

# Microfluidics by **staiger** FLUID CONTROL EXCELLENCE

Magnetventile



Ventilelektronik



Pneumatikmodule



## Agenda

### Quick definition of “Microfluidics”

- What to expect in this presentation

### Quick overview: Staiger GmbH & Co.KG

- Company Profile
- Valve Technology

### Staiger Microfluidic Examples

- General Examples
- Detailed Examples

### Summary

## Microfluidics - Definitions

- deals with the behaviour, precise control and manipulation of fluids that are geometrically constrained to a small, typically sub-millimeter, scale
- ... practical applications in the design of systems in which low volumes of fluids are processed, e.g. inkjet printheads, DNA chips, lab-on-a-chip technology, micro-propulsion, and micro-thermal technologies
- Numerous applications employ passive fluid control techniques like capillary forces
- Active microfluidics refers to the defined manipulation of the working fluid by active (micro) components such as micropumps or **microvalves**

(<https://en.wikipedia.org/wiki/Microfluidics>)

## Microfluidics – Focus of this presentation

- Active microfluid systems : microvalves
- Continuous flow microfluidics (<> droplet based m.)
- “Sub-millimeter” refers to port size of 10µm or higher
- “low volumes of fluids” refers to flow rate of 50 µL or higher

## Company profile

- Founded 1974, 200 Employees
- **Industries:** Medical and Analytical Technology, Automotive, Sanitary-/Drinking Water, Energy Systems, Pneumatics, Airspace /Aeronautical and Special Machinery
- Certificates DIN EN ISO 9001 and 14001, EFQM-Award in preparation
- More than 200 patents and utility patents in solenoid valve technology
- **Location:** Erlligheim (north of Stuttgart)

## Staiger – classic valve technology

### Any kind of diving plunger solenoid valves

- 2/2-way, 3/2-way, 4/2-way, proportional, ...
- **valvebody:** Brass, Stainless steel, PVC, Teflon, Aluminium, ...
- **Port sizes:** 0,15 mm – 6 mm
- **Media:** Air, Water, Gases, Acids, Oils, Solvents,...
- **Typical pressures :** 0 – 8 bar, but also up to 200 bar



## Staiger – Spider®- Microvalves

- 2/2- and 3/2-way-valves and „real“ proportional valves
- **outer diameter:** 7 mm, 15 mm, 21 mm, ...
- Quasiproportional Function via PWM (pulse width modulation)
- **Extremely high life cycle: more than 1.000.000.000 ( $10^9$ ) duty cycles possible**
- **Extremely fast switching time : < 1 Millisecond**
- **Highly Energy Efficient : < 0,3 Watt (7 mm Spider®-valve)**



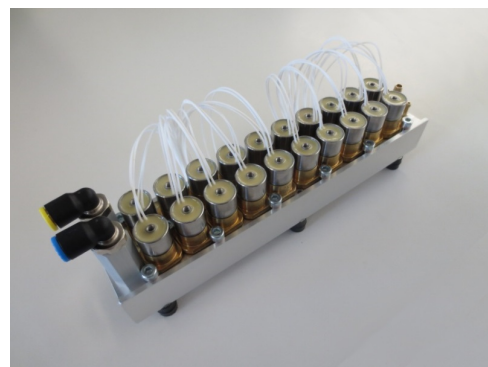
### Animations



Spider Valve 2.2.avi

## Staiger – Integrated Fluidic Manifolds

- Design, Validation, Serial Production
- Including valves, sensors, filters, connectors, wiring..
- Manifolds made of Aluminium, Stainless Steel, Plastics, Teflon, Acryl
- For liquids and gases



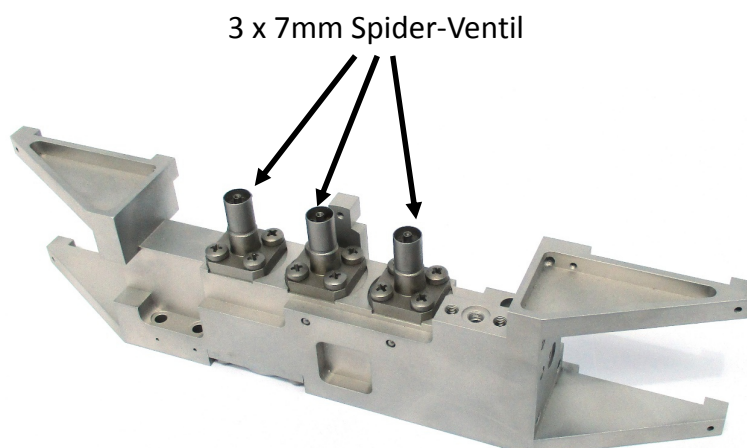
# Examples of Microfluidic Applications

- Space / Micro-Propulsion : cold gas thrusters for small satellites
  - Micro dosing of inert gas which creates a micro thrust
- Industry / Ink-Jet-Printing, highly integrated printing head
  - Dosing of ink and cleaning solvents
- Medical/ handheld blood diagnostics device
  - Precise control of vacuum for  $\mu\text{L}$ -sampling

