

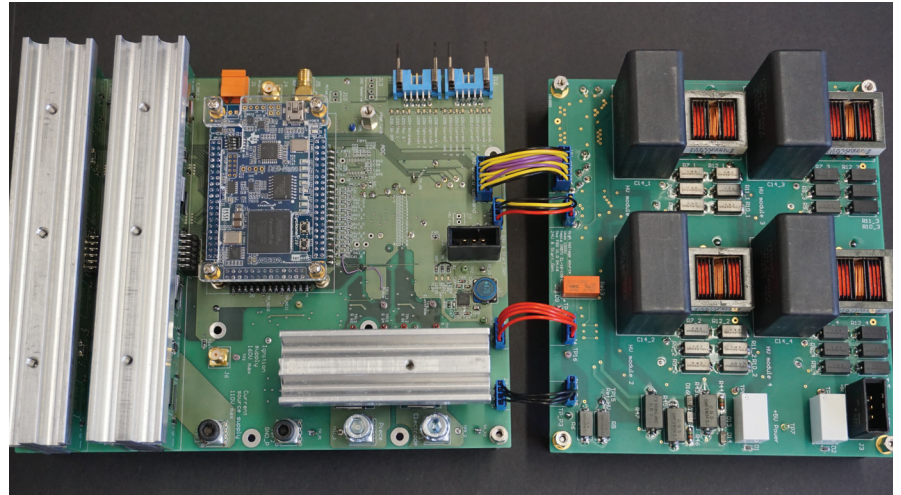
# Smart EDM Generator

## Development of a «smart» Electro Discharge Machining (EDM) Generator

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### Brief description

The generator is said to be «smart» because in addition to the generation of the sparks for the EDM machining, it possesses the sparks analysis, the state machine and the process control algorithm: sparks analysis stands for counting the sparks and listing them in different categories while the principle of the process control is to vary the spark frequency, depending on the machining conditions, with a constant axis speed. This principle radically changes the way to regulate EDM machining.



The «Smart» EDM Generator

The generator has the functions of current and high voltage generation, process measurements, spark analysis and process control. It can count and classify the sparks and control the electro-erosion process. With traditional EDM systems, these tasks are achieved on multiples cards. In our case, all these functionalities are integrated in a single system. An innovative and flexible solution has been found for the current generation, using standard and low cost components called «Constant current regulator».

The process control novelty is to vary the spark frequency according to the machining conditions while maintaining a constant axis speed. This is radically changing the way to regulate EDM: one sets the speed and the generator varies the sparks' frequency according to the machining conditions. The axis control is simplified and the link between the CNC and the EDM process control becomes less constraining from the point of view of real time.

The machining works as follows: during the machining at constant axis speed, sparks are generated at a certain frequency and as soon as the electrode encounters a front of matter, two cases can occur:

- the material front is too far, in which case the generator will lower the sparking frequency and the front of material will be closer to the electrode
- on the contrary, if the material front is too close, the generator will increase the sparking frequency

The frequency control is based on a real-time calculation of the time corresponding to the sparks occurring after applying the voltage.

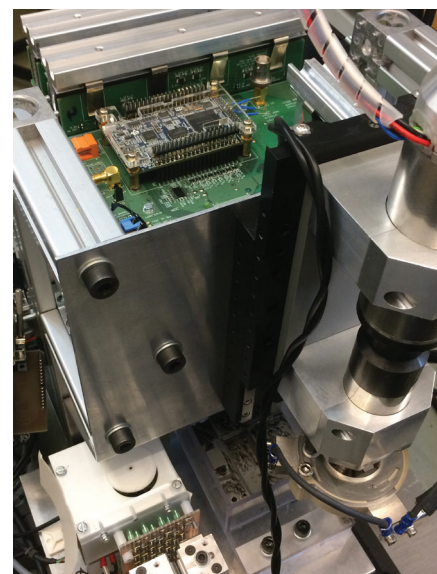
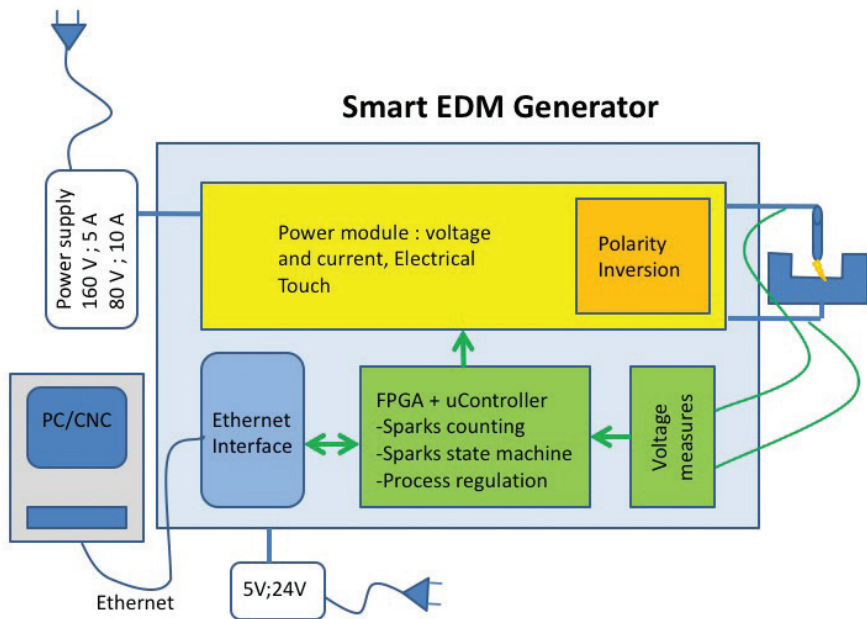
All the sparks are counted and classified in 4 different types. By knowing the number of sparks and their nature, one can calculate the electrode wear's rate.

The statistical distribution of the sparks and other parameters can be acquired and visualized by a Numerical Control via a direct Ethernet link.

### Key points

The generator has been developed for two purposes:

- the need to produce a growing number of pieces made with materials having low electrical conductivity (for example ceramics) for markets like aerospace, medical, electronics, automotive and ICT;
- the Micro-EDM-milling process which has a strong innovation potential because there is no machining technology that can perform accurate and fine detailed cavities with such a high aspect ratio.



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## Output

This development has received financial support from the Commission of Technology and Innovation (CTI 15976.1, PoliHVGEN project) and the University of Applied Sciences and Arts Western Switzerland (HES-SO, LEMM project).

It has been presented during the CTI Micro-Nano Event in Fribourg in June 2017 and an article has been written for the Conference on Electro Physical and Chemical Machining (ISEM 2018) in Bilbao.

**Legend**

- 1 - Smart Generator functional diagram
- 2 - Integration of the Smart Generator in the Micro-EDM-Milling machine