ÄKTA readyflux™ single-use filtration system

BIOPROCESS FILTRATION

The ÄKTA readyflux™ automated single-use filtration system is suitable for process development and pilot- and small-scale manufacturing (Fig 1). The system is intended for crossflow (also called tangential flow) and normal flow filtration applications in both upstream and downstream workflows.

Bring confidence to filtration

- Easy method preparation and flexible automation methods require no programming expertise and free up time for other activities.
- Three flow kit sizes with quick installation enable easy conversion of the system to meet different process requirements.
- Innovative and compact design with low minimum recirculation volume for high concentration factors and product recovery.
- Works with filter cassettes and hollow fiber filter cartridges for flexible microfiltration and ultrafiltration operations.
- Operates as a closed system when used with aseptic flow kits and ReadyToProcess™ hollow fiber cartridges.

The ÄKTA readyflux filtration system provides excellent filtration capabilities in a compact design. Its single-use flow path minimizes cross-contamination risk, reduces the need for cleaning, and shortens batch change-over time. The system features verified methods and extensive monitoring and control capacities. Using the phase editor of UNICORN™ system control software, you can easily create automation methods to fit your application. The system allows the use of filter cassettes, hollow fiber filter cartridges, and a wide range of disposable bags. You can connect additional equipment via the external input/output (I/O) interface for incorporation into the ÄKTA readyflux automation methods.

The ÄKTA readyflux filtration system is suitable for use in a cGMP environment and can be connected to other single-use equipment. In upstream applications, for example, ÄKTA readyflux filtration systems can be connected to Xcellerex™ XDR stirred-tank bioreactor systems or rocking WAVE™ bioreactor systems for use in clarification of cell culture feed. Used together with the ÄKTA ready single-use chromatography system in a connected process, the

Fig 1. ÄKTA readyflux single-use filtration system.

ÄKTA readyflux system can also be used for concentration and buffer exchange in downstream applications.

The Xcellerex XDUO mixer system, LevMixer™ 10 L single-use mixer, or ReadyCircuit™ 2D hanging pillow bags can be used as a recirculation reservoir when working with the ÄKTA readyflux system.

System overview

The ÄKTA readyflux system puts the application in focus. The system is floor-standing and can easily be rolled in and out of the production facility. The system can be used with filter cassettes and hollow fiber filter cartridges. Adequate mixing can be achieved in a short duration of time when tested in combination at low flow rate and high viscosity. In general, high viscosity gives longer mixing times than low viscosity. UNICORN software provides intuitive and flexible method creation, system control, and process evaluation to simplify your filtration tasks. Both the software process picture and system hardware are color coded to identify different sections of the flow path and facilitate installation of the flow path.

Flow kit

The flow kits include single-use pump head and tubing, as well as sensors for pressure, conductivity, temperature, flow, UV, and pH (depending on the flow kit; see ordering information). The flow kit is available with sanitary clamp or other aseptic connectors. The flow kit is supplied gamma irradiated. Flow kits with aseptic connectors are supplied with a sterile claim.

The flow path is delivered in separate sections for feed, retentate, and permeate (Fig 2). NFF flow kit is delivered in separate sections for feed and permeate. The flow kit can be installed in less than 15 min using the installation wizard in UNICORN software. Use a barcode scanner to identify the installed flow path and follow the installation wizard instructions for correct and easy installation. A report is generated when installation is complete. An installation test can be performed to ensure proper functionality of sensors. If you're using the ¼ in. flow kit, the feed pump assembly needs to be changed, which can be done on site using the instructions provided.

The flow path has been designed to enable low minimum working volumes for high concentration factors and is sloped to maximize product recovery.

Transfer line

The transfer line has three inlets: one for buffers, one for product, and one for air. A peristaltic pump transfers buffer to the recirculation line. The pump can also be used for automated fed-batch operation and diafiltration. An air sensor allows complete loading of sample and prevents air from entering the system. An air filter is included in the transfer line and is used to filter air during sample recovery by air blow down.

Recirculation line

The recirculation line has three inlets: one for liquids for flushing, one for filter cleaning, and one for storage of the filter. The ÄKTA readyflux system recirculation pump is diaphragm type for low shear, and the single-use pump head is integrated in the flow path. Pressure sensors are in the feed line and in the retentate line along with sensors for conductivity and temperature. Product can be recovered through the low-point port. The retentate pressure control valve is used to control transmembrane pressure (TMP) during ultrafiltration. For inline integrity testing, which does not require dismantling or reassembling the filter, the system has a port for connection of an integrity test instrument.

Permeate line

The permeate line includes sensors for pressure, conductivity, temperature, flow, UV, and pH (depending on the flow kit; see ordering information) to control and monitor the filtration run. A peristaltic pump can be used for permeate flow control during microfiltration operation.

