

**INSTRUCTION BOOK No. 60604R
CRYSTAL OSCILLATOR UNIT
TYPE 1C60604**

**AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED
47 YORK STREET,
SYDNEY**

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	Crystal Oscillator Unit type 1C60604 Circuit	60604D1

1.—GENERAL DESCRIPTION

1.1 Application

The A.W.A. Crystal Oscillator Unit type 1C60604 is specially designed to supplement the resources of the General Purpose Communication Receiver CR-6, series C60600. It may be fitted to the receiver to provide up to six crystal-locked receiving frequencies anywhere within the range of the receiver.

With this facility the receiver is converted to a highly stable unit suitable for the reception of fixed services such as radio telephone networks using amplitude modulation. The receiver is also suitable for the reception of single-sideband and frequency shift keying signals with the local 100 kc/s oscillator used as a carrier re-insertion generator. Fine tuning may be carried out using the B.F.O. control and the vernier **FREQ. CONTROL** on the oscillator unit.

The oscillator unit is supplied complete and may be fitted to the receiver with very little trouble, the necessary mounting holes being already provided in the chassis and front panel. Type "D" plug-in crystals are supplied for frequencies and tolerances as required. The crystals may be changed at any time without further modification to the equipment.

1.2 Mechanical Construction

The unit is assembled on a small chassis which carries the oscillator valve, the crystals and associated components, and a trimmer capacitor and band switch driven by concentric controls. Mounting holes are provided on the main chassis of the receiver to take the crystal oscillator unit; the sub-panel and the front panel are drilled for the control spindles and the unit is mounted by means of two 4 BA screws.

When the front cover panel is not stencilled for the crystal oscillator controls, an adhesive plate is supplied with the designations printed on it.

The concentric controls take the form of a knob operating the trimmer capacitor and a lever type control to operate the crystal selector switch. The **MANUAL** position of this switch disconnects the crystal oscillator and converts the receiver to the continuously tunable condition.

1.3 Technical Description

The crystal oscillator circuit comprises a half-12AU7 type valve with the crystal connected between anode and grid in a Pierce circuit. The crystals are switched by SWA, and in the crystal positions, the unit is connected to the first mixer valve so that the variable oscillator (triode section of V2 in the R.F. Coil Unit) now acts as an amplifier for the crystal oscillator, or as a doubler-amplifier if the receiver circuits are tuned to twice the fundamental frequency. The trimmer capacitor C2 is used as a fine frequency control and is adjusted for each channel by the **FREQ. CONTROL** knob.

A compensating circuit is provided to maintain a constant shunt capacitance across the mixer tuned

circuit under all conditions. When the unit is fitted, the fixed shunt capacitor C42 ($15\mu\mu\text{F.}$) is removed from the mixer tuned circuit. The two coaxial leads to the oscillator unit each have a shunt capacitance of approximately $7.5\mu\mu\text{F.}$ to earth. In the **MANUAL** position of the switch the inner conductors are connected together by SWA and the shunt capacitance is then $15\mu\mu\text{F.}$ In the crystal positions one of these leads is open circuited, and the compensating capacitor C1 is then switched across the tuned circuit to provide an equivalent capacitance. This compensating capacitor is adjusted on installation as described in sub-section 2.3.

A protective cathode bias is provided to avoid excessive current in the crystal oscillator valve in the event of selection of a switch position for which no crystal is fitted.

1.4 Crystals

The crystals supplied are type "D," with frequency and tolerance as specified, and adjusted for a shunt capacitance of $30\mu\mu\text{F.}$ When ordering, full details of frequency, tolerance and operating temperature range should be supplied.

The frequencies may be anywhere within the range of the receiver, and may be on any band or combination of bands. The crystal required for any frequency f may be calculated as follows:

(a) Double Sideband plus Carrier (AM)

Signal Frequency (f) (Mc/s)	Crystal Frequency (Mc/s)
2 to 14.2	$f + 1.8$
14.2 to 15	$f + 1.8$
	2
15 to 17.8	$f - 1.8$
17.8 to 30	$f - 1.8$
	2

Tolerance $\pm 0.01\%$ from $+10^\circ\text{C.}$ to $+60^\circ\text{C.}$

(b) SSB Reception

If the unit is required to receive SSB signals it will be necessary to know whether upper or lower sideband reception is required.

