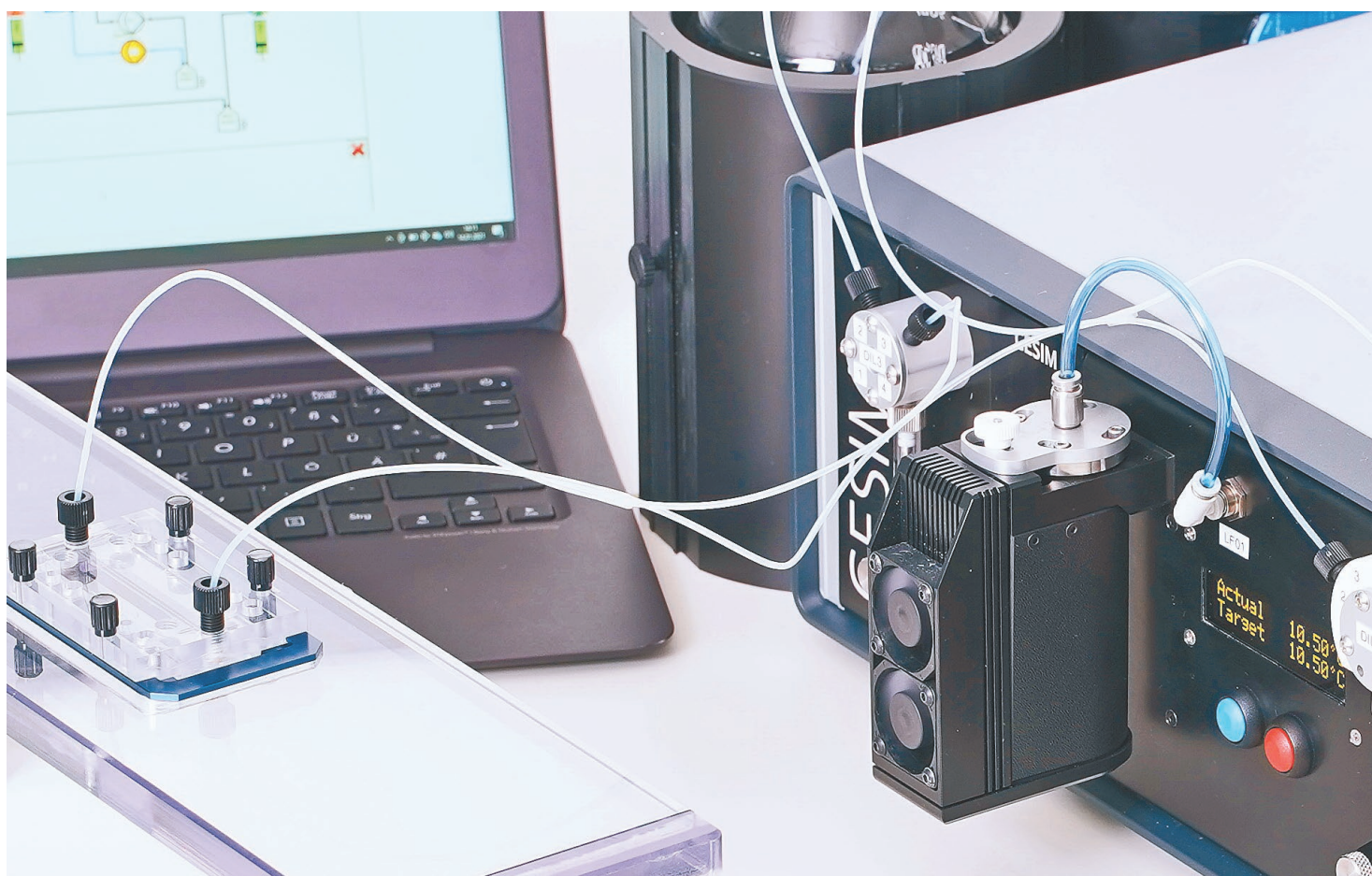


FluidProcessor

Microfluidic and Pneumatic Control System



The Environment for Microfluidic and Pneumatic
Automation – Right on Your Bench Top



FluidProcessor Basics, Applications

- PLC-based control box with racks for various fluidic tools (pumps, extruders, valves...)
- Easy to use software with automatic tool detection



Automation of fluid handling at the bench top can dramatically accelerate your lab work. The **GeSiM FluidProcessor** is here to become your central processing unit for liquids and gases, be it on the micro- or macro-scale. Drive intricate multi-layer microfluidic systems, e.g. for point-of-care diagnostics, or just use pumps to automate the handling of chemicals, e.g. to incubate/block/wash Western blots or microtitre wells.

