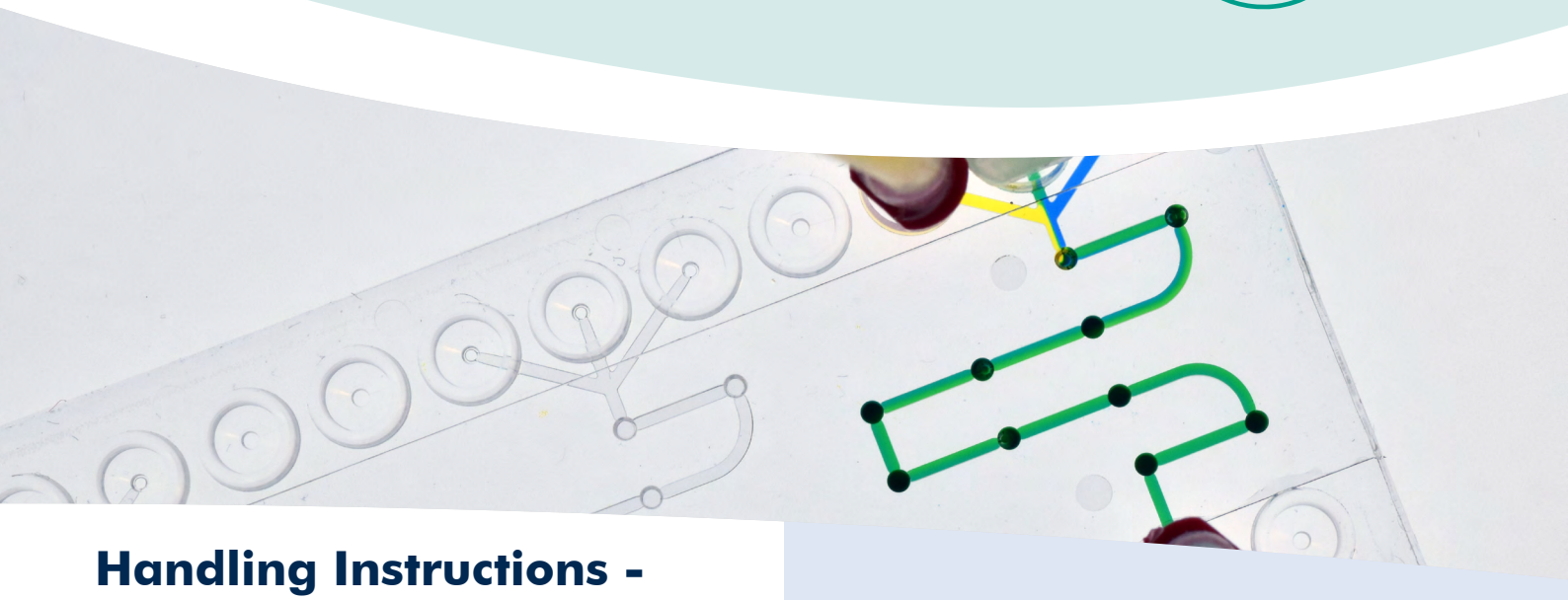
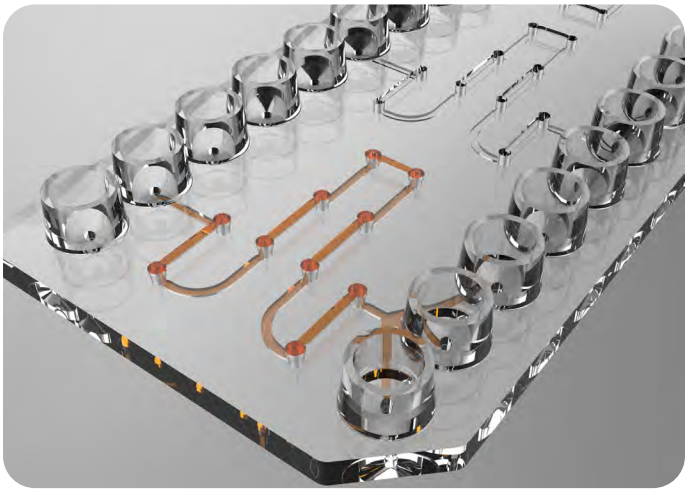
microfluidic ChipShop



