

Test bench to separate different drugs in a multi-infusion system using gas bubbles

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Motivation

Risk prevention in infusion therapy

Multi-infusion setups for medication administration (e.g. in ICUs) seem uncontrolled due to flow rates and pressure differences between syringe pumps[1].

The more catheters are used, (e.g. when moving patient between OR and ICU), especially after dis-/reconnecting them to patient, higher the chance for hygiene problems to arise.



Source: http://www.k-k-o.de/uploads/pics/Intensiv_1.jpg

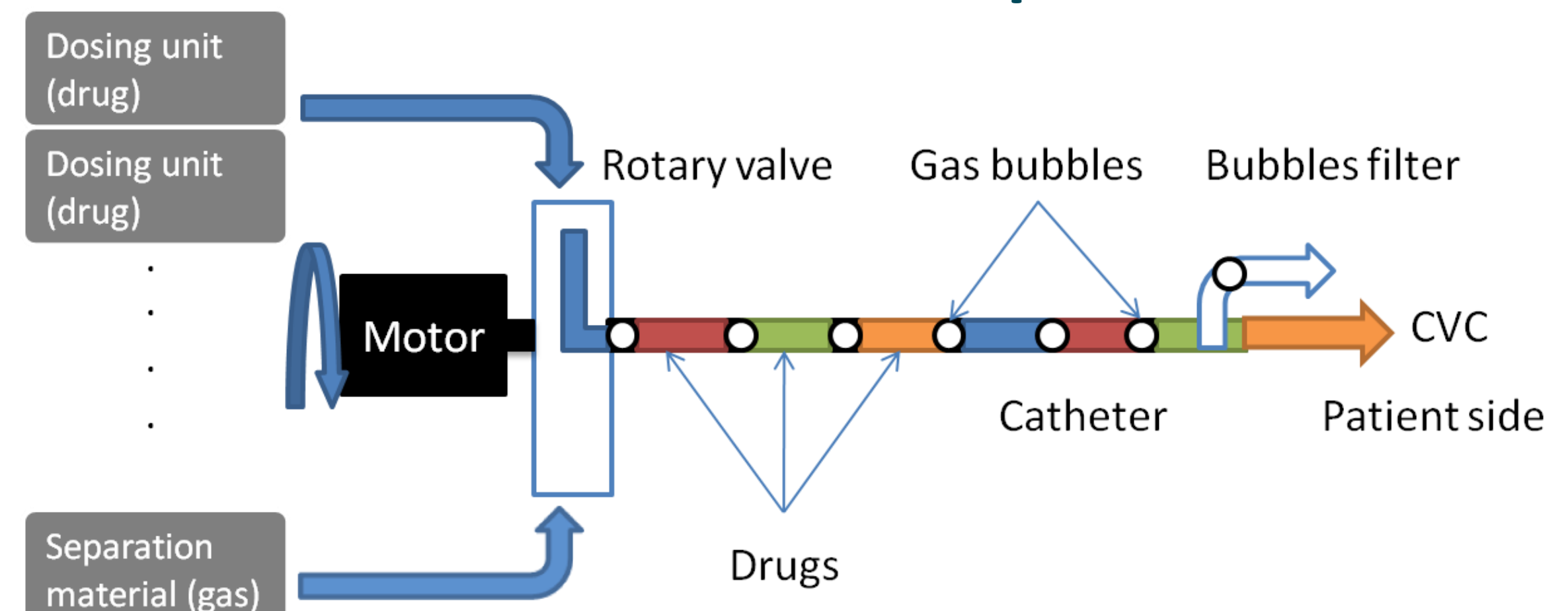
Furthermore, chemical incompatibility means that the drug is chemically degraded, due to oxidation, reduction, hydrolysis, or decomposition. Chemical reactions can manifest themselves through turbidity, precipitation and color changes. As a consequence, the amount of the active agent decreases and/ or toxic by-products form[2].

Requirements

Building a multiplex system, that

- utilizes merely one catheter at patient side
- separates drugs and remove bubbles
- mimics conditions of clinic
- generates flow (different volumes/ flow rates)
- synchronizes work of dosing systems with selection valve
- is reproducible
- is reliable

Concept



Gas bubbles were used as barriers between successive flowing drugs in catheter.

