ÄKTAxpress

Operating Instructions

Original instructions

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1 Introduction

Purpose of the Operating Instructions

The *Operating Instructions* provide you with the instructions needed to handle ÄKTAxpress in a safe way.

Prerequisites

In order to operate ÄKTAxpress as is intended, the following pre-requisites must be fulfilled:

- The user should have a general understanding of how a PC and the Microsoft® Windows® operating system works.
- The user must understand the concepts of liquid chromatography.
- The user must read and understand the Safety Instructions in this manual.
- ÄKTAxpress and software should be installed, configured and calibrated according to these Operating Instructions.

About this chapter

This chapter contains important user information, a description of the intended use of ÄKTAxpress, regulatory information, list of associated documentation, definitions of safety notices and so on.

1.1 Important user information

Read this before operating the product

All users must read the entire *Operating Instructions* before installing, operating or maintaining the product.

Always keep the *Operating Instructions* at hand when operating the product.

Do not operate the product in any other way than described in the user documentation. If you do, you may be exposed to hazards that can lead to personal injury and you may cause damage to the equipment.

Intended use

ÄKTAxpress is a liquid chromatography system intended for automated, multi-step purification processes. The system has been developed and optimized for purification of antibodies and tagged recombinant proteins from clarified or crude cell lysates.

ÄKTAxpress is intended for research use only, and shall not be used in any clinical procedures, or for diagnostic purposes.

Safety notices

This user documentation contains WARNINGS, CAUTIONS and NOTICES concerning the safe use of the product. See definitions below.

Warnings

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. It is important not to proceed until all stated conditions are met and clearly understood.

Cautions

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. It is important not to proceed until all stated conditions are met and clearly understood.

Notices

NOTICE

NOTICE indicates instructions that must be followed to avoid damage to the product or other equipment.

Notes and tips

Note: *A note is used to indicate information that is important for trouble-free and optimal use of the product.*

Tip: *A tip contains useful information that can improve or optimize your procedures.*

Typographical conventions

Software items are identified in the text by ***bold italic*** text. A colon separates menu levels, thus ***File:Open*** refers to the ***Open*** command in the ***File*** menu.

Hardware items are identified in the text by **bold** text (e.g., **Power** switch).

1.2 Regulatory information

In this section

This section describes the directives and standards that are fulfilled by ÄKTAxpress.

Manufacturing information

The table below summarizes the required manufacturing information. For further information, see the EU Declaration of Conformity (DoC) document.

Requirement	Content
Name and address of manufacturer	GE Healthcare Bio-Sciences AB, Björkgatan 30, SE 751 84 Uppsala, Sweden

Conformity with EU Directives

This product complies with the European directives listed in the table, by fulfilling the corresponding harmonized standards.

Directive	Title
2006/42/EC	Machinery Directive (MD)
2004/108/EC	Electromagnetic Compatibility (EMC) Directive
2006/95/EC	Low Voltage Directive (LVD)

CE marking

CE

The CE marking and the corresponding EU Declaration of Conformity is valid for the instrument when it is:

- used as a stand-alone unit, or
- connected to other products recommended or described in the user documentation, and
- used in the same state as it was delivered from GE, except for alterations described in the user documentation.

International standards

This product fulfills the requirements of the following standards:

Standard	Description	Notes
EN/IEC 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use	EN standard is harmonized with EU directive 2006/95/EC
EN 61326-1	Electrical equipment for measurement, control and laboratory use - EMC requirements	EN standard is harmonized with EU directive 2004/108/EC
EN ISO 12100	Safety of machinery. General principles for design. Risk assessment and risk reduction.	EN ISO standard is harmonized with EU directive 2006/42/EC

FCC compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: *The user is cautioned that any changes or modifications not expressly approved by GE could void the user's authority to operate the equipment*.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Regulatory compliance of connected equipment

Any equipment connected to ÄKTAxpress should meet the safety requirements of EN 61010-1/IEC 61010-1, or relevant harmonized standards. Within the EU, connected equipment must be CE marked.

Environmental conformity

This product conforms to the following environmental requirements.

Requirement	Title
2011/65/EU	Restriction of Hazardous Substances (RoHS) Directive
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE) Directive
ACPEIP	Administration on the Control of Pollution Caused by Electronic Information Products, China Restriction of Hazardous Substances (RoHS)
Regulation (EC) No 1907/2006	Registration, Evaluation, Authorization and restriction of CHemicals (REACH)

1.3 Instrument

Product description

ÄKTAxpress is a liquid chromatography system intended for automated, multi-step purification processes.

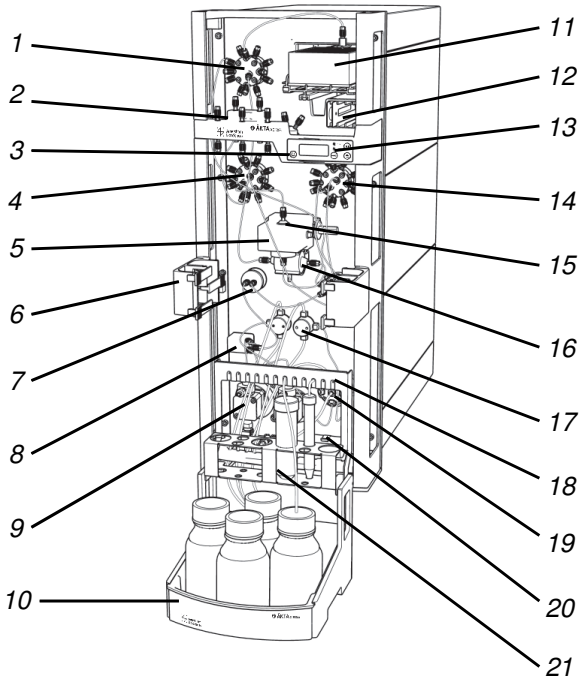
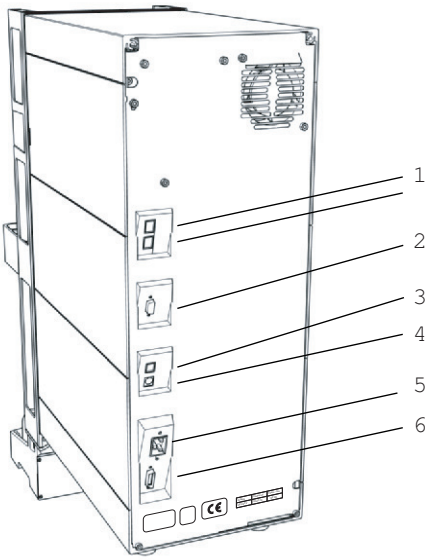


Figure 1.1: The main parts of the equipment.

No.	Description	No.	Description
1	Outlet valve	12	Sample loops
2	Column block	13	Control panel
3	Power ON/Stand-by	14	Loop valve
4	Column valve	15	UV cell
5	UV optical unit	16	Conductivity cell
6	Column holder	17	Switch valves
7	Pressure sensor	18	Tubing holder

No.	Description	No.	Description
8	Mixer	19	Inlet valve
9	Pump	20	Air sensor
10	Flask holder (optional)	21	Tube holder
11	Fraction collector		

Electrical and communication connections



No.	Connection	No.	Connection
1	UniNet network	4	Air sensor
2	Conductivity flow cell	5	AC Power inlet
3	UV monitor, optical unit	6	UV monitor, lamp

Basic flow path

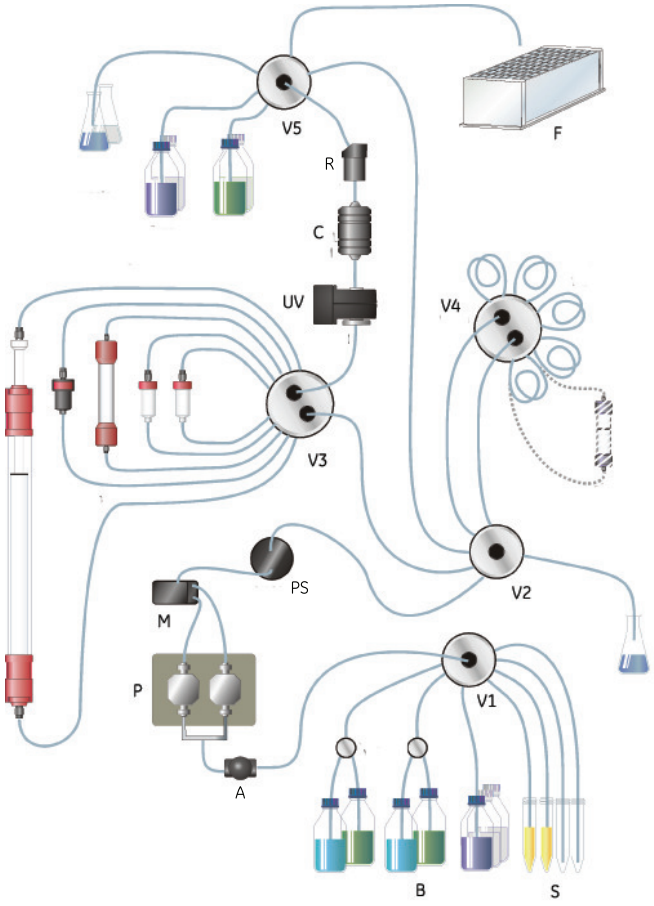


Figure 1.2: Basic principles

Step	Part	Description
1	V1	Sample or buffer pass through the inlet valve, which selects a liquid depending on the setting in UNICORN™. The switch valves will form a gradient between A1 and B1 or A2 and B2 as selected in the method.
2	A	The air sensor will detect air and e.g. pause the system if air is detected, or continue purification method after all sample has been loaded.

Step	Part	Description
3	P	A combined sample and buffer pump P, pumps liquid through the system.
4	M	The solution passes through the Mixer M where buffers are mixed.
5	V2	Sample is added manually through the injection valve if gel filtration or desalting is the first chromatography step.
6	V3	Column valve, directs flow through a connected column.
7	UV, C, R	Liquid returns from the column valve and is directed to the outlet valve via UV and conductivity monitors and the restrictor.
8	V4, V5	The outlet valve directs the flow either to a waste container or to the fraction collector. It can also direct fractions to the sample loops via the injection valve to allow reinjection on the next column.

1.4 Control software

UNICORN control software

UNICORN is a complete software for control and supervision of ÄKTAxpress. The software runs under Microsoft® Windows operating system.

