

# Plasma Generators

## Plasma Generators

### Introduction

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#### Applications

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Plasma is generated from a gas by introducing energy, usually applied by an electric field with alternating voltage in the range from some kHz to several MHz. The voltage required to initiate the plasma process becomes lower when gas pressure is reduced. However this requires a sealed reactor and a vacuum pump.

The plasma generators we offer are designed for use at normal atmospheric pressure. This is the most economic way to go for in-line production applications as well as for any kind of research and development.

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#### Generators

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Our plasma generators are targeted for research and development, process engineering, and science. They are also a good choice for low-power production applications as well as in-line quality control.

The generators are built with all-air insulation. Thus there are no parts that have to be serviced.

The user may freely program all variables of the generator independently. This makes our generators the ideal choice for development purposes. However with automation interfaces for PLC as well as a CAN field bus interface integration into a production line becomes seamlessly easy.

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#### Customer Specific

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All models shown are examples of our standard range. We are happy to tailor any product to your special requirements or do a complete new design from scratch, conforming to your specifications.

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#### Disclaimer

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All data, pictures and descriptions presented in this catalog is given at our best knowledge and thought to be reliable. However these may change at any time due to our commitment to continuous improvement. Thus we assume no responsibility that the data is up-to-date, correct or that a product is suitable for a certain use.

If you need an approval for specified data or for the suitability of a product for your application please request a written confirmation before placing an order.

# G2000 High Voltage Plasma Generator

## Datasheet

Medium Frequency Generator for Plasma Generation at Normal Pressure



### Shortform Data

property	value	unit
output voltage	20	kV <sub>pp</sub>
output power	500	W
frequency	4-500	kHz
mains voltage	230	V <sub>ac</sub>
dimensions	19" 4HE	

### Applications

- barrier discharge
- corona discharge
- liquid-free cleansing
- surface conditioning
- treatment of textiles
- food sterilisation
- gas detoxication
- spectroscopy

### Benefits

- plasma generation at normal air pressure
- variable output voltage from 0 to 100%
- wide frequency range
- pulse packet modulation
- short circuit and no-load proof
- air-insulated transformer
- fully programmable

## Your Task

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There are nearly unlimited applications for low temperature plasma at normal atmospheric pressure.

Plasma sterilises. It kills germs and spores in food products, paints and textiles.

Plasma ablates material. It cleans, degreases, improves and conditions surfaces prior to painting, glueing or electroplating.

Plasma enforces chemical reactions. It passivates or oxidates surfaces of metals to protect against corrosion or to ease consecutive treatments.

Its reactivity is usable for purifying exhaust gases of motors or incinerators. Toxic molecules are transformed into less dangerous ones.

Plasma makes gases emit its characteristic spectrum. With a spectrometer you can analyze the contents of a gas fillings inside transparent materials, such as glass tubes and bulbs.

## Our Solution

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The high voltage generates a plasma at a dielectrically insulated electrode (barrier), even at normal atmospheric pressure. This effect is known as barrier or corona discharge.

At normal pressure no vacuum is needed to initiate plasma generation, and thus no sealed reactor. This eases integration in a production flow.

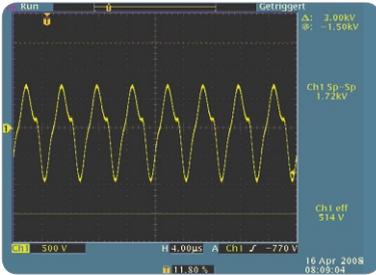
No liquid is needed. You neither have to supply nor to dispose or decontaminate any liquid. And there is no need for filters or catalytic converters that have to be replaced periodically.

Because of the completely variable setting of output voltage and frequency you can optimize the plasma formation for your application.

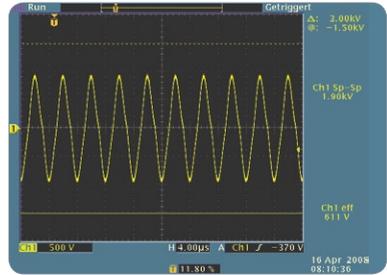
## Function

From an intermediate DC circuit the G2000 generates square unipolar pulses with programmable frequency, width and amplitude. These pulses are transformed to high voltage and coupled to the electrode.

