redline TECHNOLOGIES

Unified HV / G2020
High Voltage Generator Modules

Preliminary

The Data Sheet



Plasma

Plasma is generated from a gas by introducing energy, usually applied by an electric field with alternating voltage in the range of some kHz to several MHz. The voltage for initiating the plasma process becomes lower when reducing gas pressure. The downside is that you need a sealed reactor and a vacuum pump.

There are countless applications for plasma at normal atmospheric pressure. Plasma sterilisates. It kills germs, spores, viruses and bacteria in food products, paints, textiles and breathing air. Plasma ablates material. It cleans and degreases surfaces and improves the adhesion prior to painting, glueing or electroplating. Plasma enforces chemical reactions. It passivates or oxidates surfaces of metals to protect against corrosion or or to ease consecutive treatments.

Its reactivity is usable for purifying exhaust gases of engines and incinerators or from paint shops containing solvents. Toxic molecules are converted into less dangerous ones. Plasma makes gases emit its characteristic spectrum. With a spectrometer you can analyze the contents of a gas filling inside transparent materials, such as glass tubes and light bulbs.

For all these applications no liquid is used. You neither have to supply nor to dispose or decontanimate any such liquid. And there is no need for filters or catalytic converters that have to be replaced periodically.

When using plasma the energy introduced goes directly into the process. There is no detour via thermal energy from heating or incineration. Thus total heat dissipation is considerably lower and efficiency is much higher than with conventional approaches.

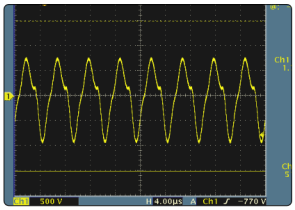
Generator

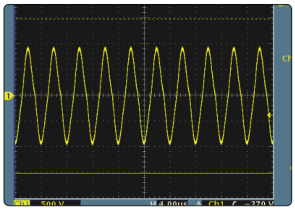
The high voltage generators we offer are designed for use at normal atmospheric pressure. This is the most economic way to go for many in-line production applications as well as for all kinds of research and development.

Our generators are built with all-air insulation. Thus there are no parts that require regular service. Plus you can use them in clean room environments without risking pollution.

You can program all settings of the generator independently. This makes our generators the ideal choice for research and development, process engineering, and science. Plus when going live its automation interface make the integration into a production line seamlessly easy.

Function





The Unified HV modular generator converts an intermediate DC voltage into square unipolar pulses with programmable frequency, width and amplitude. These pulses are transformed to high voltage and coupled to the electrode.

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

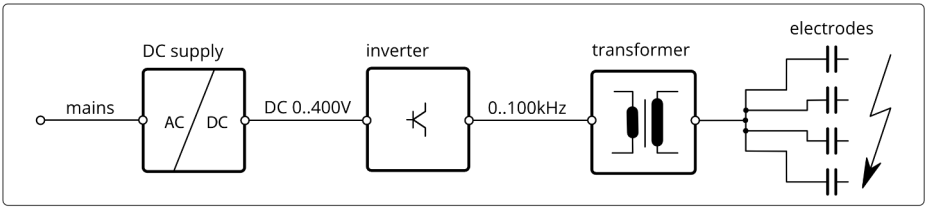
The system of transformer inductance plus the capacitance of the cable and your load builds a resonant circuit. Applying high voltage pulses results in a (quasi-)sinusoidal voltage across your load. Thus electromagnetic interference is considerably lower than with other types of generators.

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 indepently via menus on a large liquid chrystal display with only a few keystrokes and a data wheel.

The Unified HV generator 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 supply side an active power factor correction (PFC) and a mains filter reduce harmonics and smoothe the operating current.

Modular Generator

The Unified HV modular high voltage generator is made of three components. The DC power source, the AC inverter and the high voltage transformer.



You can connect more than one inverter to one DC power supply. This reduces system cost. However you cannot adjust the voltage amplitude of the connected inverters separately.

DC Supply Module

The DC power supply from our „Unified DC“ series is a programmable power supply. Voltage and current limit can be both set from 0 to maximum. It has a quick-acting regulation which is mandatory due to the rapid load changes by the inverter.

Select from our „Unified DC“ series with CAN interface. We recommend the 2400W 300V or the 5kW 400V model. There is a separate data sheet available for the „Unified DC“ range of power supplies.

