Amperex

4PR1000A

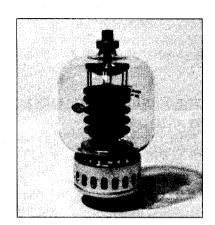
RADIAL-BEAM PULSE TETRODE

MODULATOR OSCILLATOR AMPLIFIER

The 4PR1000A is a pulse tetrode intended for use in pulse modulator, pulsed-amplifier and pulsed-oscillator service. This compact, high vacuum radial-beam tetrode, incorporating a graphite anode and non-emitting grids, is recommended for use in new equipments where high voltage, high current, or high duty factor is encountered.

Cooling of the tube is accomplished by radiation from the anode and by circulation of forced-air through the base and around the envelope. Cooling can be simplified by the use of the SK-510 Air System Socket and the SK-506 Air chimney.

The 4PR1000A is specially designed for medical MRI applications where high noise immunity and high stability are required.



GENERAL CHARACTERISTICS

EL	F	T	RI	C	ΔI
	_		м	•	

Filament: Thoriated Tungsten	<u>Min.</u>	Nom.	<u> Max.</u>	
Voltage	_	_	7.5	Volts
Current	20.0		22.7	Amps
Amplification Factor (Grid to screen)		6.9		·
Direct Interelectrode Capacitances (Grounded Cathode)				
Grid Plate			0.35	pf
Input	23.8		32.4	pf
Output	6.8		9.4	pf
Transconductance (1, = 300 ma)	10		ma/v	
Highest Frequency for Maximum Ratings	110		MHz	

MECHANICAL

Base	5 Pin metal shell
Basing	See drawing
Recommended Socket	SK-510 Air-System Socket
Operating Position	Vertical base down or up
Maximum Operating Temperatures :	
Base Seals	150°C
Plate Seal	200°C
Cooling	Radiation and forced-air
Recommended Heat-Dissipating Plate Connector	HR-8
Maximum Over-all Dimensions :	
Length	(9.63 inches) 235 mm
Diameter	(5.25 inches) 133 mm
Net Weight (tube only)	(1.5 lbs.) 0,74 kg
Shipping Weight in Shielded Fixture	(12 lbs) 3,70 kg



40W267 Keslinger Road LaFox, IL 60147 USA (630) 208-2200

PULSE MODULATOR SERVICE

MAXIMUM RATINGS			TYPICAL OPERATION				
DC Plate Voltage	30 max.	kV	DC Plate Voltage	20	25	30	kV
DC Screen Voltage	2.5 max.	kV	DC Screen Voltage	1.5	1.5	1.5	kV
DC Grid Voltage	 1.0 max. 	kV	DC Grid Voltage	- 335	- 360	- 380	V
Peak Plate Current	8.0 max.	amperes	Pulse Plate Voltage	17.7	22.7	27.7	kV
Plate Dissipation (Ave.)	1000 max.	watts	Peak Plate Current	8.0	8.0	8.0	Amp
Screen Dissipation (Ave.)	75 max.	watts	Pulse Screen Current	1.25	1.25	1.25	Amp
Grid Dissipation (Ave.)	25 max.	watts	Pulse Grid Current	0.2	0.2	0.2	Amp
			Pulse Pos. Grid Voltage	200	200	200	V .
			Pulse Drive Power	107	112	116	W
			Pulse Plate Input Power	160	200	240	kW
			Pulse Plate Output Power	140	180	220	kW
			Duty	4.0	4.0	4.0	%

