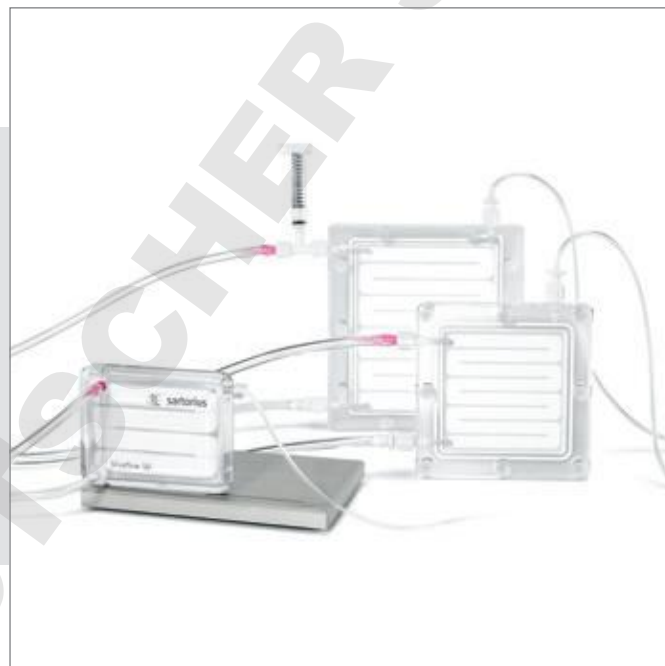


## Vivaflow® 50 | 50R | 200

Unique, "Plug & Play" Laboratory  
Crossflow Devices

### Benefits

- Easy to Operate Using a Standard Pump
- Unique Volume Range from 0.1 l to 5 l
- Fast Concentration
- High Recoveries



### Product Information

Vivaflow® crossflow devices have been designed for use in research and are ideal for concentration and diafiltration of aqueous samples with volumes ranging from 100 ml to 5 l. They achieve concentrations of 10-fold to 50 fold, depending on the initial sample volume.

#### Plug and Play Convenience

The clear Vivaflow® housing allows visual monitoring of the sample at all times. The devices are easy to set up and need only a standard peristaltic pump to operate.

Our Vivaflow® range offers the right crossflow device for every concentration need:

**Vivaflow® 50** is a disposable, modular crossflow device, which can be easily scaled up to 6 units that run both in parallel and in series. Designed as unique interlocking modules, the units are conveniently connected in the required number on an aluminum stand according to the scaleup level required. Vivaflow® 50 saves regeneration time and is the economical choice for concentration and buffer exchange of 0.1 ml to 3 l samples containing proteins, viruses and nanoparticles.

**Vivaflow® 50R** is a reusable crossflow device featuring a unique, low-binding regenerated cellulose membrane, Hydrosart®. Therefore, it is the ideal choice for concentrating expensive samples like viruses and antibodies. Vivaflow® 50R can be scaled up with one additional unit to increase the flow speed for concentrating initial sample volumes of up to 1 l.

**Vivaflow® 200**, like Vivaflow® 50R, is a reusable crossflow device, but is available in a choice of membranes: Hydrosart® and PES. This device is perfect for concentrating expensive samples like viruses and antibodies. Vivaflow® 200 can be scaled up with one additional unit to increase the flow speed for concentrating initial sample volumes of up to 5 l.

## Applications

Vivaflow® devices lend themselves to a multitude of different concentration applications whenever larger volumes of sample need to be concentrated in a lab environment.

Typical applications and areas of use include the following:

- Antibody | recombinant protein concentration | diafiltration in biopharma research
- Concentration of small production lots of proteins for diagnostic purposes
- Concentration of viruses from cell culture supernatants or of environmental samples
- Nanoparticle concentration

## Vivaflow® Working Principle

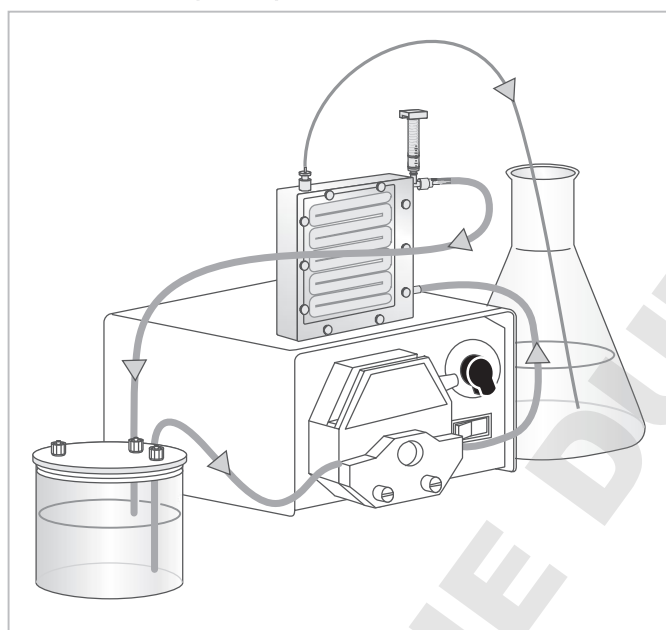


Diagram 1: Operating Vivaflow® cassettes

## Summary

Sartorius offers a complete range of Vivaflow® crossflow devices for scientists and lab technicians who need to reliably concentrate or rebuffer and | or diafilter aqueous samples with initial volumes of up to 5 l. Unlike other crossflow cassettes on the market, Vivaflow® is a dedicated laboratory product that meets the demand for ease of use without requiring any additional non-standard instrumentation. Just a standard laboratory peristaltic pump is all that is needed to operate Vivaflow® units.