The box comes with standardized device slots. Choose from a sheer endless number of functional modules to adapt the FluidProcessor to your particular application. Reconfiguration of your FluidProcessor for any a new task is easy, thus giving you the maximum return on your investment.

The FluidProcessor can be connected to any (micro-)fluidic system including your own and also to systems from other companies (e.g. Microfluidic Chip-Shop). The combination with a **GeSiM MicCell** micro-flow system gives you an ideal environment to tackle numerous applications in the life sciences and chemistry.

The GeSiM FluidProcessor is based on the same electronic platform as the other GeSiM Robotics systems; therefore microfluidic cells (with intricate channel structures, semi-permeable membranes, wells and many other features) controlled by the FluidProcessor can easily talk with tools for micropipetting, 3D printing or camera inspection present on other GeSiM instruments. To name just one application, 3D deposition of organoids into fluidic cartridges, sealing, cell cultivation and camera inspection can be done on the same platform using the same software without having to move your sensitive substrates through non-sterile environments or switch to a different software.

Please also have a look at our 'Microfluidic Workstation' that can do all of this and much more in a single instrument (separate brochure).

Possible microfluidic applications

- Study of adherent/immobilized cells or tissue slices in laminar flow (interaction studies, viability or adhesion tests, shear stress, simulation of blood flow, electrical activity etc.)
- Experiments with suspended cells in the flow (optical tweezers, optical stretcher to measure cell rigidity, transfection)
- Bead/cell size detection and sorting
- Single-molecule detection (multi-colour fluorescence, kinetics of receptor-ligand binding and other molecular interactions etc.)
- Generation of hydrodynamic flow fields e.g. to study single molecules (DNA, motor proteins etc.)
- Generation of chemical gradients and applying them to cells or single molecules
- Generation of micro-droplets e.g. to make small chemical compartments or to encapsulate cells
- Capillary electrophoresis
- Flow cell to study the formation of biofilms on transparent and opaque anti-fouling surfaces
- Surface plasmon resonance (SPR) or other sensor applications, with flow injection analysis, e.g. for wastewater
- Detection of pollutants in wastewater using e.g. immobilized yeast reporter cells
- Impedance measurements of live cells etc.
- Fluidic control of (or development tool for) in-vitro diagnostics devices

How can you get your personalized FluidProcessor system?

- Describe your application (including drawings, charts) in detail.
- Select from the the large library of functional modules.
- GeSiM will design your FluidProcessor, complete with internal/external tubes, filters and reservoirs. Connectors are available for GeSiM flow cells (MicCell), but of course also for your own microfluidic components.
- A detailed tubing scheme and, if applicable, protocols will be sent to you before your FluidProcessor leaves our factory.

Tools available for the GeSiM FluidProcessor

- Syringe pumps with valves (also called diluters) for precise displacement dispensing and uptake
- Syringe pump valve types: either non-distribution (connects adjacent ports in any combination) or distribution (syringe connects to any port)
- Diaphragm pumps for continuous liquid flow
- Two-way and three-way valves and liquid distributors
- Pressure regulators for various gas pressure ranges
- Vacuum generator
- Liquid-level sensors for external reservoirs

- Flow and pressure sensors to control both
- External reservoirs of different volumes (250 to 1000 ml)
- Pneumatic extruder unit with cooler/ heater for 10 ml cartridges
- Controllers for piezoelectric drop-on-demand dispensers
- Controllers for chip-based micro-flow sensors (measurement range -70 to +70 $\mu\text{l}/\text{min}$)
- **Third-party devices**, e.g. those that control microfluidic flows via pressure regulation, can be used as well (inquire).