The system of transformer inductance plus the capacitance of the cable and your load builds a resonant circuit. Applying high voltage pulses results in a (quasi-) sinusoidal voltage across your load.



output voltage below resonance



output voltage near resonance

The output pulse train can be periodically blanked by means of pulse packet modulation. This allows a burst mode operation to stabilize the plasma formation.

You can set all variables freely and independently via menus on a large 4-line LC display with only a few keystrokes and a datawheel.

The G2000 is short-circuit and open-circuit proof. Several independent current limiters control the mains current, the average current and the peak current.

On the mains side an active power factor correction (PFC) and a mains filter reduces harmonics and smoothes the operating current.

## Interfaces



front panel menu



rear panel

All variables are normally set via the front panel menu.

For production environments there is a set of digital control and monitor lines to control the G2000 remotely.

For complete remote control the G2000 has a CAN interface to set the variables and to control its operation.

## Usage

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The generator is designed to be mounted inside a cabinet. It must not be operated outside such a cabinet. The protection class is IP40 for the front and IP20 for the rear.

## Options

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The G2000 has an optional RS-485 interface for programming and control.

To adopt to a wide range of loads the airgap, and thus the inductance, or the secondary winding of the high voltage transformer might be modified. The winding is easily accessible, and so is the air gap.

## Variants

The generator is available with internal transformer or with external transformer.

### Internal Transformer

The G2000 with internal transformer connects to a coaxial high voltage cable. The cable and also the jack for the other end are available as accessories.

### External Transformer



external transformer

The G2000 with external transformer comes with a separate transformer box. Both units are interconnected by a pair of control wires, which are included in the delivery.

We will also supply the G2000 also without transformer in case you want to use your own one.

### Comparison

Using an internal transformer means that you have everything contained in one box. On the other hand the usable frequency of the generator is practically limited due to the capacitance of the cable.

Using an external transformer means placement of the transformer near to the load with short wires. This allows operation at higher frequencies.

## Accessories



high voltage cable



coaxial jack

The high voltage cable is a critical part, considering the high voltage and frequency applied to it. We deliver a proven cable with lugs on both ends in different lengths. To adopt your electrode the matching jack for the far end is also available.

## Specifications

Lamp Power Supplies

Plasma Generators

DC Power Supplies

Optical

Interface

Others

Operating Range	min	typ	max	unit
output voltage (1)	0		20k	V <sub>pp</sub>
output power			500	W
frequency (2)	4		500	kHz
packet pulse or pause width			1000	ms
intermediate circuit voltage	0		300	V <sub>dc</sub>
intermediate circuit current			4	A <sub>dc</sub>
secondary inductance				
20kV <sub>pp</sub> transformer		10		mH
10kV <sub>pp</sub> transformer		2		mH
secondary capacitance		100		pF
secondary peak current				
20kV <sub>pp</sub> transformer		1.5		A
10kV <sub>pp</sub> transformer		3		A

(1) The output voltage depends on the frequency adjustment and the load capacity.

(2) Lower frequencies are feasible, but locked by means of software.

Environment	min	typ	max	unit
ambient temperature	0		40	°C
storage temperature	-10		70	°C
relative humidity			70%	
mains voltage	207	230	253	V <sub>ac</sub>
mains current		4	10	A <sub>ac</sub>
mains frequency	48	50	62	Hz
<b>Dimensions</b>	<b>min</b>	<b>typ</b>	<b>max</b>	<b>unit</b>
height		132		mm
width		482		mm
depth (3)		420		mm

