UF 21 Variable MU R.F. pentode

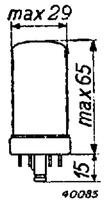
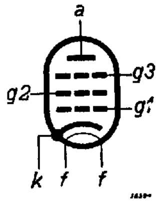


Fig. 1
Dimensions in mm

The UF 21 is a variable-mu R.F. or I.F. amplifier pentode for AC/DC receivers, consuming a heater current of 100 mA. It can also be employed as an R–C coupled A.F. amplifier, in which case it is also possible to obtain very excellent automatic gain control; since in such cases it is very important to know the amount of distortion occurring at a given output voltage and grid bias, details have been included in the Operating Data.
Apart from the heater ratings, the UF 21 is identical with the EF 22, also as far as the sliding screen voltage is concerned.



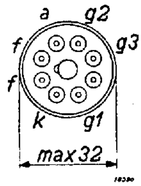


Fig. 2
Arrangement and sequence of contacts.

HEATER RATINGS

Heating: indirect, AC or DC, series supply.
Heater voltage . . . . V_f = 12.6 V
Heater current . . . . I_f = 0.100 A

CAPACITANCES

C_a = 6.6 pF C_{ag1} < 0.002 pF
C_{g1} = 5.6 pF C_{g1f} < 0.006 pF

OPERATING DATA: valve employed as R.F. or I.F. amplifier

a) With fixed screen voltage.

Anode voltage V_a	= 100 V			200 V		
Suppressor grid voltage V_{g3}	= 0 V			0 V		
Screen grid voltage V_{g2}	= 100 V			100 V		
Cathode resistance R_k	= 325 Ohms			325 Ohms		
Grid bias V_{g1}	= —2.5 V[1])	—19 V[2])	—22 V[3])	—2.5 V[1])	—19 V[2])	—22 V[3])
Anode current I_a	= 6 mA	—	—	6 mA	—	—
Screen grid current I_{g2}	= 1.7 mA	—	—	1.7 mA	—	—
Mutual conductance S	= 2200	22	7	2200	22	7 μA/V
Internal resistance R_i	= 0.4 MΩ	>10 MΩ	>10 MΩ	1 MΩ	>10 MΩ	>10 MΩ
Gain factor in respect of screen grid μ_{g2g1}	= 17	—	—	17	—	—
Equivalent noise resistance R_{aeq}	= 6200 Ohms	—	—	6200 Ohms	—	—

b) With sliding screen voltage.

Anode voltage						
V_a	= 100 V			200 V		
Suppressor grid voltage						
V_{g3}	= 0 V			0 V		
Screen grid resistance						
R_{g2}	= 60,000 Ohms			60,000 Ohms		
Cathode resistance						
R_k	= 325 Ohms			325 Ohms		
Grid bias						
V_{g1}	= —1.3V[1])	—19 V[2])	—23 V[3])	—2.5 V[1])	—37 V[2])	—46 V[3])
Screen grid voltage						
V_{g2}	= 50 V	—	100 V	100 V	—	200 V
Anode current						
I_a	= 3.2 mA	—	—	6 mA	—	—
Screen grid current						
I_{g2}	= 0.85 mA	—	—	1.7 mA	—	—
Mutual conductance						
S	= 2000	20	5	2200	22	4.5 μA/V
Internal resistance						
R_i	= 1 M Ω	>10 M Ω	>10 M Ω	1 M Ω	>10 M Ω	>10 M Ω
Equivalent noise resistance						
R_{aeq}	= 4000 Ω	—	—	6200 Ohms	—	—

1) Valve not controlled.
2) Mutual conductance controlled to 1/100.
3) Extreme limit of control range.

