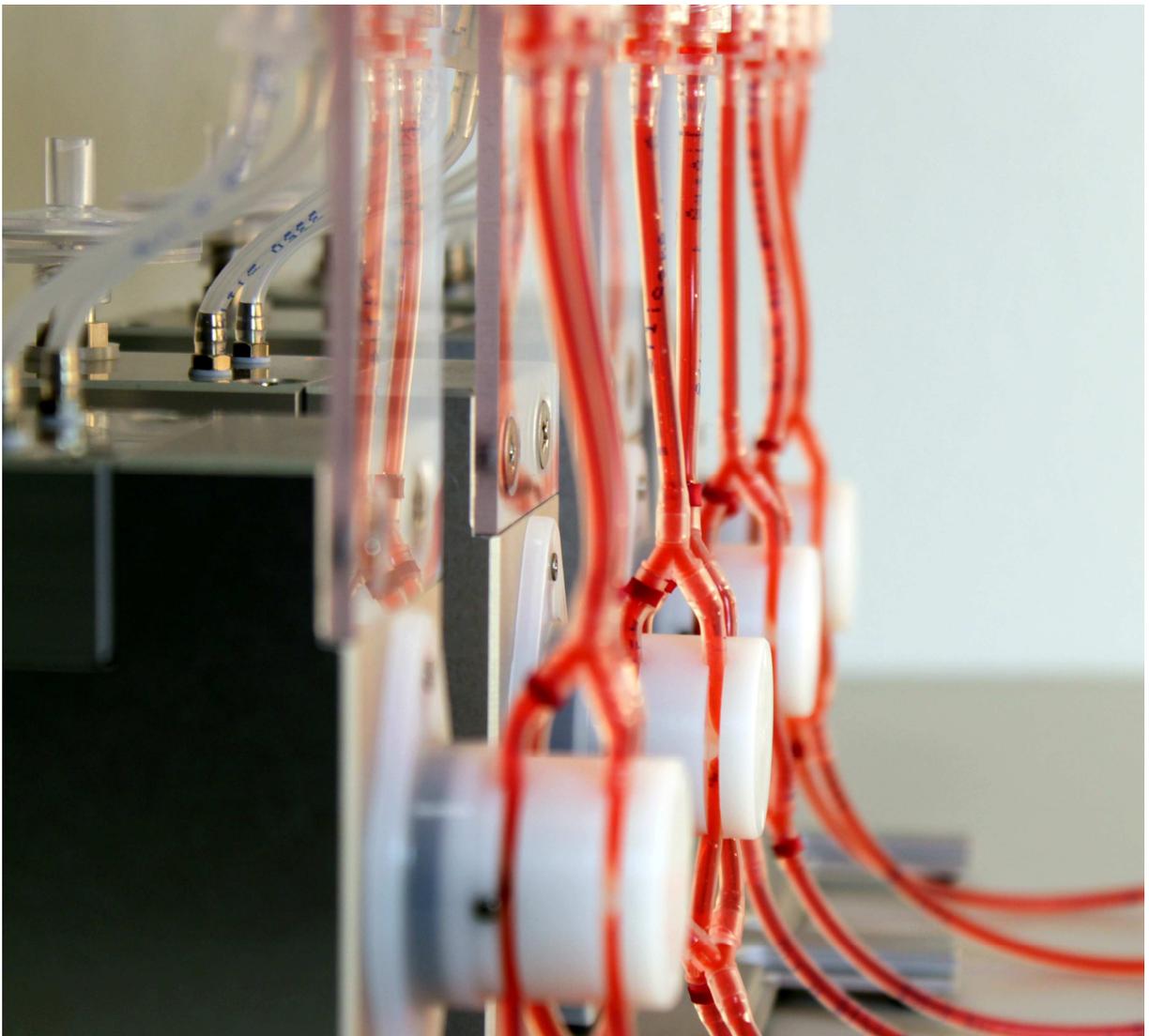




# Instruction Manual for Oscillating Flow

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*Version 1.5.0*





## 1 Instructions for oscillating flow experiments

In order to apply oscillating flow to the  $\mu$ -Slides you need at least two Fluidic Units (one 'master' and one 'slave' Fluidic Unit) to separate the switching times of the two valves of the Fluidic Unit as simultaneous switching results in unidirectional flow. The basic principle is such that the