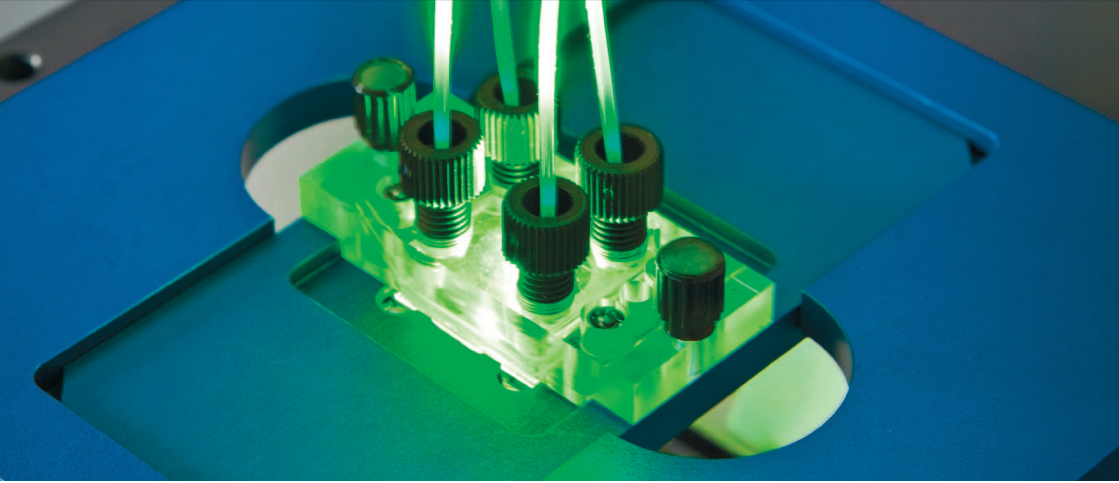


GeSiM MicCell

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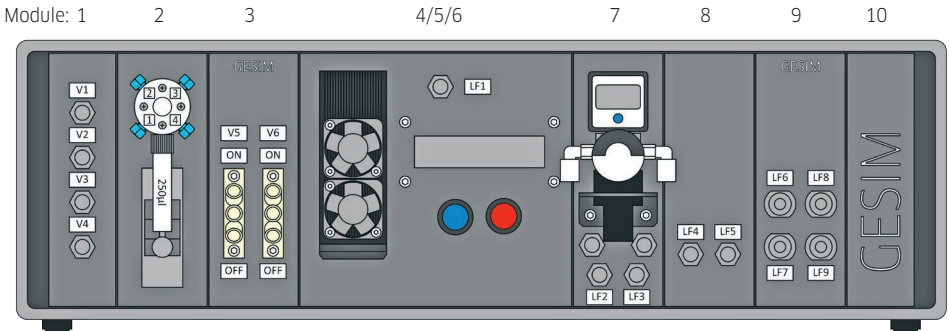
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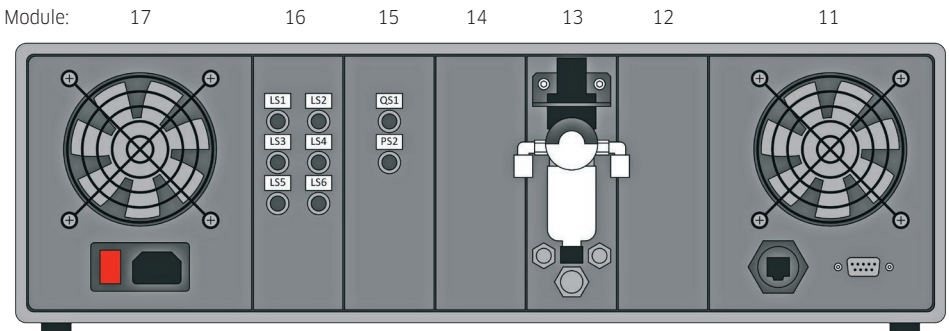
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GeSiM MicCell FluidProcessor

Front panel (example)



Rear panel (example)



These pictures show an example of a MicCell FluidProcessor. The front panel can host up to ten functional modules, the rear panel up to seven. Some modules use more space and thus occupy two or three slots; modules 1 and 10 are smaller. Typical modules on the front panel are pumps (syringe and diaphragms), valves and modules for temperature control, vacuum and compressed air; typical modules on the rear panel are an inlet for compressed air with pressure reducing valve (here: module 13) or liquid level sensor sockets (module 16). Modules 11 (data cable sockets) and 17 (power supply), including fans, are mounted in every FluidProcessor. See below for a detailed description of the modules.



FluidProcessor main unit

While MicCell microperfusion chambers can be driven by your own systems, the best solution is GeSiM's Fluid-Processor, as this modular system can host a variety of functions for fluidic and pneumatic control, under one hood. Select from a library of functional modules, but it is also possible to control devices from other companies, e.g. microfluidic controllers based on compressed air.

Although designed for GeSiM MicCell micro-flow systems, it can be used for numerous other purposes. It is therefore devised as a standalone unit.

The FluidProcessor features device slots of standardized width, where slots 1 and 10 are narrower and slots 11 and 17 reserved for Ethernet connection, power and fans. Modules can occupy one to three slots and slide in from the front or the rear. Each FluidProcessor contains a CPU, power adapter, regulated fans and a data connection backplane, and is connected with the control computer via a standard Ethernet cable.

Note: the FluidProcessor described here has superseded similar units from GeSiM (old article numbers A050-001 to -020).

An overview of the modules is given on the following pages. Items and technical details are subject to change without notice; and not all modules are shown. If you need a special device, just tell us

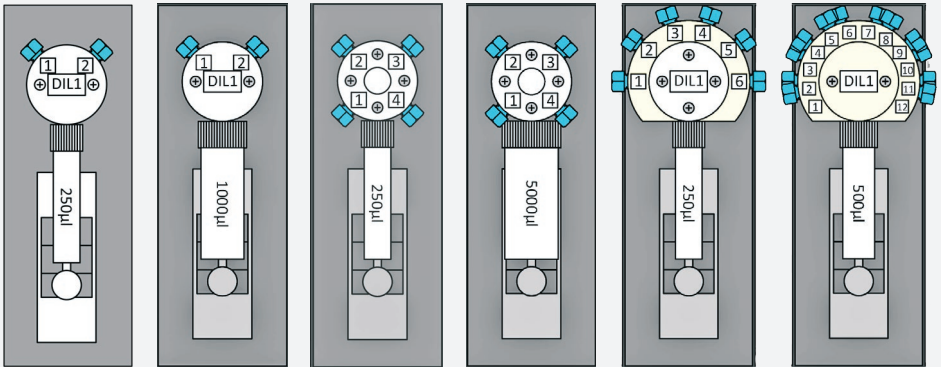
This is how to get your individual GeSiM FluidProcessor:

- Outline your application, including drawings, charts, and descriptions.
- Select functional modules of interest,
- GeSiM designs your FluidProcessor, with all accessories such as internal/external tubes, filters and reservoirs. Fittings are available for GeSiM flow-cells as well as for your own microfluidic components.
- A detailed tubing scheme and, if applicable, protocols to drive the unit will be sent to the customer before the FluidProcessor leaves our factory.

The FluidProcessor comes with the *GeSiM Fluidics* software that can be easily configured by clicking and dragging. Examples are given in this document.

Functional units of the FluidProcessor (front panel)

Syringe pump (article number A050-050)



Examples of the XCalibur syringe pump with non-distribution 3-way valve (left two) and 4/6/12-port distribution valves (all others), equipped with syringes of different size.

Syringe pumps are most important for driving fluids in micro-chambers. We use Tecan Cavro XCalibur pumps that can both aspirate (e.g. from a reservoir) and push liquid through microchannels. Syringe sizes between 50 µl and 5 ml are available (50, 100, 250, 500, 1000, 2500 and 5000 µl), with different gasket materials (e.g. PTFE); please order separately.

For a 50 µl syringe and 24000 steps per full stroke, 2 nl would be pumped per step.

Syringe pumps have valves (ceramic or plastic) to steer fluids to the right direction. Two types can be distinguished:

- **Distribution valves:** They connect the syringe with one of the ports by turning the valve. Available are 3-port, 4-port, 6-port, 9-port and 12-port distribution valves.
- **Non-distribution valves:** In this case, any of the ports can be connected with any other. For the 3-way valve shown above, this means that you can connect the syringe with port 1 or port 2, but also port 1 with port 2 and bypassing the syringe. The following non-distribution valves exist: 3-port, 4 port, 4-port dual loop, also T- and Y-junctions.

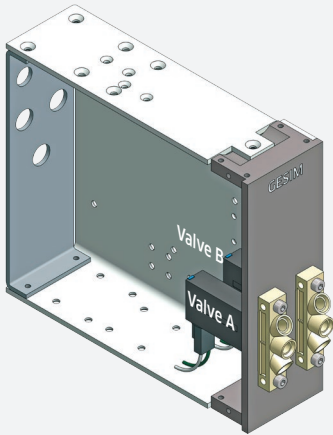
It is possible to use only the valve (without syringe) to lead a fluid flow to a certain outlet. In this case, connect a tube to the port that is normally occupied by the syringe. It also may be necessary to leave free space around the valves or you have only limited access to the valve ports.

Blind plate (different sizes, front and rear side)



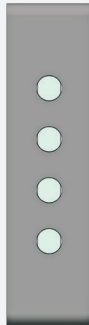
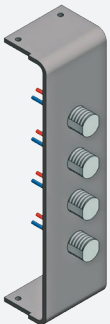
If a slot is empty, it is covered by a blind plate. This one is narrower, as it is built into the outer slots 1 and 10 on the front side.

