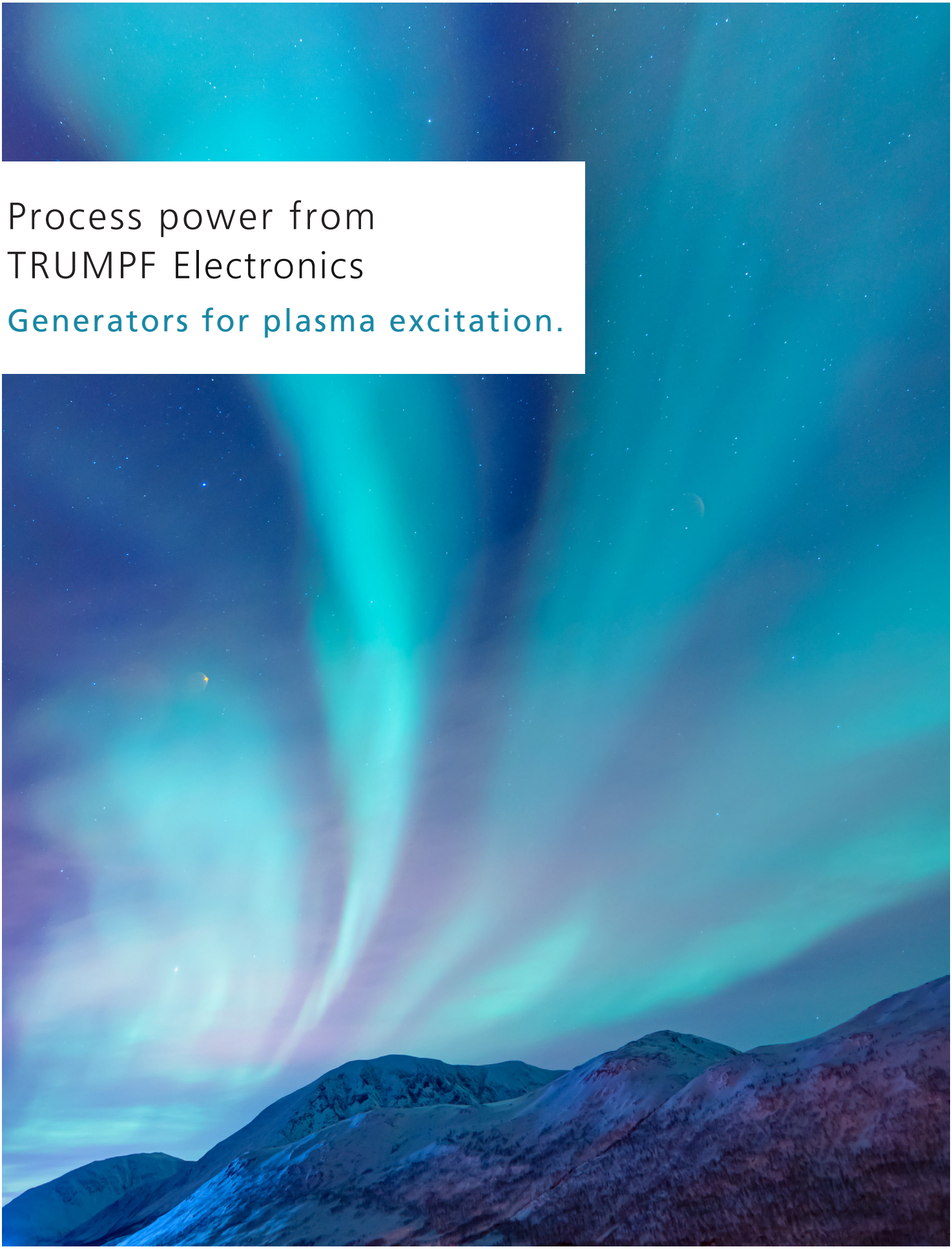
Process power from TRUMPF Electronics

Generators for plasma excitation.



TRUMPF

TRUMPF Electronics
generating confidence

TRUMPF Electronics is a high-tech company and a leading global manufacturer of DC, medium-frequency, high-frequency and semiconductor-based solid-state microwave generators. We generate electricity at the required frequency and power. Our business divisions include plasma technology, industrial heating, battery inverter systems and microwave generators and amplifiers. Our process power supplies are being used in many key processes in research, development and production.

Behind all these technologies is a TRUMPF Group company with its own development, production, sales and service with subsidiaries in Europe, America and Asia. Development and production are located in Germany and Poland. TRUMPF Electronics employs around 2000 people worldwide, 600 of them at its headquarters in Freiburg, Germany.

Finding the best solution is what drives us. Or as we say at TRUMPF Electronics: generating confidence!

