K.W. ELECTRONICS

SINGLE SIDE BAND TRANSCEIVER

KW 2000B

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.

INSTRUCTION MANUAL

ISSUE 1

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ERRATUM

Throughout this handbook, for 'KW 2000A' read 'KW 2000B'

ADDENDA

WAVECHANGE SWITCH SETTINGS:

STANDARD KW 2000B		ALTERNATIVE FREQUENCIES
1.8	1.8—2.0 MHz	—
3.5A	3.5—3.7 MHz	3.9—4.1 MHz
3.5B	3.7—3.9 MHz	3.9—4.1 MHz
7A	7.0—7.2 MHz	7.1—7.3 MHz
14A	14.0—14.2 MHz	—
14B	14.2—14.4 MHz	—
21A	21.0—21.2 MHz	21.2—21.4 MHz
21B	21.3—21.5 MHz	21.2—21.4 MHz
28A	28.0—28.2 MHz	28.2—28.4 MHz
28B	28.4—28.6 MHz	28.2—28.4 MHz
28C	28.6—28.8 MHz	28.8—29.0 MHz
		29.0—29.2 MHz
		29.2—29.4 MHz
		29.4—29.6 MHz
		29.6—29.8 MHz

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K.W. 2000A SSB TRANSCEIVER

SECTION 1

GENERAL DESCRIPTION AND SPECIFICATION

1—1 INTRODUCTION

The K.W. 2000A TRANSCEIVER is a complete unit enabling transmission and reception of single-sideband and CW on all amateur bands between 1.8 MHz and 30 MHz. Reception of AM signals is also possible. It is capable of transmitting and receiving either upper or lower sideband signals. Separate power units for operation on 200—250v A.C. and 12v D.C. make the equipment suitable for "fixed" or "mobile" stations where a compact installation is required.

1—2 RECEIVER

The receiver section of the KW 2000A transceiver is a double conversion superhet, with a CRYSTAL CONTROLLED 1st MIXER, and a highly stable VFO, a MECHANICAL FILTER for optimum performance on SSB, and a CRYSTAL CONTROLLED CARRIER OSCILLATOR. Independent receiver frequency tuning (IRT) is provided with a deviation of approximately ±6 KHz. A product detector is used for all modes of reception. Output stage is capable of delivering 1.5 watts of audio to the loudspeaker. The equipment is fitted with a cystal calibrator 100 KHz marker.

1—3 TRANSMITTER

The exciter/transmitter section uses the same CARRIER OSCILLATOR, MECHANICAL FILTER, VFO and HF XTAL OSCILLATOR as the receiving section. The PA stage has an output of 100 watts P.E.P. on SSB and 150 watts D.C. input on CW. A Pi output stage provides a variable output impedance. Independent transmitter frequency tuning (ITT) is provided with a deviation of approximately ±6 KHz from the indicated dial reading. The equipment is fitted with Voice Control but can also be operated with a "press to talk" function.

1—4 POWER SUPPLIES

Two power supplies are available, one for operation on 200—250v 45—65 Hz A.C. mains supply, and the other for operation on 12 volts D.C. battery supply. A special A.C. power supply is available for 100—125 volt 60 Hz line voltage. A power reduction switch is fitted to both types of power supply unit for 160 metre operation. The A.C. power supply has a loudspeaker incorporated within the cabinet.

1—5 ANTENNA

The antenna system used should have a low V.S.W.R. Antennas for use on "fixed" or "Mobile" installations are available. Generally a feed impedance of approximately 20 to 300 ohm is acceptable to transmitter output Pi circuit.

1—6 SPECIFICATION

(1) GENERAL

MODE:	Single sideband suppressed carrier (A3J). CW (A1).
BANDS COVERED:	1.8—2.0, 3.5—3.7, 3.7—3.9, 7.0—7.2, 14.0—14.2, 14.2—14.4, 21.0—21.2, 21.3—21.5, 28.0—28.2, 28.4—28.6, 28.6—28.8 MHz.
AMBIENT TEMPERATURE RANGE:	−10°C to +40°C
V.F.O. STABILITY:	With constant input voltage to P.S.U. better than 200 Hz after warm-up period of 30 minutes.
INDEPENDENT TRANSMITTER/ RECEIVER TUNING:	±6 KHz from V.F.O. setting.
POWER REQUIREMENTS:	Fixed station 200—250 volts 45—65 Hz. Mobile station 12.6 volts D.C. nominal.
POWER CONSUMPTION:	Fixed station approximately 320 watts on transmit.
CURRENT DRAIN:	Mobile 10 amps Receiver 10—28 amps Transmit
DIMENSIONS IN CABINET:	
Transceiver:	6¼" Height; 13⅞" Width; 13¼" Depth.
A.C. Power Unit:	6¼" Height; 7¾" Width; 13" Depth.
12v D.C. Power Unit:	5¼" Height; 4⅜" Width 8" Depth.
WEIGHT:	
Transceiver:	18lb appriximately.
A.C. Power Unit:	24lb approximately.
12v D.C. Power Unit:	6¼lb approximately.

(2) RECEIVER

RECEPTION MODES:	(i) SSB (either sideband selectable) (ii) AM (exalted carrier either sideband) (iii) CW
INPUT IMPEDANCE:	52 ohms
SENSITIVITY:	Better than 1 uv for 500 mw output.
SIGNAL/NOISE RATIO:	Better than 20 db signal plus noise to noise ratio at 1 uv input.
OUTPUT IMPEDANCE:	3 ohms
SELECTIVITY:	Nominal 2.4 KHz at 6 db better than 5 KHz at 60 db.
A.F. OUTPUT:	1.5 watts
SPURIOUS:	Less than 1 uv equivalent antenna signal.

(3) TRANSMITTER

EMISSION:	SSB (either sideband selectable) CW (break in keying)
TYPE OF SERVICE:	SSB—continuous CW—50% duty cycle.
CARRIER SUPPRESSION:	50db down relative to maximum output.

UNWANTED SIDEBAND:	45 db down relative to maximum output.
MIC. INPUT:	High impedance.
AUDIO RESPONSE:	300—2600 Hz ±6 db.
OUTPUT IMPEDANCE:	20—300 ohms approximately on all bands.
PLATE POWER INPUT:	180 watts P.E.P. on SSB. 150 watts on CW.
KEYING:	Break in.
SECOND HARMONIC:	40 db down from output signal.
THIRD ORDER DISTORTION:	30 db down from output signal.

1—7 VALVE AND SEMI-CONDUCTOR COMPLIMENT

Valve, Semi-conductor and Lamps Transceiver

SYMBOL	FUNCTION	TYPE
V1a	Mic. Amp.	½ 12AX7
V1b	1st Vox Amp	½ 12AX7
V2b	Cathode Follower	½ 12AX7
V3	Tx IF Amp	EF 183
V4	1st Tx Mixer	12AT7
V5	2nd Tx Mixer	12AT7
V6	Rx RF Amp	EF 183
V7	Tx Driver	6CH6
V8, V23	Power Amp	6146
V9	1st Rx Mixer	6BE6
V10	HF Crystal Osc.	6AM6
V11	VFO	6U8
V12	2nd IF Amp	6BA6
V13	1st IF Amp	6BA6
V14	AVC Det.	6AL5
V15a	Tone Oscillator	½ 12AX7
V15b	Product Detector	½ 12AX7
V16a	LSB Carrier Osc.	½ 12AT7
V16b	USB Carrier Osc.	½ 12AT7
V17a	AF Amp	½ ECL82
V17b	AF Output Amp	½ ECL82
V18	'S' meter Amp	12AT7
V19	2nd Rx Mixer	6BE6
V20	Voltage Regulator	OA2
V21a	2nd VOX Amp	½ 12AT7
V21b	VOX relay actuator	½ 12AT7
V22	100 KHz crystal calibrator	6BA6
D1, D2	Balanced modulator	OA79
D3	I.R.T. Vari Cap	8SC20
D4	VOX Rect.	DD006 or BY130
D5	Anti Trip Rect.	DD006 or BY130
D6, D7	ALC Rectifier	BY130
D8	Bias Blocking Rectifier	BY130
FS1, FS2	EHT and HT Fuse	750mA Antisurge and 750mA

FS3	Mains Fuse	3 amp (240v) 5 amp (115v)
PL1, PL2	Dial Lamp, Meter Lamp	6.3v .15A Lilliput (L.E.S.)

Power Supply Semi-conductors

D1—D4	EHT Rectifiers	BY105 or BY238
D5—D8	HT Rectifiers	BY103 or BY236
MR9—12	Bias Rectifiers	B250 C75
D13	Negative DC Rectifier	40266

SECTION 2

CIRCUIT DESCRIPTION

2—1 TRANSMITTER CIRCUITS

1 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 V2 across MIC GAIN control. Output from the cathode follower is fed to the resistive balance point of the BALANCED MODULATOR. In the TUNE position (this is USB) or when the key is pressed on USB or LSB, output from the TONE OSCILLATOR (V15a) at 1500Hz is fed to the grid of the CATHODE FOLLOWER (V2).

2 ALC CIRCUIT

Detected Audio from the Power Amplifier Grid circuit is rectified by D6 and D7, the negateive DC output is fed to the grid of the 455KHz 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 D8 is used to prevent the transmitter muting bias charging the ALC circuit when on receive.

2 VOX CIRCUITS

When VOX is selected on the CONTROL switch, audio is taken from the anode of V1a (either tone or speech) and fed to the grid of the 1st VOX AMP V1b, amplified, and coupled to the grid of the 2nd VOX AMP across VOX GAIN control. Amplified audio is then rectified by the VOX RECTIFIER (D4) and a positive going voltage is fed to the grid of the RELAY ACTUATOR V21b. When this voltage is high enough to overcome the negative bias on the grid, the VOX RELAY will be actuated, switching the transmitter section on, and muting the receiver section.

3 ANTI TRIP CIRCUIT

Audio is taken from the receiver output valve V17 and fed across the ANTI TRIP GAIN control to the ANTI TRIP RECTIFIER D5, a negative going voltage is fed to the grid of the RELAY ACTUATOR V21b to provide the bias necessary to keep the transmitter section disabled during receive periods. The ANTI TRIP circuit provides a threshold voltage to prevent loudspeaker output (picked up by the microphone) from tripping the VOX circuits into transmit.

4 BALANCED MODULATOR AND LOW FREQUENCY IF CIRCUITS

Audio output from the cathode of V2a, and the CARRIER OSCILLATOR voltage, are fed to the slider of the CARRIER BALANCE potentiometer RV14. Both upper and lower sideband output from the BALANCED MODULATOR are coupled through IF transformer IFT1 to the grid of the IF AMPLIFIER V3. Output from the IF AMPLIFIER is fed to the MECHANICAL FILTER. The Passband of the FILTER is centred at a nominal frequency of 455KHz. This passes either upper or lower sideband, depending upon which sideband is selected at the FUNCTION switch. This operates either CARRIER OSC crystal X12 or X13. The SSB output of the FILTER is fed to the control grid of the transmitter first mixer.