Reservoirs

A wide range of disposable reservoirs can be fitted to the ÄKTA readyflux system. 2D bags with volumes up to 20 L and 3D bags with volumes ranging from 50 L to 1000 L can be used with the system. A Bagkart™ bag trolley can be used for 2D bags (Fig 3), and 3D bags are used with the Xcellerex XDUO mixer system with integrated load cells. When 3D bags are used with the Xcellerex XDUO mixer system, in-bag pH measurement, mixing, and temperature can be monitored by UNICORN software. With the LevMixer 10 L mixer system, UNICORN software can be used to monitor in-bag pH measurement and temperature and control mixing speed and weight (Fig 4). 2D and 3D bags can also be used with a user-supplied load cell of choice. The load cell is connected to the UNICORN software that displays bag weight for our 2D and 3D bags, or your reservoir of choice.

The ÄKTA readyflux system can be connected to one Xcellerex XDM-S UF mixer functioning as a feed mixer, two Xcellerex XDUO mixers functioning as a feed mixer and transfer or permeate mixer, or to a LevMixer 10 L mixer system as a feed mixer using the ¼ in. flow kit.

Fig 3. ÄKTA readyflux system with Bagkart trolley (left) and Fluxkart™ trolley (right).

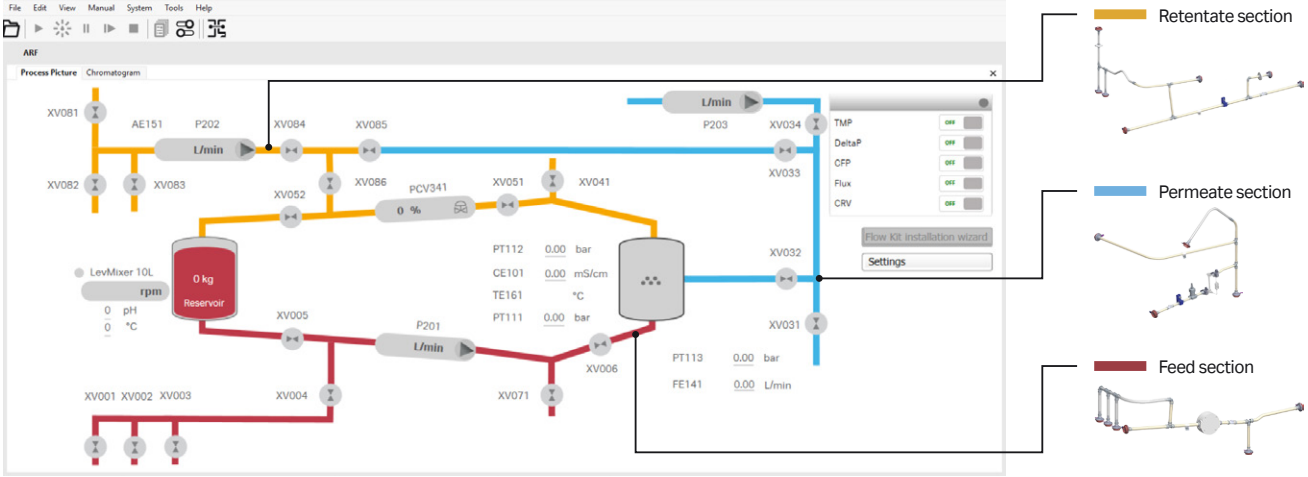


Fig 2. In the process picture of the UNICORN software, the flow path sections are displayed with different colors to facilitate flow kit installation.

Fig 4. LevMixer 10 L single-use mixing system.

Designed for low minimum recirculation volume

Hold-up volume

System hold-up volume refers to the volume of liquid in the filtration system and is independent of the filter used. To obtain the total hold-up volume, add the filter hold-up volume to the hold-up volume of the flow kit. System and filter should be selected for the lowest hold-up volume compatible with other performance requirements of the process. The ÄKTA readyflux system hold-up volume < 400 mL with the ½ in. flow kit, of which typically about 30 mL or less is non-recoverable liquid. With the ⅜ in. flow kit, the hold-up volume is < 225 mL, of which around 15 mL is non-recoverable liquid. With the ¼ in. flow kit, the hold-up volume is < 90 mL, with around 8 mL non-recoverable liquid.

Minimum working volume

The system's minimum working volume represents the minimum volume of fluid in the recirculation line required to operate the system at the desired crossflow rate without drawing air into the feed line. The minimum working volume is determined by the design of the system (reservoir, feed, and retentate tubing), the filter hold-up volume, and the crossflow rate. When designing a filtration process, minimum working volume needs to be considered to ensure that the target recirculation volume is not less than the system's minimum working volume. For ÄKTA readyflux systems, the minimum working volume at different feed flow rates is shown in Figure 5 for a 5 g/L BSA solution. Figure 6 shows the minimum working volume at different feed flow rates using purified water when the system is integrated with the LevMixer 10 L mixer.