UNICORN is supplied with an ÄKTAxpress method wizard which provide easy creation of methods for purification.

For more information about UNICORN control system, see the UNICORN user manuals supplied.

1.5 User documentation

In addition to these *Operating Instructions*, the documentation package supplied with ÄKTAxpress also includes product documentation binders containing detailed specifications and traceability documents.

The most important documents in the document package with regard to technical aspects of ÄKTAxpress are:

System-specific documentation

User documentation	Content
ÄKTAxpress Operating Instructions	All instructions needed to operate the instrument in a safe way, including brief system description, installation, and maintenance.
ÄKTAxpress User Manual and *ÄKTAxpress MAb User Manual*	Detailed system description. Comprehensive user instructions, method creation, operation, advanced maintenance and troubleshooting.
ÄKTAxpress Cue Cards and *ÄKTAxpress MAb Cue Cards*	Short step-by-step instructions for selected applications using the preprogrammed method templates. System preparation and value table for the method templates.
ÄKTAxpress Installation Guide	Instructions for installation and installation test.
EU Declaration of Conformity for ÄKTAxpress	Document whereby the manufacturer ensures that the product satisfies and is in conformity with the essential requirements of the applicable directives.

Software documentation

Together with each system, the following software documentation is supplied providing additional information that applies to ÄKTAxpress, independent of the specific configuration:

Document	Purpose/Contents
UNICORN™ manual package	• The manuals contain detailed instructions on how to administer UNICORN, work with methods, perform runs and evaluate results. • The Online help contains dialog descriptions for UNICORN. The Online help is accessed from the ***Help*** menu.

Component documentation

Documentation for components produced both by GE and by a third-party are, if existent, also included in the document package.

2 Safety instructions

About this chapter

This chapter describes safety compliance, safety labels, general safety precautions, emergency procedures, power failure and recycling of ÄKTAxpress.

2.1 Safety precautions

Introduction

The ÄKTAxpress instrument is powered by mains voltage and handles pressurized liquids that may be hazardous. Before installing, operating or maintaining the system, you must be aware of the hazards described in this manual. **Follow the instructions provided to avoid personal injury or damage to the equipment.**

The safety precautions in this section are grouped into the following categories:

- General precautions
- Using flammable liquids
- Personal protection
- Installing and moving the instrument
- System operation
- Maintenance

General precautions

Always follow these General precautions to avoid injury when using the ÄKTAxpress instrument.

WARNING

Do not operate ÄKTAxpress in any other way than described in the ÄKTAxpress and UNICORN manuals. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING

Operation and user maintenance of the ÄKTAxpress instrument should be performed by properly trained personnel only.

WARNING

Before connecting a column to the ÄKTAxpress instrument, read the instructions for use of the column. To avoid exposing the column to excessive pressure, make sure that the pressure limit is set to the specified maximum pressure of the column.

WARNING

Do not use any accessories not supplied or recommended by GE.

WARNING

Do not use ÄKTAxpress if it is not working properly, or if it has suffered any damage, for example:

- damage to the power cord or its plug
- damage caused by dropping the equipment
- damage caused by splashing liquid onto it

CAUTION

Waste tubes and containers must be secured and sealed to prevent accidental spillage.

CAUTION

Make sure that the waste container is dimensioned for maximum possible volume when the instrument is left unattended.

NOTICE

Avoid condensation by letting the unit equilibrate to ambient temperature.

Using flammable liquids

When using flammable liquids with the ÄKTAxpress instrument, follow these precautions to avoid any risk of fire or explosion.

WARNING

Fire Hazard. Before starting the system, make sure that there is no leakage.

WARNING

A fume hood or similar ventilation system shall be installed when flammable or noxious substances are used.

Personal protection

WARNING

Always use appropriate Personal Protective Equipment (PPE) during operation and maintenance of ÄKTAxpress system.

WARNING

When using hazardous chemical and biological agents, take all suitable protective measures, such as wearing protective glasses and gloves resistant to the substances used. Follow local and/or national regulations for safe operation and maintenance of ÄKTAxpress.

WARNING

Spread of biological agents. The operator has to take all necessary actions to avoid spreading hazardous biological agents in the vicinity of the instrument. The facility should comply with the national code of practice for biosafety.

WARNING

High pressure. ÄKTAxpress operates under high pressure. Wear protective glasses and other required Personal Protective Equipment (PPE) at all times.

WARNING

Personal Protective Equipment (PPE). Whenever packing, unpacking, transporting or moving ÄKTAxpress, wear:

- Protective footwear, preferably with steel lining.
- Working gloves, protecting against sharp edges.
- Protective glasses.

Installing and moving the instrument

WARNING

Supply voltage. Make sure that the supply voltage at the wall outlet corresponds to the marking on the instrument, before connecting the power cord.

WARNING

ÄKTAxpress must always be connected to a grounded power outlet.

WARNING

Power cord. Only use power cords with approved plugs delivered or approved by GE Healthcare.

WARNING

Access to power cord. Do not block the rear and side panel of the instrument. The power cord must always be easy to disconnect.

WARNING

Installing the computer. The computer should be installed and used according to the instructions provided by the manufacturer of the computer.

CAUTION

Heavy object. Use suitable lifting equipment when moving the systems. Two people are required to lift the system safely.

NOTICE

Disconnect power. To prevent equipment damage, always disconnect power from the ÄKTAxpress instrument before an instrument module is removed or installed, or a cable is connected or disconnected.

NOTICE

ÄKTAxpress shall be installed and prepared by GE personnel or third party authorized by GE Healthcare.

NOTICE

Any computer used with the equipment shall comply with IEC 60950 and be installed and used according to the manufacturer's instructions.

System operation

WARNING

Hazardous chemicals during run. When using hazardous chemicals, run ***System CIP*** to flush the entire system tubing with distilled water, before service and maintenance.

WARNING

Hazardous biological agents during run. When using hazardous biological agents, run ***System CIP*** and flush the entire system tubing with bacteriostatic solution (e.g. NaOH) followed by a neutral buffer and finally distilled water, before service and maintenance.

CAUTION

Hazardous chemicals in UV flow cell. Make sure that the entire flow cell has been flushed thoroughly with bacteriostatic solution, for example NaOH, and distilled water, before service and maintenance.

Maintenance

WARNING

Electrical shock hazard. All repairs should be done by service personnel authorized by GE Healthcare. Do not open any covers or replace parts unless specifically stated in the user documentation.

WARNING

Disconnect power. Always disconnect power from the instrument before replacing any component on the instrument, unless stated otherwise in the user documentation.

WARNING

Hazardous chemicals during maintenance. When using hazardous chemicals for system or column cleaning, wash the system or columns with a neutral solution in the last phase or step.

WARNING

Do not perform any type of maintenance work while the system is powered electrically or when the piping system is pressurized. Note that the piping system can be pressurized even when the system is closed down.

WARNING

Only spare parts and accessories that are approved or supplied by GE may be used for maintaining or servicing ÄKTAxpress.

WARNING

Make sure that the piping system is completely leakage free before performing any CIP on the system.

WARNING

NaOH is corrosive and therefore dangerous to health. When using hazardous chemicals, avoid spillage and wear protective glasses and other suitable Personal Protective Equipment (PPE).

WARNING

After assembly, the piping system must be tested for leakage at maximum pressure for continued protection against injury risks due to fluid jets, burst pipes or explosive atmosphere.

WARNING

Before disassembly, check that there is no pressure in the piping system.

WARNING

Disconnect power. Always disconnect power from the instrument before replacing fuses.

WARNING

Decontaminate the equipment before decommissioning to ensure that hazardous residues are removed.

NOTICE

Cleaning. Keep the instrument dry and clean. Wipe regularly with a soft damp tissue and, if necessary, a mild cleaning agent. Let the instrument dry completely before use.

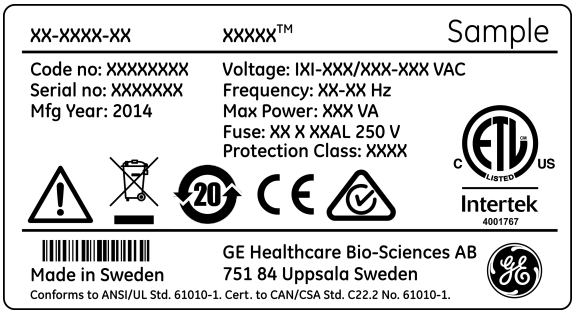
2.2 Labels

In this section

This section describes the instrument labels and labels concerning hazardous substances that are attached to the ÄKTAxpress instrument. For information about marking of the computer equipment, refer to the manufacturer's instructions.

Labels on the instrument

The illustration below shows an example of the identification label that is attached to ÄKTAxpress.



Symbols used in instrument labels

Label	Meaning
	**Warning!** Read the user documentation before using the equipment. Do not open any covers or replace parts unless specifically stated in the user documentation.
	The equipment complies with the requirements for electromagnetic compliance (EMC) in Australia and New Zealand.
	The equipment complies with applicable European directives.
	This symbol indicates that ÄKTAxpress has been certified by a Nationally Recognized Testing Laboratory (NRTL). NRTL means an organization, which is recognized by the US Occupational Safety and Health Administration (OSHA) as meeting the legal requirements of Title 29 of the Code of Federal Regulations (29 CFR), Part 1910.7.

Labels concerning hazardous substances

Label	Meaning
	This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of equipment.
	This symbol indicates that the product contains hazardous materials in excess of the limits established by the Chinese standard SJ/T11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronics.

2.3 Emergency procedures

In this section

This section describes how to do an emergency shutdown of the ÄKTAxpress system. The section also describes the result in the event of power failure.

Emergency shutdown

In an emergency situation, do as follows to stop the run:

Step	Action
1	To pause the run from UNICORN, click the ***Pause*** button.
2	Press the Power ON/Stand-by button on the instrument. If required, disconnect the mains power cord. The run is interrupted immediately.

Power failure

The result of a power failure depends on which unit that is affected.

Power failure to...	will result in...
ÄKTAxpress	• The run is interrupted immediately, in an undefined state • The data collected up to the time of the power failure is available in UNICORN
Computer	• The UNICORN computer shuts down in an undefined state • The run is interrupted immediately, in an undefined state

2.4 Recycling information

Decontamination

ÄKTAxpress shall be decontaminated before decommissioning and all local regulations shall be followed with regard to scrapping of the equipment.

Disposal, general instructions

When taking ÄKTAxpress out of service, the different materials must be separated and recycled according to national and local environmental regulations.