5 BALANCED MIXERS

The 455KHz SSB signal is fed to the grid of the FIRST BALANCED MIXER (V4) and VFO output voltage (2,500—2,700KHz) is fed to the signal input cathode and to the control grid of the second half of the twin triode. This arrangement cancels the high-frequency injection signal within the mixer and converts the 455KHz SSB signal to a 2955 to 3155KHz SSB signal. The coupling network between the plates of the FIRST MIXER and the grid of the SECOND BALANCED MIXER is made "broadband" to provide a uniform response to the band-pass-IF frequency. The transmit frequency is determined within the passband by the VFO frequency. The band-pass-IF signal is fed to the control grid of the SECOND BALANCED MIXER, and the HF 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 (V5). The HF injection voltage is cancelled within the mixer and the band-pass-IF signal is converted to the desired band of operation.

6 R.F. CIRCUITS

The tuned circuits associated with the anodes of V5, V6 grid and the anode of V7 are ganged to the PRE-SELECTOR tuning control. The signal from the second BALANCED MIXER is amplified by the DRIVER (V7) to drive the POWER AMPLIFIERS (V8, V23) in CLASS AB1. Output from the PA is tuned by a PI NETWORK and fed to the ANTENNA through contacts of transmit-receive relay RL1.

2—2 RECEIVER CIRCUITS

1 RF CIRCUITS

Signal input from the ANTENNA is connected through relay contacts to the tuned input circuit L1—L5. The signal voltage is then applied to the grid of the RF AMPLIFIER V6. The tuned circuits L6—L10 couple the amplified signal to the grid of the FIRST RECEIVER MIXER V9.

2 RECEIVER MIXERS

The amplified RF SIGNAL is fed to the signal grid of the RECEIVER FIRST MIXER V9, and the H.F. OSCILLATOR injection signal is fed to the control grid of V9. The anode load of V9 is band-pass I.F. transformers, IFT2, IFT3, which are tuned to a frequency which is the difference between the input signal and the H.F. oscillator, this is 2955 to 3155KHz. Output of IFT3 is applied to the signal grid of the RECEIVER SECOND MIXER V19. The VFO (V11) output is injected to the control grid of V19, producing an output frequency of 455KHz at the anode which is fed to the MECHANICAL FILTER.

3 IF CIRCUITS

The output from the MECHANICAL FILTER at 455 KHz is applied to the grid of the first IF AMP (V13). The IF signal is amplified by V13 and V12 and applied through IFT5 to the AVC DETECTOR V14, and the grid of the PRODUCT DETECTOR V15b. The CARRIER OSCILLATOR (V16) is also used as a BFO, the output of which is fed to the cathode of V15b. The resultant mixing process produces the detected signal at audio frequencies. Output of the AVC detector is used to control the two IF amplifiers

and the RF amplifier. The AVC is fast attack, slow release, for SSB and CW operation. The AVC threshold is at approximately 1 microvolt level with 50 microvolts necessary to read S9 on the 'S' meter.

4 AF CIRCUITS

Output from the product detector is applied through the A.F. GAIN control RV95, to the grid of the AF AMP V17a. Amplified audio output is coupled to the grid of the AF OUTPUT AMP V17b, which produces the power to operate loudspeaker or headphones. Low Impedance headphones are recommended for use with KW 2000A.

2—3 OSCILLATORS

1 TONE OSCILLATORS

The TONE OSCILLATOR V15a operates when the FUNCTION switch is at TUNE or when the key is pressed with the FUNCTION switch at LSB or USB. A phase shift oscillator circuit is employed operating at approximately 1500Hz. The output is fed to the transmitter audio CATHODE FOLLOWER V2a for TUNE and CW, and across the RECEIVER AF GAIN control for SIDE TONE monitoring of CW Transmission.

2 CARRIER OSCILLATOR

The CARRIER OSCILLATOR is crystal controlled at a frequency which puts the carrier approximately 20 db down the skirt of the MECHANICAL FILTER (X13) or LOWER (X12) SIDEBAND crystals are selected by the FUNCTION switch.

3 VARIABLE FREQUENCY OSCILLATOR

The VFO operates in the range 2500 to 2700KHz. 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 LSB, and is accomplished by switching a one turn coil in circuit by operation of a reed relay RL3.

4 HIGH-FREQUENCY CRYSTAL OSCILLATOR

The H.F. CRYSTAL OSCILLATOR V10, is crystal controlled by one of 11 crystals selected by BAND SWITCH S2. The output frequency of this oscillator is always 3155KHz higher than the lower edge of the desired band.

5 CRYSTAL CALIBRATOR

The 100KHz CRYSTAL CALIBRATOR signal is fed to the wiper of S2d, which is connected to the RF AMPLIFIER tuned input circuit L1—L5. The 100KHz signal may be calibrated to an external standard by adjusting C158, which is located next to the 100KHz crystal.

2—4 POWER SUPPLIES

1 A.C. POWER SUPPLY

The A.C. POWER SUPPLY operates from 200—250v 45—65Hz or to order 105—125v A.C. The A.C. circuit is looped through the inter-connecting cable to the FUNCTION switch on the transceiver, in order that the power supply

can be switched on and off from the operating position. Transformer DS 4078 has three secondary windings which supply the HT voltage, the negative bias, the 12 volt heater and negative 12 volts for the relays. The A.C. line is fused in the LIVE side of the mains with FS3.

1(a) HT +245 VOLTS

The HT winding feeds a bridge rectifier circuit using four silicon-rectifiers D5—8, which delivers +245 volts D.C. via the smoothing circuits. The HT supply is fused by FS2 in the earth return of D5, D8.

1(b) NEGATIVE BIAS

Two negative bias voltages are required, and are provided by rectifying the second secondary of DS 4078 by MR 9—12, a selenium rectifier. This bias voltage is smoothed, and two potential dividers are used to give -65 volts for the receiver and transmitter muting, and a variable bias of -50 to -65 volts adjustable by the potentiometer at the rear of the power supply for the operating bias of the PA V8, V23.

1(c) HEATERS AND NEGATIVE 12 VOLTS

The remaining winding is for the 12v A.C. heater line, this supply is also rectified by D13 to provide the -12v D.C. necessary to operate the relays. 6v A.C. is provided via R9 to operate the heaters V11, V10.

1(d) H.T. 750 VOLTS

Transformer DS4077 has a tapped secondary for reduced power operation. A switch is provided on the rear of the power supply for this purpose. Voltage from the secondary winding is applied to two semi-conductor rectifier strings connected in a full-wave voltage doubler configuration. The resulting D.C. is approximately +750 volts with the HIGH LOW power switch at HIGH and 675 volts with it at LOW. This voltage is applied to the anodes of the PA V8, V23. The supply is fused by FS1.

1(e) LOUDSPEAKER

The loudspeaker is built into the A.C. power supply cabinet.

2 D.C. POWER SUPPLY

This unit is intended to be used from a 12 volt storage battery such as is normally fitted in a vehicle. The input voltage should not be allowed to drop below 11.5 volts, otherwise frequency modulation may be noticeable on the transmitted signal.

2(a) The power supply consists of a two transformer D.C. to D.C. converter employing toroidal windings for optimum performance, and gives a conversion efficiency of 85%. A small driver transformer operating at 600 Hz controls the switching of the two power transistors. The circuit includes a silicon diode to ensure reliable starting under all load conditions and over a wide temperature range.

2(b) The square wave produced by the switched transistors is stepped up via a linear transformer to the required output voltages. The 750v and 245v D.C. supplies are obtained from Silicon Rectifiers in a bridge circuit followed by smoothing. The low current bias supplies are derived from a half wave circuit. A High/Low power switch enables the 750 volts to be reduced to 675v. Both input and output circuits are filtered to minimise interference.

2(c) The power supply can be supplied for mobile installations having an earth on either positive or negative battery terminals. A remote switching relay is included to eliminate long high current leads to the control position whilst a protection circuit prevents damage to the power supply should the input polarity be accidentally reversed.

2(d) A 6 volt stabilised line is provided for the heaters of V11, V10 to reduce VFO drift with varying battery voltages. The line is stabilised by a zener diode.

SECTION 3

INSTALLATION

3—1 UNPACKING

Carefully unpack all items of the KW 2000A 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 valves and crystals for obvious damage and ensure that they are firmly seated in their respective sockets.

3—2 FIXED STATION INSTALLATION

Connect the transceiver, power supply, and antenna as shown in fig. 6—4. Connect the transceiver to a good earth ground, such as a metal water pipe, or a metal stake driven deep into moist soil. Connect microphone or key as shown in fig. 6—4. Allow adequate ventilation for the equipment.

3—3 INSTALLATION WITH THE KW 1000 LINEAR AMPLIFIER

Connect the transceiver, power supply, KW 1000 and antenna as shown in fig. 6—6. Use twin screened lead for connection between pins 2 and 3 of the OCTAL plug on the KW 2000A and the plug marked MOX on the KW 1000.

3—4 MOBILE INSTALLATION

1 VEHICLE INSTALLATION

Connect the transceiver, power supply, antenna and microphone as shown in fig. 6—5. The most practical installation is to place the transceiver under the instrument panel of the vehicle, with the D.C. power supply unit located under the bonnet. A shallow U shaped bracket is available for mobile installation and is intended to be bolted upside-down beneath the instrument panel. The transceiver is then slung from the downward projecting arms of the U bracket.

2 MOBILE ELECTRICAL INSTALLATION PROCEDURE

(a) Check that the polarity of the D.C. power supply is the same as the vehicle.

(b) The cable available for connection between the D.C. power supply and transceiver is six feet long, this should be remembered when installing in other than a normal passenger vehicle.

(c) A fuse block containing a 25A fuse is available, and should be installed as close to the battery as possible. Install the fuse block in the LIVE side of the battery.

LEAVE THE FUSE OUT UNTIL THE INSTALLATION IS COMPLETE

(d) Use cable capable of carrying 30A, such as 110/0076 for connecting the power supply to the battery. Ensure that no chafing to cables can occur while the vehicle is moving.

3—5 MOBILE ANTENNA INSTALLATION

1 One of the most efficient antennas for use on the Amateur bands is the centre-loaded whip. These antennas use an insulated bumper or body mount, with provision for coaxial feed from the base.