Signal Frequency (f) (Mc/s)	Crystal Frequency (Mc/s)	
	Upper Sideband	Lower Sideband
2 to 14.2	$f + 1.8015$	$f + 1.7985$
14.2 to 15	$f + 1.8015$	$f + 1.7985$
	2	2
15 to 17.8	$f - 1.8015$	$f - 1.7985$
17.8 to 30	$f - 1.8015$	$f - 1.7985$
	2	2

Tolerance $\pm 0.005\%$ from $+10^\circ\text{C.}$ to $+60^\circ\text{C.}$

2.—INSTALLATION AND OPERATION

2.1 Installation

To install the crystal oscillator unit, remove the receiver from the case or rack and proceed as follows:

1. The front panel is drilled to take the control spindles, and a removable plug is fitted to the hole when not in use. This hole is on the right hand side of the panel, directly above the R.F. GAIN control. Remove the plug.
2. Slide the unit in from the rear so that the spindles project through the hole to the front panel and the chassis is over the mounting holes in the main chassis of the receiver. Screw in position with the two 4 BA screws, washers and nuts supplied, aligning the unit so that the spindles are free in the front panel hole.
3. If the panel is not already stencilled, fix the adhesive plate supplied, with the 0 of the **FREQ. CONTROL** scale vertical.
4. Fit the switch lever, with the window showing **MANUAL** when the switch is in the extreme anti-clockwise position. Fit the **FREQ. CONTROL** knob over the inner spindle and align the pointer to F crystal channel when the trimmer capacitor is fully in mesh.

2.2 Connections

In order to complete the wiring of the unit to the receiver it will be necessary to remove the rearmost partition from the r.f. coil box. This is done by unscrewing the four screws holding the partition to the chassis. An insulating post will be found adjacent to pins 6 and 7 of V2 on the R.F. Coil Unit. The tags on the terminal board on the side of the r.f. coil box (TSA in Drg. 60602C1) are numbered from the rear of the unit.

CAUTION. The greatest care must be exercised when soldering the coaxial leads. It is essential to use a small soldering iron with a clean, well tinned bit, so as to avoid damage to the insulation of the cables, the r.f. coils and the Styrofoam capacitors. All of these can be damaged by excessive heat or accidental contact with the soldering iron.

1. Connect the leads from the crystal oscillator unit as follows:
 - (a) Brown lead (heater) to TSA5 on R.F. Coil Unit.
 - (b) Red lead (150V. h.t.) to TSA7 on R.F. Coil Unit.
 - (c) Coaxial cable (green sleeve) to insulated post on R.F. Coil Unit.
 - (d) Coaxial cable (plain) to pin 7, V2 on R.F. Coil Unit.
 - (e) Coaxial screening braids to earth tag on the oscillator coil nearest V2.

NOTE. Do not shorten the coaxial leads; the length has been adjusted to provide the correct shunt capacitance.

2. Transfer C84 from pin 7 of V2 to the insulated post.
3. Remove C42 ($15\mu\text{F.}$) from the R.F. Coil Unit.

2.3 Alignment

After the crystal oscillator unit has been fitted, switch to **MANUAL** and carefully check the calibration of the receiver. The r.f. circuits have not been disturbed and should not require any attention, but it may be necessary to make some slight adjustments to the oscillator section, using the built-in crystal calibrator and following the instructions on R.F. Alignment, sub-section 4.4 in the Receiver Handbook.

As explained above in sub-section 1.3, the two coaxial leads provide an effective shunt capacitance of $15\mu\text{F.}$ across the oscillator tuned circuit when the selector switch is in the **MANUAL** position. In the crystal positions, one of these leads is open-circuited, and $7.5\mu\text{F.}$ is removed from the tuned circuit and replaced by the compensating trimmer capacitor C1. To adjust this compensating capacitor, proceed as follows:

1. Select a crystal which will give a signal frequency on the high end of any band (e.g., 11.8 Mc/s crystal for 10 Mc/s signal frequency).
2. Plug in the crystal and set the selector switch to the appropriate position. Set the **FREQ. CONTROL** to 0.
3. Plug an 0-100 $\mu\text{A.}$ meter into TJA (pin jacks at the rear of the R.F. Coil Unit).
4. Set the dial pointer accurately to the signal frequency of the selected crystal (10 Mc/s in the example).
5. Peak trimmer C1 on the oscillator unit for maximum reading on the $\mu\text{A.}$ meter.