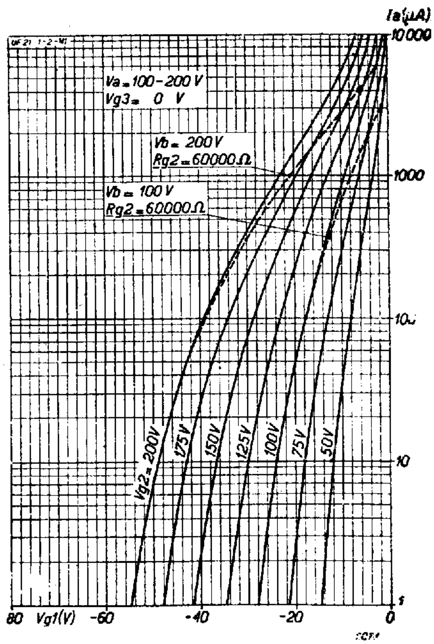


Fig 3
Anode current as a function of grid bias at Va = 100 — 200 V and Vg_3 = 0 V, with screen voltage as parameter. The broken lines show the anode current when the valve is controlled, with the screen grid fed through a resistance of 60,000 Ohms from the 200 V or 100 V source.

OPERATING DATA: valve employed as resistance-capacitance coupled A.F. amplifier, with gain control applied to the control grid

Anode coupling res. R_a (M Ohm)	Screen grid res. R_{g_2} (M Ohm)	Anode current I_a (mA)	Screen grid current I_{g_2} (mA)	Cathode res. R_k (Ohms)	Control volts on grid 1. $-V_R$ (V)	Gain $\frac{V_{o_{eff}}}{V_{g_{1eff}}}$	Required alternating grid voltage and total distortion to give an alternating output voltage of: $V_{o_{eff}} = 3$ V		$V_{o_{eff}} = 5$ V		$V_{o_{eff}} = 8$ V	
							$V_{g_{1eff}}$ (V)	d_{tot} (%)	$V_{g_{1eff}}$ (V)	d_{tot} (%)	$V_{g_{1eff}}$ (V)	d_{tot} (%)
$V_b = 200$ V												
0.2	0.8	0.65	0.17	2500	0	88	0.034	0.75	0.057	1.25	0.091	2.0
0.2	0.8	0.54	0.14	2500	5	35	0.086	1.2	0.140	2.0	0.228	3.2
0.2	0.8	0.46	0.11	2500	10	22	0.136	1.4	0.228	2.3	0.364	3.7
0.2	0.8	0.38	0.08	2500	15	15	0.200	1.7	0.334	2.8	0.534	4.5
0.2	0.8	0.31	0.06	2500	20	11	0.272	1.8	0.455	3.0	0.726	4.8
0.2	0.8	0.25	0.05	2500	25	8	0.375	2.3	0.625	3.8	1.0	5.8
0.1	0.4	1.2	0.35	1300	0	78	0.038	0.75	0.064	1.25	0.102	2.0
0.1	0.4	0.96	0.28	1300	5	33	0.091	1.2	0.152	2.0	0.242	3.2
0.1	0.4	0.78	0.22	1300	10	20	0.150	1.6	0.250	2.65	0.400	4.25
0.1	0.4	0.62	0.16	1300	15	13	0.230	2.0	0.385	3.3	0.615	5.3
0.1	0.4	0.48	0.12	1300	20	8	0.375	2.2	0.625	3.65	1.000	5.85
0.1	0.4	0.36	0.09	1300	25	6	0.500	3.45	0.832	5.65	1.333	9
$V_b = 100$ V												
0.2	0.8	0.33	0.08	2500	0	82	0.037	0.85				
0.2	0.8	0.26	0.06	2500	2.5	37	0.081	2.3				
0.2	0.8	0.21	0.055	2500	5	21	0.143	3.4				
0.2	0.8	0.18	0.03	2500	7.5	13	0.230	4.1				
0.2	0.8	0.14	0.025	2500	10	9	0.334	4.3				
0.2	0.8	0.12	0.02	2500	12.5	7	0.430	5.1				
0.1	0.4	0.61	0.15	1300	0	72	0.041	0.85				
0.1	0.4	0.47	0.13	1300	2.5	35	0.086	2.3				
0.1	0.4	0.37	0.10	1300	5	20	0.150	3.45				
0.1	0.4	0.29	0.06	1300	7.5	12	0.250	4.3				
0.1	0.4	0.22	0.05	1300	10	7	0.430	5.25				
0.1	0.4	0.17	0.04	1300	12.5	6	0.500	6.2				

