ÄKTAFPLC

High-performance purification of proteins

Fast and easy protein purification

- method wizard for easy programming
- comprehensive column library
- automatic scouting for purification development and optimization
- short separation times with modern media

Reliability in every run

- consistent reproducibility with high sensitivity
- efficient fraction collection
- automatic evaluation and report procedures
- easy, fast scale-up

Flexibility for any purification

- easy system modification
- all chromatographic techniques

ÄKTAdesign support

Introduction

ÄKTA™FPLC™ is a biocompatible, high performance liquid chromatography system for fast and easy purification of proteins. The unique design provides a compact, ready to use chromatography system (Fig 1) with an expandable rack (Fig 2). The rack system gives built-in flexibility for the use of longer chromatographic columns, changes in system configuration, and increased automation.

ÄKTA FPLC is controlled by UNICORN™, the control, evaluation, and reporting platform for ÄKTA™design systems, ensuring quick and simple communication between systems and users. UNICORN control system is designed for Windows NT™/Windows 2000 and includes an option for network control of multiple systems.

ÄKTA FPLC is compatible with all solvents commonly used in protein purification, including the high salt concentrations used in hydrophobic interaction chromatography.
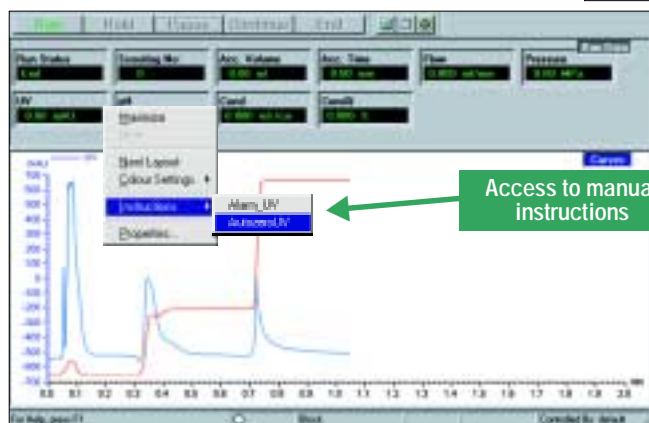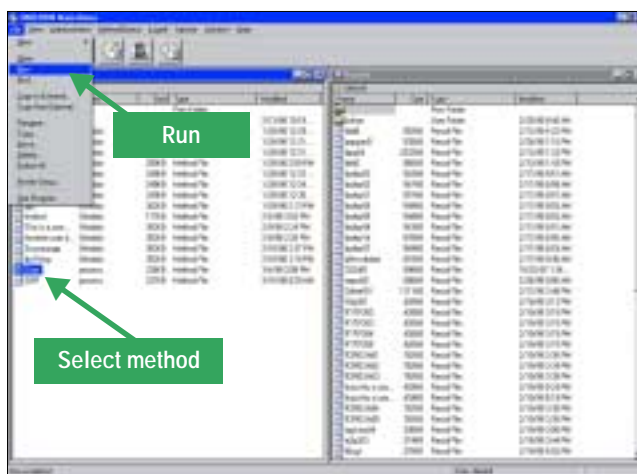

Fig 1. ÄKTAFPLC system.

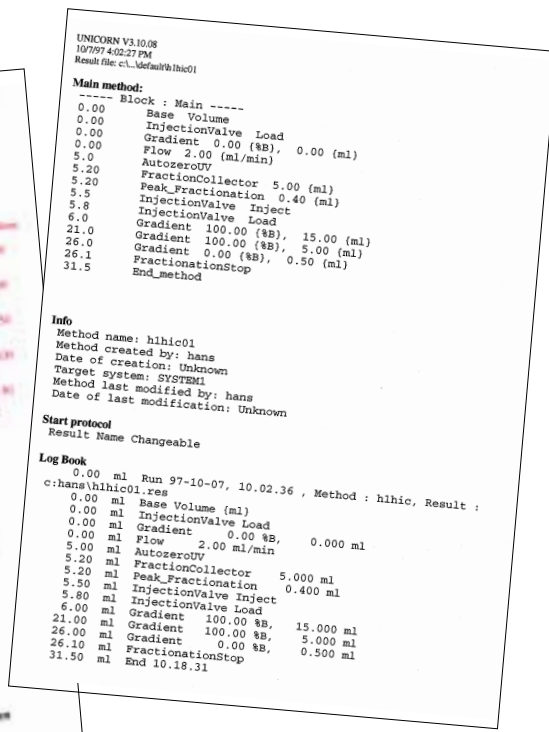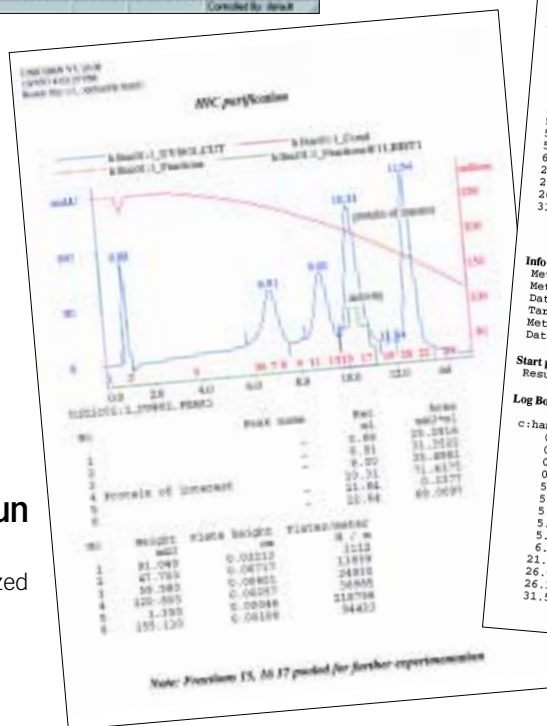**Fig 2.** Rack system provides built-in flexibility.

Amersham
Biosciences

Fast and easy protein purification

Begin work immediately

See the real-time status of the run

Direct access to manual instructions via run data or system flow path

Reliability in every run

Evaluate and produce customized reports automatically

**Fig 3.** Protein purification is fast and easy using the UNICORN control platform.

Flexibility for any protein purification

Clarified *E. coli* extract, enzyme (DAOCS) purification
HiPrep™ 16/10 Q XL
10 ml/min
Buffer A: 50 mM Tris-HCl, 1 mM EDTA, 2 mM DTT, 0.2 mM PMSF
Buffer B: Buffer A + 1 M NaCl
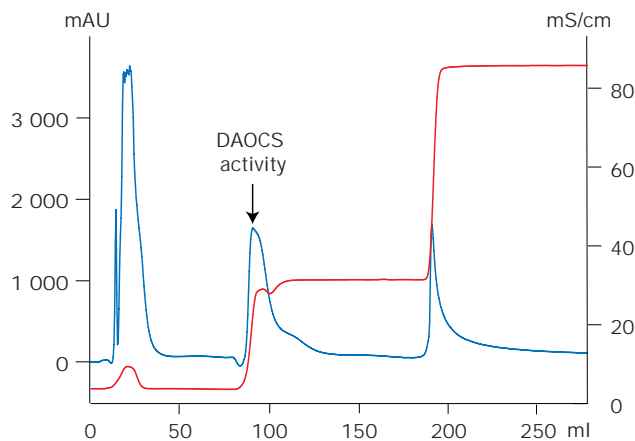
Fig 4A. Anion exchange purification of recombinant enzyme (DAOCS) using a step elution of increasing ionic strength.