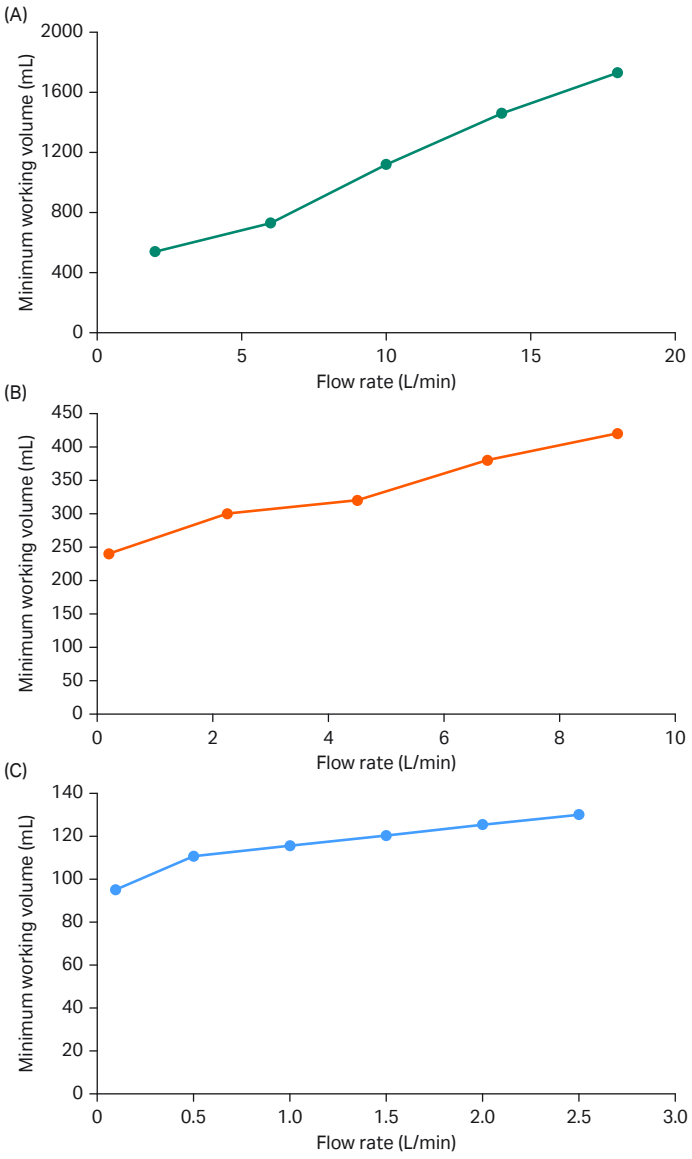


Fig 5. Minimum working volume (recirculation line excluding filter) at different feed flow rates with (A) ½ in., (B) ⅜ in., and (C) ¼ in. ÄKTA readyflux flow kits. Here, a BSA solution of 5 g/L was used.

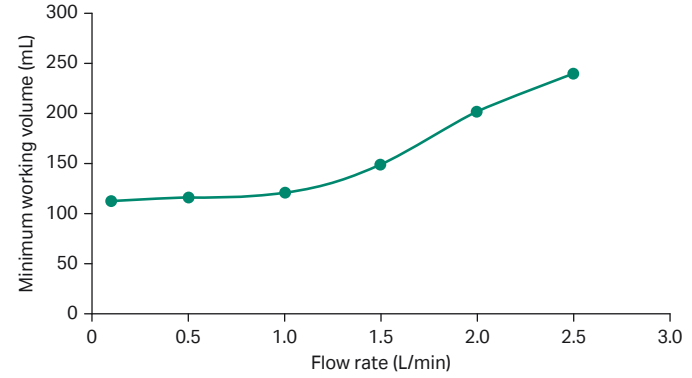


Fig 6. Minimum working volume (recirculation line excluding filter) at different feed flow rates with the ÄKTA readyflux system, integrated with LevMixer 10 L mixer system using purified water.

Comprehensive control with UNICORN software

UNICORN system control software is based on an integrated controller and an intuitive user interface. To facilitate handling, the interface uses the familiar Windows environment. The run sequence is determined by the end-user for control of a specific process. A graphical interface helps you create the process sequence. Conventional line programming can be performed by advanced users. The UNICORN software contains the tools needed to perform almost any type of crossflow filtration process at different scales, from setting up and running a method to evaluating the data.

The software includes four modules:

- ***Administration:*** Used to set up each system with its installed components, user access, view logs, and management of the inbuilt SQL server.
- ***System Control:*** Allows you to perform and monitor the run in real time.
- ***Method Editor (recipe editor):*** Provides an easy interface to help you create or modify methods.
- ***Evaluation:*** Supports data analysis and report generation. Additional tools for data handling and reporting are available in the optional evaluation classic module.

External user audits have shown that the UNICORN development process offers good adherence to the framework, principles, and practices described in GAMP 5, and that the functionality of the product is acceptable for use in a cGMP regulated environment that complies with 21 CFR Part 11. The UNICORN software uses a standard for open platform communication (OPC), allowing for real-time and historical data access, as well as third-party software control. A PROFIBUS node is available for connection to external programmable logic controller (PLC)/distributed control system (DCS).

