ÄKTA™ ready XL

READYTOPROCESS™

ÄKTA™ ready XL is a liquid chromatography system designed for manufacturing scale (Fig 1). To meet the capacity demands from single-use upstream processes (2000 L high-titer feeds), the system operates large-scale columns (up to 1200 mm), using the two flow kit sizes that cover a broad range of flow rates from 45 to 3500 L/h. The single-use flow path minimizes the need for cleaning and cleaning validation, allowing for quick changeover between productions, while eliminating the risk of carryover. ÄKTA™ ready XL offers the accuracy and documentation required for use in a GMP-regulated environment.

Taking single-use chromatography to manufacturing scale:

• High capacity in a compact format

• Flexibility supporting use in multiproduct facilities

• Reliability suitable for GMP production

Suited for large-scale manufacturing

ÄKTA™ ready XL provides high flow capacity, making the system well suited for purification of high-titer entities or for products produced in large-volume bioreactor cultures. The possibility of using high flow rates allows for few process cycles per batch, shortening the overall process time and enhancing lifetime of the chromatography equipment.

The small system footprint enables an efficient facility use. The system is movable and all system components are easily accessed for operator convenience. ÄKTA™ ready XL is controlled from an industrial computer installed with the UNICORN™ system control software. Using a standard for open platform communication (OPC), the interface is compatible with third-party system control software. Both the system and computer are designed to withstand the sanitization conditions used in cleanroom environments.

Fig 1. ÄKTA™ ready XL offers flexibility at manufacturing scale.

Flexible use in a broad range of applications

ÄKTA™ ready XL can be used for both isocratic and gradient elution. The flow kit for isocratic operations can be equipped with a section that provides gradient capability to the flow path (Fig 2). An ergonomic system design makes flow kit installation easy, and is quickly performed using the software-aided installation wizard. Markings on the system provides information on where the tubing should be placed and sensors connected. An installation test ensures proper connection of the sensors before start of the purification process. The system is ready for use within 1 h.

cytiva
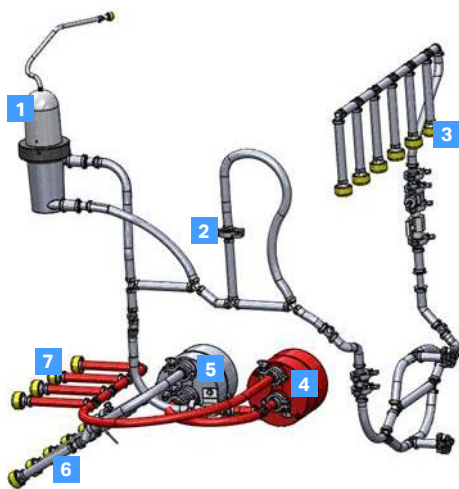
1	Air trap	**5**	Pump head of isocratic flow kit
2	Location of prefilter insertion	**6**	Inlets of isocratic flow kit
3	Outlets of isocratic flow kit	**7**	Inlets of gradient section
4	Pump head of gradient section		

Fig 2. The isocratic flow kit, including six inlets, pump head, air trap, as well as sensors for pre- and post-filter pressure, precolumn air, and post-column pressure, conductivity, temperature, pH, flow, and UV monitoring. The gradient section (red) with four inlets is provided separately and contains a pump head for a second pump as well as a conductivity sensor for conductivity-controlled gradient feed-back.

The flow kits are produced in clean room ISO 7, packed in double bags, and gamma irradiated before delivery. Upon completion of the run, the single-use flow path is conveniently disposed to prevent carryover between production batches or campaigns, facilitating use of the system in a multiproduct facility.

ÄKTA™ ready XL allows for operation of the chromatography column in upward or downward flow, depending on the operation mode. With the ability to monitor UV at three different wavelengths and with multiple fluid inlets, the system is easily adapted to different process requirements.

Offering the reliability required for GMP production

Single-use sensor technology

Single-use sensors with high accuracy allows for reliable monitoring and control of the purification process (Fig 3). Together with precolumn air sensors at the inlet and in the flow path, the air trap automatically detects and prevents introduction of air into the column. Post-column sensors monitor the pressure, conductivity, temperature, pH, flow, and UV.

As reliable control of pH, flow, and UV is critical for a consistent process performance, these sensors have been improved further from predecessor products. The gamma-stable pH sensor is integrated with the flow path to prevent contamination of the flow path by insertion of a conventional pH probe. The pH sensor needs no calibration. Two calibration constants provided on the sensor unit are entered in the UNICORN™ software. An induction flow meter ensures correct flow through the column independent of liquid properties such as temperature and viscosity. The UV sensor has the option of using three wavelengths in the range of 206 to 700 nm.

