



**DRYING OF
STRAIN GAUGES
IN THE DRYING OVEN**

Greg LeMond, Mark Cavendish, Normann Stadler and Faris Al-Sultan are only a few of the thousands of athletes who have monitored their performance with the help of an SRM PowerMeter during their athletic careers. The highly sensitive strain sensors in the interior of the device enable precision and measurement accuracy. The hardening of the strain gauges is performed in three Memmert drying ovens.



Adhesive bonds between the strain gauges and crank spider are dried in the Memmert drying oven

In the year 1987, the German engineer and cyclist

enthusiast Ulrich Schoberer registered a patent for his PowerMeter. Elite race cyclists, triathletes and mountain bikers had long awaited a mobile performance measurement device with such high reliability and precision that enabled real-time evaluation of their current form. What followed was a product evolution: high precision, light and robust materials, adaptation for bottom bracket sets of all leading manufacturers and wireless data transmission. The integration of additional real-time data like heart rate, distance covered, speed and altitude enable the modern athlete to optimise training and competition on-the-fly, so to speak. The idea behind this is simple but ingenious, like any other great invention.

Pedal power in watts as a performance indicator

Until now, in most cases heart rate was used as a performance indicator. However, fatigue and the weather can falsify physiological values. For Schoberer, pedal power seemed like the most objective indicator of a cyclist's performance. For this reason, he invented a device which measures the power at the point where the two pedal forces intersect, before the force is transmitted to the chain and rear wheel: at the crank spider between the inside bearing axle and chainrings. In addition to monitoring performance, athletes can also use the PowerMeter to test their aerodynamics and try different seating positions for optimum power transmission to the pedals.

Power measurement using strain gauges

Pedal power is measured with conductors on a foil, so-called strain gauges, which are placed on the crank spider with utmost care. High-end models feature up to 16 strips (8 carriers with two individual grids each). With every pedalling movement, the strips are stretched and the electrical resistance changes. The PowerMeter converts the resulting voltage change into a frequency proportional to the torque. Based on the simultaneously measured angular speed (pedalling frequency), the PowerControl calculates the pedal power in watts. The athletes can check their power in real time, as an instantaneous, average or maximum value in the PowerControl display and save it in adjustable intervals.



Display of an SRM PowerControl

After the assembly of the electronic components, which is also done manually, each PowerMeter device is calibrated using standard weights to guarantee a measurement accuracy with a deviation of less than 1 % for the entire performance range of an athlete.

Tempering of strain gauges in the drying oven

The highly sensitive strain gauges are the core of the SRM PowerMeter because what counts for the athletes in the end is measurement accuracy. Alongside the manual assembly, the controlled drying of the strain gauges after gluing are a decisive quality factor. Due in particular to the excellent performance regarding temperature distribution and stability, SRM decided to purchase three Memmert drying ovens for their headquarters in Jülich and their production site in Colorado. "As in microbiology, precision and reliability are the most important things for what we are doing", says Markus Biewer, responsible for quality assurance at SRM. Each night, glued parts are put in the drying oven and a defined process runs until the morning, starting with the warming up and hardening of the strain gauges at 135 °C until the cooling phase.

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An overview of the main topics

- SRM, Schoberer Rad Messtechnik
- SRM PowerMeter
- Performance measuring cycling
- Memmert drying chamber
- Drying of strain gauges
- Strain gauges

Picture credits: SRM, Memmert

Conditioning of weighing cells in the climatic test chamber

Adjustment of the strain gauge weighing cells is performed at Atoma MULTIPOND in a Memmert climatic test chamber CTC, as well as in a TTC temperature test chamber.

[more information](#)

Laboratory appliances for conditioning

[Universal oven UN/UF](#)

[Climate chamber ICH](#)

[HPP constant climate chamber](#)

[CTC climatic test chamber](#)

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