Method creation

The ***Method Editor*** provides a range of predefined methods for ultrafiltration and microfiltration applications, as well as for filter cleaning and storage, and allows you to create or adjust methods to suit your application needs (Fig 7). The module features built-in application support and contains all instructions needed to control a run. The interface provides easy viewing and editing of the run parameters.

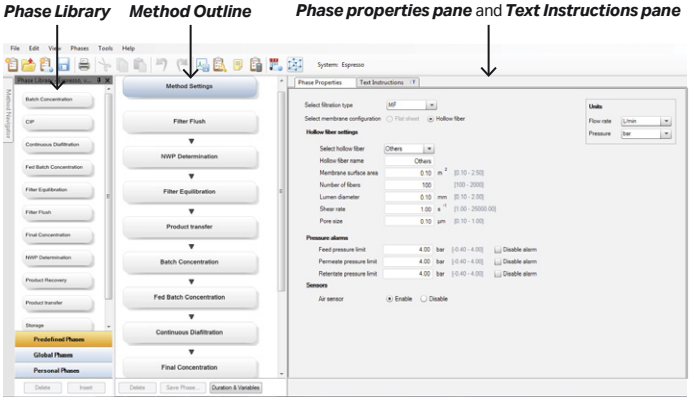


Fig 7. Automated methods can quickly and easily be created by dragging and dropping phases in the ***Method Editor*** of the UNICORN software.

The UNICORN software includes a library of predefined phases for creating or editing your own methods. Each phase reflects a step in the process, such as filter equilibration, product transfer, batch concentration, or continuous diafiltration. A method is created or edited by dragging-and-dropping phases from the ***Phase Library*** to the ***Method Outline*** and by entering process parameters in the ***Phase Properties*** pane. A wide range of control options and monitors are available to ensure that the process is run according to set specifications and that the batch is completed on time.

Parameters for our hollow fiber filter cartridges are predefined in the software. By selecting the cartridge in the ***Phase Properties*** pane, filter parameters (e.g., filter area and lumen diameter) are automatically programmed into the method. For other types of filters, such as filter cassettes, parameters are filled in by the user.

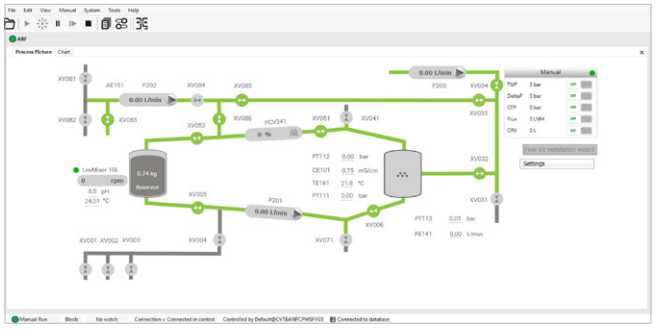
For added flexibility, advanced users can edit programming instructions directly in the ***Text Instructions*** pane.

System control

The ***System Control*** module is used to start, monitor, edit, and control a run in real time. Features of the ***System Control*** module include:

- Full control during manual or programmed runs. Parameters can be changed at any time and are included in the run log.
- Real-time flow scheme showing the current flow path, valve positions, and monitor values for CFF and NFF clow paths (Fig 8).
- Allowing control of up to three instruments, with an individual layout for each system.
- ***Method Queue*** function to enable unattended operation of multiple methods in queues.

(A)



(B)

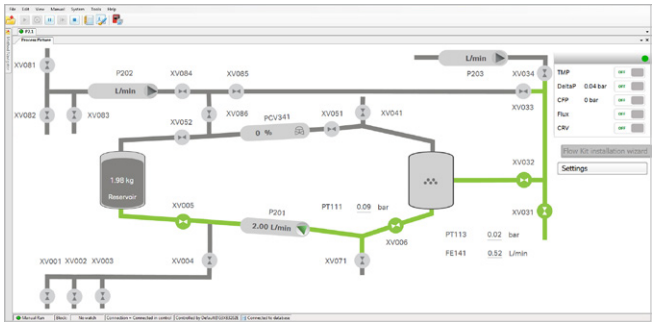


Fig 8. Interactive process picture in the UNICORN software. (A) CFF and (B) NFF flow paths.

ÄKTA readyflux system features the following control parameters:

- Automated feedback control of the filtration process (e.g., TMP, delta pressure, flux, constant retentate volume).
- Filtration-specific end point monitoring during different run modes (e.g., concentration factor, permeate flux, retentate volume, conductivity).
- Automated maintenance alerts based on component-defined run hour limits.

Evaluation

With UNICORN 7, the Evaluation module provides a simplified user interface optimized for most used workflows such as quick evaluation and comparison of results (Fig 9).

