ÄKTAprime plus

Operating Instructions

Original instructions

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1 Introduction

About this chapter

This chapter contains important user information, descriptions of safety notices, regulatory information, intended use of the ÄKTAprime plus instrument, and lists of associated documentation.

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1.1 About this manual

Purpose of this manual

The *Operating Instructions* provide you with the information needed to install, operate and maintain the product in a safe way.

Scope of this manual

The *Operating Instructions* cover the ÄKTAprime plus instrument, and the PrimeView™ software. The illustration below shows the ÄKTAprime plus system.

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 (for example, **Power**).

1.2 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 of the product

ÄKTAprime plus is a compact liquid chromatography system designed for one-step purification of proteins at laboratory scale.

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

Prerequisites

In order to operate ÄKTAprime plus 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. (If a computer is used.)
- The user must understand the concepts of liquid chromatography.
- The user must read and understand the Safety Instructions in this manual.
- ÄKTAprime plus and software should be installed, configured and calibrated according to these Operating Instructions.

Safety notices

This user documentation contains safety notices (WARNING, CAUTION, and NOTICE) concerning the safe use of the product. See definitions below.

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.

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.

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.*

1.3 Regulatory information

Introduction

This section lists the regulations and standards that apply to the ÄKTAprime plus instrument.

Manufacturing information

The table below summarizes the required manufacturing information.

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

In this section

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1.3.1 EU Directives

Introduction

This section describes the EU Directives that apply to the ÄKTAprime plus instrument.

Conformity with EU Directives

This product fulfills the European Directives listed below. See the EU Declaration of Conformity for the directives and regulations that apply for the CE marking.

If not included with the product, a copy of the EU Declaration of Conformity is available on request.

Directive	Title
2006/42/EC	Machinery Directive (MD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2014/35/EU	Low Voltage Directive (LVD)
2011/65/EU	Restriction of Hazardous Substances (RoHS) Directive

CE marking

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

- used according to the Operating Instructions or user manuals, and
- used in the same state as it was delivered from GE, except for alterations described in the Operating Instructions or user manuals.

1.3.2 Eurasian Customs Union

Introduction

This section contains additional regulatory information to comply with the Eurasian Customs Union technical regulations.

Manufacturer and importer information

The table below summarizes the manufacturer and importer information required by the Eurasian Customs Union.

Requirement	Information
Name and address of manufacturer	See *Manufacturing information*
Telephone number of manufacturer	Telephone: + 46 771 400 600
Importer and/or company for obtaining information about importer	GE Healthcare LLC GE Healthcare Life Sciences Presnenskaya nab., 10C, 12th floor RU-123 317 Moscow, Russian Federation Telephone 1: + 7 495 411 9714 Fax nr: + 7 495 739 6932 Email: LSrus@ge.com

1.3.3 Regulations for USA and Canada

Introduction

This section describes the regulations that apply to the ÄKTAprime plus instrument in the USA and Canada.

NRTL certification

This symbol indicates that the product has been certified by Intertek, which is a US Occupational Safety and Health Administration Nationally Recognized Testing Laboratory (NRTL).

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 A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.3.4 Notification - products containing mercury (Canada)

Introduction

This notice is provided in accordance with the Products Containing Mercury Regulation SOR/2014-254 November 7, 2014 as annexed in the Canadian Environmental Protection Act, 1999.

Cette mise en garde est fournie conformément au règlement DORS/2014-254 du 7 novembre 2014 sur les produits contenant du mercure, tel qu'annexé à la loi canadienne sur la protection de l'environnement (1999).

Notification (English)

Notification about this product.

- Contains mercury.
- For safe handling procedures and the measures to be taken in case of accidental breakage, and for options available for disposal and recycling, please refer to https://www.ec.gc.ca/mercuremercury/Default.asp?lang=En&n=DB6D2996-1. If additional support is needed, please contact your GE representative.
- This product should be disposed of or recycled in accordance with the applicable laws.

Notification (français)

Notification sur ce produit.

- Contient du mercure.
- Pour les procédures de manipulation sécuritaires et les mesures à prendre en cas de rupture accidentelle, et pour les options disponibles pour l'élimination et le recyclage, veuillez consulter le site https://www.ec.gc.ca/mercure-mercury/Default.asp?lang=Fr&n=DB6D2996-1. Pour obtenir une aide supplémentaire, veuillez communiquer avec votre représentant GE.
- Ce produit doit être éliminé ou recyclé en conformité avec les lois applicables.

1.3.5 Other regulations and standards

Introduction

This section describes the standards that apply to the ÄKTAprime plus instrument.

Environmental conformity

This product conforms to the following environmental requirements.

Requirement	Title
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE) Directive
China RoHS	Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products.

Standards, applied to this product

Standard requirements fulfilled by this product are summarized in the table below.

Standard	Description
EN ISO 12100	Safety of machinery. General principles for design. Risk assessment and risk reduction.
EN 61010-1, IEC 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.
EN 61326-1	Electrical Equipment for Measurement, Control, and Laboratory Use-EMC requirements-Part 1: General requirements Emission according to CISPR 11, Group 1, class A
EN 50581	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

NOTICE

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

1.4 Associated documentation

Introduction

This section describes the user documentation that is delivered with the product, and how to find related literature that can be downloaded or ordered from GE.

Software documentation

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

Document	Purpose/Contents
PrimeView User Manual	A complete control software package for supervision of ÄKTAprime plus automated liquid chromatography systems.

Data files, application notes and user documentation on the web

To order or download data files, application notes or user documentation, see the instruction below.

Step	Action
1	Go to www.gelifesciences.com/aktaprime.
2	Click ***RELATED DOCUMENTS***.
3	Select to download the chosen literature.

1.5 Abbreviations

Introduction

This section explains abbreviations that appear in the user documentation for ÄKTAprime plus.

Abbreviations

Abbreviation	Definition
CIP	Cleaning-In-Place
DoHS	Declaration of Hazardous Substances
EMC	Electromagnetic Compatibility Directive
LVD	Low Voltage Directive
MD	Machinery Directive
NRTL	Nationally Recognized Testing Laboratory
PPE	Personal Protective Equipment
RH	Relative humidity
RoHS	Restriction of Hazardous Substances Directive
WEEE	Waste Electrical and Electronic Equipment Directive

2 Safety instructions

About this chapter

This chapter describes safety precautions, labels and symbols that are attached to the equipment. In addition, the chapter describes emergency and recovery procedures, and provides recycling information.

Important

WARNING

Before installing, operating or maintaining the product, all users must read and understand the entire contents of this chapter to become aware of the hazards involved.

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2.1 Safety precautions

Introduction

ÄKTAprime plus is powered by mains voltage and handles materials that can be hazardous. Before installing, operating or maintaining the system, you must be aware of the hazards described in this manual.

Follow the instructions to avoid injury to the operator or other personnel, damage to samples or other substances handled by the equipment, to the product, or to other equipment in the area.

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

- General precautions
- Personal protection
- Flammable liquids and explosive environment
- Installing and moving the product
- Operation
- Maintenance

General precautions

WARNING

Only properly trained personnel may operate and maintain the product.

WARNING

Before connecting a column, 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 for the column.

WARNING

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

WARNING

Do not use ÄKTAprime plus 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 equipment is left unattended.

