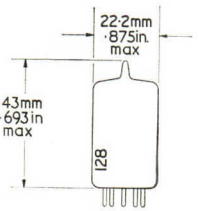
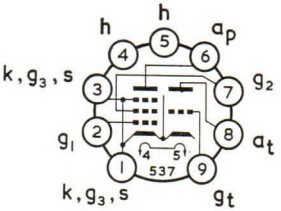


V.H.F. TRIODE PENTODE



B9A Base

GENERAL

This combined triode and variable-mu, frame grid pentode is for use as a frequency changer and I.F. amplifier at frequencies up to 200 Mc/s in television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	8·5	V

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$P_{a(max)}$	1·5	2·0	W
Maximum Screen Grid Dissipation (V_{g_1}=0 V)	$P_{g_2(max)}$	—	0·45†	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	125	250	V
Maximum Screen Grid Supply Voltage	$V_{g_2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g_2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100*	100*	V
Maximum Negative Control Grid Voltage	$-V_{g_1(max)}$	50	50	V
Maximum Cathode Current	$I_{k(max)}$	20	18	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	0·5	1·0	MΩ

* To fulfil hum requirements on A.M. sound it will be necessary for $V_{h\text{-}k}$ to be less than 50 V r.m.s.

† For V_{g_1} equal to or more negative than 5·2 V then $P_{g_2(max)}$ = 0·2 W.

INTER-ELECTRODE CAPACITANCES (Shielded)

Pentode Input	$C_{in(p)}$	6·2	pF
Pentode Output	$C_{out(p)}$	3·7	pF
Pentode Anode to Grid 1	$C_{ap\text{-}g_1}$	0·009	pF
Pentode Anode to Grid 1	$C_{ap\text{-}g_1}$	<0·012	pF
Grid 1 to Grid 2	$C_{g_1\text{-}g_2}$	1·6	pF
Triode Input	$C_{in(t)}$	3·3	pF
Triode Output	$C_{out(t)}$	1·7	pF
Anode Triode to Grid Triode	$C_{at\text{-}gt}$	1·8	pF
Anode Pentode to Anode Triode	$C_{ap\text{-}at}$	<0·025	pF
Anode Pentode to Grid Triode	$C_{ap\text{-}gt}$	<0·010	pF
Grid 1 to Anode Triode	$C_{g_1\text{-}at}$	<0·010	pF
Grid 1 to Grid Triode	$C_{g_1\text{-}gt}$	<0·010	pF

CHARACTERISTICS

		Triode	Pentode	
Anode Voltage	V_a	100	170	V
Screen Grid Voltage	V_{g_2}	—	120	V
Control Grid Voltage	V_{g_1}	−3·0	−1·4	V
Anode Current	I_a	15	10	mA
Screen Grid Current	I_{g_2}	—	3·0	mA
Mutual Conductance	g_m	9·0	11	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	2·2	>350	kΩ
Inner Amplification Factor	$\mu_{g_1\text{-}g_2}$	—	55	
Amplification Factor	μ	20	—	
Equivalent Grid Noise Resistance	R_{eq}	—	1·5	kΩ

THORN—AEI RADIO VALVES & TUBES LTD.

TYPICAL OPERATION

Pentode as Frequency Changer

Anode Supply Voltage	$V_{a(b)}$	200	200	V
Screen Grid Supply Voltage	$V_{g2(b)}$	200	200	V
Anode Load Resistance	R_a	2·7	4·7	kΩ
Screen Grid Resistance	R_{g2}	27	27	kΩ
Control Grid Resistance	R_{g1}	0·1	1·0	MΩ
Anode Current	I_a	10	9·3	mA
Screen Grid Current	I_{g2}	3·0	2·9	mA
Control Grid Current	I_{g1}	8·0	2·3	μA
Control Grid Supply Voltage	$V_{g1(b)}$	−1·4	0	V
R.M.S. Heterodyne Voltage	$V_{het(r.m.s.)}$	1·6	1·6	V
Conversion Conductance	g_c	5·0	4·7	mA/V