Your contact at TRUMPF Electronics:

TRUMPF Electronics harnesses one of nature’s most impressive powers.

How we are putting plasma excitation to work.

We can see it in lightning, the northern lights and the sun’s corona – fascinating examples of naturally occurring plasma phenomena. Also called the Fourth State of Matter, plasma is created when gas is heated to an extremely high temperature, causing the kinetic energy of the gas particles to rise so much that electrons are released from the atoms and molecules. In nature, plasmas are self-igniting and highly unstable. Fortunately, scientists and engineers have figured out how to create sustained and precisely controlled plasmas for use in the world of industrial technology.

Generators from TRUMPF Electronics help to achieve the mastery of plasma creation, making it possible to perform a wide range of intriguing applications. Our generators, developed and refined over many years, deliver the stable and accurate energy needed for these various plasma applications, as e.g. large area coating respectively etching semiconductors, solar cells and flat panel displays; surface treatment of metals and plastics among others. As a result, DC, middle, radio and microwave frequency generators from TRUMPF Electronics are the acknowledged leaders in many high technology markets.

Providing customer solutions. Every day.

DC generators from TRUMPF Electronics are built to perform in the harshest of industrial environments. Across the range, our generators do not compromise when it comes to accuracy, repeatability or arc suppression. Continually, they deliver the energy needed to run your processes efficiently and effectively. But even better, DC power supplies from TRUMPF Electronics are modular and scalable. Individual blocks can be easily combined to provide an extended power range. You get flexibility and redundancy with unparalleled performance.

Direct current (DC)

TruPlasma DC Series 3000 (G2) / 4000 (G2) – the versatile ones
Compact DC generators with high power density. Ideal for demanding plasma applications like solar cell production. Stackable for high power, featuring advanced arc management. Pulse mode available.

TruPlasma DC Series 3000 G2.1 / 4000 G2.1 – the powerhouses
Next-generation DC generators with even greater performance. Designed for advanced DC processes – standalone or in stacks. Equipped with cutting-edge arc management and pulse mode.

TruPlasma Highpulse Series 4000 (G2) – the peak performers
High impulse DC generators for outstanding film quality. Developed for HIPIMS applications, delivering up to 2 megawatts peak power – the key to innovative PVD processes.

TruPlasma Arc Series 3000 (G2) – the dynamic ones
Built for arc evaporation and other high-energy applications. With dynamic current regulation for stable performance across a wide current range – ideal for hard coatings, decorative layers, and ion source applications.

TRUMPF Electronics DC solutions: Our portfolio

TruPlasma DC Series 3000 (G2)		TruPlasma DC Series 4000 (G2)	
			
This generation of compact, water-cooled units is ideally suited for metallic sputtering applications. TruPlasma DC 3000 generators have a high power density and provide full rated power over a broad range of load impedances. The arc management CompensateLine ensures superior film qualities at high deposition rates.		Compact DC generators with pulse mode for demanding sputtering applications. The flexible pulse parameters with maximum pulse frequencies reduce the arcs also in critical processes. The arc management circuitry allows you to achieve high yields in critical deposition processes.	
Output	10 – 300 kW	**Output**	5 – 200 kW
Cooling	Water	**Frequency**	0 – 150 kHz
		Cooling	Water
Interfaces	Analog/Digital EtherCAT (optional) DeviceNet (optional) RS 232/485 PROFIBUS	**Interfaces**	Analog/Digital EtherCAT (optional) EtherNET/IP (optional) DeviceNet (optional) RS 232/485 PROFIBUS PROFINET (optional) USB

TruPlasma DC Series 3000 G2.1 (10+ kW)

A series of DC generators designed to meet the highest demands of industrial and research applications. With a broad range of voltage and current outputs, they offer exceptional versatility across diverse use cases. Ultra-fast arc management boosts yield, while unmatched repeatability ensures consistent results every time.

Output Power	10 – 200 kW
Cooling	Water
Interfaces	Analog/Digital EtherCAT (optional) EtherNET/IP (optional) DeviceNet (optional) RS 232/485 PROFIBUS PROFINET (optional) USB

TruPlasma DC Series 3000/4000 G2.1 (1 – 5 kW)

TruPlasma DC Series 3000/4000 G2.1 is the compact solution for demanding sputtering applications. By providing flexible pulse parameters with maximum pulse frequency, the number of electric arcs is reduced also in critical processes. The arc management circuitry allows you to achieve high yields in critical deposition processes.