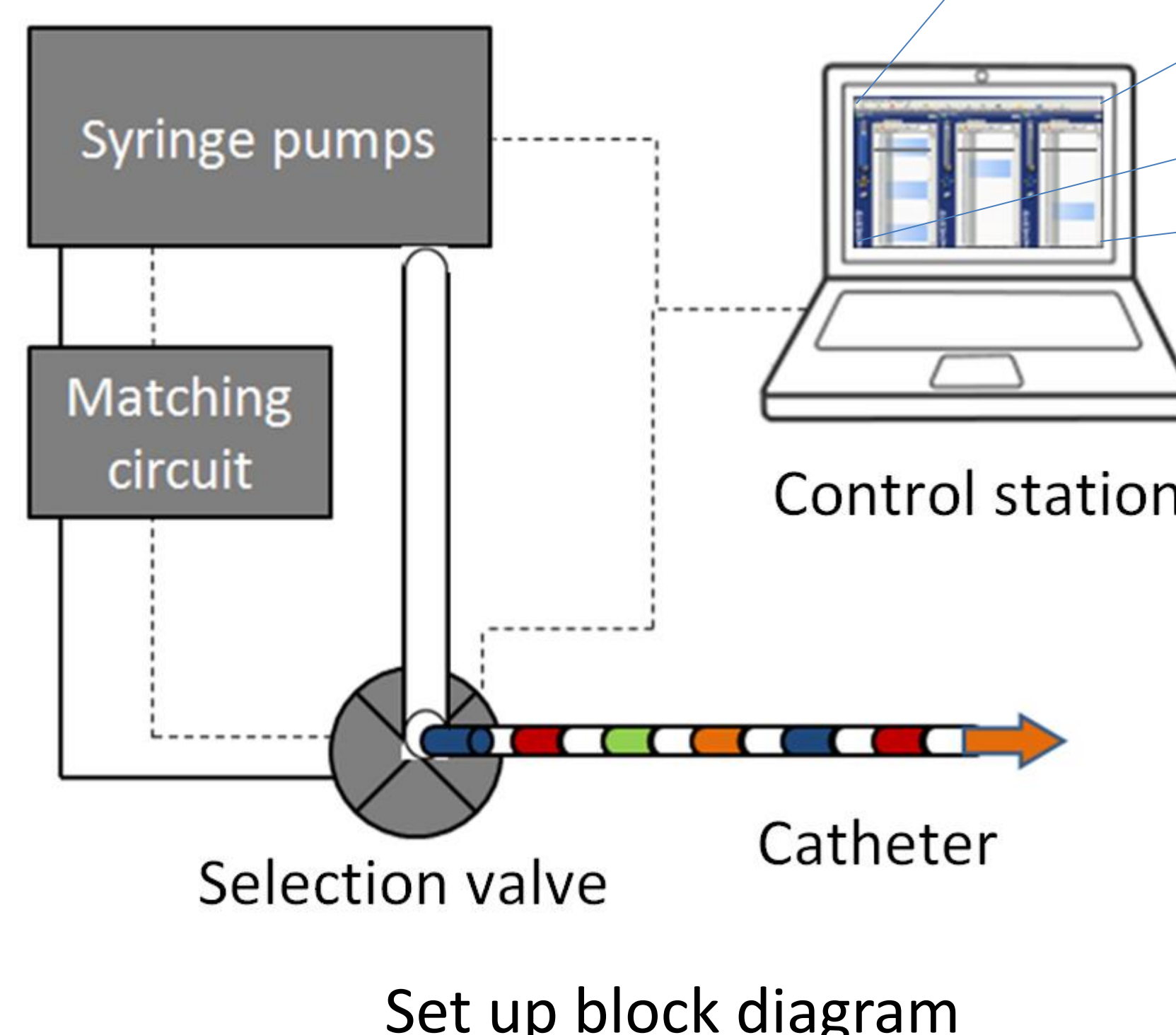