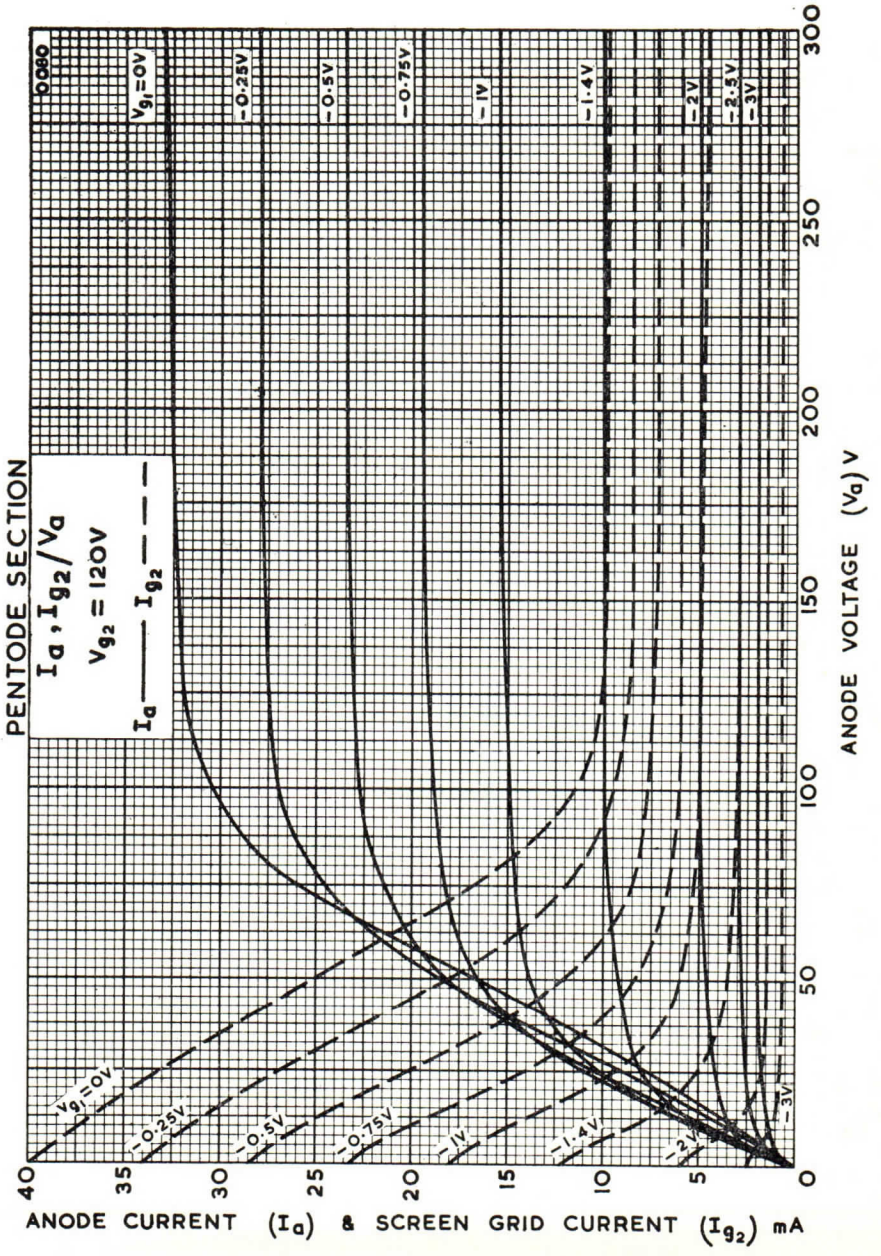
Pentode as I.F. Amplifier

Anode Supply Voltage	$V_{a(b)}$	200	200	V
Screen Grid Supply Voltage	$V_{g2(b)}$	200	200	V
Anode Load Resistance	R_a	2·7	4·7	kΩ
Screen Grid Resistance	R_{g2}	27	27	kΩ
Control Grid Resistance	R_{g1}	0·1	1·0	MΩ
Anode Current	I_a	10	13	mA
Screen Grid Current	I_{g2}	3·0	3·9	mA
Control Grid Supply Voltage	$V_{g1(b)}$	−1·4	0	V
Mutual Conductance	g_m	11	14·5	mA/V
Control Grid Voltage for g_m = 0·11 mA/V	V_{g1}	−12	—	V
Input Resistance at 50 Mc/s	R_{in}	10	10	kΩ

Triode as Oscillator

Anode Supply Voltage	$V_{a(b)}$	200	200	V
Anode Load Resistance	R_a	8·2	12	kΩ
Grid Resistance	R_g	10	10	kΩ
R.M.S. Heterodyne Voltage	$V_{het(r.m.s.)}$	4·5	3·3	V
Anode Current	I_a	16	12	mA
Mutual Conductance	g_m	3·7	3·7	mA/V

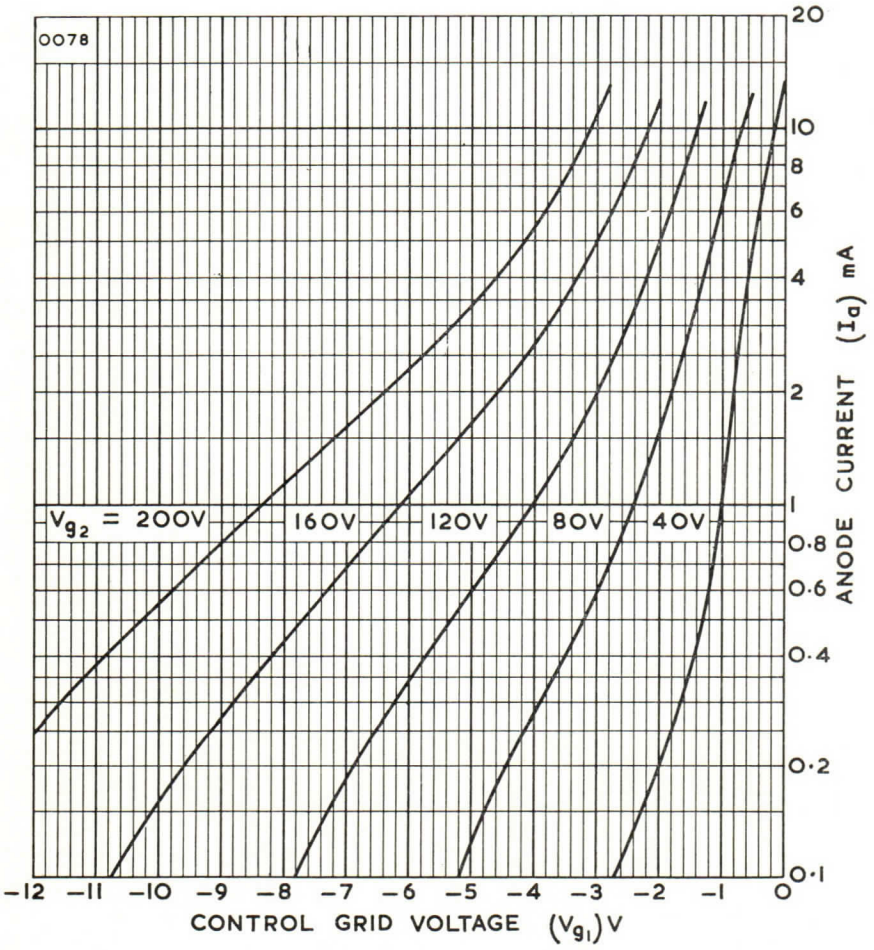
MOUNTING POSITION—Unrestricted


PENTODE SECTION
I_a ; I_{g_2}/V_a
V_{g_2} = 120V
I_a —— I_{g_2} – – –
V_{g_1}=0V
-0.25V
-0.5V
-0.75V
-1V
-1.4V
-2V
-2.5V
-3V
0.080
ANODE VOLTAGE (V_a) V
300
250
200
150
100
50
0
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g_2}) mA
40
35
30
25
20
15
10
5
0

