Working in partnership for a virtual scalpel:

How Burkert's mass flow controller with MEMS technology enabled the inventing company to develop PlasmaJet

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PlasmaJet is a virtual scalpel that enables surgeons to achieve more, with less damage to tissue. “Working in partnership with Burkert enabled us to do what we otherwise couldn’t have done,” said Professor Nikolay Suslov. The ultra-fine control, accuracy and repeatability provided by Burkert’s mass flow controller with MEMS technology (MFC) has been instrumental in enabling the inventing company to develop PlasmaJet, the first and only true plasma surgery system for surgical cutting and coagulation.

The virtual scalpel comprises a console, a service trolley and a range of single use hand pieces. The console houses the control system with LCD display and touchpad. There is also an integrated cooling circuit, which uses Bürkert fluid control valves to cool the tip of the hand-piece. “It is true to say that the ability of Burkert’s mass flow controller to control very low gas flows precisely, and with continuous repeatability, has made our unique technology possible,” said Professor Nikolay Suslov - Chief Technology Officer and inventor of the PlasmaJet Technology.

FDA-approved (Food and Drug Administration, US-amerikanische Behörde für Lebensmittel- und Arzneimittelsicherheit.), the PlasmaJet system cuts & coagulates tissue with a fine beam of electrically neutral, high energy plasma.

This is generated by ionizing a low flow of inert argon gas within the insulated body of a single use hand-piece. The gas is excited into a plasma state & emerges from the tip of the hand-piece as a precise pale blue jet stream.

PlasmaJet, a plasma surgery system for surgical cutting and coagulation. The virtual scalpel comprises a console, a service trolley and a range of single use hand pieces

Burkert's involvement in the PlasmaJet development project began as a result of problems with the mass flow controllers that the developping company was using initially. The problem was lack of consistency in settling times from one MFC to another; and the ramifications this had on the correct operation of the PlasmaJet. For the system to work properly, the MFC first has to provide the high pressure / high flow rate required to ignite the plasma, and then ramp down to tenths of slpm. It is important that there is no over-shoot, otherwise the plasma beam is lost.

Burkert's brief upon joining the project was to provide an MFC that would avoid this problem, controlling the extremely low flow rates with a repeatable accuracy of +/-0.01 slpm. In addition, other elements of the specification required that the MFC should be suitable for use in EMC noisy environments (each unit is sited below a large 3.5kV power supply and has two fans working at low frequency); that each MFC should be stable between 25 & 40 °C; and that manufacturing tolerances should ensure each MFC has the same settling time.

For the system to work properly, Burkert´s MFC first has to provide the higher pressure and higher flow rate of the plasma gas required to ignite the plasma, and then ramp down to tenths of standardliters per minute – avoiding over-shoot and loosing the plasma beam

The first prototype of the 8711 MFC was supplied just 9-days after Burkert's initial visit to their client in August 2008. This unit was then tested in Sweden that same month at the company's R&D facility, in the presence of engineers from Burkert's Gas segment support team. Following successful tests, the Burkert factory created a part number for the variant of the 8711, in October 2008. This was followed by the RoHS statement and request for UR approval, also in November 2008. The culmination of this activity also occurred in the same month, with a pre-production order to Burkert for an initial batch of ten 8711 units. From start to finish, therefore, the development process had taken just three months.

“Burkert were interested enough in the application to take up the considerable challenge, understand it, and configure a solu¬tion that worked, shortening our development time considerably.“ tells Professor Nikolay Suslov. „We could have taken much longer, or even failed in our development without their input. We are very happy with them.” Key to the success of PlasmaJet application is the unique MEMS technology integrated into 8711 MFC. This operates according to a thermal principle which has the advantage of delivering the mass flow without any corrections for the required pressure or temperature. The actual flow rate is detected by a sensor embedded in the wall of a specifically designed bypass channel, into which a small part of the total gas stream is diverted, ensuring laminar flow conditions.

The sensor element, a CMOS chip, contains a heating resistor and two temperature sensors (thermopiles) which are arranged symmetrically upstream and downstream of the heater. The differential voltage of the thermopiles is a measure of the mass flow rate passing this bypass channel; the calibration procedure employed ensuring a unique assignment of the sensor signal to the total flow rate passing the device.

The key to succss of the PlasmaJet is the unique MEMS technology integrated into 8711 MFC

Kontakt

Can we help you also to realise your ideas? Or do you have further questions?
Then just contact us:

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