Output	1 – 5 kW
Frequency	0 – 150 kHz
Cooling	Air
Interfaces	Analog/Digital EtherCAT EtherNET/IP DeviceNet RS 232/485 PROFIBUS PROFINET USB

TruPlasma Highpulse Series 4000 (G2)

High impulse power DC generators for depositing extremely precise thin film layers. Peak powers of up to 2 megawatts. Designed especially for High Power Impulse Magnetron Sputtering (HIPIMS), they create high plasma densities. Ideal for functional and decorative applications, metal ion etching and semiconductor applications.

Output	1 – 2 MW
Frequency	1 – 40 kHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT (optional) DeviceNet (optional) RS 232/485 PROFIBUS USB

TruPlasma Arc Series 3000 (G2)

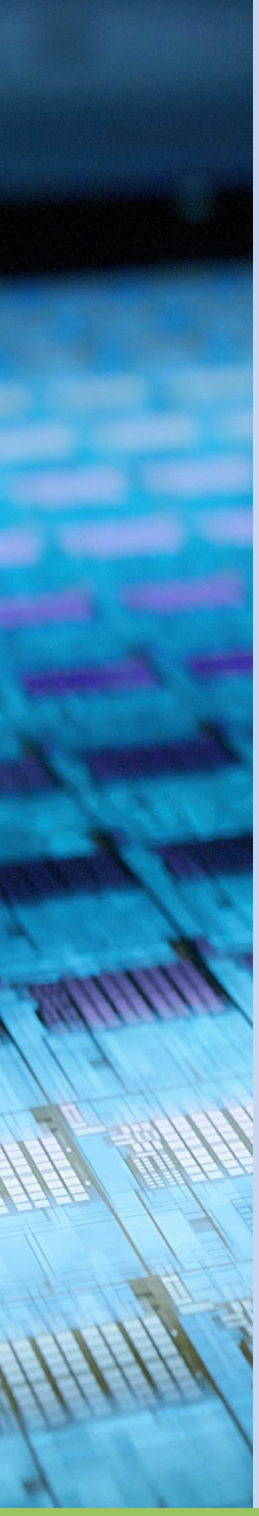
With dynamic current regulation, these power supplies are perfect for cathodic arc evaporation. They are suitable for any application with similar current and voltage demands. Common uses include hard and decorative coatings, as well as ion source applications.

Output Current	225 A
Cooling	Water
Interfaces	Analog/Digital EtherCAT (optional) RS 232/485 PROFIBUS PROFINET (optional) USB

Using our knowledge for your benefits.

RF Generators from TRUMPF Electronics – power built for your demands.

TruPlasma RF generators from TRUMPF Electronics provide the highest process stability of all power supplies for plasma excitation. The RF technology is therefore especially suited to processes which need the highest level of precision and reproducibility. Also in terms of energy efficiency and robustness, our RF generators are amongst the leaders on the market – they are therefore the first choice for demanding applications such as the manufacture of semi-conductor elements, microchips, solar cells or flat screens.



Radio Frequency (RF)

TruPlasma RF Series 1000 / 3000 (G2/13) – the robust ones
Energy-efficient RF generators for coating and etching in semiconductor production. Precise power control and rugged operation ensure maximum uptime and productivity.

TruPlasma RF Series 1000 / 3000 G3 – the next generation ones
The high dynamic series is now available at 13.56 MHz — built on a modular platform and equipped with proven CombineLine Technology. The new G3 enables advanced etch processes with multi-level and high-speed pulsing.

TruPlasma VHF Series 3000 – the innovative ones
Designed for process stability and precision. These VHF generators deliver excellent, reproducible results – tailored to meet the needs of demanding plasma applications.

TruPlasma RF Air 1000 – the compact ones
Optimized for plasma processes like RIE, ALD, and PECVD. Their flexible, compact design boosts throughput and cuts operating costs.

TruPlasma Match Series 1000 (G2/13) – the complementary ones
With intelligent matching and digital process control, they complete the TRUMPF RF system – ensuring all components work in perfect harmony.

TruPlasma LF 1000 – the reliable ones
Featuring ultra-wide auto-frequency tuning, burst mode ignition, and advanced diagnostics. Built for stable, reliable low-frequency plasma processes.

TruPlasma LF 3000 – the space efficient ones
Available in a 2U, 4U or 5U design, this system features up to four fully independent outputs, making it an excellent choice for biasing applications in semiconductor manufacturing where flexibility and precision are essential.

Ready for tomorrow: RF generators from TRUMPF Electronics.

TRUMPF Electronics RF solutions: Our portfolio

TruPlasma LF 3000

Highly reliable low-frequency generator in a compact 2U design: The TruPlasma LF3000 ensures precision, stability, and top performance. Software-defined functionalities enable superior quality in semiconductor manufacturing, particularly for biasing applications. Durable and efficient, it's the ideal choice for cost-effective, high-quality production.