NOTICE

Avoid condensation. If ÄKTAprime plus is kept in a cold room, cold cabinet or similar, keep it switched on in order to avoid condensation.

Personal protection

WARNING

Always use appropriate Personal Protective Equipment (PPE) during operation and maintenance of this product.

WARNING

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

WARNING

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

WARNING

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

Flammable liquids and explosive environment

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.

Installing and moving the product

WARNING

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

WARNING

Protective ground. The product must always be connected to a grounded power outlet.

WARNING

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

WARNING

Access to power switch and power cord with plug. Do not block access to the power switch and power cord. The power switch must always be easy to access. The power cord with plug must always be easy to disconnect.

WARNING

Do not block the ventilation inlets or outlets on the system.

WARNING

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

WARNING

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

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

NOTICE

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

NOTICE

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

NOTICE

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

Operation

WARNING

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

WARNING

There must always be a sample loop connected to ports 2 and 6 of the injection valve. This is to prevent liquid spraying out of the ports when switching the valve. This is especially dangerous if hazardous chemicals are used.

WARNING

Before connecting a column, 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 for the column.

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.

CAUTION

Sharp object. Handle the tube cutter included in the toolkit with care to avoid injuries. The tube cutter is very sharp.

NOTICE

Avoid condensation. If ÄKTAprime plus is kept in a cold room, cold cabinet or similar, keep it switched on in order to avoid condensation.

NOTICE

Avoid overheating. If ÄKTAprime plus is kept in a cold cabinet and the cold cabinet is switched off, make sure to switch off ÄKTAprime plus and keep the cold cabinet open to avoid overheating.

NOTICE

Keep UV flow cell clean. Do not allow solutions containing dissolved salts, proteins or other solid solutes to dry out in the flow cell. Do not allow particles to enter the flow cell, as damage to the flow cell may occur.

NOTICE

If a buffer containing salt has been used, the flow path must be flushed with deionized water.

Maintenance

WARNING

Electrical shock hazard. All repairs should be done by service personnel authorized by GE. 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

Use only approved parts. Only spare parts and accessories that are approved or supplied by GE may be used for maintaining or servicing the product.

WARNING

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

WARNING

Corrosive substance. 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 the maximum system pressure for continued protection against injury risks due to water jets or burst pipes. Refer to leakage test in the user documentation.

WARNING

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

WARNING

Decommissioning. Decontaminate the equipment before decommissioning to make sure that hazardous residues are removed.

CAUTION

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

CAUTION

The system uses high intensity ultra-violet light. Do not remove the UV lamp while the system is running. Before replacing a UV lamp, make sure that the lamp is disconnected to prevent injury to eye.

If the mercury lamp is broken, make sure that all mercury is removed and disposed of according to national and local environmental regulations.

CAUTION

The system uses high intensity ultra-violet light that is harmful to the eyes. Before changing or cleaning the UV cell optical fiber, make sure that the UV lamp is disconnected or that the power is disconnected.

NOTICE

Cleaning. Keep the exterior of 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

Introduction

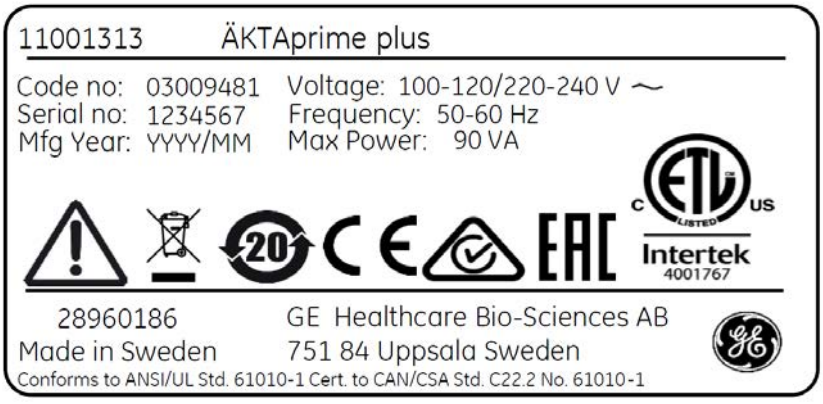
This section describes the system label and other safety or regulatory labels that are attached to the product.

For information about marking of the computer equipment, refer to the manufacturer's instructions.

System label

The following illustration shows an example of the system label that is attached to the ÄKTAprime plus instrument. The system label identifies the product and shows electrical data and regulatory compliance.

Note: *Actual data is specific for each individual system and may vary from system to system.*



Description of symbols on the system label

Symbol/text	Meaning
	**Warning!** Read the user documentation before using the system. Do not open any covers or replace parts unless specifically stated in the user documentation.

Symbol/text	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 *GB/T 26572 Requirements of concentration limits for certain hazardous substances in electrical and electronic products*.
	The system complies with applicable European directives.
	The equipment complies with the requirements for electromagnetic compliance (EMC) in Australia and New Zealand.
	Eurasian Conformity mark: the single conformity mark indicates that the product is approved for circulation on the markets of the member states of the Eurasian Customs Union.
	This symbol indicates that ÄKTAprime plus has been certified by a Nationally Recognized Testing Laboratory (NRTL). This product Conforms to UL 61010-1, and is Certified to CAN/CSA-C22.2 No. 61010-1.
Code no	Instrument assembly number
Serial no	Instrument serial number
Mfg Year	Year (YYYY) and month (MM) of manufacture
Voltage **Frequency** **Max Power**	Electrical requirements: • Mains voltage (VAC) • Frequency (Hz) • Max. power (VA)

2.3 Emergency procedures

Introduction

This section describes how to shut down the ÄKTAprime plus instrument in an emergency situation, and the procedure for restarting the ÄKTAprime plus instrument.

The section also describes the result in the event of power failure.

Safety precautions

WARNING

Access to power switch and power cord with plug. Do not block access to the power switch and power cord. The power switch must always be easy to access. The power cord with plug must always be easy to disconnect.

Emergency shutdown

In an emergency situation, stop the run by either pausing the run or switching off the instrument as described in the following table:

Step	Action
1	To pause the run from PrimeView, click the ***Pause*** button in ***System Control***. 
2	If required, switch off power to the instrument by pressing the **Main power** switch to the **0** position.

Power failure

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

Power failure to...	will result in...
ÄKTAprime plus	• The run is interrupted immediately, in an undefined state • The data collected up to the time of the power failure is available in PrimeView
Computer	• The PrimeView computer shuts down in an undefined state • The run continues, but data cannot be saved in PrimeView.

Restart after emergency shutdown or power failure

Follow the steps below to restart the instrument after an emergency shutdown or power failure.

Step	Action
1	Make sure that the condition that caused the emergency shutdown or power failure is corrected.
2	If the instrument was switched off, press the **Power** switch on the instrument. *Result*: The instrument should start and the Instrument display should show **Not connected**.
3	Turn on the computer and monitor.
4	Start PrimeView and connect to the system.

2.4 Recycling information

Introduction

This section contains information about the decommissioning of ÄKTAprime plus.

CAUTION

Always use appropriate personal protective equipment when decommissioning the equipment.

Decontamination

The product must be decontaminated before decommissioning. All local regulations must be followed with regard to scrapping of the equipment.

Disposal of the product

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

Recycling of hazardous substances

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

Disposal of electrical components

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

Instructions for disposal

Follow the steps below for disposal of the ÄKTAprime plus instrument.