Vivaflow® cassettes are crossflow devices that contain an ultrafiltration membrane and are operated by using a standard peristaltic pump to recirculate a sample through them. The thin-channel, flip-flow recirculation path geometry of all Vivaflow® modules provides high crossflow velocities with minimum pump speed requirements of 200 – 400 ml/min. A special flow restrictor at the outlet tubing readily generates back pressure in each cassette, resulting in the concentration of the sample and separation of sample constituents as the sample flows across the membrane. While the sample is recirculated by the pump, the filtrate is collected in a separate vessel. Concentration can be stopped anytime the desired volume is achieved.

A single 50 cm<sup>2</sup> module typically reduces 500 ml to 15 ml in less than 50 min. Virtually total recovery of the concentrate is achieved with a single rinse.

## Guide to Selecting the Right Vivaflow® Device

| Sample Volume [l] | Vivaflow® 50<br>No. of Units | Vivaflow® 50R<br>No. of Units | Vivaflow® 200<br>No. of Units |
|-------------------|------------------------------|-------------------------------|-------------------------------|
| 0.1 – 0.25        | 1                            | 1                             | NR                            |
| 0.25 – 0.5        | 1 – 2                        | 1 – 2                         | NR                            |
| 0.5 – 1           | 2                            | 2                             | 1                             |
| 1 – 2             | 3 – 4                        | NR                            | 1                             |
| 2 – 3             | 4 – 6                        | NR                            | 2                             |
| 3 – 4             | NR                           | NR                            | 2                             |
| 4 – 5             | NR                           | NR                            | 2                             |

NR: Not Recommended

Table 1: Overview of the optimal operating volumes for the various Vivaflow® systems

## Operating Conditions for Vivaflow® 50, 50R and Vivaflow® 200

|                                     |                 |
|-------------------------------------|-----------------|
| Pump flow                           | 200–400 ml/min  |
| Maximum pressure                    | 4 bar (60 psi)  |
| Pressure drop across inlet   outlet | 0.5 bar (7 psi) |
| Maximum temperature                 | 60°C            |

## Diafiltration with Vivaflow® Devices

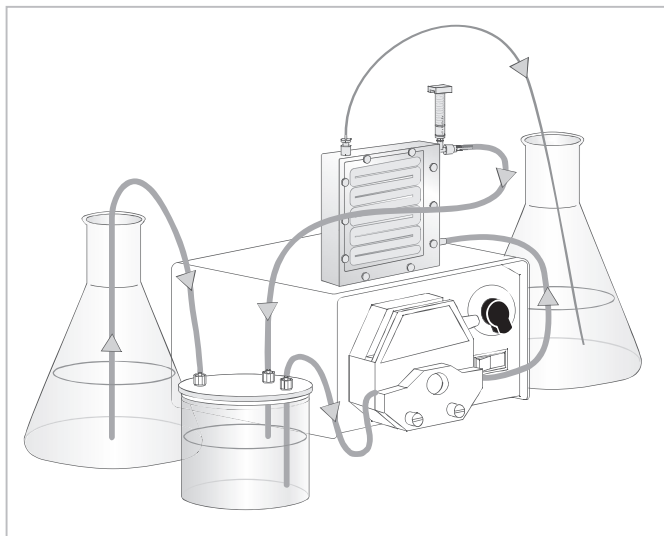


Diagram 2: Diafiltration with Vivaflow®

### Convenient Diafiltration with Vivaflow®

Vivaflow® crossflow devices are ideal not only for sample concentration. They are just as easy to use for buffer exchange and | or diafiltration.

The diafiltration reservoir (order number VFA006) makes both the concentration step and the subsequent diafiltration step exceptionally convenient. The sample is concentrated using the diafiltration reservoir to hold a sample. When the requested concentration has been achieved, a tube leading into an additional buffer vessel will transfer new buffer into the system as the filtration run continues. The sample concentration and volume remain constant because buffer is gradually exchanged with the volume in the new vessel.