PENTODE SECTION

I_a / V_{g1}

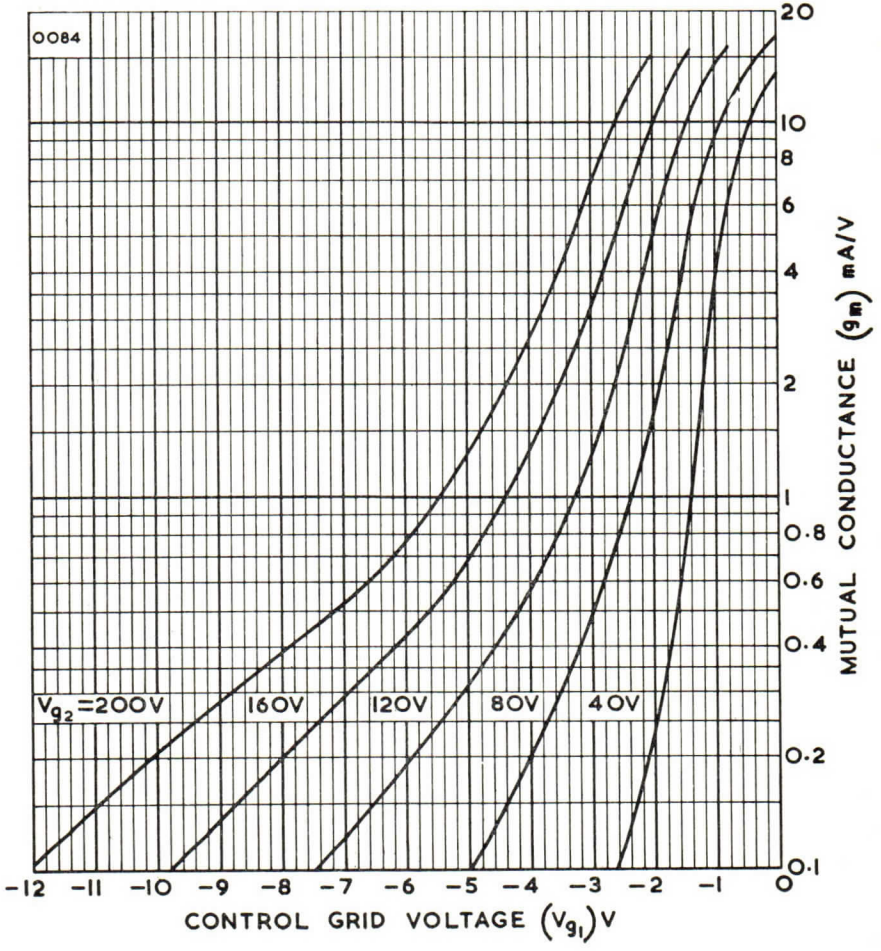
V_a = 170V



PENTODE SECTION

g_m / V_{g_1}

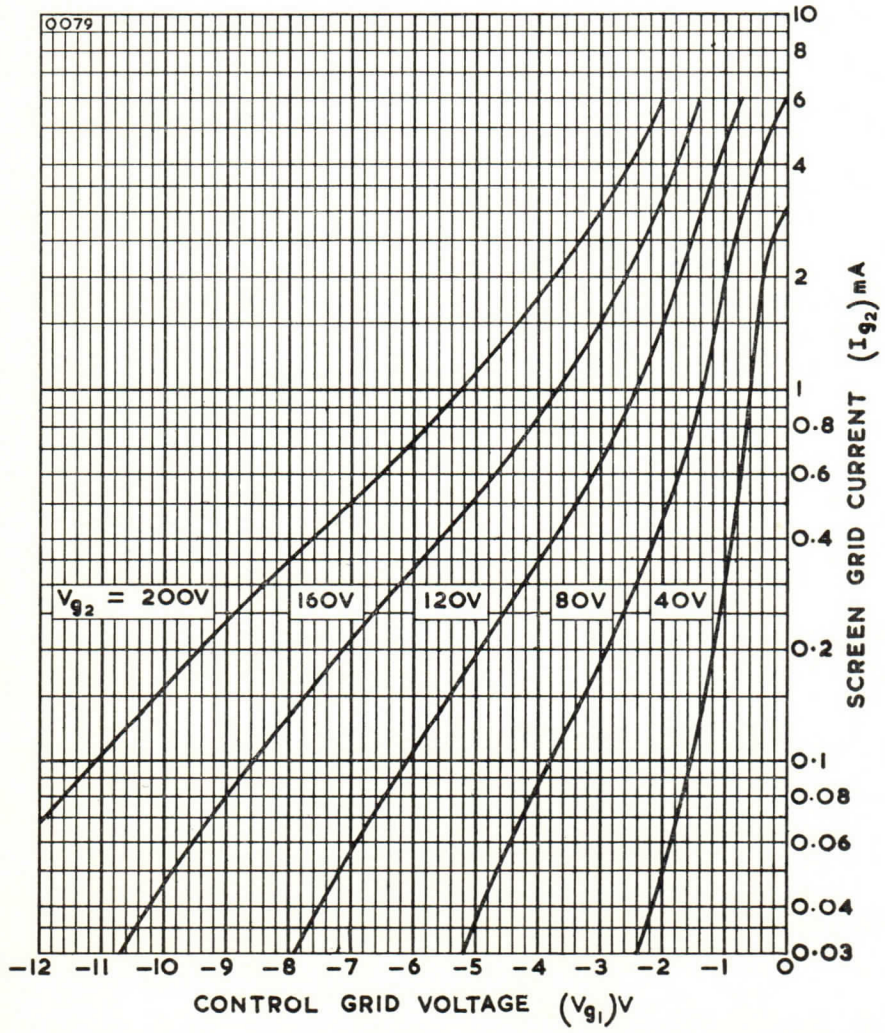
$V_a = 170V$

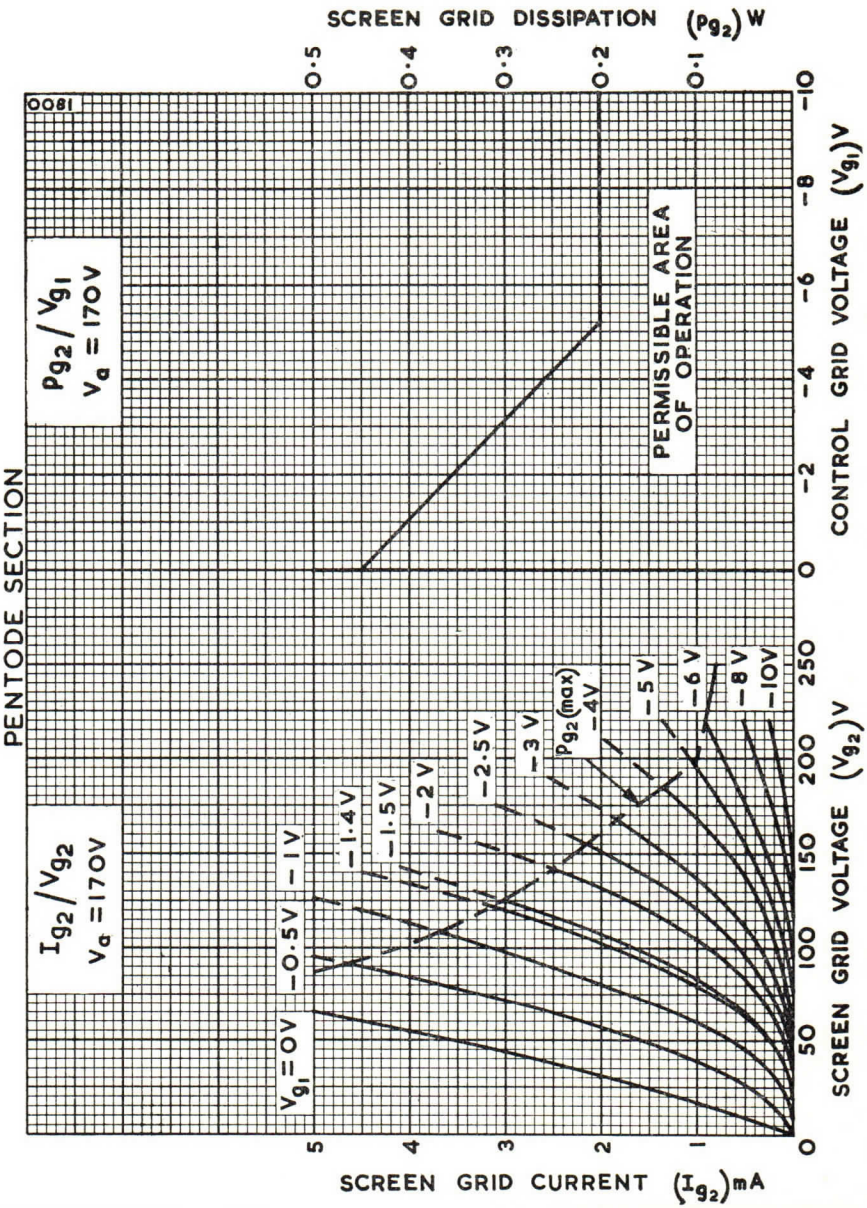


PENTODE SECTION

I_{g2} / V_{g1}

V_a = 170V




SCREEN GRID DISSIPATION (P_{g_2}) W
0·5
0·4
0·3
0·2
0·1
0081
P_{g_2}/V_{g1}
V_a = 170V
PERMISSIBLE AREA OF OPERATION
CONTROL GRID VOLTAGE (V_{g_1}) V
−10
−8
−6
−4
−2
0
PENTODE SECTION
I_{g_2}/V_{g_2}
V_a = 170V
V_{g_1}=0V
−0·5V
−1V
−1·4V
−1·5V
−2V
−2·5V
−3V
P_{g_2}(max)
−4V
−5V
−6V
−8V
−10V
SCREEN GRID VOLTAGE (V_{g_2}) V
0
50
100
150
200
250
SCREEN GRID CURRENT (I_{g_2}) mA
0
1
2
3
4
5

