A.F. STAGES

Microphone input is connected to the grid of the MIC AMP V1a, amplified and coupled to the grid of the CATHODE FOLLOWER V2a across MIC GAIN control RV1. Output from the cathode follower is fed to the resistive balance point of the BALANCED MODULATOR.

2. BALANCED MODULATOR AND LOW FREQUENCY I.F. CIRCUIT

Audio output from the cathode of V2a and the CARRIER OSCILLATOR voltage are fed to the slider of the CARRIER BALANCE Potentiometer RV3. Both upper and lower sideband output from the BALANCED MODULATOR are coupled through I.F. transformer IFT1 to the grid of the 455 KHz I.F. AMPLIFIER V3. Output from the I.F. AMPLIFIER is fed to the MECHANICAL FILTER. The passband of the FILTER is centred at a nominal frequency of 455 KHz. This passes either upper or lower sideband, depending upon which sideband is selected at the FUNCTION switch, this operates either CARRIER OSCILLATOR crystal X10 or X11. The SSB output of the FILTER is fed to the control grid of the FIRST MIXER.

3. A.M. AND C.W.

For operation on A.M. or C.W. a small amount of carrier from the anode of the CARRIER OSCILLATOR is injected into the grid of V4 1st mixer, via CARRIER injection control RV2.

4. BALANCED MIXERS.

The 455 KHz signal is fed to the control grid of the FIRST BALANCED MIXER V4 and the VFO output (2200 KHz to 2700 KHz) is fed to the signal input cathode and to the grid of the second half of the twin triode. This arrangement cancels the high frequency injection signal within the mixer and converts the 455 KHz signal to a 2.655 to 3.155 MHz variable I.F. signal. The coupling networks between the anodes of the FIRST MIXER and the SECOND BALANCED MIXER consists of two transformers tuned by a twin gang capacitor which is coupled to the VFO capacitor. The V.I.F. signal is fed to the control grid of the SECOND BALANCED MIXER V5, and the H.F. injection signal voltage from the CRYSTAL OSCILLATOR V10 is fed to the signal input cathode and to the control grid of the second half of the twin triode. The H.F. injection voltage is cancelled within the mixer and the V.I.F. signal is converted to the desired frequency of operation.

5. R.F. CIRCUITS

The tuned circuits associated with the anode of V5 and the anode of the DRIVER V6 are ganged to the PRE-SELECTOR tuning control. The signal capacity coupled from the anode of V5 to the grid of V6, amplified and capacity coupled to the POWER AMPLIFIER'S V7, V8, which operates in class AB1. Output from the P.A. is tuned by a PI NETWORK and fed to the ANTENNA through contacts of transmit and receive relay RLL. A small amount of R.F. is rectified by D7 and fed to the meter via the meter switch, to indicate approximate R.F. voltage output.

2.2 Oscillators

1. CARRIER OSCILLATOR

The CARRIER OSCILLATOR is crystal controlled at a frequency which puts the carrier approximately 20db down the skirt of the MECHANICAL FILTER. UPPER X11 or LOWER X10 SIDE-BAND crystals are selected by the FUNCTION switch.

2. VARIABLE FREQUENCY OSCILLATOR

The VFO operates in the range 2.2 - 2.7 MHz. In addition to switching the upper or lower sideband crystal, the VFO must be moved in frequency, by an amount equal to the spacing of the carrier crystals. The VFO is moved by this amount when switching to L.S.B. and is accomplished by switching a one turn coil in circuit by the operation of RL2. The Calibration of the VFO may be adjusted on the front panel, by adjustment of the CAL SET control, this varies the bias applied to diode D3, which acts as a variable capacitance across the VFO tuned circuit.

3. HIGH FREQUENCY CRYSTAL OSCILLATOR

The H.F. CRYSTAL OSCILLATOR V10 is crystal controlled by one of nine crystals selected by the BAND SWITCH. The output frequency of this oscillator is always 3.155MHz higher than the lower edge of the desired band.

4. SIDETONE OSCILLATOR

The SIDETONE OSCILLATOR V1b operates only when the FUNCTION switch is on C.W., and is used as a C.W. monitor when the transmitter is operated with the K.W.202 Receiver. A phase-shift oscillator circuit is employed operating at approximately 1500 Hz.

2.3 Control Units

1. NET RECEIVE SEND SWITCH

a) When the SEND-RECEIVE switch is on NET the NEGATIVE BIAS line is shorted to earth, removing the muting bias from V3, V4, V5 and V6, the VOX is made inoperative, and the audio cathode follower is biased off. Turning the CARRIER CONTROL clockwise injects a small amount of carrier into the grid of V4 1st Mixer. The PA valve is quiescent when netting.

b) When the switch is on RECEIVE the transmitter is muted. When the external VOX unit is used, and the VOX ON OFF switch is at VOX, speaking into the microphone with the FUNCTION switch at LSB/USB or pressing the KEY on C.W. will cause the VOX circuit to trip, switching the transmitter to transmit.

c) With the switch on SEND, RL1 and RL3 closes, removing the muting bias from the controlled stages, changes the ANTENNA over from receive, operates the EXTERNAL switching circuits, and applies HT to the screen grids of the P.A.

2. FUNCTION SWITCH

The FUNCTION SWITCH is a five way, six pole, plus mains switch.

a) On LSB or USB it selects the sideband crystal, switches the audio cathode follower on, applies full HT voltage to the screen grids of the PA stage, and on LSB switches in a one turn link on the VFO coil.

b) On CW it selects the USB crystal, applies full HT to the screen grids of the PA stage, switches off the ALC circuit, and enables the sidetone oscillator to be keyed.

c) In the TUNE position, it selects the USB crystal, applies reduced HT to the screen grids of the PA stage, switches off the ALC circuit, removes bias from the controlled stages, and switches the transmitter to transmit.

3. VOX SWITCH

The VOX switch enables the transmitter to operate on VOX or PRESS TO TALK when the optional VOX unit is plugged into the eight pin socket on the rear drop, with the switch in the VOX position, VOX can be used on LSB, USB and CW.

4. A.L.C. CIRCUIT

Detected audio from the Power Amplifier grid circuit is rectified by D4 and D5, the negative DC output is fed to the grid of the 455 KHz amplifier V3. A fast attack slow release time constant is used to prevent overdriving on initial syllables and to hold gain constant between words. Diode D6 is used to prevent the transmitter muting bias charging the ALC circuit when on receive.

5. VOX UNIT

An optional VOX unit is available, all the necessary wiring and switching is incorporated in the transmitter, all that has to be done is to screw the VOX unit to the rear of the cabinet, and plug the unit into the eight pin socket. The VOX unit has full ANTI TRIP circuits included.

2.4 Power Supply

1. The AC POWER SUPPLY is built into the transmitter and operates from 117v or 234v \pm 5% 45-65 Hz. The transformer has four secondary windings which supply the EHT voltage, the HT voltage, the negative bias, the 12 volt heater and relay voltage. The AC line is fused in the LIVE side of the mains with F1.

2. E.H.T. VOLTAGE

Voltage from secondary one, is applied to a full wave bridge rectifier circuit, using four silicon rectifiers D8-D11. The resulting D.C. is approximately 850v. This voltage is applied to the anodes of the PA V7, V8.

