

ÄKTA™ start

ÄKTA start is a preparative chromatography system for laboratory scale protein purification (Fig 1). ÄKTA start is designed as a stand-alone system, with intuitive design, simple flow path, and user-friendly interface. With ÄKTA start it is easy to purify a wide variety of proteins using built-in quick start methods or predefined templates, or by creating your own methods.

ÄKTA start can be combined with the Frac30 fraction collector, the user-friendly UNICORN™ start 1.0 control software, and application-focused prepacked columns for an automated solution (Fig 2).

ÄKTA start offers the following features:

- Compact solution for quick and reliable one-step protein purification
- Sample injection and fraction collection options
- Quick start methods and templates for common purification techniques
- Intuitive touchscreen display and real-time monitoring

With ÄKTA start, protein purification is quick, reliable, and easy. The system is easy to learn and use, and has an intuitive design, front-facing work area, visible flow path, and a user-friendly interface. ÄKTA start makes it easy to purify proteins, with predefined quick start and editable method templates, real-time run control and visualization, and single-click operations with a compact and portable size suitable for cold-room operations. With proven and reliable technology like LED-based UV detection, and built-in help and diagnostics, you can trust ÄKTA start to help you make an effortless switch from manual to automated protein purification.



Fig 1. ÄKTA start is an easy-to-use preparative chromatography system designed to facilitate the move into automated protein purification.

System overview

ÄKTA start can be operated using the touchscreen display or from a computer connected to the instrument using UNICORN start. UNICORN start provides additional options for designing, running, and analyzing experiments. ÄKTA start can be complemented with a Frac30 fraction collector, providing the option for collecting fractions in four different tube sizes.



