


SIEMENS

RS 2022 CL
10 kW
Metal-Ceramic Tetrode

A new forced-air cooled power tetrode
for television transmitters



Properties

The RS 2022 CL is a metal-ceramic power tetrode designed for frequencies up to 300 MHz. The screen grid, control grid and cathode terminals are arranged in coaxial form. This tube is especially suitable for grounded control grid/screen grid circuits in television transmitters.

The electrode construction is stable and rugged. The use of a seamless drawn molybdenum tube with punched apertures to control the electron current produces a very stable grid structure. The introduction of this type of grid design into power tubes offers the tube user the following important advantages:

1. With a suitable combination of grid apertures and stiffening struts, the stability and hence reliability of the punched grid considerably exceeds that of conventional wire grids.
2. The punched holes of the screen and control grids are exceptionally true to size and can be reproduced in fabrication. This results in constant characteristic curves and consequently very low spreads.

The RS 2022 CL contains the well-proven mesh cathode used for many years in Siemens power tubes. Together with its tubular molybdenum supports, this cathode represents a very robust construction.

Technical data RS 2022 CL

General data

Filament Characteristic values

$$E_f = 10 \text{ V}; \quad I_e = 35 \text{ A at } E_b = E_{c2} = E_{c1} = 300 \text{ V}$$

$$I_f = 86 \text{ A}; \quad \mu_{g1g2} = 8.4 \text{ at } E_b = 2 \text{ kV}, E_{c2} = 600 \text{ to } 1000 \text{ V},$$

$$I_b = 3 \text{ A}$$

$$S = 67,000 \mu\text{mhos at } E_b = 2 \text{ kV}, E_{c2} = 800 \text{ V},$$

$$I_b = 2.5 \text{ to } 3.5 \text{ A}$$

Directly heated, thoriated tungsten cathode

Capacitances

$$C_{ag2} = 22 \text{ pF}$$

$$C_{g1g2} = 115 \text{ pF}$$

$$C_{kg2} = 5.5 \text{ pF}$$

$$C_{kg1} = 78 \text{ pF}$$

$$C_{ag1} = 0.7 \text{ pF}$$

$$C_{ak} = 0.07 \text{ pF}$$

Air cooling (sea level, 25 °C ambient temperature)

Plate dissipation	P_p	12	7	kW
Air flow rate	V	12	7.3	m ³ /min
		424	258	cfm
Pressure drop	Δp	88	35	mm H ₂ O
		3 ¹ / ₂	1 ³ / ₈	in H ₂ O

Low level modulated television video transmitter, grounded control grid/screen grid operation

Negative modulation

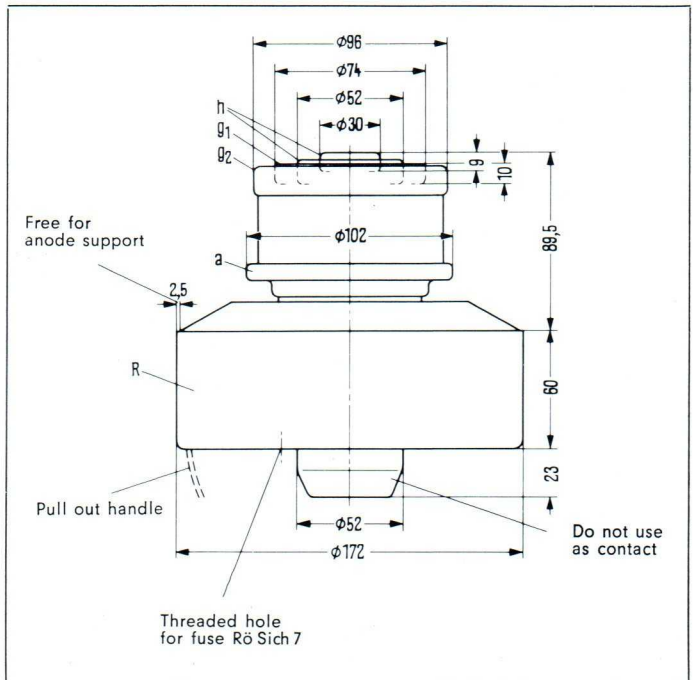
Maximum ratings

F	≤	250	MHz
E_b	=	5	kV ¹⁾
E_{c2}	=	1000	V ¹⁾
I_{kpk}	=	35	A
I_k	=	8	A
P_p	=	12	kW
P_{g2}	=	100	W
P_{g1}	=	50	W