MAXIMUM RATINGS

V_{ao} ($I_a = 0$)	= max. 550 V
V_a	= max. 250 V
W_a	= max. 2 W
V_{g2o} ($I_{g2} = 0$)	= max. 550 V
V_{g2} ($I_a < 3$ mA)	= max. 250 V
V_{g2} ($I_a = 6$ mA)	= max. 150 V
W_{g2}	= max. 0.3 W
I_k	= max. 10 mA
V_{g1} ($I_{g1} = +0.3$ μA)	= max. —1.3 V
R_{g1k}	= max. 3 M Ohms
R_{fk}	= max. 20,000 Ohms
V_{fk}	= max. 150 V

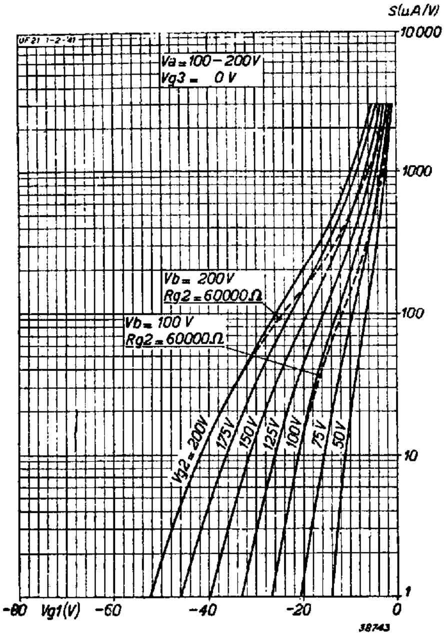


Fig. 4
Mutual conductance as a function of grid bias, with screen grid voltage as parameter. The dotted lines show the conductance with control on the valve and the screen fed through a resistance of 60,000 Ohms from the 100 V or 200 V source.

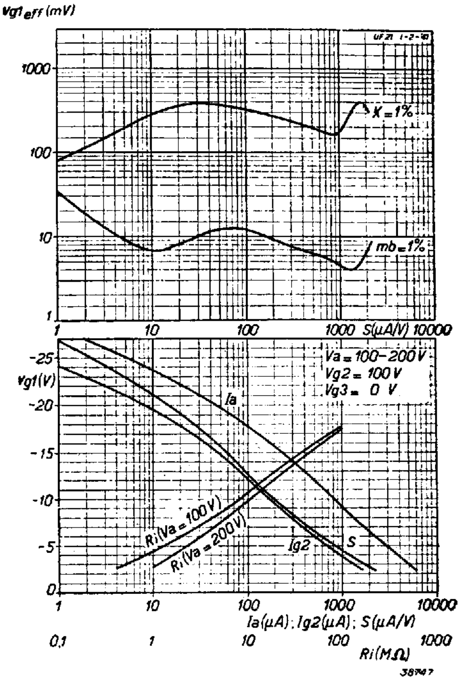


Fig. 5
At Va = 100—200 V, Vg_2 = 100 V (fixed screen voltage) and Vg_3 = 0 V.
Upper diagram; maximum permissible effective value of alternating grid voltage with 1 % cross modulation (K = 1%) and also with 1% modulation hum (mb = 1%), as function of the mutual conductance.
Lower diagram; Mutual conductance, anode current, screen grid current and internal resistance as function of grid bias.

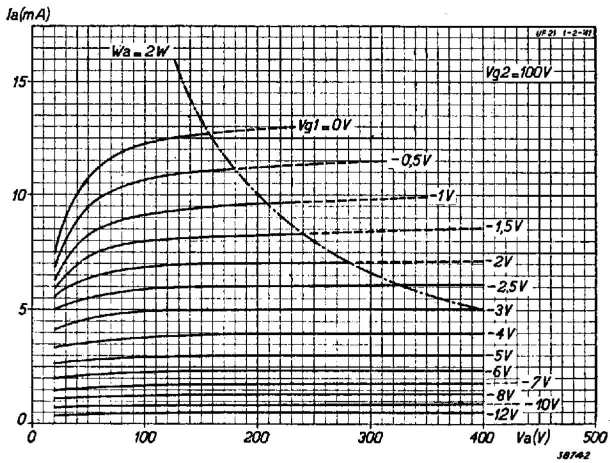


Fig. 6
Anode current as a function of anode voltage at a fixed screen voltage of 100 V, with grid bias as parameter.