The ***Evaluation*** module features:

- Simplified interface, including single-click operations with instant feedback for operations.
- Preview of results for quick evaluation of data.
- Comparison of results in overlay and tile view.
- Sorting of results according to running parameters to see trends in data.

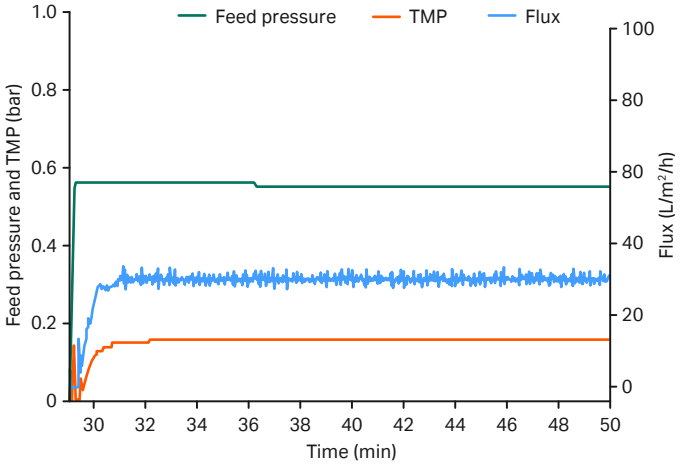
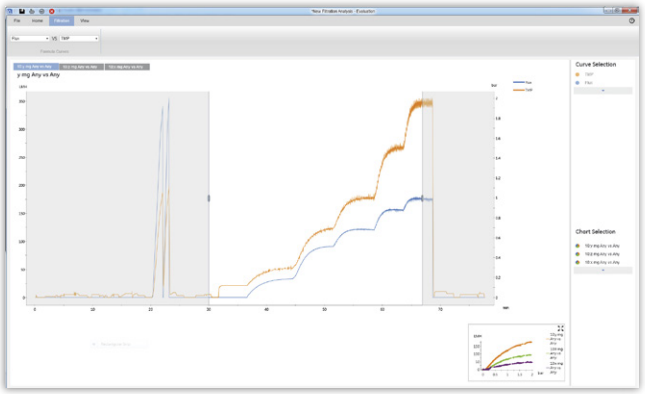


Fig 9. Example of user-selected curves. Run data is captured in real time and easily evaluated using the ***Evaluation*** module post-run.

ÄKTA readyflux system supports a number of crossflow evaluation algorithms for analysis of generated results:

- **Process optimization** is used to analyze process characterization experiments in which a series of set points are tested. The plot is used to visualize flux versus TMP (Fig 10).
- **Diafiltration time optimization** allows identifying the concentration factor for which the least time is required to complete the diafiltration.
- **Capacity plot** can be used to evaluate capacity of the filter.
- The **Normalized water flux (NWF)** function tests the membrane permeability. This is performed to ensure that the filter cleaning process is still effective and to determine the lifetime of a filter. The test enables the user not only to automatically calculate the NWF from a result file, but also to plot results from multiple cycles on a single plot.
- **Any vs any** is used to graphically display data from any two curves generated during concentration, buffer exchange, or cell culture clarification. The analysis provides the possibility to plot any process parameter captured as a curve from a filtration system.

A)



B)

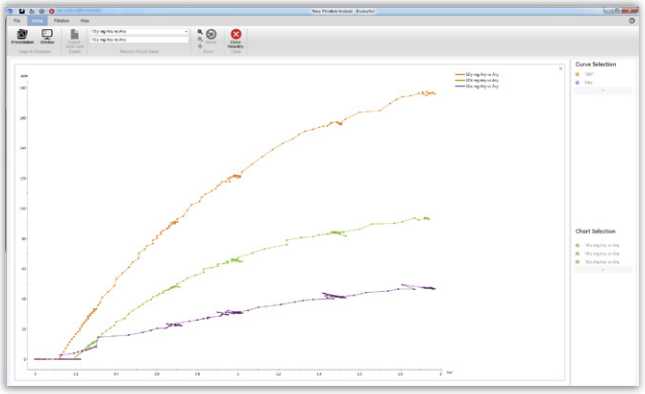


Fig 10. Flux vs TMP curve. (A) Run data plotted in UNICORN result file, (B) graph for flux vs TMP generated in ***Evaluation*** module.

Regulatory

Robust and hygienic design

All wetted polymer materials and/or pressure holding parts have been tested and classified according to USP <88> Class VI Biological Reactivity Tests, *in vivo*, and are free from animal derived components, or comply to EMA 410/01, Rev.3. Used materials are traceable back to their production batches.

The flow path is produced and packed under controlled conditions in a clean room environment (class ISO 7) using validated procedures. The ÄKTA readyflux flow kits are delivered in double plastic bags to protect against contamination and gamma irradiated (25 to 40 kGy). The flow kits with aseptic connectors have either undergone sterile and bioburden testing or have been categorized under existing testing to meet claims.