Cell culture supernatant, mouse IgG_{2a}
HiTrap™ rProtein A, 1 ml
1 ml/min
Binding buffer: 100 mM Na_2PO_4, pH 7.7
Elution buffer: 100 mM sodium citrate, pH 3.3
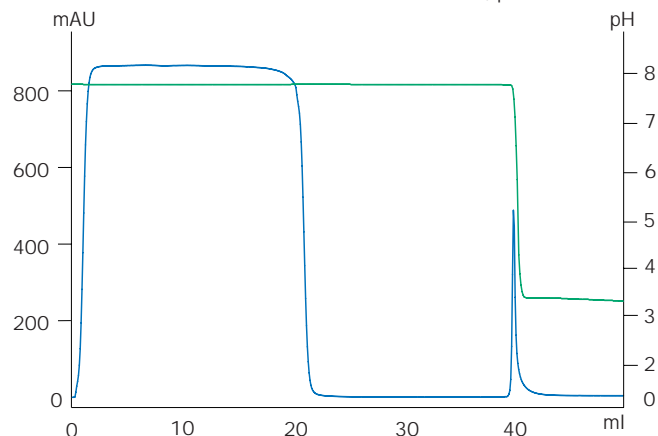
Fig 4B. Affinity purification of mouse monoclonal IgG_{2a} using pH elution.

Clarified *E. coli* extract, enzyme (DAOCS) purification
HiTrap HIC Test Kit
3 ml/min
Buffer A: 50 mM Tris-HCl, 1 mM EDTA, 1 mM DTT, pH 7.5
Buffer B: Buffer A + 2 M $(NH_4)_2SO_4$
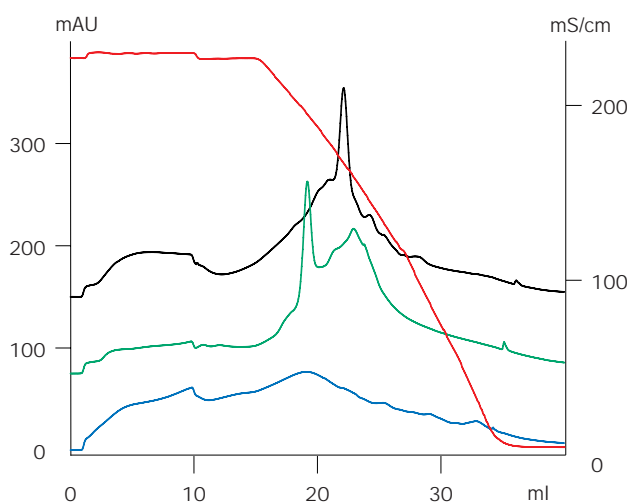
Fig 4C. Media scouting for hydrophobic interaction purification of recombinant enzyme (DAOCS) using gradient elution.

Protein standards:
chymotrypsinogen A
ovalbumin
albumin
Superdex™ 200 HR 10/30
0.5 ml/min
Buffer: 50 mM sodium phosphate,
150 mM NaCl, pH 7.4
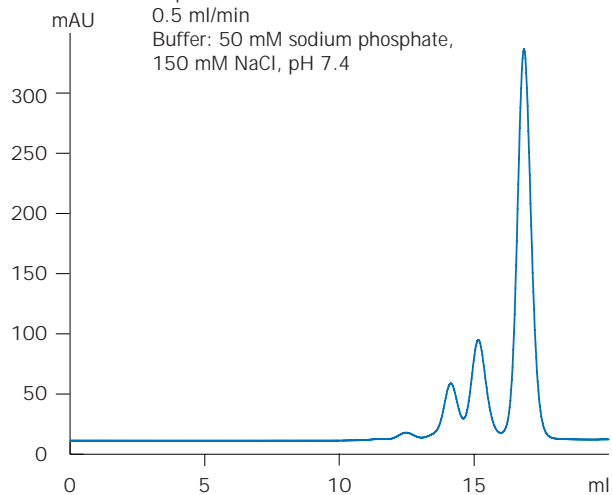
Fig 4D. Gel filtration using isocratic elution.

Fast and easy protein purification

– method wizard for easy programming

Fig 5. Start established method immediately (or create a new method in less than 3 minutes).

Fig 6. Simple input of chromatographic parameters.
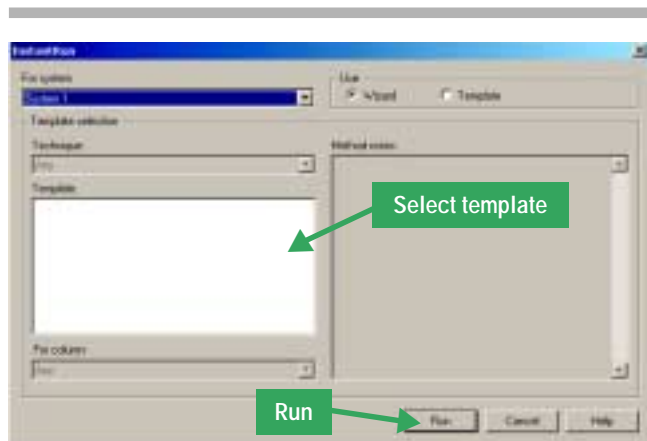
Figure 5 and 6 shows how fast you can start an existing method and the simplicity of programming ÄKTA FPLC using the method wizard.

The method wizard in ÄKTA FPLC provide a unique combination of flow configuration and methods support for all chromatographic techniques:

- Gel filtration (size exclusion) chromatography
- Anion exchange chromatography
- Cation exchange chromatography
- Hydrophobic interaction chromatography
- Affinity chromatography

The method wizard is based on extensive and well-documented work in our laboratories and can be used directly. Using input parameters as for example, components in use, flow rate, sample volume or gradient, the wizard builds up the method to fit your needs.