3/2 valve module, two-fold (A050-080)



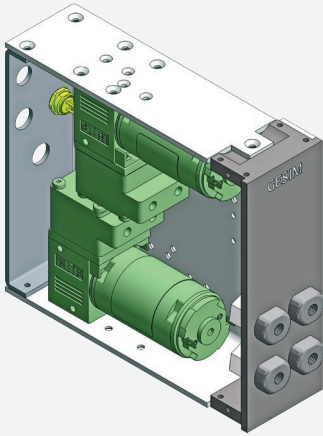
Two 'TwinPower' rocker solenoid valves with separating diaphragm are built into one module. They connect either ports 1/2 or 2/3, closing the other one. (The middle port is the inlet, the upper port normally closed, the lower one normally open.) Pressure resistance is up to 2 MPa (2 bar), with high back pressure tightness and excellent cleanability. The flow direction is unimportant. Tube connectors 1/4"-28 UNF (female) are used for easy hook-up to flow cells. A module with 2/2 magnetic valves is also available.

Valve connection module, four-fold (A050-085)



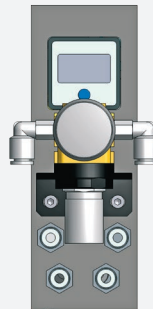
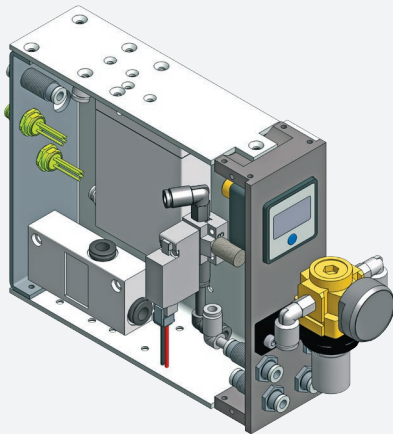
This module, to be mounted on the front side of the FluidProcessor, contains sockets to drive external valves. It is small and thus must be placed in slot 1 or 10.

Two-fold diaphragm pump module (A050-090)



Although not as accurate as syringe pumps, diaphragm pumps are a cost-effective solution for bulk liquid handling. Other than syringe pumps, they operate in one direction only. Max. flow approx. 0.3 l/min (fixed pump rate), max pressure max. 100 kPa (1 bar). Pump chambers consist of FFKM/PTFE, other materials available on request. Tube connectors ¼"-28 UNF (female) are used for easy hook-up to flow cells. This FluidProcessor module contains two of these pumps (green).

Vacuum module (A050-100)



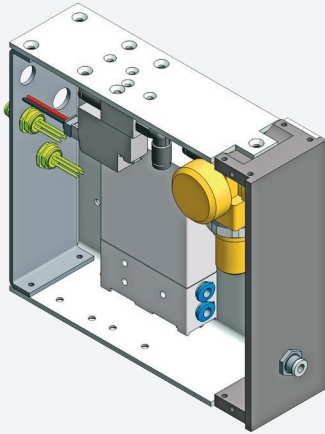
This module contains two controllers for vacuum in the range of -0.8 to 0 bar. As the vacuum controllers utilise the Venturi principle, prerequisite is a pressure inlet module that is normally mounted on the rear side.

Channel 1: manual vacuum setting with digital display

Channel 2: electro-pneumatic regulator from SMC

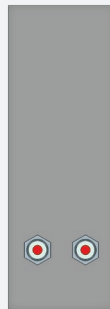
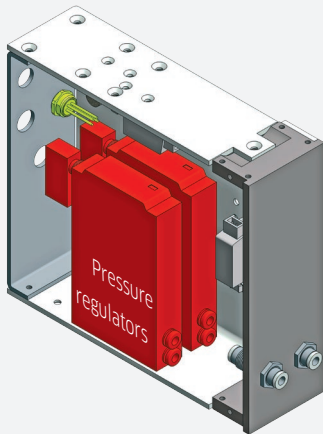
Note: Internal connections (fluidic/electric) not shown

Low pressure module (A050-110)



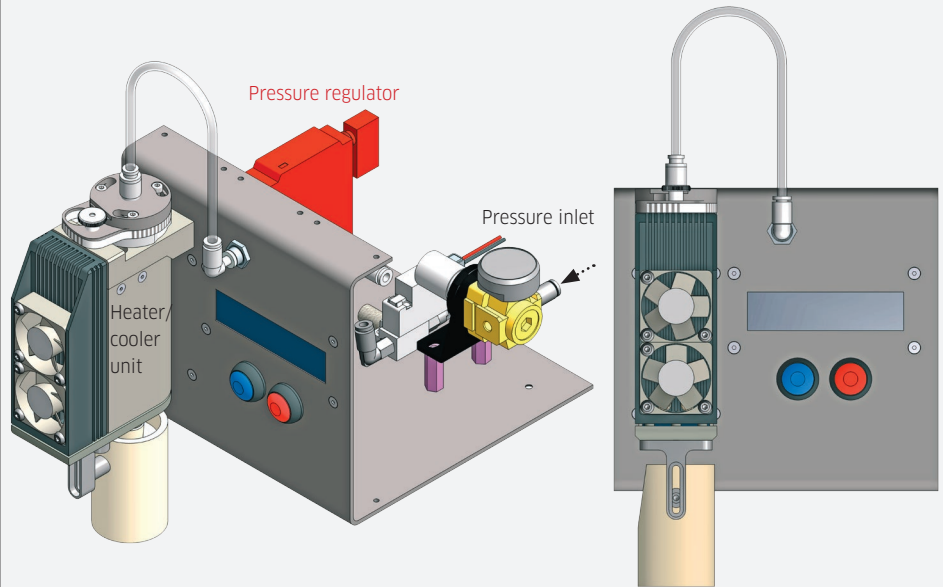
This module contains one pressure regulator for lower pressures of up to 100 kPa (1 bar). Again a source of compressed air is required; see below.

High pressure module, two-fold (A050-115)



This front-side module contains two pressure controllers in the range of up to 600 kPa (6 bar). A source of compressed air and the pressure inlet module are required; see below.

Cartridge cooler / pneumatic extruder module (A050-120)

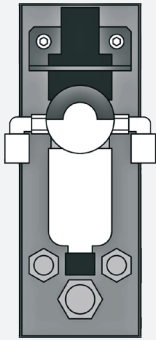


This pneumatic extrusion module is used to cool or heat pasty material in a cartridge to a certain temperature, Peltier-based (cooling: 4–15; heating: 32–80 °C). Extrusion of liquids or pastes from a 10 ml cartridge, either through nozzles into vials or to a flow cell via tubes, is controlled by compressed air, connected via a metal cap at the top of the cartridge.

Alternatively, liquid can be heated or cooled to a certain temperature.

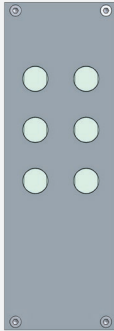
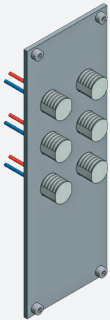
Functional units of the FluidProcessor (rear panel)

Pressure inlet module (A050-105)



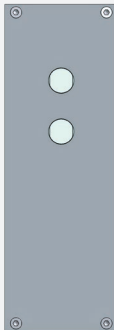
This module, mounted on the rear side of the FluidProcessor, is fed with house gas of up to 1 MPa (10 bar) and contains a manual reducing valve to reduce the pressure further.

Six-fold liquid level sensor module (A050-125)



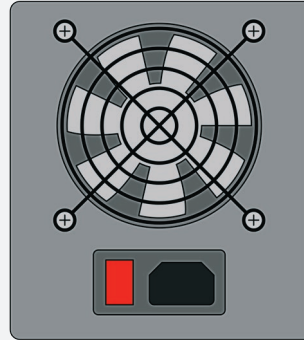
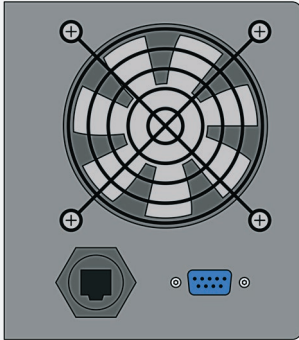
This module, mounted on the rear side, contains six sockets for capacitive liquid level sensors. Such sensors can be important to maintain a certain filling level in a bottle.

Two-fold liquid level sensor module (A050-130)



This module, to be mounted on the rear side, contains two sockets for liquid level sensors.

Modules for data cables and power, with fans



These modules provide the data connection with the control computer via an Ethernet cable (and to external devices via RS-322) and the connection to mains; they also provide cooling fans for the electronics. Every FluidProcessor has both modules in slots 11 and 17 on the rear side. More devices are yet to come – please visit our homepage or contact us.

Custom modules



If you have a specific third-party device you would like to integrate into the MicCell FluidProcessor environment, do not hesitate contacting us! We will try our best to make your specific needs possible, especially if connectivity to other external analysis units or implementation into larger process clusters is required.

This also includes the development of new tools you might be missing in our current inventory. Suggestions for new software features are always welcome as well.

Article Number	Name	Description	Detailed Description
A050-025	MicCell Fluidprocessor Basic Unit	MicCell Fluidprocessor Housing Basic Unit, with industry PC (IPC), housing, power supply, fans	
A050-050	Tecan syringe pump module 1-slot front side module for GeSiM Fluidprocessor	- Without valve and syringe (order separately) - 1x Cavro® XCalibur Modular Digital Pump	- Flow rate dependent of syringe size: 0,0025-261.6 ml/min - also usable as selector valve - Tube connections: ¼-28 UNF (female)
A050-060	Distributor Module 4-Port	see A050-050	see A050-050
A050-062	Distributor Module 6-Port	see A050-050	see A050-050
A050-066	Distributor Module 9-Port	see A050-050	see A050-050
A050-080	3/2-way valve module 1-slot front side module for GeSiM Fluidprocessor	2x TwinPower rocker solenoid valve (type 6624 of Bürkert)	- Compression strength min. 2 bar - Tube connections: ¼-28 UNF (female) - Valve materials FKM/PEEK - other materials on request
A050-085	24 V valve connection module 1/2-slot front side module for GeSiM FP	4-fold	
A050-086	24 V valve connection module 1/2-slot front side module for GeSiM FP	8-fold	
A050-090	Diaphragm pump module 1-slot front side module for GeSiM Fluidprocessor	2x diaphragm liquid pump (type NF 30, KNF)	- Tube connections: ¼-28 UNF (female) - Flow rate (max.): 0.3 l/min - Pressure (max): 1 bar (rel.) - Suction height (max): 6 mH2O - Pump chamber materials: FFKM/PTFE - other materials on request - Flow rate not adjustable
A050-100	2-fold vacuum controller 1-slot front side module for GeSiM Fluidprocessor	- Vacuum generation by ejector/Venturi principle - Needs pressure inlet module - Please order pressure inlet module separately - 1x manual setting with digital indicator (channel 1) - 1x electro-pneumatic regulator type ITV90 of SMC (channel 2)	- Tube connections: quick couplings for tubes 4 mm OD - Vacuum range: -0.8...0 bar (other pressure ranges on request)
A050-105	Inlet module for max. operating pressure 1-slot back side module for GeSiM Fluidprocessor	- Manual input of the max. incoming pressure (<7 bar, <0.7 MPa) via manometer with analogue indicator - Requires pneumatic source - Pneumatic source can be ordered on request	- Max. inlet pressure from pneumatic source: 10 bar (1 MPa) - Tube connections: quick couplings for tubes 4 mm OD - Other connectors on request
A050-110	1-fold low pressure control 1-slot front side module for GeSiM Fluidprocessor	- Requires pressure inlet module - Please order pressure inlet module separately - 1x electro-pneumatic regulator (type ITV10, SMC)	- Tube connections: quick couplings for tubes 4 mm OD - Pressure range: 0-1 bar (other ranges < 1 bar on request)
A050-115	2-fold high pressure control 1-slot front side module for GeSiM Fluidprocessor	- Requires pressure inlet module - Please order pressure inlet module separately	- Tube connections: quick couplings for tubes 4 mm OD