## Technical Data

|                                  | Vivaflow® 50               | Vivaflow® 50R              | Vivaflow® 200              |
|----------------------------------|----------------------------|----------------------------|----------------------------|
| <b>Materials of construction</b> |                            |                            |                            |
| Main housing                     | Polycarbonate              | Acrylic                    | Acrylic                    |
| Flow channel                     | TPX (PMP)                  | Acrylic                    | Acrylic                    |
| Membrane support                 | TPX (PMP)                  | Polypropylene              | Polypropylene              |
| Membrane seals and O rings       | Silicone                   | Silicone                   | Silicone                   |
| Pressure indicator               | Polypropylene, SS** spring | Polypropylene, SS** spring | Polypropylene, SS** spring |
| Flow restrictor                  | Polypropylene              | Polypropylene              | Polypropylene              |
| Fittings                         | Nylon                      | Nylon                      | Nylon                      |
| Tubing                           | PVC (medical grade)        | PVC (medical grade)        | PVC (medical grade)        |
| <b>Dimensions</b>                |                            |                            |                            |
| Overall L   H   W                | 107   84   25 mm           | 100   100   24 mm          | 126   138   38 mm          |
| Channel W   H                    | 15 mm   0.3 mm             | 7.5   0.4 mm               | 10 mm   0.4 mm             |
| Active membrane area             | 50 cm <sup>2</sup>         | 50 cm <sup>2</sup>         | 200 cm <sup>2</sup>        |
| Unrecoverable concentrate        | 1.5 ml                     | 1.7 ml                     | 5.3 ml                     |
| Hold-up volume (module)          |                            |                            |                            |
| Min. recirculation volume        | < 10 ml                    | 10 ml                      | < 20 ml                    |
| Non-recoverable hold-up          | < 0.5 ml                   | < 0.5 ml                   | < 1 ml                     |
| <b>Operating Conditions</b>      |                            |                            |                            |
| Pump flow rate                   | 200–400 ml/min             | 200–400 ml/min             | 200–400 ml/min             |
| Maximum pressure                 | 3 bar (45 psi)             | 3 bar (45 psi)*            | 3 bar (45 psi)*            |
| Maximum temperature              | 60°C                       | 60°C                       | 60°C                       |
| Non-recoverable hold-up          | < 0.5 ml                   | < 0.5 ml                   | < 1 ml                     |

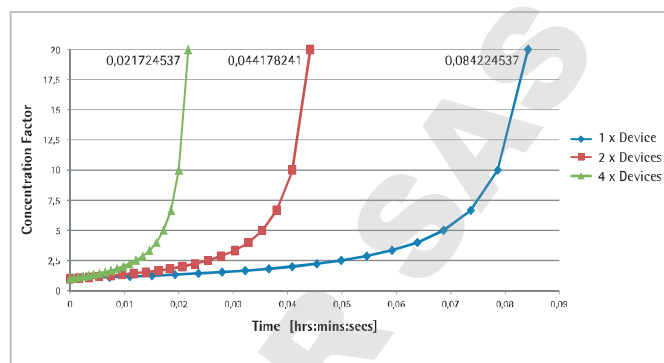
\* Pressure drop across inlet | outlet 0.5 bar (7 psi)

\*\* SS= Stainless steel

## Operating Several Vivaflow® Devices for Higher Concentration Speed and Throughput

### Vivaflow® 50

Vivaflow® 50 cassettes are modular devices that can easily be scaled up to six devices in order to increase the maximum throughput within challenging timelines. Accelerated speed and throughput in all Vivaflow® devices completely depend on, and are proportional, to their membrane area, as demonstrated in Diagram 3.