All column specifications

Create your own library

Choose any column

Methods are automatically adapted to your new column

Fig 7. Comprehensive column library ensures optimum running conditions.
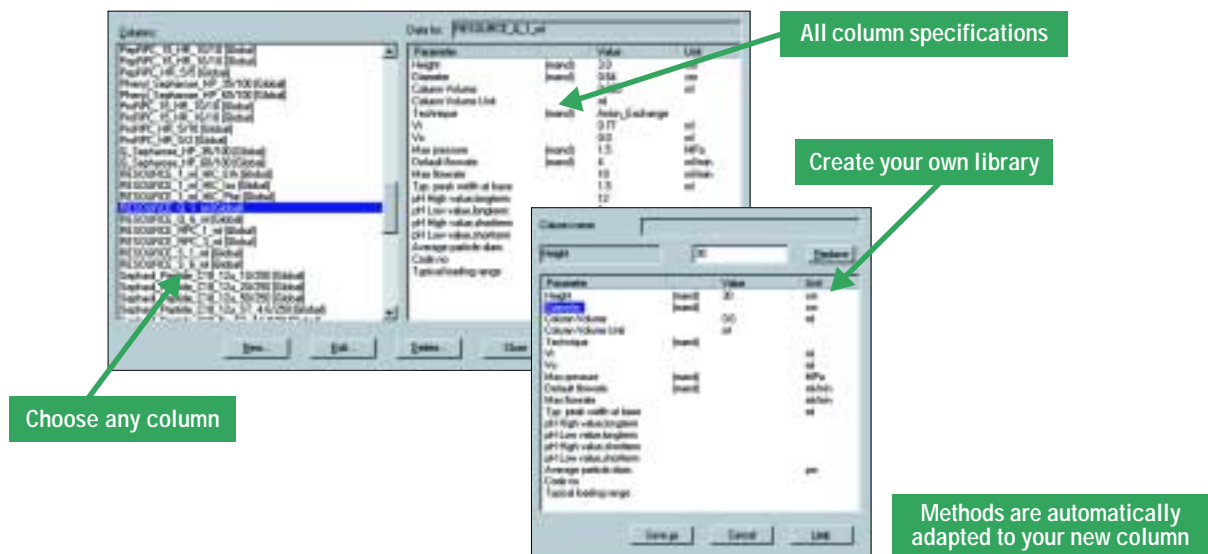
– comprehensive column library

For simple, safe column selection ÄKTA_{FPLC} contains an extensive column library that includes details of run parameters for each prepacked column. The user selects a column and ÄKTA_{FPLC} automatically sets these run parameters, such as column volume, flow rate, and pressure limit, into the method wizard (Fig 7). This procedure allows immediate, optimal use of the column without any previous special knowledge or experience, and protects columns from damage, such as overpressure. If required, running conditions are adjusted by simple method editing. New columns can be added to the library and run in the same secure way (Fig 7).

– automatic scouting for purification development and optimization

Development and optimization of a purification often involve systematic variation of key run parameters, for example, binding and elution buffers, sample loading volume or flow rates. ÄKTA_{FPLC} includes scouting schemes within each general method template that eliminate the need for creating new methods for each set of parameters. These scouting schemes make it easy to systematically vary any parameter in repeated automated runs (Fig 8).

Fig 8. Automatic scouting during purification development and optimization. Example shows scouting for flow rate, sample volume, and gradient length.

– short separation times with modern media

ÄKTA_{FPLC} provides fast and reliable protein purification using modern high-performance media. Figure 9 shows an example of gradient optimization using a RESOURCE ion exchange column (1 ml). Each run is performed in less than 3 minutes.

Protein standards: α-lactalbumin, α-amylase. amyloglucosidase, catalase
RESOURCE™ Q, 1 ml
8 ml/min
Buffer A: 20 mM Tris pH 8.0
Buffer B: Buffer A + 500 mM NaCl
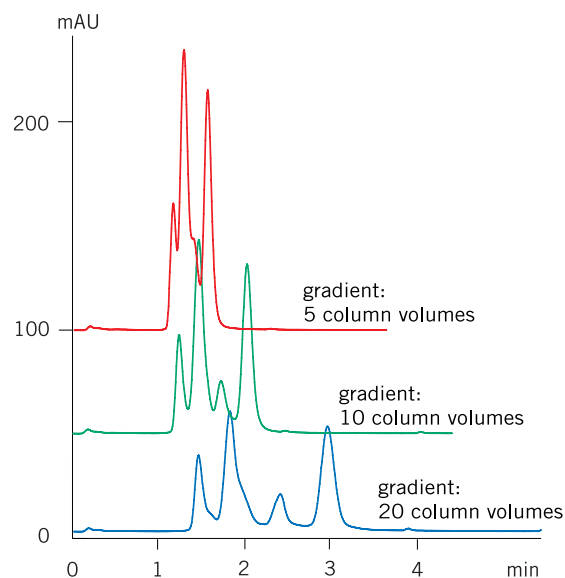

Fig 9. ÄKTA_{FPLC} runs modern media at optimum flow rates.

Reliability in every run

– consistent reproducibility with high sensitivity

Figure 10 shows typical examples of ÄKTA_{FPLC} system performance.

ÄKTA_{FPLC} is designed to ensure consistently reproducible results:

- Automatic self diagnostic tests check performance at every system start
- Full biocompatibility ensures high recovery of biological activity
- An optimized flow path minimizes band-broadening effects
- Pump P-920 generates accurate, reproducible flow rates and gradients
- Accurate on-line monitoring of UV, conductivity, and pH (pH flow cell optional accessory) shows true conditions during a separation
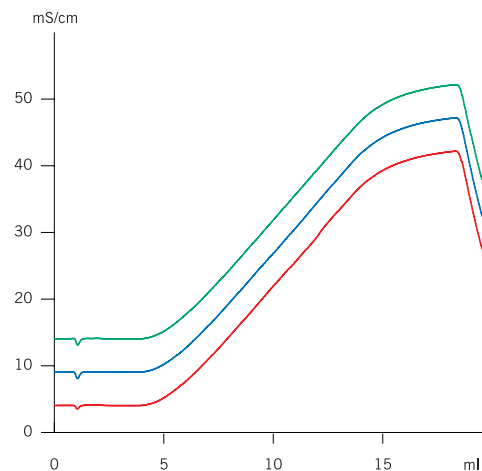
Fig 10A. Reproducibility of gradient formation monitored by UPC-900 conductivity monitor.