This compensating adjustment is only required when the crystal oscillator unit is first installed. No adjustment is required thereafter.

2.4 Operation

To operate on a crystal-locked frequency, turn the selector switch to the channel required, the **FREQ. CONTROL** to 0 and then manually tune the receiver to the channel frequency, as described in the receiver handbook, sub-section 3.6. Tune the receiver for maximum noise output. If a signal is present on the channel, the receiver should be adjusted for maximum output as indicated on the signal strength meter. The **FREQ. CONTROL** may then be used as a fine tuning control.

When the crystal oscillator unit is switched out of circuit (**MANUAL** position of selector switch) the equipment operates as a conventional tunable receiver. The method of operation is then exactly as described in the receiver handbook.

3.—MAINTENANCE

3.1 General

The oscillator valve is a miniature type and the remarks on the handling of such valves, in sub-section 4.2 of the Receiver Handbook, apply to this unit.

The rotary switch may be cleaned and lubricated following the procedure given in sub-section 4.5 of the Receiver Handbook. If the inner spindle (controlling the trimmer capacitor) appears to bind on the outer spindle, as evidenced by a tendency of the **FREQ. CONTROL** knob to turn as the switch is rotated, it may be cleaned by removing the knob, dismounting the trimmer capacitor and withdrawing it complete with inner spindle from the rear. Thoroughly clean the inner spindle and the inside of the

hollow outer spindle; then check that the inner spindle is straight, and runs freely in the outer spindle. Apply a small quantity of switch lubricant to the inner spindle and then reassemble, taking care to adjust the trimmer capacitor so that its spindle is quite free and does not foul the outer spindle.

3.2 Voltages

The following voltages were measured with respect to earth (chassis) using a Voltohmyst.

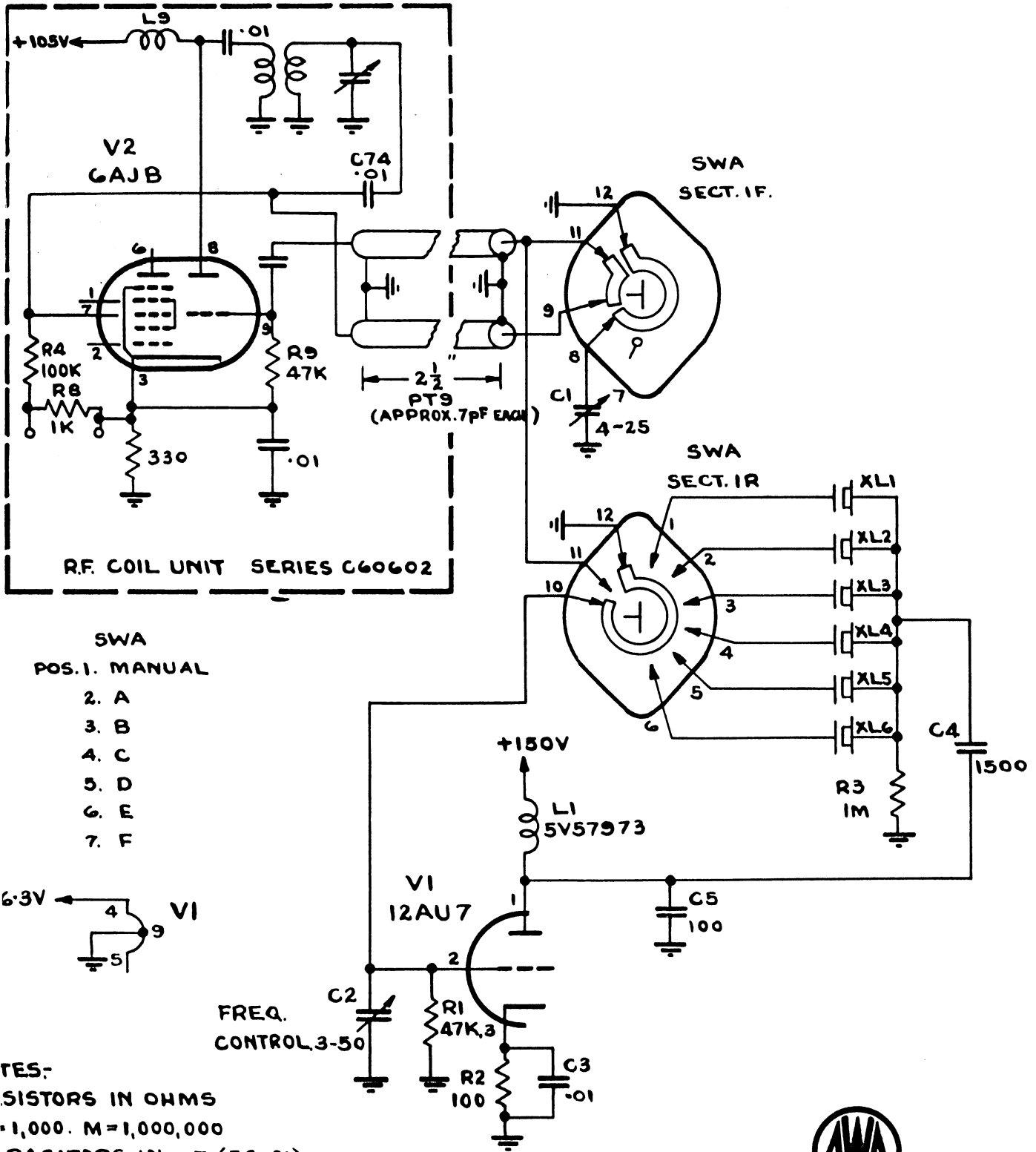
V1 pin 1 (anode)	150V
V1 pin 3 (cathode)	1.1V (protective bias)