Step	Action
1	Separate all electronic components (terminal strips, power supplies, transmitters, pumps, probes / sensors, etc.) from the Electrical Cabinet.
2	Decontaminate the ÄKTAprime plus Cabinet and Electrical Cabinet following appropriate procedures depending on what type of environment the unit was located in. Follow local and/or national/federal requirements for disposal of the ÄKTAprime plus Cabinet and the Electrical Cabinet.
3	Dispose of electronic components as specified by local regulations depending on material used in the construction of the components. Follow local and/or national/federal requirements for disposal of the electronic components.

2.5 Declaration of Hazardous Substances (DoHS)

根据SJ/T11364-2014《电子电气产品有害物质限制使用标识要求》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/T11364-2014 Marking for Restriction of Hazardous Substances caused by electrical and electronic 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中国标准GB/T 26572《电子电气产品中限用物质的限量要求》中限量的有害物质。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定期维修和保养要求。

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 GB/T 26572 Requirements of concentration limits for certain restricted substances in electrical and electronic products. The number in the symbol is the Environment-friendly Use Period (EFUP), which indicates the period during which the hazardous substances contained in electrical and electronic products will not leak or mutate under normal operating conditions so that the use of such electrical and electronic 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.

有害物质的名称及含量
Name and Concentration of Hazardous Substances

产品中有害物质的名称及含量
Table of Hazardous Substances' Name and Concentration

部件名称 Component name	有害物质 Hazardous substance					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
11001313	X	O	O	O	O	O

本表格依据SJ/T 11364的规定编制。

This table is prepared according to SJ/T 11364.

0: **表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。**

X: **表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572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 hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X: Indicates that this hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572.

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

3 System description

About this chapter

This chapter gives an overview of the ÄKTAprime plus instrument, and a brief description of its function.

In this chapter

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3.1 System overview

Introduction

ÄKTAprime plus is a compact liquid chromatography system designed for one-step purification of proteins at laboratory scale.

Illustration of the instrument

The illustration below shows the ÄKTAprime plus instrument.

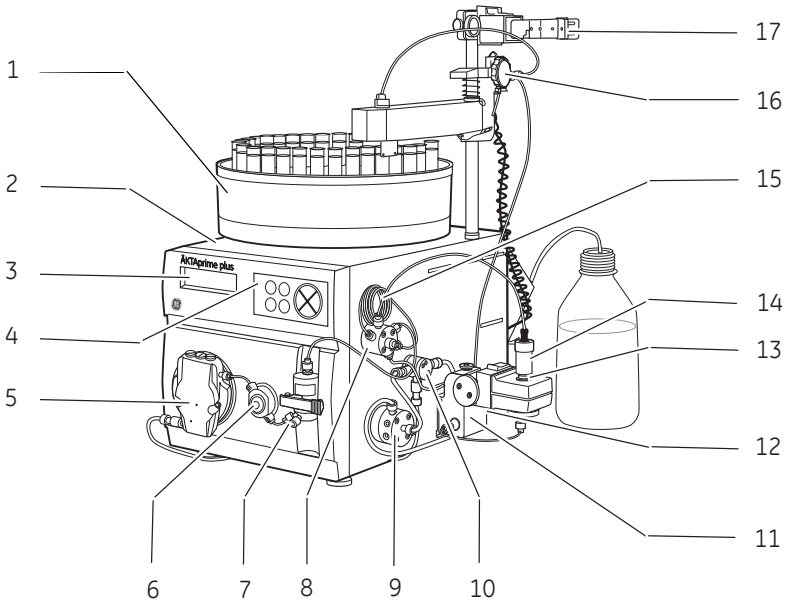
3.2 Instrument overview

Introduction

This section gives an overview of the ÄKTAprime plus instrument.

Illustration of the instrument modules

The illustration below shows the locations and gives brief descriptions of the modules placed on the wet side of the instrument.



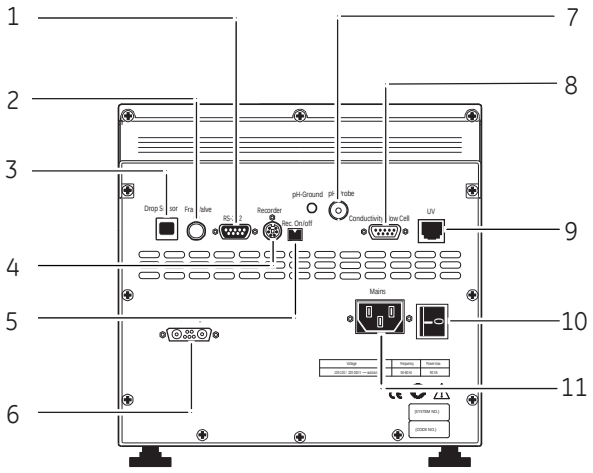
Part	Function	Part	Function
1	Fraction collector	10	Switch valve
2	Monitor and controller	11	Conductivity cell
3	LCD display	12	Flow restrictor
4	Push buttons	13	UV flow cell
5	Pump	14	Column

Part	Function	Part	Function
6	Pressure sensor	15	Sample loop
7	Mixer	16	Flow diversion valve
8	Injection valve	17	Column holder
9	Buffer valve		

The **Power** switch is located at the rear of the system.

Illustration of the rear panel of the instrument

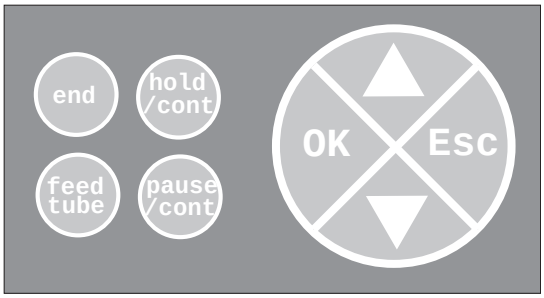
The illustration below shows the locations and gives brief descriptions of the rear side of the instrument.



No.	Connection	No.	Connection
1	RS-232 to computer	7	pH electrode
2	Flow diversion valve	8	Conductivity flow cell
3	Fraction collector	9	Optical unit
4	Measurement data to recorder	10	**Power** switch
5	On/off signals to recorder	11	Mains power inlet
6	UV lamp		

Illustration of the navigation menu

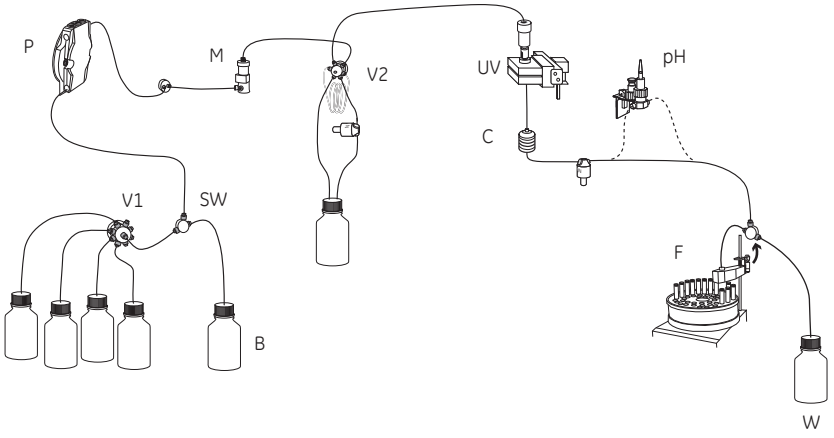
The illustration below shows the navigation menu at the front panel of the instrument. The navigation panel with push buttons and LCD display is used to operate the instrument.