2 The centre-loaded whip must be tuned to obtain optimum operation on the desired frequency of operation. They will operate at maximum efficiency over a range of, perhaps, 10KHz on the 160 meter band, 20KHz on 80 meters, a somewhat wider range on 40 meters, and the whole of 20 meters, without retuning.

3 One procedure for tuning the antenna is as follows. The antenna is installed, and the vehicle parked in an open space, with all doors closed. The end of the coaxial cable which will plug into the transceiver is terminated in a link of 3 to 4 turns of wire. This link is then coupled to a grid-dip meter and the resonant frequency of the antenna determined by noting the frequency at which the G.D.O. dips. The coils furnished with the antenna are normally too large, and on some antennas it may be necessary to remove turns from the loading coil, and others, to vary the length of the top section, to obtain resonance.

3—6 NOISE SUPPRESSION

1 A motor vehicle generates a considerable amount of electrical noise and to permit satisfactory reception by a mobile installation it is necessary to reduce this noise to a low level.

2 The ignition system is responsible for a considerable amount of the electrical noise. The sparking plugs should be of the type with built-in suppression, or plug suppressors should be used. It is beneficial to use sheathed cable for the leads from the distributor to the sparking plugs and from the ignition coil to the rotor terminal on the distributor, the sheathing being securely bonded to the car frame. There are two terminals on the ignition coil, the one marked 'SW' should be by-passed to the car frame through 0.1—0.5 uf capacitor.

3 Dynamo whine can be identified by the following procedure. Run the engine at a fast idling speed. Tune the transceiver to a frequency where there are no signals. Switch the ignition off. If the noise persists for a short time after the ignition has been switched off, then it is due to the dynamo. This type of noise can often be eliminated by connecting a capacitance of about 0.5 uf from the 'D' terminal on the dynamo to the car frame. In no circumstances should the field terminal 'F' be by-passed or the regulator action will be impaired and the unit damaged.

3—7 INITIAL CHECKS

Adjust the two mains selectors at the rear of the A.C. PSU to suit the supply voltage. Put the HIGH LOW power switch to the required position. Set the MIC GAIN control full counterclockwise, FUNCTION switch to LSB, WAVECHANGE switch 3.5, PRE-SELECTOR 80m segment. CONTROL

switch INT MOX, allow transceiver 60 secs. to warm up. Adjust RV1 located on rear of AC PSU, and adjustable through the rubber grommet on the side of the DC PSU, for a standing cathode current of 50ma. Switch to EXT MOX and OFF.

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 VALVES DAMAGED.

SECTION 4

OPERATION

4—1 RECEIVER

1 After making external connection as in section 3—2, 3—3 and 3—4 and doing initial checks, as in section 3—7, set controls to the following positions:

AF GAIN	VERTICAL
RF GAIN	FULLY CLOCKWISE
PA TUNE	REQUIRED BAND
PRE-SELECTOR	REQUIRED BAND
CONTROL SWITCH	EXT MOX
IRT TUNE	0
IRT SWITCH	OFF
FUNCTION SWITCH	REQUIRED SIDEBAND
MIC GAIN	FULLY COUNTERCLOCKWISE
PA LOAD	8
WAVE CHANGE SWITCH	REQUIRED BAND

2 CALIBRATION

(a) Set VFO dial to 0, 100 or 200 with tuning knob.

(b) Adjust PRE-SELECTOR for maximum signal or noise output.

(c) Press CAL ON button.

(d) Tune back and forth near 0, 100 or 200 until calibrate signal is at ZERO BEAT. Adjust CAL SET until dial is calibrated. Release CAL ON button.

3 SINGLE-SIDEBAND TUNING

(a) Tune in signal and adjust PRE-SELECTOR for maximum S METER reading, adjust AF GAIN for desired audio output level.

(b) When listening to strong signals, a reduction in background noise under no-modulation conditions may be obtained by rotating RF GAIN control counterclockwise, away from the maximum position. As this is done, S meter static reading will shift up in scale.

(c) To read frequency, add the dial setting to the WAVECHANGE switch setting. For example, if the WAVECHANGE switch is set to 3.5 and the dial is set at 108, the frequency is 3.608MHz. If the WAVECHANGE switch is set at 14.0 and the dial to 070, the frequency is 14.070MHz.

4 AM TUNING

Set controls as outlined in 4—1 1. Tune in signal for ZERO BEAT, adjust PRE-SELECTOR for peak S meter reading, and adjust AF GAIN for desired audio output level. Once the desired signal is tuned in, switching to the opposite sideband may yield a more readable signal if interference is present.

5 IRT

If it desired to tune the receiver off the transmitting frequency, turn the IRT switch to IRT and adjust IRT TUNE, this will vary the frequency by approximately ±6KHz on receive only.

6 IRTT

If it is desired the receiver and transmitter sections may be tuned off the indicated dial frequency. Turn the IRT switch to IRTT, and adjust IRT

TUNE, this will vary the frequency by approximately ±6KHz on receive and transmit.

7 USE OF S METER

(a) The S meter is intended to indicate relative rather than absolute signal strength. A nominal meter reading of S-9 is obtained with an input signal of 50 microvolts. Due to normal tolerance in receiver operation, AVC threshold varies slightly from band to band causing correspondingly slight changes in the number of db represented by each S unit, a figure of 4 db per S unit can be taken as correct for all practical purposes.

(b) Due to valve aging and/or input voltage variations, the S meter may move off the ZERO point with no signal input; to correct, remove the antenna, short the antenna socket to earth, make sure the RF GAIN control is fully clockwise and adjust the potentiometer RV101 until the S meter reads ZERO. Caution, do NOT adjust S SENS potentiometer, this has been set at the factory.

4—2 TRANSMITTER

Set the transceiver up as in 4—1 1.

1 VOX ANTI-VOX AND DELAY

(a) To adjust the VOX circuit, adjust AF GAIN for desired audio output level, put the CONTROL switch to VOX, leave the MIC GAIN control fully counterclockwise.

(b) Speak into the microphone and slowly advance the VOX SENS potentiometer until the relays drop in.

(c) If noise from the loudspeaker tends to trip the VOX relays, advance the ANTI-VOX potentiometer until the effect is stopped.

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

2 SINGLE-SIDEBAND TUNE PROCEDURE

(a) Set the CONTROL switch to either the VOX or EXT MOX.

(b) With the transceiver set up on the required band, adjust the PRE-SELECTOR in the required band segment, for a peak in noise or peak S meter reading.

(c) Turn the FUNCTION switch to TUNE, this will cause the relays to close, the transceiver will go on to transmit and the TONE oscillator will be switched on, a 1500Hz note will be heard in the loudspeaker.

(d) Slowly advance the MIC GAIN, this will cause the meter to rise from zero, advance MIC GAIN until cathode current of 50ma is indicated on meter, adjust PRE-SELECTOR for a peak in cathode current, continue to advance MIC GAIN until with the PA TUNE control off RESONANCE, PA cathode current of 130ma flows.

(e) Adjust PA TUNE control for a DIP in cathode current, increase loading of PA by turning PA LOAD control counterclockwise, re-adjust PA TUNE for DIP in cathode current, continue adjustments until PA is loaded to 120ma.

(f) Turn MIC GAIN control fully counterclockwise.

(g) Turn FUNCTION switch to required sideband, it is normal practise to operate on LSB on 160-80 and 40m and USB on 20-15 and 10m.

3 (a) To put the transceiver in the TRANSMIT SSB mode either press the press to talk button on the microphone, operate the external send/receive switch wired to pins 1 and 6 of the octal plug, both with the CONTROL switch at EXT MOX, or turn the CONTROL switch to INT MOX or VOX.

SINGLE-SIDEBAND OPERATION

(b) Note that when the transceiver is in the transmit position the standing cathode current is 50mA.

(c) Advance the MIC GAIN control while speaking into the microphone until P.A. cathode current averages 100mA.

4 C.W. OPERATION

(a) Load the transceiver as for SSB TUNE PROCEDURE 4—2 2.

(b) Unplug the microphone.

(c) Switch to transmit by operating the external SEND/RECEIVE switch with the CONTROL switch at EXT MOX or putting the CONTROL switch to INT MOX or VOX. With the CONTROL switch at VOX pressing the key will cause the transmitter to operate break-in C.W.

(d) With the transceiver at transmit, press the key and advance the MIC GAIN control until cathode current of 200mA flows, this will give a P.A. input of 150 watts, do not hold the key down for more than one second, otherwise damage to the P.A. valves may be done.

5 ITT

If required the transmitter may be tuned off the receiver frequency by approximately ±6KHz. Turn the IRT switch to ITT, and adjust IRT TUNE potentiometer the required amount.

6 160 METER SSB OPERATION

In order to comply with the GPO regulations, a HIGH LOW power switch is fitted to the power supply, and one P.A. valve is switched out of circuit when on 160 metres.

(a) Put the HIGH LOW power switch to LOW power.

(b) Carry out the TUNE PROCEDURE in 4—2 2 (a) to (c).

(c) Advance the MIC GAIN control for P.A. OFF RESONANCE cathode current of 90mA.

(d) Load the P.A. to 70mA.

(e) On speech average 50mA cathode current and do not peak above 65mA.

4—3 SETTING OF PA LOAD CONTROL

BAND	52 OHM P.A. LOAD SETTING
160	8
80	8
40	6
20	5
15	4
10	3½

4—4 Operation on other 200KHz Segments

The KW 2000A can be operated on any 200KHz segment in the 1.8 to 29.7MHz Amateur bands, as follows:

New 200KHz Segment required	New Crystal required	Unwanted Crystal to be removed and New Crystal put in its place
3.9—4.1MHz	7055.0KHz	6655.0KHz (3.5) or 6855.0KHz (3.8)
7.1—7.3MHz	10255.0KHz	10155.0KHz (7.0)
21.2—21.4MHz	12177.5KHz	12077.5KHz (21.0) or 12227.5KHz (21.3)
28.2—28.4MHz	15677.5KHz	15577.5KHz (28.0) or 15777.5KHz (28.4)
28.8—29.0MHz	15977.5KHz	15877.5KHz (28.6)
29.0—29.2MHz	16077.5KHz	15877.5KHz (28.6)
29.2—29.4MHz	16177.5KHz	15877.5KHz (28.6)
29.4—29.6MHz	16277.5KHz	15877.5KHz (28.6)
29.6—29.8MHz	16377.5KHz	15877.5KHz (28.6)

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 KW 2000A SSB Transceiver. 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. Minor adjustments in alignment may be made using the crystal calibrator as a signal source. Except for an occasional touch-up to compensate for possible component ageing, alignment normally will be necessary only if frequency determining components have been replaced.

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 the two front feet from the bottom of the cabinet.
3 From the rear, push the transceiver chassis forward until the front panel protrudes from the cabinet about an inch.
4 Grasping the front panel at the edges, slide the transceiver out of the cabinet.