Handling Instructions - 3D Serpentine Mixer Fluidic 1079



Effective micromixing of up to three fluids in a 3D serpentine channel

Many microfluidic systems require rapid mixing of different fluids within microchannels. While diffusion can be an effective mode of mixing in microchannels with predominantly laminar flows, it often requires prolonged mixing times and/or ideally increase of interfacial area.

Introducing chaotic (but still laminar) flow patterns can aid mixing efficiency in microchannels. This strategy becomes even more important when mixing solutions with particularly low diffusion coefficients.

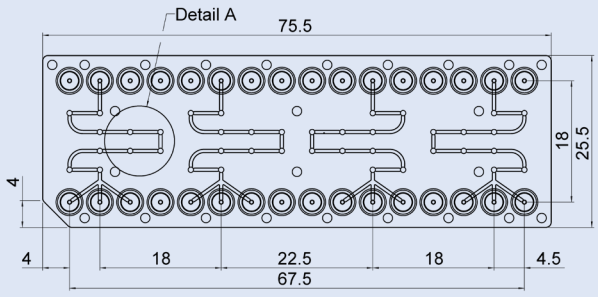
The 3D serpentine mixer has been developed especially to address this challenge in microfluidics. It is the perfect tool to investigate fast and efficient passive micromixing of up to three liquids.

Chip description

The 3D serpentine mixer chip Fluidic 1079 possesses four identical micromixing units. Each unit features three inlet ports and one outlet port. Those ports come in Mini Luer format. The mixing channel is characterized by a sequence of directional changes in all three dimensions. It therefore possesses three different types of channel sections that are:
1.) horizontal, located on the bottom side of the chip,
2.) horizontal, located on the top side of the chip, and
3.) vertical, connecting the two horizontal channels.

Channel features of the mixing units are:

- Channel depth horizontal channels: 200 µm
- Channel width horizontal channels: 500 µm
- Channel diameter vertical channel: 800 µm
- Total channel volume: 12.93 µl
- Total channel length: 60 mm
- Directional changes per mixing unit: 10



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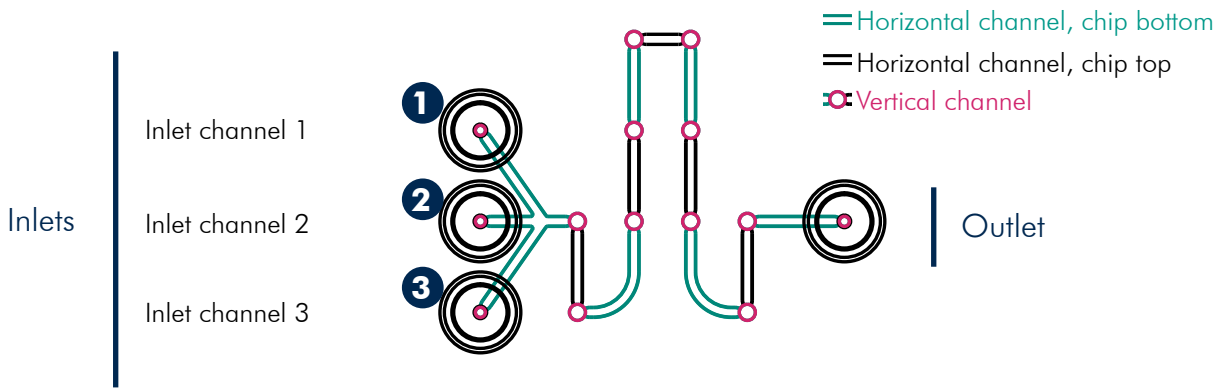
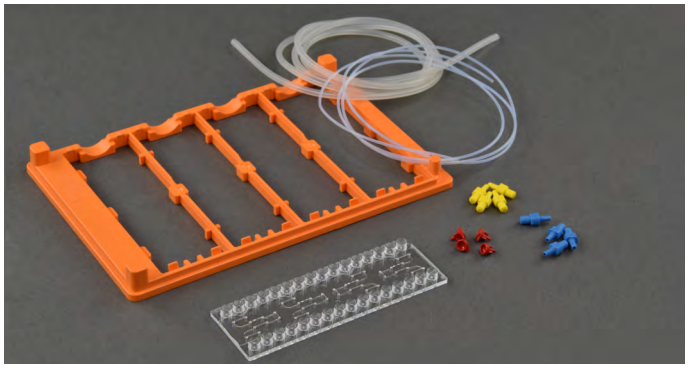
Handling instructions - a step-by-step description