Button	Description
△ or ▽	Find a specific menu option
OK	Enter a menu.
Esc	Return one menu level.
end	Interrupt method operation before the run is completed. Stop manual operation.
hold /cont	Hold method time or volume and the gradient at the current concentration. Pump and fraction collector continue uninterrupted. Continue the normal method operation.
pause /cont	Pause all operation without ending the method. All functions, including pump and fraction collector, are stopped. Continue the normal method operation.
feed tube	Advance the fraction collector one position.

Illustration of the basic flow path

The illustration below shows the basic flow path of the instrument.



Stage	Part	Description
1	P, V1	The pump (P) pumps buffer from a buffer container connected to the buffer valve V1.
2	SW, B	To form a gradient the switch valve (SW) can be used to pull liquid from buffer container (B).
3	M	The mixer (M) mixes the buffers.
4	V2	Sample is applied from the sample loop connected to injection valve (V2) that has been previously filled manually using a syringe.
5	UV, C, pH	From the injection valve, the flow is directed to the column, and then to the UV, Conductivity, and optional pH monitor.
6	F, W	From the monitors, the flow is directed to the Fraction collector F or the Waste W.

4 Installation

About this chapter

This chapter provides required information to enable users and service personnel to unpack, install, move and transport the ÄKTAprime plus instrument.

Important

ÄKTAprime plus is delivered in protective packing material and shall be unpacked with great care. Any equipment connected to ÄKTAprime plus must fulfill applicable standards and local regulations.

For detailed information on Installation, see *ÄKTAprime plus User Manual*.

Safety precautions

WARNING

Protective ground. The product must always be connected to a grounded power outlet.

WARNING

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

WARNING

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

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

In this chapter

Section	See page
4.1 Site requirements	44
4.2 Transport	47
4.3 Unpacking	49
4.4 Electrical connections	50

4.1 Site requirements

Space requirements

Prepare a clean working area on a stable laboratory bench. The bench must comply with the specifications in the following table.

Parameter	Specification
Minimum bench area for operating ÄKTAprime plus	53 × 40 cm
Free space required around the product	At least 40 cm free space in front of the instrument 10 cm free space on all other sides
Space for computer with keyboard and mouse	60 × 60 cm
Load capacity	196 N (20 kg) or higher
Inclination of bench surface	Horizontal ± 2°

WARNING

Access to power cord. Do not block access to the power cord. The power cord must always be easy to disconnect.

Dimensions

The following illustration shows the dimensions of the ÄKTAprime plus instrument.

ÄKTAprime plus weighs 13 kg.

Environmental requirements

The following general requirements must be fulfilled:

- The room must have exhaust ventilation
- The instrument should not be exposed to sources of heat, such as direct sunlight
- Dust in the atmosphere should be kept to a minimum
- The equipment must not be exposed to vibrations

The installation site must comply with the following specifications.

Parameter	Requirement
Allowed location	Indoor use only
Ambient temperature	5°C to 40°C

Parameter	Requirement
Max. relative humidity (RH)	20% RH, non-condensing, up to 95°C
Altitude, operation	Up to 2000 m
Pollution degree of the intended environment	Pollution degree 2

Electrical power requirements

Parameter	Specification
Supply voltage	100 to 120 V AC 220 to 240 V AC
Frequency	50/60 Hz
Transient overvoltages	Overvoltage category II

WARNING

Protective ground. The product must always be connected to a grounded power outlet.

Computer requirements

The use of a computer supplied/approved by GE is recommended. A computer with 64-bit Windows operating system is acceptable if it complies with the requirements in the table below.

Components	Specification
Processor	Intel® Core™ i5-2400 with 4 cores, 3.10 GHz
System Memory	4 GB
Hard disk drive	250 GB
DVD RW	unspecified
Number of serial ports	2
Network card	Extra Network Interface Card

4.2 Transport

Introduction

This section gives important information that must be considered when transporting the product.

For more information on transport, see *ÄKTAprime plus User Manual*.

Required tools and equipment

- Gloves
- A trolley

Safety precautions

WARNING

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

- Protective footwear, preferably with steel toe-cap.
- 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.

Moving when unpacked

Before moving the system:

Step	Action
1	Disconnect all cables and tubing connected to peripheral components and liquid containers.
2	Remove any loose items from the top of the instrument.
3	Grasp the instrument firmly by placing the fingers under the base of the main unit and lift.

The equipment can be transported on a trolley capable of supporting at least 20 kg.

4.3 Unpacking

Safety precautions

CAUTION

Make sure that the system is placed on a stable, level bench with adequate space for ventilation.

Unpacking procedure

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

Visual inspection

Inspect all visible parts for damage or missing pieces. If any damage is observed, record this on the receiving documents and inform your GE representative.

4.4 Electrical connections

Introduction

If the ÄKTAprime plus instrument is moved within the lab or to another building, the instrument has to be connected to electrical power. This section shows the electrical connections that must be made to the instrument.

Safety precautions

WARNING

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

WARNING

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

Connect network and accessories

Connect the system according to the electrical drawings in *Illustration of the rear panel of the instrument, on page 39*.

Connect power to ÄKTAprime plus

WARNING

Protective ground. The product must always be connected to a grounded power outlet.

Connect the power cord to a grounded power outlet as specified in *Electrical power requirements, on page 46*.

5 Preparation

About this chapter

This chapter gives instructions on how to prepare the ÄKTAprime plus instrument before a run.

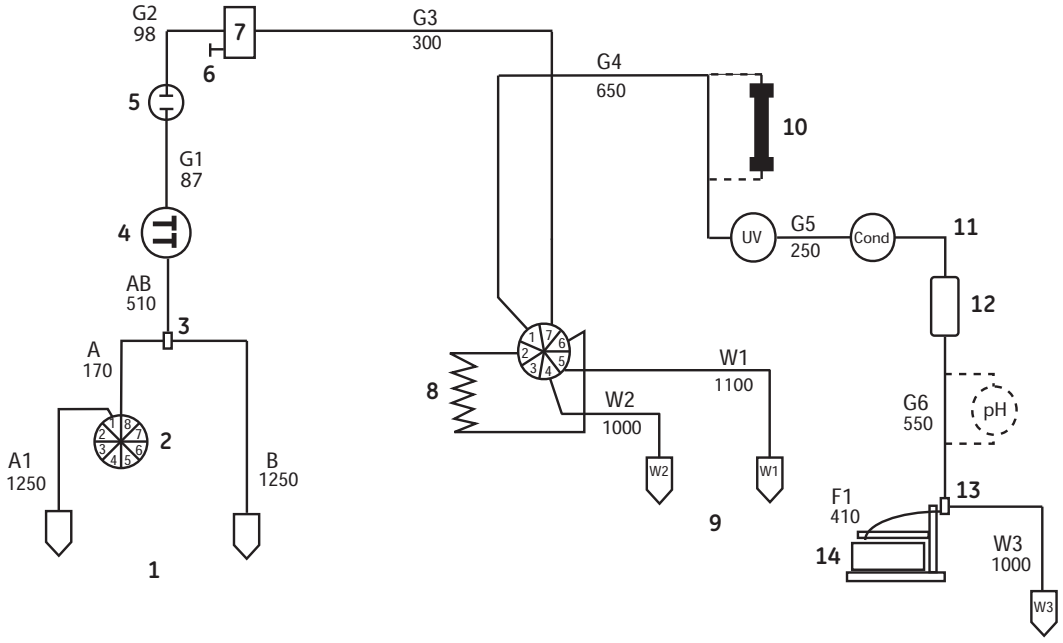
In this chapter

Section	See page
5.1 Prepare the flow path	53
5.2 Starting the instrument	54
5.3 Buffer and sample preparation	55
5.4 Removing the storage solution	56
5.5 Purging the pump and inlet tubing	57
5.6 Preparing column and inlet tubing	59
5.7 Preparing the fraction collector	60
5.8 Preparing the monitors	62
5.9 Filling the buffer inlet tubing	63
5.10 Filling the sample loop	64

5.1 Prepare the flow path

Liquid flow path

Prepare the liquid flow path as shown in the illustration below.