3. H.T. VOLTAGE

Secondary two, feeds a bridge rectifier circuit using four silicon rectifiers D12-D15, which delivers +260 volts D.C. via the smoothing circuits.

4. NEGATIVE BIAS

Three negative bias voltages are required, and are provided by rectifying secondary three, with D16. This bias voltage is smoothed and provides the -90v for transmitter muting, a potential divider is used to give - 80 to - 90v adjustable by RV5 located on the chassis near RELAY 3 for the operating bias of the PA V7, V8. The third negative voltage is required for the VOX circuit and is stabilised at -10v by D18.

5. HEATERS AND POSITIVE 12 VOLTS.

The remaining winding is for the 12.6v A.C. Heater Line, this supply is also rectified by D17 to provide the +12v necessary to operate the relays and VOX circuit.

SECTION 3

INSTALLATION

3.1 Unpacking

Carefully unpack all items of the transmitter and inspect for any damage which may have occurred during transit. Examine all packing materials before discarding to ensure that no parts are inadvertently thrown away. Check all tubes and crystals for obvious damage and ensure that they are firmly seated in their respective sockets.

3.2 Station Installation

Connect the transmitter, receiver and antenna as shown in Fig. 6 - 1. Connect the transmitter to a good earth, such as a metal water pipe or metal stake driven deep into moist soil. Connect microphone if S.S.B. or A.M. is required, of key if CW is required as shown in Fig. 6 - 1. Allow adequate ventilation for the equipment. NOTE: The key must be unplugged if S.S.B. or A.M. operation is required.

3.3 Installation with the K.W.1000 Linear Amplifier

Connect the transmitter, receiver, K.W.1000 and antenna as shown in Fig. 6-2. Connect the transmitter and linear amplifier to a good earth.

3.4 Optional VOX Unit Installation

Screw the optional VOX unit to the rear of the cabinet in the position indicated in Fig. 6-1, use PK No. 4 x $\frac{1}{4}$ screws, plug the octal plug into the octal socket on the rear of the transmitter.

3.5 Antenna

The antenna should have a VSWR of 2:1 or better. With some multi-band antennas it may be advisable to use an antenna matching unit such as the K.W. E-Z MATCH or K.W.107.

3.6 Initial Checks

1. The transmitter is designed to operate from either 117 or 234 volts \pm 5% 45-65 Hz A.C. power. The unit has the power transformer set for 234 volt A.C. operation when it leaves the factory. For 117 volt operation it is necessary to make changes to the transformer primary taps, this can be done with reference to the transmitter circuit diagram, and Fig. 6-3. (Units ordered for Export will be "shipped" with transformer adjusted for 117v, on request).

2. Set the MIC GAIN and CARRIER controls fully counter clockwise, METER SWITCH to PA, WAVECHANGE SWITCH to 3.5, PRE-SELECTOR TO L.F., VOX SWITCH to OFF, SEND RECEIVE SWITCH to RECEIVE, FUNCTION SWITCH TO LSB, allow the transmitter a few minutes to warm up, put the SEND RECEIVE SWITCH to SEND, adjust RV5 PA BIAS potentiometer located next to RELAY 3, for a standing PA cathode current of 50mA, switch back to RECEIVE.

CAUTION DO NOT SET STANDING CATHODE CURRENT TOO LOW:
AMPLIFIER LINEARITY WILL BE DEGRADED.
DO NOT SET TOO HIGH: PA PLATE DISSIPATION WILL
BE EXCEEDED AND PA TUBES DAMAGED.

SECTION 4

OPERATION

4.1 Setting up

After making external connections as in section 3-2 or 3-3 and doing initial checks as in section 3-6, set controls to the following positions:

CARRIER	FULLY COUNTERCLOCKWISE.
METER SWITCH	PA
CAL SET	VERTICAL
PRE-SELECTOR	VERTICAL
PA TUNE	REQUIRED BAND
SEND RECEIVE	RECEIVE
VOX	OFF
FUNCTION	REQUIRED SIDEBAND
MIC GAIN	FULLY COUNTERCLOCKWISE
PA LOAD	FULLY CLOCKWISE
WAVECHANGE SWITCH	REQUIRED BAND

4.2 Netting

1. To net onto a signal being received on the station receiver, put the SEND/RECEIVE switch to NET, advance the CARRIER control a small amount, tune the VFO about the required frequency until ZERO BEAT is obtained with the incoming signal. The amount of netting signal can be varied by adjusting the carrier control.

2. Turn the CARRIER control fully counterclockwise and OFF. Switch back to RECEIVE.

4.3 Tune Procedure

1. To load the transmitter into the antenna, check that the METER SWITCH is at P.A., put the FUNCTION SWITCH to TUNE, this will put the transmitter in the transmit state with reduced voltage on the screen grid of the P.A., mute the station receiver and change the antenna over from the receiver to the transmitter.

2. Slowly advance the CARRIER control for an indication of P.A. cathode current on the meter, adjust the PRE-SELECTOR for a peak in cathode current, the pre-selector will peak near the LF end on 160-80 and 40M, and near the HF end on 20-15 and 10M, keep the level of carrier at about 50mA while peaking the PRE-SELECTOR and when peaked, continue to advance the carrier level until the P.A. TUNE control OFF RESONANCE, cathode current of 130mA flows.

3. Adjust P.A. TUNE control for a DIP in cathode current, increase loading of P.A. by turning P.A. LOAD control counterclockwise. Re-adjust P.A. TUNE for "dip" in cathode current, continue adjustments until P.A. is loaded to 120mA with P.A. TUNE AT DIP.

4. Turn CARRIER control fully counterclockwise and OFF.

5. Turn FUNCTION SWITCH to required sideband or CW, it is normal practice to operate LSB on 160, 80 and 40M and USB on 20, 15 and 10M.

4.4 Setting of PA Load Control

BAND	52 OHM P.A. LOAD SETTING
160 1.8 MHz	8
80 3.5	8
40 7	6
20 14	5
15 21	4
10 28	3½

(75 ohm will be only slightly different)

4.5 S.S.B. Operation

1. To put the transmitter in the SSB mode, check that the FUNCTION switch is on the required sideband, press the press-to-talk button on the microphone, or put the SEND/RECEIVE switch to SEND.

2. Note that when the transmitter is in the transmit position the standing cathode current is 50mA, except on 160M when the standing current will be 25 mA.

3. Advance the MIC GAIN control while speaking into the microphone, until P.A. cathode current averages 100mA.

4.6 A.M. Operation

1. Load the transmitter up as in Section 4-3.
2. Switch to transmit by one of the methods described in 4-5, (1.)
3. Advance the CARRIER control for a cathode current of 100mA.
4. Advance the MIC GAIN control while speaking into the microphone until a slight upward kick in cathode current is noted. To obtain the exact setting of the MIC GAIN control it is advisable to monitor the signal on the station receiver.