Protein standards: ovalbumin, β-lactoglobulin
Mono Q™ HR 5/5
1 ml/min
Buffer A: 20 mM TrisHCl, 150 mM NaCl, pH 7.0
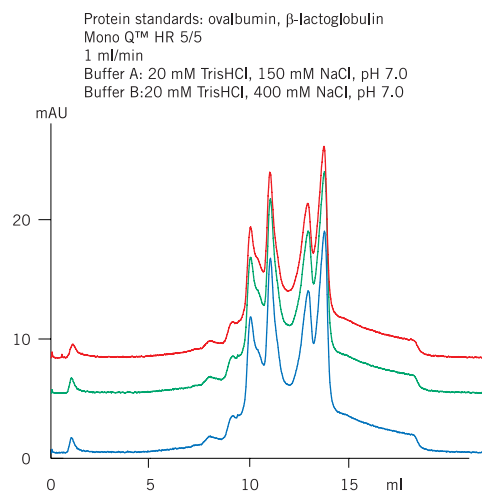Buffer B: 20 mM TrisHCl, 400 mM NaCl, pH 7.0

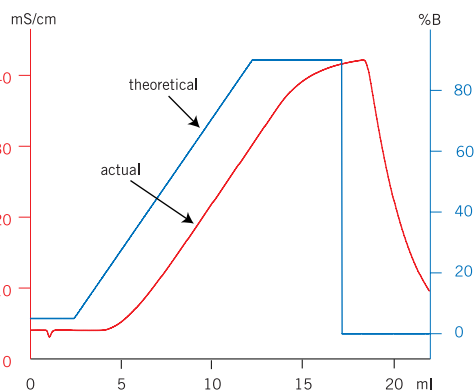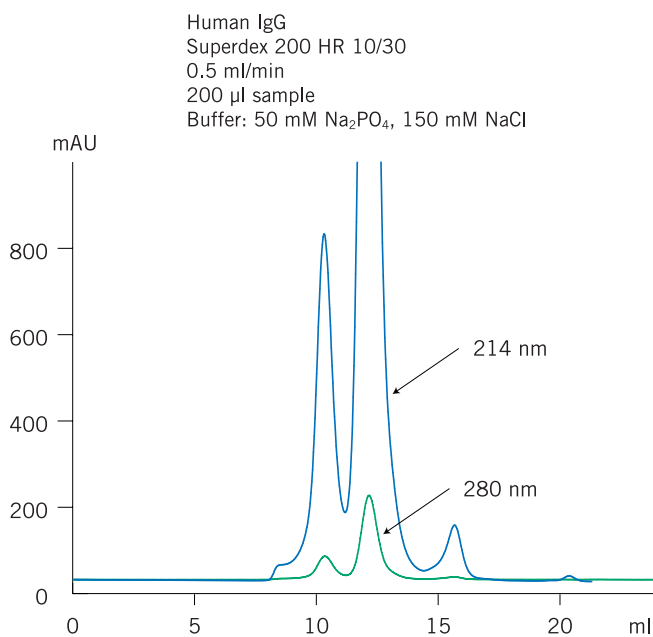**Fig 10B**. Reproducibility of chromatographic separations monitored at 280 nm.

Fig 10C. Accuracy of gradient formation compared to theoretical gradient.
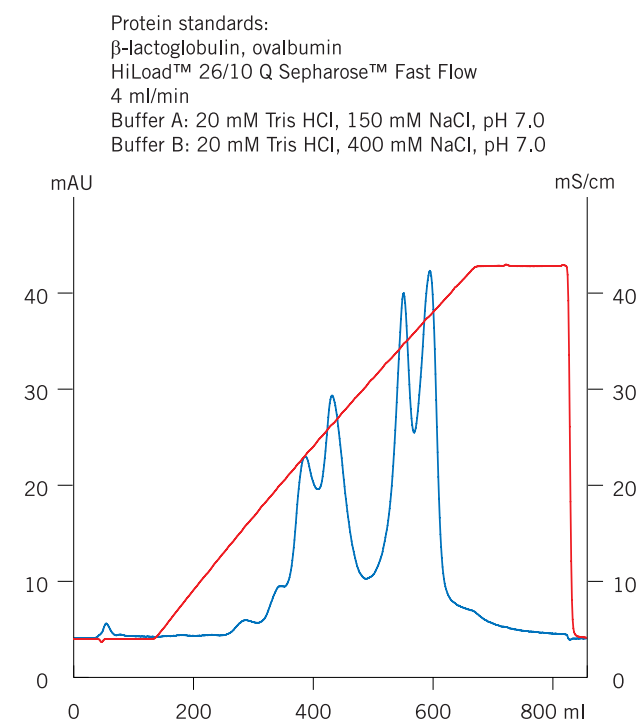
Selection of the correct wavelength for detection of the target protein is essential to achieve highest selectivity and sensitivity. ÄKTA_FPLC allows detection at 280 nm and 254 nm, suitable for most protein and nucleic acid separations. An option to use 214 nm increases the sensitivity of detection by approximately 20 fold (Fig 11). Other wavelengths are available for special applications.

Human IgG
Superdex 200 HR 10/30
0.5 ml/min
200 µl sample
Buffer: 50 mM Na_2PO_4, 150 mM NaCl

mAU

214 nm

280 nm

Fig 11. Detection at 214 nm increases sensitivity (UV traces superimposed from two separate runs).

– easy, fast scale up

UNICORN enables direct transfer of optimized purification methods to larger scale columns. The system flow rate range, up to 20 ml/min, together with a maximum pressure limit of 5 MPa allows the use of modern high-performance media, as well as, media which generate very low back pressures. Sample volumes up to several litres can be applied through the system pump or Sample Pump P-950 can be used for flow rates up to 50 ml/min (pressure limit 1 MPa). Figure 12 shows a large-scale separation using a HiLoad 26/10 Q Sepharose Fast Flow column (50 ml).

Protein standards:
β-lactoglobulin, ovalbumin
HiLoad™ 26/10 Q Sepharose™ Fast Flow
4 ml/min
Buffer A: 20 mM Tris HCl, 150 mM NaCl, pH 7.0
Buffer B: 20 mM Tris HCl, 400 mM NaCl, pH 7.0

mAU   mS/cm

Fig 12. Flow rates compatible with larger scale separations.

– efficient fraction collection

Frac-950 offers two independent ways to prevent sample loss. At low flow rates, fraction changes can be timed to occur between drops (drop synchronization) and at high flow rates, liquid flow can be diverted to an accumulator during the time it takes to move to the next collection position. It also offers the highest flexibility in the choice of collection mode, from microplates to large 250 ml vessels or even funnels for unlimited fraction size. A recycle function enables collection from repetitive runs. Automatic peak fractionation minimizes peak dilution and cross-contamination (Fig 13) while unwanted eluent is diverted to waste.
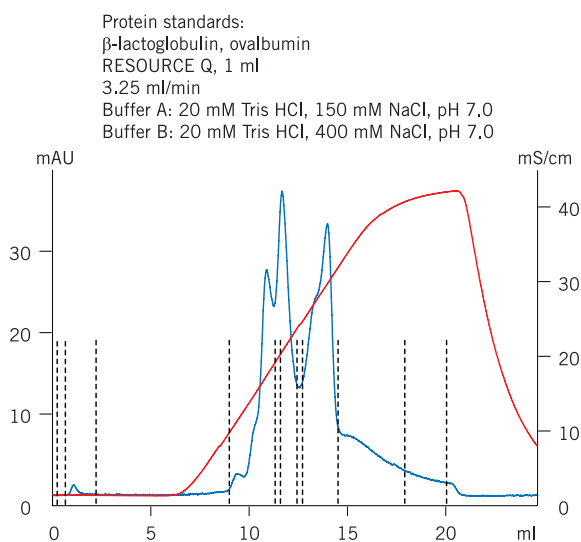

Fig 13. Efficient fraction collection using automatic peak fractionation.