RADIO FREQUENCY PLATE AND SCREEN-PULSED AMPLIFIER AND OSCILLATOR *

		TYPICAL OPERATION				
20 max.	kV	Pulse Plate Voltage	10	15	20	kV
2.5 max.	kV	Pulse Screen Voltage	1.5	1.5	1.5	kV
- 1.0 max.	kV	DC Grid Voltage	-480	-510	-535	V
12.0	max. Amp	Pulse Plate Current (Note 1)	1.95	1.95	1.95	Α
1000	max. W	Pulse Screen Current	0.32	0.32	0.32	Α
75	max. W	Pulse Grid Current	0.02	0.02	0.02	Α
25	max. W	Peak RF Grid Voltage	735	760	785	V
		Pulse Drive Power	14.7	15.2	15.7	W
n-Puised Ampli	fier, the grid	Pulse Plate Input Power	19.5	29.3	39.0	kW
heating this ele	ement during	Pulse Plate Output Power	17.0	23.0	31.5	kW
		Duty	15.0	15.0	12.0	%
	2.5 max. - 1.0 max. 12.0 1000 75 25	2.5 max. kV - 1.0 max. kV 12.0 max. Amp 1000 max. W 75 max. W	20 max. kV Pulse Plate Voltage 2.5 max. kV Pulse Screen Voltage 1.0 max. kV DC Grid Voltage 12.0 max. Amp Pulse Plate Current (Note 1) 1000 max. W Pulse Screen Current 75 max. W Pulse Grid Current 25 max. W Peak RF Grid Voltage Pulse Drive Power 1-Pulsed Amplifier, the grid heating this element during Pulse Plate Output Power	20 max. kV Pulse Plate Voltage 10 2.5 max. kV Pulse Screen Voltage 1.5 - 1.0 max. kV DC Grid Voltage -480 12.0 max. Amp Pulse Plate Current (Note 1) 1.95 1000 max. W Pulse Screen Current 0.32 75 max. W Pulse Grid Current 0.02 25 max. W Peak RF Grid Voltage 735 Pulse Drive Power 14.7 n-Pulsed Amplifier, the grid heating this element during Pulse Plate Input Power 19.5 heating this element during Pulse Plate Output Power 17.0	20 max. kV Pulse Plate Voltage 10 15 2.5 max. kV Pulse Screen Voltage 1.5 1.5 - 1.0 max. kV DC Grid Voltage -480 -510 12.0 max. Amp Pulse Plate Current (Note 1) 1.95 1.95 1000 max. W Pulse Screen Current 0.32 0.32 75 max. W Pulse Grid Current 0.02 0.02 25 max. W Peak RF Grid Voltage 735 760 Pulse Drive Power 14.7 15.2 1-Pulsed Amplifier, the grid heating this element during Pulse Plate Output Power 19.5 29.3 heating this element during Pulse Plate Output Power 17.0 23.0	20 max. kV Pulse Plate Voltage 10 15 20 2.5 max. kV Pulse Screen Voltage 1.5 1.5 1.5 - 1.0 max. kV DC Grid Voltage -480 -510 -535 12.0 max. Amp Pulse Plate Current (Note 1) 1.95 1.95 1.95 1000 max. W Pulse Screen Current 0.32 0.32 0.32 75 max. W Pulse Grid Current 0.02 0.02 0.02 25 max. W Peak RF Grid Voltage 735 760 785 Pulse Drive Power 14.7 15.2 15.7 n-Pulsed Amplifier, the grid heating this element during Pulse Plate Output Power 17.0 23.0 31.5

RADIO FREQUENCY GRID-PULSED AMPLIFIER AND OSCILLATOR

emission throughout life of 80 milliamperes per watt of filament power. The

pulse plate current data shown under the Typical Operation sections refers

MAXIMUM RATINGS			TYPICAL OPERATION				
DC Plate Voltage	15 max.	kV	DC Plate Voltage	10	12.5	15	kV
DC Screen Voltage	2.5 max.	kV	DC Screen Voltage	1.5	1.5	1.5	kV
DC Grid Voltage	- 1.0 max.	kV	DC Grid Voltage	- 480	- 495	- 510	٧
Peak Cathode Current (Note 1)	12.0	max. A	Pulse Plate Current (Note 1)	1.95	1.95	1.95	Α
Plate Dissipation (Ave.)	1000	max. W	Pulse Screen Current	0.32	0.32	0.32	Α
Screen Dissipation (Ave.)	75	max. W	Pulse Grid Current	0.02	0.02	0.02	Α
Grid Dissipation (Ave.)	25	max. W	Peak RF Grid Voltage	735	745	760	٧
Note 1 : The maximum peak cathode curren	t rating rafara to the	a imptonto	Pulse Drive Power	14.7	15.0	15.2	W
neous peak cathode current available. This	•		Pulse Plate Input Power	19.5	24.4	29.3	kW