Output	1, 1.5 kW
Frequency	350 kHz, 400kHz
Cooling	Air
Interfaces	Analog EtherCAT SystemPort DeviceNet RS 232 USB

TruPlasma LF 3000 4x1

This 4-channel unit is designed specifically to meet the needs of the semiconductor industry, combining precision with space efficiency. Its four independent output channels not only optimize system-level space usage but also contribute to space efficiency at the fab level.

Output	4 x 1 kW
Frequency	350 kHz
Cooling	Air
Interfaces	EtherCAT RS 232/485 USB

TruPlasma LF 1000-10

This non-50-ohm generator offers ultra-wide auto-frequency tuning with rapid adjustment. The burst mode, managed by Safe Operation Area, ensures reliable ignition even in tough conditions. Its log event feature and 10 Gbit/s interface enable efficient process and yield optimization.

Output	10 kW
Frequency	200 – 800 kHz
Cooling	Water/Air
Interfaces	Analog EtherCAT RS 232 USB ETH 10Gbit/s

TruPlasma RF 1003/2

Due to its advanced technology, the TruPlasma RF 1003/2 reaches an efficiency of up to 83%, effectively reducing energy losses by half compared to the industry standard

Output	3 kW
Frequency	3 MHz
Cooling	Water/Air
Interfaces	Analog EtherCAT DeviceNet SystemPort USB Pulse IN/OUT Clock IN/OUT Arc IN/OUT

TruPlasma RF 3000-12/2

The TruPlasma 3000-12/2 delivers outstanding accuracy, consistency, and performance. Its software-defined features enable it to introduce a new standard in semiconductor manufacturing, particularly in biasing tasks. Due to its robustness and overall efficiency, this system is an ideal choice where cost-effectiveness and top-notch quality are essential design objectives. Generator is available in a compact 5U size.

Output	12 kW
Frequency	12 MHz
Cooling	Water/Air
Interfaces	Analog EtherCAT DeviceNet SystemPort USB Pulse IN/OUT Clock IN/OUT Arc IN/OUT

TruPlasma RF Air 1000

The air-cooled TruPlasma RF 1000 Air delivers up to 1000 watts of high-precision, reproducible RF energy with an extremely fine resolution and is thus suitable for diverse plasma applications. Whether manufac-t uring semiconductors, solar cells, or displays – the patented TRUMPF El ectronics technology garantees top reliability.

Output	1 kW
Frequency	13.56 MHz
Cooling	Air
Interfaces	Analog/Digital EtherCAT DeviceNet RS 232/485 SystemPort Pulse IN/OUT Clock IN/OUT Arc IN/OUT

TruPlasma RF 1000 (G2/13)

Extremely robust RF generator for PECVD and etching applications in semiconductor manufacturing. Accurate output power regulation and CombineLine allow for stable processes and best productivity. Cost-efficient system integration due to compact half 19“ design.

Output	3 kW
Frequency	13.56 MHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT DeviceNet RS 232/485 PROFIBUS SystemPort Sync IN/OUT Clock IN/OUT

TruPlasma RF 3006 (G2/13)

Thanks to special power regulation, the TruPlasma RF Series 3000 achieves up to 80 % efficiency – which means energy losses are halved compared to the market standard. The patented CombineLine coupler ensures a particularly steady process.

Output	6 kW
Frequency	13.56 MHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT DeviceNet RS 232/485 PROFIBUS SystemPort Sync IN/OUT Clock IN/OUT

TruPlasma RF 3000-5/13 (High Dynamic)

Introducing the High Dynamic series to 13.56 MHz.
Featuring a modular platform concept as well as the well known CombineLine Technology, the new G3 is able to provide cutting etch technology such as multi-level and high-speed pulsing up to 400kHz.

Output	5 kW
Frequency	13.56 MHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT EtherNET/IP DeviceNet RS 232/485 SystemPort Clock IN/OUT Arc IN/OUT Pulse IN/OUT

TruPlasma RF 1000-2.5/13 (High Dynamic)

Pushing the High Dynamic capabilities even further, the new 2.5kW G3 maximizes the multi-level pulsing flexibility and handles reflected power up to 30% for increased robustness.

Output	2.5 kW
Frequency	13.56 MHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT EtherNET/IP DeviceNet RS 232/485 SystemPort Pulse IN/OUT Clock IN/OUT Arc IN/OUT

TruPlasma RF Series 3000

Thanks to its advanced power regulation, the TruPlasma RF Series 3000 achieves an efficiency of up to 80% – cutting energy losses in half compared to the industry standard. Our patented CombineLine coupler ensures exceptionally stable processing.