– automatic evaluation and report procedures

Extensive data evaluation is available. For automatic data processing and report generation the evaluation procedures can be included as part of a programmed method.

A UNICORN analysis module can be added to the evaluation module offering:

- Quantification by internal or external standards
- Determination of molecular weight by gel filtration
- Quantification of sample amount and sample concentration
- Recovery calculations

Figure 14 shows an example of molecular weight estimation using UNICORN analysis module. Procedures and reports are easily customized to suit individual user needs.

All data from a run are stored in a single Result File, together with the method, start protocols and run log. Original data are protected and cannot be manipulated, an essential requirement when working to GLP (Good Laboratory Practice).
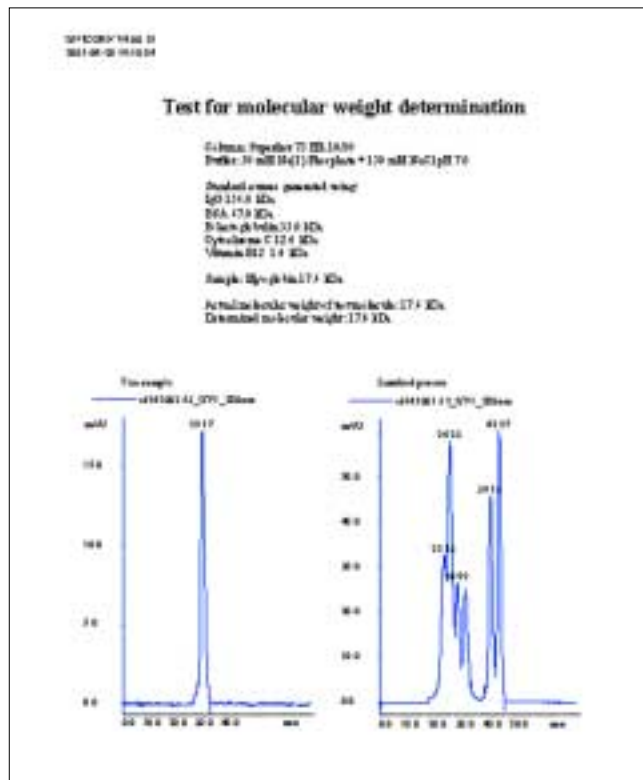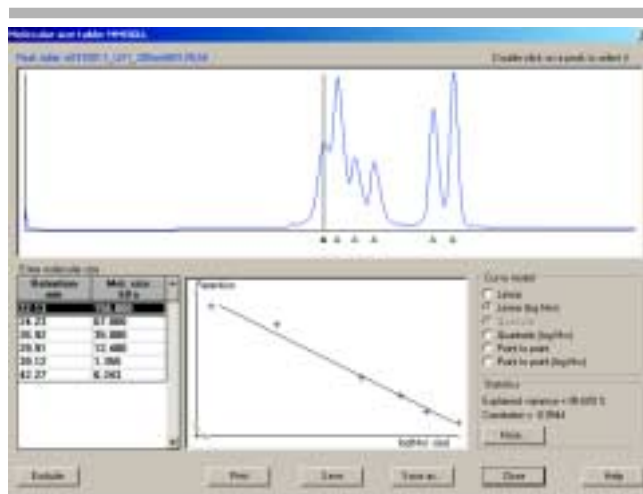

Fig 14. Molecular weight estimations using UNICORN analysis module and customized reporting.
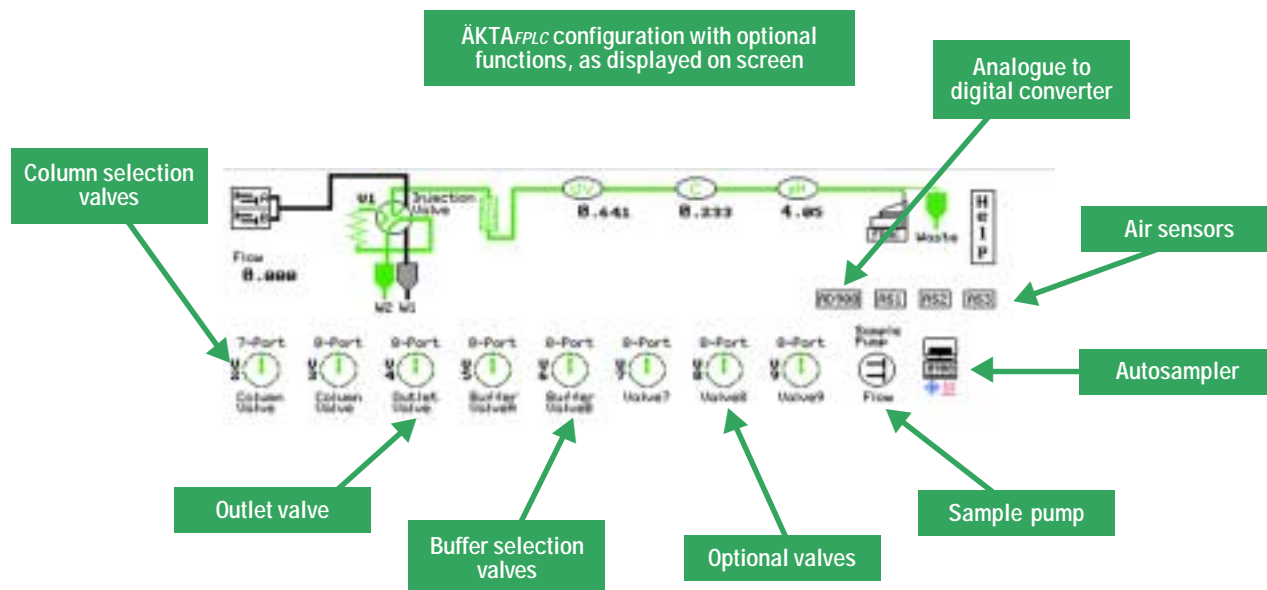
Fig 15. Additional equipment is easily added to an ÄKTAFPLC system.

