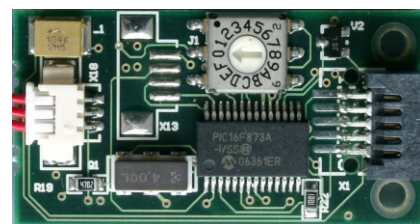


Additional pipetting channels

The *multi-dos* can be extended by additional controller modules PM1 and thus control up to eight (or more) microdosage heads. All dispensers are independent, but can also operate synchronously.

For OEM applications, controller modules are also available without housing.



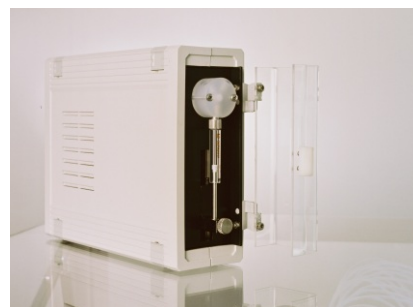
PM1 module (A020-303)

Syringe pump/dilutor

The microdosage heads can be filled manually using a disposable syringe. However, we recommend a dilutor system consisting of a computer-controlled syringe pump with three-way valve. This gives you the following additional functions:

- Flushing with system liquid (usually water)
- Automatic sample uptake from the nozzle or feeding of the sample from the back via the fluidic inlet

Control of the diluter requires a second serial interface (RS-232). The syringe pump is controlled by an extra instruction set.



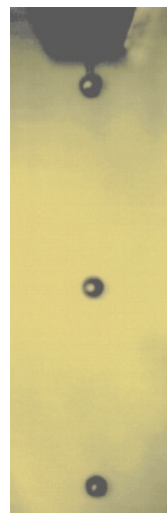
1-channel dilutor (A072-102)

Stroboscope for droplet visualization

The stroboscope provides real-time views of the microdrops in different phases of their flight. This allows the adjustment of the dispensing parameters to different liquids under optical control. Aside from a yellow illuminating diode, and a video camera, it contains a holder for an SPIP or a PICPIP microdispenser. The stroboscope control module occupies a slot in the *multi-dos* (can be upgraded by GeSiM).



Heatable pipette (A010-300) in the stroboscope (A020-302), in the back *multi-dos* above temperature controller (A020-011). Bottom: stroboscopic picture of flying droplets.



Successfully dispensed liquids (selection)

Acetic anhydride, acetone, acetonitrile, betaine (*N,N,N*-trimethylglycine, < 1 M), chloroform, cyclohexanone, dextrane solutions, detergents (e. g. 2 % Triton X-100 or Tween-20), dichloromethane/trifluoroacetic acid (98:2), *N,N*-dimethylformamide (DMF), dimethylsulfoxide (DMSO), 1,4-dioxane, DNA (oligos or PCR product < 3 mg/ml, 4 kbp plasmid < 1 mg/ml), ethanol, ethyleneglycole, *N*-FMOC-Ile (200 mM in DMF), glues (Epoxy Technologies OG169, UVO-114, 301-2), glycerol (< 50 % in H₂O), iodine (in THF/pyridine/H₂O 3:75:20:75), isopropanol, liquid crystals (Merck Licristal ZLI-2222 and MLC-6681 at 43 °C), MALDI matrix (-cyano-4-hydroxycinnamic acid in NMP, 3-HPA in 20 % acetonitrile), methanol, 1-methyl-2-pyrrolidone (NMP), 1-methylimidazole (16 % in THF), NaCl (< 3 M), PDMS (up to 30 % in -butyrolactone), phosphoramidite (T-CE in acetonitrile), polyethyleneglycol 10000 (PEG, 5 %), polymers (P3OT 1 mg/ml in trichloroethylene or chlorobenzene, PEDOT:PSS 0.14/2.6 %), Protein (< 5 mg/ml in PBS), silane (2-3 % in propanol), SSC (saline sodium citrate, 3x), tetrahydrofurane (THF), tetrazole (in acetonitrile), toluene, urea (< 7 M), water

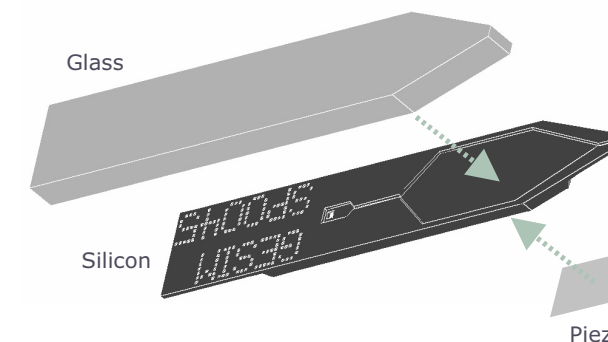
NANOLITER DOSAGE

WITH PIEZOELECTRIC MICRODISPENSERS



GeSiM is practically the only supplier of single piezo print heads that are reproducibly manufactured from silicon using microsystems technology. We have developed a wealth of contact-free dispensers that deliver different volumes of diverse fluids and can be integrated into a wide range of laboratory systems.