High Voltage Transformer

The high voltage transformer steps up the pulses from the inverter. Due to the resonant tank characteristic of the combination o trranformer inductance and electrode capacitance a quasi-sinusoidal waveform will be generated. One end of the secondary transformer winding is grounded, the other carries high potential. Connection to the electrode(s) can be accomplished by a single litz wire. Because of the variable voltage of the generator there is no need for taps on the transformer.

A transformers with reduced winding ratio is available for applications with lower voltage requirements. With half maximum output voltage it supplies double the output currrent.

The transformer is also available with coaxial high voltage connector for applications with large distance between transformer and electrode.

Inverter Module

The inverter module is essentially a programmable high power pulse generator. It converts the incoming DC voltage to a train of pulses.

The inverter module is available with two channels. In effect you have two pulse generators in one case. This setup offers a lot of options.

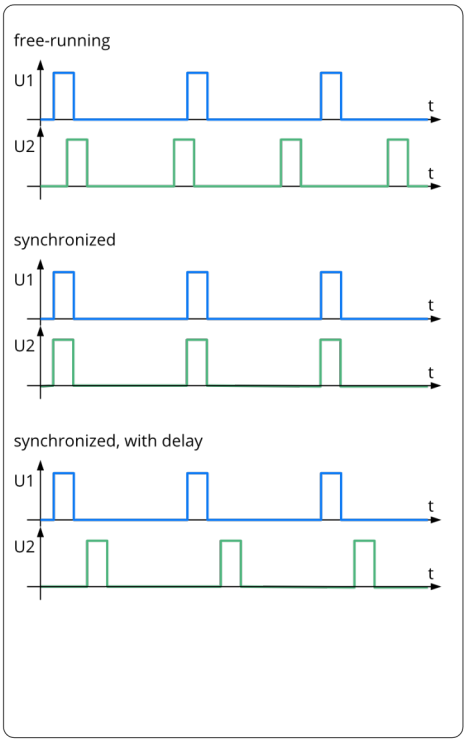
Operation modes

Both channels can operate independently in a **free-running** mode with different frequency. In this case you will connect each channel to its own high voltage transformer.

Both channels can operate **synchronized** with frequency and phase locked. You may connect both channels in parallel to the same high voltage transformer effectively doubling the output current and output power.

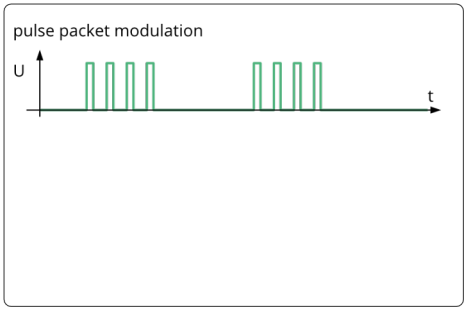
Both channels can operate **synchronized with delay** with frequency and phase locked. You may connect both channels to the same high voltage transformer effectively doubling the pulse frequency and thus the output power without increasing pulse current.

In any case both channels operate on the same DC voltage and thus also the output voltage of the two will be the same.



Pulse Packet Modulation

Instead of issueing a continuous pulse train the Unified HV inverter can supply an intermittent pulse train. You can set number of pulses per pulse packet und number of blanked pulses. This will reduce average output power while maintaining a stable plasma.



Control

Both the DC power supply and the inverter are controlled via a CAN bus interface on each module. You may connect several DC power supplies and inverters to one CAN bus.

Other interfaces are available on request. The interface is socketed, thus you have the option to select one of your choice or to change it later.

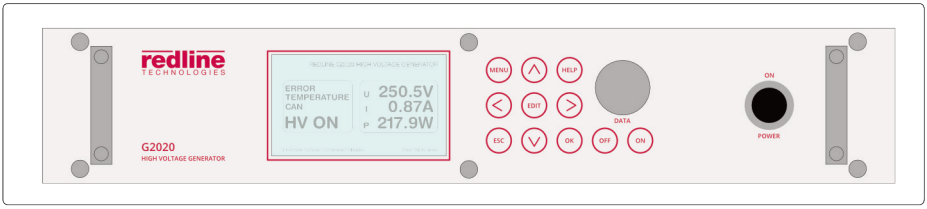
The inverter module requires an auxiliary voltage supply of 12...24V_{DC}

Use

The generator system is designed to be mounted inside a cabinet. It must not be operated outside such a cabinet.