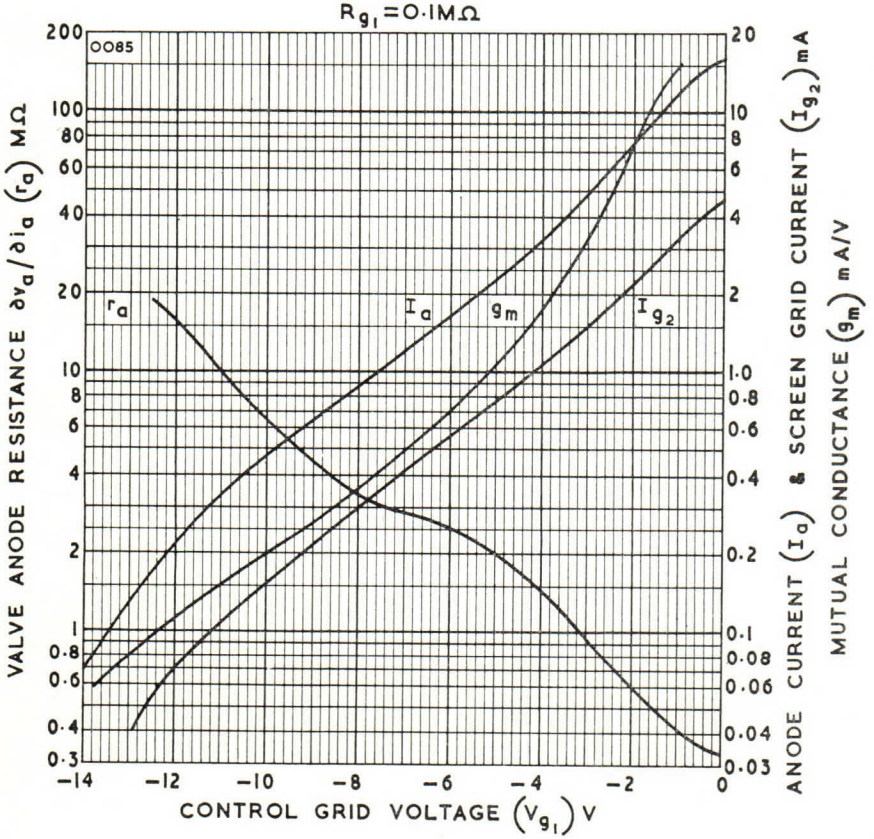
PENTODE SECTION

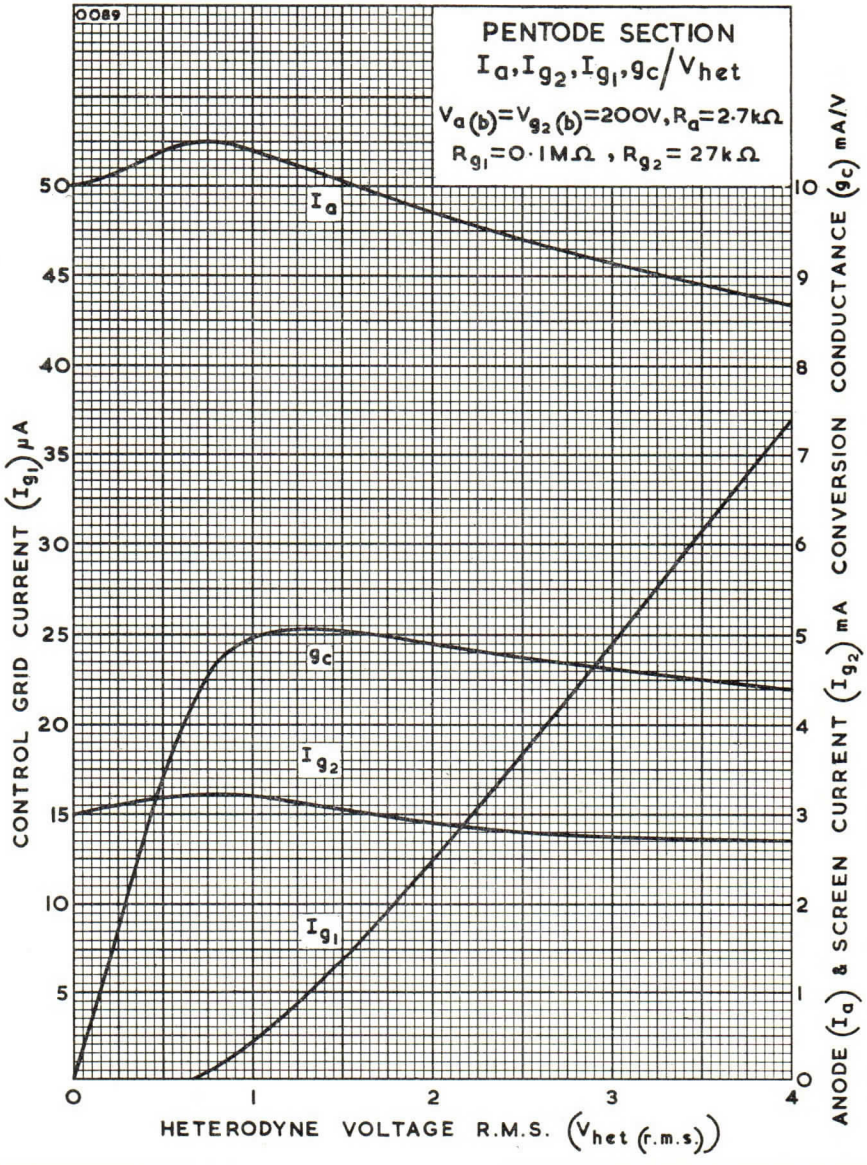
r_a, g_m, I_a, I_{g_2}/V_{g_1}

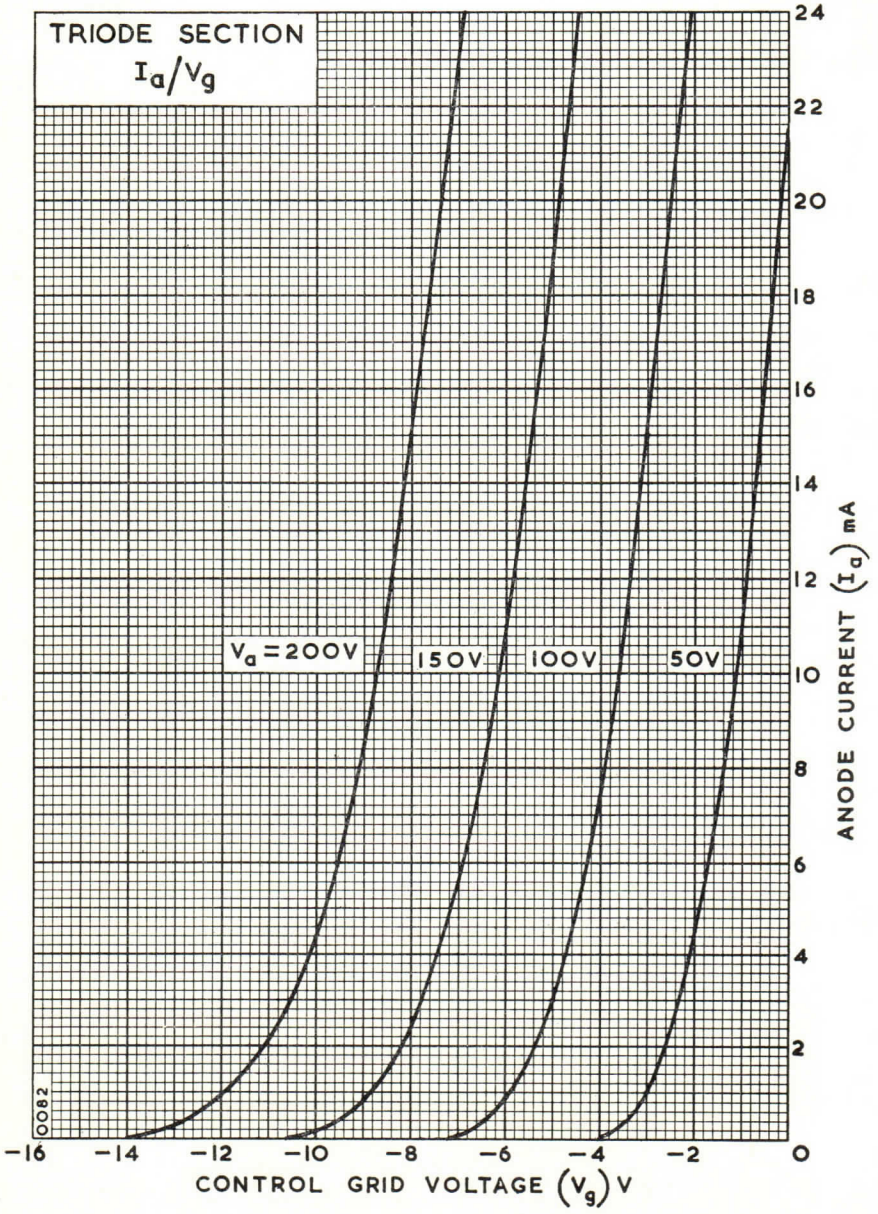
$V_{a(b)} = 200V$ $R_a = 2{\cdot}7k\Omega$