Article Number	Name	Description	Detailed Description
A050-120	Temperature-controlled pneumatic extruder module 3-slot front side module for GeSiM Fluidprocessor	<ul style="list-style-type: none">- Temperature-controllable reservoir (cartridge holder)- Requires pressure inlet module- Please order pressure inlet module separately- 1x electro-pneumatic regulator (type ITV10, SMC)- x* 10 ml cartridges + compressed-air connection	<ul style="list-style-type: none">- Reservoir for 10ml Optimum® cartridges from Nordson EFD- Tube connections: quick couplings for tubes 4 mm OD- Pressure range: 0-1 bar (other ranges < 6 bar on request)- Cartridge connection: Luer-Lock (male)- Temperature range: 4-80°C at RT
A050-125	6-fold level sensor connection module 1-slot back side module for GeSiM Fluidprocessor	<ul style="list-style-type: none">- Up to 6x connections for level sensors for external liquid level sensors- Level sensors not included- Please order level sensors separately or as part of bottle racks	<ul style="list-style-type: none">- Electrical connections: 24V digital connection; M8, 3-pin (type 718, Binder)- Digital connection; M8, 3-pin (type 718, Binder)
A050-130	6-fold level sensor connection module 1-slot back side module for GeSiM Fluidprocessor	<ul style="list-style-type: none">- Up to 2x connections for level sensors for external liquid level sensors- Level sensors not included- Sensor types on request	<ul style="list-style-type: none">- electrical connections: 24V analogue input; M8, 4-pin (type 718, Binder)- Analogue input; M8, 4-pin (type 718, Binder)
A050-140	Temperature control module 2-slot front side module for GeSiM Fluidprocessor	<ul style="list-style-type: none">- for temperature control, control of a temperature-controlled unit via manual T-setting F4	
A050-142	External temperature control		
A050-150	Front Plate "DB"		
A050-152	Front Plate "HDB"		
A050-154	Rear Plate "DB"		

Bottles and racks

Article Number	Name	Description	Detailed Description
A050-180	Rack for 1x 250 ml, incl. bottle with GL 45 screw cap	<ul style="list-style-type: none"> - Bottle holder with liquid level sensor - 250 ml Schott glass bottle with GL45 thread - No connections (order separately) 	<ul style="list-style-type: none"> - Utilisation as waste or system liquid bottle - Other bottle material on request (e.g. UV-non-transparent or coated) - Holder can be connected with others to a rack
A050-185	Rack for 1x 500 ml, incl. bottle with GL 45 screw cap	<ul style="list-style-type: none"> - Bottle holder with liquid level sensor - 500 ml Schott glass bottle with GL45 thread - No connections (order separately) 	<ul style="list-style-type: none"> - Utilisation as waste or system liquid bottle - Other bottle material on request (e.g. UV-non-transparent or coated) - Holder can be connected with others to a rack
A050-190	Rack for 1x 1000 ml, incl. bottle with GL 45 screw cap	<ul style="list-style-type: none"> - Bottle holder with liquid level sensor - 1000 ml Schott glass bottle with GL45 thread - No connections (order separately) 	<ul style="list-style-type: none"> - Utilisation as waste or system liquid bottle - Other bottle material on request (e.g. UV-non-transparent or coated) - Holder can be connected with others to a rack
A050-195	System bottle 5 l GLS 80	<ul style="list-style-type: none"> - Bottle holder with liquid level sensor - 5000 ml Schott glass bottle with GLS 80 thread - No connections (order separately) 	<ul style="list-style-type: none"> - Can be used as waste or system liquid bottle
A050-205	Pressure-tight rack for vials	<ul style="list-style-type: none"> - Holder without liquid level sensor - For small containers (e.g. vials) - Without vials - Metal bottom - Connections: M5 (male) [for connection to HPLC] - Other connections on request 	<ul style="list-style-type: none"> - Fits on e.g. heat plates for temperature control - Heat plate not included! - Holder can be connected with others to a rack - Utilisation for pneumatic fluid handling (e.g. as droplet generator)
A050-250	Digital interface		
A050-253	Interface CANopen Bus		
A050-750	MC-Fluidprocessor, customized - Example -	Configuration: <ul style="list-style-type: none"> - Chassis with PLC module and power supply, - Dlutur module, - Valve for smart valve+, 6-port distributor, - Vacuum module, - 2x Low pressure module, - 6-fold Level sensor connector, - 2-fold Level sensor connector, - Temperature controller - Bottle rack, 1 Litre, with bottle, - Flow sensor kit SLI-1000 - Electronic/ fluidic accessories 	Customized MicCell Fluidprocessor Other customized Fluidprocessors available

More configurations on request.

GeSiM MicCell

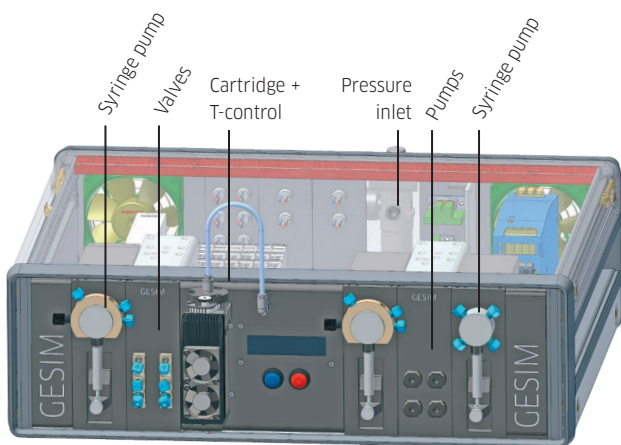
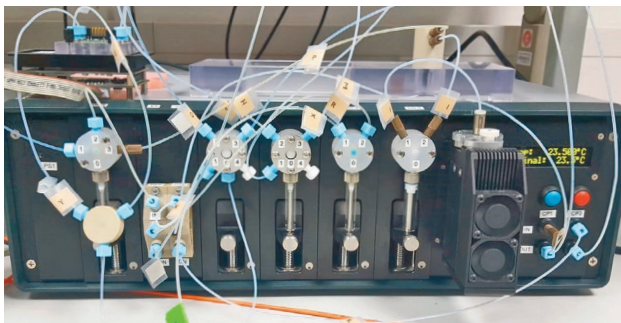
Examples of FluidProcessor Configurations

Project ANTHROPLAS: Fast detection of wastewater contaminants

Anthropogenic wastewater pollution by biologically active compounds is a global concern and poses an increasing threat for sewage treatment plants, as many chemicals can only be removed with an additional purifying step.

In a joint project, we and others have focused on the on-line detection of drugs such as diclofenac for on-line process control. The system is designed for robust 24/7 analysis of wastewater using a novel sensitive plasmonic micro-sensor (developed by Fraunhofer IKTS, Dresden, and manufactured by the GeSiM μ CP4.1) that does not require an expensive optical setup.

Our goal was to design an autonomous microfluidic environment, which we solved using the flexible FluidProcessor and a MicCell-based microfluidic chamber. The project won an application award at the international 'Analytica Virtual 2020' in the field of water and environmental analytics.



Top picture: FluidProcessor test set-up, with flow cell containing the plasmonic sensor on top of the FluidProcessor; bottom picture, new concept. See next page for the software interface.

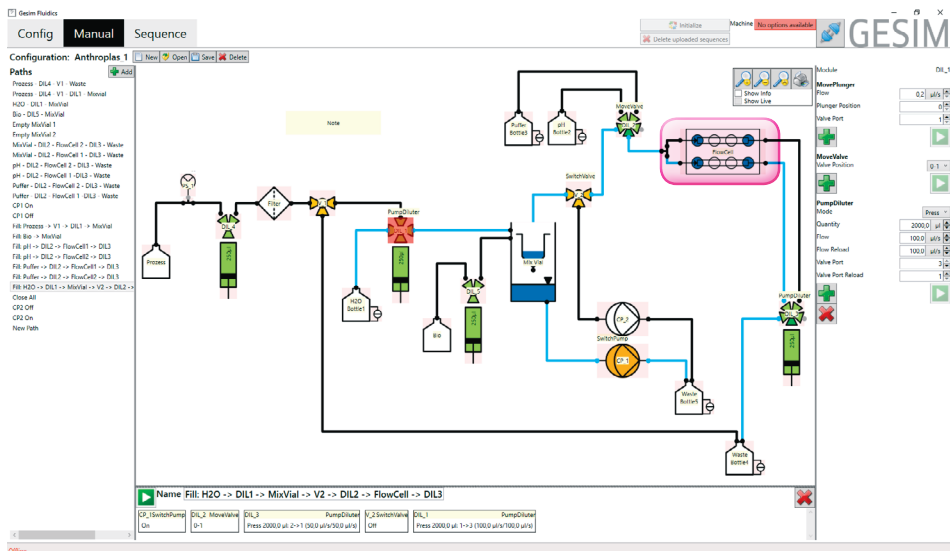
Reference: Steinke, N. et al.: Detection of diclofenac molecules by planar and nanostructured plasmonic sensor substrates. *Sens. Act. B* 254, 2018, 749–754, DOI:10.1016/j.snb.2017.07.123

Software GeSiM Fluidics

GeSiM Fluidics is the control software for the GeSiM FluidProcessor. Like the hardware, GeSiM Fluidics is modular. Once configured, it exactly represents the hardware on your bench. The graphical user interface renders possible click-and-drop steering of functional modules, tubes, reservoir bottles and microfluidic or macrofluidic flow cells.