Recycling of hazardous substances

ÄKTAxpress contains hazardous substances. Detailed information is available from your GE representative.

Disposal of electrical components

Waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of equipment.

2.5 Declaration of Hazardous Substances (DoHS)

根据SJ/T11364-2006《电子信息产品污染控制标识要求》特提供如下有关污染 控制方面的信息。

The following product pollution control information is provided according to SJ/T11364-2006 Marking for Control of Pollution caused by Electronic Information Products.

电子信息产品污染控制标志说明
Explanation of Pollution Control Label

该标志表明本产品含有超过SJ/T11363-2006《电子信息产品中有毒有害物质的限量要求》中限量的有毒有害物质。标志中的数字为本产品的环保使用期，表明本产品在正常使用的条件下，有毒有害物质不会发生外泄或突变，用户使用本产品不会对环境造成严重污染或对其人身、财产造成严重损害的期限。单位为年。

为保证所申明的环保使用期限，应按产品手册中所规定的环境条件和方法进行正常使用，并严格遵守产品维修手册中规定的期维修和保养要求。

产品中的消耗件和某些零部件可能有其单独的环保使用期限标志，并且其环保使用期限有可能比整个产品本身的环保使用期限短。应到期按产品维修程序更换那些消耗件和零部件，以保证所申明的整个产品的环保使用期限。

本产品在使用寿命结束时不可作为普通生活垃圾处理，应被单独收集妥善处理。

This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese standard SJ/T11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products. The number in the symbol is the Environment-friendly Use Period (EFUP), which indicates the period during which the toxic or hazardous substances or elements contained in electronic information products will not leak or mutate under normal operating conditions so that the use of such electronic information products will not result in any severe environmental pollution, any bodily injury or damage to any assets. The unit of the period is “Year”.

In order to maintain the declared EFUP, the product shall be operated normally according to the instructions and environmental conditions as defined in the product manual, and periodic maintenance schedules specified in Product Maintenance Procedures shall be followed strictly.

Consumables or certain parts may have their own label with an EFUP value less than the product. Periodic replacement of those consumables or parts to maintain the declared EFUP shall be done in accordance with the Product Maintenance Procedures.

This product must not be disposed of as unsorted municipal waste, and must be collected separately and handled properly after decommissioning.

有毒有害物质或元素的名称及含量
Name and Concentration of Hazardous Substances

产品中有毒有害物质或元素的名称及含量
Table of Hazardous Substances' Name and Concentration

部件名称 Component name	有毒有害物质或元素 Hazardous substance					
	铅 Pb	汞 Hg	镉 Cd	六价铬 Cr6+	多溴联苯 PBB	多溴二苯醚 PBDE
18-6645-01	X	0	0	0	0	0

0: **表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006标准规定的限量要 求以下**

X: **表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求**

- **此表所列数据为发布时所能获得的最佳信息**

0: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.

- Data listed in the table represents best information available at the time of publication.

3 Installation

NOTICE

ÄKTAxpress shall be installed and prepared by GE personnel or third party authorized by GE Healthcare.

NOTICE

Any computer used with the equipment shall comply with IEC 60950 and be installed and used according to the manufacturer's instructions.

ÄKTAxpress is delivered in protective packing material and shall be unpacked with great care.

Any equipment connected to ÄKTAxpress must fulfill applicable standards and local regulations.

For detailed information on Installation, see *ÄKTAxpress User Manual*.

3.1 Site requirements

Parameter	Requirement
Operation site	Indoor use
Altitude	Maximum 2000 m
Placement	Stable laboratory bench e.g. 200 × 80 cm
Electrical power	100-120/220-240 V AC ±10%, 50-60 Hz
Transient overvoltages	Overvoltage category II
Ambient temperature	4°C to 40°C
Humidity	20% to 95%, non-condensing
Atmospheric pressure	84 to 106 kPa (840 to 1060 mbar)
Pollution degree	2

3.2 Transport

The equipment weighs 30 kg and requires at least two people to lift and move it unless a suitable lifting device is used.

The equipment can be transported on a trolley capable of supporting at least 50 kg.

WARNING

Personal Protective Equipment (PPE). Whenever packing, unpacking, transporting or moving ÄKTAxpress, wear:

- Protective footwear, preferably with steel lining.
- Working gloves, protecting against sharp edges.
- Protective glasses.

NOTICE

Lift the instrument in the upright position. Do not use the front panel bar as a lifting handle.

Before moving the system:

- disconnect all cables and tubing connected to peripheral components and liquid containers.
- remove all items from the top of the instrument.
- grasp the system firmly by the base of the unit and the side rails and lift.

For more information on transport, see *ÄKTAxpress User Manual*.

3.3 Unpacking

Check for damage

Check the equipment for damage before starting assembly and installation. There are no loose parts in the transport box. All parts are either mounted on the system or located in the accessory kit box. If any damage is found, document the damage, and contact your local GE representative.

Unpack the system

Remove straps and packing material. Then set the equipment upright before starting installation.

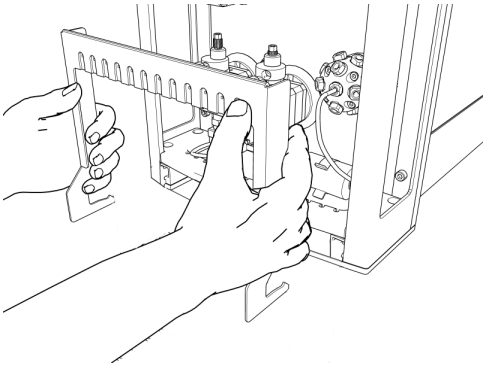
3.4 Assembly

The following parts must be added to the ÄKTAxpress instrument before it can be used:

- Tubing holder
- Tube holder
- USB/CAN converter
- Various buffer and sample bottles
- Flask holder (optional)
- Pump rinse solution (20% EtOH in a 50 ml Falcon tube)

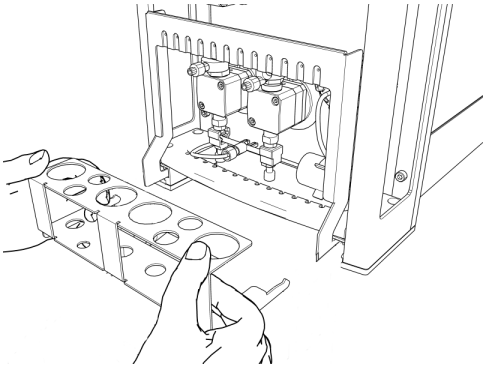
Installing the tubing holder

Insert the tubing holder according to the picture below.



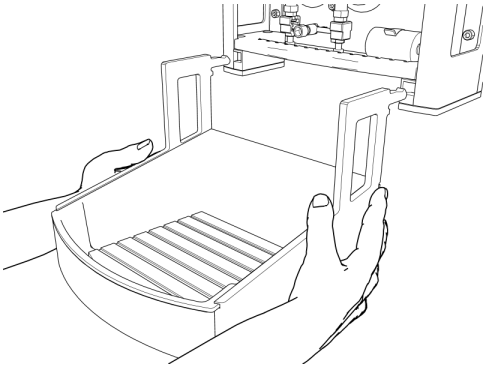
Installing the tube holder

Insert the tube holder according to the picture below.



Installing the flask holder

Insert the flask holder according to the picture below.



3.5 Connections

Communication

Connect the network, signal cables and computer according to the electrical drawings in *Electrical and communication connections, on page 12*

Make sure that UNICORN control software is installed on the computer.

Note: *For detailed information on Installation, see ÄKTAxpress User Manual and ÄKTAxpress Installation Guide.*

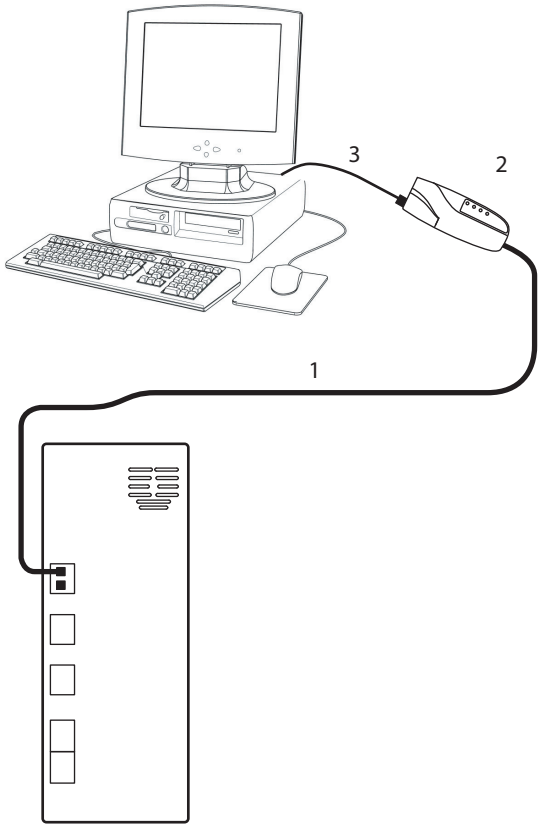
Connecting USB/CAN converter

The USB/CAN converter is needed between the ÄKTAxpress instrument and the computer.

1 Keep the computer turned off while connecting the USB/CAN converter.

Note: *Ensure that UNICORN control software and USB/CAN driver have been pre-installed on the computer.*

2 Connect the USB/CAN converter according to the drawing below.



No.	Description
1	UniNet
2	USB/CAN converter
3	USB

3 Connect a termination plug to the empty UniNet-1 socket.

Flow path

All parts and tubing are mounted on the system at delivery.

Electrical power

Connect the power cord to a grounded power outlet specified in *Section 3.1 Site requirements, on page 30*.

3.6 Spare parts and accessories

For correct up to date information on spare parts and accessories visit:
www.gelifesciences.com/AKTA

4 Operation

About this chapter

This chapter provides instructions for the use of ÄKTAxpress.

4.1 Operation overview

Workflow

The typical workflow in ÄKTAxpress, after turning on the system and connecting it to UNICORN, can be divided into a number of steps.

Step	Action	Section
1	Create a method plan	*Create a method plan, on page 41*
2	Prepare the system for a run	*Section 4.4 Setting up a run, on page 41* *Section 4.5 Preparations before start, on page 44*
3	Start a run using a method plan	*Section 4.6 Performing a run, on page 47*
4	During a run - view and change parameters	*Viewing the run, on page 50*
5	Procedures after a run - clean the system and columns	*Section 4.7 Procedures after a run, on page 52*
6	Evaluate the results	See UNICORN user documentation.