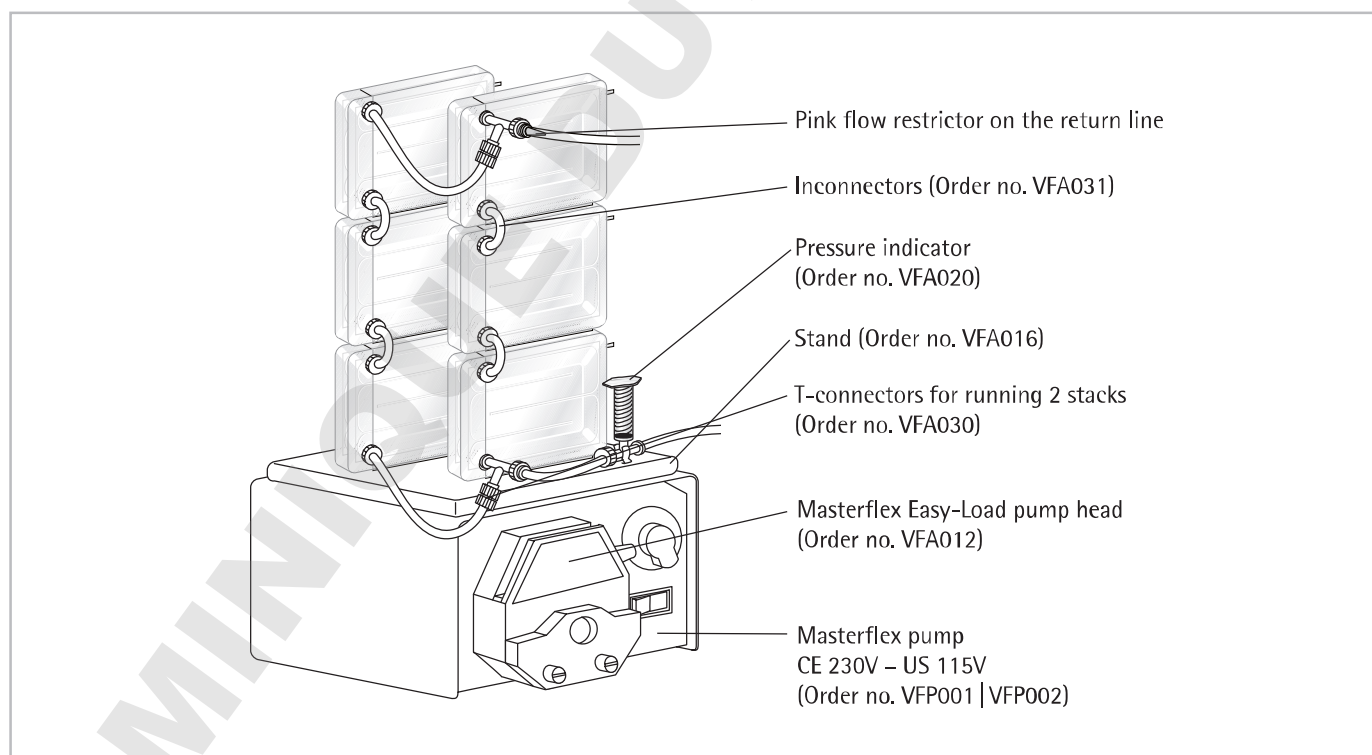
**Diagram 3:** Accurate scaleup of Vivaflow® 50, as shown here for one to four units

## Setting Up Multiple Vivaflow® Cassettes

### Vivaflow® 50

The membrane area is easy to expand by attaching several Vivaflow® 50 units featuring a unique interlocking mechanism. Up to three devices can be stacked, thus increasing the throughput in series. When more than three devices are connected, two separate stacks must be used. As a result, these devices operate both in parallel and in series.

However, this does not have any effect on the performance of the Vivaflow® 50 devices, as this configuration ensure that flow remains completely proportional to the membrane surface area. Diagram 4 and Table 2 provide an overview on how to scale up Vivaflow® 50 along with the accessories required.



**Diagram 4:** System components for setting up multiple Vivaflow® 50 cassettes

### Choosing the components for operating 1 to 6 Vivaflow® 50 units

|                                        | Order No.      | 1 VF 50  | 2 VF 50                          | 3 VF50                           | 4 VF50                           | 5 VF50                           | 6 VF50                                                       |
|----------------------------------------|----------------|----------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--------------------------------------------------------------|
| Masterflex pump                        | FP001   VFP002 | 1        | 1                                | 1                                | 1                                | 1                                | 1                                                            |
| Masterflex Easy-Load pump head size 16 | VFA012         | 1        | 1                                | 1                                | 1                                | 1                                | 1                                                            |
| Pressure indicator                     | VFA020         | optional | 1                                | 1                                | 1                                | 1                                | 1                                                            |
| Interconnectors                        | VFA031         | –        | (1)*<br>Available in the package | (2)*<br>Available in the package | (2)*<br>Available in the package | (3)*<br>Available in the package | 4<br>(3) Available in the package – Additional VFA031 needed |
| T-connector                            | VFA030         | –        | –                                | –                                | 1 pkg.**                         | 1 pkg.**                         | 1 pkg.**                                                     |
| Vivaflow® 50 stand                     | VFA016         | optional | 1                                | 1                                | 1                                | 1                                | 1                                                            |
| Diafiltration reservoir                | VFA006         | optional | optional                         | optional                         | optional                         | optional                         | optional                                                     |
| Operating mode                         |                | Single   | Serial                           | Serial                           | Serial and parallel              | Serial and parallel              | Serial and parallel                                          |

\* No additional purchase is necessary. One series interconnector is included in a package of two Vivaflow® 50 devices.

\*\* One package of T-connectors contains two T-connectors.

**Table 2:** System components for setting up multiple Vivaflow® 50 cassettes

### Choosing the components for operating 2 Vivaflow® 50R or 2 Vivaflow® 200 units

|                                        | Order No.       | 1 VF 50R             | 2 VF 50R             | 1 VF200              | 2 VF200              |
|----------------------------------------|-----------------|----------------------|----------------------|----------------------|----------------------|
| Masterflex pump                        | VFP001   VFP002 | 1                    | 1                    | 1                    | 1                    |
| Masterflex Easy-Load pump head size 16 | VFA012          | 1                    | 1                    | 1                    | –                    |
| Masterflex Easy-Load pump head size 15 | VFA013          | –                    | –                    | –                    | 1                    |
| Pressure indicator                     | VFA020          | Available in package | Available in package | Available in package | Available in package |
| Y-connector                            | VFA005          | –                    | –                    | –                    | 1                    |
| T-connector                            | VFA030          | –                    | 1                    | –                    | –                    |
| Diafiltration reservoir                | VFA006          | optional             | optional             | optional             | –                    |
| Operation mode                         |                 | Single               | Series               | Series               | Series               |

**Table 3:** System components for setting up 2 Vivaflow® 50R and 2 Vivaflow® 200 cassettes

#### Vivaflow® 50R and Vivaflow® 200

The throughput for Vivaflow® 50R and Vivaflow® 200 can be increased and the filtration time reduced by adding another unit to the setup. Table 3 shows the additional components required for scaling up either system.

