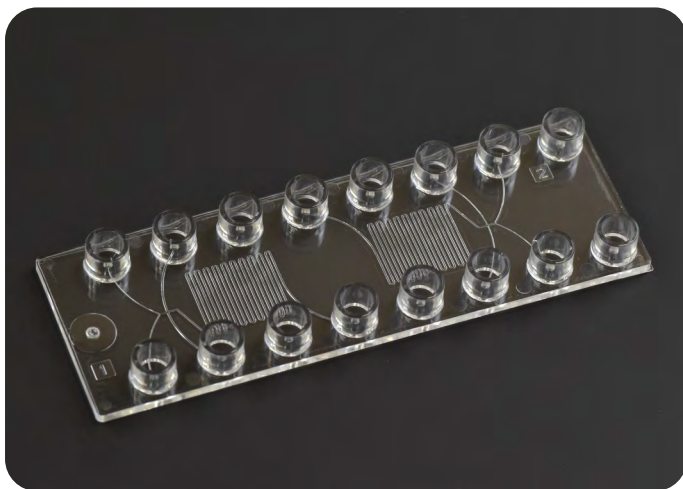


## Handling Instructions - Diffusion Mixer Fluidic 186



### Passive micromixing through diffusion

As flows in microchannels are usually laminar, mixing of liquids at microscale is a challenge but can be tackled using various approaches. One of the simplest methods for effective micromixing is to increase the interfacial areas between the fluids. Diffusion will cause the transfer of molecules through the interfacial area.

microfluidic ChipShop's diffusion mixer with its 217 mm long channel that enables a prolonged co-flow of fluids, makes use exactly of this principle.

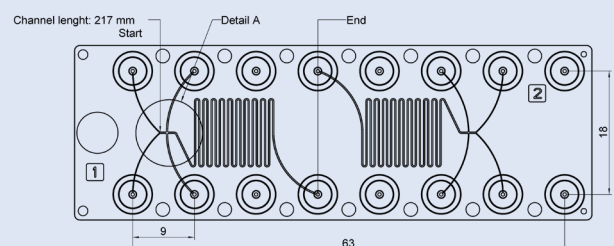
Not only the interfacial area but also contact time will influence the mixing results. By varying the flow rates of fluids to be mixed, the contact time can be controlled in order to achieve effective mixing.

### Chip description

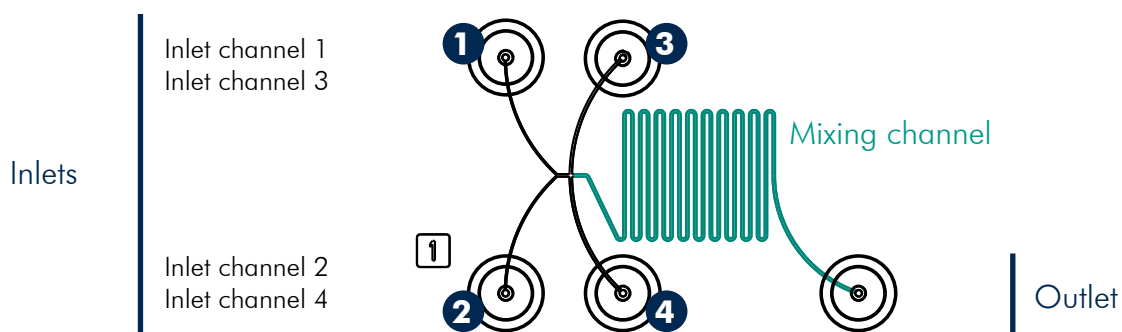
The diffusion mixer chip Fluidic 186 possesses two independent functional mixing units. Each unit features four inlet ports and one outlet port. Those ports possess Luer format. The two mixing units are nearly identical, apart from varying channel widths of two inlet channels.

Channel features of the mixing units are:

- Channel depth: 100  $\mu\text{m}$  (all channels)
- Channel width mixing channel: 200  $\mu\text{m}$
- Channel width inlets 1 and 2: 100  $\mu\text{m}$
- Channel width inlets 3 and 4: 100  $\mu\text{m}$  (unit 2); 200  $\mu\text{m}$  (unit 1)
- Volume mixing channel: 4.11  $\mu\text{l}$
- Length mixing channel: 217 mm

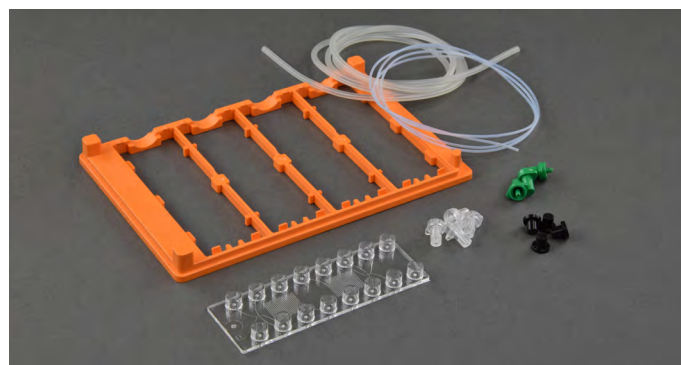


## Handling instructions - a step-by-step description



### Necessary equipment

- 1 x chip Fluidic 186
- 3 pcs male Luer Fluid connectors
- 2 pcs male 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 Luer connectors with silicone sleeves
- Insert PTFE tubing into silicone sleeves
- Insert Luer connectors into Luer interfaces (here: green - inlets; opaque - outlet)
- Close unused Luer ports with Luer plugs (black)
- Connect PTFE tubing with pumps