NOTE

Valve filaments and pilot lomps are connected in a series parallel arrangement for 12v operation. When making valve or lamp replacements be sure that rated filament currents are the same as the original units.

5—2 TROUBLE ANALYSIS

1 Most cases of trouble can be traced to defective valves. Many valve checkers cannot duplicate the conditions under which the valves work in the transceiver. Substitution of new valves will sometimes clear an obscure case of valve trouble. Intermittent trouble conditions in valves can usually be discovered by lightly tapping the envelope. Occasionally valve pins or socket terminals will become dirty or corroded causing an intermittent condition. When this situation is suspected, remove the valve and apply a few drops of contact cleaner to the valve pins. Replace the valve and work it up and down in the socket a few times. Shorted valves or capacitors will often cause associated resistors to overheat and crack, blister or discolour. Making the measurements listed in Tables 6—3 and 6—4 will help to isolate this type of trouble to a particular stage or component. A logical process of elimination

in conjunction with a study of the main schematic diagram and block diagram will aid in isolating trouble. For example:

RECEIVER

2 If the receiver S METER functions properly, and there is no audio output, then the fault will either be in the CARRIER OSCILLATOR (V16) the PRODUCT DETECTOR (V15b) or the AF AMP and OUTPUT VALVES (V17).

3 If no signal is received and all valves and voltages appear to be correct, the HF CRYSTAL OSCILLATOR (V10) and the VFO (V11) CARRIER OSCILLATOR (V16) may be suspected. These may be tested by checking the operation of the transmitter section, since these oscillators are common to both transmitter and receiver sections of the KW2000A.

TRANSMITTER

4 No RF signal passes through the transmitter section until the operator speaks into the microphone, presses the key or puts the FUNCTION switch to TUNE. This means that with no input signal, all stages except the CARRIER OSCILLATOR the VFO and the HF CRYSTAL OSCILLATOR are quiescent.

5 Should no output be obtained from the transmitter section when the FUNCTION switch is at TUNE or when speaking into the microphone with the FUNCTION switch at LSB or USB and the CONTROL switch at INT MOX, then the fault can be isolated to the stages before or after the BALANCED MODULATOR. By shorting one side of the primary of IFT 1 to chassis, the BALANCED MODULATOR will be unbalanced. If under this condition RF output is obtained the fault must be in the stages before the balanced modulator.

6 If by unbalancing the BALANCED MODULATOR, output is obtained, then the fault can be still further isolated, by putting the FUNCTION switch to TUNE, this should cause a 1500Hz tone to be heard in the loudspeaker, this indicates that the TONE OSC (V15a) is working. If RF output is obtained in the TUNE position, and there is no output on LSB or USB with speech, then either the MIC AMP (V1a) or the microphone is at fault; also check microphone plug.

7 In carrying out the above checks, the transceiver should be set up as in the operation instructions.

5—3 SIGNAL TRACING PROCEDURES

Tables 6—1, 6—2 list significant test points, normal signal test points and normal signal levels. Figs. 6—1, 6—3 show location of adjustments. Voltages given in the tables are nominal and may vary plus or minus 20 per cent. A signal generator with an accurately calibrated output attenuator must be used to provide the RF signal source indicated. Be careful each time to set signal generator to frequency shown in table. Oscillator output voltages must be measured with a valve voltmeter and RF probe.

1 For audio measurements, use an audio oscillator as the signal source and an a-c VVM or audio wattmeter to monitor receiver output. Set AF GAIN at maximum, and terminate the 3 ohm AUDIO output with a three ohm resistive load.

2 Oscillator injection voltages are measured with VVM with an RF probe.
3 To check RF signal levels, connect D.C. VVM to the receiver AVC line. Set RF GAIN fully clockwise. Static D.C. voltage on the AVC line should be approximately 0.6 volt. Connect the RF signal generator to the point indicated in the table, and vary the generator dial to produce maximum AVC voltage, and compare with the value listed in the table.

5—4 Voltage and Resistance Measurements

Tables 6—3, 6—4 list voltage measurements with the transceiver on receive and transmit respectively. Table 6—5 lists resistance measurements. Voltages and resistances given in the tables are nominal and may vary plus or minus 20 per cent.

Alignment Procedure Equipment Required

Complete alignment of the KW2000A requires the use of the following equipment:

a Signal Generator (S.G.) covering 455KHz to 30 MHz with output impedance of 52 ohms, type use Airmec 201.
b Audio Oscillator.
c Audio Wattmeter.
d Valve Voltmeter (VTVM) with RF Probe, type used Airmec 314.
e 100w 52 ohm Dummy Load or Wattmeter
f Swamping Tool consisting of a 0.01 uf 400 vw capacitor wired in series, with a lk ohm ½w resistor.
g Non metallic hexagonal trimming tool, screwdriver.

5—5 Alignment Procedure

Before attempting to align the KW2000A please read the instructions very carefully.

Dissolve the fixative holding the cores in the pre-selector coils with acetone, do not force the cores as the coils may become distorted.

1 Set the transceiver up as follows:

AF GAIN	NORMAL LISTENING LEVEL
RF GAIN	FULLY CLOCKWISE (F.C.)
PA TUNE	80m
PRESELECTOR	80m LOWER EDGE OF SEGMENT
CONTROL SWITCH	EXT MOX
IRT TUNE	0
IRT SWITCH	OFF
FUNCTION SWITCH	LSB
MIC GAIN	FULLY COUNTERCLOCKWISE (F.C.C.)
PA LOAD	F.C.
BANDSWITCH	3.5
VFO	000

2 Plug the Signal Generator into the co-axial socket on the rear drop of the transceiver, allow 10 minutes for warm up.

3 CARRIER OSCILLATOR OUTPUT LEVEL
Check the output of the carrier oscillator with the VTVM and RF probe. See fig. 6—3 for test point "A". A voltage of 1.5v should be obtained on both sidebands.

4 VFO OUTPUT LEVEL
Check the output of the VFO with the VTVM and RF probe. See fig. 6—3 for test point "B". A voltage of 0.4v RF should be obtained. If a lower level is obtained this will be due to a faulty ECF82 V11.

5 HF OSCILLATOR LEVEL
Connect the VTVM with RF probe to the junction of C70 60pf and C69 220pf. See Fig. 6—3 for test point "C". Adjust capacitors and inductances for equal reading on band segments as follows. It will first be necessary to loosen the cores in the inductances with acetone. See Fig. 6—1 for location of adjustments. If VTVM is not available, connect multimeter of minimum sensitivity 20,000 ohms per volt on 10 volt range, to pin 1 of V9 1st RX MIXER (6BE6). Adjust capacitors and inductances for equal reading on band segments as follows:

BAND	XTAL FREQUENCY	C OR L	VTVM READING	AVO READING 10V RANGE
1.8	4955	L25	2.0v	- 2.0v
3.5	6655	C73	1.5v	- 1.5v
3.7	6855	C73	1.5v	- 1.5v
7.0	10155	C74	2.0v	- 0.3v
14.0	2x8577.5	L22	2.0v	- 1.2v
14.3	2x8677.5	L22	2.0v	- 1.2v
21.0	2x12077.5	L21	1.3v	- 1.2v
21.3	2x12227.5	L21	1.3v	- 1.2v
28.0	2x15577.5	L20	0.8v	- 1.2v
28.4	2x15777.5	L20	0.8v	- 1.2v
28.6	2x15877.5	L20	0.8v	- 1.2v

5—6 PRE-SELECTOR RECEIVER 3.5MHz BAND

1 Connect the VTVM reading D.C. NEGATIVE to the AVC line. See Fig. 6—3 for test point 'D'. With no signal input a voltage of 0.6v will be obtained.

2 Check that the PRE-SELECTOR pointer is at the lower edge of the 80m segment, and that the transceiver is on 3500KHz.

3 Adjust the output of the S.G. so that there is an input to the Transceiver of 50 microvolts at 3500KHz, rock the S.G. dial until the signal is heard and a peak reading on VTVM is obtained. NOTE: To obtain a 50uv input to the KW2000A, the open circuit voltage of the S.G. will be 100uv.

4 Adjust core of L1 and L6 (see Fig. 6—1 for location) for a peak VTVM reading, the core of L1 must be tuned to the bottom tuning point. NOTE: L1 has two cores in it, the bottomcore is for tuning L1 and the top core for L19 trap.

5 IF TRAP
Adjust frequency of S.G. to 3155KHz and increase input by 54 db i.e. 50uv to 25mv, rock dial about 3155KHz until signal is heard (note a 3155KHz signal is heard because the VFO is on 2700KHz and the difference between 3155KHz and 2700KHz is 455KHz which is the IF frequency). Adjust core of L19 for minimum VTVM reading, should go below that obtained with the 50uv signal at 3500KHz. NOTE: L19 is the top winding of L1.

6 Tune transceiver to 3600KHz, check the frequency by tuning to the 100KHz point at 3600KHz.

7 Adjust frequency of S.G. to 3600KHz, reduce input to Transceiver to 50uv, and adjust PRE-SELECTOR for a peak in VTVM reading.

8 Re-adjust cores of L1 and L6 for peak VTVM reading.

9 4190KHz TRAP
Tune transceiver to 3800KHz, adjust frequency of S.G. to 3800KHz input 50uv, peak Pre-Selector for maximum VTVM, retune S.G. to 4190KHz maximum output, rock S.G. dial until signal is heard, NOTE: signal may be very weak, adjust core of L29 for reduction in signal, it should be just possible to hear signal at 4190KHz when L29 is correctly adjusted. Retune S.G. to 3800KHz input 50uv, adjust L1 for peak reading on VTVM. Change transceiver and S.G. frequency to 3600KHz, repeak Pre-Selector for maximum VTVM reading.

5—7 WIDEBAND COUPLER IFT 2 IFT 3, 455KHz I.F. IFT 4 IFT 5

1 Connect swamping tool between pin 4 IFT 2 and earth, adjust bottom core for peak VTVM reading. See fig. 6—3 for location.

2 Transfer swamping tool to pin 6 IFT2, adjust top core for peak VTVM reading. NOTE: Pin 6 of IFT2 has HT on it—take care.