Output	12, 24, 27 kW
Frequency	13.56 MHz
Cooling	Water / Air
Interfaces	Analog/Digital EtherCAT DeviceNet RS 232/485 PROFIBUS SystemPort Pulse IN/OUT Clock IN/OUT Arc IN/OUT

TruPlasma VHF Series 3000

Based on an innovative platform concept that enables the highest level of power density and meets the most demanding process requirements. These compact VHF generators are also very cost-effective and have a robust design.

Output	2.5, 5, 10, 20 kW
Frequency	27.12 - 60 MHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT DeviceNet RS 232/485 SystemPort Pulse IN/OUT Clock IN/OUT Arc IN/OUT

TruPlasma Match Series 1000

Our matchboxes are the ideal complement to RF generators from TRUMPF Electronics. Their intelligent matching algorithm and digital control platform for process monitoring provide a comprehensive solution in which all of the components work together optimally – the TRUMPF RF System.

Output	1 – 24 kW
Frequency	2 – 60 MHz
Cooling	Water/Air
Interfaces	Analog EtherCAT RS 232/485 PROFIBUS SystemPort

Using our knowledge for your benefits.

MF Generators from TRUMPF Electronics – the power to meet your needs.

MF Plasma Excitation from TRUMPF Electronics is above all used in dual cathode systems, for example, for dual magnetron sputtering. Due to their high output power and process stability, the medium frequency generators are suited to both the coating of large surfaces of architectural glass with high deposition rates as well as for the application of ultra-thin, homogeneous layers on semiconductors or solar cells. As a result of their excellent precision and productivity, our MF process power supplies are the ideal solution for numerous applications in plasma excitation.

Middle Frequency (MF)

TruPlasma MF Series 7000 (G2) – the superior ones
Top choice for large-area coatings with double magnetron sputtering. Delivers unmatched film quality, even in demanding reactive processes – with high sputtering rates and consistent performance.

TruPlasma Bipolar Series 4000 (G2.1) – the bi-polar choice
Versatile pulsed DC generators with wide output range and fine adjustability. Ideal for reactive sputtering with dual magnetrons.

TruPlasma Bipolar Series 4000 (G2.1 / G3) PECVD – the reliable ones
Developed for plasma-assisted processes like PECVD and dual-cathode sputtering. A trusted solution for efficient and precise solar cell production.

TruPlasma Bipolar Series 4000 (G2.1) HV – the strong ones
High-voltage generator for demanding PVD and PECVD processes – including plasma applications at atmospheric pressure. Built for power and reliability.

TRUMPF Electronics MF solutions: Our portfolio

TruPlasma MF Series 7000 (G2)

With their superior arc management and ignition behavior, the output voltage and frequency (adjustable over a wide range) and their high current reserve, our new MF generators are the number one choice for large area coating and demanding processes. As a result of peak efficiencies of more than 90 percent and particularly efficient water management, unique in MF technology, they are also extremely economical to operate.

Output	50 – 150 kW
Frequency	20 – 50 kHz*
Cooling	Water
Interfaces	Analog/Digital (optional) EtherNet RS 232/485 PROFIBUS PROFINET (optional)

TruPlasma Bipolar Series 4000 (G2.1)

Optimized for plasma-assisted film deposition methods like dual cathode sputtering, ensuring exceptional reliability and performance. Ideal for applications in semiconductor manufacturing, architectural glass coating, solar cell production, hard and decorative coatings, and optical films.

Output	5 – 180 kW
Frequency	1Hz – 100 kHz
Cooling	Water
Interfaces	Analog/Digital EtherCAT EtherNet/IP DeviceNet (optional) RS 232/485 PROFIBUS PROFINET

* 20 – 70 kHz up to 100 kW optionally available.

TruPlasma Bipolar Series 4000 G2.1 PECVD

TruPlasma Bipolar Series 4000 G3 PECVD

Designed specifically for plasma-assisted film deposition processes such as PECVD, this product family delivers the stability and precision required in demanding applications like solar cell manufacturing, where consistent layer quality, uptime, and long-term reliability are critical to production efficiency.

Output	15 – 30 kW	**Output**	15 – 40 kW
Frequency	5 – 50 kHz	**Frequency**	40 – 200 kHz
Cooling	Water	**Cooling**	Water
Interfaces	Analog/Digital PROFIBUS RS 232/485	**Interfaces**	Modbus RS 232/485

TruPlasma Bipolar Series 4000 HV

Ideally suited for various kinds of applications: plasma cleaning, barrier discharge, corona discharge, surface conditioning, treatment of textiles, food sterilization, gas detoxication and many more. The high voltage allows to ignite plasma even in normal atmospheric pressure without sealed reactor or vacuum pump. A built-in transformer makes it compact and easy to use.

Output	10 – 20 kW
Frequency	40 kHz
Cooling	Water
Interfaces	RS 232 PROFIBUS

Using our knowledge for your benefits.