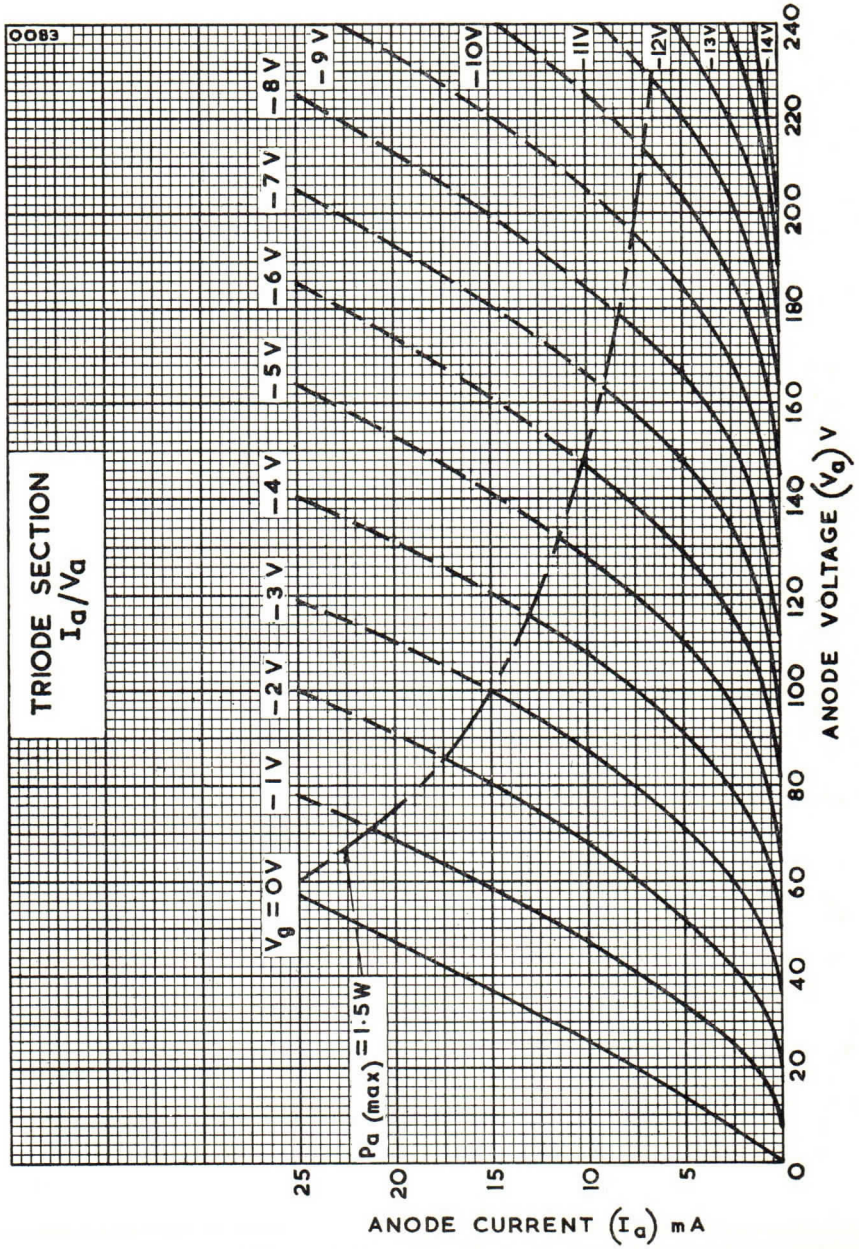
$V_{g_2(b)} = 200V$ $R_{g_2} = 27k\Omega$