GeSiM Fluidics is structured like a website and offers three main 'pages':

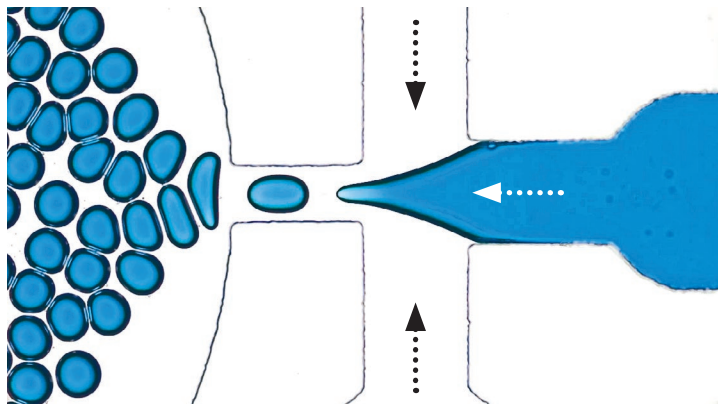
- **Configuration:** Hardware modules and tube connections can be arranged to meet your application, works by clicking and dragging.
- **Manual:** After initialisation, hardware components can be operated by mouse click. To do this, 'operational paths', e.g. for pumping liquid into a waste reservoir, must be defined.
- **Sequence:** Create, save and execute complex sequences, including conditional branch instructions and loops, for automatic runs and unattended operation.



GeSiM Fluidics software for the project ANTHROPLAS, here in the manual mode after configuration of the flow system; the flow sensor is boxed in magenta. A certain flow path (cyan) and a certain tool (diluter, red) is selected.

Droplet generator

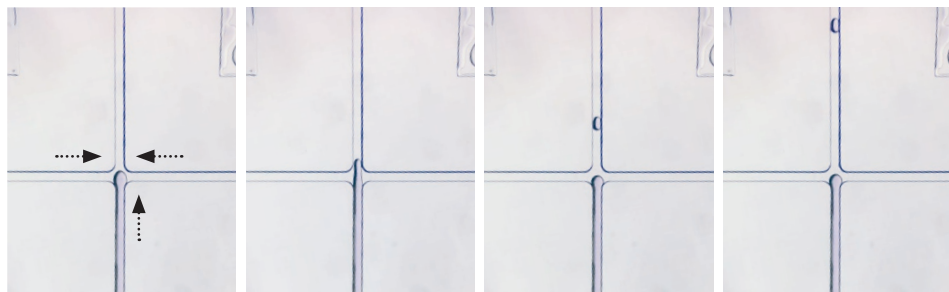
Separate droplets are produced by injection of hydrophilic and hydrophobic fluids into one microchannel. This method can be used to generate fluidic microreactors for single-molecule reactions, the encapsulation of cells, dosage of compounds in small reactors etc. It can also be used to isolate bacterial and other colonies in small volumes and storing them in long tubes (see below).



Aqueous droplets (blue) generated in a hydrophobic environment. The two side channels contain organic solvent; fluid flows are depicted by arrows.. Droplets are collected in the storage reservoir on the left.

Liquid compartmentalization in tubes

Again small droplets are separated by a hydrophobic environment and then transported to an outgoing tube. This can be used for e.g. compound dosage or the storage of single bacterial colonies in long tubes.

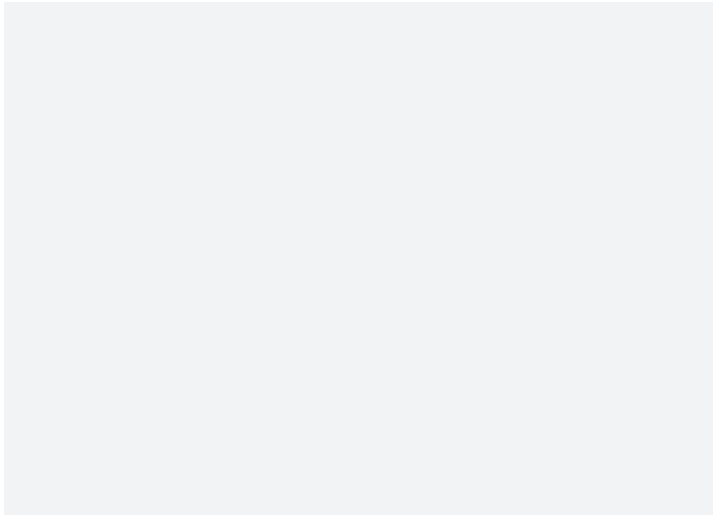


Generation of separate droplets in a PDMS channel. Water comes from the lower channel, organic solvent from the two side channels.

Project SIMPLE-IVD

The goal of this project is the development and scalable integrated manufacturing of in vitro diagnostic (IVD) microfluidic cartridges from multi-layer plastic foils using a production line. This line contains machines with different functions in a row, ideally in conjunction with the assay the microsystem encodes. This means that the FluidProcessor interacts with other lab robots from GeSiM with which it shares the same automation platform. The project is aiming at flexible and cost-efficient manufacturing of chips for the personalized medicine, from prototype stage to mass production.

Machines for the following process steps are involved: microcontact printing, foil cutting, transport of parts using grippers, multi-layer lamination (without and with integrated membrane filters), microarray spotting into micro-channels and 3D printing, with stackers for unmachined and fully assembled parts at the beginning and end of the line. More techniques are to be added in the future.



FluidProcessor in combination with a flow cell from the SIMPLE-IVD project (will be shown when more data are available)

GeSiM MicCell

MicCell Flow Cell Technologies

Build your own PDMS micro-perfusion cell

The modular 'MicCell' is a rapid prototyping system for the easy fabrication and assembly of soft-polymer-based microfluidic chips. These chips can be pre-cast (ready-to-use); we also offer custom-designed silicon moulds for the casting of individual polydimethylsiloxane (PDMS, 'silicone') chips.

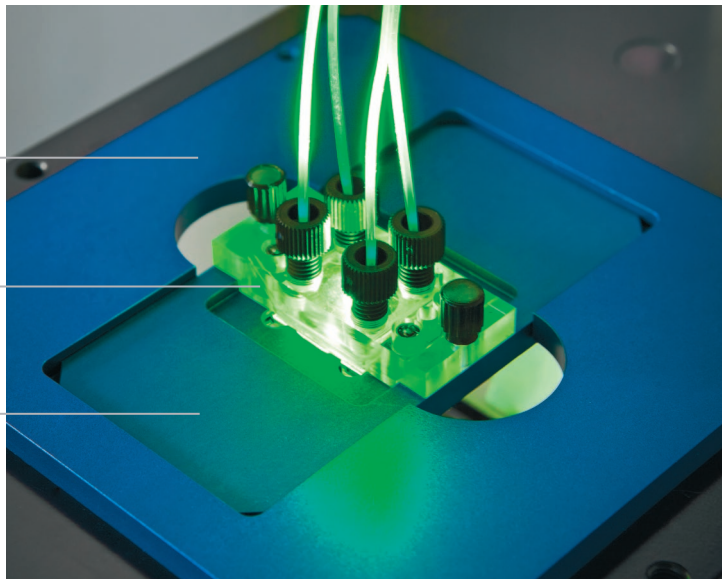
The MicCell is set up by (1) casting a polymer channel plate, (2) adding a coverslip (that can also contain microarrays, nanostructures and cultured cells) and (3) mounting it in the holder, which is then (4) transferred to a microscope via a mechanical frame (various microscopes supported). Creating a new channel requires only a new silicon master for gel casting, which is available from GeSiM. A MicCell version for upright microscopes exists. (Light microscope not included.)

The **PDMS channel plate** (PDMS-CP), is formed by a PDMS layer with microchannels on a polycarbonate (PC) body that provides the 'chip-to-world' interface via standard UNF fittings. You can buy pre-cast channel plates or mould them yourself in a casting chamber. The microchannels in the PDMS layer are sealed with a coverslip (with or without electrodes) and mounted in the MicCell support, which is inserted in the adapter plate.

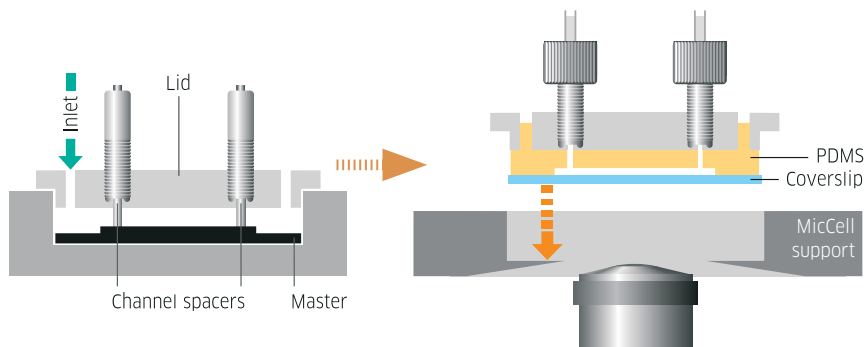
A070-600
MicCell Work Plate
(mechanical frame)

A040-106
MicCell PDMS-CP
22×22

A040-018
MicCell Support
22×22



MicCell (here: 22 mm × 22 mm) in an inverted microscope, consisting of work plate (adapter), support, channel plate (incl. lid), and tubes with fittings. This is the minimal configuration; further macrofluidic and microfluidic accessories can be added.