Please ask for the MicCell catalogue with detailed information on available functional modules.

Explore the FluidProcessor

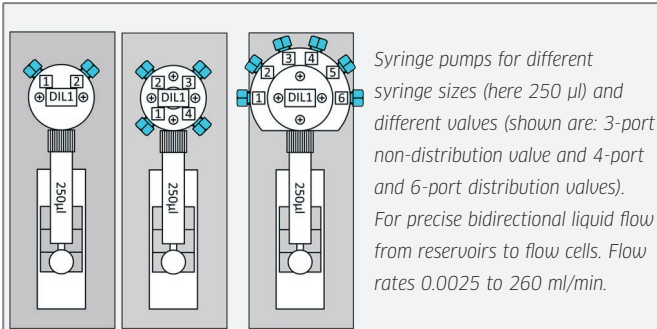
- The FluidProcessor combines fluid handling modules in an application-specific manner – mix and match.
- Depending on their function, modules slide into the standardized slots of the instrument via the front or the rear panel.
- Modules occupy either one or multiple slots.
- Each FluidProcessor comes with embedded computer (PLC), power adapter and regulated fans and is connected with the control computer by an Ethernet (LAN) cable.

Here is an example:

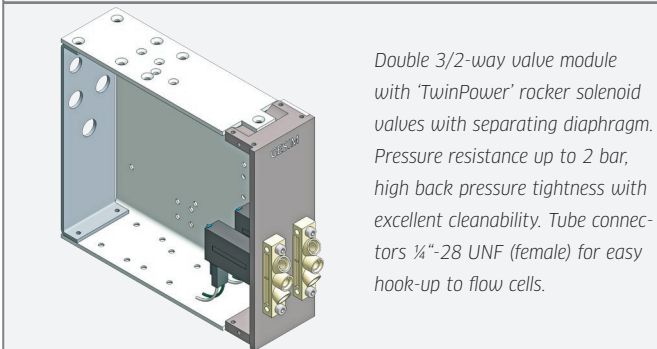


The FluidProcessor has space for up to ten modules that slide in from the front (up to seven from the rear). Here you see a configuration with three syringe pumps (with selector/distribution valves), two 3/2-way valves, a pneumatic extrusion module (4...80 °C) and inlets/outlets of diaphragm pumps for bulk liquid transport. The rear view shows a pressure inlet module that connects to e.g. compressed air or nitrogen (up to 1 MPa = 10 bar). The manual pressure reducing valve provides pressure for other modules in the FluidProcessor. The right half of the panel has sockets for sensors (flow, pressure, liquid levels) and for an Ethernet cable.

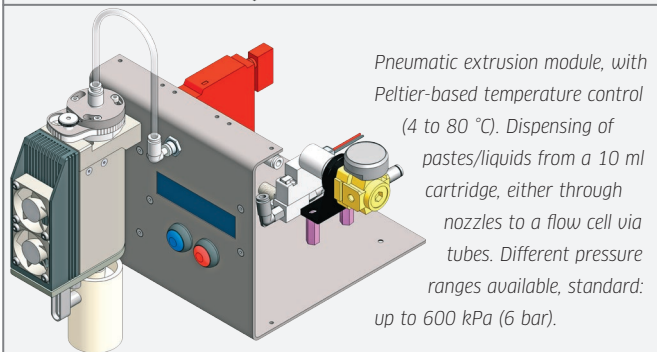
Hardware modules (selection)



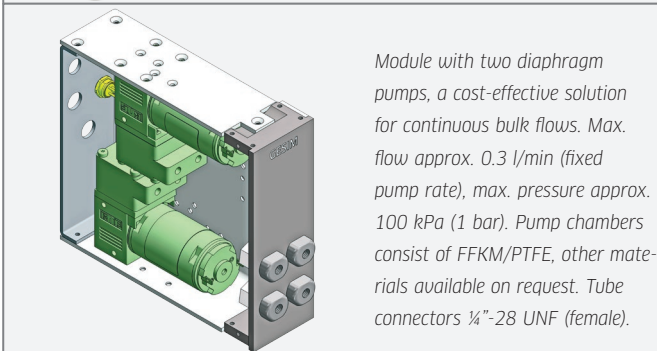
Syringe pumps for different syringe sizes (here 250 μ l) and different valves (shown are: 3-port non-distribution valve and 4-port and 6-port distribution valves). For precise bidirectional liquid flow from reservoirs to flow cells. Flow rates 0.0025 to 260 ml/min.



