

# CRYSTAL OSCILLATOR UNIT

Ass. Drawing D.214090 Grp.3 \*r 4

## Schematic T.14163

### 1. GENERAL

This unit is a 4 kc/s (Grp.3) or 5 kcs (Grp.4) crystal controlled oscillator, having a frequency stability of 5 parts in a million for all conditions normally encountered.

The overall dimensions are  $7\frac{1}{8}'' \times 3\frac{1}{4}'' \times 6''$  (18.1 cms x 8.25 cms x 15.2 cms) and the weight is approximately 4.75 lbs (2.15 kilograms).

### 2. DESCRIPTION

The unit employs an indirectly heated H.F. pentode. The crystal (which is mounted in a temperature controlled oven) is connected between the anode, earth and grid, with capacitor C2 present for D.C. blocking. A variable capacitor, with clamping device, is wired in series with the earth connection to the crystal, and provides a small degree of frequency adjustment (nominally 40 parts in  $10^6$ ). A capacitor C3 is connected between the anode circuit and earth, and limits the voltage applied to the crystal, by strapping combinations of the associated capacitors C4 and C5 in parallel with C3, a degree of oscillator output level adjustment is obtained. Part of the oscillator output signal is rectified, smoothed, and applied as an A.V.C. voltage to the grid of the valve via a potential divider.

The crystal oven employs a Carpenter type relay, having two similar windings, for oven heater switching. One winding is connected in series with a thermistor situated in the oven assembly, and the other winding in series with an external resistor chain and associated thermistor. Both paths are connected across a D.C. supply, and form a bridge circuit. With the oven operating at its correct working temperature (nominally within the range  $65^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ ), equal current flows through each winding of the oven relay and the oven heater relay contacts are open. The oven thermistor is thermally connected to the oven, and with a decrease in oven temperature the thermistor resistance increases, this causes a bridge unbalance and the relay operates. The relay contacts connect the supply to the oven heater, which restores the oven to the correct temperature, the bridge is now balanced and oven relay contacts open, thus restoring to the original condition. The strapping of resistor chain R10 and the tapping point for external thermistor RTH.2 is a critical factory adjustment, and is carried out with the object of providing optimum frequency stability for ambient temperature and supply voltage changes.

### 3. SUPPLIES

The following supplies are required by the unit with connection tag numbers:-

H.T. 150V D.C. (tags 9 +ve and 7 -ve)

L.T. 6.3V A.C. or D.C. (tags 16 and 18)

Oven Heater Supply 21V A.C. or D.C. (tags 1 & 2)

Oven Heater Control Circuit 24V D.C. (tags 6 +ve and 8 -ve)

Note:- No measurements of oscillator output voltage and frequency should be recorded until oscillator has "warmed up" for at least 2 hours.

### 4. OUTPUT VOLTAGE

The oscillator output voltage at 4 or 5 kc/s (as applicable), is a nominal 2.75V R.M.S. across tags 10 & 11 earthy, when loaded with 100K ohms.

### 5. FREQUENCY ADJUSTMENT

The frequency of the oscillator may be adjusted if necessary to a limited extent, by means of control C1 (knob with reference scale), the locking device should be released with the aid of a screwdriver and when new required setting has been obtained, control should be relocked.