A precolumn filter can be placed after the air trap and is easily connected using the TC end connectors of the flow path. The filter is held in place by the system filter holder. Together with a precolumn pressure sensor, the prefilter pressure sensor enables measuring the pressure drop over the precolumn filter. Although the high flow capacity of the system, the swirl design of the air trap provides low hold-up volumes.
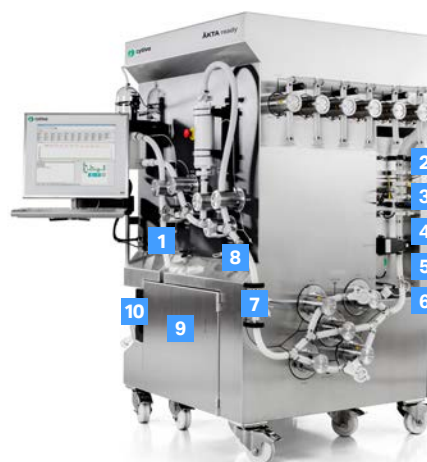
1	Prefilter pressure sensor	**6**	Pressure sensor
2	UV sensor	**7**	Precolumn air sensor
3	pH sensor	**8**	Post-filter pressure sensor
4	Post-column conductivity/ temperature sensor	**9**	Precolumn conductivity sensor
5	Flow meter	**10**	Inlet air sensor

Fig 3. ÄKTA™ ready XL installed with flow kit.

Preclinical

Clinical manufacturing

Full-scale manufacturing

| ReadyToProcess™ columns Ø 80–178 mm | Ø 251 mm | Ø 359 mm | Ø 450 mm | AxiChrom™ columns Ø 600–1200 mm |

ÄKTA™ ready flow kits

ÄKTA™ ready XL flow kits

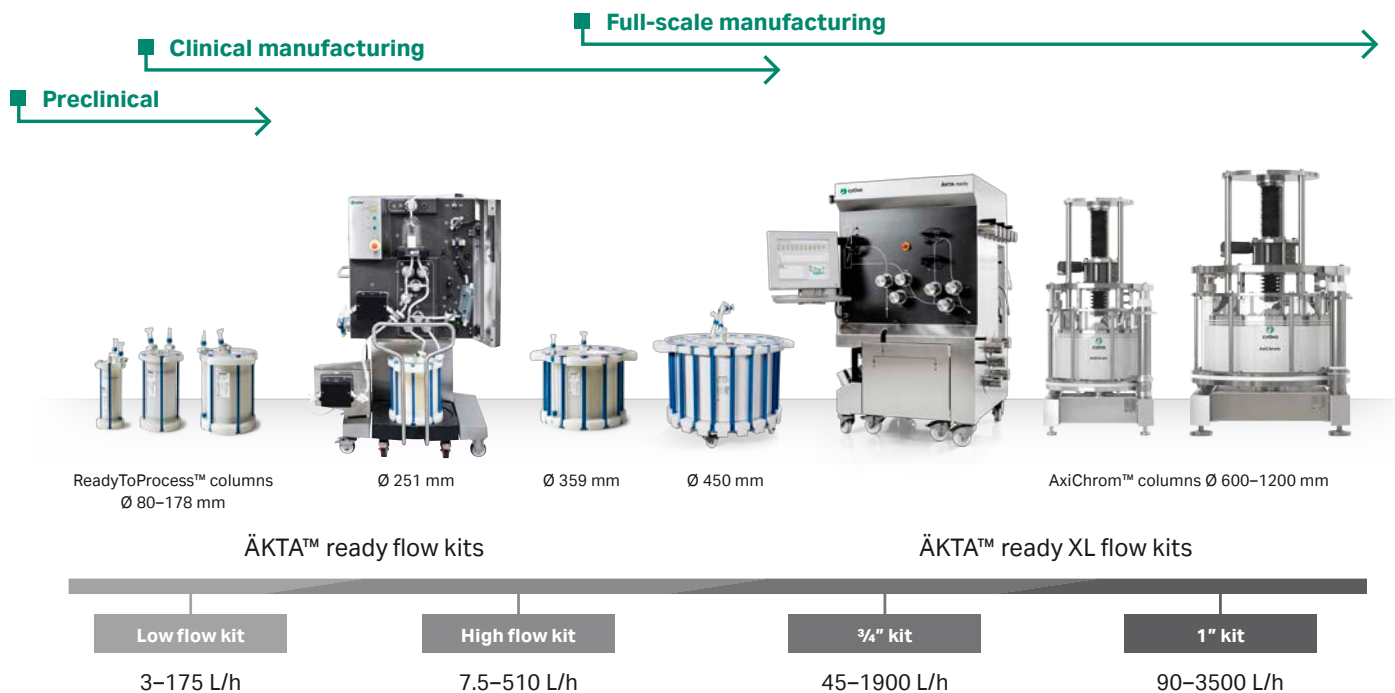| Low flow kit	High flow kit	¾" kit	1" kit
3–175 L/h	7.5–510 L/h	45–1900 L/h	90–3500 L/h

Fig 4. ÄKTA™ ready and ÄKTA™ ready XL operate ReadyToProcess™ columns with inner diameters from 80 to 450 mm for purification of biomolecules from bioreactor culture volumes of 10–2000 L. For larger bioreactor volumes, ÄKTA™ ready XL can also operate AxiChrom™ columns with inner diameters of up to 1200 mm. The common UNICORN™ software platform simplifies transfer of processes between systems.