Product documentation and services

Regulatory authorities expect manufacturers of pharmaceuticals to qualify equipment before use in production. Process safety is an integral part of the ÄKTA readyflux system concept, including the single-use flow kit. The flow kit for ÄKTA readyflux system is supported with an extensive documentation package.

- **Product documentation:** Provides information about the materials used in wetted parts. Product documentation is delivered with the ÄKTA readyflux flow kit. Extensive system documentation, such as drawings and schematics, is delivered with the ÄKTA readyflux system.
- **Validation guide:** Includes a description of the flow kit manufacturing process, qualification tests, and extractable information.
- **Release documentation:** ÄKTA readyflux system is delivered with a functional test protocol. The flow kit is also delivered with a certificate of quality, including product release criteria.
- **IQ/OQ documentation:** The system can be delivered with installation and operational qualification (IQ/OQ) documentation, and the qualification can be performed by certified Cytiva specialists.

Filters

ÄKTA readyflux system can be used with both hollow fiber filter cartridges and filter cassettes. For closed system operations, ReadyToProcess hollow fiber filters are recommended. Multiple sterile connector offerings allow aseptic connection of the filter to the system. Hollow fiber filter cartridges are connected to the system using an adjustable filter holder. Most commercially available filter cassettes can be used with the system. The Fluxkart trolley can be used to fit cassette holders of choice.

System specifications

General specifications

Main system dimensions (weight × height × depth)	1100 × 1520 × 880 mm
Main system weight	280 kg
Bagkart trolley dimensions (weight × height × depth)	910 × 1550 × 810 mm
Bagkart trolley weight	87 kg
Fluxkart trolley dimensions (weight × height × depth)	720 × 1000 × 450 mm
Fluxkart trolley weight	40 kg
Software	UNICORN 7.6 or later
Control system	100–240 V ~
AC voltage frequency	50/60 Hz
Max. power consumption	1 kVA
Ingress protection	IP45
Compressed air interface	5.5–7 bar, 50 NL/min, oil- and particle-free
Weight scale connector	Bagkart
Analog inputs	Recirculation weight, transfer weight, and permeate weight
PROFIBUS interface	Xcellerex XDM S UF and Xcellerex XDUO mixers

Recommended operating conditions

Ambient temperature	4°C to 32°C
Liquid temperature	4°C to 40°C
Liquid pressure	-0.4 to 4 bar
Fluid density	800 to 1200 kg/m
Fluid viscosity:	
Recirculation	5-fold of water viscosity
Permeate	1.3-fold of water viscosity

Flow rates

¼ in. flow kit	Feed pump	0.1–2.5 L/min
	Transfer pump	0.2–3 L/min
	Permeate pump	0.05–0.8 L/min
⅜ in. flow kit	Feed pump	0.2–9 L/min
	Transfer pump	0.5–6 L/min
	Permeate pump	0.05–1.6 L/min
½ in. flow kit	Feed pump	0.2–18 L/min
	Transfer pump	0.5–6 L/min
	Permeate pump	0.05–1.6 L/min

Flow kit specifications

¼ in. flow kit	*Tubing internal diameter (i.d.):*	
	Feed and retentate	6.4 mm
	Transfer, permeate, and drain	6.4 mm
	Inlet manifold i.d.	6.4 mm
	Pump tubing i.d.:	
	Transfer and permeate	6.4 mm
⅜ in. flow kit	*Tubing i.d.:*	
	Feed	12.7 mm
	Retentate	9.5 mm
	Transfer, permeate, and drain	9.5 mm
	Inlet manifold i.d.	12.7 and 9.5 mm
	Pump tubing i.d.:	
	Transfer	9.5 mm
	Permeate	6.4 mm
½ in. flow kit	*Tubing i.d.:*	
	Feed and retentate	12.7 mm
	Transfer, permeate, and drain	9.5 mm
	Inlet manifold i.d.	12.7 mm
	Pump tubing i.d.:	
	Transfer	9.5 mm
	Permeate	6.4 mm

Sensor specifications

Flow rate, feed	Range	Accuracy
¼ in. flow kit	0.1–2.5 L/min	± 0.1 L/min or ± 12% of reading, whichever is greater*
⅜ in. flow kit	0.2–9 L/min	± 0.2 L/min or ± 12% of reading, whichever is greater*
½ in. flow kit	0.2–18 L/min	± 0.2 L/min or ± 12% of reading, whichever is greater*

Flow rate, permeate	Range	Accuracy
¼ in. flow kit	0.05–0.8 L/min	± 0.05 L/min of reading after calibration
⅜ in. and ½ in. flow kits	0.05–1.6 L/min	± 0.05 L/min of reading after calibration

Flow rate, transfer	Range	Accuracy
¼ in. flow kit	0.2–3 L/min	± 0.4 L/min or ± 10% of reading, whichever is greater*
⅜ in. and ½ in. flow kits	0.5–6 L/min	± 0.2 L/min or ±10% of reading, whichever is greater*