### 6. RELAY ADJUSTMENT

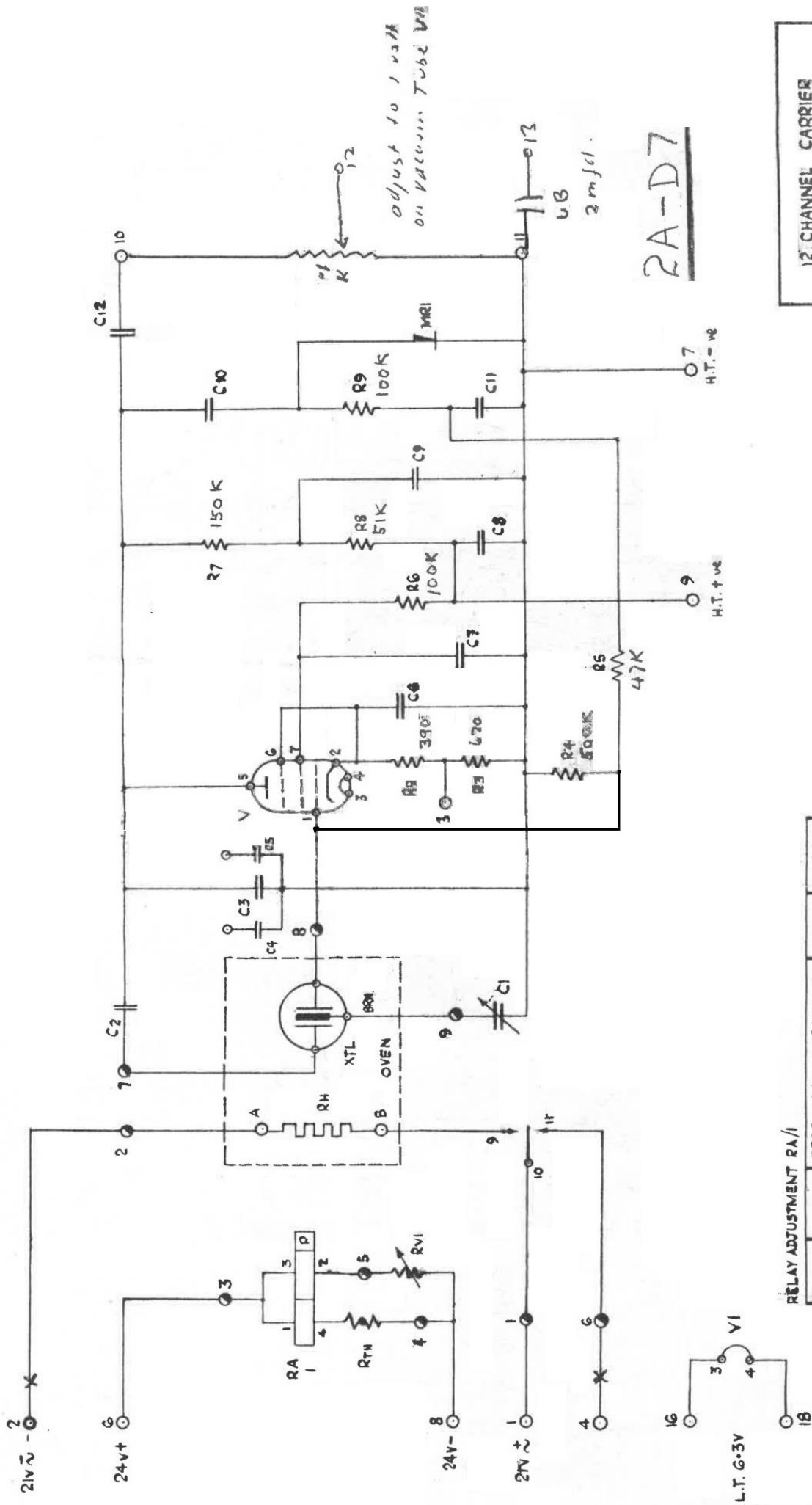
For correct operation of the oven, and thus correct frequency stability of the oscillator unit, it is necessary to ensure that the relay RA associated with the oven is correctly adjusted. The relay operating current (in either direction for winding tags 1 & 4) should be as near .5 mA as possible, and for the frequency stability quoted must be within 20% of .5 mA. With a relay adjustment current of .5 mA + 20% the frequency stability is reduced and with higher relay adjustment currents the frequency stability is progressively reduced. A relay current of .5 mA -20% increases the frequency stability but currents below this figure reduce the reliability of operation. An oven heater switching time ratio of greater than 10:1 indicates incorrect operation of the oven.

### 7. THERMISTOR RESISTOR

The oven temperature setting is carried out by means of R10 resistor chain strapping, it is a critical factory adjustment and should not be altered. With the oven operating at its correct working temperature (nominally 65°C to 70°C) the very approximate resistance of the oven thermistor RTH.1 is 300 ohms, and if measured "cold" at an ambient temperature of 20°C is approximately 2000 ohms.

The thermistor RTH.2 associated with the control resistor chain R10 has a resistance with a 20°C ambient temperature of approximately 200 ohms.

CODE	DESCRIPTIONS	
C1	250005 $\mu$ F VARIABLE AIR CAP.	S. 201167
C2, C6, C8, C11	0.1 $\mu$ F $\pm$ 20%	S. 34554
C4, C12	1000 $\mu$ F $\pm$ 10%	D. 215326/29
C3, C5	2000 $\mu$ F $\pm$ 20%	D. 215326/34
C10	10,000 $\mu$ F $\pm$ 20%	D. 215326/31
C7, C9	0.1 $\mu$ F $\pm$ 20%	S. 34554
R2	390 $\Omega$ $\pm$ 1% RESISTOR # 109	S. 201187
R3	620 $\Omega$ $\pm$ 1% # 109	S. 201188
R4	0.5 M $\Omega$ $\pm$ 1% RESISTOR # 109	S. 201189
R5	47K $\Omega$ $\pm$ 1% " # 109	S. 201190
R6	100K $\Omega$ $\pm$ 5% " # 9	S. 201184
R7	150K $\Omega$ $\pm$ 5% " # 9	S. 201185
R8	51K $\Omega$ $\pm$ 5% " # 9	S. 201186
R9	100K $\Omega$ $\pm$ 1% " # 109	S. 200801
RA	SAG CARPENTER RELAY	S. 42881
RTH	KB 2322 THERMISTOR S.T.C	S. 109000
RW	550 $\Omega$ RESISTOR	S. 201191
VI	VALVE TYPE C.V. 138	S. 105885
MRI	G.E.X 34	S. 201175
XTL	GEC TYPE L.C.P 4Kc	S. 201107
	" " " 5Kc	S. 201108



adjust to 1 v/mA  
on Vacuum Tube VM

2A-D7

12 CHANNEL CARRIER  
TELEPHONE SYSTEMS  
XTL OSCILLATOR  
4 Kc/s. & 5 Kc/s  
T. 12648  
TELEPHONE MFG. CO. LTD LONDON

○ DENOTES TERMINALS IN MICRO PLATE  
● CRYSTAL OVEN

RELAY ADJUSTMENT RA/1

CODE	ENERGISED WINDING (TAGS)	TEST IN BOTH DIRECTIONS		CONTACT D.C. RESIS (TAGS)
		NON OPERATE	OPERATE	
5AG 542881 (1&4)	5000T (1&4)	RE-ADJ TEST	RE-ADJ TEST	.0015" TO .002"
		0.4mA 0.19mA	0.52mA 0.85mA	