Duty

Pulse Plate Output Power

17.0

15.0

18.6

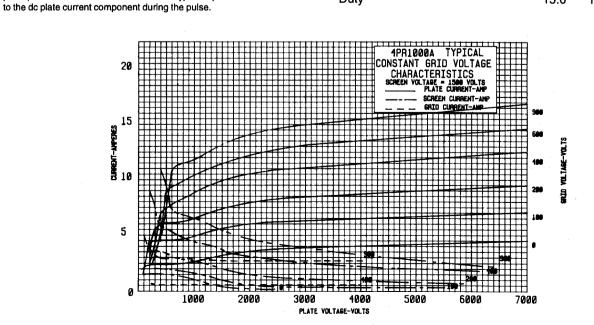
15.0

23.0

15.0

kW

%



MECHANICAL

Mounting — The 4PR1000A must be operated vertically, base up or base down. When the SK-510 Air-System Socket is used in conjunction with the SK-506 Air Chimney, the socket must be mounted to the under surface of the chassis to maintain proper air space between the plate seal and the chimney opening, otherwise plate seal cooling will be seriously impaired.

In the event the SK-510 Air-System Socket is not used, the socket must provide clearance for the glass tip-off which extends from the center of the tube. The metal tube-base shell should be grounded by means of suitable spring fingers.

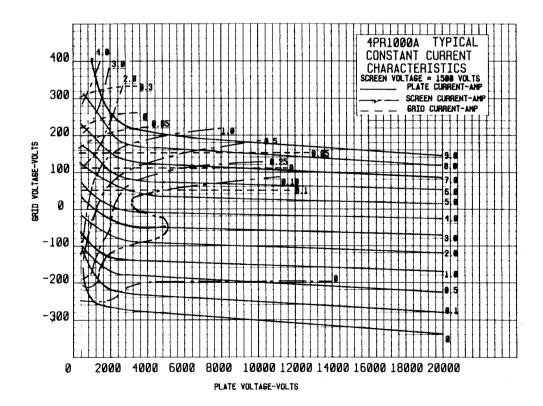
Cooling — Adequate forced-air cooling must be provided to maintain base-seal and plate-seal temperatures below 150°C and 200°C, respectively. In all classes of operation, it is recommended that a heat-radiating connector, the HR-8 or equivalent, be installed on the anode terminal and that a socket and chimney be employed which provides for proper seal cooling. When the 4PR1000A is operated at d-c or low frequencies in a SK-510 Air-System Socket, complete with SK-506 Air Chimney and HR-8 Heat Radiator, the minimum airflow requirements to maintain seal temperatures at 150°C in 50°C inlet air are tabulated below:

	S	ea Level	1(10,000 Feet+		
Ave. Plate	Air Flow	Plenum Pressure	Air Flow	Plenum Pressure		
Dissipation	(CFM)*	Drop. (Inches	(CFM)*	Drop. (Inches		
(watts)		of Water) **		of Water) **		
600	17.0	0.30	24.0	0.45		
800	20.0	0.40	28.0	0.56		
1000	25.0	0.55	36.0	0.80		

- * 1 CFM = 0.47195 Liters/sec
- ** 1 inch of $H_20 = 0.002458$ ATM
 - + Approx 3,000 meters

When the 4PR1000A is used as a pulsed-amplifier or oscillator at frequencies above 30 MHz, additional cooling may be required to compensate for the effects of plate and base-seal heating caused by rf charging currents and dielectric losses. Since the amount of seal heating varies with the particular application, it is suggested that the user monitor the seal temperatures to determine the adequacy of the cooling air.

Cooling air should be applied before or simultaneously with the application of filament voltage and may be removed simultaneously with filament voltage. In any questionable situation, the only criterion for adequate cooling is temperature. Tube temperature may be measured conveniently by using a temperature sensitive paint.



PULSE MODULATOR SERVICE

to the dc plate current component during the pulse.