4.—COMPONENT SCHEDULE

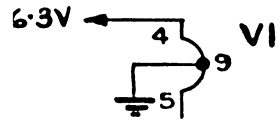
When ordering replacement parts, please quote ALL details given below for a particular component. The component supplied against the order may not be identical with the original item in the equipment,

but will be a satisfactory replacement differing in only minor mechanical or electrical details; such differences will not impair the operation of the equipment.

CIRC. REF. NO.	DESCRIPTION	A.W.A. PART No. Unless otherwise stated
(a) Capacitors		
C1	21 $\mu\mu\text{F}$. swing, variable, concentric	Philips type 82755/25E
C2	42 $\mu\mu\text{F}$. swing, variable, air dielectric	Oxley type CVA-50
C3	.01 μF . $\pm 20\%$, 500V.W., ceramic tubular	Ducon type CTR K6000-B
C4	1500 $\mu\mu\text{F}$. $-0+100\%$, 500V.W., ceramic disc	Ducon type CDS K6000-A
C5	100 $\mu\mu\text{F}$. $\pm 5\%$, 500V.W., ceramic disc	Ducon type CDS NPO-D
(b) Resistors		
R1	47 $\text{k}\Omega$ $\pm 10\%$, 1/4W., composition, grade 2.	
R2	100 Ω $\pm 10\%$, 1/4W., composition, grade 2.	
R3	1 $\text{M}\Omega$ $\pm 10\%$, 1/4W., composition, grade 2.	
(c) Miscellaneous		
L1	Inductor	5V57973
SWA	Switch, Oak type "H"	60604V4