Extensive product documentation

The system is delivered with comprehensive operating instructions and extensive system documentation including assembly drawings, piping and instrumentation diagrams (PID), and system specifications. Installation and operation qualification (IQ/OQ) protocols are available. IQ/OQ can be performed either by the user or by a certified specialist from Cytiva.

Reliable process control

The UNICORN™ software is designed according to GAMP™ 5 guidelines (ISPE) and can be used in a manner that complies with 21 CFR part 11. The software supports full data integrity and consistency throughout the process, enabling a digitized and validated manufacturing. Process data is reliably stored in a database repository. For access control, the software is secured by password-protected user login. User activities are logged in audit trails for usage history. The UNICORN™ software provides the ability to generate reports, and data is exported in a tabular spreadsheet.

Part of a scalable single-use chromatography platform

ÄKTA™ ready XL is preferably used with ReadyToProcess™ disposable columns with inner diameters of up to 600 mm. For design of a disposable production line from upstream to downstream, ÄKTA™ ready XL and ReadyToProcess™ columns can be used with Xcellerex™ XDR single-use bioreactor systems, covering working volumes in the range from 10 to 2000 L, as well as Xcellerex™ XDM and XDUO single-use mixing systems. As the smaller ÄKTA™ ready system, ÄKTA™ ready XL is controlled through the UNICORN™ software, simplifying tech transfer between systems (Fig 4). ÄKTA™ ready XL can also operate AxiChrom™ clean-and reuse columns with inner diameters of up to 1200 mm. Consistency in column geometries allows for convenient scaling, from early preclinical to commercial manufacturing scale.

Specifications

System specifications are listed in Table 1.

Table 1. ÄKTA™ ready XL system specifications

General specifications

Dimensions (W × H × D)	1295 × 1920 × 1215 mm
Dry weight	685 kg
Compressed air interface	5.5–7 bar, oil- and particle-free
Instrument input voltage	Depending on region
Ingression protection	IP55 (field mounted instruments IP54)

System capacity

Flow rates	45–1900 L/h 3/4" flow kit 90–3500 L/h 1" flow kit
Max. pressure	4.0 bar

Sensor specifications

Operating max. pressure	4 bar
Pressure sensor	Range: 0.1–4 bar Accuracy: ± 0.1 bar, or ± 5% of actual value
Temperature sensor	Range: 5°C to 30°C* Accuracy: ± 4°C
Conductivity sensor	Range: 1–200 mS/cm Accuracy: ± 0.5 mS/cm, or ± 7% of actual value
UV sensor	Range: 0–2 AU Accuracy: linearity ± 2%[†]
pH sensor	Range: 3–10 Accuracy: ± 0.3
Flow rate, ¾ inch i.d.	Range: 45–1900 L/h Accuracy: ± 5 L/h or 2% whichever is greater
Flow rate, 1 inch i.d.	Range: 90–3500 L/h Accuracy: ± 5 L/h or 2% whichever is greater

* Valid only when buffer and room temperature are within 5°C.
[†] Valid for 250–700 nm, 2% linearity 0–1 AU for 206–250 nm.

Wetted materials

Tubing	Silicone
Connectors	Polypropylene (PP)
Flow meter	Polysulfone (PS), SS 316L
Air trap	Ethylene propylene rubber (EPDM), polyamid (PA), PP
Air sensor	PP
pH sensor	High-density polyethylene (HDPE), EPDM, porous zirconia, LBF360 glass
Conductivity sensor	PS, gold
Temperature sensor	PS, gold
UV sensor	Polyetheretherketone (PEEK), EPDM, quartz, titanium
Pressure sensor	PS
Pump chamber	EPDM, thermoplastic elastomer (TPE), PP, 316L stainless steel

Material compliance

USP <88> Class VI Test for biocompatibility
Animal free or complies with the conditions in EMA/410/01

Pretreatment of flow kits (wetted components)

Assembly of cleaned parts in ISO class 7 clean room
The complete flow kit is gamma irradiated

System control

Software	UNICORN™ 7.0.2 or higher, alternatively Figurate DeltaV

Ordering information

To order ÄKTA™ ready XL, please contact your local sales representative.