Liquid flow path

See *Appendix A Connection diagram - Liquid flow path, on page 73* for an illustration of the liquid flow path in ÄKTAxpress.

4.2 Starting the instrument

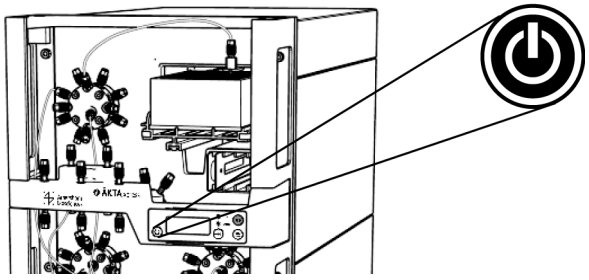
Ensure that the waste container and needed buffer bottles are correctly connected. Check that all tubing connections are properly tightened and that all valves are connected to a tube or termination.

1 If the system unit number is shown in the display:

The system is set in Idle mode. No action is required, because the system was turned on when the power cord was inserted. Two segments might flash to indicate no communication with the UNICORN computer.

2 If only one segment is shown in the display:

The system is set in Standby mode. Turn on the system by pressing the **On** button on the front panel.



The display indicates Idle mode and the system identity (1–12) is shown.

3 Check that the system identity is correct. The separation system should have a unique identity within the interval 1–12 which might have been set from factory.

If the identity is incorrect it has to be set, see *ÄKTAxpress Installation Guide*.

4.3 Starting the control system

Starting UNICORN

1 Turn on the monitor, computer and optional printer according to the manufacturer's instructions. Wait for the computer to start up.

2 Verify that the power indicator on the USB/CAN-converter is on when the computer has been turned on.

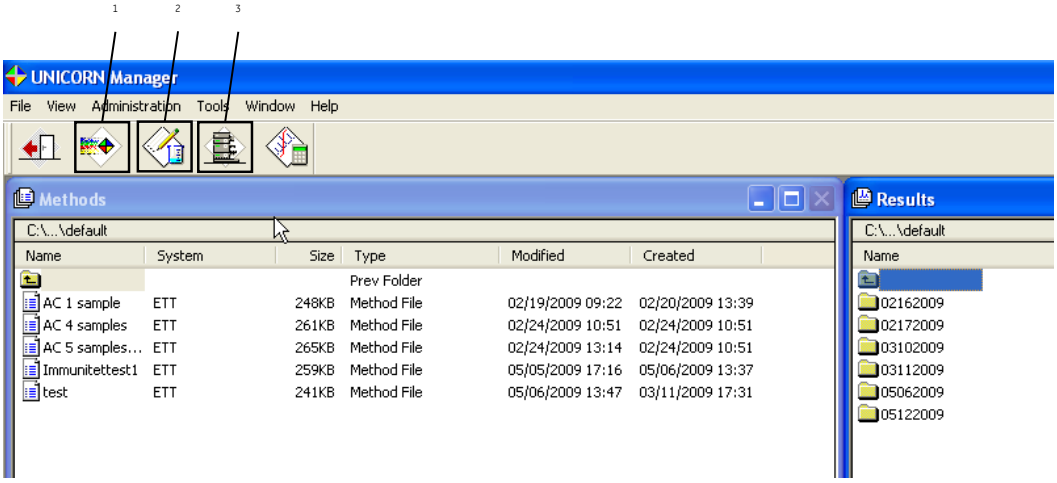
3 Log on to Windows operating system.

4 Start UNICORN by double-clicking on the UNICORN shortcut icon on the desktop.

5 In the ***Logon*** dialog, select a user from the ***User name*** list and enter the password. If you log on for the very first time, select user ***default*** and enter the password ***default***. Click ***OK***.

UNICORN starts and the ***UNICORN Manager*** window opens, see *Figure 4.1*.

Note: *See the UNICORN user documentation for instructions about how to create new users.*



No.	Description
1	The ***Instant Run*** icon immediately starts the system control wizard used to start a run.
2	The ***New Method*** icon opens the ***Method Editor*** module and displays the ***New Method*** dialog box.
3	The ***System Control*** icon activates the first connected ***System Control*** module and displays the ***Manual instruction*** dialog box.

*Figure 4.1: The **UNICORN Manager** window.*

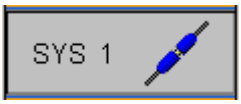
Control system in UNICORN

To open the ***System Control*** module in UNICORN, click the ***System Control*** icon in the ***UNICORN Manager*** window, see *Figure 4.1*.

Connecting an instrument to UNICORN

Up to twelve instruments can be connected in the ***System Control*** module.

The separation systems that are available in UNICORN are shown in the vertical bar at the left-hand side of ***System Control***. Disconnected systems are identified by a blue connector symbol.



- Left-click the symbol of the system to be connected.

  The system is connected and the symbol changes to a white status indicator, see *Figure 4.2*. The run data, curves and logbook for the system is shown.

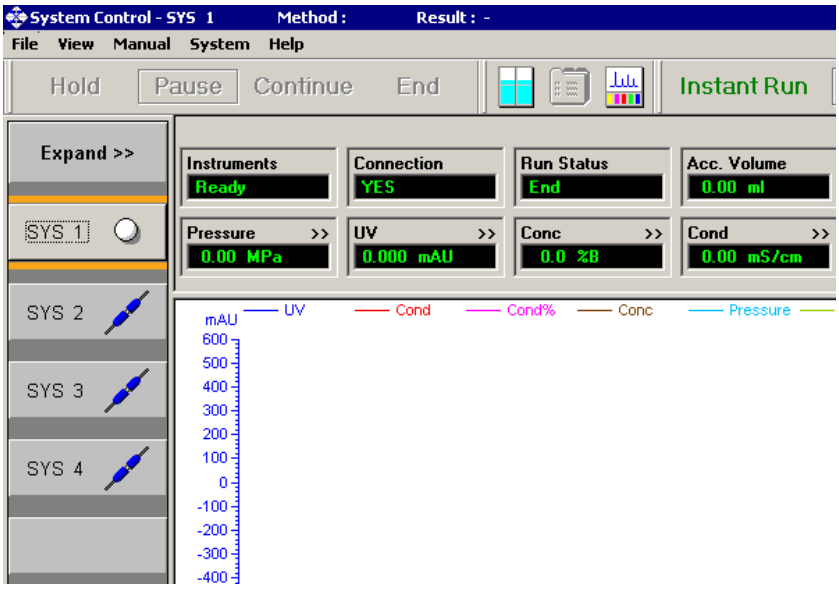


*Figure 4.2: The **System Control** window*

4.4 Setting up a run

Create a method plan

There are two main types of method plan available:

- ***Prepare and Maintain*** – Preparation and maintenance of the system and/or columns
- ***Purify*** – Purification of protein.

To create a method plan:

1 Click the ***New Method*** icon in the ***UNICORN Manager*** window, see *Figure 4.1*.

  The ***Method Editor*** module opens.

2 Click the ***Method Wizard*** icon in the ***Method Editor*** module.

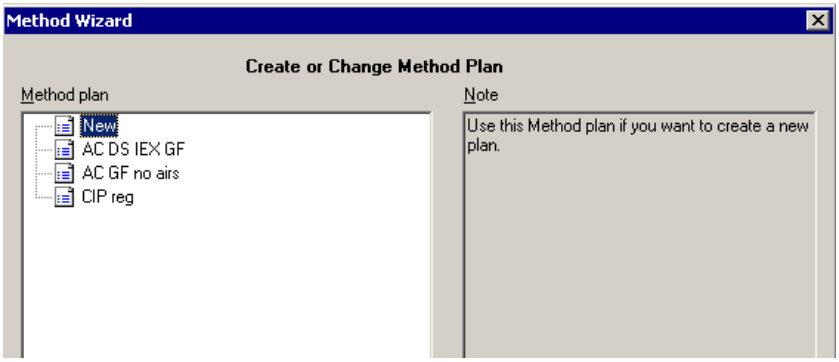
The ***Method Wizard*** dialog opens.

3 Choose one of the alternatives that follows:

- ***New*** to create a new method plan

  or

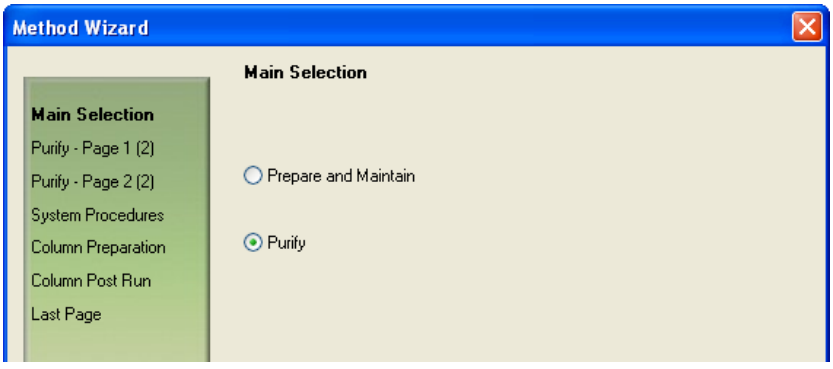
- an existing method plan to edit or view.



4 Click ***Next***.

The ***Main Selections*** page appears.

5 Select the main type of method plan to be created and click ***Next***.



6 On each new page, select the appropriate parameters and click ***Next*** to continue.

7 On the last page:

- Click ***Finish*** to save the selections as a method plan. The ***Save As*** page appears.