4.7 C.W. Operation

1. Plug the key into the key jack.
2. Load the transmitter up as in Section 4-3.
3. Put the FUNCTION switch to C.W.
4. Switch to transmit by operating the SEND/RECEIVE switch.
5. Press the key and advance the CARRIER control until cathode current of 200mA flows, Do not hold the key down for very long otherwise damage to the PA valves may be done.

4.8 160M SSB Operation

1. Tune the transmitter as in Section 4-3 but instead of a PA OFF-RESONANCE cathode current of 130mA, adjust carrier control for a PA current of 80mA, load the transmitter to 70mA with P.A. TUNE on "dip".
2. Turn CARRIER control fully counterclockwise.
3. Turn FUNCTION switch to required sideband.
4. Switch to transmit and adjust MIC GAIN control while speaking into the microphone for an average P.A. cathode current of 50mA.

4.9 VOX Operation

1. To adjust the VOX circuit, set the AF GAIN control on the station receiver for the desired audio output level, put the VOX switch to VOX, the FUNCTION switch to the desired sideband, the SEND/RECEIVE switch to RECEIVE and while speaking into the microphone adjust the VOX GAIN control until the relays drop in.

2. If audio from the receiver loudspeaker trips the VOX circuit, advance the ANTI-TRIP control until the effect stops. Do not turn the ANTI-TRIP control up too far or the VOX circuit will not operate.

3. To adjust the VOX delay, that is the time taken for the relays to be de-energised, turn the DELAY control clockwise to increase the delay and anti-clockwise to decrease the delay.

SECTION 5

SERVICE INSTRUCTIONS

DANGER

EXTREME CARE MUST BE TAKEN WHEN SERVICING THIS EQUIPMENT, ESPECIALLY IF ANY COVERS ARE REMOVED SINCE POTENTIALS AS HIGH AS 900 VOLTS ARE PRESENT.

5.1 General

This section covers maintenance, and service of the transmitter. It includes information on trouble analysis, signal tracing procedures, voltage and resistance measurements and alignment procedures. The usefulness of signal level and alignment data given depends upon the accuracy of the test equipment used. If servicing requires that the cabinet be removed, proceed as follows:

1. Disconnect all power and external connections.
2. Remove the two rear feet and rear fixing screws. Take up the two plugs from the front feet to gain access to fixing screws and unscrew. Lift up the cabinet lid and unscrew the two countersunk screws from the bezel.
3. From the rear push the transmitter chassis forward until the front panel protrudes about an inch.
4. Slide chassis from cabinet.

NOTE

Tube heaters and pilot lamps are connected in a series parallel arrangement for 12v operation. When making tube or lamp replacements, be sure that rated heater currents are the same as the original units.

5.2 Trouble Analysis

1. Most cases of trouble can be traced to defective tubes. Many tube checkers cannot duplicate the conditions under which the tubes work in the transmitter. Substitution by new tubes will sometimes cure an obscure case of trouble. Intermittent trouble conditions in tubes can usually be discovered by lightly tapping the envelope while listening to the signal on the station receiver. Occasionally tube pins will become dirty or corroded causing an intermittent condition. When this situation is suspected, remove the tube and apply a few drops of contact cleaner to the pins, replace the tube and work it up and down in the socket a few times. Shorted tubes or capacitors will often cause associated resistors to overheat and crack, blister or discolour. Making the measurements listed in Tables 6-1 will help to isolate this type of trouble to a particular stage or component.

2. A logical process of elimination in conjunction with the main circuit diagram will aid in isolating trouble. For example:

a) No R.F. signal passes through the transmitter section until the operator either speaks into the microphone, presses the key or inserts carrier, with the SEND/RECEIVE switch at SEND or NET. This means that with no input signal and the SEND/RECEIVE switch at RECEIVE, all stages except the CARRIER OSCILLATOR, the V.F.O. and the H.F. CRYSTAL OSCILLATOR are inoperative.

b) Should no output be obtained from the transmitter, then the fault can be isolated to the stages before or after the MECHANICAL FILTER. When carrier is inserted, the audio stages, balanced modulator, 455 KHz amplifier and the mechanical filter are not used, so if there is output with carrier inserted, but no output when speaking into the microphone, then the fault must be in the audio stages, or the balanced modulator or the 455 KHz amp, or the mechanical filter.

c) If the netting circuit is working, that is, it is possible to net on to a signal, but no signal is transmitted when on send, then check that the PA standing cathode current is 50mA. If it is not, then there may be a fault in the EHT supply, or the relays may not be operating due to a faulty relay or a fault in the relay supply.

5.3 Signal Tracing Procedures

1. Table 6-3 lists significant test points and normal signal levels. Fig. 6-3 shows location of adjustments, voltages given in the tables are nominal and may vary plus or minus 20 per cent. An audio generator with an accurately calibrated attenuator must be used to provide the signal source, and a vacuum tube voltmeter with an R.F. probe to measure the voltages.

2. Connect the 52 ohm dummy load to the antenna socket, the audio generator to the mic. socket, and the V.T.V.M. to the test point. Set the controls as indicated in Table 6-3.

5.4 Voltage and Resistance Measurements

Table 6-1 lists voltage measurements with the transmitter on SEND. Table 6-2 lists resistance measurements. Voltages and resistances given in the tables are nominal and may vary plus or minus 20 per cent. Set the controls as indicated in Table 6-1 or 6-2. Resistance measurements are made with all external cables disconnected. It is recommended that a meter with a resistance of at least 20,000 ohms per volt be used for voltage measurements.

5.5 Alignment Procedure

Complete alignment of the transmitter requires the use of the following equipment:

- a) Vacuum Tube Voltmeter with R.F. probe. Type used - Airmec 314.
- b) 52 ohm Dummy Load or Wattmeter.
- c) A receiver covering at least one of the bands used.
- d) Non metallic hexagonal trimming tool and screwdriver.
- e) Multimeter. Type used - AVO model 8.

NOTE: Before attempting to align the transmitter, please read the instructions very carefully.

1. Set the transmitter up as follows:

CARRIER	FULLY COUNTERCLOCKWISE (FCC)
METER SWITCH	PA
CAL SET	VERTICAL
PRE-SELECTOR	FULLY OPEN
P.A. TUNE	10M
SEND RECEIVE	RECEIVE
VOX	OFF
FUNCTION	USB
MIC GAIN	FULLY COUNTERCLOCKWISE
P.A. LOAD	3 $\frac{1}{2}$
WAVECHANGE	29.5
V.F.O.	500
MICROPHONE	OUT
KEY	OUT

2. Plug the wattmeter into the antenna socket, allow ten minutes for warm up. Make sure the CARRIER control is fully counterclockwise. Switch to NET.

3. CARRIER OSCILLATOR OUTPUT LEVEL

check the output of the carrier oscillator with the V.T.V.M. and R.F. probe, see Fig. 6-3 for test point 'A'. A voltage of 0.2v RF should be obtained on both sidebands.

4. VFO OUTPUT LEVEL

Check the output of the VFO with the V.T.V.M. and R.F. probe, see Fig. 6-3 for test point 'C'. A voltage of 0.5v should be obtained.

5. H.F. OSCILLATOR OUTPUT LEVEL

Connect the V.T.V.M. with R.F. probe to test point 'D' see Fig. 6-3 for location. Adjust inductances on each band for peak V.T.V.M. reading as follows, see Fig. 6-3 for location of inductances.

