

The new generation of signal generators is engineered for solid-state generators in industrial heating and plasma processes. Installed in all generators, these signal generators are equipped with numerous new innovations.



The new signal generators can be used for the common ISM bands (Industrial, Scientific and Medical Band) 900 MHz to 930 MHz, 2400 MHz to 2500 MHz and 5725 MHz to 5875 MHz.

- Other frequency ranges between 400 MHz - 6 GHz also available on request for special applications

Semiconductor-based microwave generators, which are controlled with the nine signal generator, have a variety of communication interfaces in order to communicate with both higher-level control systems by means of the nine signal generator as well as with the nine signal generator:

- PROFINET,
- USB,
- RS422/RS485 (with additional transport protection layer),

as well as via interfaces for further system components (sensors, monitoring units, actuators...) that can communicate via

- CAN-BUS,
- I2C

can be connected.

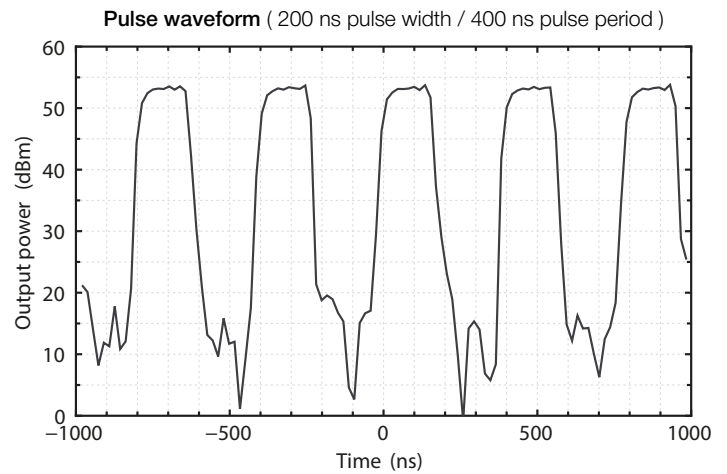
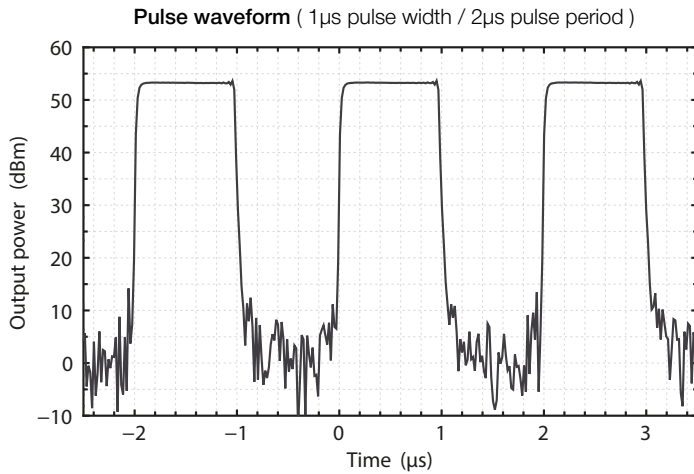
The signal generator is controlled and monitored via the USB or RS422/RS485 interface using an easy-to-implement SCPI99-compatible protocol. This enables simple integration into LabView or MATLAB environments. A Python library for controlling the signal generator is also available on request.

For the safety of the user, the signal generator has a hardware-based RF interlock, which means that the generators comply with current standards and regulations, such as IEC 60519-6 / VDE 0721-6 (safety in electrical heating installations and installations for electromagnetic processing). The signal generator can be operated with any supply voltage in the range from 12 VDC to 36 VDC, which makes it possible to operate the signal generator with the same supply voltage as the amplifier or with a supply voltage selected independently of the amplifier. To minimize downtimes, the signal generator has extensive instrumentation and monitoring of its own functions as well as the connected power amplifiers, including feedback options via the communication interfaces.

The signal generators have both internal and external power control, guaranteeing stable output power across the respective ISM band and also enabling very precise and fast power adjustment. Additional functions have been implemented for the various application areas to simplify process control for the user. For this purpose, there are different equipment variants of the signal generators, which are specially adapted to the respective application.

Benefits for drying, heating and plasma processes:

- **SCAN:** The entire ISM band is scanned in 1 MHz steps within 100 ms. The function returns the frequency with the lowest reflected power. Depending on the scope of the order, the course of the reflected power over the frequency can be displayed graphically.
- **DLL:** DLL: With the DLL function, the signal generator follows the frequency with the lowest reflected power. The user has the option of defining a threshold value for the reflected power, above which the DLL function begins to search for a frequency with a lower reflected power.
- The generators (amplifier + signal generator) can handle the entire reflected power for a short time, as well as working continuously with 80% reflected power.
- If a process sequence is to be optimized with the signal generator, an option can be used to measure the adjustment over the entire frequency range during operation.
- By supplementing the signal generator with the vector receiver from Fricke und Mallah Microwave Technology GmbH, it is still possible to measure the complex matching. In addition, the matching can optionally be measured over the entire frequency range during operation.
- Thanks to the internal and external control loop, the signal generator can produce very reproducible and amplitude-true different pulses. The temporal resolution of the pulse width is 6.25 ns, the minimum width is 100 ns, with a rise/fall time 50 ns. The measurement of the reflected power is measured during pulsing. This enables operation of the DLL function during pulse application, allowing stable power supply to the applicator.



EXAMPLE: Pulse shape with SG board & 250W amplifier

- A further option can ensure a frequency change in less than 0.5 μ s for plasma applications, which minimizes the influence on the plasma.
- Amplitude control in pulse mode and the influence of a frequency change on the plasma process is also reduced when the DLL function is executed.
- When pulsing, the effects of long supply lines are compensated for by further additions to the amplifier, which increases both reproducibility and signal integrity.

For both operating modes, it is possible to synchronize several generators with each other and thus change the phase between the individual generators to a reproducible extent in addition to the frequency and power. Amplifier systems from 250 W to 8000 W can be realized with the signal generators. In all systems, the ratio between forward and reflected power can be measured in terms of magnitude as standard and optionally also complex (magnitude and phase) using the vector receiver.

In the future, there will also be the option of carrying out reflection and transmission measurements by magnitude and phase in combination with a separate vector receiver for process control and optimization.