Diagram 5 and diagram 6 sketch the setting of two Vivaflow® 50R and two Vivaflow® 200, showing all necessary accessories and connectors.

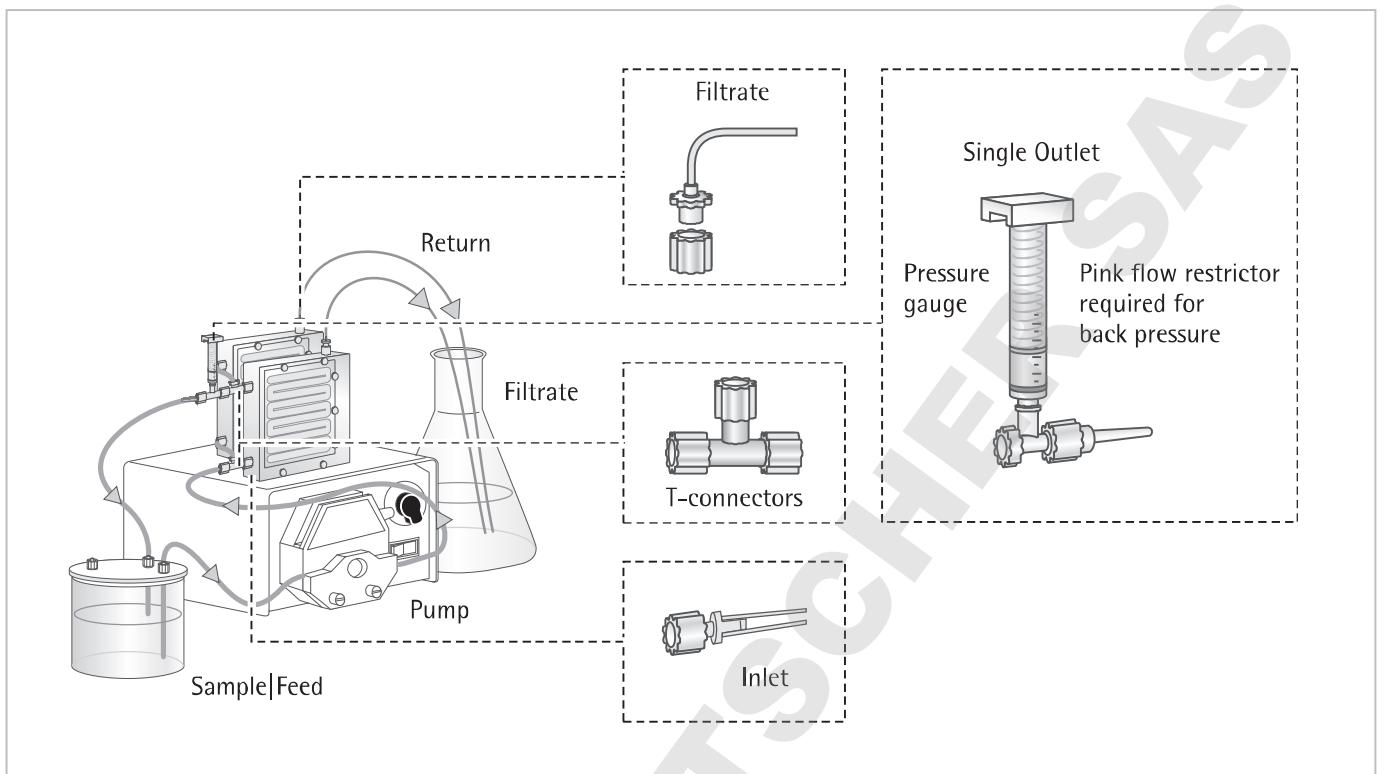


Diagram 5: Setting up two Vivaflow® 50R devices

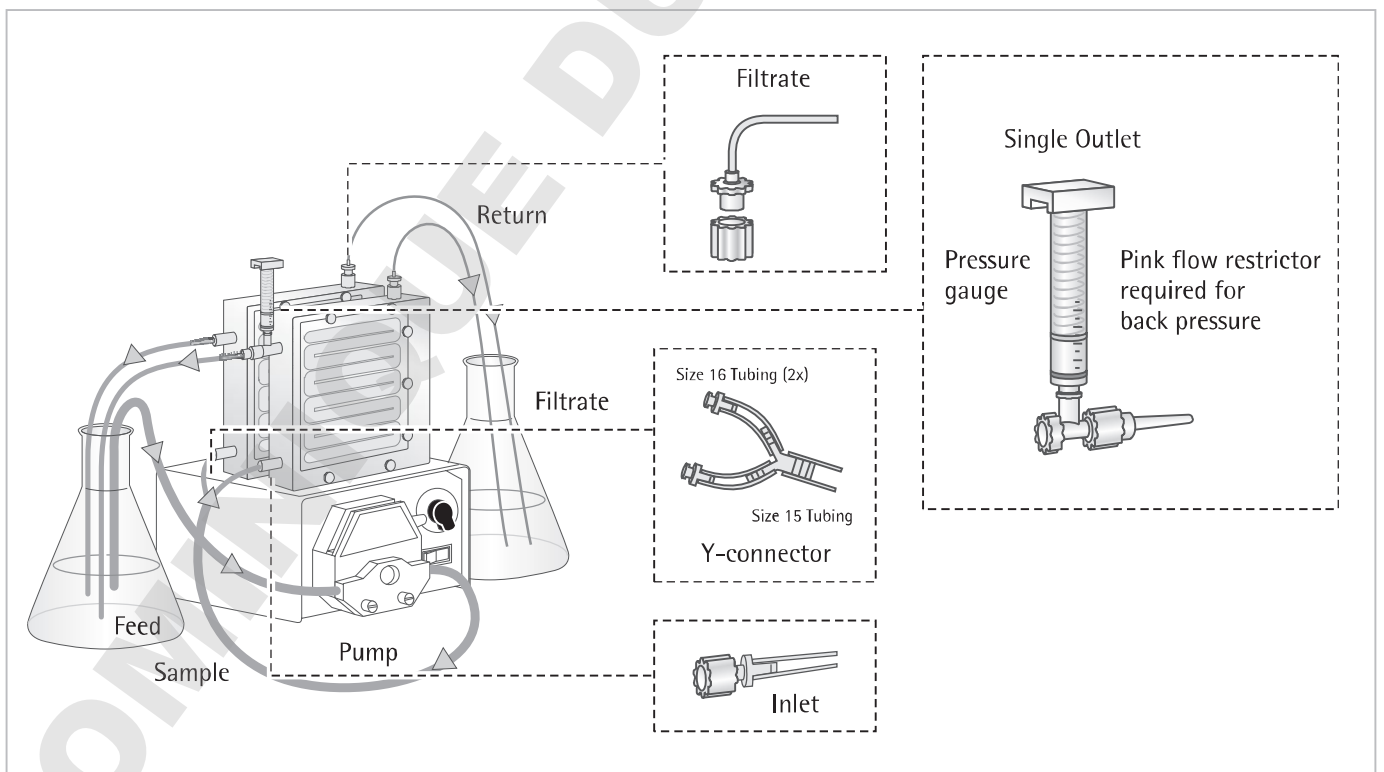


Diagram 6: Setting up two Vivaflow® 200 devices

## Performance Characteristics for Vivaflow® 50

|                                           | Time needed to achieve a 20-fold concentration (in minutes) at 3 bar (45 psi) inlet pressure, 20°C |                          |                      |             |
|-------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------|----------------------|-------------|
|                                           | Single Device                                                                                      | Three Devices            | Solute Recovery in % |             |
|                                           | 250 ml Initial Vol. in Min.                                                                        | 1 l Initial Vol. in Min. | Direct               | 10 ml Rinse |
| BSA 1.0 mg/ml (66,000 MW)                 |                                                                                                    |                          |                      |             |
| 5,000 MWCO PES                            | 34                                                                                                 | 49                       | 96%                  | > 99%       |
| 10,000 MWCO PES                           | 22                                                                                                 | 32                       | 94%                  | > 99%       |
| 30,000 MWCO PES                           | 22                                                                                                 | 32                       | 92%                  | 99%         |
| 50,000 MWCO PES                           | 20                                                                                                 | 29                       | 92%                  | 98%         |
| γ Globulins 1.0 mg/ml                     |                                                                                                    |                          |                      |             |
| 100,000 MWCO PES                          | 43                                                                                                 | 62                       | 92%                  | 98%         |
| 100,000 MWCO RC                           | 40                                                                                                 | 58                       | 92%                  | 98%         |
| Yeast, 1.0 mg/ml ( <i>S. cerevisiae</i> ) |                                                                                                    |                          |                      |             |
| 0.2 μm PES                                | 33                                                                                                 | 47                       | 92%                  | 98%         |