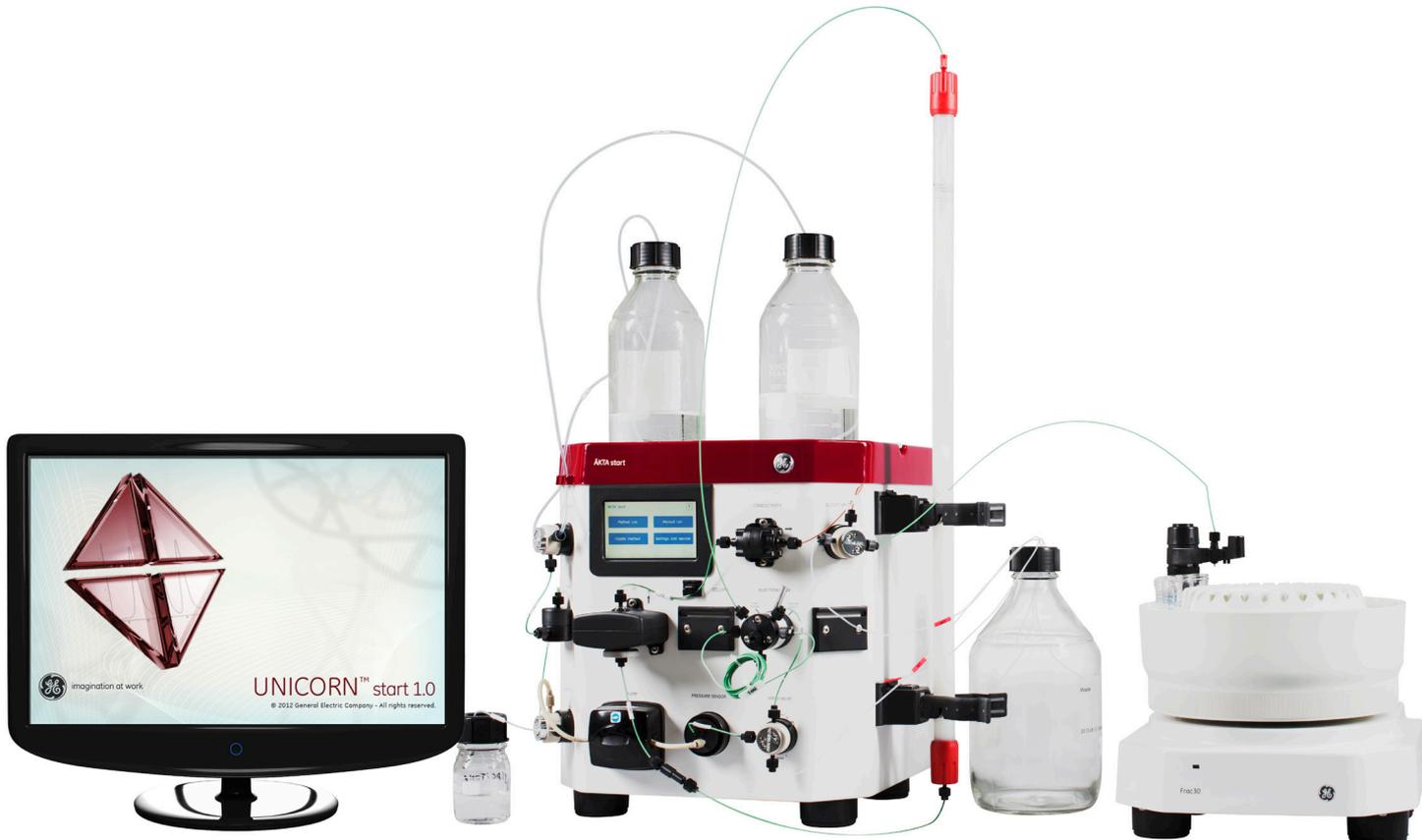


Fig 2. The ÄKTA start solution includes a stand-alone instrument with touchscreen display, the Frac30 fraction collector and user-friendly UNICORN start control software.

The ÄKTA start touchscreen display offers a range of options to meet your purification needs. ÄKTA start is run either by using a predefined **Quick start** method or template, or by creating your own method. Method templates are available for common applications such as purification of tagged or untagged recombinant proteins, antibodies, and native proteins. **Quick start** methods are optimized for use with prepacked chromatography columns such as the HiTrap™ and HiPrep™ families. Predefined methods are available for cleaning the system flow path and flow cells (UV, conductivity), as well as for testing the system performance.

Results can be stored on a USB memory stick and then easily viewed and analyzed using UNICORN start. Additionally the instrument provides the result in .bmp format to allow viewing of the generated result without UNICORN start.

The compact size of ÄKTA start provides another level of flexibility. With an effective operating range from +4°C to +35°C and a weight of only 8 kg, ÄKTA start makes it easy to transfer operations from laboratory bench to cold room depending on your needs. Flow rates range from 0.5 to 5 ml/min (operating range), with a wash flow rate of 10 ml/min, and a maximum pressure of 5 bar (0.5 MPa, 72 psi).

ÄKTA start standard modules

There are 10 modules placed on the wet side of ÄKTA start (Fig 3). The modules are interconnected by tubing, and function to deliver the liquid through the system flow path and divert the flow as required; and to monitor UV absorbance and conductivity of the liquids (Fig 4).

Part	Description
1	Buffer valve
2	Mixer
3	Sample valve
4	Pump
5	Pressure sensor
6	Wash valve
7	Injection valve
8	UV monitor
9	Conductivity monitor
10	Outlet valve

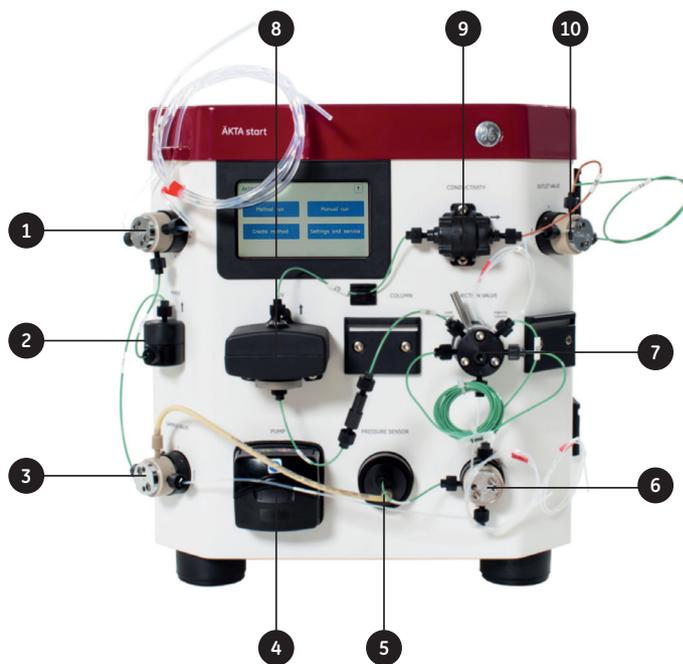


Fig 3. Locations of the modules placed on the wet side of ÄKTA start.