master Fluidic Unit has a long switching time  $t_{\text{master}}$ . During  $t_{\text{master}}$  the master Fluidic Unit supplies an unchanged air flow to the reservoirs of the slave Fluidic Unit. Now the switching time of the slave Fluidic Unit  $t_{\text{slave}}$  can be set as a fraction of the  $t_{\text{master}}$  so that the flow direction is reversed  $t_{\text{master}} / t_{\text{slave}}$  times before the master Fluidic Unit switches the air flow to the reservoirs. As a result you have a setup where one Fluidic Unit creates a unidirectional flow and one which supplies oscillating flow within the  $\mu$ -Slide channel. Since only one controlling master Fluidic Unit is needed but the pump can control up to four Fluidic Units, you can extend the setup to operate with up to 3 oscillating slave Fluidic Units.

### 1.1 Setting up the Fluidic Units

You will also need air tubing splitters (Figure 1), besides the two Fluidic Units.

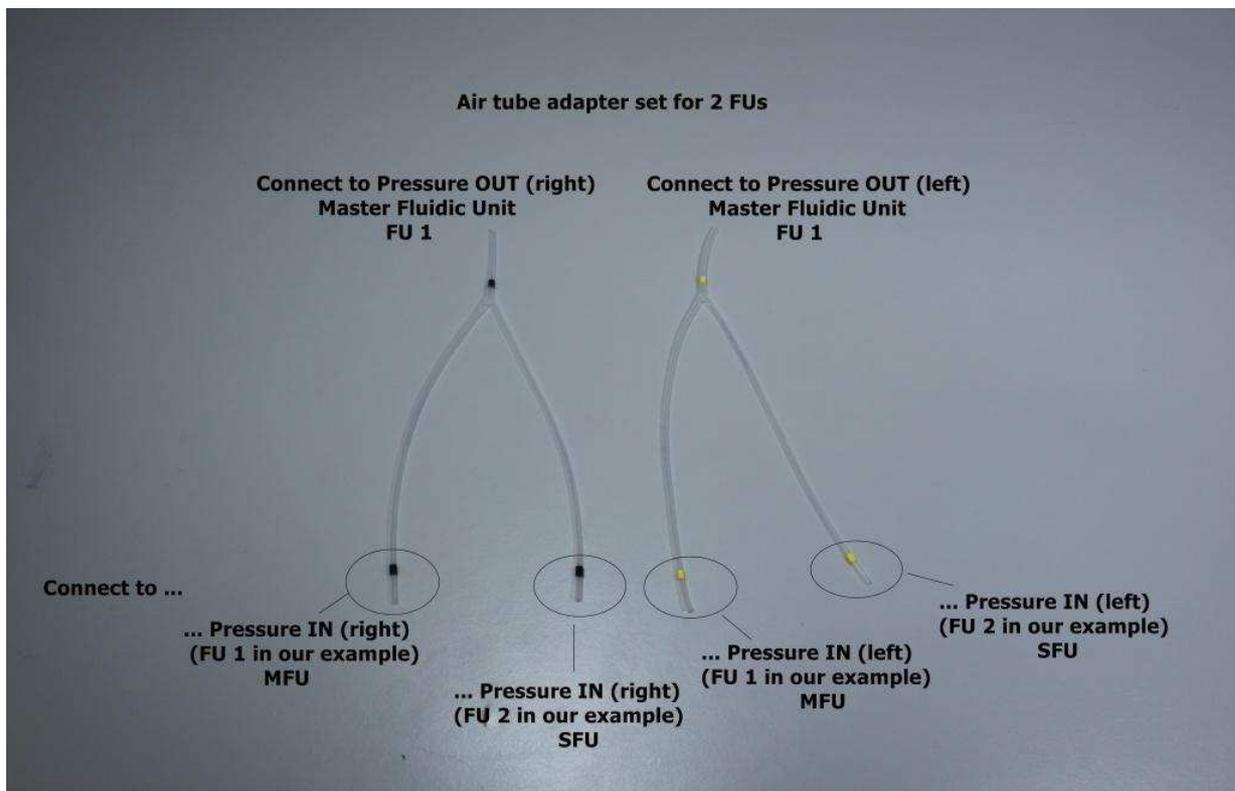
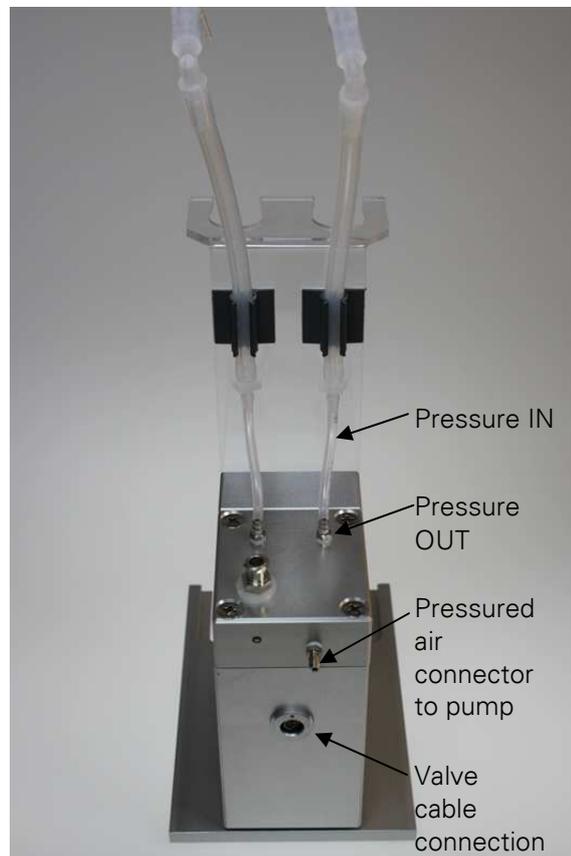