- SWA
POS. 1. MANUAL
- 2. A
 - 3. B
 - 4. C
 - 5. D
 - 6. E
 - 7. F

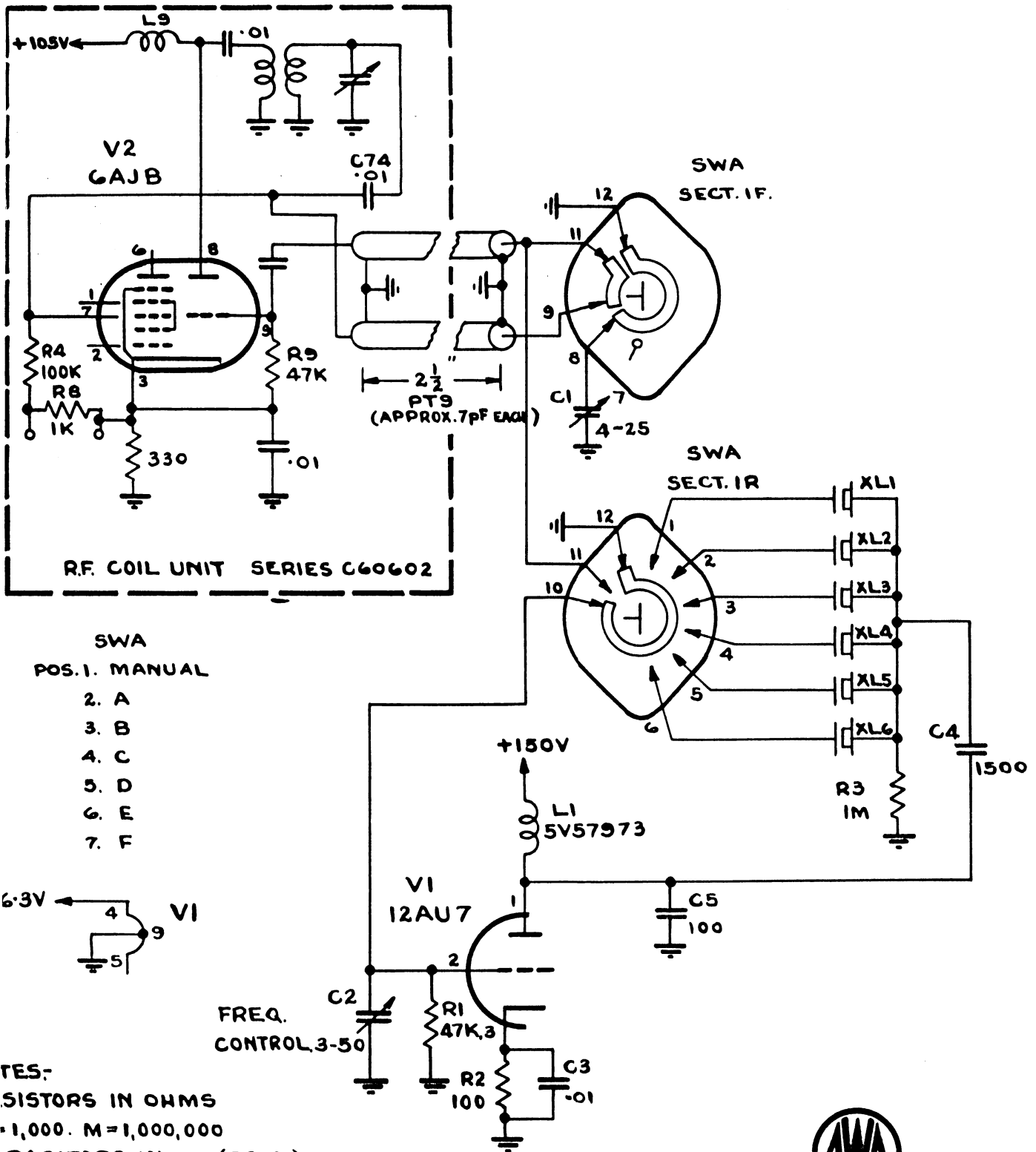


RESISTORS IN OHMS
 K=1,000. M=1,000,000
 CAPACITORS IN μ F (EG. .01)
 MFD (EG. 150)
 ELECTROLYTICS IN μ F.
 RELAY SWITCHES VIEWED
 20M KNOB-END IN
 EXTREME ANTI-CLOCKWISE POSITION.

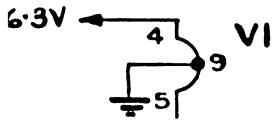


CRYSTAL OSCILLATOR UNIT
 TYPE 1J60604
 DRG. 60604D1

P.V.-619.0



- SWA
POS. 1. MANUAL
- 2. A
 - 3. B
 - 4. C
 - 5. D
 - 6. E
 - 7. F



RESISTORS IN OHMS
 .1, .100, .1M = 1,000,000
 CAPACITORS IN μ F (EG. .01)
 .1 μ F (EG. 150)
 ELECTROLYTICS IN μ F.
 1K SWITCHES VIEWED
 20M KNOB-END IN
 EXTREME ANTI-CLOCKWISE POSITION.



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 TYPE 1J60604
 DRG. 60604D1

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