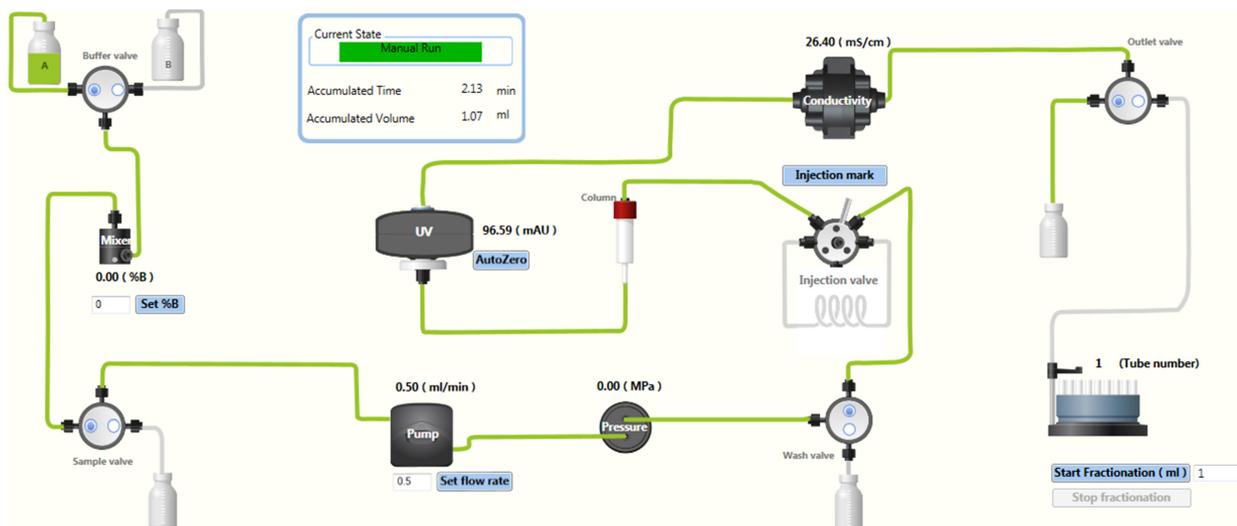


Fig 4. ÄKTA start process picture. The flow path contains valves, mixer, pump, pressure sensor, column, UV monitor, and conductivity monitor and collection option.

Pump

The single-channel, robust peristaltic pump consists of a four-roller pump head that delivers low pulsation. The accurate flow rates generated enable reproducible isocratic or gradient elution. The pump provides flow rates up to 5 ml/min (up to 10 ml/min when washing) at operating pressures of up to 5 bar (0.5 MPa, 72.5 psi). The system pump allows for unattended sample application and application of large sample volumes.

Mixer

The ÄKTA start mixer is a 0.4 ml static mixer used for blending buffers during gradient runs, ensuring reproducibility across purification runs.

Pressure sensor

The Pressure sensor reads the pressure in the flow path and senses overpressure, to ensure that columns are kept secure without compression of the bed.

UV monitor

ÄKTA start is equipped with a UV monitor to continuously measure the absorbance of the liquid in the UV flow cell at a fixed wavelength (280 nm). The UV monitor incorporates durable and reliable LED technology that is ready-to-use without any warm-up time. Moreover, the UV monitor does not generate any local heating of the flow cell, making it particularly suitable for heat-sensitive samples. The monitor is available with a 2 mm optical path length flow cell and gives linear absorbance up to 1.5 AU.

Conductivity monitor

The conductivity monitor continuously reads the conductivity of the liquid in the flow cell. The conductivity value is automatically calculated by multiplying the measured conductance by the cell constant of the flow cell taking the temperature effect into account. The cell constant is factory-calibrated and a built in temperature sensor continuously measures the temperature of the liquid in the flow cell.

Valves

The buffer, sample, wash, and outlet valves are 3-port solenoid type switch valves. The buffer valve is used as a switching valve for gradient formation. It enables the use of two buffers, A and B, which are required for forming gradient during runs. The sample valve allows either the buffer or the sample to enter the flow path. The sample valve enables the direct application of the sample onto the column using the pump. The outlet valve is used to direct the flow to the fraction collector, or to waste, and the wash valve is used to divert the flow path to waste when needed.

Manual injection valve

The manual injection valve is a 6-port rotary valve that is manually operated to transfer the preloaded sample onto the column. The sample loop (for the injection of small sample volumes [25 µl to 5 ml], or a Superloop™ injection loop for larger sample volumes [10 to 150 ml]), can easily be connected to the appropriate ports of the valve.

The injection valve is manually switched to positions **Load** (default) to allow loading of the sample into the sample loop using a syringe through Port 3, and **Inject** to transfer the sample from the loop on to the column during a chromatography run (Fig 5).