3 Transfer swamping tool to pin 4 IFT3, adjust bottom core.

4 Transfer swamping tool to pin 6 IFT3, peak top core.

5 Repeat 1, 2, 3, 4.

6 Peak cores of IFT4 and IFT5. VTVM reading should now be 4v for an input of 50uv at 3600KHz.

5—8 S METER CALIBRATION

1 Adjust the S meter linearity pot. RV102, so that the wiper is in the centre of the track.

2 Tune slightly off the 3600KHz signal so that it cannot be heard.

3 Adjust the S METER ZERO pot. RV101 so that the meter reads ZERO.

4 Tune back to the 3600KHz signal for maximum S METER reading.

5 Adjust the S METER SENSITIVITY pot. RV99 so that the S METER reads S9 for an input of 50uv.

6 Increase the input to 50mv. Adjust the S METER LINEARITY pot. for an S METER reading of S9 + 40db.

7 Decrease input to 50uv.

8 Off tune from 3600KHz signal.

9 Re-adjust S METER ZERO pot. for S METER ZERO.

10 Re-tune on to 3600KHz for maximum S METER reading.
11 Re-adjust S METER SENSITIVITY pot. for S9.
12 Increase input to 5mv.
13 Re-adjust S METER LINEARITY pot. for S9 + 40db.
14 Repeat 8, 9, 10, 11, 12, 13 until S METER reads ZERO with no input, S9 with 50uv S9 + 40db with 5mv.

5—9 PRE-SELECTOR TRANSMIT 3.5MHz BAND

1 Unplug S.G. and plug Dummy Load into transceiver, switch to INT MOX.
2 Adjust the PA bias pot. on the PSU, for a standing cathode current of 50mA.
3 Turn the control switch to EXT MOX and the function switch to TUNE.
4 Advance the Mic gain control until cathode current starts to rise and adjust the core of L11 for a peak in cathode current, back off Mic gain to keep cathode current below 75mA as L11 core is adjusted.

5—10 CARRIER BALANCE

1 Connect VTVM reading RF direct across dummy load.
2 Load transceiver to 120mA. A reading of 35v RF should be obtained on VTVM with MIC gain advanced. Switch to INT MOX and USB.
3 Turn MIC gain FCC adjust RV14 and C12 for minimum reading on VTVM. It should be possible to balance down to 0.2v on both side bands.
4 Turn function switch back to USB, control switch to EXT MOX.

5—11 TRANSMITTER SENSITIVITY

1 Turn MIC GAIN FCC. Function switch to INT MOX.
2 Plug the audio generator into the MIC SOCKET f 1.7KHz output ZERO, and switched to 600 ohm Load.
3 Turn the MIC GAIN control FC.
4 Increase the output of the audio generator until the cathode current reaches 120mA.
5 Input required for stated cathode current should be less than 1mV.
6 Turn control switch to EXT MOX. MIC GAIN FCC.
7 Unplug audio generator.
8 Unplug dummy load and plug S.G. into transceiver.

5—12 VFO CALIBRATION & IRT

1 With IRT switch at IRT and IRT tune at 0, tune the transceiver to 3700KHz using the 100KHz calibrator as the signal source. Check the accuracy of the 100KHz signal against a known accurate 100 KHz signal, zero beat by adjusting C158.
2 (a) Check the tracking of the VFO at each 100KHz point. If it is overtracking at 3.5MHz reduce the capacity of C80 by inserting a probe through the hole in the top of the VFO and turning the Philips trimmer anticlockwise.
(b) Reset the VFO dial at 3.7MHz and adjust the core of L28 (see Fig. 6—3) for zero beat. Repeat the above adjustments until the tracking is correct.

(c) If the VFO is undertracking, increase the capacity of C80 by turning the Philips trimmer clockwise. Re-adjust at 3.7MHz for zero beat. Repeat until the tracking is correct.

3 Tune to zero beat at 3600KHz and turn the IRT switch to OFF, adjust RV53 (IRT set pot) for zero beat. See Fig. 6—3 for location.

4 ULSB SWITCHING

(a) Switch to LSB, adjust L28 LINK by inserting a probe through the lower hole in the VFO box for ZERO BEAT, (when transceiver is switched to LSB, RL3 closes completely the circuit of L28 link to earth, causing the frequency of the VFO to increase by an amount equal to the spacing of the carrier crystals, approximately 3KHz).

(b) Switch back to USB and check that ZERO BEAT is still maintained, repeat (a) until switching between USB and LSB ZERO BEAT is maintained.

(c) Leave function switch on USB.

5—13 PRE-SELECTOR GENERAL

It is only necessary to adjust the inductances on one segment of each band, as the PRE-SELECTOR tracking holds good for the whole of each band.

5—14 PRE-SELECTOR 28.4MHz BAND

1 With VTVM connected to AVC test point, tune the transceiver to 28500KHz.
2 Adjust the pre-selector so that the pointer is in the centre of the 10m segment.
3 Tune the S.G. to 28500KHz input 50 uv, rock the dial until the signal is heard.
4 Adjust the cores of L5 and L10 for a peak VTVM reading, final adjustments VTVM should read 4v for 50uv input. Unplug S.G. plug in dummy load.
5 Turn function switch to tune, advance MIC GAIN control for increase in cathode current, adjust L15 for a peak in cathode current.

5—15 NEUTRALISING

1 Adjust MIC GAIN for an OFF RESONANCE cathode current of 130ma.
2 Load up for a cathode current of 120ma at DIP into wattmeter, or if wattmeter not available, connect VTVM with RF PROBE to 75 ohm dummy load via 12pf capacitor, and use the VTVM for RF OUTPUT reading.
3 Check that MAX OUTPUT occurs when PA CATHODE CURRENT is at DIP, i.e. move PA TUNE capacitor either side of DIP and note that RF OUTPUT drops, if it does not, note which side of dip output increases, if it is on the LF side then reduce value of C56, (neutralising C) if it is on the HF side, increase value of C56, repeat until maximum output occurs when PA is at dip. Re-adjust L15 for maximum cathode current. Turn MIC GAIN F.C.C.
4 Turn FUNCTION switch to USB. Unplug dummy load, plug in S.G.

5—16 PRE-SELECTOR 21.3MHz BAND

1 Adjust the pre-selector so that the pointer is in the centre of the segment.
2 Tune the transceiver to 21400KHz.

3 Tune the S.G. to 21400KHz input 50uv—rock the dial until the signal is heard.
4 Adjust the cores of L4 and L9 for a peak VTVM reading, VTVM should read 4v. If L4 has no core in it, rock PRE-SELECTOR about 21400KHz and adjust core of L9 for peak. Unplug S.G. plug in dummy load.
5 Turn function switch to tune, adjust core of L14 to same position in coil as L9, advance MIC GAIN control, adjust C61 for peak in cathode current, reduce MIC GAIN to maintain 75mA cathode current.
6 Adjust MIC GAIN for an OFF RESONANCE cathode current of 130mA.
7 Load up for a cathode current of 120mA at DIP into load with output indication as 5—15 2.
8 Check that MAX OUTPUT occurs when PA CATHODE CURRENT is at DIP. If maximum output occurs when PA TUNE capacitor tuned LF of DIP then increase value of C61, re-adjust L14 for resonance. If it is on the HF side decrease value of C61, re-adjust L14 for resonance. Repeat until maximum output occurs when PA is at dip. Turn MIC GAIN F.C.C.
9 Turn FUNCTION SWITCH to USB. Unplug dummy load, plug in S.G.

5—17 PRE-SELECTOR 14.2MHz BAND

1 Adjust the pre-selector so that the pointer is in the centre of 20m segment.
2 Tune the transceiver to 14300KHz.
3 Tune the S.G. to 14300KHz input 50uv, rock the dial until the signal is heard.
4 Adjust the cores of L3 and L8 for peak VTVM reading, VTVM should read 4v or better. Unplug S.G., plug in dummy load.
5 Turn function switch to tune, adjust core of L13 to same position in coil as L8, advance MIC GAIN control, adjust C162 for peak in cathode current, reduce MIC GAIN to maintain 75mA cathode current.
6 Adjust MIC GAIN for an OFF RESONANCE cathode current of 130mA.
7 Load up for a cathode current of 120mA at DIP into load with output indication as 5—15 2.
8 Check that MAX OUTPUT occurs when PA CATHODE CURRENT is at DIP. If maximum output occurs when PA TUNE capacitor tuned LF of dip, then increase value of C162, re-adjust L13 for resonance. If it is on the HF side, decrease value of C162, re-adjust L13 for resonance. Repeat until maximum output occurs when PA is at dip. Turn MIC GAIN F.C.C.
9 Turn FUNCTION switch to USB. Unplug dummy load, plug in S.G.

5—18 PRE-SELECTOR 40M

1 Adjust the pre-selector so that the pointer is in the centre of the 40m segment.
2 Tune the transceiver to 7100KHz.
3 Tune the S.G. to 7100KHz input 50uv, rock the dial until the signal is heard.
4 Adjust the cores of L2 and L7 for a peak VTVM reading, VTVM should read 4v. Unplug S.G., plug in dummy load.
5 Turn FUNCTION switch to TUNE, advance MIC GAIN, adjust core of L12 for peak in cathode current, reduce MIC GAIN to maintain 75mA cathode current. Turn MIC GAIN F.C.C.
6 Turn FUNCTION switch to USB. Unplug dummy load, plug in S.G.

5—19 PRE-SELECTOR 160M

1 Adjust the pre-selector so that the pointer is between HF end of the 160m segment and the LF end of the 80m segment.

2 Tune the transceiver to 1900KHz.

3 Tune the S.G. to 1900KHz input 50uv, rock the dial until the signal is heard.

4 Adjust the C143 and C43 for peak VTVM reading, VTVM should read 4v for 50uv input. Unplug S.G., plug in dummy load.

5 Turn function switch to tune, advance MIC GAIN control for increase in cathode current, adjust C47 for peak cathode current. Turn MIC GAIN F.C.C.

6 Turn FUNCTION switch to USB.

TABLE 6—1

SIGNAL LEVELS RECEIVER

TEST POINT	SIGNAL INJECTION POINT	GENERATOR OUTPUT FREQUENCY	GENERATOR OUTPUT VOLTAGE	NORMAL INDICATION
	V17 Pin 3	1700Hz	8.6 volts	1.5w AF o/p
	V17 Pin 1	1700Hz	200m volts	1.5w AF o/p
A	V16 Pin 8	Carrier Oscillator Injection (BFO)		1.5—2.5v RF
	V12 Pin 1	455KHz	120m volts	4.0v AVC
	V13 Pin 1	455KHz	1.4m volts	4.0v AVC
B	V19 Pin 1	VFO Injection		0.3—0.5v RF
	V19 Pin 5	455KHz	1.5m volts	4.0v AVC
	V19 Pin 7	455KHz	800u volts	4.0v AVC
	V19 Pin 7	3055KHz	1.5m volts	4.0v AVC
C	V5 Pin 3	H.F. Osc. Injection	All bands	0.8—2.0 RF
	V9 Pin 5	3055KHz	1m volts	4.0v AVC
	V9 Pin 7	3055KHz	1.4m volts	4.0v AVC
	V6 Pin 7	3.6MHz	1.6m volts	4.0v AVC
	V6 Pin 2	3.6MHz	200u volts	4.0v AVC
	ANT	3.6MHz	50u volts	4.0v AVC

SIGNAL GENERATOR TERMINATION IMPEDANCE 52 OHMS. INJECTION VIA 0.01 uf CONDENSER EXCEPT ANTENNA MEASUREMENT. TRANSCEIVER ON 3600KHz.