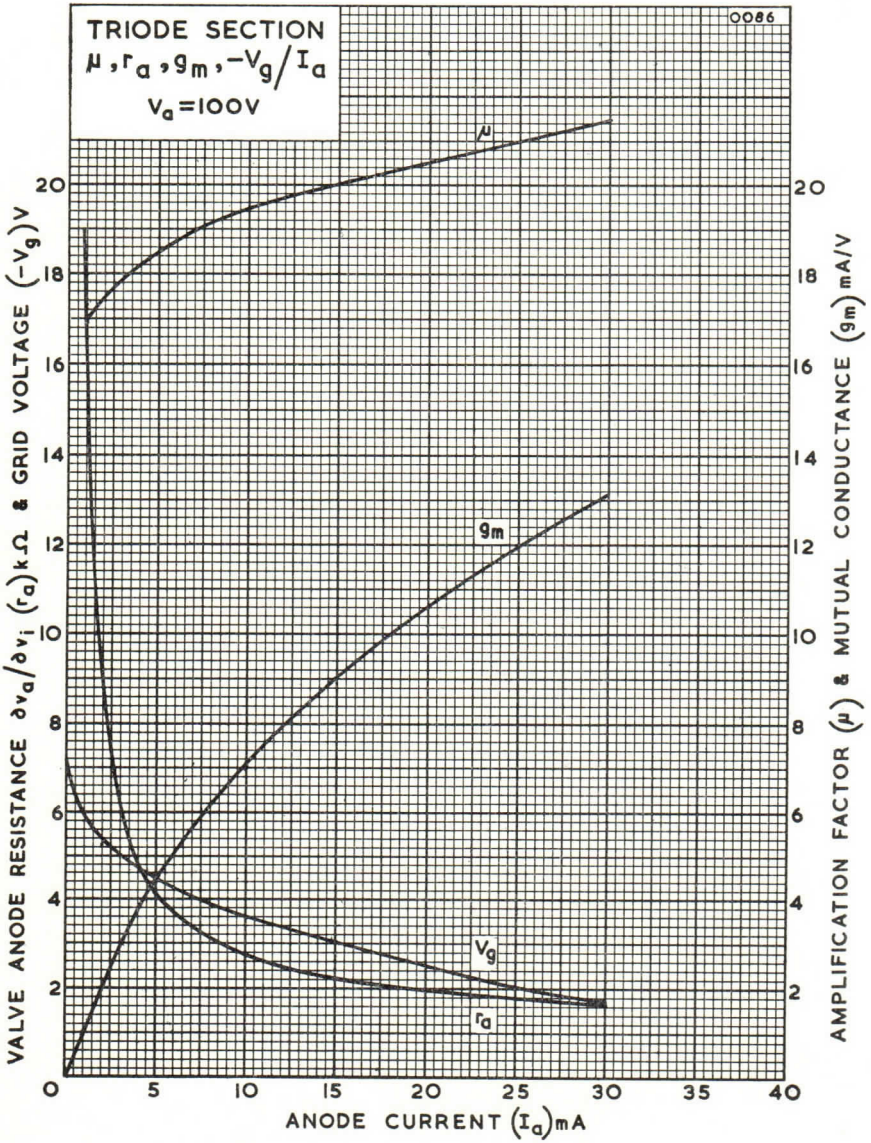
$R_{g_1} = 0{\cdot}1M\Omega$

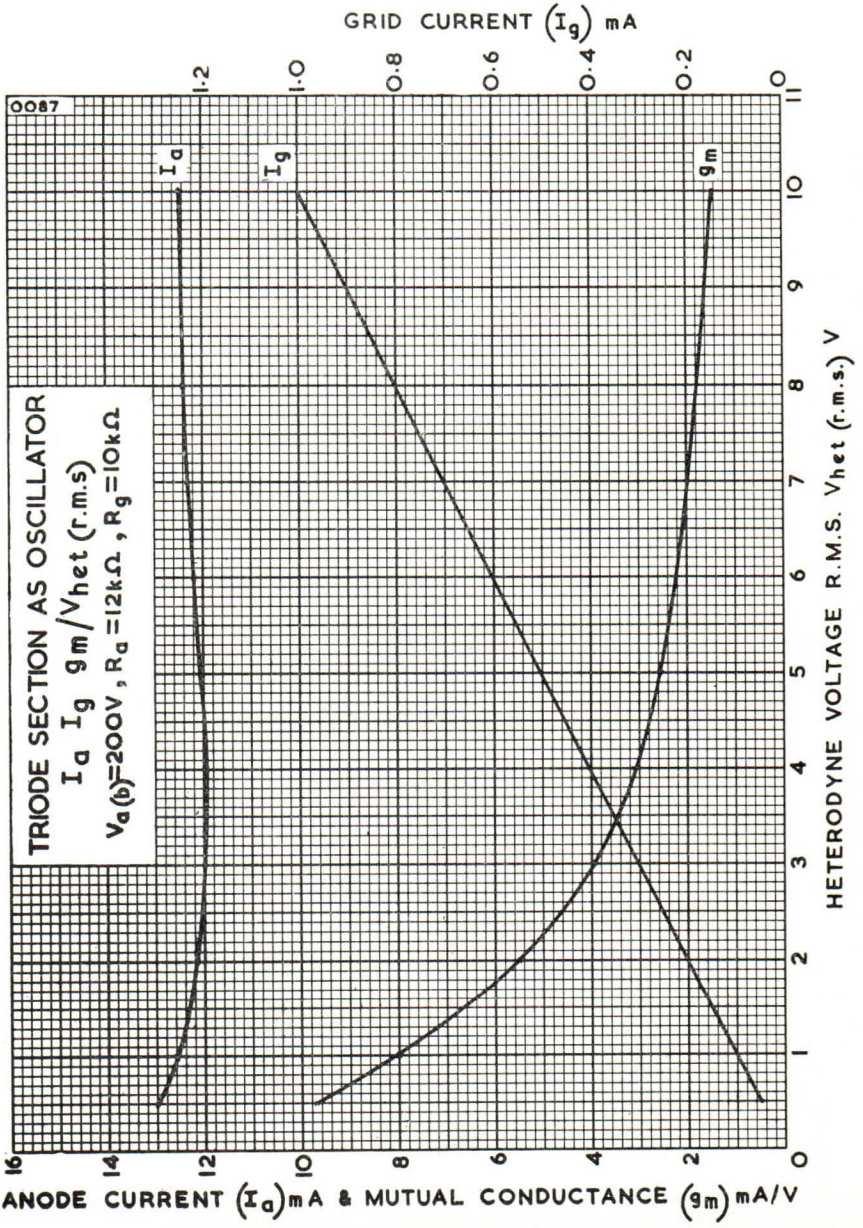


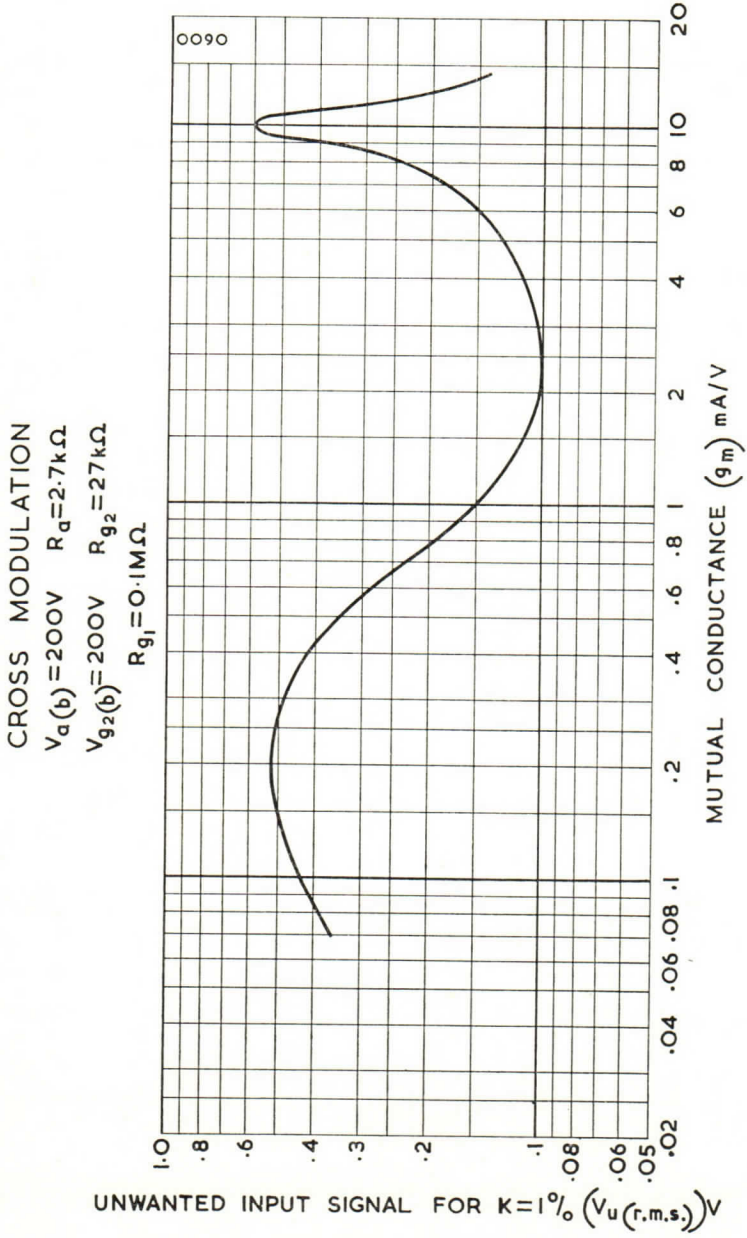

0089
PENTODE SECTION
$I_a, I_{g_2}, I_{g_1}, g_c / V_{het}$
$V_{a(b)} = V_{g_2(b)} = 200V, R_a = 2{\cdot}7k\Omega$
$R_{g_1} = 0{\cdot}1M\Omega$, $R_{g_2} = 27k\Omega$
I_a
g_c
I_{g_2}
I_{g_1}
CONTROL GRID CURRENT $(I_{g_1})\mu A$
ANODE (I_a) & SCREEN CURRENT (I_{g_2}) mA CONVERSION CONDUCTANCE (g_c) mA/V
HETERODYNE VOLTAGE R.M.S. $(V_{het\ (r.m.s.)})$
0
1
2
3
4
5
10
15
20
25
30
35
40
45
50
0
1
2
3
4
5
6
7
8
9
10


TRIODE SECTION
I_a/V_g
V_a = 200V
150V
100V
50V
0082
24
22
20
18
16
14
12
10
8
6
4
2
0
ANODE CURRENT (I_a) mA
−16
−14
−12
−10
−8
−6
−4
−2
CONTROL GRID VOLTAGE (V_g) V


0083
TRIODE SECTION
Ia/Va
Vg = 0V
-1V
-2V
-3V
-4V
-5V
-6V
-7V
-8V
-9V
-10V
-11V
-12V
-13V
-14V
Pa (max) = 1·5W
ANODE CURRENT (Ia) mA
25
20
15
10