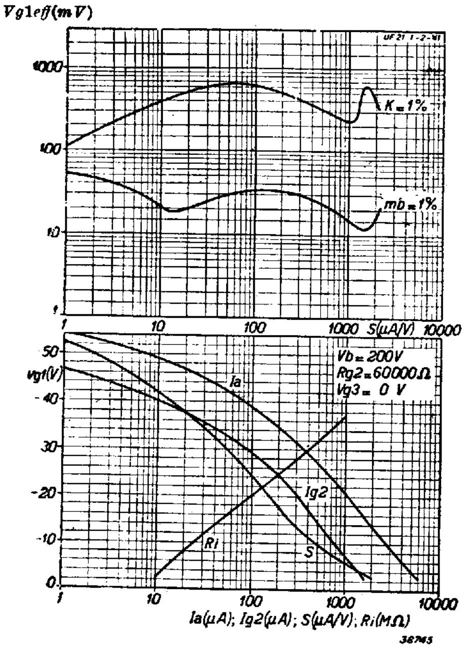


Fig. 7
At $Vb = 200$ V, $Rg_2 = 60{,}000$ Ohms (screen fed through a resistance) and $Vg_3 = 0$ V.
Upper diagram; maximum permissible effective value of alternating grid voltage with 1 % cross modulation (K = 1%) and also 1 % modulation hum (*mb*=1%), as function of mutual conductance.
Lower diagram; Mutual conductance, anode current, screen grid current and internal resistance as function of grid bias.

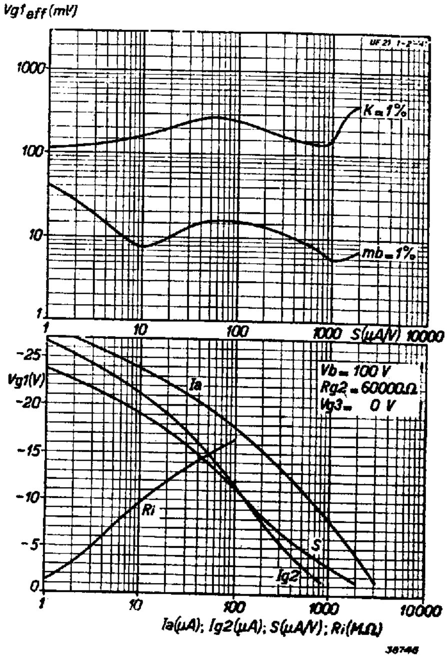


Fig. 8
At $Vb = 100$ V, $Rg_2 = 60{,}000$ Ohms (screen fed through a resistance) and $Vg_3 = 0$ V.
Upper diagram; maximum permissible effective value of alternating grid voltage with 1 % cross modulation (K = 1%) and also with 1 % hum modulation (*mb* = 1%), as function of mutual conductance.
Lower diagram; Mutual conductance, anode current, screen grid current and internal resistance as function of grid bias.

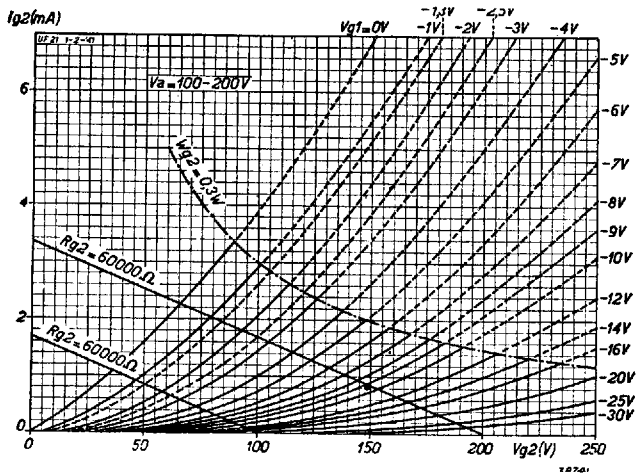


Fig. 9
Screen grid current as a function of screen voltage, with grid bias as parameter. The curves are a fair approximation in respect of all anode voltages between 100 and 200 V.