Flexibility for any protein purification

– easy system modification

New functions are easily added to ÄKTAFPLC (Fig 15) to enhance system capabilities and create new system configurations as required.

Functions, consisting of both hardware components and software instructions, are selected, installed, and implemented by the user. UNICORN controls and monitors new functions in the same way as all other ÄKTAFPLC components.

Figure 16 shows an example of several optional functions added to an ÄKTAFPLC system.

Fig 16. Example of optional features for ÄKTAFPLC.

Examples of functionalities available for ÄKTA<small>FPLC</small> are listed below:

On-line measurement of pH conditions

Addition of a pH flow cell and pH electrode allows direct on-line monitoring and recording of pH conditions.

Increased automation: automatic column, media or buffer scouting

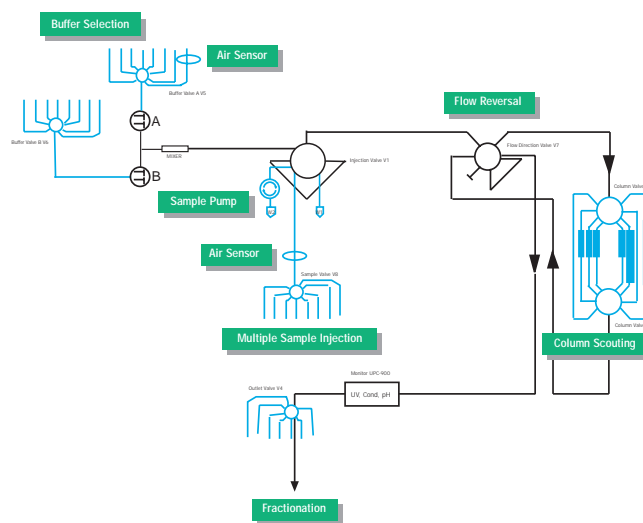A maximum of eight additional motorized multi-port valves can be added to ÄKTA<small>FPLC</small> to increase automation. For example, to allow automatic column, media or buffer scouting, additional 8-port valves can be used for column switching and buffer selection.

Automatic multiple sample injection

For increased sample throughput, Autosampler A-900 can be added. This allows automatic injection of up to 96 samples from standard vials or 160 samples from micro-vials. An extended evaluation package, UNICORN analysis module, provides:

- Quantification by internal or external standards
- Determination of molecular weight by gel filtration
- Quantification of sample amount and sample concentration
- Recovery calculations

For large sample volumes the Pump P-950 together with an IV-908 valve enables automatic multiple sample injection of up to 8 different samples. The flow rate range (up to 50 ml/min), low pulsation, and pressure specification (up to 1 MPa) allow rapid sample application directly onto a column or via a Superloop. Large sample volumes can be applied smoothly and safely. The pump is controlled by UNICORN and requires no calibration before use.

Increased security in programmed events

A maximum of three air sensors can be positioned within the system and controlled through UNICORN to increase security in programmed events. For example, UNICORN can be programmed to ensure that a chromatographic elution begins only when the completion of sample application has been detected by an air sensor. Variable sample volumes are applied with no risk of air entering the system or column.

– all chromatographic techniques used in protein purification

All chromatographic techniques suitable for protein purification can be used with ÄKTA<small>FPLC</small>; ion exchange, hydrophobic interaction, affinity chromatography, gel filtration, and chromatofocusing. ÄKTA<small>FPLC</small> components are compatible with all solvents commonly used in protein purification.

ÄKTAdesign support

ÄKTAdesign knowledge

Knowledge built into the method wizard and column knowledge in the column library ensures that columns run correctly.

A comprehensive method handbook gives background information for recommended purification strategies together with specific examples, recommended columns, running parameters and buffers, and advice on optimization.

ÄKTAdesign networks

- Faster communication
- High security
- Complete overview of operations
- Maximum compliance with regulatory needs

UNICORN control system has full networking capability, with high security and maximum compliance with regulatory needs. Network support allows control of ÄKTAdesign systems from any connected UNICORN workstation (Fig 17).
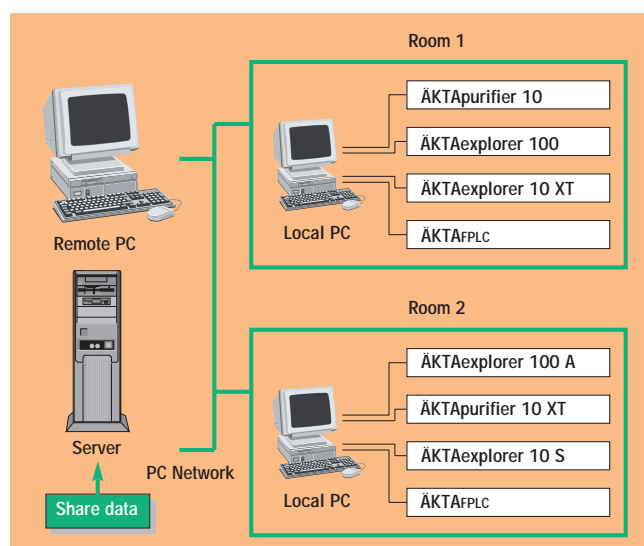
Fig 17. Users control and monitor chromatography systems from network-connected computers.

System control and data access via a PC network are easy to use and give a complete overview of operations.

With defined access rights, operators connect to, and control, systems from any remote or local PC. The user interface is exactly the same. Results can be automatically saved on a server and evaluation and generation of reports can be made locally or at remote PCs.

ÄKTAdesign service

- Controlled costs
- Traceable results
- Support for regulatory requirements
- Maximum productivity
- Continuous operation at optimal performance

Regular, planned maintenance increases productivity by keeping a system in top working condition and minimizing downtime. A service support agreement lets users budget for all service and maintenance costs, giving full cost control and eliminating unexpected expenses.

Service support agreements will greatly simplify compliance with regulatory and quality demands. Scheduled preventive maintenance carried out by qualified engineers using traceable test equipment and the in-built service diagnostics of ÄKTAdesign, provides users with support to meet the requirements of Good Laboratory Practice (GLP). ÄKTAdesign systems are supported with a comprehensive range of after-sales service agreements that can be customized to individual needs including:

- ÄKTAdesign extended support agreement
- Flexible agreements
- Test and Calibration Certification Upgrade

Your local Amersham Biosciences representative will be pleased to discuss the options with you.

Monitor UPC-900

Pump P-920

Frac-900
(or Frac-950 option)

Fig 18. ÄKTA<small>FPLC</small> system.

System Description

General description

ÄKTA<small>FPLC</small> is supplied pre-assembled and tested (Fig 18). The system uses minimal bench space and is mounted on a base platform with low friction pads for easy access to the sides and rear of the system. Columns are easily snapped in place on the outside of the system.