5. H.F. OSCILLATOR OUTPUT LEVEL - contd.

BAND	CRYSTAL FREQUENCY	L	VTVM READING
1.8	4955	L1 L1	1.3v RF
3.5	6655	L2	2.0v RF
7.0	10155	L3	2.5v RF
14.0	2 x 8577.5	L4	2.5vRF
21.0	2 x 12077.5	L5	1.5v RF
28.5	2 x 15827.5	L6	0.8v RF
29.5	2 x 16327.5	L7	0.8v RF
28.0	2 x 15577.5	See Below	
29.0	2 x 16077.5	See Below	

On the 28.0 and 29.0 MHz range, a small link coil is wired between the 28.5/29.0 MHz switch contact and also between the 29.5/29.0 MHz switch contacts, these coils should not require adjustment.

5.6 Pre-Selector 29.5 MHz Band

1. Check that the PRE-SELECTOR capacitor is fully open, and that the transmitter is on 30.0 MHz. Set VFO dial at 500.
2. Switch to SEND and check that the PA standing current is 50mA, switch back to RECEIVE.
3. Put the FUNCTION SWITCH to TUNE and insert CARRIER until a cathode current of 50mA flows.
4. Adjust L14 and L21 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to OFF.

5.7 Neutralising 29.5 MHz Band

1. Load the transmitter up to 120mA as in Section 4-3.
2. Check that MAXIMUM R.F. output occurs when P.A. cathode current is at DIP, i.e. move P.A. TUNE capacitor either side of DIP and note that R.F. output drops, if it does not, note which side of dip output increases, if it is on the L.F. side then reduce value of C45 neutralising capacitor, if it is on the H.F. side, increase value of C45, repeat until maximum output occurs when PA is at dip. Re-adjust L21 for peak in cathode current.
3. It is only necessary to neutralise on the 29.5 MHz band, as all other bands have fixed value neutralising capacitors, switch to USB.

5.8 Pre-Selector 29.0 MHz Band

No adjustments are necessary on this band, as the 29.5 MHz band coils are used, and are tuned to the lower frequency with the Pre-selector capacitor.

5.9 Pre-Selector 28.5 MHz Band

1. Leave the PRE-SELECTOR in the same position as for the 29.5 MHz band.
2. Switch to TUNE, and insert CARRIER until a cathode current of 50mA flows.
3. Adjust L13 and L20 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to OFF, switch to USB.

5.10 Pre-Selector 28.0 MHz Band

No adjustments are necessary on this band, as the 28.5 MHz band coils are used.

5.11 Pre-Selector 21.0 MHz Band

1. Leave the PRE-SELECTOR in the same position as for 29.5 MHz.
2. Switch to TUNE and insert CARRIER until a cathode current of 50mA flows.
3. Adjust L12 and L19 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to OFF, switch to USB.

5.12 Pre-Selector 14.0 MHz Band.

1. Leave the PRE-SELECTOR in the same position as for the 29.5 MHz band.
2. Switch to TUNE and insert CARRIER until a cathode current of 50mA flows.
3. Adjust L11 and L18 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to OFF, switch to USB.

5.13 Pre-Selector 7.0 MHz Band

1. Re-set the PRE-SELECTOR so that the capacitor is fully closed, check the transmitter is on 7.0 MHz. Set V.F.O. dial at 000.
2. Switch to TUNE, and insert CARRIER until a cathode current of 50mA flows.
3. Adjust L10 and L17 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to OFF, switch to USB.

5.14 Pre-Selector 3.5 MHz Band

1. Leave the PRE-SELECTOR in the same position as for the 7.0 MHz Band.
2. Switch to TUNE, and insert CARRIER until a cathode current of 50mA flows.
3. Adjust L9 and L16 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to off, switch to USB.

5.15 Pre-Selector 1.8 MHz Band

1. Leave the PRE-SELECTOR in the same position as for the 7.0 MHz band.
2. Switch to TUNE, and insert CARRIER until a cathode current of 50mA flows.
3. Adjust L8 and L15 for a peak in cathode current, back off CARRIER control to keep cathode current below 130mA. Turn CARRIER to OFF, switch to USB.

5.16 V.I.F. Transformers

1. Set the transmitter up on 4.0 MHz (wavechange switch 3.5, VFO 500).
2. Switch to TUNE, insert a small amount of carrier, tune the PRE-SELECTOR for a peak in cathode current.
3. Adjust the core of IFT2 and the core of IFT3 for a peak in cathode current, backing off the carrier control to keep cathode current below 130mA.
4. Change frequency to 3.5 MHz, adjust the concentric trimmers on the VIF capacitor for a peak in cathode current.
5. Continue to adjust the cores of IFT2/IFT3 at 4.0 MHz. and the concentric trimmers at 3.5 MHz until the drive is flat within ± 3 db over the band.
6. Turn CARRIER to OFF, switch to USB.

5.17 Carrier Balance.

1. Load the transmitter up on the 3.5 MHz band, switch to LSB and SEND. Check CARRIER control is OFF.
2. Listen on the station receiver on the same frequency as the transmitter is on.
3. Adjust RV2 carrier balance control and C12 for minimum signal on the receiver, it should be possible to balance until only the mush is heard. Switch back to RECEIVE.

5.18 VFO Calibration

1. Tune the station receive to 4.0 MHz.
2. Tune the transmitter up on 4.0 MHz, switch to NET, USB. Set the CAL SET knob so that the pointer is vertical. Set the VFO to 500.
3. Insert just enough CARRIER for the signal to be heard on the receiver.
4. Adjust the core of L25 (See Fig. 6-3 for location) until signal is heard exactly on 4.0 MHz zero beat.
5. Check the tracking of the VFO at each 100 KHz point. If it is over tracking at 3.5 MHz reduce capacity of C77 (See Fig. 6-4 for location) by inserting a probe through the hole in the top of the VFO and turning the concentric trimmer anticlockwise.
6. Repeat the VFO at 4.0 MHz and adjust the core of L25 for zero beat. Repeat the above adjustments until the tracking is correct.
7. If the VFO is undertracking, follow the above procedure, but increase the capacity of C77 at 3.5 MHz.

5.19 Upper Lower Sideband Switching

1. Tune the transmitter to 3750 KHz zero beat with the receiver, make sure the FUNCTION SWITCH is at USB.
2. Switch to LSB, adjust L25 link (by inserting a probe through the lower hole in the VFO box cover) for zero beat.
3. Switch back to USB and check that zero beat is maintained, repeat 2 until switching between USB and LSB zero beat is maintained.
4. Switch to RECEIVE, turn CARRIER control OFF.
5. This completes the alignment of the transmitter.

TABLE 6 - 1

VOLTAGE AND RESISTANCE MEASUREMENTS.

BAND 3.5 MHz. CONTROL SEND.
 MIC GAIN F.C.C. VOX OFF.
 FUNCTION L.S.B. METER USED AVO MODEL 8

UNPLUG TRANSMITTER FROM MAINS FOR RESISTANCE MEASUREMENTS.