MW Generators from TRUMPF Electronics – Reliable power. Precise results.

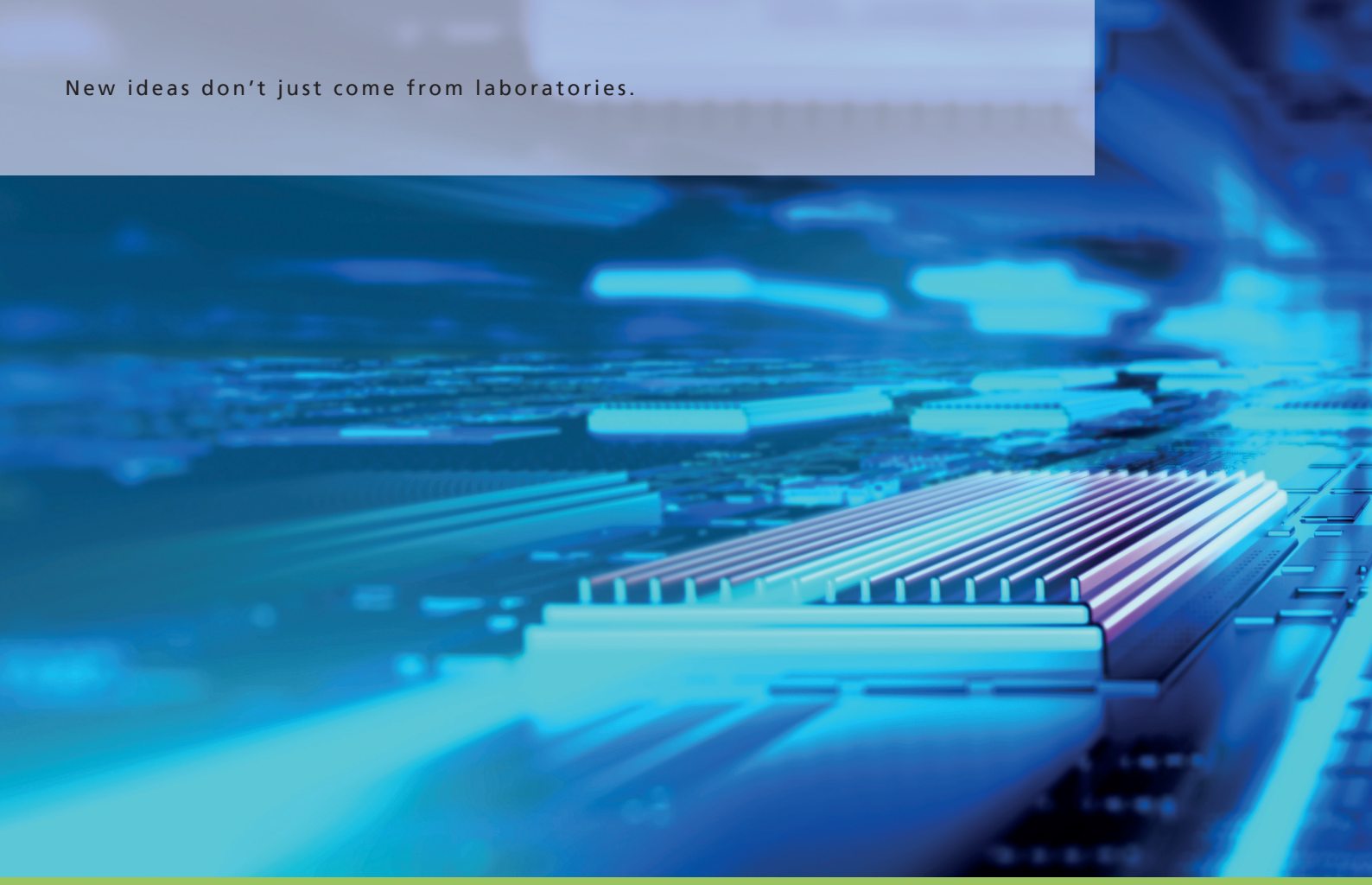
Our MW generators are engineered to meet the highest demands of plasma processes, ensuring seamless integration into any system design. They can be precisely adapted to all applications and operate phase synchronously even in multi-antenna systems, enabling uniform plasma distribution over large areas. Thanks to an innovative platform concept, the TruPlasma MW generators enable the efficient and cost-effective generation of extremely high plasma densities, making them ideal for semiconductor, solar cell, and display manufacturing. With high frequency accuracy and advanced control features, they provide exceptional process stability, reproducibility, and optimal results.

Microwave Frequency (MW)

TruPlasma MW Series 1000 – the flexibel ones
Ideal for retrofitting and multi-generator setups. High efficiency and long service life keep operating costs low. Perfect for demanding plasma coating and growth processes.