No.	Description	No.	Description
1	Buffers	8	Loop (500 µL)
2	Buffer valve	9	Waste
3	Gradient switch valve	10	Column
4	System pump	11	Male/Male
5	Pressure monitor	12	Flow restrictor (0.2 MPa)
6	Stop plug	13	Flow diversion valve
7	Mixer	14	Fraction collector

For tubing specifications, see *Appendix A Tubing, on page 101*.

5.2 Starting the instrument

Startup

If the system is not already turned on:

1 Turn on the system using the **Power** switch at the rear panel. The system now performs a self-test.

2 First the system name and software version number are displayed. Several messages are then shown during the self-test. If an error is detected during the self-test, an error message is shown.

3 All parameters are automatically set to factory default values during the self-test.

4 The self-test takes about 30–40 seconds. When the test is completed, the display shows the ***Templates*** menu.

Note: *The system can be used for most applications after 15 min of lamp warm-up but the full specifications are not obtained until after 1 hour.*

5.3 Buffer and sample preparation

Buffer preparation

Prepare buffers according to *ÄKTAprime plus Cue Cards*.

Sample preparation

Step	Action
1	Adjust the sample composition to the binding buffer by: • diluting the sample in binding buffer, *or* • performing buffer exchange using HiTrap™ Desalting or HiPrep™ 26/10 Desalting column.
2	Filter the sample through a 0.45 µm filter.

5.4 Removing the storage solution

Procedure

At delivery and during storage, the flow path is filled with 20% ethanol. This should be removed before continuing the setup.

Note: *Do not use buffer with high salt concentration to flush out the ethanol. It might cause too high backpressure.*

Follow the steps below to flush out the ethanol using deionized water.

Step	Action
1	Put the inlet tubing **A1**–**A8** that is used and **B** in deionized water. ***Note:*** *At delivery, only **A1** and **B** are installed.*
2	Put all waste capillaries, **W1**–**W3**, in waste.
3	Select ***Templates*** in the main menu using the △ and ▽ buttons and press **OK**.
4	Select ***Application Template*** and press **OK**.
5	Select ***System Wash Method*** and press **OK**.
6	Choose to wash the **A2**–**A8** inlet tubing that is used by pressing **OK** at those cursor positions. **A1** and **B** will always be washed. ***Note:*** *At delivery, only **A1** and **B** are installed.*
7	Scroll to ***OK*** and press the **OK** button.
8	Press **OK** to start the method.
9	When the method is finished, replace the first collection tube. It will contain a small amount of water after the system wash.

5.5 Purging the pump and inlet tubing

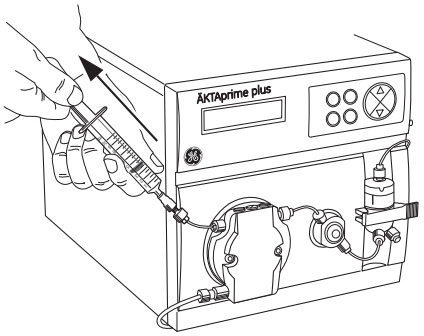
Introduction

If there are large amounts of air in the tubing or if you suspect air in the pump, use the Purge kit to purge the flow path. Air bubbles that still are trapped in the pump (causing increased pulsation) can be removed by flushing 100% ethanol through the pump. These two procedures are described in the following two sections.

Purge the flow path using the Purge kit

Follow the steps below to purge the flow path using the Purge kit.

Step	Action
1	Remove the stop plug from the pump.
2	Connect the Purge kit to the pump.



3	Put the used inlet tubing in the appropriate buffers.
4	Run the pump at 0.1 mL/min.

Follow the steps below to fill the inlet tubing **A1**–**A8**.

Step	Action
1	Go to ***Set Buffer Valve*** using the arrow buttons.
2	Set the chosen **A** inlet and press **OK**. The valve switches to the selected port.
3	Draw buffer with the purge syringe until liquid enters the syringe.
4	Repeat step 1–3 until all chosen **A** inlet tubing is filled.

Follow the steps below to fill the inlet tubing **B**.

Step	Action
1	Go to ***Set Concentration %B*** and set the concentration to ***100%***.
2	Press **OK**. The switch valve turns to the inlet **B** port.
3	Draw buffer with the purge syringe until liquid enters the syringe.
4	Replace the purge tubing with the stop plug.
5	Stop the pump by pressing **end** and then **OK**.

Flush the pump with ethanol

Follow the steps below to flush the pump with 100% ethanol.

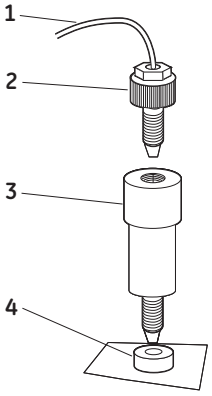
Step	Action
1	Put inlet tubing **A1** in deionized water.
2	Run the pump at 40 mL/min for 1 min and press **pause/cont**.
3	Move inlet tubing **A1** to 100% ethanol
4	Press **pause/cont**, run the pump for 10–20 s and press **pause/cont**.
5	Set the flow rate to 5 mL/min using the arrow buttons.
6	Press **pause/cont**, run the pump for at least 30 s and press **pause/cont**.
7	Move inlet tubing **A1** to deionized water.
8	Press **pause/cont** and run the pump for 1 min.
9	Finish by pressing **end** and then **OK**.

5.6 Preparing column and inlet tubing

Procedure

Follow the steps below to prepare the column and inlet tubings.

Step	Action
1	Put inlet tubing **A1** in the binding buffer.
2	Put inlet tubing **B** in the elution buffer.
3	Put the three brown waste capillaries from port **4** and **5** on the injection valve and port **NO** on the fraction collector valve in waste.
4	Connect a column, for example a HisTrap™ HP 1 mL column, between port **1** on the injection valve and the upper port of the UV flow cell. Use a suitable length of PEEK tubing and 1/16" male connectors.