Double 3/2-way valve module with 'TwinPower' rocker solenoid valves with separating diaphragm. Pressure resistance up to 2 bar, high back pressure tightness with excellent cleanability. Tube connectors 1/4"-28 UNF (female) for easy hook-up to flow cells.



Pneumatic extrusion module, with Peltier-based temperature control (4 to 80 $^{\circ}$ C). Dispensing of pastes/liquids from a 10 ml cartridge, either through nozzles to a flow cell via tubes. Different pressure ranges available, standard: up to 600 kPa (6 bar).

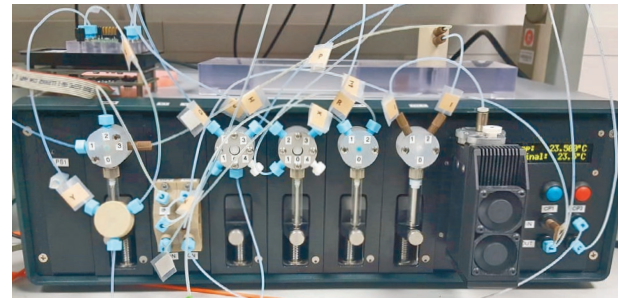
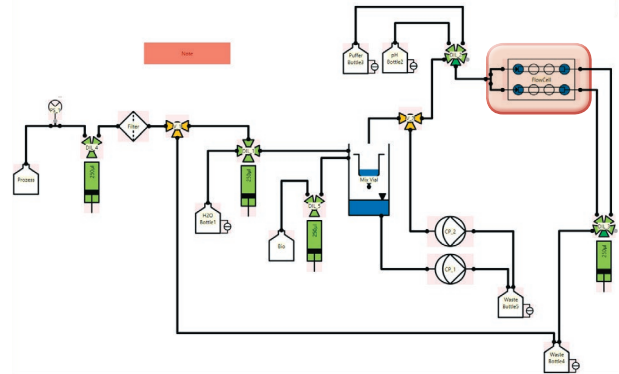


Module with two diaphragm pumps, a cost-effective solution for continuous bulk flows. Max. flow approx. 0.3 l/min (fixed pump rate), max. pressure approx. 100 kPa (1 bar). Pump chambers consist of FFKM/PTFE, other materials available on request. Tube connectors 1/4"-28 UNF (female).

Software 'GeSiM Fluidics'

GeSiM Fluidics is the control software for your GeSiM Fluid-Processor. Like the hardware, the software is modular, with a graphical user interface that offers click-and-drop to define functional modules, tubes, reservoirs and flow-cells. GeSiM Fluidics, structured much like a website, offers tabs with main operational modes. Just flip though from left to right when working with your FluidProcessor:

- 'Configuration': Prepare hardware modules and tube connections according to your application as seen on your bench.
- 'Manual' mode: After initialization, hardware components can be operated at the click of a mouse. Basic operations, e.g. pumping liquid into or aspirating liquid from a reservoir, can be started and stopped.
- 'Sequence': Create, save and execute complex sequences of events, including loops and conditional branches, for unattended operation.



Top picture: GeSiM Fluidics software (partial view), here for a plasmonic sensor for wastewater analysis (project ANTHROPLAS). The flow sensor is boxed in red. Bottom picture: 'Real life spaghetti monster', with flow cell top left. The project won an application award at the 'Analytica Virtual 2020' in the field of water and environmental analytics.

Gesellschaft für Silizium-Mikrosysteme mbH
 Bautzner Landstraße 45
 01454 Radeberg, Germany
 Tel. +49-351-2695 322
 Fax +49-351-2695 320
 contact@gesim.de
 www.gesim.de



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