TruPlasma MW Series 3000 – the modular ones
Tailored for MW-CVD applications. Available in compact 2 kW and 6 kW versions, scalable in 6 kW steps up to 48 kW – for flexible, high-performance plasma systems.

New ideas don’t just come from laboratories.



TRUMPF Electronics MW solutions: Our portfolio

TruPlasma MW Series 1000	TruPlasma MW Series 3000
	
Their ability to synchronize phase and frequency makes them ideal for operating small plasma torches and plasma systems with multiple distributed generators. They are equipped with a number of unique features as standard, such as nano-pulsing, dual-level pulsing, auto frequency control and power stabilization.	Optimized for the operation of larger microwave plasma systems. Depending on the required power level, several 6 kW generators can be modularly interconnected up to 48 kW.

Output	300 W and 1000 W	**Output**	2 kW – 48 kW
Frequency	2400 – 2500 MHz	**Frequency**	2400 – 2500 MHz
Cooling	Water (300 W also as air cooled available)	**Cooling**	Water
Interfaces	EtherCAT EtherNet	**Interfaces**	EtherCAT EtherNet

TRUMPF Electronics: Plasma Applications and Industry Solutions

With decades of experience and strong process know-how, TRUMPF Electronics is your reliable partner for plasma-based technologies. Our power supplies stand for stability, efficiency, and proven performance in countless applications.

We offer the right energy source for both established and emerging processes – from semiconductors and photovoltaics to automotive, glass, and research. Our broad portfolio of DC, MF, RF, and MW generators is cost-effective, field-proven, and customizable to your needs.

Applications

Our technology – your advantage in plasma processes.

TRUMPF Electronics power supplies are used in a wide range of plasma-based applications, including:

Plasma-enhanced chemical vapor deposition (PECVD)
Plasma etching (dry etching)
Plasma diffusion
Plasma polymerization
Plasma cleaning
Unipolar magnetron sputtering
Dual magnetron sputtering (DMS)
Hard coating
Microwave atomic layer deposition (ALD)

Industries We Serve

From glass to semiconductors – trusted across industries.

Our products are used in a wide range of sectors, including:

- Glass industry
- Photovoltaic industry
- Automotive industry
- Flat panel display industry
- Semiconductor industry
- Chemical industry
- Science and research
- Manufacturing industry

You certainly need more than just a power source.

It’s not just accessories.

The conditions and constraints present in many plasma environments require special devices to ensure that your equipment functions as desired. Matching networks, master oscillators, RF switches and coaxial cables: these are all critical elements in a well designed RF power delivery system. We, TRUMPF Electronics, are chosen by experts because of our extensive high frequency expertise and decades of process experience.

CombineLine - innovative Combiner technology

Unique high-frequency combiner technology with true 50-Ohm output impedance. Ensures stable processes for best productivity.

Components

Matchboxes
Impedance matching networks for the complex loads typical in plasma excitation.

Master oscillators
Precise frequency synchronization for applications with multiple RF sources.

RF switches
Provide power to several process chambers from a single generator

Coaxial cables
Perfect for low-loss connections between the generator and matchbox.

TruPlasma RF System
Plasma processes behave like a complex, variable load, to which the power supply from the generator needs to be continually adjusted. Active matchboxes handle this task, ensuring precise adjustment to the optimal impedance of 50 ohms at all times. The result is a perfectly matched system solution, the TRUMPF RF System.

Features

Arc Management
Targeted arc detection guarantees the highest productivity possible, while protecting the product and your system at the same time.

Auto Frequency Tuning
The patented auto frequency tuning solution enables simultaneous and fast frequency tuning between the generator and matchbox.

Multi-Level pulsing
Any type of pulse shape can be achieved with the multi-level, freely-selectable pulsing mode.

For the products listed in this brochure, the following life cycle dependent services could be available:

Startup Service

Ensures a seamless start of production with power supply matching and setting assistance, taking the first steps together.

Product Trainings

Training on operation and trouble-shooting to ensure effective use and quick issue resolution.

Service Agreements

Include warranty extension, spare parts, labor, remote service, and maintenance for comprehensive support.

In-house Repair / Field Service

We offer local repair services around the globe, in the field and in-house.

Backup Power Supply

Reduces downtime to a minimum, ensuring continuous operation during power interruptions.

Spare Part Packages

Critical parts package covering 80% of potential issues, ensuring quick resolution and minimal downtime.

Technical Guide/Troubleshooting Guides

For a quick and independent solution of the problem.

Customer Service App

Digital service case handling, installed base management, and order tracking for streamlined support and easy monitoring.