No.	Description	No.	Description
1	Tubing from injection valve	3	HisTrap column
2	1/16" male connector	4	UV cell

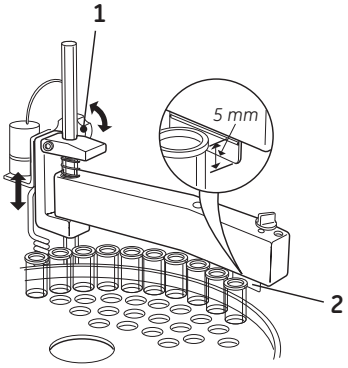
Note: *Other unions and connectors might be required for other columns.*

5.7 Preparing the fraction collector

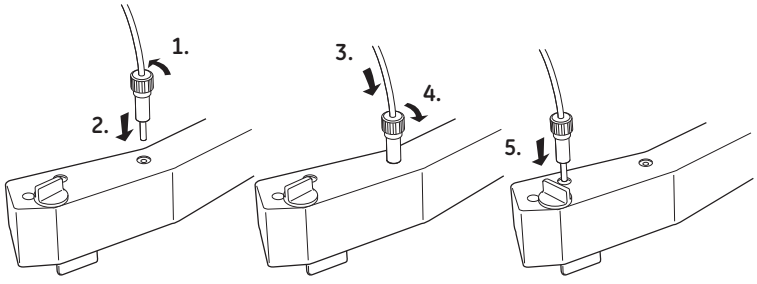
Procedure

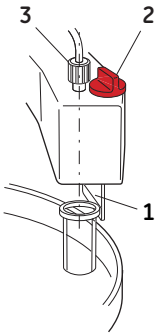
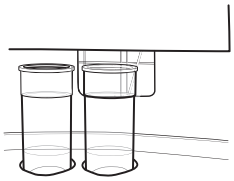
Follow the steps below to prepare the fraction collector.

Step	Action
1	Fill the fraction collector rack with, for example, 18 mm tubes (minimum 40 pcs.).
2	Adjust the height of the delivery arm using the lock knob (1) so that the bottom of the tube sensor (2) is about 5 mm below the top of the tubes. The tubes should always be below the horizontal mark on the tube sensor.



3	If necessary, adjust the length of the tubing exposed according to the sequence shown below (the hole in the delivery arm used in step 3 and 4 is only used for adjusting the tubing length).



Step	Action
4	Check that the tube sensor (1) is in the correct position for the tube size. The eluent tubing should be over the center of the collection tube. Use the red sensor control knob (2) to position the tube holder (3). 
5	Rotate the rack by hand until the rear half of the tube sensor rests against the first tube. 
6	Press **feed tube** on the front panel (see *Illustration of the navigation menu, on page 40*). The bowl moves to the correct position to collect the first fraction in the first tube.
7	Make sure that drop synchronization is turned on. ***Note:*** *Drop synchronization can NOT be used at flowrates above 3 mL/min.*

5.8 Preparing the monitors

Procedure

Follow the steps below to prepare the monitors.

Step	Action
1	Check the UV lamp filter position and the lamp position.
2	Calibrate the pH electrode (optional).

See *ÄKTAprime plus User Manual* for more information.

5.9 Filling the buffer inlet tubing

Application template

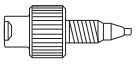
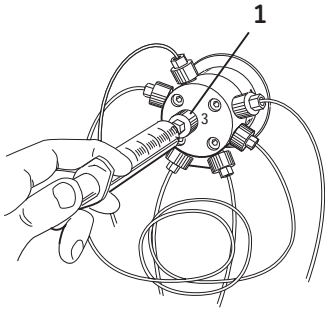
When running an application template, the buffer inlet tubing will automatically be filled with buffer.

For other applications, fill the inlet tubing manually with buffer as described in the *ÄKTAprime plus User Manual*.

5.10 Filling the sample loop

Procedure

Follow the steps below to fill the sample loop using an injection fill port.

Step	Action
1	Connect a sample loop between port **2** and **6** on the injection valve. Make sure that the sample loop is large enough for your sample.
2	Connect a Luer-Lok™ female/1/16" male union to port **3**. 
3	Fill a syringe with five loop volumes of deionized water or binding buffer.
4	Fit the syringe in the Luer union (1) and carefully inject the buffer. 
5	Remove the syringe and fill it with at least two loop volumes of the sample.
6	Carefully inject the sample into the sample loop. *Note: Do NOT remove the syringe after the injection because the loop might otherwise be emptied due to self-drainage or air may be introduced in the flow path.*

6 Operation

About this chapter

This chapter gives instructions on how to safely operate the product.

Safety precautions

WARNING

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

WARNING

There must always be a sample loop connected to ports 2 and 6 of the injection valve. This is to prevent liquid spraying out of the ports when switching the valve. This is especially dangerous if hazardous chemicals are used.

In this chapter

Section	See page
6.1 Operation overview	67

Section	See page
6.2 Performing a run	68
6.3 Procedures after a run	71

6.1 Operation overview

Workflow

The typical workflow in ÄKTAprime plus, after turning on the system, can be divided into a number of steps.

Step	Action	Section
1	Prepare the system for a run	*Chapter 5 Preparation, on page 52*
2	Start a run using a method	*Section 6.2 Performing a run, on page 68*
3	During a run - view and change parameters	*Viewing the run, on page 68*
4	Procedures after a run	*Section 6.3 Procedures after a run, on page 71*
5	Evaluate the results	See *PrimeView user documentation*.

6.2 Performing a run

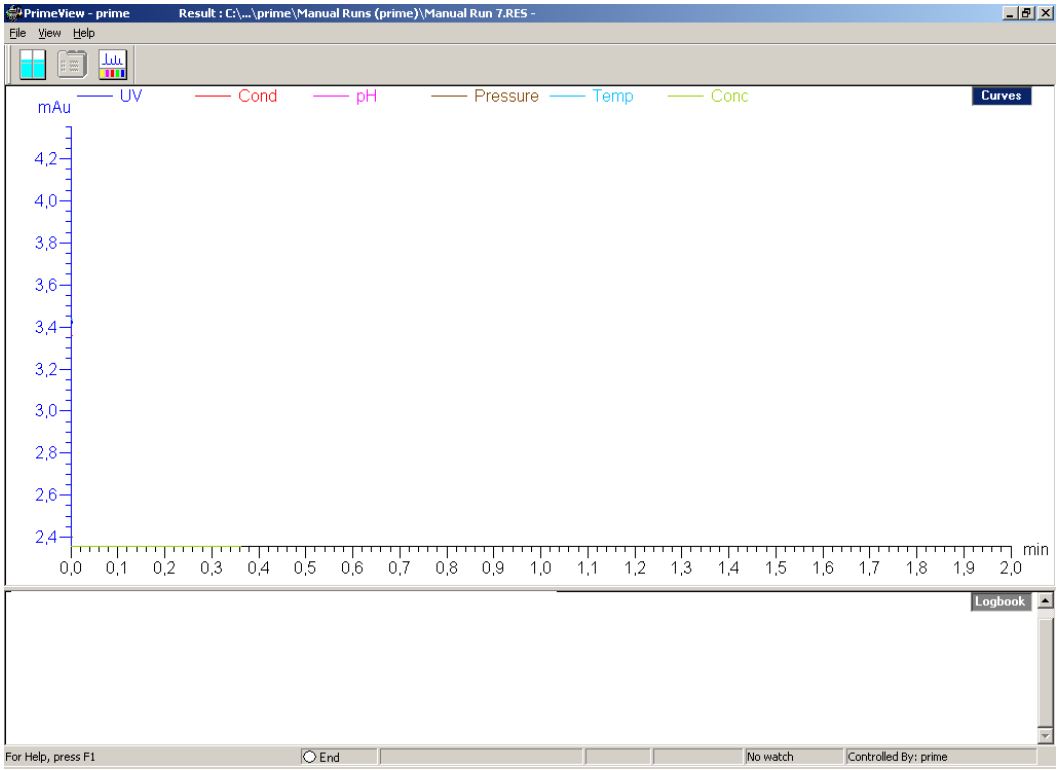
Selecting template and starting the run

Follow the steps below to select the template and start the run.