VALVE	1	2	3	4	5	6	7	8	9
<u>V1A</u> MIC AMP 12AX7	88 - 235K	0 - 1M	0.75 - 1K	- 0 00	- 12.6 0	- - -	- - -	- - -	- - -
<u>V1B</u> SIDETONE OSC 12AX7	- - -	- - -	- - -	- 0 0	- 12.6 0	184 - 125V	0 - 160V	1.95 - 3.3K	- - 0
<u>V2A</u> CATH FOLL 12AT7	205 - 29K	0 - 470K	5.3 - 2.2K	- 0 0	- 12.6 0	- - -	- - -	- - -	- - -
<u>V2B</u> CARR OSC. 12AT7	- - -	- - -	- - -	- 0 0	- 12.6 0	92 - 34K	0.5 - 100K	0 - 3.5	- - 0
<u>V3</u> 455 KHzAMP EF183	1 - 100	0 - 1.2M	1 - 100	- 6.3 0	- 12.6 0	0 - 0	50 - 38K	54 - 60K	0 - 0
<u>V4</u> 1st MIXER 12AT7	176 - 11K	0 - 220K	1.65 - 220	- 0 0	- 12.6 0	176 - 11K	0 - 220K	1.92 - 220	- - 0

TABLE 6-1

VOLTAGE AND RESISTANCE MEASUREMENTS contd.

VALVE		1	2	3	4	5	6	7	8	9
<u>V5</u> 2nd MIXER 12A77	DCV ACV OHM	245 - 5.5K	0 - 220K	4.8 - 1K	- 0 0	- 12.6 0	245 - 5.5K	0 - 220K	5.1 - 1K	- - 0
<u>V6</u> DRIVER 6CH6	DCV ACV OHM	- - 0	0 - 150K	3.8 - 100	- 6.3 0	- 0 0	- - -	260 - 2.7K	232 - 15K	0 - 0
<u>V7</u> P.A. 6146	DCV ACV OHM	0 - 0	- 12.6 0	260 - 0	0 - 0	-62* - 28K	0 - 0	- 6.3 0	0 - 0	TOP CAP 840V 20K
<u>V8</u> P.A. 6146	DCV ACV OHM	0 - 0	- 0 0	260 - 0	0 - 0	-62* - 28K	0 - 0	- 6.3 0	0 - 0	TOP CAP 840V 20K
<u>V9</u> V.F.O 6U8	DCV ACV OHM	115 - 14K	0 - 68K	84 - 56V	- 6.3 0	- 12.6 0	74 - 33K	1.2 - 250	4.5 - 700	0 - 100K
<u>V10</u> H.F. OSC 6AM6	DCV ACV OHM	4.5 - 100K	0 - 0	- 12.6 0	- 6.3 0	235 - 11.5K	0 - 0	168 - 60K	- - -	- - -
<u>V11</u> STABILISER OA2	DCV ACV OHM	150 - 8.2K	- - 0	- - -	- - 0	150 - 8.2K	- - -	0 - 0	- - -	- - -

* DEPENDS ON P.A. BIAS SETTING.

ALL MEASUREMENTS WITH RESPECT TO CHASSIS.

TABLE 6 - 2

SIGNAL LEVELS

Set Transmitter Up On 3.7 MHz Mic Gain F.C.
Control Switch Net Vox Switch Off
Function Switch L.S.B.

Short Junction of R 6 (470K) and R 44 (100K) to chassis.
Connect Audio Signal Generator to Mic Socket.

V.T.V.M. uses, AIRMEC type 314.

TEST POINT	AUDIO INPUT TO MIC SOCKET	VALVE AND FUNCTION	R.F. VOLTS A.F. VOLTS	DC VOLTS
	15mV 1700 Hz	Pin 1 V1a Mic Amp.	1.0	88v
	50mV 1700 Hz	Pin 3 V2a Cath Fol.	1.0	5.3v
A	Mic Gain F.C.C.	Wiper RV3 Car Bal.	0.3	
	150mV 1700 Hz	Pri IFT1 Bal Mod.	1.0	
	150mV 1700 Hz	Sec IFT1	0.6	
B	12mV 1700 Hz	P Terminal M Filter	10.0	
	12mV 1700 Hz	G Terminal M Filter	4.0	
	12mV 1700 Hz	Pin 1 V4 1st Mixer	4.0	176v
C	Mic Gain F.C.C.	VFO Injection	0.5	
	10mV 1700 Hz	Pin 2 V5 2nd Mixer	2.5	
	10mV 1700 Hz	Pin 1 V5 2nd Mixer	6.0	245v
D	Mic Gain F.C.C.	H.F. Osc. Injection	1.5-4.0	
	3mV 1700 Hz	Pin 2 V6 Driver	4.0	
	3mV 1700 Hz	Pin 7 V6 Driver	92.0	260v