Upgrades and Refurbishment

Extend the power supply lifetime and assure operation with maximized uptime at lower costs compared to the investment in new power supplies.

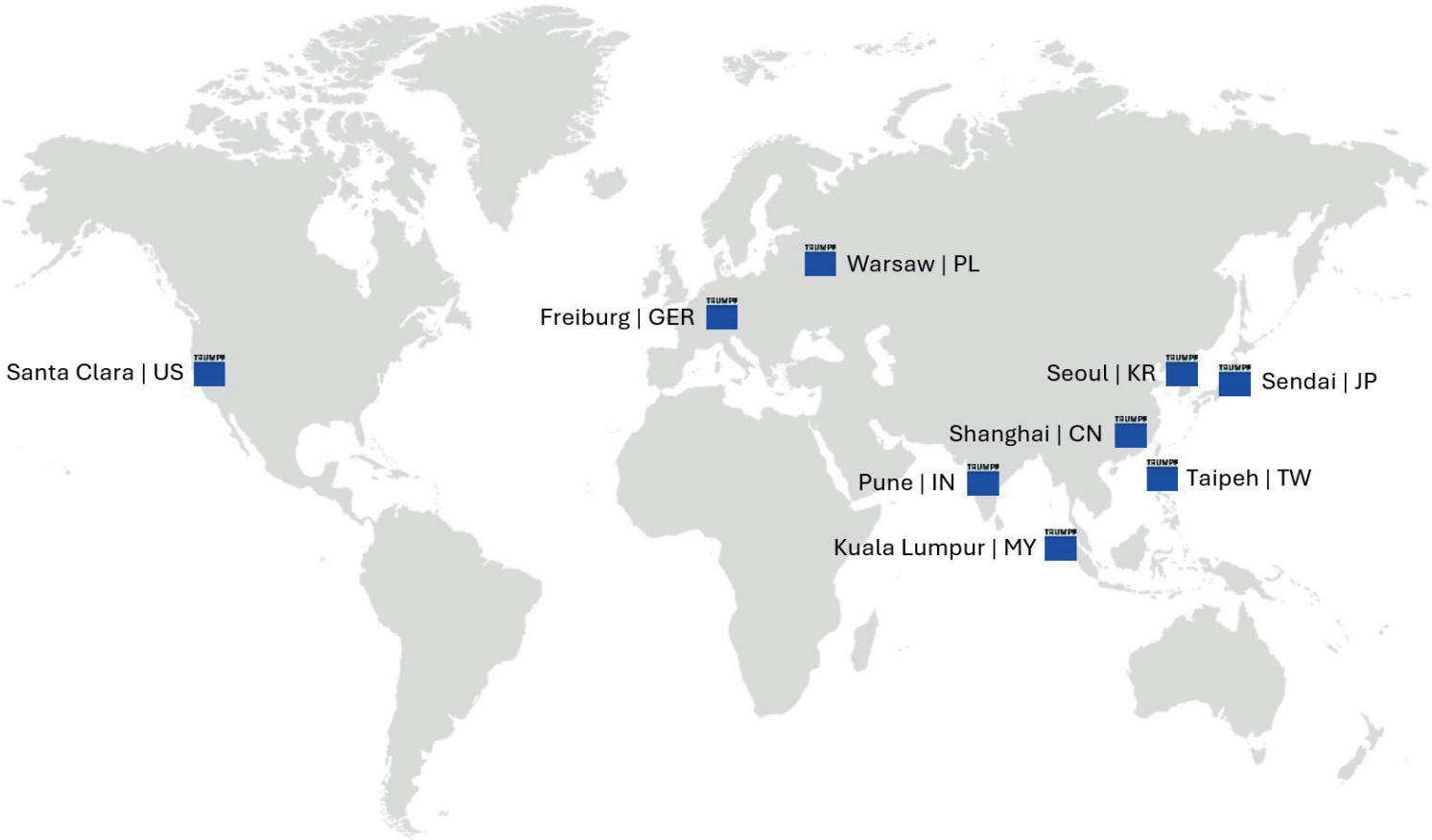
Retrofit / Replacement

Modernization and retrofitting of old power supplies to secure existing systems and production processes.

Our service portfolio.

Power supply systems are essential for process stability and uptime. Our service portfolio is designed to ensure stable operation, fast troubleshooting, and minimal downtime. From startup support and targeted training to spare parts logistics, digital tools, and system upgrades – we provide the technical expertise and infrastructure to keep your equipment running at peak performance throughout its lifecycle.

Worldwide close to you with over 100 service employees



The scope of services available varies depending on the generator type in use.
Curious to know more? We're happy to help!

Scan for your worldwide contact partner!

Service.Electronic@trumpf.com

To our Website:

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TRUMPF Electronics
generating confidence