Figure 1: Air pressure splitter for 2 Fluidic Units



**Figure 2: Fluidic Unit connectors**

Please follow the steps below for correct installation and compare with Figure 2:

- 1) Connect the air pressure tube of the pump to the master Fluidic Unit.
- 2) Use one of the splitters, for example, the yellow marked to connect the left 'Pressure OUT' port of the Master Fluidic Unit to
  - a) the left 'Pressure IN' port of the master Fluidic Unit and
  - b) the left 'Pressure IN' port of the slave Fluidic Unit.
- 3) Repeat step 2) with the black marked air splitters and the right side of the master and slave Fluidic Unit.
- 4) Connect the pump and the two Fluidic Units with the electric cables. In the presented case we use 'Port 1' for the master Fluidic Unit and 'Port 2' for the slave Unit.



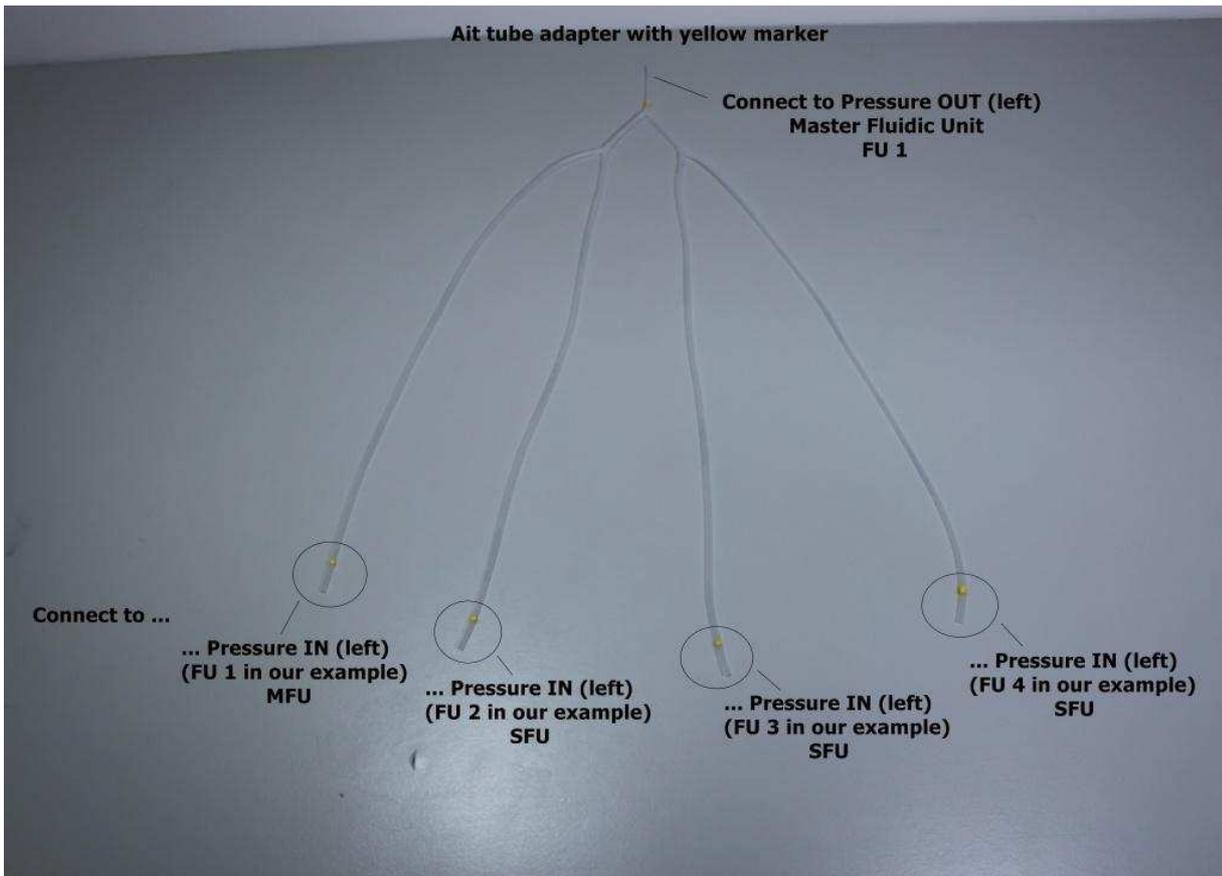
**Figure 3: Connected master (MFU) and slave Fluidic Unit (SFU)**

The setup should look like Figure 3

## 1.2 Oscillating experiment with 4 Fluidic Units

To extend an experiment to one master Unit and 3 oscillating slave Fluidic Units, a corresponding air pressure splitter is needed. The connection is according to the setup with two Fluidic Units. Figure 4 shows an example of the required air pressure tubing.

The connection is according to section 1.1 with a simple extension for the additional Fluidic Units. The connection to the air pressure tubing is shown in Figure 5.



**Figure 4: Air tubing for experiment with 4 Fluidic Units: 1 master Fluidic Unit (MFU) and 3 slave Fluidic Units (SFU 1-3).**