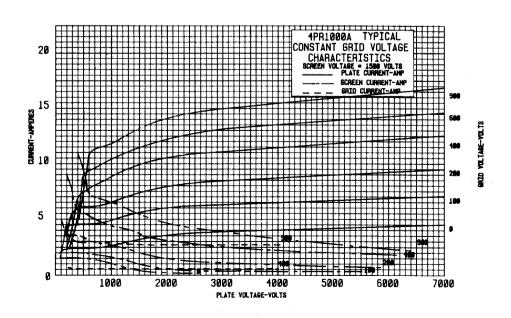
		TYPICAL OPERATION				
30 max.	kV	DC Plate Voltage	20	25	30	kV
2.5 max.	kV	DC Screen Voltage	1.5	1.5	1.5	kV
 1.0 max. 	kV	DC Grid Voltage	- 335	- 360	- 380	٧
8.0 max.	amperes	Pulse Plate Voltage	17.7	22.7	27.7	kV
1000 max.	watts	Peak Plate Current	8.0	8.0	8.0	Amp
75 max.	watts	Pulse Screen Current	1.25	1.25	1.25	Amp
25 max.	watts	Pulse Grid Current	0.2	0.2	0.2	Amp
		Pulse Pos. Grid Voltage	200	200	200	٧ .
		Pulse Drive Power	107	112	116	W
		Pulse Plate Input Power	160	200	240	kW
		Pulse Plate Output Power	140	180	220	kW
		Duty	4.0	4.0	4.0	%
	2.5 max. - 1.0 max. 8.0 max. 1000 max. 75 max.	2.5 max. kV - 1.0 max. kV 8.0 max. amperes 1000 max. watts 75 max. watts	30 max. kV DC Plate Voltage 2.5 max. kV DC Screen Voltage - 1.0 max. kV DC Grid Voltage 8.0 max. amperes Pulse Plate Voltage 1000 max. watts Peak Plate Current 75 max. watts Pulse Screen Current 25 max. watts Pulse Grid Current Pulse Pos. Grid Voltage Pulse Drive Power Pulse Plate Input Power	30 max. kV DC Plate Voltage 20 2.5 max. kV DC Screen Voltage 1.5 - 1.0 max. kV DC Grid Voltage - 335 8.0 max. amperes Pulse Plate Voltage 17.7 1000 max. watts Peak Plate Current 8.0 75 max. watts Pulse Screen Current 1.25 25 max. watts Pulse Grid Current 0.2 Pulse Pos. Grid Voltage 200 Pulse Drive Power 107 Pulse Plate Input Power 160 Pulse Plate Output Power 140	30 max. kV DC Plate Voltage 20 25 2.5 max. kV DC Screen Voltage 1.5 1.5 - 1.0 max. kV DC Grid Voltage - 335 - 360 8.0 max. amperes Pulse Plate Voltage 17.7 22.7 1000 max. watts Peak Plate Current 8.0 8.0 75 max. watts Pulse Screen Current 1.25 1.25 25 max. watts Pulse Grid Current 0.2 0.2 Pulse Pos. Grid Voltage 200 200 Pulse Drive Power 107 112 Pulse Plate Input Power 160 200 Pulse Plate Output Power 140 180	30 max. kV DC Plate Voltage 20 25 30 2.5 max. kV DC Screen Voltage 1.5 1.5 1.5 - 1.0 max. kV DC Grid Voltage - 335 - 360 - 380 8.0 max. amperes Pulse Plate Voltage 17.7 22.7 27.7 1000 max. watts Peak Plate Current 8.0 8.0 8.0 75 max. watts Pulse Screen Current 1.25 1.25 1.25 25 max. watts Pulse Grid Current 0.2 0.2 0.2 Pulse Pos. Grid Voltage 200 200 200 Pulse Drive Power 107 112 116 Pulse Plate Input Power 160 200 240 Pulse Plate Output Power 140 180 220