## Performance Characteristics for Vivaflow® 50R

|                                                                                        | Time to concentrate up to 20x (min) at 3.0 bar inlet   2.5 bar outlet pressure, 20°C |              |               |             |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------|---------------|-------------|
|                                                                                        | Initial Volume                                                                       | Average Flux | Recovery in % |             |
|                                                                                        | 250 ml                                                                               | ml/min       | Direct        | 25 ml Rinse |
| Lysozyme, 0.25 mg/ml (14,000 MW)                                                       |                                                                                      |              |               |             |
| 5,000 MWCO Hydrosart®                                                                  | 70                                                                                   | 3.4          | 96%           | 98%         |
| 10,000 MWCO Hydrosart®                                                                 | 23                                                                                   | 10.3         | 94%           | 96%         |
| BSA 1.0 mg/ml (66,000 MW)                                                              |                                                                                      |              |               |             |
| 10,000 MWCO Hydrosart®                                                                 | 24                                                                                   | 9.9          | 98%           | > 99%       |
| 30,000 MWCO Hydrosart®                                                                 | 15                                                                                   | 15.8         | 97%           | > 99%       |
| γ Globulins 1.0 mg/ml (150,000 MW)                                                     |                                                                                      |              |               |             |
| 100,000 MWCO Hydrosart®                                                                | 46                                                                                   | 5.2          | 97%           | > 99%       |
| Initial volume 1 liter (one Vivaflow® 50R at 3 bar) 10,000 MWCO Hydrosart®             |                                                                                      |              |               |             |
| BSA 1.0 mg/ml                                                                          | 95                                                                                   | 10.0         | 98%           | > 99%       |
| Initial volume 1 liter (two Vivaflow® 50R in parallel at 3 bar) 10,000 MWCO Hydrosart® |                                                                                      |              |               |             |
| BSA 1.0 mg/ml                                                                          | 48                                                                                   | 19.8         | 98%           | > 99%       |

## Performance Characteristics for Vivaflow® 200

|                                                                                | Time to achieve a 20-fold concentration (in minutes) at 3 bar (45 psi)<br>inlet pressure, 20°C |                        |                         |             |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------|-------------------------|-------------|
|                                                                                | Initial Volume<br>1 liter                                                                      | Average Flux<br>ml/min | Recovery in %<br>Direct | 25 ml Rinse |
| Lysozyme, 0.25 mg/ml (14,000 MW)                                               |                                                                                                |                        |                         |             |
| 2,000 MWCO Hydrosart®                                                          | 160                                                                                            | 6                      | 97%                     | > 99%       |
| 3,000 MWCO PES                                                                 | 180                                                                                            | 5                      | 97%                     | > 99%       |
| BSA 1.0 mg/ml (66,000 MW)                                                      |                                                                                                |                        |                         |             |
| 5,000 MWCO PES                                                                 | 29                                                                                             | 33                     | 98%                     | > 99%       |
| 5,000 MWCO Hydrosart®                                                          | 70                                                                                             | 14                     | 98%                     | > 99%       |
| 10,000 MWCO PES                                                                | 23                                                                                             | 41                     | 96%                     | > 99%       |
| 10,000 MWCO Hydrosart®                                                         | 35                                                                                             | 27                     | 98%                     | > 99%       |
| 30,000 MWCO PES                                                                | 25                                                                                             | 38                     | 96%                     | 99%         |
| 30,000 MWCO Hydrosart®                                                         | 20                                                                                             | 48                     | 96%                     | > 99%       |
| 50,000 MWCO PES                                                                | 22                                                                                             | 43                     | 96%                     | 98%         |
| γ Globulins 1.0 mg/ml (average 160,000 MW)                                     |                                                                                                |                        |                         |             |
| 100,000 MWCO PES                                                               | 54                                                                                             | 18                     | 96%                     | 99%         |
| 100,000 MWCO Hydrosart®                                                        | 45                                                                                             | 21                     | 96%                     | 99%         |
| Yeast, 1.0 mg/ml ( <i>S. cerevisiae</i> )                                      |                                                                                                |                        |                         |             |
| 0.2 μm PES                                                                     | 11                                                                                             | 86                     | 92%                     | 98%         |
| Dilute solute concentration, initial volume 1 liter at 3 bar, 10,000 MWCO PES  |                                                                                                |                        |                         |             |
| BSA 0.001 mg/ml                                                                | 18                                                                                             | 52                     | 90%                     | 98%         |
| BSA 0.01 mg/ml                                                                 | 20                                                                                             | 47                     | 92%                     | 98%         |
| BSA 0.1 mg/ml                                                                  | 21                                                                                             | 45                     | 94%                     | 99%         |
| Start volume 5 liters (two Vivaflow® 200 in parallel at 3 bar) 10,000 MWCO PES |                                                                                                |                        |                         |             |
| BSA 1.0 mg/ml (66,000 MW)                                                      | 67                                                                                             | 70                     | 97%                     | > 99%       |