Our actuators are piezoelectric ceramics that are deformed when a voltage is applied, thus ejecting a droplet from the nozzle at a speed of one to five meters per second. Each electrical pulse generates a single droplet ("drop on demand"). Burst with a predefined number of drops at a certain frequency are freely selectable and can be used to deliver varying amounts of fluid or draw lines.



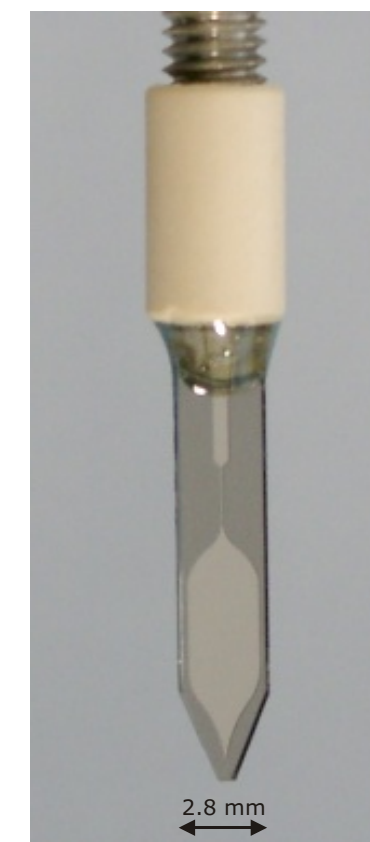
Key features:

- Spherical droplets
- Different droplet sizes: ~ 1 nanoliter (SPIP) and ~ 0.1 nl (PICPIP)
- Firing by mouse click or by hardware triggering
- Burst mode or continuous dosage
- Ready to use after plugging the control device, *multi-dos*, into the PC
- Special designs (multi-channel and heatable pipettes) available

Possible applications:

- Microarray spotting
- Diagnostic (e. g. toxicology) tests
- High-throughput screening (HTS)
- Combinatorial chemistry
- Sample preparation
- Surface coating
- Generation of gradients by varying the droplet number
- Aerosol production / drug delivery
- Usage as simple suction pump in microfluidics

and much more!



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Subject to change without notice



Standard pipettes SPIP and PICPIP

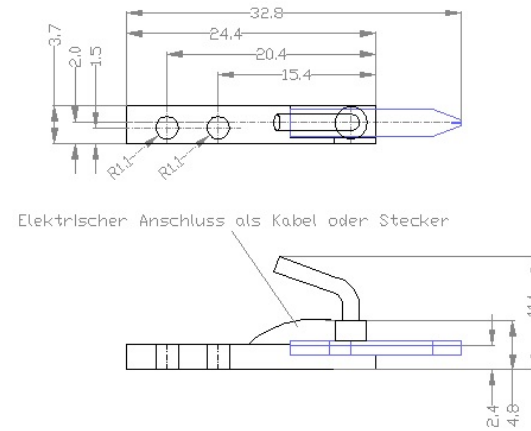
Both dispenser types are identical, except that their nozzle sizes are different and thus produce different droplet sizes:

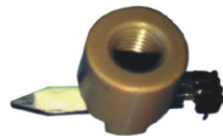

- Material in contact to liquid: SiO₂, PEEK, stainless steel (where used)
- Low-power piezoelectric actuators (~ 70 V, pulse duration ~ 100 µs)
- Valveless dispensing (i. e. no pressure difference between orifice and reservoir)
- Pump chamber volume approx. 0.8 µl
- Droplet volume only slightly dependent on piezo voltage: SPIP 0.6 – 1.1 nI (100 – 130 µm diameter), PICPIP 0.1 – 0.2 nI
- Droplet frequency 16 – 1000 Hz
- Max. volume flow approx. 70 µl/min (SPIP) or 12 µl/min (PICPIP)
- Max. viscosity approx. 5 mPa·s (5 cP)
- Volume accuracy around 1 % upon dispensing of 1000 droplets

Both droplet size and dispensing performance depend on viscosity, density, and surface tension. Highly viscous solutions may be handled by producing a burst of droplets

at the resonance frequency. Or the pipette is heated and pressure is applied for dispensing. This way, glues, liquid crystals, and semiconducting polymers can be dispensed, up to a viscosity of 700 mPa·s. Please ask for further information.

Both dosage head types are available with a number of different inlet adapters, e. g. a cylindrical shaft, plus a mounting pad with two boreholes.