Flow, permeate	Range	Accuracy
¼ in. flow kit	0.05–0.8 L/min	± 0.05 L/min
⅜ in. and ½ in. flow kits	0.05–6 L/min	0.05–2 L/min shall be ± 0.05 L/min of reading 2–6 L/min shall be ± 0.1 L/min of reading

	Range	Accuracy
Pressure (feed, retentate, and permeate)	-0.4–4 barg	± 0.1 bar for full scale or ± 5% of reading, whichever is greater
UV	0.01–1.0 AU	Deviation from linearity ± 5%[†]
Conductivity (retentate and permeate)	0.1–200 mS/cm	± 0.15 mS/cm for full scale or ± 7% of reading, whichever is greater[‡]
pH	3–10	± 0.3 of reading
Temperature (retentate and permeate)	4°C–40°C	± 0.1°C when ambient and liquid temperature are same
Weight	0–25 kg	± 50 g or ± 0.1% of reading, whichever is greater

*Calibration can improve accuracy for the usage range.

[†]Valid for 1.0 to 1.3-fold the viscosity of water at the actual liquid temperature, and maximum temperature difference of 10°C between liquid and ambient temperature.

[‡]Accuracy can be improved by configuring the output signal to usage range. Valid for maximum temperature difference of 5°C between liquid and ambient temperature. Valid at actual temperature (no temperature compensation).

Filter specifications

Hollow fiber filter cartridges:	
Max. no. of cartridges	2
Cartridge size	4, 5, 6, 8, or 9
Filter cassettes:	
No. of cassette holders	1
Total filter area (depending on application parameters)	0.1–2.5 $m^{2§}$

[§]Filter area based on a feed flow of 6–8 L/min/m^2.

Ordering information

Product	Description	Product code
ÄKTA readyflux system	Main instrument	29151000

ÄKTA readyflux flow kits with sanitary clamp connectors*

Product	Description	Size	Product code
Flow kit	Flow path with sanitary clamp connectors, pump head and tubing, and sensors for pressure (F, R, P), conductivity and temperature (R), and flow (P)	¼ in.	29700628
		⅜ in.	29704692
		½ in.	29187383
Flow kit plus	Flow path with sanitary clamp connectors, pump head and tubing, and sensors for pressure (F, R, P). conductivity and temperature (R, P), flow, UV, and pH (P)	¼ in.	29700629
		⅜ in.	29403629
		½ in.	29151600
NFF flow kit	Flow path with sanitary clamp connectors, pump head and tubing, and sensors for pressure (F, P), and flow (P)	⅜ in.	29707632

*F: feed, R: retentate, P: permeate.

ÄKTA readyflux flow kits with ReadyMate™ connectors*

Product	Description	Size	Product code
Flow kit	Flow path with ReadyMate connectors, pump head and tubing, and sensors for pressure (F, R, P), conductivity and temperature (R), and flow (P)	¼ in.	29704688
		⅜ in.	29704691
		½ in.	29187381
Flow kit plus	Flow path with ReadyMate connectors, pump head and tubing, and sensors for pressure (F, R, P). conductivity and temperature (R, P), flow, UV, and pH (P)	¼ in.	29700630
		⅜ in.	29405657
		½ in.	29187382

*F: feed, R: retentate, P: permeate.

ÄKTA readyflux flow kits with AseptiQuik connectors*

Product	Description	Size	Product code
Flow kit	Flow path with AseptiQuik connectors, pump head and tubing, and sensors for pressure (F, R, P), conductivity and temperature (R), and flow (P)	½ in.	29742758
Flow kit plus	Flow path with AseptiQuik connectors, pump head and tubing, and sensors for pressure (F, R, P). conductivity and temperature (R, P), flow, UV, and pH (P)	¼ in.	29798491
		⅜ in.	29596399
		½ in.	29226326

*F: feed, R: retentate, P: permeate.

ÄKTA readyflux flow kits with Kleenpak™ Presto connectors*

Product	Description	Size	Product code
Flow kit	Flow path with Kleenpak Presto connectors, pump head and tubing, and sensors for pressure (F, R, P), conductivity and temperature (R), and flow (P)	¼ in.	30042734
		⅜ in.	30042733
		½ in.	31188828
Flow kit plus	Flow path with Kleenpak Presto connectors, pump head and tubing, and sensors for pressure (F, R, P). conductivity and temperature (R, P), flow, UV, and pH (P)	¼ in.	31188829
		⅜ in.	31188825
		½ in.	31188827

*F: feed, R: retentate, P: permeate.