## Ordering Information

|                                                                                                                                                                    | Quantity | Order No. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|
| Vivaflow® 50 include filtrate tube, size 16 peristaltic tubing, flow restrictor and fittings and 1 × series interconnector                                         |          |           |
| 3,000 MWCO (PES)                                                                                                                                                   | 2        | VF05P9    |
| 5,000 MWCO (PES)                                                                                                                                                   | 2        | VF05P1    |
| 10,000 MWCO (PES)                                                                                                                                                  | 2        | VF05P0    |
| 30,000 MWCO (PES)                                                                                                                                                  | 2        | VF05P2    |
| 50,000 MWCO (PES)                                                                                                                                                  | 2        | VF05P3    |
| 100,000 MWCO (PES)                                                                                                                                                 | 2        | VF05P4    |
| 0.2 µm (PES)                                                                                                                                                       | 2        | VF05P7    |
| 100,000 MWCO (RC)                                                                                                                                                  | 2        | VF05C4    |
| Vivaflow® 50 complete system comprises                                                                                                                             |          |           |
| Pump (240 V), Easy-Load pump head (size 16), tubing, 500 ml sample diafiltration reservoir, module stand, pressure indicator, T connectors, series interconnectors | 1        | VFS502    |
| Pump (115 V), Easy-Load pump head (size 16), tubing, 500 ml sample diafiltration reservoir, module stand, pressure indicator, T-connectors, series interconnectors | 1        | VFS504    |
| Vivaflow® 50R modules include pressure indicator, flow restrictor and size 16 PVC peristaltic tubing and fittings                                                  |          |           |
| 5,000 MWCO Hydrosart®                                                                                                                                              | 1        | VF05H1    |
| 10,000 MWCO Hydrosart®                                                                                                                                             | 1        | VF05H0    |
| 30,000 MWCO Hydrosart®                                                                                                                                             | 1        | VF05H2    |
| 100,000 MWCO Hydrosart®                                                                                                                                            | 1        | VF05H4    |
| Vivaflow® 200 modules include pressure indicator, flow restrictor and size 16 PVC peristaltic tubing and fittings                                                  |          |           |
| 3,000 MWCO PES                                                                                                                                                     | 1        | VF20P9    |
| 5,000 MWCO PES                                                                                                                                                     | 1        | VF20P1    |
| 10,000 MWCO PES                                                                                                                                                    | 1        | VF20P0    |
| 30,000 MWCO PES                                                                                                                                                    | 1        | VF20P2    |
| 50,000 MWCO PES                                                                                                                                                    | 1        | VF20P3    |
| 100,000 MWCO PES                                                                                                                                                   | 1        | VF20P4    |
| 0.2 µm PES                                                                                                                                                         | 1        | VF20P7    |
| 2,000 MWCO Hydrosart®                                                                                                                                              | 1        | VF20H9    |
| 5,000 MWCO Hydrosart®                                                                                                                                              | 1        | VF20H1    |
| 10,000 MWCO Hydrosart®                                                                                                                                             | 1        | VF20H0    |
| 30,000 MWCO Hydrosart®                                                                                                                                             | 1        | VF20H2    |
| 100,000 MWCO Hydrosart®                                                                                                                                            | 1        | VF20C4    |

|                                                                                            | Quantity | Order No. |
|--------------------------------------------------------------------------------------------|----------|-----------|
| <b>Vivaflow® 50R   200 complete system comprises</b>                                       |          |           |
| Pump (240 V), Easy-Load pump head (size 16), tubing, 500 ml sample diafiltration reservoir | 1        | VFS202    |
| Pump (115 V), Easy-Load pump head (size 16), tubing, 500 ml sample diafiltration reservoir | 1        | VFS204    |
| <b>Vivaflow® accessories</b>                                                               |          |           |
| Masterflex Economy Drive variable speed peristaltic pump (230 V)                           |          | VFP001    |
| Masterflex Economy Drive variable speed peristaltic pump (115 V)                           |          | VFP002    |
| 500 ml sample and/or diafiltration reservoir                                               |          | VFA006    |
| Masterflex Easy-Load pump head – size 15                                                   |          | VFA013    |
| Masterflex Easy-Load pump head – size 16                                                   |          | VFA012    |
| Vivaflow® 50 stand                                                                         |          | VFA016    |
| Pressure indicator (1 – 3 bar)                                                             |          | VFA020    |
| <b>Vivaflow® 50 accessories for operating &gt; 2 devices</b>                               |          |           |
| T-connectors for running 2 stacks                                                          | 2        | VFA030    |
| Series interconnectors                                                                     | 6        | VFA031    |
| Pressure indicator (1 – 3 bar)                                                             | 1        | VFA020    |
| <b>Vivaflow® 50R accessories for operation of two modules</b>                              |          |           |
| T-connector                                                                                | 2        | VFA030    |
| <b>Vivaflow® 200 accessories for operating two modules</b>                                 |          |           |
| Y-connector (size 15 to 2 × size 16, Luer fittings)                                        | 1        | VFA005    |
| Masterflex Easy-Load pump head – size 15                                                   | 1        | VFA013    |

For a complete set of accessories, please see our website or our Lab Filtration catalogue.

**DOMINIQUE DUTSCHER SAS**

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