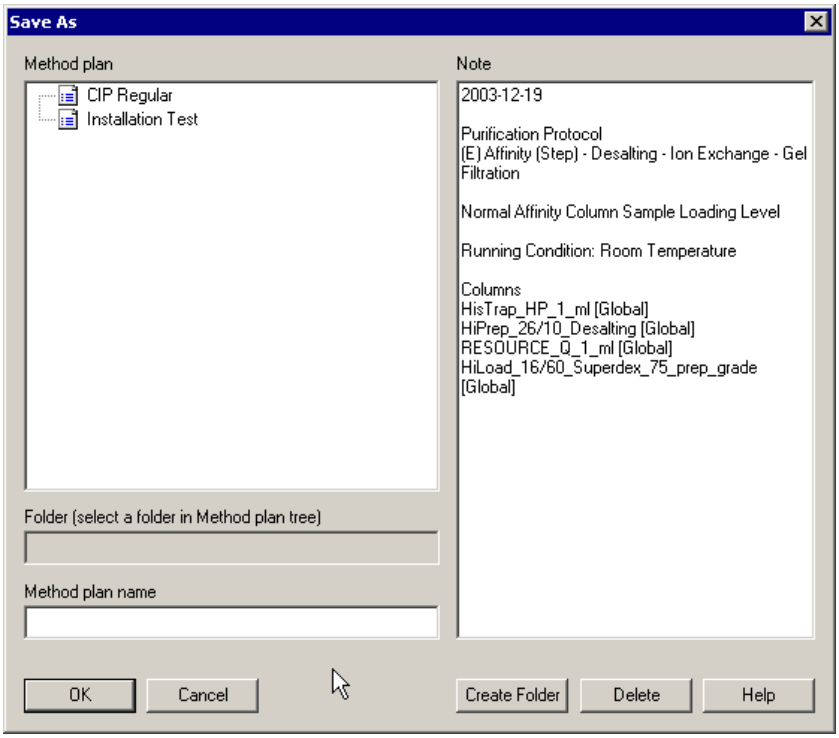
  or

- Click ***Next*** to enter the ***Advanced Zone*** to view or edit default values. For more information about the ***Advanced Zone***, see *ÄKTAxpress User Manual*.

  Note: *Do not change any values in the **Advanced zone** unless the consequences are fully understood.*

8 On the ***Save As*** page:

- Select destination folder in the Method plan tree or create a new one, if needed.
- Type any additional information in the ***Note*** field, for example changes made in Advanced Zone.



9 Type the name of the method plan and click ***OK***.

The method plan is saved. It can now be started from the ***System Control*** module on a single or on several ÄKTAxpress instruments.

4.5 Preparations before start

Print out *Summary*

The ***Summary*** list can be printed from ***System Control*** and it is useful during the preparation of the system, columns and all solutions. The list includes:

- Buffers/solutions, volumes and inlets
- Sample inlet positions
- Usage of inlet and outlet position
- Type of column, and column positions
- Loop positions
- Microplate type

To create the ***Summary***:

1 In ***System Control***, click ***Instant Run***.

2 Select the required Method plan from the list.

3 Select on which ***System***(s) the method plan will be run and the ***Number of Samples*** on each system.

4 Print out the ***Summary*** by clicking ***Print***.

Prepare buffers, solutions and inlets

1 Prepare buffers and solutions required for the run.

2 Immerse all inlet tubing in the appropriate liquid containers as described in the ***Summary*** check list.

Purging the pump and inlet tubing

Fill the pump and inlet tubing with liquid if small amounts of air need to be removed or if the inlet tubing is empty.

To fill the inlet tubing manually in ***System Control***:

1 Make sure that no method plan has been started.

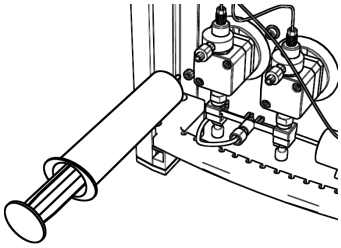
2 Select which system to fill by left-clicking on the symbol for the system to the left in ***System control***.

3 Set a low flow in ***System Control:Manual:Pump:Flow***, for example 0.5 ml/min.

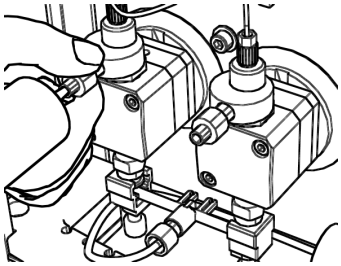
4 Click ***Execute***.

5 Set the inlet valve to the appropriate position in ***System Control:Manual:Flowpath:InletValve***.

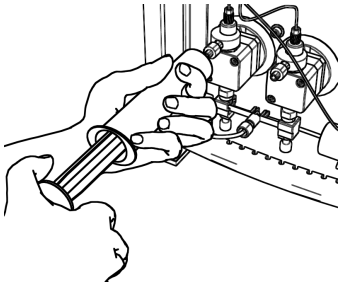
6 Connect a syringe to the purge valve.



7 Turn the purge valve counter clockwise half a turn to open it.



8 Slowly draw solution into the syringe. When fluid starts to enter the syringe, continue to draw a few milliliters before closing the purge valve. Check that there is no visible air left in the tubing.



9 Repeat for the other purge valve.

10 To fill inlet **B1** and **B2**:

a In ***System Control:Manual:Pump:Gradient***, select ***Target 100% B*** and ***Mode A1/B1*** to fill **B1** or ***Mode A2/B2*** to fill **B2**. Wait for the valve to turn (a clicking sound) before starting the purging procedure.

b When all inlets are filled, click ***End***.

Connect columns and Superloop™

For column positions, see the ***Summary*** list in *Print out* ***Summary***, *on page 44* or *Appendix C Column positions, on page 78*.

Remove air before connecting columns

Air remaining in the system may be removed by purging the pump and by selecting ***Pump Wash*** and ***System Wash***.

1 Immerse **A1** tubing in the buffer to be used.

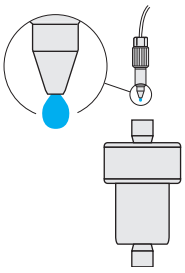
2 Select ***System Control:Manual:PumpWash*** or ***SystemWash***.

Connecting tubing to columns

Refer to column manufacturer's instructions.

Column attachment drop-to-drop

To avoid air bubbles, use the ***drop-to-drop*** procedure when connecting columns:

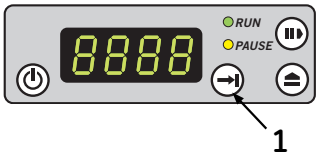


1 In ***Prepare and Maintain***, select ***Column Attachment*** to create this method plan and start it. This will start a low flow rate over the first column position.

2 Click ***Continue*** to start filling Column position 1.

3 Fix the tubing to the column drop-to-drop.

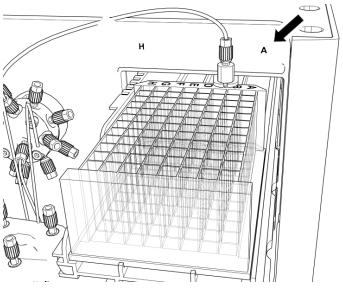
4 Press the **Next Breakpoint** button (1) on the instrument control panel to start filling the next column position.



Note: *It is also possible to attach columns manually by starting a low flow (see Purging the pump and inlet tubing, on page 44) and selecting* ***System Control:Manual:Flowpath:ColumnPosition****.*

Preparing the fraction collector

Place an empty deep well microplate on the sled and check that the labelling **A** matches the labelling on the system. A deep well plate with 96 wells or 24 wells can be used.



4.6 Performing a run

1 **Select method plan**

2 a In ***System Control***, click ***Instant Run***.

b Select the required ***Method plan*** from the list.

3 **Select systems for the run**

Select on which ***System***(s) the method plan will be run and the ***Number of Samples*** on each system.

4 **Specify samples**

5 **variables**

a Enter identification names for the samples, either via the keyboard or using a bar code reader.

b For each sample, it is possible to enter:

- isoelectric point, ***pI***
- extinction coefficient for the protein, ***Ext Coeff***
- molecular weight of the protein, ***MW***.

The data can also be automatically imported from an import file, if it has been prepared and placed in the specified folder and the location must be specified in ***Import File Location*** in ***Advanced Zone*** settings pages. See UNICORN user documentation for further information.

c Enter optional text, for example culture batch number.

6 **Edit result file location and names**

If required, edit the folder path and file names of the result files to be created.

7 **Print out *Summary***

Print out the ***Summary*** by clicking ***Print***.

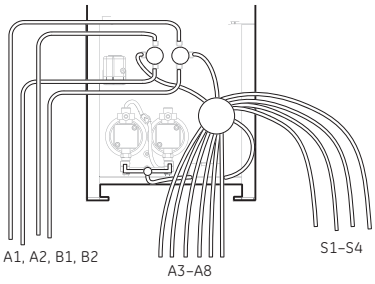
8 **Preparations completed?**

Make sure that the preparations according to *Section 4.5 Preparations before start, on page 44* has been performed.

9 **Check the flow path**

Check against the ***Summary*** and make sure that:

- there is enough buffer available
- the correct inlet is placed in each buffer
- the outlets are placed in correct bottles
- the columns are placed in correct positions
- the chosen fraction collector microplate is in correct place.



10 **Prepare the samples**

The samples should have been prepared and clarified using centrifugation and/or filtration through a 0.45 µm filter. If using crude columns, clarification is not needed.

a Place the sample tubes in the tube or (optional) flask holder or inject the sample into the Superloop depending on chosen method plan.

b
- If ***Fill sample inlets*** is included in the method plan, the inlets should be placed in affinity binding buffer. During the run, the system will pause after initial buffer filling, and a message will appear requesting each sample inlet tubing to be gently moved to its sample.
- If ***Fill sample inlets*** is not included, gently move the already buffer filled sample inlet tubing to each sample before starting the run.

Make sure that no air enters the tubing. Place the tubing close to the bottom of the liquid container but not too tight against the bottom.

c Secure the tubing with the tubing holder.

11 **Final check**

Perform a final check that tubing, columns, solutions and buffers are placed according to the ***Summary***.