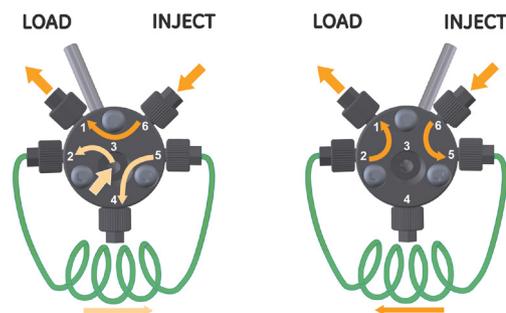
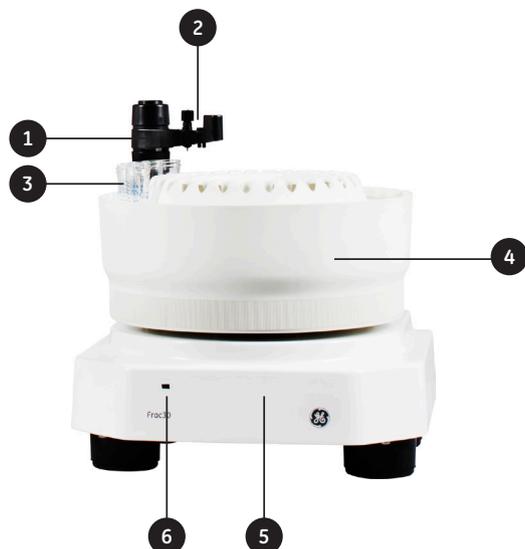


Fig 5. The different positions of the manual injection valve. The injection valve position can be changed manually by turning the lever to the left (Load position) or the right (Inject position).

Frac30 fraction collector



Description	Function
1 Dispenser arm	Holds and positions the tubing holder nozzle for dispensing the liquid into fractions
2 Tubing holder	Holds the tubing used for dispensing the liquid fractions into the collection tubes
3 Collection tubes	Tubes used to collect the fractions
4 Bowl assembly	Holder for collection tubes, which supports tubes of four sizes
5 Base unit	Case for electromechanical assembly and holder for the bowl assembly
6 LED	Power on indicator

Fig 6. Frac30 is a round fraction collector that can accommodate four different fractionation tube sizes.

ÄKTA start can be equipped with Frac30, a round fraction collector (Fig 6) that is controlled through either the ÄKTA start touchscreen display or through UNICORN start. Frac30 allows you to collect up to 30 fractions and supports four tube sizes, ranging from 1.5 to 15 ml. Fractions can be automatically collected in volumes ranging from 0.5 to 15 ml. The entire fraction collector rack can be easily removed and used for storage of purified samples.

Table 1. Examples of **Quick start** methods

Method	Chromatography technique	Details
AC step 1 ml HiTrap AC step 5 ml HiTrap	AC	Bound proteins are eluted in a single step, using an elution buffer. Commonly used for purification of tagged proteins, e.g. histidine-tagged proteins
DS 5 ml HiTrap DS 53 ml HiPrep	DS	Desalting or buffer exchange is performed in a single step
IEX step 1 ml HiTrap IEX step 5 ml HiTrap	IEX	Bound proteins are eluted using two buffers (A and B) with a single-step gradient between buffer A and Buffer B
IEX gradient 1 ml HiTrap IEX gradient 5 ml HiTrap	IEX	Bound proteins are eluted using two buffers (A and B) with linear increase in the concentration of Buffer B over a specified time
GF 16/60 HiPrep	GF	Desalting or buffer exchange is performed in a single step

Note: It is recommended to use the appropriate column as indicated in the template. For example, use a HiTrap 1 ml column when selecting AC/IEX step 1 ml HiTrap or a HiTrap 5 ml column when selecting AC/IEX step 5 ml HiTrap.

System operations

Touchscreen display

The ÄKTA start main screen displays options for the user to select and perform operations (Fig 7).

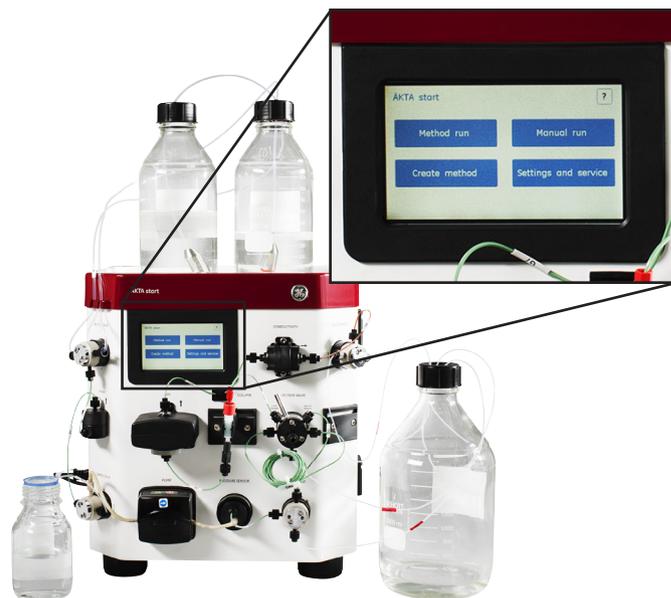


Fig 7. The ÄKTA start touchscreen display is simple and easy to use. The home screen page provides four alternatives to meet your needs. **Method run**, **Manual run**, **Create method** and **Settings and service**.