TABLE 6—2

SIGNAL LEVELS TRANSMITTER

FREQUENCY	3600KHz
FUNCTION	TUNE
MICROPHONE	DISCONNECT
ANT SOCKET	52 OHM LOAD
PA TUNE	ON RESONANCE
PA LOAD	8
PRE-SELECTOR	PEAKED ON 80m

ADJUST THE MIC GAIN CONTROL FOR 1 VOLT R.M.S. ON ITS WIPER CONTACT

TEST POINT	VALVE	FREQUENCY	R.F. VOLTAGE	SETTING OF MIC GAIN
'A' pin 1 tone osc	V15 12AX7	1.4KHz	19.5v	1v on wiper
Wiper mic gain		1.4KHz	1.0v	1v on wiper
Junction RFC 1, C6, C7		1.4KHz	370mv	1v on wiper
Wiper carrier bal pot	RV 14	456.0KHz	190mv	F.C.C.
Wiper carrier bal pot	RV 14	454.6KHz	480mv	1v on wiper
Primary I.F.T. 1		454.6KHz	340mv	1v on wiper
Secondary I.F.T. 1		454.6KHz	460mv	1v on wiper
'G' pin 2 TX IF amp	V3 EF183	454.6KHz	440mv	1v on wiper
'A' pin 7 TX IF amp	V3 EF183	454.6KHz	16.5v	1v on wiper
G terminal mech filter		454.6KHz	12.5v	1v on wiper
P terminal mech filter		454.6KHz	5.5v	1v on wiper
'G' pin 2 1st TX mixer	V4 12AT7	454.6KHz	5.3v	1v on wiper
'K' pin 3 1st TX mixer	V4 12AT7	2599.0KHz	290mv	F.C.C.
'A' pin 1 1st TX mixer	V4 12AT7	3053.6KHz	2.3v	1v on wiper
Pin 4 I.F.T. 2		3053.6KHz	1.6v	1v on wiper
Pin 4 I.F.T. 3		3053.6KHz	460mv	1v on wiper
'G' pin 2 2nd TX mixer	V5 12AT7	3053.6KHz	1.0v	1v on wiper
'K' pin 3 2nd TX mixer	V5 12AT7	6655.0KHz	2.0v	F.C.C.
'A' pin 1 2nd TX mixer	V5 12AT7	3601.4KHz	8.6v	1v on wiper
'G' pin 2 driver	V7 6CH6	3601.4KHz	7.8v	1v on wiper
'A' pin 7 driver	V7 6CH6	3601.4KHz	95.0v	1v on wiper
'G' pin 5 P.A.	V8 6146	3601.4KHz	72.0v	1v on wiper

P.A. GRID CURRENT FOR ABOVE TEST = 12mA

VALVE VOLTMETER USED, AIRMEC TYPE 314

TABLE 6—3

VOLTAGE MEASUREMENTS RECEIVE CONDITION

BAND	3.5
AF GAIN	FCC
FUNCTION	LSB
MIC	DISCONNECTED
RF GAIN	FC
CONTROL	EXT. MOX

VALVE PIN CONNECTIONS

V	TYPE	FUNCTION	1	2	3	4	5	6	7	8	9
V1	12AX7	Mic Amp/ 1st Vox	175	0	2.8	0	0	95	0	0.9	6.3
V2	12AT7	Cath Foi	—		—	—	0	185	- 55	0	6.3
V3	EF183	Tx IF Amp	0	- 40	0	6.3	12.6	0	240	240	0
V4	12AT7	1st Tx Mix	230	- 55	0	6.3	6.3	230	- 55	0	12.6
V5	12AT7	2nd Tx Mix	230	- 55	0	12.6	12.6	230	- 55	0	6.3
V6	EF183	Rx RF Amp	0.35	- 0.2	0.35	6.3	0	0	235a	35a	0
V7	6CH6	Tx Driver	—	- 55	0	6.3	0	—	240	240	0
V8/23	6146	Power Amp	0	6.3	0	0	- 50	0	0	0	840 T.C.
V9	6BE6	1st Rx Mix	- 1.5a	1	6.3	12.6	230	52	0		
V10	6AM6	HF Osc	- 2.5a	0	6.3	0	220	0	160a		
V11	6U8	V.F.O.	115	0	78	0	6.3	72	1.2	4.5	4.2
V12	6BA6	2nd IF Amp	0	—	6.3	12.6	200	135	3.0		
V13	6BA6	1st IF Amp	0	—	6.3	12.6	200	135	3.0		
V14	6AL5	AVC Det	0	- 0.2	12.6	6.3	4	—	- 0.2		
V15	12AX7	Prod Det/ Tone Osc	175	0	2.6	6.3	6.3	135	- 1	0.6	12.6
V16	12AT7	Car Osc	95	- 0.3	0	0	0	95	0	3.5	6.3
V17	ECL82	A.F. Amp	0	17	0	6.3	12.6	225	240	1	75
V18	12AT7	S Meter Amp	180	0	2.4	6.3	6.3	180	0	2.4	12.6
V19	6BE6	2nd Rx Mix	0	1.2	6.3	12.6	235	52	0		
V20	OA2	V. Reg.	150v	—	—	—	150v	—	0		
V21	12AT7	2nd Vox/ Vox Act	80	0	1.6	6.3	6.3	240	0	50	12.6
V22	6BA6	Calib.	- 55	0	12.6	6.3	100	65	0		

a VARIES WITH BAND

V22 MEASURED WITH CALIBRATOR ON

TABLE 6—4

VOLTAGE MEASUREMENTS TRANSMIT CONDITION

BAND	3.5
MIC GAIN	FCC
CAL	OFF
FUNCTION	LSB
MIC	CONNECT
CONTROL	INT. MOX

VALVE PIN CONNECTIONS

V	TYPE	FUNCTION	1	2	3	4	5	6	7	8	
V1	12AX7	Mic Amp/ 1st Vox	60	0	0.4	0	0	90	0	0.8	6.
V2	12AT7	Cath Fol	—	—	—	—	0	150	0	2.6	6
V3	EF183	Tx IF Amp	1.0	0	1.0	6.3	12.6	0	57	55	(
V4	12AT7	1st Tx Mix	170	0	1.5	6.3	6.3	170	0	1.5	12
V5	12AT7	2nd Tx Mix	210	- 0.3a	1.7	12.6	12.6	210	- 0.5a	1.3	6.
V6	EF183	Rx RF Amp	0	- 55	0	6.3	0	0	210	225	(
V7	6CH6	Tx Driver	0	0	3	6.3	0	—	230	200	(
V8/23	6146	Power Amp	0	6.3	230	0	- 50b	0	0	0	750
V9	6BE6	1st Rx Mix	- 55	0	6.3	12.6	170	230	- 55		
V10	6AM6	HF Osc	- 2.5a	0	6.3	0	210	0	150a		
V11	6U8	V.F.O.	115	0	78	0	6.3	72	1.2	4.5	4.
V12	6BA6	2nd IF Amp	- 55	0	6.3	12.6	230	225	0		
V13	6BA6	1st IF Amp	- 55	0	6.3	12.6	230	225	0		
V14	6AL5	AVC Det	- 55	- 55	12.6	6.3	3.5	—	- 55		
V15	12AX7	Prod Det/ Tone Osc	165	0	2.5	6.3	6.3	165	- 50	0	12
V16	12AT7	Car Osc	95	- 0.3	0	0	0	95	0	3.5	6.
V17	ECL82	A.F. Amp	0	16.5	0	6.3	12.6	210	230	1	7
V18	12AT7	S Meter	165	0	2	6.3	6.3	165	- 2c	2.0	12
V19	6BE6	2nd Rx Mix	- 55	0	6.3	12.6	230	225	- 55		
V20	OA2	V. Reg.	150	—	—	—	150	—	0		
V21	12AT7	2nd Vox/ Vox Act	75	0	1.5	6.3	6.3	135	0	0.9	12
V22	6BA6	Calib.	0	0	12.6	6.3	225	220	52		

a VARIES WITH BAND
b DEPENDENT ON PA BIAS POT SETTING
c DEPENDENT ON S METER SENSITIVITY POT SETTING

TABLE 6—5

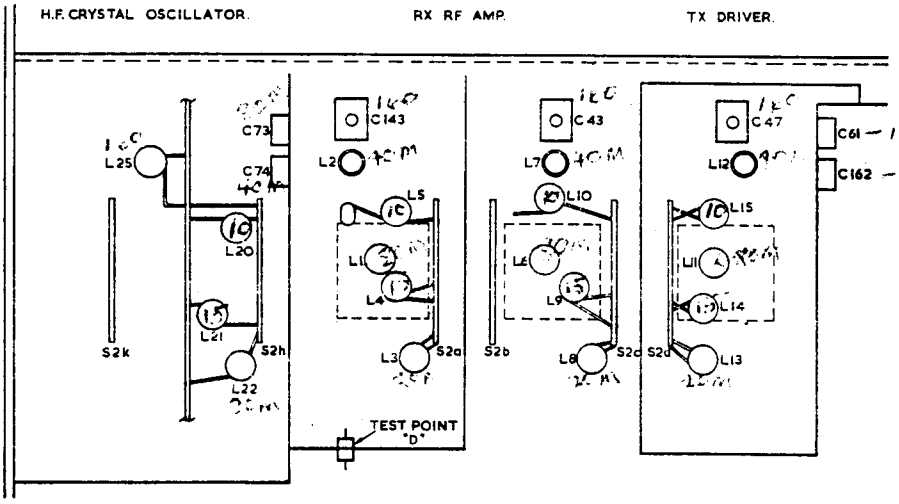
RESISTANCE MEASUREMENTS

BAND	3.5
AF GAIN	FC
RF GAIN	FC
FUNCTION	OFF
MIC GAIN	FCC
CONTROL	EXT MOX
IRT	OFF
POWER	DISCONNECTED
MICROPHONE	DISCONNECTED