Step	Action
1	Select ***Templates*** in the main menu and press **OK**.
2	Select ***Application Template*** and press **OK**.
3	Select the appropriate template, for example ***His Tag Purification HisTrap***, and press **OK**.
4	Set the sample volume and press **OK**.
5	Press **OK** to start the purification run.

Viewing the run

When the pump starts running, the progress of the run can be viewed in the two panes in PrimeView.



- The ***Curves*** pane displays monitor signal values graphically.
- The ***Logbook*** pane displays all actions (e.g. method start and end, base instructions and method instructions) and unexpected conditions (e.g. warnings and alarms). The log is saved in the result file.

Selecting curves to be displayed

Follow the steps below to select the curves that need to be displayed.

Step	Action
1	In PrimeView module, select ***View:Properties***.
2	In the ***Properties*** dialog, click the ***Curves*** tab.
3	In the ***Display curves*** list, select the curves you want to display.
4	Click ***OK***.

For more information on customizing the view panes, see *PrimeView User Manual*.

Ending the run

Press **OK** at the ***Method Complete*** prompt. This will cause all valves to return to their default positions.

Follow the steps below to stop the run on a system before it is finished.

Step	Action
1	Press the **end** button.
2	Select ***yes*** and press **OK**.

Error indication

When a warning or an alarm is issued from a system, an error code is displayed. See *ÄKTAprime plus User Manual* for guidance.

Evaluate the results

PrimeView Evaluation module provides facilities for the presentation and evaluation of separation results.

To start ***PrimeView Evaluation*** module, click ***PrimeView Evaluation*** icon on the Windows desktop.

See *ÄKTAprime plus User Manual* and *PrimeView User Manual* for how to evaluate the results.

6.3 Procedures after a run

Cleaning after a run

NOTICE

Keep UV flow cell clean. Do not allow solutions containing dissolved salts, proteins or other solid solutes to dry out in the flow cell. Do not allow particles to enter the flow cell, as damage to the flow cell may occur.

Buffers not containing any salt can be left in the system for a short time after a run, even overnight (not in the pH electrode, see instructions below).

NOTICE

If a buffer containing salt has been used, the flow path must be flushed with deionized water.

Follow the steps below to flush the liquid flow path.

Step	Action
1	Fill a syringe with five times the sample loop volume of deionized water.
2	Rinse the sample loop by injecting the water through the fill port on the injection valve.
3	Put all used inlet tubings in water.
4	In the ***Templates*** menu, select ***Application Template*** and then ***System Wash Method***.
5	Select the used inlet ports. Inlets **A1** and **B** will always be washed.
6	Press **OK** to start the method. The system flow path is now automatically flushed.

For information on cleaning and long-term storage, see *Section 7.2 Cleaning, on page 76* and *Section 7.6 Storage, on page 81*.

7 Maintenance

About this chapter

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.

This chapter provides information to enable users and service personnel to clean, maintain, calibrate and store the product.

Safety precautions

WARNING

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

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

Use only approved parts. Only spare parts and accessories that are approved or supplied by GE may be used for maintaining or servicing the product.

WARNING

Corrosive substance. 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

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

CAUTION

The system uses high intensity ultra-violet light. Do not remove the UV lamp while the system is running. Before replacing a UV lamp, make sure that the lamp is disconnected to prevent injury to eye.

If the mercury lamp is broken, make sure that all mercury is removed and disposed of according to national and local environmental regulations.

In this chapter

Section	See page
7.1 User maintenance schedule	74
7.2 Cleaning	76
7.3 Component maintenance	78
7.4 Disassembly and assembly of components and consumables	79
7.5 Calibration	80
7.6 Storage	81

7.1 User maintenance schedule

Introduction

The user maintenance schedule 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.

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 76*. 2 For leaving the system for a few days, see *Section 7.6 Storage, on page 81*.
	Calibrate pH electrode (optional)	Calibrate the pH electrode (if applicable) according to *Monitor pH/C-900 User Manual*.
Weekly	Check inlet filters	Check the inlet filters visually and replace them if necessary.
	Replace on-line filter (if applicable)	Replace the on-line filter.

Interval	Action	Instructions/reference
Monthly	Flow restrictor	Check that flow restrictor generates the following back-pressure: FR-904: 0.4 ±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 the waste port (port 5) on the injection valve. Set the injection valve manually to ***Waste*** position. Put the open end in a waste container. 3 Run the pump manually at 10 mL/min with water. Note the back-pressure (Bp1) on the pump display, or in the ***Run Data*** window. 4 Pause the system by pressing **pause/cont** and connect the flow restrictor to the open end of the tubing (observe the **IN** marking). Put the flow restrictor in the waste container. 5 Press **pause/cont** to continue, running the pump run 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 (Bp2-Bp1). 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.

7.2 Cleaning

Introduction

All components in the system are designed for ease of CIP. Routine cleaning should be performed at intervals aimed at prevention rather than cleaning the system from growth or contamination.

Safety precautions

WARNING

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

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

Corrosive substance. 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).

Cleaning-In-Place

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.

See also *Section 7.6 Storage, on page 81*.

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 9.5 Health and Safety Declaration Forms, on page 99* or print it from the PDF file available on the User Documentation CD.

7.3 Component maintenance

Maintenance and preventive replacement

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/aktaprime.

7.4 Disassembly and assembly of components and consumables

Important

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 necessary safety precautions must be taken. Contact your local GE representative if further information or help is needed.

Safety precautions

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

Before operation, all process connections and the piping system must be tested for leakage at maximum pressure for continued protection against injury risks due to fluid jets, burst pipes or potentially explosive atmosphere.

7.5 Calibration

Type and frequency of calibrations

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

Component		How often
pH monitor (if applicable)		Every day.
Pump		When required.
Pressure reading		When required.
Conductivity flow cell	Cell constant	Only necessary if specific conductivity with high accuracy is measured (Select ***Cond_Calib***).
	Temperature	Must be done when changing the conductivity flow cell (Select ***Temp***).
	Entering a new cell constant	Must be done when changing the conductivity flow cell (Select ***Cond_Cell***).
UV cell (length)		Only necessary when high accuracy in the absorbance measurement is desired.

7.6 Storage

General recommendation

For storage, the system must first be cleaned as described in *Section 7.2 Cleaning, on page 76*. After cleaning, the system must be filled with 0.01 M NaOH or 20% ethanol solution.

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 the system, calibrate all monitors, and perform a leakage test before using the system.

8 Troubleshooting

About this chapter

This chapter provides information to assist users and service personnel to identify and correct problems that may occur when operating the product.

If the suggested actions in this guide do not solve the problem, or if the problem is not covered by this guide, contact your GE representative for advice.

Safety precautions

WARNING

Always use appropriate Personal Protective Equipment (PPE) during operation and maintenance of this product.

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

Use only approved parts. Only spare parts and accessories that are approved or supplied by GE may be used for maintaining or servicing the product.