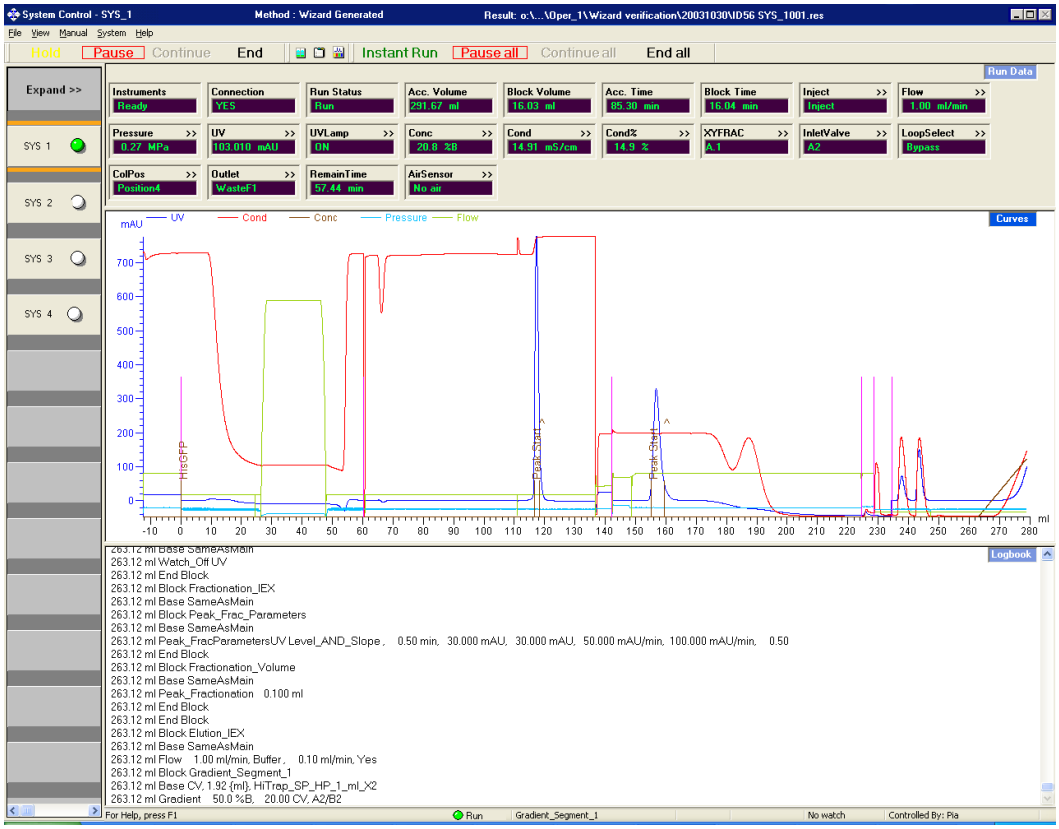
12 **Start the run**

Click ***Run*** to start the run on the selected systems.

Be prepared for manual interactions (fill loops, guided loading of Superloop, fill sample inlets etc.).

Viewing the run

The progress of the run can be viewed in detail in the ***System Control*** module. By clicking the separation system symbol on the left, the current status for the particular system can be displayed.



Up to three view panes, ***Run Data***, ***Curves*** and ***Logbook*** can be displayed showing different aspects of the run in real-time.

- The ***Run Data*** view pane displays the current values for selected run parameters.
- The ***Curves*** view pane displays the monitor signal values graphically.
- The ***Logbook*** view pane shows the actions as the run proceeds. All actions and unexpected conditons are logged, with date, time and current user name. The log book provides a complete history of the run and is saved in the result file.

Customize the view panes

To customize the view panes, right-click in the respective view pane and select ***Properties***. For more information about customizing the view panes, see the UNICORN user documentation.

Ending the run

To stop the run on a system before it is finished:

1 Check that the correct system is selected on the screen.

2 Click ***End*** above the ***Run data*** view pane.

Status indicator colors

The status indicator is located at the bottom of ***System Control***.

The table below shows how the indicator colors relate to the run status.

Indicator color	Run status
White	End
Green	Run or Manual
Yellow	Hold
Red	Pause

Error indication

When a warning or an alarm is issued from a system, the background of the system symbol starts flashing and the background color turns yellow. An error code is displayed on the instrument control panel. See *ÄKTAxpress User Manual* for guidance.

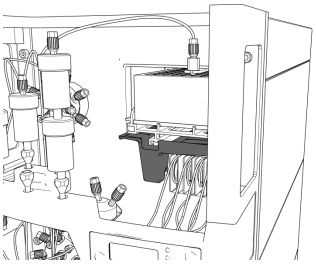
Evaluate the results

See *ÄKTAxpress User Manual* and UNICORN user documentation for how to evaluate the results.

4.7 Procedures after a run

Emptying drip plate

The drip plate, located below the microplate in the fraction collector, should be emptied and rinsed when necessary.



The purpose of the drip plate is to collect any overflow from the microplate. Overflow might indicate an error. If the drip plate becomes full, there is a risk of damage to the system.

Cleaning system

To keep the system in good shape, it is important to clean both the tubing and the outside of the system regularly.

1 In the ***Method Editor*** module in UNICORN, create a method plan for cleaning the system.

2 Wash the outside of the inlet tubings with water and/or ethanol.

3 Immerse the tubing ends to be used in the container with cleaning solution 1.

4 If the column valve is to be cleaned, remove the columns and reconnect the tubings to the column valves.

5 If all outlets are to be cleaned, remember to also insert a microplate.

6 Run the cleaning method plan as described in *Section 4.6 Performing a run, on page 47*.

Cleaning columns

When running different types of purification methods and different samples after each other, the columns should be cleaned between the runs according to the column instructions. This will remove unspecific bound proteins and prevent column clogging.

1 In the ***Method Editor*** module in UNICORN, create a method plan for column cleaning in place (CIP).

2 Immerse the tubing ends to be used in the correct containers according to the ***Summary*** page for the chosen run.

3 Run the cleaning in place method plan as described in *Section 4.6 Performing a run, on page 47*.

5 Maintenance

About this chapter

This chapter provides instructions for routine component maintenance and a maintenance schedule.

5.1 General

Regular maintenance is important for safe and trouble-free operation of your instrument. The user should perform daily and monthly maintenance. Preventive maintenance should be performed on a yearly basis by qualified service personnel.

For maintenance of a specific component, carefully read the component manual and follow the instructions.

WARNING

Electrical shock hazard. All repairs should be done by service personnel authorized by GE Healthcare. Do not open any covers or replace parts unless specifically stated in the user documentation.

WARNING

Disconnect power. Always disconnect power from the instrument before replacing any component on the instrument, unless stated otherwise in the user documentation.

WARNING

Hazardous chemicals during maintenance. When using hazardous chemicals for system or column cleaning, wash the system or columns with a neutral solution in the last phase or step.

WARNING

Do not perform any type of maintenance work while the system is powered electrically or when the piping system is pressurized. Note that the piping system can be pressurized even when the system is closed down.

WARNING

When using hazardous chemical and biological agents, take all suitable protective measures, such as wearing protective glasses and gloves resistant to the substances used. Follow local and/or national regulations for safe operation and maintenance of ÄKTAxpress.

CAUTION

Fire hazard. Follow instructions in *ÄKTAxpress Operating Instructions* for correct installation of a new UV-lamp. If the lamp is not installed properly it may be overheated and cause a fire hazard.

NOTICE

Cleaning. Keep the instrument dry and clean. Wipe regularly with a soft damp tissue and, if necessary, a mild cleaning agent. Let the instrument dry completely before use.

5.2 User maintenance schedule

Table 5.1 provides a guide to maintenance operations and intervals at which these operations should be performed by the user. The user is however responsible for deciding the type of operations and length of intervals necessary to maintain system function and safety.

Table 5.1: User maintenance schedule

Interval	Action	Instructions/reference
Daily	Leak inspection	Visually inspect the system for leaks.
	Wash the system flow path	1 For cleaning the flow path, see *Cleaning-In-Place, on page 58*. 2 For leaving the system for a few days, see *Section 5.8 Storage, on page 60*.
Weekly	Replace on-line filter (if applicable)	Replace the on-line filter.
	Change pump rinsing solution	Change rinsing solution. Always use 20% ethanol with 10 mM NaOH as rinsing solution. If the volume of rinsing solution in the storage bottle has increased, it can be an indication of internal pump leakage. Replace the piston seals according to the User manual. If the volume of rinsing solution in the storage bottle has decreased significantly, check if the rinsing system connectors are mounted properly. If the rinsing system connectors are not leaking, the rinsing membranes or piston seals may be leaking. Replace the membranes and piston seals according to the User manual.

Interval	Action	Instructions/reference
Monthly	Flow restrictor	Check that flow restrictor generates the following back-pressure: FR-902: 0.2 ±0.05 MPa Check the back-pressure as follows: 1 Disconnect the flow restrictor. 2 Connect a tubing (approx. 1 m, i.d. 1 mm) to a free port in the injection valve. Set the valve manually to this port. Put the open end in a waste container. 3 Run the pump at 10 ml/min with water. Note the back-pressure (Bp1) on the pump display, or in the ***Run Data*** window. 4 Connect the flow restrictor to the open end of the tubing (observe the IN marking). Put the flow restrictor in the waste container. 5 Run the pump at 10 ml/min with water. Note the back-pressure (Bp2) on the pump display, or in the ***Run Data*** window. 6 Calculate the back-pressure generated by the flow restrictor. Replace it if it is not within limit.
Yearly	Valve inspection	Check for external or internal leakage. Replace channel plate and distribution plate yearly or when required. Refer to the relevant valve instruction sheet.

5.3 Cleaning

Cleaning before planned maintenance/service

To ensure the protection and safety of service personnel, all equipment and work areas must be clean and free of any hazardous contaminants before a Service Engineer starts maintenance work.

Please complete the checklist in the *On Site Service Health and Safety Declaration Form* or the *Health and Safety Declaration Form for Product Return or Servicing*, depending on whether the instrument is going to be serviced on site or returned for service, respectively.

Copy the form you need from *Section 7.4 Health and Safety Declaration Form, on page 70* or print it from the PDF file available on the User Documentation CD.

Cleaning-In-Place

All components in the system are designed for ease of CIP.

After repeated separation cycles, contaminating material might progressively build up in the system and on the column. This material may not have been removed by the cleaning step described above. The nature and degree of contamination depends on the sample and the chromatographic conditions employed. These should be considered when designing a cleaning protocol.

A method for cleaning-in-place, CIP, is available in the UNICORN Method Wizard. It gives many possibilities to design a powerful cleaning protocol for individual problems, with up to 9 cleaning segments.

Routine cleaning should be performed at intervals aimed at prevention rather than cleaning the system from growth or contamination.

WARNING

Make sure that the piping system is completely leakage free before performing any CIP on the system.

Make sure that the process control method for cleaning flushes all possible flow paths in the system. After cleaning, rinse the entire system with water or suitable liquid until the piping/tubing system is completely free from the CIP solution (monitors in the system can be used as detectors). Do not leave NaOH or other cleaning agents in the system for long periods.

WARNING

Hazardous chemicals during maintenance. When using hazardous chemicals for system or column cleaning, wash the system or columns with a neutral solution in the last phase or step.

WARNING

NaOH is corrosive and therefore dangerous to health. When using hazardous chemicals, avoid spillage and wear protective glasses and other suitable Personal Protective Equipment (PPE).