The Unified HV generator is short-circuit proof. The output current is limited but not turned off. It is also open-circuit proof as long as the high voltage line is connected. If it is not there is a chance of electric discharge inside the connector.

G2020 Integrated Generator



Not yet available but in the making is an integrated generator named G2020. Like its famous predecessor G2000 this will contain DC power supply and inverter plus a front panel with menu and keypad operation. Its the perfect device for research and development where you want to tweak each parameter of operation on the fly.

The G2020 will connect to one or two external transformers.



Inverter module



DC power supply 2400W



External transformer, front



External Transformer with single wire output, rear

Order Codes
Generators and Transformers



DC Supply Module

45.22.90.106	single-phase 2400W 300V 8A CAN
45.24.90.102	three-phase 5000W 400V 12A CAN



Inverter Module

45.20.200.20	dual channel 2x 1000W
45.20.200.22	single channel 1000W



External Transformer with Single Ended Output

High voltage connector included. Any wire might be used, with or without insulation, e.g. high voltage litz wire.
Cables are not included.

31.35.20.10	20kV$_{PP}$ 2000W
31.35.20.12	10kV$_{PP}$ 2000W

No picture available

External Transformer with Coaxial Output

Coaxial cable and coaxial jack required for operation.
Cables to generator are included, length 3 meters.

31.35.22.10	20kV$_{PP}$ 2000W
31.35.22.12	10kV$_{PP}$ 2000W

Order Codes
Accessories

Coaxial Cable

Mates with transformer with coaxial output. Coaxial jack on other end required. Different lengths available. Capacitance 100pF/m.

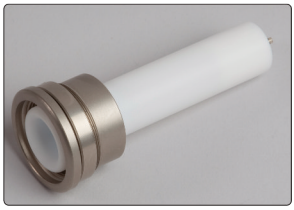


35.130.20.110	1 meter
35.130.20.115	1.5 meters
35.130.20.120	2 meters

Any length not mentioned is available on request. For the brave we also offer cables with only one connector and the other end open.

Coaxial Jack

Mates with coaxial cable. Mounting hole diameter 36mm.



34.36.11.131	

High Voltage Single-Ended Connector

Mates with external transformer with single ended output.
Litz wire has silicone insulation.



34.36.11.191	solder contact
35.4.96.2510	litz wire 25kV 1sqmm AWG30, per meter

Specification

Inverter Module	min	typ	max	unit
input voltage	0		400	V_{DC}
input current, per channel			4	A_{DC}
output voltage (1)(2)	0		800	V_{PP}
output real power, per channel			1000	W
output peak current			500	A
frequency (3)(4)	0.1		100	kHz
packet pulse or pause width	0.1		1000	ms
Transformer				
output voltage (1)(2)	0		20	kV_{PP}
output real power			2000	W
frequency (3)	0.1		500	kHz
secondary inductance		10		mH
secondary capacitance		100		pF
secondary peak current		15		A

Preliminary

Data for the DC power supplies to be found in the separate „Unified DC“ data sheet.

(1) The data applies to the model with 20kVpp / 500W output.

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

(3) Frequencies above self-resonance (ca. 100 kHz) are usable for low-power applications only.

(4) Frequency is purely limited by software.

Dimensions

DC Supply Module	min	typ	max	unit
height		82		mm
width		220		mm
depth (5)		340		mm
Inverter Module				**unit**
height		82		mm
width		220		mm
depth (5)		340		mm
Single-Ended Transformer				
height		115		mm
width		110		mm
length (6)		240		mm
Coaxial Transformer				
height		115		mm
width		110		mm
length (6)		340 (TBD)		mm

(5) Depth is case only. Allow extra space for connectors extending to the front.

(6) Length is case only. Allow extra space for connectors extending to the front and rear.

Environment

Environment	min	typ	max	unit
ambient temperature	0		40	°C
storage temperature	-10		70	°C
relative humidty	0.1		70 %	
secondary inductance		10		mH
secondary capacitance		100		pF
secondary peak current		15		A

Variants

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

Disclaimer

All data, pictures and descriptions presented in this catalog are 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.

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