The system is completed by other microfluidic parts and a macrofluidic environment (tubes, filters, bottles, syringes, valves, flow sensors etc.), ideally controlled by the FluidProcessor, but you can also use your own devices.

Instead of making your own flow cells, you can buy **ready-to-use** PDMS channel plates or multi-layer foil structures or permanently bonded glass/polymer or glass/silicon microfluidic chambers. See below.

Channel plates – Different sizes and features

Off-the-shelf sizes are:

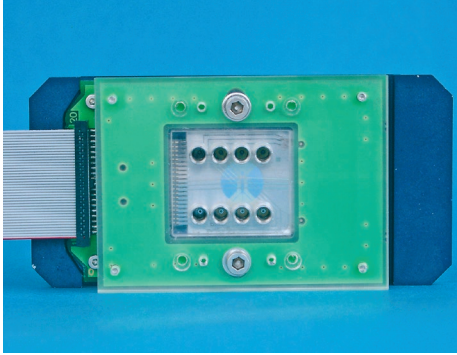
- 22 mm × 22 mm (normal coverslip)
- 22 mm × 50 mm (large coverslip)
- 25 mm × 75 mm (slide size)

The PDMS layer is moulded between the polycarbonate body and the silicon master; after curing it gets sealed by a standard glass coverslip.

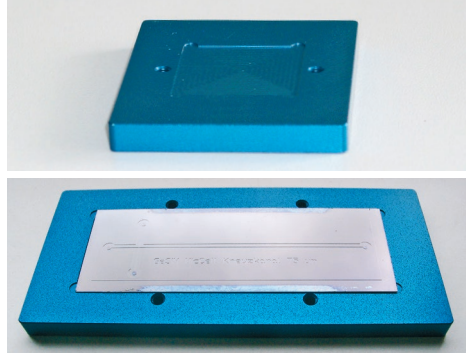
Different sizes allow different numbers of inlet and outlet ports, e.g. one to two inlets and one to two outlets for the 22×22 channel plate. The channel layout is defined by the silicon master, i.e. by you. If you order at GeSiM, you pay for a full batch of diced masters that fit on a 4-inch (10 cm) wafer. GeSiM silicon masters are deep etched (reactive ion etching, RIE, Bosch process), can have different resolutions (25 µm with photo-emulsion mask, or 2 µm with chrome mask) and are **coated with PTFE** (Teflon) for easy demoulding.

You can order pre-cast channel plates for immediate use. The PC body is recycled to reduce costs.

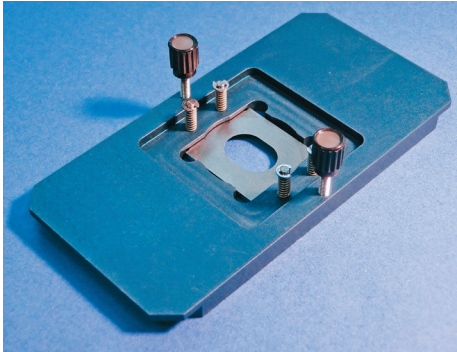
Channel plates from other materials (e.g. glass only) and with microelectrodes exist. And don't forget that we offer pre-assembled, ready to use **foil-based multi-layer channel plates** (see below).



A040-019 MicCell support with printed circuit board (PCB) to connect to electrodes on the coverslip, plus electrical connector to the outside world



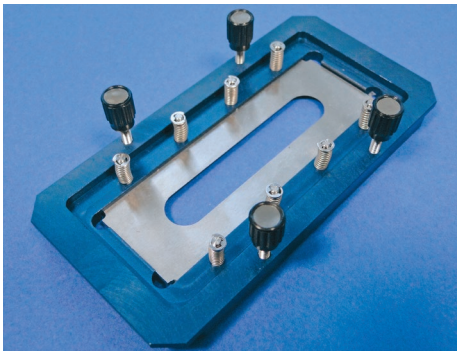
A040-020, -021 Aluminium base plate ('calotte') 22×22 (top) and 25×75 (bottom, with master) of PDMS casting stations



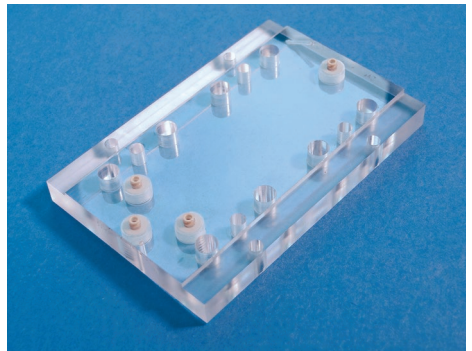
A040-018 MicCell support for 22×22 mm² coverslips



A040-109 PC body (lid) for PDMS-CP 22×22



A040-026 MicCell support 25×75 mm²



A040-025 PC body (lid) for PDMS-CP 25×75

Gel casting stations

You gain flexibility by making your own channel plates in the GeSiM casting chambers. They are assembled as follows: first place the holder for the master ('calotte'), then the master on top, then the Teflon case, then the polycarbonate lid for the channel plate ('PC body', as it is made of polycarbonate), then the screws.

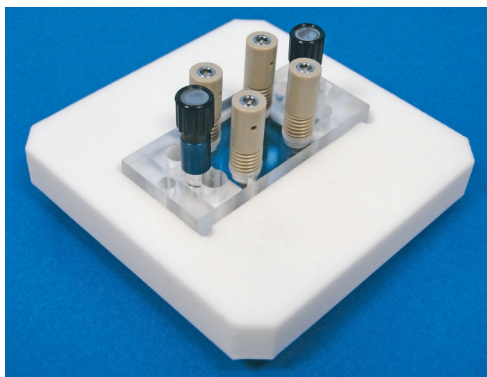
As liquid must pass through the PDMS layer to reach the channel, through-holes must be created using 'channel spacers'. These look like regular fittings, but have spring-loaded pins that are pressed against the master. Plasma treatment of the PDMS for sealing is usually not necessary.

Silicone elastomer base and curing agent (cross-linker) are mixed, degassed and injected. After curing, the channel plate (PC body with PDMS) is taken out and the channel spacers and PDMS burs are removed. The lid (PC body) stays on as chip-to-world interface.

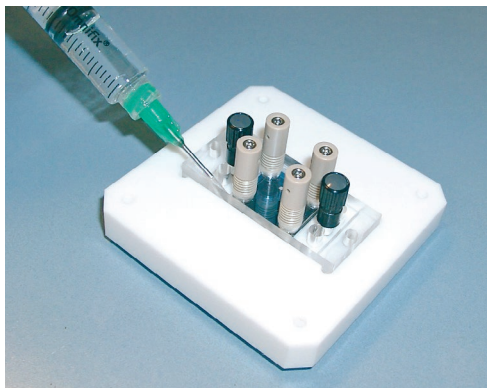
A coverslip is added and the stack fixed with screws in the MicCell support. The coverslip is pressed against the PDMS via springs and so the channel gets sealed. Finally, the MicCell support is inserted into the work plate sitting in your microscope and the tubes and other accessories connected to the MicCell.

Casting stations come with a technology overview and detailed hands-on instructions, PC bodies, channel spacers and one litre of Sylgard 184 two-component PDMS solution (base and curing agent). You also need single-use glassware and syringes with needles to prepare and inject the PDMS mixture, a pump and a desiccator for degassing and an oven for curing. An initial set of mixing glasses, syringes and needles is included in the box; you should order more in time.

Microstructured silicon masters for moulding must be ordered separately. They are usually made to order. Prices depend on the necessary photomask. Predefined designs (e.g. single channel, T-channel, K-channel) are available; see the table below. Please inquire for details.

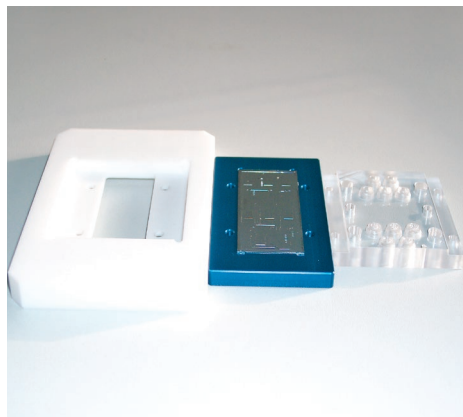


A040-054 Casting chamber 22x22, fully assembled, including master and channel spacers. A040-033 contains in addition PDMS solution and channel spacers.

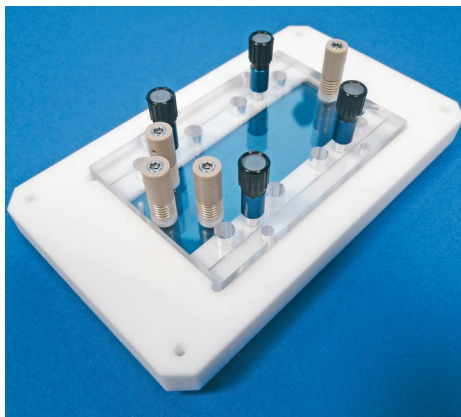


A040-054 Injection of PDMS into the casting station

You should also have enough PC bodies at hand so that you can cast a new PDMS channel plate while others are in use. Accessories can be added, such as connectors for heaters, sensors and microelectrodes, to name a few. And don't forget to buy PDMS stock solutions, mixing glasses and a desiccator, all available from GeSiM.