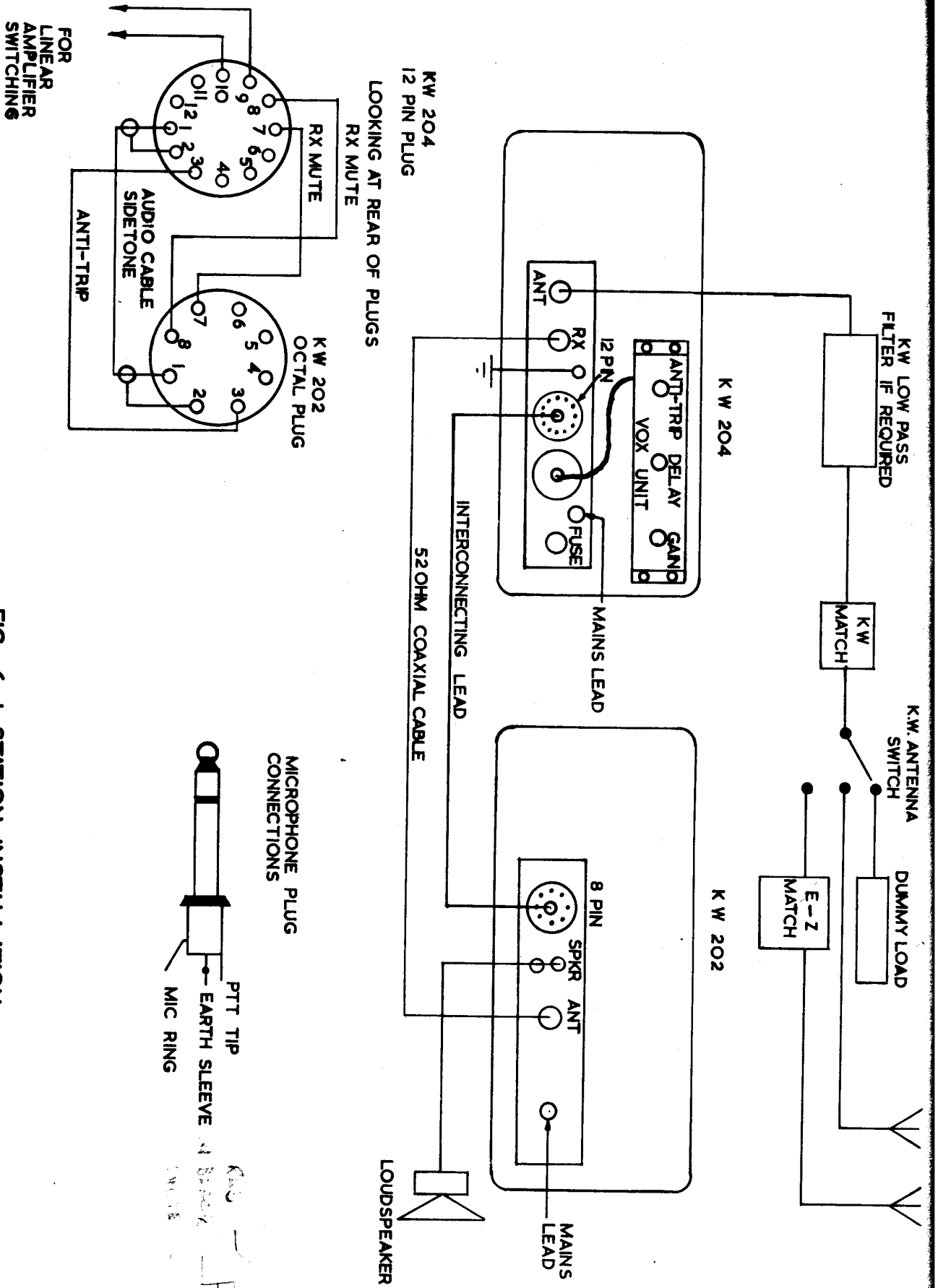


FIG 6-1 STATION INSTALLATION

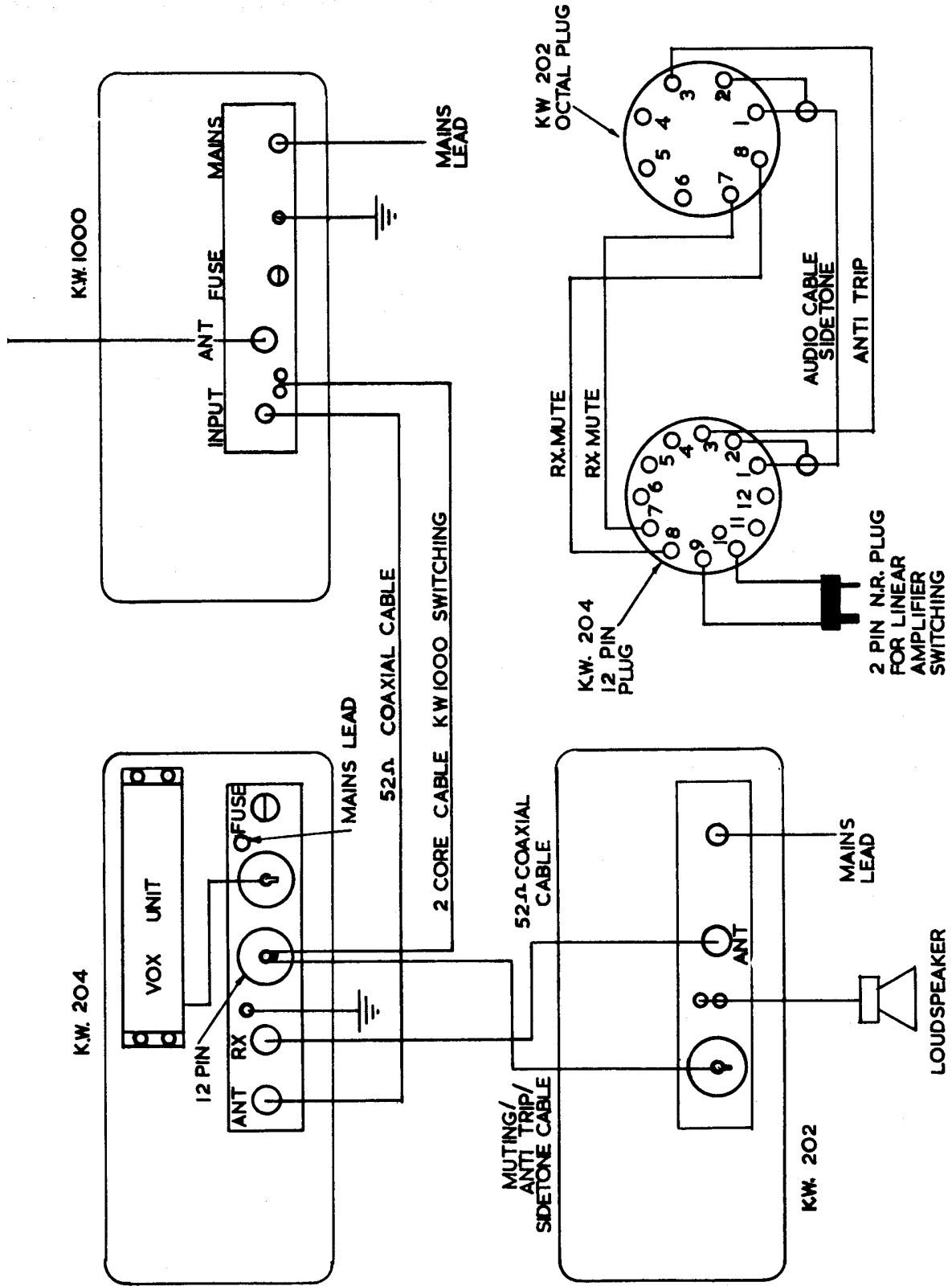
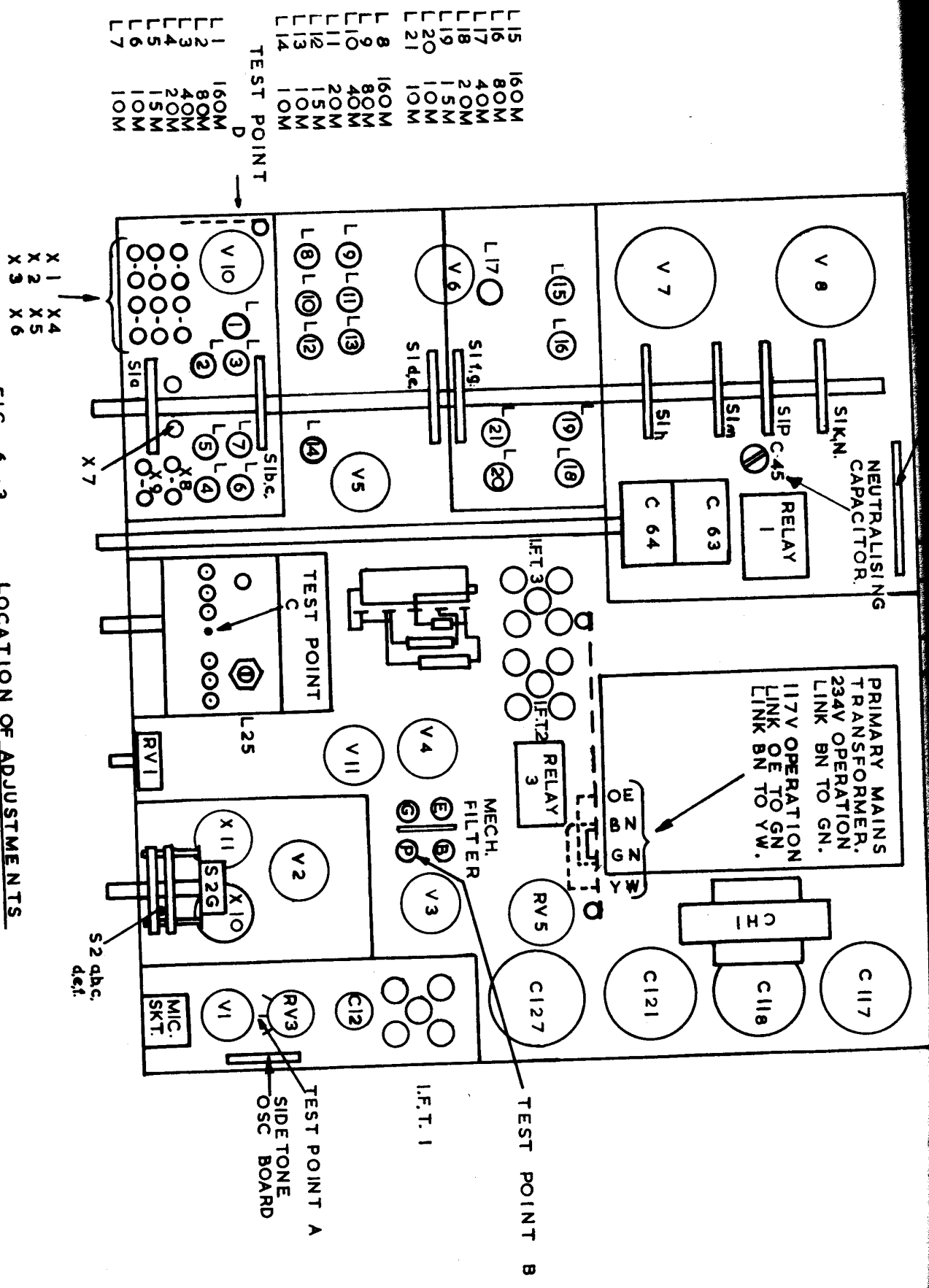