1) Method run: For running predefined methods. There are four options:

a) Quick start. Templates comprising “ready-to-run” methods to purify the most common proteins based on affinity chromatography (AC), ion exchange chromatography (IEX), gel filtration (GF), and desalting (DS) techniques. Examples are provided in Table 1. Run parameters like column volume, flow rate, equilibration, elution mode, and fractionation volume are predefined in the method. The user only needs to enter the sample volume to be loaded on to the column and to ensure that a USB memory stick is connected to the system. When using **Quick start** methods samples are loaded through the Pump.

b) Templates. ÄKTA start provides four method templates based on the most commonly used protein purification techniques (AC, DS, IEX, and GF). The templates are provided with default run parameters that can be changed to suit the desired run conditions. New methods can be created and saved from these predefined templates using **Create method** option.

c) User-defined. Allows a run based on a user-defined method. Displays the methods previously created by the user.

d) Prepare system. ÄKTA start has built-in, predefined methods for preparation and cleaning of the system, preparation of a column and system performance tests. The **Prepare system** methods can be used to clean the entire system flow path when needed, and to fill the system with storage solution when the instrument is not going to be used for a long period of time.

2) Manual run: For starting and real-time control of ÄKTA start. The run parameters are configured and the ongoing run is controlled through manual operation, by tapping the touchscreen display.

3) Create method: For creating new methods, editing, or deleting existing user methods. Also used for importing methods stored on a USB memory stick connected to the instrument.

4) Settings and service: For configuring, calibrating, and troubleshooting as well as diagnosing individual parts of ÄKTA start (Fig 8). For the listed components, important diagnostic tests, calibration settings, and self-serviceable maintenance routines are available.

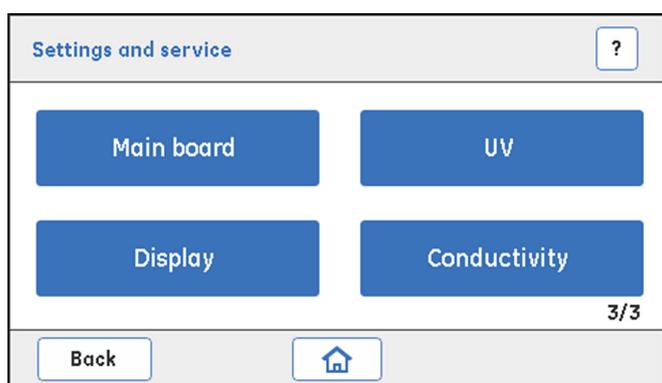


Fig 8. A wide range of settings and service options are available for ÄKTA start, easily accessed from the display. The help button [?] provides guidance for the active page.

UNICORN start 1.0 control software

UNICORN start includes four different modules: **System Control**, **Method Editor**, **Evaluation**, and **Administration**, allowing you to design runs, operate the ÄKTA start instrument, and to evaluate and share results. While ÄKTA start can function as a stand-alone system controlled from the the touch screen, UNICORN start maximizes the performance of the instrument.

The software offers a simple and intuitive method editor for creating custom methods, easier system controls with process picture map and real-time monitoring of the manual and method runs, and a simplified evaluation module to evaluate and compare results. The software also enables you to create and print PDF reports and manage data.

System Control

The **System Control** module is used to perform and monitor manual, automated predefined, or user-defined chromatography method runs. During the run, a real-time chromatogram is displayed, depicting the complete run with curves including UV, conductivity, system flow, gradient concentrations, fraction marks, run logs, and pressure (Fig 9).

System Control module enables you to run predefined methods such as the **Quick start** templates, and **Prepare System** methods. **System Control** also enables you to perform system performance tests and generate system error reports.