WARNING

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

In this chapter

Section	See page
8.1 UV curve problems	84
8.2 Conductivity curve problems	85
8.3 pH curve problems	87
8.4 Pressure curve problems	90

8.1 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.
	Incorrect mixer function	Check the mixer function by placing a stirrer bar on top of the mixer housing. The stirrer bar should rotate when the system is in ***Run*** mode. The mixer function can also be checked by running the installation test.
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 *ÄKTAprime plus 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 *ÄKTAprime plus 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.

8.2 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.
	Incorrect mixer function	Check the mixer function by placing a stirrer bar on top of the mixer housing. The stirrer bar should rotate when the system is in ***Run*** mode. The mixer function can also be checked by running the installation test.
	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.
	Insufficient mixing chamber volume	Change to a larger mixing chamber volume if necessary.
	Incorrect motor function	Check the motor operation. Place a hand on the mixer and start it by starting the pump at a low flow rate. You should both hear and feel the mixer motor and stirrer when they are spinning.
Ghost peaks appear in the gradient profile	Air in the flow cell	Check for loose tubing connections. Use the flow restrictor.

Error symptom	Possible cause	Corrective action
Unlinear gradients or slow response to %B changes	Dirty tubing	Wash the tubing and check pump is operating properly.
	Incorrect mixer volume	Change to smaller mixer volume.
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.
	Incorrect temperature compensation factor	If temperature compensation is being used, check that the temperature sensor is calibrated, and that the correct temperature compensation factor is in use.
	Dirty or incorrectly equilibrated column	Check that the column is equilibrated. If necessary clean the column.
	Incorrect mixer function	Check the operation of the mixer. The mixer function is checked by placing a stirrer bar on top of the mixer housing. The stirrer bar should rotate when the system is in ***Run*** mode. The mixer function can also be checked by running the installation test.

8.3 pH curve problems

Error symptom	Possible cause	Corrective action
No response to pH changes	Faulty electrode connection	Check that the electrode cable is connected properly.
	Damaged electrode	The electrode glass membrane may be cracked. Replace the electrode.
	Incorrectly connected pH monitor	Check that the pH monitor is correctly connected according to the *ÄKTAprime plus User Manual*.
Small response to pH changes	Dirty pH electrode	Clean the pH electrode as detailed in *Monitor pH/C-900 User Manual*. If the problem remains, replace the pH electrode.
Slow pH response or Calibration impossible	Contaminated electrode glass membrane	Check the electrode glass membrane. If it is contaminated, clean the electrode following the instructions in *Monitor pH/C-900 User Manual*.
	Membrane has dried out	If the membrane has dried out, the electrode may be restored by soaking it in buffer overnight.

Error symptom	Possible cause	Corrective action
Incorrect or unstable pH reading	Problem with electrode	Check that the electrode cable is connected properly. Check that the electrode is correctly inserted in the flow cell and, if necessary, hand-tighten the nut. Check that the pH electrode is not broken. Calibrate the pH electrode. Clean the pH electrode if required, see *Monitor pH/C-900 User Manual*. Compare the response of the pH electrode with that of another pH electrode. If the response differ greatly, the electrode may require cleaning or replacement. In organic solvents such as ethanol, methanol and acetonitrile, stable pH measurements are not possible since dehydration of the membrane will occur. It is recommended that the pH electrode is not used in applications using organic solvents. Mount the dummy electrode instead.
	Incorrect pump or valve operation	Check that the pump and valves operate correctly.
	Air in the flow cell	If air in the flow cell is suspected, tap the flow cell carefully or tilt it to remove the air. Alternatively, flush the cell with buffer at 20 mL/min (E 100 system) for 1 min or at 10 mL/min (E 10 system) for 2 min. Use the flow restrictor FR-902 after the pH electrode.
	Static interference	There may be interference from static fields. Connect the pH flow cell and the rear panel of the monitor using a standard laboratory 4 mm “banana plug” cable.

Error symptom	Possible cause	Corrective action
pH values vary with varied back pressure	Problem with the electrode	Replace the pH electrode.

8.4 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 *ÄKTAprime plus User Manual*.
	Inlet or outlet check valves not functioning correctly	Clean the valves according to *Pump P-920 User Manual*. Clean the valves according to *ÄKTAprime plus User Manual*.
	Piston seal leaking	Replace the piston seal according to the instructions in *ÄKTAprime plus 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 *ÄKTAprime plus User Manual*.

9 Reference information

About this chapter

This chapter lists the technical specifications of ÄKTAprime plus. The chapter also includes a chemical resistance guide, ordering information, and Health and Safety Declaration forms for service.

In this chapter

Section	See page
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9.2 Chemical resistance	93
9.3 System recommendations	97
9.4 Ordering information	98
9.5 Health and Safety Declaration Forms	99

9.1 Specifications

General technical specifications

Parameter	Value
Ingression protection	Housing: IP20 Flow cells: IP44
Supply voltage	100-120/220-240 V~ autorange [1]
Maximum voltage fluctuation	± 10% from the nominal voltage
Frequency	50-60 Hz
Maximum power	90 VA
Transient overvoltages	Overvoltage category II
Fuse specification	T 1.0 AH 250 V AC, approved type (not replaceable by the user)
Dimensions (H × W × D)	530 × 400 × 450 mm
Weight	13 kg
Altitude	Maximum 2000 m
Ambient temperature	4°C to 40°C
Relative humidity tolerance (non-condensing)	10% to 95%
Atmospheric pressure	84 to 106 kPa (840 to 1060 mbar)
Acoustic noise level	< 80 dB A

1 The instrument switches automatically to the input voltage supplied, within the limits specified in the table.

9.2 Chemical resistance

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.
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.

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
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	
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	

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
Potassium chloride	OK	OK	7447-40-7	231-211-8	
Pyridine	Avoid	Avoid			ETFE, PP and PE not resistant.
Sodium acetate	OK	OK			
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	

Chemical	Exposure < 1 day	Exposure up to 2 months	CAS no.	EEC no.	Comments
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.

9.3 System recommendations

Information

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

9.4 Ordering information

Contact details

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

9.5 Health and Safety Declaration Forms

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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Appendix A Tubing

Tubing specifications for ÄKTAprime plus

The names in the column Label refer to the tubing labels in the illustration of the liquid flow path, see *Section 5.1 Prepare the flow path, on page 53*.

Use	Label	Material	Length (mm)	I.D. (mm)	Volume (µl)
Inlet A11	A1	FEP	1250	2.9	8.2×10^3
Inlet A1	A	FEP	170	2.9	1.1×10^3
Inlet A2	B	FEP	1250	2.9	8.2×10^3
Switch valve - Pump A3	AB	FEP	510	1.6	1.0×10^3
Pump - Pressure monitor	G1	PEEK	150	0.75	66
Pressure monitor - Mixer	G2	PEEK	120	0.75	53
Mixer - Valve	G3	PEEK	300	0.75	133
Valve - UV (Column)	G4	PEEK	650	0.75	287
UV - Cond	G5	PEEK	250	0.75	110
Cond - Flow restrictor	Union, 1/16" male / 1/16" male	PEEK	38	0.50	7
Flow restrictor – Frac. coll.	G6	PEEK	550	0.75	243
Frac. tubing	F1	PEEK	410	0.75	181
Waste	W1, W2, W3	PEEK	1000	1.0	785

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