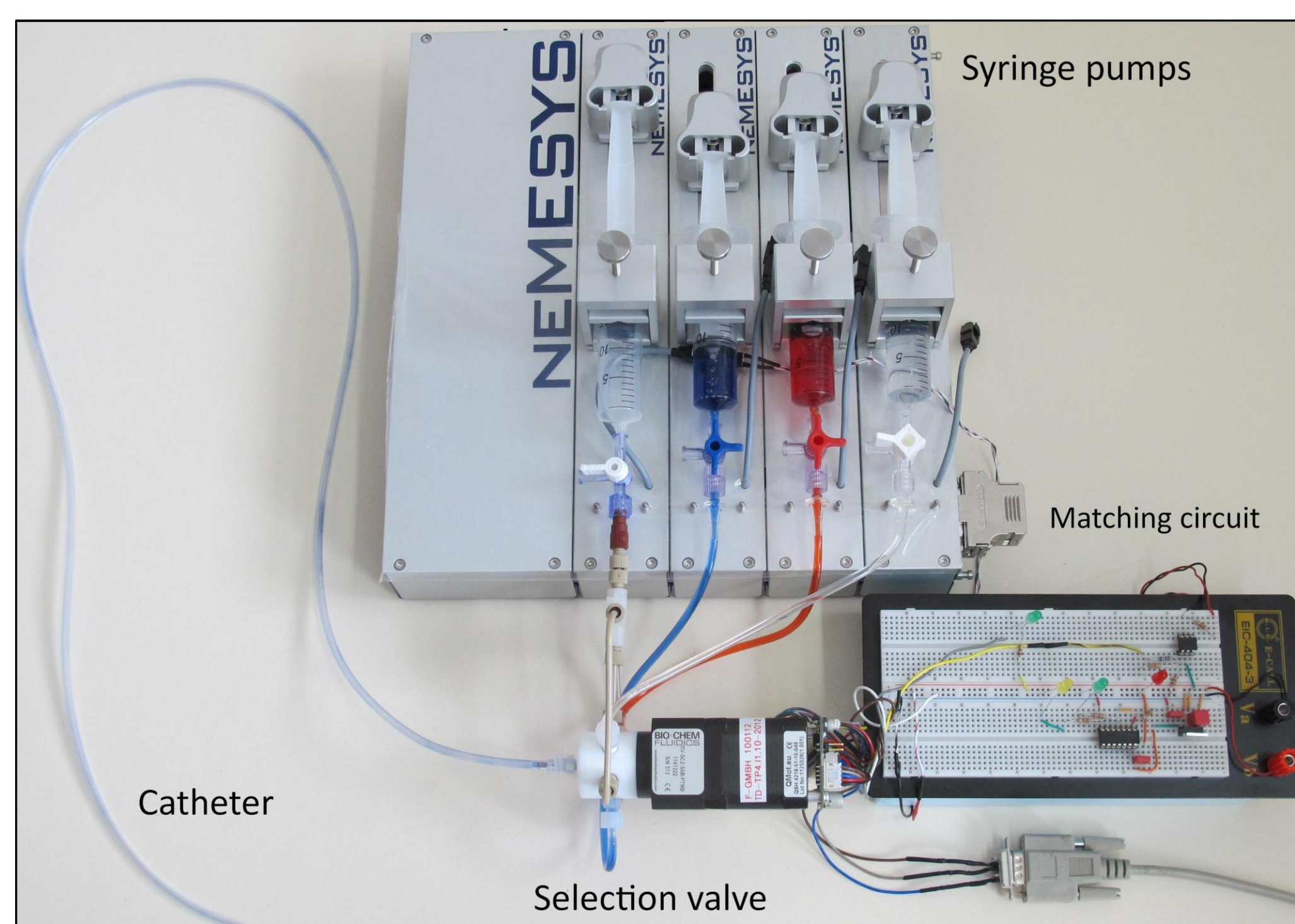
Realization