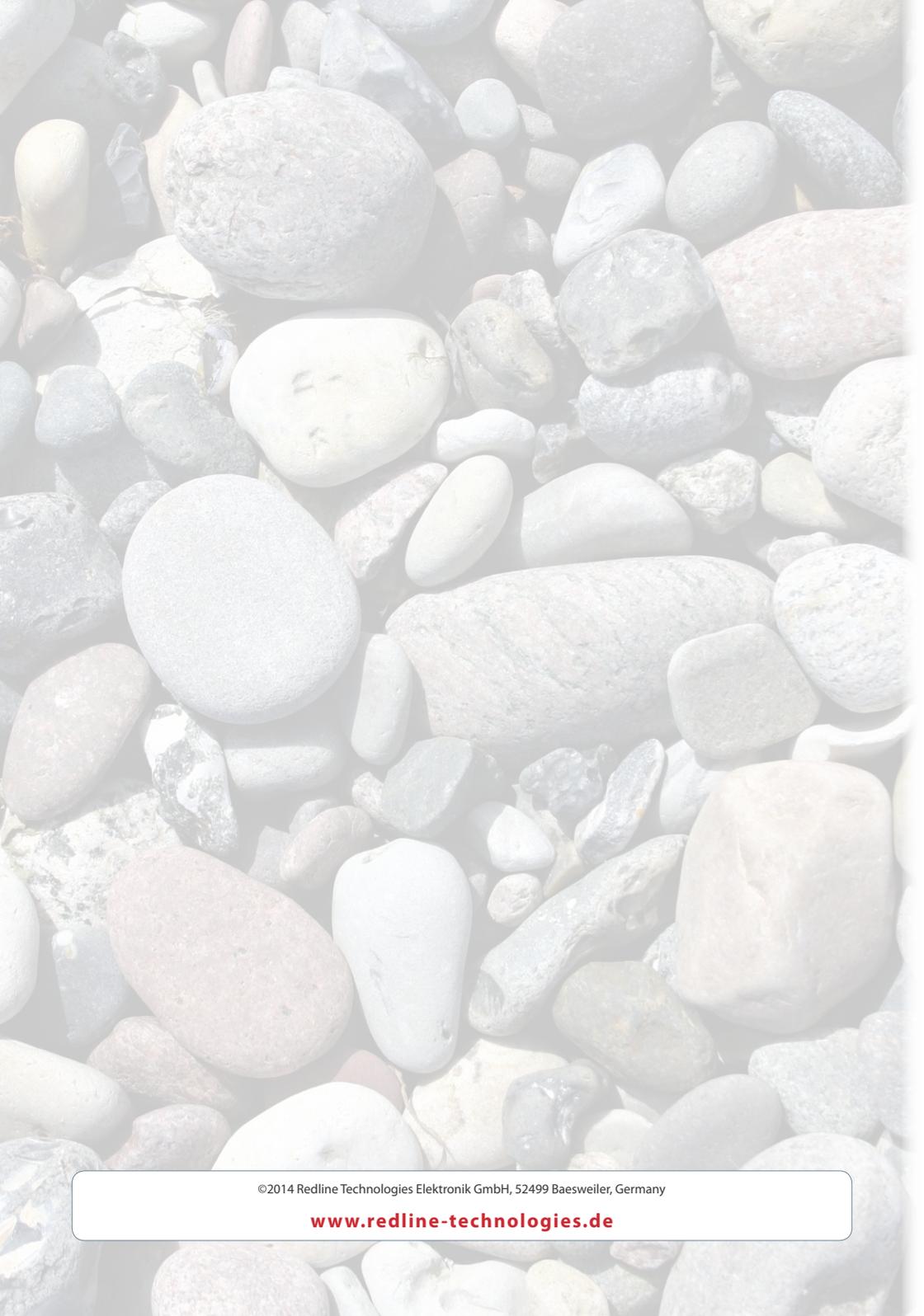
(3) Allow extra space for the high voltage connector extending to the rear.

## Order Code

number	description
<b>generators</b>	
45.20.100.10	generator 500W with internal transformer 20kV <sub>pp</sub>
45.20.100.14	generator 500W with internal transformer 10kV <sub>pp</sub>
45.20.100.20	generator 500W without transformer
45.20.100.30	generator 500W with external transformer 20kV <sub>pp</sub> and cables, consists of - 45.20.100.20 generator - 31.35.10.10 transformer - set of interconnecting cables 3 meters
<b>transformers</b>	
31.35.10.10	external transformer 500W 20kV <sub>pp</sub> in case
31.35.10.20	external transformer 500W 10kV <sub>pp</sub> in case
<b>cables and accessories</b>	
35.130.20.110	high voltage cable with coaxial jacks 1 meter
35.130.20.115	high voltage cable with coaxial jacks 1.5 meter
35.130.20.120	high voltage cable with coaxial jacks 2 meter
34.36.11.131	coaxial jack for connecting high voltage cable

(1) The high voltage cables are available with any length.

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