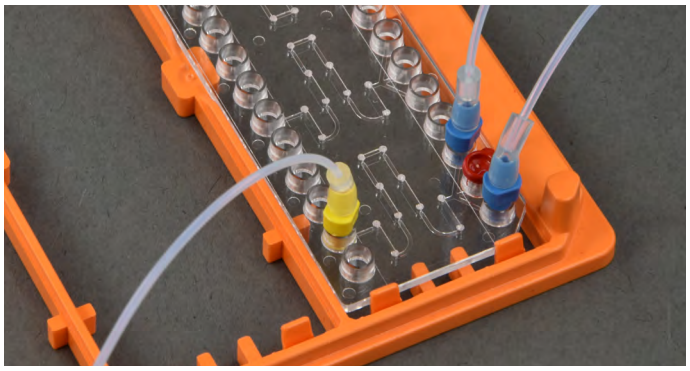


Necessary equipment

- 1 x chip Fluidic 1079
- 3 pcs male Mini Luer Fluid connectors
- 1 pc male Mini Luer plug
- Silicon sleeve (cut from silicone tube)
- PTFE tubing
- Handling frame
- Pump system of your choice (e.g. pressure-driven pump with two channels)



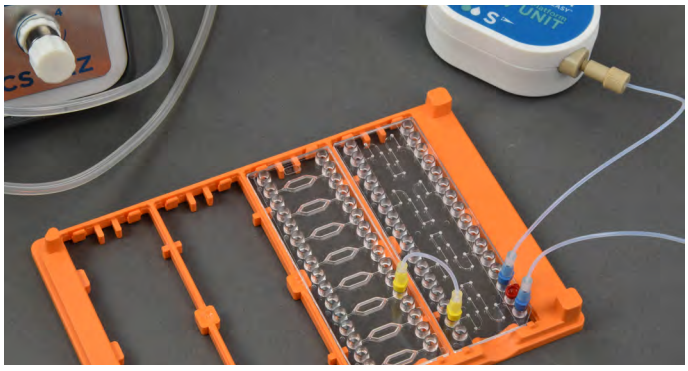
Step 1



- Place chip into the handling frame
- Connect Mini Luer connectors with silicone sleeves
- Insert PTFE tubing into silicone sleeves
- Insert Mini Luer connectors into Mini Luer interfaces (here: blue - inlets; yellow - outlet)
- Close unused Mini Luer ports with Mini Luer plug (red)
- Connect PTFE tubing with pumps

Step 2

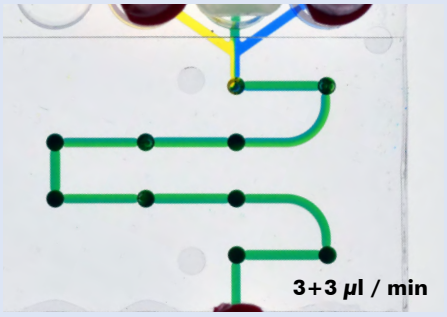
- Connect further chip modules to your setup, e.g. channel or chamber chips (optional)
- Start micropumps to pump fluids to be mixed
- Use low flow rates (e.g. 5 µl/min for each channel)
- Adjust flow rates depending on fluids to achieve complete mixing within microchannel