See also *Section 5.8 Storage, on page 60*.

5.4 Component maintenance

Maintenance and preventive replacement of parts of the major components are described in the respective manuals included in the system documentation.

The system documentation also includes a spare part list to be used to find common spare parts and their code numbers for ordering. This list can also be found online at www.gelifesciences.com/AKTA.

5.5 Disassembly and assembly of components and consumables

The operator must carefully read and understand the instructions supplied for each component before disassembly and assembly of the component. When replacing consumables, such as tubing and tubing connectors, all neccessary safety precautions must be taken. Contact your local GE Healthcare representative if further information or help is needed.

WARNING

Disconnect power. Always disconnect power from the instrument before replacing any component on the instrument, unless stated otherwise in the user documentation.

WARNING

Before disassembly, check that there is no pressure in the piping system.

WARNING

After assembly, the piping system must be tested for leakage at maximum pressure for continued protection against injury risks due to fluid jets, burst pipes or explosive atmosphere.

5.6 Replacement of fuses

WARNING

Disconnect power. Always disconnect power from the instrument before replacing fuses.

Refer to *Section 7.1 Specifications, on page 65* for information about the fuse type and rating. If a fuse repeatedly blows, switch off the system mains switch and contact your local GE Healthcare representative.

WARNING

For continued protection from fire hazard, replace only with same type and rating of fuse.

5.7 Calibration

The table below lists the type and frequency of calibrations that can be done on the instrument. Refer to UNICORN user documentation and to the individual component User Manuals and Instructions for descriptions of how to perform these calibrations. The calibrations are performed from UNICORN by selecting ***System:Calibrate*** in ***System Control***.

Component	How often
Pressure reading	When required.

5.8 Storage

General recommendation

For storage, the system must first be cleaned as described in *Cleaning-In-Place, on page 58*. After cleaning, the system must be filled with 0.01 M NaOH or 20% ethanol solution.

Columns and media shall be stored according to their respective instructions.

Storage conditions

The following conditions shall be maintained while the system is in storage:

- Temperature: 2°C to 30°C (preferably room temperature)
- Relative humidity: 0% to 95%, non-condensing (preferably low humidity).

After storage, clean and sanitize the system, calibrate all monitors, and perform a leakage test before using the system.

6 Troubleshooting

6.1 UV curve problems

Error symptom	Possible cause	Corrective action
Ghost peak	Dirt or residues in the flow path from previous runs. Air in the eluents.	Clean the system. Make sure air is removed.
	Residue in the column from previous runs	Clean the column according to the column instructions.
Noisy UV-signal, signal drift or instability	Dirty UV cell	Clean the UV cell by flushing Decon™ 90, Deconex™ 11 or equivalent.
	Impure buffer	Check if the signal is still noisy with water.
	Air in the pump or in the UV cell	Purge the pump according to *Pump User Manual*. Run a system wash with buffer.
Low sensitivity	Aging UV lamp	Check the lamp run time according to and replace if necessary. Refer to *ÄKTAxpress User Manual*.
	UV lamp in wrong position	Check that the lamp position and the filter position are both set to the wavelength to be used, 280 nm or 254 nm. Refer to *ÄKTAxpress User Manual*.
	The theoretical extinction coefficient too low	Calculate the theoretical extinction coefficient of the protein. If it is zero or very low at 280 nm, the protein cannot be detected.

6.2 Conductivity curve problems

Error symptom	Possible cause	Corrective action
Baseline drift or noisy signal	Air in the pump or the flow cell	Check the flow restrictor after the flow cell.
	Leaking tube connections	Tighten the clamps. If necessary, replace the clamps.
	Dirty conductivity cell	Clean the conductivity cell by flushing 1 M NaOH or 20% ethanol.
	Column not equilibrated	Equilibrate the column. If necessary, clean the column using a method plan for column cleaning.
Conductivity measurement with the same buffer appears to decrease over time	Dirty flow cell	Clean the flow cell according to procedure in *Monitor User Manual*.
	Decrease in ambient temperature	Use a temperature compensation factor. See *Monitor User Manual*.
Waves on the gradient	Incorrect pump function	Check that the pump is operating and is programmed correctly.
	Dirty mixing chamber	Check that the mixing chamber is free from dirt or particles.
Ghost peaks appear in the gradient profile	Air in the flow cell	Check for loose tubing connections. Use the flow restrictor.
Unlinear gradients or slow response to %B changes	Dirty tubing	Wash the tubing and check pump is operating properly.
Incorrect or unstable reading	Loose connection of conductivity flow cable	Check that the conductivity flow cell cable is connected properly.
	Incorrect pump and valves function	Check that the pump and valves operate correctly.
	Dirty or incorrectly equilibrated column	Check that the column is equilibrated. If necessary clean the column.

6.3 Pressure curve problems

Error symptom	Possible cause	Corrective action
Erratic flow, noisy baseline signal, irregular pressure trace	Air bubbles passing through or trapped in the pump	Check all connections for leaks. Check that there is sufficient eluent present in the reservoirs. Use degassed solutions. Purge the pump. Follow the instructions in *Pump P-900 User Manual*.
	Inlet or outlet check valves not functioning correctly	Clean the valves according to *Pump P-900 User Manual*.
	Piston seal leaking	Replace the piston seal according to the instructions in *Pump P-900 User Manual*.
	Blockage or part blockage of flow path	Flush through to clear blockage. If necessary, replace tubing. Check inlet tubing filter. It can become clogged if unfiltered buffers or samples are applied. See instructions for flushing through at the end of the run in *Pump P-900 User Manual*.

7 Reference information

About this chapter

This chapter contains technical data, regulatory and other information.

7.1 Specifications

Parameter	Value
Ingression protection	IP20
Supply voltage	100-120/220-240 V AC ±10%, 50 to 60 Hz
Power consumption	120 VA
Fuse specification	T 6.3 AL 250 V
Dimensions (H × W × D)	660 × 250 × 590 mm
Weight	30 kg
Ambient temperature	4° to 40°C
Relative humidity tolerance (non-condensing)	20% to 95%
Atmospheric pressure	84 to 106 kPa (840 to 1060 mbar)
Noise emission	< 70 dB A

7.2 Chemical resistance

Note: *RPC cannot be performed with ÄKTAxpress.*

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
Acetaldehyde	OK	OK			
Acetic acid, < 5%	OK	OK			
Acetic acid, 70%	OK	OK	64-19-7	200-580-7	
Acetonitrile	OK	OK	75-05-8	200-835-2	PP and PE swell.

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
Acetone, 10%	OK	Avoid			PVDF is affected by long term use.
Ammonia, 30%	OK	OK	7664-41-7	231-635-3	Silicone is affected by long-term use.
Ammonium chloride	OK	OK	12125-02-9	235-186-4	
Ammonium bicarbonate	OK	OK			
Ammonium nitrate	OK	OK			
Ammonium sulphate	OK	OK	7783-20-2	231-984-1	
1-Butanol	OK	OK			
2-Butanol	OK	OK			
Citric acid	OK	OK	29340-81-6	249-576-7	
Chloroform	OK	Avoid			Kalrez™, CTFE, PP and PE are affected by long term use.
Cyclohexane	OK	OK			
Detergents	OK	OK			
Dimethyl sulphoxide	Avoid	Avoid	67-68-5	200-664-3	PVDF is affected by long term use.
1, 4-Dioxane	Avoid	Avoid			ETFE, PP, PE and PVDF are affected by long term use.
Ethanol, 100%	OK	OK	75-08-1	200-837-3	
Ethyl acetate	OK	Avoid			Silicone not resistant. Pressure limit for PEEK decreases.
Ethylene glycol, 100%	OK	OK	107-21-1	203-473-3	

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
Formic acid, 100%	OK	OK	64-18-6	200-579-1	Silicone not resistant.
Glycerol, 100%	OK	OK	56-81-5	200-289-5	
Guanidinium hydrochloride	OK	OK			
Hexane	OK	Avoid			Silicone not resistant. Pressure limit for PEEK decreases.
Hydrochloric acid, 0.1 M	OK	OK	7647-01-0	231-595-7	Silicone not resistant.
Hydrochloric acid, > 0.1 M	OK	Avoid			Silicone not resistant. Titanium is affected by long term use.
Isopropanol, 100%	OK	OK	67-63-0	200-661-7	
Methanol, 100%	OK	OK	74-93-1	200-659-6	
Nitric acid, diluted	OK	Avoid			Silicone not resistant.
Nitric acid, 30%	Avoid	Avoid			Elgiloy™ is affected by long term use.
Phosphoric acid, 10%	OK	Avoid	7664-38-2	231-633-2	Titanium, aluminium oxide and glass are affected by long term use.
Potassium carbonate	OK	OK	584-08-7	209-529-3	
Potassium chloride	OK	OK	7447-40-7	231-211-8	
Pyridine	Avoid	Avoid			ETFE, PP and PE not resistant.
Sodium acetate	OK	OK			

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
Sodium bicarbonate	OK	OK			
Sodium bisulphate	OK	OK			
Sodium borate	OK	OK			
Sodium carbonate	OK	OK			
Sodium chloride	OK	OK	7647-14-5	231-598-3	
Sodium hydroxide, 2 M	OK	Avoid	1310-73-2	215-185-5	PVDF and borosilicate glass are affected by long term use.
Sodium sulphate	OK	OK	7757-82-6	231-820-9	
Sulphuric acid, diluted	OK	Avoid			PEEK and titanium are affected by long term use.
Sulphuric acid, medium concentration	Avoid	Avoid			
Tetrachloroethylene	Avoid	Avoid			Silicone, PP and PE are not resistant.
Tetrahydrofuran	Avoid	Avoid			ETFE, CTFE, PP and PE are not resistant.
Toluene	OK	Avoid			Pressure limit for PEEK decreases.
Trichloroacetic acid, 1%	OK	OK	76-03-9	200-927-2	
Trifluoroacetic acid, 1%	OK	OK	176-05-1	200-929-3	
Urea, 8M	OK	OK	57-13-6	200-315-5	
o-Xylene and p-Xylene	OK	Avoid			PP and PE are affected by long term use.

7.3 System recommendations

Refer to *ÄKTAxpress User Manual*, or contact your local GE representative for the most current information.