**Figure 5: Air pressure connection with a setup using 4 Fluidic Units**

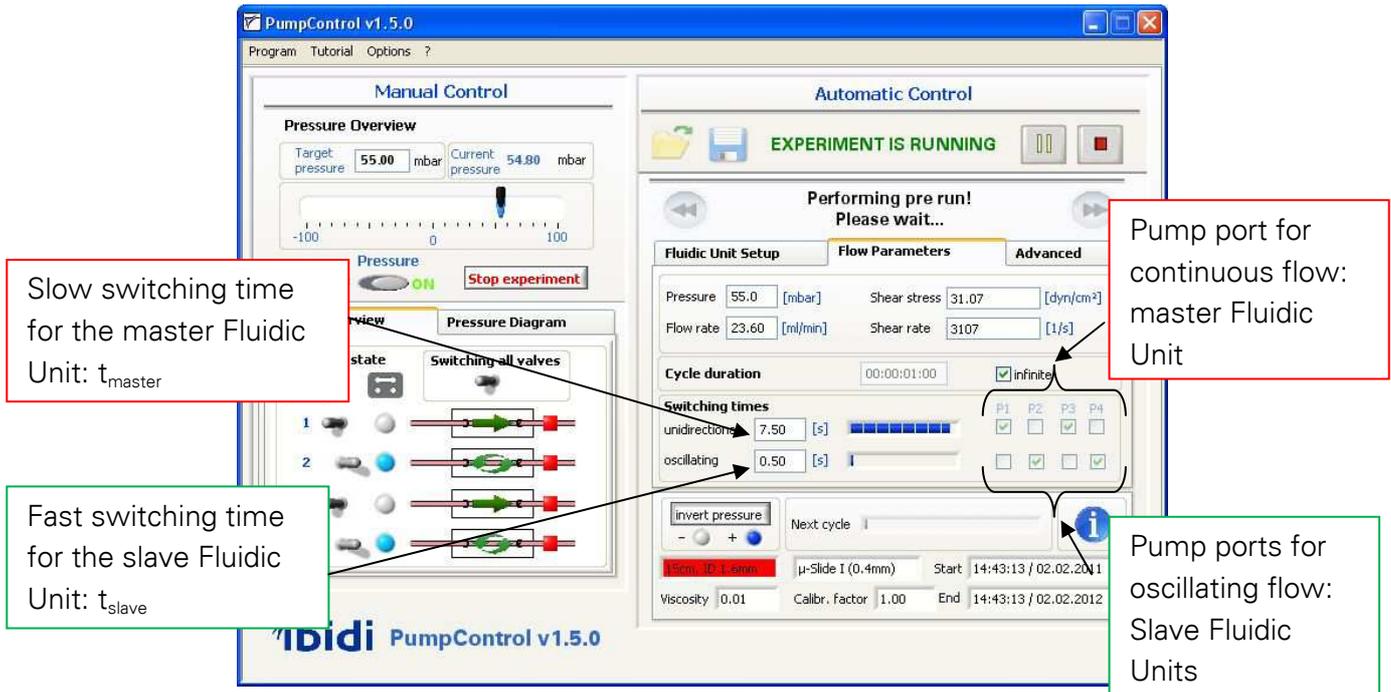
### 1.3 Operation mode for oscillation flow experiments

	Possible?	
	Oscillating flow	Continuous flow
Master Fluidic Unit (FU 1)	no	yes
Slave Fluidic Unit (FU 2)	yes	yes
Slave Fluidic Unit (FU 3)	yes	yes
Slave Fluidic Unit (FU 4)	yes	yes

Please be aware that the master Fluidic Unit can only be used for unidirectional flow experiments. All slave Fluidic Units can reverse the flow direction with switching times set by PumpControl.

### 1.4 Settings within PumpControl

As the switching times are different for the master and the slave Fluidic Units the PumpControl program of the ibidi Pump has to be set accordingly. For that you find in the PumpControl software checkboxes for ‘continuous’ and ‘oscillating’ valves and switching operations. Please check Figure 6 how to correctly set the corresponding parameters.



**Figure 6: Screen shot of settings for oscillating experiments**

## 1.5 Equilibrating master and slave Fluidic Units

As master and slave Fluidic Unit are connected to the same air pressure and switching time equilibration of the liquid levels of both Fluidic Units cannot be done simultaneously. To stop the liquid movement in the reservoirs of either Fluidic Unit the Perfusion Set has to be clamped off (pinch off test described in instruction manual for the pump system) with the supplied hose clamp. As the order is indifferent you can start off equilibrating the liquid levels of the master Fluidic Unit by clamping off the Perfusion Set of the slave unit. Afterwards the same should be done with the slave unit. This step is beneficial as it shows if the Perfusion Set is mounted correctly in both Fluidic Units.