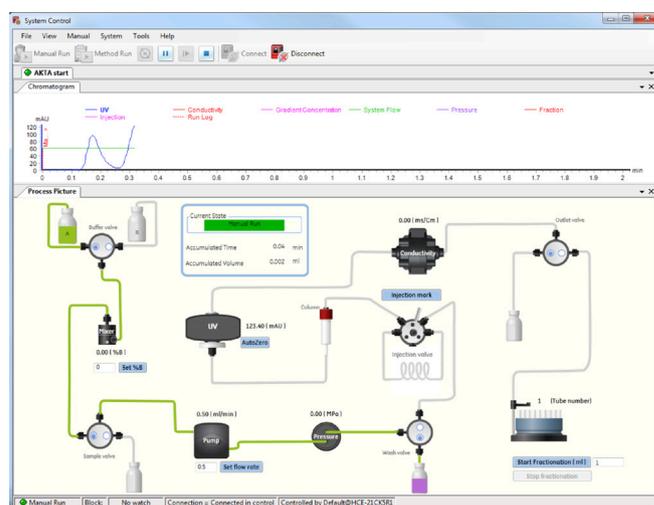


Fig 9. The **System Control** flow scheme represents the real-time flow path with indications of the different modules on the wet side of the instrument. The current run status of the system is displayed, together with the real-time chromatogram. The instrument can be controlled via clicks on the flow path, for example, to turn the valves, set flow rates, change buffer B concentrations, and start/stop fractionation.

Method Editor

The **Method Editor** module can be used for creating methods from predefined templates like **Affinity**, **Ion Exchange**, **Gel Filtration**, and **Desalting**. Customized methods can be created simply by dragging and dropping chromatography phases such as **Prime and Equilibration**, **Sample Application**, **Wash Out Unbound**, **Elution** and **Fractionation** from the phase library (Fig 10). Methods can be run directly from the **System Control** module or simply transferred to a USB memory stick and imported into ÄKTA start if the system is being used as a stand-alone unit (i.e. the system is not connected to the computer).

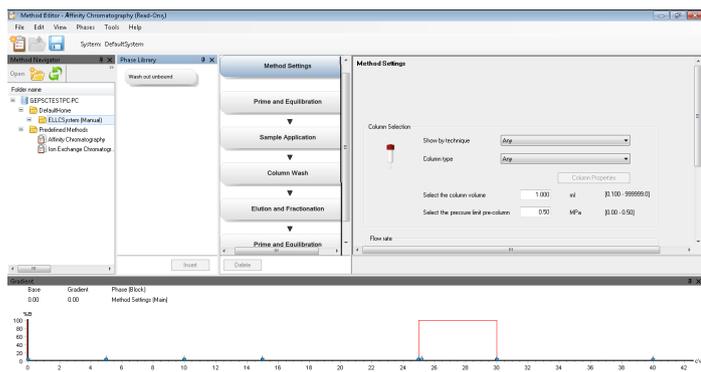


Fig 10. The user interface of the Method Editor. Customized methods can be created simply by dragging and dropping options from the display.

Evaluation

The **Evaluation** module is used to manage and evaluate the results from chromatography runs (Fig 11). A result is automatically generated at the end of a run and contains a complete record, including control method, system settings, monitored data, and run log. The **Evaluation** module allows you to compare two curves or chromatograms, perform peak integration analysis, and create and print PDF reports. Results from ÄKTA start can be imported via a USB memory stick.

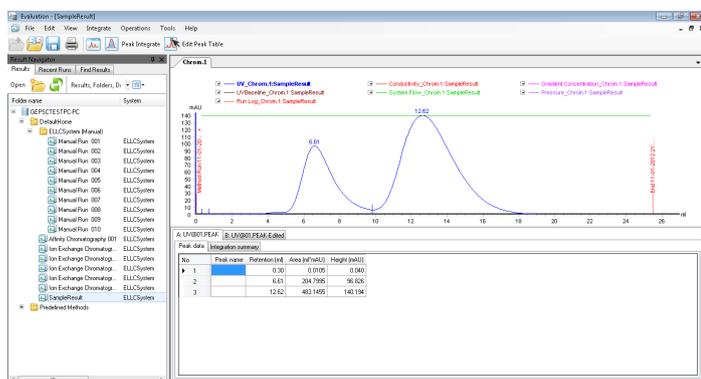


Fig 11. The user interface of the Evaluation module.

Administration

The **Administration** module is used for accessing the UNICORN start database for backup, restore, archive and retrieve operations. The **Administration** module also allows for reviewing the UNICORN start and system logs.

Prepacked columns

GE Healthcare offers a wide range of high-quality chromatography media (resins), columns, and application-specific packages for tagged proteins, antibodies, and native or untagged recombinant proteins. The **Quick start** methods in ÄKTA start are optimized for use with members of the HiTrap and HiPrep families of columns (Fig 12).