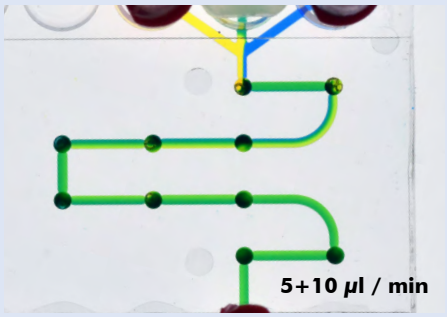
Application example: mixing of colored water

Here we show exemplary how flow speeds of the two liquids to be mixed, influence mixing results. The 3D serpentine mixer was used to mix yellow and blue colored water. Two fluid streams were used in this example application, while up to three different fluids can be mixed with the 3D serpentine mixer.

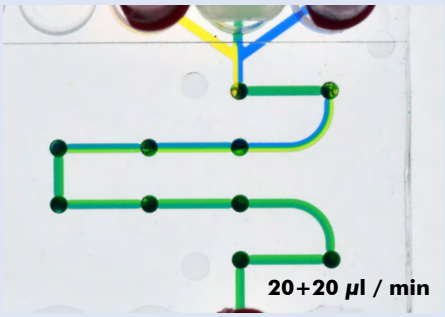
The mixing units of Fluidic 1079 can also be daisy-chained in order to increase mixing efficiency.



Mixing at relatively low flow rates (each channel 3 µl /min) of yellow and blue fluid streams



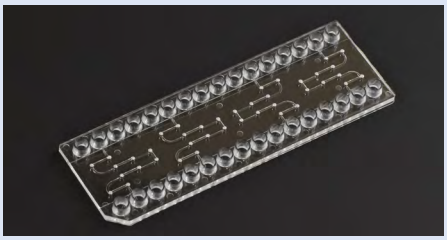
The 3D serpentine mixer is well suited to mix fluid streams with different flow rates (yellow 10 µl / min; blue 5 µl / min)



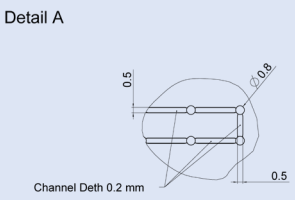
Mixing at relatively high flow rates (each channel 20 µl /min) of yellow and blue fluid streams

Off-the-shelf available - 3D serpentine mixer chip Fluidic 1079

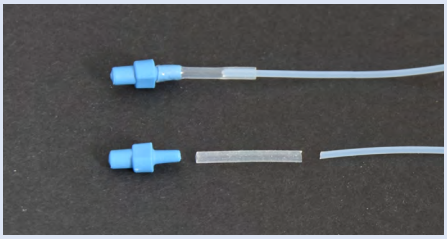
The 3D serpentine mixer chip Fluidic 1079 is off-the-shelf available in two different thermoplastic polymers, which are Zeonor (COP) and Polycarbonate (PC).



3D serpentine mixer chip with four functional mixing units and Mini Luer interfaces



Detail of serpentine channel of one mixing unit of Fluidic 1079



Assembly of Mini Luer fluid connector, silicone sleeve and PTFE tubing

Product Code for Fluidic 1079	Description	Material	Lid Thickness [µm]
10001477	3D serpentine mixer	Zeonor	188
10001480	3D serpentine mixer	PC	175

Product Code	Description of Accessories	Material	Quantity
10000096	Male Mini Luer fluid connector	PP - Blue	10 pcs / pack
10000280	Male Mini Luer plugs – Low volume displacement	PP - Red	10 pcs / pack
10000031	Silicone tube, ID: 0.76 mm, OD: 1.65 mm	Silicone	1 m
10000032	Micro tubes, PTFE, ID: 0.5 mm, OD:1.0 mm	PTFE	1 m

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