### Step 2

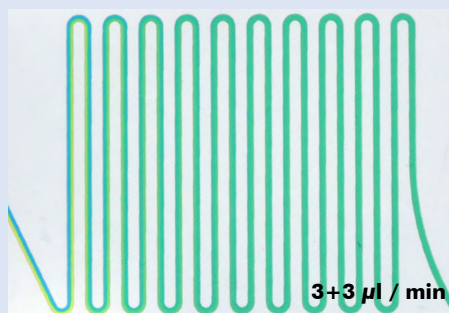
- Connect further chip modules to your setup, e.g. channel or chamber chips (optional)
- Start micropumps to pump fluids to be mixed
- Use low flow rates (e.g. 5  $\mu$ l/min for each channel)
- Adjust flow rates depending on fluids to achieve complete mixing within microchannel



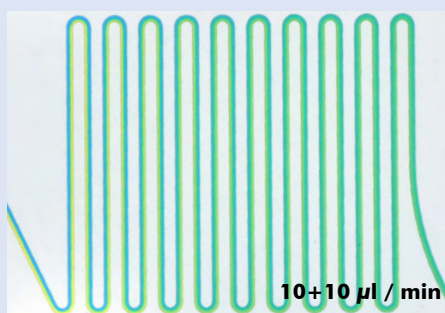
## Application example: mixing of colored water

Here we show exemplary how flow speeds (and consequently contact times) of the two liquids to be mixed, influence mixing results. The diffusion mixer was used to mix water, colored with pencil ink. One can clearly see how higher flow speeds result in less effective mixing.

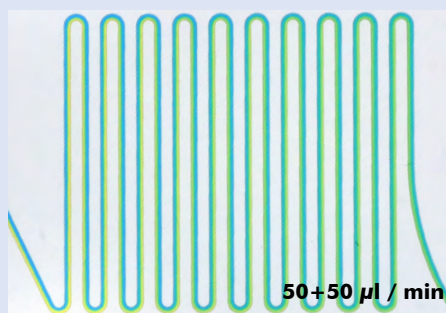
The two mixing units of Fluidic 186 can also be daisy-chained in order to obtain an even longer mixing channel.



At low flow rates (each channel 3 µl / min), mixing of yellow and blue fluid streams occurs early in the microchannel.



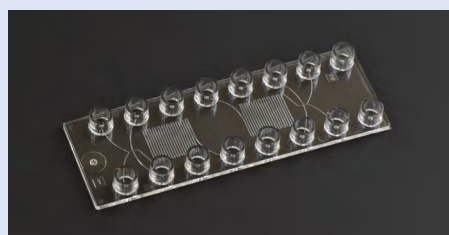
At medium flow rates (each channel 10 µl / min), mixing of the two colored fluids is achieved by the time the channel outlet is reached.



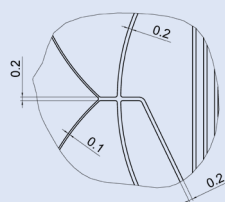
At high flow rates (each channel 50 µl / min) diffusion is not sufficient to mix the two fluids completely within the microchannel.

## Off-the-shelf available - Diffusion mixer chip Fluidic 186

The diffusion mixer chip Fluidic 186 is off-the-shelf available in two different thermoplastic polymers, which are Zeonor (COP) and Polycarbonate (PC).



Diffusion mixer fluidic 186 with Luer interfaces



Detailed schematic drawing of channels of mixing unit 1 on diffusion mixer Fluidic 186



Assembly of a Luer fluid connector, silicone sleeve and PTFE tubing in Luer port on a disassembled connector setup

| Product Code for Fluidic 186 | Lid Thickness [µm] | Channel Depth [µm] | Channel Width [µm]                          | Material | Price [€/chip] |       |       |
|------------------------------|--------------------|--------------------|---|----------|----------------|-------|-------|
|                              |                    |                    |   |          | 1+             | 10+   | 100+  |
| 10000018                     | 175                | 100                | inlets 100 / 200<br>mixer 200<br>outlet 200 | PC       | 42.20          | 31.50 | 19.30 |
| 10000075                     | 188                | 100                | inlets 100 / 200<br>mixer 200<br>outlet 200 | Zeonor   | 42.20          | 31.50 | 19.30 |

| Product Code | Description of Accessories                | Material    | Quantity      | Price [€] |       |
|--------------|---|-------------|---------------|-----------|-------|
|              |   |             |               | 1+        | 10+   |
| 10000080     | Male Luer fluid connector                 | PP - opaque | 10 pcs / pack | 25.00     | 14.30 |
| 10000231     | Male Luer plugs                           | PP - black  | 10 pcs / pack | 19.00     | 9.40  |
| 10000031     | Silicone tube, ID: 0.76 mm, OD: 1.65 mm   | Silicone    | 1 m           | 9.50      |       |
| 10000032     | Micro tubes, PTFE, ID: 0.5 mm, OD: 1.0 mm | PTFE        | 1 m           | 9.50      |       |