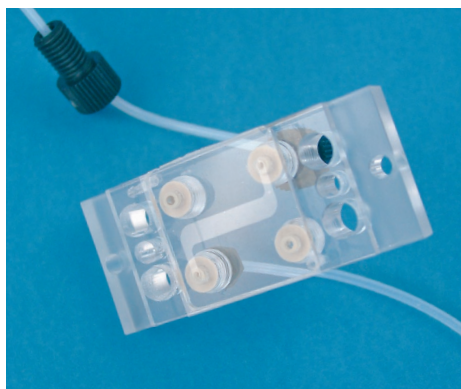
A040-057 Casting chamber 25×75 mm², before assembly, with silicon master in the base plate



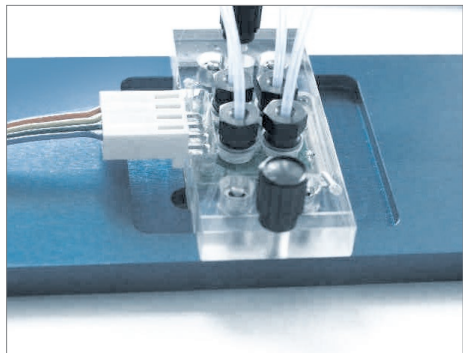
A040-057 Casting chamber 25×75, assembled, including master and channel spacers



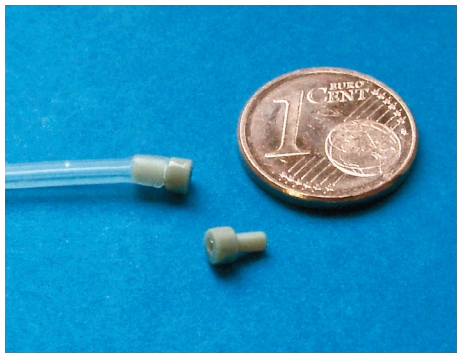
A040-091 Channel spacer in UNF ¼"-28 fitting, with spring-loaded tip (1.6 mm). Creates a hole in the PDMS layer during gel casting. Inset: A040-092, stopper fitting, UNF ¼"-28.



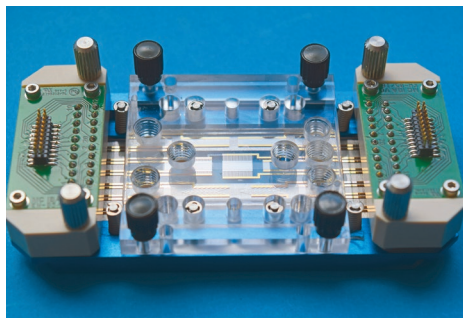
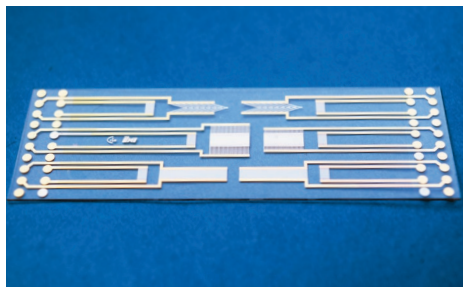
A040-105, -106 Ready-to use PDMS-CP 22×22 mm², with curved 3 mm wide S-channel, with tubes and coverslip



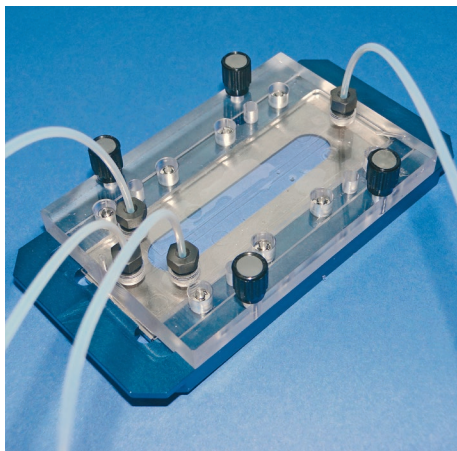
A040-112 PDMS-CP 22×22 with four inlet electrodes, in MicCell support



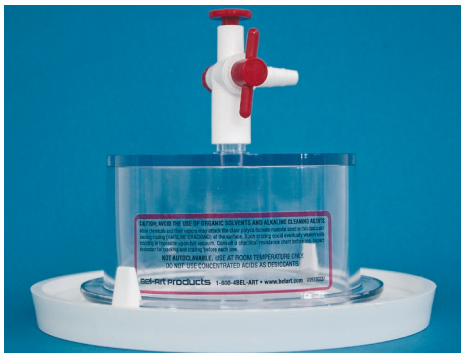
A040-114 PEEK fluid connectors to connect silicone tubes to microfluidic systems that are not mounted in a MicCell



A040-112 PDMS CP 22×22 with four inlet electrodes, in MicCell support (top). The bottom picture shows interdigitated gold electrodes for impedance measurement.



A040-026, -115, -116 PDMS channel plate, 25×75 (slide size), in MicCell support; here with 3 inlets and 1 outlet



A040-512 Small desiccator for PDMS degassing



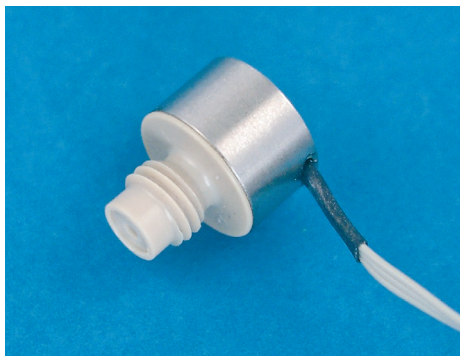
A040-514, -516, 517, -664 Large and small syringes and mixing glass for PDMS preparation, PDMS base and curing agent, syringes



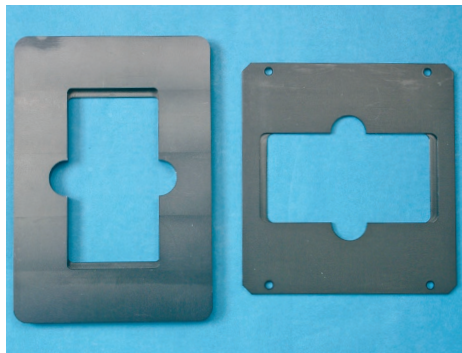
A040-530 Large desiccator for PDMS degassing



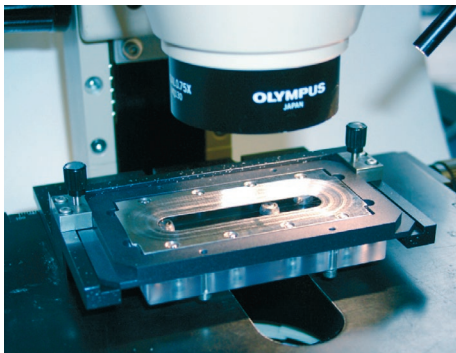
A040-540, 541 UNF 1/4"-28 fittings with Au and Ag/AgCl contact



A040-542 Pressure sensor fitting, UNF 1/4"-28



A070-600 Two different work (adapter) plates for standard inverted microscopes

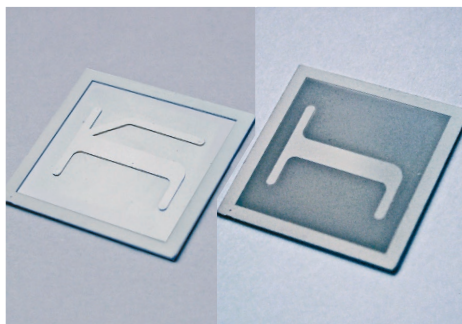


A070-610 Customized MicCell design for upright microscopes

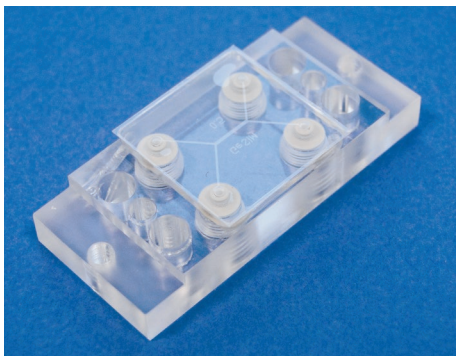
Silicon masters

GeSiM offers 4-inch (100 mm diameter) silicon wafers for PDMS casting. Up to three different channel depth can be present on the same wafer, for an extra price; the resolution depends on the mask (25 μm with a photo-emulsion mask, 2 μm with a chrome mask). All masters are deep reaction ion (RIE) etched and teflonised for better demoulding, and cut to the final size for immediate use. We thus charge all process steps per one 4-inch wafer, so you can put as many different masters on a wafer as fit on it (formats: .dwg or .dxf). Please inquire about the possibilities; we are there to help.

GeSiM has a large repository of ready-to-use channel designs from which you can choose. In this case no charges for a photolithography mask for the master apply. Customized designs require new photomasks; please inquire.



A040-550, -551 Example of a 22x22 master with 'K-channel' design (left) and 22x22 master with 'T-channel' design (right)



A040-552 Ready-to-use PDMS-CP with 2Y channel design and attached coverslip

Foil-based microfluidics, made to order

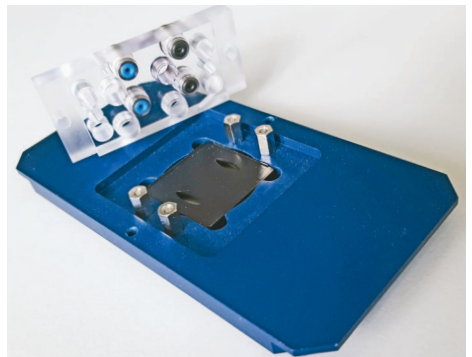
Only minimal changes in the PC body of the MicCell are necessary to accommodate the popular foil-based microfluidics. GeSiM provides even the most complex customized multi-layer systems from various plastics, as single chips or disposables in bulk quantities. As these systems can have **multi-layer structures** including micro- and nanopore filtration membranes, possibilities are endless to expand your toolbox and be up and running quickly.

- Made of different materials (e.g. polycarbonate)
- Transparent or non-transparent, without/with adhesive
- Foils cut by a blade or (better) by a laser
- Foils are accurately aligned in our lab and laminated
- Complex multi-layer structures possible
- Large quantities (disposables) possible
- Option: very selective nano- and **micropore membranes** made by 'track-etching' with heavy ions (Oxyphen AG), e.g. for filtration

Please inquire for availability and prices.



Left: simple 75×25 foil-based system consisting of (1) a bottom layer with gold-coated plasmonic sensors (made by nanoimprint lithography with a GeSiM μ CP4.1), (2) a white channel layer, and (3) a transparent top layer with holes. The right picture shows an enlarged picture of an Oxyphen micropore membrane attached to a channel layer.