HiTrap 1 and 5 ml columns are prepacked with a wide range of media for purification using various chromatography techniques. **Quick start** methods using HiTrap columns are available for AC, IEX, and DS. HiTrap columns are designed for high quality performance and reproducibility, and the column holders and design of ÄKTA start makes it easy to connect the columns.



Fig 12. GE Healthcare Life Sciences offers a wide range of prepacked columns, such as HiTrap columns, to help you with protein purification.

HiPrep prepacked columns are designed for convenient scale-up purification. Gel filtration applications using HiPrep Sephacryl™ columns allow you to polish your sample, resulting in a pure and size homogeneous target protein. The HiPrep Desalting column is also supported by ÄKTA start and has a column volume of 53 ml for convenient desalting/buffer exchange of sample with volumes up to 15 ml. Other columns supported by ÄKTA start include HiTrap™, StrepTrap™, MBPTrap™, GSTrap™, and HiLoad™ columns.

System specifications

System configuration	Bench-top system
System control	Instrument display and/or UNICORN start
Connection between PC and instrument	USB
Dimensions (W × H × D)	340 × 360 × 280 mm
Weight (excluding packaging)	8 kg
Power supply	100 to 240 VAC, 50 to 60 Hz
Power consumption	95 VA
Enclosure protective class	IP21
Fuse	Fast blow glass tube type, F5AL250V

Tubing and connectors

Inlet	PTFE tubing, 1.6 mm i.d., 5/16-24 UNF connections
Buffer valve to pump	PEEK tubing, 0.75 mm i.d., 10-32 UNF connections
Pressure sensor to conductivity	PEEK tubing, 0.75 mm i.d., 10-32 UNF connections
Conductivity to outlet valve	PEEK tubing, 0.50 mm i.d., 10-32 UNF connections
Outlet valve to Frac30	PEEK tubing, 0.75 mm i.d., 10-32 UNF connections
Outlet and waste	ETFE tubing, i.d. 1.0 mm, Fingertight connector, 1/16"
Sample tubing	ETFE tubing, i.d. 0.75 mm, Fingertight connector, 1/16"
Pump tubing	Marpren tubing, 0.80 mm i.d.

Equipment noise level

ÄKTA start	< 60 dB A
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Environmental ranges

Storage and transport temperature range	-25°C to +60°C
Chemical environment (relative humidity)	20% to 80%, noncondensing

Operating range

Operating temperature range	+4°C to +35°C
Relative humidity	20% to 80%, noncondensing

Technical specifications

Pump

Pump type	Peristaltic pump. Single channel, Four roller pump head with low pulsation
Flow rate	0.5 to 5 ml/min (operating range) 10 ml/min (wash flow)
Flow rate specifications	Accuracy: Flow rate \leq 1 ml/min: \pm 15% Flow rate $>$ 1 ml/min: \pm 10% Precision: Flow rate \leq 1 ml/min: \pm 15% Flow rate $>$ 1 ml/min: \pm 10% Condition: 0.8 to 2 cP and fresh pump tubing
Pressure range	0 to 5 bar (0.5 MPa, 72 psi)
Viscosity range	0.6 to 5 cP

Mixer

Mixing principle	Static mixer
Mixer volume	0.4 ml

Valves: buffer valve, sample valve, wash valve, and outlet valve

Type	Solenoid-type switch valve
Number of ports	3 ports. Buffer valve and sample valve: 2 in – 1 out Wash valve and outlet valve: 1 in – 2 out

Injection valve

Type	Rotary-type manual valve
Function	Sample injection through loop
Number of ports	6

Gradient formation

Gradient flow rate range	0.5 to 5 ml/min
Gradient composition accuracy	\pm 5% Conditions: 5% to 95% buffer B, 1 to 5 ml/min, 0.8 to 2 cP and fresh pump tubing

Pressure sensor

Placement of sensor	Pressure sensor is located after the pump
Range	0 to 5 bar (0.5 MPa, 72 psi)
Accuracy	\pm 0.5 bar (0.05 MPa, 7.2 psi)

UV monitor

Wave length range	280 nm \pm 3 nm, single wavelength
Absorbance range	-0.1 to +2 AU
Linearity	Within \pm 5% up to 1.5 AU
Operating pressure	0 to 5 bar (0.5 MPa, 72 psi)
Flow cell	2 mm optical path length, 2 μ l cell volume (default)

Conductivity

Conductivity range	0 to 300 mS/cm
Resolution	1 mS/cm
Accuracy	\pm 5% or \pm 2 mS/cm (whichever is greater)
Operating pressure	0 to 5 bar (0.5 MPa, 72 psi)
Flow-cell volume	22 μ l
Temperature monitor range	4°C to 35°C
Temperature monitor accuracy	\pm 10% or \pm 5°C (whichever is greater)