Fig. 1 Grid-cathode structure of the RS 2022 CL



Fig. 2 Dimensional drawing RS 2022 CL



Operating data

F	=	220	220	MHz
$2 \Delta F$ (3 dB)	=	18	12	MHz ²⁾
$2 \Delta F$ (1.2 dB)	=	10	7	MHz ²⁾
$P_{0 \text{ syne}}$	=	$12 + 0.53^3)$	$12 + 0.42^3)$	kW ⁴⁾
$P_{0 \text{ black}}$	=	$6.6 + 0.29^3)$	$6.6 + 0.22^3)$	kW ⁴⁾ 5)
E_b	=	4	4.8	kV ¹⁾
E_{c2}	=	800	800	V ¹⁾
E_{c1}	≈	-95	-95	V ⁶⁾
$e_{ke1 \text{ pk syne}}$	≈	140	130	V
$I_{b \text{ black}}$	=	3.7	3.1	A ⁵⁾
$I_{g2 \text{ black}}$	≈	110	100	mA ⁵⁾
$I_{g1 \text{ black}}$	≈	60	30	mA ⁵⁾
$P_{a \text{ black}}$	=	14.9	14.9	kW
$P_{1 \text{ syne}}$	=	$30 + 530^3)$	$10 + 420^3)$	W ⁷⁾
$P_{p \text{ black}}$	≈	8.3	8.3	kW ⁵⁾
$P_{g2 \text{ black}}$	≈	88	80	W ⁵⁾
$P_{g1 \text{ black}}$	≈	25	2	W ⁵⁾
R_p	=	400	600	Ω

1) Voltage measured with respect to cathode

2) Bandwidth calculated from tube capacitance C_{ag2}

3) Transferred power of the grounded grid circuit

4) Circuit losses not included

5) Black level with gated sync pulses

6) For quiescent plate current 0.6 A

7) Necessary output power of the driver stage

Application

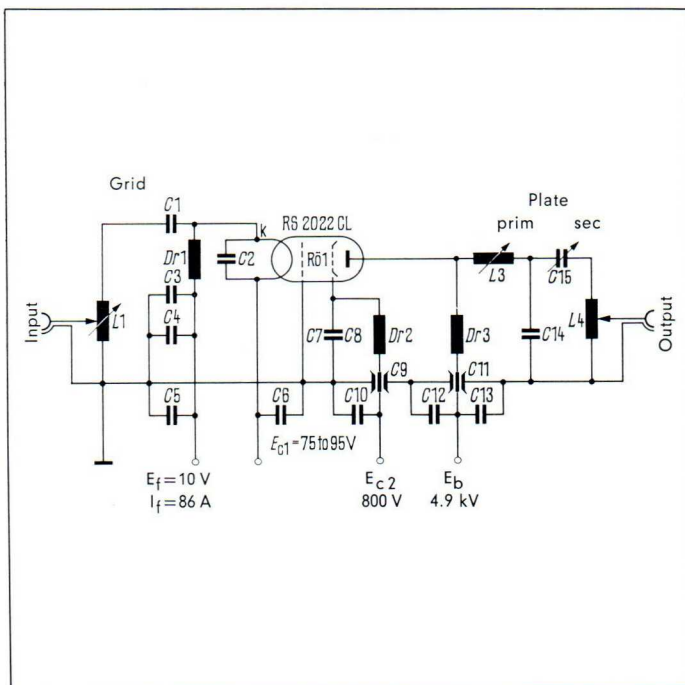
As a typical application for the tetrode RS 2022 CL, fig. 3 shows the circuit diagram of a 10 kW television video power amplifier for the frequency band 170 to 230 MHz.

The tube operates in the grounded control grid/screen grid configuration. The drive power from the 1 kW video transmitter using the tetrode YL 1052 is amplified by the RS 2022 CL to the 10 kW level. The plate circuit is a slightly overcoupled bandpass filter. With this circuit a flat response is obtained over 6 MHz of the bandwidth.

The 10 kW amplifier consists mainly of the cavity type TK 4460 (60 Ω) or TK 4461 (50 Ω) and tube RS 2022 CL.

Fig. 4 shows a schematic of the cavity with tube RS 2022 CL.

Fig. 3 Circuit diagram of a 10 kW television video transmitter output stage



The input resonant circuit consists of the inductance L1, the series ring capacitor C1 and the tube grid-cathode capacitance. The inductance is formed by a coaxial tube that can be varied by a shorting plunger to tune the circuit. The position of the input coupling can be changed to match the input circuit to the characteristic impedance of the input line.

The bandpass filter plate circuit can be tuned on the primary and secondary side. The inductances L3 of the primary and L4 of the secondary are coaxial tubes, the tuning capacitance C15 of the secondary circuit is a plunger capacitor. The plate circuit consists of the tube output capacitance, the inductance L3 and the coupling capacitance C14. The variable capacitance C15, coupling capacitance C14 and the output coupling inductance L4 form the secondary circuit. The shape of the response curve and power can be changed by varying the sliding contact tap on the inductance L4.

Fig. 4 Schematic of the cavity for the output stage of a 10 kW television transmitter using the tetrode type RS 2022 CL