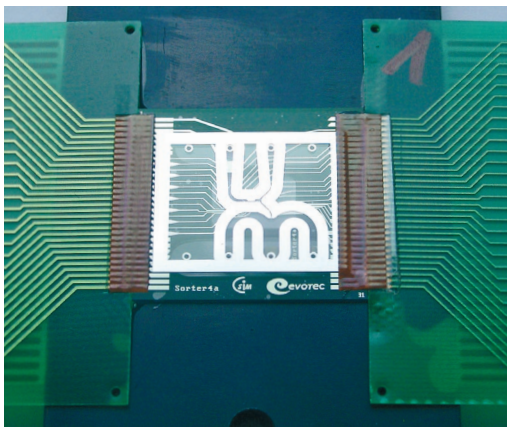
MicCell support (blue) and transparent polycarbonate body with O-rings for foil-based 22×22 microfluidic systems

Glass/silicon flow cells and microvalves

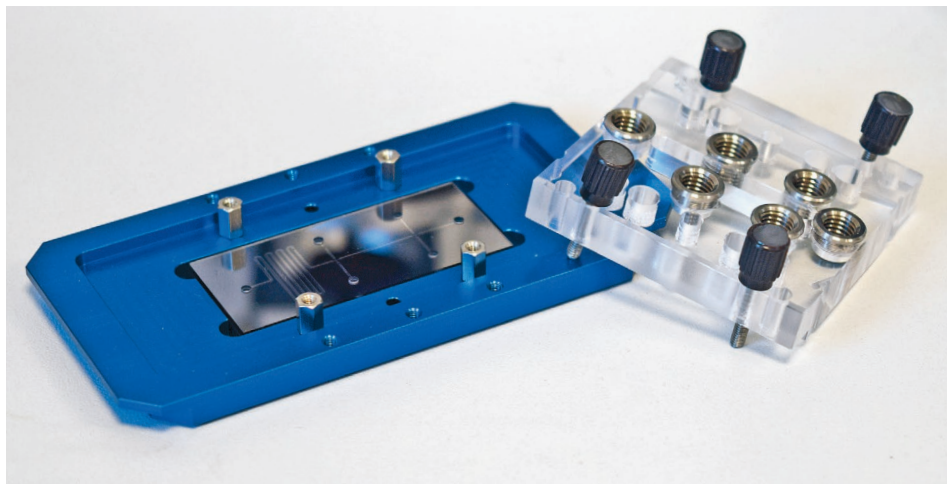
A number of designs exist for flow cells from glass, either standalone or to be used in a MicCell set-up. Channel walls can be from silicon or polymer and can also contain microelectrodes. Please inquire; we build them to order.

Dead-volume free hydrogel microvalves also exist. These normally closed valves are small silicon chambers filled with hydrated PNIPAM particles that dramatically shrink above 34 °C, hence opening the valve upon heating. Please inquire if you are interested; we don't have them in stock.

Please inquire if you are interested in our multi-organ chips (MOCs, see article list below). Also ask us if you need more information on the articles, since many articles do not come with a detailed description. (A few items belong to legacy devices, e.g. the semi-automatic μ CP3.) Not all parts are listed here. Please contact GeSiM if you need assistance with the listed flow-through systems.



A040-056 Permanently bonded glass-glass channel plate, with microelectrodes on both sides, polymer walls and PCBs on both sides wire-bonded to the chip. This is a DFC (dielectrophoretic field cage) chip for the trapping and analysis of particles/cells in inhomogeneous high-frequency electric fields. Other dielectrophoretic devices are A040-051 ('sorter'), -052 ('loader') and -053 ('DFC3').



Silicon/glass flow cell (mixer) in MicCell support and polycarbonate body with standardized chip-to-world interface

Article Number	Name	Description	Detailed Description
A040-002	Nanotitre plates, customer-specific	1 Wafer 4"	Scope of delivery: - Nanotitre plates according to your layout design. - Etching, bonding with Pyrex glass, thickness according to your specifications, - Dicing of the nanotitre plates from the wafer
A040-003	NanoWellPlate, KOH, Glass		
A040-004	NanoWellPlate, ASE, Glass	400 µm Si, without glass margin	
A040-005	Closed NWP		
A040-006	NWP, ASE, Glass	400 µm Si, surrounding glass margin	
A040-007	NWP, ASE, Glass	Si 250 µm, glass margin	
A040-008	HE Moulding Master 4"-Si		
A040-009	Si Moulding Master-1...1,5 µm SiO ₂		
A040-010	P-Carrier KOH/SiO ₂	IPF	
A040-011	FlexiPERM Support		
A040-012	MicCell Casting Station Slide		
A040-013	MicCell M5 Fitting PEEK		
A040-014	MCE Module		
A040-016	MEA Chip 1		
A040-017	SOG Flowthrough Chip	8 chips per 140.00 € / 4"-wafer	
A040-018	MicCell Support 22x22	without printed circuit board and connector	
A040-019	MicCell Support PCB and Connector		
A040-020	MicCell Al-Calotte 22x22	for master support	Chip outer dimensions 10 mm x 10 mm Membrane area 2 mm x 2 mm Membrane thickness 100 nm Membrane material Si ₃ N ₄ 60 diced chips per wafer
A040-021	MicCell Al-Calotte 25x75		Chip outer dimensions 10 mm x 10 mm Membrane area 2 mm x 2 mm Membrane thickness 100 nm Membrane material Si ₃ N ₄ 60 diced chips per wafer
A040-022	MicCell Al-Calotte 22x50	standard without PCB	
A040-023	MicCell Al Moulded Part 25x75		
A040-024	Flow-Through Module, 4" Prototype Batch	Glass-glass cell	
A040-025	MicCell PC Moulded Part 25x75		
A040-026	MicCell Support 25x75		
A040-027	150 µm Coverslip, Silicone Rubber Seal	based on 4" glass wafer	
A040-028	Si-Cover Plate Streaming Potential Measuring Cell	IPF cell	

Article Number	Name	Description	Detailed Description
A040-029	Electrode Chip without Insulator		
A040-030	Micro-Master, Pattern Lateral >1 µm	CAD, Cr-mask, process	
A040-031	Nano-Master, Pattern Lateral >100 nm	e-beam lithography	
A040-032	SOI Moulding Wafer 150 µm		
A040-033	MicCell PDMS Casting Station 22x22	"Complete set The complete set of the casting station includes a casting chamber, 1 litre PDMS Sylgard 184 plus curing agent, 4 channel spacer, 3 hypodermic syringes and a technology handbook."	For the manufacturing of PDMS Channel Plates in sandwich with a PMMA body, with 4 fluid connections 1/4-28 UNF grid 15.2x11.6 mm ² , and a PDMS channel structure cast on top of it, fits to coverslip 22x22x0,15 mm ³ .
A040-034	Coverslip ITO-Coated, Batch of 8 Pcs.	Diameter 25 or 22 mm2	
A040-035	MicCell PDMS Casting Station 22x50	Complete set	
A040-039	Hellma ASE Chip		Hellma ASE chip, made with novel technology without dicing, surface thermal SiO ₂ all over the surface, 1 µm thick; chip thickness 400 µm ± 15 µm, ref. drawing no. G5615-60006/Rev.6
A040-040	Cryo-Well Plate	SiO ₂ surface and diced	
A040-041	Silicon Die Hellma		
A040-042	4" Si Target Chips		
A040-043	EMS Drilled Glass Diced		
A040-044	Pure Coverslip 150 µm	customised, cut from 4"-glass	
A040-045	Cryo-Well Plate-II		
A040-046	Cryo-Well Plate-T-Pt		
A040-047	High-Volume Cryo-Well Plate		
A040-051	Sorter4aD-Pt-FR-30		
A040-052	Loader4D-Pt-FR-30		
A040-053	DFC3-Pt-FR-30-S	S stands for standard	
A040-054	MicCell Casting Chamber 22x22		
A040-055	MicCell Casting Chamber 22x50		
A040-056	DFC4-Pt-FR-30-S		
A040-057	MicCell Casting Chamber 25x75		
A040-061	FR-SU8 Transfer 20, Existing Design	20 µm single-sided	
A040-062	FR-SU8 Transfer 40, Existing Design	Double-sided 20 µm for 40 µm spacer	



Article Number	Name	Description	Detailed Description
A040-063	Sorter4aE-Pt-SU8-40	40 µm SU8 spacer	
A040-064	DFC4-Pt-SU8-20-S	20 µm SU8 spacer	
A040-065	DFC4-Pt-SU8-40-S	40 µm SU8 spacer	
A040-066	Loader4E-Pt-SU8-20		
A040-067	Loader4E-Pt-SU8-40		
A040-068	DFC3-Pt-SU8-20-S		
A040-069	DFC3-Pt-SU8-40-S		
A040-070	DFC3-T-Pt-FR-30	thin glass without electrodes, T-sensor passivated	
A040-071	FLC Module	without housing, LP as mechanical support	
A040-072	DFC4-Pt-FR-100		
A040-073	Porator3D-Pt-SU8-20		
A040-074	Modulab-11s/17a	DEP module in glass-glass technique firmly cemented	Features: a) D263 borosilicate glass 700 µm thick as chip base, drilled with 8 holes 500 µm diameter per each chip, D263 borosilicate glass 175 µm thick as cover chip, b) both glasses bear TiPt=10/120 nm microelectrodes with 700±100 nm PECVD-SiO ₂ passivating oxide, the oxide is partially opened via RIE according to the CAD of the passivating layer, c) bottom and cover glass are glued on top of each other with an accuracy of ±5 µm at a defined distance, the spacer consists of a photopolymer FR or SU8, the thickness of the spacers is 10 to 100 µm, d) the chip is mounted on a heat sink with printed circuit board and the electrodes are tested for exact contact
A040-075	DFC-Pt-FR-150		
A040-076	Spacer Design Update		
A040-080	Hydrogel Micro-Valve PV5	with PEEK housing and 1/16" fittings	
A040-081	Hydrogel Micro-Valve PV6	PEEK-housing, based on 1/16" fitting	
A040-082	PEEK Housing for HG-Valve, PV5 and PV6		
A040-083	MicCell Sample Carrier PEEK		
A040-090	MicCell PDMS-CP for Sample Carrier with LED		
A040-091	MicCell Channel Spacer	Part of the PDMS casting station	
A040-092	MicCell Blind Spacer		
A040-100	Hydrogel Micro-Injector	covered in 1/16" PEEK fitting	
A040-101	Hydrogel Micro Valve PV6	without housing	