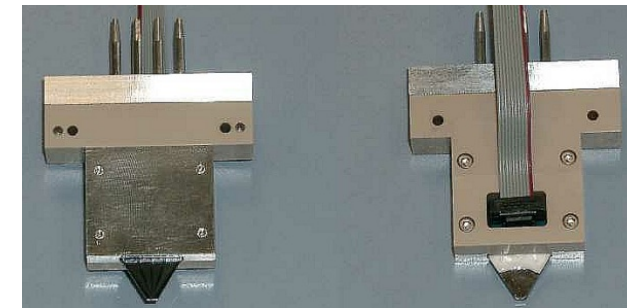


	A010-001 SPIP with stainless steel inlet A010-200 PICPIP with stainless steel inlet	<ul style="list-style-type: none"> • Stainless steel connection: OD 1.6 mm, ID 0.8 mm • For flexible tubing with 1.1 mm inner diameter • Contains mounting pad with two 2.2 mm holes
	A010-002 SPIP with angled steel capillary A010-201 PICPIP with angled steel capillary	<ul style="list-style-type: none"> • Stainless steel connection for Teflon tubing with an inner diameter of 0.7 – 0.8 mm • Contains mounting pad with two 2.2 mm holes
	A010-003 SPIP with 1/15" PEEK capillary A010-005 PICPIP with 1/15" PEEK capillary	<ul style="list-style-type: none"> • For aggressive liquids • No metal in contact with liquid • Contains mounting pad with two 2.2 mm holes
	A010-004 SPIP with 1/15" HPLC bushing, PEEK	<ul style="list-style-type: none"> • Connection via standard 1/16 inch HPLC bushing • E. g. to fractionate HPLC runs
	A010-006 SPIP, cylindrical housing	<ul style="list-style-type: none"> • Cylindrical housing with steel capillary • Also available with PEEK housing/capillary • Without mounting pad

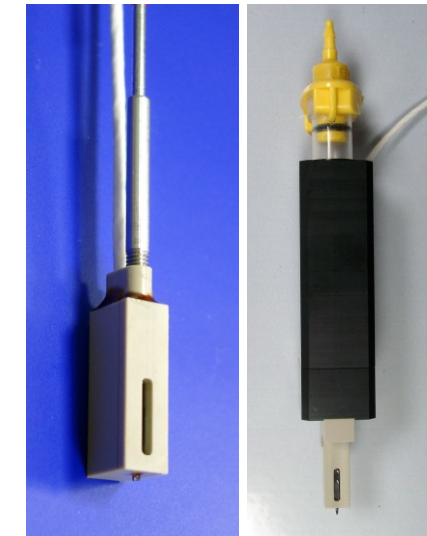
Microsystems technology allows to substantially modify our microdispensers. We can thus offer special dosage heads for practically every application, e. g.:

- Mixing heads with a second inlet channel for a second substance that is mixed into the first (not shown)
- Heatable microdosage heads to reduce the viscosity (diverse designs, including those that fit into microtiter wells). An external temperature controller is necessary.
- Integration of several dosage units in a single chip, e. g. to produce thicker lines
- Dispenser with screwed-on glass capillary for the gentle uptake of cells and for the dispensing into small reaction chambers

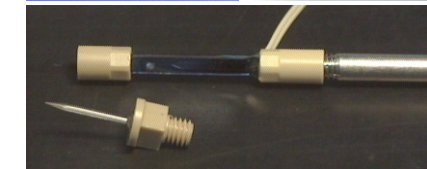
These pipettes are, when equipped with an appropriate holder, also available as accessory for our robotic system *Nano-Plotter™*. Please inquire!



Four-channel dispenser from a single silicon chip



Left: heatable dispenser (A010-300). Right: heatable pipette (< 120 °C) including heated reservoir (3 ml) that can be connected to compressed air (A010-301).



Piezo dispenser with glass capillary, disassembled



Liquid crystal spots

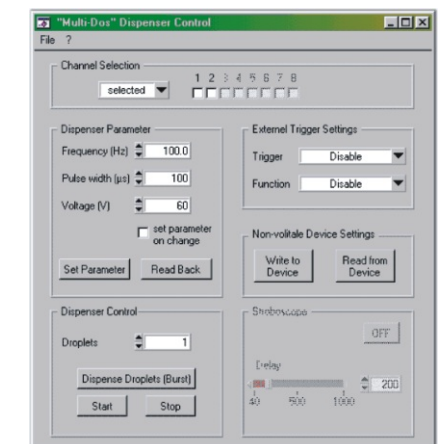
Control unit *multi-dos*

The *multi-dos* houses up to eight processor boards that control pipettes and other components (stroboscope). The Windows program *mds8* (right picture) can drive the controller modules, independently of each other.

In addition, the open application programming interface of the *multi-dos* ensures the integration of GeSiM microdosage products in customized applications and instruments, also in LabVIEW. The commands are sent by string codes through the serial interface.



multi-dos (A020-001), four-channel version



Items of shipment:

- Controller for a single microdosage head (SPIP/PICPIP)
- Wide-range power supply, serial PC cable (RS-232), cable to microdispenser, trigger input
- Technology description and programming manual
- In *multi-dos* built-in programming interface to control the dispensers by string commands
- Control software *mds8* (for Windows): adjustment of dispensing parameters (voltage/pulse width), start/stop or preset bursts (1 – 65535 drops); separately for each dispenser
- Dimensions: 19 x 14 x 5 cm