## Detail Example 1

### Application: Space-Lab on ISS

- Micro-Dosing of Enzymes to control cell growth
- Flow rate :  $10\mu\text{L} / \text{min}$
- $10\mu\text{m}$  pin hole + PTFE membrane filter with  $2\mu\text{m}$  pore size

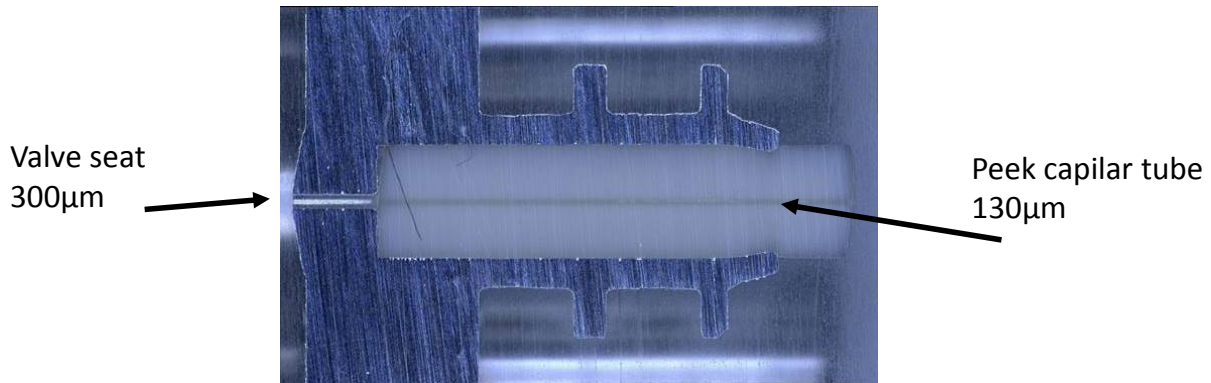




## Detail Example 2

### Application: Textile-Industry, yarn production

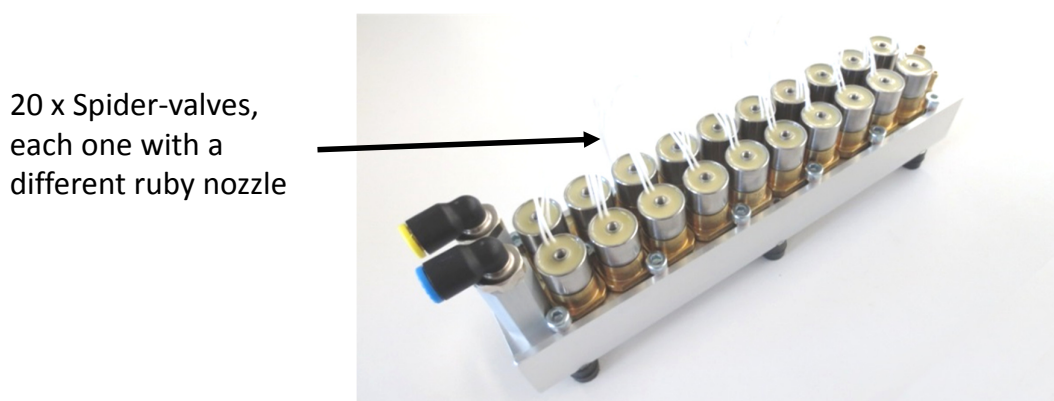
- Precise micro dosing of a liquid
- Extremely fast control : 0,25ms switch on time
- Flow rate : 0,1 mL / min @ 0,8bar



## Detail Example 3

### Application: Medical Technology, Neonatal Ventilation

- Micro dosing and blending of two gases
- smallest nozzle : 40µm
- flow min : 0,02 L / min @ 1,5bar



## Summary

### Staiger is ...

- **Research- and Development Partner**

We consult our customers in the definition of requirements (feasibility vs. Requirement vs. cost), perform feasibility study, build prototypes ... until serial production.

- **Serial Manufacturer**

We cover quantities from one single part up to high volumes (> 0,5 Mio per year).

We supply in quality and in time.

## Staiger : Supplier of the Year ! Lübeck, 2015



**Thank you for your attention !**



**[www.staiger.de](http://www.staiger.de)**

Staiger GmbH & Co. KG, Johannes-Bieg-Straße 8, 74391 Erligheim