5
0
20
40
60
80
100
120
140
160
180
200
220
240
ANODE VOLTAGE (Va) V


TRIODE SECTION
μ, r_a, g_m, $-V_g/I_a$
V_a=100V
0086
μ
g_m
V_g
r_a
VALVE ANODE RESISTANCE $\delta v_a/\delta v_i$ (r_a) kΩ & GRID VOLTAGE $(-V_g)$ V
AMPLIFICATION FACTOR (μ) & MUTUAL CONDUCTANCE (g_m) mA/V
ANODE CURRENT (I_a) mA
0
2
4
6
8
10
12
14
16
18
20
5
10
15
20
25
30
35
40


GRID CURRENT (Ig) mA
1·2
1·0
0·8
0·6
0·4
0·2
0
0087
Ia
Ig
gm
TRIODE SECTION AS OSCILLATOR
Ia Ig gm/Vhet (r.m.s)
Va(b)=200V, Ra=12kΩ, Rg=10kΩ
HETERODYNE VOLTAGE R.M.S. Vhet (r.m.s.) V
0
1
2
3
4
5
6
7
8
9
10
11
16
14
12
10
8
6
4
2
0
ANODE CURRENT (Ia) mA & MUTUAL CONDUCTANCE (gm) mA/V


CROSS MODULATION
$V_{a(b)}$=200V R_a=2·7kΩ
$V_{g2(b)}$=200V R_{g2}=27kΩ
R_{g1}=0·1MΩ
0090
MUTUAL CONDUCTANCE (g_m) mA/V
20
10
8
6
4
2
1
.8
.6
.4
.2
.1
.08
.06
.04
.02
UNWANTED INPUT SIGNAL FOR K=1% ($V_{u(r.m.s.)}$)V
1.0
.8
.6
.4
.3
.2
.1
.08
.06
.05