Article Number	Name	Description	Detailed Description
A040-102	150µm Coverslip Pt-Electrodes	based on 4" glass wafer, without SiO ₂	
A040-103	150µm Coverslip with ITO-Electrodes	based on 4" glass wafer, without SiO ₂	
A040-104	150 µm Coverslip, Passivated Electrodes	4" glass wafer batch, 600 nm SiO ₂	
A040-105	PDMS-CP, Recycled	4x UNF 1/4x28 fitting	
A040-106	PDMS CP 22x22	cast on PMMA support	
A040-107	MicCell PDMS-CP	fits to Sample Carrier	
A040-108	PDMS-CP 22x50		
A040-109	MicCell PC Moulded Part with AE-Nozzles	for customers who cast their own PDMS-CP	
A040-110	MicCell PC Moulded Part	with 10 nozzles	
A040-111	PDMS-CP 22x50; Recycled		
A040-112	MicCell PDMS-CP with 4 Electrodes and 4 Inlets		
A040-113	MicCell PEEK Nozzles	for PDMS-CP	
A040-114	AE_3x1, 6x5_DI 0,8_PEEK		
A040-115	MicCell PDMS-CP 25x75		
A040-116	MicCell PDMS-CP 25x75, Recycled		
A040-501	PV5 Naked Chip/Manifold		For diluter-based pipetting in the microlitre range
A040-510	Plastic Pipetting Tips	2-200 µl	- For manual pipettes, - non-sterile, - tip box with 96 pcs. each
A040-511	Blind Screw PTFE	UNF 1/4-28	
A040-512	Desiccator, Small		ID 102 mm / height 59 mm
A040-513	MicCell Vacuum Pump		Flow rate: 6 l/min End vacuum: 100 mbar
A040-514	Single-Use Syringe, 5 ml		
A040-515	MicCell Cannula for PDMS Dosage	green	
A040-516	Single-Use Syringe, 1 ml		
A040-517	MicCell Mixing Glass for PDMS	20 ml	
A040-518	Pipette Tip, Conical, Pink		
A040-520	Pipette Tip, Conical, Green		
A040-521	MicCell Casting Chamber 22x22 with LP	Reduced scope of delivery, only the chamber	
A040-522	MicCell Casting Chamber 25x75		
A040-530	Desiccator, Large	with UV and N ₂ adapter	




Article Number	Name	Description	Detailed Description
A040-540	Au - Contact Fitting, UNF 1/4-28		
A040-541	Ag/AgCl - Contact Fitting, UNF 1/4-28		
A040-542	Pressure Sensor Fitting, UNF 1/4-28		
A040-550	4"-Master S-T-K Channel, 22x22		
A040-551	4"-Master, T-Channel, 22x22		
A040-552	4"Master 2Y-Design, 22x22		
A040-553	4"-Master 3-Channel, 22x50		
A040-554	4"-Master T-Channel, 25x75		
A040-560	Natural 1/16" Flangeless Ferrule		
A040-561	MicCell 1/4" FL Fitting		
A040-601	Flow Stamp Module		[Special design in which the stamp contacts the surface and its channels are connected to an external flow]
A040-602	Z-Drive, ext. guide		
A040-610	DELOLUX 04 with Light Guide D5mm		
A040-650	µCP4 Casting Station		
A040-651	µCP3 Casting Station		
A040-652	µCP Casting Chamber		
A040-653	µCP CellPROM		
A040-654	µCP3, Stamp Body, 10x10, PC		
A040-655	µCP3, Stamp Body, 10x10, PEEK		
A040-656	µCP3, Stamp Body, 20x20, PC		
A040-657	µCP3, Stamp Body, 20x20, PEEK		
A040-658	µCP Pin		
A040-660	µCP-PVM-A		
A040-661	µCP Spacer, PEEK, 10x10		
A040-662	µCP Spacer, PEEK, 20x20		
A040-664	PDMS Sylgard 184 + Crosslinker		
A040-665	Adhesion Promotor Wacker 790G		
A040-667	µCP4, Stamp Body	PC	
A040-668	µCP4, Al-Calotte		

Article Number	Name	Description	Detailed Description
A040-670	μCP3, 20x20 Print Head		
A040-671	μCP3, 20x20 Stamp Frame		
A040-675	μCP3, 10 x 10 m ² Print Head UV		
A040-676	μCP3, 10 x 10 m ² Stamp Frame		
A040-680	μCP Sample Holder, Ceramic		
A040-681	μCP Vacuum Pump		
A040-682	μCP Sample Holder, Glass		
A040-690	2"-Glass with PDMS		
A040-701	MOC_Reservoir_PEEK		
A040-702	MOC_Reservoir_POM		
A040-703	MOC_TransWell Holder_PEEK		
A040-704	MOC_TransWell Holder_POM		
A040-705	MOC_PressurePlate_Ti		
A040-706	MOC_I-Fitting_PEEK		
A040-707	MOC_Reservoir Spacer		
A040-708	MOC_Insert Spacer		
A040-709	MOC_TransWell ClampingNut_Ti		
A040-710	MOC_TransWell Cap + O-Ring		
A040-711	MOC_M5 Flangeless Fitting + Ferrule		
A040-712	MOC_Support + Ti-Pressure Plate		
A040-713	MOC_CP_Moulded Part	without PDMS casting	
A040-714	MOC_PDMS-CP	no O2 glass bonding	
A040-715	MOC_PDMS-CP + O2 Bonding		
A040-716	MOC_Valve Spacer POM		
A040-717	MicCell Casting Chamber Frame	Teflon or POM	
A040-718	MOC_Sealing Insert PV - 3mm	Material: stainless steel	
A040-719	MOC_Sealing Insert PV - 3mm	Material: titanium	
A040-725	MOC_Support, Heater + Temperature Sensor, Red		
A040-726	μCP; LED - side light		

MicCell – Computers, microscope interface components etc.

Article Number	Name	Description	Detailed Description
A070-091	Notebook		
A070-098	PC without monitor	<ul style="list-style-type: none"> - Dell Optiplex 3070 or similar - Processor i3-9100T or similar - Micro Form Factor - 4 GB RAM, 128 GB SSD hard disk - Windows 10 Professional - GeSiM instrument software preinstalled, configured for your GeSiM instrument 	
A070-108	PC without monitor	<ul style="list-style-type: none"> - Dell Optiplex 3070 or similar - Processor i5-10500T or similar - Micro Form Factor - 16 GB RAM, 256 GB SSD hard disk - Windows 10 Professional - GeSiM instrument software preinstalled, configured for your GeSiM instrument 	
A070-600	Work plate for inverted microscope	customized for user's inverted microscope	
A070-610	Work plate for upright microscope	customized for user's upright microscope	
A070-620	MicCell Tube Cutter		
A070-912	SU8-5 25 % in GBL	4 ml, glass bottle	
A070-913	SU8-5 25 % in GBL	15 ml, PTFE bottle	
A070-919	Computer Keyboard US-Layout		
A070-920	Computer Keyboard UK-Layout		
A072-101	Syringe pump module		Shipment: Dilutor module, no housing !
A072-106	Syringe for dilutor systems, 250 µl		A072-402, -409, -106 Syringes 50/100/250 µl
A072-126	Liquid container 4 L		Without particle filter, tubing and air filter
A072-132	Liquid container 10 L		Without particle filter, tubing and air filter
A072-146	Particle filter 20 µm	for system liquid vessel	Particle protection of micropipettes and dilutor
A072-149	PFPE, MD700		

Article Number	Name	Description	Detailed Description
A072-162	Plug, black	1/4"-28	
A072-177	Valve for XCalibur		
A072-275	Power adapter for single channel diluter		
A072-398	Syringe for dilutor systems	1 ml	
A072-401	Syringe for dilutor systems	2.5 ml	
A072-402	Syringe for dilutor systems	50 µl	
A072-409	Syringe for dilutor systems	100 µl	
A072-421	Syringe for dilutor systems	5 ml	
A072-502	Union 1/4-28 UNF		

Abbreviations

ASE: advanced silicon etching

CP: channel plate

DFC: dielectrophoretic flow cell

IVD: in vitro diagnostics

ITO: indium tin oxide

µCP: microcontact printing

MEA: microelectrode array

MOC: multi-organ chip

NWP: Nano-well plate

PC: polycarbonate

PCB: printed circuit board

PDMS: polydimethylsiloxane

PEEK: poly(ether ether ketone)

PMMA: poly(methyl methacrylate)

PTFE: polytetrafluoroethylene

RIE: reactive ion etching

SOG: silicon-on-glass

SOI: silicon-on-insulator

UNF: Unified National Fine Thread

MicCell – Miscellaneous parts and microsystems service

Article Number	Name	Description	Detailed Description
A080-11	Repair (work)		
A080-030	MicCell Slide 70 µm		
A080-031	MicCell Slide 170 µm		
A080-032	MicCell Coverslip 170 µm		
A080-202	Film Mask		
A080-203	4" Screen for Screen Printing		
A080-204	Photomask 5" x 5"		
A080-300	Lift-Off Process ITO		
A080-301	Lift-Off process CrAu		
A080-302	Lift-off Process Pt		
A080-303	Ultrasonic Glass Drilling		
A080-304	MBS Glass Drilling		
A080-305	PECVD Nitride 150 nm		
A080-306	ITO cCating 100 nm		
A080-307	PVD TIPT 10/10		
A080-308	Initial cleansing before PVD		
A080-309	PCS foil ITO		
A080-310	PECVD Teflon		
A080-311	Mercaptanization 4" Glass Wafer		
A080-312	Lithography on Metal foil		
A080-320	DKFZ Si-SiO ₂ Chip		
A080-321	DKFZ Chip PT Mark		
A080-323	Si-Wafer SiO ₂ -CrAu		
A080-330	Glass HF etching 0..15 µm		
A080-400	Cr Mask 5-Inch		
A080-410	CAD Sketch		
A080-412	Data Conversion		
A080-413	Spotting Service		
A080-415	Soft- and Firmware Update		