Module options

Frac30 fraction collector

Number of fractions	Up to 30
Vessel type	Supports tube sizes: 1.5 ml/2 ml microcentrifuge tubes 5 ml tubes (12 \times 75 mm) 12 ml tubes (17 \times 100 mm) 15 ml tubes (17 \times 118 mm)
Fraction volumes	0.5 to 15 ml
Flammable liquids	No
Delay volume (UV to Dispenser head)	0.49 ml
Dimensions (W \times H \times D)	270 \times 285 \times 280 mm
Weight	5 kg

Ordering information

To order visit www.gelifesciences.com/AKTA

Product	Code number
ÄKTA start	29-0220-94

Optional modules

Frac30	29-0230-51
UNICORN start 1.0 control software	29-0187-51

Accessories

Pump

Marprene tube	29-0240-12
Peristaltic pump	29-0239-92

Solenoid valve

Buffer valve	29-0238-95
Sample valve	29-0238-96
Wash valve	29-0238-97
Outlet valve	29-0238-98

Manual injection valve

Injection valve, manual	29-0239-58
Valve kit, manual INV	29-0239-17

Mixer

Mixer, ÄKTA start	29-0239-60
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UV

UV module, ÄKTA start	29-0240-18
Flow-cell 2 mm, UPC-900	29-0113-25

Conductivity

Conductivity cell, ÄKTA start	29-0240-21
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Sample loops

Sample loop 10 μ l, PEEK,	18-1120-39
Sample loop 100 μ l, INV-907	18-1113-98
Sample loop 500 μ l, INV-907	18-1113-99
Sample loop 1 ml, INV-907	18-1114-01
Sample loop 2 ml, INV-907	18-1114-02
Sample loop 5 ml, PEEK	18-1140-53

Superloop (10, 50, and 150 ml)

Superloop 10 ml ÄKTA	18-1113-81
Superloop 50 ml ÄKTA	18-1113-82
Superloop 150 ml	18-1023-85

Fittings	Code number
Tubing connector 1/8"	18-1121-17
Ferrule for 1/8" tubing	18-1121-18
Union Luer female/HPLC male	18-1112-51
Fingertight connector 1/16"	18-1112-55
Stop plug 1/16", PKG/5	18-1112-52
Stop plug, 5/16", PKG/5	18-1112-50
Union, 1/16" female/1/16" female, for 1/16" o.d. tubing, titanium	18-3855-01
Union Valco™ F/F	11-0003-39

Tubing	Code number
Inlet tubing kit, ÄKTA start	29-0240-32
Complete tubing kit, ÄKTA start	29-0240-34
PEEK tubing, i.d. 0.75 mm (1/16")	18-1112-53
PEEK tubing, i.d. 1.0 mm (1/16")	18-1115-83
PEEK tubing, i.d. 0.5 mm/o.d. 1/16"	18-1113-68

Cables	Code number
Mains cable 115 V	19-2447-01
Mains cable 220 V	19-2448-01
Cable assy OTH USB	29-0240-36

Miscellaneous	Code number
Inlet filter assembly	18-1113-15
Inlet filter set	18-1114-42
Screw lid kit, ÄKTA	11-0004-10
Tubing cutter	18-1112-46
Column clamp, o.d. 10–21 mm	28-9563-19
Short column holder	18-1113-17
T-Slot holders	29-0240-38
Buffer tray	29-0240-39
Accessory box	29-0240-37

Frac30 fraction collector	Code number
Drive sleeve	19-6067-02
Tubing holder	18-6464-01
Frac30 bowl assembly	29-0240-45

Cables	Code number
Frac30 cable assembly	29-0240-65

Related literature	Code number
Purification of N-terminal histidine-tagged protein using ÄKTA start, Application note	29-0642-77
Depletion of albumin from serum samples using AKTA start, Application note	29-0642-95
Purification of GST-tagged protein using ÄKTA start, Application note	29-0642-98
Purification of antibodies using AKTA start and HiTrap Protein G HP column, Application note	29-0643-02
Prepacked chromatology columns for ÄKTA systems, Column selection guide	28-9317-78
ÄKTA start brochure	29-0652-18

Support and service

ÄKTA start comes with a variety of service support documentation including service agreements.

Please contact your GE Healthcare Sales or Service representative for details.



Purifying proteins? Get help to find suitable columns and accessories from the Purify and ÄKTA apps.

www.gelifesciences.com/purify

For local office contact information, visit www.gelifesciences.com/contact

www.gelifesciences.com/AKTA

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