VALVE PIN CONNECTIONS

V	TYPE	FUNCTION	1	2	3	4	5	6	7	8	9
V1	12AX7	Mic Amp/ 1st Vox	240k	1.0meg	Inf	0	0	200k	470k	2.2k	0
V2	12AT7	Cath Fol	—	—	—	—	0	35k	570k	2.2k	0
V3	EF183	Tx IF Amp	100	1.2meg	100	0	0	0	40k	66k	0
V4	12AT7	1st Tx Mix	20k	200k	220	0	0	20k	200k	220	0
V5	12AT7	2nd Tx Mix	16.5k	200k	220	0	0	16.5k	200k	220	0
V6	EF183	Rx RF Amp	47	700k	47	0	0	0	16.5k	137k	0
V7	6CH6	Tx Driver	100	147k	100	0	0	—	15k	22k	0 EL821
V8	6146	Power Amp	0	0	25k	0	Inf	0	0	0	Top cap Inf
V9	6BE6	1st Rx Mix	47k	270	0	0	20k	83k	100k	—	—
V10	6AM6	HF Osc	100k	0	0	0	20k	0	67k	—	—
V11	6U8	V.F.O.	22k	68k	64.5k	0	0	40k	270	680	100k
V12	6BA6	2nd IF Amp	1meg	0	0	0	24k	48k	270	—	—
V13	6BA6	1st IF Amp	1meg	0	0	0	24k	48k	270	—	—
V14	6AL5	AVC Det	0	502k	0	0	1k	—	500k	—	—
V15	12AX7	Prod Det/ Tone Osc	120k	150k	80k	0	0	66k	332k	680	0
V16	12AT7	Car Osc	40k	100k	Inf	0	0	40k	100k	Inf	0
V17	ECL82	A.F. Amp	1meg	470	470k	0	0	15k	15k	2.2k	240k
V18	12AT7	S Meter	20k	0	250	0	0	20k	360k	250	0
V19	6BE6	2nd Rx Mix	47k	270	0	0	20k	83k	100k	—	—
V20	OA2	V. Reg.	17.5k	0	—	0	17.5k	—	0	—	—
V21	12AT7	2nd Vox/ Vox Act	235k	70k	2.2k	0	0	30k	10meg	12.7k	0
V22	6BA6	Calib.	1meg	0	0	0	117k	237k	Inf	—	—

ALL MEASUREMENTS ARE GIVEN IN OHMS UNLESS OTHERWISE SPECIFIED



80m	C 73	L1	L6	L11	C61 — 15M
10m	L 20	L5	L10	L15	C162 — 20M
15m	L 21	L4	L 9	L14	
20m	L 22	L 3	L 8	L13	
40m	C 74	L 2	L 7	L12	
160 m	L 25	C143	C43	C47	

FIG. 6-1.

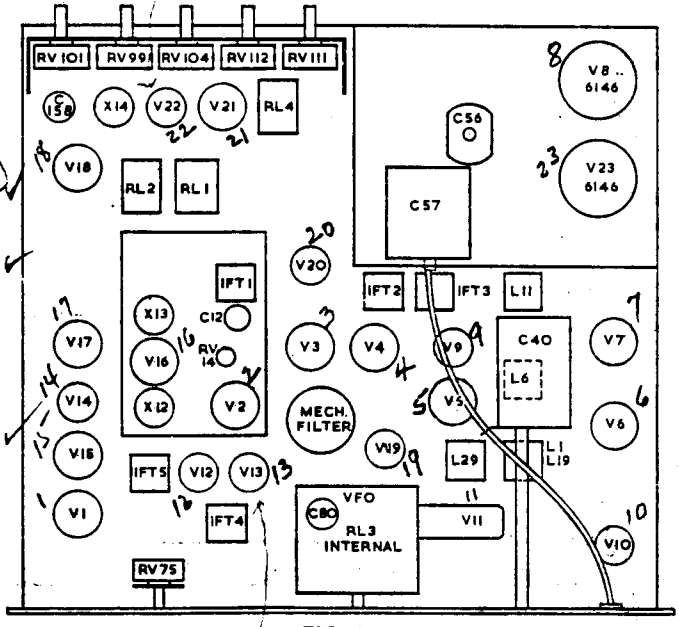


FIG. 6-2.

V1 - 12AX7
V2 - 12AT7
V3 - EF183 (6EH7)
V4 - 12AT7
V5 - 12AT7
V6 - EF183 (6EH7)
V7 - 6CH6
V8-23- 6146
V9 - 6BE6
V10 - 6AM6 EF91
V11 - 6U8
V12 - 6BA6
V13 - 6BA6
V14 - 6AL5
V15 - 12AX7
V16 - 12AT7
V17 - ECL82 (6BM8)
V18 - 12AT7
V19 - 6BE6
V20 - OA2
V21 - 12AT7
V22 - 6BA6

Replaced

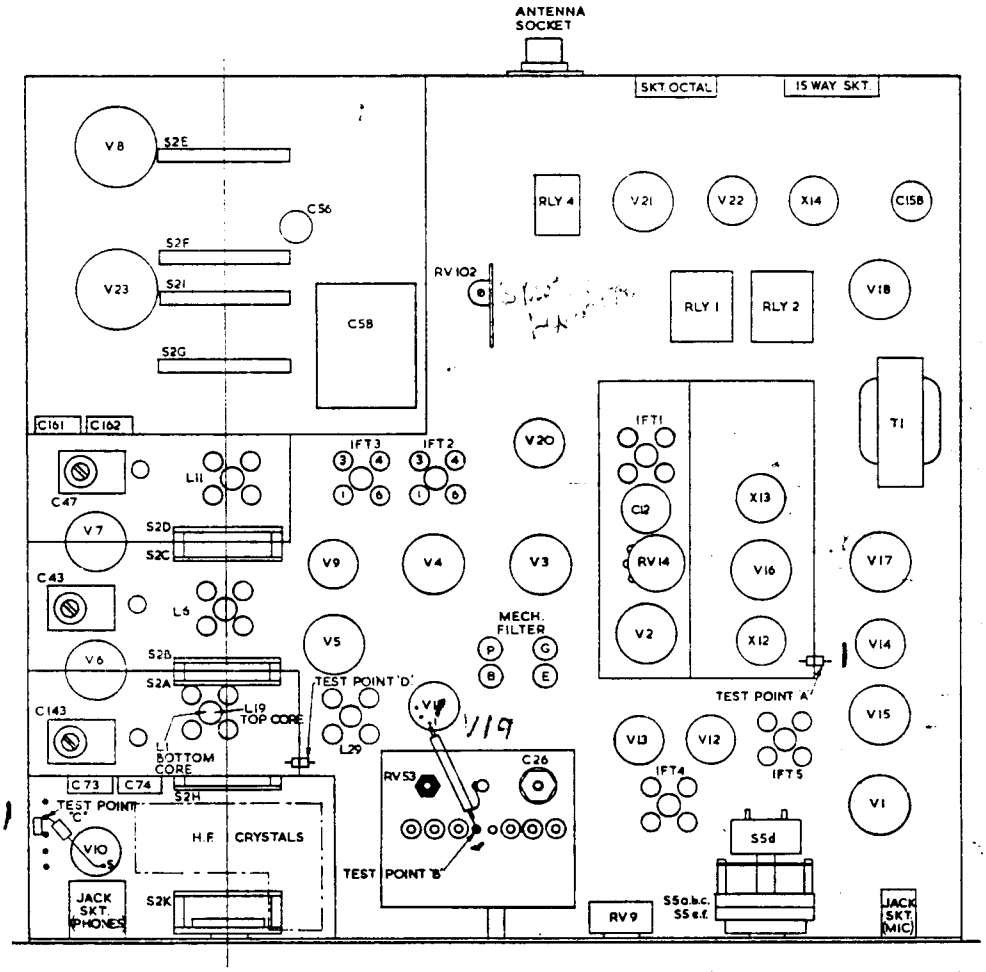


FIG. 6-3 LOCATION OF ADJUSTMENTS.
(UNDER CHASSIS VIEW).