State of the art Drug-Multiplexing setup

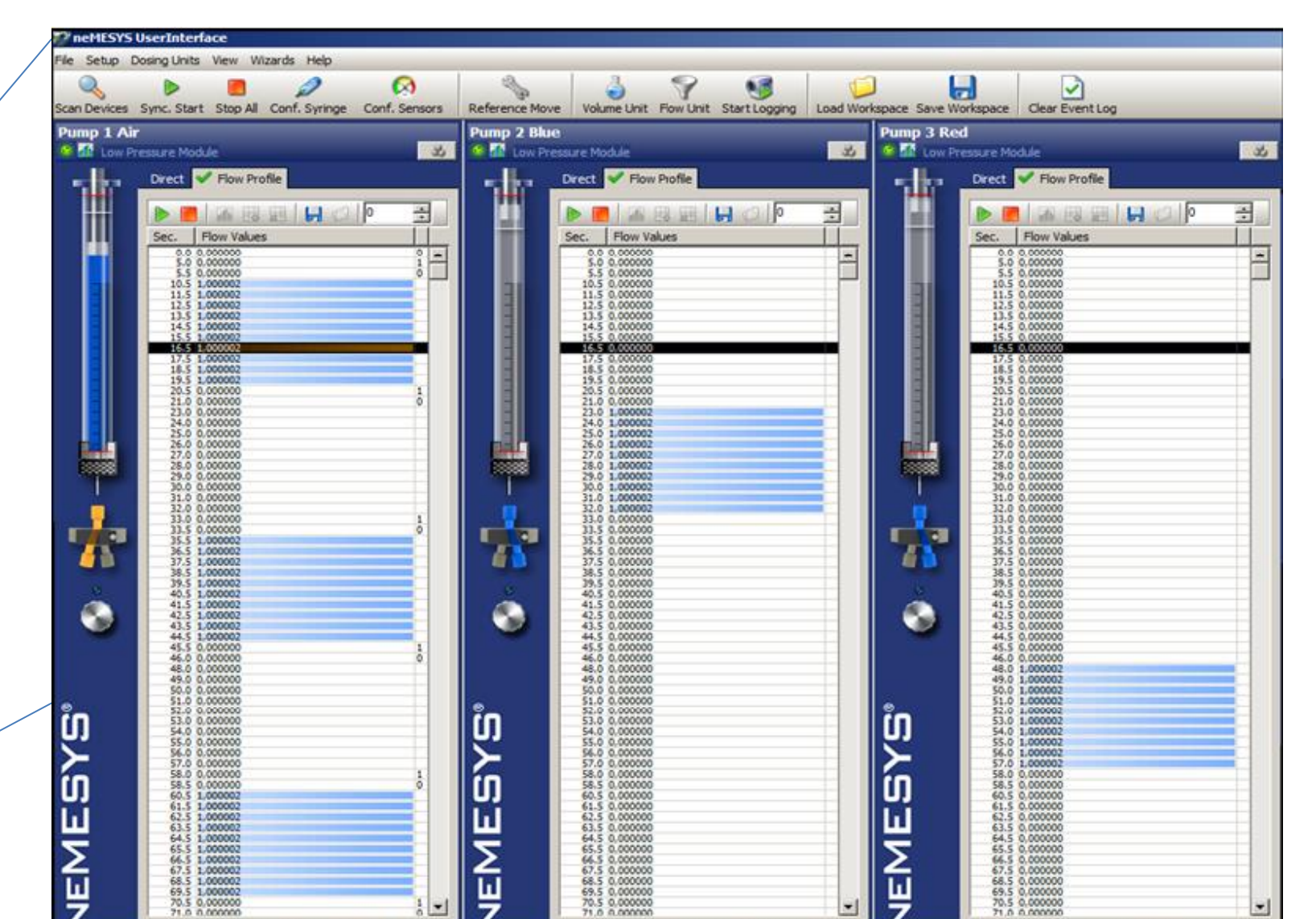
4-Channel syringe pump is connected to a 6-ports selection valve.

The syringes inject simulated drugs (water, blue and red dyes) as well as the separation material (gas).

Test bench



Set up block diagram



Interface to set workflow parameters (volume, flow rate, valve trigger signal) of each channel with respect to each sequence.



Separated dyes in catheter

Conclusion

- The test bench can dose and separate different dyes by gas bubbles.
- Flow parameters (volume, flow rate) of each solution/ gas bubble can be set independently.

References

- [1] A.M.D Timmerman, B. Riphagen, J.H.G.M Klaessens; R.M. Verdaasdonk, *Development and validation of a new method for real-time measurement of fluid dynamics during simulated multi-infusion setups IFMBE Proceedings Vol. 25, 2009*
- [2] <http://www.safeinfusiontherapy.com/cps/rde/xchg/hc-safeinfusion-en-int/hs.xsl/7854.html> (Accessed: 27th May 2013)