FIG 6-2 INSTALLATION WITH KW1000 LINEAR AMPLIFIER

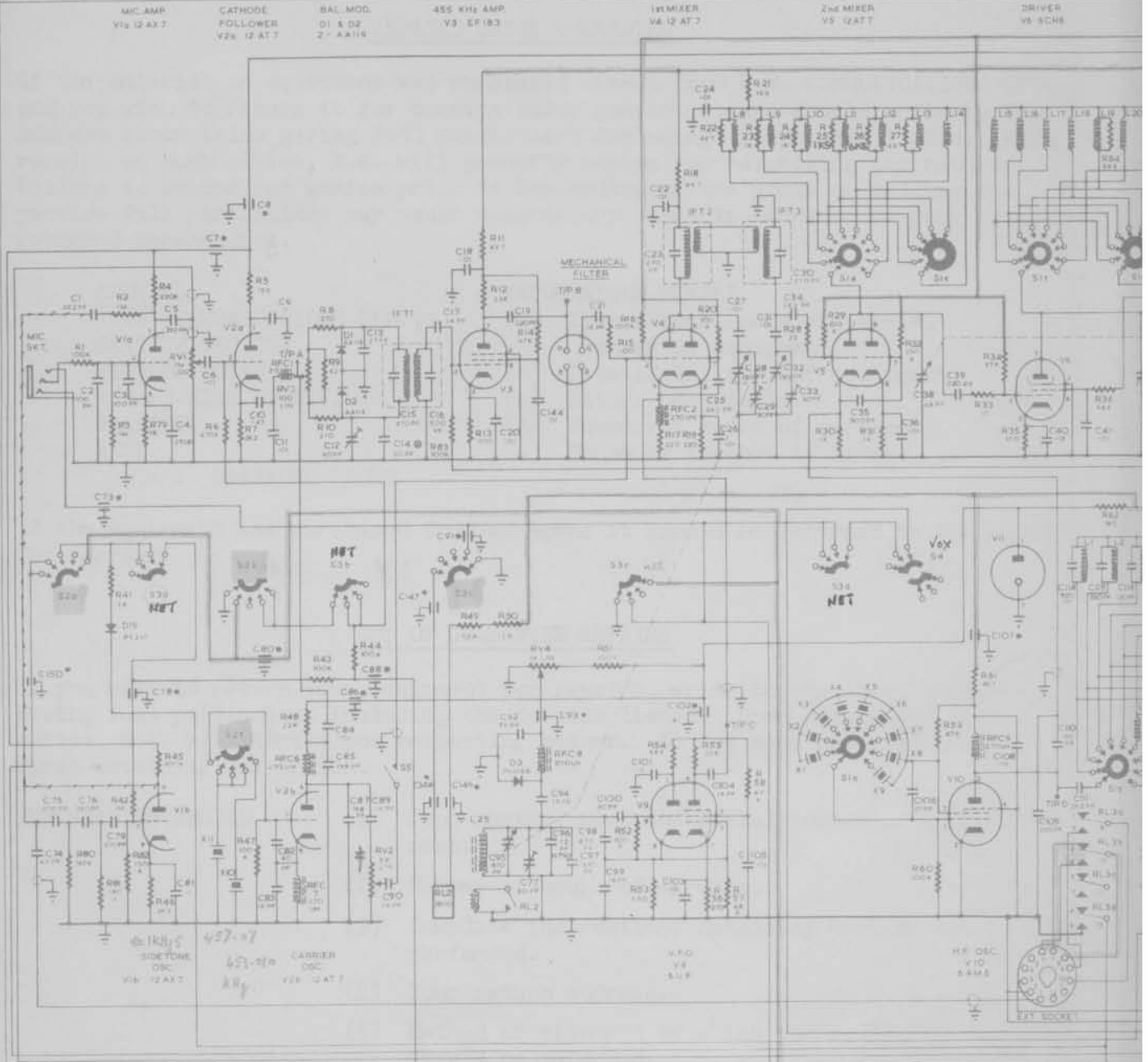


Scr. # 7386

DRAWING NO
D 1024/2

THIRD-ANGLE PROJECTION

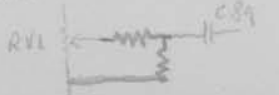
Q & SV	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
CAPACITORS	1M5	1M7	1M8	1M9	1M10	1M11	1M12	1M13	1M14	1M15	1M16	1M17	1M18	1M19	1M20	1M21	1M22	1M23	1M24	1M25	1M26	1M27	1M28	1M29	1M30	1M31	1M32	1M33	1M34	1M35	1M36	1M37	1M38	1M39	1M40	1M41	1M42	1M43	1M44	1M45	1M46	1M47	1M48	1M49	1M50	1M51	1M52	1M53	1M54	1M55	1M56	1M57	1M58	1M59	1M60	1M61	1M62	1M63	1M64	1M65	1M66	1M67	1M68	1M69	1M70	1M71	1M72	1M73	1M74	1M75	1M76	1M77	1M78	1M79	1M80	1M81	1M82	1M83	1M84	1M85	1M86	1M87	1M88	1M89	1M90	1M91	1M92	1M93	1M94	1M95	1M96	1M97	1M98	1M99	1M100					
T.T.V. & D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
VTAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
RESISTORS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
USED ON	MIC AMP V10 12 AX 7										CATHODE FOLLOWER V26 12 AT 7										BAL. MOD. D1 & D2 2- AAH10										455 KHZ AMP V9 6F1B3										1RMXER V4 12 AT 7										2ND MEXER V5 12 AT 7										DRIVER V6 6X4																																							