Supplementary products

Product	Description	Product code
LevMixer 10 L single-use mixing system, non-jacketed with weight sensing	Mixing tank	LM10NCTE-B4N
ÄKTA readyflux pump upgrade kit	Upgrade kit for ¼ in. flow kit	29720133
ÄKTA readyflux LevMixer 10 L upgrade Kit	Service upgrade kit	31188921
Bagkart bag trolley	Bag trolley for 2D bags with integrated load cell	29151500
Fluxkart bag trolley	Filter trolley for usage with filter cassettes	29245919
HF filter holder	For 1 filter	29258287
HF filter holder	For 2 filters	29256166
Multi-use distribution plate ACS1247AA	CSUK manifold multi-use	31310481
Cadence CS holder CSUH750BP with base plate	Cadence CS holder for TFF	30059595
Cadence single-use TFF T12 Plate	CSUP010 - for filter areas smaller than 0.1 m^2	40046012
TFF hardware cadence CM holder assy	CSUH040 - for filter areas smaller than 0.1 m^2	40047124
Air sensor†	Air bubble detection in additional feed inlet	29003879
Bar code reader	Scanning of flow kit serial numbers	29269812
UNICORN 7 filtration software	Software license	29708936
ReadyMate to 0.75 in. sanitary clamp adapter	Disposable aseptic connector converting ReadyMate to sanitary clamp	28936695

†Air sensor works for all flow kit sizes. Some modifications needed for ¼ in. flow kit; contact your Cytiva representative to learn more.

Qualification services‡

Description	Product code
IQ/OQ documentation	29214963
IQ/OQ performance	28992657
Binder CCP pump change	29733354
E-binder CCP pump change	29733351
Binder RQ	29606308
E-binder RQ	29606724
Commissioning and qualification performance (1 day)	28992654
Commissioning and qualification performance (2 days)	28992655
ÄKTA readyflux LevMixer 10 L upgrade with kit, labor for installation, change control protocol (CCP), and field engineer execution of the CCP	31199262

‡IQ: installation qualification, OQ: operational qualification, CCP: change control protocol, RQ: requalification.

Fittings and accessories

Product	Description	Size	Product code
ReadyMate bag	Disposable hanging bag for feed, recirculation, or permeate	1 L	12410218
		5 L	12410220
		10 L	12410222
		20 L	12410224
ReadyMate jumper	AdvantaPure reinforced tubing, connecting size 4 cartridges to retentate and permeate	0.25 in. × 1 ft.	12410129
	AdvantaPure reinforced tubing, connecting size 5 and 8 cartridges to retentate and permeate	0.375 in. × 1 ft.	12410132
	AdvantaPure reinforced tubing, connecting size 5 and 8 cartridges to retentate	0.5 in. × 1 ft.	12410135
	AdvantaPure reinforced tubing, connecting size 5 and 8 cartridges to permeate	0.38 in. × 0.5 ft.	RC2017-0062
	AdvantaPure reinforced tubing, connecting size 6 and 9 cartridges to retentate	0.5 in. × 2 ft.	RC2017-0061
	AdvantaPure reinforced tubing, connecting size 6 and 9 cartridges to permeate	0.38 in. × 1.5 ft.	RC2017-0063
ReadyMate jumper Y manifold	AdvantaPure reinforced tubing, connecting both cartridge permeate outlets to permeate	0.25 in. × 0.5 ft.	12410193
		0.38 in. × 0.5 ft.	12410194
		0.5 in. × 0.5 ft.	12410195
ReadyCircuit jumper tube set	AdvantaPure reinforced silicone: SterilEnz sanitary clamp connector:	1 ft. 0.25 in.	12410149
Sanitary clamp compatible bag	Disposable bag for feed, recirculation, or permeate	10 L	RC2017-0073
		20 L	RC2017-0074
1.5–0.75 in. sanitary clamp jumper	AdvantaPure reinforced tubing, connecting size 5 and 8 cartridges to retentate	0.5 in. × 1 ft.	RC2017-0066
	AdvantaPure reinforced tubing, connecting size 6 and 9 cartridges to retentate	0.5 in. × 2 ft.	RC2017-0067
0.75 in. sanitary clamp jumper	AdvantaPure reinforced tubing, connecting size 5 and 8 cartridges or cassette holder to permeate	0.38 in. × 1 ft.	RC2017-0068
	AdvantaPure reinforced tubing, connecting size 6 and 9 cartridges or cassette holder to permeate	0.38 in. × 2 ft.	RC2017-0064
	AdvantaPure reinforced tubing, connecting cassette holder to permeate	0.38 in. × 3 ft.	RC2017-0065
0.75 in. sanitary clamp jumper Y manifold	AdvantaPure reinforced tubing, connecting both cartridge permeate outlets to permeate	0.38 in. × 0.5 ft.	RC2017-0069
Permeate jumper set ⅜"	AdvantaPure reinforced tubing connecting filter permeate outlets to the permeate (sanitary clamp connector)	⅜ in.	8292-2480Z
Permeate jumper set ¼"	AdvantaPure reinforced tubing connecting filter permeate outlets to the permeate (sanitary clamp connector)	¼ in.	8292-2481A
Single-use biocontainer bag	LMC 10 L TFF TC, SU pH, inflation	10 L	6403-2433C
Single-use biocontainer bag	LMC 10 L TFF TC, inflation	10 L	6403-2433D

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