Figure 19 shows the design flexibility of ÄKTA<small>FPLC</small>, for example, when using larger columns.

Fig 19. Flexibility for larger columns.

df 18-1128-41 AD, 2001-06 • p12
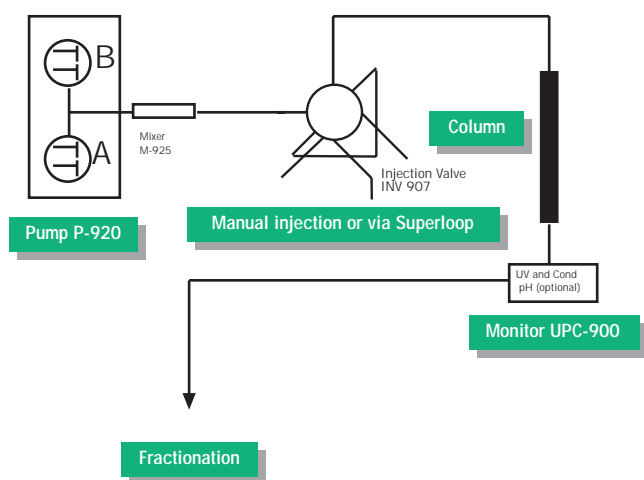
Flow configuration

Fig 20. Standard ÄKTAFPLC system configuration.

Figure 20 shows the simple and logical flow configuration of a standard ÄKTAFPLC providing:

- easy, programmable pump wash for quick eluent exchange without column disturbance

- automatic sample application

  - fixed volume loops for applying samples from 100 µl to 2 ml with accuracy and precision

  - Superloop 10 ml, Superloop 50 ml and Superloop 150 ml for applying samples in the range 1–10 ml, 1–50 ml and 1–150 ml respectively

- loading or washing of sample loop without disturbance of an operating column

- on-line fixed wavelength UV-detection

- on-line monitoring of conductivity

- optional on-line monitoring of pH

- fraction collection options ranging from microtitre plates to large vessels

System control – UNICORN

UNICORN is a control system for real-time control of ÄKTAdesign systems. UNICORN is used from laboratory to full-scale production to ensure fast, simple communication between all systems and users. The same interface and methods used to run routine applications is used to optimize a purification in research and development and applied at production scale.

Designed for Windows NT/Windows 2000, UNICORN software is installed on the PC prior to delivery and controls all ÄKTAdesign instrument settings and functions.

For further information on the latest version of UNICORN system control, please contact your local Amersham Biosciences representative.

System components

ÄKTAFPLC has two main instrument components, a number of ancillary items, and a fraction collector, with the option to add additional valves, a sample pump, air sensors and analogue to digital converter. Figure 18 shows the positions of the main components.
All instrument settings and functions are under the direct control of UNICORN.

At every start-up, each instrument automatically performs a self-diagnostic test and calibrates appropriate settings to ensure top performance throughout day-to-day operation.

To ensure high recovery and no loss of biological activity, all wetted materials are inert, fully biocompatible, and resistant to all eluents commonly used in liquid chromatography.

Pump P-920
Pump P-920 is a high performance syringe pump producing accurate, reproducible, pulse free flow rates, and precise gradient formation over the working range (up to 20 ml/min, 0–5 MPa). The instrument design is based on the original FPLC™ System P-500 pump, used successfully in thousands of laboratories for many years, and proven to be excellent for laboratory scale purification of biomolecules. Eluent is drawn in through a pump valve by the action of the pump cylinder assemblies. Twin reciprocating piston heads work in unison to deliver a smooth, low-pulsation flow through the mixer to the column. The syringe pump design eliminates problems with air bubbles and can be used with solvent or sample viscosity up to 10 cP.

Monitor UPC-900

Monitor UPC-900 is a high precision on-line monitor offering the unique possibility to measure UV, conductivity, and pH using a single instrument. A sensor inside the conductivity flow cell provides automatic temperature compensation for pH and conductivity measurements. Monitor UPC-900 records accurate information during any liquid chromatographic separation and is used from analytical to preparative scale. UV and conductivity flow cells are supplied as standard.

Automatic scaling of the UV signal removes the risk of working with incorrect range settings.
UV detection wavelengths 254 and 280 nm are supplied with ÄKTAFPLC. Other wavelengths for special applications are available, including 214 nm if higher sensitivity is required.

The conductivity monitor gives reliable measurements over the range of values typically seen during purification of biomolecules. Gradient performance is monitored from the very high salt concentrations used in hydrophobic interaction (up to 2.5 M $(NH_4)_2SO_4$) down to the very low conductivity levels seen during a desalting separation.

The pH flow cell, pH electrode, and a dummy electrode are optional.

Further information: Please ask for Monitor UPC-900 Data File No. 18-1128-40

Ancillary equipment

Injection valve

A seven port motorized valve, INV-907, is used for sample application.

Mixer M-925

Mixer M-925 is a dynamic, single-chamber mixer, powered and controlled from Pump P-920. ÄKTAFPLC is delivered with a pre-installed 0.6 ml mixer chamber suitable for flow rates up to 20 ml/min. A 2 ml chamber with higher mixing capacity is available when optimal mixing is required for eluents such as organic/aqueous mixes.

Fraction collector Frac-950

Frac-950 offers two independent ways to prevent sample loss, and the highest flexibility in the choice of collection mode. Fractions are collected in microtitre plates (over 384 fractions, up to 2.5 ml per fraction), a variety of test tube sizes, in 20 large vessels (up to 250 ml per fraction), or even funnels for unlimited sample volume. Collection is in volume or time mode and different fraction sizes can be collected during different stages of a separation.

Automatic peak fractionation, based on peak detection using slope sensing, minimizes peak dilution and cross-contamination (Fig 13). Event marks correlate the fractions with the chromatogram. A recycle function enables collection from repetitive runs.

A Frac-900 fraction collector is also available to collect up to 175 fractions in 12 mm diameter tubes, up to 95 fractions in 10–18 mm diameter tubes, and up to 40 fractions in 30 mm diameter tubes.