7.4 Health and Safety Declaration Form

On site service

On Site Service Health & Safety Declaration Form

Service Ticket #:	

To make the mutual protection and safety of GE service personnel and our customers, all equipment and work areas must be clean and free of any hazardous contaminants before a Service Engineer starts a repair. To avoid delays in the servicing of your equipment, please complete this checklist and present it to the Service Engineer upon arrival. Equipment and/or work areas not sufficiently cleaned, accessible and safe for an engineer may lead to delays in servicing the equipment and could be subject to additional charges.

Yes	No	Please review the actions below and answer "Yes" or "No". Provide explanation for any "No" answers in box below.
		Instrument has been cleaned of hazardous substances. Please rinse tubing or piping, wipe down scanner surfaces, or otherwise ensure removal of any dangerous residue. Ensure the area around the instrument is clean. If radioactivity has been used, please perform a wipe test or other suitable survey.
		Adequate space and clearance is provided to allow safe access for instrument service, repair or installation. In some cases this may require customer to move equipment from normal operating location prior to GE arrival.
		Consumables, such as columns or gels, have been removed or isolated from the instrument and from any area that may impede access to the instrument.
		All buffer / waste vessels are labeled. Excess containers have been removed from the area to provide access.
Provide explanation for any "No" answers here:		

Equipment type / Product No:		**Serial No:**	

I hereby confirm that the equipment specified above has been cleaned to remove any hazardous substances and that the area has been made safe and accessible.

Name:		**Company or institution:**	
Position or job title:		**Date (YYYY/MM/DD):**	
Signed:			

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Product return or servicing

Health & Safety Declaration Form for Product Return or Servicing

Return authorization number:		*and/or* **Service Ticket/Request:**	

To make sure the mutual protection and safety of GE personnel, our customers, transportation personnel and our environment, all equipment must be clean and free of any hazardous contaminants before shipping to GE. To avoid delays in the processing of your equipment, please complete this checklist and include it with your return.

1. Please note that items will NOT be accepted for servicing or return without this form
2. Equipment which is not sufficiently cleaned prior to return to GE may lead to delays in servicing the equipment and could be subject to additional charges
3. Visible contamination will be assumed hazardous and additional cleaning and decontamination charges will be applied

Yes	No	Please specify if the equipment has been in contact with any of the following:	
		Radioactivity (please specify)	
		Infectious or hazardous biological substances (please specify)	
		Other Hazardous Chemicals (please specify)	

Equipment must be decontaminated prior to service / return. Please provide a telephone number where GE can contact you for additional information concerning the system / equipment.

Telephone No:		
Liquid and/or gas in equipment is:	☐	**Water**
	☐	**Ethanol**
	☐	**None, empty**
	☐	**Argon, Helium, Nitrogen**
	☐	**Liquid Nitrogen**
	Other, please specify	

Equipment type / Product No:		**Serial No:**	

I hereby confirm that the equipment specified above has been cleaned to remove any hazardous substances and that the area has been made safe and accessible.

Name:		**Company or institution:**	
Position or job title:		**Date (YYYY/MM/DD)**	
Signed:			

To receive a return authorization number or service number, please call local technical support or customer service.

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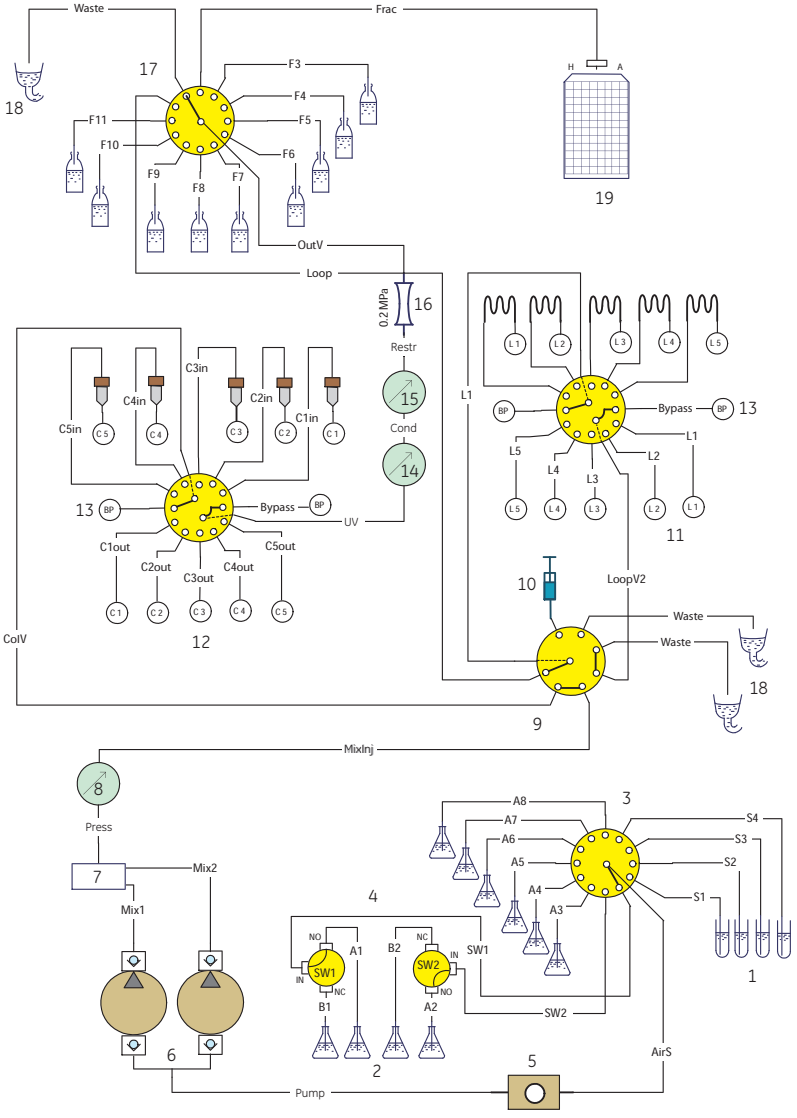
7.5 Ordering information

For ordering information visit www.gelifesciences.com/AKTA.

Appendix A

Connection diagram - Liquid flow path

Flow path and components



No.	Description	No.	Description
1	Samples	11	Loop Valve
2	Buffers	12	Column Valve
3	Inlet Valve	13	Bypass
4	Switch Valves	14	UV monitor
5	Air sensor	15	Conductivity monitor
6	Pump	16	Restrictor
7	Mixer	17	Outlet Valve
8	Pressure sensor	18	Waste
9	Injection Valve	19	Fraction Collector
10	Manual inject		

Appendix B Tubing

Names in the Label column in *Table B.1* refer to tubing labels in the liquid flow path connection diagram, see *Appendix A Connection diagram - Liquid flow path, on page 73*.

Table B.1: Tubing specifications for ÄKTAxpress

Use	Label	Material	Length (mm)	I.D. (mm)	Volume (µl)
Buffer inlets	A1-8, B1-2	FEP	1500	1.6	3.0×10^3 (each)
Sample inlets	S1-4 (color marked)	FEP	500	1.6	1.0×10^3 (each)
Inlet valve - Switch valve	SW1, SW2	FEP	350	1.6	704 (each)
Inlet valve - Air sensor	AirS	FEP	190	1.6	382
Air sensor - Pump	Pump	FEP	230	1.6	462
Pump - Mixer	Mix1, Mix2	ETFE	120	1	94 (each)
Mixer - Pressure sensor	Press	ETFE	160	1	126
Pressure sensor - Inj. valve	Mixinj	ETFE	260	1	204
Inj. valve - Column valve	ColV	ETFE	350	1	275
Column valve inlets	C1in-C5in	ETFE	350	1	275 (each)
Column valve outlets	C1out-C5out	ETFE	190	1	382 (each)
Column and Loop valve by-pass	Bypass (2)	ETFE	160	1	126 (each)
Column valve - UV cell	UV	ETFE	200	1	157
UV cell - Conductivity cell	Cond	ETFE	200	1	157
Cond. cell - Restrictor	Restr	ETFE	350	1	275
Restrictor - Outlet valve	OutV	ETFE	160	1	126
Outlet valve - Loop valve	Loop	ETFE	500	1	393
Inj. valve - Loop valve	LoopV1	ETFE	260	1	204

Use	Label	Material	Length (mm)	I.D. (mm)	Volume (µl)
Loop valve - Inj. valve	LoopV2	ETFE	260	1	204
Sample loops	L1-5	ETFE	12800	1	10×10^3 (each)
Outlet valve - Fraction collector	Frac	ETFE	260	1	204
Fraction outlets from outlet valve	F3-11 (color marked)	ETFE	1500	1	1.2×10^3 (each)
Waste tubing from Injection and Outlet valves	Waste	ETFE	1500	1	1.2×10^3 (each)
Rinsing solution inlet to pump	Rinse In	PTFE	1350	1.2	1.5×10^3
Rinsing tubing between pump heads	Rinse	Silicone	200	3	1.4×10^3
Rinsing solution outlet from pump	Rinse Out	PTFE	1350	1.2	1.5×10^3

Appendix C
Column positions

Protocol		Column position					Max no of samples	On-column tag cleavage possible
		1	2	3	4	5		
1-step	AC/IEX	AC/IEX	AC/IEX	AC/IEX	AC/IEX	-	4	Yes
	DS/GF	-	-	-	-	DS/GF	4 [1]	No
2-step	AC-DS/GF	AC	AC	AC	AC	DS/GF	4	Yes
	IEX-DS/GF	IEX	IEX	IEX	IEX	DS/GF	4	Yes [2]
	DS-AC/IEX	AC/IEX	-	-	-	DS	2	No
3-step	AC-DS-AC/IEX	AC	AC	AC	AC(2)/IEX	DS	3	Yes
	IEX-DS-AC/IEX	IEX	IEX	IEX	AC/IEX(2)	DS	3	Yes
	DS-AC/IEX-DS/GF	AC/IEX	-	-	DS(1)	DS(2)/GF	2	No
4-step	AC-DS-IEX-DS/GF	AC	AC	IEX	DS(1)	DS(2)/GF	2	Yes
	AC-DS-AC-DS/GF	AC	AC	AC(2)	DS(1)	DS(2)/GF	2	Yes
	IEX-DS-AC-DS/GF	IEX	IEX	AC	DS(1)	DS(2)/GF	2	Yes
	IEX-DS-IEX-DS/GF	IEX	IEX	IEX(2)	DS(1)	DS(2)/GF	2	Yes

1 Or one sample injected four times when using Superloop

2 Note: This may not be a useful protocol for on-column tag-cleavage if a tagged protease is used.

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