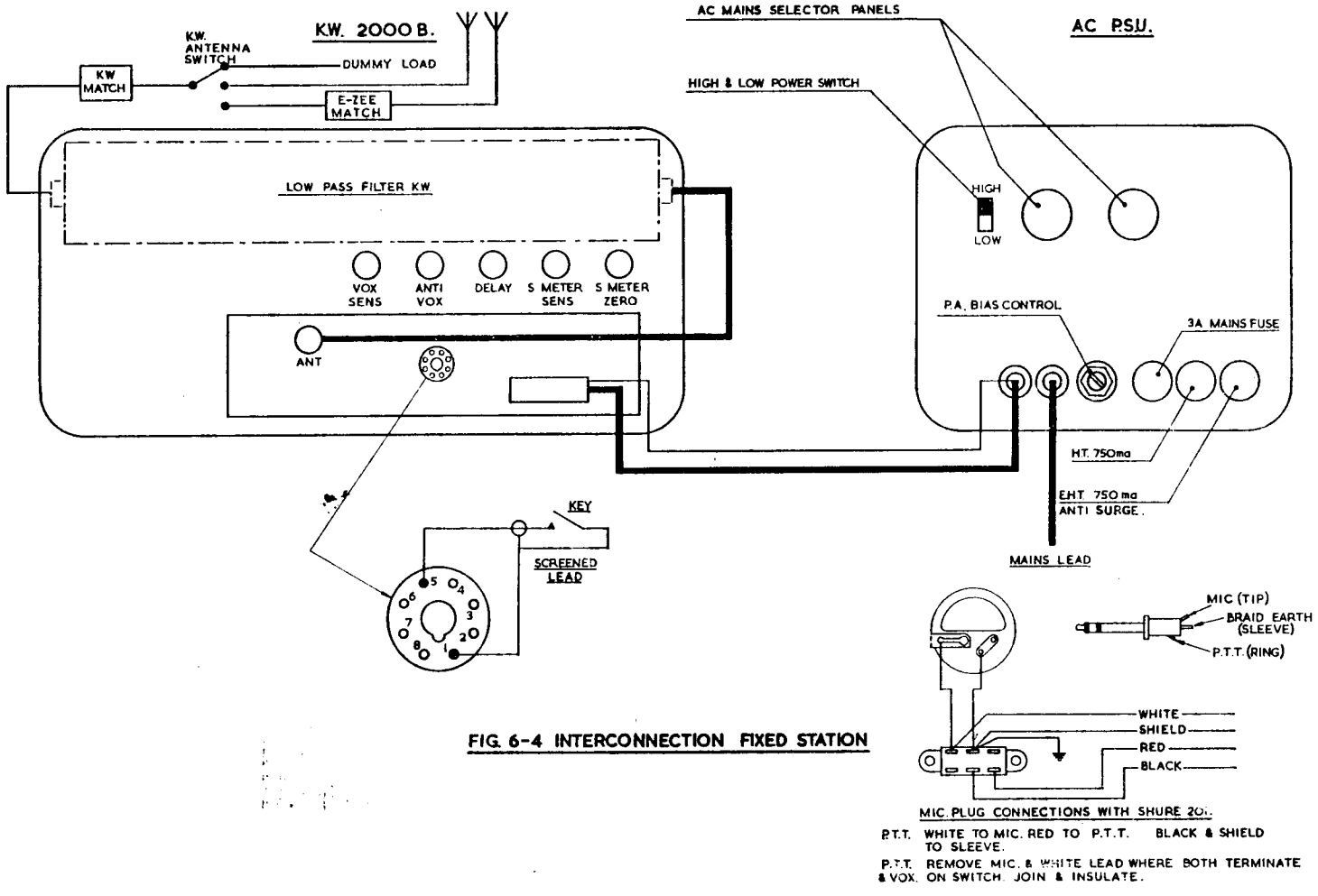


FIG. 6-4 INTERCONNECTION FIXED STATION

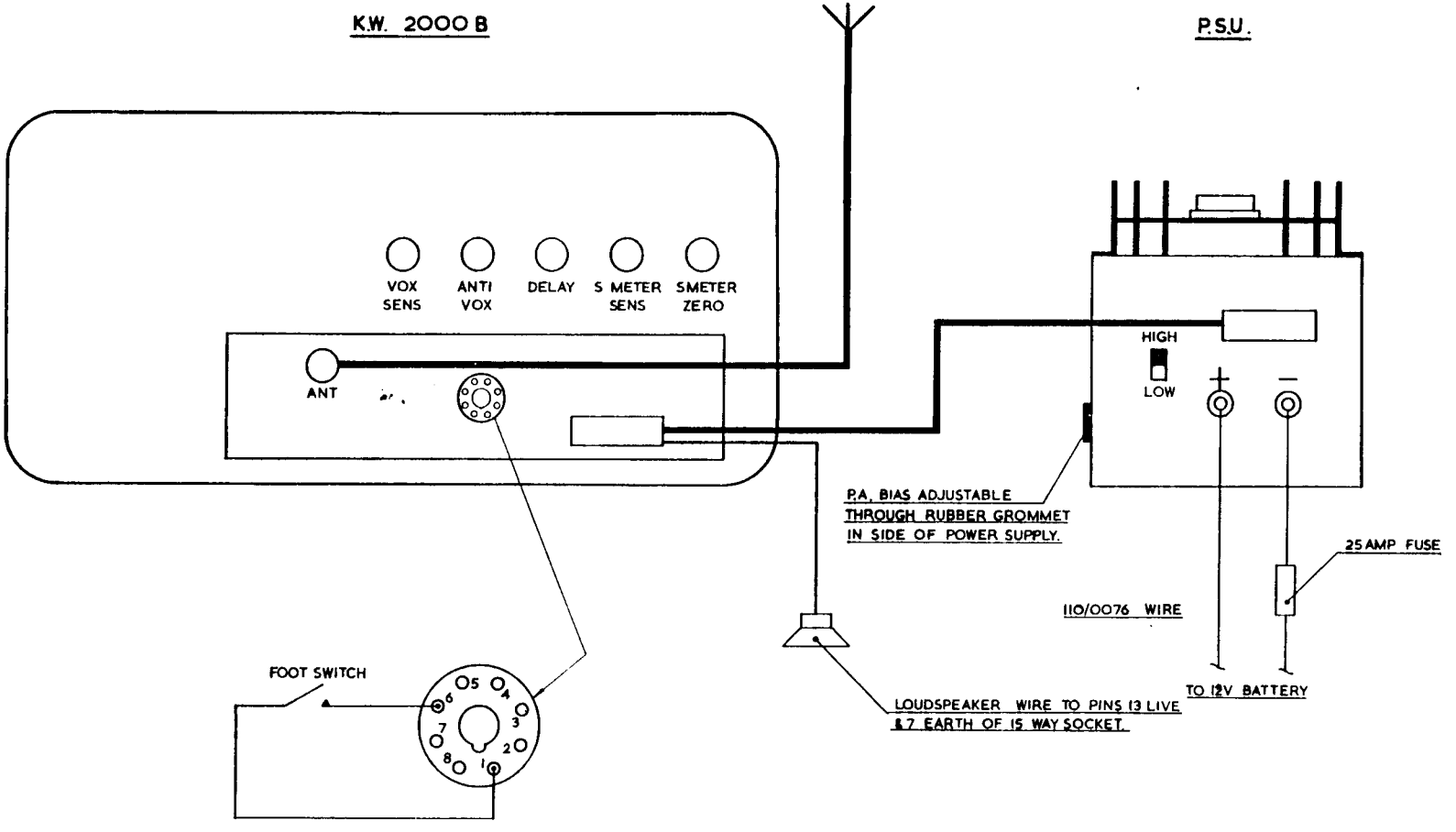


FIG. 6-5 INTERCONNECTION MOBILE STATION

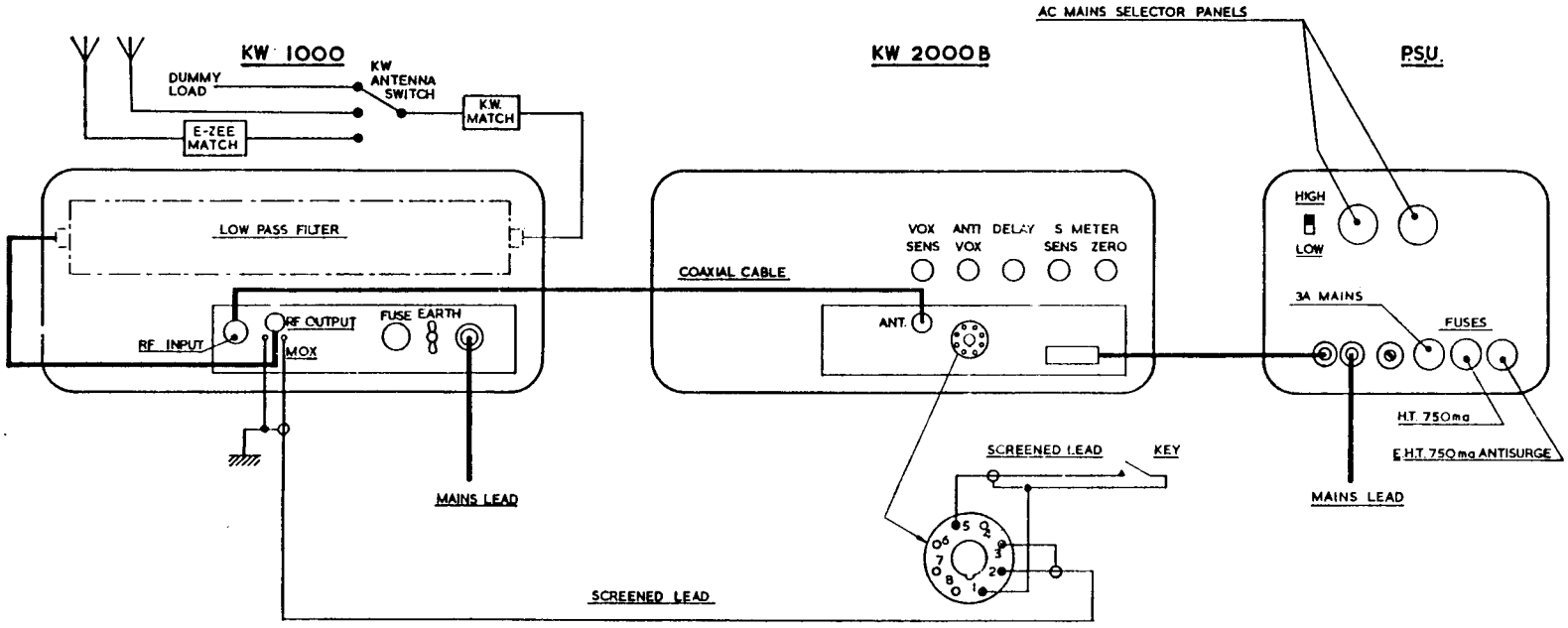


FIG. 6-6 INTERCONNECTION WITH KW 1000

REPAIRS UNDER GUARANTEE

If the material or equipment was purchased direct from K.W. ELECTRONICS LTD., and you wish to return it for service under guarantee, you should write to the address shown below giving full particulars including the details listed. Upon receipt of such notice, KW will promptly advise you respecting the return. Failure to secure our advice prior to forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

ADDRESS
K.W. ELECTRONICS LTD.
SERVICE SECTION
VICEROY WORKS
R/O 23 HIGH STREET
CRAYFORD
KENT
Tel: CRAYFORD 22040

INFORMATION NEEDED

(a) Type number, name and serial number of equipment.
(b) Date of delivery of equipment.
(c) Nature of trouble.
(d) Number of hours of service.
(e) Cause of trouble if known.

If the equipment was purchased from an agent it should be returned to the agent for service.

OUT OF GUARANTEE REPAIRS

If you wish to return your equipment for repairs, write to the above address giving full particulars including the details listed. Upon receipt of such notice, KW will advise you respecting return. Do not send the goods without first obtaining our advice.

INFORMATION NEEDED

(1) Type number, name and serial number of equipment.
(2) Number of hours of service.
(3) Complete instructions detailing work to be performed.
(4) Your return address.
(5) Method of shipment by which the equipment should be returned.
(6) Special instructions.

SERVICE QUERIES

Any technical queries regarding KW Electronics Equipment should be addressed to our Crayford works and marked "For the attention of Service Section".

GUARANTEE

This equipment is conditionally guaranteed by us for a period of six months from date of purchase by the actual user. In the event of any failure during this period, due to faulty workmanship or material, the dealer from whom the equipment was purchased should be notified. The dealer reserves the right to make a reasonable charge for labour, obtaining from us any necessary part for replacement free under this guarantee.

Equipment should not be returned to us direct without prior arrangements having been made. Equipment returned must be sent carriage paid by the sender and well packed. If rail transport is used, the package should be consigned at Railway Company's Risk rate. We also reserve the right to make a charge for labour, handling expenses and return carriage.

Any interference or alteration to equipment, without our consent, renders this guarantee void. The guarantee does not apply to equipment purchased second-hand or at less than our standard list price. The guarantee is not transferable.

Valves used in this equipment are guaranteed by the valve manufacturer for a period of three calendar months from the date of purchase. This guarantee is only given in respect of faulty workmanship and material and does not cover misuse or consequential damage. Claims under this guarantee will only be considered if the valve is returned to the valve manufacture through the dealer from whom the equipment was purchased supported by proof of the date of purchase of the equipment as issued by K.W. Electronics Ltd. To ensure proper examination, the right is reserved to break open any valve, if necessary, without obligation to return or replace.

Please complete and return the Guarantee Card within one month of the date of purchase.