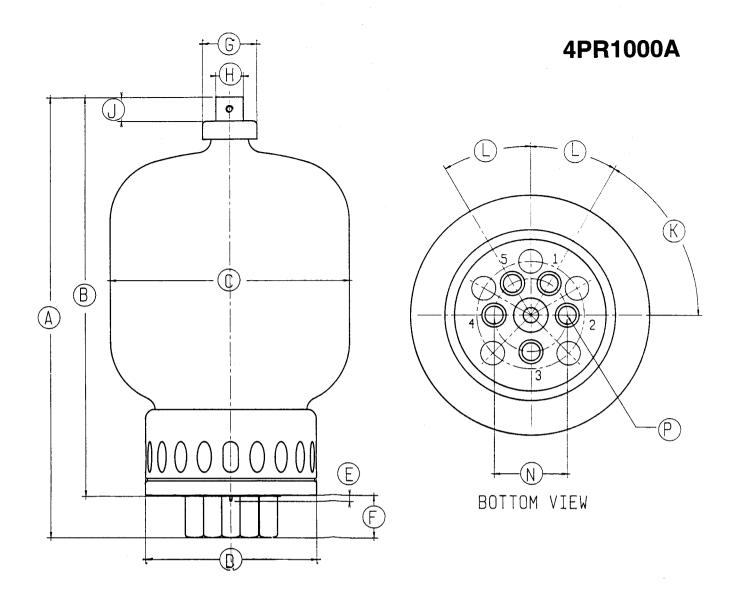
RADIO FREQUENCY PLATE AND SCREEN-PULSED AMPLIFIER AND OSCILLATOR *

MAXIMUM RATINGS			TYPICAL OPERATION				
Peak DC Plate Voltage	20 max.	kV	Pulse Plate Voltage	10	15	20	kV
DC Screen Voltage	2.5 max.	kV	Pulse Screen Voltage	1.5	1.5	1.5	kV
DC Grid Voltage	- 1.0 max.	kV	DC Grid Voltage	-480	-510	-535	V
Peak Cathode Current (Note 1)	12.0	max. Amp	Pulse Plate Current (Note 1)	1.95	1.95	1.95	Α
Plate Dissipation (Ave.)	1000	max. W	Pulse Screen Current	0.32	0.32	0.32	Α
Screen Dissipation (Ave.)	75	max. W	Pulse Grid Current	0.02	0.02	0.02	Α
Grid Dissipation (Ave.)	25	max. W	Peak RF Grid Voltage	735	760	785	٧
			Pulse Drive Power	14.7	15.2	15.7	W
* When used as a RF Plate and Scree	n-Pulsed Ampli	fier, the grid	Pulse Plate Input Power	19.5	29.3	39.0	kW
drive must also be pulsed to avoid ove	rheating this ele	ement during	Pulse Plate Output Power	17.0	23.0	31.5	kW
the inter-pulse periods.			Duty	15.0	15.0	12.0	%

RADIO FREQUENCY GRID-PULSED AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS			TYPICAL OPERATION				
DC Plate Voltage	15 max.	kV	DC Plate Voltage	10	12.5	15	kV
DC Screen Voltage	2.5 max.	kV	DC Screen Voltage	1.5	1.5	1.5	kV
DC Grid Voltage	- 1.0 max.	kV	DC Grid Voltage	- 480	- 495	- 510	V
Peak Cathode Current (Note 1)	12.0	max. A	Pulse Plate Current (Note 1)	1.95	1.95	1.95	Α
Plate Dissipation (Ave.)	1000	max. W	Pulse Screen Current	0.32	0.32	0.32	Α
Screen Dissipation (Ave.)	75	max. W	Pulse Grid Current	0.02	0.02	0.02	Α
Grid Dissipation (Ave.)	25	max. W	Peak RF Grid Voltage	735	745	760	V
Note 1 : The maximum peak cathode curren	t rating rafare to th	a instanta	Pulse Drive Power	14.7	15.0	15.2	W
neous peak cathode current available. This			Pulse Plate Input Power	19.5	24.4	29.3	kW
emission throughout life of 80 milliamperes p	er watt of filament	power. The	Pulse Plate Output Power	17.0	18.6	23.0	kW
pulse plate current data shown under the Ty		ctions refers	Duty	15.0	15.0	15.0	%





		DIM	ENSIONAL	DATA		
		INCHES	M:	CLLIMETER	RS	
DIM	MIN	MAX	REF	MIN	MAX	REF
A	8.875	9.625	9.250	225.4	244.5	234.9
В	8.000	8.750	8.375	203.2	222.2	212.7
С	_	5.250			133.3	
D	_	3.625	_	_	92.1	_
E	_	. 313		_	7.9	-
F	. 825	. 925	. 875	20.9	23.5	22.2
G	1.110	1.140	1.250	28.2	29	28.6
Н	. 559	.573	_	14.2	14.55	
J	. 484			12.3		
К	—	-	60°			6 0°
L		_	30°			30°
N	1.495	1.505	1.500	38	38.2	38.1
Р	. 371	. 377	. 374	9.42	9.57	9.49