System specifications

ÄKTAFPLC

Flow-rate range	0.05–20 ml/min
Pressure range	0–5 MPa (50 bar, 725 psi)
Wavelength selection	254, 280, 313, 405, 436, 546 nm (with Hg lamp)
	214 nm (with Zn lamp)
Conductivity range	1 µS/cm–999.9 mS/cm (RPC – IEX – HIC gradients)
pH range	0–14
Solvent compatibility	All solvents and buffers commonly used in chromatography of biomolecules, except 100% ethylacetate, 100% hexane and 100% tetrahydrofuran *(organic solvents are potentially harmful to pH electrodes, use a dummy flow cell when running organic solvents)*
Size	380 × 480 × 470 mm (W × D × H)
Weight	50 kg

Operating data

Pump P-920

Flow-rate range	0.05–20 ml/min
Increment	0.01 ml/min
Pressure range	0–5 MPa (50 bar, 725 psi)
Pressure limits	Programmable upper and lower limit
Viscosity	Up to 10 cP

Monitor UPC-900

Wavelengths	
Hg lamp	
(using filter selection)	254, 280, 313, 405, 436, 546 nm
Zn lamp	214 nm
Linerarity, 5 mm flow cell	<3% up to 2 AU at 254 nm
	<5% up to 1 AU at 280 nm
Noise (at 254 nm)	40×10^{-6} AU
Drift	$<100 \times 10^{-4}$ AU
Maximum pressure	4 MPa (40 bar, 580 psi)

	2 mm (optional)	5 mm (supplied)
Flow rate	0–100 ml/min	0–20 ml/min
Optical path length	2 mm	5 mm

Conductivity measurement

Conductivity range	1 µS/cm–999.9 mS/cm
Noise	maximum ±0.5% full scale calibrated range

pH measurement (optional)

pH range	0–14 (specifications valid between 2–12)
Accuracy	±0.1 pH unit, temperature compensated
Stability maximum	0.1 pH units deviation/10 h

Fraction collection
With Frac-950

Flow rate range	0.001–100 ml/min
Fraction capacity	
Rack A	120 × 18 mm tubes
	8 × 30 mm tubes
Optional racks	
Rack B	240 × 12 mm tubes
Rack C	4 microplates (4 × 96 wells per plate)
	8 × 30 mm tubes
Rack D	45 × 30 mm tubes
Rack E	80 × 30 mm tubes
Rack F	20 × 250 ml vessels
Rack G	30 funnels

With Frac-900 and flow diversion valve FV-903

Tube capacity	95 in Tube Rack 18 mm
	175 in Tube Rack 12 mm (optional)
	40 in Tube Rack 30 mm (optional)

Wetted materials

UV flow cells	Quartz, ETFE, titanium (only 5 mm flow cell)
Cond. flow cell	Titanium, PTFE
pH electrode and flow cell	Glass, FFKM (perfluororubber), titanium
Dummy electrode	PTFE (polytetrafluoroethylene)
Pump components	PEEK, titanium, borosilicate glass, Simriz™, PTFE (polytetrafluoroethylene)

Environment

Ambient temperature	+4–+40 °C
Relative humidity	10–95% relative humidity
Atmospheric pressure	84–106 kPa (840–1060 mbar)

Computer requirements

Pentium II/333 MHz or later (minimum Pentium/90 MHz)
One system: 64 Mb RAM (minimum 32 Mb)
Two or more systems: 92 Mb RAM (minimum 64 Mb)
1 Gb available hard disk (150 Mb to run UNICORN), NTFS file system
Colour monitor, 1024 × 768 with 64 k colours
1 ISA slot/connected system
Mouse
CD-ROM drive
1.44 Mb (3.5″) diskette drive

Software requirements for UNICORN 4.0

Windows NT Workstation 4.0 + Service Pack 4 or later
or Windows 2000

Network requirements

Supported network cards:
3COM Etherlink III
Compaq™ Netelligent 10/100 TX Embedded UTP Controller
Compaq Integrated NetFlex-3 Controller
AMD PCNET PCI Ethernet Adapter (Integrated)
Novell™ NetWare™ version 4.50.819 or later, alternatively
Windows NT Server 4.0
A valid network connection

Ordering information

Product	Code No.
ÄKTAFPLC (254 and 280 nm detection, conductivity measurement and fraction collector Frac-950 included) Computer[*]	18-6083-20
ÄKTAFPLC (254 and 280 nm detection, conductivity measurement and fraction collector Frac-900 with diversion valve included) Computer[*]	18-1118-67

[*] Your local Amersham Biosciences representative will supply details of the fully installed computer to be supplied with the system.

New functions for alternative system configurations

On-line measurement of pH conditions

pH electrode	18-1111-26
pH flow cell including dummy electrode	18-1112-92
Tubing 0.5 mm i.d.(90 mm length required) (supplied as accessory with ÄKTAFPLC)	18-1113-68

Increased automation: automatic column, media or buffer scouting

Buffer selection

Valve IV-908, including one UniNet cable (one valve for pump A, one valve for pump B)	18-1108-42

Column selection

Valve PV-908, including one UniNet cable (2 valves required)	18-1108-41

Automatic multiple sample injection

Autosampler A-900 includes 200 × 1.5 ml sample vials and caps	18-1116-61
ÄKTAdesign XT kit includes tubing, UNICORN analysis module and method templates	18-6083-19
OR	
Pump P-950	18-6083-01
Valve PV-908	18-1108-41

Increased security in programmed events – air sensors

Air-900 control box, includes one UniNet 2 cable, (controls up to 3 air sensors)	18-1121-22
Purge valve (required for buffer inlet position only)	18-1126-33
Air sensor Air-925 (2.5 mm i.d.)	18-1121-24
Air sensor Air-912 (1.2 mm i.d.)	18-1121-23

Optional function valves e.g. for reverse flow, flow diversions (up to 3 valves of any type)

INV-907, including one UniNet cable	18-1108-40
IV-908, including one UniNet cable	18-1108-42
PV-908, including one UniNet cable	18-1108-41

Sample application

Superloop 10 ml (ÄKTAdesign), load 1–10 ml	18-1113-81
Superloop 50 ml (ÄKTAdesign), load 1–50 ml	18-1113-82
Superloop 150 ml, load 1–150 ml (requires union 1/16″ female – M6 male fitting, code no. 18-1112-57)	18-1023-85

Additional items

UNICORN analysis module	18-1128-56
Zn optics with 214 nm filter	18-1128-21

Additional filters

Filter 313 nm	18-0623-01
Filter 365 nm	18-0624-01
Filter 405 nm	18-0625-01
Filter 436 nm	18-0626-01
Filter 546 nm	18-0627-01

Related product literature

Product	Code No.
Application Notes	
Purification of a labile, oxygen-sensitive enzyme for crystallization and 3D structure determinations	18-1128-91
Purification and chromatographic characterization of an integral membrane protein	18-1128-92
Rapid optimization and development of an automated two-step purification procedure for monoclonal IgG antibodies	18-1128-93

Data Files

ÄKTAexplorer Systems	18-1124-09
ÄKTApurifier	18-1119-48
Monitor UPC-900	18-1128-40
UNICORN control system	18-1111-20
ÄKTAbasic Systems	18-1128-19
ÄKTAprime	18-1136-91
UNICORN Control System	18-1111-20
Autosampler A-900	18-1152-89

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