NOTES
 ● SELECTED ON TEST
 ○ 1000 μF FEEDTHROUGH CAPACITOR
 ○ CREMED CABLE

CR. REF.	SWITCHES SHOWN	ACTION	CR. REF.	POTENTIOMETER FUNCTION	CR. REF.	CRYSTALS FREQUENCY	EXTERNAL PIN No.	SOCKET FUNCTION	SOCKET PIN No.
17	1A	WAVE CHANGE	V9	MIC GAIN CONTROL	17	455.5 KHZ	1	SIG. TONE	1
12	2A	OFF FUNCTION	V2	CARRIER CONTROL	18	455.5 KHZ	2	EARTH	2
13	3A	WIND. REC. SW	V3	CARRIER BALANCE	19	1015.5 KHZ	3	ANT. TRIP	3
14	4A	LOX SW	V4	CAL. SET	20	857.5 KHZ	5 & 8	D.X. MOUNTING	4
15	5A	WIND. SW	V5	R.F. BIAS	21	1207.5 KHZ	7 & 9	D.X. MOUNTING	5
16	6A	METER SW	V6	R.F. INDICATION	22	5527.5 KHZ	6	LINEAR SWITCHING	6
					23	1527.5 KHZ	10	LINEAR SWITCHING	7
					24	1627.5 KHZ			8
					25	1827.5 KHZ			

As low region of pot is in bad way
 # JUN 91 did. add 2x20K

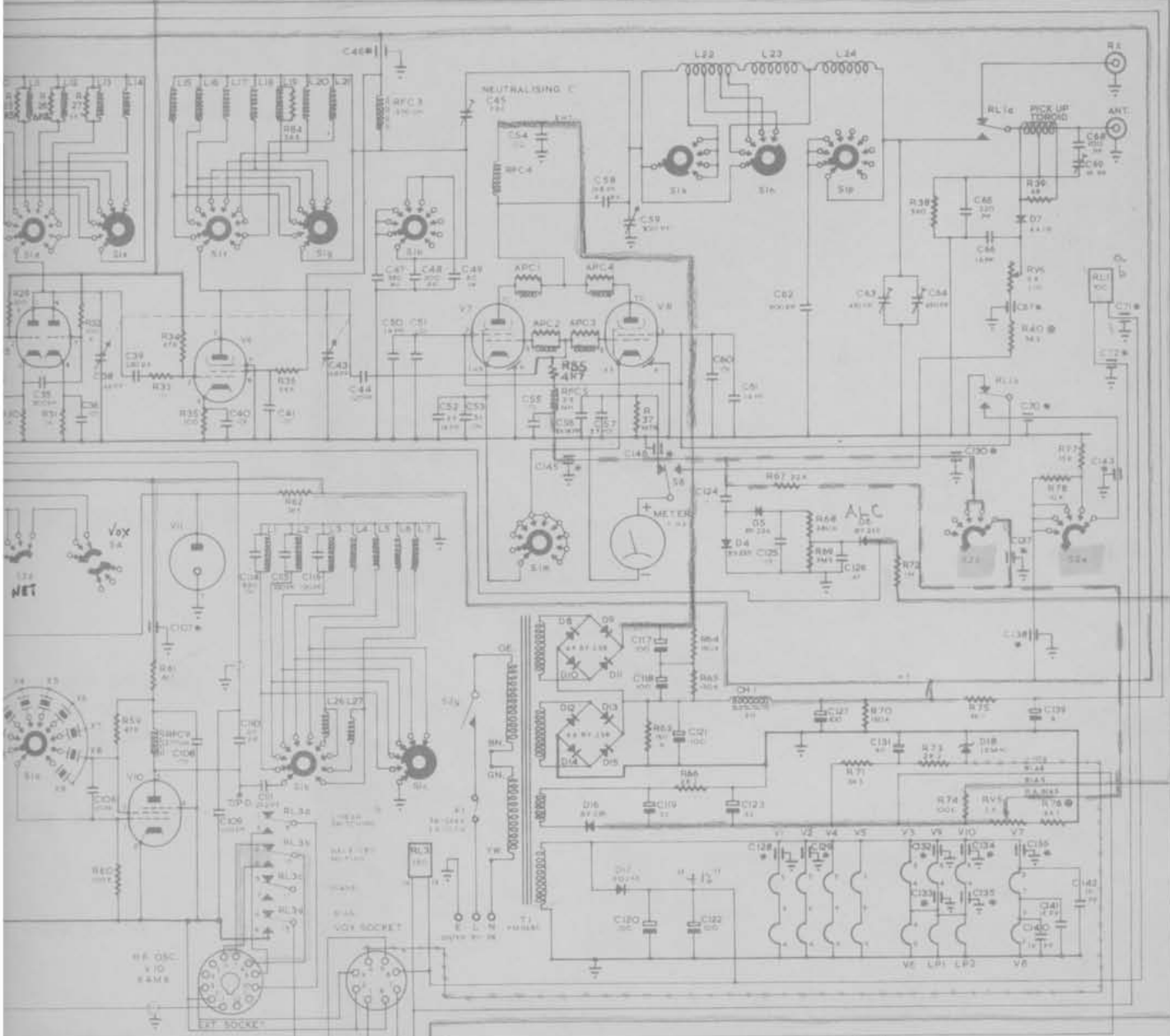


APPROVED	3	4-5-72
CHECKED	2	4-11-72
DRAWN	1	4-5-72
FILED	000	243

THIRD ANGLE PROJECTION

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
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2W MIXER V6 2A77 DRIVER V8 6CA6 POWER AMPLIFIERS V7 & V8 6146



EXTERNAL PIN NO.	FUNCTION	VOX SOCKET PIN NO.	FUNCTION
1	SIDETONE	1	AUDIO
2	EARTH	2	EARTH
3	ANT. TRIP	3	ANT. TRIP
4	R.X. METER	4	-10V
5	R.X. METER	5	C.W. BREAK IN
6	LINEAR SWITCHING	6	+12V
7	LINEAR SWITCHING	7	SENS. RECEIVE
8		8	EARTH



3	4-5-72 AM SHT. 4395 C/N 643	MATERIAL		TOLERANCES	K. W. ELECTRONICS DARTFORD KENT
2	1-3-71 AM SHT. 4284 C/N 583	REVISED			TITLE KW 204 TRANSMITTER CIRCUIT DIAGRAM.
1	9-3-71 ORIGINAL ISSUE	SCALE		OPTIONAL IN INCHES	DWG. NO. D 1024/2